Go to SUP 2 Rev.1

ENGINE CONTROL SYSTEM

SECTION EC

MODIFICATION NOTICE:

- TB45S engine has been newly adopted.
- For the TB45S engine specifications other than those described here, refer to TB42S engine of Service Manual (SM7E-1Y61G0, SM7E-2Y61G0) and Supplement-I (SM8E-Y61AG0).
- The Wiring Diagrams on models with the TB45E and TD42 engines have been changed.
- The ZD30DDTi engine has been replaced by the RD28ETi engine.

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ZD30DDTi

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ZD30DDTi

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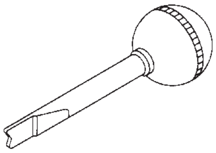
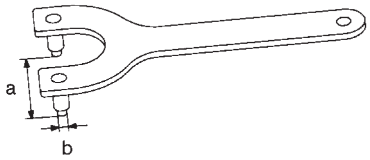
Special Service Tool (TB45S)

Tool number Tool name	Description
KV10108300 Idle adjusting screwdriver	 NT270

Special Service Tool (ZD30DDTi)

Tool number Tool name	Description
KV10109300 Puller holder	 NT628 **a = 68 mm (2.68 in)** **b = 8 mm (0.31 in) dia.**

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

The Supplemental Restraint System such as "AIR BAG" and "SEAT BELT PRE-TENSIONER" used along with a seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. The SRS system composition which is available to NISSAN MODEL Y61 is as follows (The composition varies according to the destination and optional equipment.):

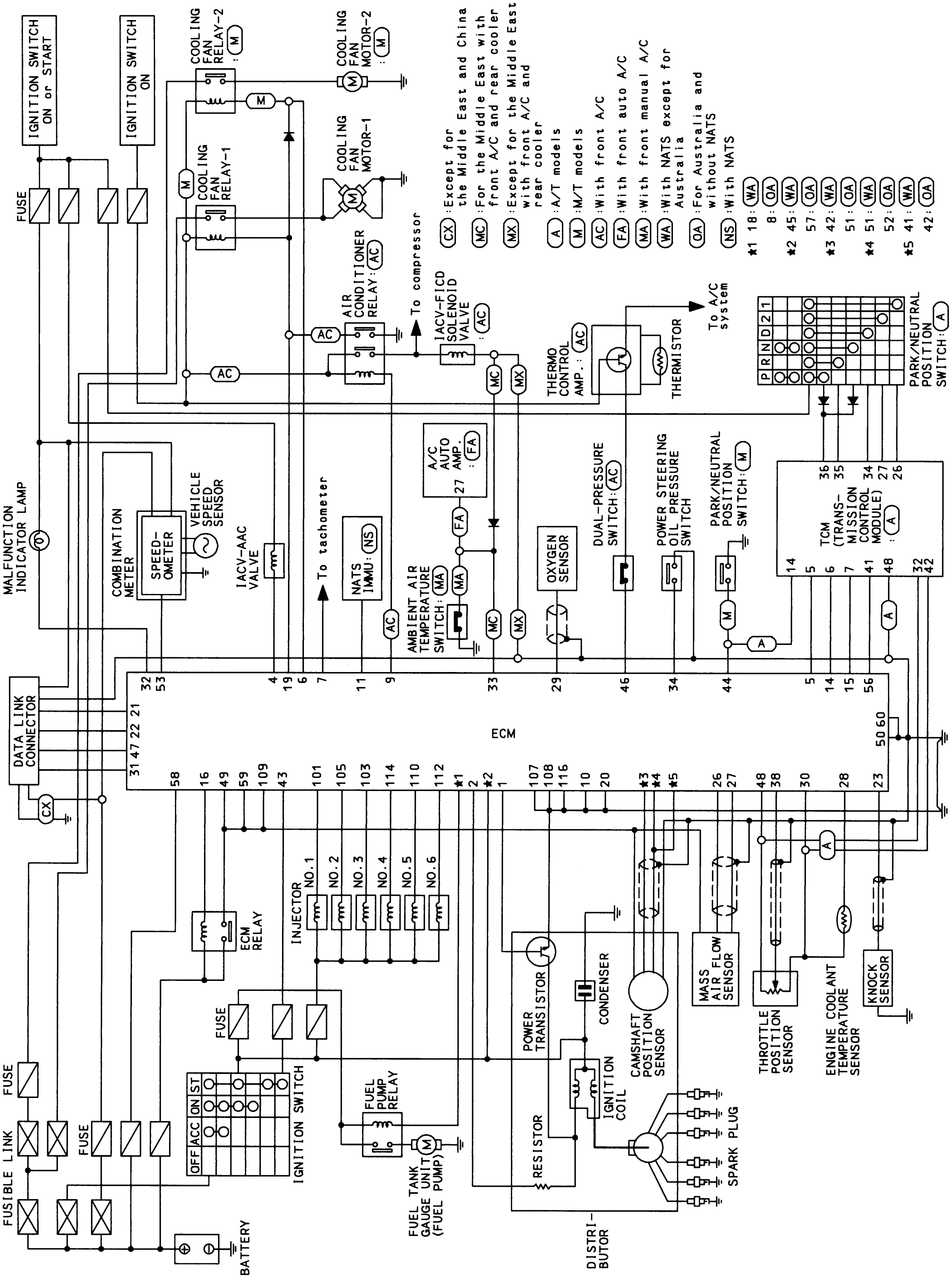
- For a frontal collision
  The Supplemental Restraint System consists of driver air bag module (located in the center of the steering wheel), front passenger air bag module (located on the instrument panel on passenger side), seat belt pre-tensioners, a diagnosis sensor unit, warning lamp, wiring harness and spiral cable.
- For a side collision
  The Supplemental Restraint System consists of front side air bag module (located in the outer side of front seat), satellite sensor, diagnosis sensor unit (one of components of air bags for a frontal collision), wiring harness, warning lamp (one of components of air bags for a frontal collision).

Information necessary to service the system safely is included in the **RS section** of this Service Manual.

WARNING:

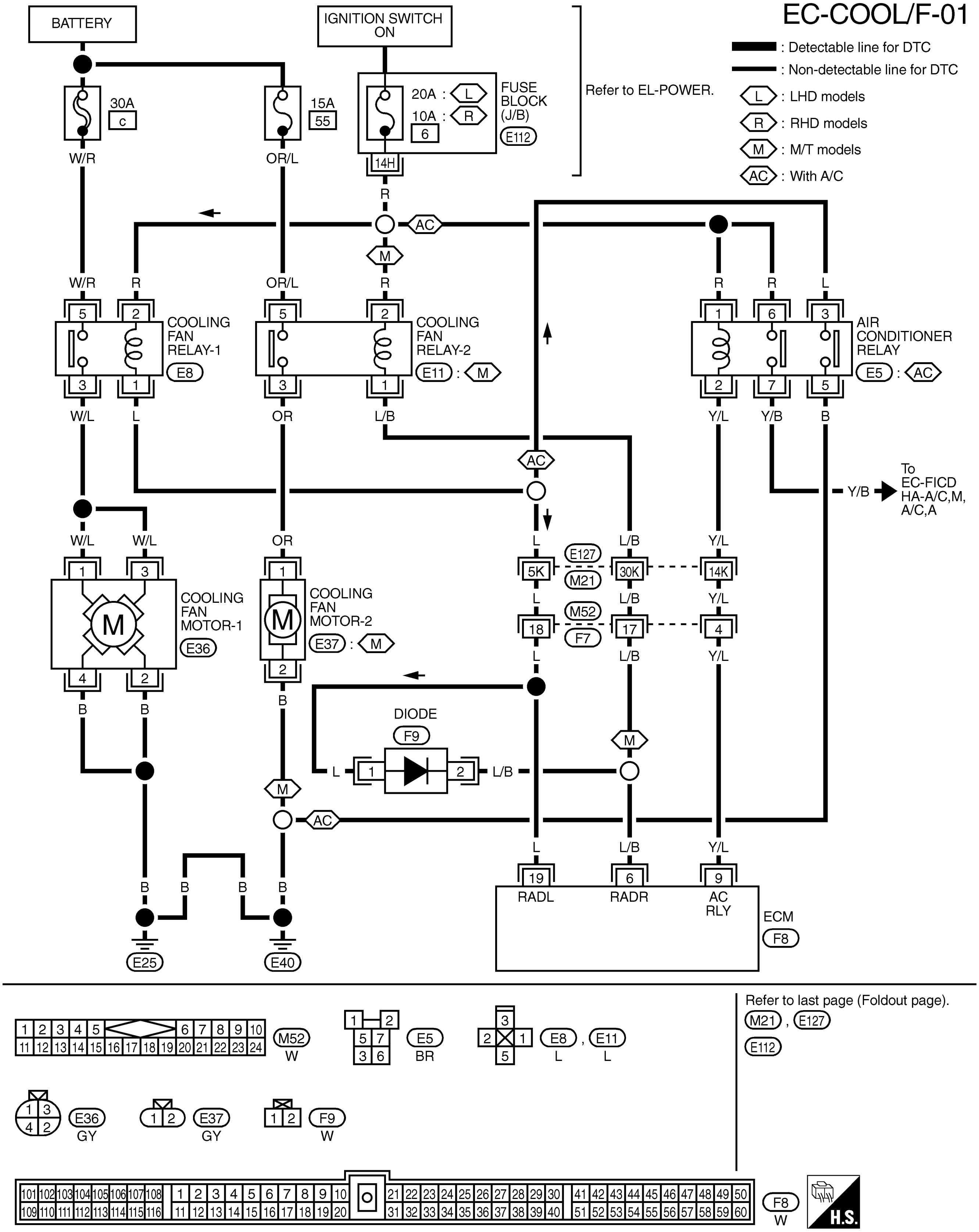
- **To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, all maintenance should be performed by an authorized NISSAN dealer.**
- **Improper maintenance, including incorrect removal and installation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

Circuit Diagram



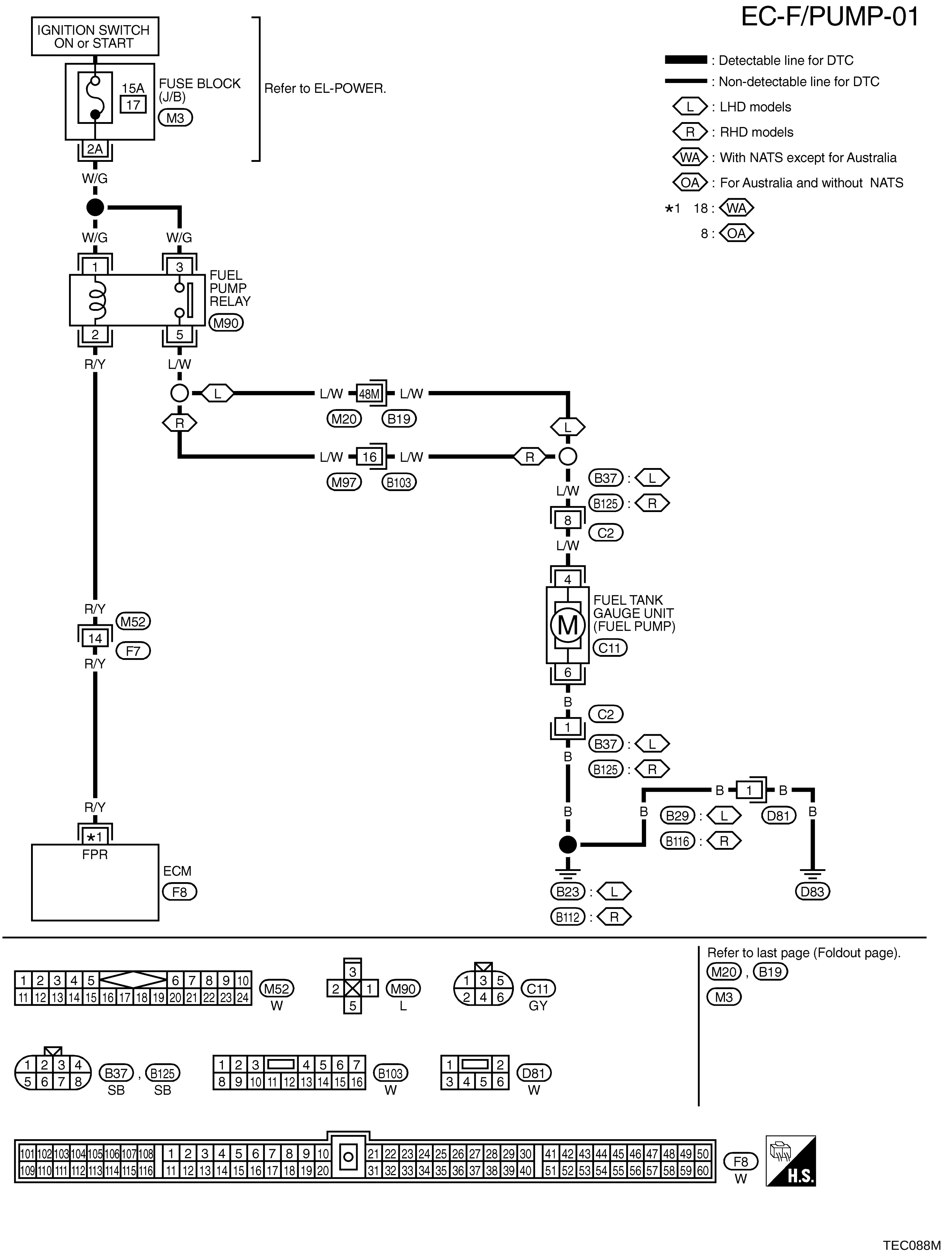
TEC087M

Cooling Fan Control (Overheat)

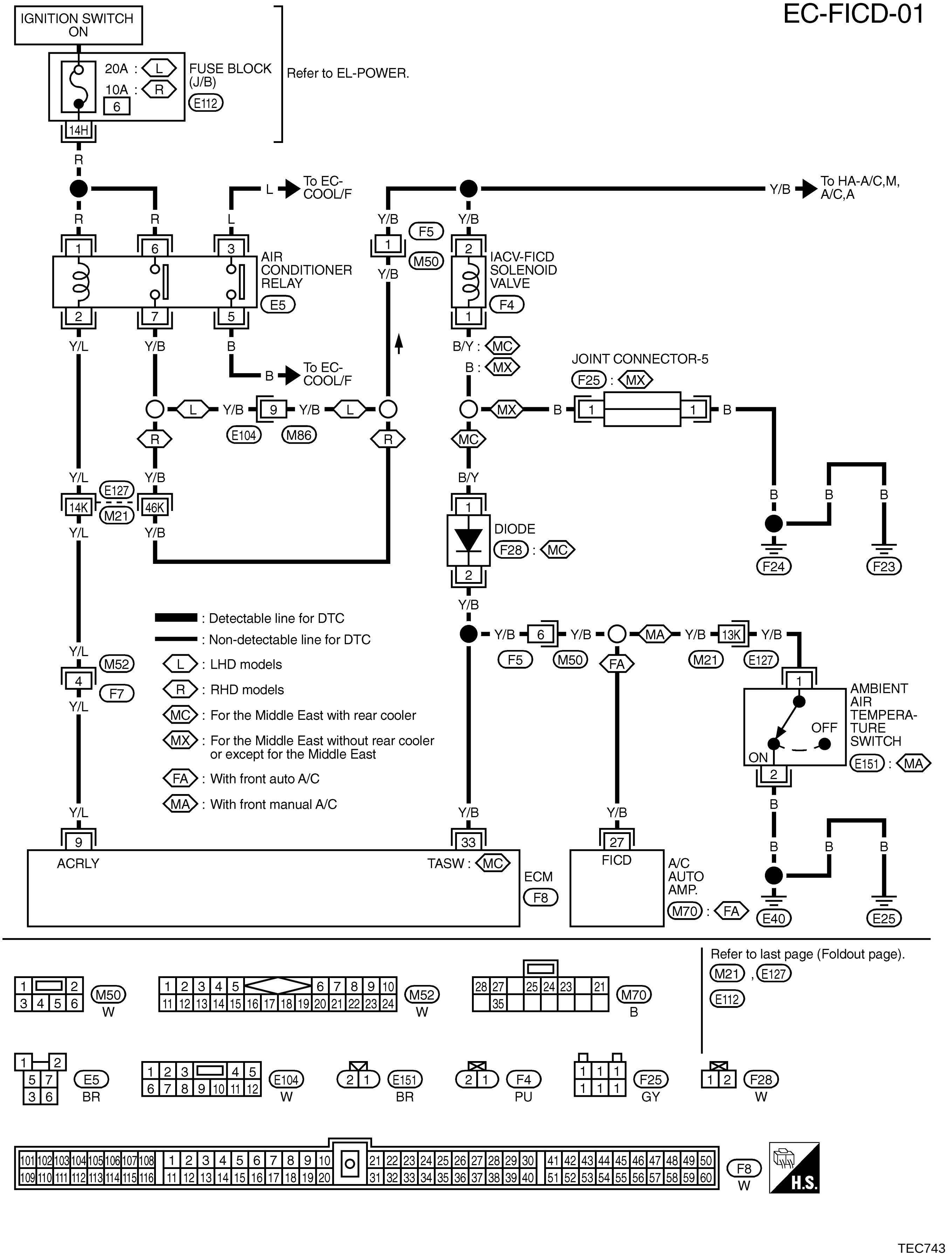


TEC736

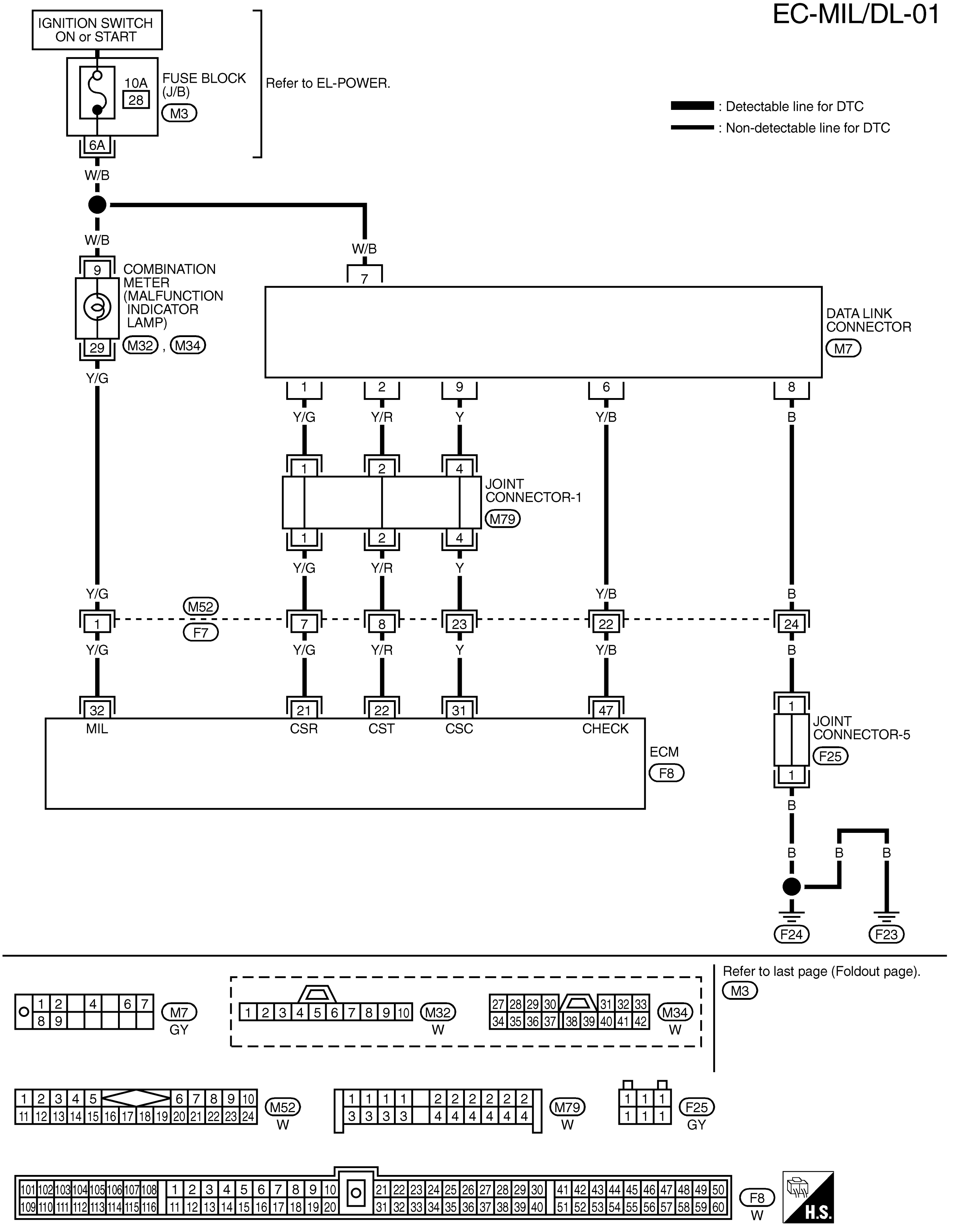
Fuel Pump


EC-F/PUMP-01
: Detectable line for DTC
: Non-detectable line for DTC
L : LHD models
R : RHD models
WA : With NATS except for Australia
OA : For Australia and without NATS
*1 18 : WA
8 : OA
IGNITION SWITCH ON or START
15A
17
FUSE BLOCK (J/B)
M3
2A
Refer to EL-POWER.
W/G
W/G
W/G
1
3
FUEL PUMP RELAY
M90
2
5
R/Y
L/W
L
L/W
48M
L/W
M20
B19
R
L/W
16
L/W
M97
B103
L
R
B37 : L
B125 : R
L/W
8
C2
L/W
4
FUEL TANK GAUGE UNIT (FUEL PUMP)
C11
6
B
C2
1
B37 : L
B125 : R
B
B
B
1
B
B
B29 : L
B116 : R
D81
B
B23 : L
B112 : R
D83
R/Y
M52
14
F7
R/Y
R/Y
*1
FPR
ECM
F8
Refer to last page (Foldout page).
M20, B19
M3
M52 W
M90 L
C11 GY
B37, B125 SB SB
B103 W
D81 W
F8 W
H.S.
TEC088M

IACV-FICD Solenoid Valve

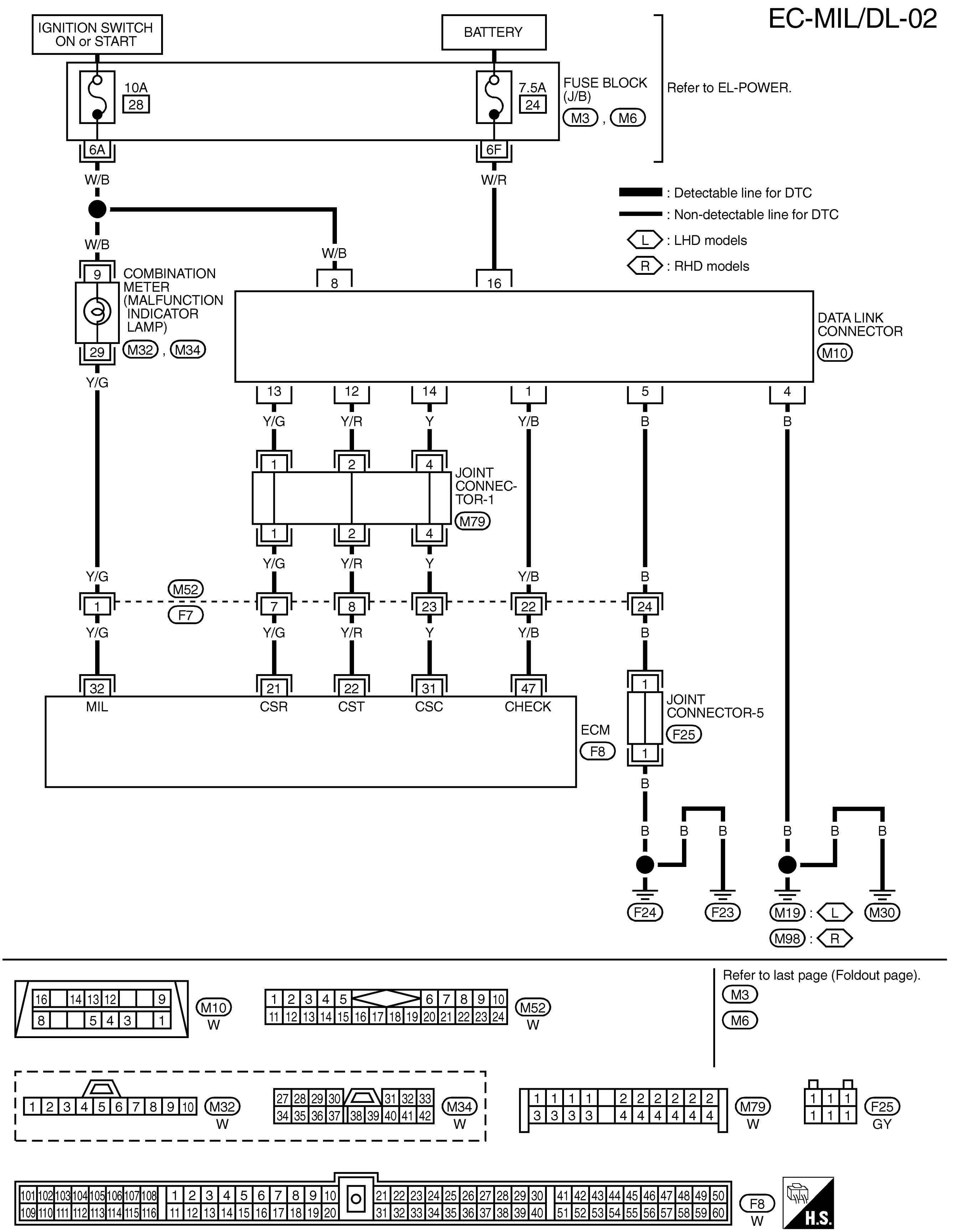


MIL & Data Link Connectors



TEC089M

MIL & Data Link Connectors (Cont'd)



GI
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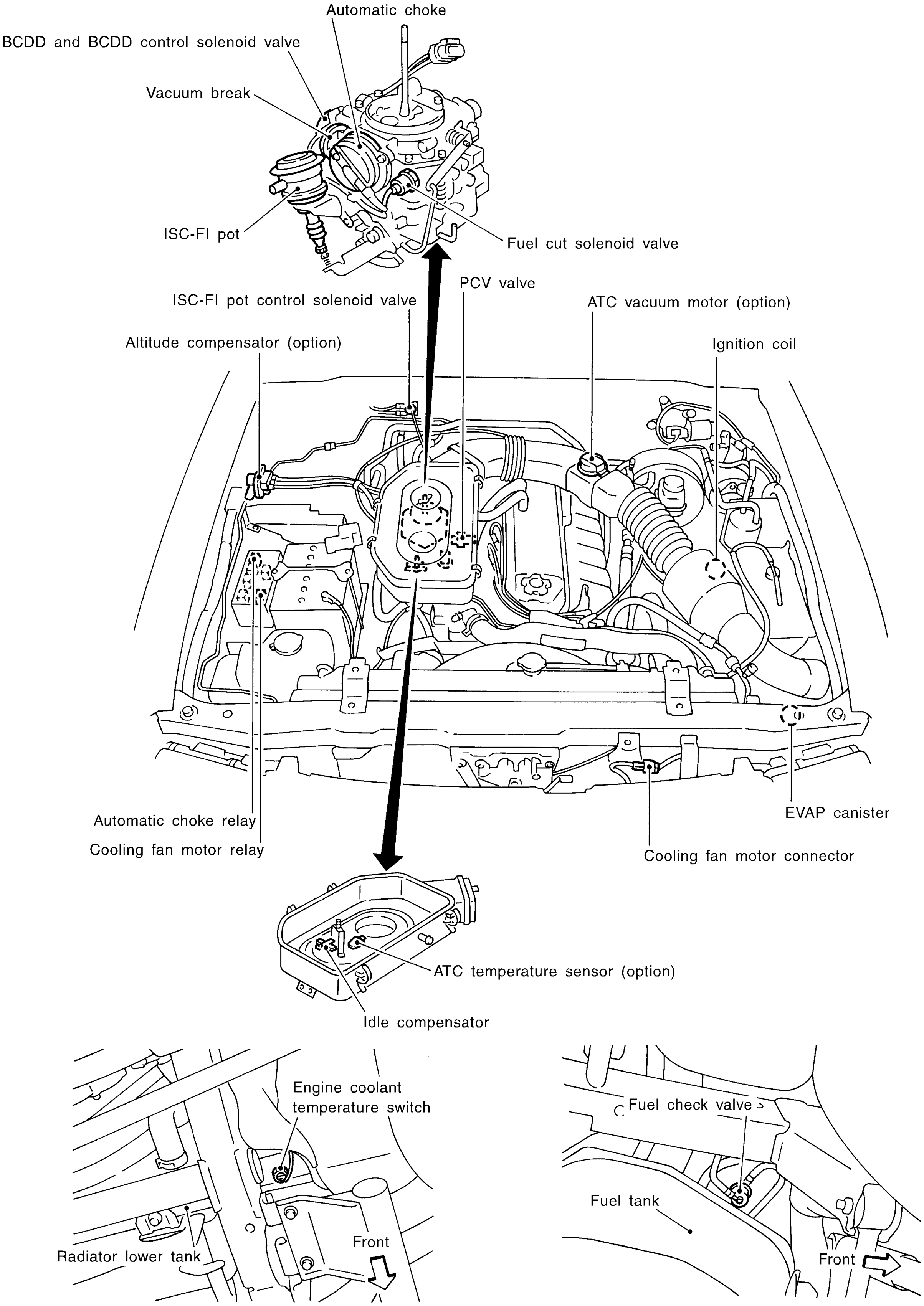
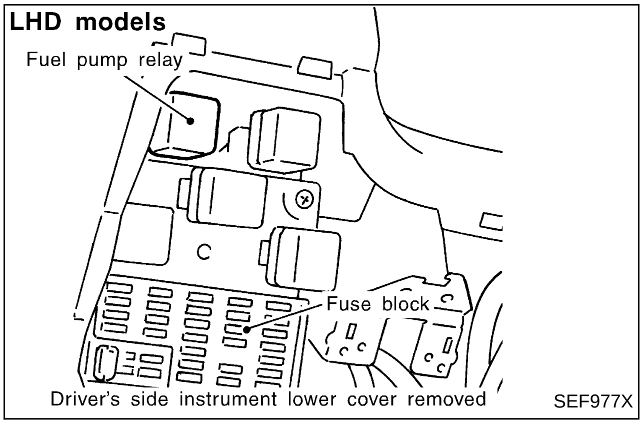
SE
IDX

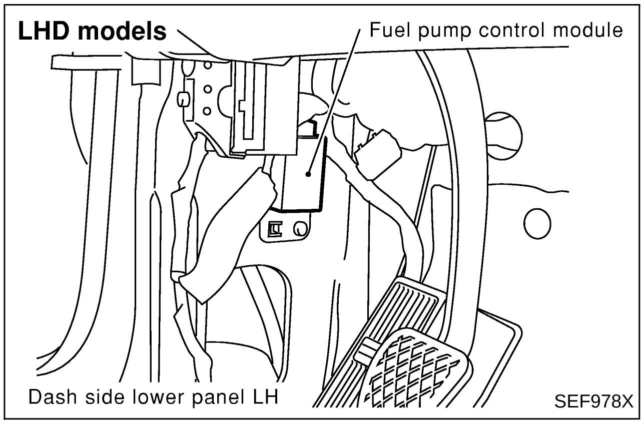
Component Parts Location


Automatic choke
BCDD and BCDD control solenoid valve
Vacuum break
ISC-FI pot
Fuel cut solenoid valve
PCV valve
ISC-FI pot control solenoid valve
ATC vacuum motor (option)
Altitude compensator (option)
Ignition coil
Automatic choke relay
Cooling fan motor relay
EVAP canister
Cooling fan motor connector
ATC temperature sensor (option)
Idle compensator
Engine coolant temperature switch
Radiator lower tank
Front
Fuel check valve
Fuel tank
Front

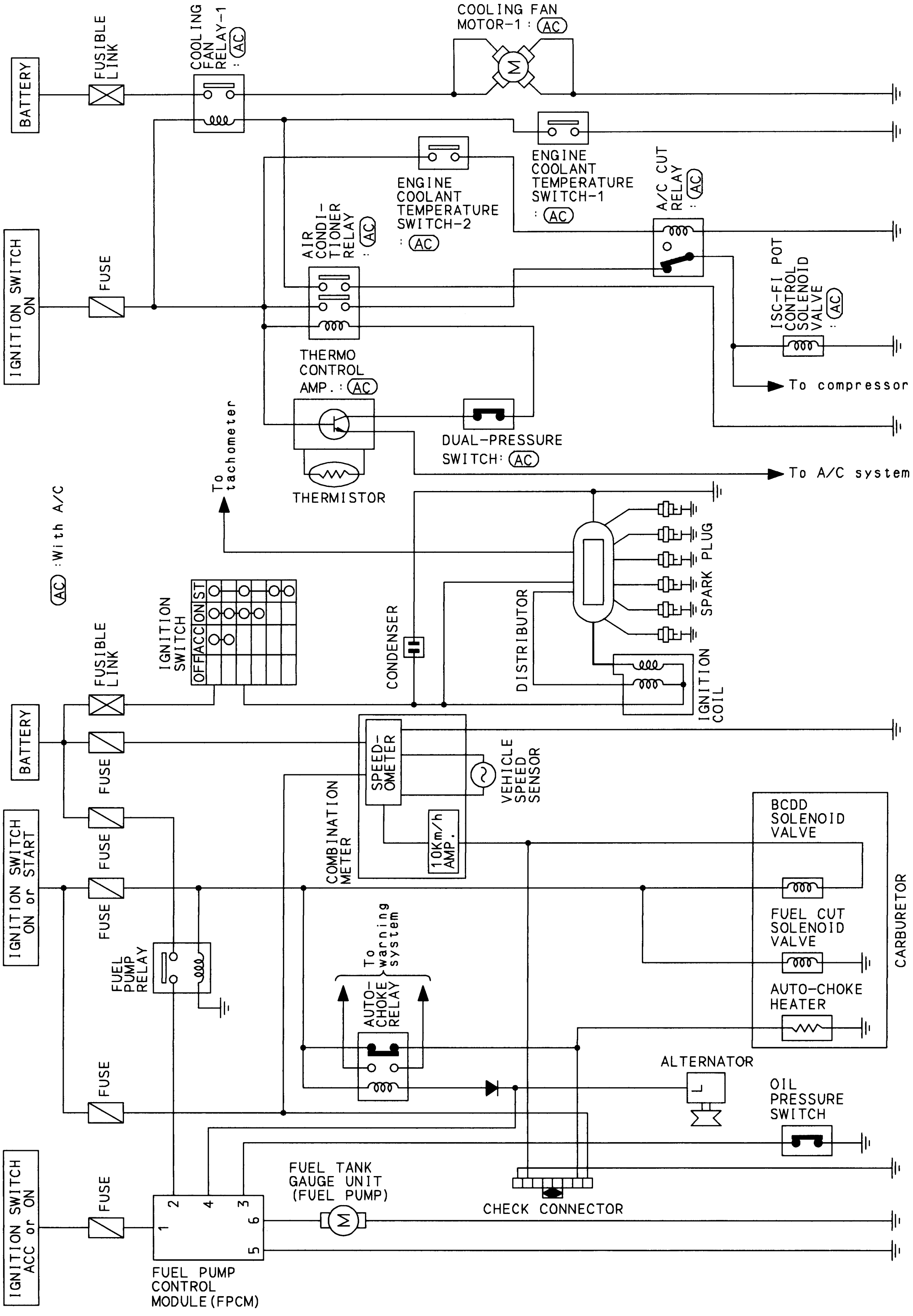
SEF976X

Component Parts Location (Cont'd)





Circuit Diagram



TEC738

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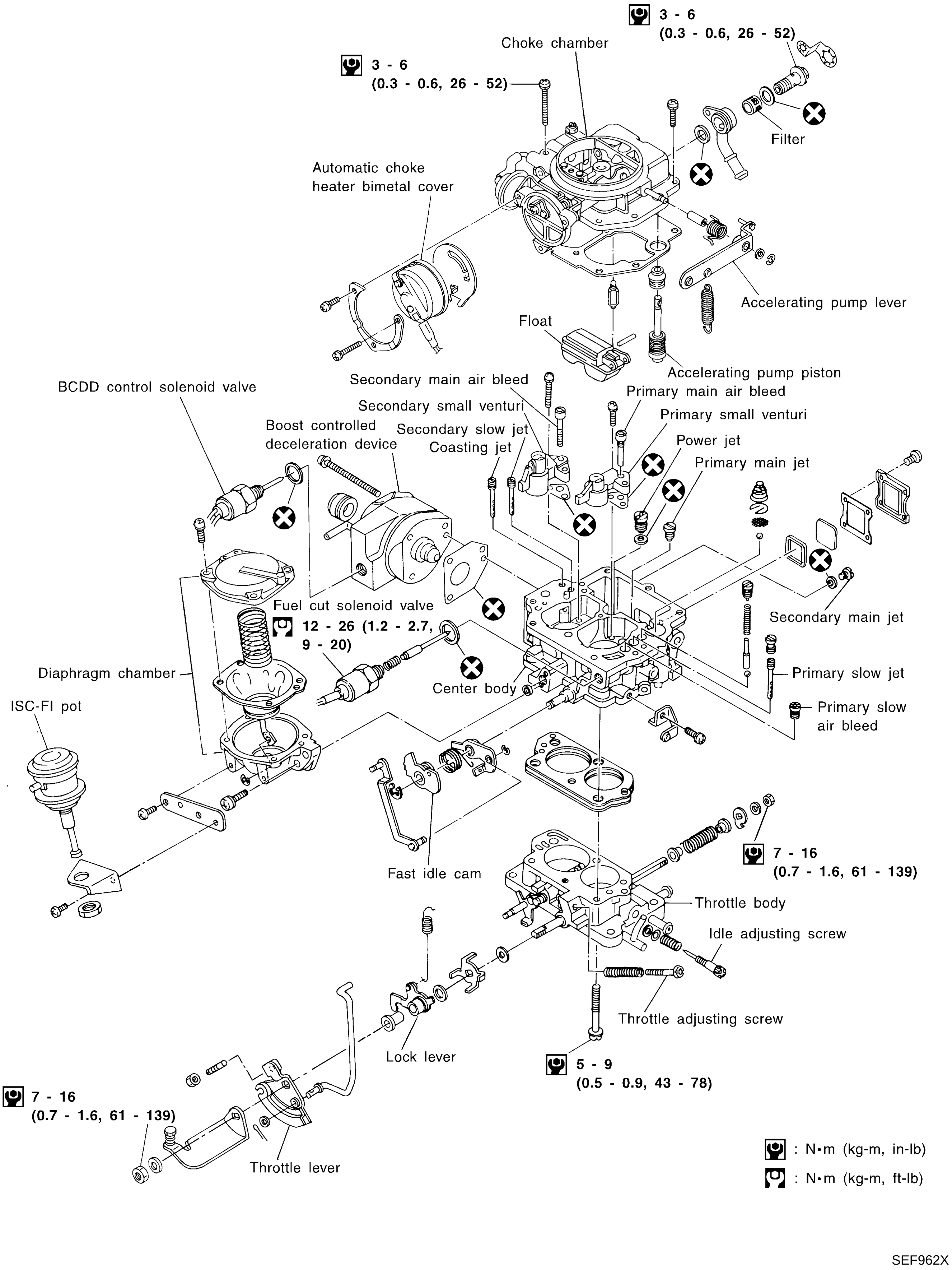
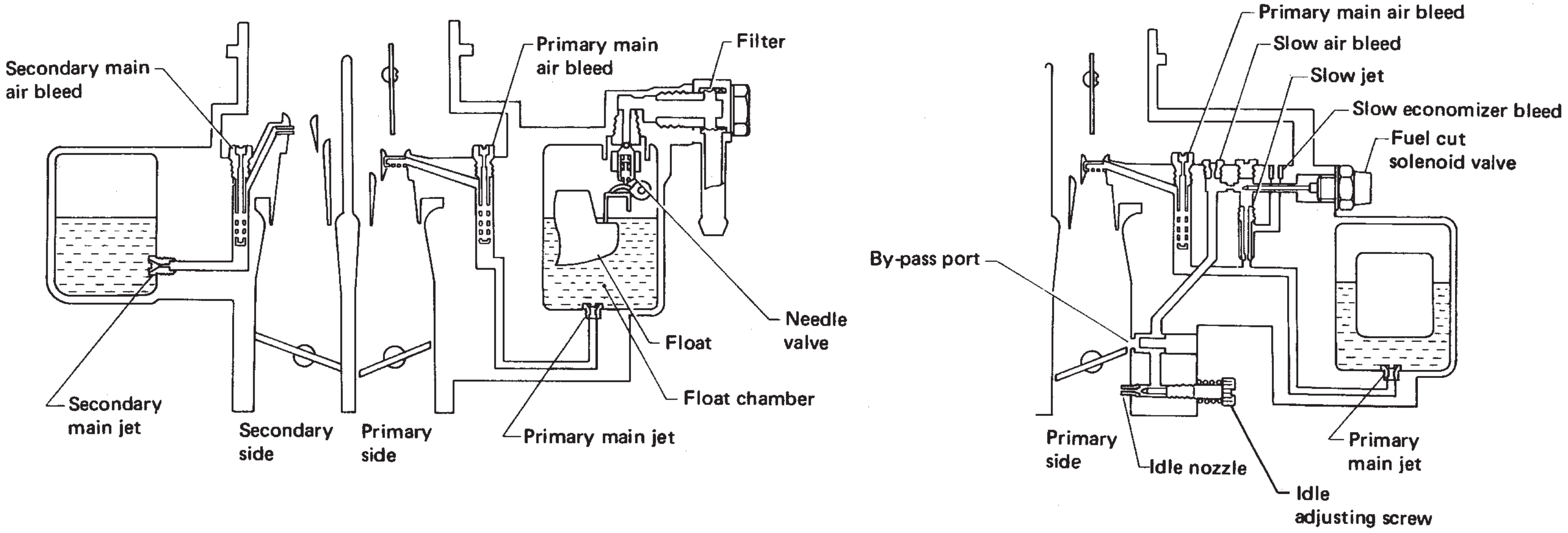
Construction

SEC. 160



SEF962X

Construction (Cont'd)



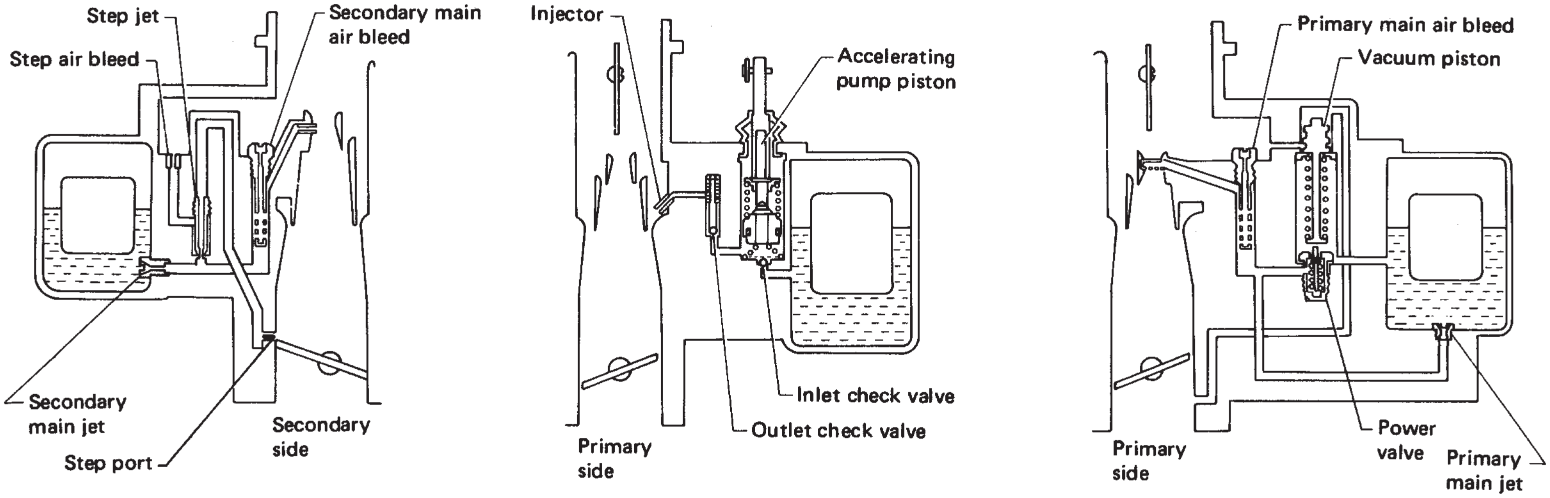
Main system

Slow system

Step system

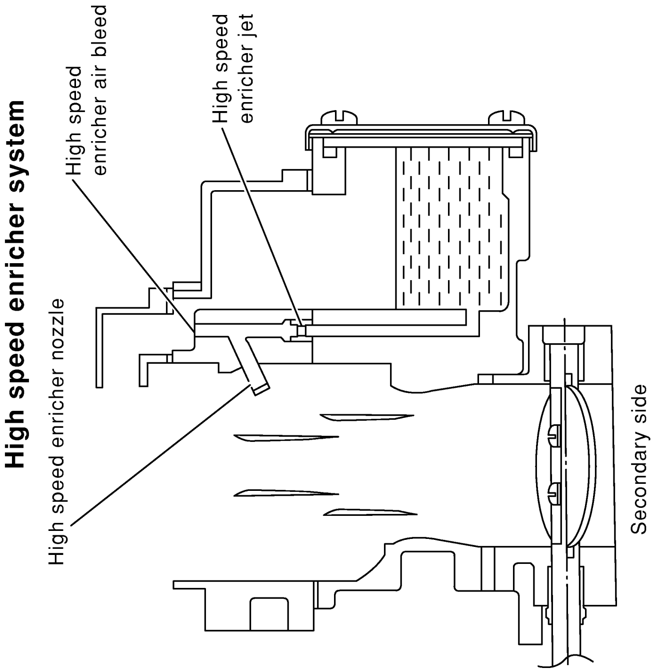
Accelerating pump system

Power valve system



SEF649G

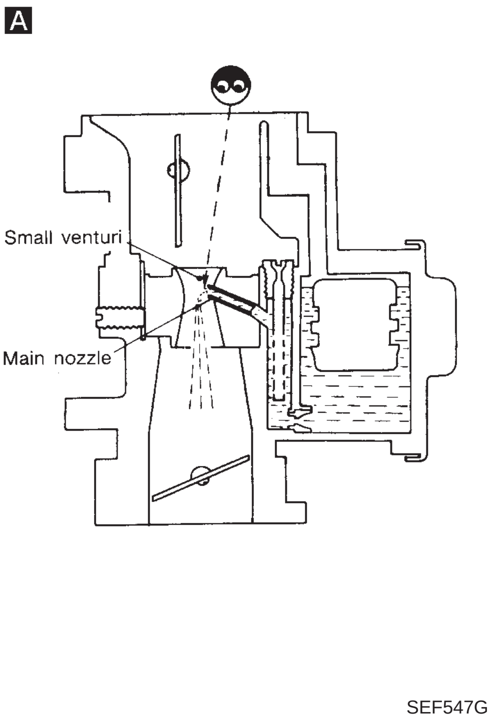
Construction (Cont’d)


High speed enricher system
High speed enricher nozzle
High speed enricher air bleed
High speed enricher jet
Secondary side

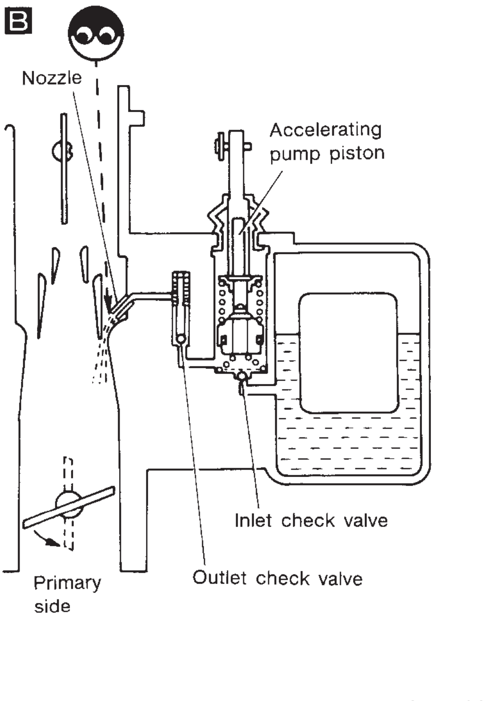
SEF963X

Fuel Level

INSPECTION



SEF547G



SEF548G

Disconnect ignition wire between distributor and ignition coil.

↓

Disconnect fuel cut solenoid valve connector of carburetor.

↓

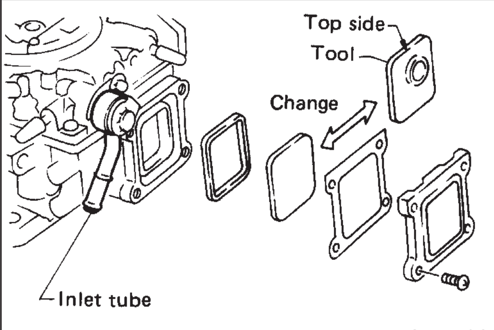
A Check primary main nozzle to ensure that no fuel is discharging while cranking engine for approximately 3 seconds.

- NG → Check needle valve for looseness or sticking. If necessary, repair or replace. Adjust fuel level.
- OK ↓

B Check that acceleration pump nozzle injects fuel when throttle valve is opened.

- NG → Check needle valve for looseness or sticking. If necessary, repair or replace. Adjust fuel level.
- OK ↓

END



SEF453G

If necessary, use Tool to visually check fuel level as follows:

1. Disconnect inlet fuel hose from carburetor, and plug opening.
2. Start engine and wait for it to stop.
3. Install Tool on carburetor, as shown.

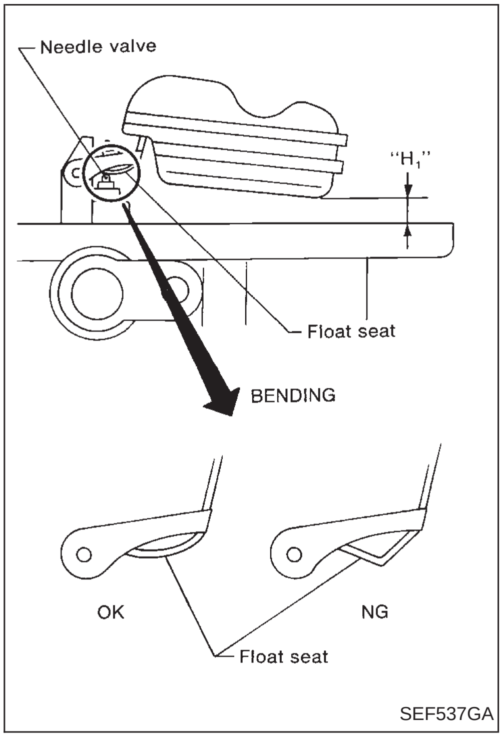
Be careful not to spill fuel.

4. Connect inlet hose to carburetor.
5. Start engine. Visually check fuel level.

If out of specification, adjust by bending float seat and float stopper.

Fuel Level (Cont'd)

ADJUSTMENT

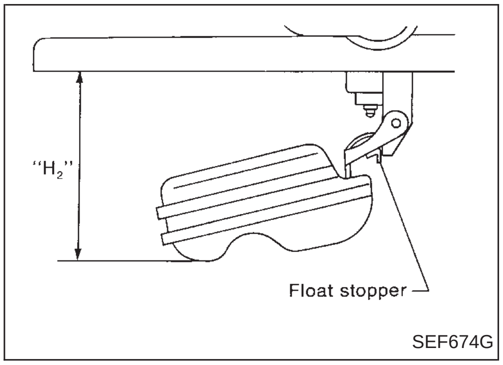


1. Remove carburetor from engine.
2. Remove float chamber cover from float chamber.
3. Turn carburetor upside down, and fix it horizontally.
4. Raise float fully, then lower it slowly until float seat contacts needle valve, and in this position, check height "H_1".

   Height "H_1":

   7.0 - 8.0 mm (0.276 - 0.315 in)

- **If out of specification, adjust by bending float seat. Make sure needle valve slides smoothly on float seat.**



5. Lower float slowly until float stopper contacts carburetor, and in this position, check height "H_2".

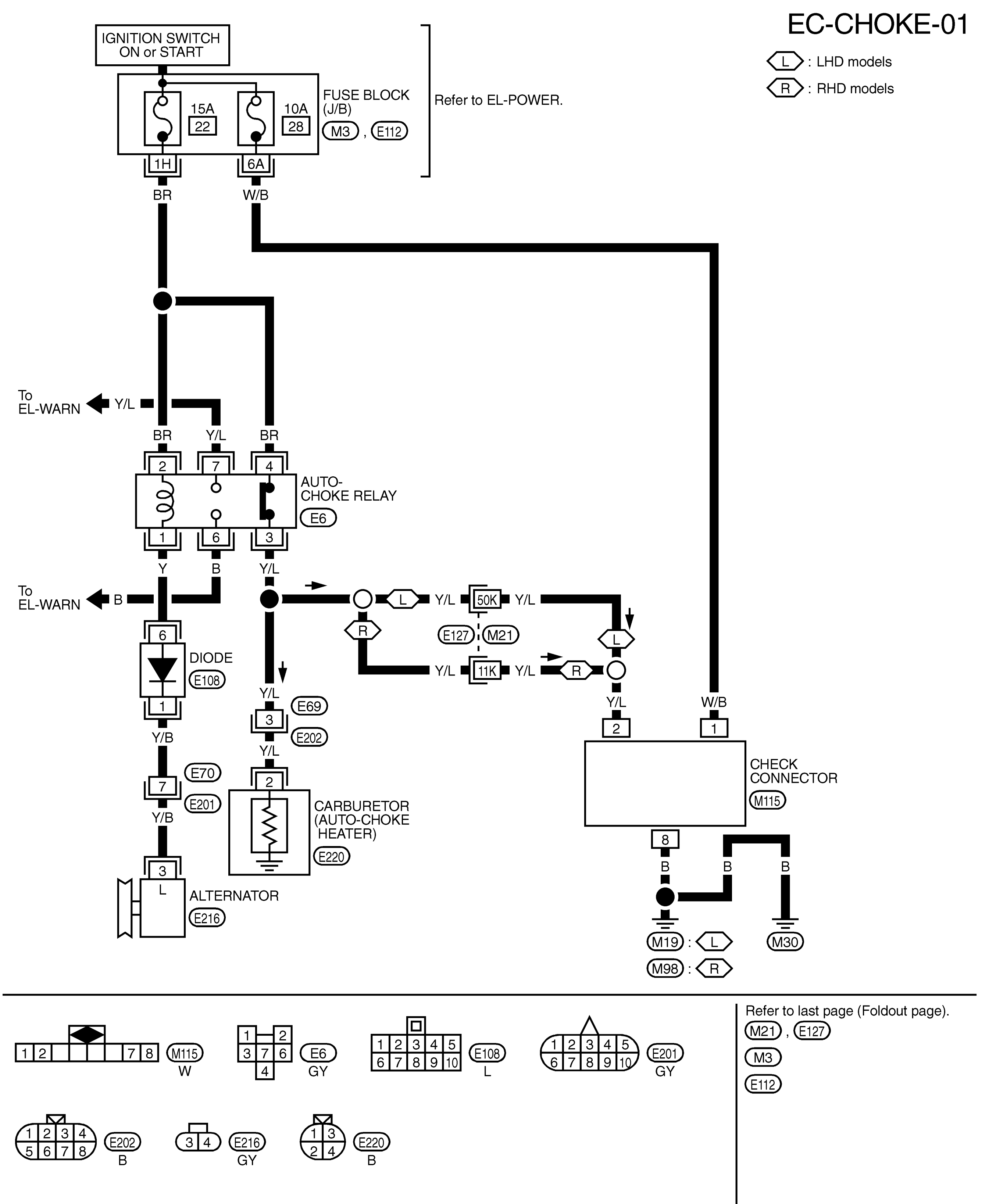
   Height "H_2":

   44.5 - 45.5 mm (1.752 - 1.791 in)

If out of specification, adjust by bending float stopper.

6. Install choke chamber and then place carburetor on engine.
7. Perform "FUEL LEVEL INSPECTION".

Automatic Choke



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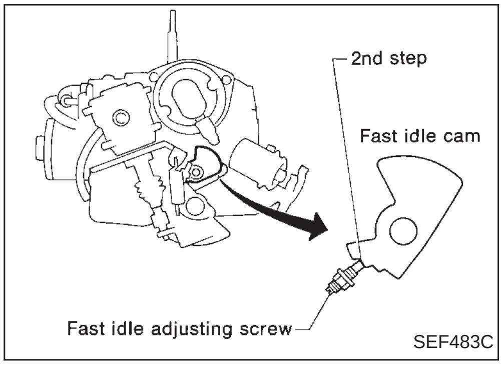


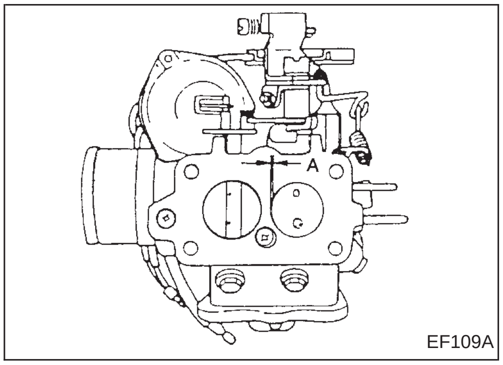
SEF483C

Fast Idle

1. Warm up engine.
2. Set fast idle arm on 2nd step of fast idle cam.
3. Check fast idle speed.

Fast idle speed (at 2nd cam step):
1,600±200 rpm

Make sure that engine is completely adjusted (idle speed, ignition timing, etc.) before checking or adjusting fast idle speed.



EF109A

4. If out of specification, remove carburetor and make fast idle adjustments as follows:
   1) Place fast idle arm on 2nd step of fast idle cam, in the same manner as in step 2. above.
   2) Adjust clearance “A” between primary throttle valve and inner carburetor wall by turning fast idle adjusting screw.

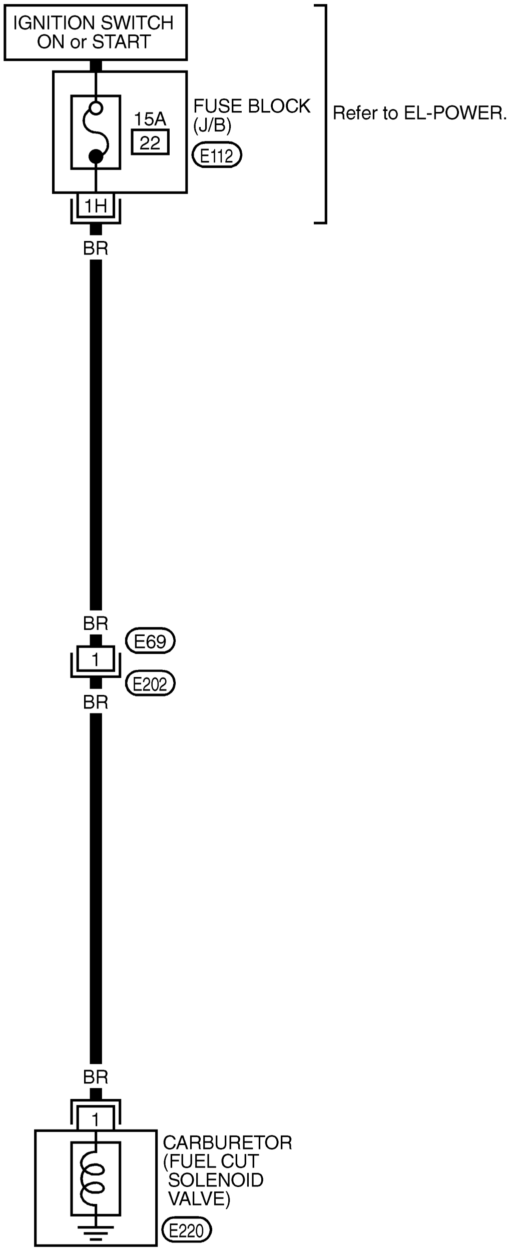
Clearance “A”:
1.37±0.14 mm (0.0539±0.0055 in)

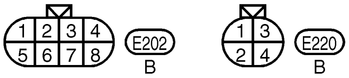
5. After adjusting clearance “A”, install carburetor on engine and check engine speed.

Following installation, do not attempt further adjustment of clearance “A” even if fast idle speed is incorrect.

Fuel Cut Control System

EC-FCUT-01





Refer to last page (Foldout page).
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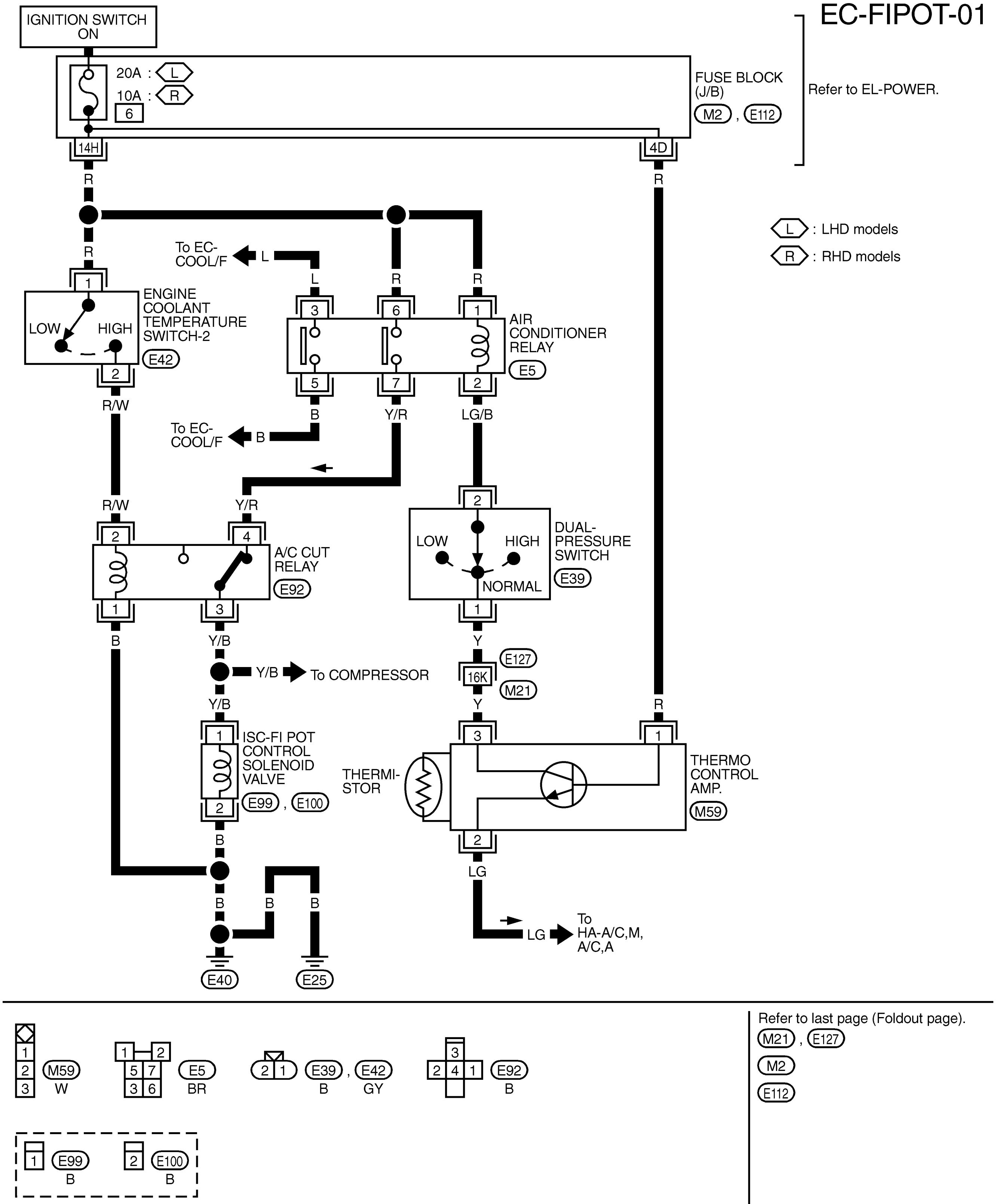
TEC745

ISC-FI Pot

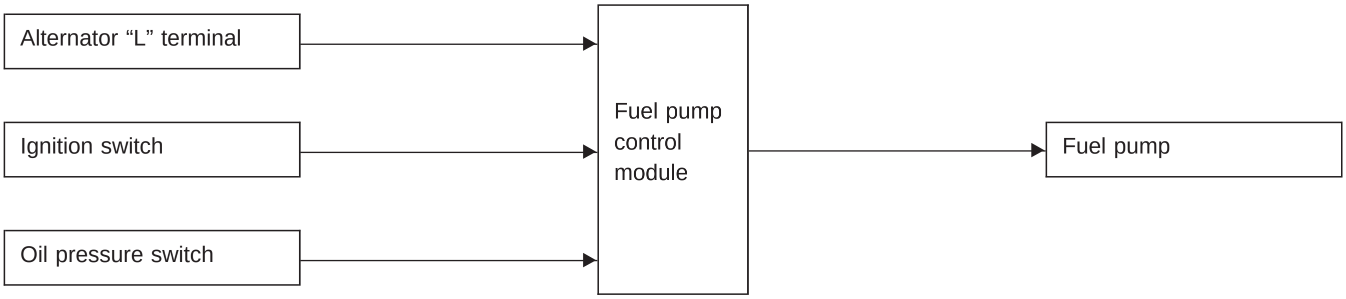


TEC746

GI
MA
EM
LC
EC
FE
CL
MT
AT
TF
PD
FA
RA
BR
ST
RS
BT
HA
EL
SE
IDX

Description

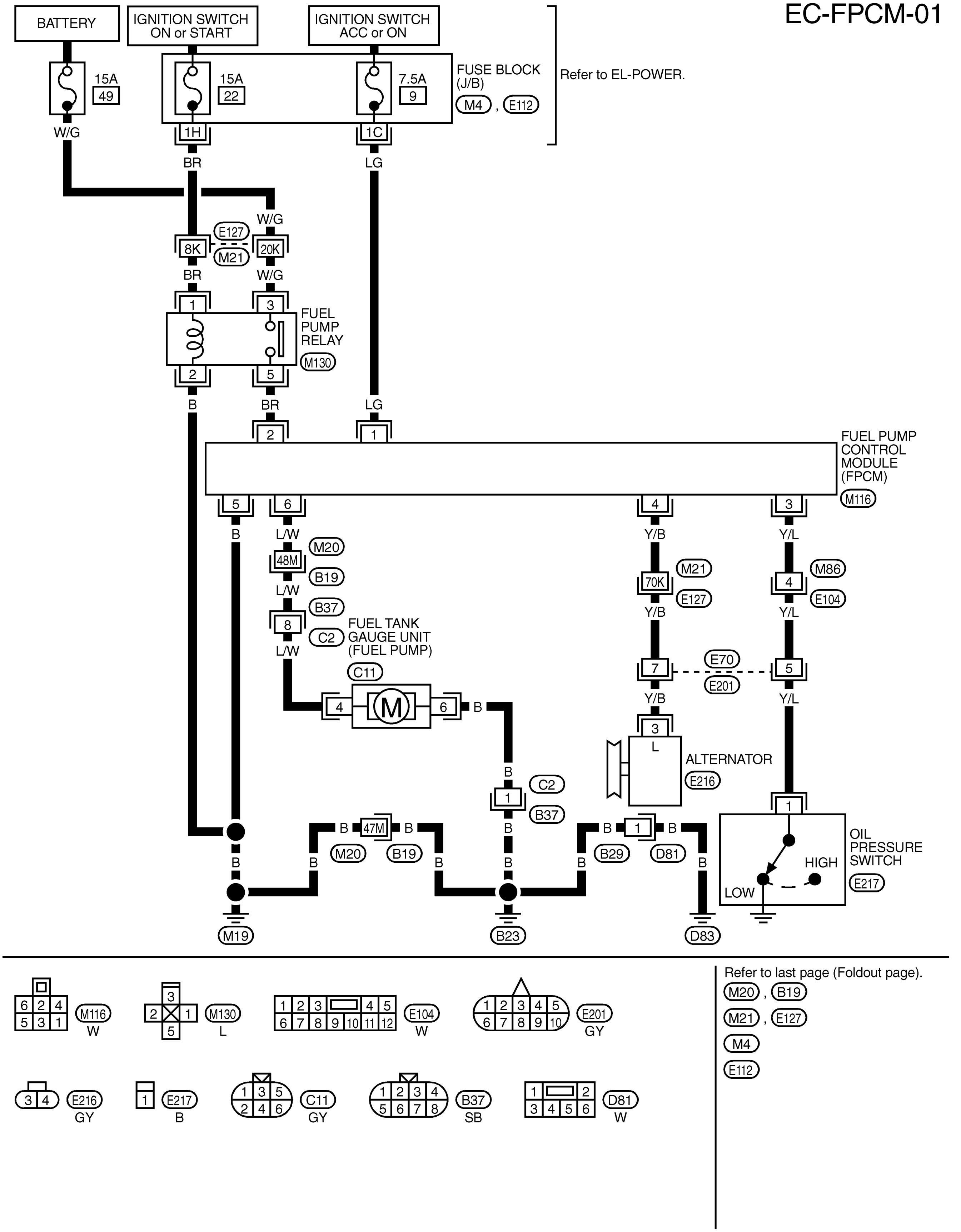
Electric fuel pump is controlled by fuel pump control module. This module drives electric fuel pump in response to the signals from alternator “L” terminal, ignition switch and oil pressure switch.



