ENGINE CONTROL SYSTEM

SECTION EC

EC

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CD

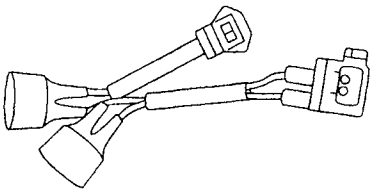
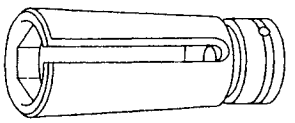
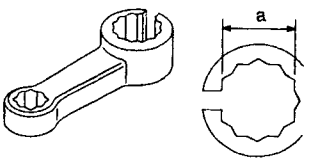
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EC

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

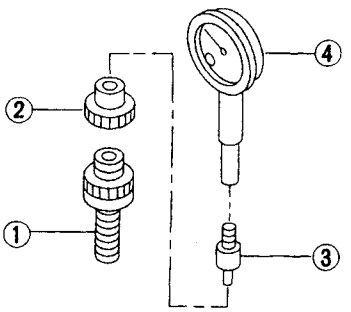
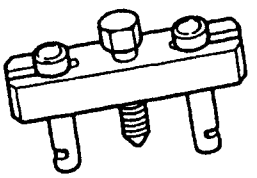
When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES" and "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT".

Special Service Tools

Tool number Tool name	Description	Engine application	
		SR	GA
EG11140000 Ignition coil adapter harness	 NT338 Measuring engine speed	X	X
KV10117100 Heated oxygen sensor wrench	 NT630 Loosening or tightening heated oxygen sensor	—	X
KV10114400 Oxygen sensor wrench	 NT636 Loosening or tightening heated oxygen sensor **a: 22 mm (0.87 in)**	X	—

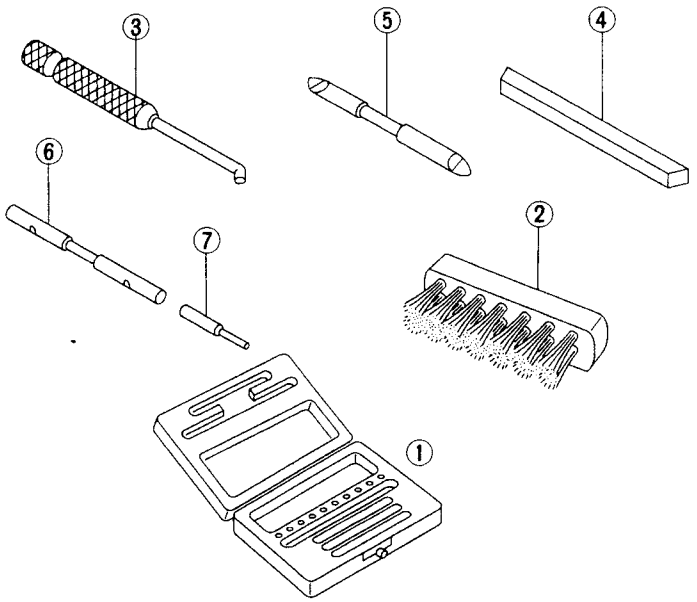
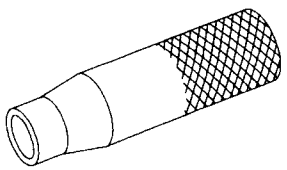
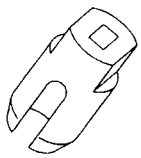
FOR CD ENGINE VE-TYPE INJECTION PUMP

Adjusting device on vehicle

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

Special Service Tools (Cont'd)

FOR CD ENGINE INJECTION NOZZLE

Tool number Tool name	Description
KV11289004 Nozzle cleaning kit ① KV11290012 Box ② KV11290110 Brush ③ KV11290122 Nozzle oil sump scraper ④ KV11290140 Nozzle needle tip cleaner ⑤ KV11290150 Nozzle seat scraper ⑥ KV11290210 Nozzle holder ⑦ KV11290220 Nozzle hole cleaning needle	 NT296
KV11292010 Nozzle centering device	 NT293
KV11100300 Nozzle holder socket	 NT563

EC

NOTE

Supplemental Restraint System (SRS) "AIR BAG" (Dual Air Bag System)

The Supplemental Restraint System "Air Bag", used along with a seat belt, helps to reduce the risk or severity of injury to the driver and front passenger in a frontal collision. The Supplemental Restraint System consists of air bag modules (located in the center of the steering wheel and on the instrument panel on the passenger side), a diagnosis sensor unit, warning lamp, wiring harness and spiral cable. Information necessary to service the system safely is included in the **RS section** of this Service Manual.

WARNING:

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

Supplemental Restraint System (SRS) "AIR BAG" (Single Air Bag System)

The Supplemental Restraint System "Air Bag", used along with a seat belt, helps to reduce the risk or severity of injury to the driver in a frontal collision. The Supplemental Restraint System consists of an air bag module (located in the center of the steering wheel), a diagnosis sensor unit, warning lamp, wiring harness and spiral cable. Information necessary to service the system safely is included in the **RS section** of this Service Manual.

WARNING:

- **To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, all maintenance must be performed by an authorized NISSAN dealer.**
- **Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system.**
- **Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual.**

Engine Fuel & Emission Control System

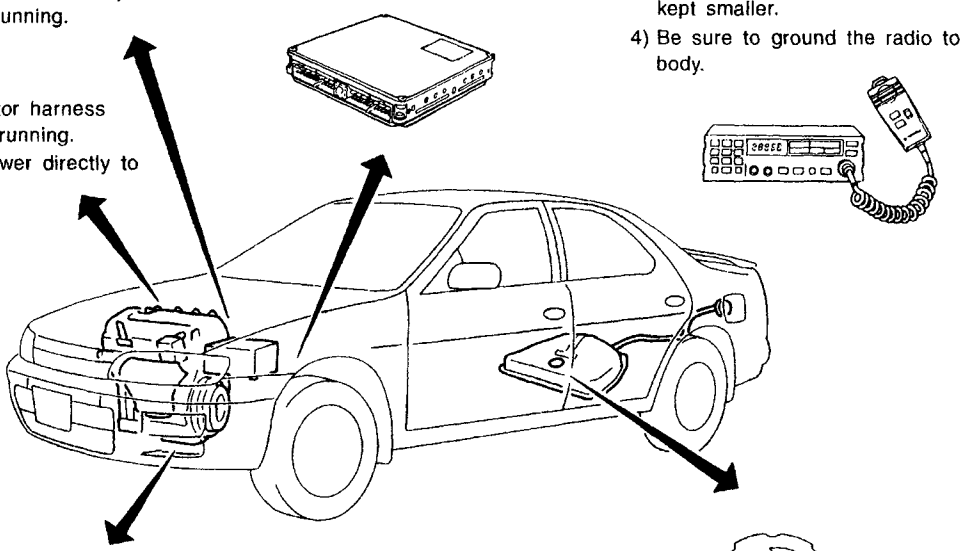
BATTERY
- Always use a 12 volt battery as power source.
- Do not attempt to disconnect battery cables while engine is running.

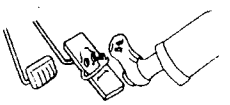
INJECTOR
- Do not disconnect injector harness connectors with engine running.
- Do not apply battery power directly to injectors.

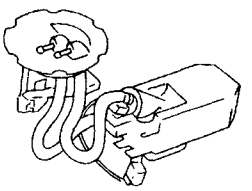
ECM
- Do not disassembly ECM (ECCS control module).
- Do not turn diagnosis mode selector forcibly.
- If a battery terminal is disconnected, the memory will return to the ECM value.
  The ECM will now start to self-control at its initial value. Engine operation can vary slightly when the terminal is disconnected. However, this is not an indication of a problem. Do not replace parts because of a slight variation.

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

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







ECCS PARTS HANDLING
- Handle mass air flow sensor carefully to avoid damage.
- Do not disassemble mass air flow sensor.
- Do not clean mass air flow sensor with any type of detergent.
- Do not disassemble IACV-AAC valve.
- Even a slight leak in the air intake system can cause serious problems.
- Do not shock or jar the camshaft position sensor.

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

FUEL PUMP
- Do not operate fuel pump when there is no fuel in lines.
- Tighten fuel hose clamps to the specified torque.

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

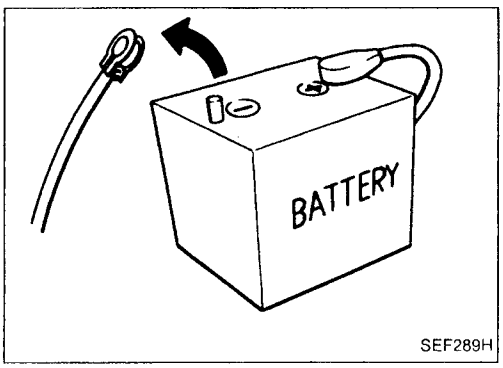
SEF320R

Precautions for ECCS Trouble Diagnosis of Engine

CAUTION:

- **Be sure to turn the ignition switch "OFF" and disconnect the negative battery terminal before any repair or inspection work. The open/short circuit of related switches, sensors, solenoid valves, etc. will cause malfunction.**
- **Be sure to connect and lock the connectors securely after work. A loose (unlocked) connector will cause malfunction due to the open circuit. (Be sure the connector is free from water, grease, dirt, bent terminals, etc.)**
- **Be sure to route and clamp the harnesses properly after work. The interference of the harness with a bracket, etc. may cause malfunction due to the short circuit.**
- **Be sure to connect rubber tubes properly after work. A misconnected or disconnected rubber tube may cause malfunction.**
- **Be sure to erase the unnecessary malfunction information (repairs completed) in the ECM before returning the vehicle to the customer.**

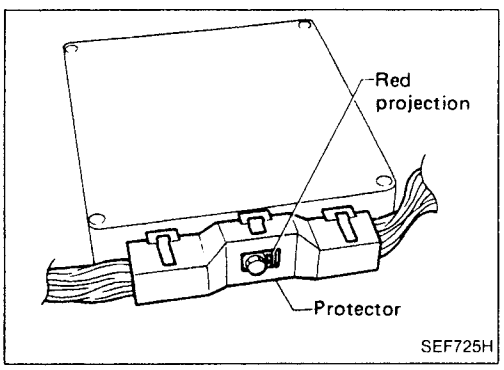
EC



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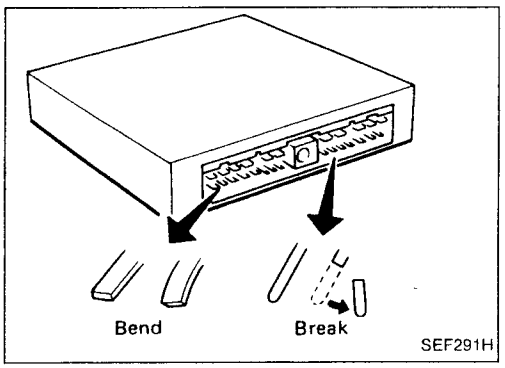
Precautions

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



SEF725H

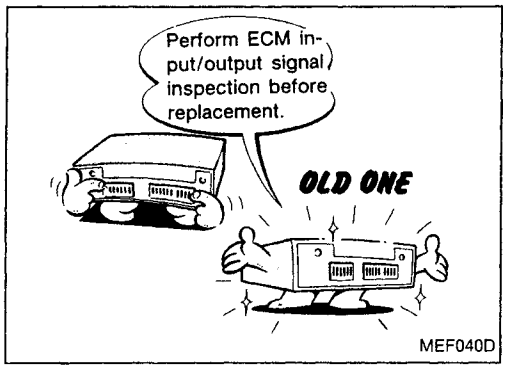
- **When connecting ECM harness connector, tighten securing bolt until red projection is in line with connector face.**



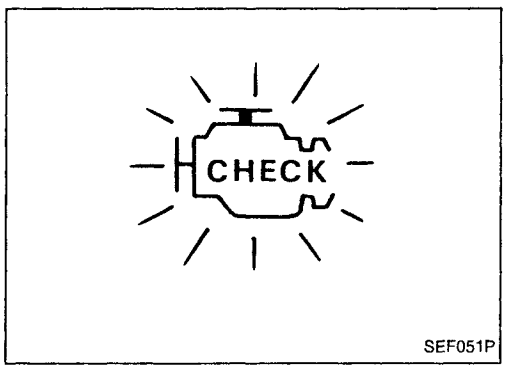
SEF291H

- **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.

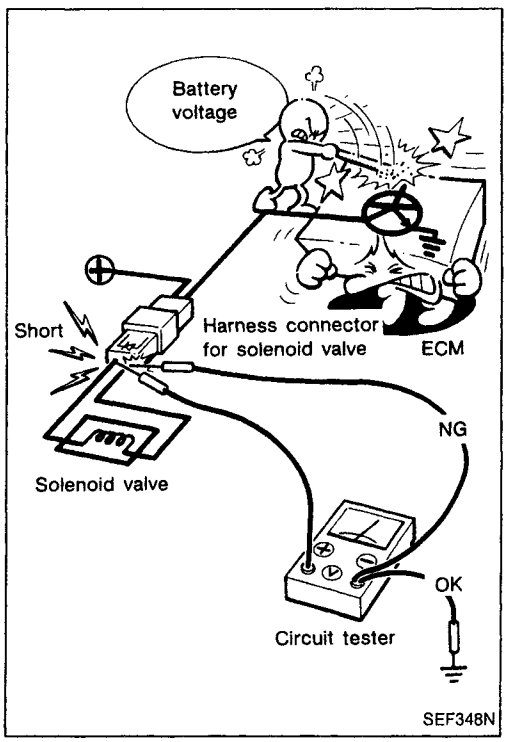
Precautions (Cont'd)



- **Before replacing ECM, perform Terminals and Reference Value inspection and make sure ECM functions properly. Refer to EC-281 for SR engine model and EC-78 for GA engine model.**

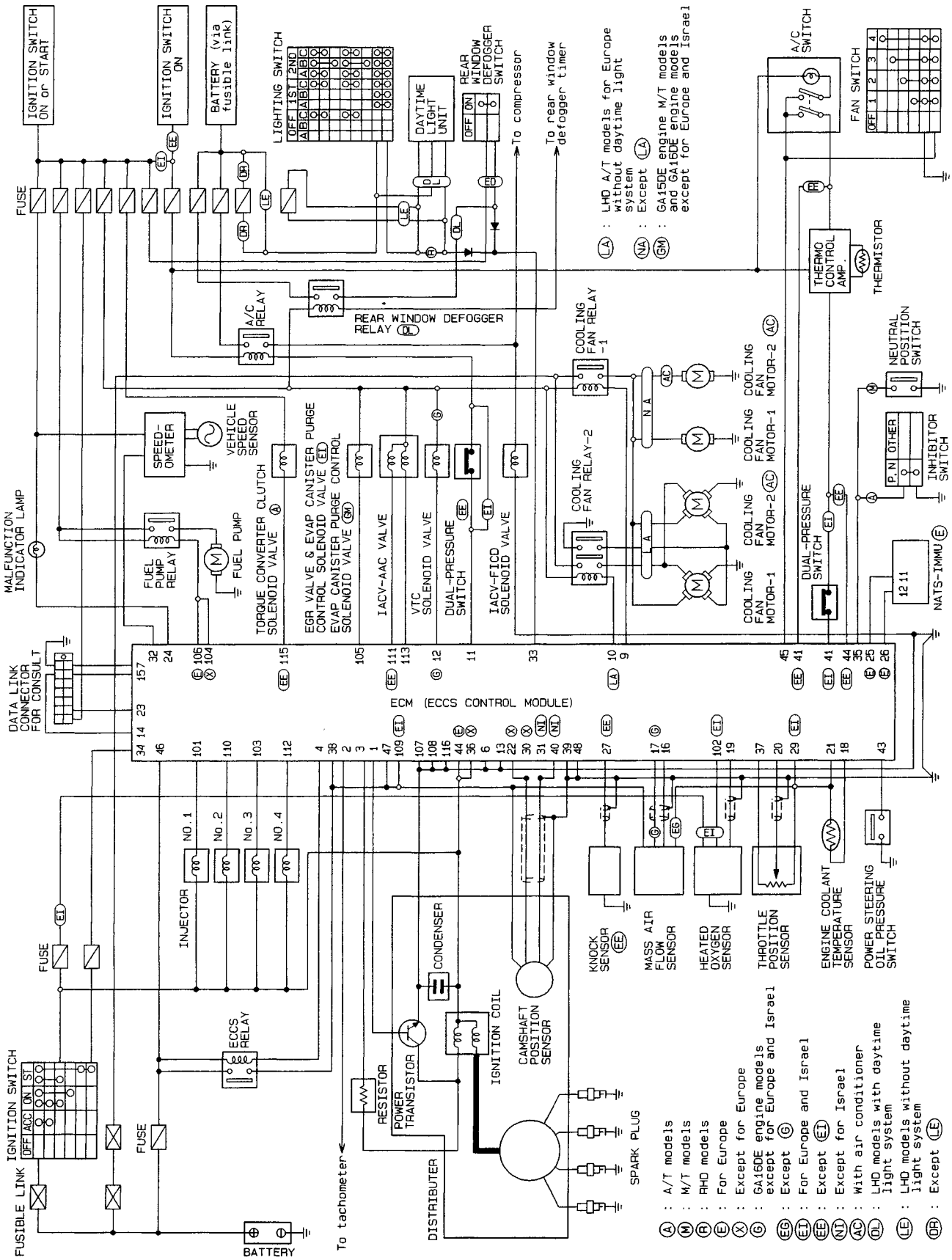


- **After performing each TROUBLE DIAGNOSIS, perform "OVERALL FUNCTION CHECK" or "DTC (Diagnostic Trouble Code) CONFIRMATION PROCEDURE".**
  The DTC should not be displayed in the "DTC CONFIRMATION PROCEDURE" if the repair is completed. The "OVERALL FUNCTION CHECK" should be a good result if the repair is completed.



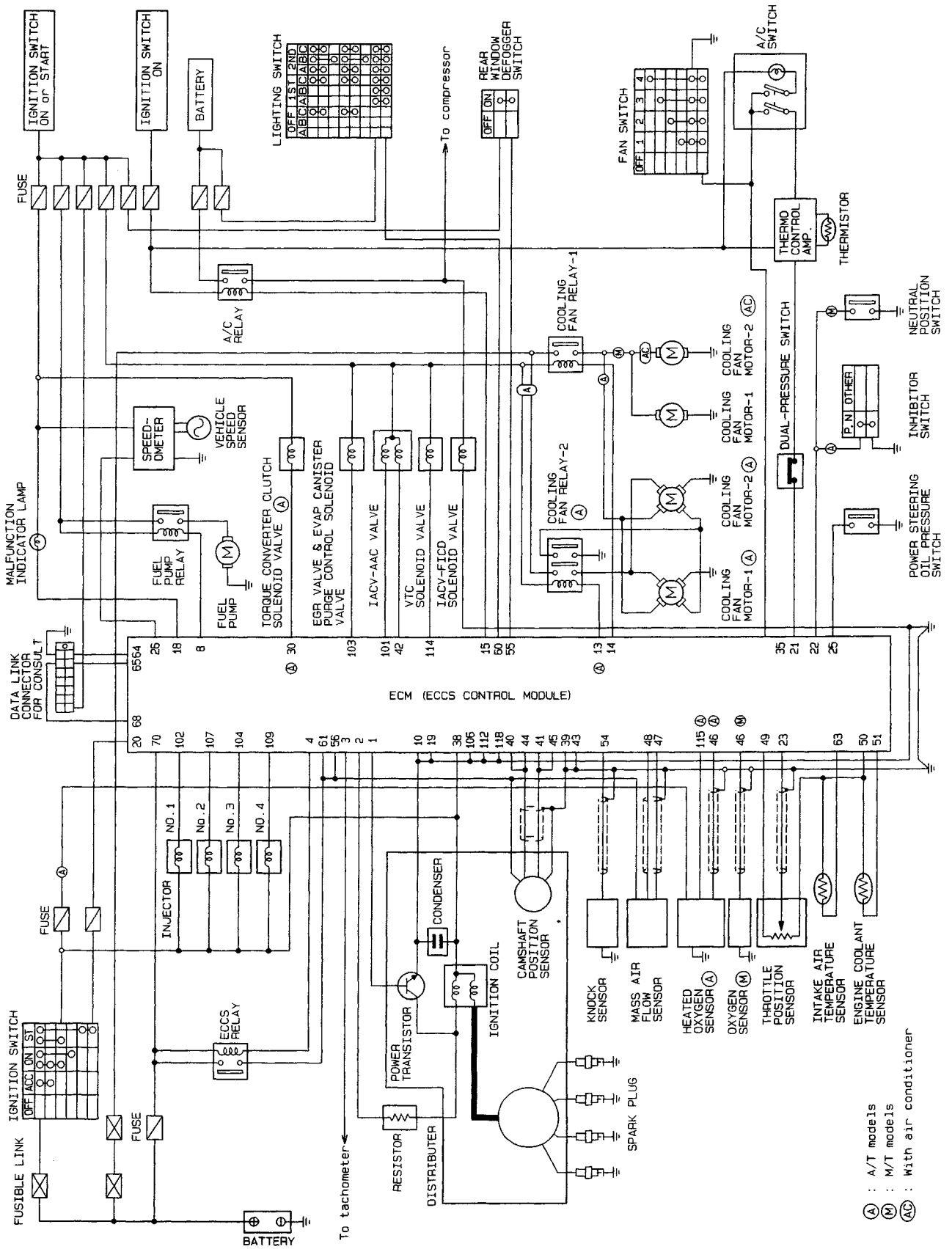
- **When measuring ECM signals with a circuit tester, never allow the two tester probes to contact.**
  Accidental contact of probes will cause a short circuit and damage the ECM power transistor.

Circuit Diagram — Except for Australia



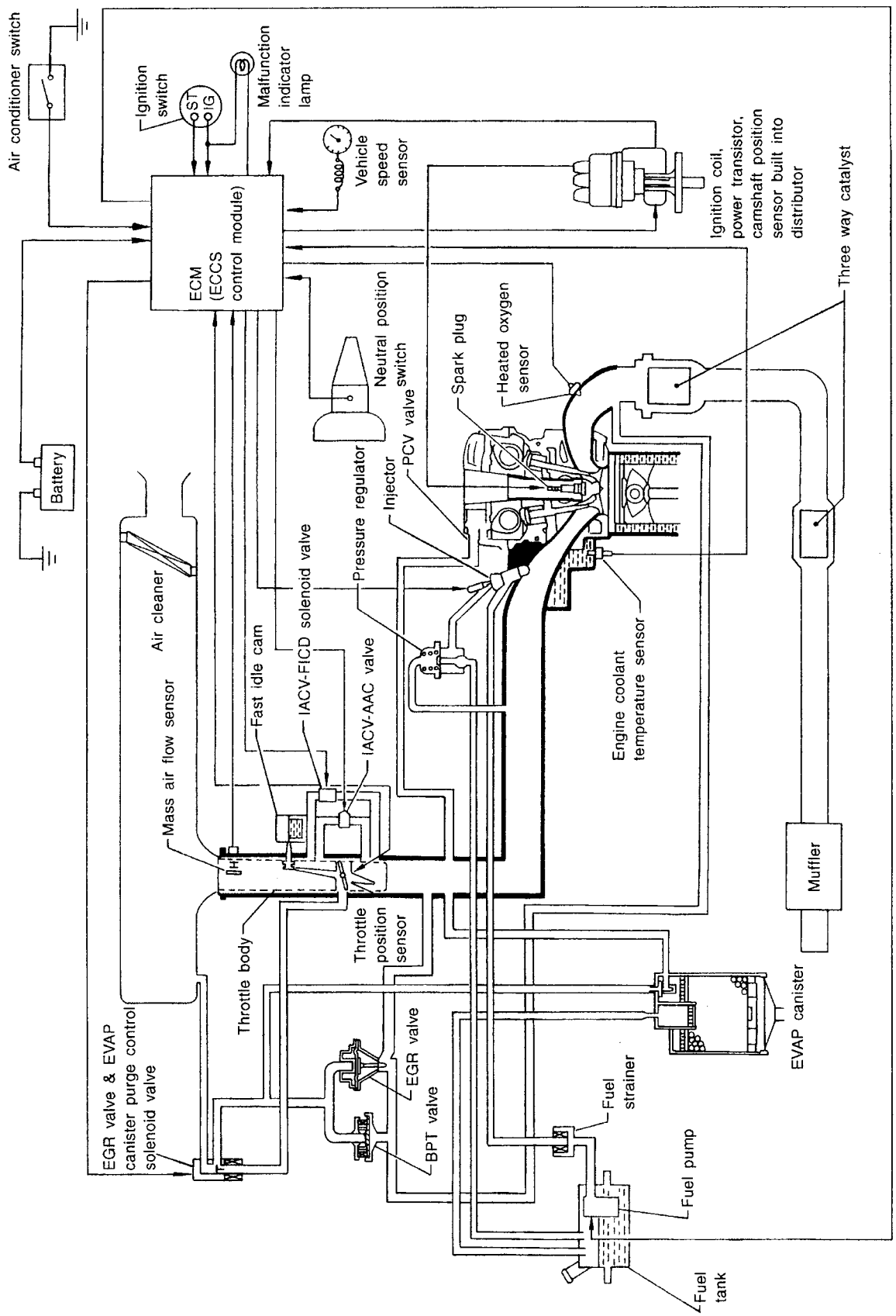
HEC060

Circuit Diagram — For Australia



HEC061

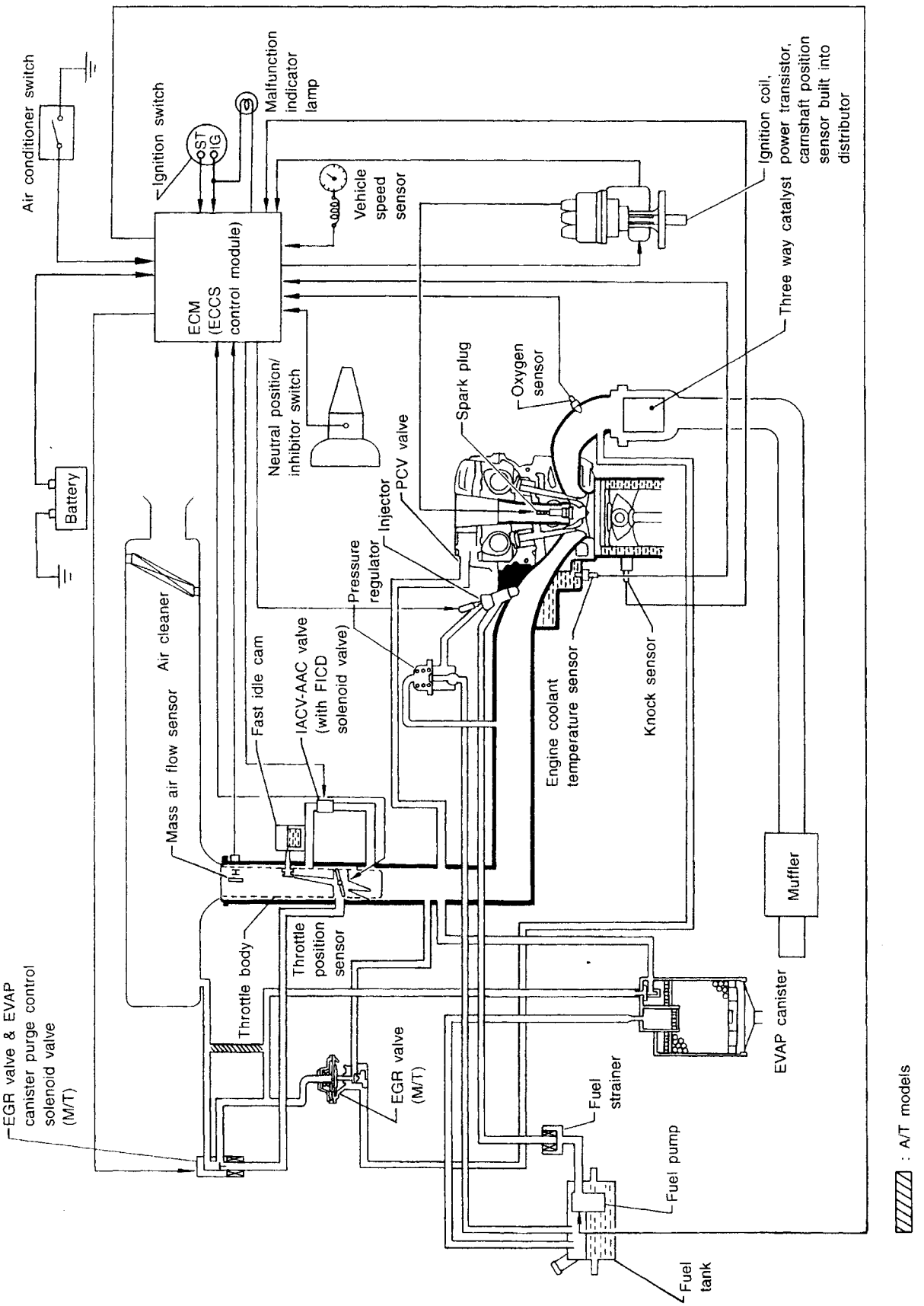
System Diagram — GA14DE, GA16DE for Europe and Israel



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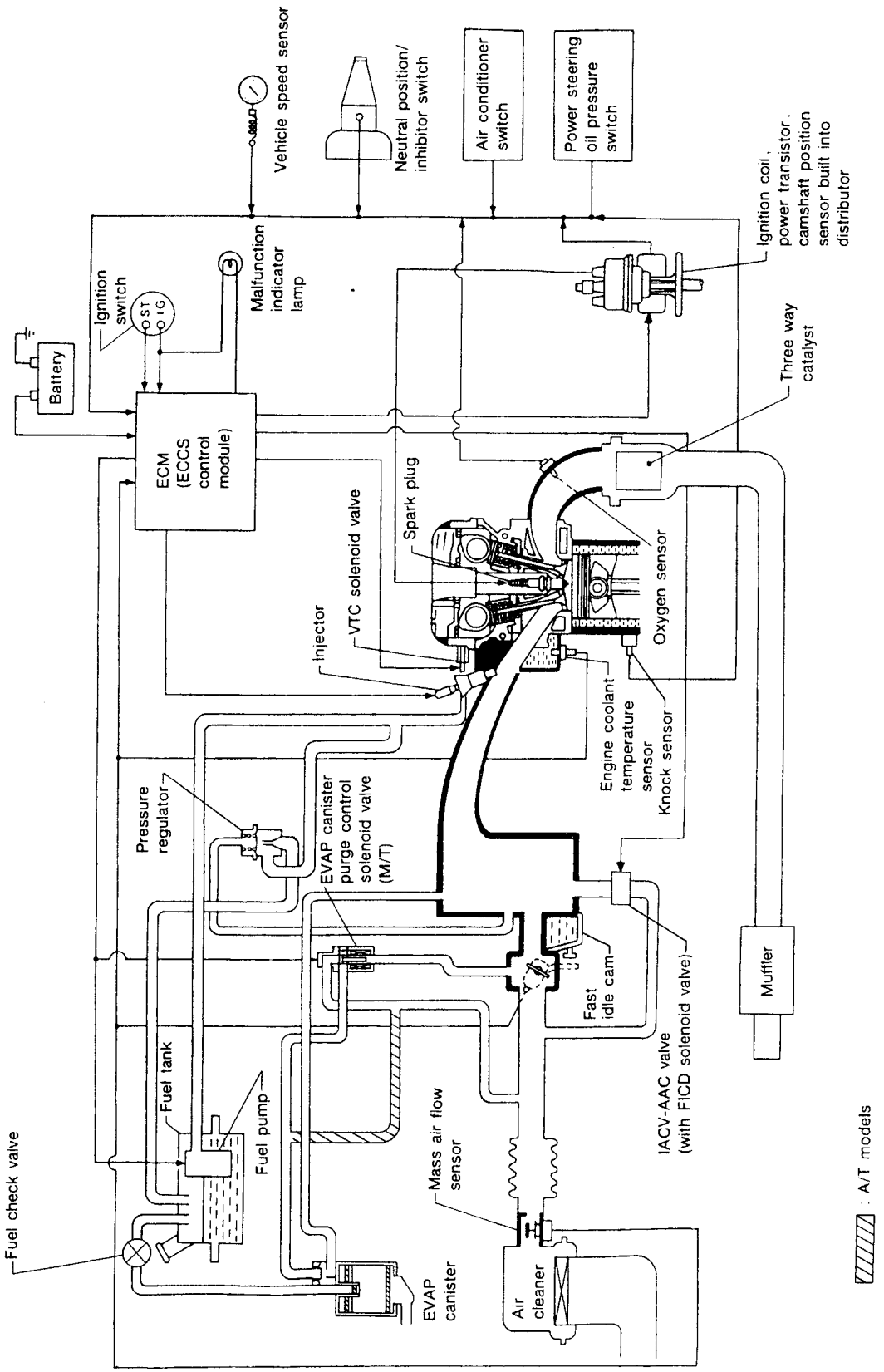
EC

System Diagram — GA15DE



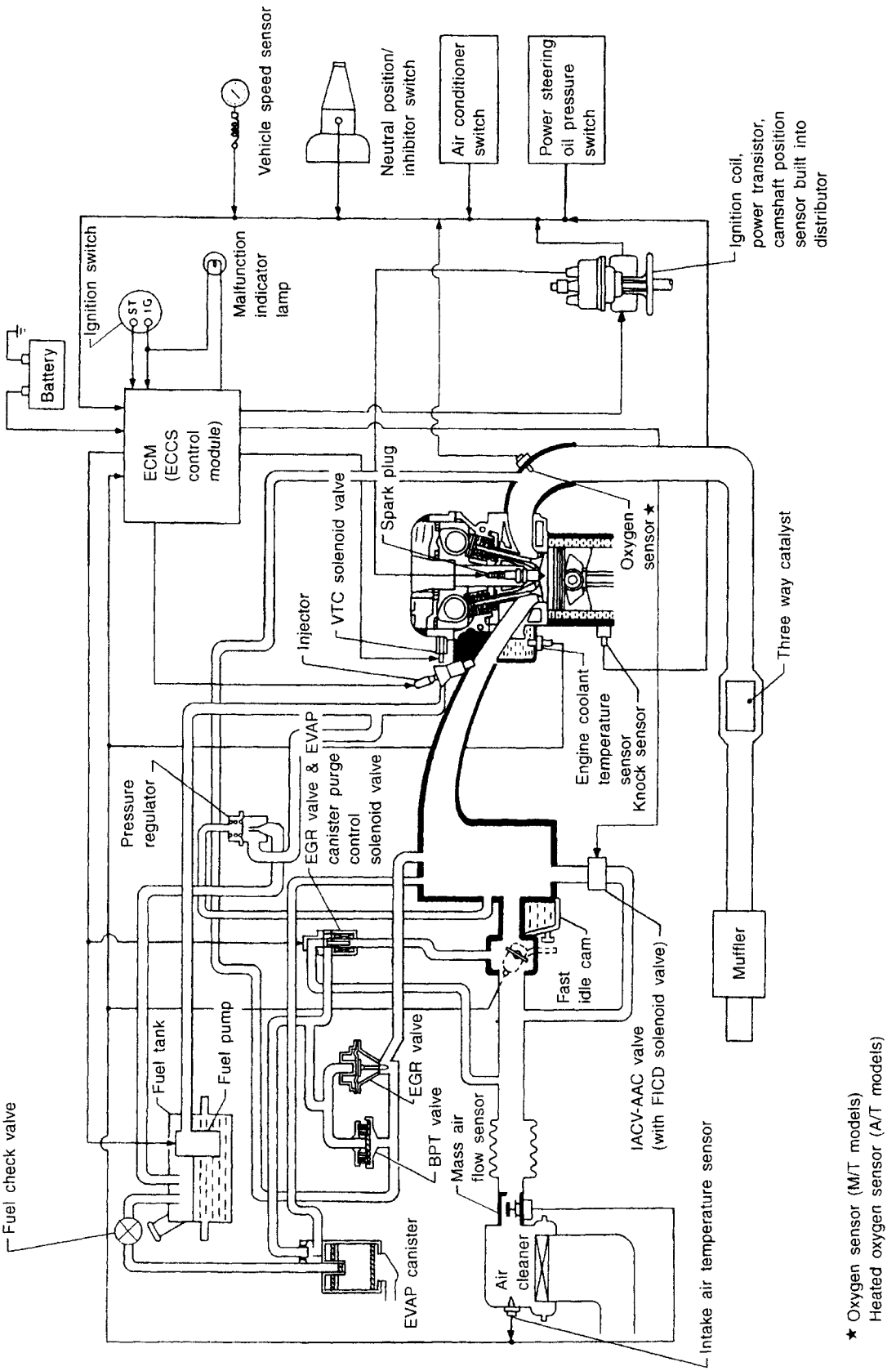
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System Diagram — GA16DE except for Europe, Israel and Australia