Operation

<table>
<tr><th>Ignition switch position</th><th>Engine</th><th>Alternator</th><th>Oil pressure</th><th>Fuel pump</th></tr>
<tr><td>OFF</td><td rowspan="3">Stopped</td><td rowspan="4">Not generating</td><td rowspan="3">No pressure</td><td rowspan="3">Not operating</td></tr>
<tr><td>ACC</td></tr>
<tr><td>ON</td></tr>
<tr><td rowspan="4">START</td><td rowspan="4">Cranking</td><td rowspan="2">Low pressure</td><td rowspan="7">Operating</td></tr>
<tr><td>Generating</td></tr>
<tr><td>Not generating</td><td rowspan="4">Normal</td></tr>
<tr><td rowspan="2">Generating</td></tr>
<tr><td rowspan="3">ON</td><td rowspan="3">Running</td></tr>
<tr><td>Failure</td></tr>
<tr><td>Generating</td><td>Failure</td></tr>
</table>

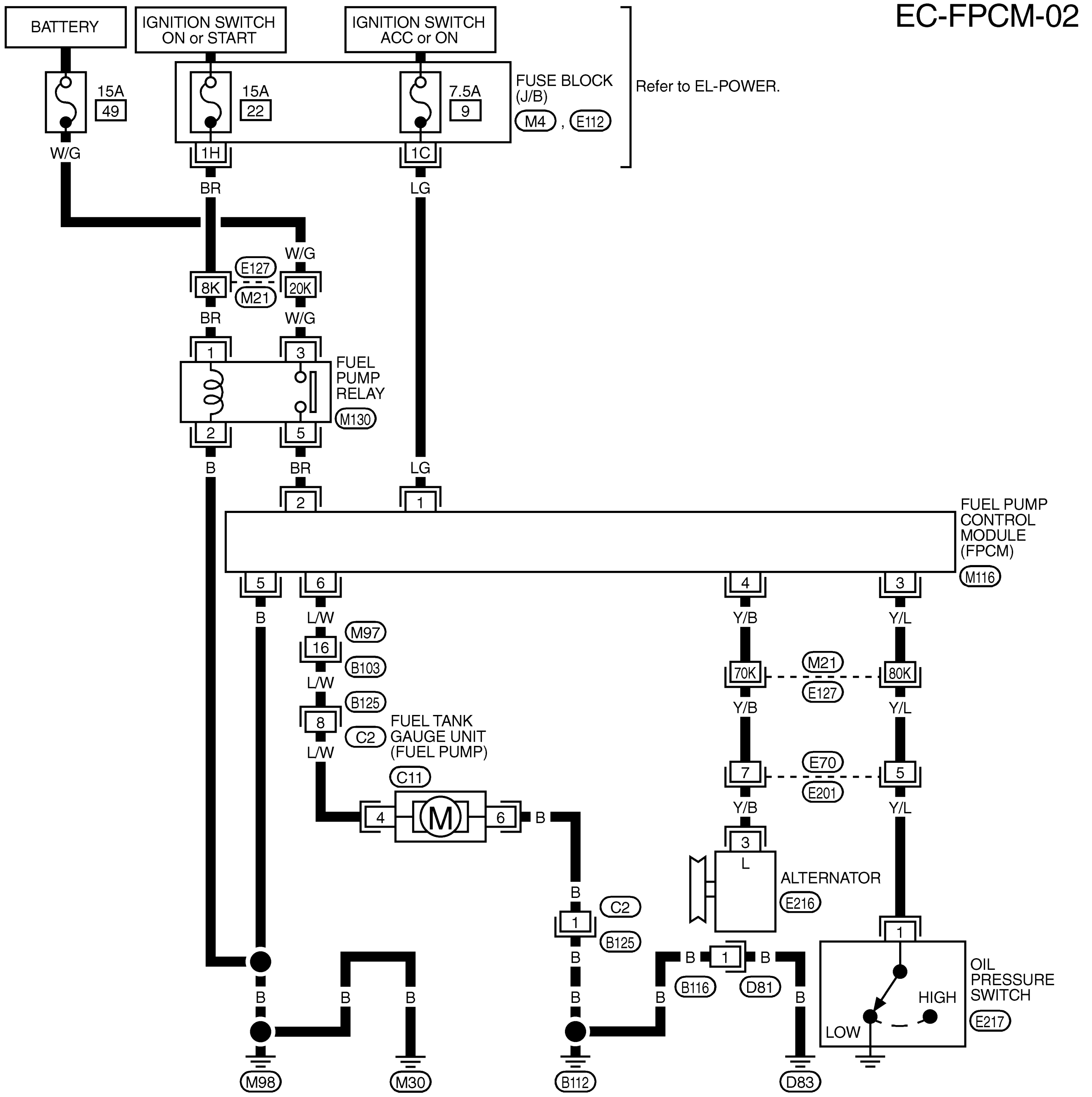
Wiring Diagram — FPCM —

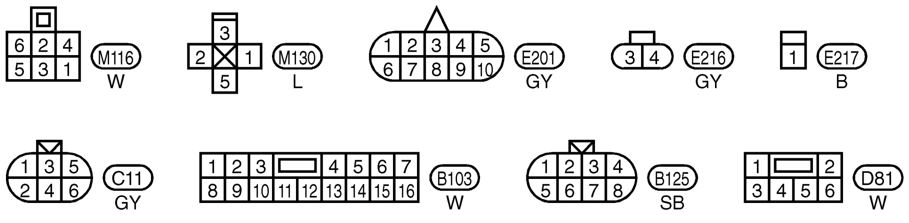


TEC739

Wiring Diagram — FPCM — (Cont'd)

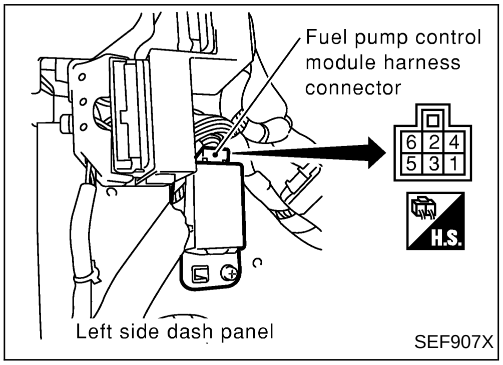
EC-FPCM-02





Refer to last page (Foldout page).
M21 , E127
M4
E112

TEC092M



Inspection

Fuel pump control module is located under the left side of dash panel.
Check input signals in each terminal of fuel pump control module, following the table shown below.

INPUT SIGNAL CHECK

Check terminals			Condition	Circuit tester	
	+	−		Range	Reading
Ground	⑤	Body earth	—	Ω	0Ω
Battery (ON or START)	②		Ignition switch “ON”	V	Battery voltage
			Ignition switch “START*”		
Battery (ACC or ON)	①		Ignition switch “ON”		
			Ignition switch “START*”		0V
Alternator “L” terminal	④		Engine running		Battery voltage
			Engine stopped		0V
Oil pressure switch	③		Engine running		Battery voltage
			Engine stopped		0V

*: Disconnect starter motor “S” terminal before turning ignition switch “START”.

If NG, check harness continuity between fuel pump control module and each component, or check each component individually. If OK, perform fuel pump control module check.

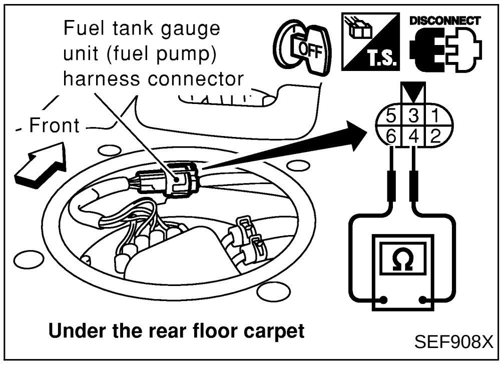
FUEL PUMP CONTROL MODULE CHECK

- **First, disconnect starter motor “S” terminal.**
- **This check should be performed without starting engine.**

Step	Condition			Output voltage of terminal ⑥
	Alternator “L” terminal	Oil pressure switch terminal	Ignition switch	
1	Connected	Connected	OFF	0V
2			ACC	
3			ON	
4			START	Battery voltage
5	Disconnected		ON	
6			START	
7		Disconnected	ON	
8			START	
9	Connected		ON	
10			START	

If NG, replace fuel pump control module.

Inspection (Cont’d)


Fuel tank gauge unit (fuel pump) harness connector
Front
OFF
T.S.
DISCONNECT
5 3 1
6 4 2
Ω
Under the rear floor carpet
SEF908X

FUEL PUMP

1) Make sure that ignition switch is “OFF”.
2) Disconnect fuel pump harness connector.
3) Check resistance between fuel pump connector terminals ④ and ⑥ .

Resistance: Approximately 0.2 - 5Ω

FUEL PRESSURE CHECK

WARNING:

- **Keep flammables away during the test.**
- **For safety, the test must be completed in as short a time as possible.**

1. Connect a suitable fuel pressure gauge.
2. Check fuel pressure.

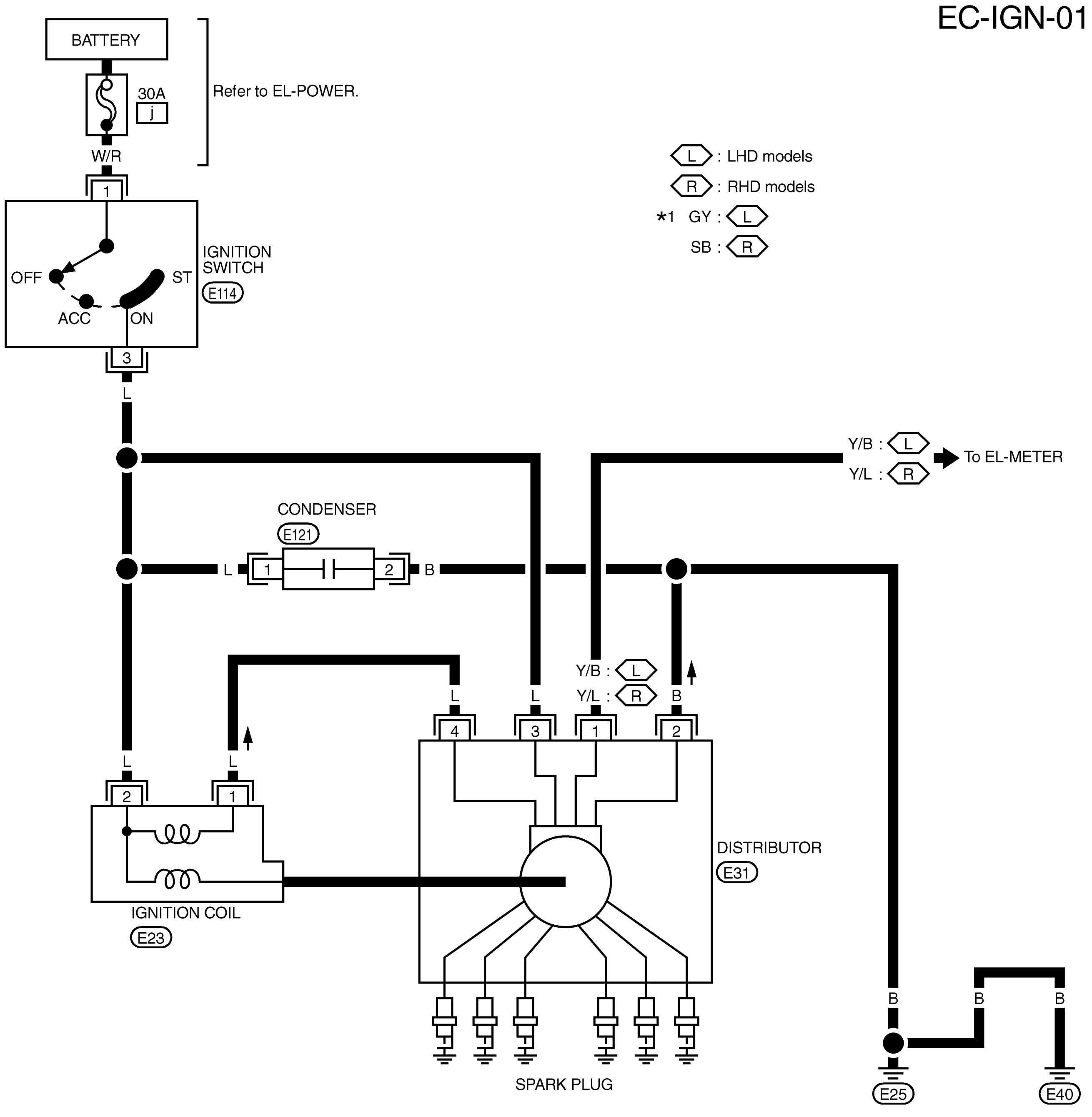
Fuel pressure (Approximately):

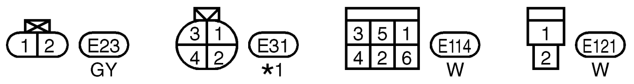
14.7 kPa (0.147 bar, 0.15 kg/cm^2, 2.1 psi)

If out of specification, check for fuel filter clogging or improper fuel pump operation.

Wiring Diagram — IGN —

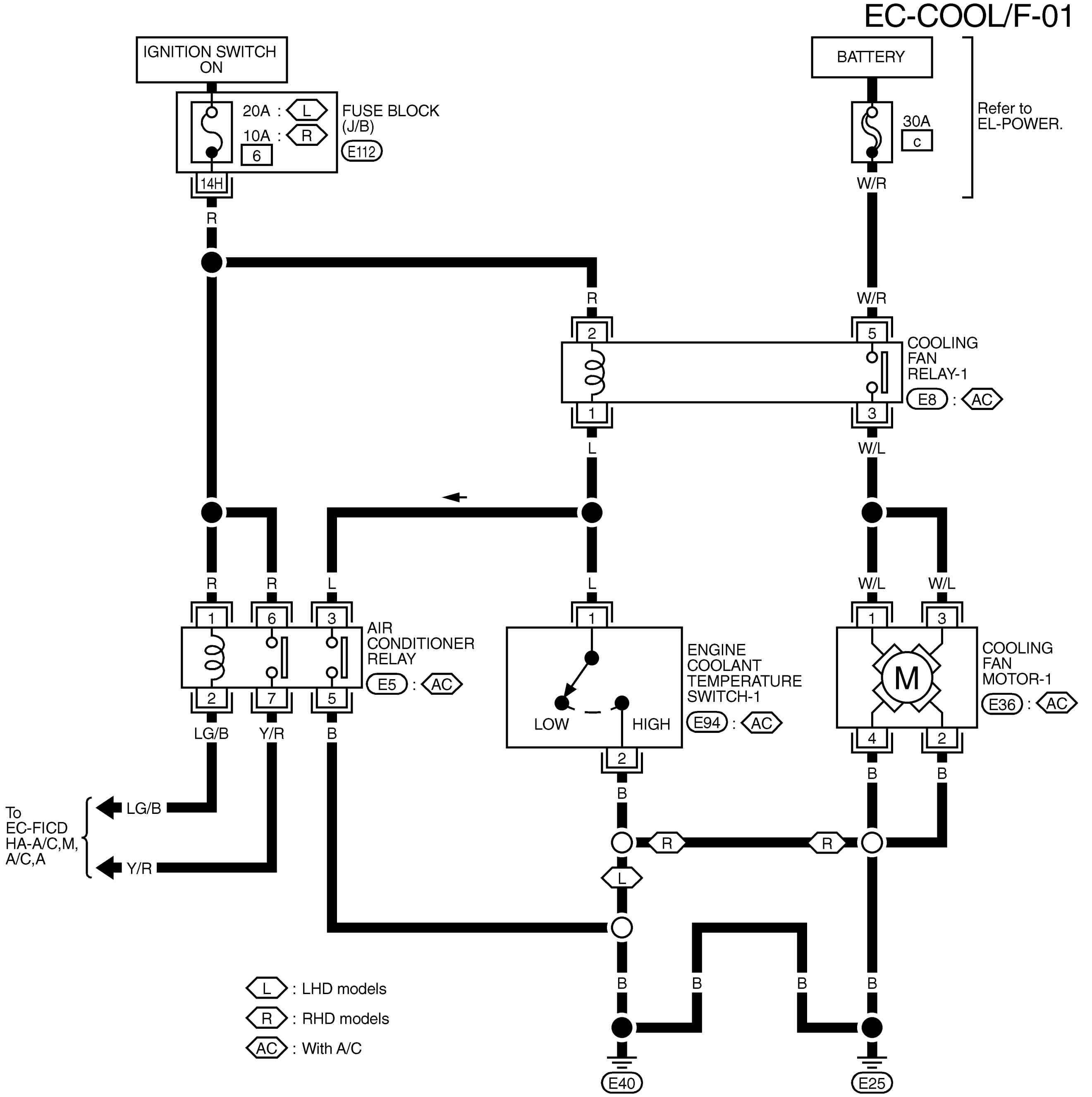
PICKUP MODELS

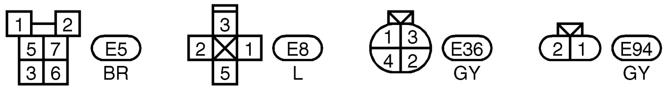




TEC091M

Wiring Diagram — COOL/F —

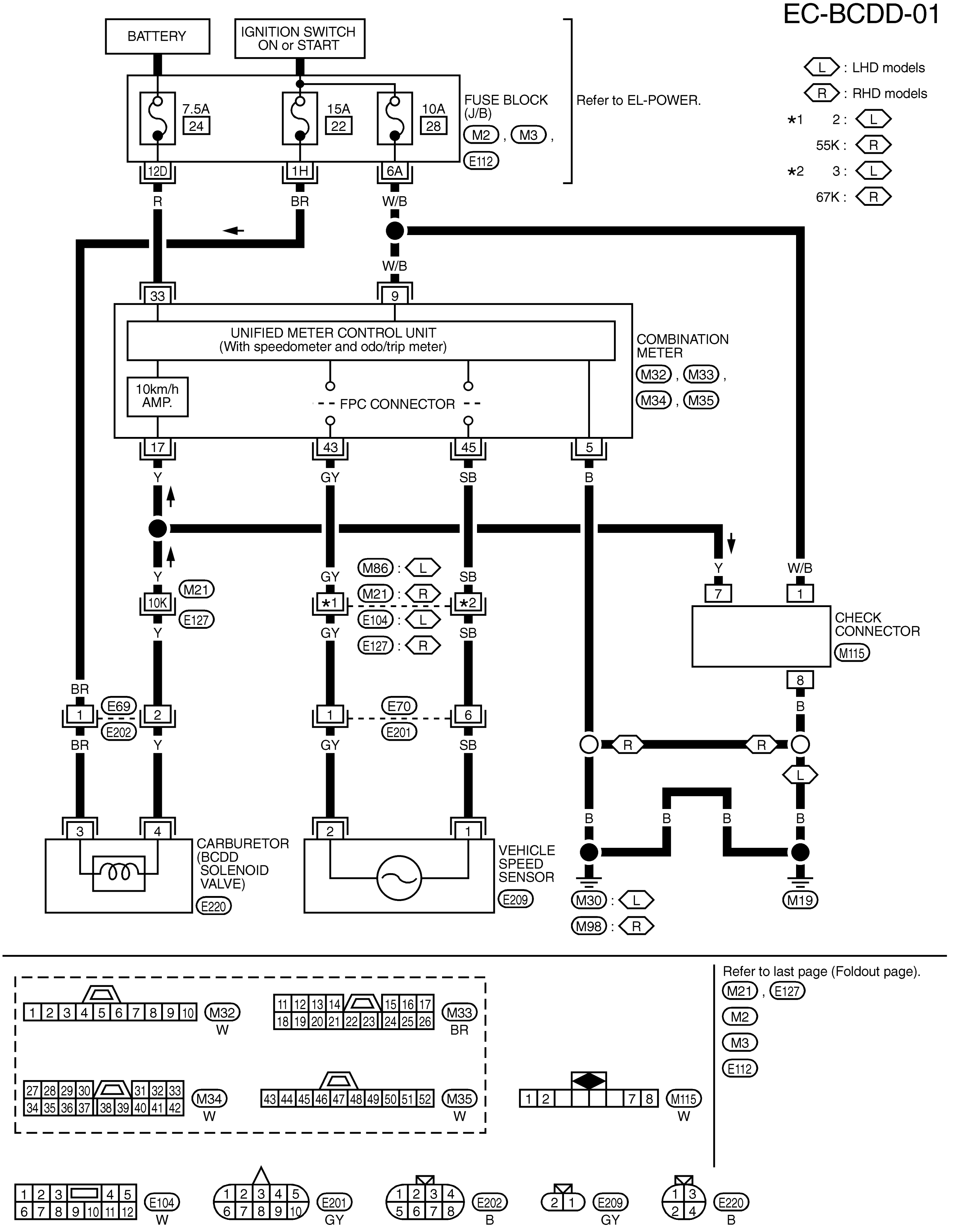




Refer to last page (Foldout page).
E112

TEC747

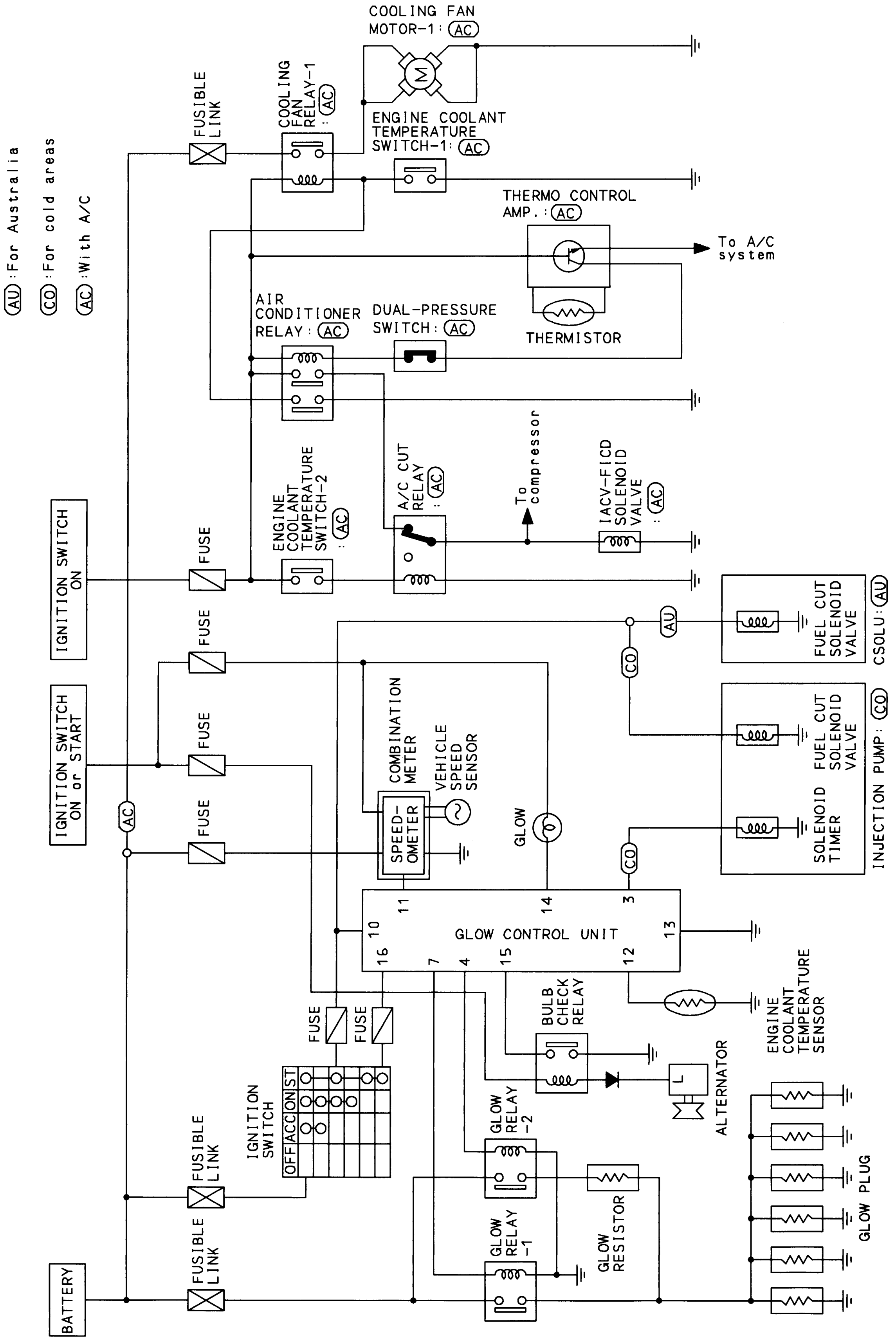
Boost Controlled Deceleration Device (BCDD)



TEC748

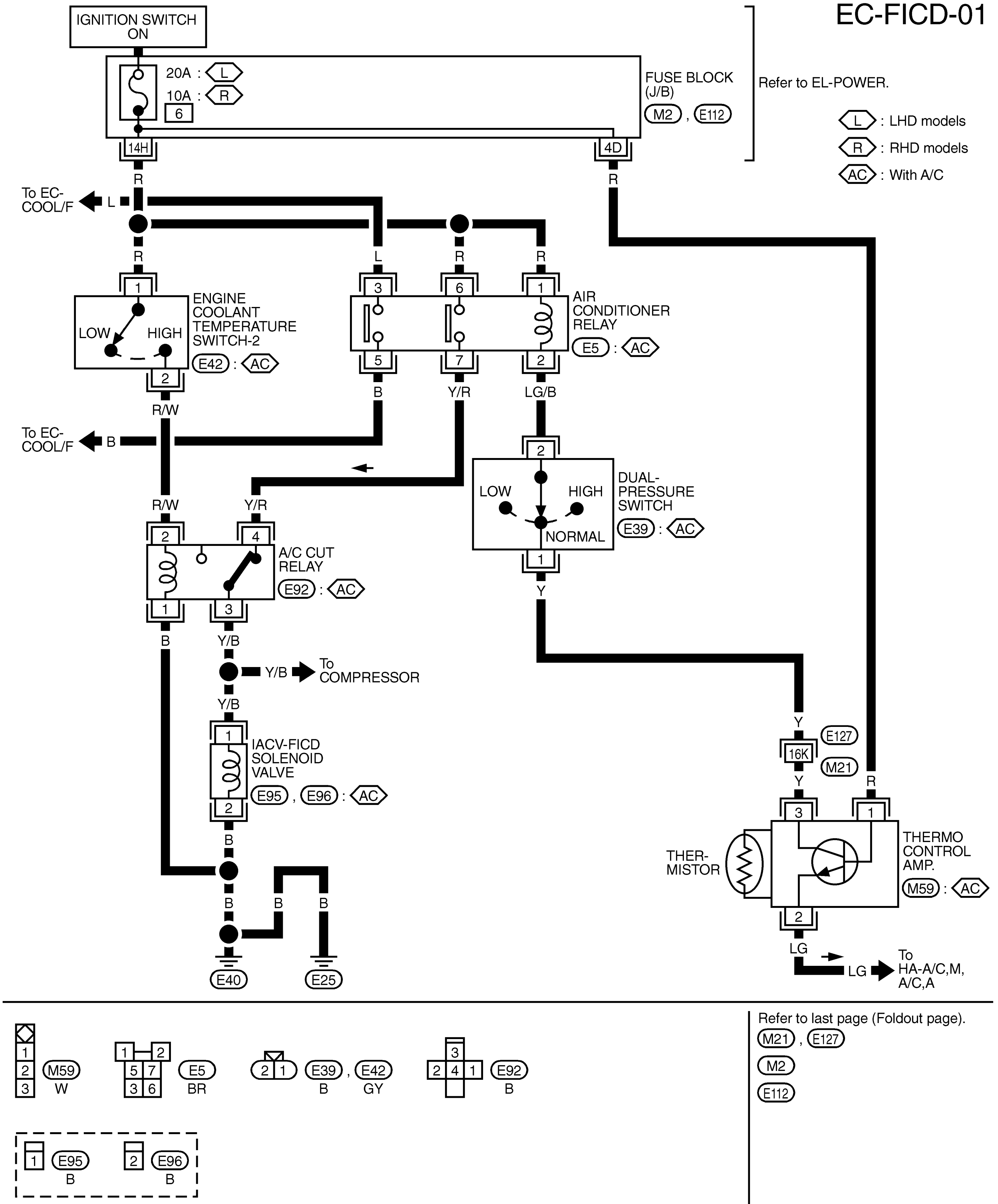
Circuit Diagram

EXCEPT FOR COLD AREAS

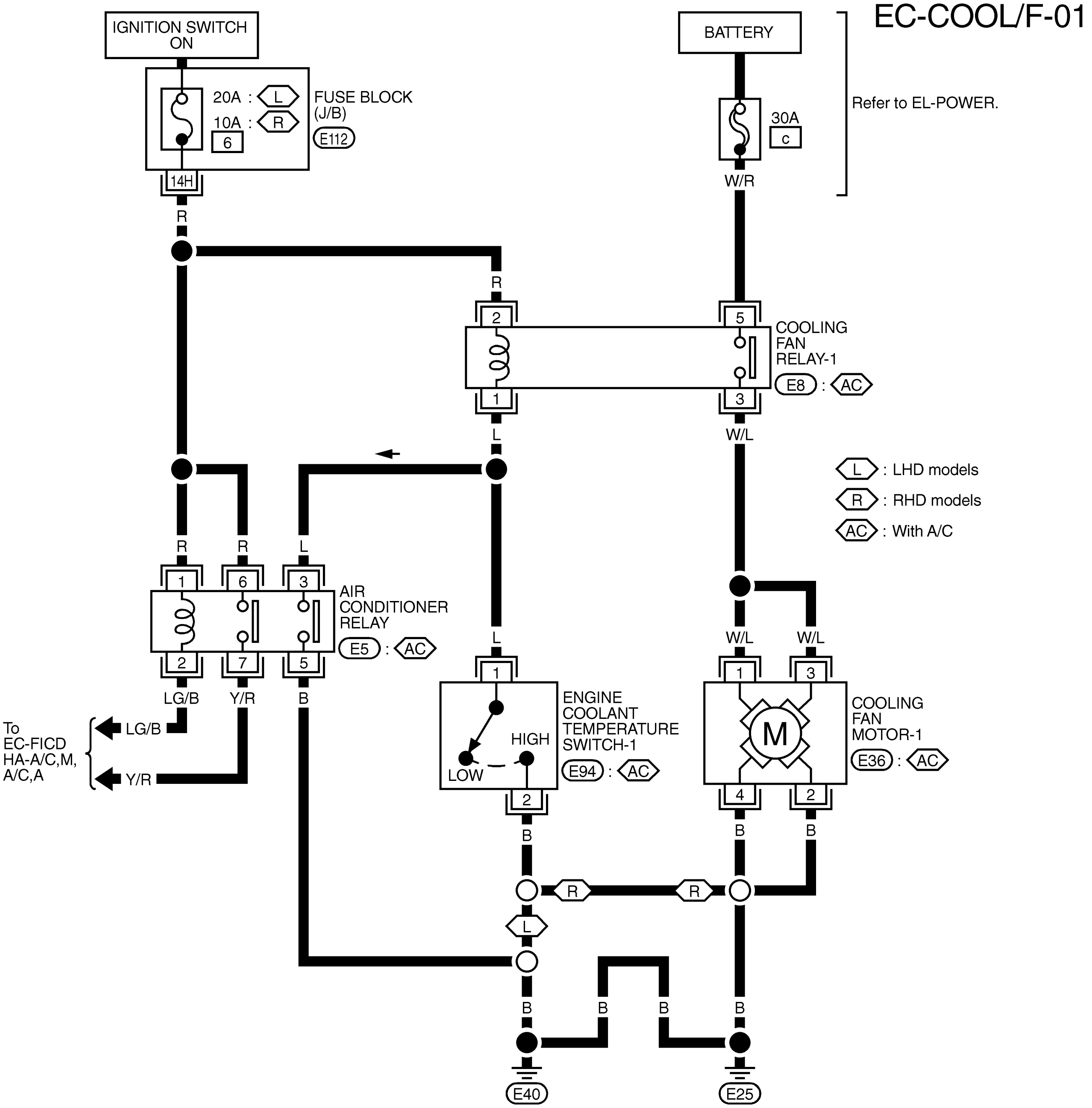


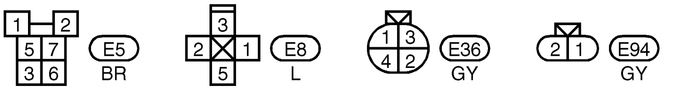
TEC093M

Wiring Diagram



Wiring Diagram



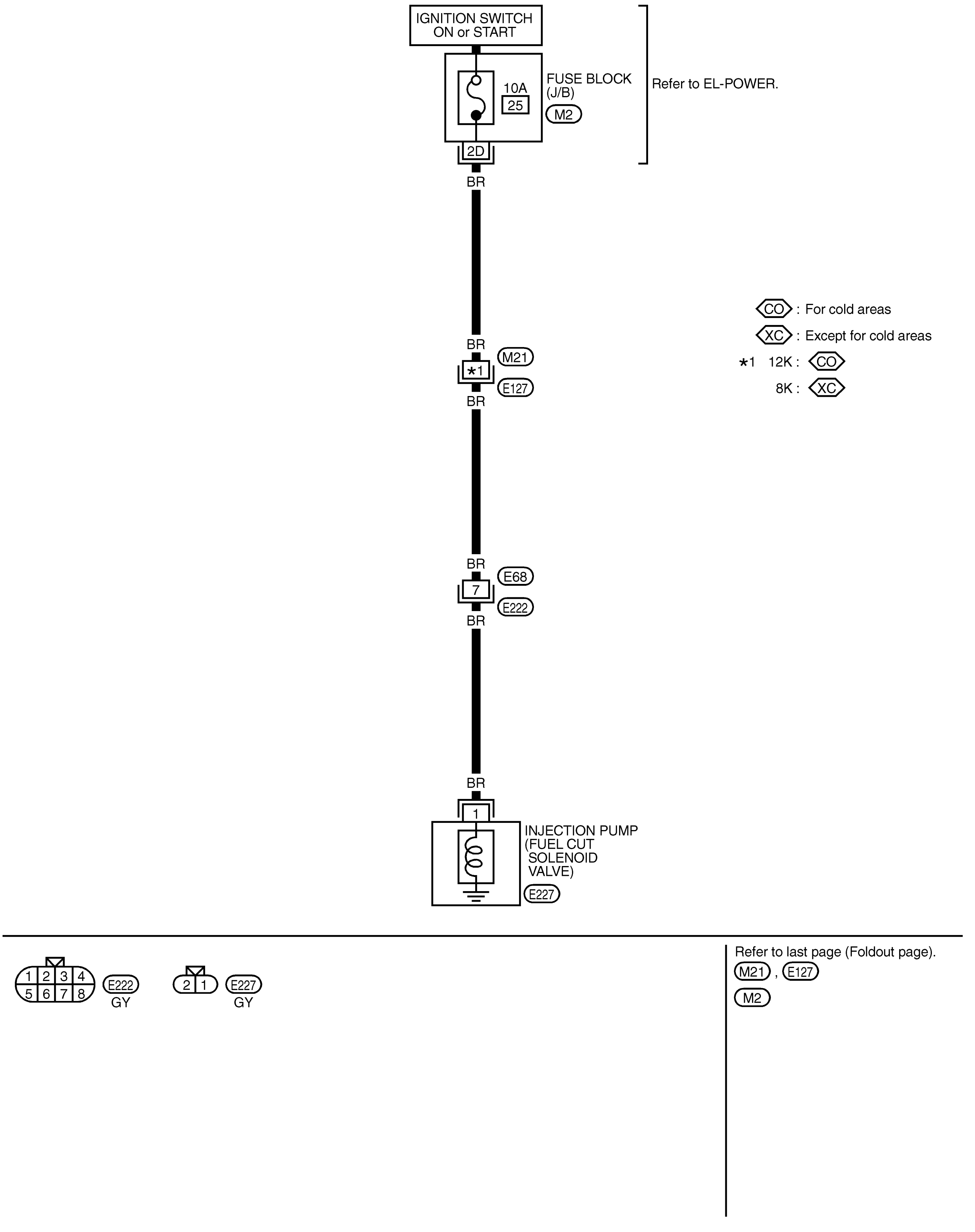


Refer to last page (Foldout page).
E112

TEC750

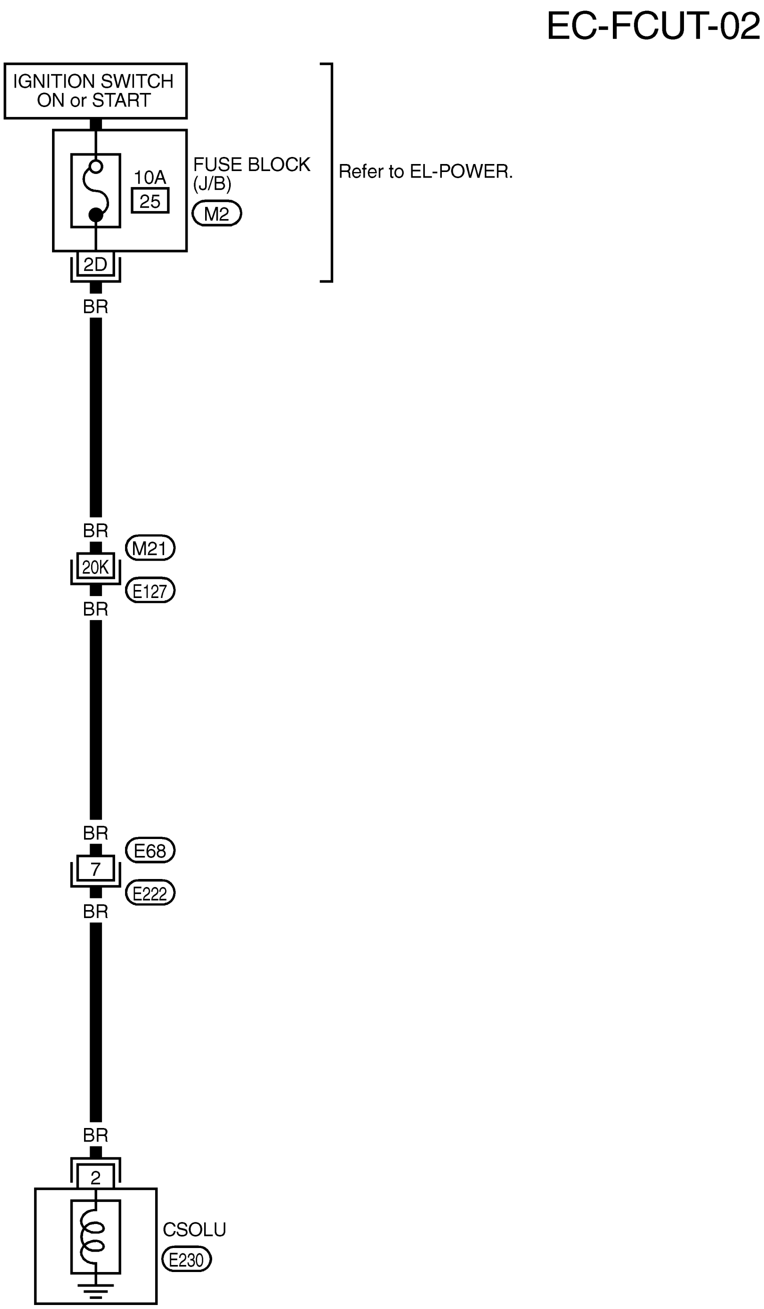
Wiring Diagram

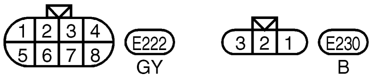
EC-FCUT-01



TEC741

Wiring Diagram (Cont'd)





Refer to last page (Foldout page).
M21 , E127
M2

TEC094M

Go to Technical Bulletin

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-156
ACCEL POS SW (F/C)	0203	X	EC-131
A/T COMM LINE	0504	—	EC-179
BATTERY VOLTAGE	0502	—	EC-177
COOLANT TEMP SEN	0103	X	EC-123
CRANK POS SEN (TDC)	0407	X	EC-171
ECM 2	0301	X	EC-148
ECM 10	0802	X	EC-218
ECM 11	0804	—	EC-220
ECM 12	0901	X	EC-148
ECM 14	0807	X	EC-222
ECM 15	0903	—	EC-231
ECM RLY	0902	X	EC-227
EGR VOLUME CONT/V	1003	X	EC-238
FUEL CUT SYSTEM1	1004	X	EC-246
INT/AIR VOLUME	0406	—	EC-169
MASS AIR FLOW SEN	0102	X	EC-117
NATS MALFUNCTION	1401 - 1408	—	EL section
NO DTC IS DETECTED. FURTHER TESTING MAY BE REQUIRED.	0505	—	—
OVER HEAT	0208	X	EC-136
P1·CAM POS SEN	0701	X	EC-184
P2·TDC PULSE SIG	0702	X	EC-190
P3·PUMP COMM LINE	0703	X	EC-196
P4·SPILL/V CIRC	0704	X	EC-202
P5·PUMP C/MODULE	0705	X	EC-208
P6·SPILL VALVE	0706	X	EC-202
P7·F/INJ TIMG FB	0707	X	EC-211
P9·FUEL TEMP SEN	0402	X	EC-150
TURBO PRESSURE	0905	X	EC-233
VEHICLE SPEED SEN	0104	X	EC-127

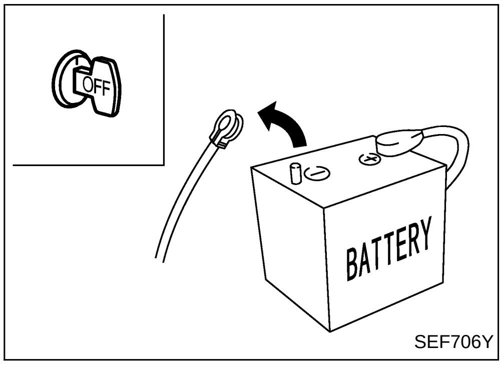
Alphabetical & Numerical Index for DTC (Cont'd)

NUMERICAL INDEX FOR DTC

X: Applicable —: Not applicable

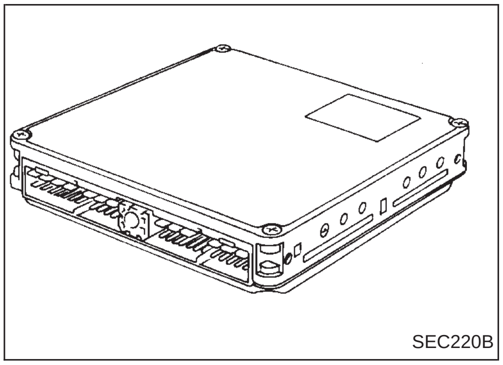
DTC	Items (CONSULT-II screen terms)	MI (MIL) illumination	Reference page
0102	MASS AIR FLOW SEN	X	EC-117
0103	COOLANT TEMP SEN	X	EC-123
0104	VEHICLE SPEED SEN	X	EC-127
0203	ACCEL POS SW (F/C)	X	EC-131
0208	OVER HEAT	X	EC-136
0301	ECM 2	X	EC-148
0402	P9·FUEL TEMP SEN	X	EC-150
0403	ACCEL POS SENSOR	X	EC-156
0406	INT/AIR VOLUME	—	EC-169
0407	CRANK POS SEN (TDC)	X	EC-171
0502	BATTERY VOLTAGE	—	EC-177
0504	A/T COMM LINE	—	EC-179
0505	**NO DTC IS DETECTED. FURTHER TESTING MAY BE REQUIRED.**	—	—
0701	P1·CAM POS SEN	X	EC-184
0702	P2·TDC PULSE SIG	X	EC-190
0703	P3·PUMP COMM LINE	X	EC-196
0704	P4·SPILL/V CIRC	X	EC-202
0705	P5·PUMP C/MODULE	X	EC-208
0706	P6·SPILL VALVE	X	EC-202
0707	P7·F/INJ TIMG FB	X	EC-211
0802	ECM 10	X	EC-218
0804	ECM 11	—	EC-220
0807	ECM 14	X	EC-222
0901	ECM 12	X	EC-148
0902	ECM RLY	X	EC-227
0903	ECM 15	—	EC-231
0905	TURBO PRESSURE	X	EC-233
1003	EGR VOLUME CONT/V	X	EC-238
1004	FUEL CUT SYSTEM1	X	EC-246
1401 - 1408	NATS MALFUNCTION	—	EL section

Precautions



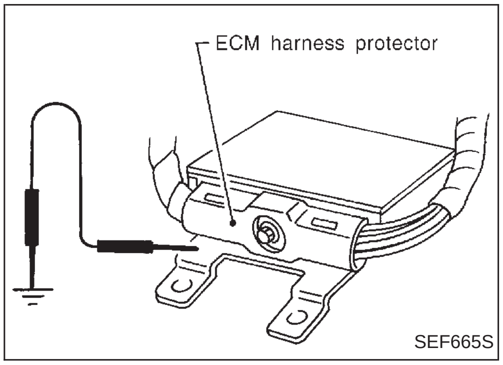
SEF706Y

- 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.



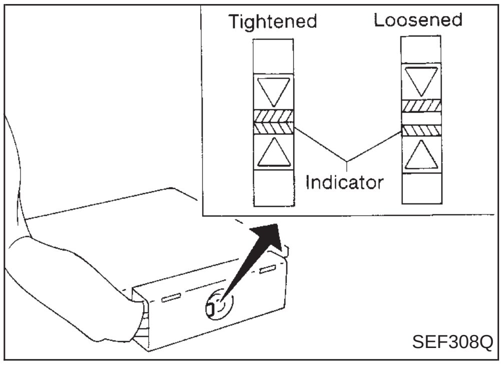
SEC220B

- 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.



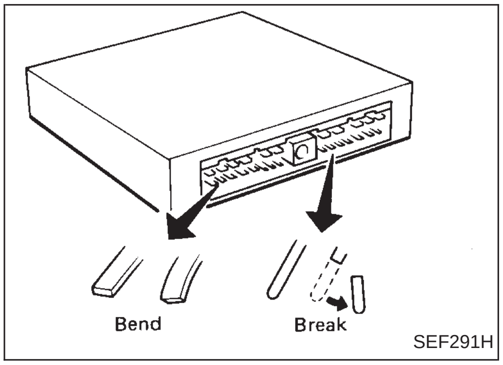
SEF665S

- 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)



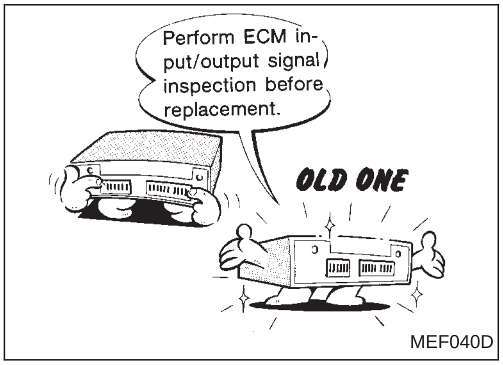
SEF291H

- 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)

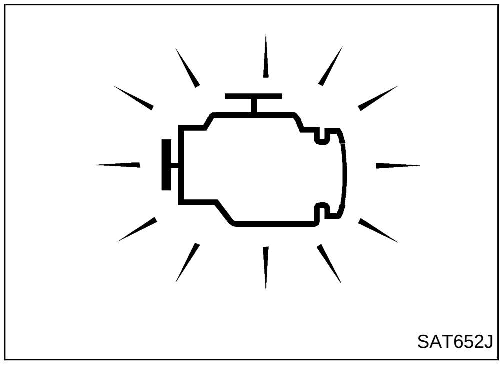
due to receiving external noise, degraded operation of ICs, etc.

- **Keep ECM parts and harnesses dry.**


Perform ECM input/output signal inspection before replacement.
OLD ONE

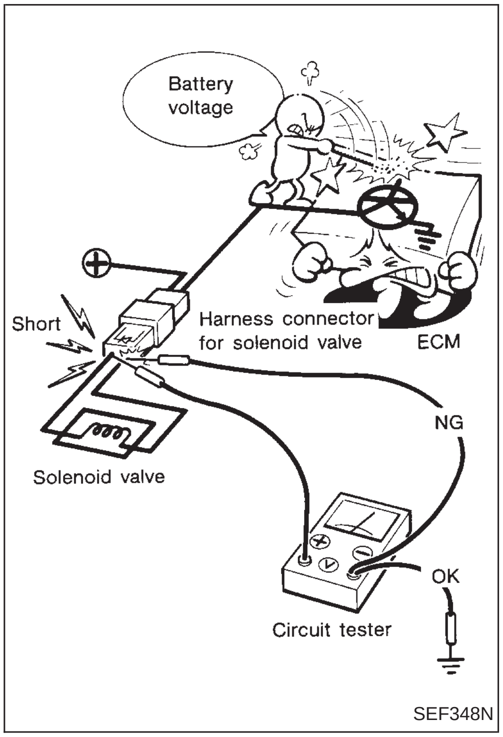
MEF040D

- **Before replacing ECM, perform Terminals and Reference Value inspection and make sure ECM functions properly. Refer to EC-99.**



SAT652J

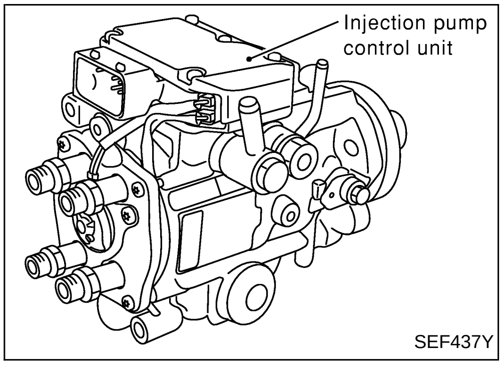
- **If MI (MIL) illuminates or blinks irregularly when engine is running, water may have accumulated in fuel filter. Drain water from fuel filter. If this does not correct the problem, perform specified trouble diagnostic procedures.**
- **After performing each TROUBLE DIAGNOSIS, perform "DTC Confirmation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

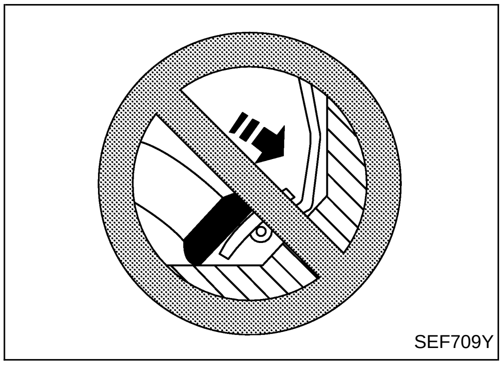
- **When measuring ECM signals with a circuit tester, never allow the two tester probes to contact.**
  Accidental contact of probes will cause a short circuit and damage the ECM power transistor.
- **Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to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

Precautions (Cont’d)



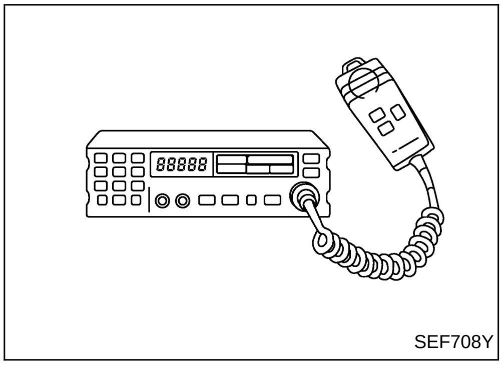
SEF437Y

- **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.**

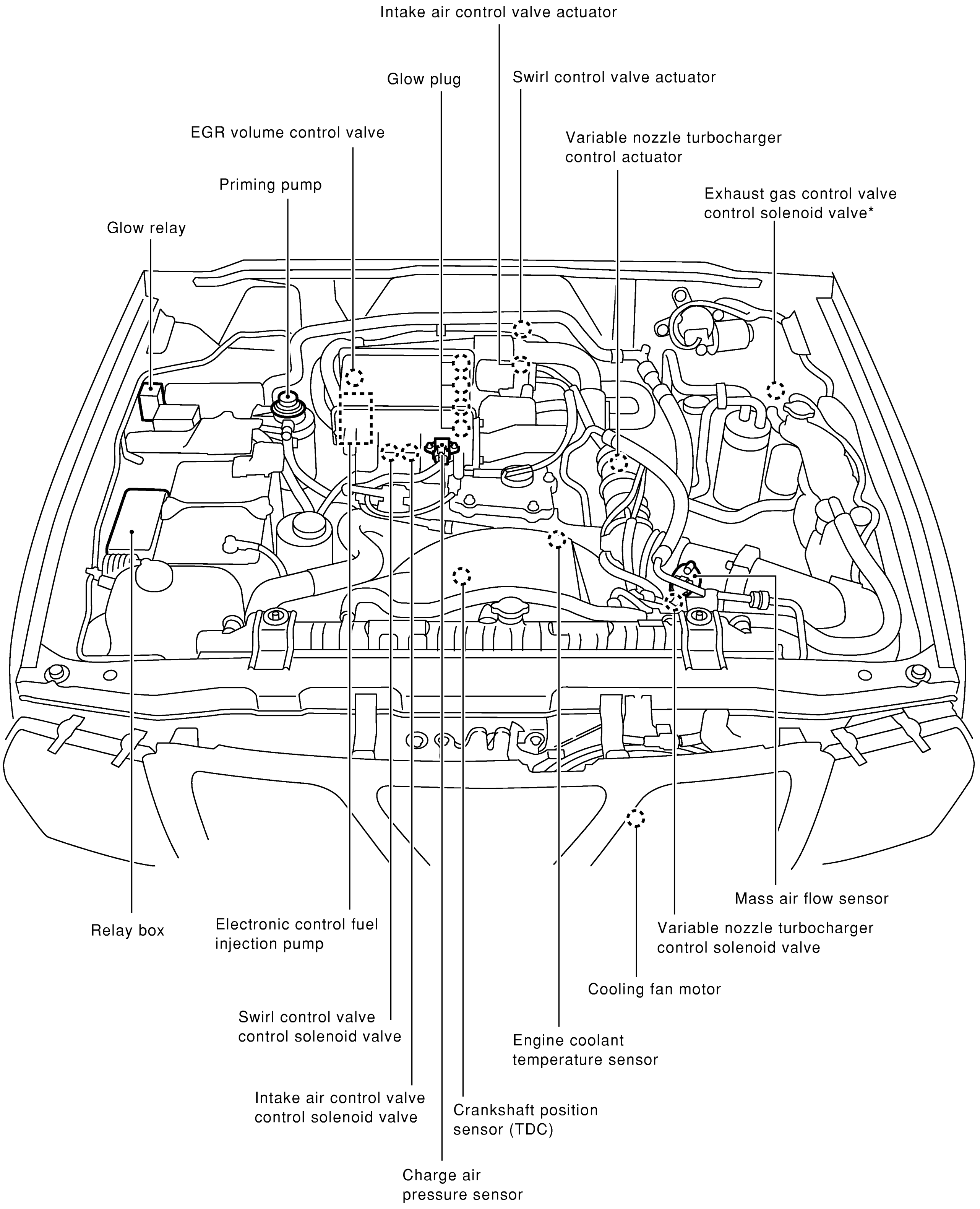


SEF708Y

- **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.**

ECCS-D Component Parts Location

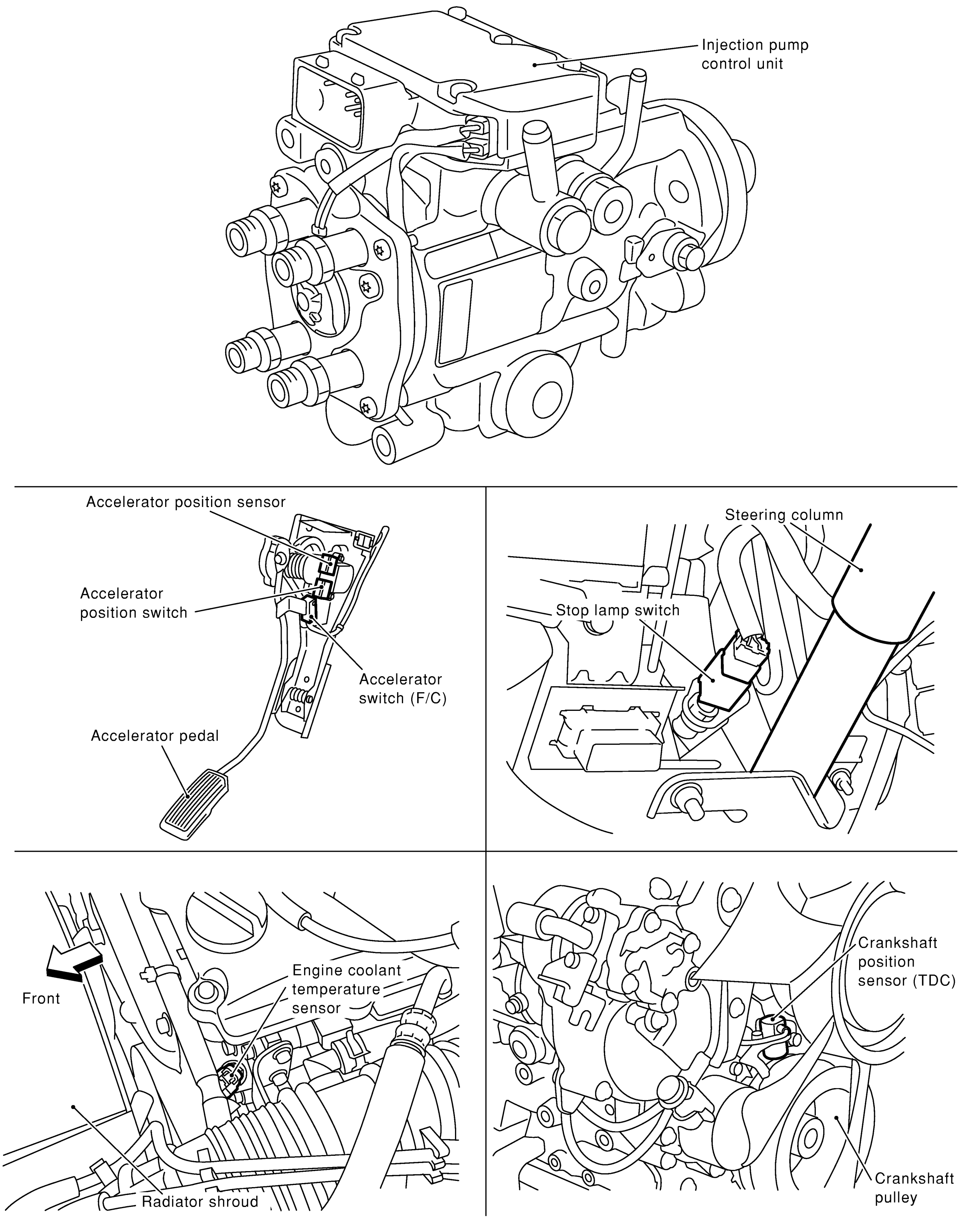

Intake air control valve actuator
Glow plug
Swirl control valve actuator
EGR volume control valve
Variable nozzle turbocharger control actuator
Priming pump
Exhaust gas control valve control solenoid valve*
Glow relay
Mass air flow sensor
Relay box
Electronic control fuel injection pump
Variable nozzle turbocharger control solenoid valve
Cooling fan motor
Swirl control valve control solenoid valve
Engine coolant temperature sensor
Intake air control valve control solenoid valve
Crankshaft position sensor (TDC)
Charge air pressure sensor

*: Only models for cold areas

SEF219Z

ECCS-D Component Parts Location (Cont'd)

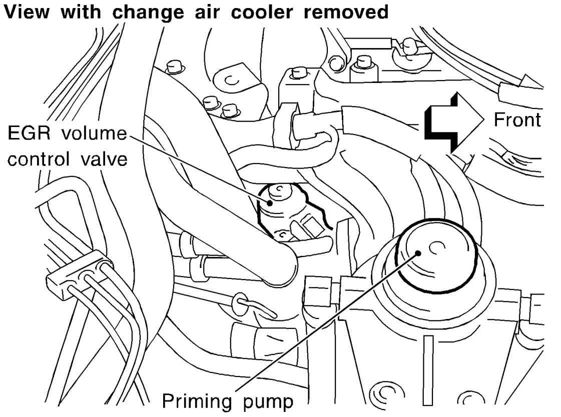
Electronic control fuel injection pump

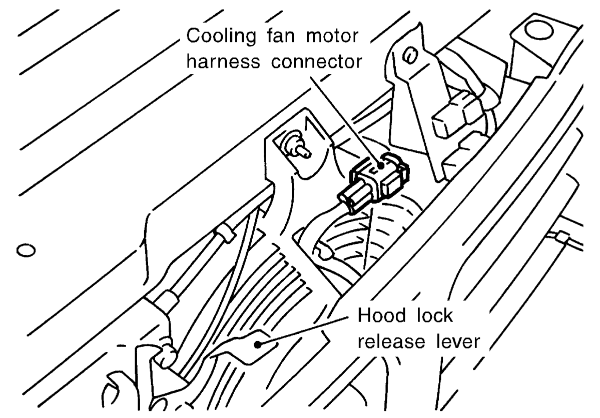

Injection pump control unit
Accelerator position sensor
Accelerator position switch
Accelerator switch (F/C)
Accelerator pedal
Steering column
Stop lamp switch
Front
Engine coolant temperature sensor
Radiator shroud
Crankshaft position sensor (TDC)
Crankshaft pulley

SEF220Z

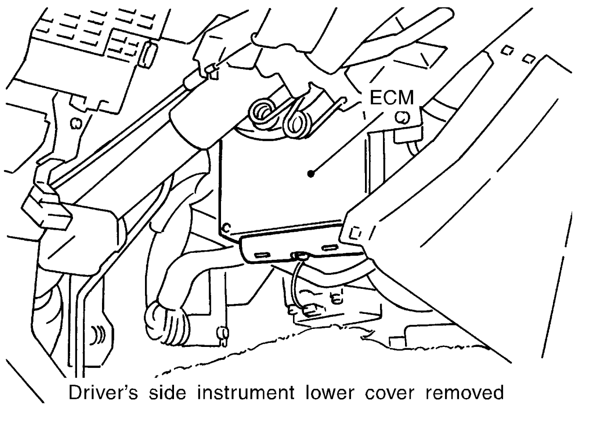
ECCS-D Component Parts Location (Cont'd)

View with change air cooler removed



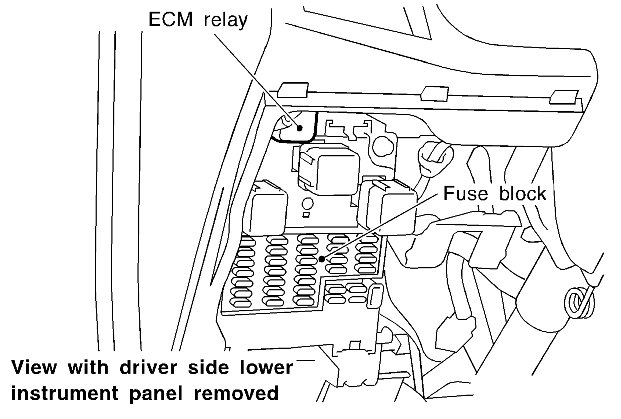


LHD models



Driver's side instrument lower cover removed

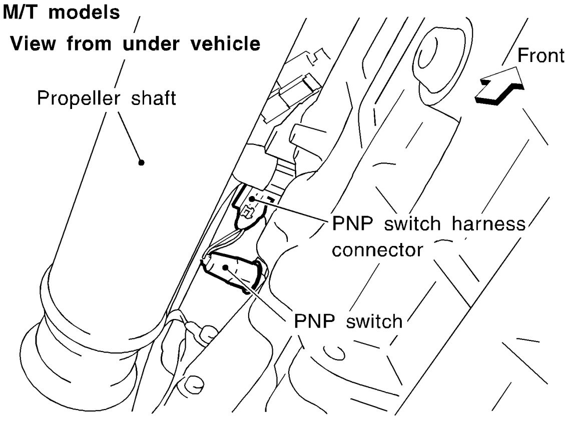
LHD models



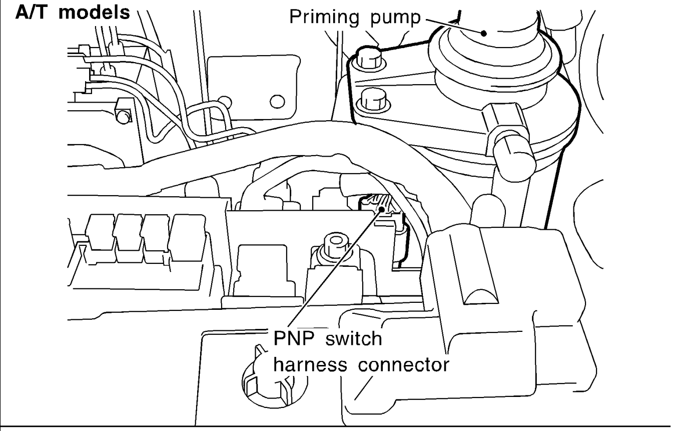
View with driver side lower instrument panel removed

M/T models

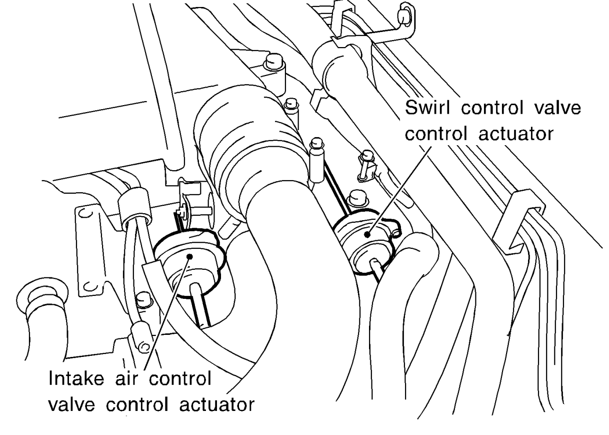
View from under vehicle



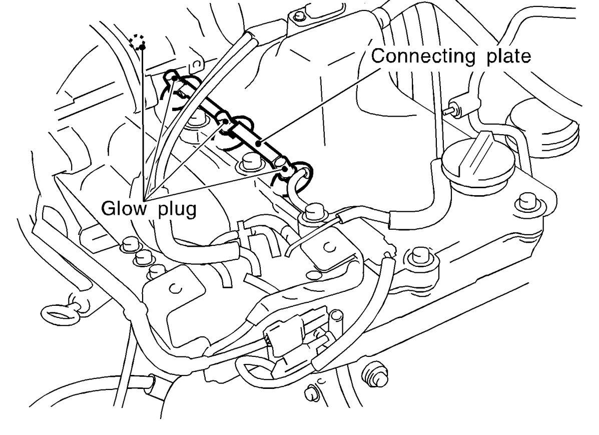
A/T models



View with vacuum tank removed


Swirl control valve control actuator
Intake air control valve control actuator

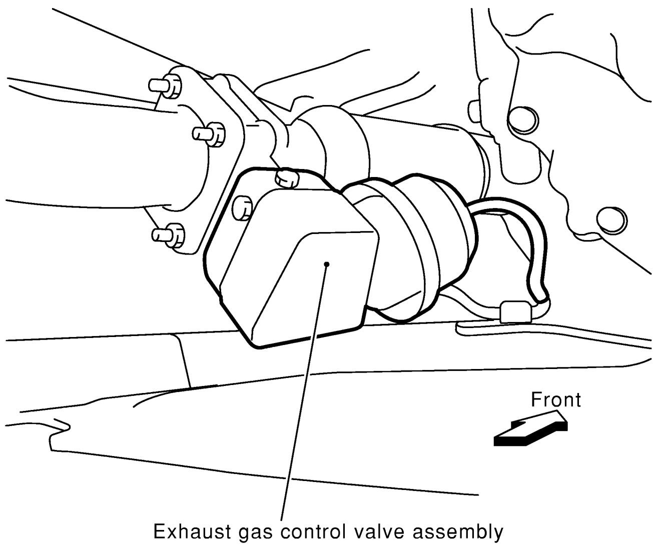
View with charge air cooler removed

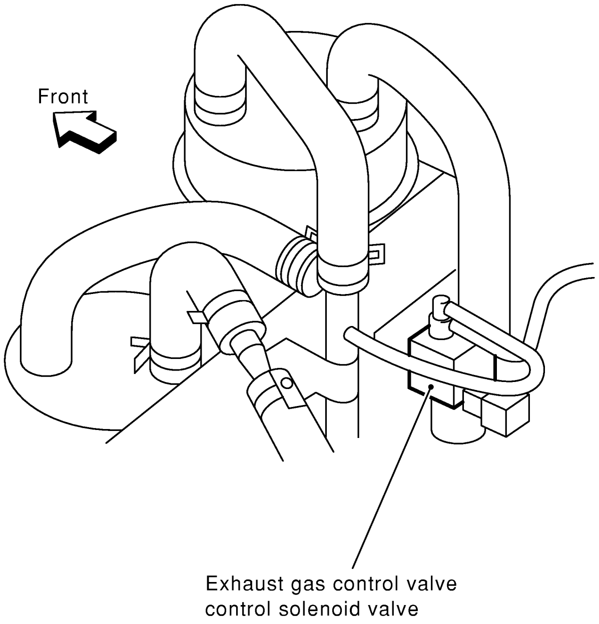


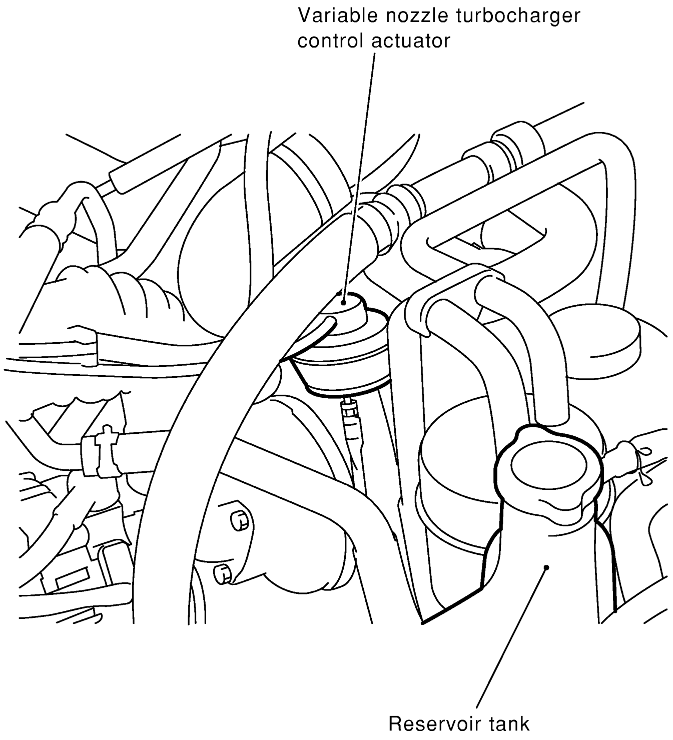
SEF221Z

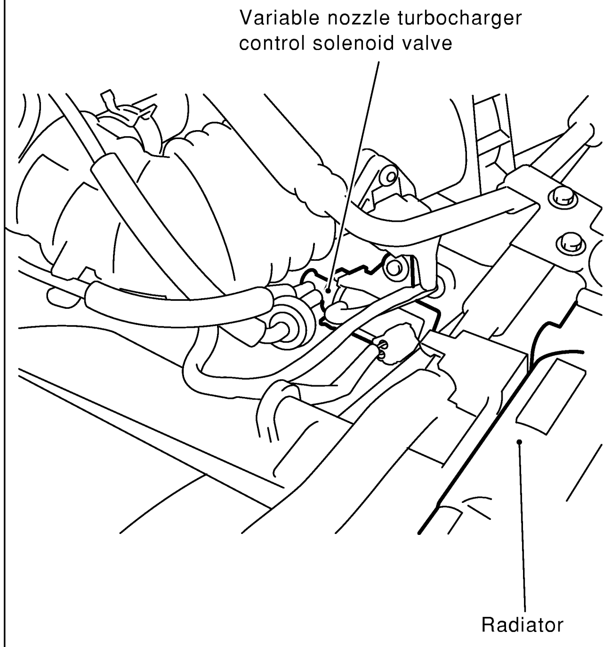
ECCS-D Component Parts Location (Cont'd)

View from under the vehicle





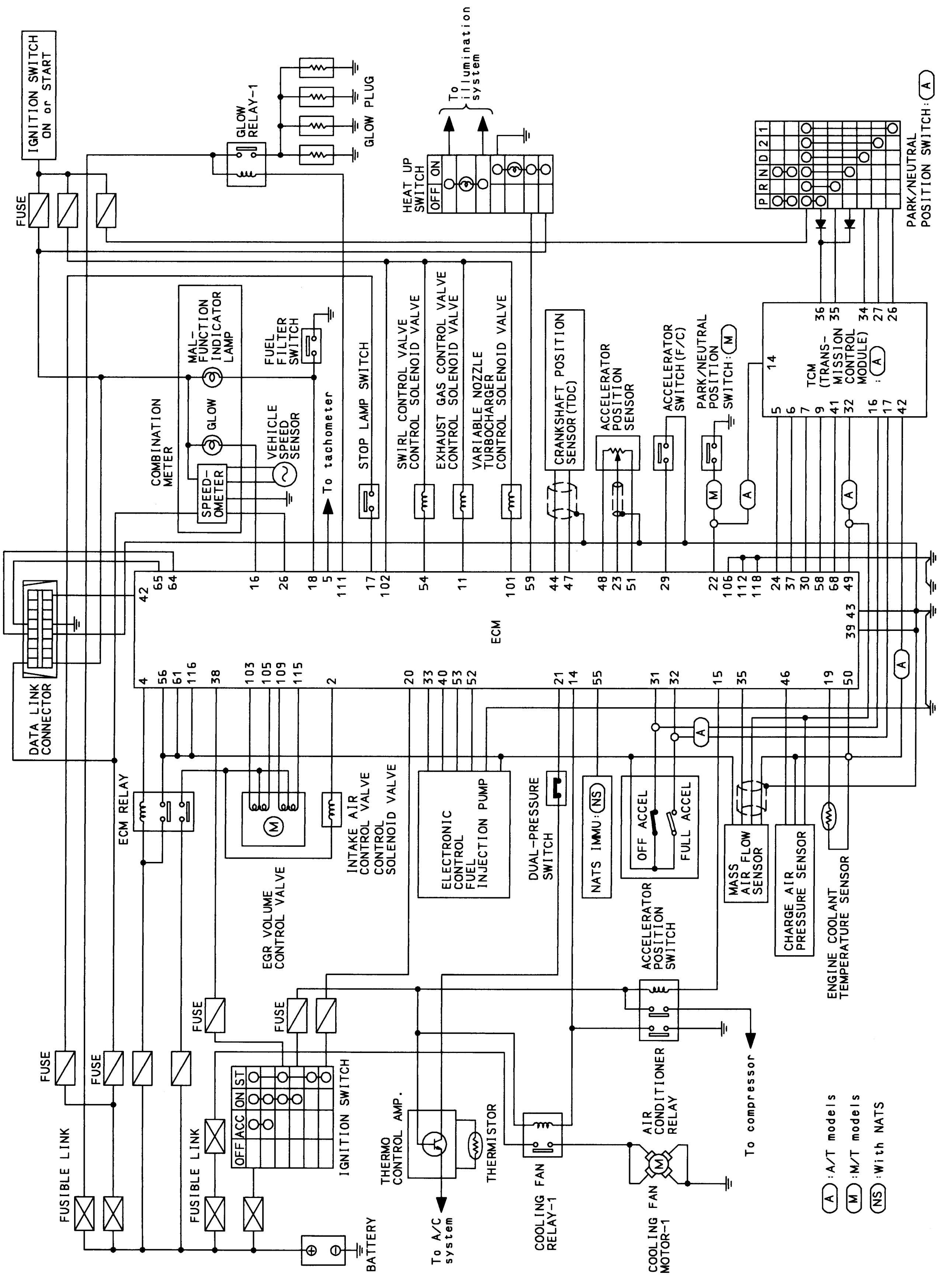




SEF286Z

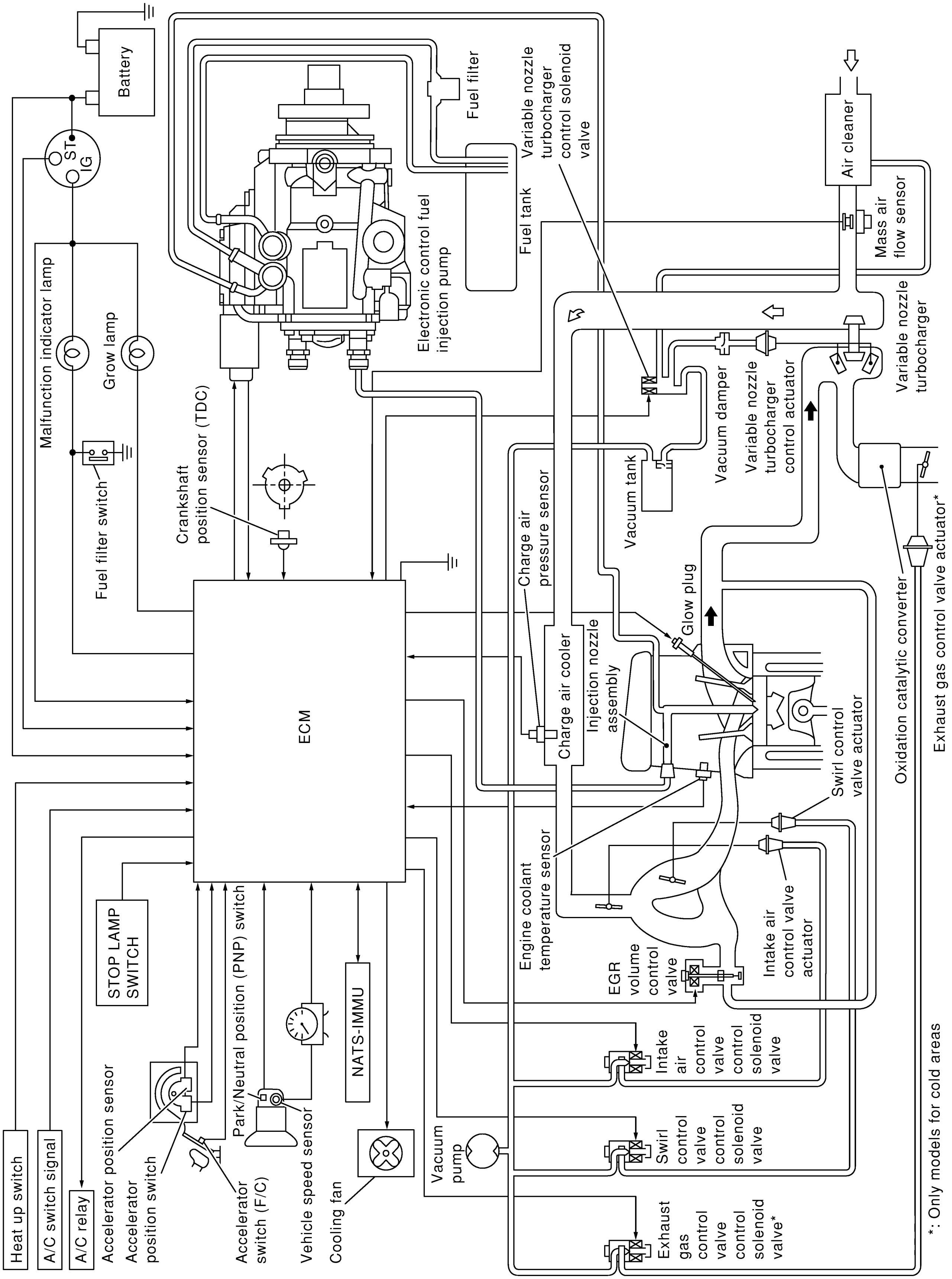
Go to Technical Bulletin

Circuit Diagram



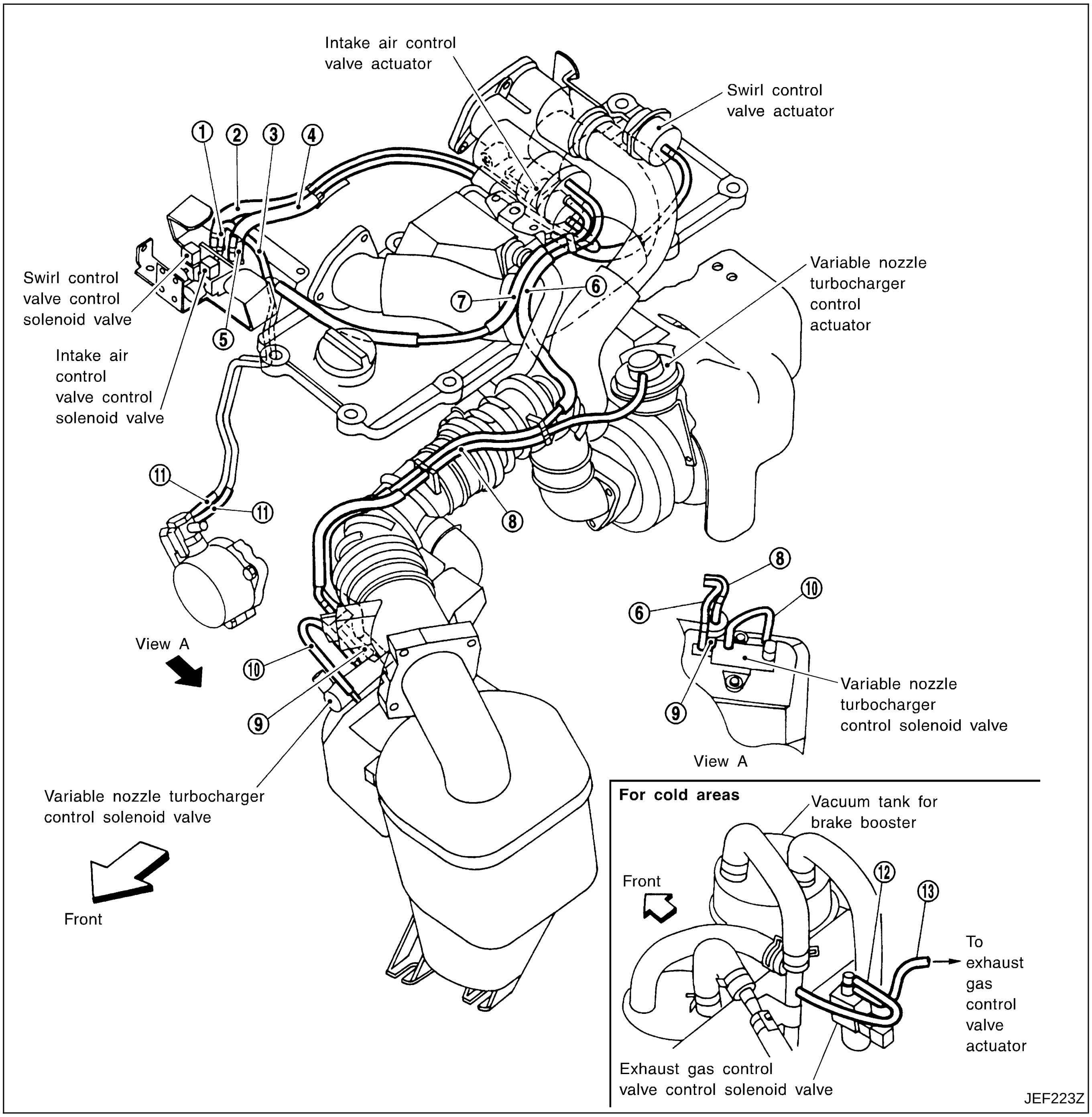
TEC095M

System Diagram


Battery
ST
IG
Malfunction indicator lamp
Grow lamp
Fuel filter switch
Crankshaft position sensor (TDC)
Fuel filter
Fuel tank
Electronic control fuel injection pump
Variable nozzle turbocharger control solenoid valve
Air cleaner
Mass air flow sensor
Variable nozzle turbocharger
Vacuum damper
Variable nozzle turbocharger control actuator
Vacuum tank
Charge air pressure sensor
Glow plug
Charge air cooler
Injection nozzle assembly
Oxidation catalytic converter
Exhaust gas control valve actuator*
Swirl control valve actuator
Engine coolant temperature sensor
EGR volume control valve
Intake air control valve actuator
ECM
STOP LAMP SWITCH
NATS-IMMU
Intake air control valve control solenoid valve
Swirl control valve control solenoid valve
Exhaust gas control valve control solenoid valve*
Vacuum pump
Heat up switch
A/C switch signal
A/C relay
Accelerator position sensor
Accelerator position switch
Park/Neutral position (PNP) switch
Accelerator switch (F/C)
Vehicle speed sensor
Cooling fan
*: Only models for cold areas

SEF222Z

Vacuum Hose Drawing


Intake air control valve actuator
Swirl control valve actuator
①
②
③
④
Swirl control valve control solenoid valve
Intake air control valve control solenoid valve
⑤
⑦
⑥
Variable nozzle turbocharger control actuator
⑪
⑪
⑧
View A
⑩
⑨
Variable nozzle turbocharger control solenoid valve
Front
⑧
⑥
⑩
⑨
Variable nozzle turbocharger control solenoid valve
View A
For cold areas
Vacuum tank for brake booster
Front
⑫
⑬
To exhaust gas control valve actuator
Exhaust gas control valve control solenoid valve
JEF223Z

1. Swirl control valve control solenoid valve to 3-way connector
2. Swirl control valve control solenoid valve to swirl control valve actuator
3. Vacuum gallery to 3-way connector
4. Intake air control valve control solenoid valve to intake air control valve actuator
5. Intake air control valve control solenoid valve to 3-way connector
6. Variable nozzle turbocharger control solenoid valve to vacuum tank
7. Vacuum tank to vacuum gallery
8. Variable nozzle turbocharger control actuator to vacuum damper
9. Variable nozzle turbocharger control solenoid valve to vacuum damper
10. Variable nozzle turbocharger control solenoid valve to resonator
11. Vacuum pump to vacuum gallery
12. Exhaust gas control valve control solenoid valve to 3-way connector
13. Exhaust gas control valve control solenoid valve to exhaust gas control valve actuator

Refer to “System Diagram”, EC-47 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
	Exhaust gas control valve control*2	Exhaust gas control valve control solenoid valve*2

*1: This sensor is not used to control the engine system under normal conditions.
*2: For models for cold areas

Fuel Injection Control System

DESCRIPTION

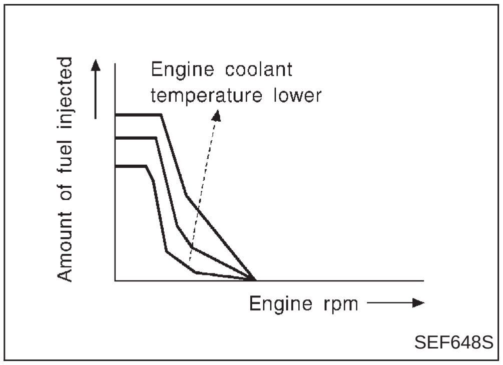
System description

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

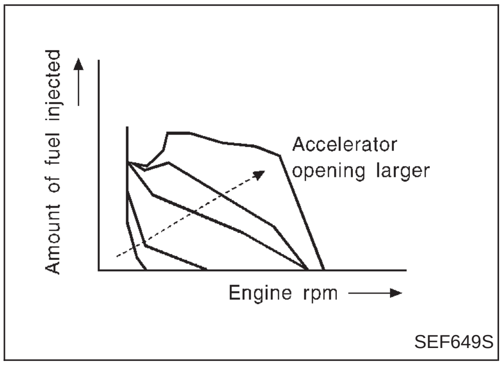
Sensor	Input Signal to ECM	ECM Function	Actuator
Engine coolant temperature sensor	Engine coolant temperature	Fuel injection control (Idle control)	Electronic control fuel injection pump
Crankshaft position sensor (TDC)	Engine speed		
Park/Neutral position (PNP) switch	Gear position		
Battery	Battery 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.

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		



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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		

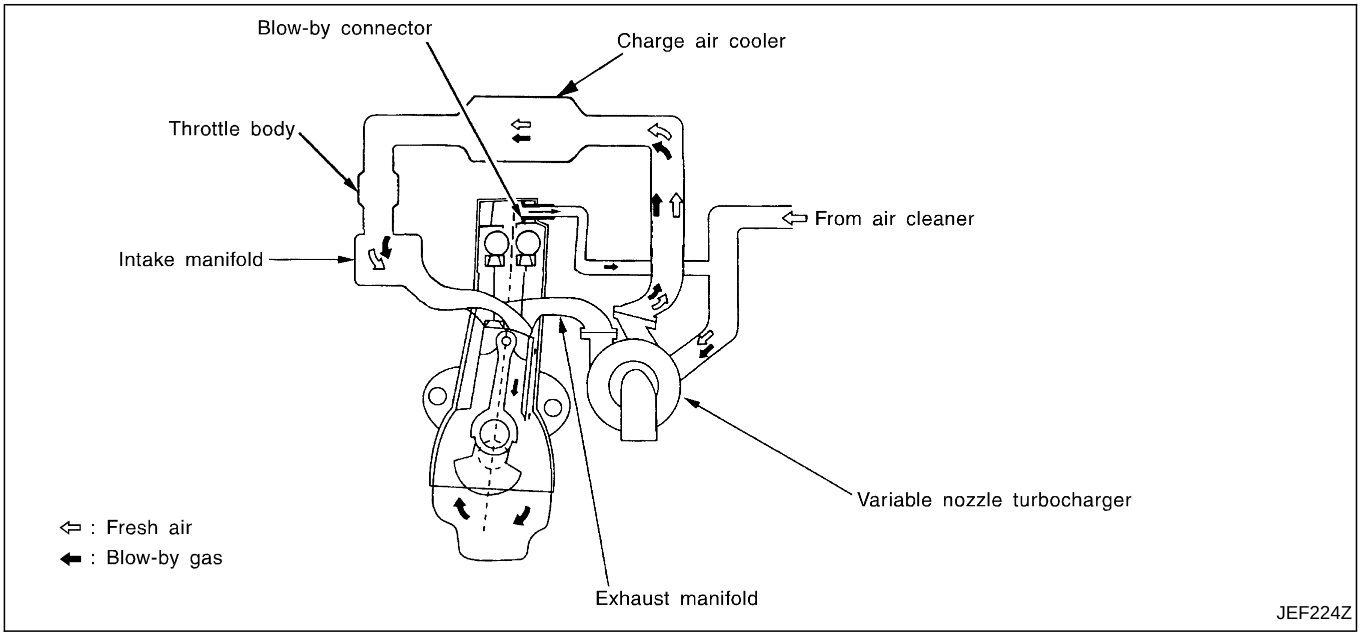
If the engine speed is above 2,700 rpm with no load (for example, in neutral and engine speed over 2,700 rpm) fuel will be cut off after some time. The exact time when the fuel is cut off varies based on engine speed. Fuel cut will operate until the engine speed reaches 1,500 rpm, then fuel cut is cancelled.

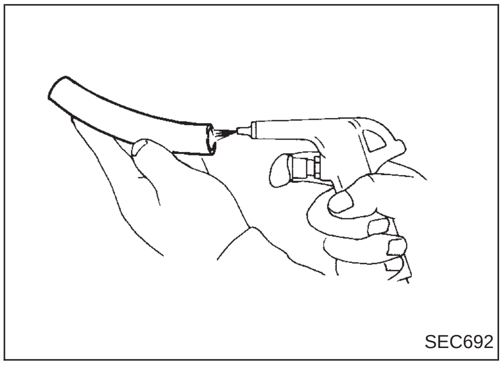
NOTE:
This function is different from deceleration control listed under “Fuel Injection Control System”, EC-50.

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

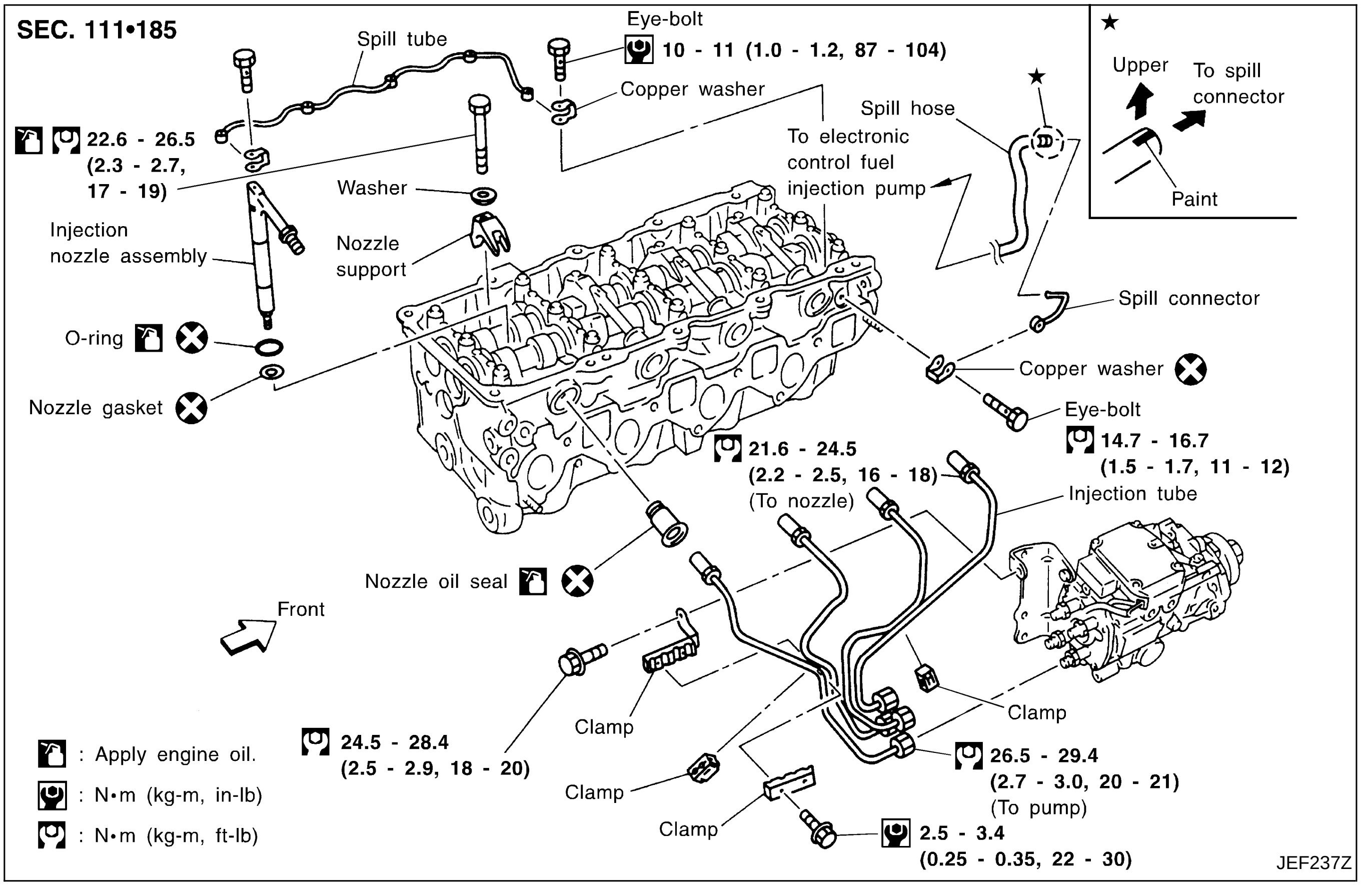
1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air. If any hose cannot be freed of obstructions, replace.

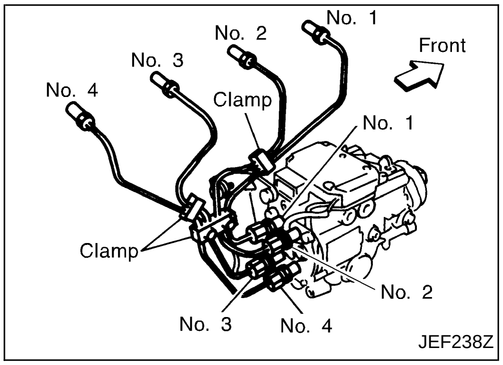
Injection Tube and Injection Nozzle

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

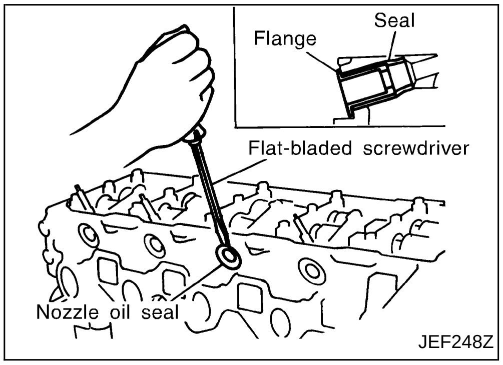
1. Mark the cylinder Nos. to the injection tubes, then disconnect them.
- **Marking should be made at proper locations and by the proper method, so that they are not erased by fuel, etc.**
2. Remove the clamps, then disconnect the tubes one by one.
- **Avoid letting leaked fuel get on the interior walls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



JEF248Z

Injection nozzle oil seal

Removal

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

Installation

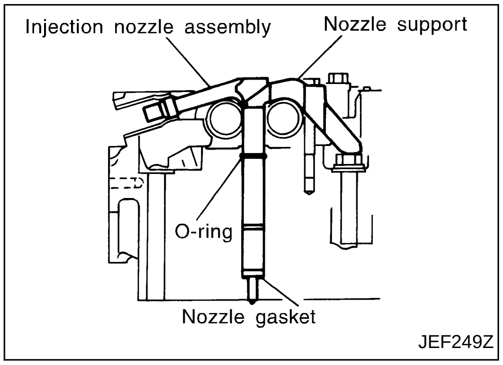
After the injection nozzle assembly is installed, push the seal from the cylinder head side until it contacts the flange.

- **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.



JEF249Z

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

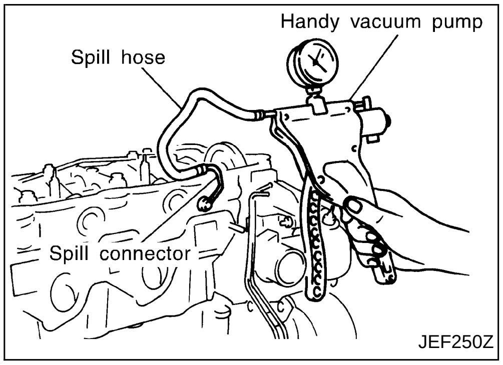
1. Insert the nozzle gasket to the cylinder head hole.
2. Attach the O-ring to the mounting groove of the nozzle side, then insert it in the cylinder head.

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)



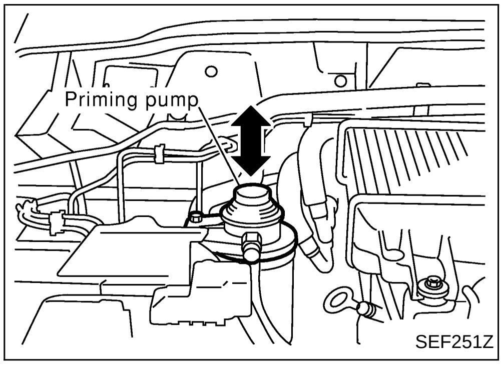
Inspection for spill tube airtightness

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.

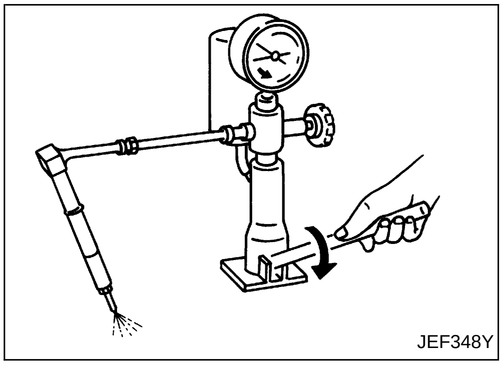
   Standard:

   −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.

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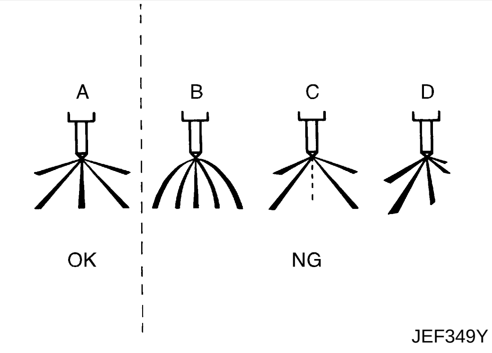
Injection Tube and Injection Nozzle (Cont'd)



Spray pattern test

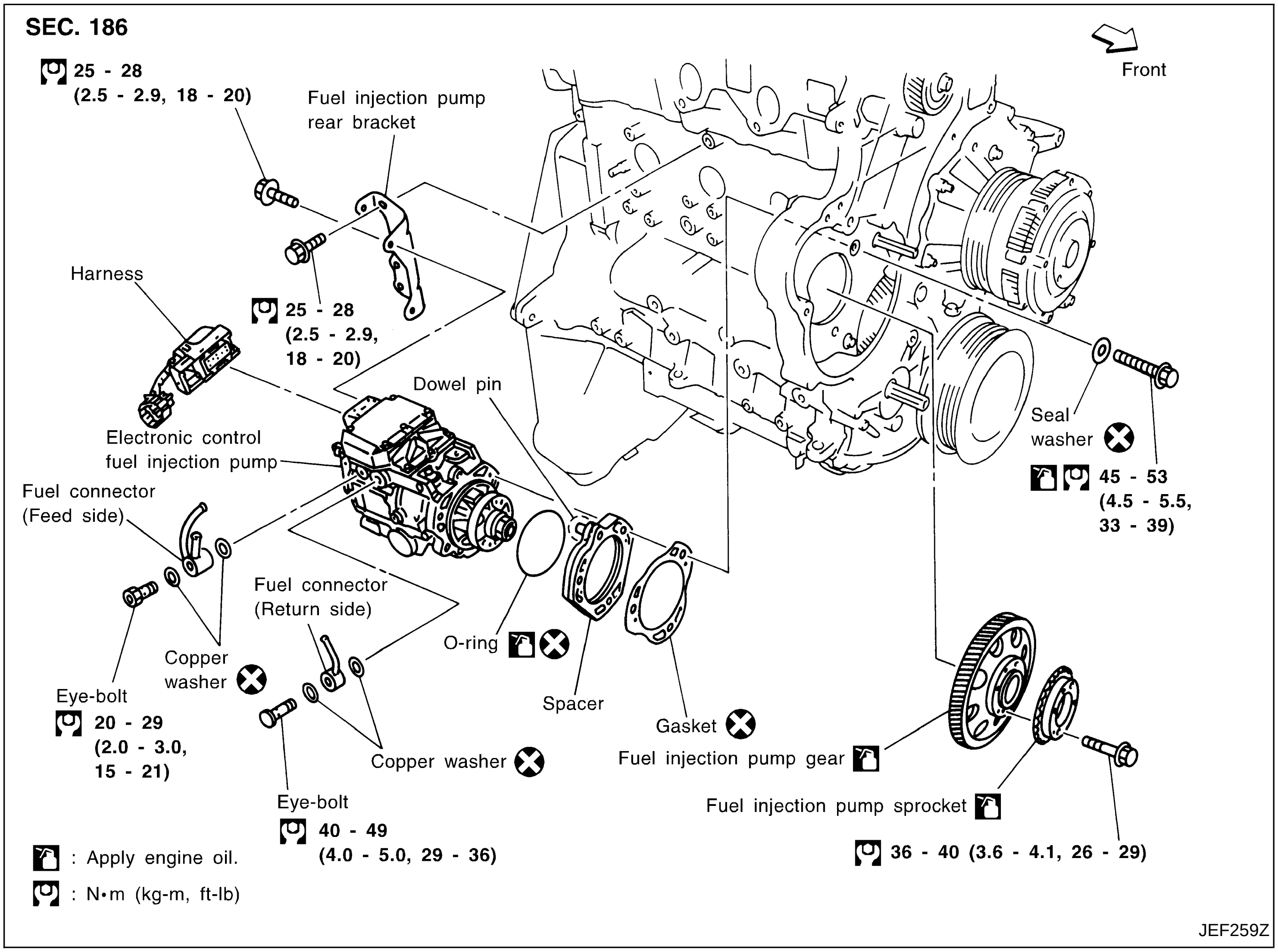
1. Check spray pattern by pumping tester handle one full stroke per second.
   NG spray pattern:
   Does not inject straight and strong (B in the figure).
   Fuel drips (C in the figure).
   Does not inject evenly (D in the figure).
2. If the spray pattern is not correct, replace injection nozzle assembly.

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.)

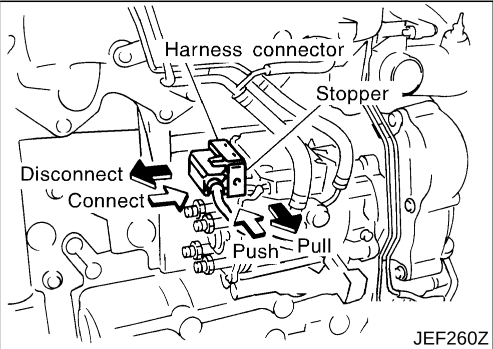


Electronic Control Fuel Injection Pump (Cont'd)

REMOVAL

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

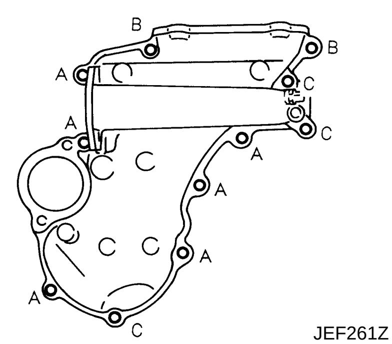
2. Move the power steering pump.



JEF260Z

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.

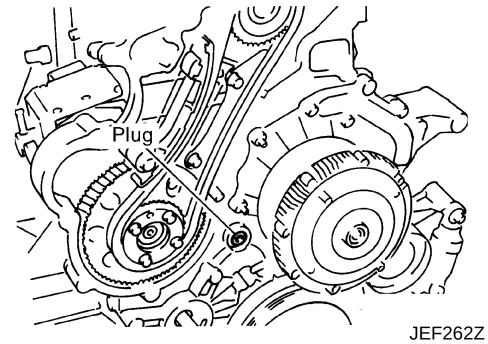


JEF261Z

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.



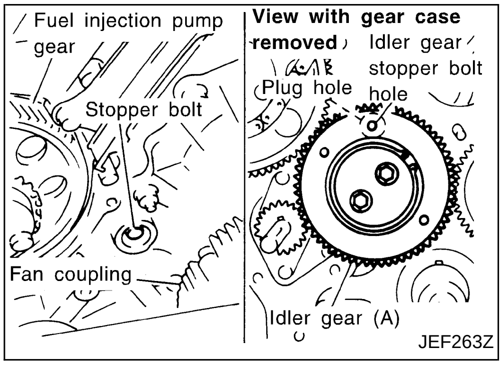
JEF262Z

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)

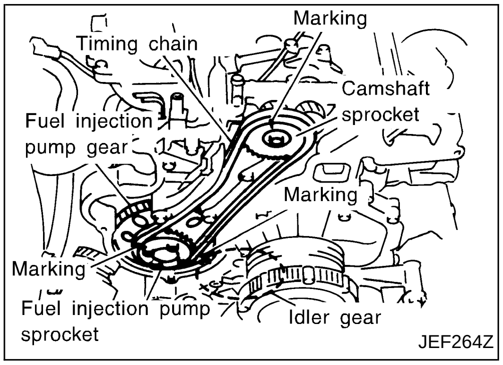


c. Install the tightening bolt [Part No.: 81-20620-28, thread diameter: M6, under head: 20 mm (0.79 in), pitch: 1.0 mm (0.039 in)] to the idler gear tightening bolt hole, and tighten to the specified torque:

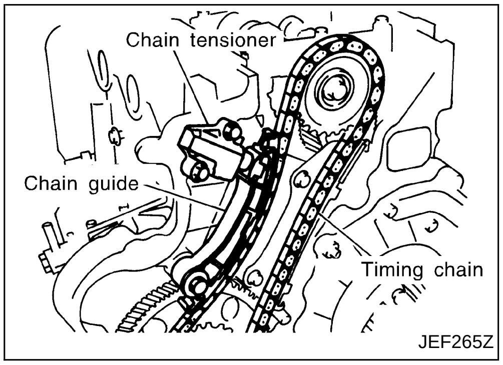
🔧 : 2.5 - 3.4 N·m (0.25 - 0.35 kg-m, 22 - 30 in-lb)

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.**



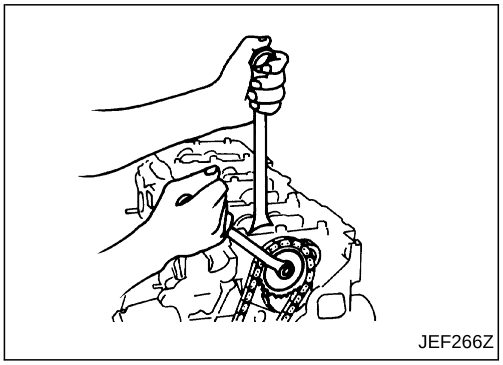
7. Make mating marks on the cam sprocket, fuel injection pump sprocket, and timing chain with paint.
8. Make mating marks on the fuel injection pump gear and idler gear with paint.



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.)

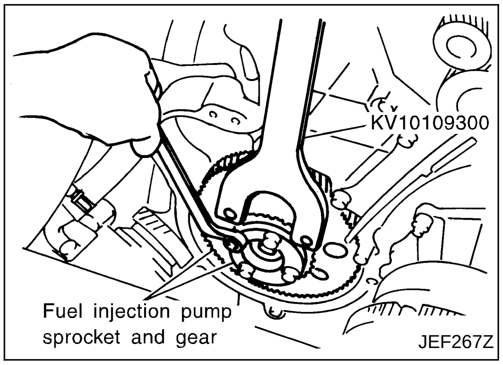


10. Remove the timing chain slack guide.
11. Remove the cam sprocket and timing chain at the same time.

- 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:

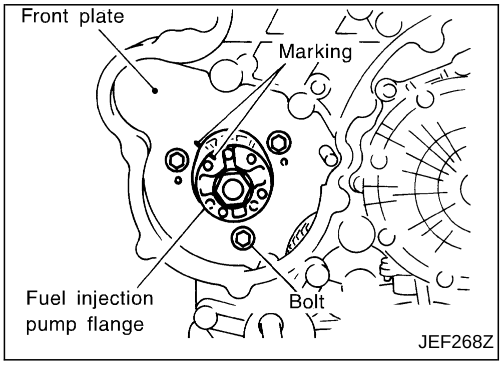
Do not loosen the installation bolt using a chain tension.



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)

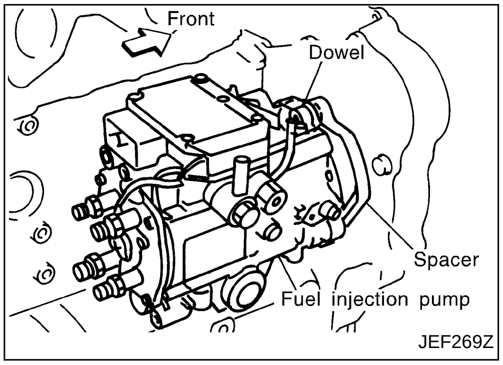


13. Make the mating marks on the fuel injection pump flange and front plate with paint.
14. Remove installation bolts first, and then fuel injection pump toward the rear side of the engine.

- 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.

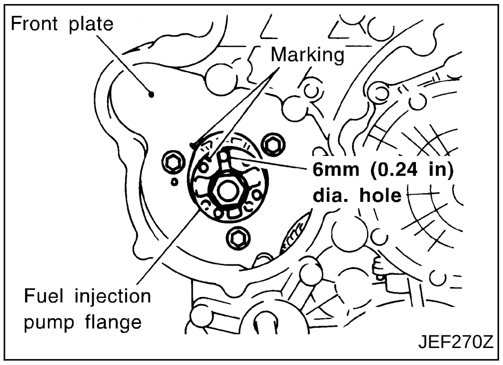


INSTALLATION

- 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.

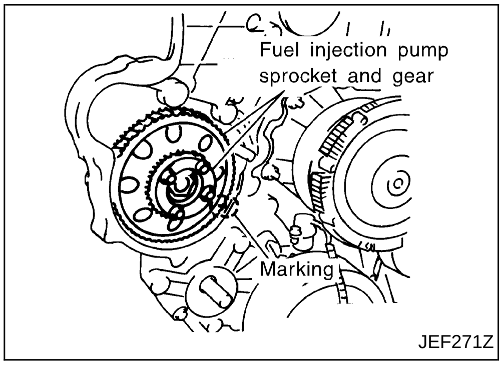
1. Install the fuel injection pump from the rear side of the engine.

- 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.



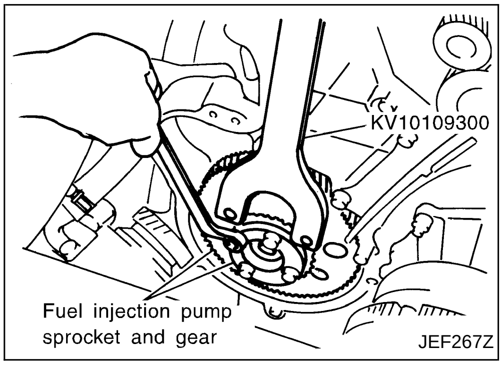
2. Align the mating marks of the fuel injection pump flange and front plate, and then adjust the approximate flange position.

- 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.



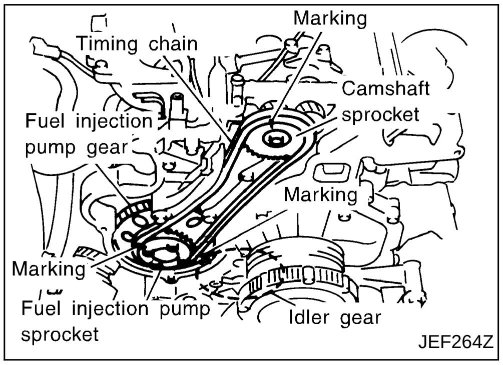
4. Tighten the installation bolt of the fuel injection pump sprocket.

- 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)



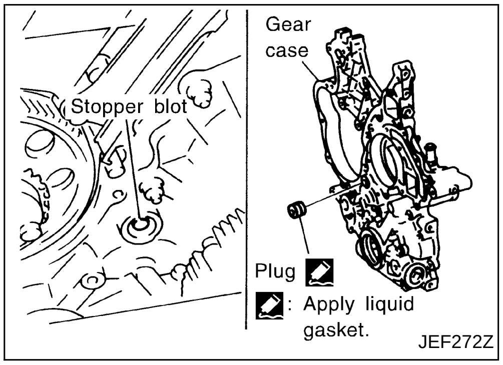
5. Install the cam sprocket and timing chain at the same time.

- 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.

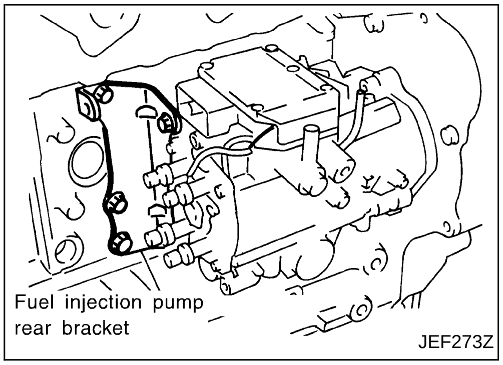
6. Install the timing chain, related parts, and the chain cover. Refer to EM section, "TIMING CHAIN".



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.

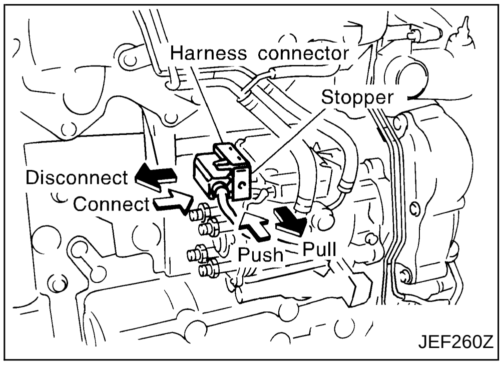
   : 7.9 - 9.8 N·m (0.8 - 1.0 kg-m, 70 - 86 in-lb)

- Use Genuine Liquid Gasket or equivalent.



9. Install the fuel injection pump rear bracket.

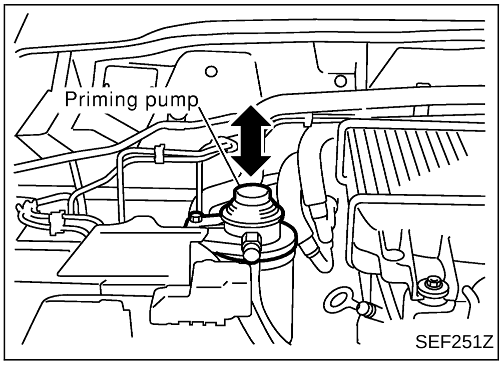
- Tighten all the installation bolts temporarily, and then tighten them firmly with both surfaces of the fuel injection pump and cylinder block attached to the installation surface.



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 (MIL) Detection Logic

When a malfunction is detected, the malfunction (DTC) is stored in the ECM memory.
The MI (MIL) will light up each time the ECM detects malfunction. For diagnostic items causing the MI (MIL) to light up, refer to “TROUBLE DIAGNOSIS — INDEX”, EC-37.

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 (MIL) illumination in the diagnostic test mode II (Self-diagnostic results). Example: 0102, 0407, 1004, etc.

With CONSULT-II

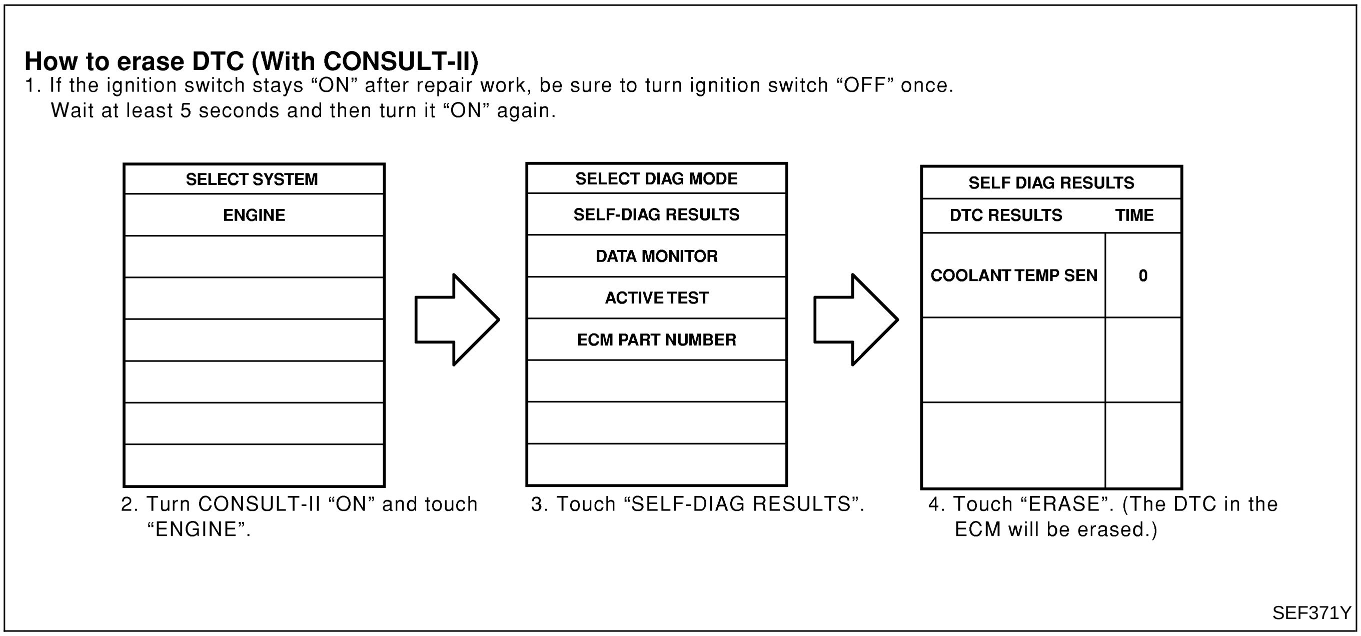
CONSULT-II displays the DTC in “SELF-DIAG RESULTS” mode. Examples: “CRANK POS SEN (TDC)”, etc.

- **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.)

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

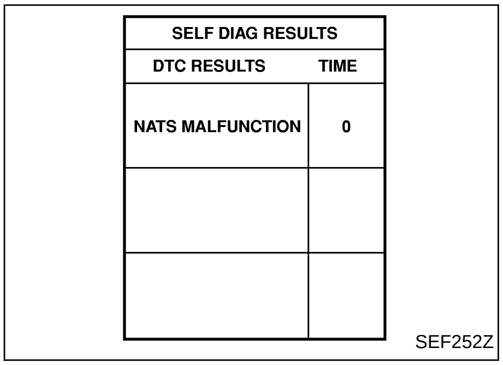
How to erase DTC (Without CONSULT-II)

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-66.)

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.**

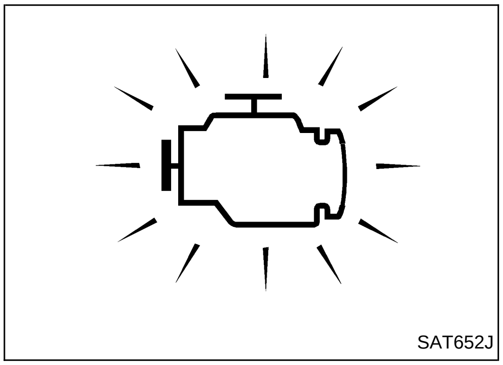


SELF DIAG RESULTS	
DTC RESULTS	TIME
NATS MALFUNCTION	0

SEF252Z

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.



SAT652J

Malfunction Indicator (MI), Malfunction Indicator Lamp (MIL)

DESCRIPTION

The MI (MIL) is located on the instrument panel.

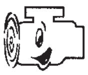
1. The MI (MIL) will light up when the ignition switch is turned ON without the engine running. This is a bulb check.
- If the MI (MIL) does not light up, refer to EL section ("WARNING LAMPS AND CHIME") or see EC-307.
2. When the engine is started, the MI (MIL) should go off.
   If the MI (MIL) remains on, the on board diagnostic system has detected an engine system malfunction.

If MI (MIL) 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), Malfunction Indicator Lamp (MIL) (Cont’d)

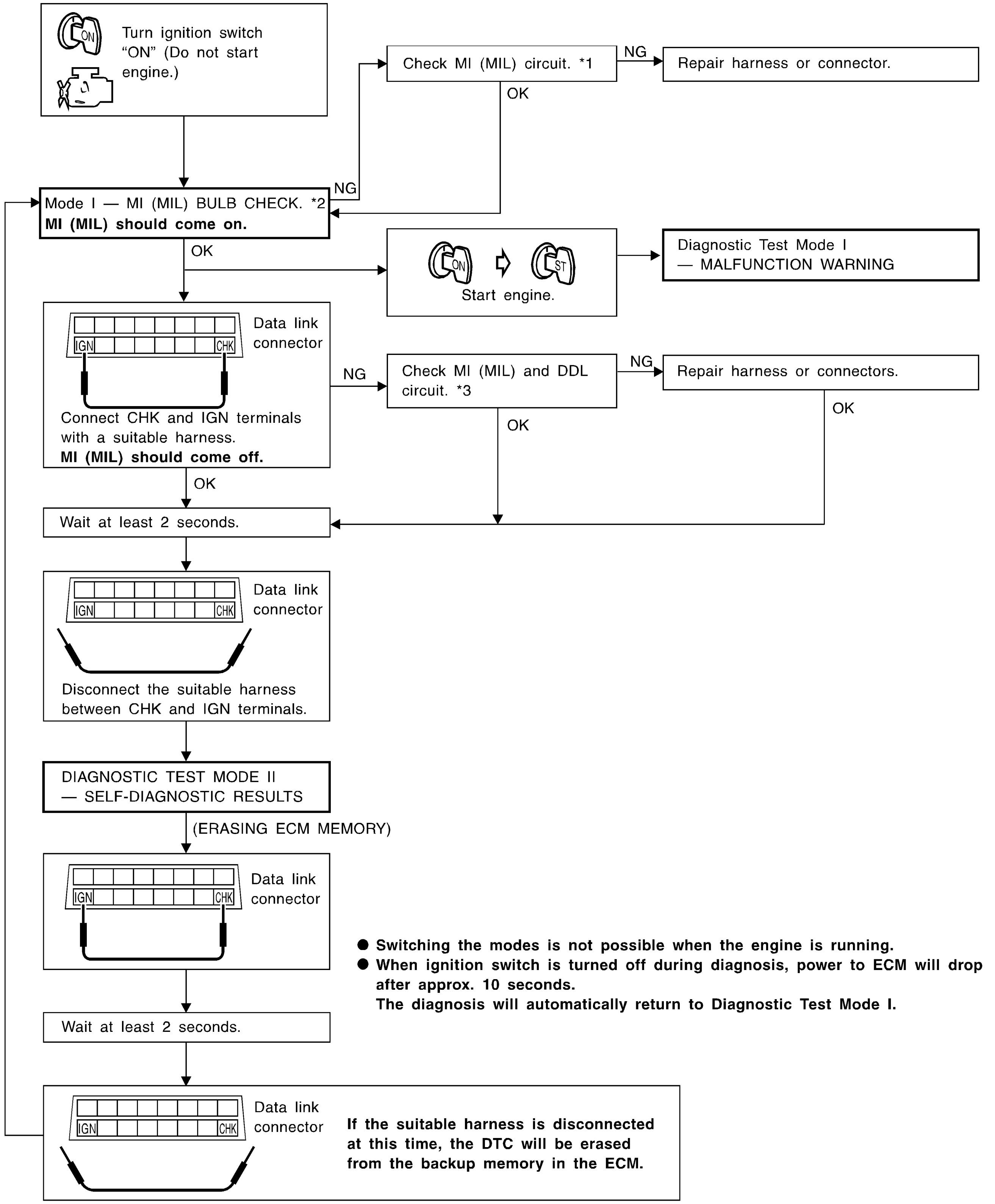
On board diagnostic system function

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 (MIL) bulb for damage (blown, open circuit, etc.). If the MI (MIL) does not come on, check MI (MIL) circuit. (See EC-307.)
	Engine running 	MALFUNCTION WARNING	This is a usual driving condition. When ECM detects a malfunction, the MI (MIL) 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), Malfunction Indicator Lamp (MIL) (Cont'd)

How to switch diagnostic test modes


ON
Turn ignition switch "ON" (Do not start engine.)
Check MI (MIL) circuit. *1
NG
Repair harness or connector.
OK
NG
Mode I — MI (MIL) BULB CHECK. *2
MI (MIL) should come on.
OK
ON
ST
Start engine.
Diagnostic Test Mode I
— MALFUNCTION WARNING
IGN
CHK
Data link connector
Connect CHK and IGN terminals with a suitable harness.
MI (MIL) should come off.
NG
Check MI (MIL) and DDL circuit. *3
NG
Repair harness or connectors.
OK
OK
OK
Wait at least 2 seconds.
IGN
CHK
Data link connector
Disconnect the suitable harness between CHK and IGN terminals.
DIAGNOSTIC TEST MODE II
— SELF-DIAGNOSTIC RESULTS
(ERASING ECM MEMORY)
IGN
CHK
Data link connector
Wait at least 2 seconds.
IGN
CHK
Data link connector
If the suitable harness is disconnected at this time, the DTC will be erased from the backup memory in the ECM.

- **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.

SEF372YA

*1: EC-307 *2: EC-65 *3: EC-307

Malfunction Indicator (MI), Malfunction Indicator Lamp (MIL) (Cont'd)

Diagnostic test mode I — Bulb check

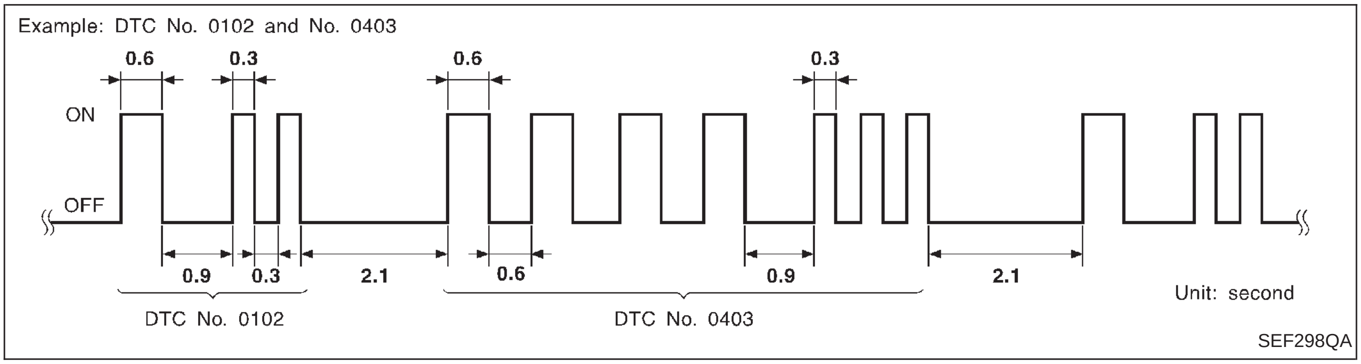
In this mode, the MI (MIL) on the instrument panel should stay ON. If it remains OFF, check the bulb. Refer to EL section, "WARNING LAMPS AND CHIME" or see EC-307.

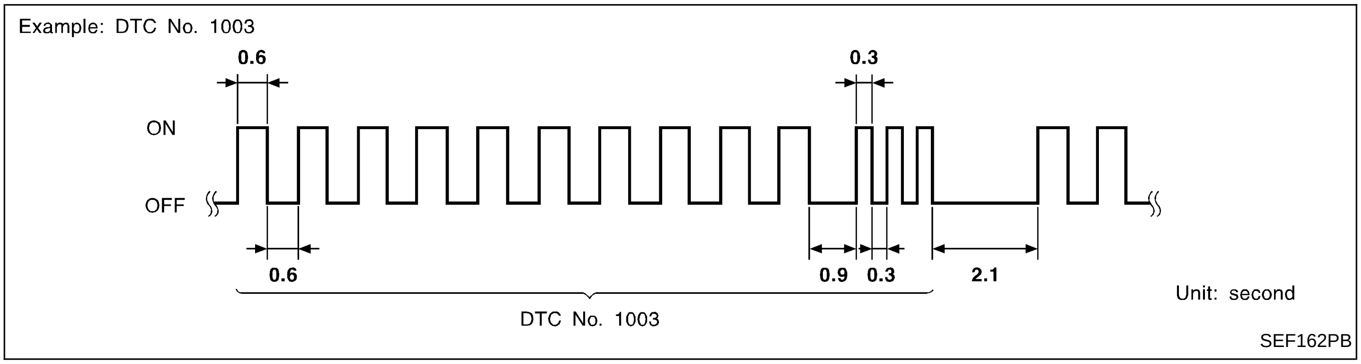
Diagnostic test mode I — Malfunction warning

MI (MIL)	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 (MIL) 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 (MIL) 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-37.)