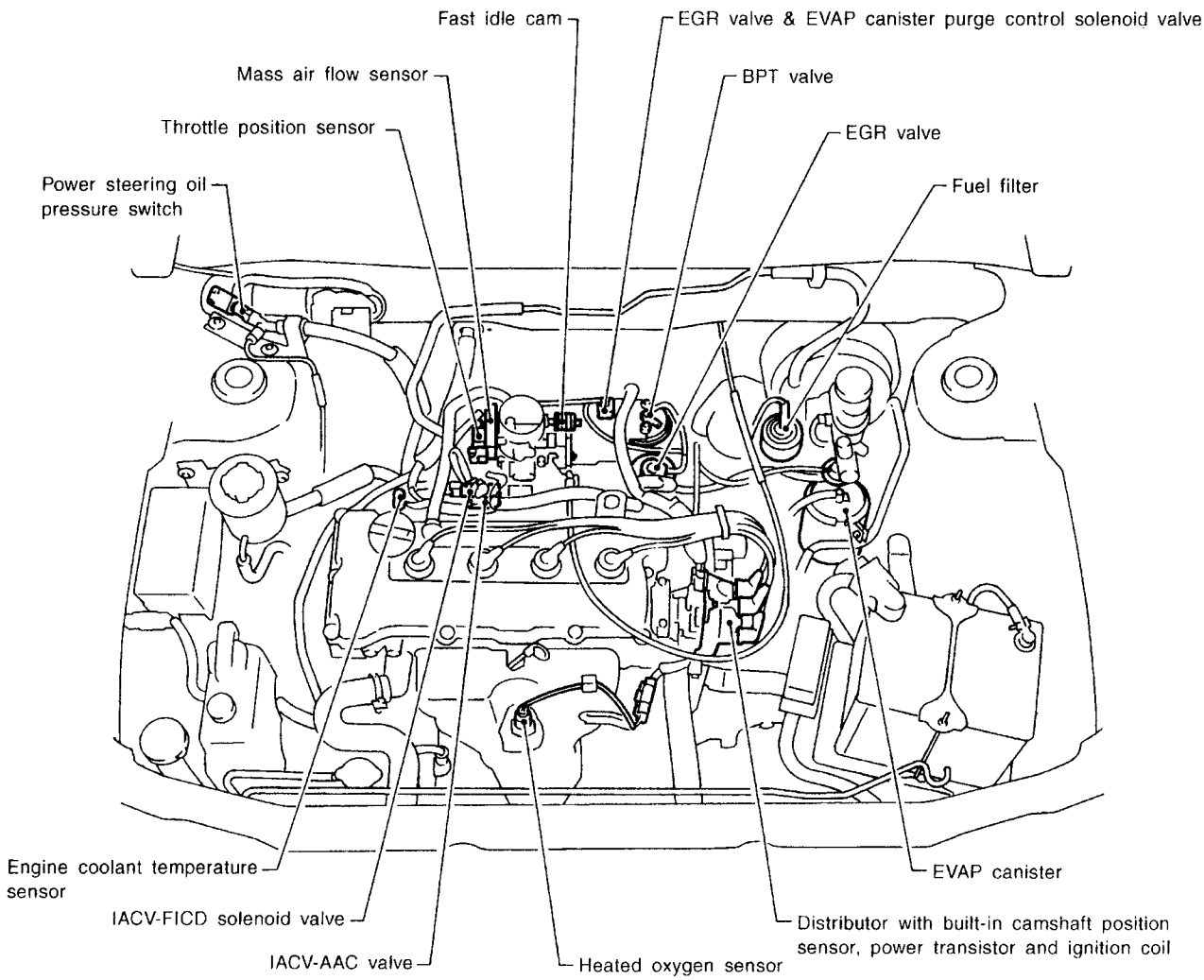
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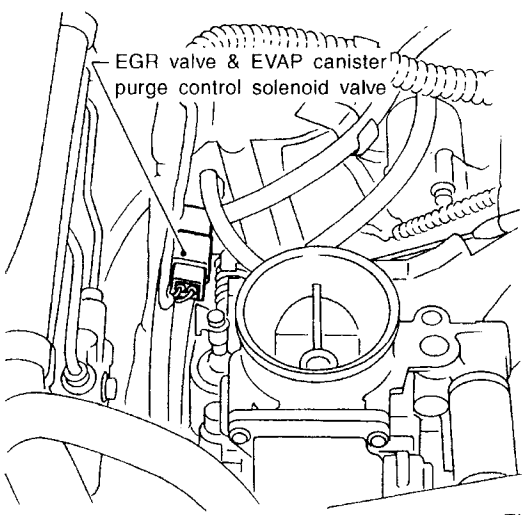
System Diagram — GA16DE for Australia

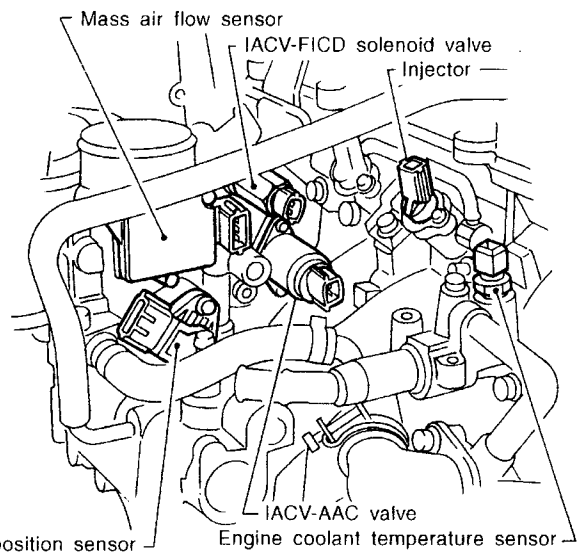


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ECCS Component Parts Location — GA14DE, GA16DE for Europe and Israel

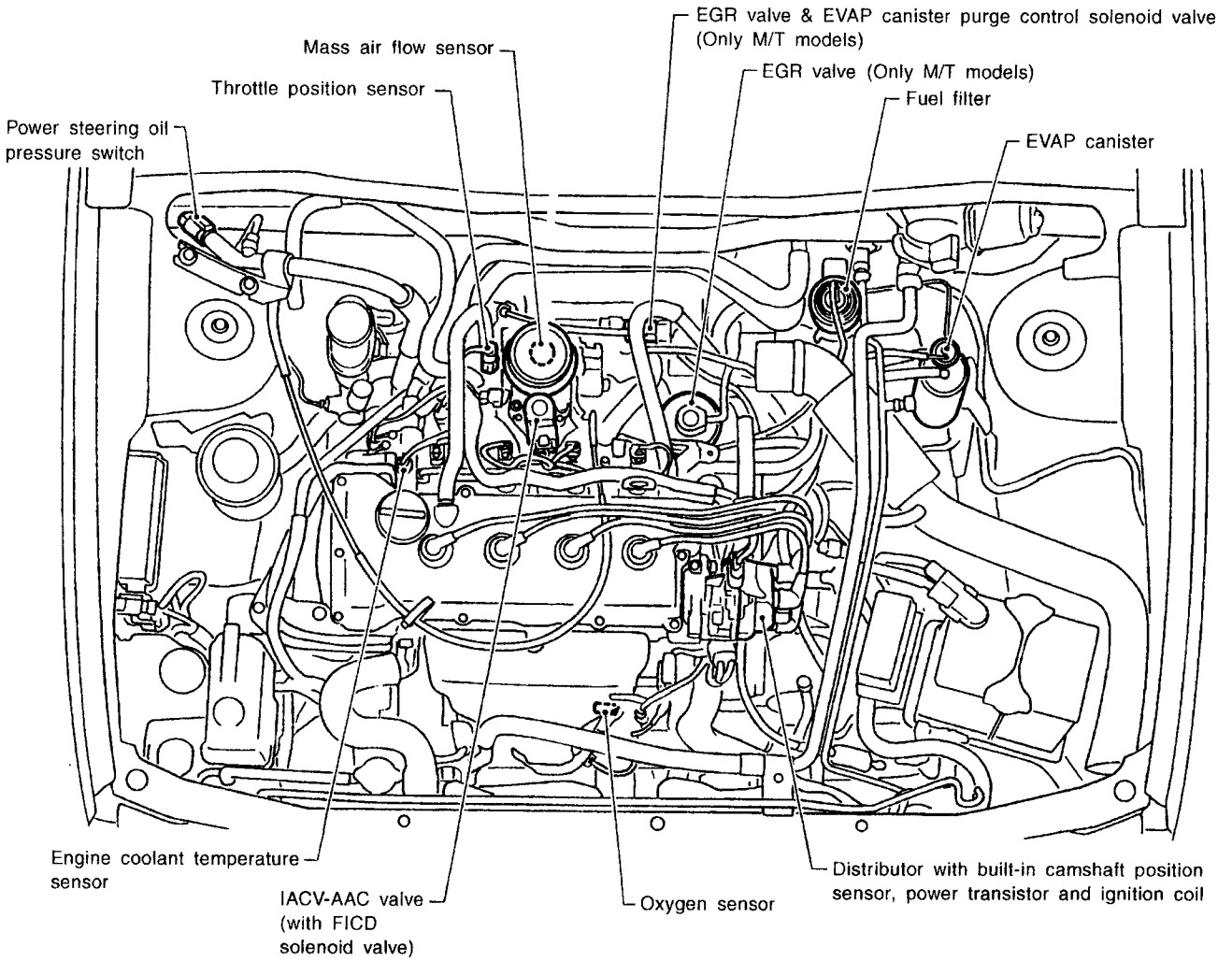


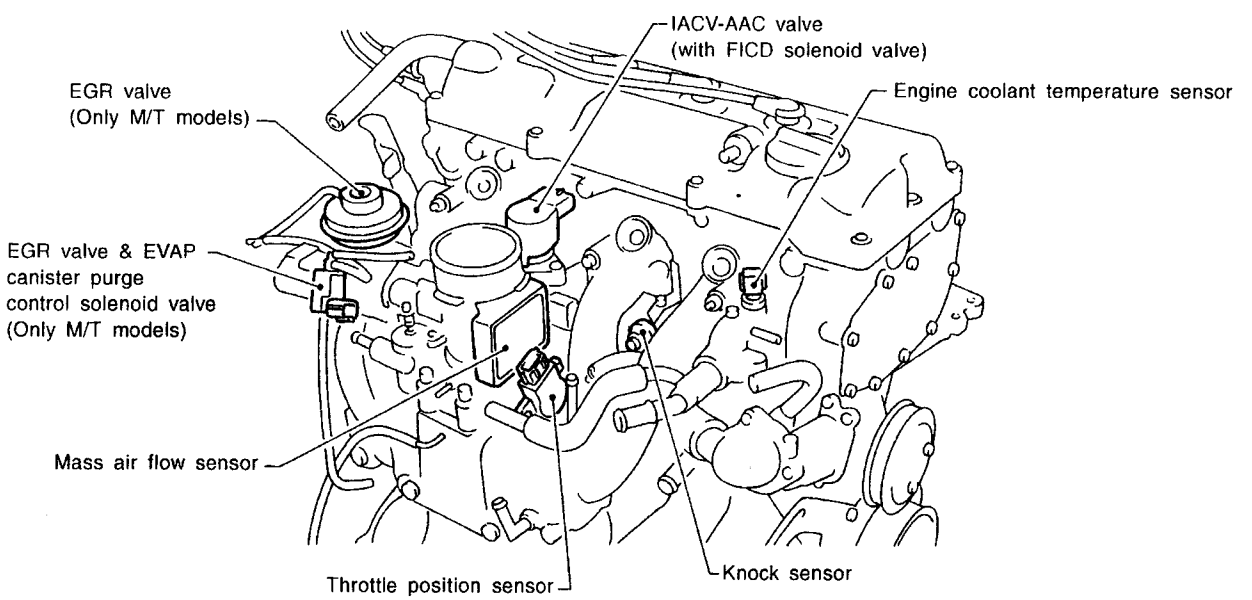




SEF122R

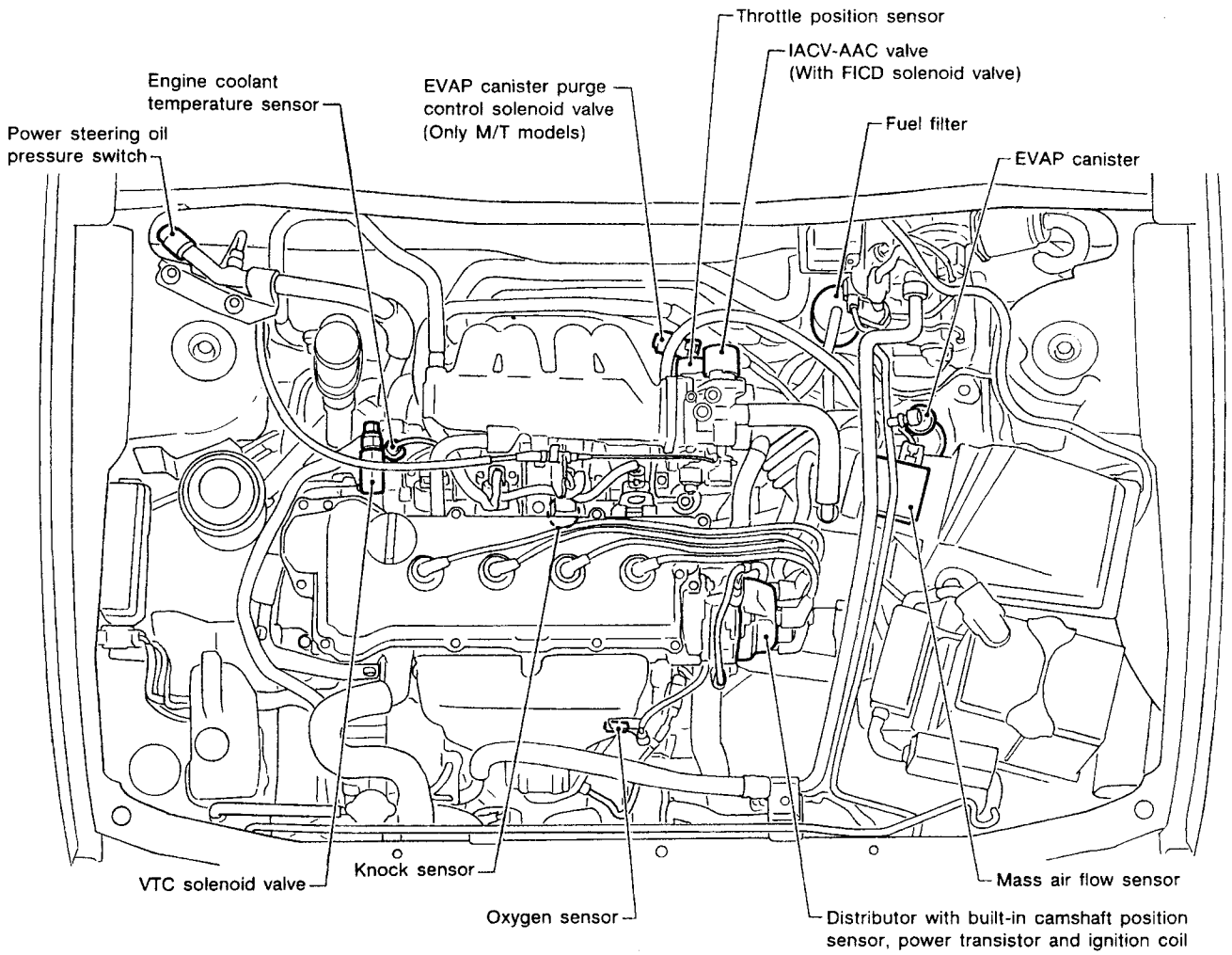
ECCS Component Parts Location — GA15DE

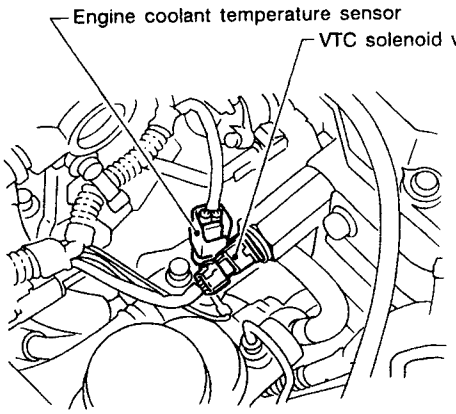


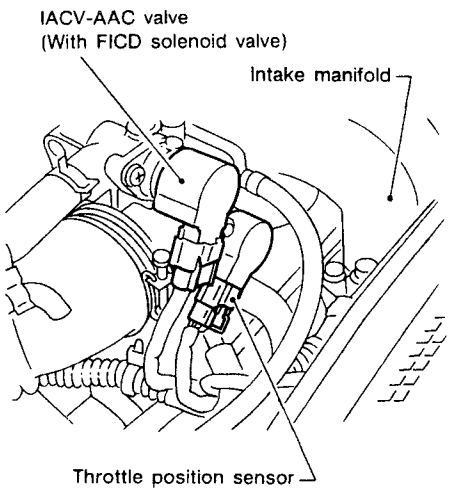


SEF123R

ECCS Component Parts Location — GA16DE except for Europe, Israel and Australia

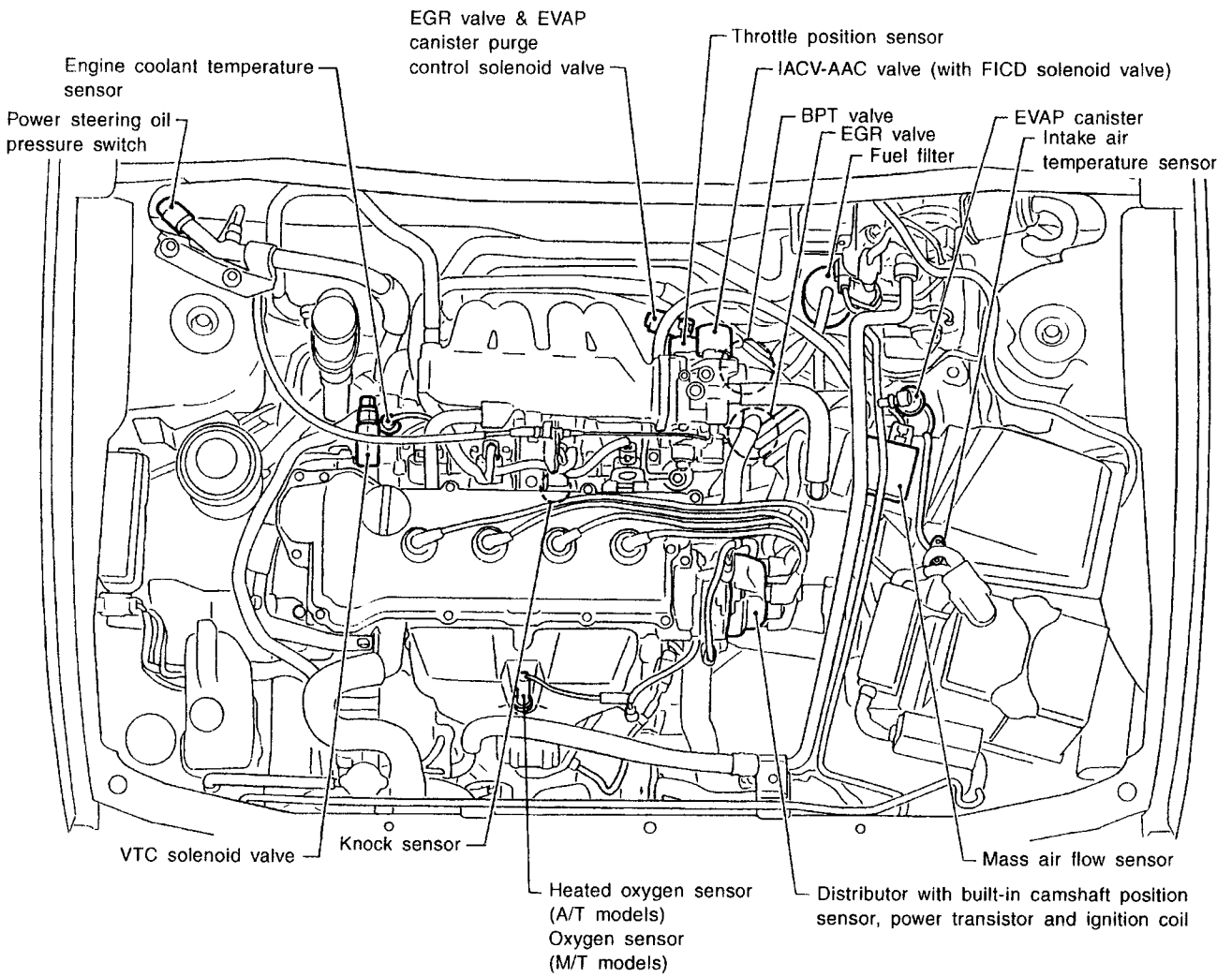


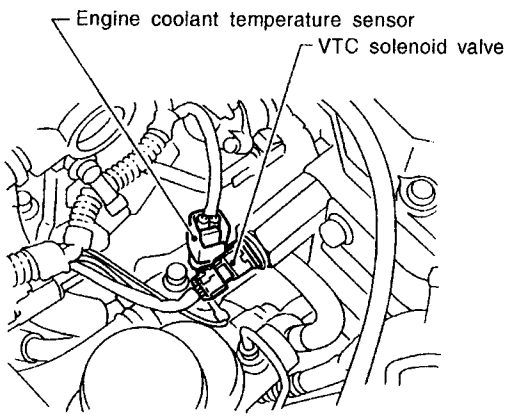


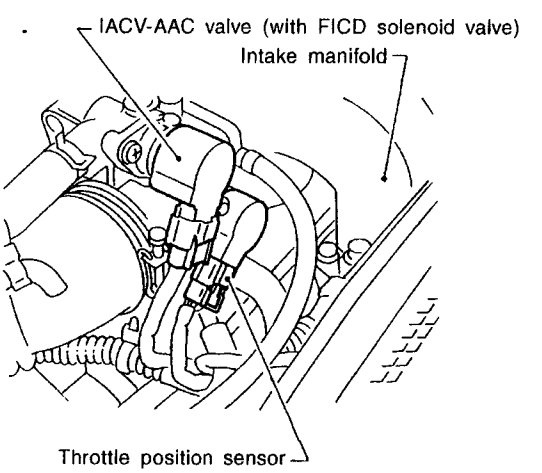


SEF451QA

ECCS Component Parts Location — GA16DE for Australia

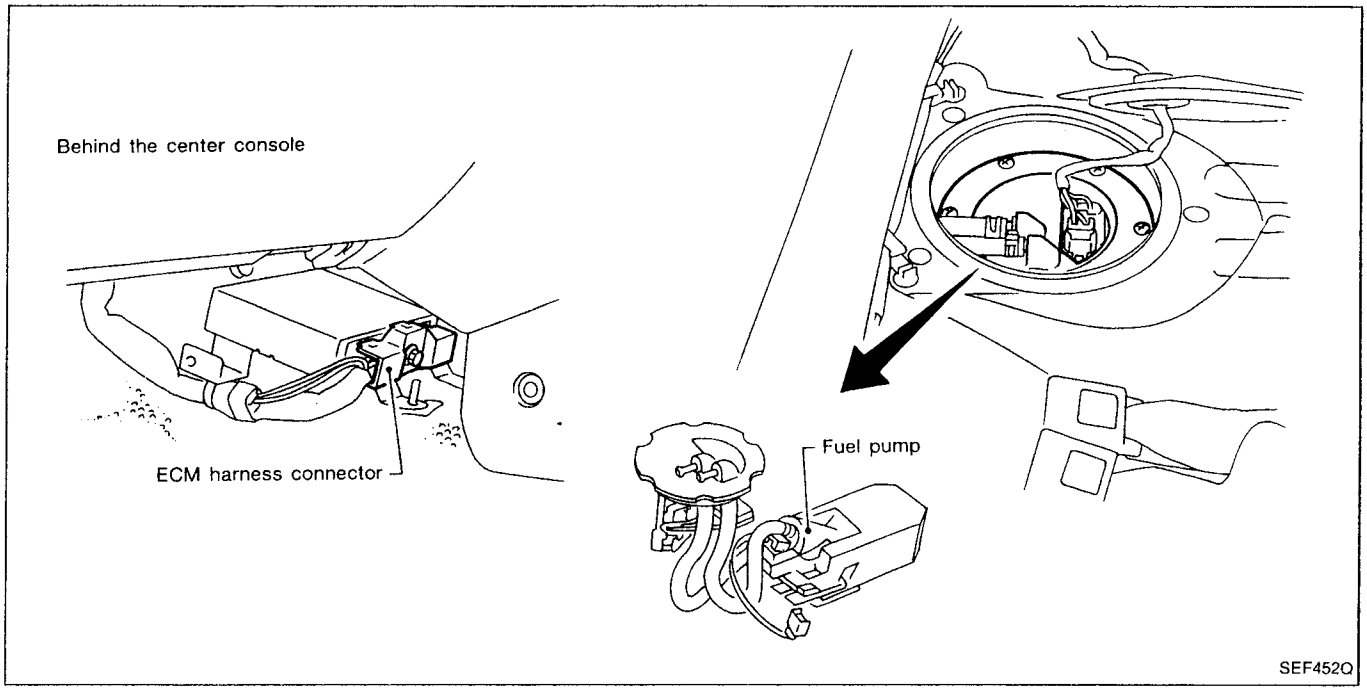






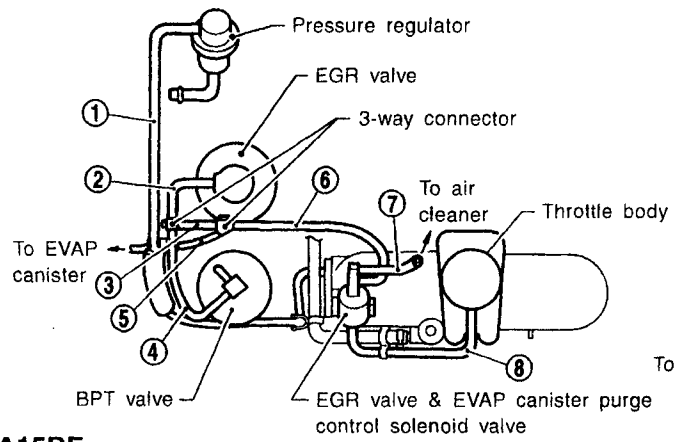
SEF124R

ECCS Component Parts Location

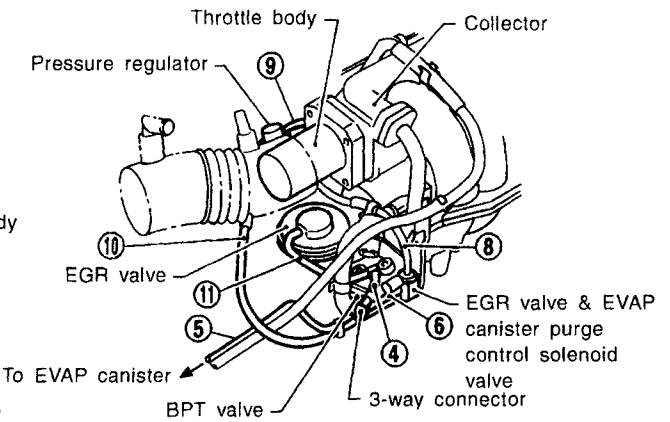


Vacuum Hose Drawing

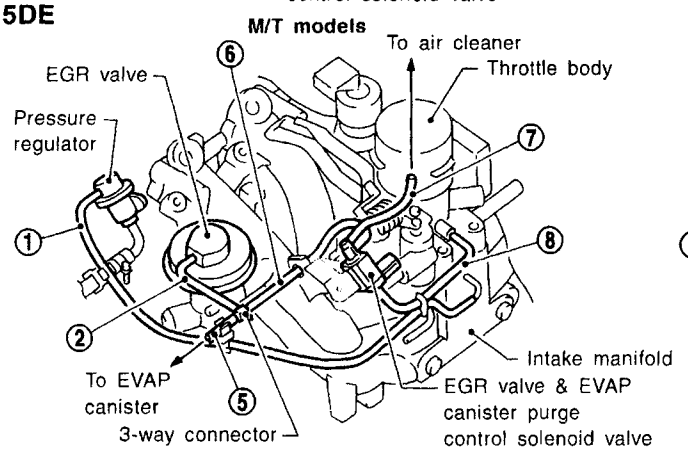
GA14DE, GA16DE for Europe

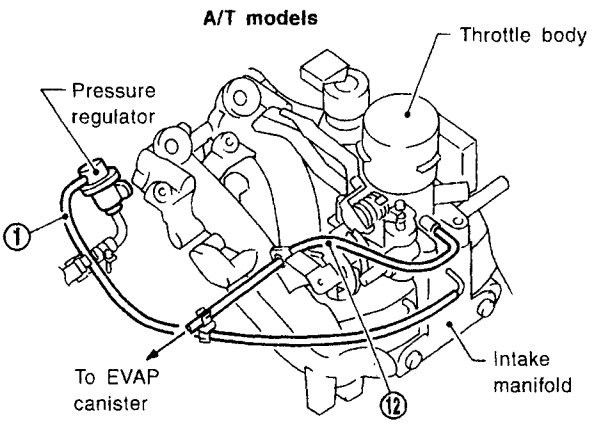


GA16DE for Australia

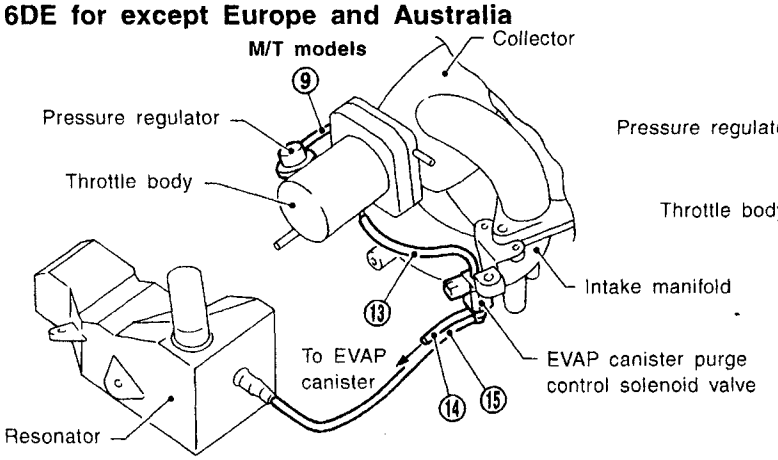


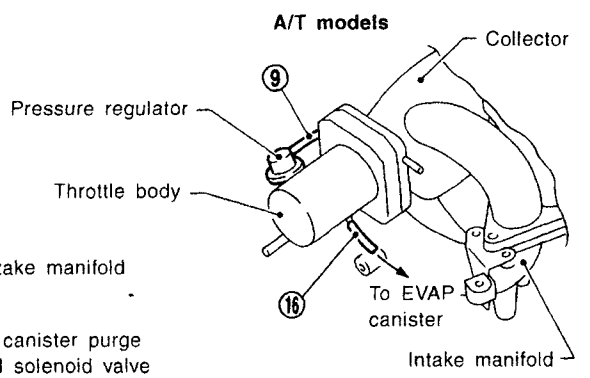
GA15DE





GA16DE for except Europe and Australia

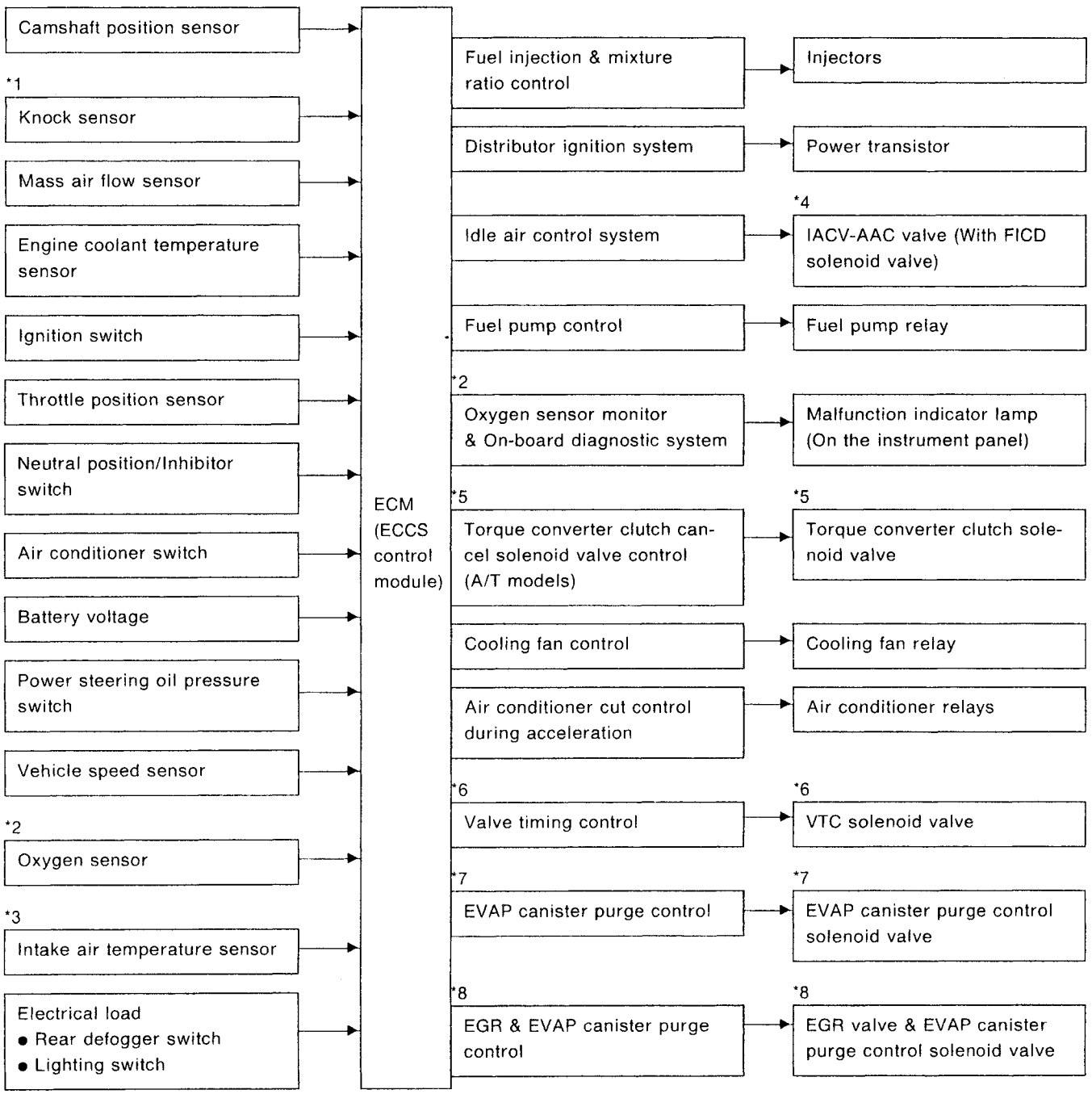




SEF125R

① Pressure regulator to intake manifold
② EGR valve to 3-way connector
③ 3-way connector to 3-way connector
④ BPT valve to 3-way connector
⑤ 3-way connector to EVAP canister
⑥ EGR valve & EVAP canister purge control solenoid valve to 3-way connector
⑦ EGR valve & EVAP canister purge control solenoid valve to air cleaner
⑧ EGR valve & EVAP canister purge control solenoid valve to throttle body
⑨ Pressure regulator to throttle body
⑩ EGR valve & EVAP canister purge control solenoid valve to air duct
⑫ Throttle body to EVAP canister
⑬ EVAP canister purge control valve to throttle body
⑭ EVAP canister purge control valve to EVAP canister
⑮ EVAP canister purge control valve to resonator
⑯ Throttle body to EVAP canister

System Chart

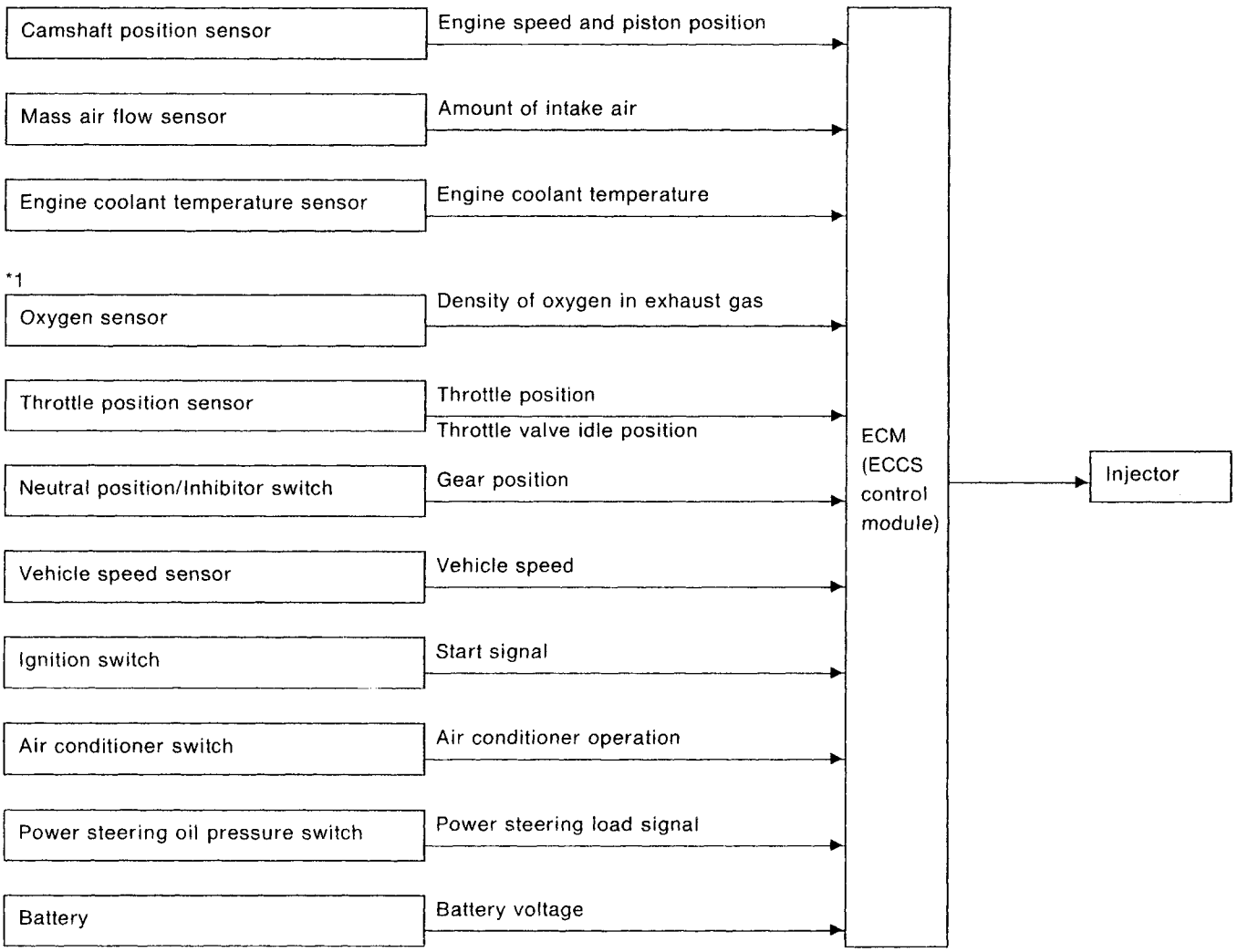


*1: Except for Europe and Israel
*2: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)
*3: For Australia
*4: IACV-AAC valve and IACV-FICD solenoid valve (For Europe and Israel)
IACV-AAC valve (with FICD solenoid valve) (Except for Europe and Israel)
*5: Except for Europe
*6: GA16DE except for Europe and Israel
*7: GA16DE M/T models except for Europe, Israel and Australia
*8: For Europe and Israel and Australia, and GA15DE M/T models

EC

Multiport Fuel Injection (MFI) System

INPUT/OUTPUT SIGNAL LINE



*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)

BASIC MULTIPORT FUEL INJECTION SYSTEM

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

VARIOUS FUEL INJECTION INCREASE/DECREASE COMPENSATION

In addition, the amount of fuel injected is compensated to improve engine performance under various operating conditions as listed below.

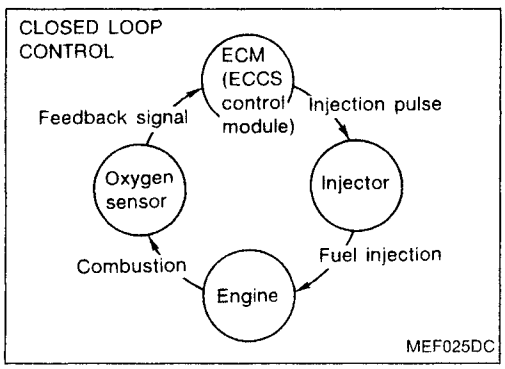
<Fuel increase>

- During warm-up
- When starting the engine
- During acceleration
- Hot-engine operation
- When selector lever is changed from "N" to "D" (A/T models only)
- High-load, high-speed operation

<Fuel decrease>

- During deceleration

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



MIXTURE RATIO FEEDBACK CONTROL (CLOSED LOOP CONTROL)

The mixture ratio feedback system provides the best air-fuel mixture ratio for driveability and emission control. The three way catalyst can then better reduce CO, HC and NOx emissions. This system uses an oxygen sensor*1 in the exhaust manifold to monitor if the engine operation is rich or lean. The ECM adjusts the injection pulse width according to the sensor voltage signal. This maintains the mixture ratio within the range of stoichiometric (ideal air-fuel mixture).
This stage is referred to as the closed loop control condition.

EC

OPEN LOOP CONTROL

The open loop system condition refers to when the ECM detects any of the following conditions. Feedback control stops in order to maintain stabilized fuel combustion.

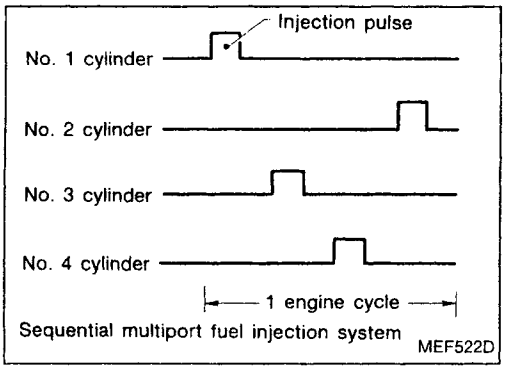
- Deceleration and acceleration
- High-load, high-speed operation
- Engine idling
- Malfunction of oxygen sensor*1 or its circuit
- Insufficient activation of oxygen sensor*1 at low engine coolant temperature
- High-engine coolant temperature
- After shifting from "N" to "D"
- During warm-up
- When starting the engine

MIXTURE RATIO SELF-LEARNING CONTROL

The mixture ratio feedback control system monitors the mixture ratio signal transmitted from the oxygen sensor*1. This feedback signal is then sent to the ECM. The ECM controls the basic mixture ratio as close to the theoretical mixture ratio as possible. However, the basic mixture ratio is not necessarily controlled as originally designed. Both manufacturing differences (i.e., mass air flow sensor hot film) and characteristic changes during operation (i.e., injector clogging) directly affect mixture ratio.
Accordingly, the difference between the basic and theoretical mixture ratios is monitored in this system. This is then computed in terms of "injection pulse duration" to automatically compensate for the difference between the two ratios.

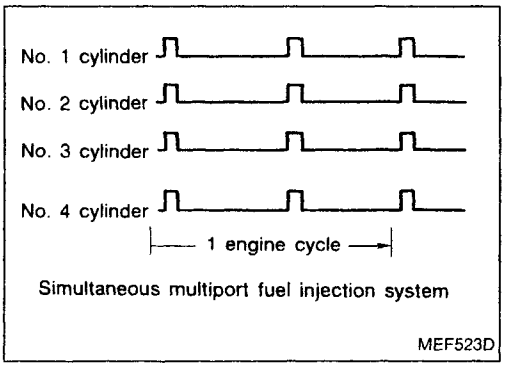
*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)

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



Sequential multiport fuel injection system

MEF522D



Simultaneous multiport fuel injection system

MEF523D

FUEL INJECTION TIMING

Two types of systems are used.

Sequential multiport fuel injection system

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

Simultaneous multiport fuel injection system

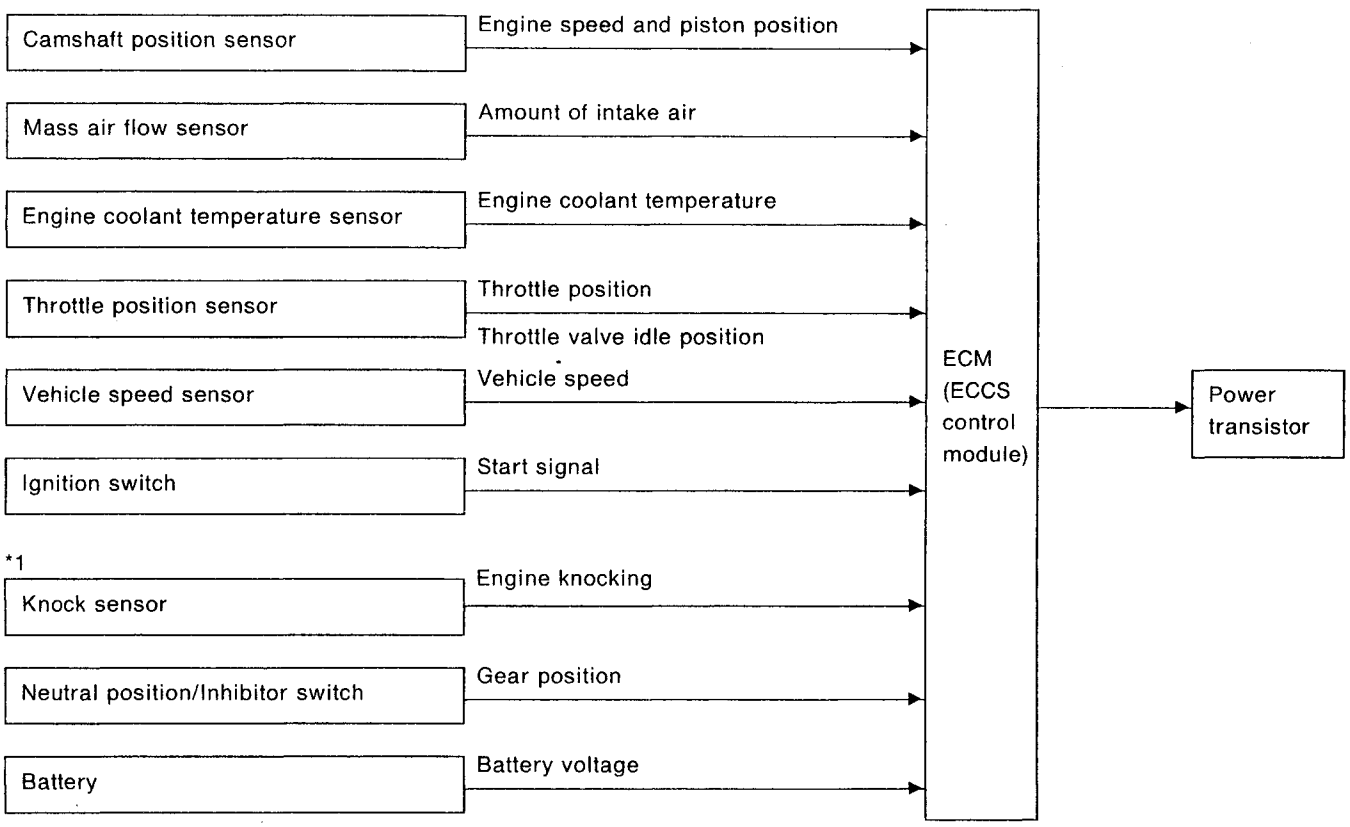
Fuel is injected simultaneously into all four cylinders twice each engine cycle. In other words, pulse signals of the same width are simultaneously transmitted from the ECM.
The four injectors will then receive the signals two times for each engine cycle.
This system is used when the engine is being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

FUEL SHUT-OFF

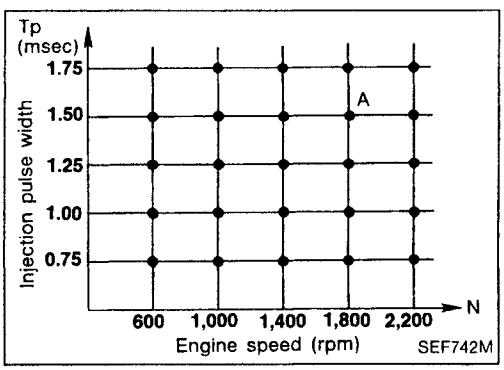
Fuel to each cylinder is cut off during deceleration or operation of the engine and the vehicle at excessively high speeds.

Distributor Ignition (DI) System

INPUT/OUTPUT SIGNAL LINE



*1: Except for Europe and Israel



SYSTEM DESCRIPTION

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

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

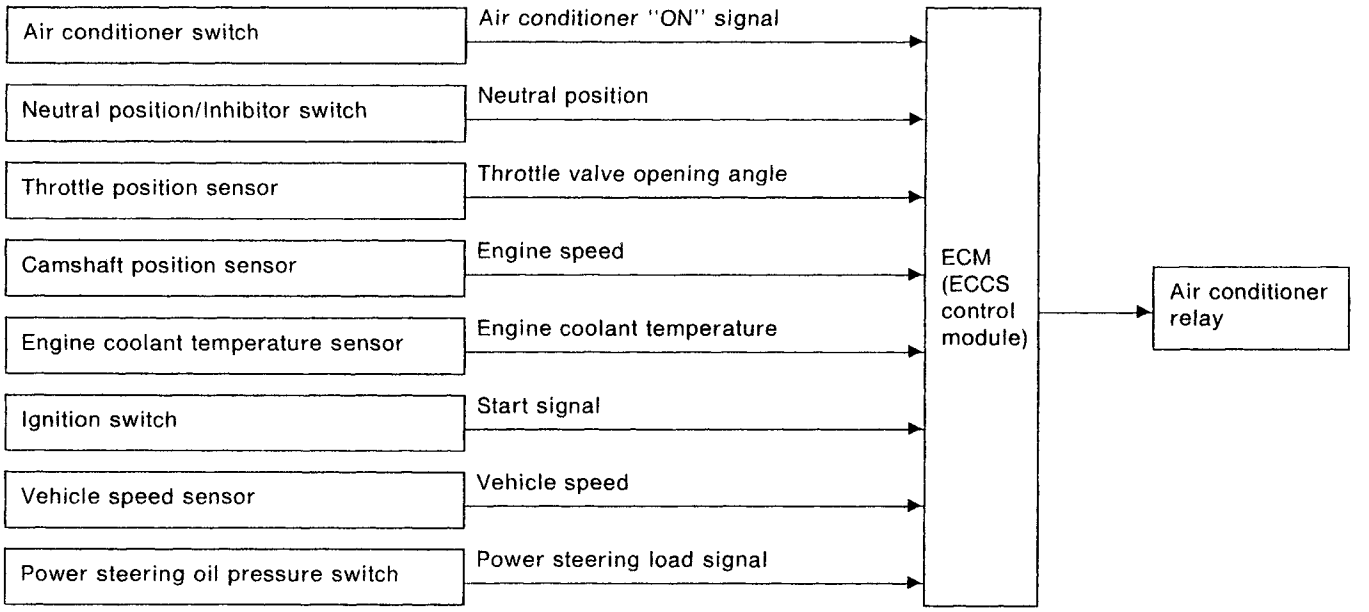
During the following conditions, the ignition timing is revised by the ECM according to the other data stored in the ECM.

- At starting
- During warm-up
- At idle
- Hot engine operation
- During acceleration
- During high-load operation (VTC on) — GA16DE except for Europe and Israel

Except for Europe and Israel
The knock sensor retard system is designed only for emergencies. The basic ignition timing is programmed within the anti-knocking zone, if recommended fuel is used under dry conditions. The retard system does not operate under normal driving conditions.
If engine knocking occurs, the knock sensor monitors the condition. The signal is transmitted to the ECM (ECCS control module). The ECM retards the ignition timing to eliminate the knocking condition.

Air Conditioning Cut Control

INPUT/OUTPUT SIGNAL LINE

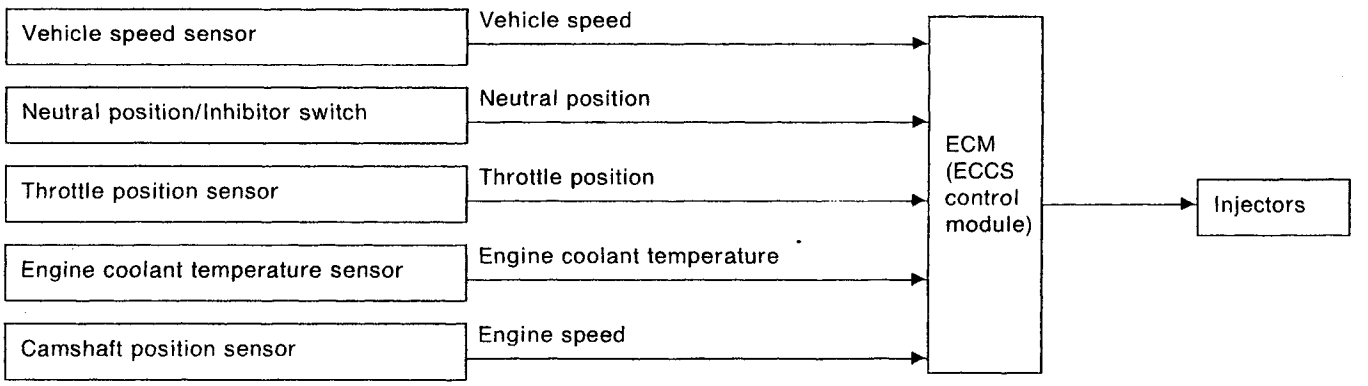


SYSTEM DESCRIPTION

This system improves acceleration when the air conditioner is used.
When the accelerator pedal is fully depressed, the air conditioner is turned off for a few seconds.

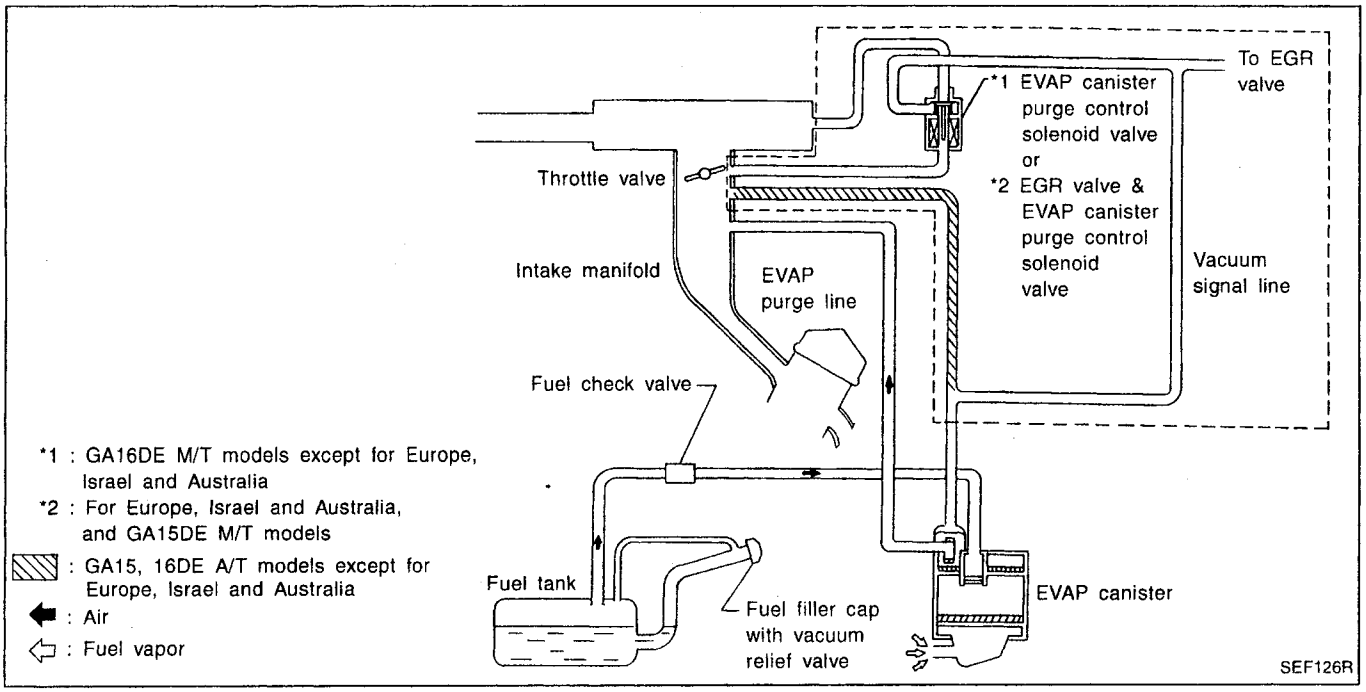
Fuel Cut Control (at no load & high engine speed)

INPUT/OUTPUT SIGNAL LINE

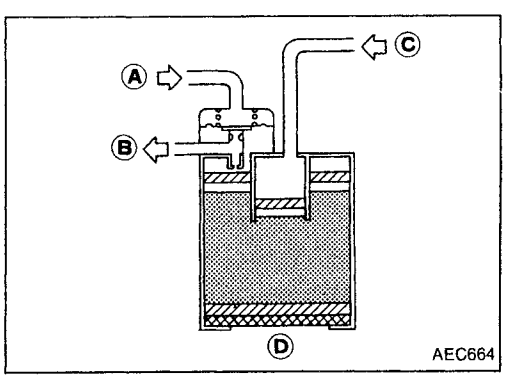


If the engine speed is above 2,500 rpm with no load (for example, in neutral and engine speed over 2,500 rpm) fuel will be cut off after some time. The exact time when the fuel is cut off varies based on engine speed.
Fuel cut will operate until the engine speed reaches 2,000 rpm, then fuel cut is cancelled.

NOTE:
This function is different than deceleration control listed under "Multiport Fuel Injection (MFI) System" on EC-24.



The evaporative emission system is used to reduce hydrocarbons emitted into the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the EVAP canister.
The fuel vapor from sealed fuel tank is led into the EVAP canister when the engine is off. The fuel vapor is then stored in the EVAP canister. The EVAP canister retains the fuel vapor until the EVAP canister is purged by air.
When the engine is running, the air is drawn through the bottom of the EVAP canister. The fuel vapor will then be led to the intake manifold.
When the engine runs at idle, the EVAP canister purge control valve is closed. Only a small amount of vapor flows into the intake manifold through the constant purge orifice.
As the engine speed increases and the throttle vacuum rises, the purge control valve opens. The vapor is sucked through both main purge and constant purge orifices.



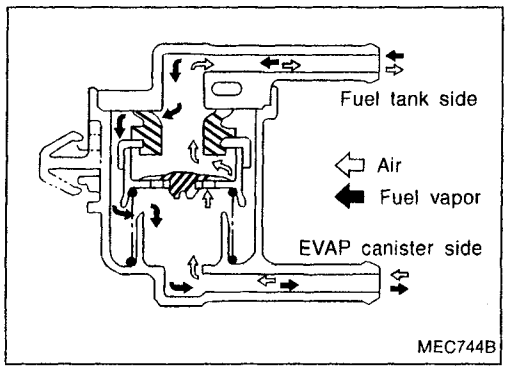
Inspection

EVAP CANISTER

Check EVAP canister as follows:

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

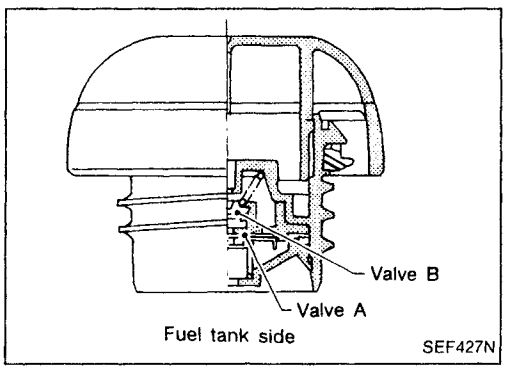
Inspection (Cont'd)



FUEL CHECK VALVE

Check valve operation

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



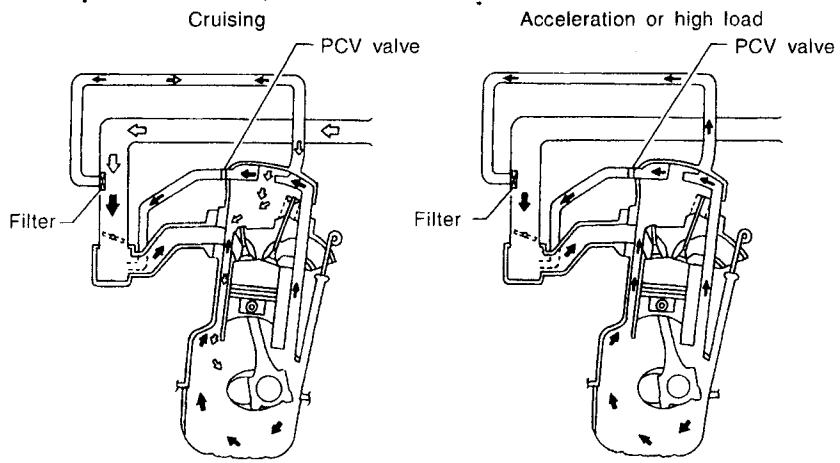
FUEL TANK VACUUM RELIEF VALVE

1. Wipe clean valve housing.
2. Suck air through the cap. A slight resistance accompanied by valve clicks indicates that valve A is in good mechanical condition. Note also that, by further sucking air, the resistance should disappear with valve clicks.
3. Blow air on fuel tank side and ensure that continuity of air passage exists through valve B.
4. If valve is clogged or if no resistance is felt, replace cap as an assembly.

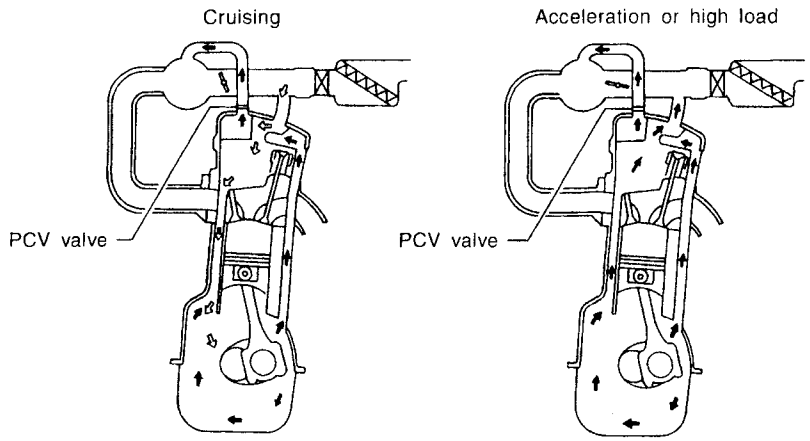
Description

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

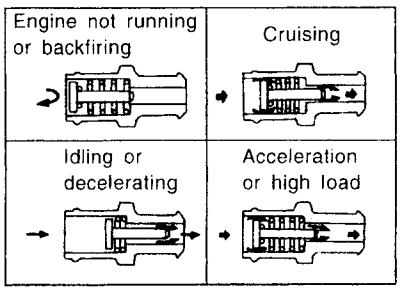
For Europe and Israel, and GA15DE



GA16DE except for Europe and Israel

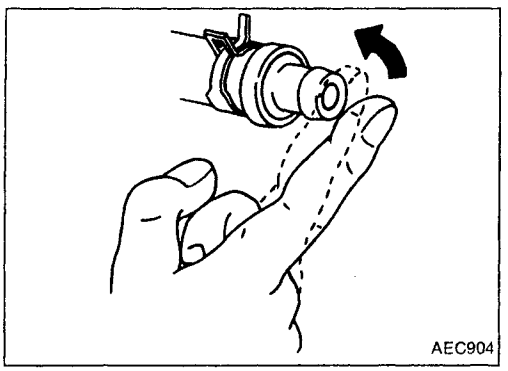


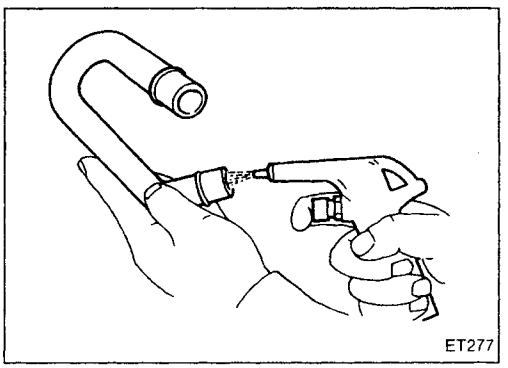
PCV valve operation



⇨ : Fresh air
➡ : Blow-by gas

SEF127R


AEC904


ET277

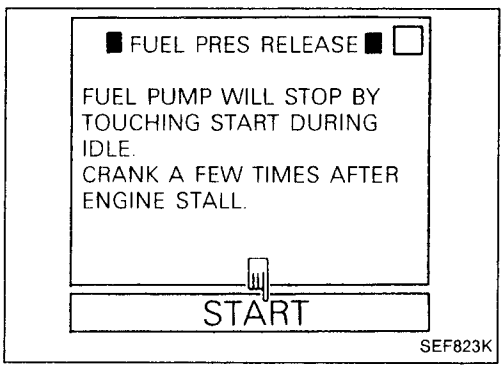
Inspection

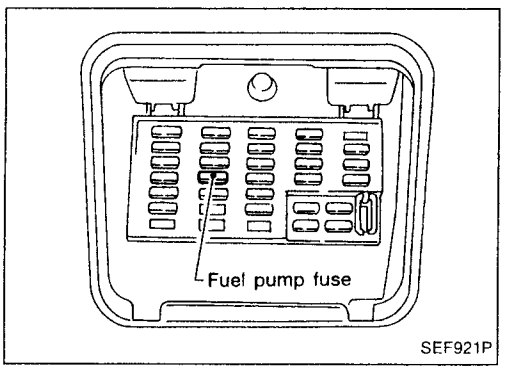
PCV (Positive Crankcase Ventilation) VALVE

With engine running at idle, remove PCV valve from rocker cover. A properly working valve makes a hissing noise as air passes through it. A strong vacuum should be felt immediately when a finger is placed over the valve inlet.

PCV HOSE

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





Fuel Pressure Release

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

1. Turn ignition switch "ON".
2. Perform "FUEL PRESSURE RELEASE" in "WORK SUPPORT" mode with CONSULT.
3. Start engine.
4. After engine stalls, crank it two or three times to release all fuel pressure.
5. Turn ignition switch "OFF".

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

EC

Fuel Pressure Check

- **When reconnecting fuel line, always use new clamps.**
- **Make sure that clamp screw does not contact adjacent parts.**
- **Use a torque driver to tighten clamps.**
- **Use Pressure Gauge to check fuel pressure.**
- **Do not perform fuel pressure check with system operating. Fuel pressure gauge may indicate false readings.**

1. Release fuel pressure to zero.
2. Disconnect fuel hose between fuel filter and fuel tube (engine side).
3. Install pressure gauge between fuel filter and fuel tube.
4. Start engine and check for fuel leakage.
5. Read the indication of fuel pressure gauge.

At idling:

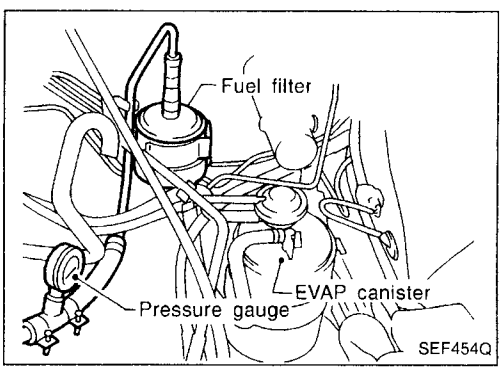
With vacuum hose connected

Approximately 245 kPa (2.45 bar, 2.5 kg/cm^2, 36 psi)

With vacuum hose disconnected

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

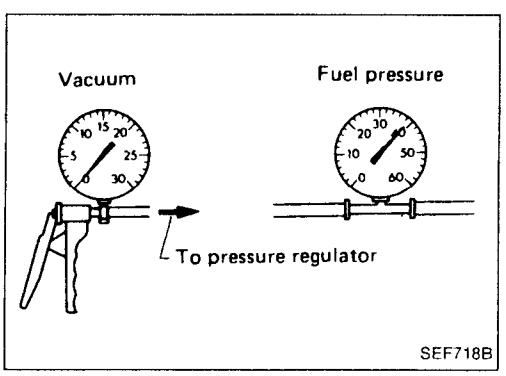
If results are unsatisfactory, perform Fuel Pressure Regulator Check.

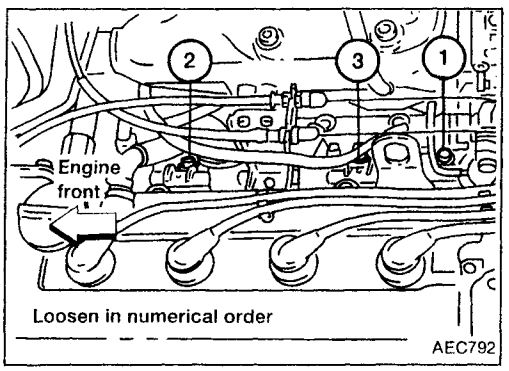


Fuel Pressure Regulator Check

1. Stop engine and disconnect fuel pressure regulator vacuum hose from intake manifold.
2. Plug intake manifold with a rubber cap.
3. Connect variable vacuum source to fuel pressure regulator.
4. Start engine and read indication of fuel pressure gauge as vacuum is changed.

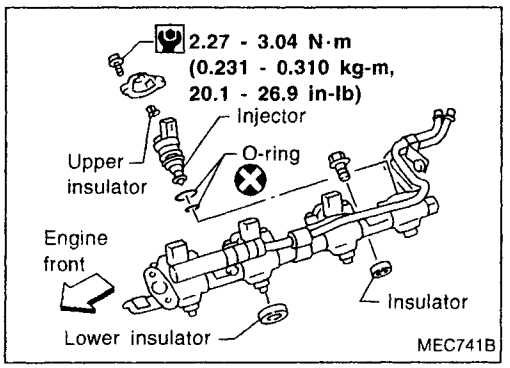
Fuel pressure should decrease as vacuum increases. If results are unsatisfactory, replace fuel pressure regulator.





Injector Removal and Installation

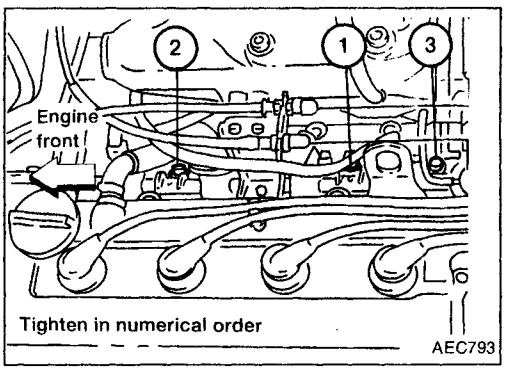
1. Release fuel pressure to zero.
2. Remove injector tube assembly with injectors from intake manifold.
3. Remove injectors from injector tube assembly.
- Push injector tail piece.
- Do not pull on the connector.



4. Install injectors.
- Clean exterior of injector tail piece.
- Use new O-rings.
- Face metal plate of upper insulator to injector.

CAUTION:
After properly connecting injectors to fuel tube assembly, check connections for fuel leakage.

5. Assemble injectors to injector tube assembly.
6. Install injector tube assembly to intake manifold.



7. Tighten fuel tube bolts to 7.86 - 10.8 N·m (0.801 - 1.10 kg-m, 5.8 - 8.0 ft-lb) as shown in the figure. Then tighten the bolts to 15.7 - 20.6 N·m (1.60 - 2.10 kg-m, 11.6 - 15.2 ft-lb).

Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment

PREPARATION

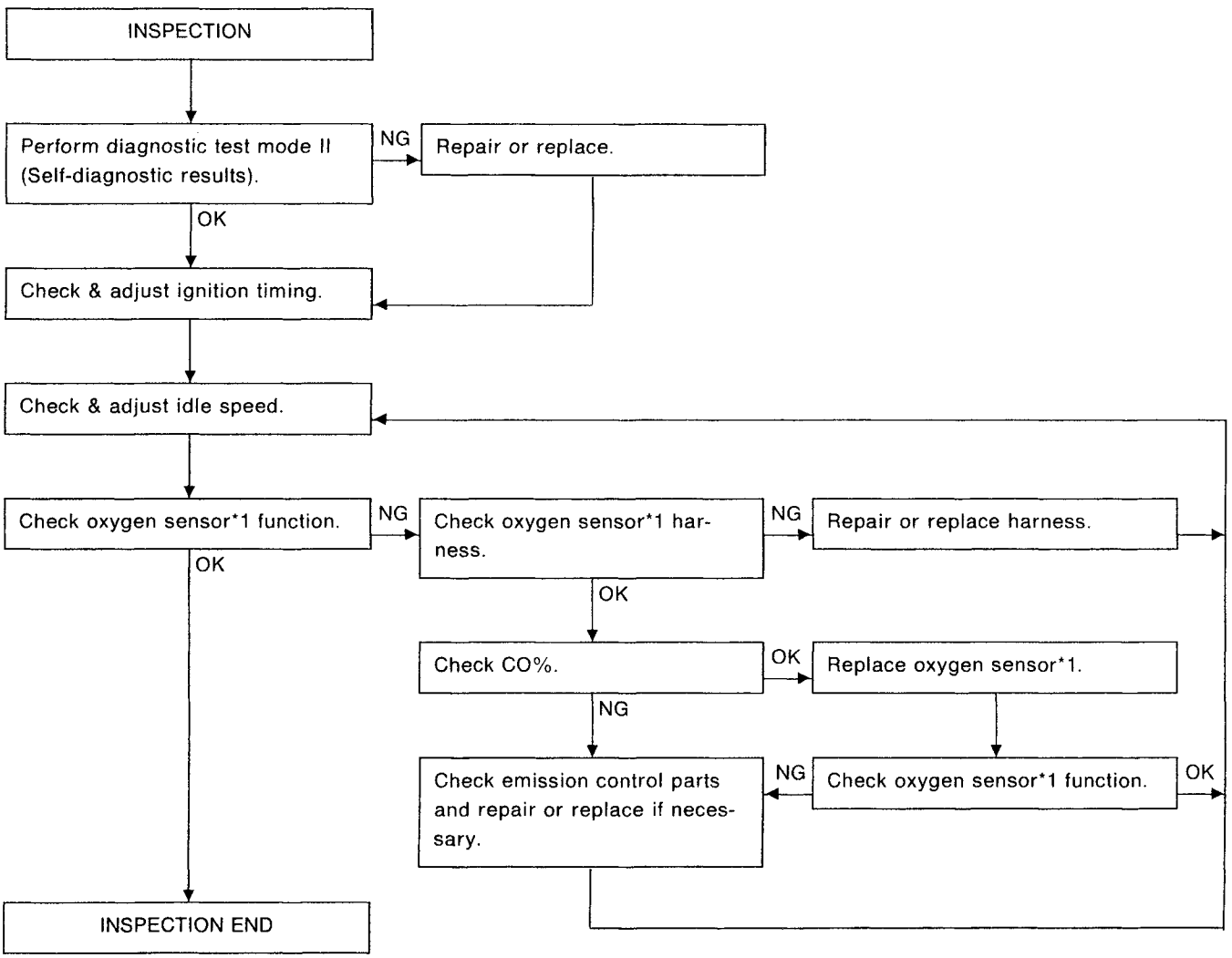
- Make sure that the following parts are in good order.

(1) Battery
(2) Ignition system
(3) Engine oil and coolant levels
(4) Fuses
(5) ECM harness connector
(6) Vacuum hoses
(7) Air intake system
(Oil filler cap, oil level gauge, etc.)
(8) Fuel pressure
(9) Engine compression
(10) Throttle valve
(11) EGR valve operation — For Europe and Israel and Australia, and GA15DE M/T models
(12) Evaporative emission system

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

EC

Overall inspection sequence



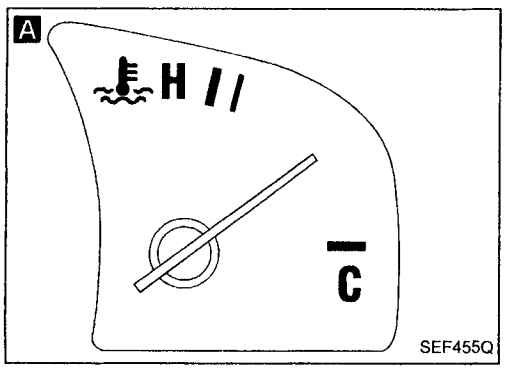
*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)

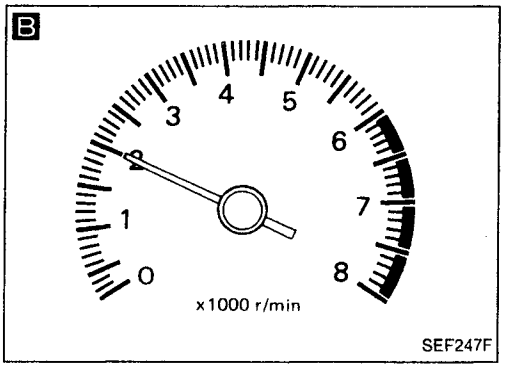
Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

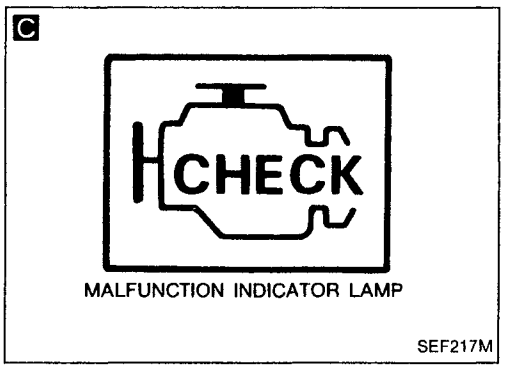
ADJUSTING VALUE

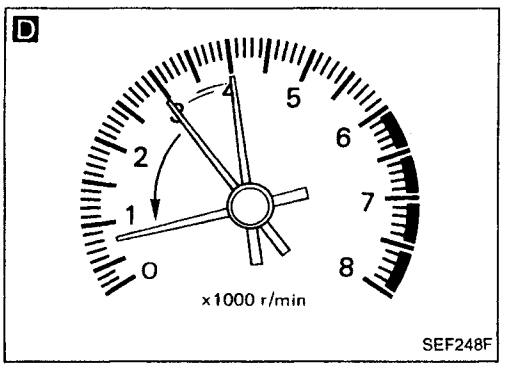
Engine models	GA14DE, GA16DE (For Europe and Israel)			GA15DE		GA16DE (For Australia)		GA16DE (Except for Europe and Israel, and Australia)	
Transaxle	M/T (With daytime light system)	M/T (Without daytime light system)	A/T (in "N" position)	M/T	A/T (in "N" position)	M/T	A/T (in "N" position)	M/T	A/T (in "N" position)
Base idle speed (rpm)	625 ± 50	625 ± 50	725 ± 50	580 ± 50	700 ± 50	625 ± 50	725 ± 50	600 ± 50	750 ± 50
Idle speed (rpm)	800 ± 50	700 ± 50	800 ± 50	630 ± 50	750 ± 50	675 ± 50	800 ± 50	650 ± 50	800 ± 50
Ignition timing (°BTDC)	10 ± 2	10 ± 2	10 ± 2	6 ± 2	6 ± 2	8 ± 2	8 ± 2	10 ± 2	10 ± 2

Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)









START

Visually check the following:
- Air cleaner clogging
- Hoses and ducts for leaks
- Electrical connectors
- Gasket
- Throttle valve and throttle position sensor operation

A

Start engine and warm it up until water temperature indicator points to the middle of gauge.
Ensure engine stays below 1,000 rpm.