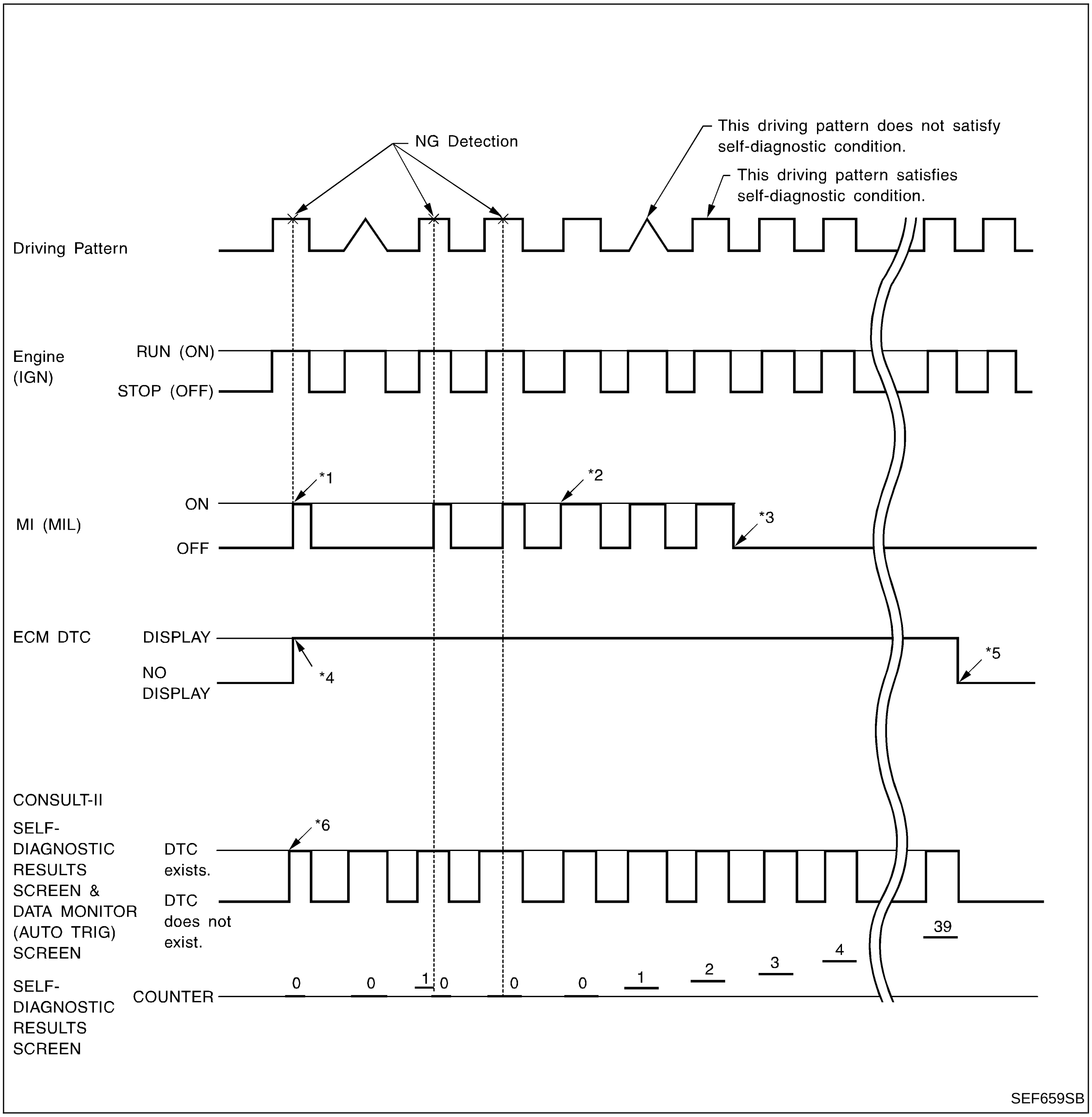
How to erase diagnostic test mode II (Self-diagnostic results)

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-66.)

- **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), Malfunction Indicator Lamp (MIL) (Cont'd)

Relationship between MI (MIL), DTC, CONSULT-II and driving patterns


NG Detection
This driving pattern does not satisfy self-diagnostic condition.
This driving pattern satisfies self-diagnostic condition.
Driving Pattern
Engine (IGN)
RUN (ON)
STOP (OFF)
MI (MIL)
ON
OFF
*1
*2
*3
ECM DTC
DISPLAY
NO DISPLAY
*4
*5
CONSULT-II SELF-DIAGNOSTIC RESULTS SCREEN & DATA MONITOR (AUTO TRIG) SCREEN
*6
DTC exists.
DTC does not exist.
SELF-DIAGNOSTIC RESULTS SCREEN
COUNTER
0
0
1
0
0
0
1
2
3
4
39
SEF659SB

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

*2: When the same malfunction is detected in two consecutive driving patterns, MI (MIL) will stay lit up.

*3: MI (MIL) will go off after vehicle is driven three times without any malfunctions.

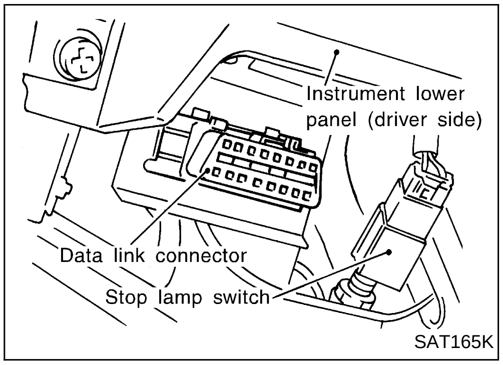
*4: When a malfunction is detected for the first time, the DTC will be stored in ECM.

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

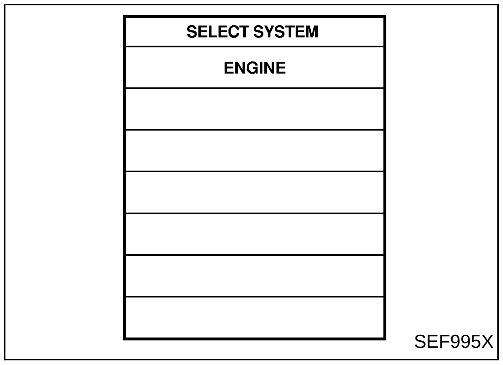
*6: Other screens except SELF-DIAGNOSTIC RESULTS & DATA MONITOR (AUTO TRIG) cannot display the malfunction. DATA MONITOR (AUTO TRIG) can display the malfunction at the moment it is detected.

CONSULT-II

CONSULT-II INSPECTION PROCEDURE



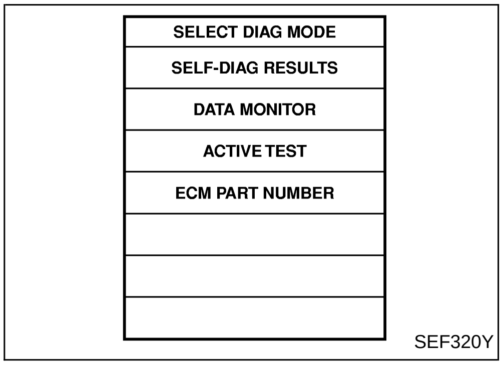
1. Turn ignition switch OFF.
2. Connect CONSULT-II to data link connector, which is located under the driver side dash panel.



SELECT SYSTEM

ENGINE

SEF995X



SELECT DIAG MODE

SELF-DIAG RESULTS

DATA MONITOR

ACTIVE TEST

ECM PART NUMBER

SEF320Y

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.

GI
MA
EM
LC
EC
FE
CL
MT
AT
TF
PD
FA
RA
BR
ST
RS
BT
HA
EL
SE
IDX

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
		Exhaust gas control valve control solenoid valve		X	

X: Applicable

SELF-DIAGNOSTIC MODE

Regarding items detected in "SELF-DIAG RESULTS" mode, refer to "TROUBLE DIAGNOSIS — INDEX", EC-37.

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.

CONSULT-II (Cont'd)

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
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 (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.	

CONSULT-II (Cont'd)

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
COOLING FAN [ON/OFF]		○	● Indicates the control condition of the cooling fans (determined by ECM according to the input signal). ● ON ... Operates. OFF ... Stopped.	
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 turbocharger 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.	
EXH/GAS REG V [ON/OFF]			● The control condition of the exhaust gas control valve control solenoid valve (computed by ECM according to the input signals) is indicated. ● ON ... Exhaust gas control valve is closed. ● OFF ... Exhaust gas control valve is opened.	● This item is applicable for cold area models. On other models, "OFF" is always displayed.

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

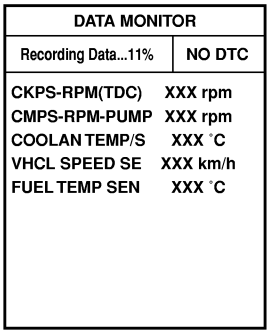
CONSULT-II (Cont'd)

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)

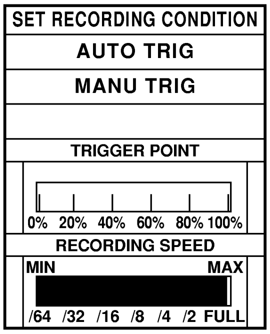


DATA MONITOR

Recording Data...11% | NO DTC

CKPS-RPM(TDC)	XXX rpm
CMPS-RPM-PUMP	XXX rpm
COOLAN TEMP/S	XXX ˚C
VHCL SPEED SE	XXX km/h
FUEL TEMP SEN	XXX ˚C

SEF373Y



SET RECORDING CONDITION

AUTO TRIG

MANU TRIG

TRIGGER POINT

RECORDING SPEED

SEF707X

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:

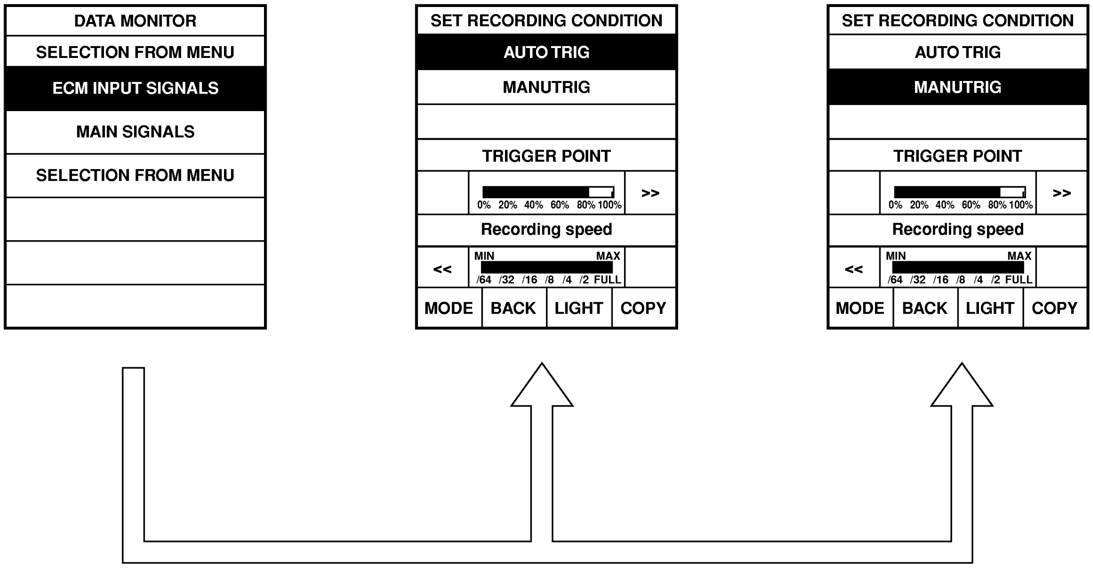
1) "AUTO TRIG"

- 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 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.

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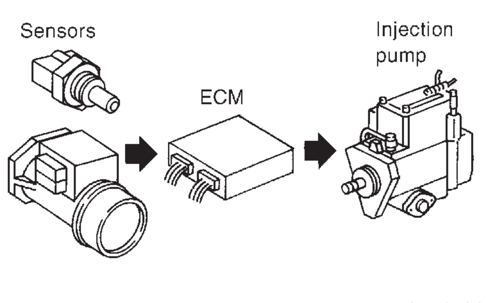
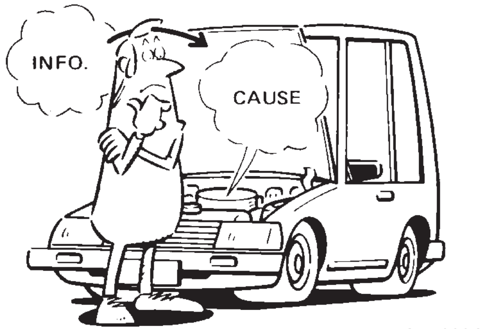


SEF858S



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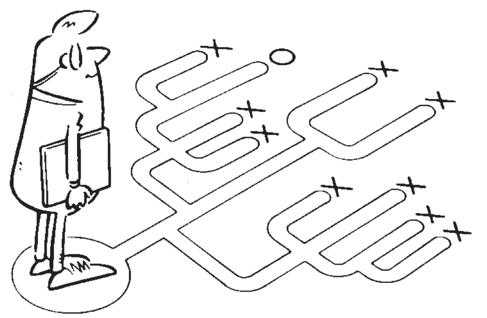


SEF234G

Introduction

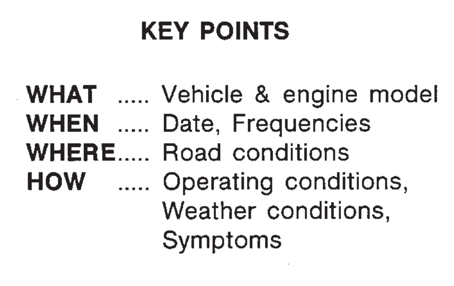
The engine has an ECM to control major systems such as fuel injection control, fuel injection timing control, glow control system, etc. The ECM accepts input signals from sensors and instantly drives electronic control fuel injection pump. It is essential that both input and output signals are proper 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-78.

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.



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 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

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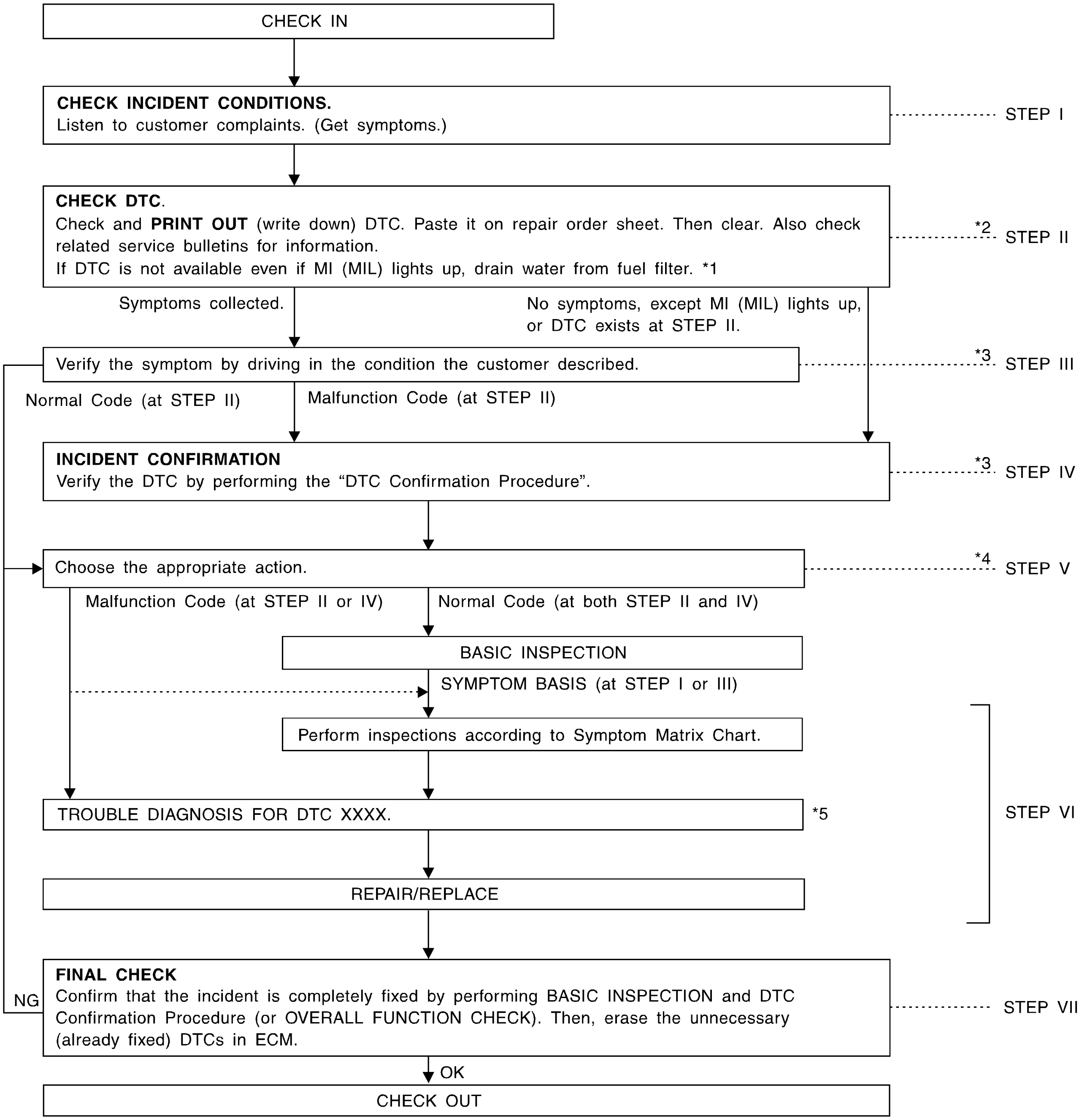
Work Flow


CHECK IN

CHECK INCIDENT CONDITIONS.
Listen to customer complaints. (Get symptoms.)

CHECK DTC.
Check and **PRINT OUT** (write down) DTC. Paste it on repair order sheet. Then clear. Also check related service bulletins for information.
If DTC is not available even if MI (MIL) lights up, drain water from fuel filter. *1

Symptoms collected.

No symptoms, except MI (MIL) lights up, or DTC exists at STEP II.

Verify the symptom by driving in the condition the customer described.

Normal Code (at STEP II)

Malfunction Code (at STEP II)

INCIDENT CONFIRMATION
Verify the DTC by performing the “DTC Confirmation Procedure”.

Choose the appropriate action.

Malfunction Code (at STEP II or IV)

Normal Code (at both STEP II and IV)

BASIC INSPECTION

SYMPTOM BASIS (at STEP I or III)

Perform inspections according to Symptom Matrix Chart.

TROUBLE DIAGNOSIS FOR DTC XXXX.

REPAIR/REPLACE

FINAL CHECK
Confirm that the incident is completely fixed by performing BASIC INSPECTION and DTC Confirmation Procedure (or OVERALL FUNCTION CHECK). Then, erase the unnecessary (already fixed) DTCs in ECM.

CHECK OUT

SEF374YA

*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-107.

*3 If the incident cannot be verified, perform “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

*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-108.

*5 If malfunctioning part cannot be detected, perform “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

Work Flow (Cont’d)

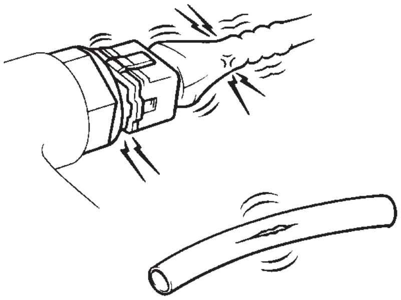
DESCRIPTION FOR WORK FLOW

STEP	DESCRIPTION
STEP I	Get detailed information about the conditions and the environment when the incident/symptom occurred using the “DIAGNOSTIC WORKSHEET”, EC-76.
STEP II	Before confirming the concern, check and write down (print out using CONSULT-II) the DTC, then erase the DTC. Refer to EC-63. If the incident cannot be verified, perform “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107. 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-86.) 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-107. 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-107. 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-80. Then perform inspections according to the Symptom Matrix Chart. Refer to EC-86.
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-99 or EC-96. 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-107.
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-63.)

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.**

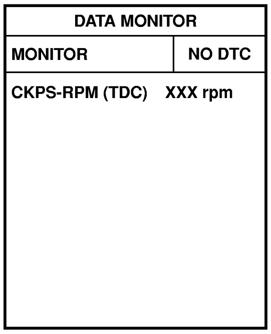
1	**INSPECTION START**
1. Check service records for any recent repairs that may indicate a related problem. 2. Check the current need for scheduled maintenance, especially for fuel filter and air cleaner filter. Refer to MA section. 3. Open engine hood and check the following: ● Harness connectors for 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.

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

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-62.

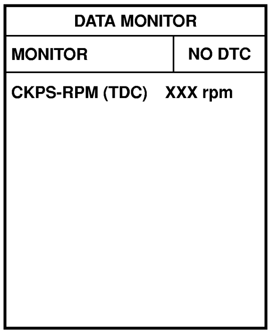
▶	GO TO 6.

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

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	DRIN WATER FROM FUEL FILTER

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

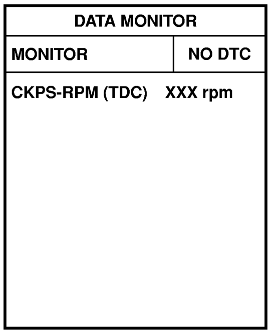
▶	GO TO 8.

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

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-56.

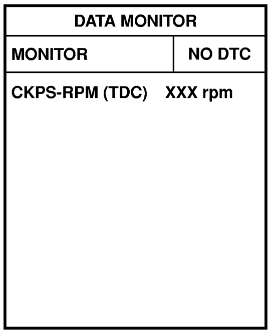
OK or NG

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

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”.

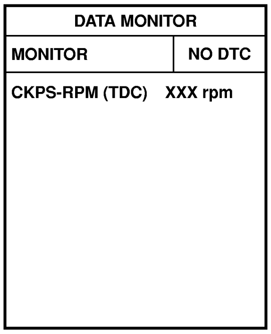
OK or NG

OK ▶	GO TO 13.
NG ▶	Follow the instruction of “MEASUREMENT OF COMPRESSION PRESSURE”.

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

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-54	*2
Glow system	1	1	1	1										EC-252	
Engine body	3	3	3	3	3	3	3		3	4	4		3	EM section	*3
EGR system										3	3			EC-238	
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-54	*2
Glow system								1					EC-252	
Engine body	3	3		3	3	3		3					EM section	*3
EGR system							3						EC-238	
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													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			
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-117	
		*b															
	Engine coolant temperature sensor circuit	*a, *b			1		1		1						1	EC-123	*1
	Vehicle speed sensor circuit	*a, *b											1			EC-127	

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												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					
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-117	
		*b							1							
	Engine coolant temperature sensor circuit	*a, *b	1	1								1	1		EC-123	*1
	Vehicle speed sensor circuit	*a, *b											1		EC-127	

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													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			
ENGINE CONTROL	Accelerator switch (FC) circuit	*a, *b								1						EC-131	
		*c															
	Fuel cut system line	*a, *c														EC-246	
		*b	1				1	1	1								*2
	Accelerator position sensor circuit	*a, *b								1		1	1			EC-156	
	Crankshaft position sensor (TDC) circuit	*a, *b														EC-171	
		*d										1	1				
	Charge air pressure sensor circuit	*a, *b, *c										1	1			EC-233	
	Swirl control valve control solenoid valve circuit	*a, *b														EC-277	
		*c								1	1	1	1				
	Variable nozzle turbocharger control solenoid valve circuit	*a, *b										1	1			EC-292	
		*c										1	1				
	Intake air control valve control solenoid valve circuit	*c	1	1	1	1	1	1	1	1						EC-285	
	Exhaust gas control valve control solenoid valve circuit	*c						1	1	1		1	1			EC-300	

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												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					
ENGINE CONTROL	Accelerator switch (FC) circuit	*a, *b										1	1		EC-131	
		*c														
	Fuel cut system line	*a, *c										1	1		EC-246	
		*b												1		*2
	Accelerator position sensor circuit	*a, *b										1	1		EC-156	
	Crankshaft position sensor (TDC) circuit	*a, *b	1	1								1	1		EC-171	
		*d														
	Charge air pressure sensor circuit	*a, *b, *c										1	1		EC-233	
	Swirl control valve control solenoid valve circuit	*a, *b							1						EC-277	
		*c					1		1	1						
	Variable nozzle turbocharger control solenoid valve circuit	*a, *b					1		1						EC-292	
		*c					1						1			
	Intake air control valve control solenoid valve circuit	*c													EC-285	
	Exhaust gas control valve control solenoid valve circuit	*c	1	1		1	1	1	1						EC-300	

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													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			
ENGINE CONTROL	Start signal circuit	*a, *b			1	1										EC-261	*3
	PNP switch circuit	*a, *b							1							EC-264	
		*c															
	Accelerator position switch (Idle) circuit	*a, *c					1		1						1	EC-156	
		*b								1		1	1				*4
	Accelerator position switch (Full) circuit	*a, *b								1		1	1			EC-156	
	Ignition switch circuit	*a		1			1	1	1							EC-108	
		*b															*5
	Power supply for ECM circuit	*a														EC-108	
		*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												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					
ENGINE CONTROL	Start signal circuit	*a, *b													EC-261	*3
	PNP switch circuit	*a, *b	1	1											EC-264	
		*c														
	Accelerator position switch (Idle) circuit	*a, *c													EC-156	
		*b										1	1			*4
	Accelerator position switch (Full) circuit	*a, *b										1	1		EC-156	
	Ignition switch circuit	*a													EC-108	
		*b														*5
	Power supply for ECM circuit	*a										1	1	1	EC-108	
		*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													Reference page	Feature of symptom, Check point
			HARD/NO START/RESTART (EXCP. HA)				ENGINE STALL			HESITATION/SURGING/FLAT SPOT	KNOCK/DETONATION	LACK OF POWER	POOR ACCELERATION	HI IDLE	LOW IDLE		
			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								
Warranty symptom code			AA				AB			AC	AD	AE		AF			
ENGINE CONTROL	EGR volume control valve circuit	*a, *b														EC-238	
		*c															*8
	Glow relay circuit	*a	1	1	1	1										EC-252	*9
		*b															*10
	ECM relay (Self-shutoff) circuit	*a					1	1	1							EC-108	
		*b															*11
	ECM, Connector circuit	*a, *b	2	2	2	2	2	2	2	2	2	2	2	2	2	EC-148, 218, 231	
	Air conditioner relay circuit	*a														EC-306	*12
		*b															*13
	Air conditioner switch circuit	*a, *c														EC-306	*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												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					
ENGINE CONTROL	EGR volume control valve circuit	*a, *b													EC-238	
		*c							1							*8
	Glow relay circuit	*a								1					EC-252	*9
		*b														*10
	ECM relay (Self-shutoff) circuit	*a												1	EC-108	
		*b	1	1												*11
	ECM, Connector circuit	*a, *b	2	2	2	2	2	2	2	2	2	2	2	2	EC-148, 218, 231	
	Air conditioner relay circuit	*a													EC-306	*12
		*b														*13
	Air conditioner switch circuit	*a, *c													EC-306	*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) CMPS·RPM-PUMP	● Tachometer: Connect ● Run engine and compare tachometer indication with the CONSULT-II value.		Almost the same speed as the CONSULT-II value.
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-252.		
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
EXH/GAS REG V*	● Vehicle: Stopped ● Engine speed: Below 1,200 rpm ● Engine coolant temperature: Below 87°C (189°F) ● Heat up switch: ON		ON
	Except above		OFF

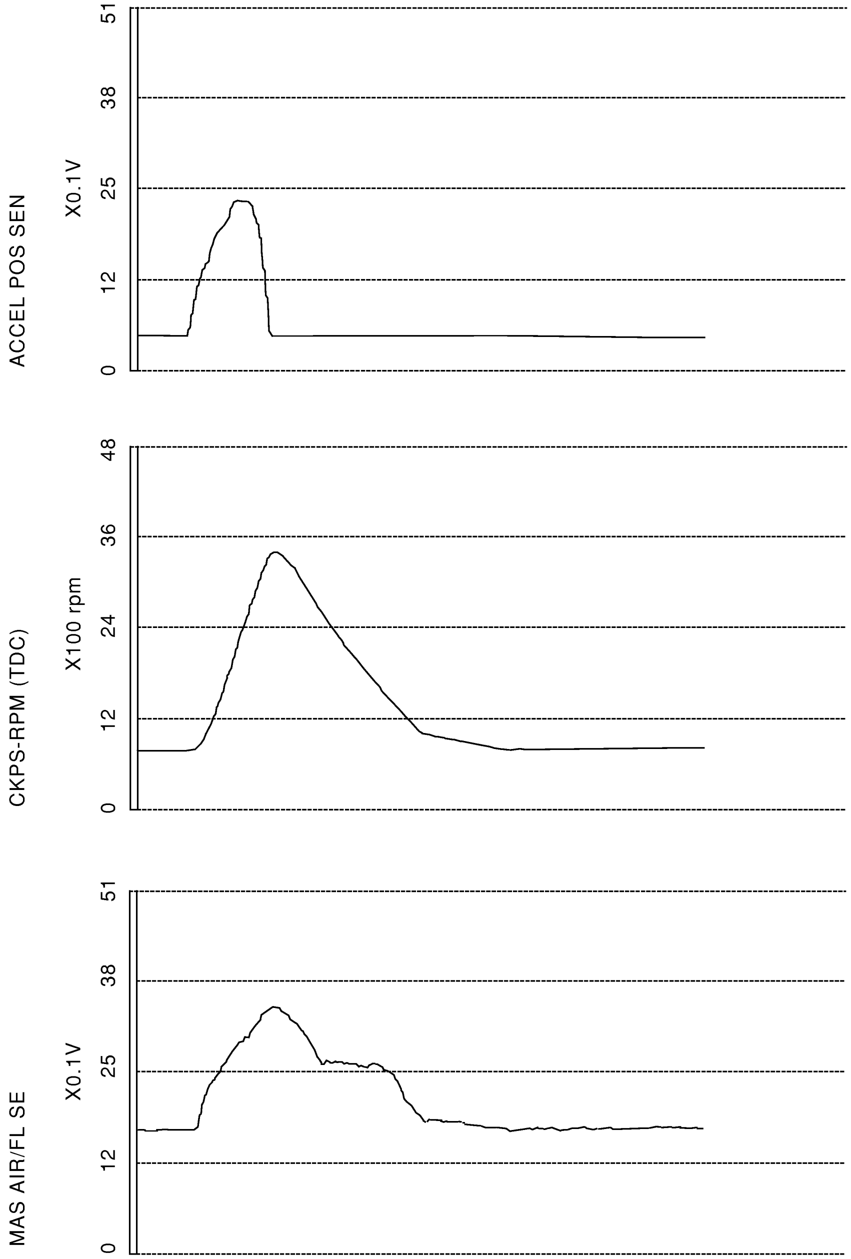
*: This item is applicable for cold area models. On other models, "OFF" is always displayed.

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.

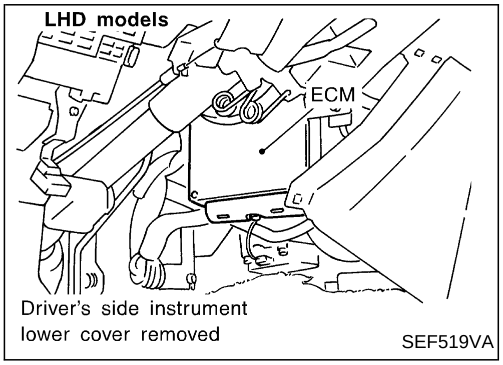


- “ACCEL POS SEN” should increase while depressing the accelerator pedal and should decrease while releasing it.
- “CKPS•RPM (TDC)” should increase gradually while depressing the accelerator pedal and should decrease gradually after releasing the pedal without any intermittent drop or rise.
- “MAS AIR/FL SE” should increase while depressing the accelerator pedal and should decrease gradually after releasing the pedal.

SEF321Y

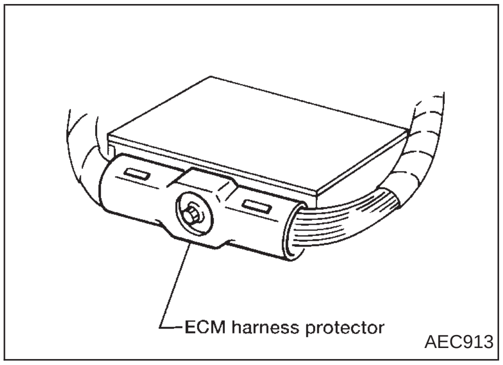
ECM Terminals and Reference Value

PREPARATION



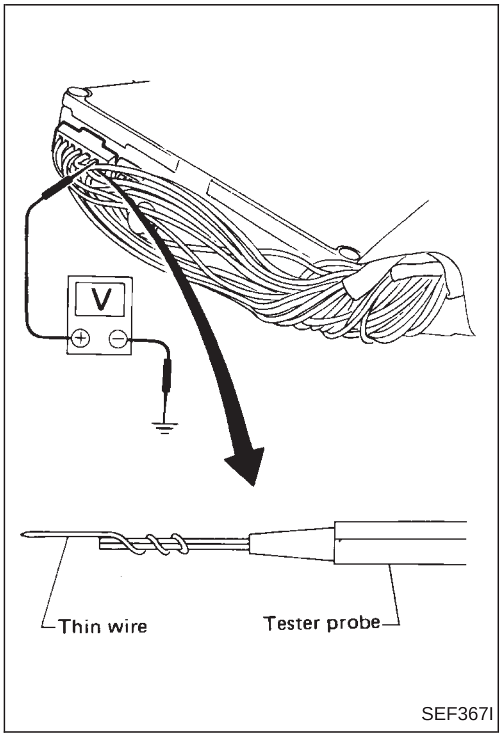
SEF519VA

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



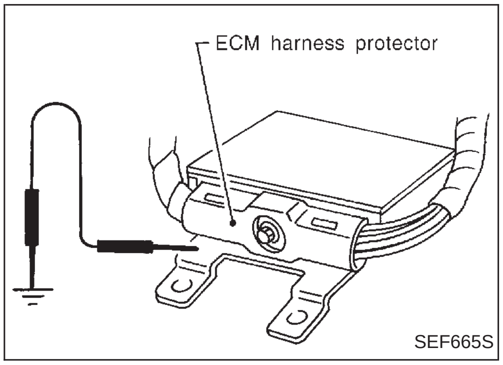
AEC913

2. Remove ECM harness protector.



SEF367I

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.

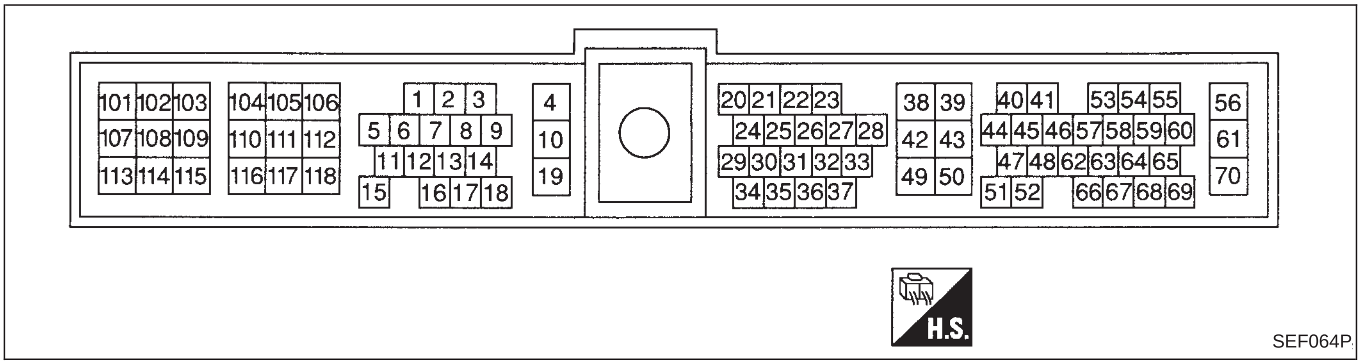


SEF665S

Be sure ECM unit is properly grounded before checking.

ECM Terminals and Reference Value (Cont’d)

ECM HARNESS CONNECTOR TERMINAL LAYOUT



ECM INSPECTION TABLE

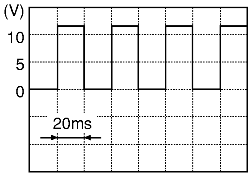
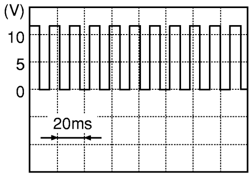
Remarks: Specification data are reference values and are measured between each terminal and ground.

CAUTION:

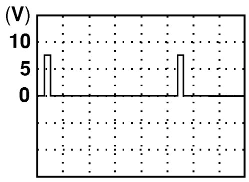
Do not use ECM ground terminals when measuring input/output voltage. Doing so may damage the ECM’s transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
2	R/W	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	B/Y	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)

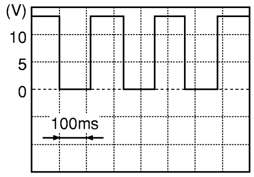
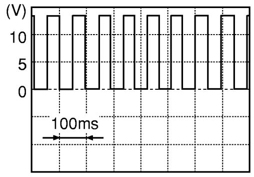
ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
5	Y/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
11	BR/Y	Exhaust gas control valve control solenoid valve	Engine is running. Engine speed is below 1,200 rpm Engine coolant temperature is below 87°C (189°F) Stop the vehicle Heat up switch is "ON"	Approximately 0.1V
			Engine is running. Except the above condition	BATTERY VOLTAGE (11 - 14V)
14	L	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	Y/L	Air conditioner relay	Engine is running. Air conditioner switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
			Engine is running. Both air conditioner switch and blower fan switch are "ON" (Compressor is operating)	Approximately 0.1V
16	L/W	Glow lamp	Ignition switch "ON" Glow lamp is "ON"	Approximately 1V
			Ignition switch "ON" Glow lamp is "OFF"	BATTERY VOLTAGE (11 - 14V)

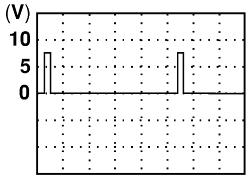
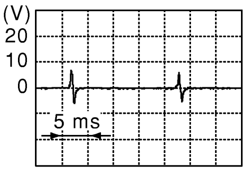
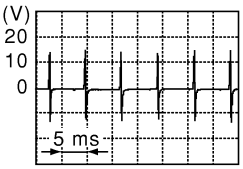
ECM Terminals and Reference Value (Cont’d)

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	G	Malfunction indicator lamp	Ignition switch “ON”	Approximately 1V
			Engine is running. Idle speed	BATTERY VOLTAGE (11 - 14V)
19	LG/R	Engine coolant temperature sensor	Engine is running.	Approximately 0 - 4.8V Output voltage varies with engine coolant temperature
20	R/W	Start signal	Ignition switch “ON”	Approximately 0V
			Ignition switch “START”	BATTERY VOLTAGE (11 - 14V)
21	LG/B	Air conditioner switch	Engine is running. Air conditioner switch is “OFF”	BATTERY VOLTAGE (11 - 14V)
			Engine is running. Both air conditioner switch and blower fan switch are “ON” (Compressor is operating)	Approximately 0.1V
22	P/B	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	W	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	PU/W	A/T signal No. 1	Engine is running. **Warm-up condition** Idle speed	Voltage goes high up once in a few seconds  SEF448Z

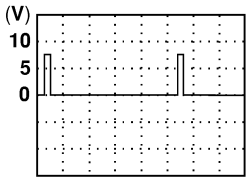
ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
26	L/OR	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	R/L	Accelerator switch (F/C)	Ignition switch "ON" └ Accelerator pedal fully released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "ON" └ Accelerator pedal depressed	Approximately 0V
30	P	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	R/L	Accelerator position switch (Idle)	Ignition switch "ON" └ Accelerator pedal fully released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "ON" └ Accelerator pedal depressed	Approximately 0V
32	W/G	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/Y	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V

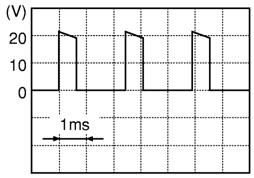
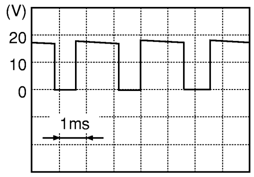
ECM Terminals and Reference Value (Cont'd)

TERMINAL 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	P/B	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/Y	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/B	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
42	L/G	Data link connector	Engine is running. Idle speed (CONSULT-II is connected and turned on)	Approximately 0V
64	Y/G			Approximately 0V
65	Y/R			Less than 9V
44	L	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)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
46	L	Charge air pressure sensor	Engine is running. **Warm-up condition** Idle speed	Approximately 2.0V
47	B/W	Crankshaft position sensor (TDC) ground	Engine is running. **Warm-up condition** Idle speed	Approximately 0V
48	G/R	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	L/W	Accelerator position sensor ground	Engine is running. **Warm-up condition** Idle speed	Approximately 0V
52	L/B	Electronic control fuel injection pump	Engine is running. Idle speed	Approximately 0.1V
53	L/R	Electronic control fuel injection pump	Engine is running. Idle speed	Approximately 1.0V
54	L/B	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	W W W	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
58	L/OR	A/T signal No. 4	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)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
59	BR/W	Heat up switch	Ignition switch "ON" Heat up switch is "ON"	Approximately 0V
			Ignition switch "ON" Heat up switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
68	B/W	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	R/B	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/R	Current return	Engine is running. Idle speed	BATTERY VOLTAGE (11 - 14V)
103 105 109 115	L/Y L/W L 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/B	Glow relay	Refer to "GLOW CONTROL SYSTEM", EC-252.	

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-63.	
▶	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.

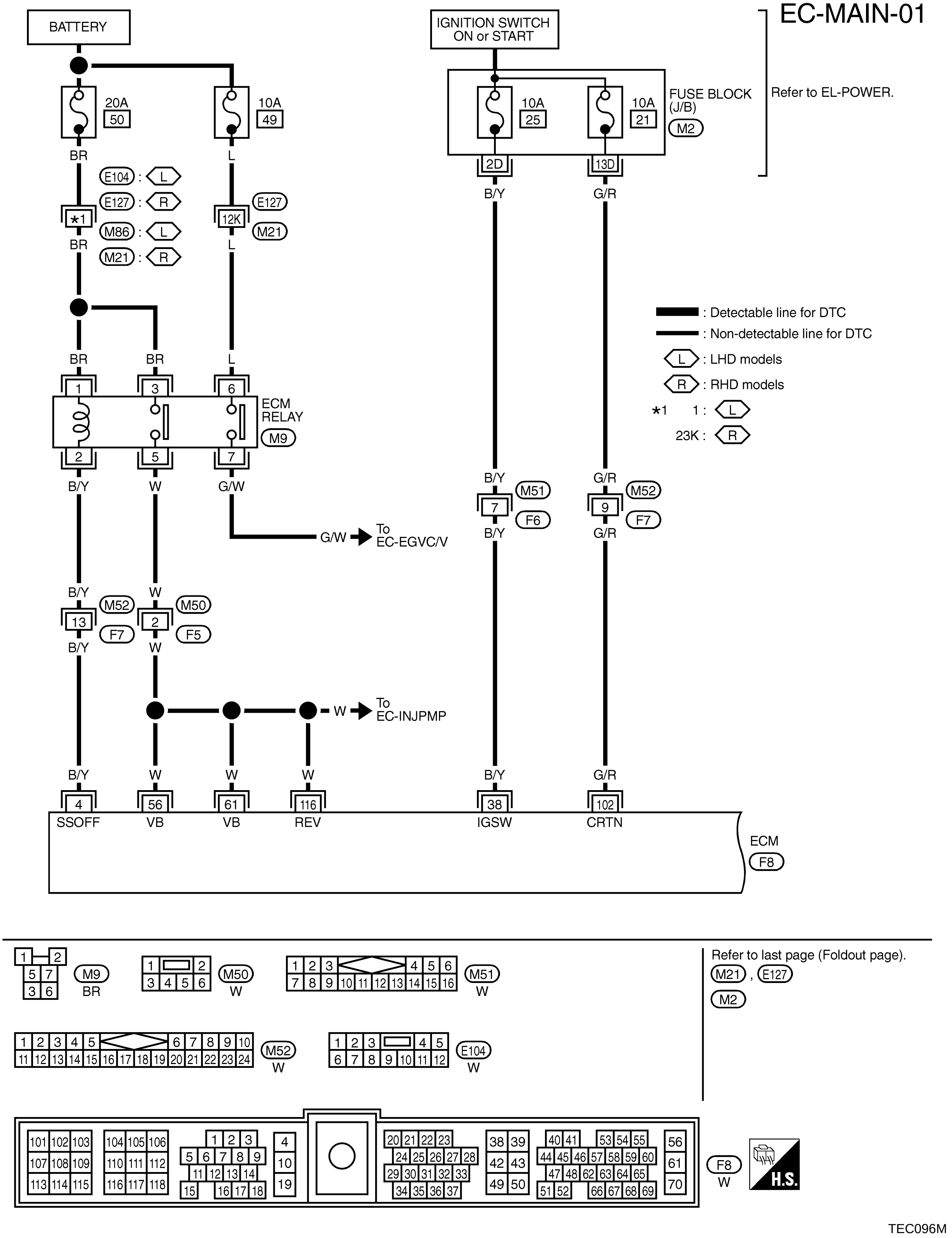
CAUTION:

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	B/Y	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/Y	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	W W W	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
102	G/R	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

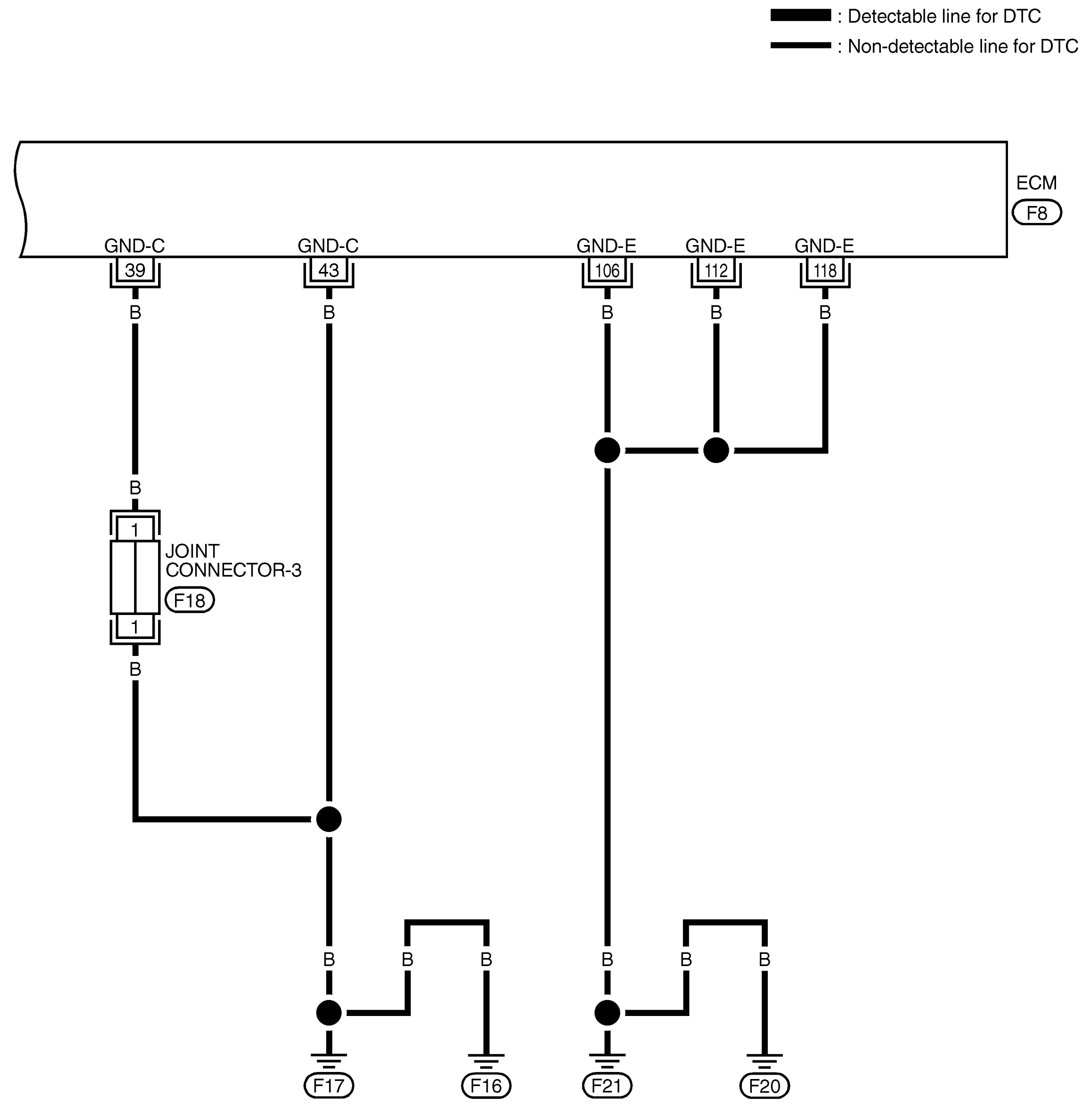
Main Power Supply and Ground Circuit (Cont'd)

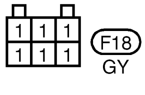
WIRING DIAGRAM

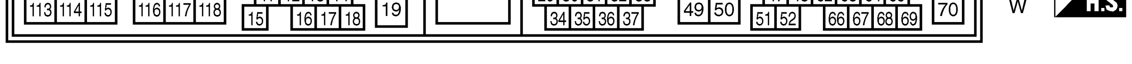


Main Power Supply and Ground Circuit (Cont'd)

EC-MAIN-02





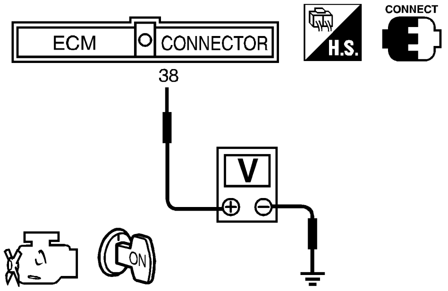


TEC097M

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.

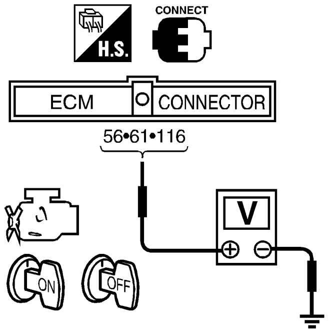
2	CHECK ECM POWER SUPPLY CIRCUIT-I
1. Turn ignition switch "ON". 2. Check voltage between ECM terminal 38 and ground with CONSULT-II or tester.	
	**Voltage: Battery voltage**
SEF397Y **OK or NG**	
OK ▶	GO TO 4.
NG ▶	GO TO 3.

3	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M51, F6 ● Fuse block (J/B) connector M2 ● 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)

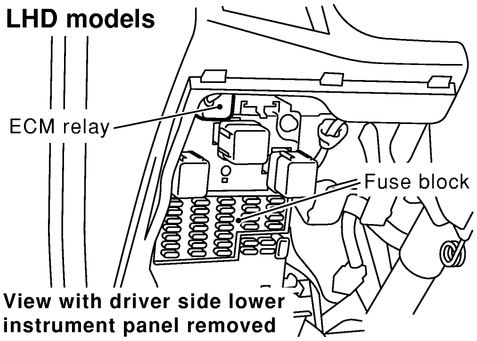
5	DETECT MALFUNCTIONING PART
Check the following. ● Joint connector-3 ● Harness for open or short between ECM and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

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.  CONNECT H.S. ECM CONNECTOR 56•61•116 V ON OFF **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-200.
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)

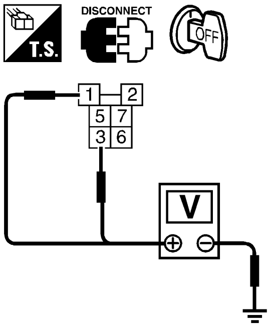
7	CHECK ECM POWER SUPPLY CIRCUIT-III

1. Disconnect ECM relay.



SEF225Z

2. Check voltage between relay terminals 1, 3 and ground with CONSULT-II or tester.



Voltage: Battery Voltage

SEF289Z

OK or NG

OK	▶	GO TO 9.
NG	▶	GO TO 8.

8	DETECT MALFUNCTIONING PART

Check the following.

- Harness connectors E104, M86 or E127, M21
- 20A 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 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 11.
NG	▶	GO TO 10.

Main Power Supply and Ground Circuit (Cont'd)

10	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M52, F7
- 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.

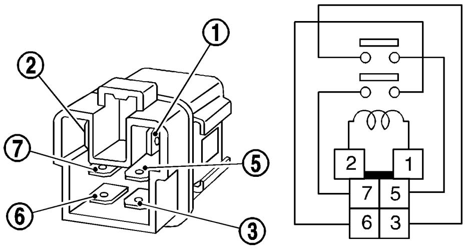
12	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M50, F5
- 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, 7 and 6.



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

SEF296X

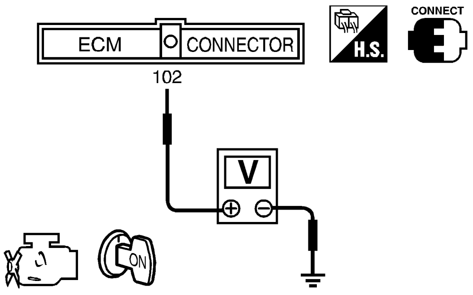
OK or NG

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.

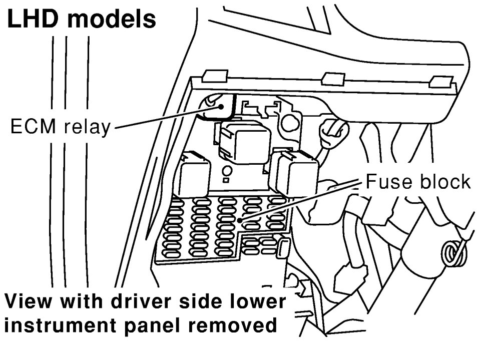
15 DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M52, F7
- Fuse block (J/B) connector M2
- 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.



SEF225Z

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)

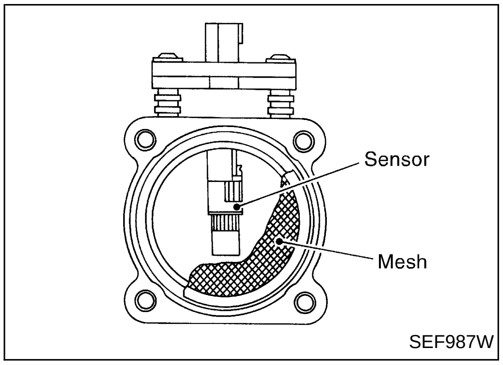
17	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M50, F5 ● Harness for open or short between ECM and ECM relay	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

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. ● Joint connector-3 ● 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-107.	
▶	**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.

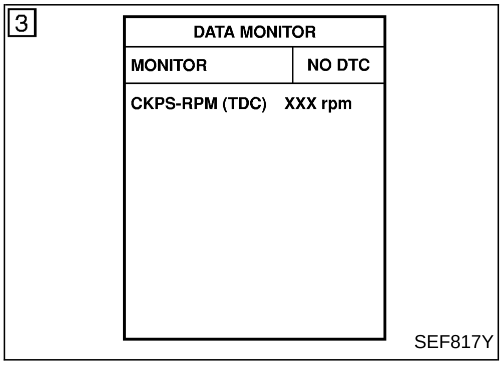
CAUTION:

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.

TERMINAL 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



DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

DTC Confirmation Procedure

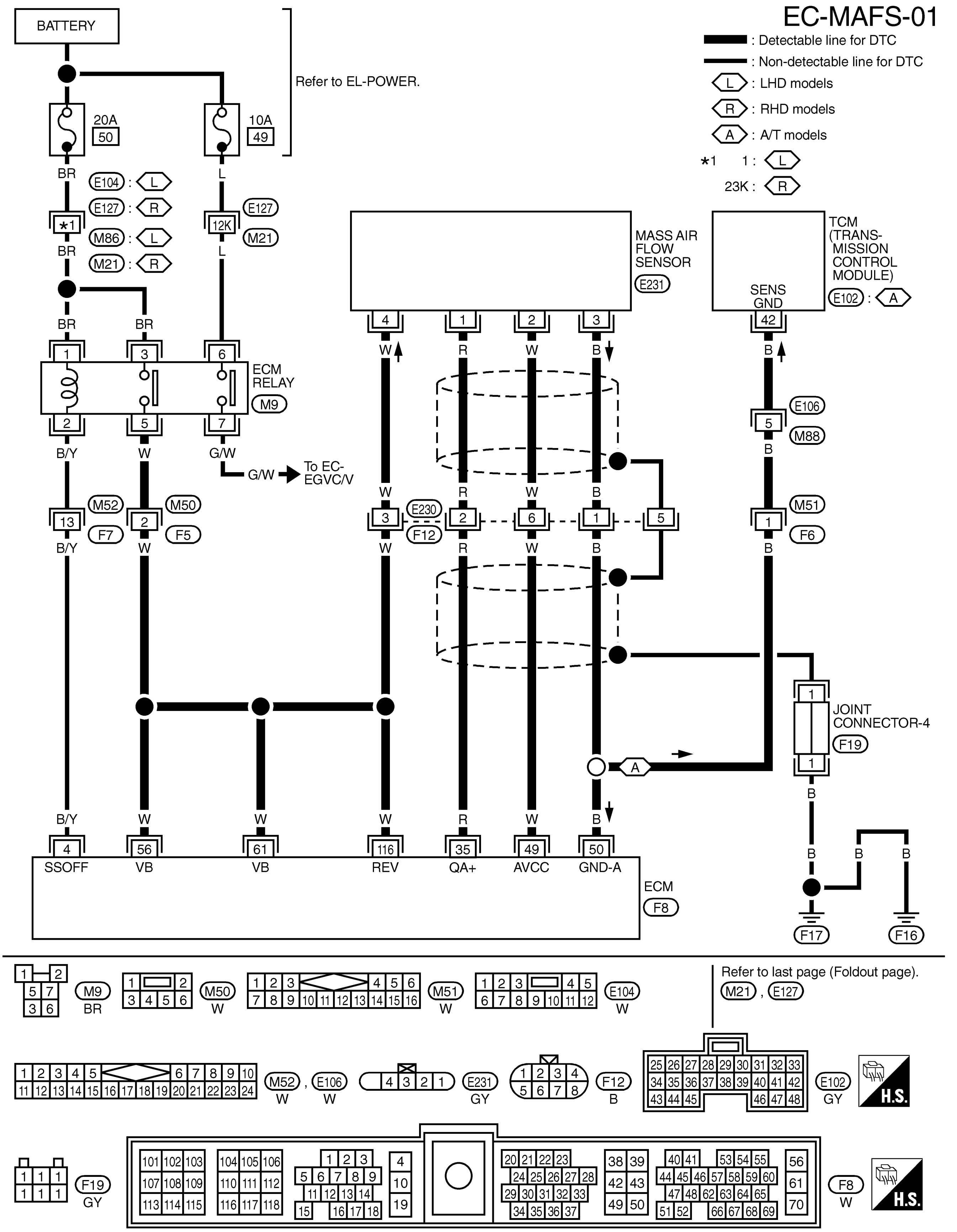
WITH CONSULT-II

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-120.

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-120.

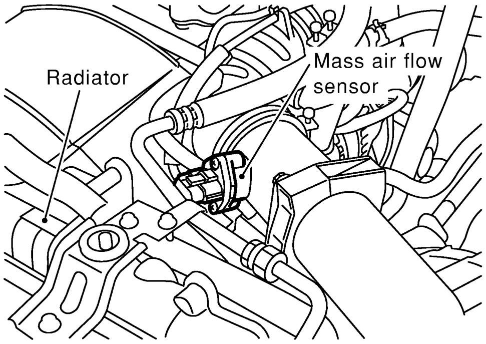
Wiring Diagram



Diagnostic Procedure

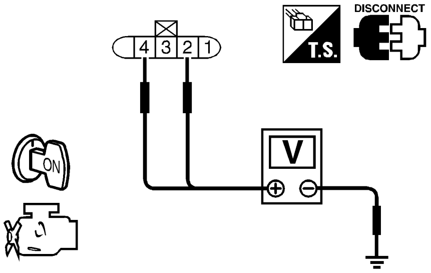
1 CHECK MAFS POWER SUPPLY CIRCUIT

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



SEF226Z

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



Terminal	Voltage
2	Approximately 5
4	Battery voltage

SEF297X

OK or NG

OK ▶	GO TO 3.
NG ▶	GO TO 2.

2 DETECT MALFUNCTIONING PART

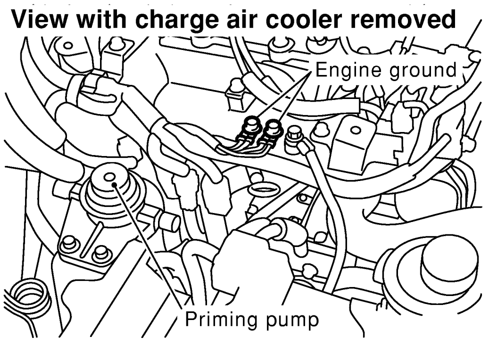
Check the following.

- Harness connectors E230, F12
- Harness connectors M50, F5
- 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.

3	CHECK MAFS GROUND CIRCUIT FOR OPEN AND SHORT

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



SEF227Z

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 E230, F12
- Harness connectors M51, F6
- Harness connectors E106, M88
- Harness for open or short between mass air flow sensor and ECM
- Harness for open or short between mass air flow sensor and TCM (Transmission control module)

▶	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 1 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

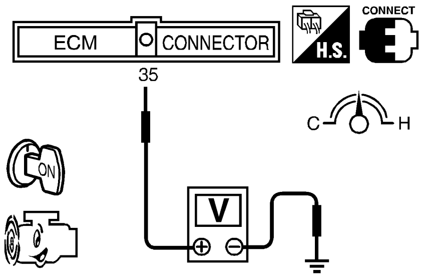
Check the following.
- Harness connectors E230, F12
- Harness for open or short between mass air flow sensor and ECM

▶	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.

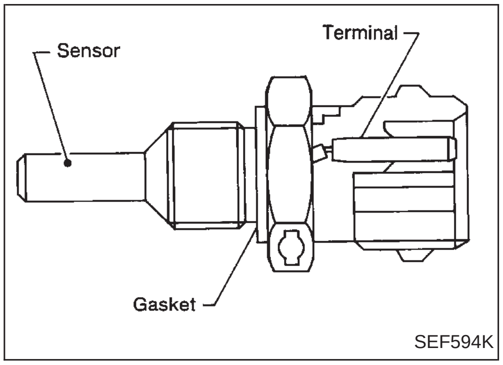
OK or NG

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

8 CHECK INTERMITTENT INCIDENT

Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.

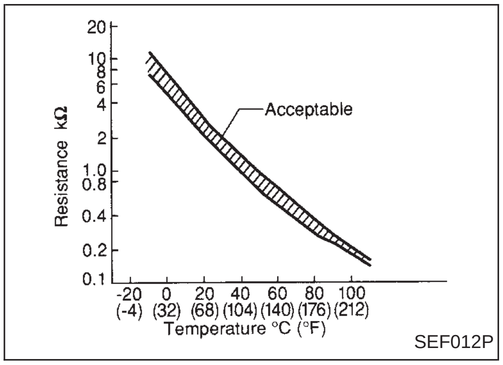
	▶	**INSPECTION END**



SEF594K

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.



SEF012P

<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

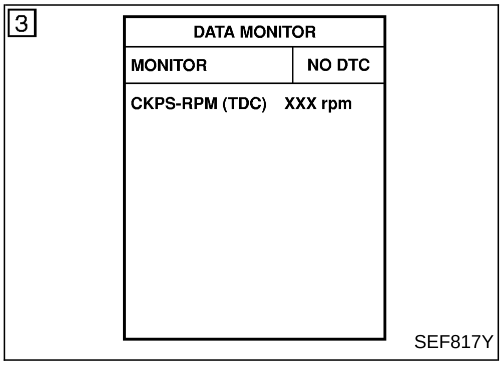
*: These data are reference values and measured between ECM terminal 19 (Engine coolant temperature sensor) and ground.

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

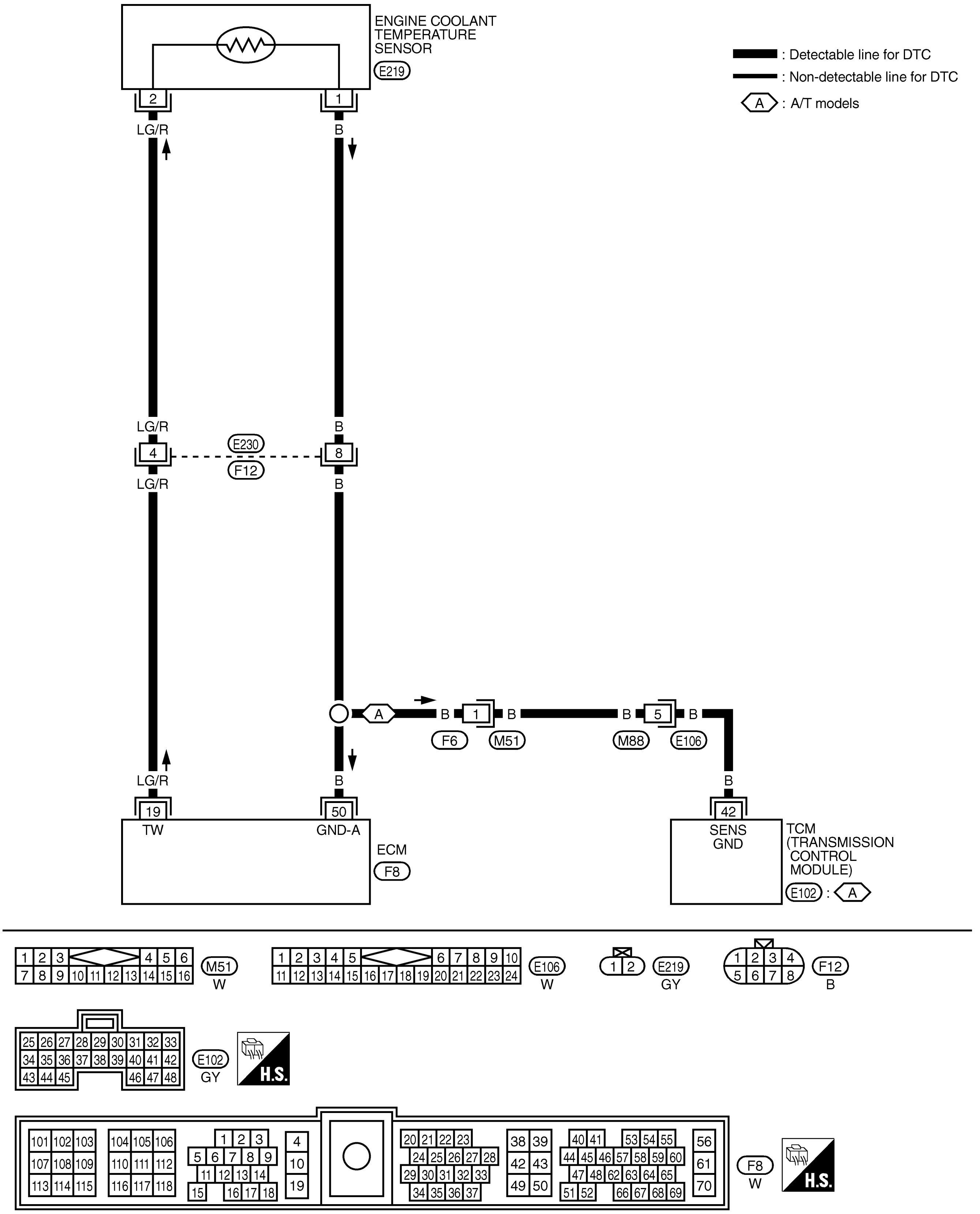
1) Turn ignition switch "ON".
2) Select "DATA MONITOR" mode with CONSULT-II.
3) Wait at least 5 seconds.
4) If DTC is detected, go to "Diagnostic Procedure", EC-125.