B

Open engine hood and run engine at about 2,000 rpm for about 2 minutes under no-load.

C

Perform ECM on-board diagnostic system (Diagnostic test mode II).

OK

NG

Repair or replace components as necessary.

D

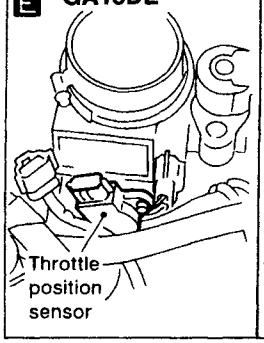
Run engine at about 2,000 rpm for about 2 minutes under no-load.
Race engine two or three times under no-load, then run engine for about 1 minute at idle speed.

Ⓐ

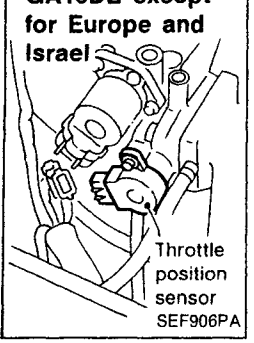
EC

Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

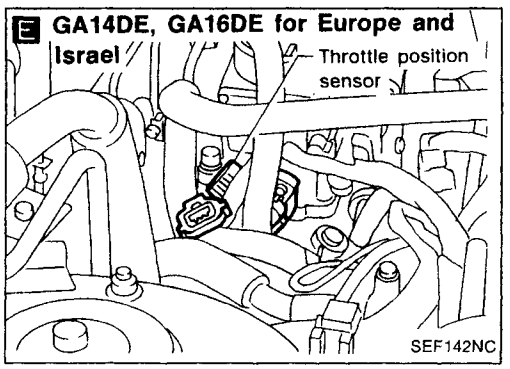
E GA15DE



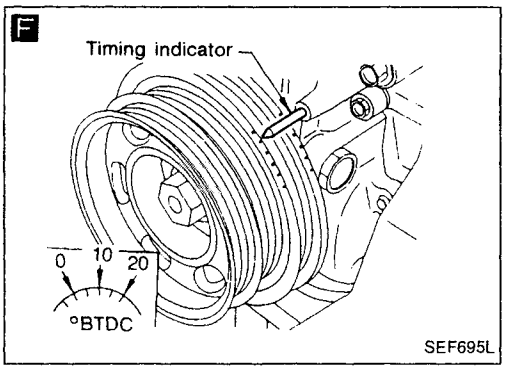
GA16DE except for Europe and Israel



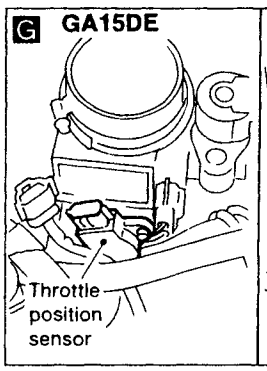
E GA14DE, GA16DE for Europe and Israel



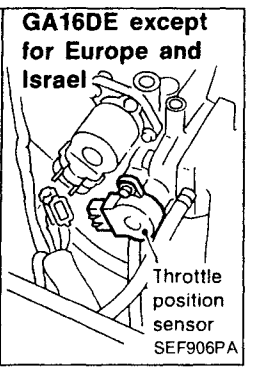
F



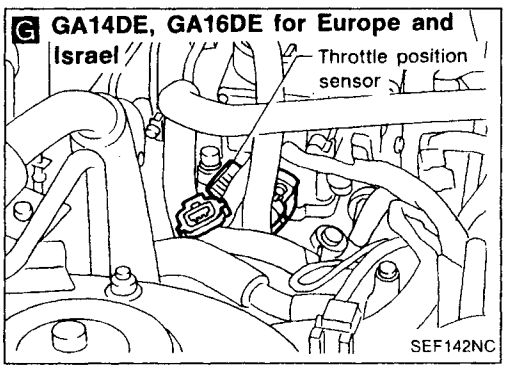
G GA15DE



GA16DE except for Europe and Israel



G GA14DE, GA16DE for Europe and Israel



Ⓐ

E 1) Turn off engine and disconnect throttle position sensor harness connector.
2) Start engine.

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

F

Check ignition timing with a timing light.

Ignition timing: Refer to EC-36.

OK

NG

Adjust ignition timing to the specified value by turning distributor after loosening bolts which secure distributor.

Ignition timing: Refer to EC-36.

Ⓑ

Ⓔ

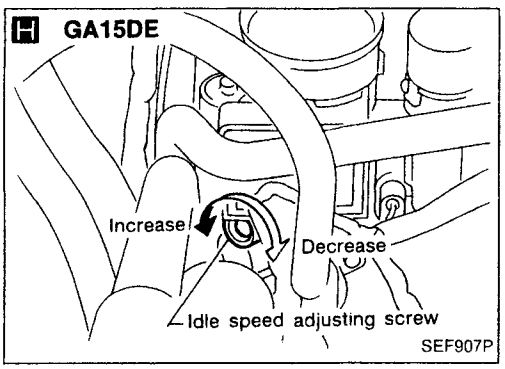
G 1) Turn off engine and disconnect throttle position sensor harness connector.
2) Start engine.

Ⓒ

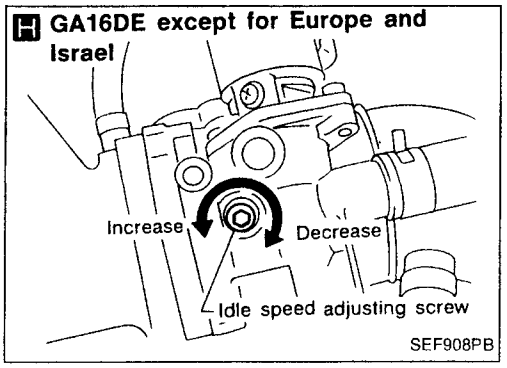
Ⓑ

Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

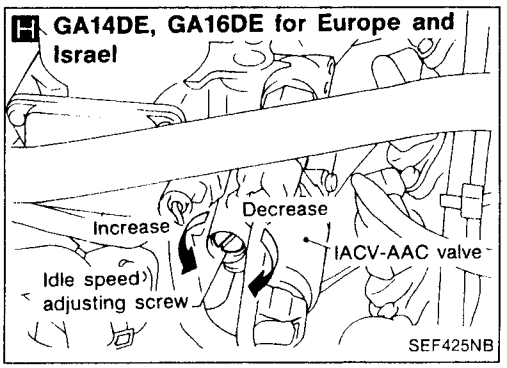
H GA15DE



H GA16DE except for Europe and Israel



H GA14DE, GA16DE for Europe and Israel



Ⓑ

Check base idle speed. Refer to EC-36.

OK / NG

Ⓒ

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

H

Adjust idle speed by turning idle speed adjusting screw.

Base idle speed: Refer to EC-36.

1) Turn off engine and connect throttle position sensor harness connector.
2) Start engine.

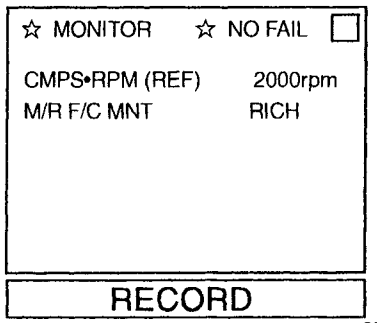
Start engine.
Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.

Ⓓ

EC

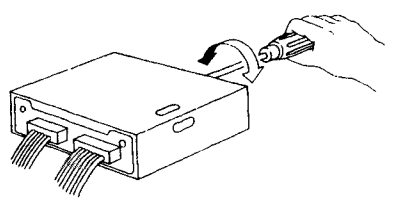
Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

I



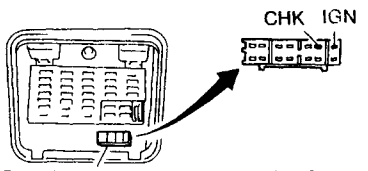
SEF515Q

J



SEF987K

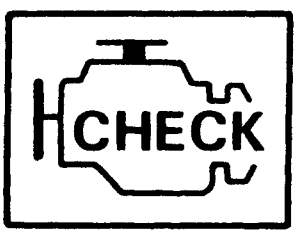
J



Data link connector for CONSULT (Connect CHK and IGN terminals with a suitable harness.)

SEF909P

K



MALFUNCTION INDICATOR LAMP

SEF217M

Ⓓ

Check idle speed. Refer to EC-36.

OK

NG

Check IACV-AAC valve and replace if necessary.

Check IACV-AAC valve harness and repair if necessary.

Check ECM function* by substituting another known good ECM.

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

I

1. See "M/R F/C MNT" in "Data monitor" mode.
2. Run engine at about 2,000 rpm for about 2 minutes under no-load.
3. Maintaining engine at 2,000 rpm under no-load (engine is warmed up sufficiently.), check that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.
   1 time : RICH → LEAN → RICH
   2 times : RICH → LEAN → RICH →LEAN → RICH

NG → Ⓕ

OR

J K

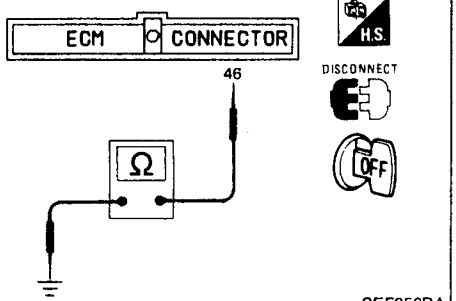
1. Set "Oxygen sensor monitor" in diagnostic test mode II. (See page EC-47.)
2. Run engine at about 2,000 rpm for about 2 minutes under no-load.
3. Maintaining engine at 2,000 rpm under no-load, check that the malfunction indicator lamp on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

OK

END

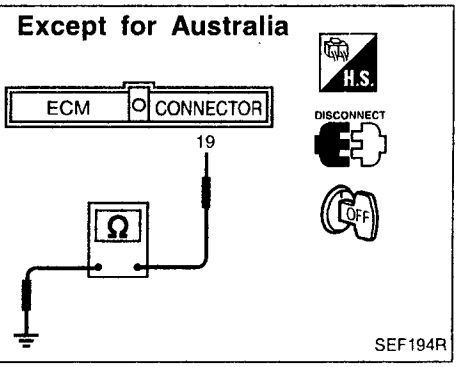
Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

L For Australia



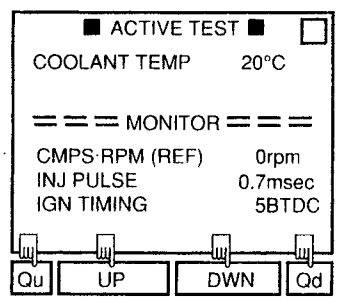
SEF056PA

L Except for Australia



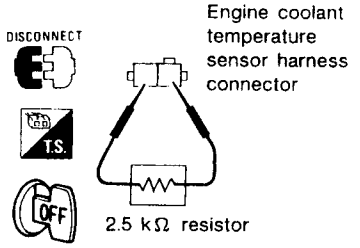
SEF194R

M



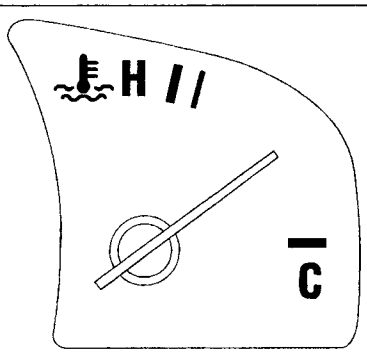
AEC681

N



SEC242BA

O



SEF455Q

Ⓕ

L

Check oxygen sensor*1 harness:
1) Turn off engine and disconnect battery ground cable.
2) Disconnect ECM harness connector from ECM.
3) Disconnect oxygen sensor*1 harness connector. Then connect harness side terminal for oxygen sensor*1 to ground with a jumper wire.
4) Check for continuity between terminal No. 46 or No. 19 of ECM harness connector and body ground.

Continuity exists .....OK
Continuity does not exist .....NG

*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)

OK / NG

NG → Repair or replace harness. → Ⓔ

OK → Connect ECM harness connector to control unit.

M **N**

1) Connect battery ground cable.
2) Select "ENG COOLANT TEMP" in "ACTIVE TEST" mode.
3) Set "COOLANT TEMP" to 20°C (68°F) by touching "Qu" and "Qd" and "UP", "DWN".

OR

1) Disconnect engine coolant temperature sensor harness connector.
2) Connect a resistor (2.5 kΩ) between terminals of engine coolant temperature sensor harness connector.

O

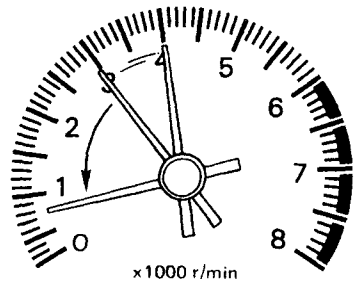
Start engine and warm it up until water temperature indicator points to middle of gauge.

Ⓖ

EC

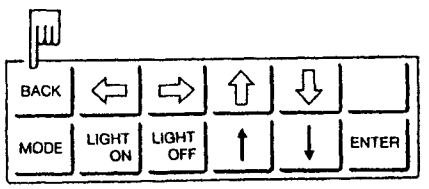
Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

P



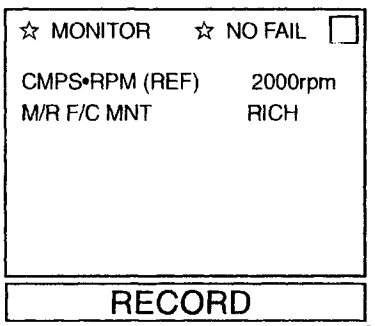
SEF248F

Q



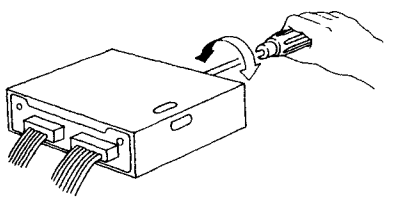
SEF913J

R



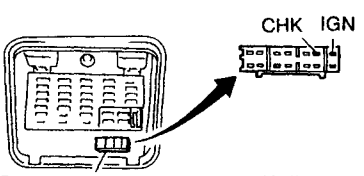
SEF515Q

S



SEF987K

S



Data link connector for CONSULT (Connect CHK and IGN terminals with a suitable harness.)

SEF909P

Ⓖ

P

Race engine two or three times under no-load, then run engine at idle speed.

Check "CO"%.

Idle CO: Less than 10%

Q

After checking CO%,

1) Touch "BACK".

1) Disconnect the resistor from terminals of engine coolant temperature sensor harness connector.
2) Connect engine coolant temperature sensor harness connector to engine coolant temperature sensor.

NG

OK

Replace oxygen sensor*1.

R

1. See "M/R F/C MNT" in "Data monitor" mode.
2. Maintaining engine at 2,000 rpm under no-load (engine is warmed up sufficiently.), check that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.
   1 time : RICH → LEAN → RICH
   2 times : RICH → LEAN → RICH → LEAN → RICH

OR

S

1. Set "Oxygen sensor monitor" in diagnostic test mode II.
   (See page EC-47.)
2. Maintaining engine at 2,000 rpm under no-load, check that the malfunction indicator lamp on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

NG

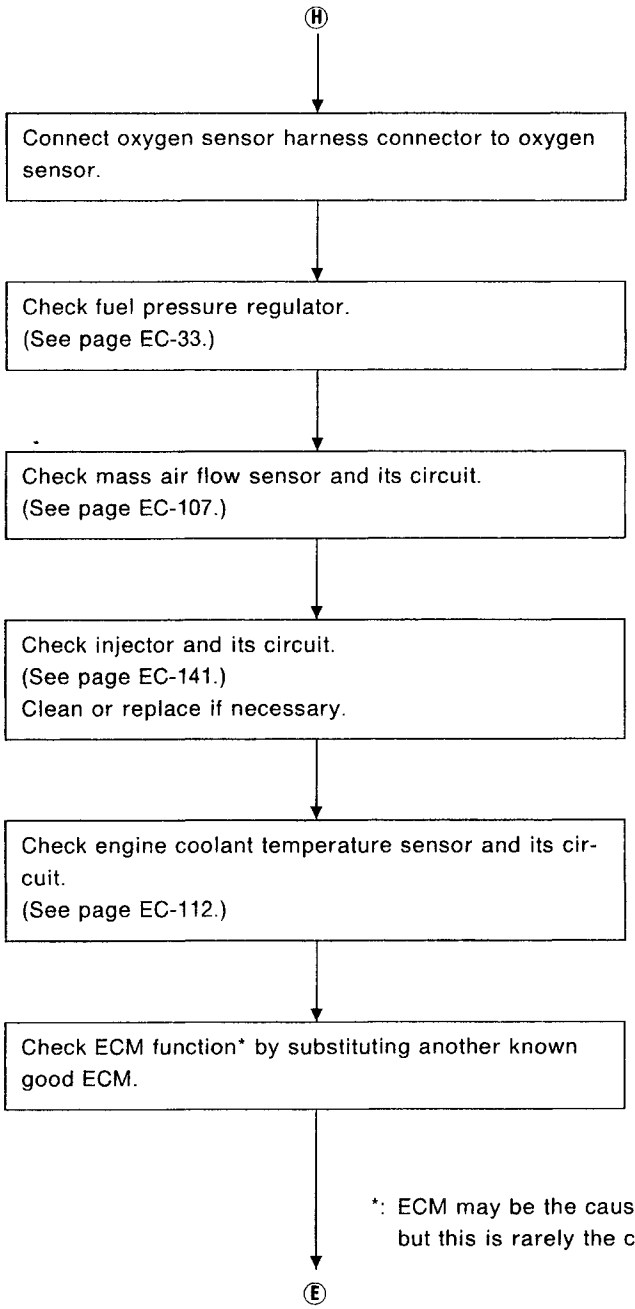
OK

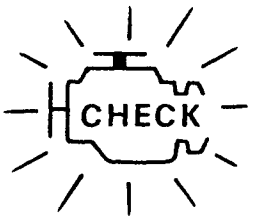
Ⓗ

Ⓔ

*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)

Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)





Malfunction indicator lamp

SEF051PA

Malfunction Indicator Lamp (MIL)

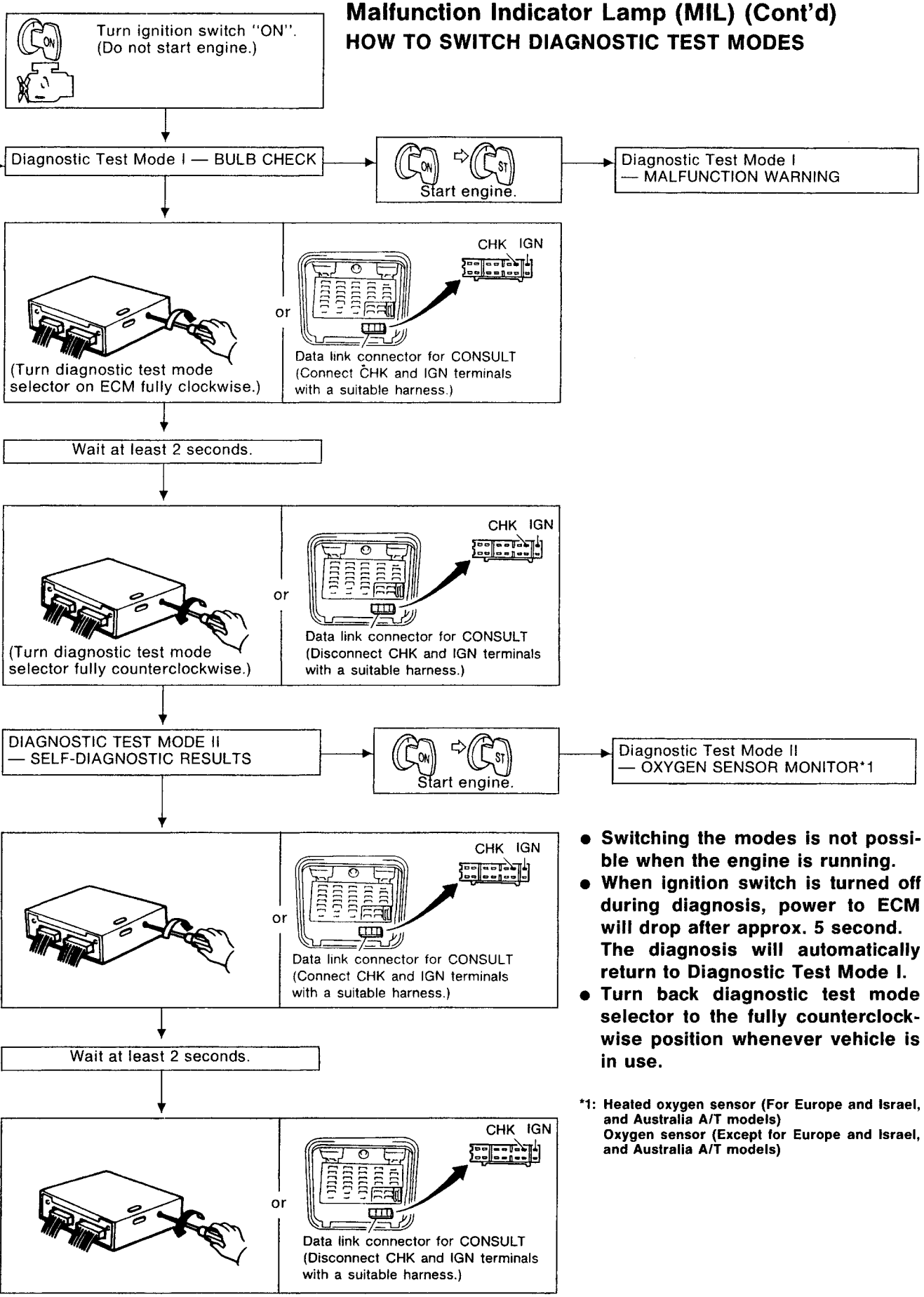
1. The malfunction indicator lamp will light up when the ignition switch is turned ON without the engine running. This is a bulb check.
- If the malfunction indicator lamp does not light up, refer to EL section ("WARNING LAMPS AND CHIME") or see EC-223.
2. When the engine is started, the malfunction indicator lamp should go off.

Condition		Diagnostic Test Mode I	Diagnostic Test Mode II
Ignition switch in "ON" position 	Engine stopped 	BULB CHECK	SELF-DIAGNOSTIC RESULTS
	Engine running 	MALFUNCTION WARNING	*1 OXYGEN SENSOR MONITOR

*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)

Malfunction Indicator Lamp (MIL) (Cont'd)

HOW TO SWITCH DIAGNOSTIC TEST MODES



- **Switching the modes is not possible when the engine is running.**
- **When ignition switch is turned off during diagnosis, power to ECM will drop after approx. 5 second. The diagnosis will automatically return to Diagnostic Test Mode I.**
- **Turn back diagnostic test mode selector to the fully counterclockwise position whenever vehicle is in use.**

***1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)**
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)

EC

Malfunction Indicator Lamp (MIL) (Cont'd)

DIAGNOSTIC TEST MODE I—BULB CHECK

In this mode, the MALFUNCTION INDICATOR LAMP on the instrument panel should stay ON. If it remains OFF, check the bulb. Refer to EL section ("WARNING LAMPS AND CHIME") or see EC-223.

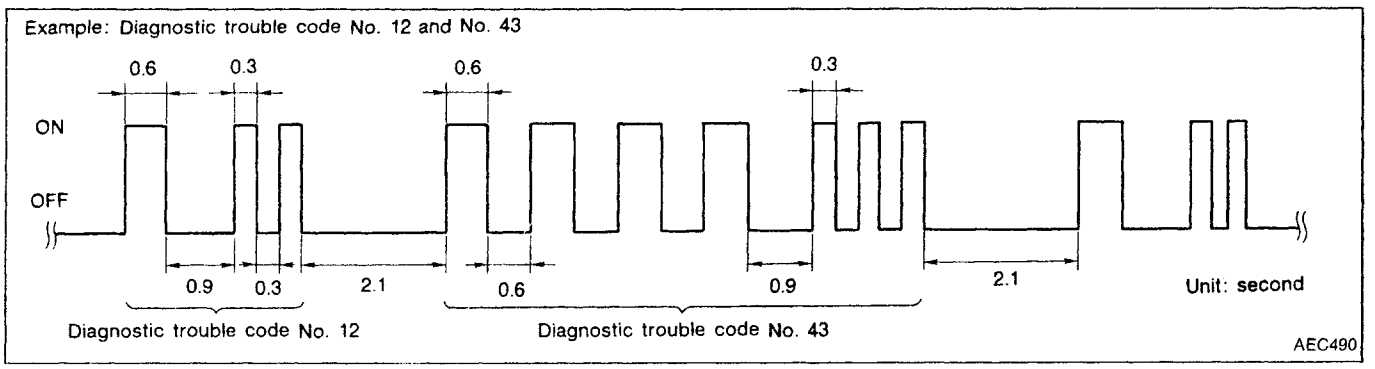
DIAGNOSTIC TEST MODE I—MALFUNCTION WARNING

MALFUNCTION INDICATOR LAMP	Condition
ON	Engine coolant temperature sensor circuit malfunction or overheating is detected, or the ECM's CPU is malfunctioning.
OFF	No malfunction.

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

DIAGNOSTIC TEST MODE II—SELF-DIAGNOSTIC RESULTS

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

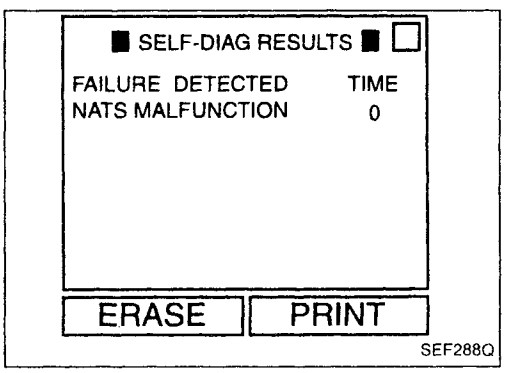


Long (0.6 second) blinking indicates the number of ten digits, and short (0.3 second) blinking indicates the number of single digits. For example, the malfunction indicator lamp blinks 4 times for about 2.5 seconds (0.6 sec x 4 times) and then it blinks three times for about 1 second (0.3 sec x 3 times). This indicates the DTC "43" and refers to the malfunction of the throttle position sensor.
In this way, all the detected malfunctions are classified by their diagnostic trouble code numbers. The DTC "55" refers to no malfunction. (See DIAGNOSTIC TROUBLE CODE CHART, refer to EC-62.)

HOW TO ERASE DIAGNOSTIC TEST MODE II (Self-diagnostic results)

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

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



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

Malfunction Indicator Lamp (MIL) (Cont'd)

DIAGNOSTIC TEST MODE II—OXYGEN SENSOR*1 MONITOR

In this mode, the MALFUNCTION INDICATOR LAMP displays the condition of the fuel mixture (lean or rich) which is monitored by the oxygen sensor*1.

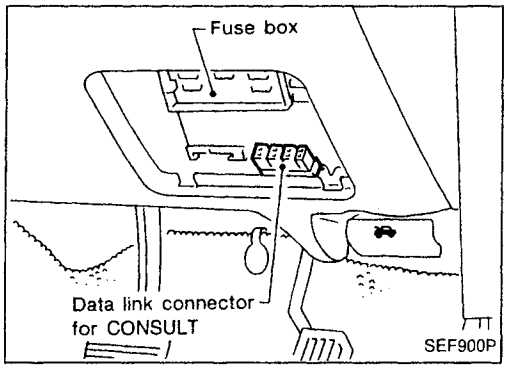
MALFUNCTION INDICATOR LAMP	Fuel mixture condition in the exhaust gas	Air fuel ratio feedback control condition
ON	Lean	Closed loop system
OFF	Rich	
*2 Remains ON or OFF	Any condition	Open loop system

*2: Maintains conditions just before switching to open loop.

To check the oxygen sensor*1 function, start engine in Diagnostic Test Mode II. Then warm it up until engine coolant temperature indicator points to middle of gauge.
Next run engine at about 2,000 rpm for about 2 minutes under no-load conditions. Make sure that the MALFUNCTION INDICATOR LAMP comes ON more than 5 times within 10 seconds with engine running at 2,000 rpm under no-load.

*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)

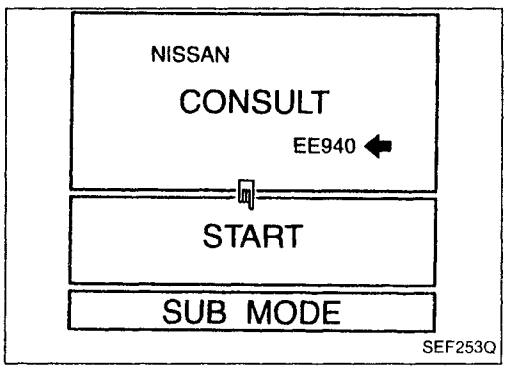
EC



CONSULT

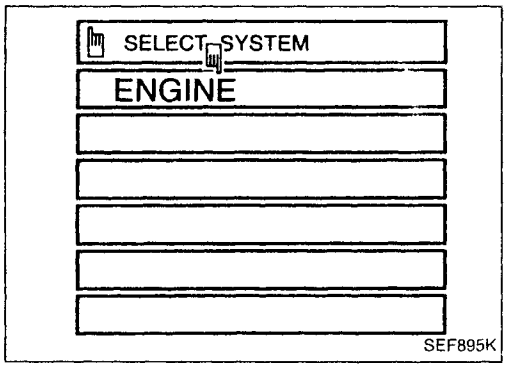
CONSULT INSPECTION PROCEDURE

1. Turn off ignition switch.
2. Connect "CONSULT" to data link connector for CONSULT. (Data link connector for CONSULT is located behind the fuse box cover.)

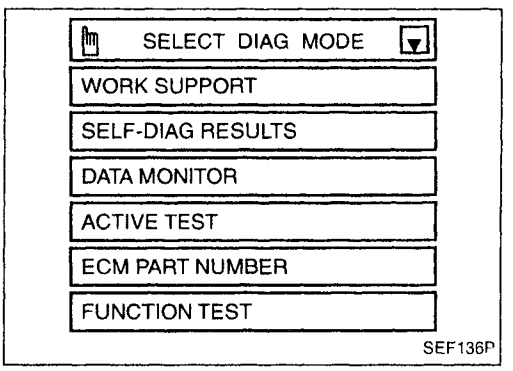


3. Turn on ignition switch.
4. Touch "START".

⬅: Program card
AE930: For Australia
EE940: Except for Australia



5. Touch "ENGINE".



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

For further information, see the CONSULT Operation Manual.

CONSULT (Cont'd)

ECCS COMPONENT PARTS/CONTROL SYSTEMS APPLICATION

		Item	DIAGNOSTIC TEST MODE				
			WORK SUPPORT	SELF-DIAGNOSTIC RESULTS	DATA MONITOR	ACTIVE TEST	FUNCTION TEST
ECCS COMPONENT PARTS	INPUT	Camshaft position sensor		X	X		
		Mass air flow sensor		X	X		
		Engine coolant temperature sensor		X	X	X	
		Oxygen sensor*1		X	X		X
		Vehicle speed sensor			X		X
		Throttle position sensor	X	X	X		X
		Intake air temperature sensor*2		X	X		
		Knock sensor*3		X			
		Ignition switch (start signal)			X		X
		Closed throttle position			X		X
		Air conditioner switch			X		
		Park/Neutral position switch			X		X
		Power steering oil pressure switch			X		X
		Electrical load signal			X		
		Battery voltage			X		
	OUTPUT	Injectors			X	X	X
		Power transistor (Ignition timing)	X	X (Ignition signal)	X	X	X
		IACV-AAC valve	X		X	X	X
		Valve timing control solenoid valve			X	X	X
		Air conditioner relay			X		
		Fuel pump relay	X		X	X	X
		Cooling fan			X	X	X
		EVAP canister purge control solenoid valve*4			X	X	X
		EGR valve & EVAP canister purge control solenoid valve*5			X	X	X

X: Applicable
*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)
*2: For Australia
*3: Except for Australia
*4: GA16DE M/T models except for Europe and Israel, and Australia
*5: For Europe and Israel and Australia, and GA15DE M/T models

EC

CONSULT (Cont'd)

FUNCTION

Diagnostic test mode	Function
Work support	A technician can adjust some devices faster and more accurately by following indications on CONSULT.
Self-diagnostic results	Self-diagnostic results can be read and erased quickly.
Data monitor	Input/Output data in the ECM can be read.
Active test	CONSULT drives some actuators apart from the ECM's and also shifts some parameters in a specified range.
ECM part numbers	ECM part numbers can be read.
Function test	Conducted by CONSULT instead of a technician to determine whether each system is "OK" or "NG".

WORK SUPPORT MODE

WORK ITEM	CONDITION	USAGE
THRTL POS SEN ADJ	CHECK THE THROTTLE POSITION SENSOR SIGNAL. ADJUST IT TO THE SPECIFIED VALUE BY ROTATING THE SENSOR BODY UNDER THE FOLLOWING CONDITIONS. • IGN SW "ON" • ENG NOT RUNNING • ACC PEDAL NOT PRESSED	When adjusting throttle position sensor initial position
IGNITION TIMING ADJ	• IGNITION TIMING FEEDBACK CONTROL WILL BE HELD BY TOUCHING "START". AFTER DOING SO, ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CAMSHAFT POSITION SENSOR.	When adjusting initial ignition timing
IACV-AAC VALVE ADJ	SET ENGINE SPEED AT THE SPECIFIED VALUE UNDER THE FOLLOWING CONDITIONS. • ENGINE WARMED UP • NO-LOAD	—
FUEL PRESSURE RELEASE	• FUEL PUMP WILL STOP BY TOUCHING "START" DURING IDLING. CRANK A FEW TIMES AFTER ENGINE STALLS.	When releasing fuel pressure from fuel line

CONSULT (Cont'd)

SELF-DIAGNOSTIC MODE

Regarding items detected in "SELF-DIAG RESULTS" mode, refer to "Diagnostic Trouble Code (DTC) Chart" (Refer to EC-62.)

DATA MONITOR MODE

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
CMPS·RPM (REF) [rpm]	○	○	• Indicates the engine speed computed from the REF signal (180° signal) of the camshaft position sensor.	• Accuracy becomes poor if engine speed drops below the idle rpm. • If the signal is interrupted while the engine is running, an abnormal value may be indicated.
MAS AIR/FL SE [V]	○	○	• The signal voltage of the mass air flow sensor is displayed.	• When the engine is stopped, a certain value is indicated.
COOLAN TEMP/S [°C] or [°F]	○	○	• The engine coolant temperature (determined by the signal voltage of the engine coolant temperature sensor) is displayed.	• When the engine coolant temperature sensor is open or short-circuited, ECM enters fail-safe mode. The engine coolant temperature determined by the ECM is displayed.
O2 SENSOR [V]	○	○	• The signal voltage of the oxygen sensor*1 is displayed.	
M/R F/C MNT [RICH/LEAN]	○	○	• Display of oxygen sensor signal during air-fuel ratio feedback control: RICH ... means the mixture became "rich", and control is being affected toward a leaner mixture. LEAN ... means the mixture became "lean", and control is being affected toward a rich mixture.	• After turning ON the ignition switch, "RICH" is displayed until air-fuel mixture ratio feedback control begins. • When the air-fuel ratio feedback is clamped, the value just before the clamping is displayed continuously.
VHCL SPEED SE [km/h] or [mph]	○	○	• The vehicle speed computed from the vehicle speed sensor signal is displayed.	
BATTERY VOLT [V]	○	○	• The power supply voltage of ECM is displayed.	
THRTL POS SEN [V]	○	○	• The throttle position sensor signal voltage is displayed.	
INT/A TEMP SE [°C] or [°F]*2	○		• The intake air temperature determined by the signal voltage of the intake air temperature sensor is indicated.	
START SIGNAL [ON/OFF]	○	○	• Indicates [ON/OFF] condition from the starter signal.	• After starting the engine, [OFF] is displayed regardless of the starter signal.
CLSD THL/POSI [ON/OFF]	○	○	• Indicates the closed throttle position [ON/OFF] determined by the throttle position sensor signal. ON: Closed throttle position OFF: Other than closed throttle position	
AIR COND SIG [ON/OFF]	○	○	• Indicates [ON/OFF] condition of the air conditioner switch as determined by the air conditioning signal.	
P/N POSI SW [ON/OFF]	○	○	• Indicates [ON/OFF] condition from the park/neutral position switch signal.	
PW/ST SIGNAL [ON/OFF]	○	○	• Indicates [ON/OFF] condition of the power steering oil pressure switch determined by the power steering oil pressure signal.	

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

*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)
*2: For Australia

CONSULT (Cont'd)

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
LOAD SIGNAL [ON/OFF]	○	○	• Indicates [ON/OFF] condition from the rear defogger signal and/or lighting switch. ON: Rear defogger is operating and/or lighting switch is on. OFF: Rear defogger is not operating and lighting switch is not on.	
INJ PULSE [msec]		○	• Indicates the actual fuel injection pulse width compensated by ECM according to the input signals.	• When the engine is stopped, a certain computed value is indicated.
IGN TIMING [BTDC]		○	• Indicates the ignition timing computed by ECM according to the input signals.	
IACV-AAC/V [%]		○	• Indicates the idle air control valve (AAC valve) control value computed by ECM according to the input signals.	
A/F ALPHA [%]		○	• Indicates the mean value of the air-fuel ratio feedback correction factor per cycle.	• When the engine is stopped, a certain value is indicated. • This data also includes the data for the air-fuel ratio learning control.
AIR COND RLY [ON/OFF]		○	• Indicates the air conditioner relay control condition (determined by ECM according to the input signal).	
COOLING FAN*2 [ON/OFF] or [LOW/HI/OFF]		○	• Indicates the control condition of the cooling fans (determined by ECM according to the input signal). ON ... Operating LOW ... Operates at low speed HI ... Operates at high speed OFF ... Stopped	
FUEL PUMP RLY [ON/OFF]		○	• Indicates the fuel pump relay control condition determined by ECM according to the input signals.	
VALVE TIM SOL*1 [ON/OFF]			• The control condition of the valve timing solenoid valve (determined by ECM according to the input signal) is indicated. ON ... VTC operating OFF ... VTC not operating	
EGRC SOL/V (EVAP canister purge control solenoid valve or EGR & EVAP canister purge control solenoid valve) [ON/OFF]		○	• Indicates the control condition of the EVAP canister purge control solenoid valve or EGR valve & EVAP canister purge control solenoid valve (determined by ECM according to the input signal). ON ... EVAP canister purge operation cut-off OFF ... EVAP canister purge operation not cut-off	
VOLTAGE [V]			• Voltage measured by the voltage probe.	
PULSE [msec] or [Hz] or [%]			• Pulse width, frequency or duty cycle measured by the pulse probe.	• Only "#" is displayed if item is unable to be measured. • Figures with "#"s are temporary ones. They are the same figures as an actual piece of data which was just previously measured.

*1: GA16DE except for Europe and Israel

*2: GA16DE engine A/T models for Europe without heavy duty kit have a 2- step control [ON/OFF] system. "LOW" and "HI" are shown on CONSULT screen to represent "ON" condition.