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-125.

Wiring Diagram

EC-ECTS-01

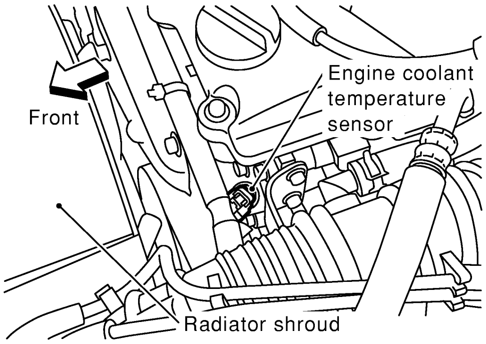


TEC099M

Diagnostic Procedure

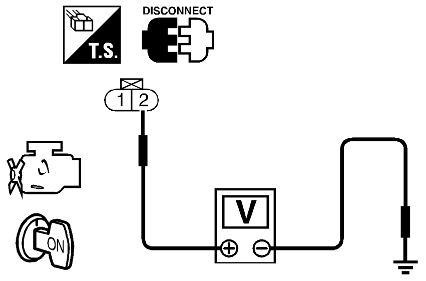
1 CHECK ECTS POWER SUPPLY CIRCUIT

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



SEF228Z

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 E230, F12
- 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.

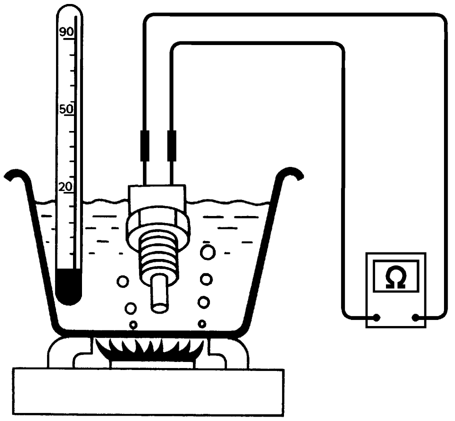
OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont’d)

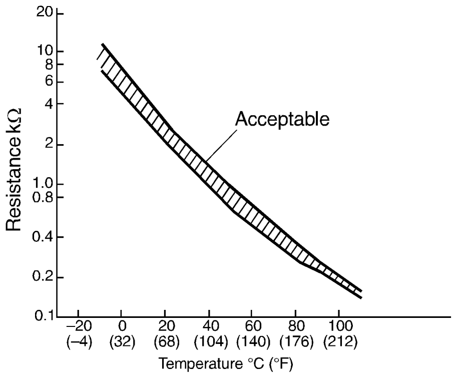
4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E230, F12 ● Harness connectors F6, M51 ● Harness connectors M88, E106 ● Harness for open or short between engine coolant temperature sensor and ECM ● Harness for open or short between engine coolant temperature sensor and TCM (Transmission control module)	
▶	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

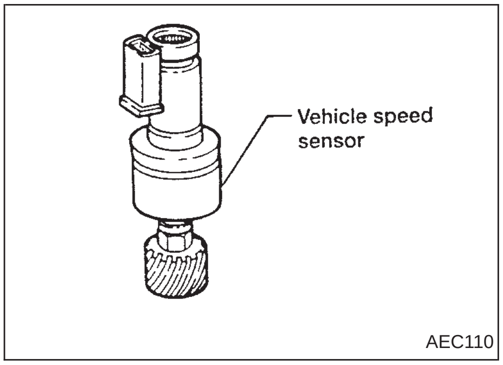


SEF304X

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-107.	
▶	**INSPECTION END**



AEC110

Description

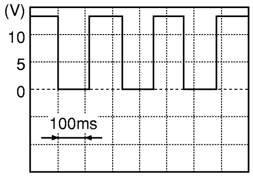
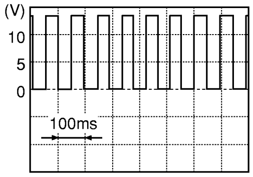
The vehicle speed sensor is installed in the transaxle. It contains a pulse generator which provides a vehicle speed signal to the speedometer. The speedometer then sends a signal to the ECM.

ECM Terminals and Reference Value

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

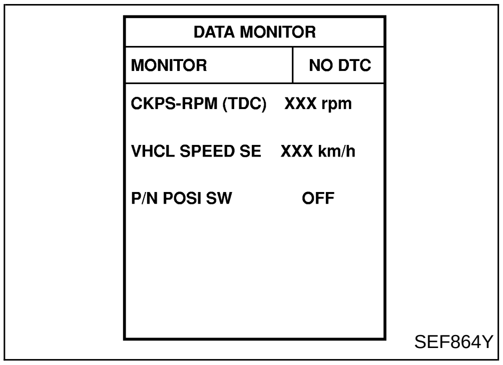
CAUTION:

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.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
26	L/OR	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

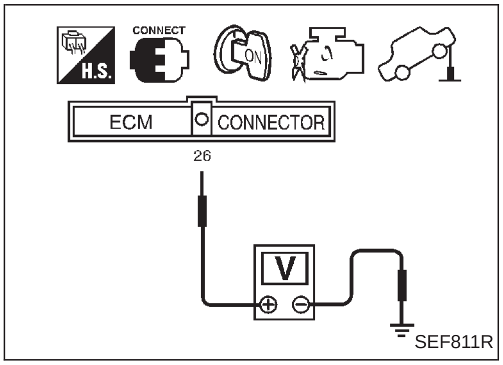
On Board Diagnosis Logic

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



DATA MONITOR	
MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm
VHCL SPEED SE	XXX km/h
P/N POSI SW	OFF

SEF864Y



SEF811R

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.

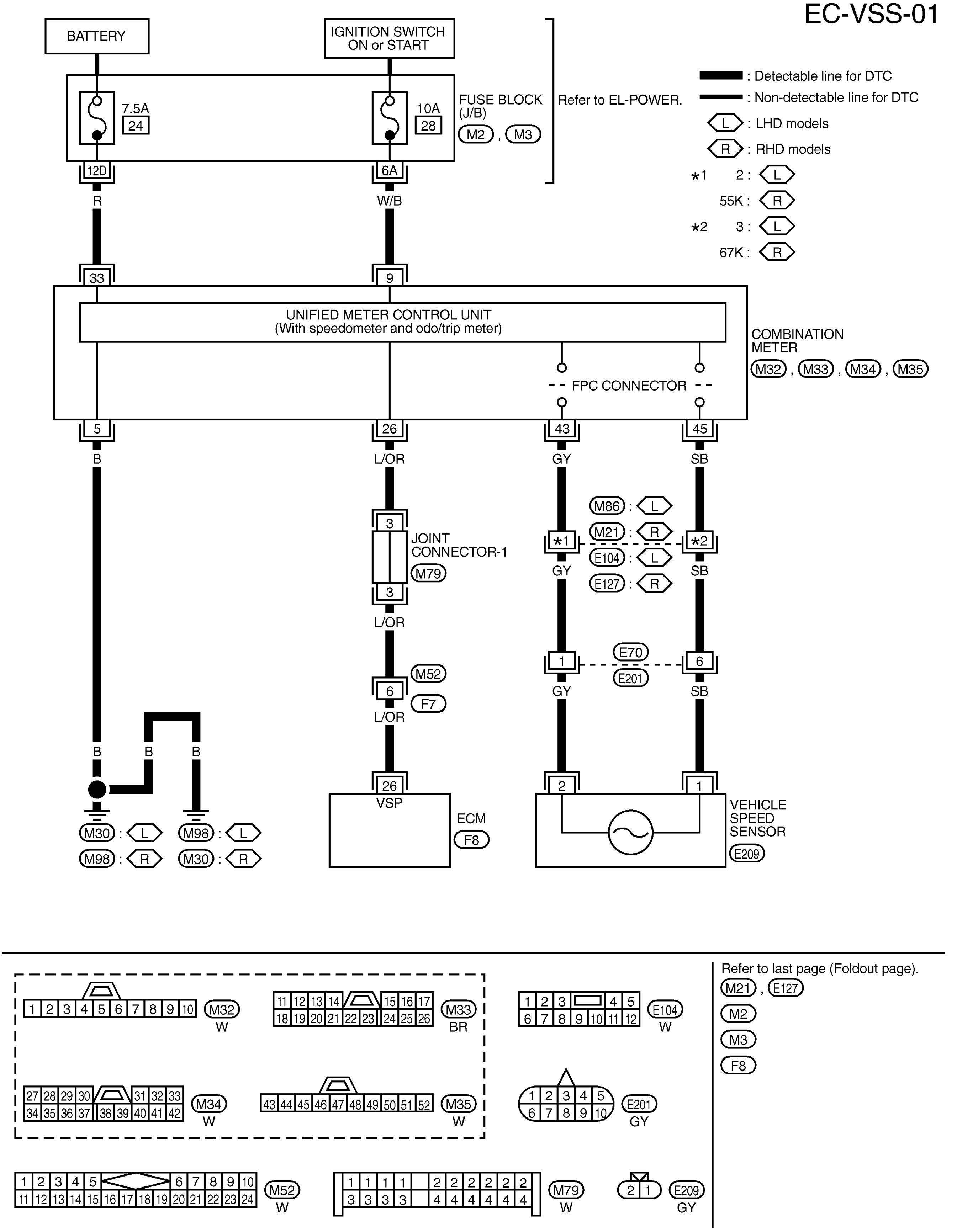
WITH CONSULT-II

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-130.

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 - 4.8V.
5) If NG, go to “Diagnostic Procedure”, EC-130.

Wiring Diagram



Diagnostic Procedure

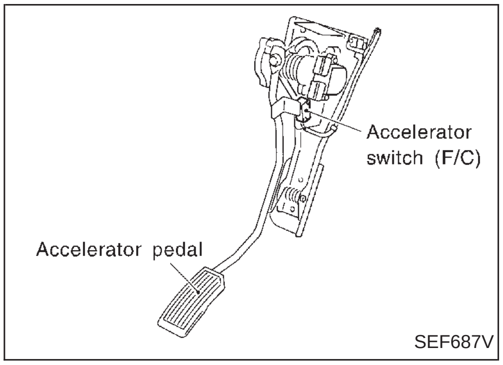
1	CHECK VEHICLE SPEED SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT
1. Turn ignition switch “OFF”. 2. Disconnect ECM harness connector and combination meter harness connector. 3. Check harness continuity between ECM terminal 26 and combination meter terminal 26. Refer to Wiring Diagram. **Continuity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

2	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M52, F7 ● Joint connector-1 ● Harness for open or short between ECM and combination meter	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

3	CHECK SPEEDOMETER FUNCTION
Make sure that speedometer functions properly. **OK or NG**	
OK ▶	GO TO 5.
NG ▶	GO TO 4.

4	CHECK SPEEDOMETER CIRCUIT FOR OPEN AND SHORT
Check the following. ● Harness connectors E70, E201 ● Harness connectors M86, E104 or M21, E127 ● 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.

5	CHECK INTERMITTENT INCIDENT
Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.	
▶	**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.

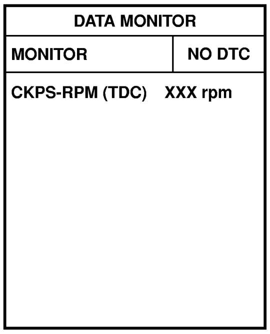
CAUTION:

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	R/L	Accelerator switch (F/C)	Ignition switch "ON" Accelerator pedal fully released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "ON" Accelerator pedal depressed	Approximately 0V

On Board Diagnosis Logic

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)



DATA MONITOR

MONITOR NO DTC

CKPS-RPM (TDC) XXX rpm

SEF817Y

DTC Confirmation Procedure

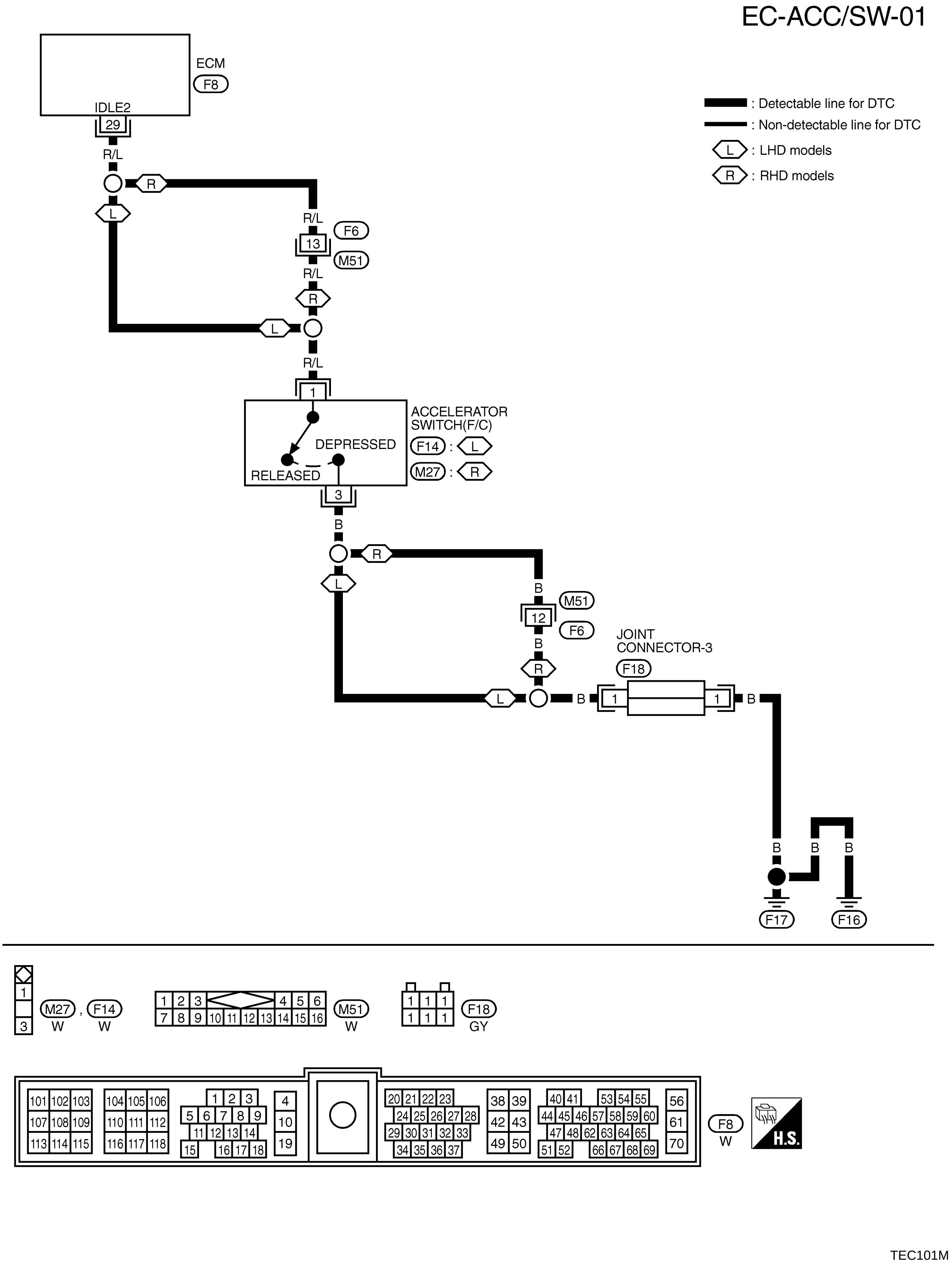
WITH CONSULT-II

1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) 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-134.

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-134.

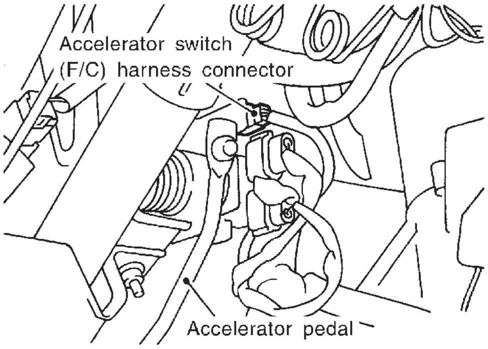
Wiring Diagram



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.



SEF688V

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 M51, F6 (RHD models)
- Joint connector-3
- 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 5.
NG	▶	GO TO 4.

4	DETECT MALFUNCTIONING PART

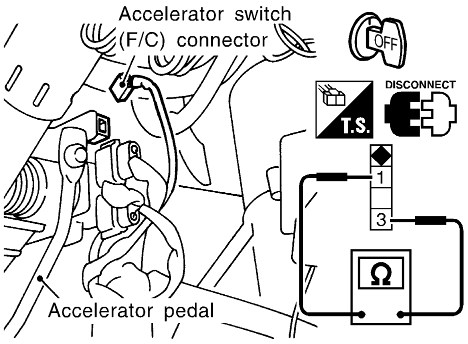
Check the following.
- Harness connectors M51, F6 (RHD models)
- Harness for open or short between ECM and accelerator switch (F/C)

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

Diagnostic Procedure (Cont’d)

5 CHECK ACCELERATOR SWITCH (F/C)

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



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

SEF274Z

OK or NG

OK ▶	GO TO 6.
NG ▶	Replace accelerator pedal assembly.

6 CHECK INTERMITTENT INCIDENT

Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

▶	**INSPECTION END**

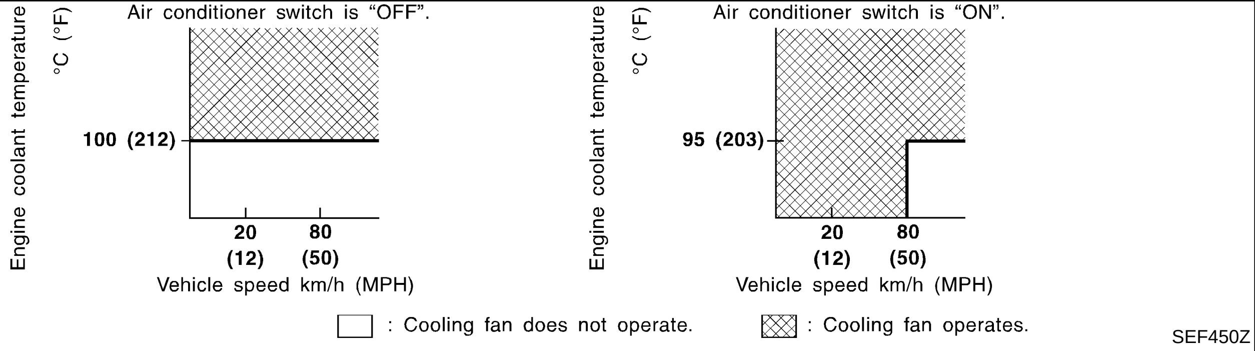
Description

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



SEF450Z

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.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
14	L	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.

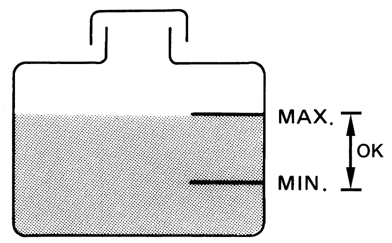
Malfunction is detected when ...	Check Items (Possible Cause)
● Cooling fan does not operate properly (Overheat). ● Cooling fan system does not operate properly (Overheat). ● Engine coolant was not added to the system using the proper filling method.	● Harness or connectors (The cooling fan circuit is 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-147.

CAUTION:

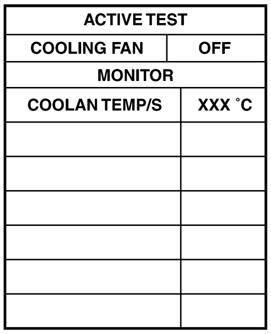
When a malfunction is indicated, be sure to replace the coolant following the procedure in the MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE"). Also, replace the engine oil.

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.

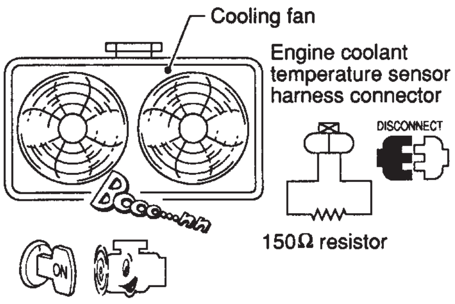


AEC640



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.

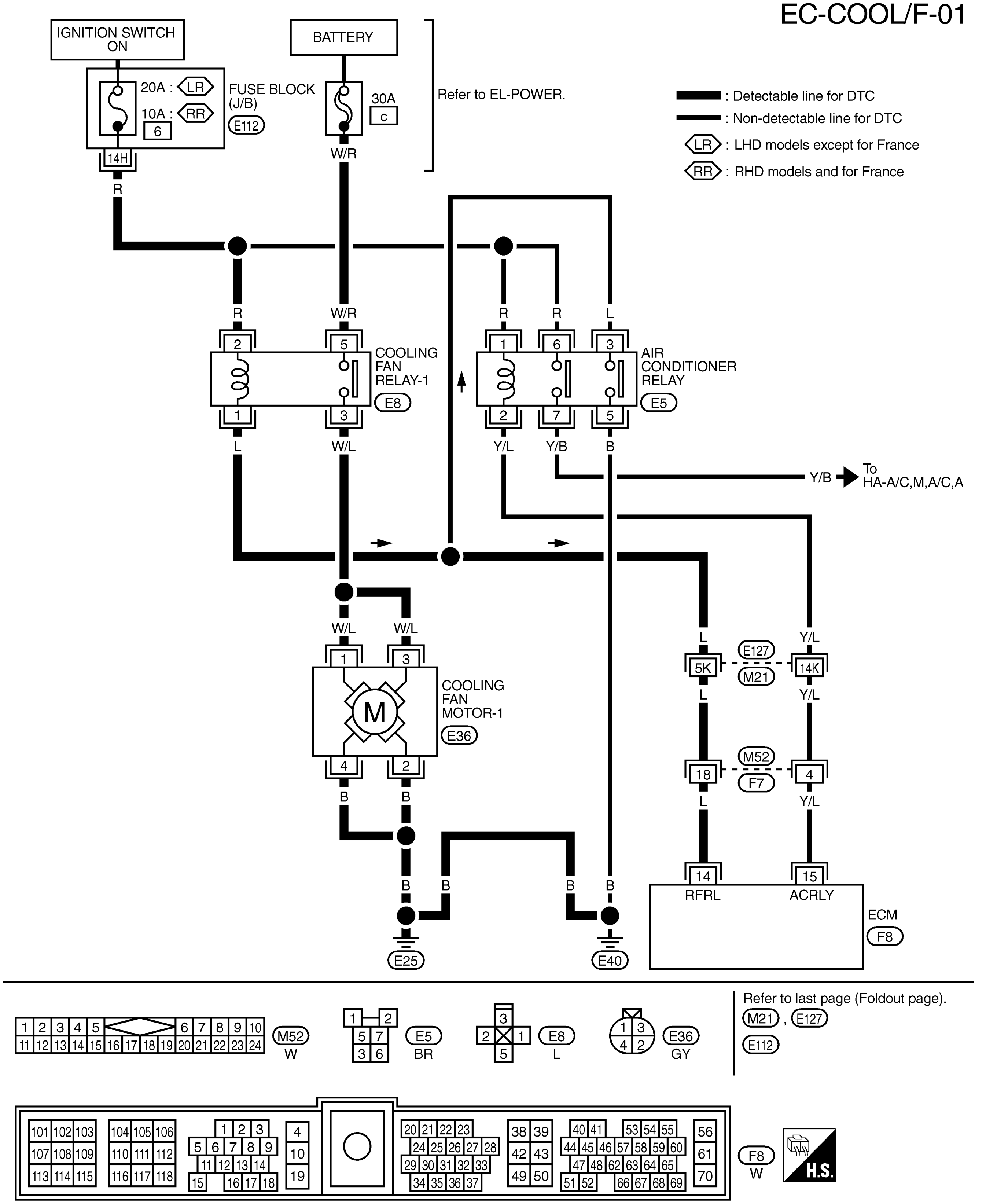
WITH CONSULT-II

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-140.
2) Confirm whether customer filled the coolant or not. If customer filled the coolant, skip the following steps and go to “Diagnostic Procedure”, EC-140.
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-140.

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-140.
2) Confirm whether customer filled the coolant or not. If customer filled the coolant, skip the following steps and go to “Diagnostic Procedure”, EC-140.
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-140.

Wiring Diagram



TEC102M

Diagnostic Procedure

1	INSPECTION START

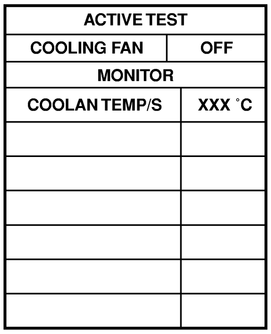
Do you have CONSULT-II?

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-1 operates.

OK or NG

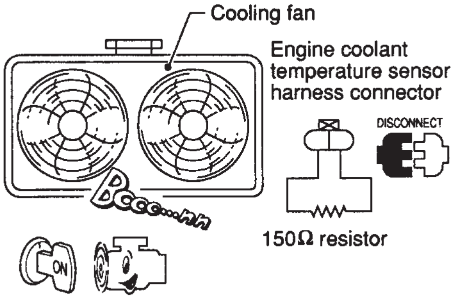
OK	▶	GO TO 12.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont'd)

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.



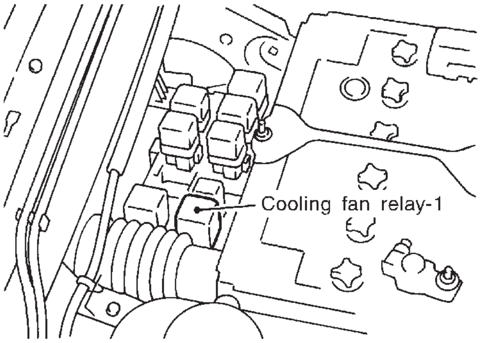
MEC475B

OK or NG

OK	▶	GO TO 12.
NG	▶	GO TO 4.

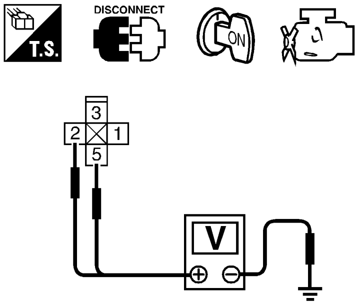
4	CHECK COOLING FAN POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect cooling fan relay-1.



SEF690V

3. Turn ignition switch “ON”.
4. Check voltage between cooling fan relay-1 terminals 2, 5 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF291Z

OK or NG

OK	▶	GO TO 6.
NG	▶	GO TO 5.

5	DETECT MALFUNCTIONING PART

Check the following.
- Fuse block (J/B) connector E112
- 10A fuse or 20A fuse
- 30A fusible links
- Harness for open or short between cooling fan relay-1 and fuse
- Harness for open or short between cooling fan relay-1 and battery

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

Diagnostic Procedure (Cont'd)

GI
MA
EM
LC
EC
FE
CL
MT
AT
TF
PD
FA
RA
BR
ST
RS
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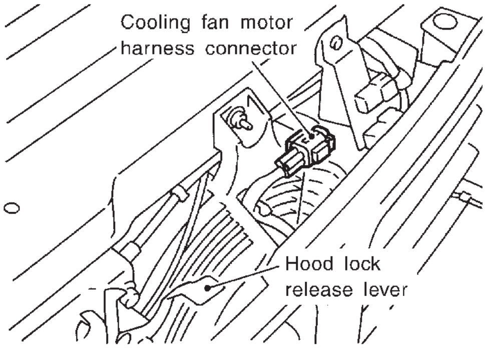
EL
SE
IDX

6	CHECK COOLING FAN GROUND CIRCUIT FOR OPEN AND SHORT

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



SEF691V

3. Check harness continuity between cooling fan relay-1 terminal 3 and cooling fan motor-1 terminals 1, 3, cooling fan motor-1 terminals 2, 4 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 7.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	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-1 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 9.
NG ▶	GO TO 8.

8	DETECT MALFUNCTIONING PART

Check the following.

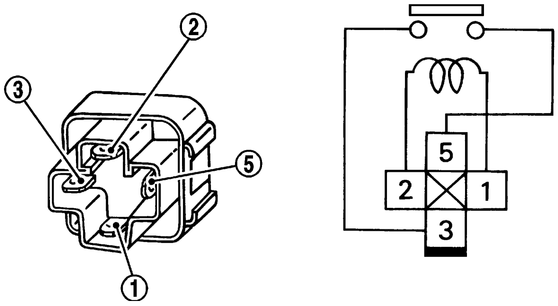
- Harness connectors E127, M21
- Harness connectors M52, F7
- Harness for open or short between cooling fan relay-1 and ECM

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

Diagnostic Procedure (Cont'd)

9	CHECK COOLING FAN RELAY-1

Check continuity between cooling fan relay-1 terminals 3 and 5 under the following conditions.



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

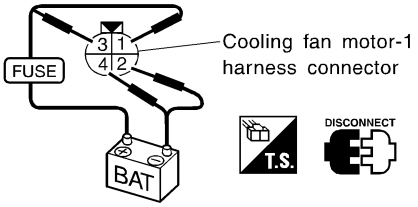
SEF608X

OK or NG

OK ▶	GO TO 10.
NG ▶	Replace cooling fan relay.

10	CHECK COOLING FAN MOTOR-1

Supply battery voltage between the following terminals and check operation.



	Speed	Terminals	
		(+)	(−)
Cooling fan motor-1	Low	1	4
	High	1 , 3	2 , 4

SEF292Z

OK or NG

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

11	CHECK INTERMITTENT INCIDENT

Perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.

▶	**INSPECTION END**

Diagnostic Procedure (Cont'd)

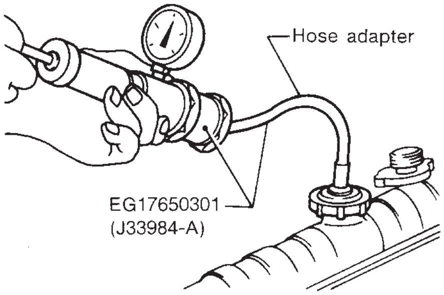
12 CHECK COOLING SYSTEM FOR LEAK

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 14.
NG ▶	GO TO 13.

13 DETECT MALFUNCTIONING PART

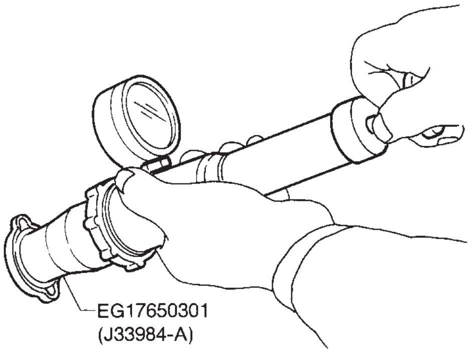
Check the following for leak.

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

▶	Repair or replace.

14 CHECK RADIATOR CAP

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



SLC755A

Radiator cap relief pressure:

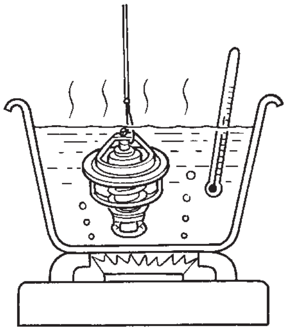
79 - 98 kPa (0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)

OK or NG

OK ▶	GO TO 15.
NG ▶	Replace radiator cap.

15	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)

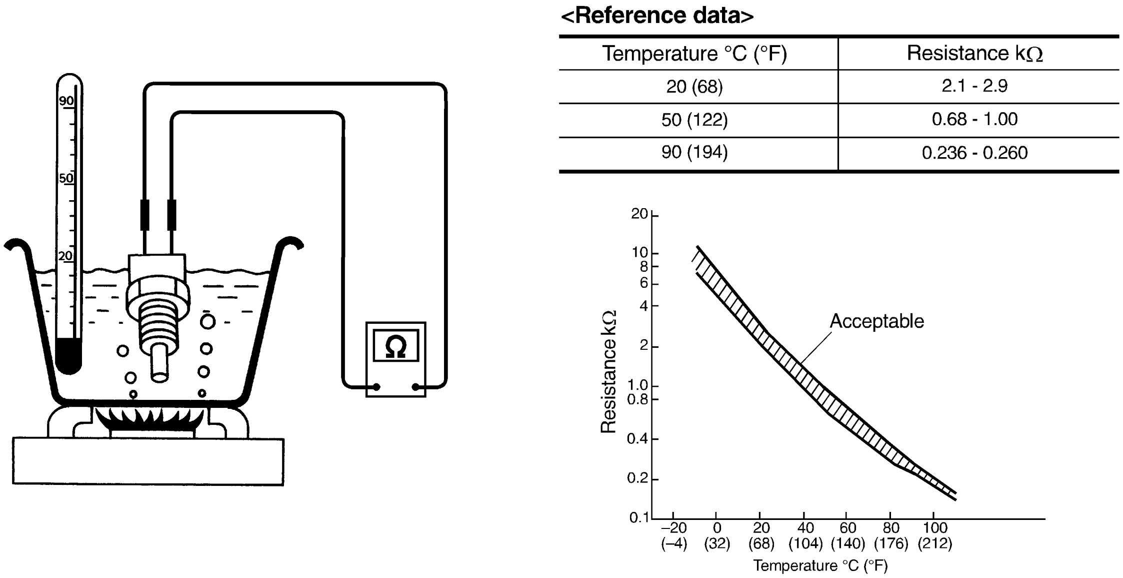
4. Check if valve is closed at 5°C (9°F) below valve opening temperature. For details, refer to LC section, "Thermostat".

OK or NG

OK ▶	GO TO 16.
NG ▶	Replace thermostat.

16	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 17.
NG ▶	Replace engine coolant temperature sensor.

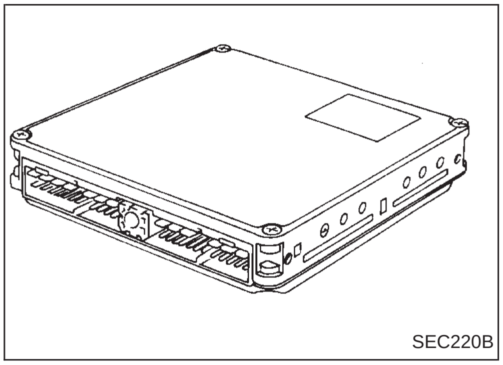
Diagnostic Procedure (Cont’d)

17	**CHECK MAIN 12 CAUSES**
If the cause cannot be isolated, go to “MAIN 12 CAUSES OF OVERHEATING”, EC-147.	
▶	**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-136.
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.

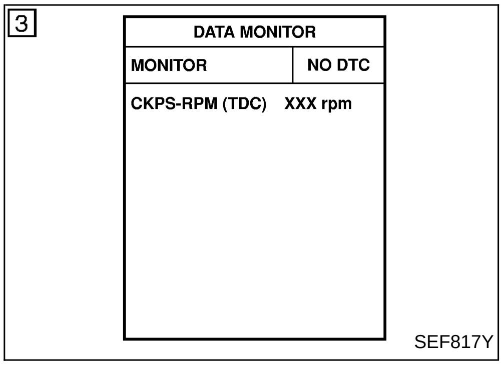


Description

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 (ECCS-D control module)



DATA MONITOR

MONITOR NO DTC

CKPS-RPM (TDC) XXX rpm

DTC Confirmation Procedure

WITH CONSULT-II

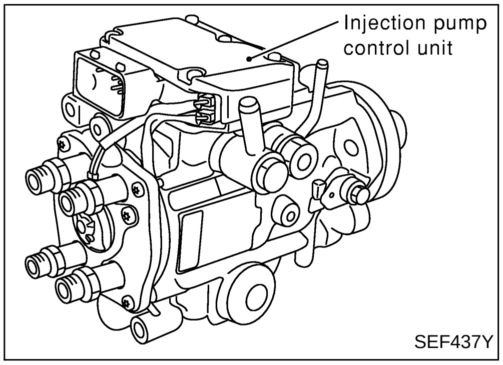
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and wait at least 2 seconds.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-149.

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-149.

Diagnostic Procedure

<table>
<tr><td><b>1</b></td><td colspan="2"><b>INSPECTION START</b></td></tr>
<tr><td colspan="3"><b>With CONSULT-II</b>
1. Turn ignition switch “ON”.
2. Select “SELF DIAG RESULTS” mode with CONSULT-II.
3. Touch “ERASE”.
4. Perform “DTC Confirmation Procedure”, EC-148, again.
5. Is the malfunction displayed again?</td></tr>
<tr><td colspan="3"><b>Without CONSULT-II</b>
1. Turn ignition switch “ON”.
2. Erase the Diagnostic Test Mode II (Self-diagnostic results) memory.
3. Perform “DTC Confirmation Procedure”, EC-148, again.
4. Perform “Diagnostic Test Mode II (Self-diagnostic results)”.
5. Is the DTC 0301 or 0901 displayed again?
<b>Yes or No</b></td></tr>
<tr><td colspan="2">Yes ▶</td><td>Replace ECM.</td></tr>
<tr><td colspan="2">No ▶</td><td><b>INSPECTION END</b></td></tr>
</table>



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.

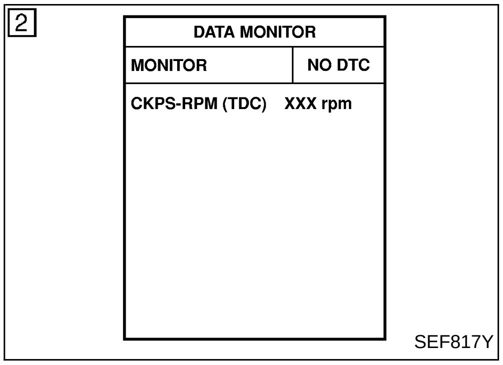
CAUTION:

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/Y	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
40	R/B	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
52	L/B	Electronic control fuel injection pump	Engine is running. Idle speed	Approximately 0.1V
53	L/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 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



2

DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

DTC Confirmation Procedure

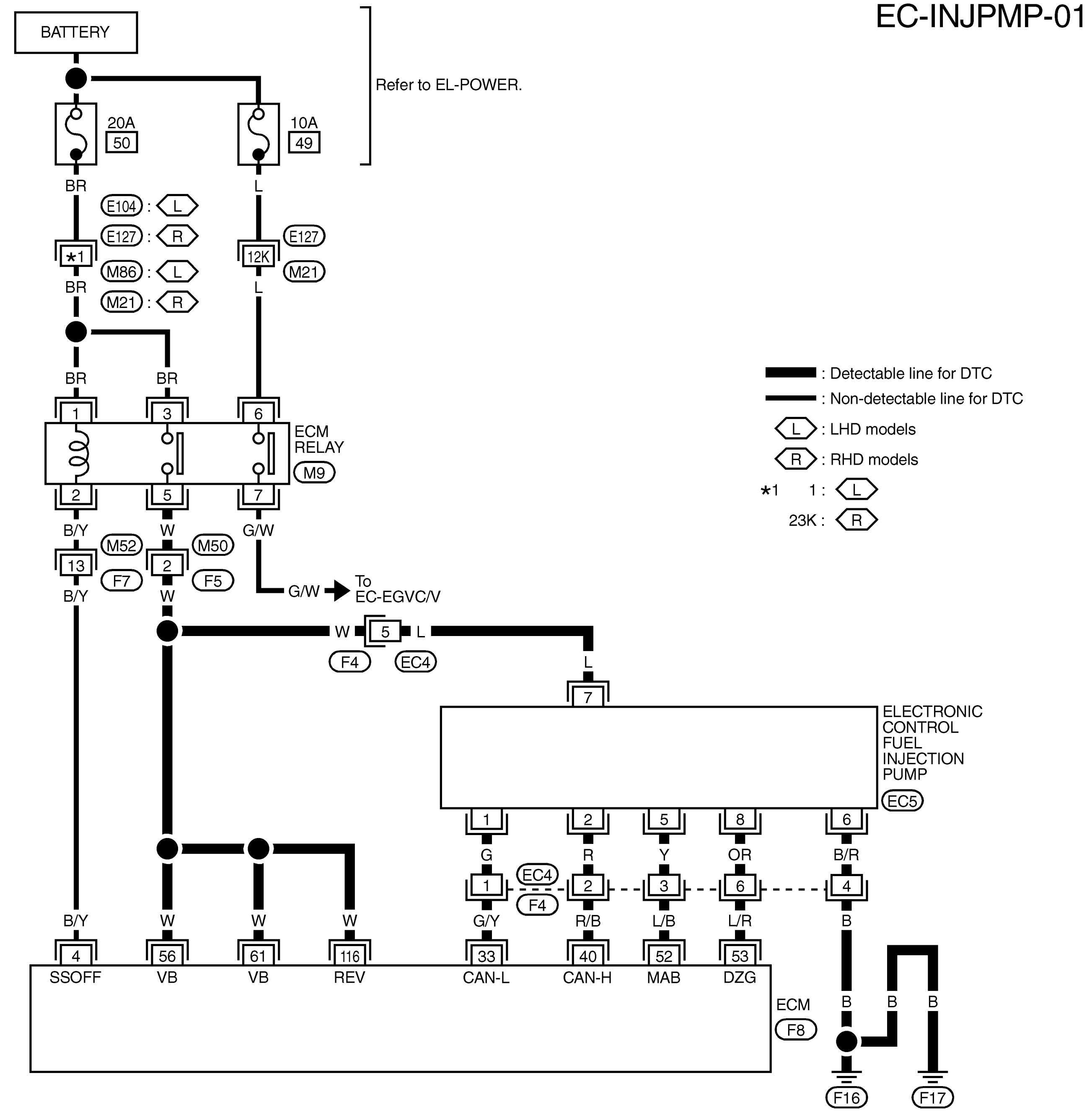
WITH CONSULT-II

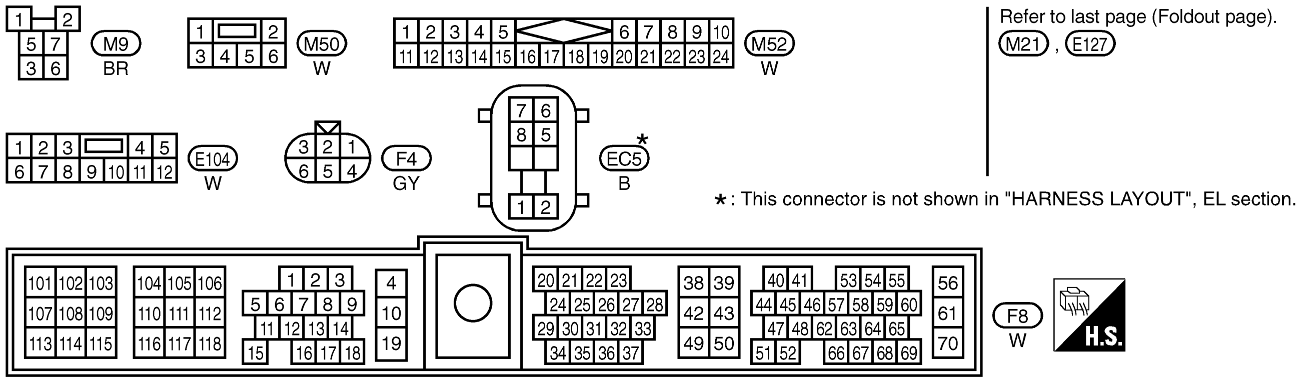
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) If DTC is detected, go to “Diagnostic Procedure”, EC-154.

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-154.

Wiring Diagram





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

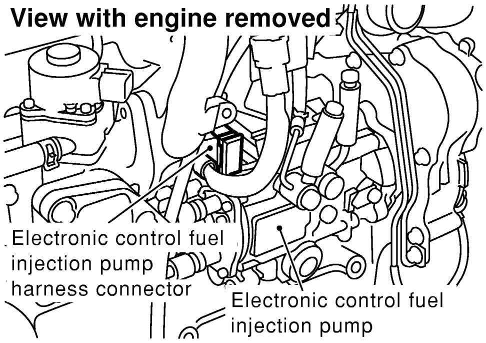
*: This connector is not shown in "HARNESS LAYOUT", EL section.

TEC113M

Diagnostic Procedure

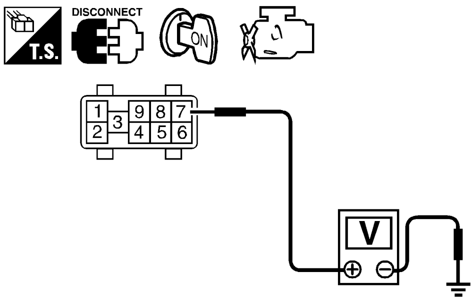
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

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


View with engine removed
Electronic control fuel injection pump harness connector
Electronic control fuel injection pump

SEF229Z

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



Voltage: Battery voltage

SEF438Y

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.

- Harness connectors M50, F5
- Harness connectors F4, EC4
- 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.

4	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors F4, EC4
- 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 F4, EC4
- 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-107.

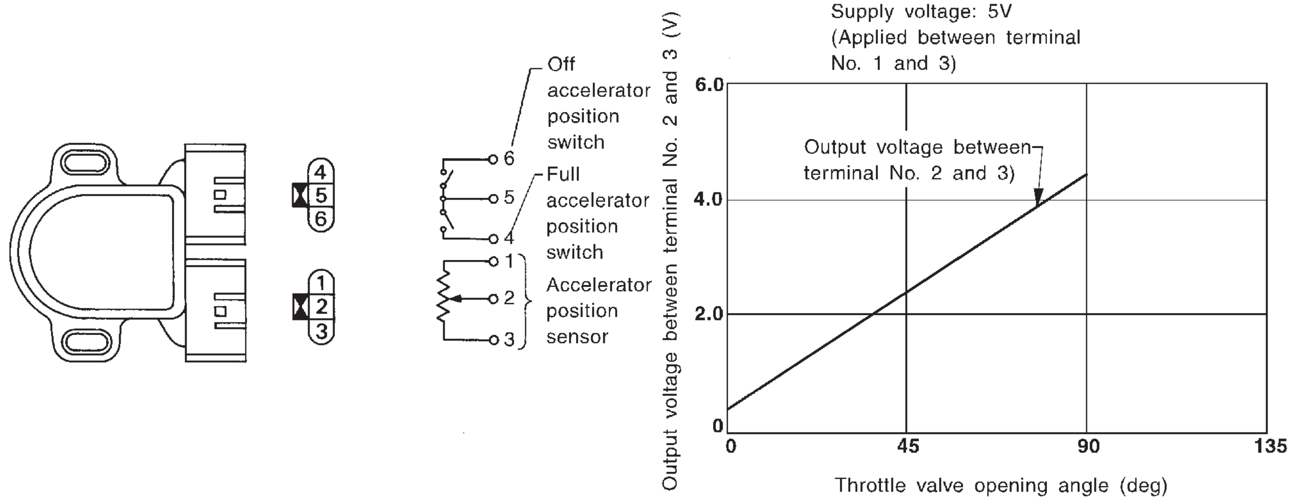
OK or NG

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.


4
5
6
1
2
3
Off accelerator position switch
6
5
4
Full accelerator position switch
1
2
3
Accelerator position sensor
Output voltage between terminal No. 2 and 3 (V)
Supply voltage: 5V (Applied between terminal No. 1 and 3)
Output voltage between terminal No. 2 and 3)
6.0
4.0
2.0
0
0
45
90
135
Throttle valve opening angle (deg)

SEF861SA

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.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
23	W	Accelerator position sensor	Ignition switch “ON” Accelerator pedal fully released	0.4 - 0.6V
			Ignition switch “ON” Accelerator pedal fully depressed	Approximately 4.5V
31	R/L	Accelerator position switch (Idle)	Ignition switch “ON” Accelerator pedal fully released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch “ON” Accelerator pedal depressed	Approximately 0V
32	W/G	Accelerator position switch (Full)	Ignition switch “ON” Accelerator pedal released	Approximately 0V
			Ignition switch “ON” Accelerator pedal fully depressed	BATTERY VOLTAGE (11 - 14V)
48	G/R	Accelerator position sensor power supply	Ignition switch “ON”	Approximately 5V
51	L/W	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)

GI
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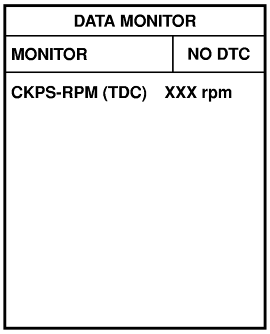
3



DATA MONITOR

MONITOR NO DTC

CKPS-RPM (TDC) XXX rpm

SEF817Y

DTC Confirmation Procedure

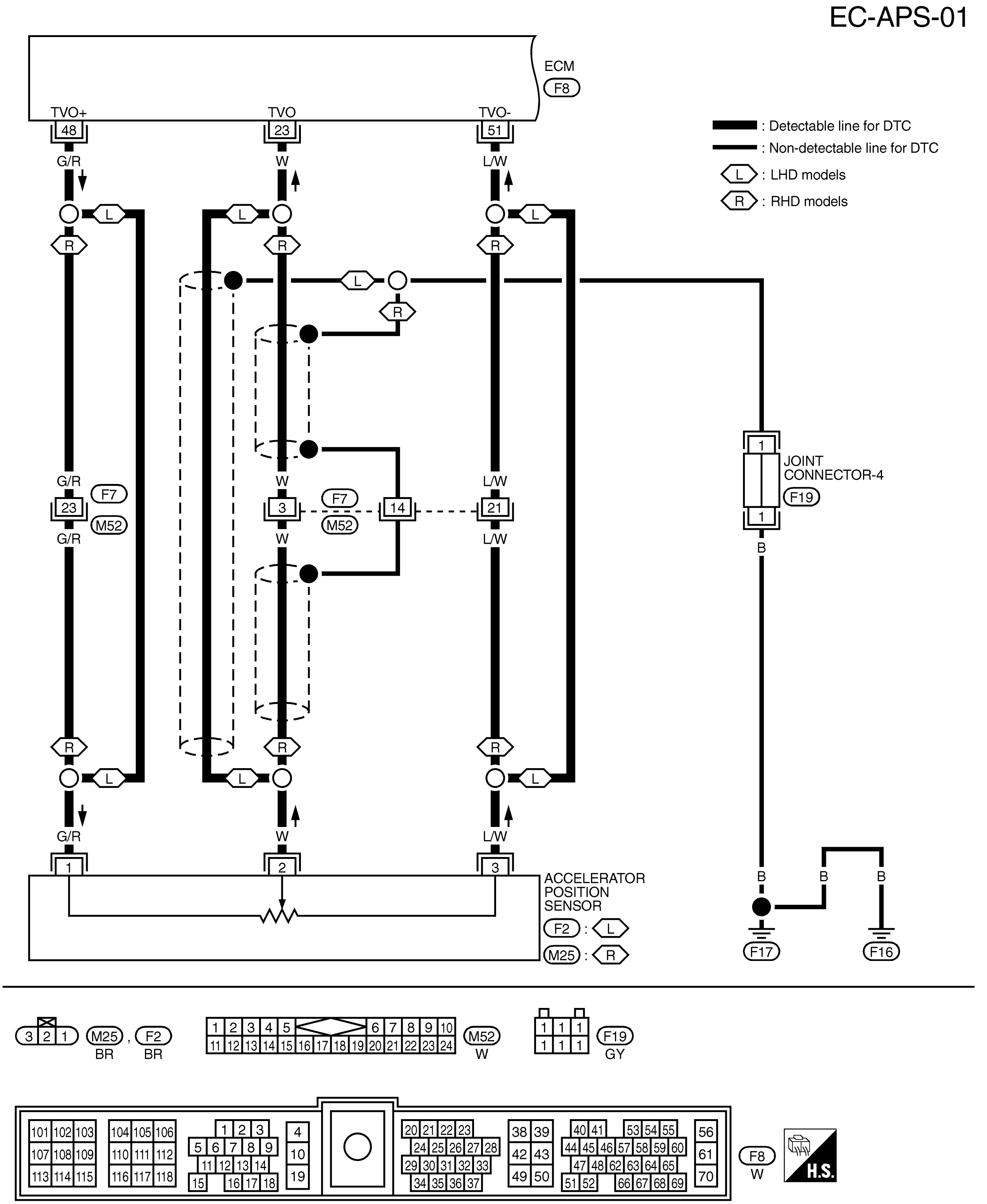
WITH CONSULT-II

1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Depress and release fully accelerator pedal slowly.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-161.

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-161.

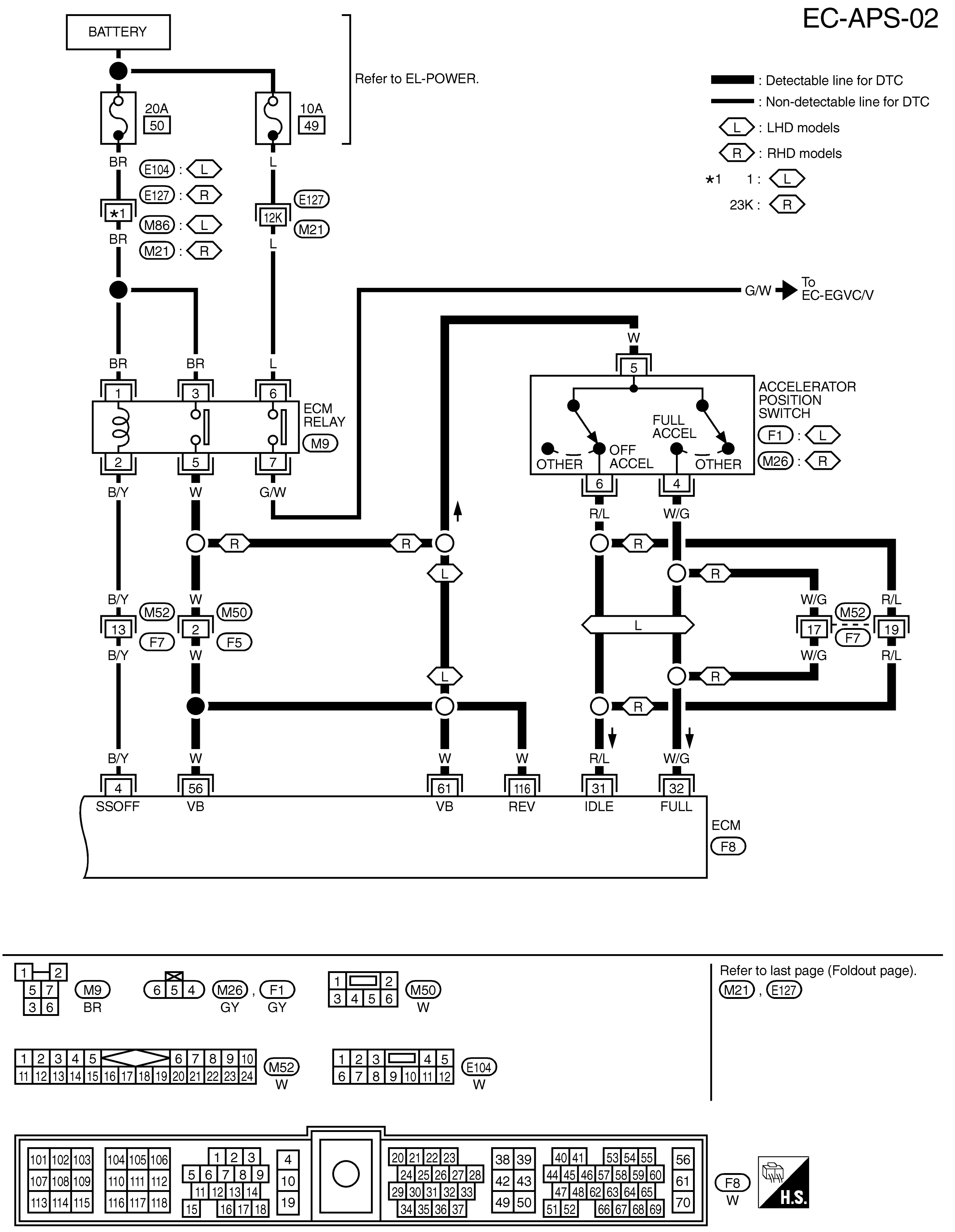
Wiring Diagram



TEC103M

DTC 0403 ACCEL POS SENSOR

Wiring Diagram (Cont'd)



TEC107M

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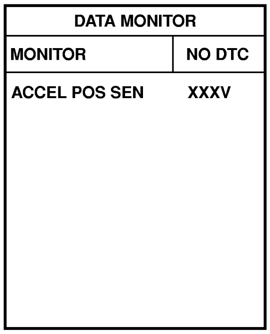
Diagnostic Procedure

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

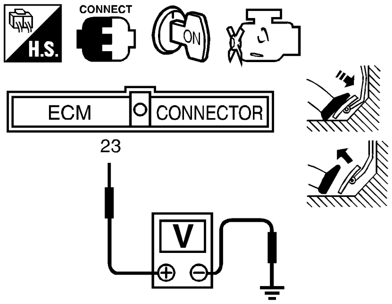
MONITOR	NO DTC
ACCEL POS SEN	XXXV

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

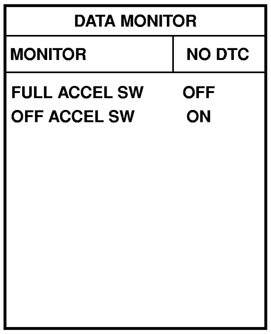
OK or NG

OK	▶	GO TO 2.
NG	▶	GO TO 3.

2	CHECK OVERALL FUNCTION

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

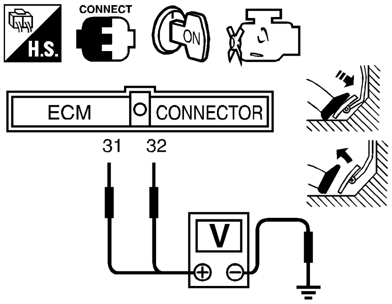
Conditions	FULL ACCEL SW
Accelerator pedal fully depressed	ON
Except above	OFF

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

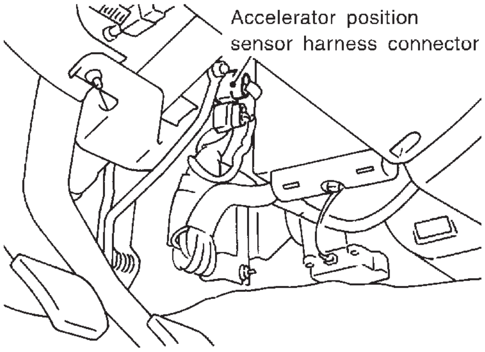
OK or NG

OK ▶	**INSPECTION END**
NG ▶	GO TO 14.

Diagnostic Procedure (Cont'd)

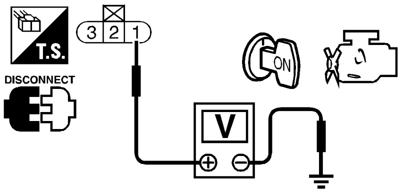
3	CHECK ACCELERATOR POSITION SENSOR POWER SUPPLY CIRCUIT

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



SEF694V

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 5.
NG ▶	GO TO 4.

4	DETECT MALFUNCTIONING PART

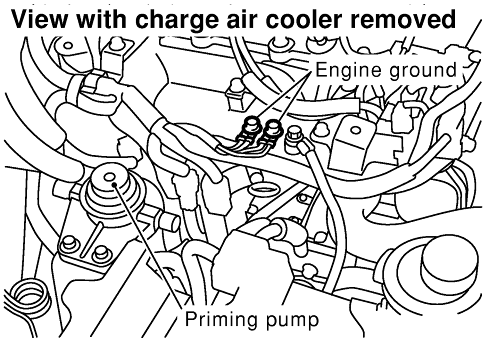
Check the following.
- Harness connectors F7, M52 (RHD models)
- Harness for open or short between ECM and accelerator position sensor

▶	Repair harness or connectors.

Diagnostic Procedure (Cont'd)

5	CHECK ACCELERATOR POSITION SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

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



SEF227Z

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 7.
NG ▶	GO TO 6.

6	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors F7, M52 (RHD models)
- Harness for open or short between ECM and accelerator position sensor

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

7	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 9.
NG ▶	GO TO 8.

8	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors F7, M52 (RHD models)
- Harness for open or short between ECM and accelerator position sensor

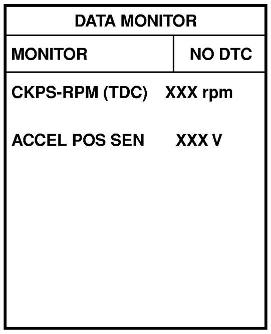
▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

9	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

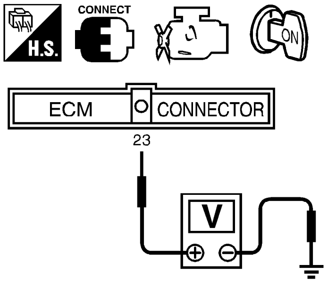
OK or NG

OK ▶	GO TO 11.
NG ▶	Replace accelerator pedal assembly.

10	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 12.
NG ▶	Replace accelerator pedal assembly.

11	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 13.

12	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 13.

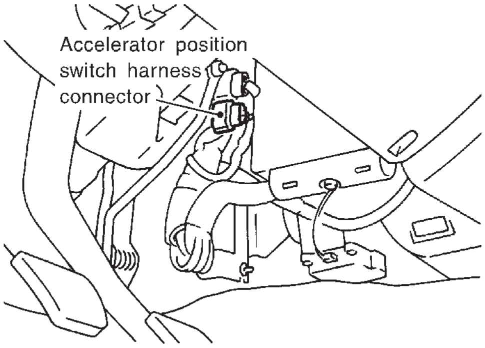
13	CHECK INTERMITTENT INCIDENT

Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

▶	**INSPECTION END**

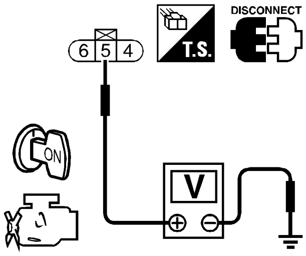
14	CHECK ACCELERATOR POSITION SWITCH POWER SUPPLY CIRCUIT

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



SEF708V

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 16.
NG	▶	GO TO 15.

15	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M50, F5 (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)

16 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 18.
NG ▶	GO TO 17.

17 DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M52, F7 (RHD models)
- Harness for open or short between ECM and accelerator position switch

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

18 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 20.
NG ▶	GO TO 19.

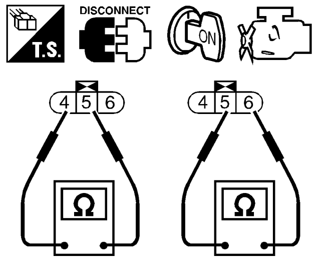
19 DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M52, F7 (RHD models)
- Harness for open or short between ECM and accelerator position switch

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

20 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 21.
OK (Without CONSULT-II) ▶	GO TO 22.
NG ▶	Replace accelerator pedal assembly.

Diagnostic Procedure (Cont'd)

21	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 23.

22	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 23.

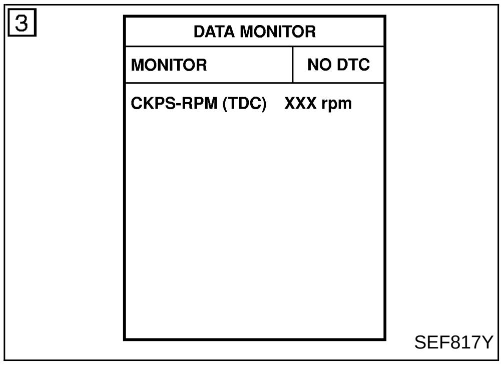
23	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.	
▶	**INSPECTION END**

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-117.)



DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

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-170.

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-170.

Diagnostic Procedure

1	CHECK INTAKE AIR LEAK

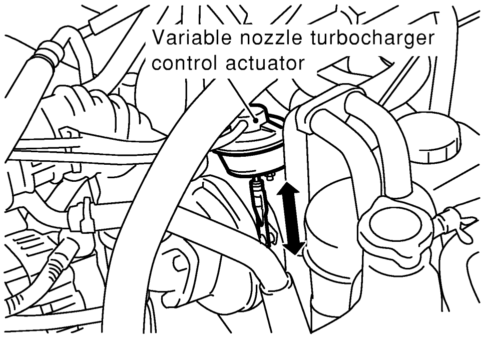
Listen for an intake air leak after the mass air flow sensor.

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.



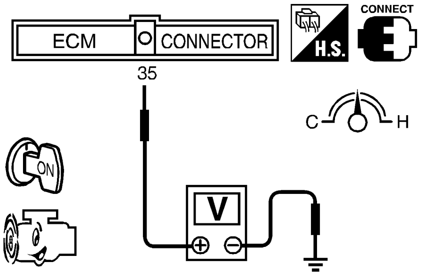
SEF320Z

OK or NG

OK	▶	GO TO 3.
NG	▶	Go to “Diagnostic Procedure” in “VARIABLE NOZZLE TURBOCHARGER CONTROL SOLENOID VALVE”, EC-295.

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.

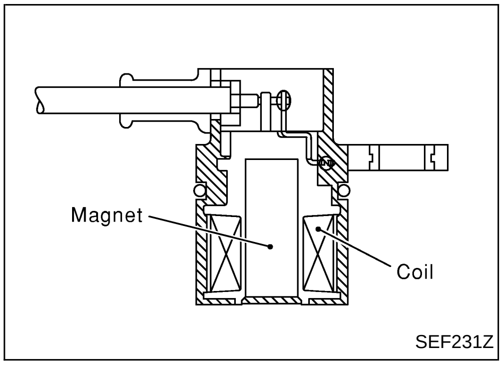
OK or NG

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

4	CHECK INTERMIT INCIDENT

Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

	▶	**INSPECTION END**



SEF231Z

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.

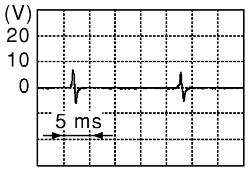
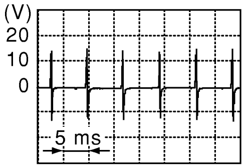
MONITOR ITEM	CONDITION	SPECIFICATION
CKPS·RPM (TDC)	● Tachometer: Connect ● Run engine and compare tachometer indication with the CONSULT-II value.	Almost the same speed as the CONSULT-II value.