CONSULT (Cont'd)

ACTIVE TEST MODE

TEST ITEM	CONDITION	JUDGEMENT	CHECK ITEM (REMEDY)
FUEL INJECTION	• Engine: Return to the original trouble condition • Change the amount of fuel injection using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Harness and connector • Fuel injectors • Oxygen sensor*1
IACV-AAC/V OPENING	• Engine: After warming up, idle the engine. • Change the IACV-AAC valve opening percent using CONSULT.	Engine speed changes according to the opening percent.	• Harness and connector • IACV-AAC valve
ENG COOLANT TEMP	• Engine: Return to the original trouble condition • Change the engine coolant temperature indication using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Harness and connector • Engine coolant temperature sensor • Fuel injectors
IGNITION TIMING	• Engine: Return to the original trouble condition • Timing light: Set • Retard the ignition timing using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Adjust initial ignition timing
POWER BALANCE	• Engine: After warming up, idle the engine. • A/C switch "OFF" • Shift lever "N" • Cut off each injector signal one at a time using CONSULT.	Engine runs rough or dies.	• Harness and connector • Compression • Injectors • Power transistor • Spark plugs • Ignition coils
COOLING FAN*3	• Ignition switch: ON • Turn the cooling fan "ON" and "OFF", or "LOW" and "HI" and "OFF" using CONSULT.	Cooling fan moves and stops.	• Harness and connector • Cooling fan motor
FUEL PUMP RELAY	• Ignition switch: ON (Engine stopped) • Turn the fuel pump relay "ON" and "OFF" using CONSULT and listen to operating sound.	Fuel pump relay makes the operating sound.	• Harness and connector • Fuel pump relay
EGRC SOLENOID VALVE (EVAP canister purge control solenoid valve or EGR valve & EVAP canister purge control solenoid valve)	• Ignition switch: ON • Turn solenoid valve "ON" and "OFF" with the CONSULT and listen to operating sound.	Solenoid valve makes an operating sound.	• Harness and connector • Solenoid valve
VALVE TIMING SOL*2	• Ignition switch: ON • Turn solenoid valve "ON" and "OFF" using CONSULT and listen to operating sound.	Solenoid valve makes an operating sound.	• Harness and connector • Solenoid valve
SELF-LEARNING CONT	• In this test, the coefficient of self-learning control mixture ratio returns to the original coefficient by touching "CLEAR" on the screen.		

*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)
*2: GA16DE except for Europe and Israel
*3: GA16DE engine A/T models for Europe without heavy duty kit have a 2- step control [ON/OFF] system. "LOW" and "HI" are shown on CONSULT screen to represent "ON" condition.

CONSULT (Cont'd)

FUNCTION TEST MODE

FUNCTION TEST ITEM	CONDITION	JUDGEMENT		CHECK ITEM (REMEDY)
SELF-DIAG RESULTS	• Ignition switch: ON (Engine stopped) • Displays the results of on-board diagnostic system.	—		Objective system
CLOSED THROTTLE POSI	• Ignition switch: ON (Engine stopped) • Closed throttle position is tested when throttle is opened and closed fully. (Closed throttle position is selected by throttle position sensor.)	Throttle valve: opened	OFF	• Harness and connector • Throttle position sensor • Throttle position sensor adjustment • Throttle linkage • Verify operation in DATA MONITOR mode.
		Throttle valve: closed	ON	
THROTTLE POSI SEN CKT	• Ignition switch: ON (Engine stopped) • Throttle position sensor circuit is tested when throttle is opened and closed fully.	Range (Throttle valve fully opened — Throttle valve fully closed)	More than 3.0V	• Harness and connector • Throttle position sensor • Throttle position sensor adjustment • Throttle linkage • Verify operation in DATA MONITOR mode.
PARK/NEUT POSI SW CKT	• Ignition switch: ON (Engine stopped) • Inhibitor/Neutral position switch circuit is tested when shift lever is manipulated.	Out of N/P positions	OFF	• Harness and connector • Neutral position switch or inhibitor switch • Linkage or inhibitor switch adjustment
		In N/P positions	ON	
FUEL PUMP CIRCUIT	• Ignition switch: ON (Engine stopped) • Fuel pump circuit is tested by checking the pulsation in fuel pressure when fuel tube is pinched.	There is pressure pulsation on the fuel feed hose.		• Harness and connector • Fuel pump • Fuel pump relay • Fuel filter clogging • Fuel level
EGRC SOL/V CIRCUIT (EVAP canister purge control solenoid valve or EGR valve & EVAP canister purge control solenoid valve)	• Ignition switch: ON (Engine stopped) • EVAP canister purge control solenoid valve or EGR valve & EVAP canister purge control solenoid valve circuit is tested by checking solenoid valve operating noise.	The solenoid valve makes an operating sound every 3 seconds.		• Harness and connector • EVAP canister purge control solenoid valve or EGR valve & EVAP canister purge control solenoid valve
VALVE TIMING S/V CKT*1	• Ignition switch: ON (Engine stopped) • Valve timing S/V circuit is tested by checking solenoid valve operating sound	The solenoid valve makes an operating sound periodically.		• Harness and connector • Valve timing solenoid valve

*1: GA16DE except for Europe and Israel

CONSULT (Cont'd)

FUNCTION TEST ITEM	CONDITION	JUDGEMENT		CHECK ITEM (REMEDY)
COOLING FAN CIRCUIT	• Ignition switch: ON (Engine stopped) • Cooling fan circuit is tested when cooling fan is rotated.	The cooling fan rotates and stops every 3 seconds.		• Harness and connector • Cooling fan motor • Cooling fan relay
START SIGNAL CIRCUIT	• Ignition switch: ON → START • Start signal circuit is tested when engine is started by operating the starter. Before cranking, battery voltage and engine coolant temperature are displayed. During cranking, average battery voltage, mass air flow sensor output voltage and cranking speed are displayed.	Start signal: OFF → ON		• Harness and connector • Ignition switch
PW/ST SIGNAL CIRCUIT	• Ignition switch: ON (Engine running) • Power steering circuit is tested when steering wheel is rotated fully and then set to a straight line running position.	Locked position	ON	• Harness and connector • Power steering oil pressure switch • Power steering pump
		Neutral position	OFF	
VEHICLE SPEED SEN CKT	• Vehicle speed sensor circuit is tested when vehicle is running at a speed of 10 km/h (6 MPH) or higher.	Vehicle speed sensor input signal is greater than 4 km/h (2 MPH)		• Harness and connector • Vehicle speed sensor • Electric speedometer
IGN TIMING ADJ	• After warming up, idle the engine. • Ignition timing adjustment is checked by reading ignition timing with a timing light and checking whether it agrees with specifications.	The timing light indicates the same value on the screen.		• Adjust ignition timing (by moving camshaft position sensor or distributor) • Camshaft position sensor drive mechanism
MIXTURE RATIO TEST	• Air-fuel ratio feedback circuit (injection system, ignition system, vacuum system, etc.) is tested by examining the oxygen sensor*1 output at 2,000 rpm under non-loaded state.	Oxygen sensor*1 COUNT: More than 5 times during 10 seconds		• INJECTION SYS (Injector, fuel pressure regulator, harness or connector) • IGNITION SYS (Spark plug, power transistor, ignition coil, harness or connector) • VACUUM SYS (Intake air leaks) • Oxygen sensor*1 circuit • Oxygen sensor*1 operation • Fuel pressure high or low • Mass air flow sensor

*1: Heated oxygen sensor (For Europe and Israel, and Australia A/T models)
Oxygen sensor (Except for Europe and Israel, and Australia A/T models)

CONSULT (Cont'd)

FUNCTION TEST ITEM	CONDITION	JUDGEMENT	CHECK ITEM (REMEDY)
POWER BALANCE	• After warming up, idle the engine. • Injector operation of each cylinder is stopped one after another, and resultant change in engine rotation is examined to evaluate combustion of each cylinder. (This is only displayed for models where a sequential multiport fuel injection system is used.)	Difference in engine speed is greater than 25 rpm before and after cutting off the injector of each cylinder.	• Injector circuit (Injector, harness or connector) • Ignition circuit (Spark plug, power transistor, ignition coil, harness or connector) • Compression • Valve timing
IACV-AAC/V SYSTEM	• After warming up, idle the engine. • IACV-AAC valve system is tested by detecting change in engine speed when IACV-AAC valve opening is changed to 0%, 20% and 80%.	Difference in engine speed is greater than 150 rpm between when valve opening is at 80% and at 20%.	• Harness and connector • IACV-AAC valve • Air passage restriction between air inlet and IACV-AAC valve • IAS (Idle adjusting screw) adjustment

CONSULT (Cont'd)

REAL TIME DIAGNOSIS IN DATA MONITOR MODE

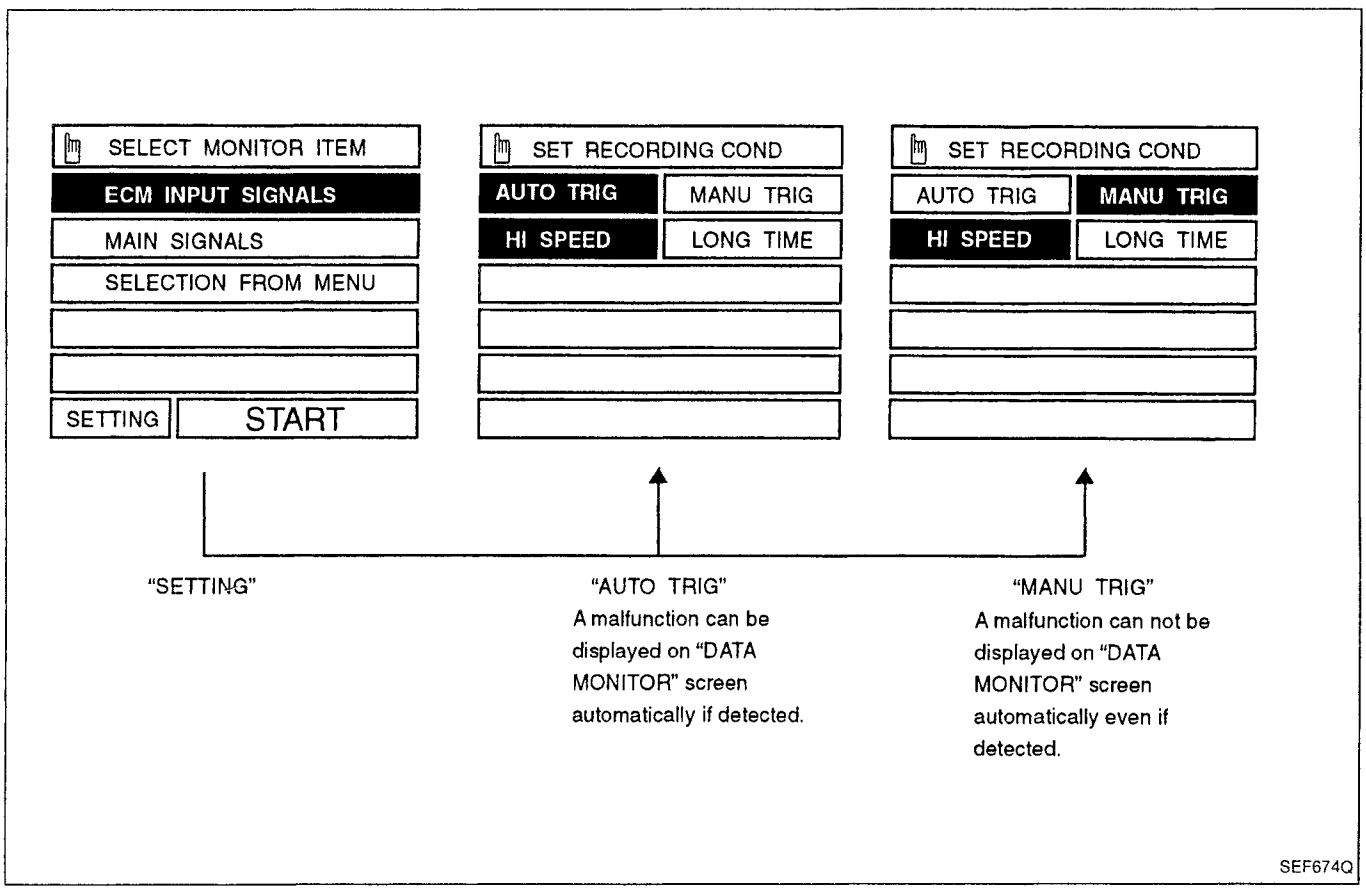
CONSULT has two kinds of triggers and they can be selected by touching "SETTING" in "DATA MONITOR" mode.

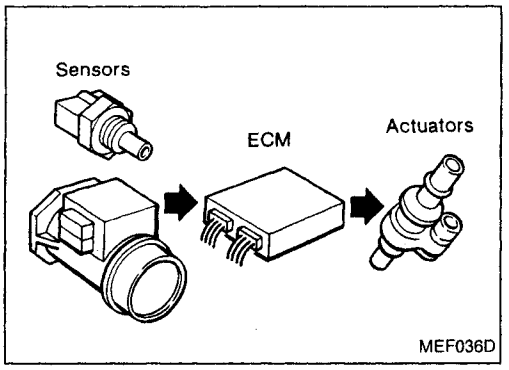
1. "AUTO TRIG" (Automatic trigger):
   - The malfunction will be identified on the CONSULT screen in real time.
     In other words, DTC and malfunction item will be displayed at the moment the malfunction is detected by ECM.
     DATA MONITOR can be performed continuously until a malfunction is detected.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

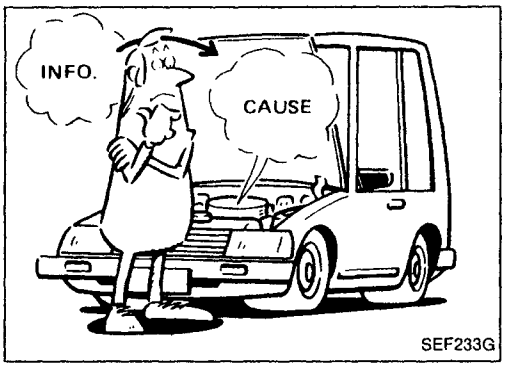
EC

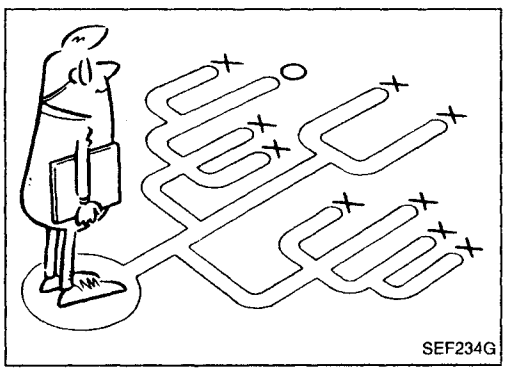
Use these triggers as follows:

1. "AUTO TRIG"
   - While trying to detect the DTC by performing the "DTC CONFIRMATION PROCEDURE", be sure to select to "DATA MONITOR (AUTO TRIG)" mode. You can confirm the malfunction at the moment it is detected.
   - While narrowing down the possible causes, CONSULT should be set in "DATA MONITOR (AUTO TRIG)" mode, especially in case the incident is intermittent.
     Inspect the circuit by gently shaking (or twisting) suspicious connectors, components and harness in the "DTC CONFIRMATION PROCEDURE". The moment a malfunction is found the DTC will be displayed. (Refer to GI section, "Incident Simulation Tests" in "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT".)
2. "MANU TRIG"
   - If the malfunction is displayed as soon as "DATA MONITOR" is selected, reset CONSULT to "MANU TRIG". By selecting "MANU TRIG" you can monitor and store the data. The data can be utilized for further diagnosis, such as a comparison with the value for the normal operating condition.









Introduction

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

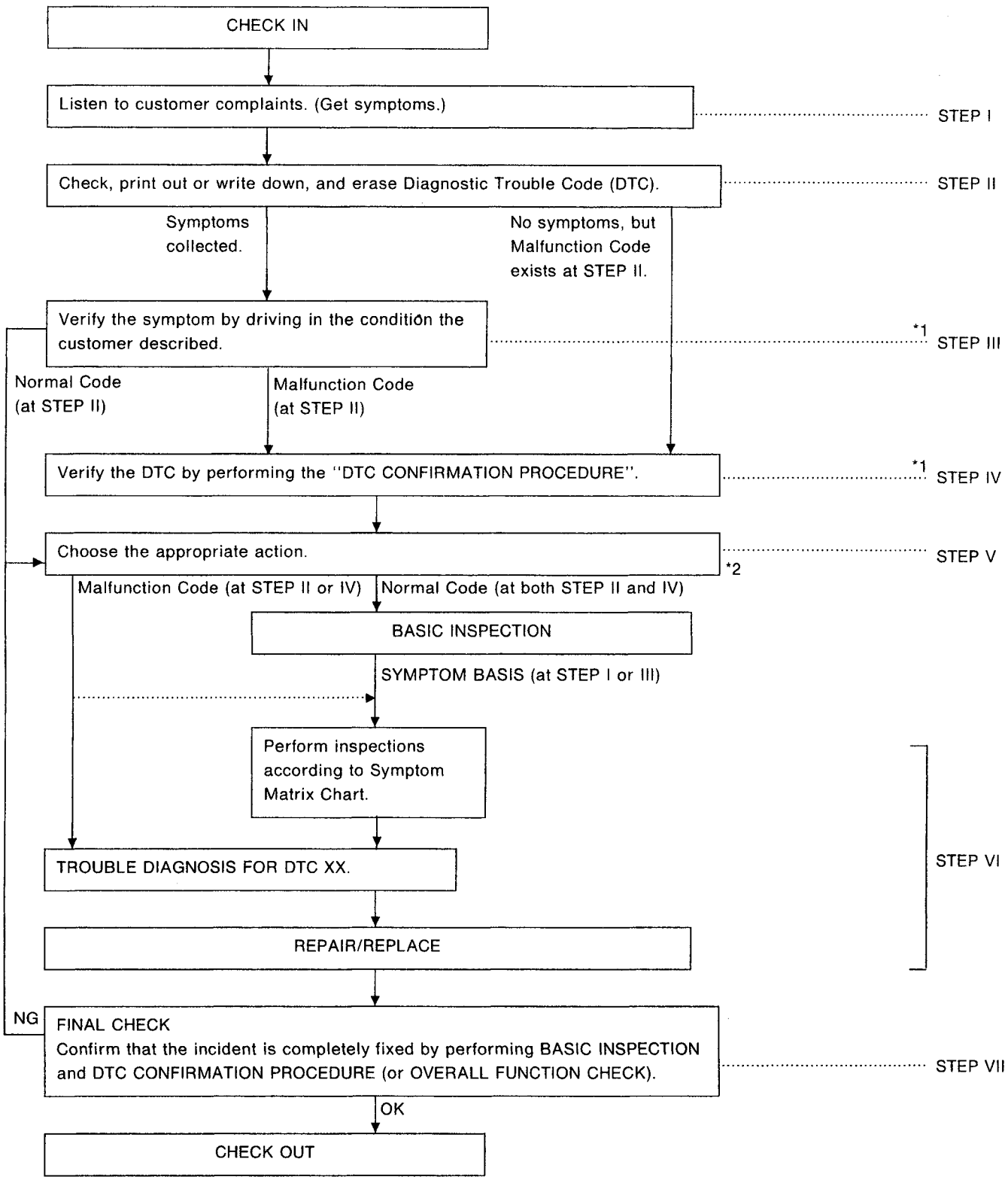
It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or improper wiring. In this case, careful checking of suspected circuits may help prevent the replacement of good parts.

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

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a driveability complaint. The customer can supply good information about such problems, especially intermittent ones. Find out what symptoms are present and under what conditions they occur. A "Diagnostic Worksheet" like the example on EC-61 should be used.

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

Work Flow



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

***2: If the on-board diagnostic system cannot be performed, check main power supply and ground circuit. Refer to "TROUBLE DIAGNOSIS FOR POWER SUPPLY", EC-88.**

Description for Work Flow

STEP	DESCRIPTION
STEP I	Get detailed information about the conditions and the environment when the incident/symptom occurred using the "DIAGNOSTIC WORKSHEET" as shown on the next page.
STEP II	Before confirming the concern, check and write down (print out using CONSULT) the Diagnostic Trouble Code (DTC), then erase the code. The DTC can be used when duplicating the incident at STEP III & IV. Study the relationship between the cause, specified by DTC, and the symptom described by the customer. (The "Symptom Matrix Chart" will be useful. Refer to EC-72.)
STEP III	Try to confirm the symptom and under what conditions the incident occurs. The "DIAGNOSTIC WORK SHEET" is useful to verify the incident. Connect CONSULT to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results. If the incident cannot be verified, perform INCIDENT SIMULATION TESTS. Refer to GI section. If the malfunction code is detected, skip STEP IV and perform STEP V.
STEP IV	Try to detect the Diagnostic Trouble Code (DTC) by driving in (or performing) the "DTC CONFIRMATION PROCEDURE". Check and read the DTC by using CONSULT. During the DTC verification, be sure to connect CONSULT to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results. If the incident cannot be verified, perform INCIDENT SIMULATION TESTS. Refer to GI section. In case the "DTC CONFIRMATION PROCEDURE" is not available, perform the "OVERALL FUNCTION CHECK" instead. The DTC cannot be displayed by this check, however, this simplified "check" is an effective alternative. The "NG" result of the "OVERALL FUNCTION CHECK" is the same as the DTC detection.
STEP V	Take the appropriate action based on the results of STEP I through IV. If the malfunction code is indicated, proceed to TROUBLE DIAGNOSIS FOR DTC XX. If the normal code is indicated, proceed to the BASIC INSPECTION. Refer to EC-65. Then perform inspections according to the Symptom Matrix Chart. Refer to EC-72.
STEP VI	Identify where to begin diagnosis based on the relationship study between symptom and possible causes. Inspect the system for mechanical binding, loose connectors or wiring damage using (tracing) "Harness Layouts". Gently shake the related connectors, components or wiring harness with CONSULT set in "DATA MONITOR (AUTO TRIG)" mode. Check the voltage of the related ECM terminals or monitor the output data from the related sensors with CONSULT. Refer to EC-74. The "DIAGNOSTIC PROCEDURE" in EC section contains a description based on open circuit inspection. A short circuit inspection is also required for the circuit check in the DIAGNOSTIC PROCEDURE. For details, refer to GI section ("HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT", "Circuit Inspection"). Repair or replace the malfunction parts.
STEP VII	Once you have repaired the circuit or replaced a component, you need to run the engine in the same conditions and circumstances which resulted in the customer's initial complaint. Perform the "DTC CONFIRMATION PROCEDURE" and confirm the normal code (Diagnostic trouble code No. 55) is detected. If the incident is still detected in the final check, perform STEP VI by using a different method from the previous one. Before returning the vehicle to the customer, be sure to erase the unnecessary (already fixed) DTC in ECM. Refer to EC-46.

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.

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

Diagnostic Trouble Code (DTC) Chart

ENGINE RELATED ITEMS

Diagnostic trouble code No.	Detected items (Screen terms for CONSULT, "SELF-DIAG RESULTS" mode)	Malfunction is detected when ...
11	Camshaft position sensor circuit (CAMSHAFT POSI SEN)	• Either 1° or 180° signal is not detected by the ECM for the first few seconds during engine cranking. • Either 1° or 180° signal is not detected by the ECM often enough while the engine speed is higher than the specified rpm. • The relation between 1° and 180° signals is not in the normal range during the specified rpm.
12	Mass air flow sensor circuit (MASS AIR FLOW SEN)	• An excessively high or low voltage is entered to ECM. • Voltage sent to ECM is not practical when compared with the camshaft position sensor signal and throttle position sensor signal.
13	Engine coolant temperature sensor circuit (COOLANT TEMP SEN)	• An excessively high or low voltage from the sensor is detected by the ECM.
21	Ignition signal circuit (IGN SIGNAL-PRIMARY)	• The ignition signal in the primary circuit is not detected by the ECM during engine cranking or running.
28*1	OVER HEAT	• The engine coolant temperature sensor output voltage is below 0.35V.
34*2	Knock sensor circuit (KNOCK SENSOR)	• An excessively low or high voltage from the sensor is detected by the ECM.
41*3	Intake air temperature sensor circuit (INT AIR TEMP SEN)	• An excessively high or low voltage from the sensor is detected by the ECM. • Voltage sent to ECM is not practical when compared with the engine coolant temperature sensor signal.
55	No failure (NO SELF DIAGNOSTIC FAILURE INDICATED...)	• No malfunction is detected by the ECM.

*1: Except for Australia
*2: Except for Europe and Israel
*3: For Australia
*4: This is Quick Reference of "DTC CONFIRMATION PROCEDURE".
Details are described in each TROUBLE DIAGNOSIS FOR DTC XX.
Abbreviations are as follows:
IGN: ON : Turning the ignition switch ON is required for the ECM to detect a malfunction (if one exists).
RUNNING : Running engine is required for the ECM to detect a malfunction (if one exists).

*5: • The "OVERALL FUNCTION CHECK" is a simplified and effective way to inspect a component or circuit.
In some cases, the "OVERALL FUNCTION CHECK" is used rather than a "DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE".
When no DTC CONFIRMATION PROCEDURE is available, the "NG" result of the OVERALL FUNCTION CHECK can be considered to mean the same as a DTC detection.
• During an "NG" OVERALL FUNCTION CHECK, the DTC might not be confirmed.

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

X: Applicable
—: Not applicable

Check Items (Possible Cause)	"DTC CONFIRMATION PROCEDURE" Quick Ref. *4	"OVERALL FUNCTION CHECK" Quick Ref. *5	Fail Safe System	Reference Page
• Harness or connectors (The sensor circuit is open or shorted.) • Camshaft position sensor • Starter motor • Starting system circuit (EL section) • Dead (Weak) battery	RUNNING	—	—	EC-94
• Harness or connectors (The sensor circuit is open or shorted.) • Mass air flow sensor	RUNNING	RUNNING	X	EC-101
• Harness or connectors (The sensor circuit is open or shorted.) • Engine coolant temperature sensor	IGN: ON	—	X	EC-108
• Harness or connectors (The ignition primary circuit is open or shorted.) • Power transistor unit • Camshaft position sensor • Camshaft position sensor circuit	RUNNING	—	—	EC-113
• Harness or connector • Engine coolant temperature sensor	—	IGN: ON (after warming up)	—	EC-108
• Harness or connectors (The sensor circuit is open or shorted.) • Knock sensor	RUNNING	—	—	EC-119
• Harness or connectors (The sensor circuit is open or shorted.) • Intake air temperature sensor	IGN: ON	—	—	EC-124
• No failure	—	—	—	—

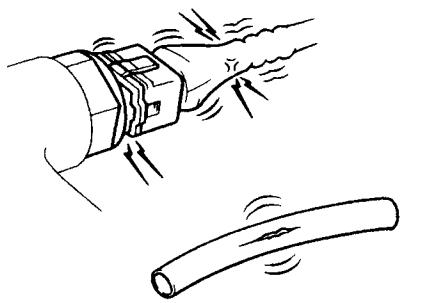
EC

Fail-Safe Chart

The ECM enters fail-safe mode, if any of the following DTCs is recorded due to the open or short circuit.

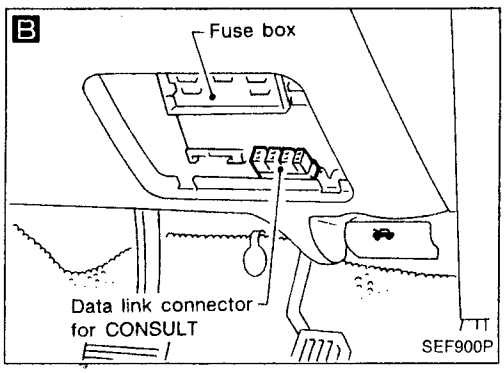
<table>
<tr><th>DTC No.</th><th>Detected items</th><th>Engine operating condition in fail-safe mode</th></tr>
<tr><td>12</td><td>Mass air flow sensor circuit</td><td>Engine speed will not rise more than 3,000 rpm*1 due to the fuel cut.</td></tr>
<tr><td>13</td><td>Engine coolant temperature sensor circuit</td><td>Engine coolant temperature will be determined based on the time after turning ignition switch "ON" or "START".
Except for Europe and Israel
<table>
<tr><th>Condition</th><th>Engine coolant temperature decided</th></tr>
<tr><td>Just as ignition switch is turned ON or Start</td><td>30°C (86°F)</td></tr>
<tr><td>More than 5 minutes after ignition ON or Start</td><td>80°C (176°F)</td></tr>
<tr><td>Except as shown above</td><td>30 - 80°C (86 - 176°F)
(Depends on the time)</td></tr>
</table>
For Europe and Israel
<table>
<tr><th>Condition</th><th>Engine coolant temperature decided</th></tr>
<tr><td>Just as ignition switch is turned ON or Start</td><td>35°C (95°F)</td></tr>
<tr><td>More than 4.5 minutes after ignition ON or Start</td><td>80°C (176°F)</td></tr>
<tr><td>Except as shown above</td><td>35 - 80°C (95 - 176°F)
(Depends on the time)</td></tr>
</table>
When the fail-safe system for engine coolant temperature sensor is activated, the cooling fan operates while engine is running.</td></tr>
<tr><td>43</td><td>Throttle position sensor circuit</td><td>Throttle position will be determined based on the injected fuel amount and the engine speed.
Therefore, acceleration will be poor.
<table>
<tr><th>Condition</th><th>Driving condition</th></tr>
<tr><td>When engine is idling</td><td>Normal</td></tr>
<tr><td>When accelerating</td><td>Poor acceleration</td></tr>
</table></td></tr>
<tr><td>—</td><td>ECM</td><td>Fail-safe system activating condition when ECM is malfunctioning
The computing function of the ECM was judged to be malfunctioning.
When the fail-safe system activates (i.e., if the ECM detects a malfunction condition in the CPU of ECM), the MALFUNCTION INDICATOR LAMP on the instrument panel lights to warn the driver.
Engine control, with fail-safe system, operates when ECM is malfunctioning
When the fail-safe system is operating, fuel injection, ignition timing, fuel pump operation, IACV-AAC valve operation and cooling fan operation are controlled under certain limitations.
<table>
<tr><th></th><th>Operation</th></tr>
<tr><td>Engine speed</td><td>Engine speed will not rise more than 3,000 rpm</td></tr>
<tr><td>Fuel injection</td><td>Simultaneous multiport fuel injection system</td></tr>
<tr><td>Ignition timing</td><td>Ignition timing is fixed at the preset valve</td></tr>
<tr><td>Fuel pump</td><td>Fuel pump relay is "ON" when engine is running and "OFF" when engine stalls</td></tr>
<tr><td>IACV-AAC valve</td><td>Full open</td></tr>
<tr><td>Cooling fans</td><td>Cooling fan relay "ON" when engine is running, and "OFF" when engine stalls</td></tr>
</table></td></tr>
</table>

A

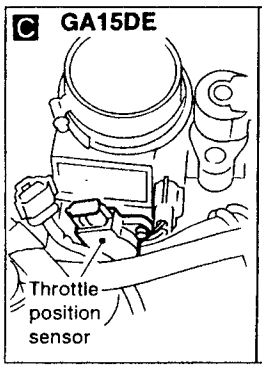


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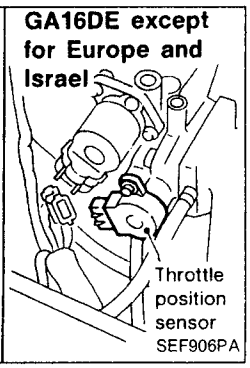
B



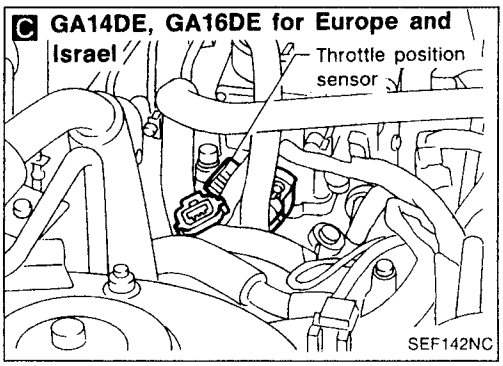
C GA15DE



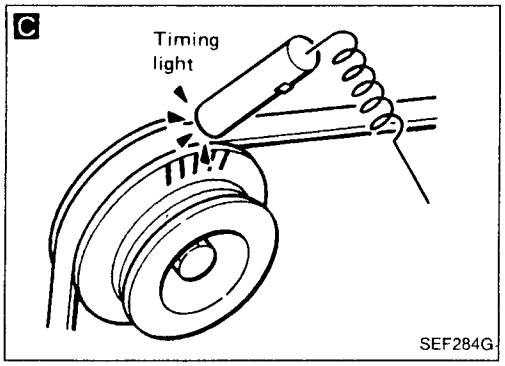
GA16DE except for Europe and Israel



C GA14DE, GA16DE for Europe and Israel



C



Basic Inspection

Precaution:

Perform Basic Inspection without electrical or mechanical loads applied;

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

A

BEFORE STARTING

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

B

CONNECT CONSULT TO THE VEHICLE.

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

DOES ENGINE START? — No → Go to E.

Yes

C

CHECK IGNITION TIMING.

1. Warm up engine sufficiently.
2. Stop engine and disconnect throttle position sensor harness connector.
3. Start engine.
4. Check ignition timing at idle using timing light.

   Ignition timing:

   Refer to EC-36.

NG → Adjust ignition timing by turning distributor.

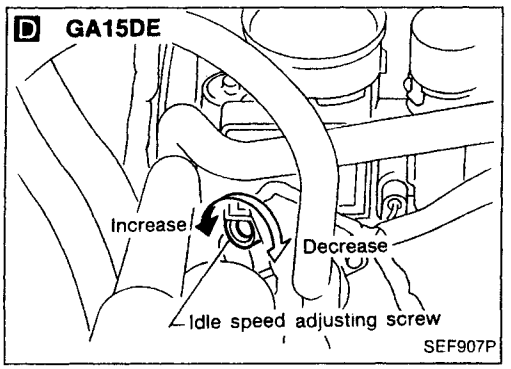
OK

(Go to Ⓐ on next page.)

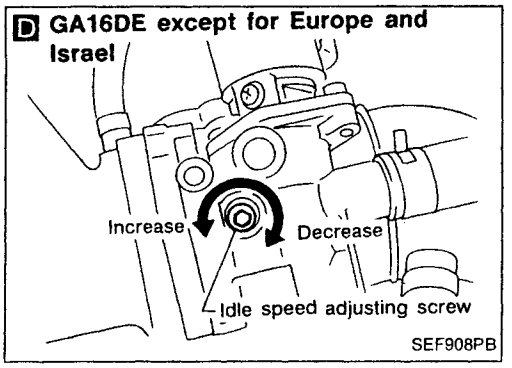
EC

Basic Inspection (Cont'd)

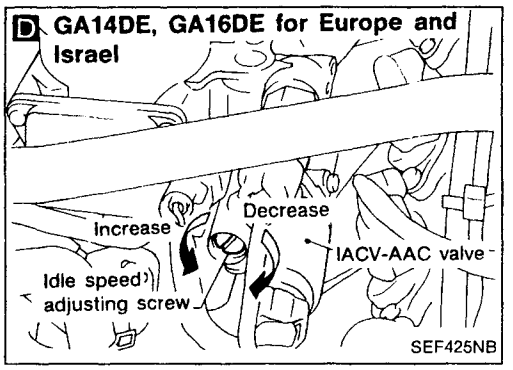
D GA15DE



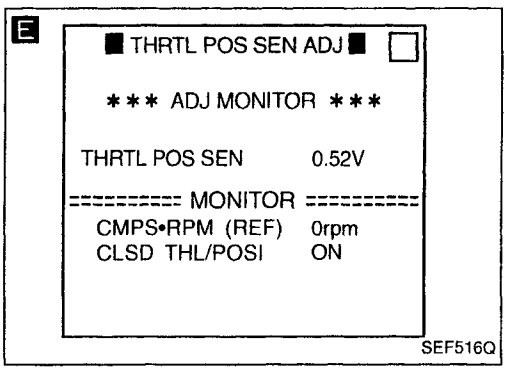
D GA16DE except for Europe and Israel



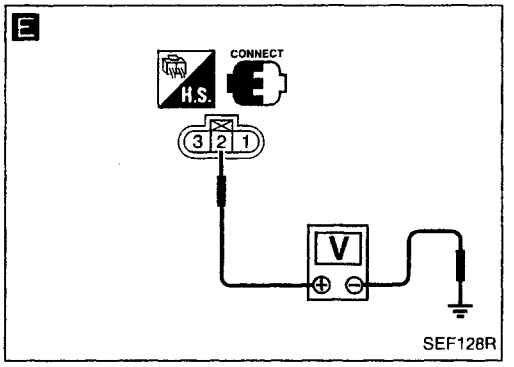
D GA14DE, GA16DE for Europe and Israel



E



E



Ⓐ

D

CHECK IDLE ADJ. SCREW INITIAL SET RPM.
Base idle speed: Refer to EC-36.

NG → Adjust engine speed by turning idle adjusting screw.

OK

E

CHECK THROTTLE POSITION SENSOR IDLE POSITION.

1. Perform "THRTL POS SEN ADJ" in "WORK SUPPORT" mode.
2. Check that output voltage of throttle position sensor is approx. 0.35 to 0.65V (Throttle valve fully closes.) and "CLSD THL/P SW" stays "ON".

OR

Measure output voltage of throttle position sensor using voltmeter, and check that it is approx. 0.35 to 0.65V. (Throttle valve fully closed.)

NG → Adjust output voltage to 0.50 ± 0.1V by rotating throttle position sensor body.

OK

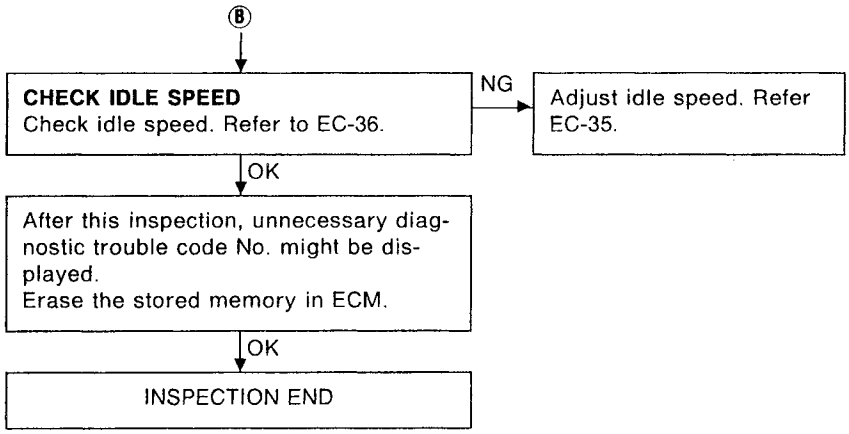
RESET IDLE POSITION MEMORY.