ECM Terminals and Reference Value

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

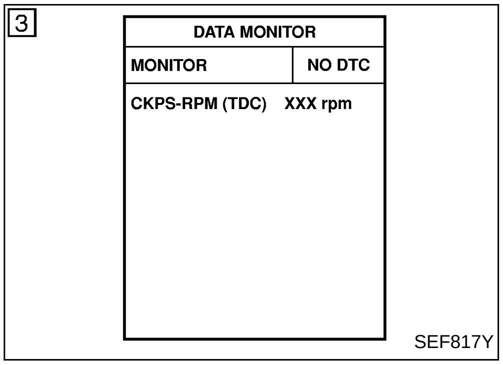
CAUTION:

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	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	B/W	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.

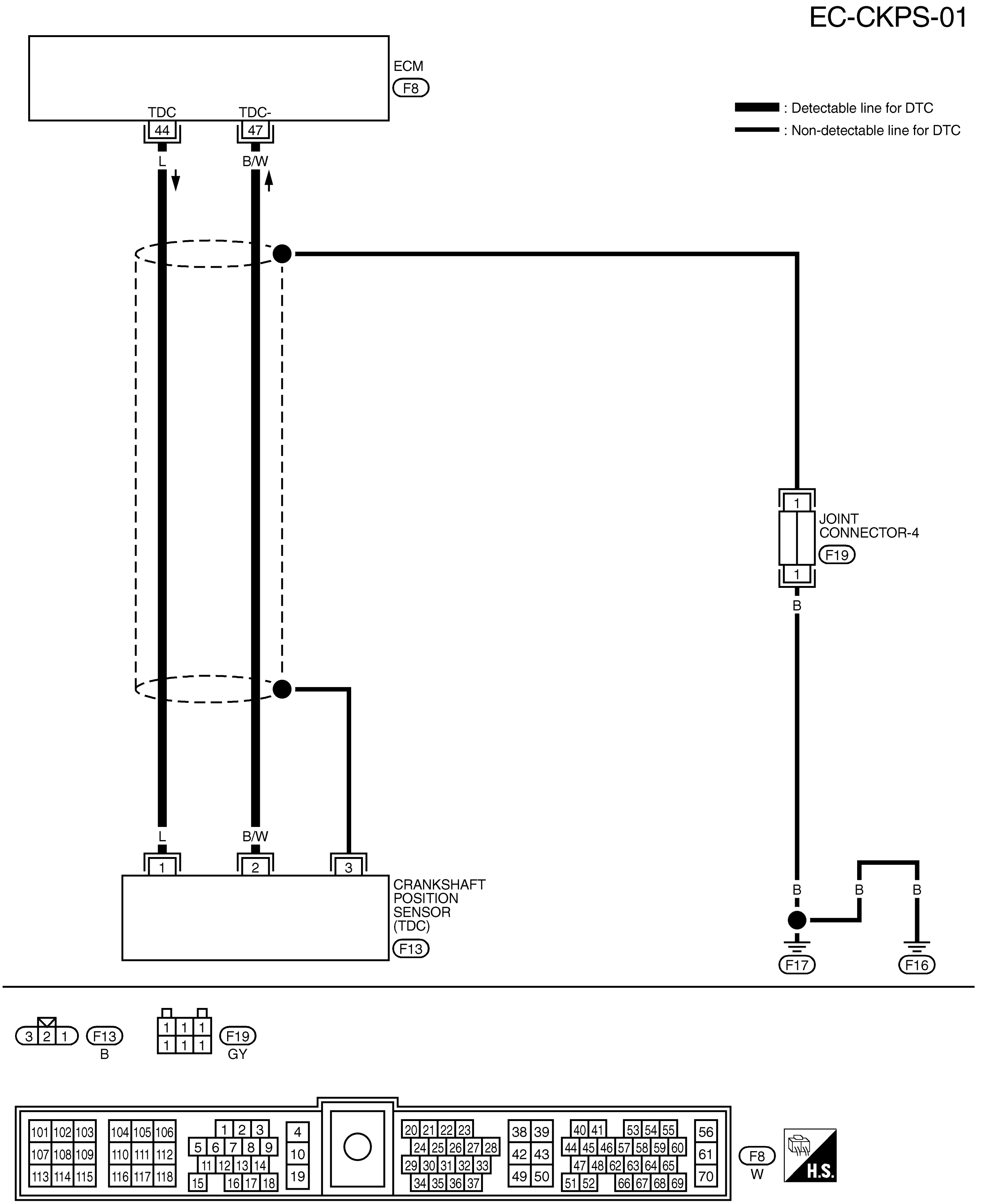
WITH CONSULT-II

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-174.

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-174.

Wiring Diagram

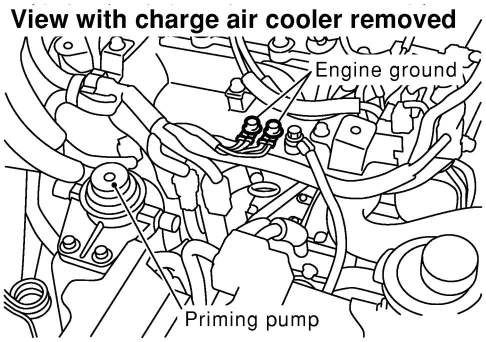


TEC104M

Diagnostic Procedure

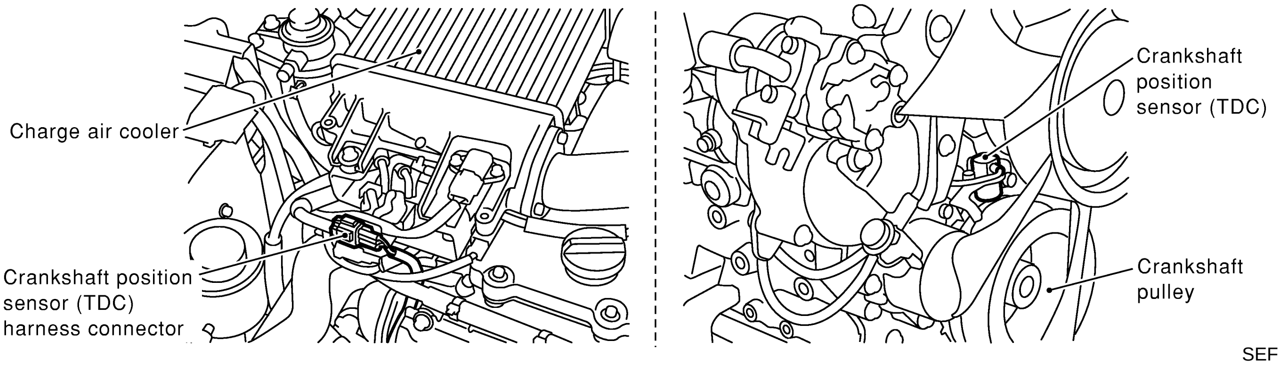
1	CHECK CRANKSHAFT POSITION SENSOR (TDC) GROUND CIRCUIT FOR OPEN AND SHORT

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



SEF227Z

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


Charge air cooler
Crankshaft position sensor (TDC) harness connector
Crankshaft position sensor (TDC)
Crankshaft pulley

SEF230Z

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 2.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.

2	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 3.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.

3	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 5.
NG ▶	GO TO 4.

Diagnostic Procedure (Cont'd)

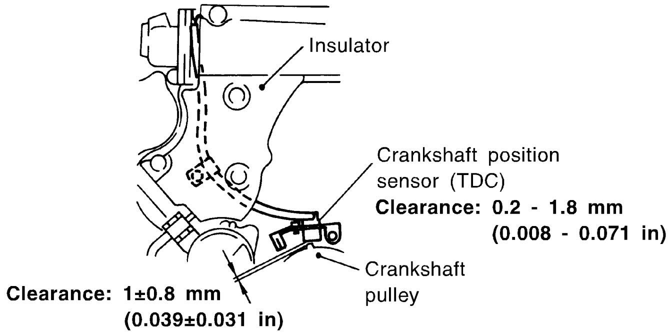
4	DETECT MALFUNCTIONING PART

Check the following.
- Joint connector-4
- 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.

5	CHECK CRANKSHAFT POSITION SENSOR (TDC) INSTALLATION

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



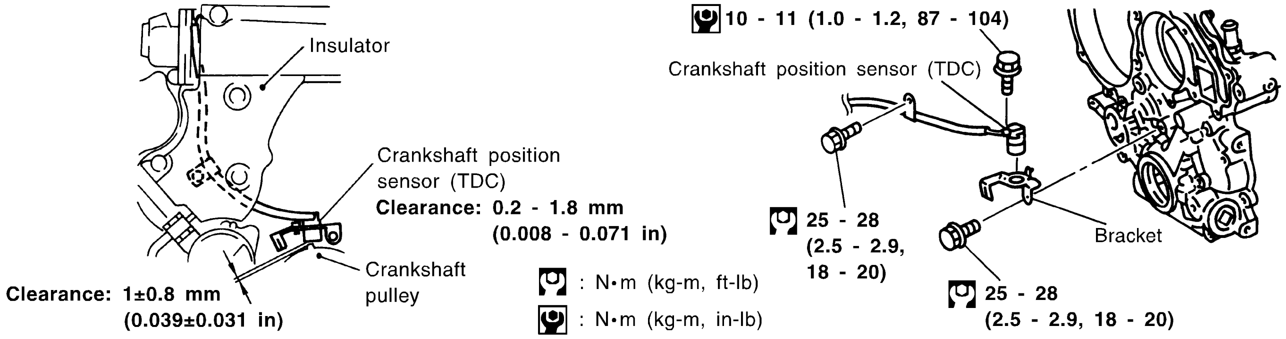
JEF293Z

OK or NG

OK	▶	GO TO 6.
NG	▶	GO TO 7.

6	REINSTALL CRANKSHAFT POSITION SENSOR (TDC)

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



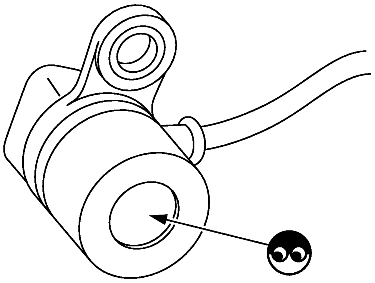
JEF294Z

	▶	INSPECTION END

Diagnostic Procedure (Cont’d)

7	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.



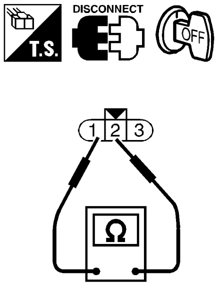
SEF232Z

OK or NG

OK	▶	GO TO 8.
NG	▶	Replace crankshaft position sensor (TDC).

8	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 9.
NG	▶	Replace crankshaft position sensor (TDC).

9	CHECK INTERMITTENT INCIDENT

Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

	▶	**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-177.
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-177.
   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-177.

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-177.
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-177.
   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-177.

Diagnostic Procedure

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

2 CHECK BATTERY AND ALTERNATOR

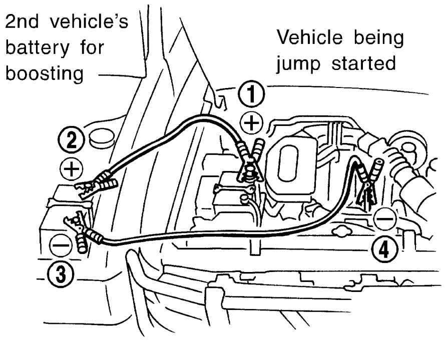
Check that the proper type of battery and alternator is installed.
Refer to EL section ("BATTERY" and "CHARGING SYSTEM").

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.


2nd vehicle's battery for boosting
Vehicle being jump started
①
⊕
②
⊕
⊖
③
⊖
④

SEF488Z

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-177, 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

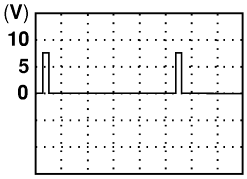
These circuit lines are used to control the smooth shifting up and down of A/T during the hard acceleration/ deceleration.
Voltage signals are exchanged between ECM and TCM (Transmission control module).

ECM Terminals and Reference Value

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

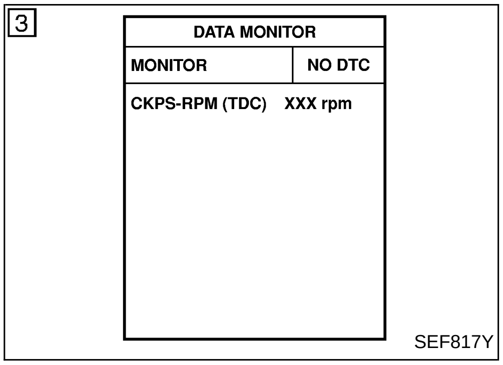
CAUTION:

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.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
24 37 58	PU/W P/B L/OR	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	P	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.]



3

DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

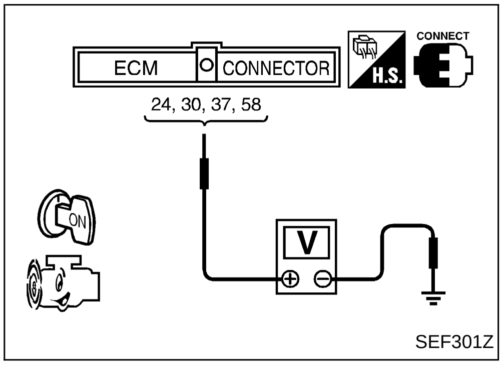
SEF817Y

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-182.



SEF301Z

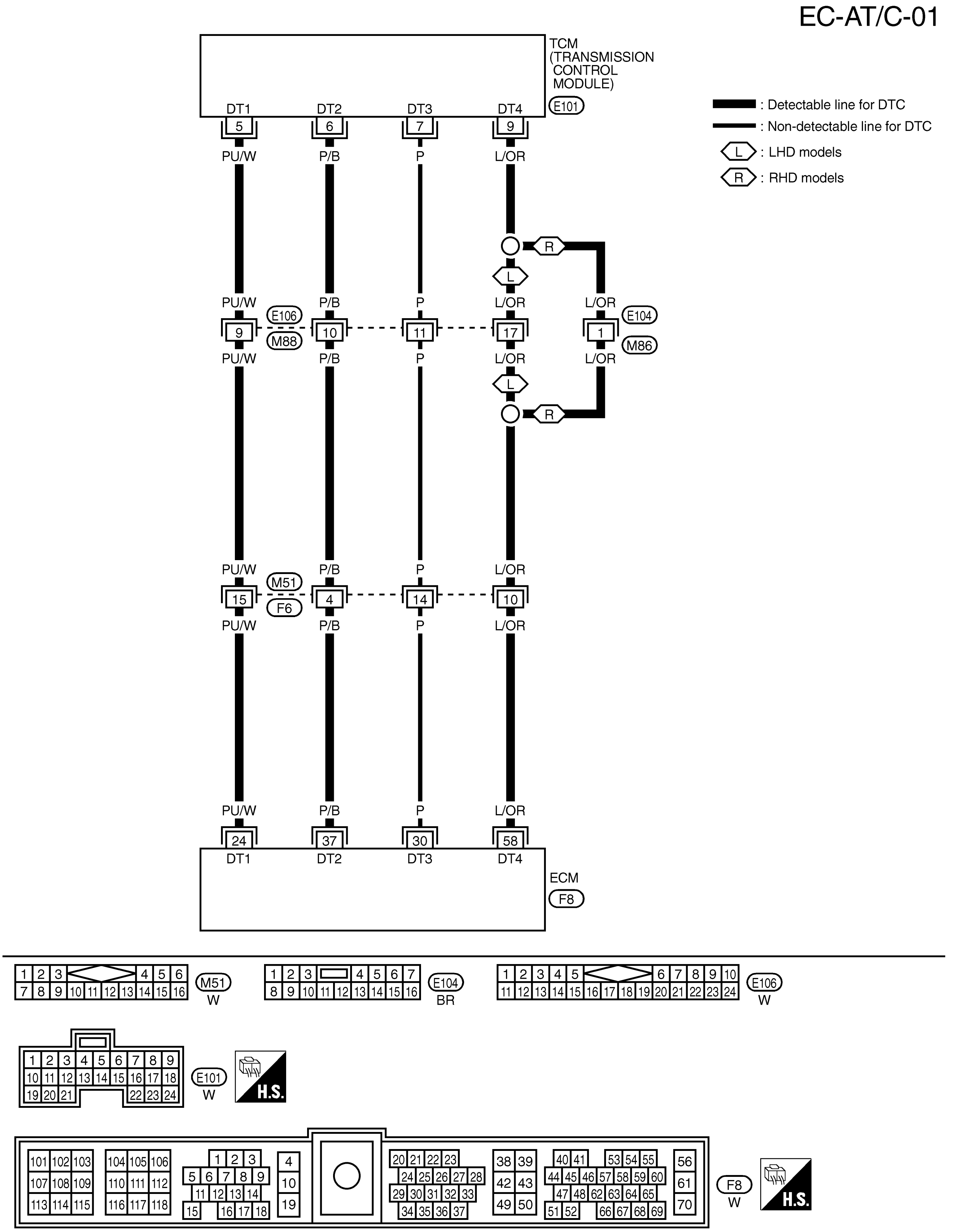
Overall Function Check

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-182.

Wiring Diagram

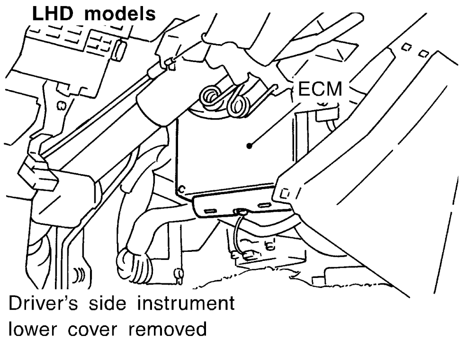


TEC109M

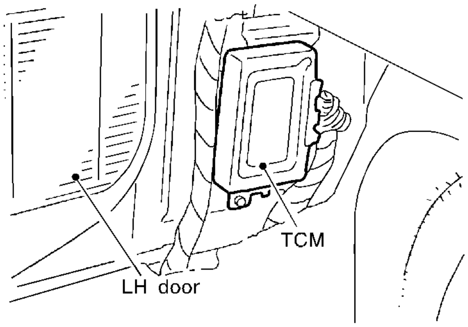
Diagnostic Procedure

1	CHECK INPUT SIGNAL CIRCUIT

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



SEF519VA



SEF792V

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 E106, M88
- Harness connectors M51, F6
- Harness connectors E104, M86 (RHD models)
- Harness for open or short between ECM and TCM (Transmission control module)

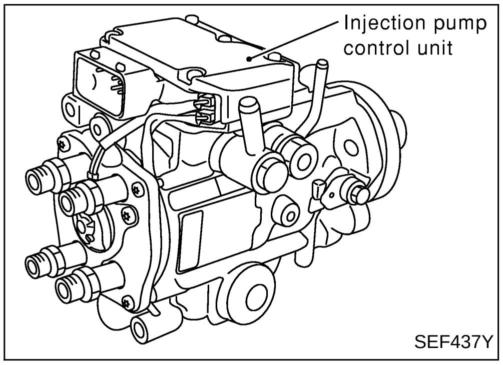
	▶	Repair harness or connectors.

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-107.	
▶	**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.

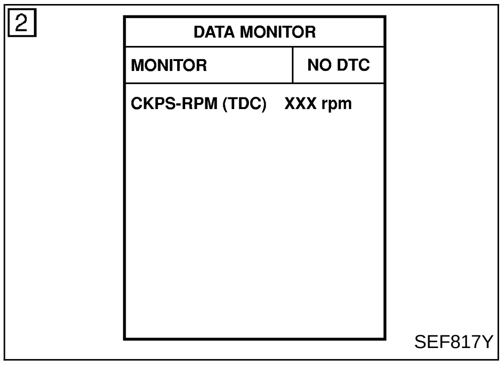
CAUTION:

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/Y	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
40	R/B	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
52	L/B	Electronic control fuel injection pump	Engine is running. Idle speed	Approximately 0.1V
53	L/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



DATA MONITOR

MONITOR NO DTC

CKPS-RPM (TDC) XXX rpm

DTC Confirmation Procedure

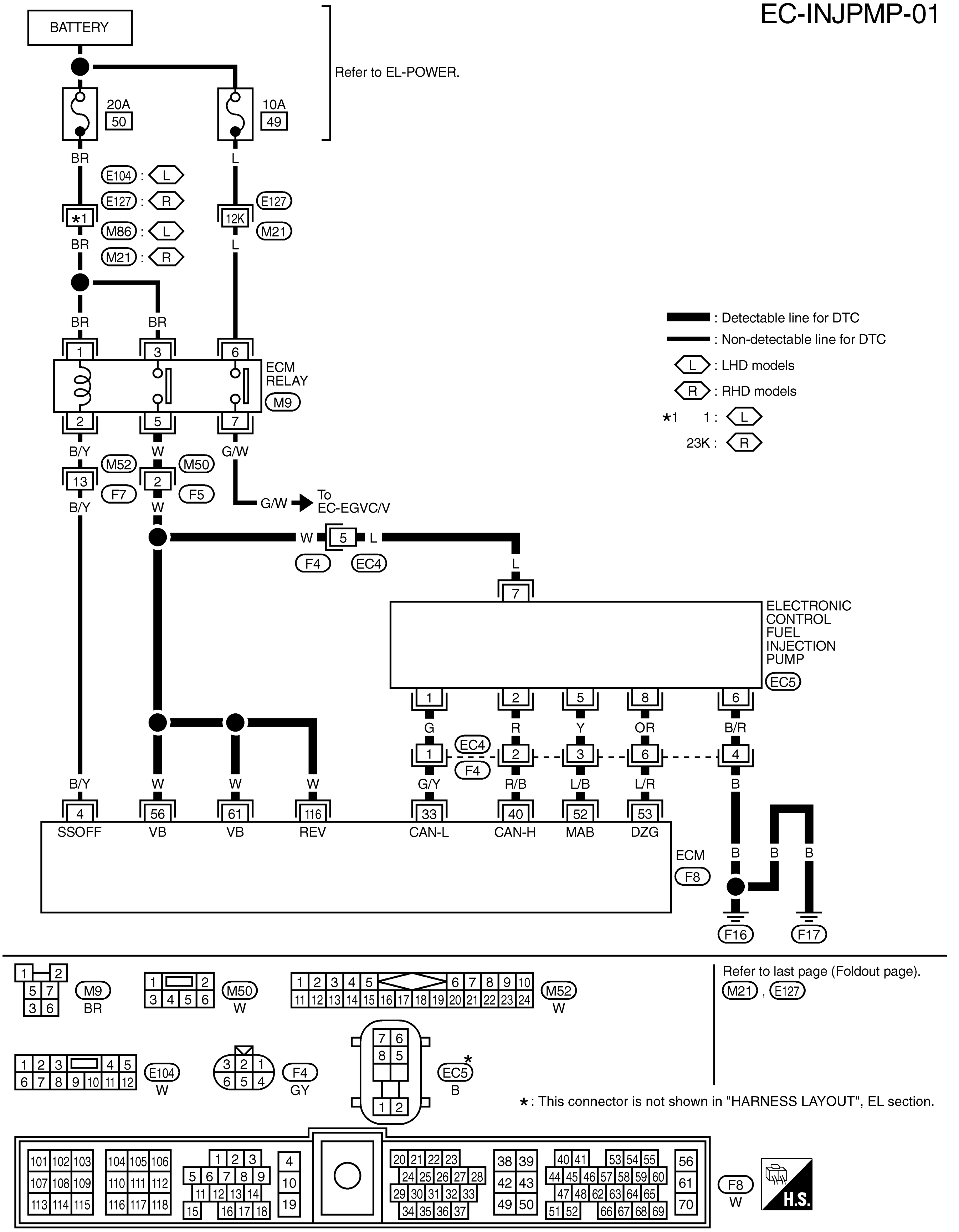
WITH CONSULT-II

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-188.

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-188.

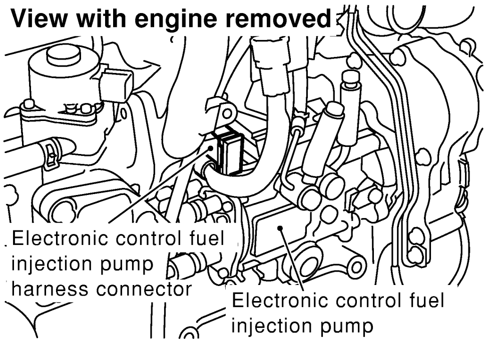
Wiring Diagram



Diagnostic Procedure

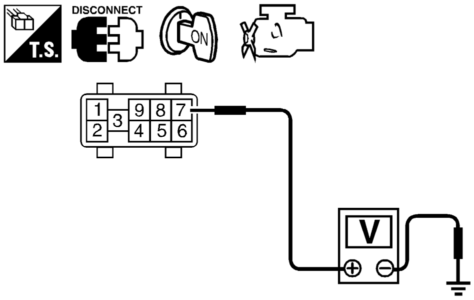
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

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


View with engine removed
Electronic control fuel injection pump harness connector
Electronic control fuel injection pump

SEF229Z

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



Voltage: Battery voltage

SEF438Y

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M50, F5
- Harness connectors F4, EC4
- 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.

4	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors F4, EC4
- 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 F4, EC4
- Harness for open or short between electronic control fuel injection pump and ECM

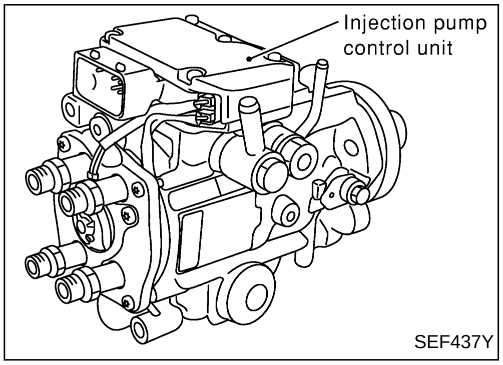
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	CHECK INTERMITTENT INCIDENT

Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

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.

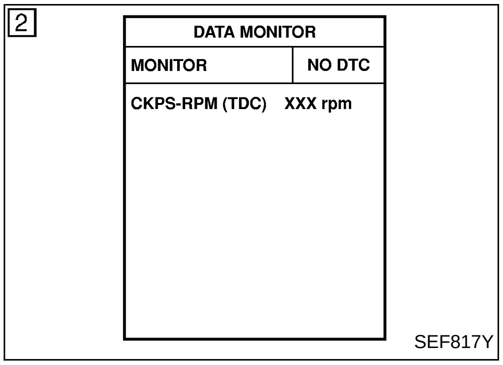
CAUTION:

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/Y	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
40	R/B	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
52	L/B	Electronic control fuel injection pump	Engine is running. Idle speed	Approximately 0.1V
53	L/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)
● 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



2

DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

DTC Confirmation Procedure

WITH CONSULT-II

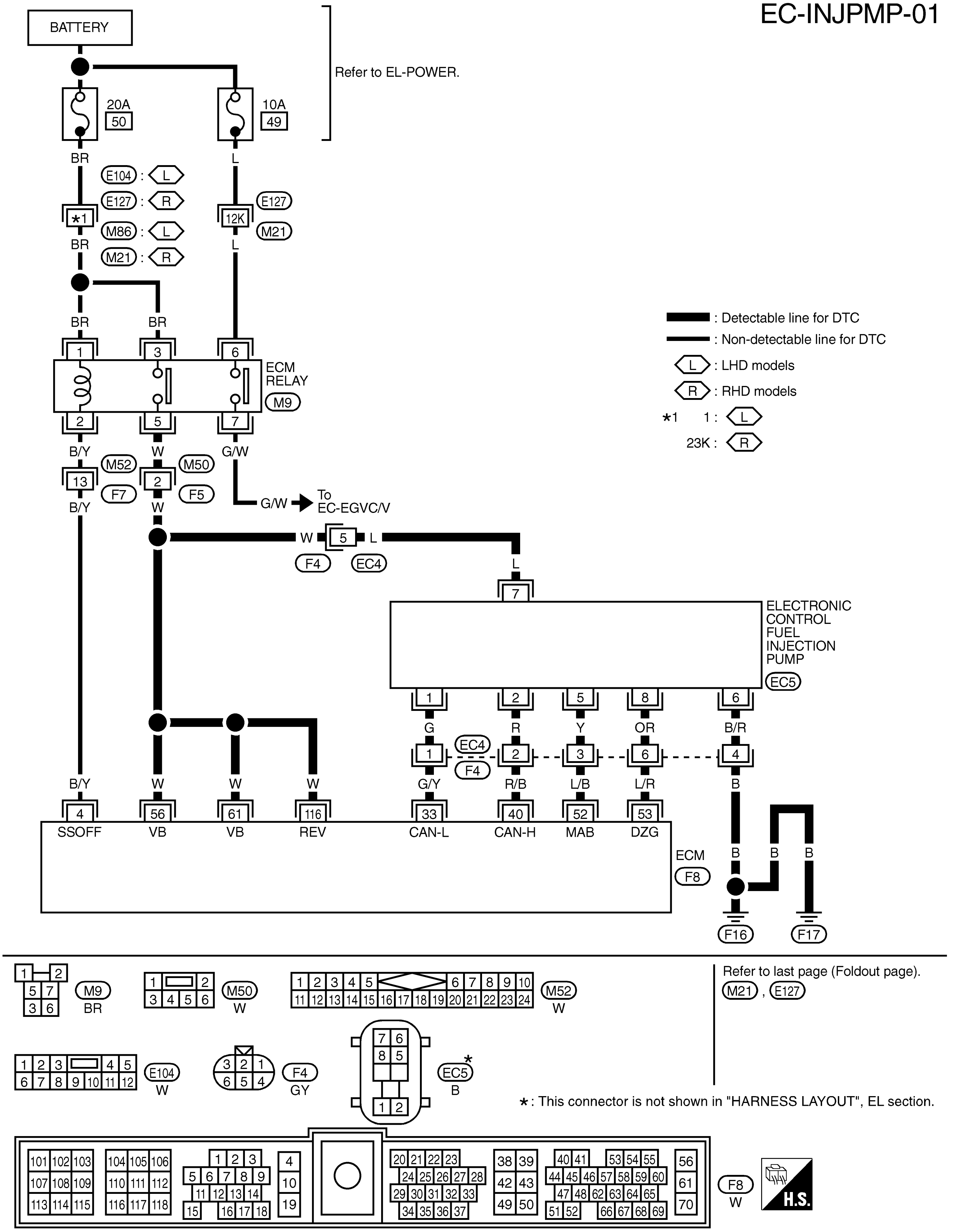
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed.
   (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) If DTC 0407 is detected, go to “Diagnostic procedure”, EC-174.
   If DTC 0702 is detected, go to “Diagnostic Procedure”, EC-194.

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-174.
   If DTC 0702 is detected, go to “Diagnostic Procedure”, EC-194.

Wiring Diagram

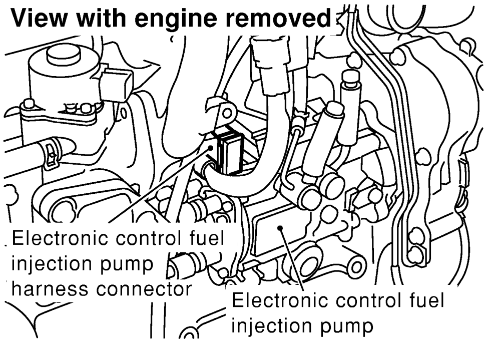
EC-INJPMP-01



Diagnostic Procedure

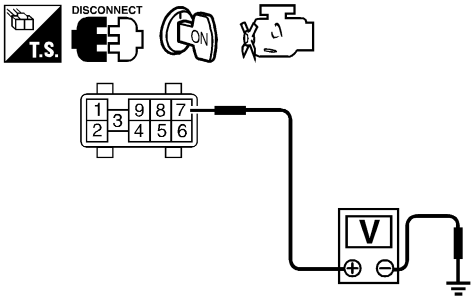
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

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


View with engine removed
Electronic control fuel injection pump harness connector
Electronic control fuel injection pump

SEF229Z

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



Voltage: Battery voltage

SEF438Y

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M50, F5
- Harness connectors F4, EC4
- 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.

4 DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors F4, EC4
- 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 F4, EC4
- Harness for open or short between electronic control fuel injection pump and ECM

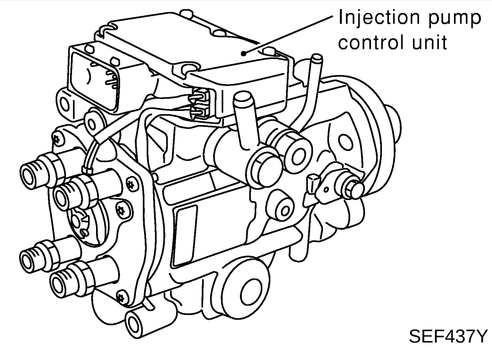
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7 CHECK INTERMITTENT INCIDENT

Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

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.

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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:

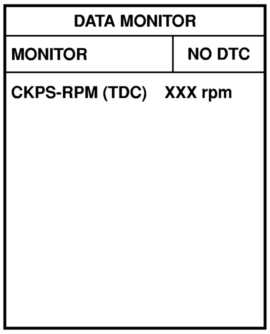
Do not use ECM ground terminals when measuring input/output voltage. Doing so may damage the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

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

2



DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

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-200.

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-200.

GI
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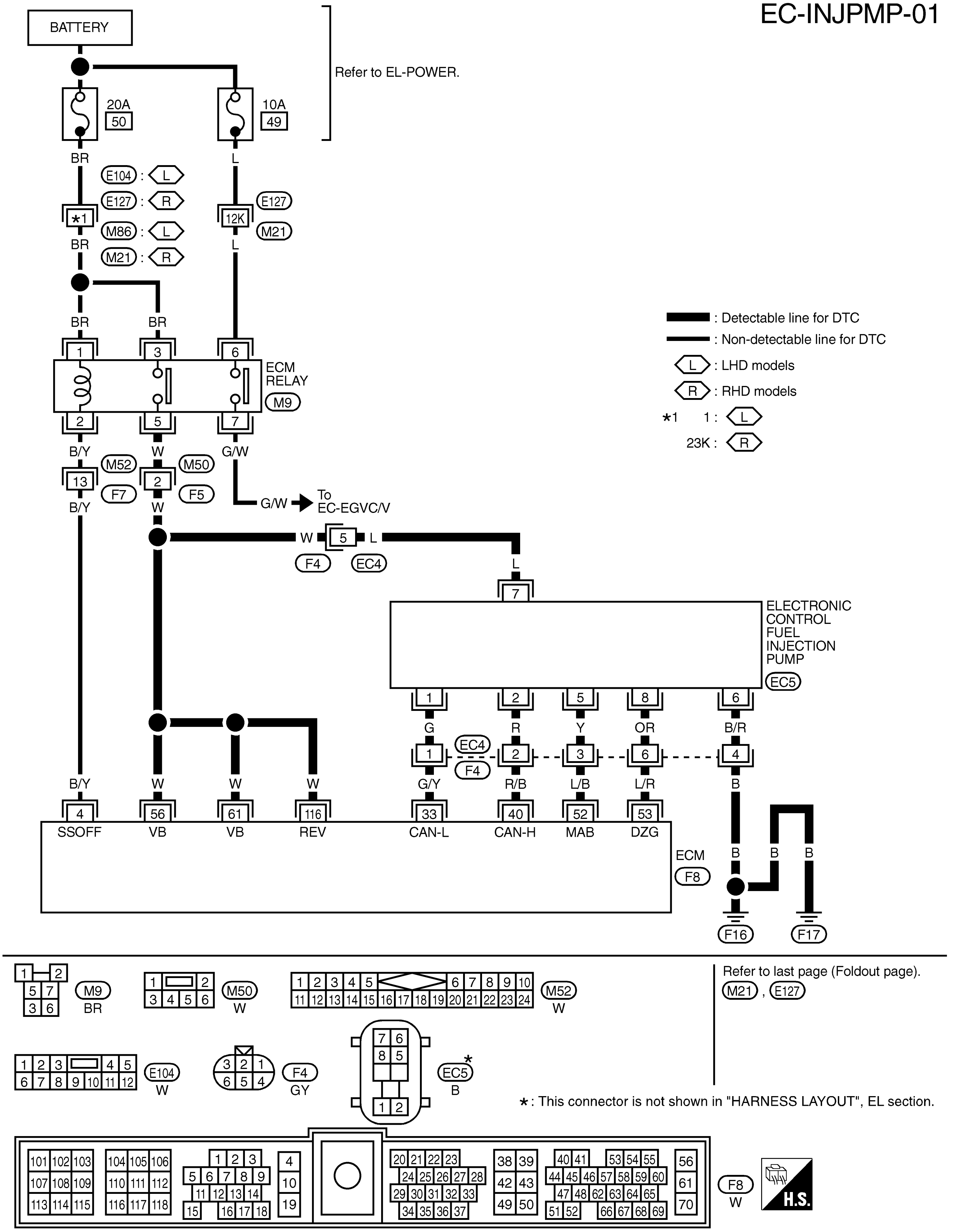
Wiring Diagram

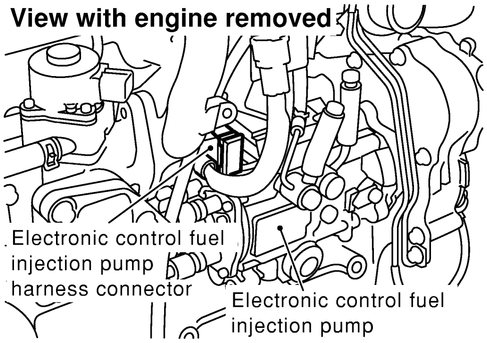


TEC113M

Diagnostic Procedure

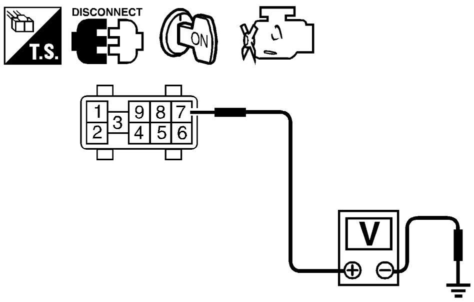
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

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


View with engine removed
Electronic control fuel injection pump harness connector
Electronic control fuel injection pump

SEF229Z

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



Voltage: Battery voltage

SEF438Y

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.

- Harness connectors M50, F5
- Harness connectors F4, EC4
- 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 F4, EC4 ● 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.

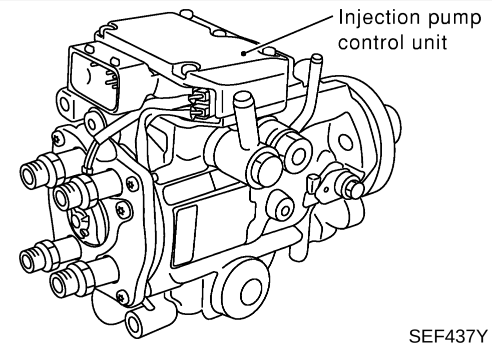
6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors F4, EC4 ● Harness for open or short between electronic control fuel injection pump and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	CHECK INTERMITTENT INCIDENT

Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.

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.

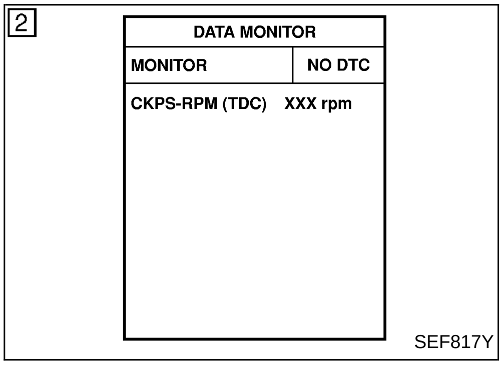
CAUTION:

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/Y	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
40	R/B	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
52	L/B	Electronic control fuel injection pump	Engine is running. Idle speed	Approximately 0.1V
53	L/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)
● 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



DATA MONITOR

MONITOR NO DTC

CKPS-RPM (TDC) XXX rpm

DTC Confirmation Procedure

WITH CONSULT-II

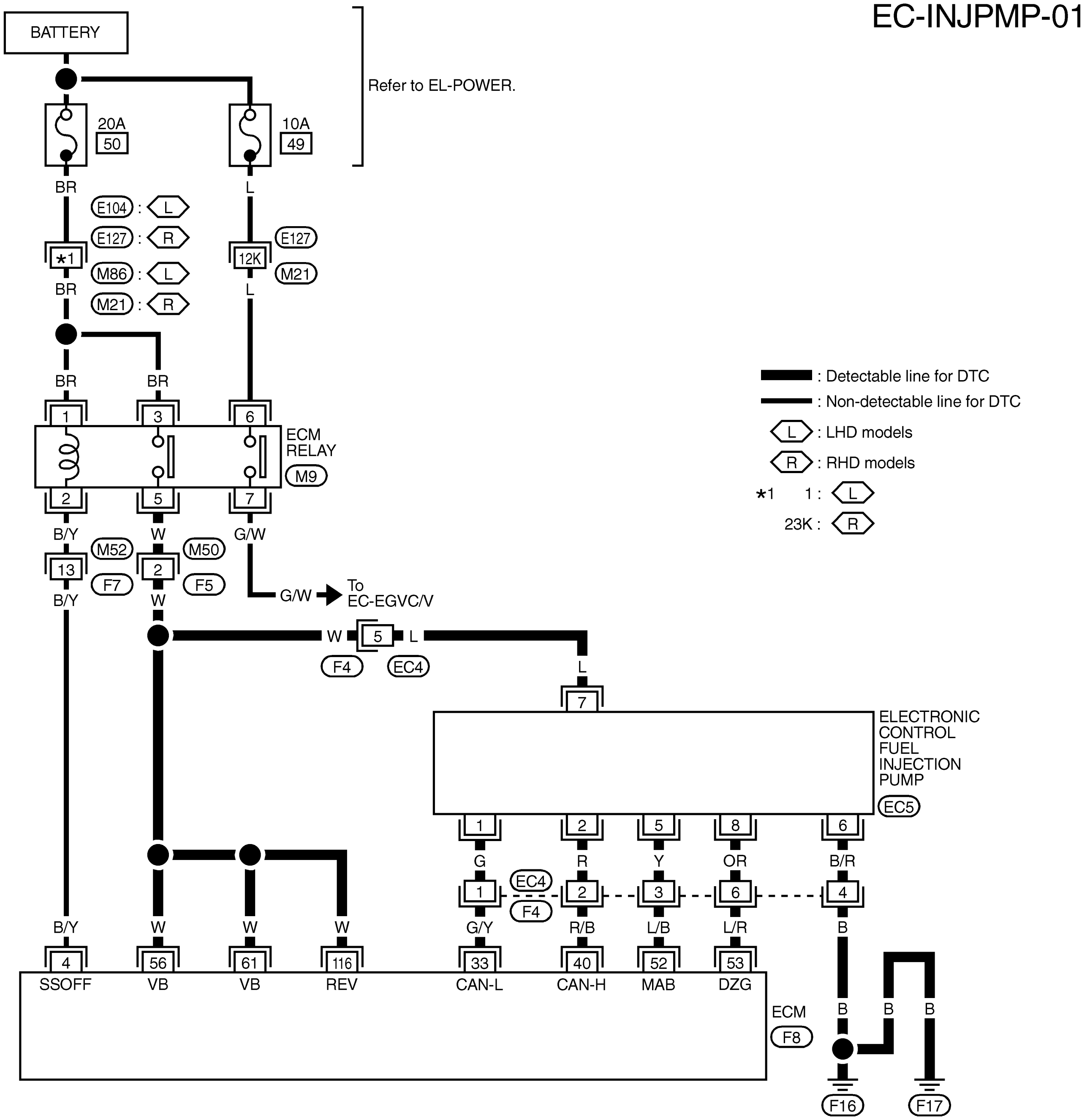
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) If DTC is detected, go to “Diagnostic Procedure”, EC-206.

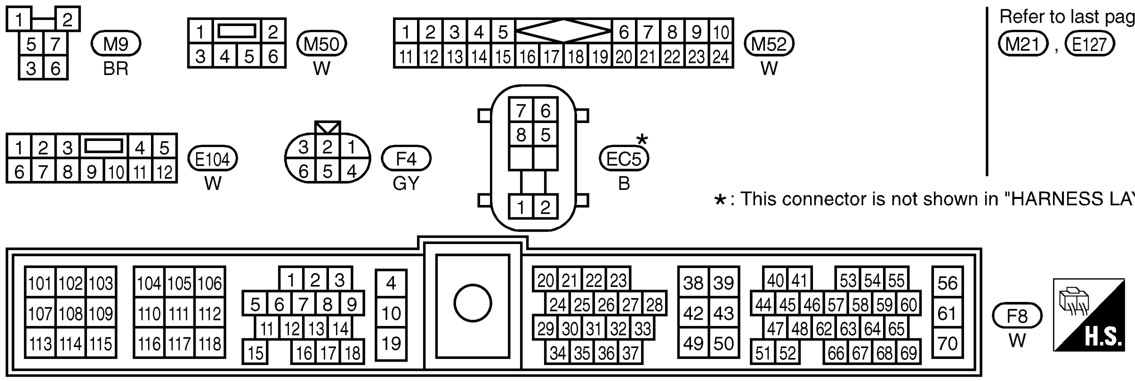
WITHOUT CONSULT-II

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-206.

Wiring Diagram

EC-INJPMP-01





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

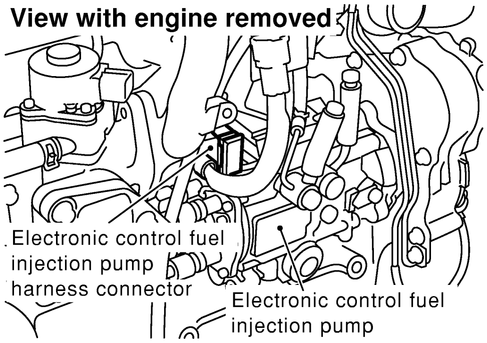
*: This connector is not shown in "HARNESS LAYOUT", EL section.

TEC113M

Diagnostic Procedure

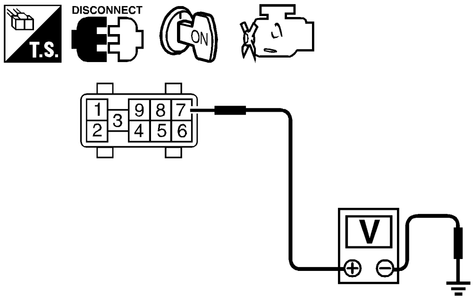
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

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


View with engine removed
Electronic control fuel injection pump harness connector
Electronic control fuel injection pump

SEF229Z

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



Voltage: Battery voltage

SEF438Y

OK or NG

OK ▶	GO TO 3.
NG ▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M50, F5
- Harness connectors F4, EC4
- 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

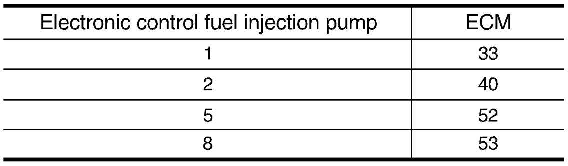
OK ▶	GO TO 5.
NG ▶	GO TO 4.

Diagnostic Procedure (Cont’d)

4	**DETECT MALFUNCTIONING PART**
Check the following. ● Harness connectors F4, EC4 ● 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.

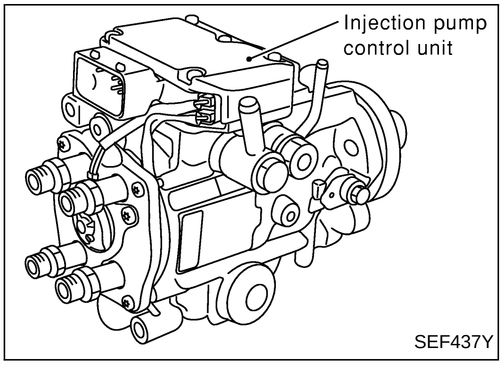
6	**DETECT MALFUNCTIONING PART**
Check the following. ● Harness connectors F4, EC4 ● Harness for open or short between electronic control fuel injection pump and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	**CHECK INTERMITTENT INCIDENT**

Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

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.

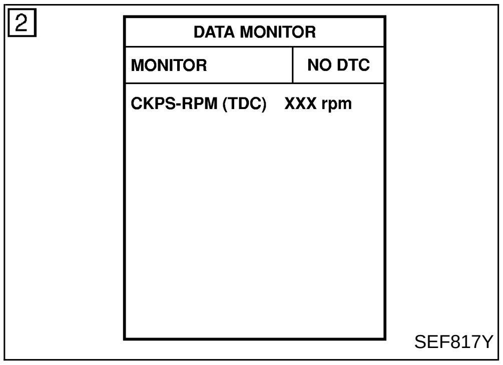
CAUTION:

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/Y	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
40	R/B	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
52	L/B	Electronic control fuel injection pump	Engine is running. Idle speed	Approximately 0.1V
53	L/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)
• Injection pump control unit does not function properly.	• Electronic control fuel injection pump



DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

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-210.

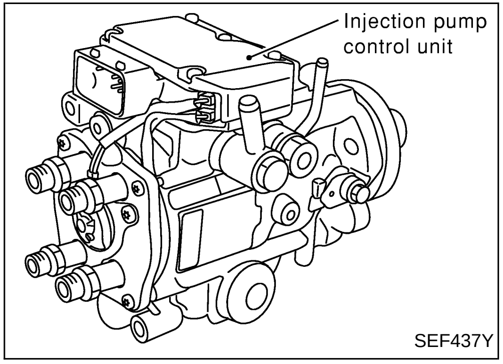
WITHOUT CONSULT-II

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-210.

Diagnostic Procedure

<table>
<tr><td><b>1</b></td><td colspan="2"><b>INSPECTION START</b></td></tr>
<tr><td colspan="3"><b>With CONSULT-II</b>
1. Turn ignition switch “ON”.
2. Select “SELF DIAG RESULTS” mode with CONSULT-II.
3. Touch “ERASE”.
4. Perform “DTC Confirmation Procedure”, EC-210, again.
5. Is the malfunction displayed again?</td></tr>
<tr><td colspan="3"><b>Without CONSULT-II</b>
1. Turn ignition switch “ON”.
2. Erase the Diagnostic Test Mode II (Self-diagnostic results) memory.
3. Perform “DTC Confirmation Procedure”, EC-210, again.
4. Perform “Diagnostic Test Mode II (Self-diagnostic results)”.
5. Is the DTC 0705 displayed again?

<b>Yes or No</b></td></tr>
<tr><td colspan="2">Yes ▶</td><td>Replace electronic control fuel injection pump.</td></tr>
<tr><td colspan="2">No ▶</td><td><b>INSPECTION END</b></td></tr>
</table>



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:

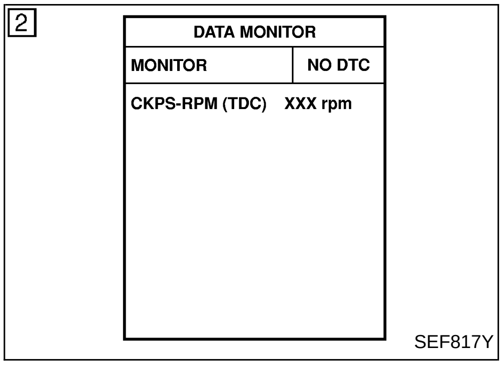
Do not use ECM ground terminals when measuring input/output voltage. Doing so may damage the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

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



DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

DTC Confirmation Procedure

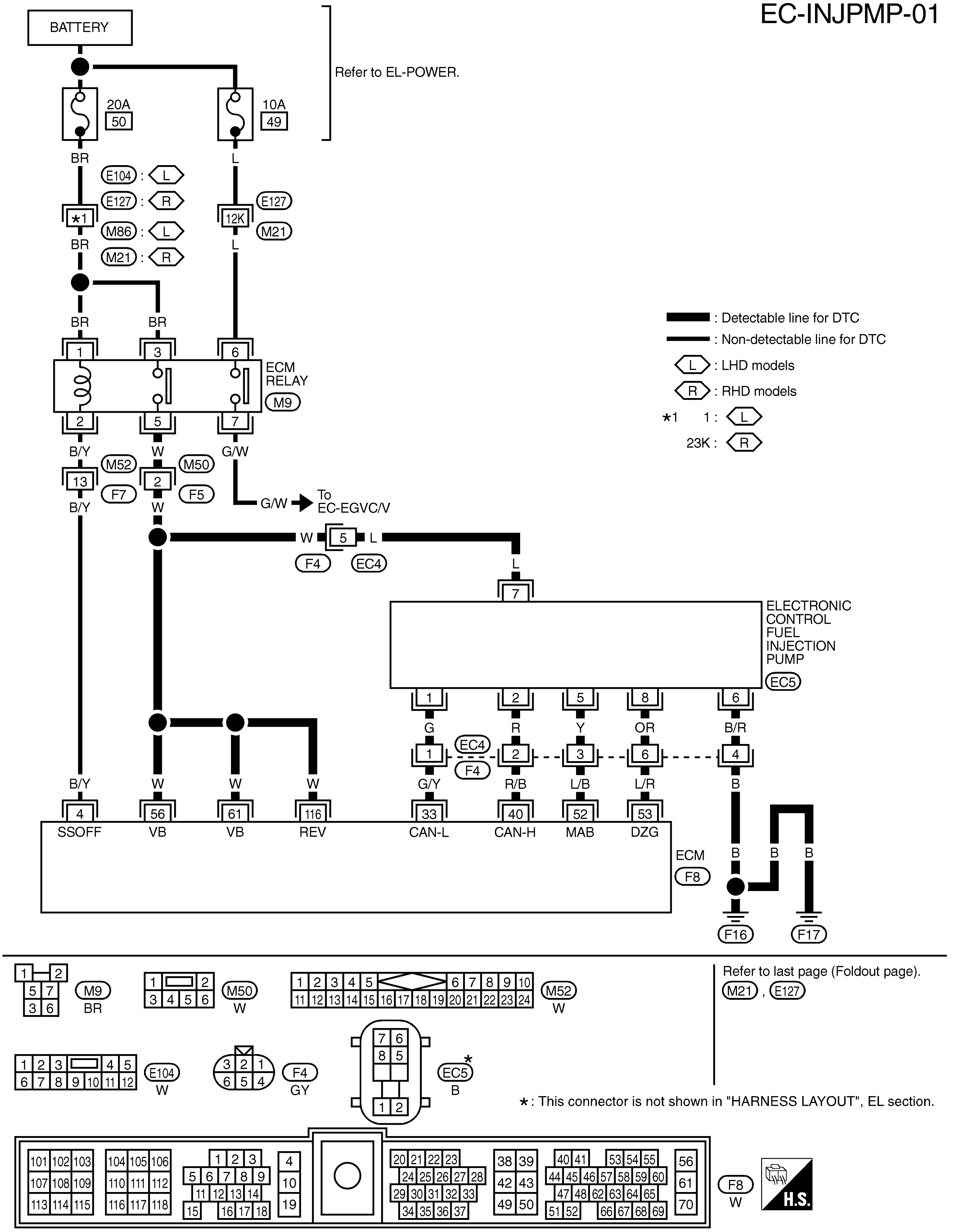
WITH CONSULT-II

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-215.

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-215.

Wiring Diagram



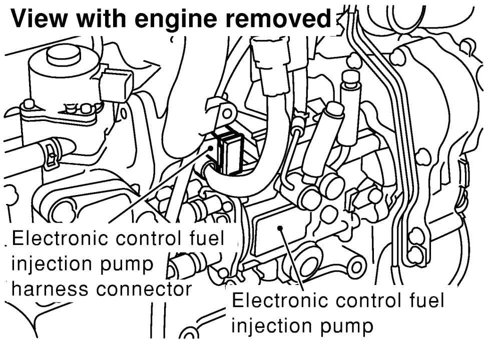
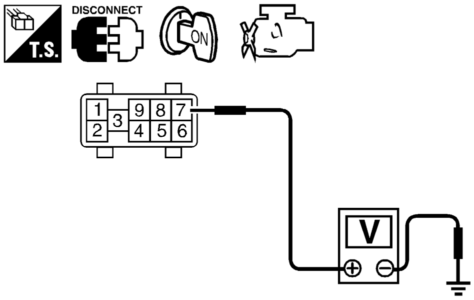
Refer to last page (Foldout page).
M21 , E127

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

Diagnostic Procedure

1	**INSPECTION START**
1. Turn ignition switch "OFF". 2. Perform "Air Bleeding", EC-62, and "DRAINING WATER" in MA section.	
▶	GO TO 2.

2	**PERFORM DTC CONFIRMATION PROCEDURE AGAIN**
Perform "DTC Confirmation Procedure", EC-213 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.  View with engine removed Electronic control fuel injection pump harness connector Electronic control fuel injection pump SEF229Z 3. Turn ignition switch "ON". 4. Check voltage between electronic control fuel injection pump terminal 7 and ground.  **Voltage: Battery voltage** SEF438Y **OK or NG**	
OK ▶	GO TO 5.
NG ▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M50, F5 ● Harness connectors F4, EC4 ● 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 F4, EC4 ● 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

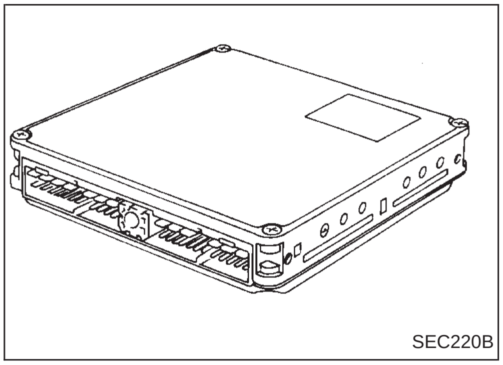
OK ▶	GO TO 9.
NG ▶	GO TO 8.

8	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors F4, EC4 ● 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-107. **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.

DTC 0802 ECM 10

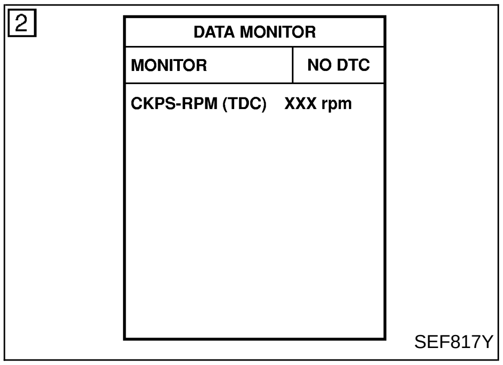


Description

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 (ECCS-D control module)



DATA MONITOR

MONITOR NO DTC

CKPS-RPM (TDC) XXX rpm

DTC Confirmation Procedure

WITH CONSULT-II

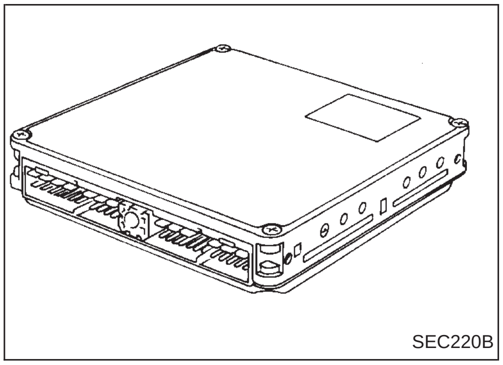
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and wait at least 2 seconds.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-219.

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-219.

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-218, 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-218, 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**

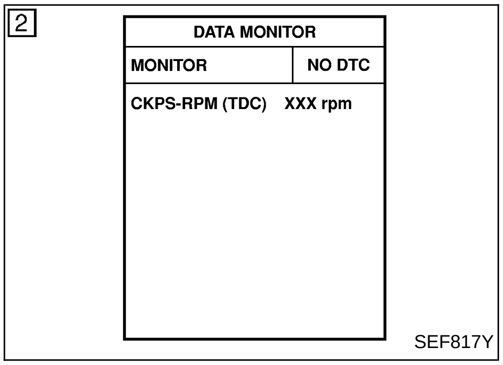

SEC220B

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 (ECCS-D control module)



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

SEF817Y

DTC Confirmation Procedure

WITH CONSULT-II

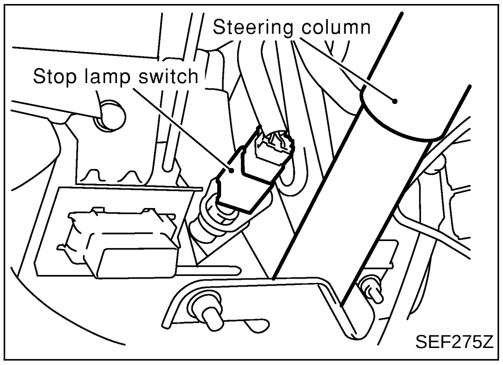
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Wait at least 1 second.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-221.

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-221.

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-220, 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-220, 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.

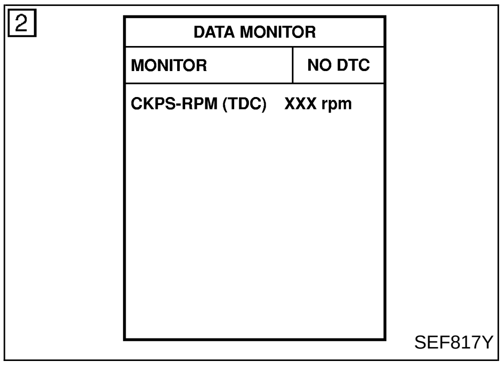
CAUTION:

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



2

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) Depress and release brake pedal more than 10 times.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-224.

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-224.

GI
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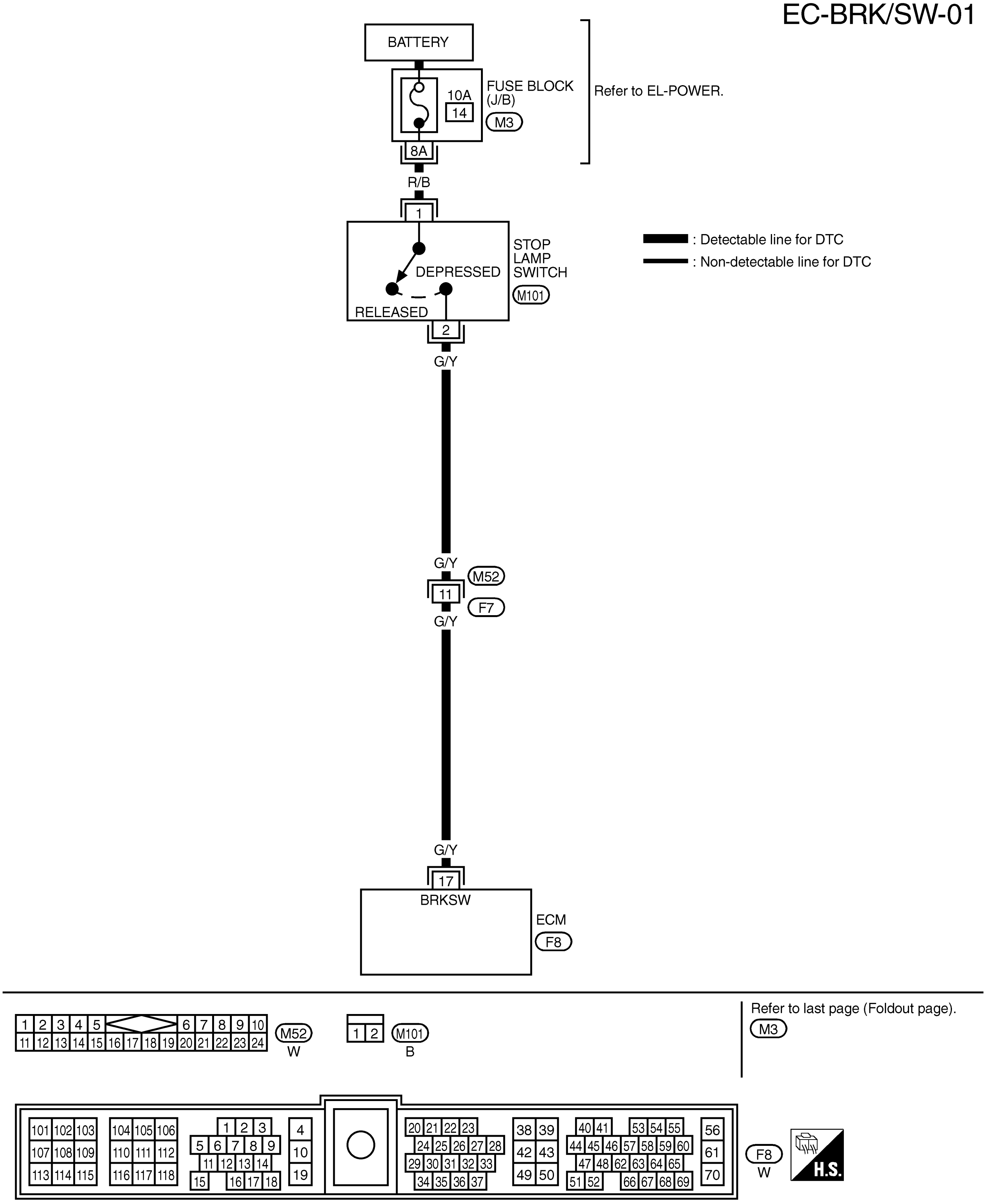
Wiring Diagram



TEC121M

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

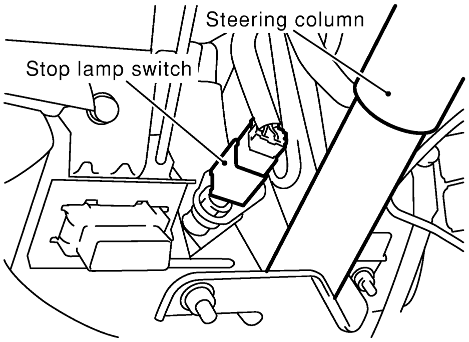
MTBL0443

OK or NG

OK ▶	GO TO 4.
NG ▶	GO TO 2.

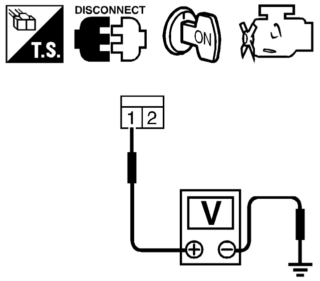
2	CHECK STOP LAMP SWITCH POWER SUPPLY CIRCUIT

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



SEF275Z

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

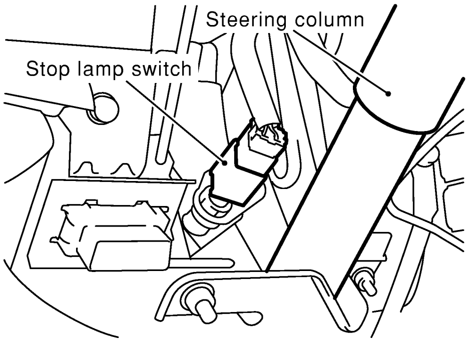
OK or NG

OK ▶	GO TO 4.
NG ▶	GO TO 3.

3	DETECT MALFUNCTIONING PART
Check the following. ● Fuse block (J/B) connector M3 ● 10A 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.