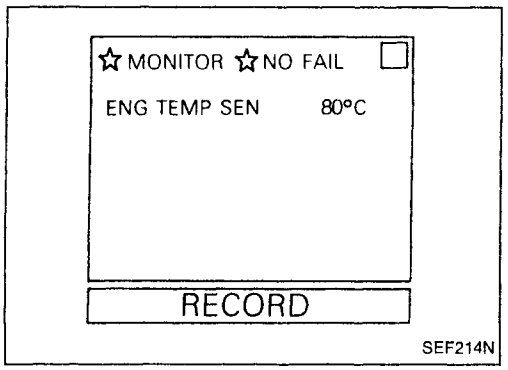
1. Warm up engine sufficiently.
2. Turn ignition switch "OFF" and wait at least 5 seconds.
3. Disconnect throttle position sensor harness connector.
4. Start engine and wait at least 5 seconds in "N" position.
5. Reconnect throttle position sensor harness connector while running engine.

Ⓑ

(Go to next page)

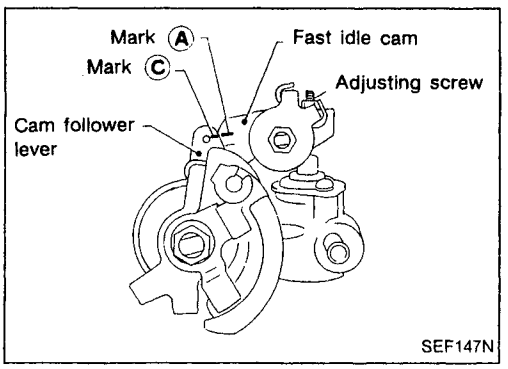
Basic Inspection (Cont'd)



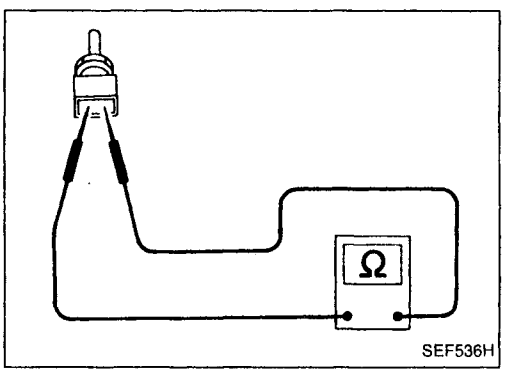


Fast Idle Cam (FIC) Inspection and Adjustment — For Europe and Israel

1. Start engine and warm it up.
2. See "ENG TEMP SEN" or "COOLAN TEMP/S" in "DATA MONITOR" mode with CONSULT.
3. When engine coolant temperature is 80±5°C (176±9°F), make sure that mark Ⓐ is aligned with mark Ⓒ as shown in the figure.



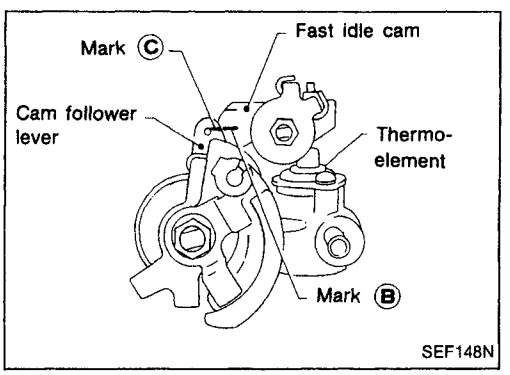
2. Disconnect engine coolant temperature sensor harness connector and check resistance as shown in the figure.
3. When the resistance of engine coolant temperature sensor is 0.26 to 0.39 kΩ, make sure that mark Ⓐ is aligned with mark Ⓒ as shown in the figure.



- If NG, adjust by turning adjusting screw.

Adjusting screw tightening torque:
0.98 - 1.96 N·m (10 - 20 kg-cm, 8.7 - 17.4 in-lb)

4. Stop engine.
5. Turn ignition switch "ON" and see "ENG TEMP SEN" or "COOLAN TEMP/S" in "DATA MONITOR" mode with CONSULT.
6. When engine coolant temperature is 25±5°C (77±9°F), make sure that mark Ⓑ is aligned with mark Ⓒ as shown in the figure.



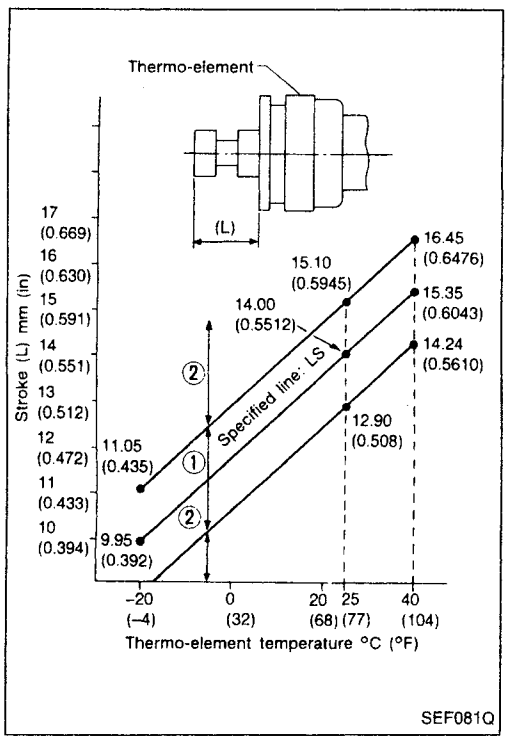
5. When the resistance of engine coolant temperature sensor is 1.65 to 2.40 kΩ, make sure that mark Ⓑ is aligned with mark Ⓒ as shown in the figure.

- If NG, replace thermo-element and perform the above inspection and adjustment again.

Fast Idle Cam (FIC) Inspection and Adjustment — Except for Europe and Israel

1. Remove throttle body from engine.
2. Wait for at least 3 hours.
   (This step is necessary to bring the temperature of the thermo-element to the room temperature

Fast Idle Cam (FIC) Inspection and Adjustment — Except for Europe and Israel (Cont'd)

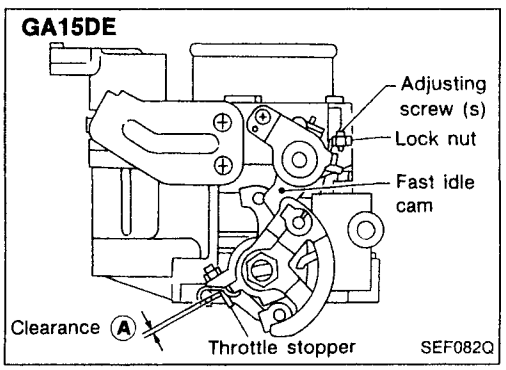


3. Measure thermo-element stroke (L) and room temperature.
4. Check thermo-element stroke (L) as shown in the figure.

L: Thermo-element stroke	①	②
Go to step	5*	2**

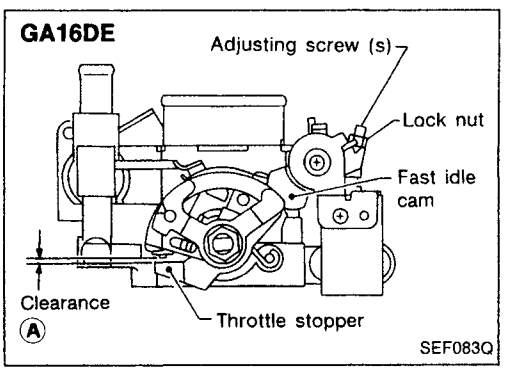
*: Thermo-element is normal. Adjust first idle cam only.
**: Thermo-element is malfunctioning. Replace thermo-element, and perform inspection beginning with step 2.

EC



5. Adjust clearance Ⓐ between throttle stopper and throttle adjusting screw to specification by turning adjusting screw (S).

Engine models		Clearance Ⓐ mm (in)
GA15DE	M/T	0.40 - 0.75 (0.0157 - 0.0295)
	A/T	0.61 - 0.95 (0.0240 - 0.0374)
GA16DE	M/T	0.72 - 1.18 (0.0283 - 0.0465)
	A/T	0.95 - 1.43 (0.0374 - 0.0563)



6. Rotate adjusting screw (S) clockwise or counterclockwise by Z turns according to the following equation, then tighten the adjusting screw lock nut.

$$Z = \frac{L\ (mm) - LS^*\ (mm)}{Y\ (mm)} \quad / \quad Z = \frac{L\ (in) - LS^*\ (IN)}{Y\ (in)}$$

*: Value of the specified line (Ls) at the temperature of thermo-element actually measured.
Y = 0.5 (GA15DE)
0.8 (GA16DE)

- Direction of adjusting screw (S) rotation

(1) Positive (+) Z: Counterclockwise
(2) Negative (−) Z: Clockwise

Fast Idle Cam (FIC) Inspection and Adjustment — Except for Europe and Israel (Cont'd)

For example:

	Case I	Case II
Thermo-element temperature °C (°F)	25 (77)	40 (104)
Thermo-element specified stroke (Ls) mm (in)	14.0 (0.551)	15.35 (0.6043)
Thermo-element stroke (L) mm (in)	14.5 (0.571)	14.60 (0.5748)
Revolutions of adjusting screw (Z) mm/in	$Z = \frac{14.5 - 14.0}{0.80} = 0.63$ / $\frac{0.571 - 0.551}{0.0315} = 0.63$	$Z = \frac{14.60 - 15.35}{0.80} = -0.94$ / $\frac{0.5748 - 0.6043}{0.0315} = -0.94$
Direction of revolution	Counterclockwise	Clockwise

Symptom Matrix Chart

SYSTEM — Basic engine control system		SYMPTOM													Reference page
		HARD/NO START/RESTART (EXCP. HA)	ENGINE STALL	HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER/POOR ACCELERATION	HIGH IDLE/LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEATS/WATER TEMPERATURE HIGH	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BATTERY DEAD (UNDER CHARGE)	
		AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	HA	
Fuel	Fuel pump circuit	●	●	●	○	●		●	●			●		○	EC-145
	Fuel pressure regulator system	●	●	●	○	●	○	●	●	○		●			EC-33
	Injector circuit	●	●	●	○	●		●	●			●			EC-141
	Evaporative emission system	○	○	○	○	○	○	○	○	○		○			EC-29
Air	Positive crankcase ventilation system	○	○	●	○	○	○	●	●	○		○			EC-31
	Incorrect idle speed adjustment	○	○				○	○	○	○		○			EC-35
	IACV-AAC valve circuit	●	●	●	○	●	●	●	●	●		●		○	EC-150
	IACV-FICD solenoid valve circuit	○	○	○	○	○	○	○	○	○		○			EC-204
Ignition	Incorrect ignition timing adjustment	○	○	●	●	●		●	●			●			EC-35
	Ignition circuit	●	●	●	●	●		●	●			●			EC-113
EGR	(EGR valve &) EVAP canister purge control solenoid valve circuit		●	●	●	○						●			EC-179, 183
	EGR system	○	●	●	●	○	○	●	●	○		○			EC-179, 183
Main power supply and ground circuit		○	○	○	○	○		○	○		○	○		○	EC-88
Cooling	Cooling fan circuit	○	○	○	○	○	○	○	○	○	○	○		○	EC-156
Air conditioner circuit		○	○	○	○	○	○	○	○	○		○		○	HA section

● ; High Possibility Item
○; Low Possibility Item

(continued on next page)

EC

Symptom Matrix Chart (Cont'd)

SYSTEM — ECCS system		SYMPTOM													Reference page
		HARD/NO START/RESTART (EXCP. HA)	ENGINE STALL	HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER/POOR ACCELERATION	HIGH IDLE/LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEATS/WATER TEMPERATURE HIGH	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BATTERY DEAD (UNDER CHARGE)	
		AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	HA	
ECCS	Camshaft position sensor circuit	●	●	●	○	○		○	○			○			EC-94
	Mass air flow sensor circuit	●	●	●	○	●		●	●			●			EC-101
	(Heated) oxygen sensor circuit		●	●	○	●		●	●			●			EC-189, 194
	Engine coolant temperature sensor circuit	●	●	●	○	●	●	●	●	●		●			EC-108
	Throttle position sensor circuit		●	●		●	●	●	●	●		●			EC-128
	Incorrect throttle position sensor adjustment		●	○		○	●	○	○	●		○			EC-65
	Vehicle speed sensor circuit		○	○		○						○			EC-133
	Knock sensor circuit			○	○	○						○			EC-119
	ECM	○	○	○	○	○	○	○	○	○	○	○			EC-64
	Start signal circuit	○													EC-138
	Park/Neutral position switch circuit			○		○		○	○			○			EC-173
	Power steering oil pressure switch circuit		○					○	○						EC-169

● ; High Possibility Item
○; Low Possibility Item

(continued on next page)

Symptom Matrix Chart (Cont'd)

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

● ; High Possibility Item
○; Low Possibility Item

EC

CONSULT Reference Value in Data Monitor Mode

Remarks:

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

MONITOR ITEM	CONDITION		SPECIFICATION
CMPS·RPM (REF)	• Tachometer: Connect • Run engine and compare tachometer indication with the CONSULT value.		Almost the same speed as the CONSULT value.
MAS AIR/FL SE	• Engine: After warming up • Air conditioner switch: OFF • Shift lever: "N" • No-load	Idle	1.0 - 1.7V
		2,000 rpm	1.5 - 2.1V
COOLAN TEMP/S	• Engine: After warming up		More than 70°C (158°F)
O2 SEN	• Engine: After warming up	Maintaining engine speed at 2,000 rpm	0 - 0.3V ↔ 0.6 - 1.0V
M/R F/C MNT			LEAN ↔ RICH Changes more than 5 times during 10 seconds.
VHCL SPEED SE	• Turn drive wheels and compare speedometer indication with the CONSULT value		Almost the same speed as the CONSULT value
BATTERY VOLT	• Ignition switch: ON (Engine stopped)		11 - 14V
THRTL POS SEN	• Ignition switch: ON (Engine stopped)	Throttle valve fully closed	0.35 - 0.65V
		Throttle valve fully opened	Approx. 4.0V
START SIGNAL	• Ignition switch: ON → START → ON		OFF → ON → OFF
CLSD THL/POS	• Ignition switch: ON (Engine stopped)	Throttle valve: Idle position	ON
		Throttle valve: Slightly open	OFF
AIR COND SIG	• Engine: After warming up, idle the engine	A/C switch "OFF"	OFF
		A/C switch "ON" (Compressor operates)	ON
P/N POSI SW	• Ignition switch: ON	Shift lever "P" or "N"	ON
		Except above	OFF

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

MONITOR ITEM	CONDITION		SPECIFICATION
PW/ST SIGNAL	• Engine: After warming up, idle the engine	Steering wheel in neutral position (forward direction)	OFF
		The steering wheel is turned	ON
IGNITION SW	• Ignition switch: ON → OFF		ON → OFF
LOAD SIGNAL	• Ignition switch: ON	Rear window defogger is operating and/or lighting switch is on	ON
		Rear window defogger is not operating and lighting switch is not on	OFF
INJ PULSE	• Engine: After warming up • Air conditioner switch: OFF • Shift lever: "N" • No-load	Idle	2.4 - 3.2 msec.
		2,000 rpm	1.9 - 3.2 msec.
IGN TIMING	ditto	Idle	6 -10° BTDC
		2,000 rpm	More than 25° BTDC
IACV-AAC/V	ditto	Idle	20 - 40%
		2,000 rpm	—
A/F ALPHA	• Engine: After warming up	Maintaining engine speed at 2,000 rpm	75 - 125%
AIR COND RLY	• Air conditioner switch: OFF → ON		OFF → ON
FUEL PUMP RLY	• Ignition switch is turned to ON (Operates for 5 seconds) • Engine running and cranking • When engine is stopped (stops in 1.0 seconds)		ON
	• Except as shown above		OFF
COOLING FAN	• When cooling fan is stopped		OFF
	• When cooling fan operates at low speed		LOW
	• When cooling fan operates at high speed		HI
VALVE TIM SOL*1	• Engine: After warming up	Idle	OFF
		Racing engine quickly from idle to 4,000 rpm	ON
EGRC SOL/V (EVAP canister purge control solenoid valve or EGR valve & EVAP canister purge control solenoid valve)	• Engine: After warming up • Air conditioner switch: OFF • Shift lever: N • No-load	Idle	ON
		Racing engine from idle to 3,000 rpm in 1st position	OFF

*1: GA16DE except for Europe and Israel

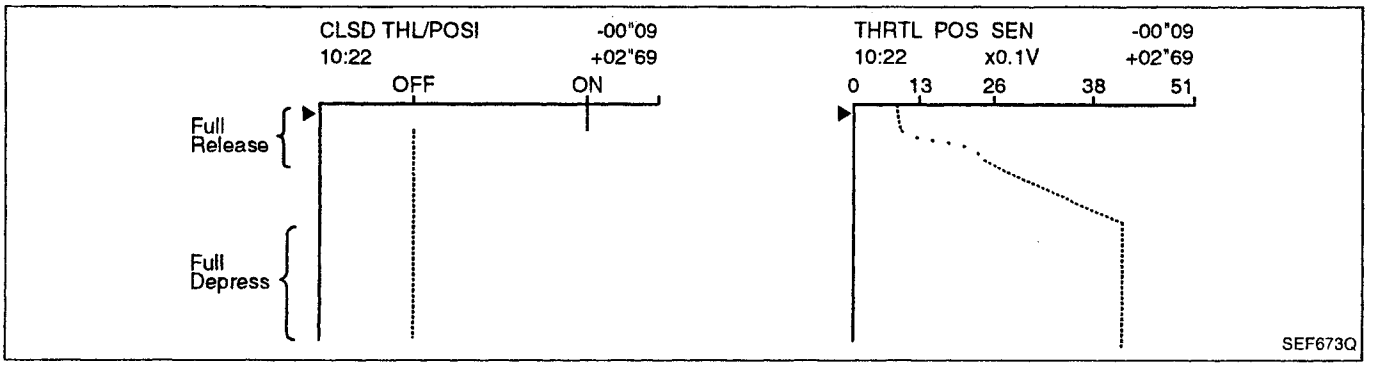
EC

Major Sensor Reference Graph in Data Monitor Mode

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

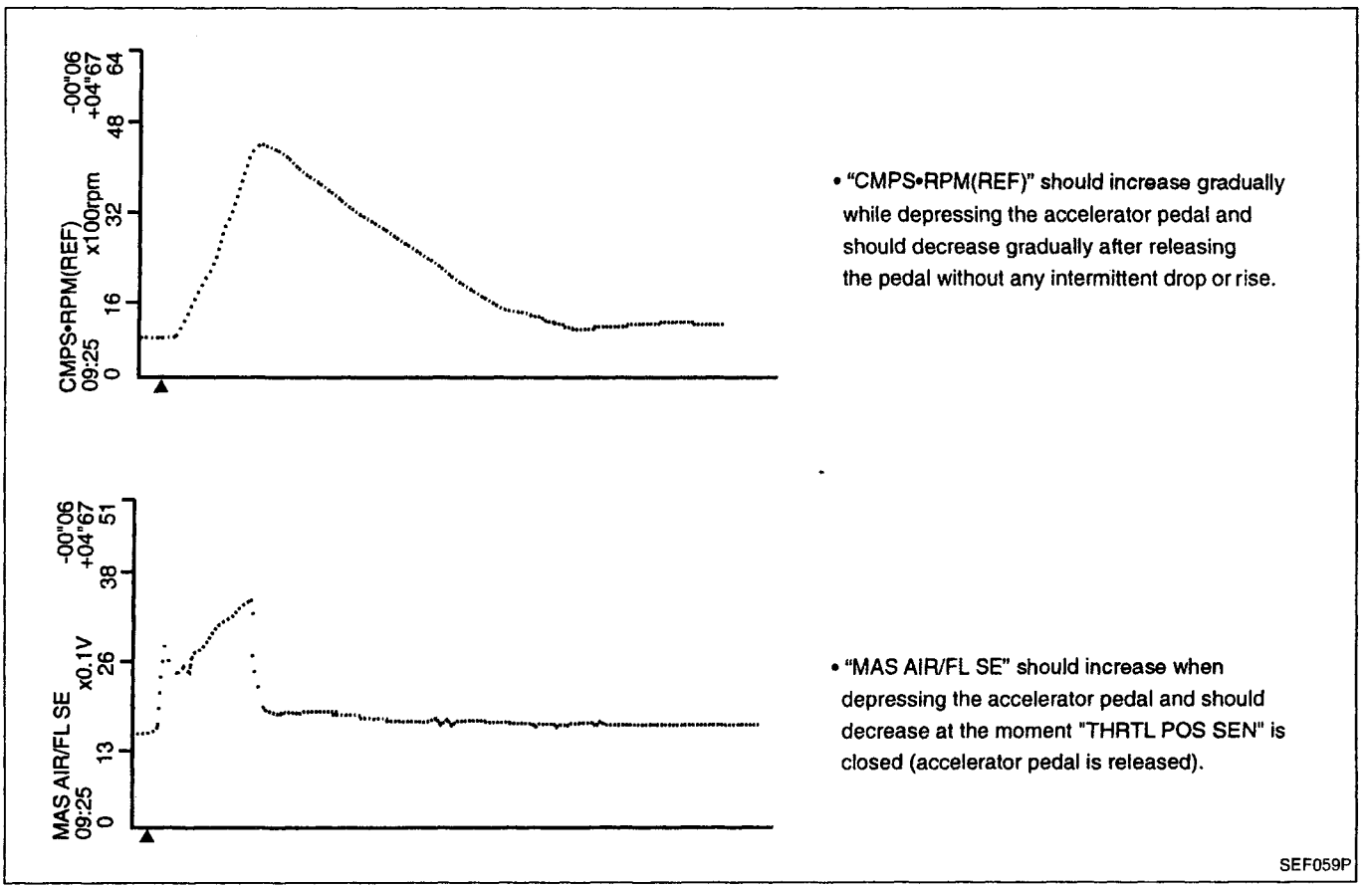
THRTL POS SEN, CLSD THL/POSI

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

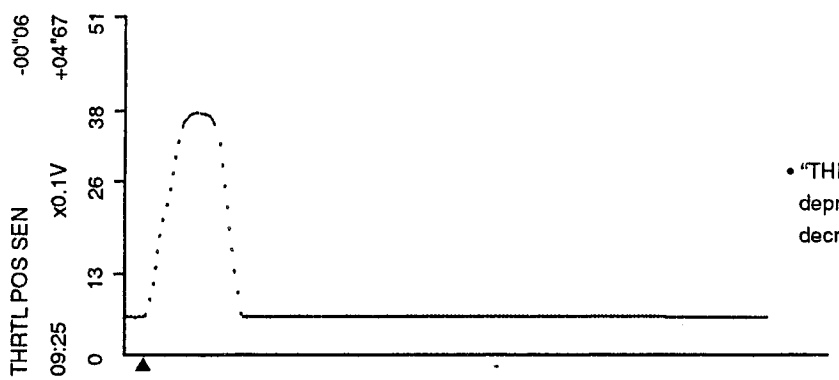


CMPS·RPM (REF), MAS AIR/FL SE, THRTL POS SEN, O2 SENSOR, INJ PULSE

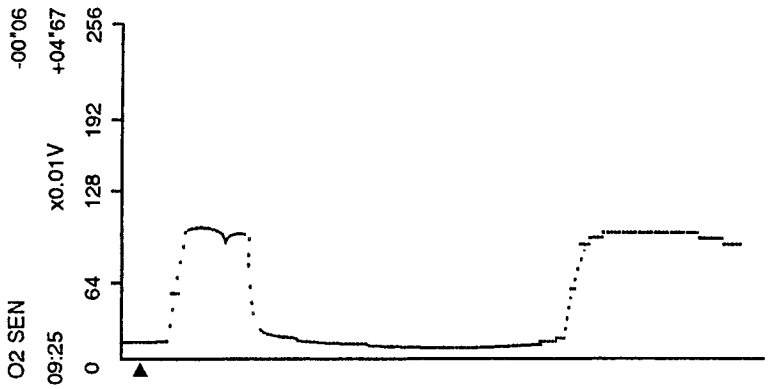
Below is the data for "CMPS·RPM (REF)", "MAS AIR/FL SE", "THRTL POS SEN", "O2 SENSOR" and "INJ PULSE" when revving quickly up to 4,800 rpm under no load after warming up engine sufficiently.
Each value is for reference, the exact value may vary.



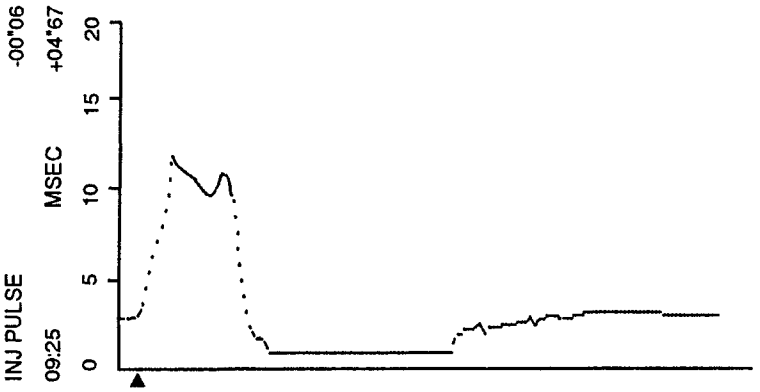
Major Sensor Reference Graph in Data Monitor Mode (Cont'd)



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



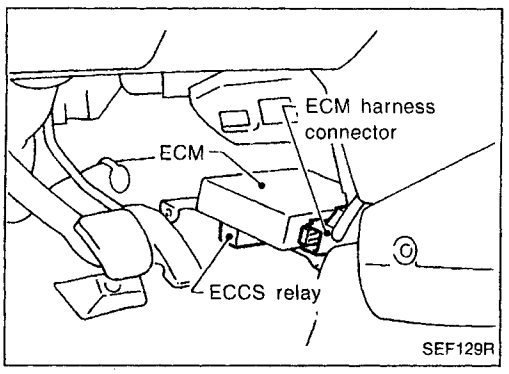
• "O2 SEN" may increase immediately after depressing the accelerator pedel and may decrease after releasing the pedal.



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

SEF259QA

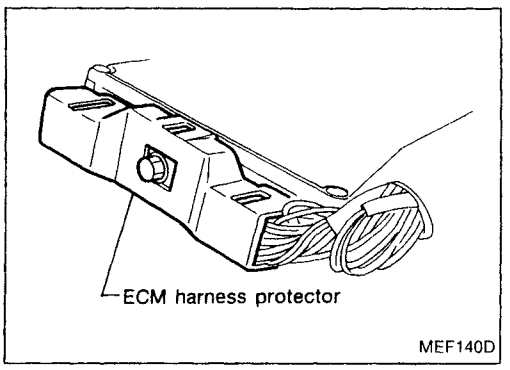
EC



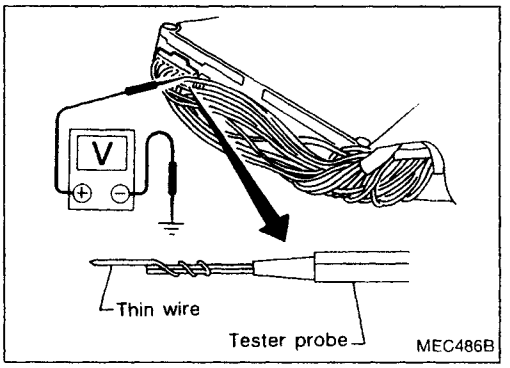
ECM Terminals and Reference Value

PREPARATION

1. ECM is located behind the center console panel. For this inspection, remove the center console under cover.



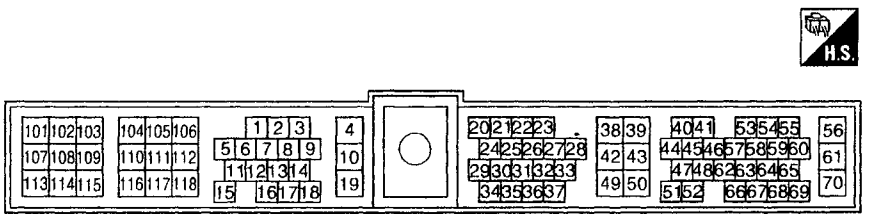
2. Remove ECM harness protector.



3. Perform all voltage measurements with the connectors connected. Extend tester probe as shown to perform tests easily.

ECM HARNESS CONNECTOR TERMINAL LAYOUT

For Australia



SEF130R

Except for Australia



SEF131R

ECM Terminals and Reference Value (Cont'd)

ECM INSPECTION TABLE — GA16DE for Australia

Specification data are reference values and are measured between each terminal and ㊸ (ECCS ground).

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA
1	W/B	Ignition signal	Engine is running. └ Idle speed	0.3 - 0.6V
			Engine is running. └ Engine speed is 2,000 rpm.	Approximately 0.9V
2	GY/R	Ignition check	Engine is running. └ Idle speed	Approximately 12V
3	L/B	Tachometer	Engine is running. └ Idle speed	Approximately 0.9V
4	W/G	ECCS relay (Self-shut-off)	Engine is running. Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	0 - 1V
			Ignition switch "OFF" └ A few seconds passed after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
8	B/P	Fuel pump relay	Ignition switch "ON" └ For 5 seconds after turning ignition switch "ON" Engine is running.	0.07 - 0.20V
			Ignition switch "ON" └ More than 5 seconds after turning ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
10	B/W	ECCS ground	Engine is running. └ Idle speed	Engine ground
13	LG	Cooling fan relay (High speed: For A/T models)	Engine is running. ├ Cooling fan is not operating. └ Cooling fan is operating at low speed.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating at high speed.	Approximately 0V
14	LG/R	Cooling fan relay (Low speed)	Engine is running. └ Cooling fan is not operating.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating.	0.07 - 0.30V
15	Y	Air conditioner relay	Engine is running. └ Both A/C switch and blower switch are "ON".	0.08 - 0.2V
			Engine is running. └ A/C switch is "OFF".	BATTERY VOLTAGE (11 - 14V)

EC

ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA
18	OR/L	Malfunction indicator lamp	Ignition switch "ON"	Approximately 50mV
			Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
19	B/W	ECCS ground	Engine is running. └ Idle speed	Engine ground
20	B/Y	Start signal	Ignition switch "ON"	Approximately 0V
			Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)
21	G	Air conditioner switch	Engine is running. └ Both air conditioner switch and blower switch are "ON" (Compressor operates)	Approximately 0V
			Engine is running. └ Air conditioner switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
22	G/OR	Neutral position switch (M/T models) Inhibitor switch (A/T models)	Ignition switch "ON" ├ Gear position is "Neutral position" (M/T models) └ Gear position is "N" or "P" (A/T models)	Approximately 0V
			Ignition switch "ON" └ Except the above gear position	A/T models: BATTERY VOLTAGE (11 - 14V) M/T models: Approximately 5V
23	Y	Throttle position sensor	Ignition switch "ON" └ Accelerator pedal released	0.35 - 0.65V
			Ignition switch "ON" └ Accelerator pedal fully depressed	Approximately 4V
25	PU/W	Power steering oil pressure switch	Engine is running. └ Steering wheel is being turned	Approximately 0V
			Engine is running. └ Steering wheel is not being turned	Approximately 5V
26	PU/R	Vehicle speed sensor	Engine is running. └ Front of vehicle raised and front wheels are rotating	Approximately 1.8 - 2.4V (AC voltage)
30	P/B	Torque converter clutch solenoid valve (A/T models only)	Engine is running. └ Idle speed	Approximately 0V
			Engine is running. (Warm-up condition) └ Vehicle speed is 64 km/h (40 MPH) or more in "D" position	BATTERY VOLTAGE (11 - 14V)
35	LG/B	Blower fan switch	Ignition switch "ON" └ Blower fan switch is "ON"	Approximately 0V

ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA
38	B/R	Ignition switch	Ignition switch "OFF"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
39	B	ECCS ground	Engine is running. └ Idle speed	Engine ground
40 44	L L	Camshaft position sensor (Reference signal)	Engine is running. └ Idle speed	Approximately 2.7V (AC voltage)
42	PU/W	IACV-AAC valve (Close)	Ignition switch "ON"	Approximately 0V
			Engine is running. (Warm-up condition) └ Engine speed is 2,000 rpm.	BATTERY VOLTAGE (11 - 14V)
43	B	ECCS ground	Engine is running. └ Idle speed	Engine ground (Probe this terminal with ⊖ tester probe when measuring.)
41 45	B/W B/W	Camshaft position sensor (Position signal)	Engine is running. └ Idle speed	Approximately 2.7V (AC voltage)
46	W	Oxygen sensor	Engine is running. └ After warming up sufficiently and engine speed is 2,000 rpm.	0 - Approximately 1.0V (periodically change)
47	OR	Mass air flow sensor	Engine is running. (Warm-up condition) └ Idle speed	1.0 - 1.7V
			Engine is running. (Warm-up condition) └ Engine speed is 2,000 rpm.	1.5 - 2.1V
48	W	Mass air flow sensor ground	Engine is running. (Warm-up condition) └ Idle speed	0.005 - 0.02V
49	P/L	Throttle position sensor power supply	Ignition switch "ON"	Approximately 5V
50	B	Sensors' ground	Engine is running. (Warm-up condition) └ Idle speed	0.001 - 0.02V
51	BR/Y	Engine coolant temperature sensor	Engine is running.	0 - 4.84V Output voltage varies with engine coolant temperature.
54	W	Knock sensor	Engine is running. └ Idle speed	2.0 - 3.0V
55	L/R	Rear defogger relay	Ignition switch "ON" └ Rear defogger is "OFF".	Approximately 0V
			Ignition switch "ON" └ Rear defogger is "ON".	BATTERY VOLTAGE (11 - 14V)
56 61	W/R W/R	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)

EC

ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA
60	R/G	Headlamp switch	Lighting switch "ON"	BATTERY VOLTAGE (11 - 14V)
			Lighting switch "OFF"	Approximately 0V
63	R/Y	Intake air temperature sensor	Engine is running.	0 - 5.0V Output voltage varies with intake air temperature.
64	G/R	Data link connector for CONSULT	Engine is running. └ Idle speed (CONSULT is connected and turned on)	Approximately 0V
65	GY/L			Approximately 4 - 9V
68	G/W			Approximately 3.5V
70	W/L	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
101	SB	IACV-AAC valve (Open)	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
			Engine is running. (Warm-up condition) └ Engine speed is 2,000 rpm.	0 - 4V
102	R/B	Injector No. 1	Engine is running	BATTERY VOLTAGE (11 - 14V)
104	G/B	Injector No. 3		
107	Y/B	Injector No. 2		
109	L/B	Injector No. 4		
103	P	EGR valve & EVAP canister purge control solenoid valve	Engine is running. (Warm-up condition) ├ M/T models: Jack up front wheels and drive wheels at 16 km/h (10 mph) └ Engine speed is 2,000 rpm.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. (Warm-up condition) └ Idle speed	Approximately 0V
106	B/Y	ECCS ground	Engine is running. └ Idle speed	Engine ground
112	B/Y	ECCS ground	Engine is running. └ Idle speed	Engine ground
114	Y/R	VTC solenoid valve	Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Engine speed is 2,000 rpm.	Approximately 0V
115	OR	Heated oxygen sensor heater ground (A/T models)	Engine is running. └ Engine speed is above 3,200 rpm.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Engine speed is below 3,200 rpm.	Approximately 0V
118	B/Y	ECCS ground	Engine is running. └ Idle speed	Engine ground

ECM Terminals and Reference Value (Cont'd)

ECM INSPECTION TABLE — Except GA16DE for Australia

Specification data are reference values and are measured between each terminal and ㊴ (ECCS ground).