SEF275Z

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.

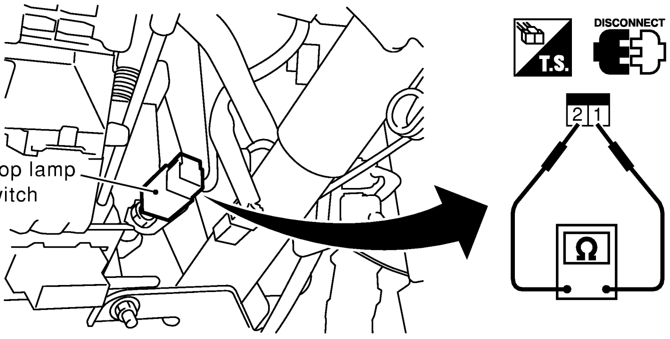
OK or NG

OK ▶	GO TO 6.
NG ▶	GO TO 5.

5	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M52, F7 ● Harness for open or short between ECM and stop lamp switch	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

6	CHECK STOP LAMP SWITCH

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



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

SEF276Z

OK or NG

OK	▶	GO TO 7.
NG	▶	Replace stop lamp switch.

7	CHECK INTERMITTENT INCIDENT

Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

	▶	**INSPECTION END**

ECM Terminals and Reference Value

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

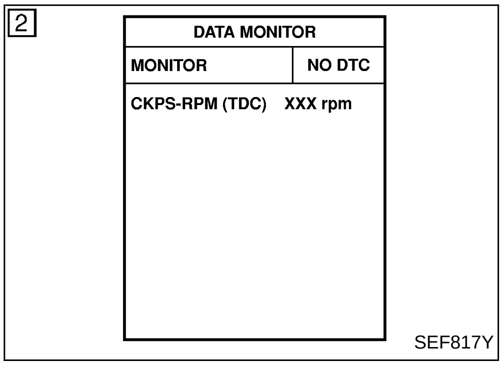
CAUTION:

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	B/Y	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/Y	Ignition switch	Ignition switch "OFF"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
56 61 116	W W 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



2

DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

DTC Confirmation Procedure

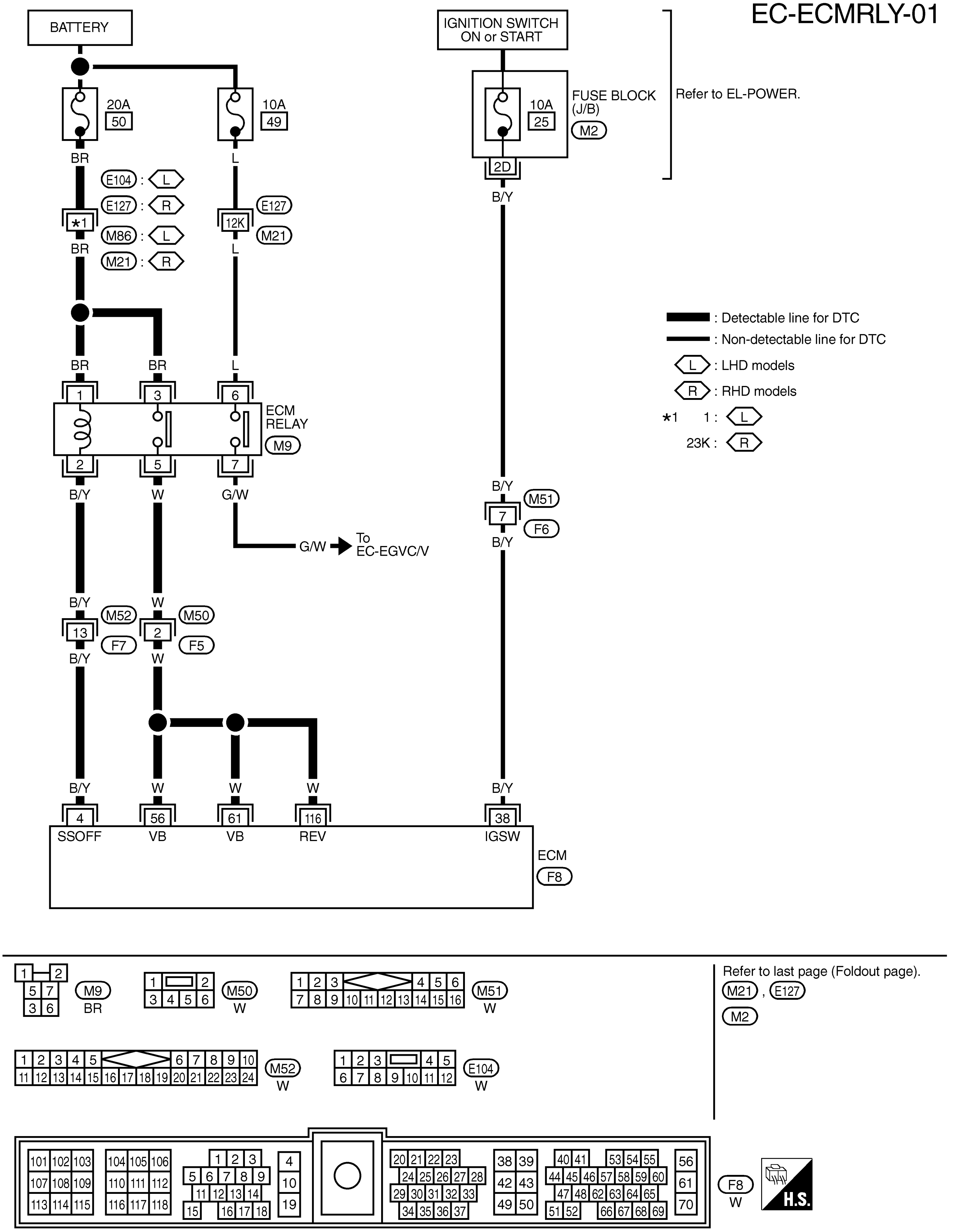
WITH CONSULT-II

1) Turn ignition switch "ON".
2) Select "DATA MONITOR" mode with CONSULT-II.
3) Turn ignition switch "OFF", wait at least 20 seconds and then turn "ON".
4) If DTC is detected, go to "Diagnostic Procedure", EC-229.

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-229.

Wiring Diagram

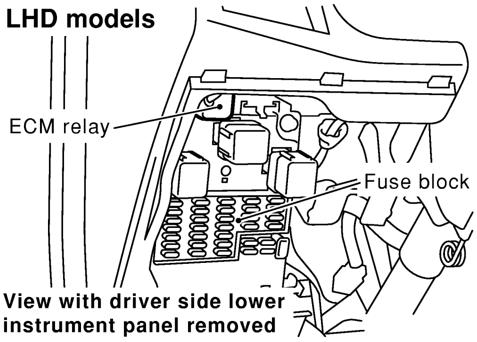


TEC123M

Diagnostic Procedure

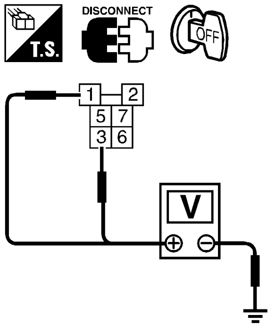
1	CHECK ECM POWER SUPPLY CIRCUIT

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



SEF225Z

3. Check voltage between ECM terminals 1, 3 and ground with CONSULT-II or tester.



Voltage: Battery Voltage

SEF289Z

OK or NG

OK ▶	GO TO 3.
NG ▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
1. Harness connectors E104, M86 or E127, M21
2. 20A 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.

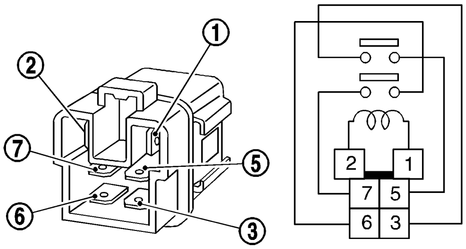
Diagnostic Procedure (Cont’d)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M50, F5 ● 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 2. 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 M52, F7 ● 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.	



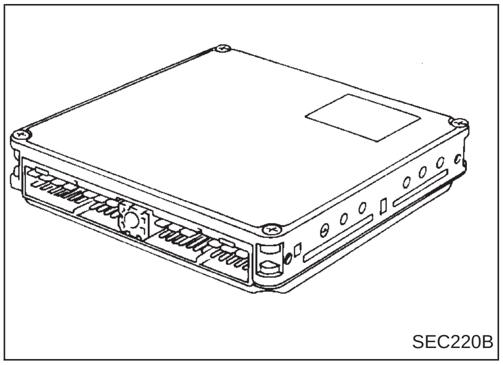
Condition	Continuity
12V direct current supply between terminals 1 and 2	Yes
OFF	No

SEF296X

OK or NG

OK ▶	GO TO 8.
NG ▶	Replace ECM relay.

8	CHECK INTERMITTENT INCIDENT
Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.	
▶	**INSPECTION END**



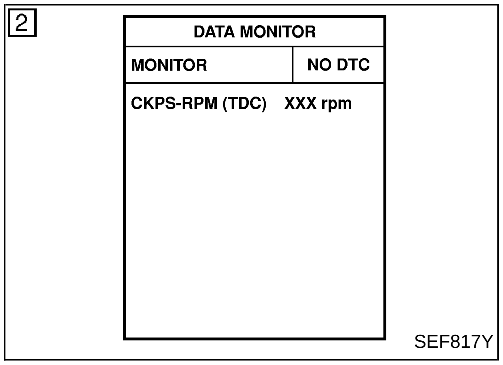
SEC220B

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 (ECCS-D control module)



2

DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

DTC Confirmation Procedure

WITH CONSULT-II

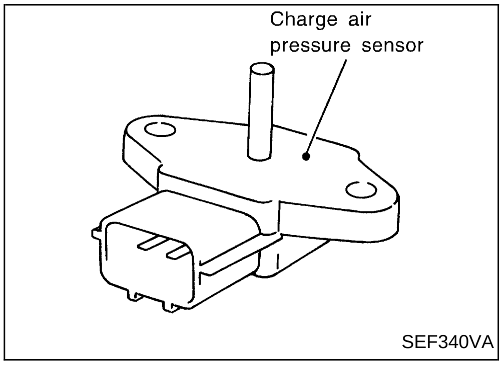
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Turn ignition switch “OFF”, wait at least 20 seconds and then turn “ON”.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-232.

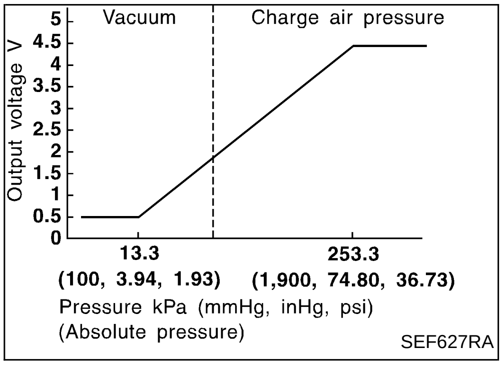
WITHOUT CONSULT-II

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-232.

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-231, 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-231, 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.

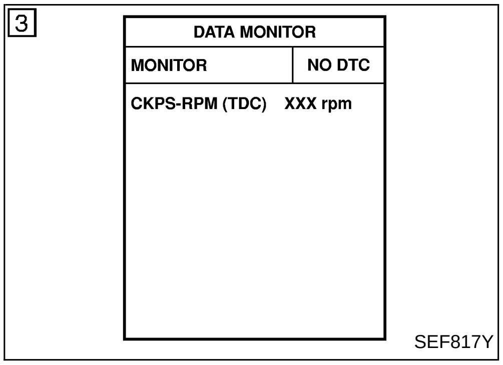
CAUTION:

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	L	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



3

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

SEF817Y

DTC Confirmation Procedure

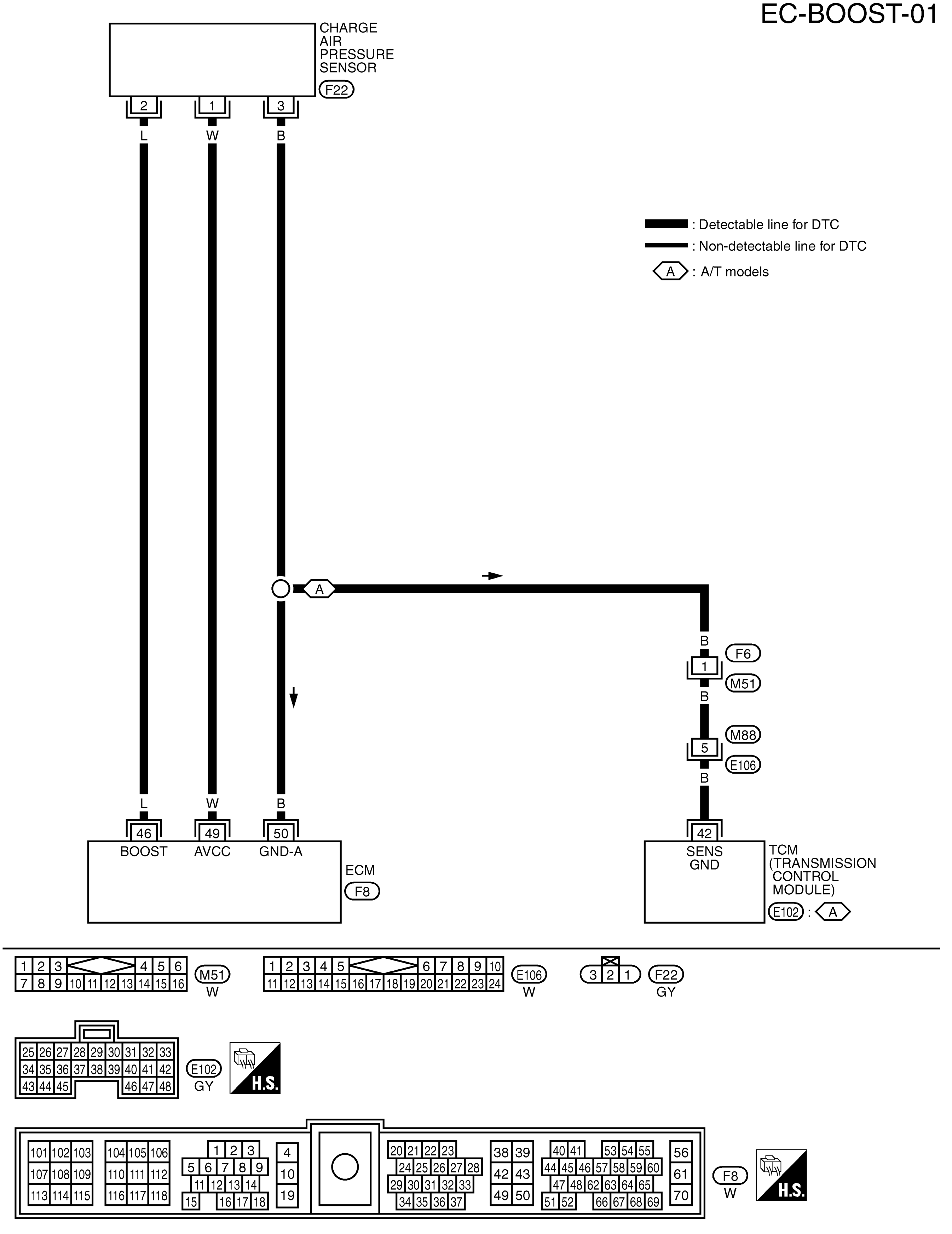
WITH CONSULT-II

1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Wait at least 1 second.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-236.

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-236.

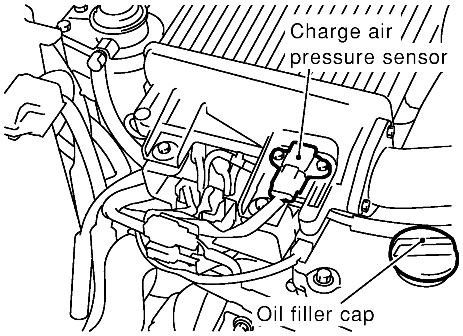
Wiring Diagram



Diagnostic Procedure

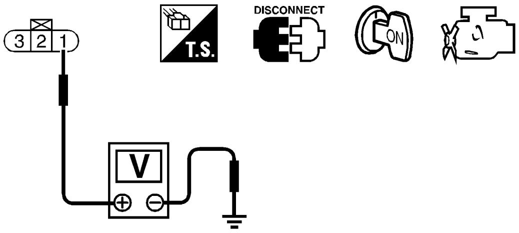
1	**CHECK CHARGE AIR PRESSURE SENSOR POWER SUPPLY CIRCUIT**

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 2.
NG	▶	Repair harness or connectors.

2	**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 4.
NG	▶	GO TO 3.

3	**DETECT MALFUNCTIONING PART**

Check the following.
- Harness connectors F6, M51 (A/T models)
- Harness connectors M88, E106 (A/T models)
- Harness for open or short between ECM and charge air pressure sensor
- Harness for open or short between TCM (Transmission control module) and charge air pressure sensor

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

4	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

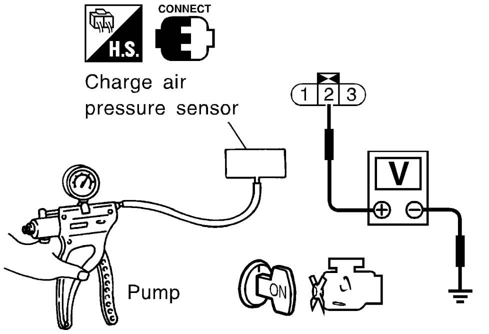
OK ▶	GO TO 5.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	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 6.
NG ▶	Replace charge air pressure sensor.

6	CHECK INTERMITTENT INCIDENT

Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.

▶	**INSPECTION END**

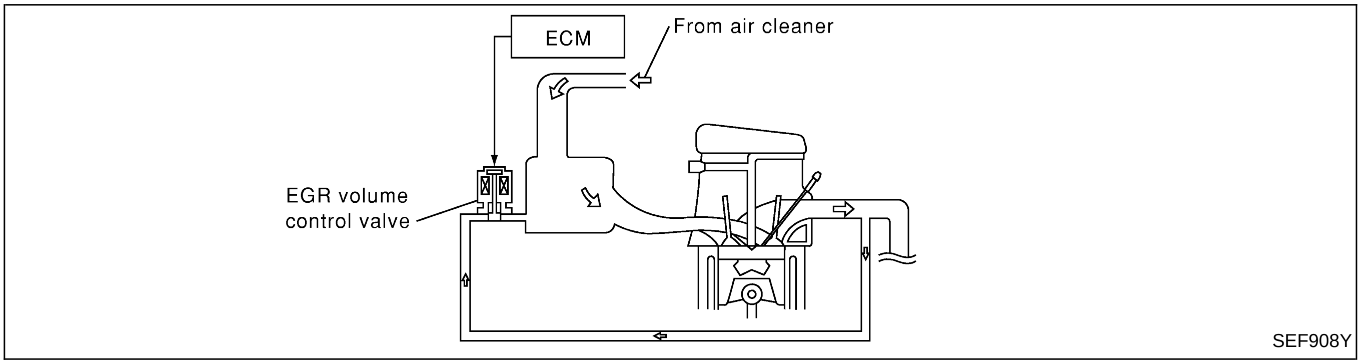
Description

SYSTEM DESCRIPTION

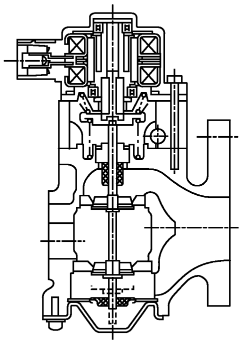
Sensor	Input Signal to ECM	ECM Function	Actuator
Electronic controlled fuel injection pump	Fuel injection signal	EGR volume control	EGR volume control valve
Crankshaft position sensor (TDC)	Engine speed		
Vehicle speed sensor	Vehicle speed		
Engine coolant temperature sensor	Engine coolant temperature		
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



Description (Cont'd)



SEF411Y

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

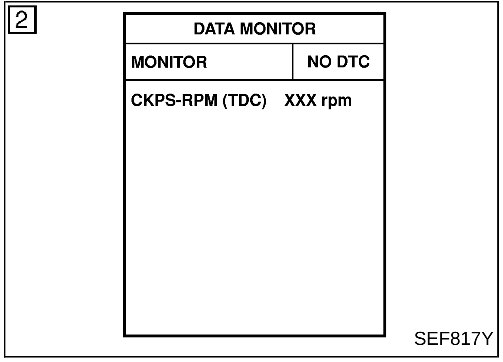
Specification data are reference values and are measured between each terminal and ground.

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)
103 105 109 115	L/Y L/W L R/L	EGR volume control valve	Engine is running. **Warm-up condition** Idle speed	0.1 - 14V

DTC Confirmation Procedure



2

DATA MONITOR

MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

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-241.

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-241.

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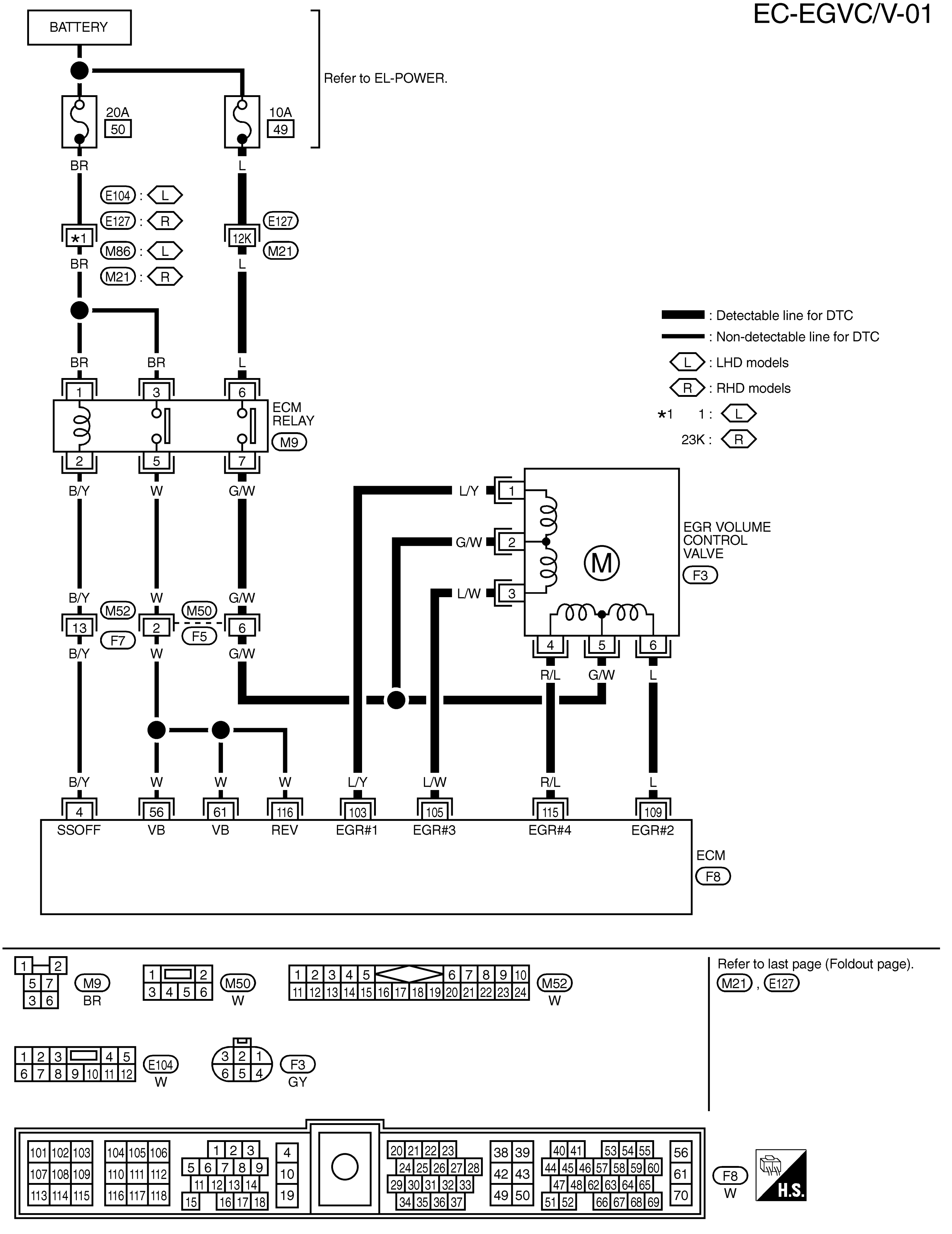
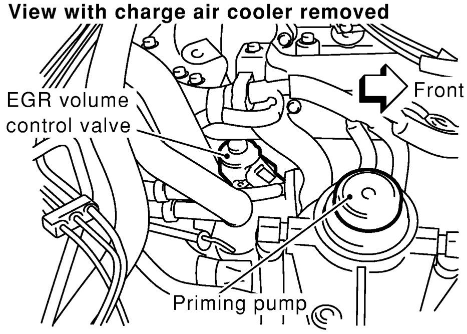
Wiring Diagram



Diagnostic Procedure

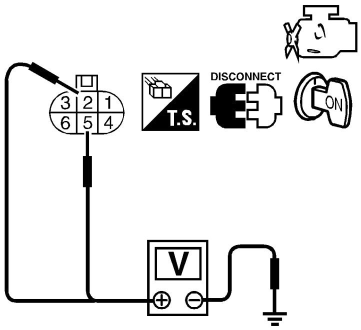
1	CHECK EGR VOLUME CONTROL VALVE POWER SUPPLY CIRCUIT-I

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



SEF277Z

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.

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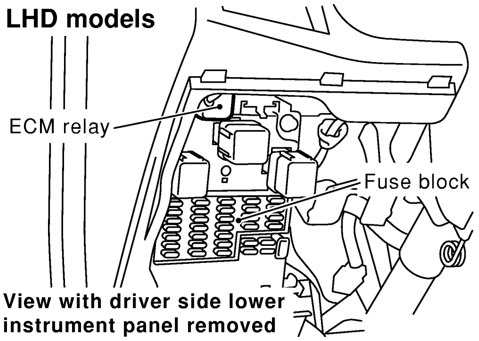
2	CHECK EGR VOLUME CONTROL VALVE POWER SUPPLY CIRCUIT-II

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



SEF225Z

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.

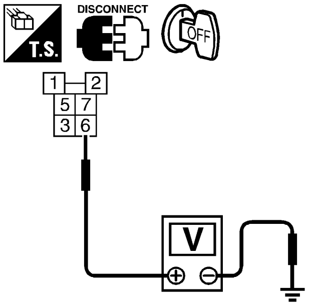
3	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M50, F5
- 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.
- Harness connectors E127, M21
- 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.

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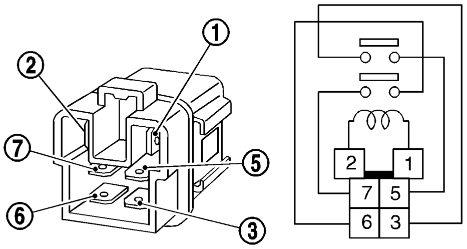
6 CHECK ECM RELAY

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.

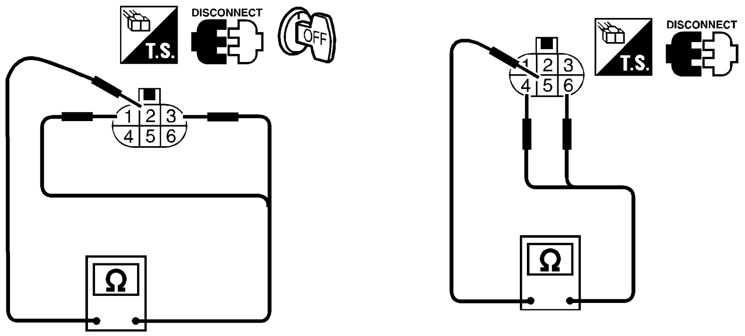
OK or NG

OK	▶	GO TO 8.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

8	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

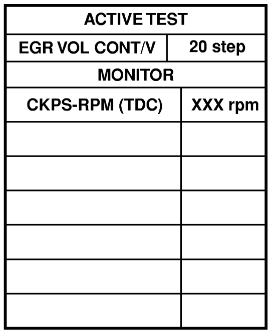
OK or NG

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

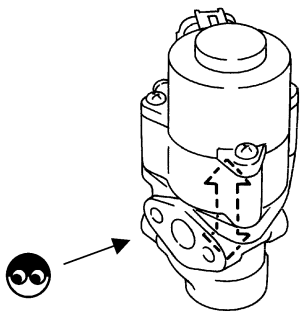
9	CHECK EGR VOLUME CONTROL VALVE-II

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

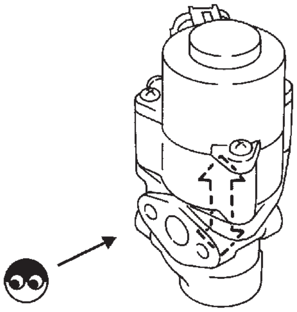
OK	▶	GO TO 11.
NG	▶	Replace EGR volume control valve.

Diagnostic Procedure (Cont'd)

10	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

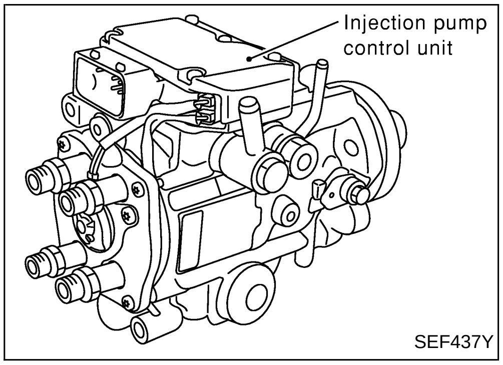
OK or NG

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

11	CHECK INTERMITTENT INCIDENT

Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.

	▶	**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.

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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:

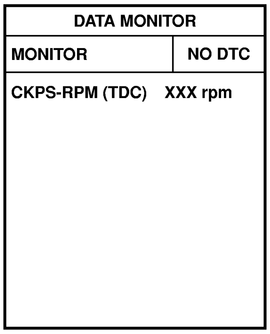
Do not use ECM ground terminals when measuring input/output voltage. Doing so may damage the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
33	G/Y	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
40	R/B	Electronic control fuel injection pump	Engine is running. **Warm-up condition** Idle speed	Approximately 2.5V
52	L/B	Electronic control fuel injection pump	Engine is running. Idle speed	Approximately 0.1V
53	L/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)
• Fuel cut control system does not function properly.	• Harness or connectors (Electronic control fuel circuit is open or shorted.) • Electronic control fuel

2



DATA MONITOR

MONITOR NO DTC

CKPS-RPM (TDC) XXX rpm

SEF817Y

DTC Confirmation Procedure

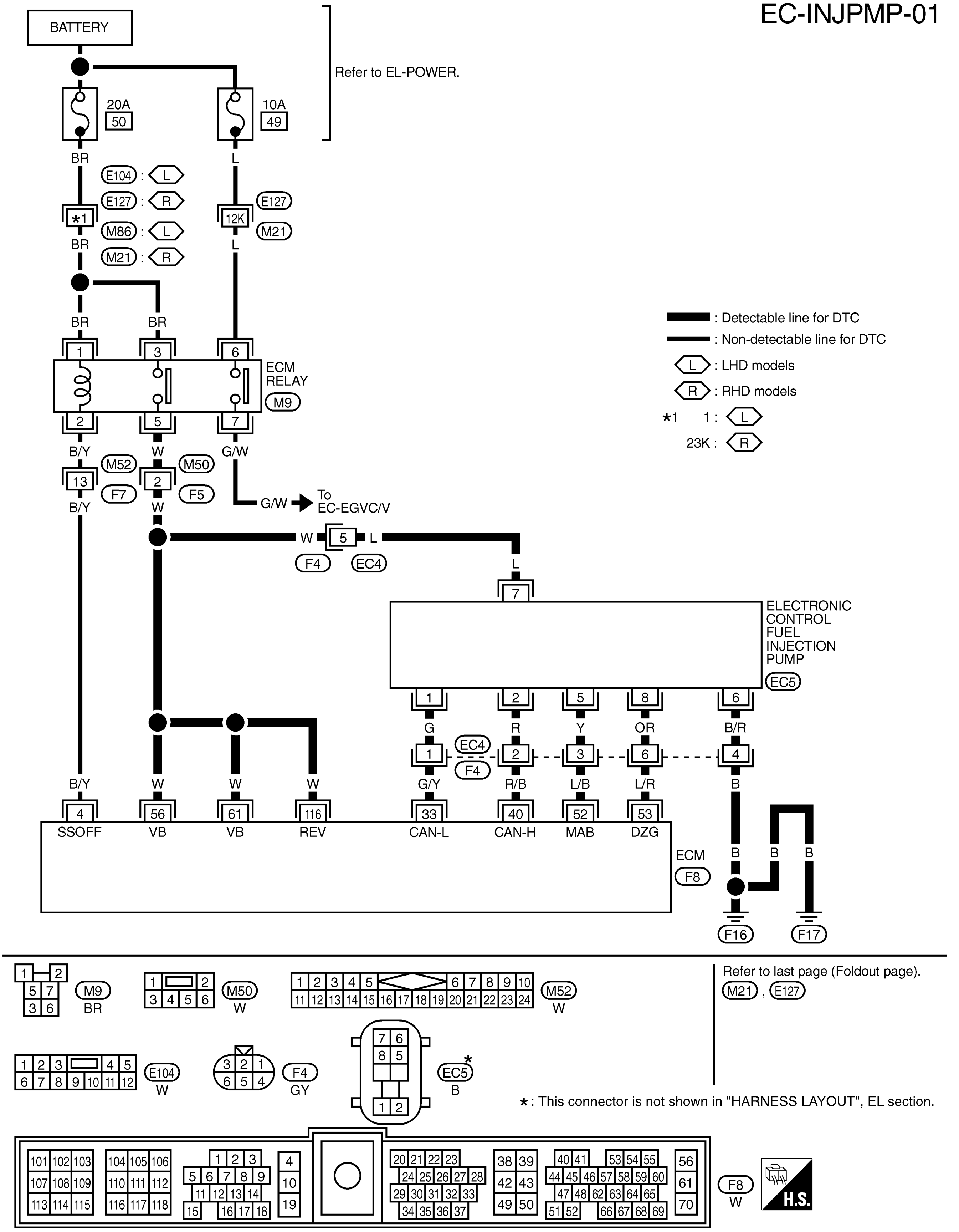
WITH CONSULT-II

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-250.

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-250.

Wiring Diagram

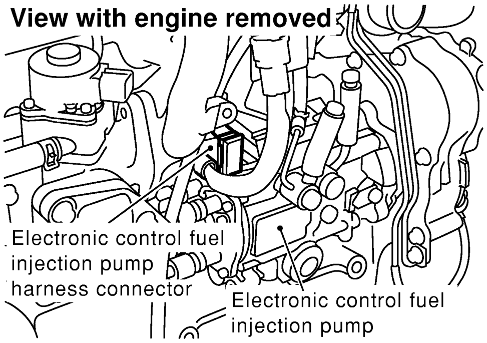


TEC113M

Diagnostic Procedure

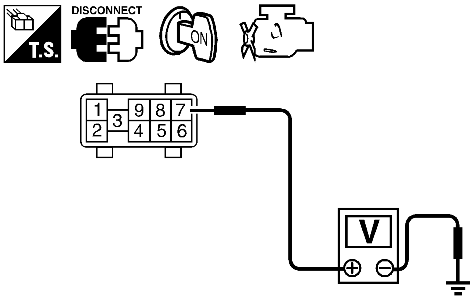
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

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


View with engine removed
Electronic control fuel injection pump harness connector
Electronic control fuel injection pump

SEF229Z

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



Voltage: Battery voltage

SEF438Y

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M50, F5
- Harness connectors F4, EC4
- 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)

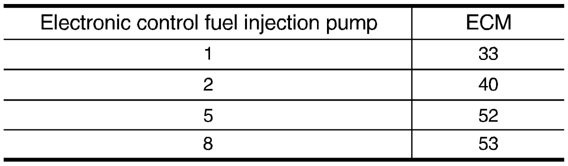
4	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors F4, EC4
- 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 F4, EC4
- 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-107.

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).

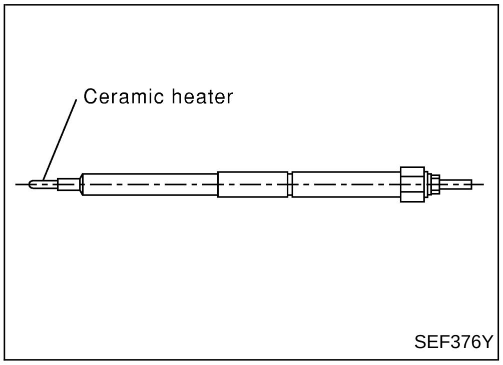
When coolant temperature is lower than approximately 75°C (167°F):

- 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.

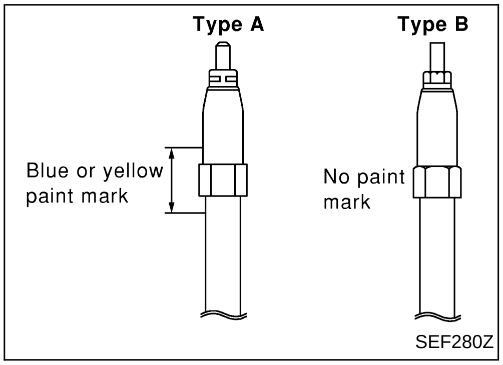
The glow indicator lamp turns ON for a certain period of time in relation to engine coolant temperature at the time glow relay is turned ON.

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.

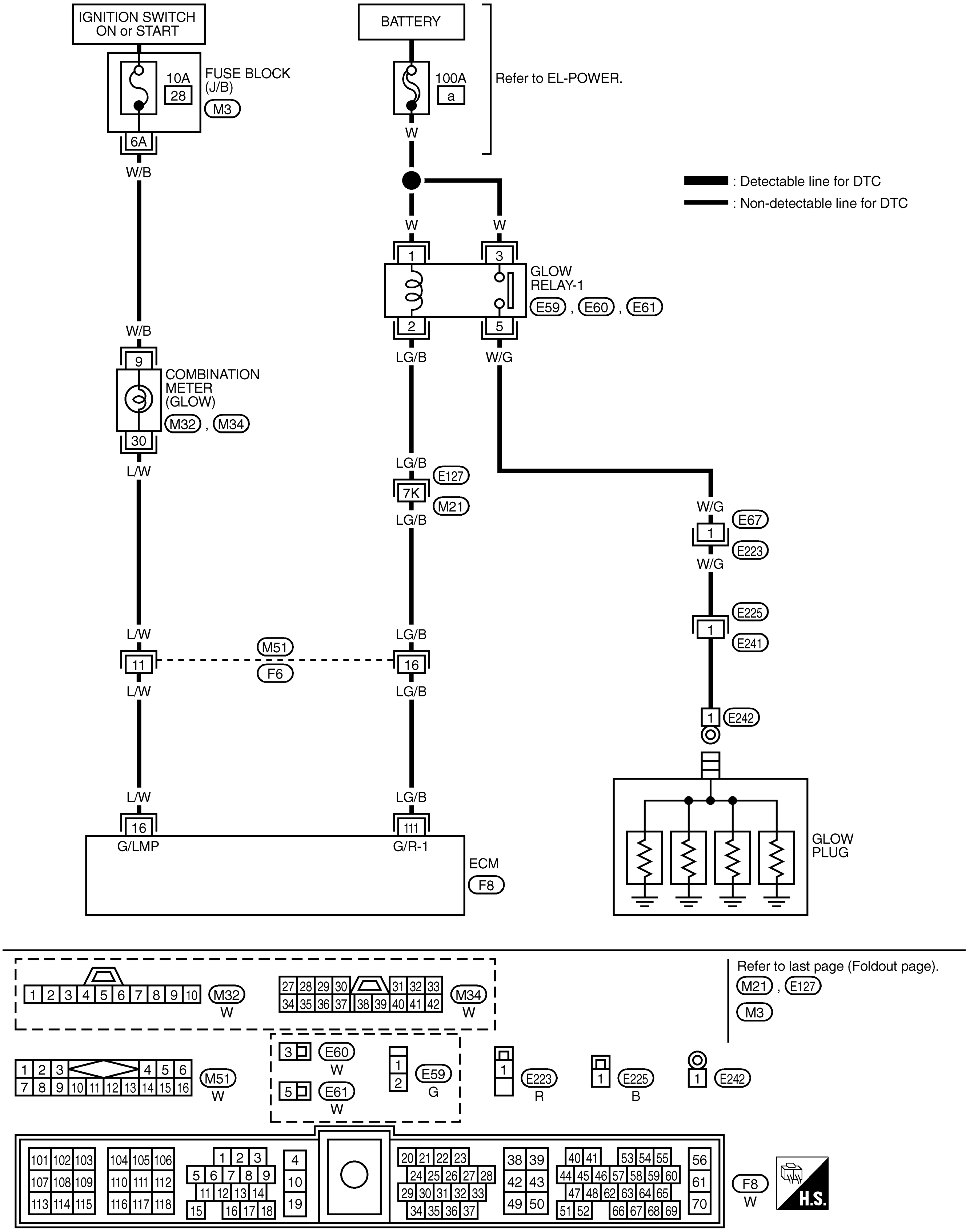
CAUTION:

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.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
16	L/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/B	Glow relay	Refer to "SYSTEM DESCRIPTION", EC-252.	

Wiring Diagram

EC-GLOW-01



TEC105M

Diagnostic Procedure

1	INSPECTION START

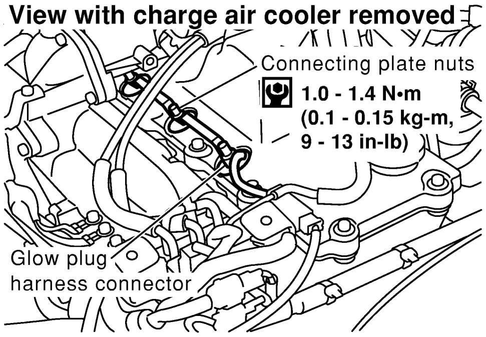
Check fuel level, fuel supplying system, starter motor, etc.

OK or NG

OK	▶	GO TO 2.
NG	▶	Correct.

2	CHECK INSTALLATION

Check that all glow plug connecting plate nuts are installed properly.



SEF233Z

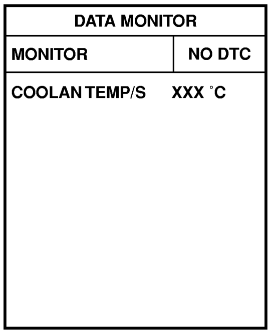
OK or NG

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”.

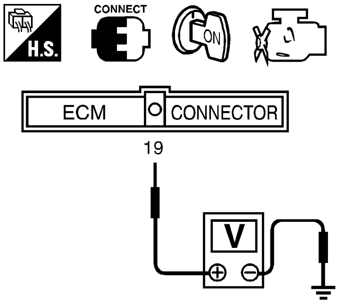
OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 6.

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".

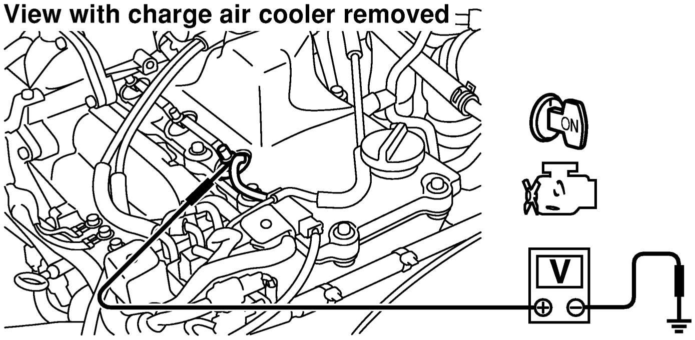
OK or NG

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



Conditions	Voltage
For 20 seconds after turning ignition switch ON	Battery voltage
More than 20 seconds after turning ignition switch ON	Approx. 0V

SEF234Z

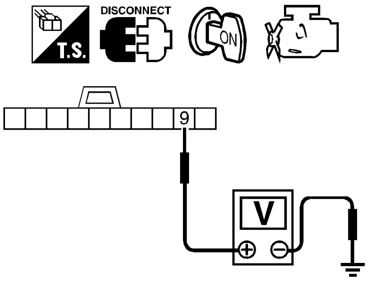
OK or NG

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

Diagnostic Procedure (Cont’d)

6	CHECK GLOW INDICATOR LAMP POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect combination meter harness connector M32.
3. Turn ignition switch “ON”.
4. Check voltage between combination meter terminal 9 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF296Z

OK or NG

OK ▶	GO TO 8.
NG ▶	GO TO 7.

7	DETECT MALFUNCTIONING PART

Check the following.
1. Fuse block (J/B) connector M3
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 M34.
4. Check harness continuity between ECM terminal 16 and combination meter terminal 30. 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 10.
NG ▶	GO TO 9.

9	DETECT MALFUNCTIONING PART

Check the following.
1. Harness connectors M51, F6
2. Harness for open or short between combination meter and ECM

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

10	CHECK COMBINATION METER

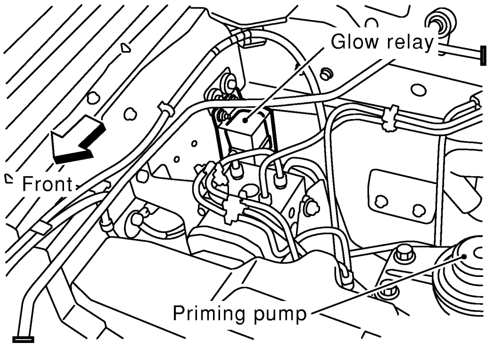
Check combination meter and glow indicator lamp. Refer to EL section (“METER AND GAUGES”).

OK or NG

OK ▶	GO TO 18.
NG ▶	Repair or replace combination meter or glow indicator lamp.

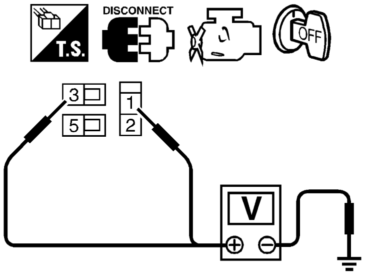
11 CHECK GLOW RELAY POWER SUPPLY CIRCUIT

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



SEF235Z

3. Check voltage between glow relay terminals 1, 3 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF451Z

OK or NG

OK	▶	GO TO 13.
NG	▶	GO TO 12.

12 DETECT MALFUNCTIONING PART

Check the following.
- 100A fusible link
- Harness for open or short between glow relay and battery

	▶	Repair harness or connectors.

13 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 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 15.
NG	▶	GO TO 14.

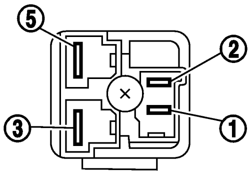
14	**DETECT MALFUNCTIONING PART**
Check the following. ● Harness connectors E127, M21 ● Harness connectors M51, F6 ● Harness for open or short between glow relay and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

15	**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 5 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 ▶	Repair open circuit or short to ground or short to power in harness or connectors.

16	**DETECT MALFUNCTIONING PART**
Check the following. ● Harness connectors E67, E223 ● Harness connectors E225, 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.

17	**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.

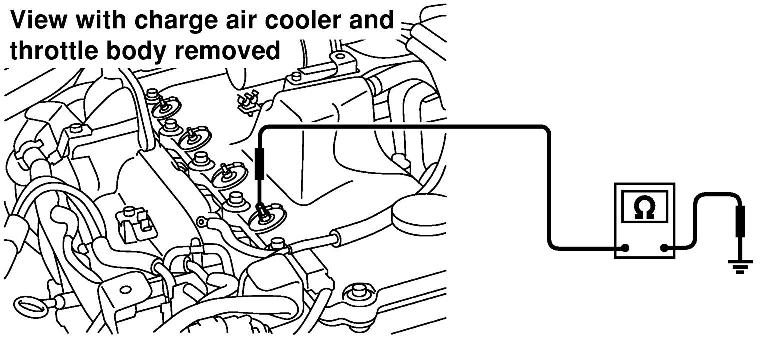
SEF433Y

OK or NG	
OK ▶	GO TO 18.
NG ▶	Replace glow relay.

Diagnostic Procedure (Cont’d)

18	CHECK GLOW PLUG

1. Remove glow plug connecting plate.
2. Check glow plug resistance.



Resistance:
Approx. 0.5 Ω
[at 20°C (68°F)]

SEF236Z

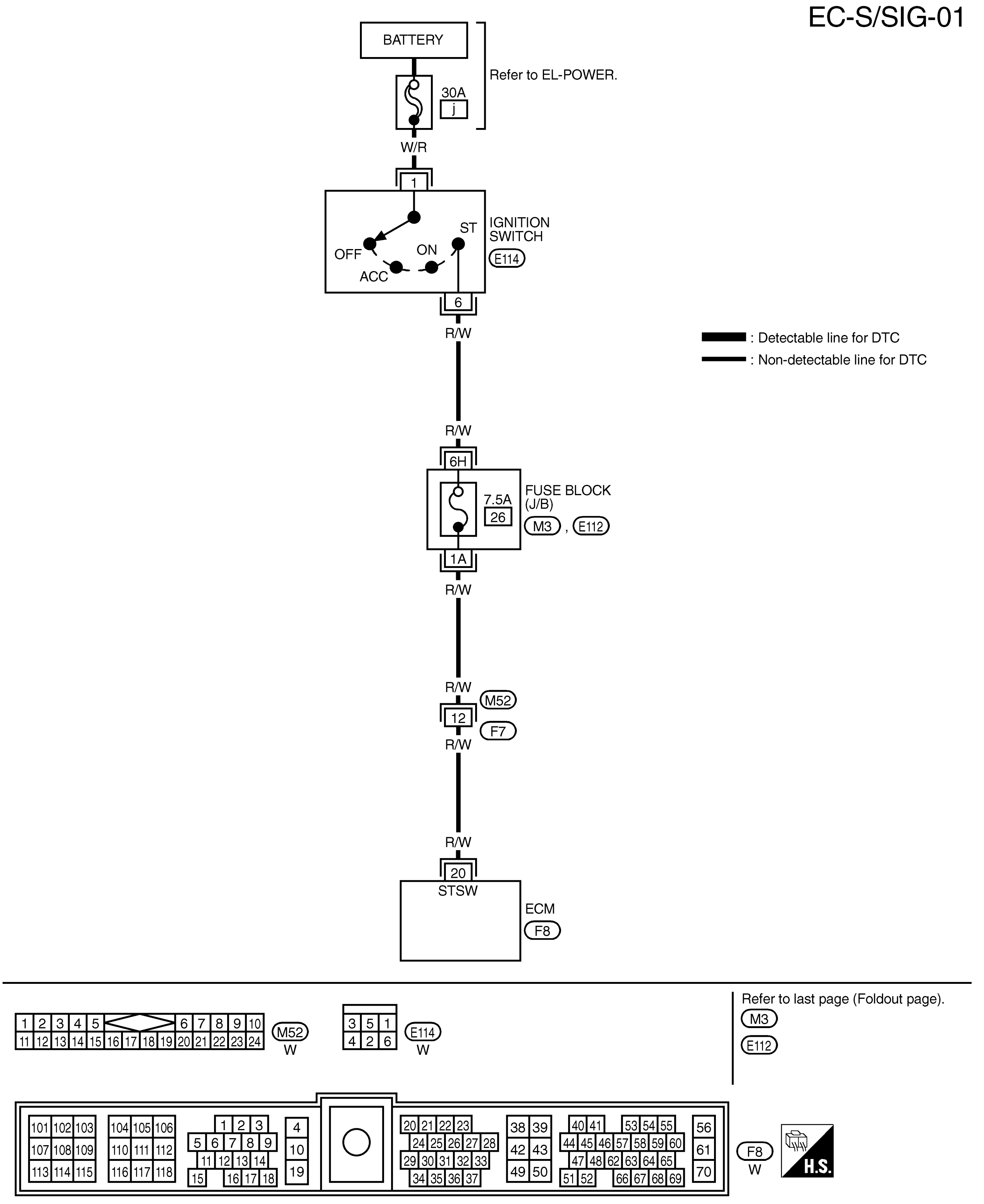
NOTE:
- **Do not bump glow plug heating element. If it is bumped, replace glow plug with a new one.**
- **If glow plug is dropped from a height of 10 cm (3.94 in) or higher, replace with a new one.**
- **If glow plug installation hole is contaminated with carbon, remove it with a reamer or suitable tool.**
- **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 19.
NG ▶	Replace glow plug.

19	CHECK INTERMITTENT INCIDENT
Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.	
▶	**INSPECTION END**

Wiring Diagram



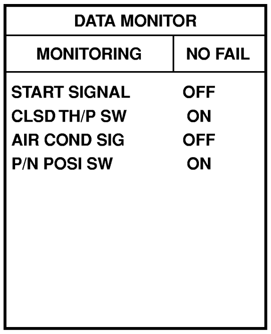
TEC106M

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.



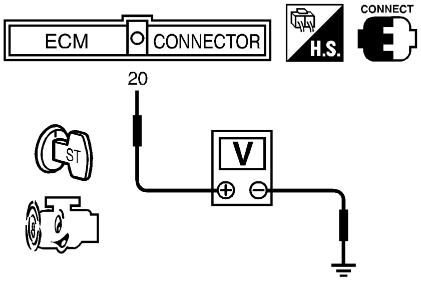
DATA MONITOR	
MONITORING	NO FAIL
START SIGNAL	OFF
CLSD TH/P SW	ON
AIR COND SIG	OFF
P/N POSI SW	ON

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 6. 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 M52, F7
- 7.5A fuse
- Fuse block (J/B) connectors M3, E112
- 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-107.	
▶	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

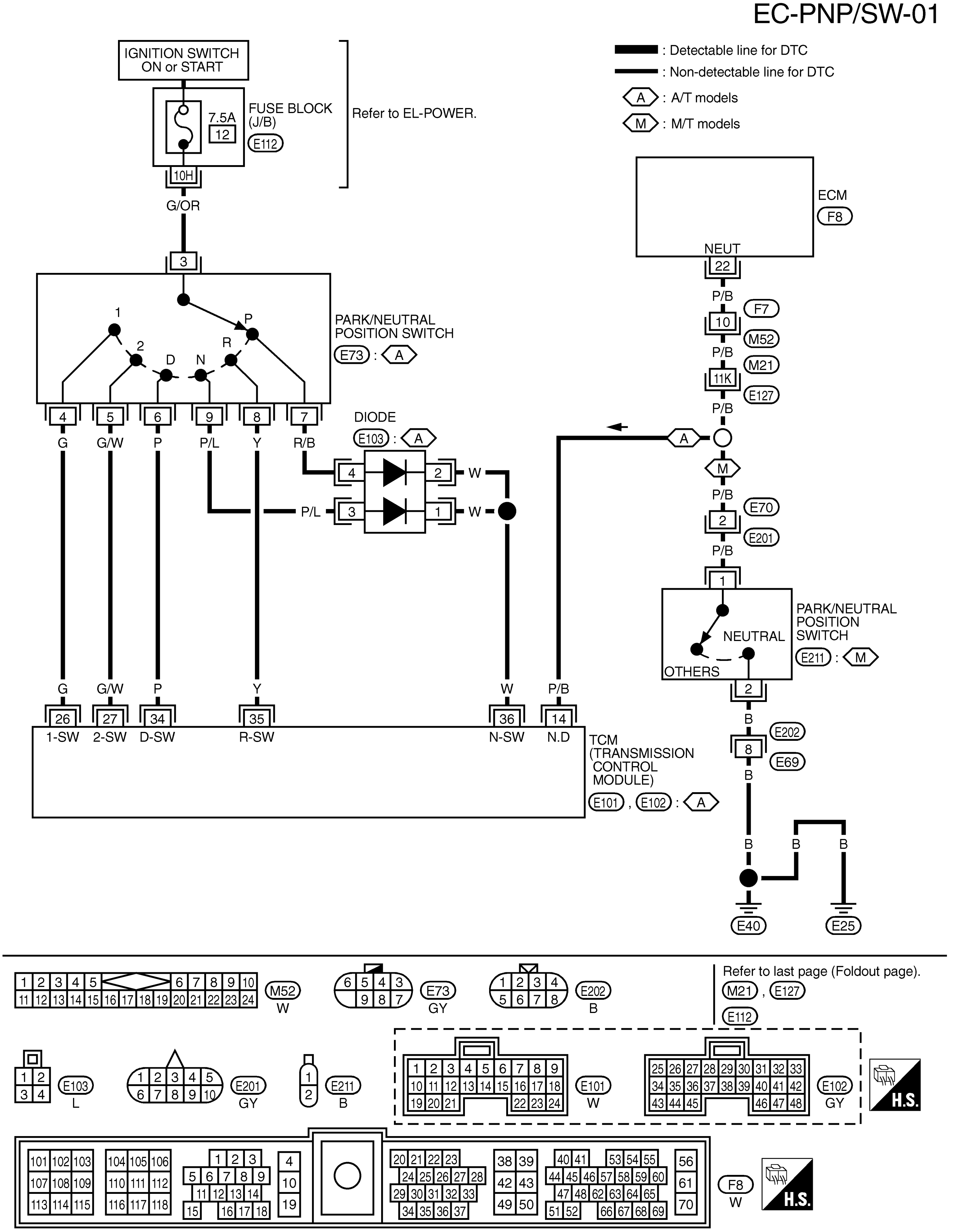
Specification data are reference values and are measured between each terminal and ground.

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	P/B	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



TEC108M

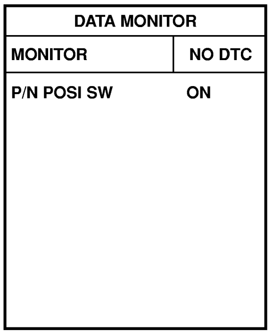
Diagnostic Procedure

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

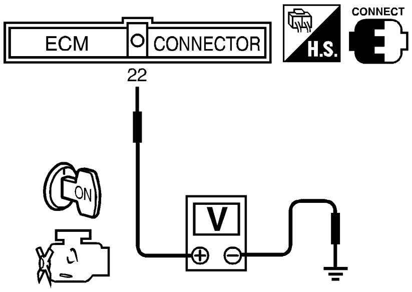
MONITOR	NO DTC
P/N POSI SW	ON

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.

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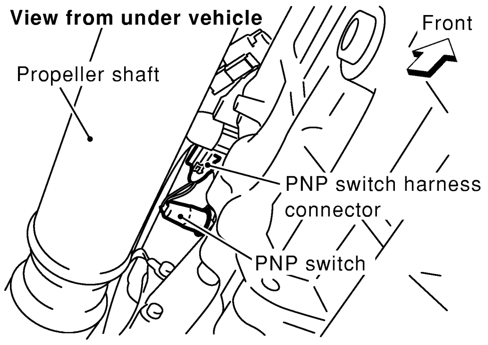
2	CHECK PNP SWITCH GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Disconnect park/neutral position (PNP) switch harness connector.



SEF281Z

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 4.
NG	▶	GO TO 3.

3	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E202, E69
- Harness for open or short between PNP switch and body ground

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

4	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 6.
NG	▶	GO TO 5.

5	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors F7, M52
- Harness connectors M21, E127
- Harness connectors E70, E201
- 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.

6	CHECK PARK/NEUTRAL POSITION SWITCH

Refer to MT section (“POSITION SWITCH CHECK”).

OK or NG

OK	▶	GO TO 7.
NG	▶	Replace park/neutral position switch.

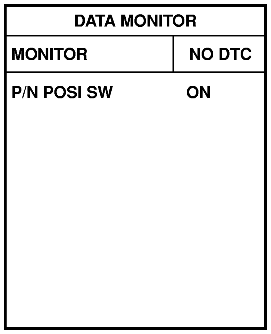
7	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.	
▶	**INSPECTION END**

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

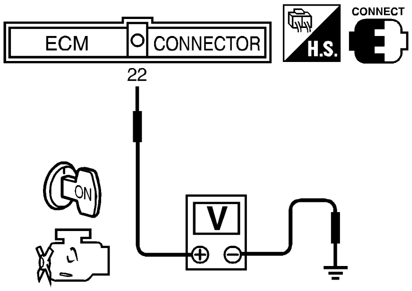
MONITOR	NO DTC
P/N POSI SW	ON

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

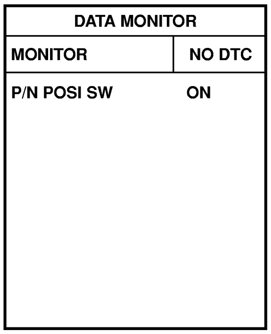
OK ▶	**INSPECTION END**
NG ▶	GO TO 2.

Diagnostic Procedure (Cont'd)

2 **CHECK PNP SWITCH CIRCUIT**

With CONSULT-II

1. Select “A/T” and then select “P/N POSI SW” in “DATA MONITOR” mode with CONSULT-II.
2. 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

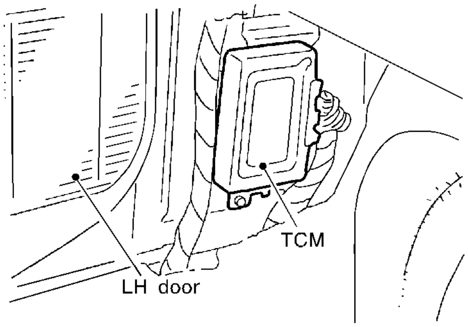
OK or NG

OK	▶	GO TO 9.
NG	▶	GO TO 4.

3 **CHECK PNP SWITCH CIRCUIT**

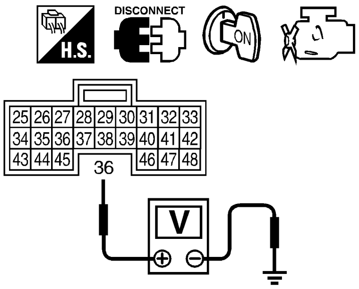
Without CONSULT-II

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



SEF792V

3. Turn ignition switch “ON”.
4. Check voltage between TCM terminal 36 and ground under the following conditions.



Conditions (Gear position)	Voltage
“P” or “N” position	Approx. 0V
Positions	Battery voltage

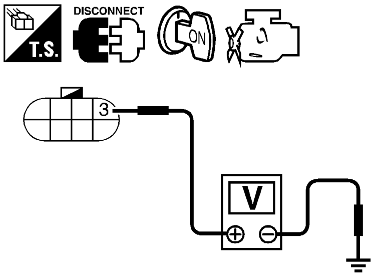
SEF298Z

OK or NG

OK	▶	GO TO 9.
NG	▶	GO TO 4.

4	CHECK PNP SWITCH POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect PNP switch harness connector.
3. Turn ignition switch “ON”.
4. Check voltage between PNP switch terminal 3 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF299Z

OK or NG

OK	▶	GO TO 6.
NG	▶	GO TO 5.

5	DETECT MALFUNCTIONING PART

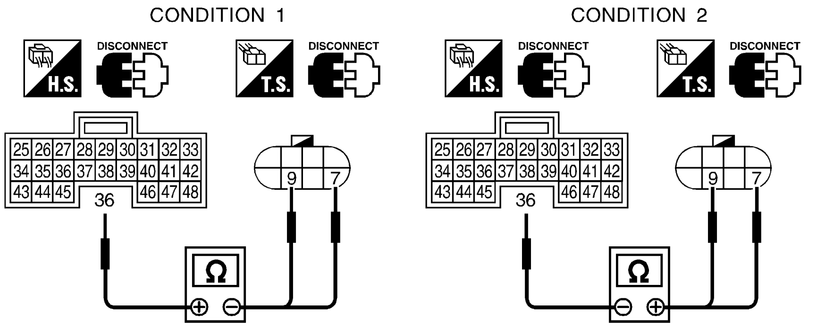
Check the following.

- Fuse block (J/B) connector E112
- 7.5A fuse
- Harness for open or short between PNP switch and fuse

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

6	CHECK PNP SWITCH INPUT SIGNAL CIRCUIT FOR OPEN OR SHORT-I

1. Turn ignition switch “OFF”.
2. Disconnect TCM (Transmission control module) harness connector.
3. Check harness continuity between TCM terminal 36 and PNP switch terminals 7, 9 under the following conditions.



Conditions	Continuity
1	Should exist.
2	Should not exist.

SEF300Z

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. ● Diode E103 ● Harness for open or short between PNP switch and TCM (Transmission control module)	
▶	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 PNP SWITCH INPUT SIGNAL CIRCUIT FOR OPEN OR SHORT-II
1. Turn ignition switch “OFF”. 2. Disconnect ECM harness connector. 3. Check harness continuity between ECM terminal 22 and TCM terminal 14. 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 11.
NG ▶	GO TO 10.

10	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors F7, M52 ● Harness connectors M21, E127 ● Harness for open or short between ECM and TCM (Transmission control module)	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

11	CHECK INTERMITTENT INCIDENT
Perform “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.	
▶	**INSPECTION END**

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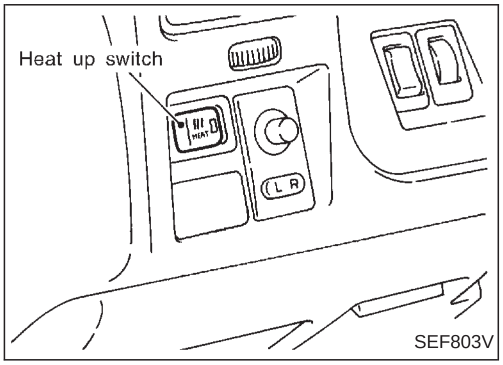


Component Description

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

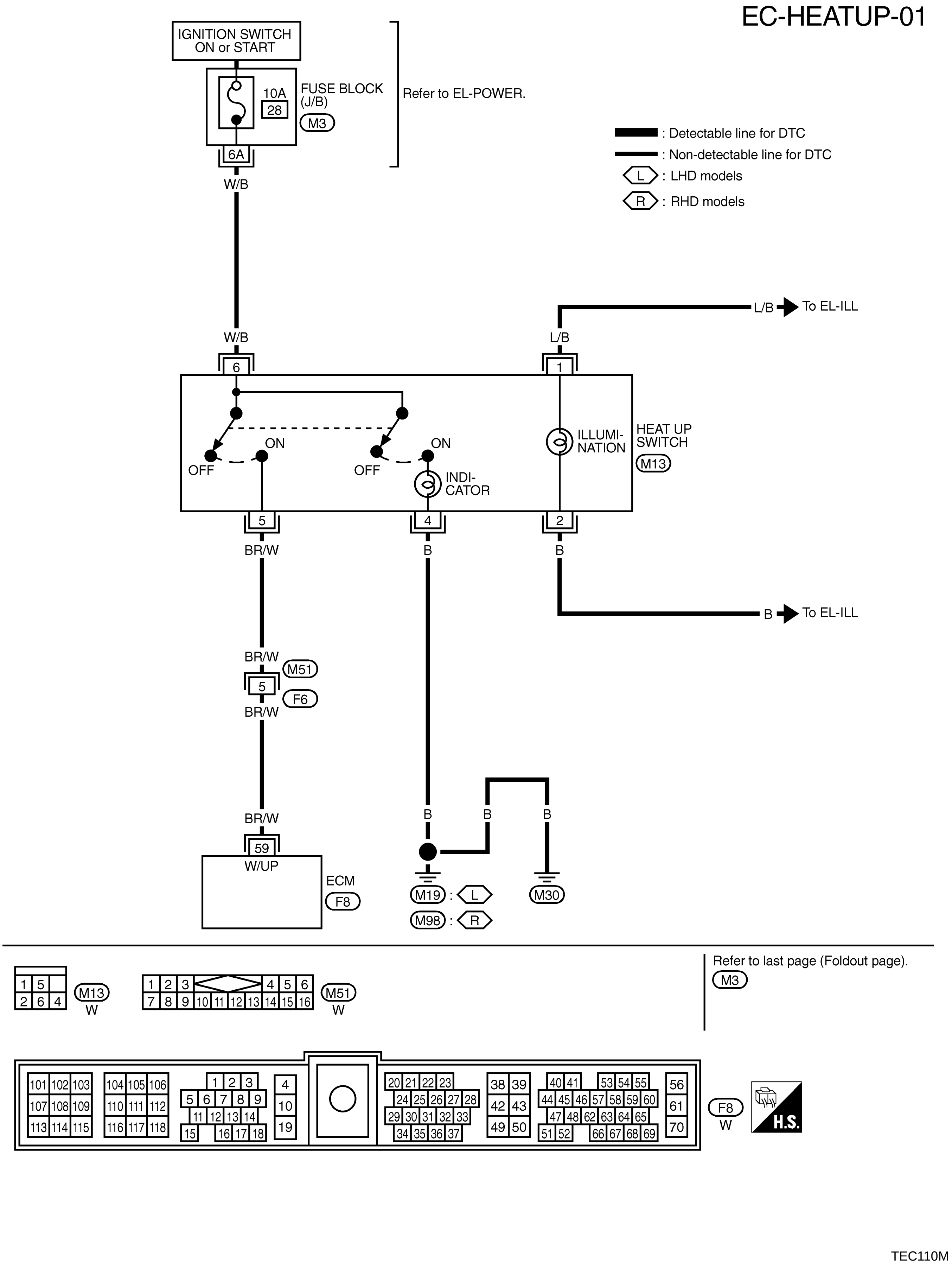
Specification data are reference values and are measured between each terminal and ground.

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	BR/W	Heat up switch	Ignition switch "ON" └ Heat up switch is "OFF".	0V
			Ignition switch "ON" └ Heat up switch is "ON".	BATTERY VOLTAGE (11 - 14V)

Wiring Diagram



Diagnostic Procedure

1	INSPECTION START

Do you have CONSULT-II?

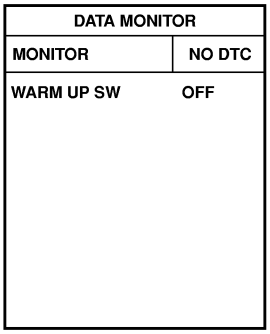
Yes or No

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

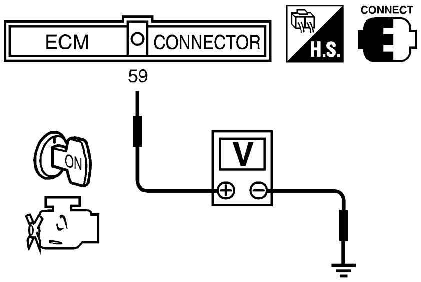
OK or NG

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

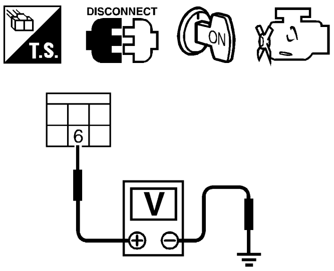
OK or NG

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 6 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF304Z

OK or NG

OK	▶	GO TO 6.
NG	▶	GO TO 5.

5 DETECT MALFUNCTIONING PART

Check the following.
- Fuse block (J/B) connector M3
- 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 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 8.
NG	▶	GO TO 7.

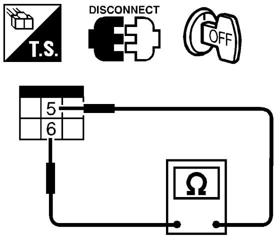
7 DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M51, F6
- Harness for open or short between heat up switch and ECM

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

8	**CHECK HEAT UP SWITCH**

Check continuity between heat up switch terminals 5 and 6 under the following conditions.



Conditions	Continuity
Heat-up switch is "OFF".	Should not exist.
Heat-up switch is "ON".	Should exist.

SEF305Z

OK or NG

OK ▶	GO TO 9.
NG ▶	Replace heat up switch.

9	**CHECK INTERMITTENT INCIDENT**

Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.

▶	**INSPECTION END**

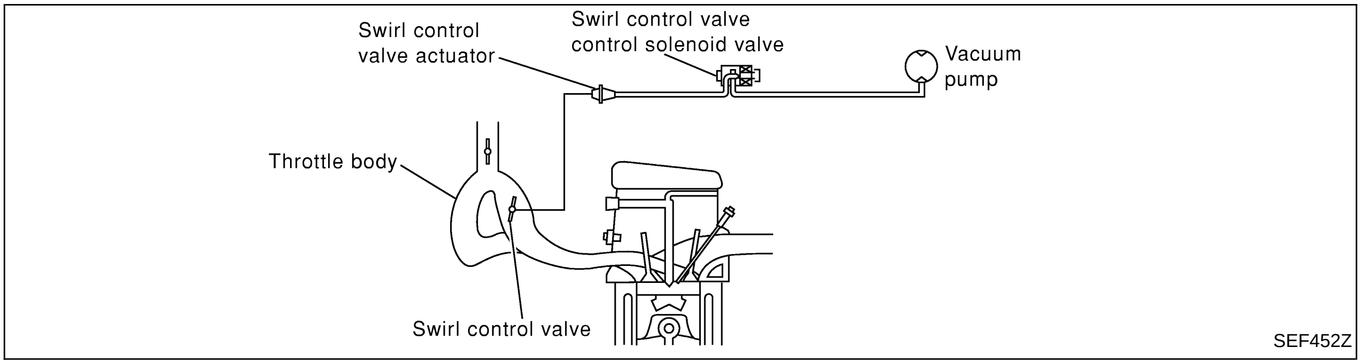
Description

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.

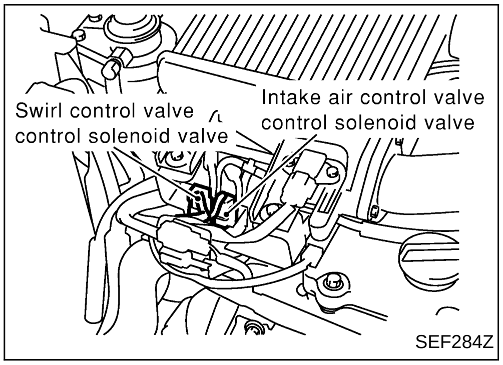
PNP switch	Engine speed	Engine coolant temperature	Swirl control valve control solenoid valve	Swirl control valve
OFF	Less than 1,250 rpm	Less than 50°C (122°F)	OFF	Open
		More than 50°C (122°F)	ON	Closed
	More than 1,250 rpm	Less than 50°C (122°F)	OFF	Open
		More than 50°C (122°F)	OFF	Open
ON	—	—	OFF	Open


Swirl control valve actuator
Swirl control valve control solenoid valve
Vacuum pump
Throttle body
Swirl control valve

SEF452Z

Description (Cont'd)

COMPONENT DESCRIPTION


Swirl control valve control solenoid valve
Intake air control valve control solenoid valve
SEF284Z

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	L/B	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)

GI
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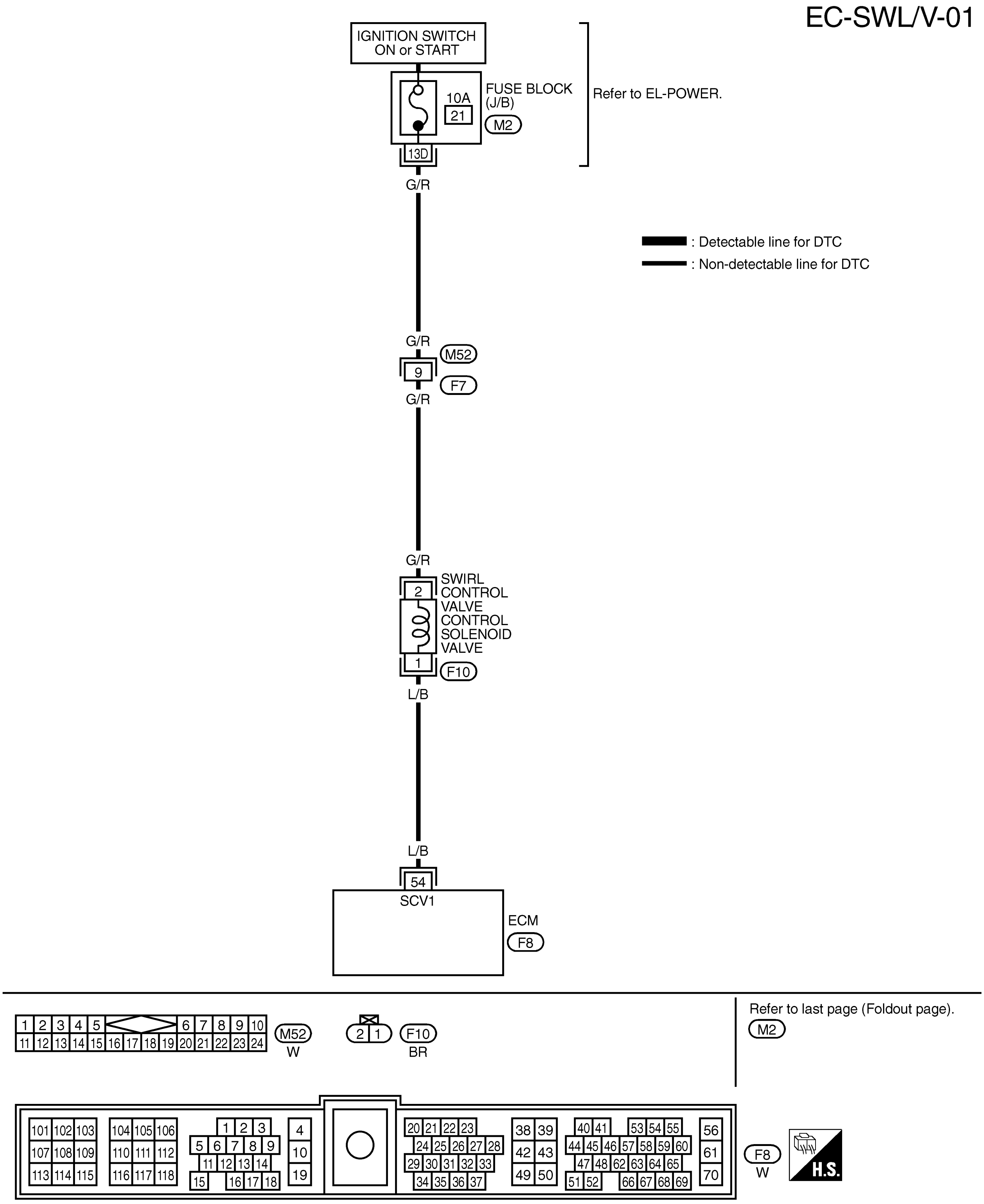
Wiring Diagram



TEC117M

Diagnostic Procedure

1	INSPECTION START

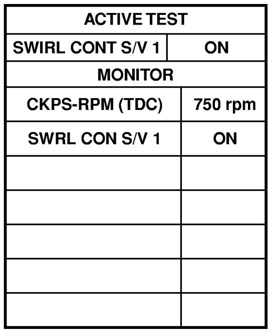
Do you have CONSULT-II?

Yes or No

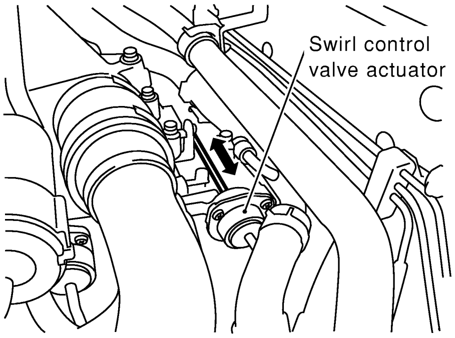
Yes ▶	GO TO 2.
No ▶	GO TO 3.

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



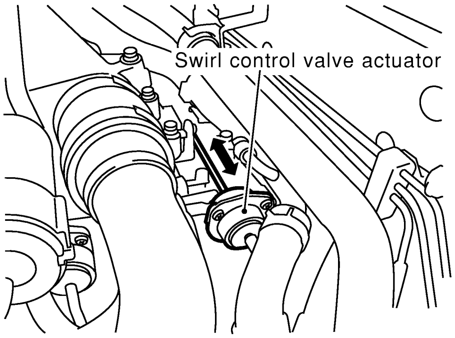
SEF307Z

OK or NG

OK ▶	**INSPECTION END**
NG ▶	GO TO 4.

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”.



SEF308Z

OK or NG

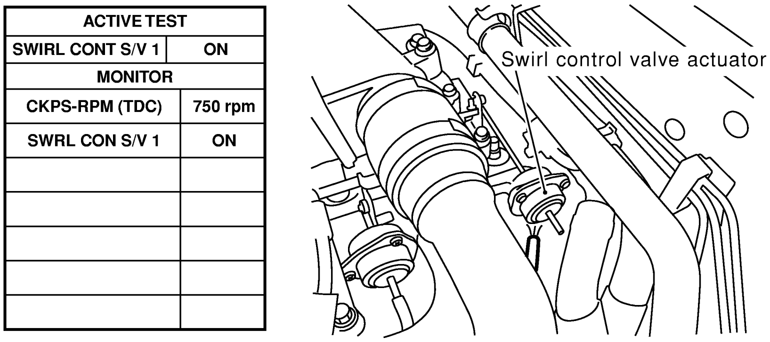
OK ▶	**INSPECTION END**
NG ▶	GO TO 5.

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

SWIRL CONT S/V 1	Vacuum
ON	Should exist.
OFF	Should not exist.

SEF309Z

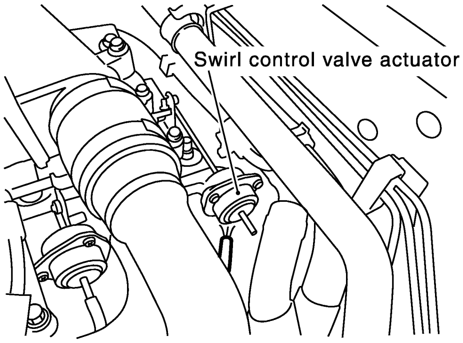
OK or NG

OK ▶	GO TO 7.
NG ▶	GO TO 6.

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.



Condition	Vacuum
Shift lever is in positions other than "P" and "Neutral".	Should exist.
Shift lever is in "P" or "Neutral" position.	Should not exist.

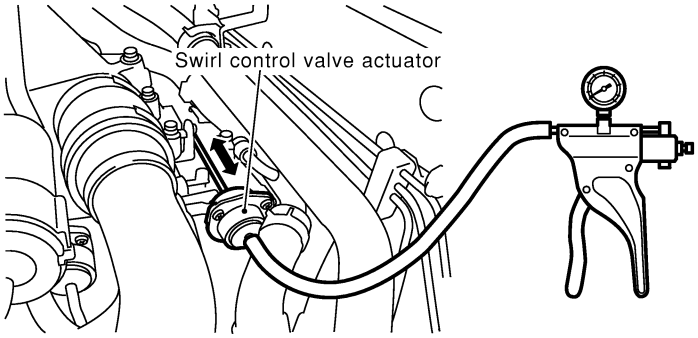
SEF310Z

OK or NG

OK ▶	GO TO 7.
NG ▶	GO TO 6.

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.



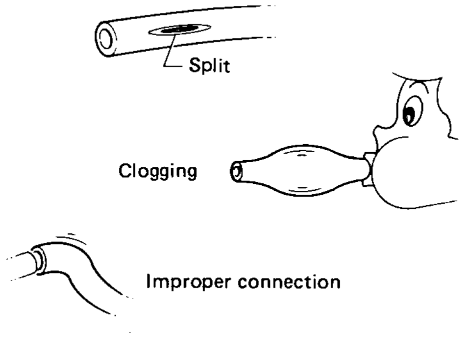
SEF311Z

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

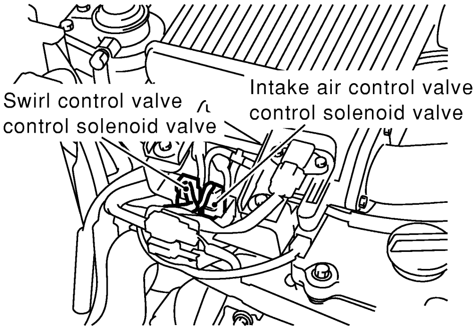
OK or NG

OK	▶	GO TO 8.
NG	▶	Repair or replace vacuum hoses and vacuum gallery.

Diagnostic Procedure (Cont'd)

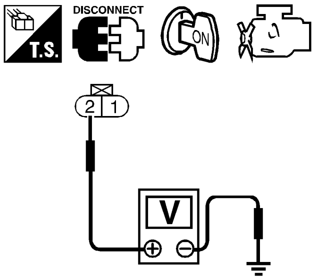
8	**CHECK SWIRL CONTROL VALVE CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT**

1. Turn ignition switch "OFF".
2. Disconnect swirl control valve control solenoid valve harness connector.



SEF284Z

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 M52, F7
- Fuse block (J/B) connector M2
- 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 11.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

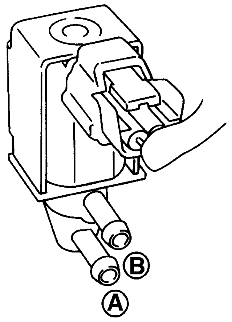
Diagnostic Procedure (Cont'd)

11	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

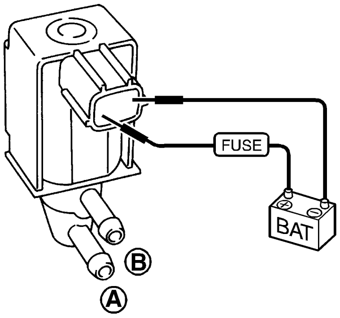


SWIRL CONT S/V 1	Air passage continuity between A and B
ON	Yes
OFF	No

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

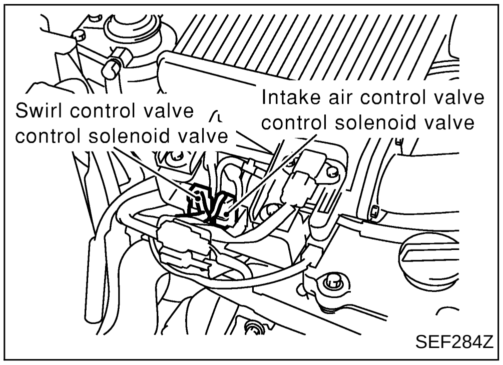
OK or NG

OK ▶	GO TO 12.
NG ▶	Replace swirl control valve control solenoid valve.

12	CHECK INTERMITTENT INCIDENT

Perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.

▶	**INSPECTION END**


Swirl control valve control solenoid valve
Intake air control valve control solenoid valve

SEF284Z

Description

Vibration when stopping the engine can be controlled by cutting intake air right 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.

ECM Terminals and Reference Value

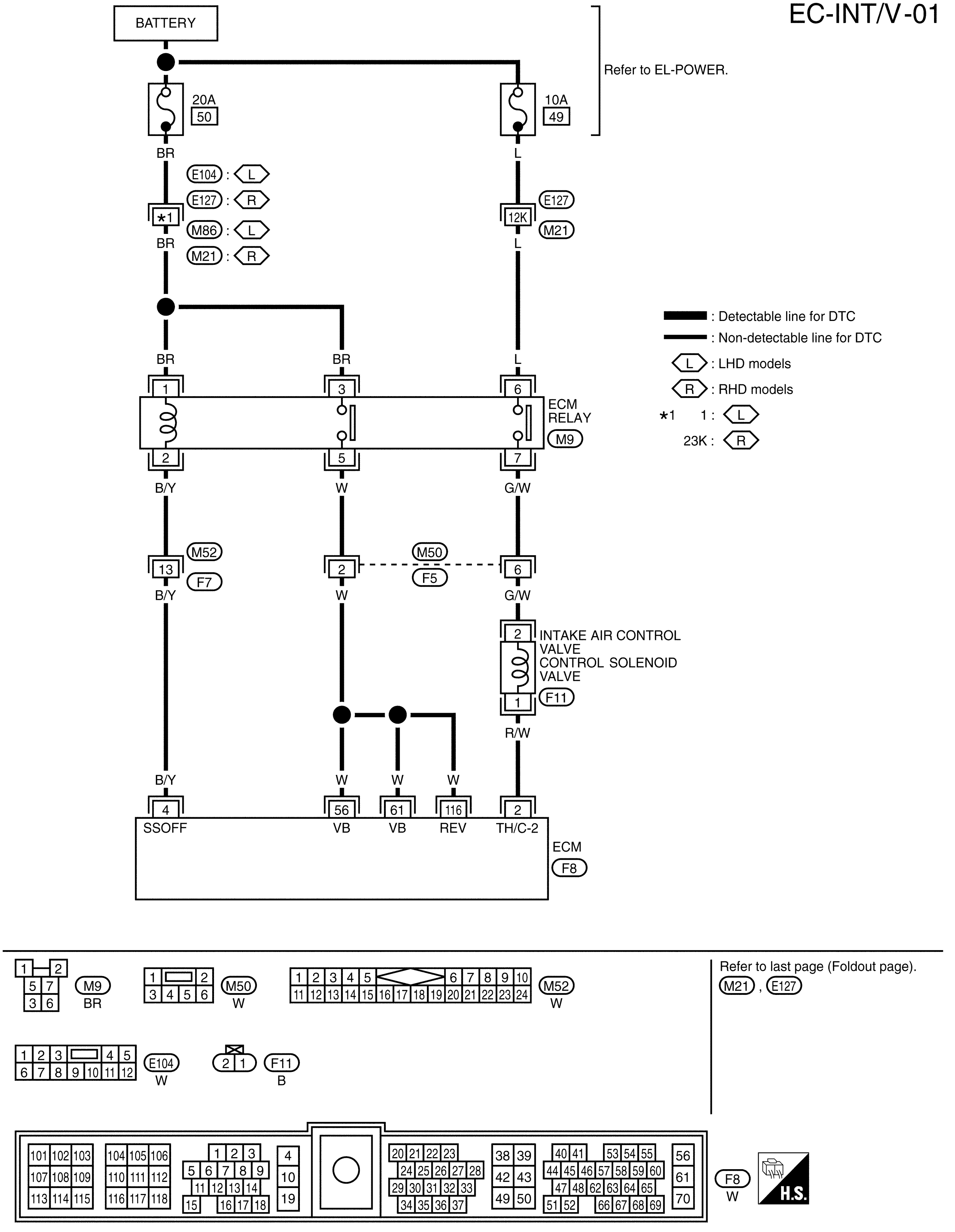
Specification data are reference values, and are measured between each terminal and ground.

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	R/W	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

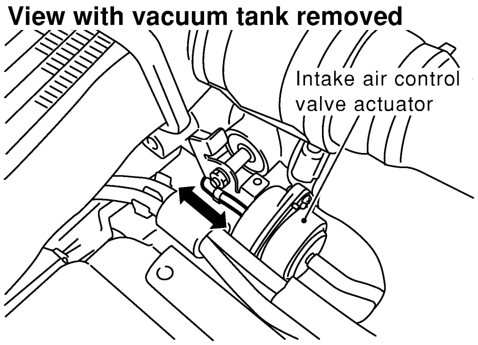


TEC122M

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”.


View with vacuum tank removed
Intake air control valve actuator

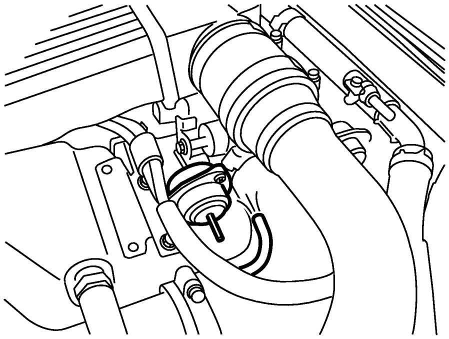
SEF315Z

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.



Condition	Vacuum
For a few seconds after turning ignition switch OFF	Should exist.
Except above.	Should not exist.

SEF316Z

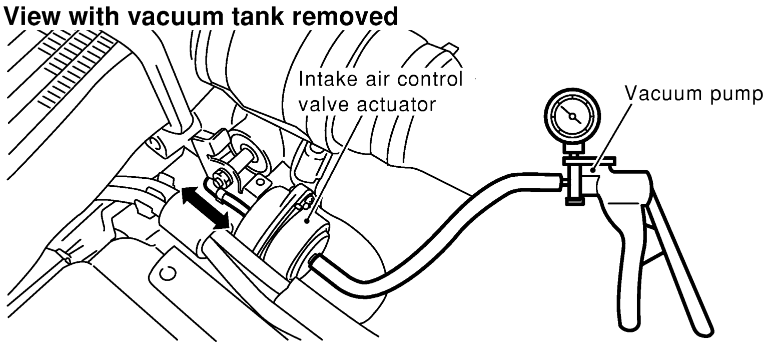
OK or NG

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.


View with vacuum tank removed
Intake air control valve actuator
Vacuum pump

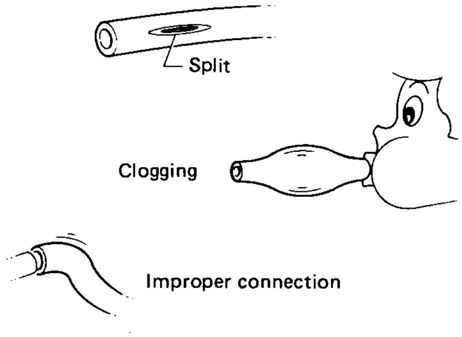
SEF317Z

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

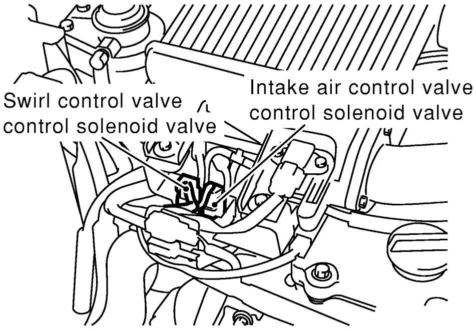
OK or NG

OK	▶	GO TO 5.
NG	▶	Repair or replace vacuum hoses and vacuum gallery.

Diagnostic Procedure (Cont'd)

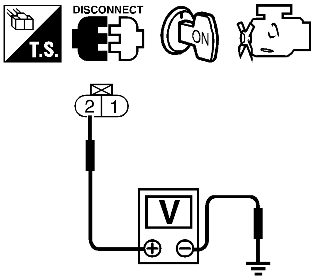
5	CHECK INTAKE AIR CONTROL VALVE CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT-I

1. Turn ignition switch “OFF”.
2. Disconnect intake air control valve control solenoid valve harness connector.


Swirl control valve control solenoid valve
Intake air control valve control solenoid valve

SEF284Z

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

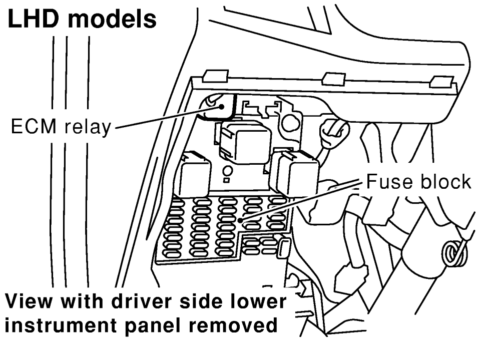
OK or NG

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.



SEF225Z

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.

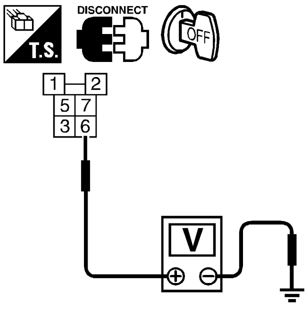
7	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M50, F5
- 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

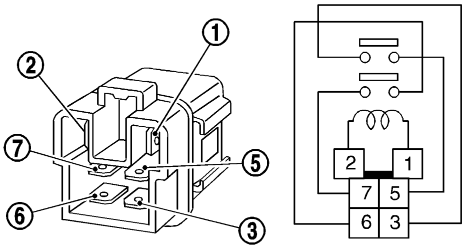
Check the following.
- Harness connectors M21, E127
- 10A fuse
- Harness for open or short between ECM relay and battery

	▶	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

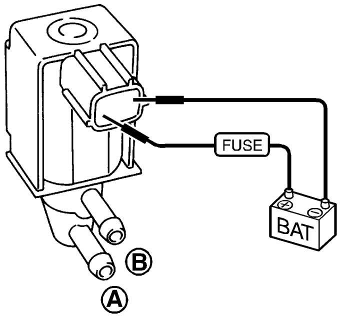
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal 2 and intake air control valve control solenoid valve terminal 1. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 12.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

12 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

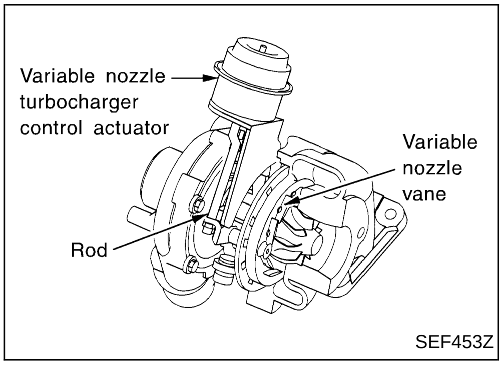
OK	▶	GO TO 13.
NG	▶	Replace intake control valve control solenoid valve.

13 CHECK INTERMITTENT INCIDENT

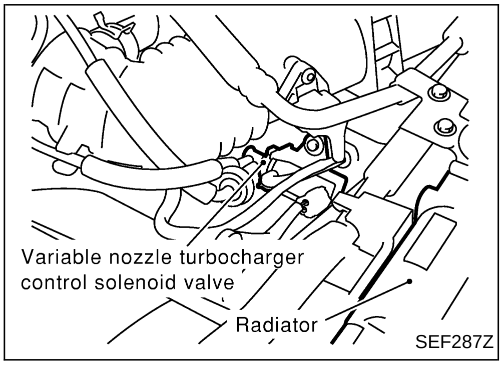
Perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.

	▶	**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.

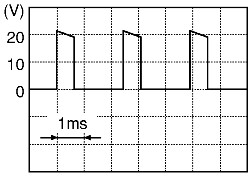
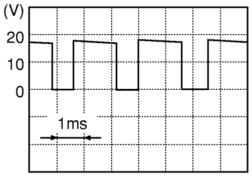
MONITOR ITEM	CONDITION		SPECIFICATION
VNT S/V 1	● Engine: After warming up ● Air conditioner switch: “OFF” ● Shift lever: Neutral position ● No-load	Idle	Approx. 56%
		2,000 rpm	Approx. 20%

ECM Terminals and Reference Value

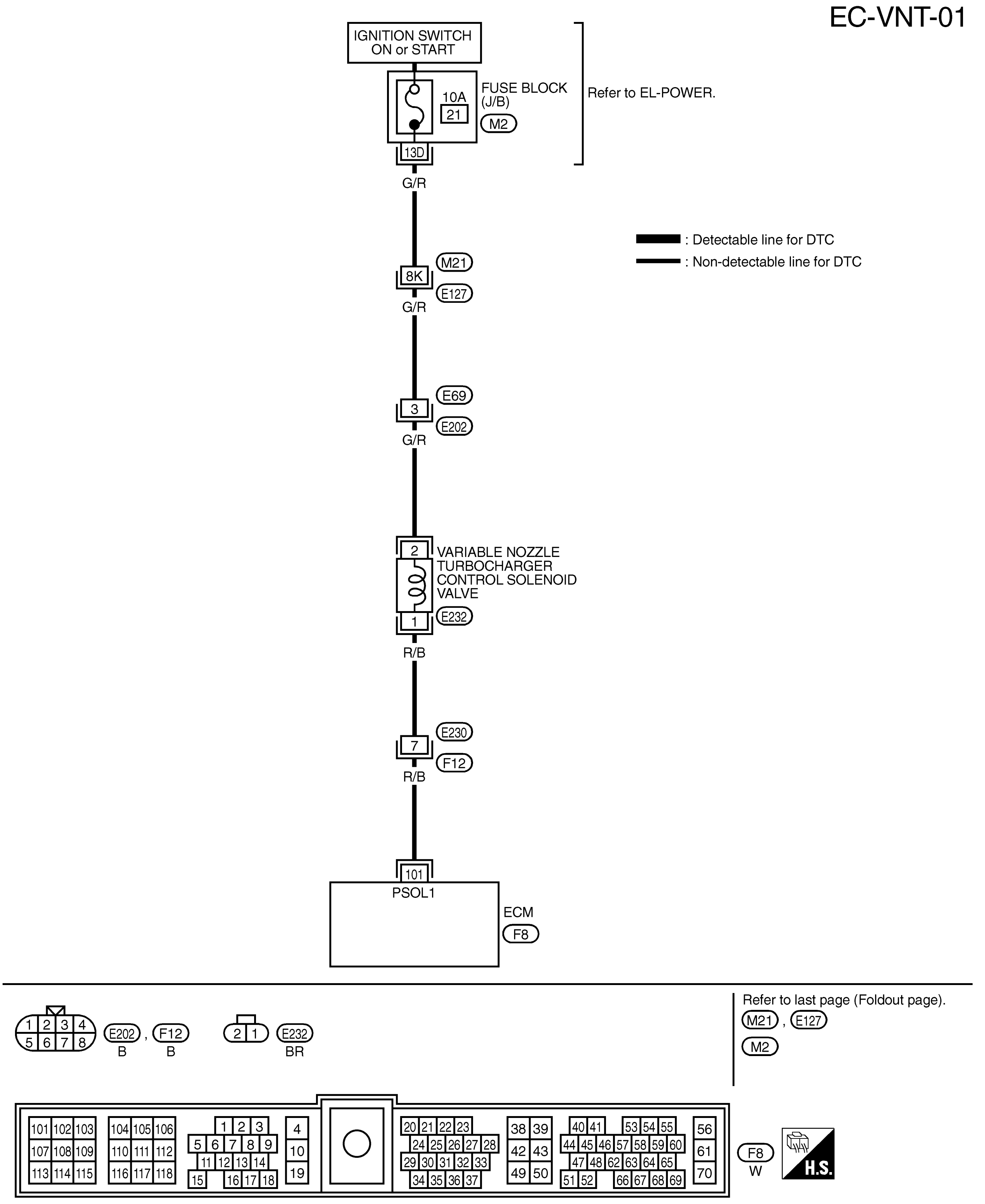
Specification data are reference values, and are measured between each terminal and ground.

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	R/B	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



TEC120M

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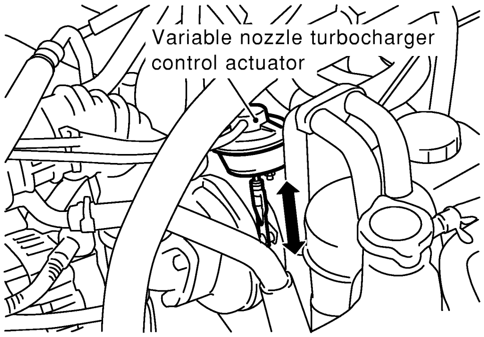
Diagnostic Procedure

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.



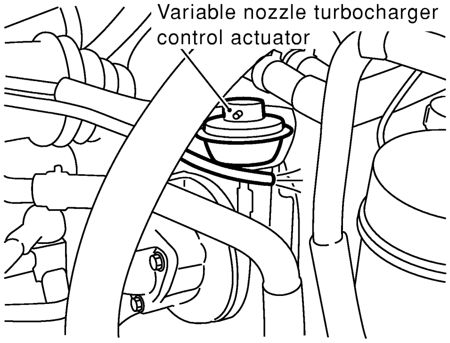
SEF320Z

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.



Vacuum should exist.

SEF321Z

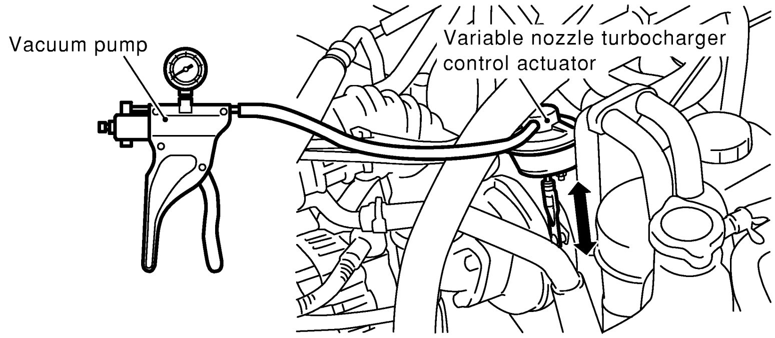
OK or NG

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.



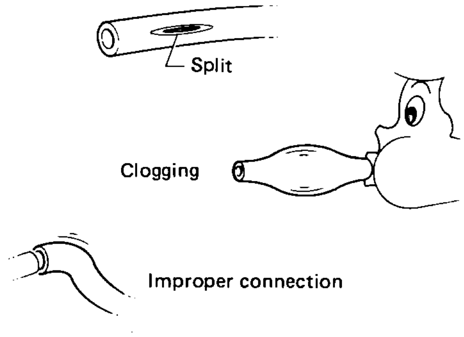
SEF322Z

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.

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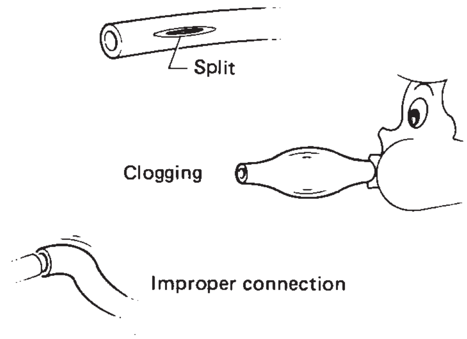
5	CHECK VACUUM HOSE

1. Turn ignition switch "OFF".
2. Check vacuum hoses and vacuum gallery for clogging, cracks or improper connection.



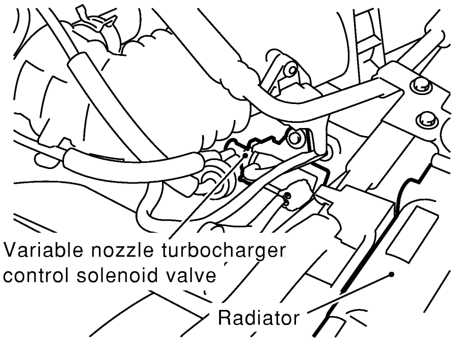
SEF109L

OK or NG

OK ▶	GO TO 6.
NG ▶	Repair or replace vacuum hoses and vacuum gallery.

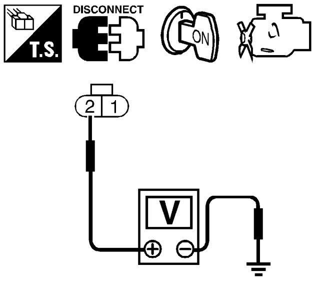
6	CHECK VARIABLE NOZZLE TURBOCHARGER CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch "OFF".
2. Disconnect variable nozzle turbocharger control solenoid valve harness connector.



SEF287Z

3. Turn ignition switch "ON".
4. Check voltage between variable nozzle turbocharger control solenoid valve terminal 2 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF314Z

OK or NG

OK ▶	GO TO 8.
NG ▶	GO TO 7.

Diagnostic Procedure (Cont'd)

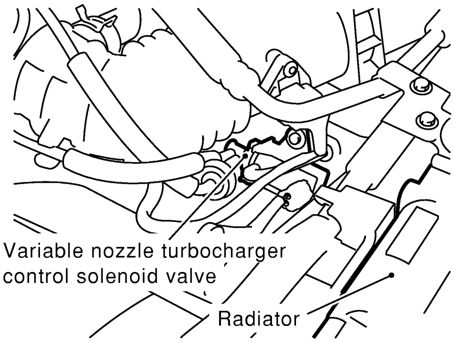
7	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M21, E127 ● Harness connectors E69, E202 ● Fuse block (J/B) connector M2 ● 10A fuse ● Harness for open or short between variable nozzle turbocharger control solenoid valve and fuse	
▶	Repair open circuit or short to ground or short 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 E230, F12 ● 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.

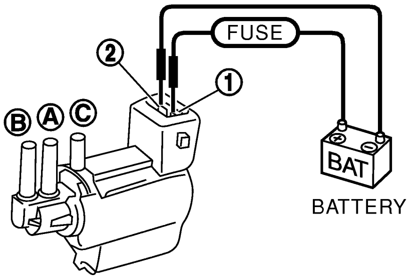
10 CHECK VARIABLE NOZZLE TURBOCHARGER CONTROL SOLENOID VALVE

1. Disconnect variable nozzle turbocharger control solenoid valve harness connector.



SEF287Z

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

Operation takes less than 1 second.

SEF454Z

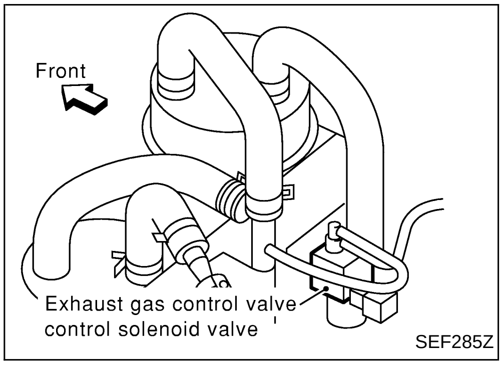
OK or NG

OK ▶	GO TO 11.
NG ▶	Replace variable nozzle turbocharger control solenoid valve.

11 CHECK INTERMITTENT INCIDENT

Perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-107.

▶	**INSPECTION END**



Description

With the heat up switch ON, engine speed is increased and the exhaust gas control valve is closed, which helps to promote heating and improve heating performance.

The exhaust gas 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 exhaust gas control valve actuator. This operation closes the exhaust gas control valve. When the ECM sends an OFF signal, the vacuum signal is cut and the exhaust gas control valve opens.

CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
EXH/GAS REG V	● Vehicle: Stopped ● Engine speed: Below 1,200 rpm ● Engine coolant temperature: Below 87°C (189°F) ● Heat up switch: ON	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)
11	BR/Y	Exhaust gas control valve control solenoid valve	Engine is running. Engine speed is below 1,200 rpm Engine coolant temperature is below 87°C (189°F) Stop the vehicle Heat up switch is "ON"	Approximately 0.1V
			Engine is running. Except the above condition	BATTERY VOLTAGE (11 - 14V)

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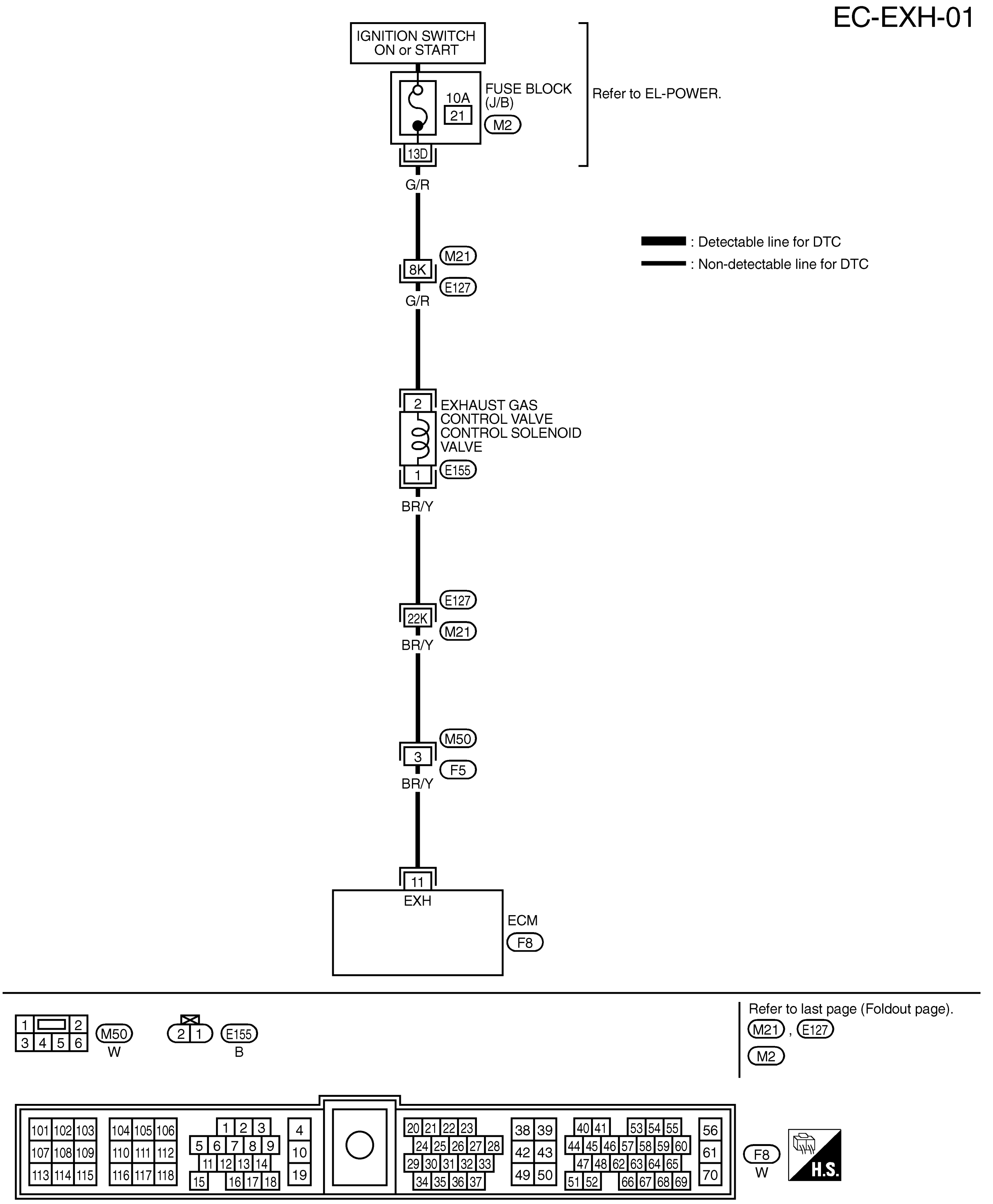
Wiring Diagram



TEC118M

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-I

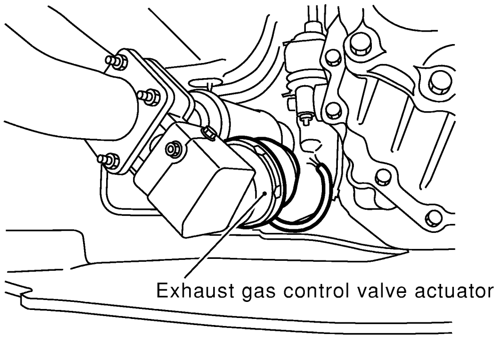
With CONSULT-II

1. Turn ignition switch “ON”.
2. Select “COOLAN TEMP/S” in “DATA MONITOR” mode with CONSULT-II.
3. Make sure that “COOLAN TEMP/S” indication is below 60°C (140°F). If out of range, cool down the engine.

NOTE:

The following procedure should be performed before the engine coolant temperature reaches 87°C (189°F).

4. Disconnect vacuum hose connected to exhaust gas control valve actuator.
5. Start engine and let it idle.
6. Check vacuum hose for vacuum existence under the following conditions.



Heat up switch	Vacuum
ON	Should exist.
OFF	Should not exist.

Operation takes less than 1 second.

SEF318Z

OK or NG

OK ▶	GO TO 4.
NG ▶	GO TO 5.

Diagnostic Procedure (Cont'd)

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3	CHECK OVERALL FUNCTION-I

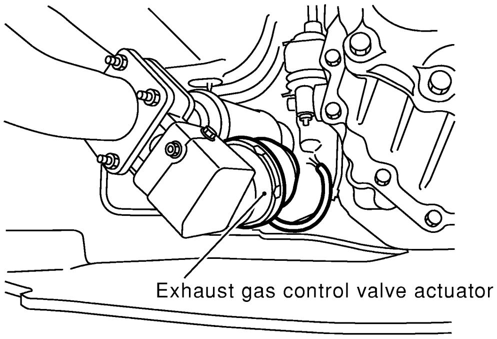
Without CONSULT-II

7. Turn ignition switch “ON”.
8. Make sure that voltage between ECM terminal 19 and ground is more than 1.88V. If out of range, cool down the engine.

NOTE:

The following procedure should be performed before the voltage becomes less than 1.06V.

9. Disconnect vacuum hose connected to exhaust gas control valve actuator.
10. Start engine and let it idle.
11. Check vacuum hose for vacuum existence under the following conditions.



Heat up switch	Vacuum
ON	Should exist.
OFF	Should not exist.

Operation takes less than 1 second.

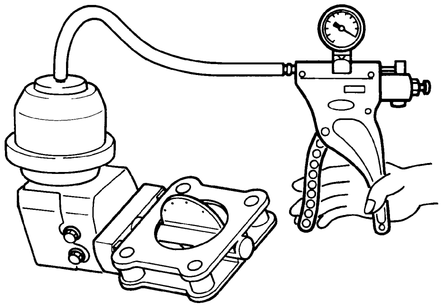
SEF318Z

OK or NG

OK	▶	GO TO 4.
NG	▶	GO TO 5.

4	CHECK OVERALL FUNCTION-II

1. Turn ignition switch “OFF”.
2. Remove exhaust gas control valve actuator from exhaust tube.
3. Install a vacuum pump to exhaust gas control valve actuator.
4. Make sure that the exhaust gas control valve moves smoothly when applying vacuum of −86.6 to −93.3 kPa (−866 to −933 mbar, −650 to −700 mmHg, −25.59 to −27.56 inHg) and releasing it.



SEF319Z

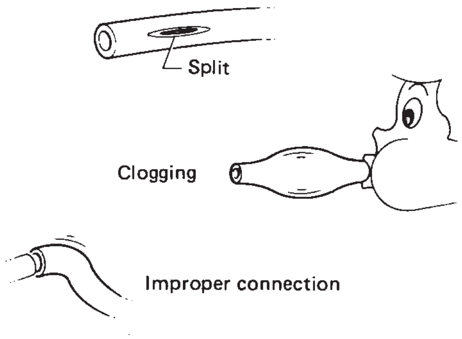
OK or NG

OK	▶	**INSPECTION END**
NG	▶	Replace exhaust gas control valve assembly.

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.



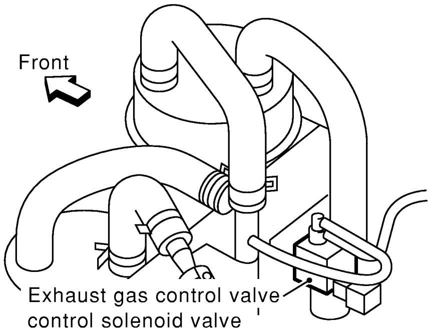
SEF109L

OK or NG

OK	▶	GO TO 6.
NG	▶	Repair or replace vacuum hoses and vacuum gallery.

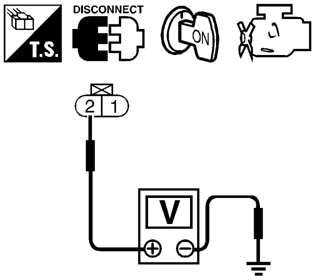
6	CHECK EXHAUST GAS CONTROL VALVE CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch "OFF".
2. Disconnect exhaust gas control valve control solenoid valve harness connector.



SEF285Z

3. Turn ignition switch "ON".
4. Check voltage between exhaust gas control valve control solenoid valve terminal 2 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF312Z

OK or NG

OK	▶	GO TO 8.
NG	▶	GO TO 7.

Diagnostic Procedure (Cont’d)

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7	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M21, E127
- Fuse block (J/B) connector M2
- 10A fuse
- Harness for open or short between exhaust gas control valve control solenoid valve and fuse

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

8	CHECK EXHAUST GAS 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 11 and exhaust gas 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 10.
NG ▶	GO TO 9.

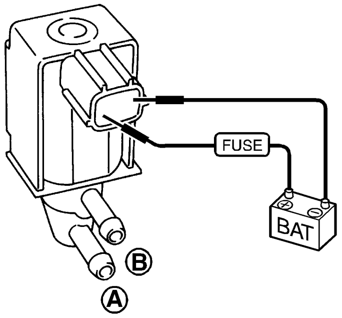
9	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M21, E127
- Harness connectors M50, F5
- Harness for open or short between exhaust gas control valve control solenoid valve and ECM

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

10	CHECK EXHAUST GAS CONTROL VALVE CONTROL SOLENOID VALVE

1. Apply 12V direct current between exhaust gas control valve control solenoid valve terminals.
2. Check air passage continuity of exhaust gas 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 11.
NG ▶	Replace exhaust gas control valve control solenoid valve.

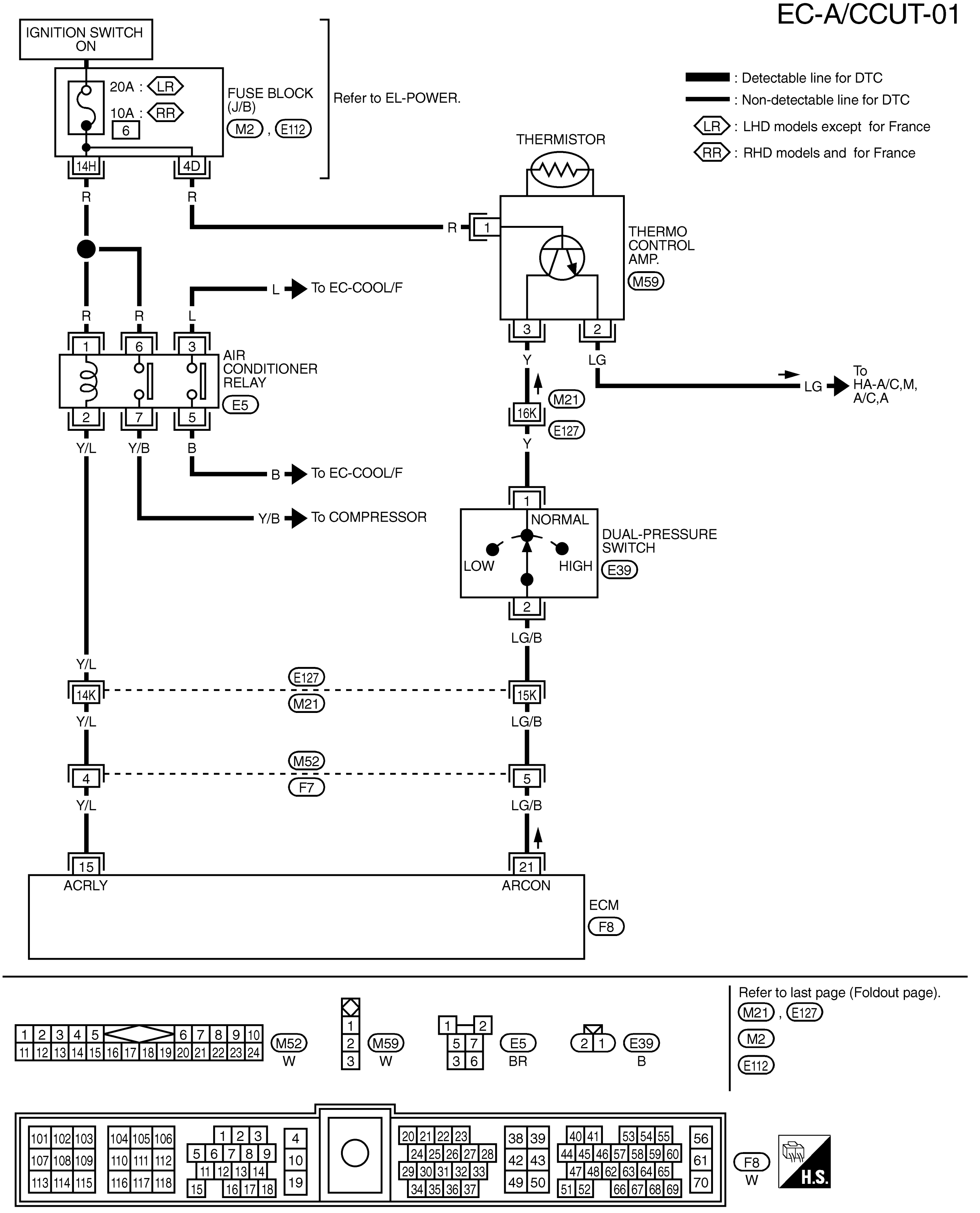
11	CHECK INTERMITTENT INCIDENT

Perform “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-107.

▶	**INSPECTION END**

Wiring Diagram

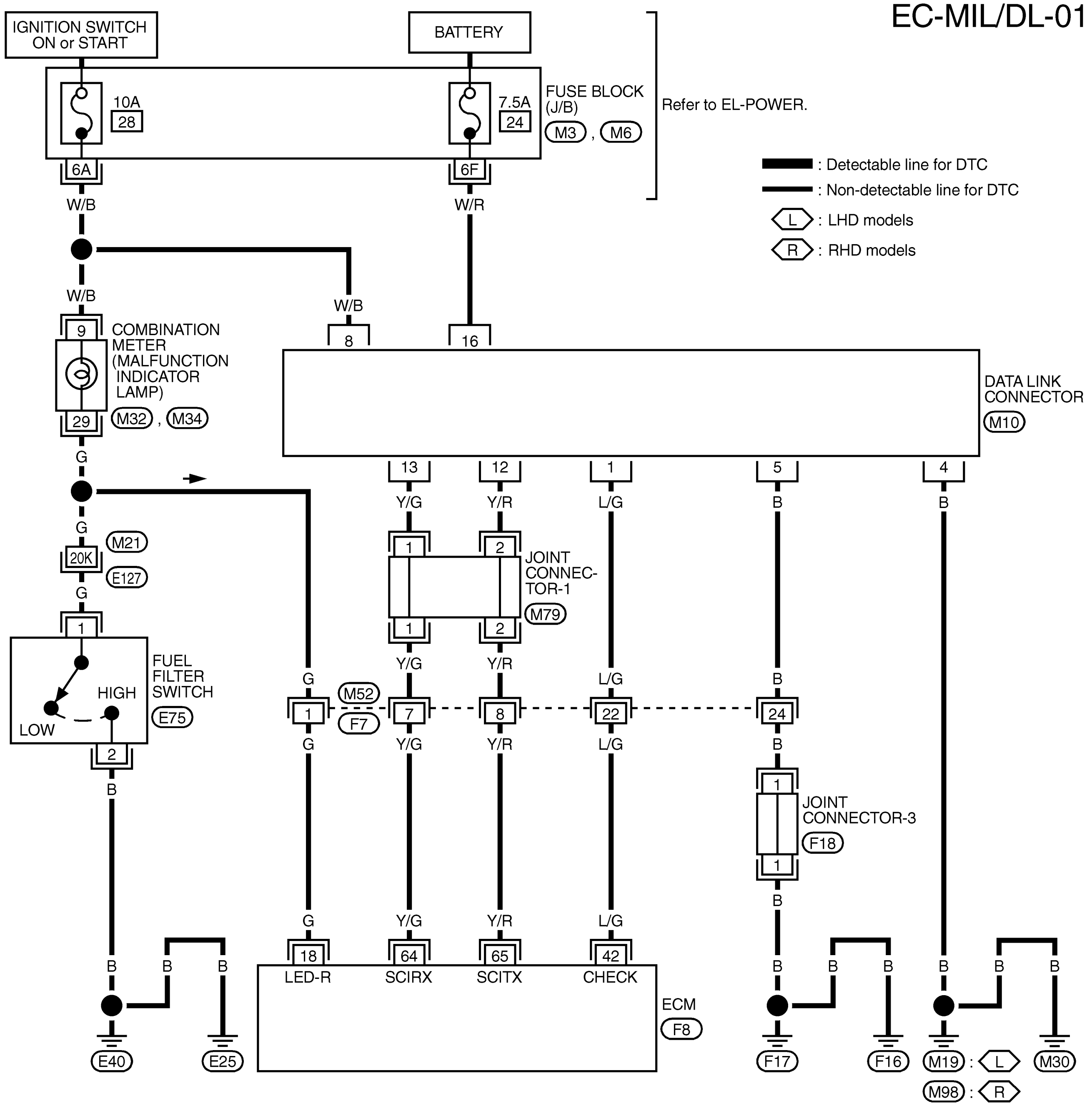
EC-A/CCUT-01

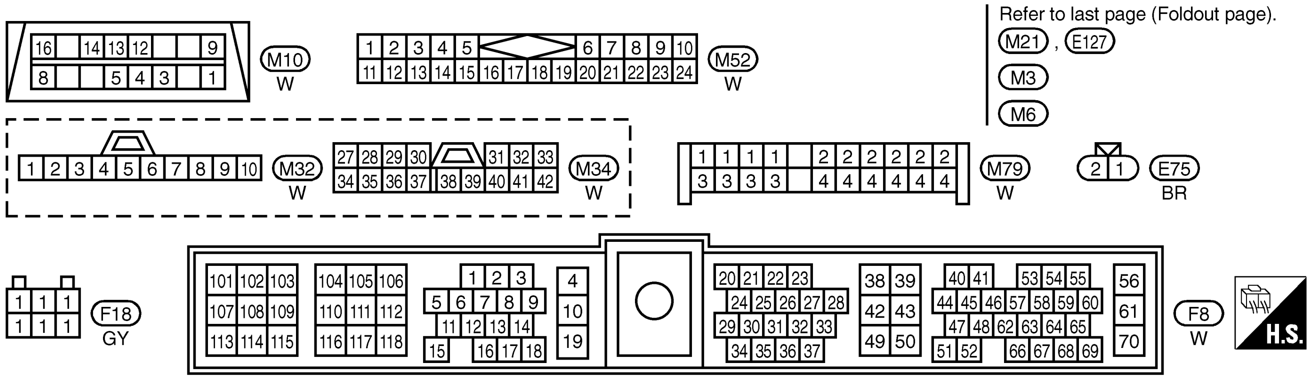


TEC111M

Wiring Diagram

EC-MIL/DL-01





TEC112M

General Specifications

CARBURETOR

Carburetor model			21J360-56
Throttle body bore	mm (in)	P	36 (1.42)
		S	40 (1.57)
Venturi diameter	mm (in)	P	32 (1.26)
		S	36 (1.42)
Main jet		P	#140
		S	#210
Main air bleed		P	#60
		S	#80
Slow jet		P	#50
		S	#130
Slow air bleed		P	#170
		S	#60
Power jet			#120
Choke type			Automatic choke
Fast idle adjustment			
Fast idle speed (A/T model in “N” position)	rpm		1,600±200
Clearance “A” (at 2nd cam step)	mm (in)		1.37±0.14 (0.0539±0.0055)
Vacuum break adjustment	mm (in)		
Clearance “R_1”			3.25±0.25 (0.1280±0.0098)
Clearance “R_2”			5.0±0.5 (0.197±0.020)
Idle speed	rpm	Normal	650±50
		Air conditioner: ON	1,100±50
Ignition timing (BTDC)			10°±1°
Idle CO%			1.5

P: Primary S: Secondary #: 1/100 mm

Vacuum motor

kPa (mbar, mmHg, inHg)

Opening starts	−9.6 (−96, −72, −2.83)
Fully open	Over −19.5 (−195, −146, −5.75)

Inspection and Adjustment

ATC AIR CLEANER

Intake manifold vacuum kPa (mbar, mmHg, inHg)	Atmospheric temperature °C (°F)	
	Below 38 (100)	Above 48 (118)
Below 10.7 (107, 80, 3.15)	Cool air	Cool air
Above 22.7 (227, 170, 6.69)	Hot air	Cool air

IDLE COMPENSATOR

Unit: °C (°F)

Idle compensator partially opens	65 - 74 (149 - 165)
Idle compensator fully opens	Above 74 (165)

FUEL PUMP

Fuel pump capacity mℓ (Imp fl oz)/minute	1,250 (44.0)
Fuel pressure kPa (bar, kg/cm^2, psi)	14.7 (0.147, 0.15, 2.1)

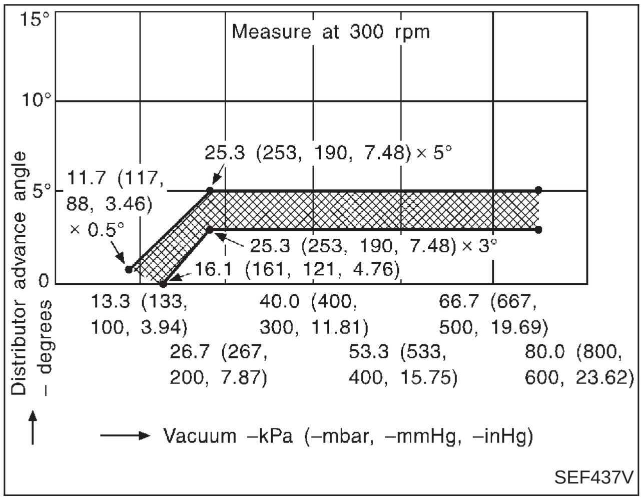
BCDD

BCDD set pressure (at sea level) kPa (mbar, mmHg, inHg)	−76.0±0.7 (−760±7, −570±5, −22.44±0.20)

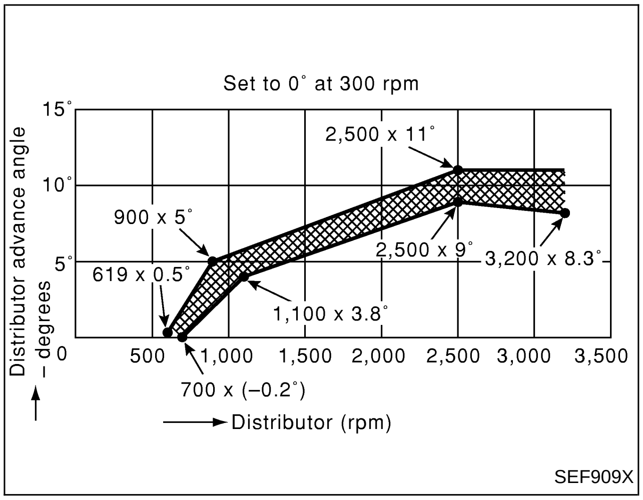
DISTRIBUTOR

Firing order	1-5-3-6-2-4
Rotating direction	Counterclockwise
Air gap mm (in)	0.25 - 0.5 (0.0098 - 0.0197)
Cap insulation resistance MΩ	More than 50
Rotor head insulation resistance MΩ	More than 50

Distributor spark advance curve



SEF437V



SEF909X

IGNITION COIL

Primary resistance [at 20°C (68°F)] Ω	Approximately 1
Secondary resistance [at 20°C (68°F)] kΩ	Approximately 10

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