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA
1	W/B	Ignition signal	Engine is running. └ Idle speed	0.2 - 0.3V
			Engine is running. └ Engine speed is 2,000 rpm.	Approximately 0.7V
2	L/B	Tachometer (Models with tachometer)	Engine is running. └ Idle speed	0.7 - 0.9V
3	GY/R	Ignition check	Engine is running. └ Idle speed	Approximately 13V
4	W/G	ECCS relay (Self-shut-off)	Engine is running. Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	0 - 1V
			Ignition switch "OFF" └ A few seconds after turning ignition switch "OFF" and thereafter	BATTERY VOLTAGE (11 - 14V)
9	LG/R	Cooling fan relay (Low speed)	Engine is running. └ Cooling fan is not operating.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating.	Approximately 0V
10	LG	Cooling fan relay (High speed)	Engine is running. ├ Cooling fan is not operating. └ Cooling fan is operating at low speed.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating at high speed.	Approximately 0V
11	Y or G	Air conditioner relay	Engine is running. └ Both A/C switch and blower fan switch are "ON".	Approximately 0V
			Engine is running. └ A/C switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
12	Y/R	VTC solenoid valve (GA16DE engine models except for Europe and Israel)	Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Engine is racing quickly from idle to 4,000 rpm at 1st position.	Approximately 0V

EC

ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA
16	OR or G	Mass air flow sensor	Engine is running. (Warm-up condition) └ Idle speed	1.2 - 1.8V
			Engine is running. (Warm-up condition) └ Engine speed is 2,000 rpm.	1.7 - 2.3V
18	BR/Y or GY	Engine coolant temperature sensor	Engine is running.	0 - 5.0V Output voltage varies with engine coolant temperature.
19	W	Oxygen sensor (Except for Europe and Israel)	Engine is running. └ After warming up sufficiently	0 - Approximately 1.0V
20	Y	Throttle position sensor	Ignition switch "ON" (Warm-up condition) └ Accelerator pedal released	0.40 - 0.60V
			Ignition switch "ON" └ Accelerator pedal fully depressed	Approximately 4V
22 30	L	Camshaft position sensor (Reference signal: Except for Europe)	Engine is running.	For Israel 1.5 - 3.0V
				Except for Israel 0.1 - 0.4V
24	OR/L	Malfunction indicator lamp	Ignition switch "ON"	Approximately 1.5V
			Engine is running.	BATTERY VOLTAGE (11 - 14V)
27	W	Knock sensor (Except for Europe and Israel)	Engine is running. └ Idle speed	Approximately 2.5V
31 40	L	Camshaft position sensor (Reference signal: For Europe)	Engine is running.	1.5 - 3.0V
	B/W	Camshaft position sensor (Position signal: Except for Europe and Israel)		2.0 - 3.0V
32	PU/R	Vehicle speed sensor	Ignition switch "ON" ├ Engine stopped and gear position is "Neutral position". └ While rotating drive wheel by hand	Varies from 0 to 5V
33	R	Electric load switch	Engine is running. ├ Rear window defogger switch is "ON". └ Lighting switch is "ON".	BATTERY VOLTAGE (11 - 14V)
			Engine is running. ├ Rear window defogger switch is "OFF". └ Lighting switch is "ON".	0V

ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA
34	B/Y	Start signal	Ignition switch "ON"	Approximately 0V
			Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)
35	G/OR	Neutral position switch/ Inhibitor switch	Ignition switch "ON" "N" or "P" position (A/T) Neutral position (M/T)	0V
			Ignition switch "ON" Except the above gear position	For Europe and Israel Approximately 5V
				Except for Europe and Israel BATTERY VOLTAGE (11 - 14V)
36	B/R	Ignition switch (Except for Europe)	Ignition switch "OFF"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
37	P/L	Throttle position sensor power supply	Ignition switch "ON"	Approximately 5V
38 47	W/R	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
41	G or GY	Air conditioner switch	Engine is running. Both air conditioner switch and blower fan switch are "ON".	Approximately 0V
			Engine is running. Air conditioner switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
43	PU/W	Power steering oil pressure switch	Engine is running. Steering wheel is being turned.	0V
			Engine is running. Steering wheel is not being turned.	Approximately 5V
44	B/R	Ignition switch (For Europe)	Ignition switch "OFF"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
44	R/L	Thermo control amp. (Except for Europe and Israel)	Engine is running. Both air conditioner switch and blower fan switch are "ON".	Approximately 0V
			Engine is running. Air conditioner switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
45	LG/B or G/Y	Blower fan switch	Engine is running. Blower fan switch is "ON".	Approximately 0V
			Engine is running. Blower fan switch is "OFF".	Approximately 5V

EC

ECM Terminals and Reference Value (Cont'd)

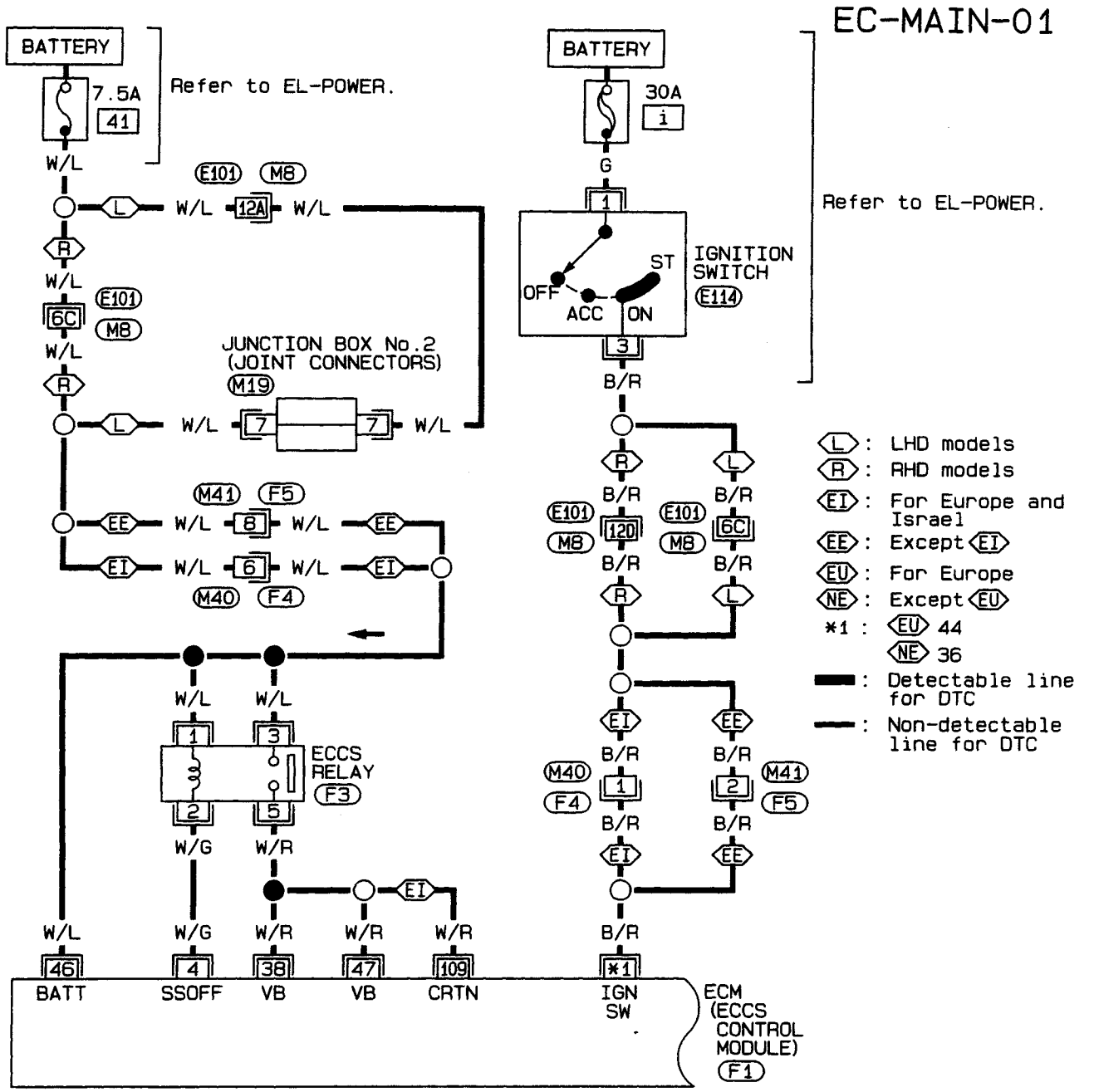
TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA
46	W/L	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
101	R/B	Injector No. 1	Engine is running.	BATTERY VOLTAGE (11 - 14V)
103	G/B	Injector No. 3		
110	Y/B	Injector No. 2		
112	L/B	Injector No. 4		
102	OR	Heated oxygen sensor heater ground (For Europe and Israel)	Engine is running. └ Engine speed is above 3,200 rpm.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Engine speed is below 3,200 rpm.	Approximately 0V
104	B/P	Fuel pump relay (Except for Europe)	Ignition switch "ON" └ For 5 seconds after turning ignition switch "ON" Engine is running.	Approximately 0V
			Ignition switch "ON" └ 5 seconds after turning ignition switch "ON" and thereafter	BATTERY VOLTAGE (11 - 14V)
105	P	EVAP canister purge control solenoid valve (GA16DE M/T models except for Europe & Israel) EGR valve & EVAP canister purge control solenoid valve (For Europe and Israel, and GA15DE M/T models)	Engine is running. (Warm-up condition) └ Idle speed	Approximately 0V
			Engine is running. (Warm-up condition) └ Engine is racing from idle to 3,000 rpm in 1st position.	BATTERY VOLTAGE (11 - 14V)
106	B/P	Fuel pump relay (For Europe)	Ignition switch "ON" └ For 5 seconds after turning ignition switch "ON" Engine is running.	0.7 - 0.9V
			Ignition switch "ON" └ 5 seconds after turning ignition switch "ON" and thereafter	BATTERY VOLTAGE (11 - 14V)
111	SB	IACV-AAC valve (Opening signal: Except for Europe and Israel)	Engine is running. └ Idle speed	10 - 13V
			Engine is running. ├ Steering wheel is being turned. ├ Air conditioner is operating. ├ Rear window defogger switch is "ON". └ Lighting switch is "ON".	Approximately 5.0V

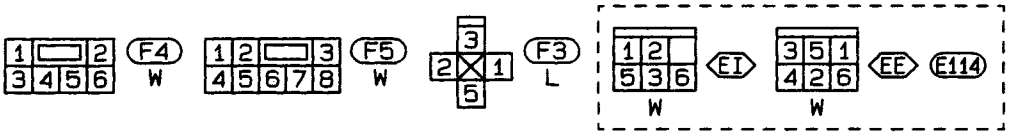
ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA
113	PU/W	IACV-AAC valve (Closing signal: Except for Europe and Israel)	Engine is running. └ Idle speed	7 - 13V
			Engine is running. ├ Steering wheel is being turned. ├ Air conditioner is operating. ├ Rear window defogger switch is "ON". └ Lighting switch is "ON".	11 - 14V
	SB	IACV-AAC valve (For Europe and Israel)	Engine is running. └ Idle speed	11 - 14V
			Engine is running. ├ Steering wheel is being turned. ├ Air conditioner is operating. ├ Rear window defogger switch is "ON". └ Lighting switch is "ON".	1 - 10V
115	P/B	Torque converter clutch solenoid valve (A/T models except for Europe and Israel)	Engine is running. └ Idle speed	Approximately 0V
			Engine is running. (Warm-up condition) └ Vehicle speed is 60 km/h (37 MPH) or more in "D" position.	BATTERY VOLTAGE (11 - 14V)

EC

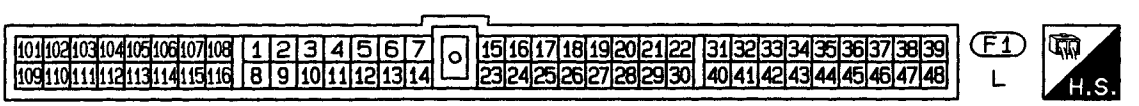
Main Power Supply and Ground Circuit





Refer to last page (Foldout page).

M8, E101, M19

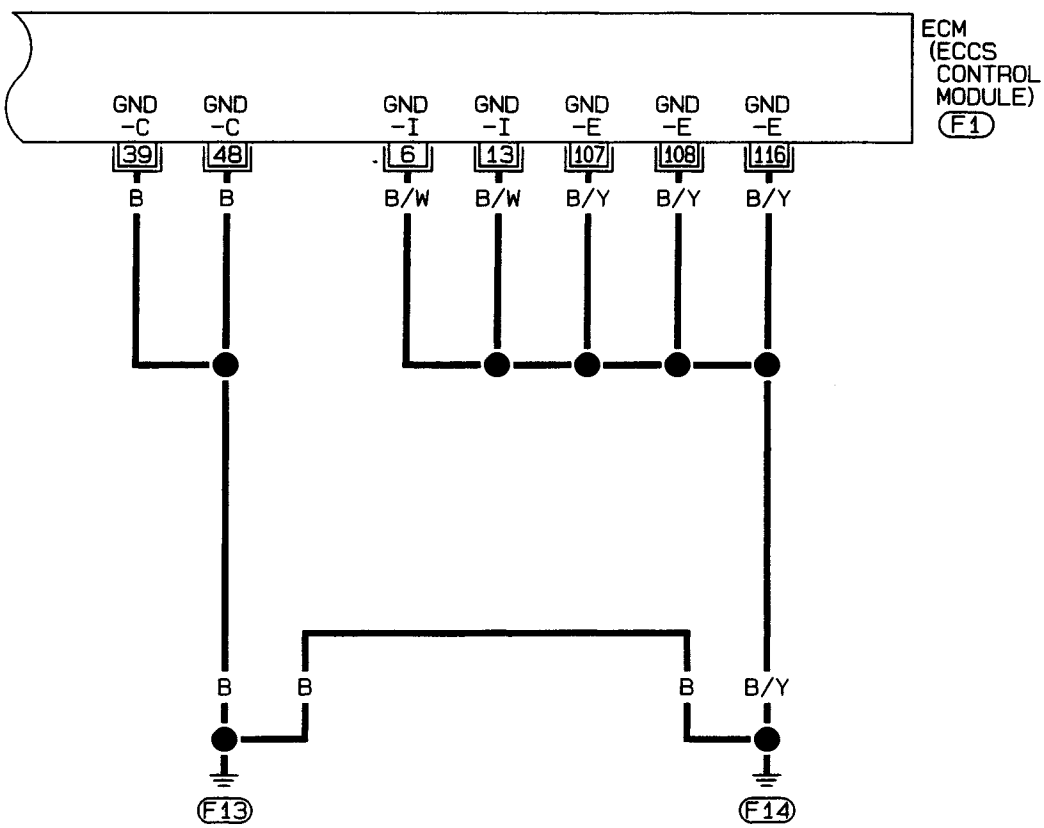


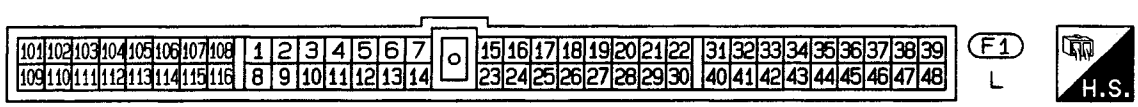
HEC026

Except GA16DE for Australia

EC-MAIN-02

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

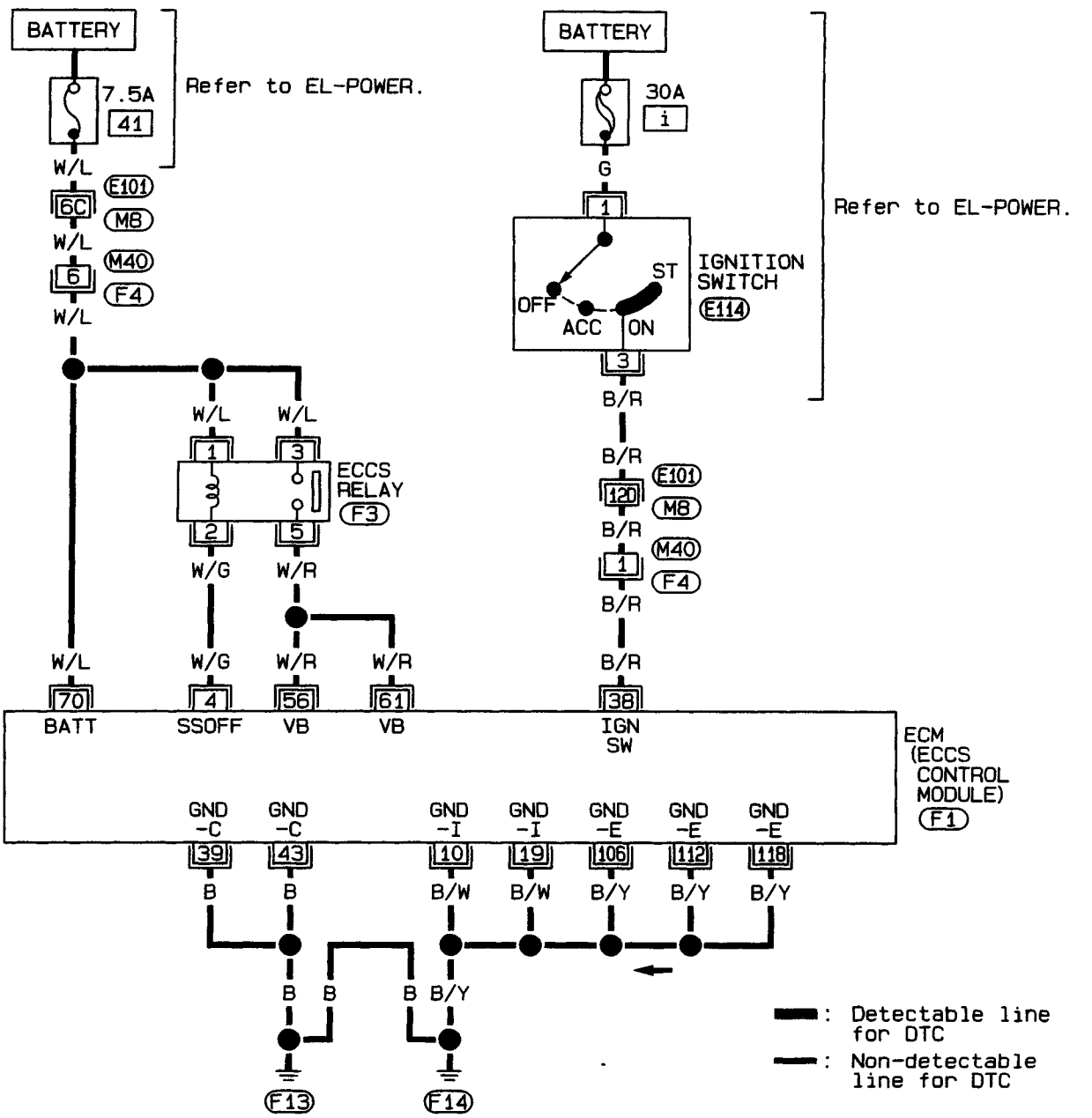


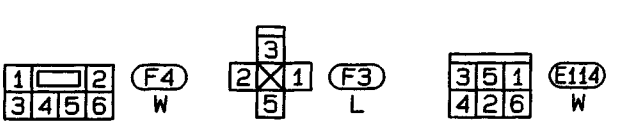


HEC027

GA16DE for Australia

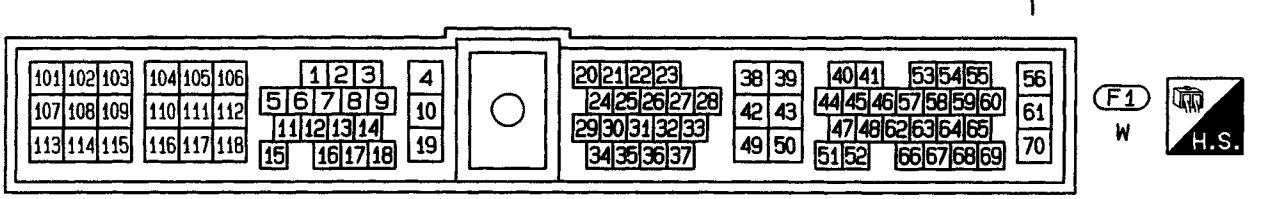
EC-MAIN-01





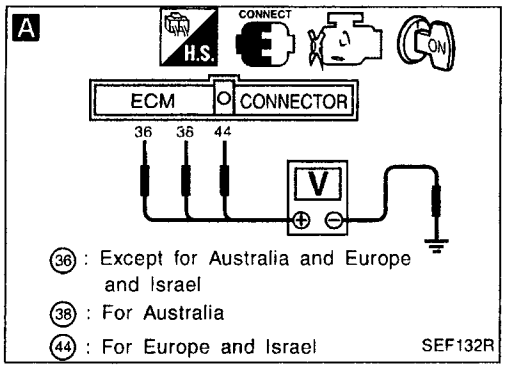
Refer to last page (Foldout page).

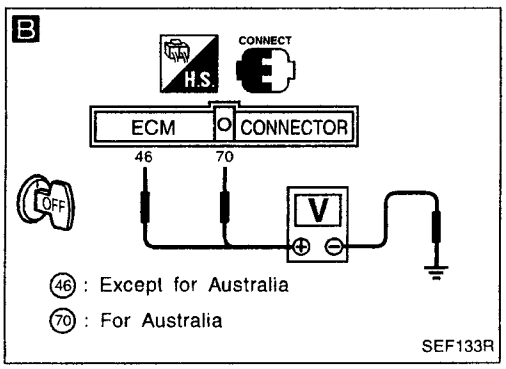
M8, E101

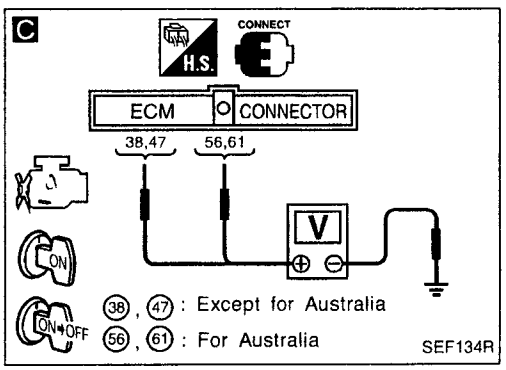


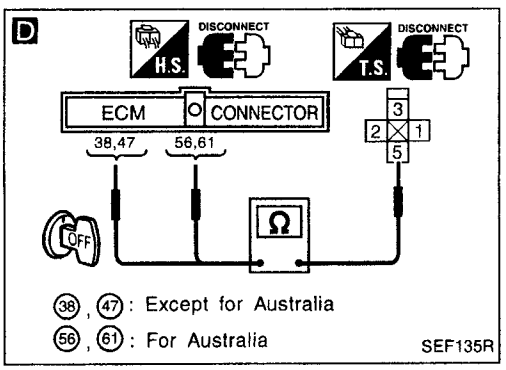
HEC062

Main Power Supply and Ground Circuit (Cont'd)









INSPECTION START

Start engine.
Is engine running?

No

A

CHECK POWER SUPPLY-I.
1. Turn ignition switch "ON".
2. Check voltage between ECM terminal 36, 38 or 44 and ground with CONSULT or tester.
   Voltage: Battery voltage

If NG, check the following.
- Harness connectors F4, M40 or F5, M41
- Harness connectors M8, E101
- Harness for open or short between ECM and ignition switch

If NG, repair harness or connectors.

OK

Go to H "CHECK GROUND CIRCUIT" on next page.

Yes

B

CHECK POWER SUPPLY-II.
1. Stop engine.
2. Check voltage between ECM terminal 46 or 70 and ground with CONSULT or tester.
   Voltage: Battery voltage

NG

Check the following.
- Harness connectors F4, M40 or F5, M41 or F4, M71
- Harness connectors M8, E101 or F4, M78
- Harness connectors M12, E101
- Joint connector M19
- 7.5A fuse
- Harness for open or short between ECM and battery

If NG, repair harness or connectors.

OK

C

CHECK POWER SUPPLY-III.
1. Turn ignition switch "ON" and then "OFF".
2. Check voltage between ECM terminals 38, 47, or 56, 61 and ground with CONSULT or tester.
   After turning ignition switch "OFF", battery voltage will exist for a few seconds, then drop to approximately 0V.

OK

Go to H "CHECK GROUND CIRCUIT" on next page.

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

NG

Case-1

Case-2

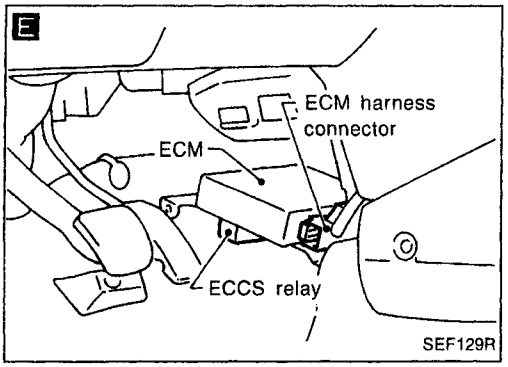
Go to G "CHECK ECCS RELAY" on next page.

Ⓐ

EC

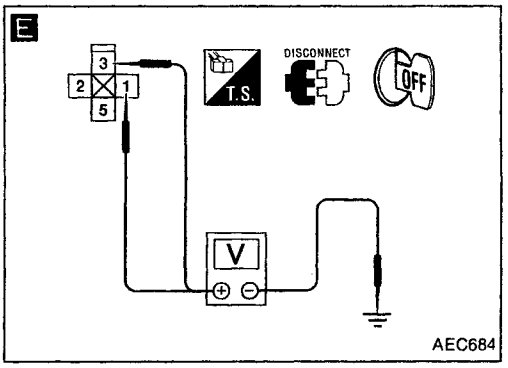
Main Power Supply and Ground Circuit (Cont'd)

E



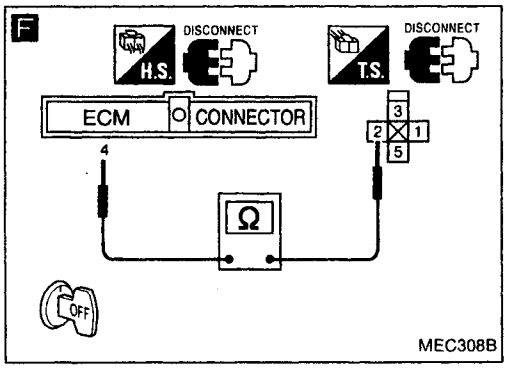
SEF129R

E



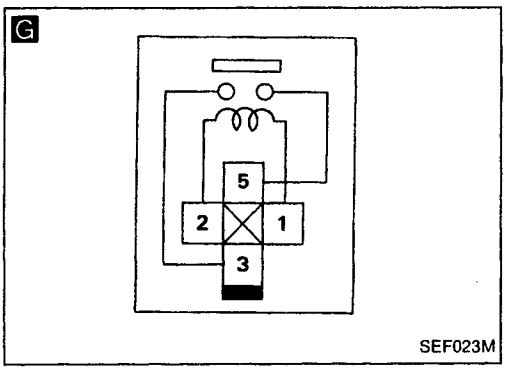
AEC684

F



MEC308B

G



SEF023M

Ⓐ

D

CHECK HARNESS CONTINUITY BETWEEN ECCS RELAY AND ECM
1. Disconnect ECM harness connector.
2. Disconnect ECCS relay.
3. Check harness continuity between ECM terminals ㊳, ㊼, or ㊺, ㊶ and terminal ⑤.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK

E

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

NG → Check the following.
- Harness connectors (F4), (M40) or (F5), (M41) or (F4), (M71)
- Harness connectors (M8), (E101) or (F4), (M78)
- Harness connectors (M12), (E101)
- Joint connector (M19)
- Harness for open or short between ECCS relay and battery

If NG, repair harness or connectors.

OK

F

CHECK OUTPUT SIGNAL CIRCUIT.
1. Check harness continuity between ECM terminal ④ and terminal ②.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK

G

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

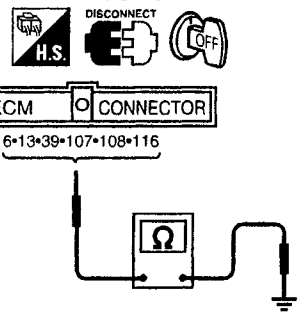
NG → Replace ECCS relay.

OK

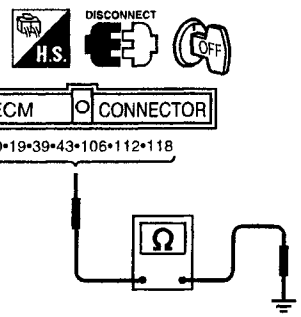
Ⓑ

Main Power Supply and Ground Circuit (Cont'd)

H **Except for Australia**



For Australia



SEF136R

Ⓑ

H

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Loosen and retighten engine ground screws.
3. Disconnect ECM harness connector.
4. Check harness continuity between ECM terminals ⑥, ⑬, ㊴, ㊽, (107), (108), (116), or ⑩, ⑲, ㊴, ㊸, (106), (112), (118) and engine ground.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

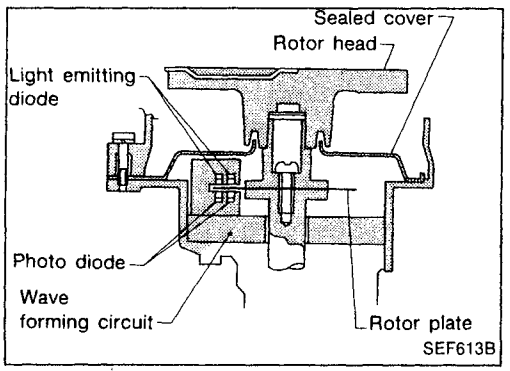
OK ↓

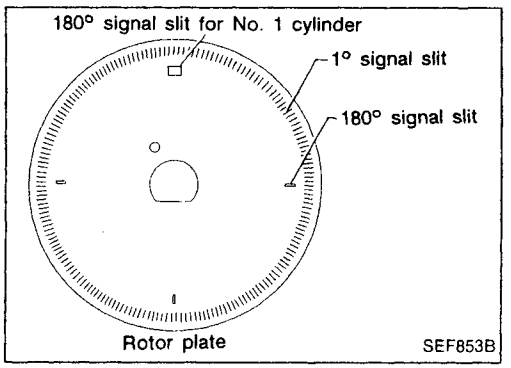
Check ECM pin terminals for damage or the connection of ECM harness connector.

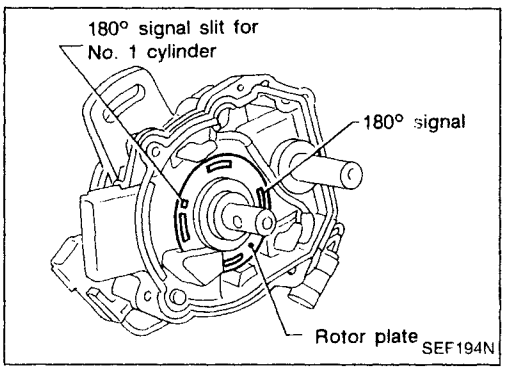
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INSPECTION END

EC







Camshaft Position Sensor (CMPS)

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

The camshaft position sensor has a rotor plate and a wave-forming circuit. The rotor plate has 360 slits for a 1° (POS) signal (except for Europe and Israel) and 4 slits for a 180° (REF) signal. The wave-forming circuit consists of Light Emitting Diodes (LED) and photo diodes.

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

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible cause)
11	• Either 1° or 180° signal is not entered to ECM for the first few seconds during engine cranking. • Either 1° or 180° signal is not entered to ECM often enough while the engine speed is higher than the specified engine speed. • The relation between 1° and 180° signal is not in the normal range during the specified engine speed.	• Harness or connectors (The camshaft position sensor circuit is open or shorted.) • Camshaft position sensor • Starter motor (Refer to EL section.) • Starting system circuit (Refer to EL section.) • Dead (Weak) battery

Camshaft Position Sensor (CMPS) (Cont'd)

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE



1) Turn ignition switch "ON" and select "DATA MONITOR" mode with CONSULT.
2) Crank engine for at least 2 seconds.

OR



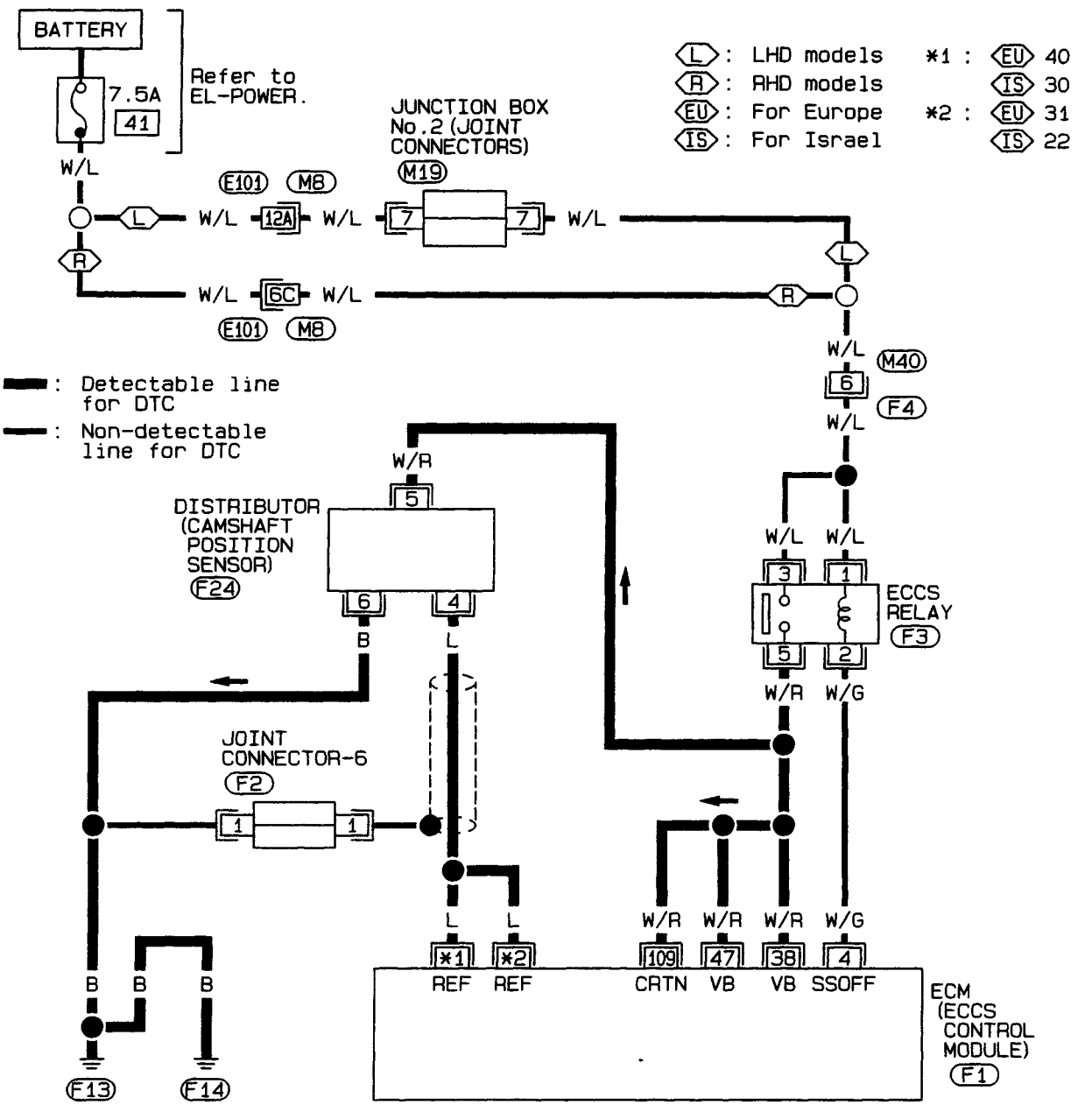
1) Crank engine for at least 2 seconds.
2) Turn ignition switch "OFF", wait for at least 5 seconds and then turn "ON".
3) Perform "Diagnostic Test Mode II" (Self-diagnostic results) with ECM.

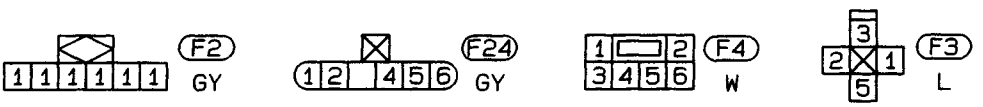
EC

Camshaft Position Sensor (CMPS) (Cont'd)

For Europe and Israel

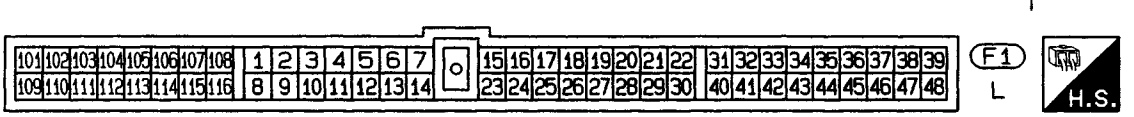
EC-CMPS-01





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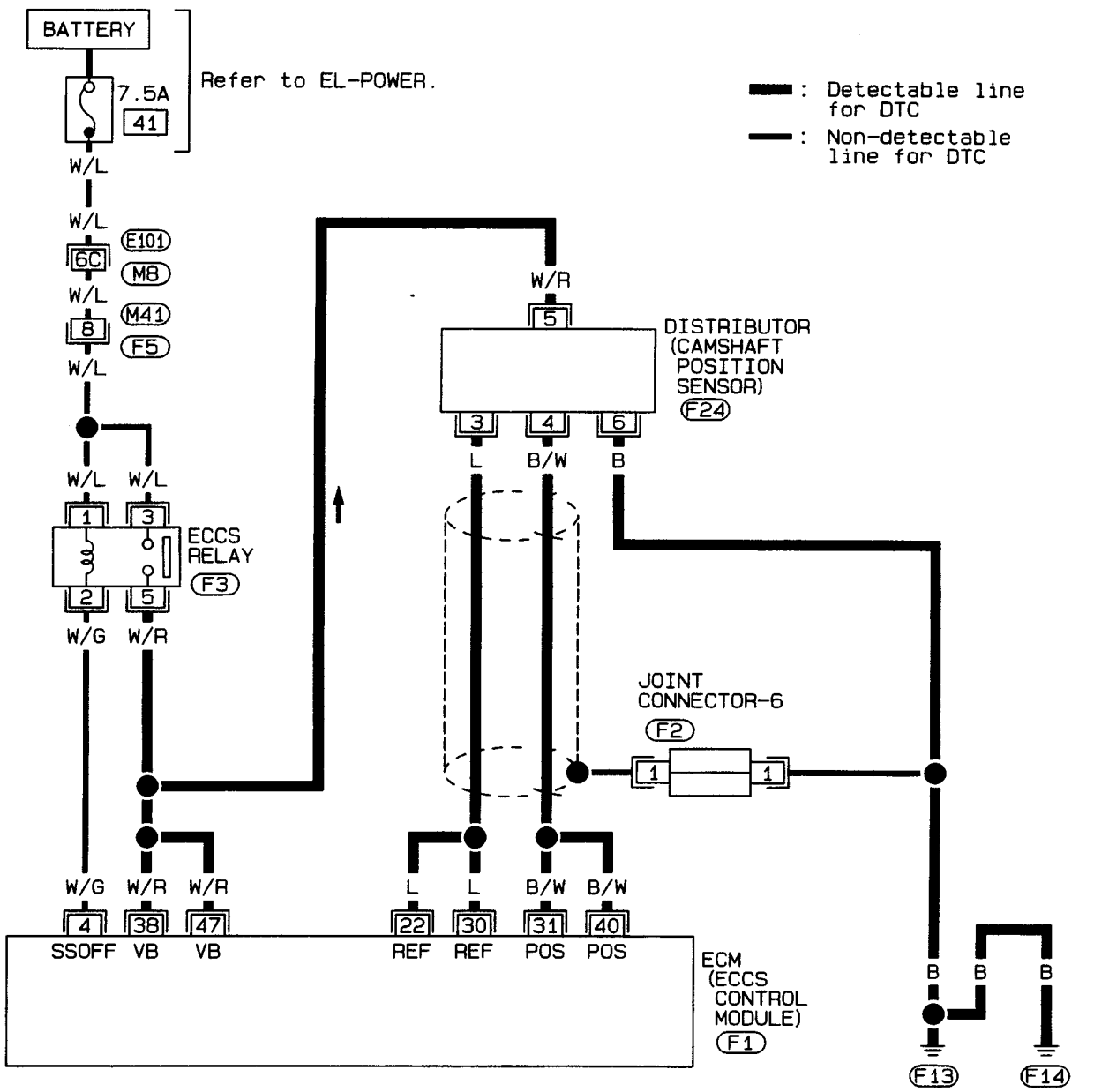
M8, E101, M19

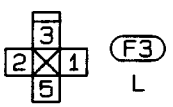


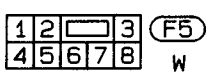
HEC028

Except for Europe and Israel

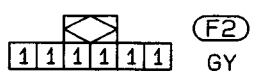
EC-CMPS-02





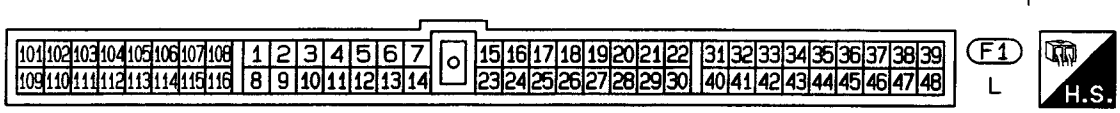






Refer to last page (Foldout page).

M8, E101

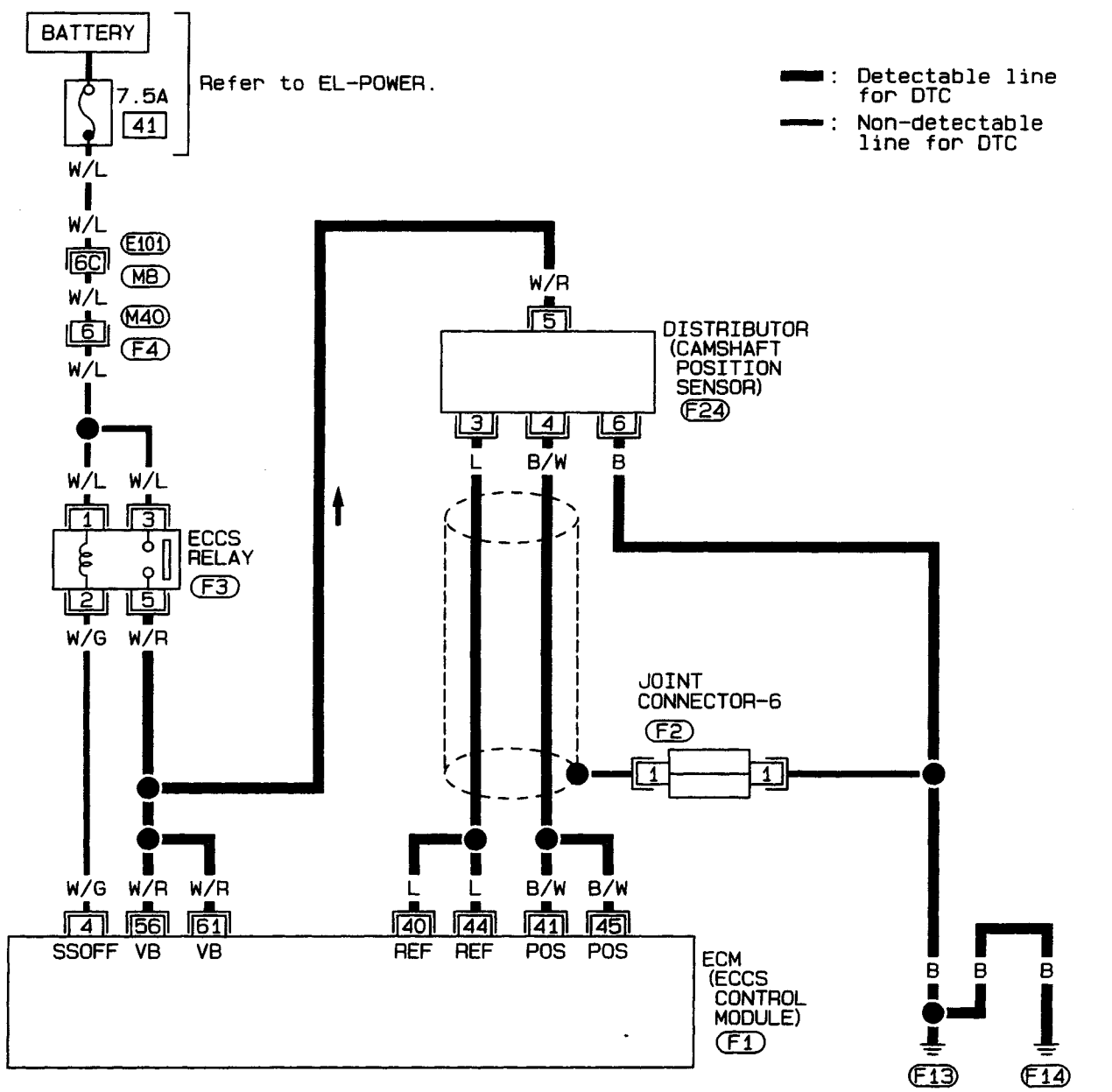


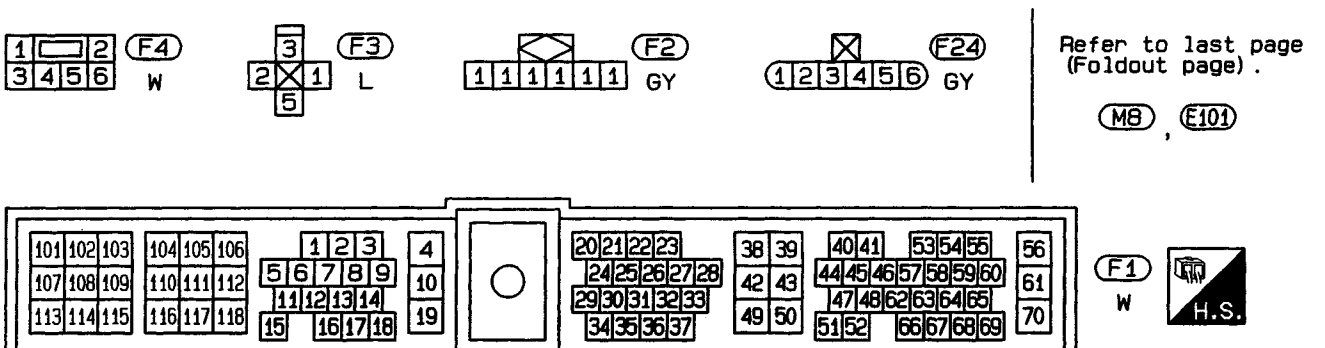
HEC029

Camshaft Position Sensor (CMPS) (Cont'd)

GA16DE for Australia

EC-CMPS-01



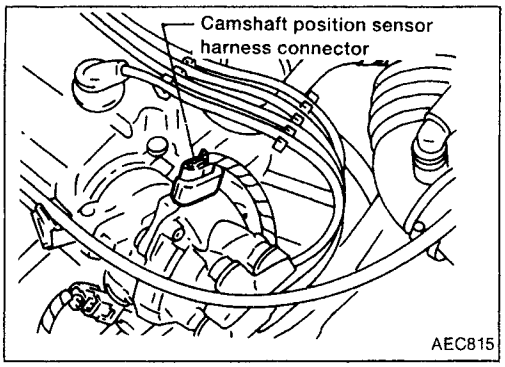


Refer to last page (Foldout page).
M8, E101

HEC063

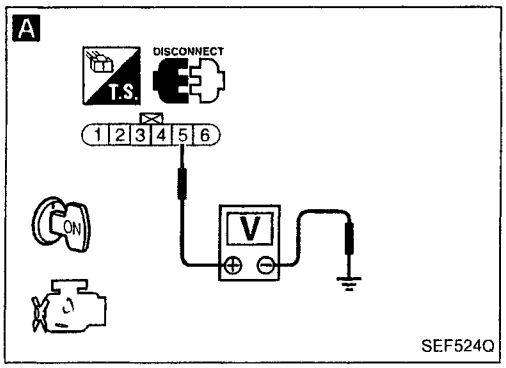
Camshaft Position Sensor (CMPS) (Cont'd)

DIAGNOSTIC PROCEDURE



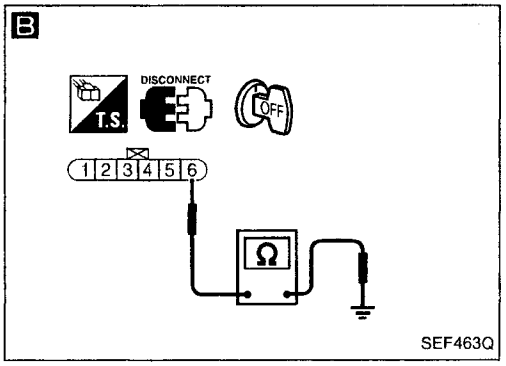
AEC815

A



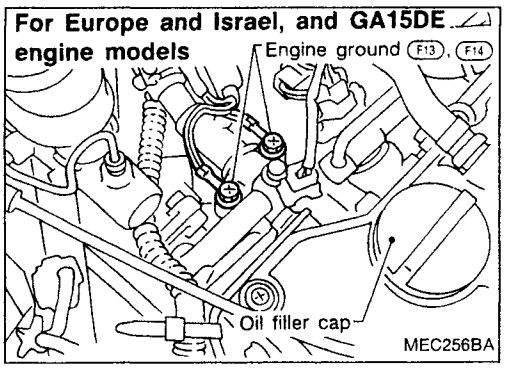
SEF524Q

B

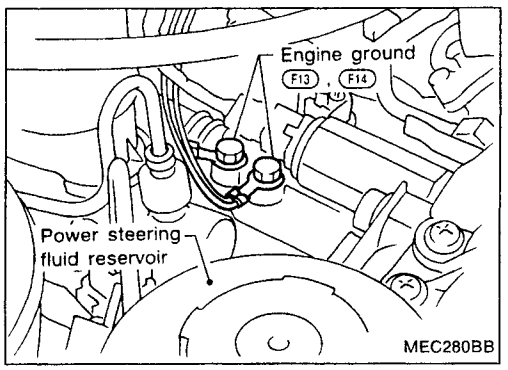


SEF463Q

For Europe and Israel, and GA15DE engine models



MEC256BA



MEC280BB

INSPECTION START

A

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect camshaft position sensor harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ⑤ and ground with CONSULT or tester.

Voltage: Battery voltage

NG → Check the following.
- Harness for open or short between camshaft position sensor and ECCS relay

If NG, repair harness or connectors.

OK ↓

B

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Loosen and retighten engine ground screws.
3. Check harness continuity between terminal ⑥ and engine ground.

Continuity should exist.

If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between terminal ④ and ECM terminals ㉛, ㊵, or ㉒, ㉚ or ㊶, ㊺ terminal ③ and ECM terminals ㊵, ㊹ or ㉒, ㉚.

Continuity should exist.

If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

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

NG → Replace camshaft position sensor.

OK ↓

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

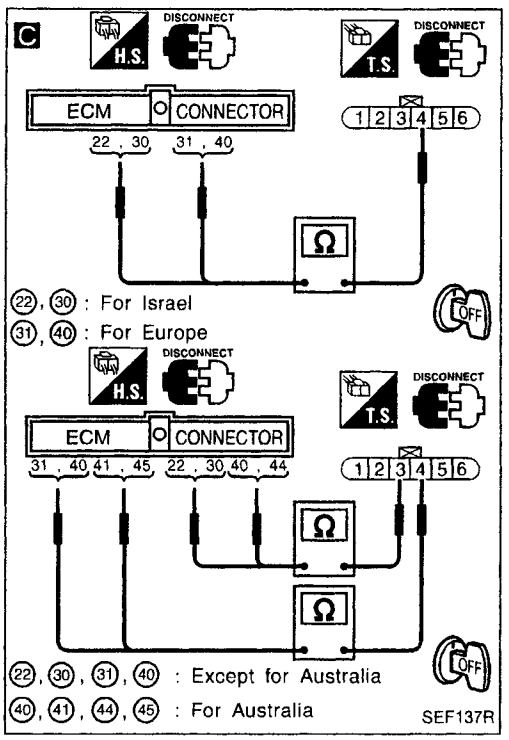
Trouble is not fixed. ↓

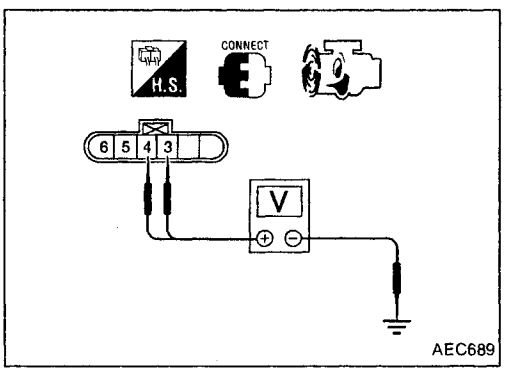
Check ECM pin terminals for damage or the connection of ECM harness connector. Reconnect ECM harness connector and retest.

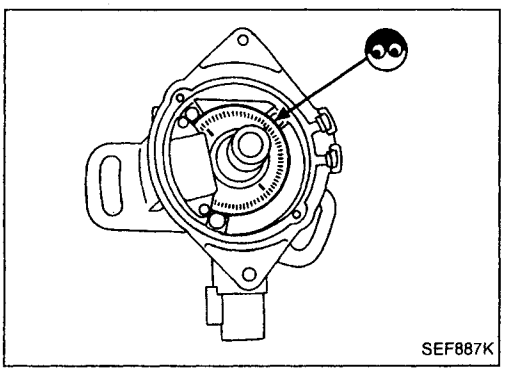
INSPECTION END

EC

Camshaft Position Sensor (CMPS) (Cont'd)







COMPONENT INSPECTION

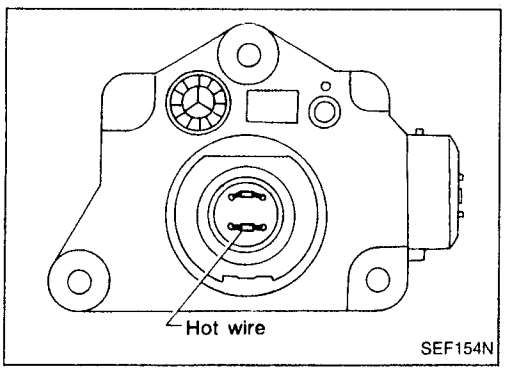
Camshaft position sensor

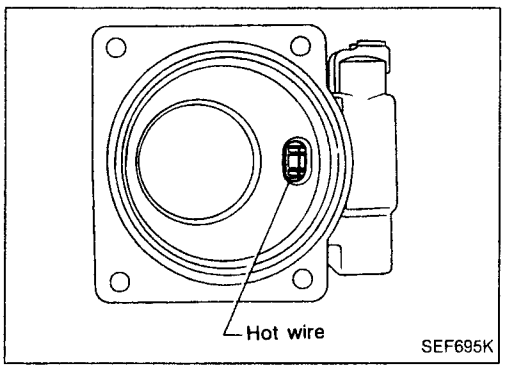
1. Start engine.
2. Check voltage between camshaft position sensor terminals ③, ④ and ground with AC range.

Terminal	Voltage
③ : Except for Europe and Israel ④ : For Europe and Israel (180° signal)	Tester's pointer fluctuates between 5V and 0V.
④ : Except for Europe and Israel (1° signal)	

3. If NG, replace distributor assembly with camshaft position sensor.
4. Remove distributor cap. Visually check signal plate for damage or dust.

After this inspection, diagnostic trouble code No. 11 might be displayed with camshaft position sensor functioning properly. Erase the stored memory.





Mass Air Flow Sensor (MAFS)

The mass air flow sensor measures the intake air flow rate by taking a part of the entire flow. Measurements are made in such a manner that the ECM receives electrical output signals varied by the amount of heat emitting from the hot wire placed in the stream of the intake air.

When intake air flows into the intake manifold through a route around the hot wire, the heat generated from the hot wire is taken away by the air. The amount of heat depends on the air flow. On the other hand, the temperature of the hot wire is automatically controlled to a certain number of degrees.

Therefore, it is necessary to supply the hot wire with more electric current in order to maintain the temperature of the hot wire. The ECM knows the air flow by means of the electric change.

EC

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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

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

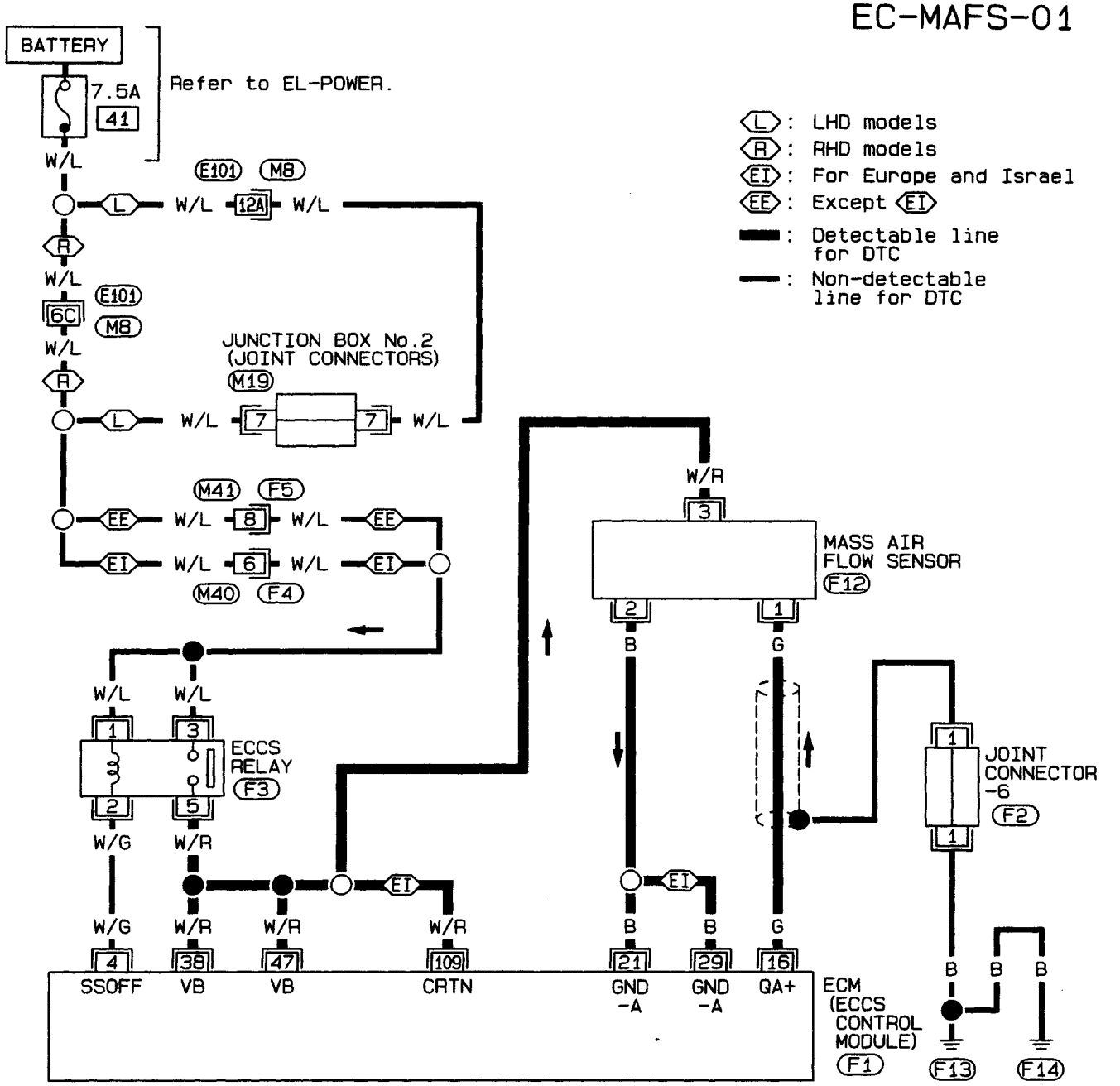
OR

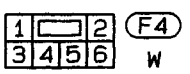
1) Turn ignition switch "ON", and wait for at least 6 seconds.
2) Start engine and wait for at least 3 seconds.
3) Turn ignition switch "OFF", wait for at least 5 seconds and then turn "ON".
4) Perform "Diagnostic Test Mode II" (Self-diagnostic results) with ECM.

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

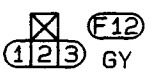
GA14DE, 16DE engine for Europe and Israel, and GA15DE engine

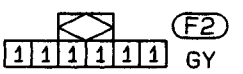
EC-MAFS-01

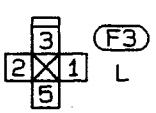






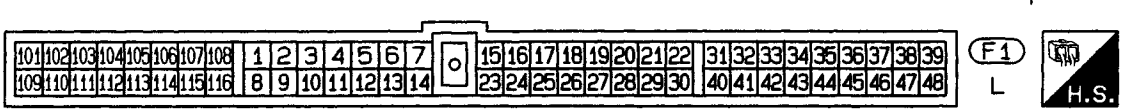






Refer to last page (Foldout page).

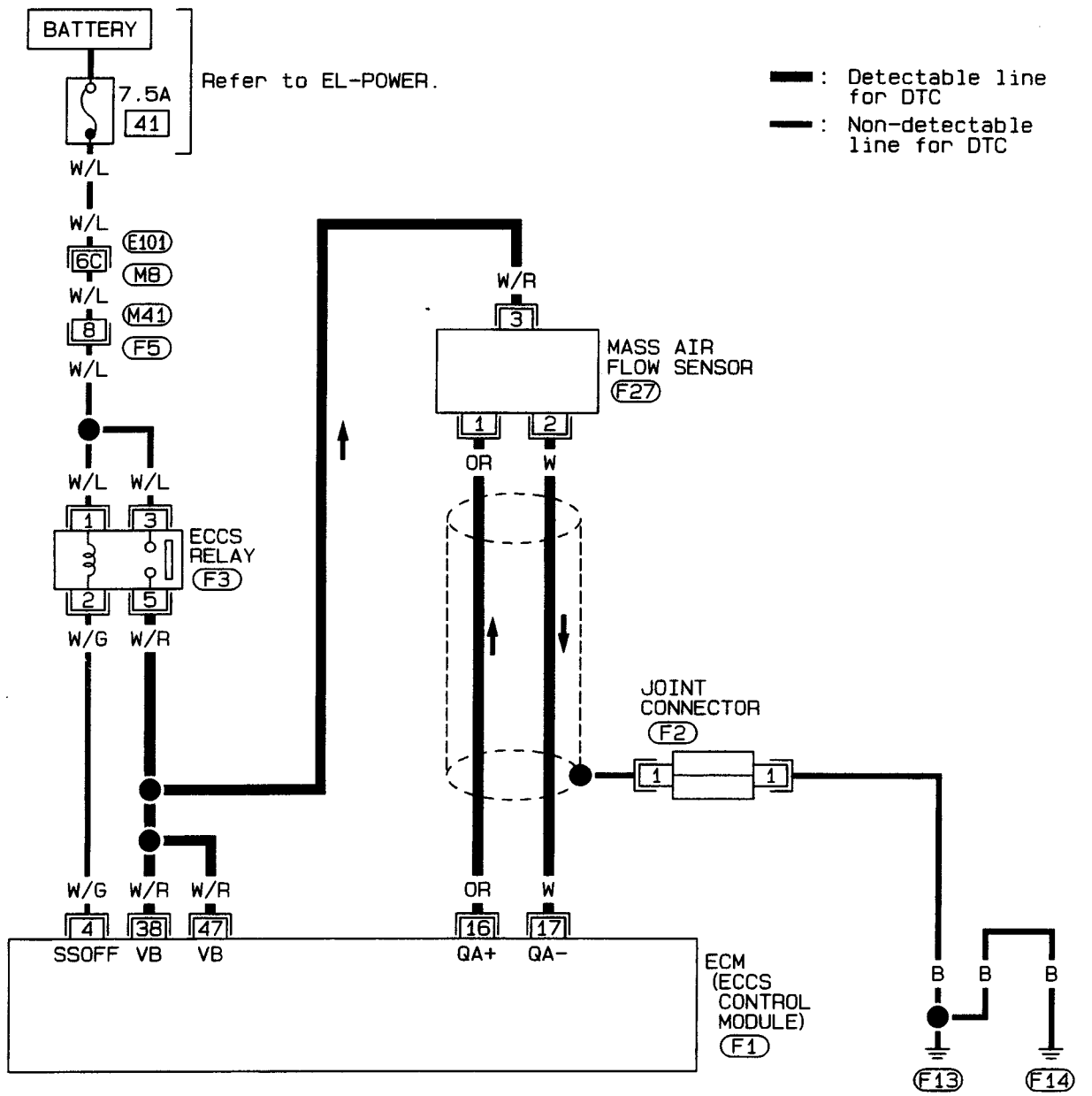
M8 E101 M19

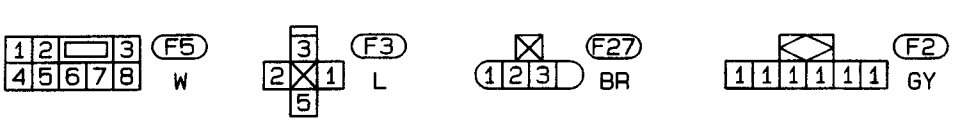


HEC030

GA16DE engine models except for Europe and Israel

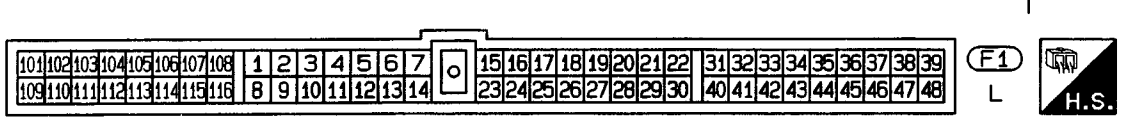
EC-MAFS-02





Refer to last page (Foldout page).

M8, E101

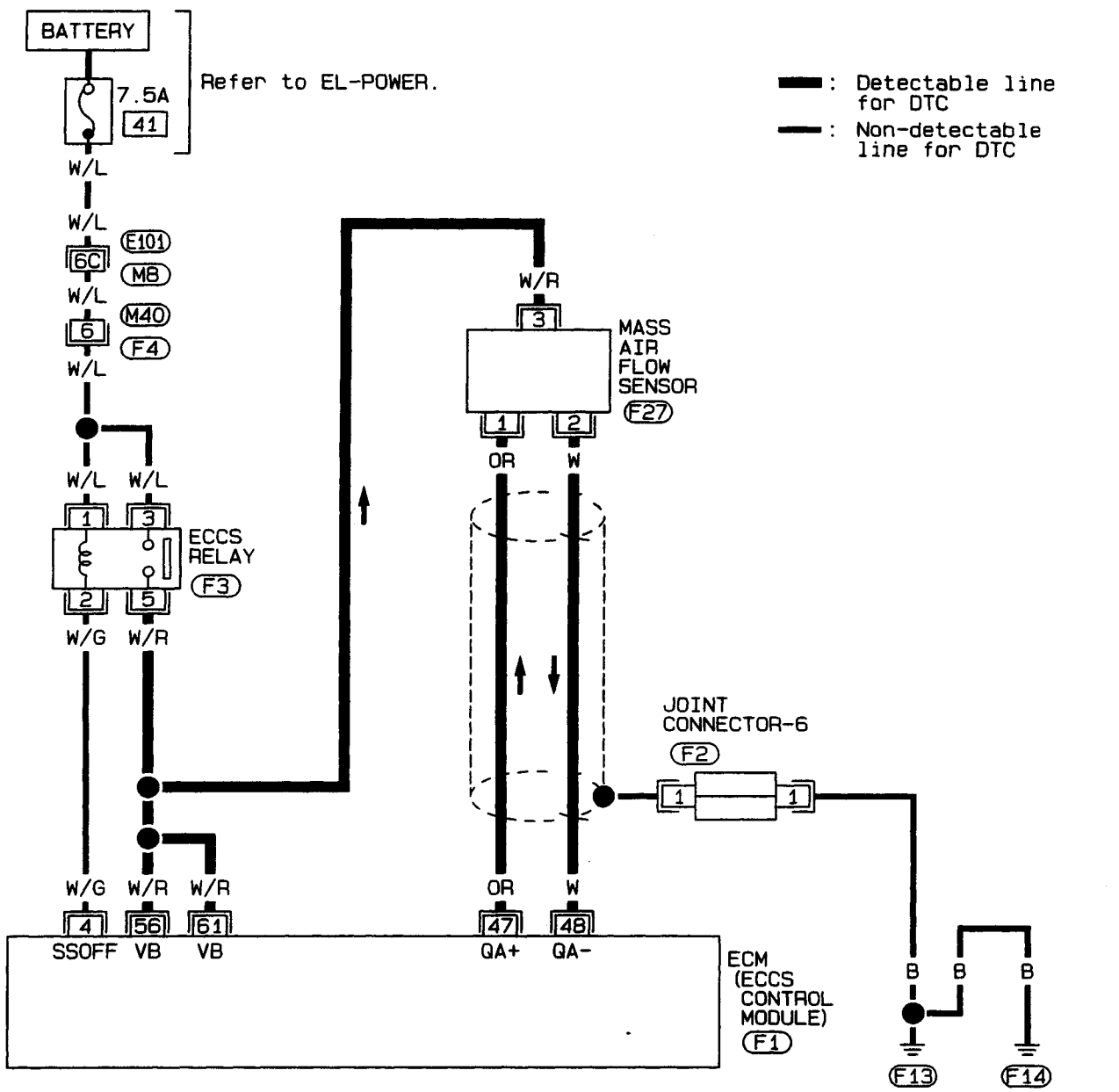


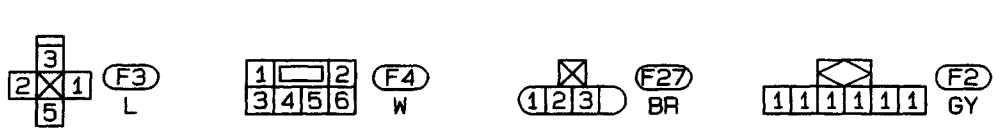
HEC031

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

GA16DE for Australia

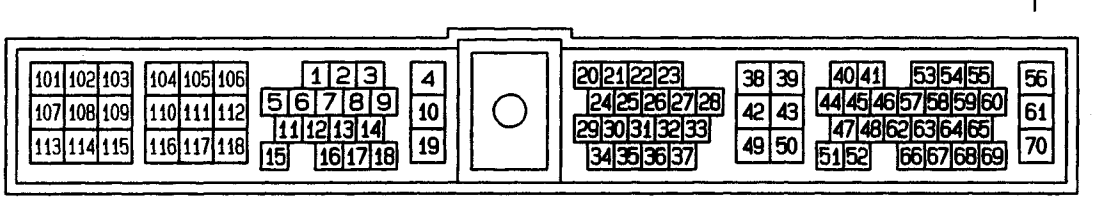
EC-MAFS-01





Refer to last page (Foldout page).

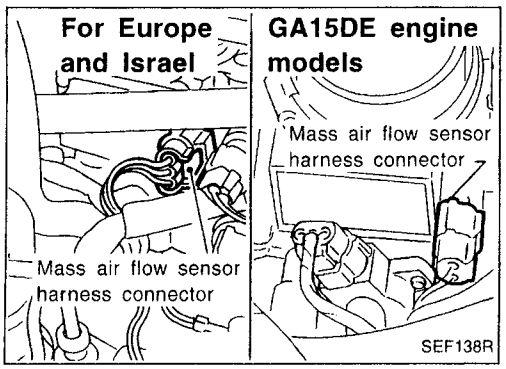
M8, E101

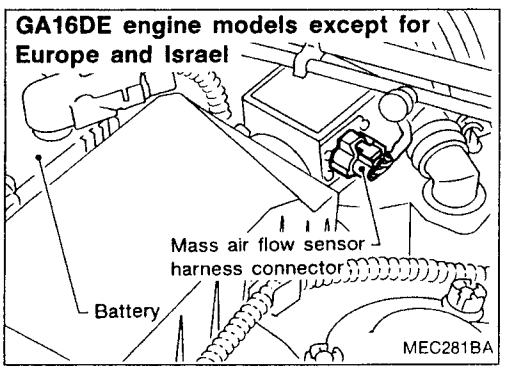


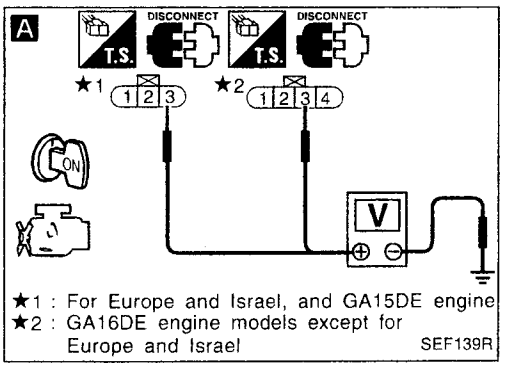
HEC064

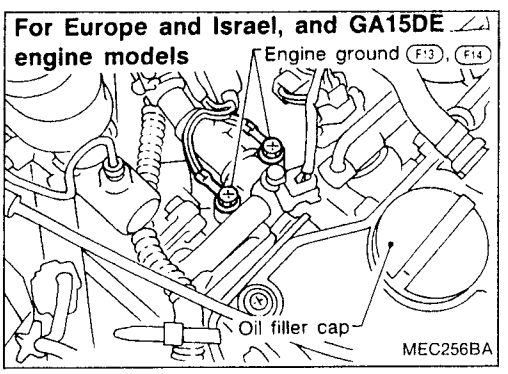
Mass Air Flow Sensor (MAFS) (Cont'd)

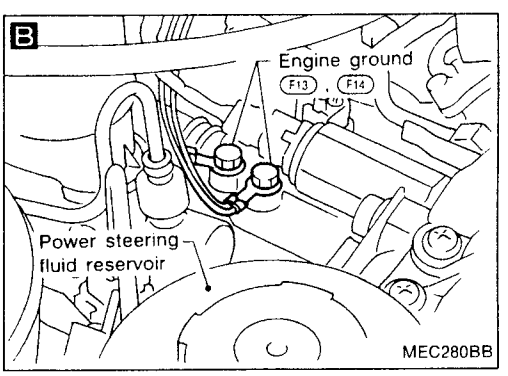
DIAGNOSTIC PROCEDURE











INSPECTION START

A

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect mass air flow sensor harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ③ and ground with CONSULT or tester.
Voltage: Battery positive voltage

NG → Repair harness or connectors.

OK

B

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Loosen and retighten engine ground screws.
4. Check harness continuity between terminal ② and ECM terminal ⑰ or ㊽ or engine ground.
Continuity should exist.
If OK, check harness for short.

NG → Repair harness or connectors.

OK

C

CHECK INPUT SIGNAL CIRCUIT.
Check harness continuity between terminal ① and ECM terminal ⑯ or ㊼.
Continuity should exist.
If OK, check harness for short.

NG → Repair harness or connectors.

OK

CHECK COMPONENT (Mass air flow sensor).
Refer to "COMPONENT INSPECTION" on page EC-107.

NG → Replace mass air flow sensor.

OK

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

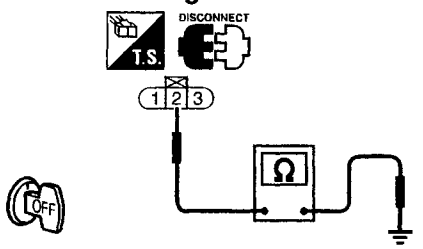
Trouble is not fixed.

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

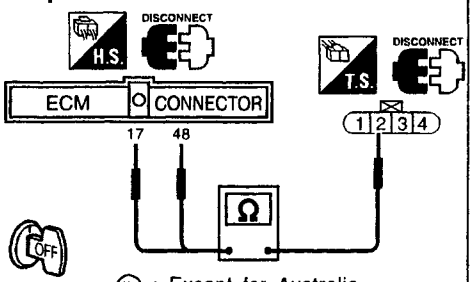
INSPECTION END

EC

B For Europe and Israel, and GA15DE engine

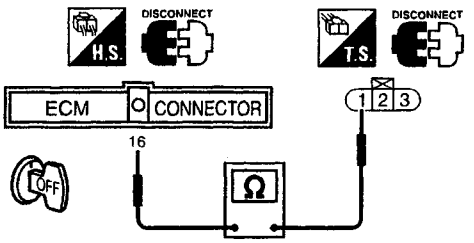


GA16DE engine models except for Europe and Israel

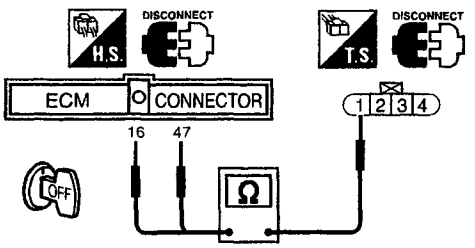


⑰ : Except for Australia
㊽ : For Australia
SEF140R

C For Europe and Israel, and GA15DE engine models



GA16DE engine models except for Europe and Israel



⑯ : Except for Australia
㊼ : For Australia
SEF141R

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

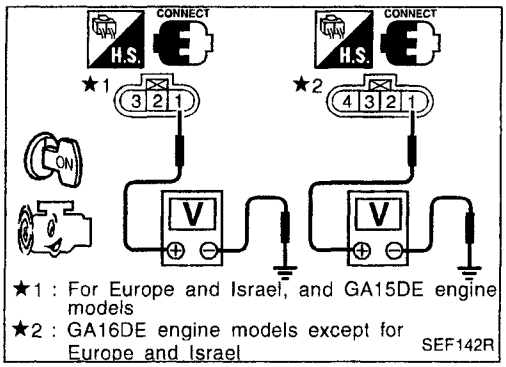
COMPONENT INSPECTION

Mass air flow sensor

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

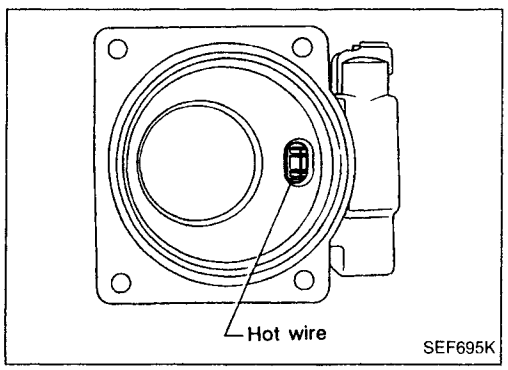
Conditions	Voltage V
Ignition switch "ON" (Engine stopped.)	Less than 1.0
Idle (Engine is warmed-up sufficiently.)	1.2 - 1.8

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

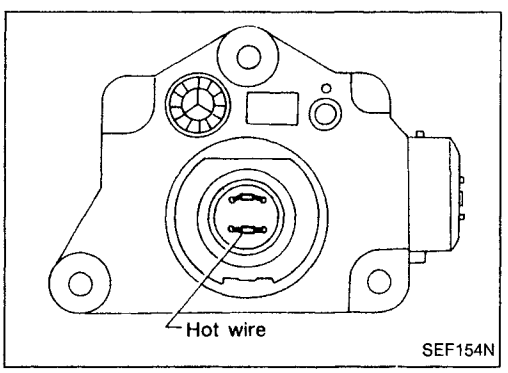


★1 : For Europe and Israel, and GA15DE engine models
★2 : GA16DE engine models except for Europe and Israel

SEF142R

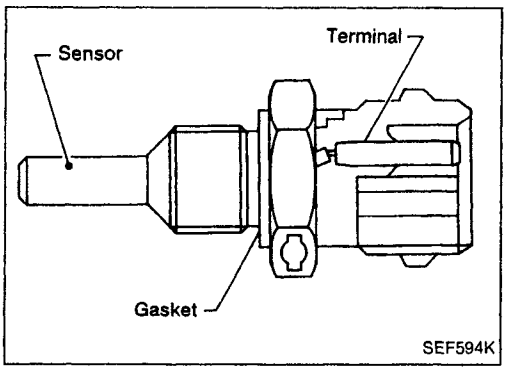


SEF695K



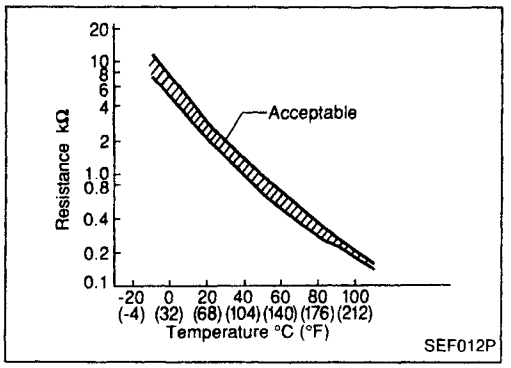
SEF154N

EC



Engine Coolant Temperature Sensor (ECTS)

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



<Reference data>

Engine coolant temperature °C (°F)	Voltage (V)	Resistance (kΩ)
−10 (14)	4.4	7.0 - 11.4
20 (68)	3.5	2.1 - 2.9
50 (122)	2.2	0.6 - 1.0
90 (194)	0.9	0.23 - 0.26

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
13	• 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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

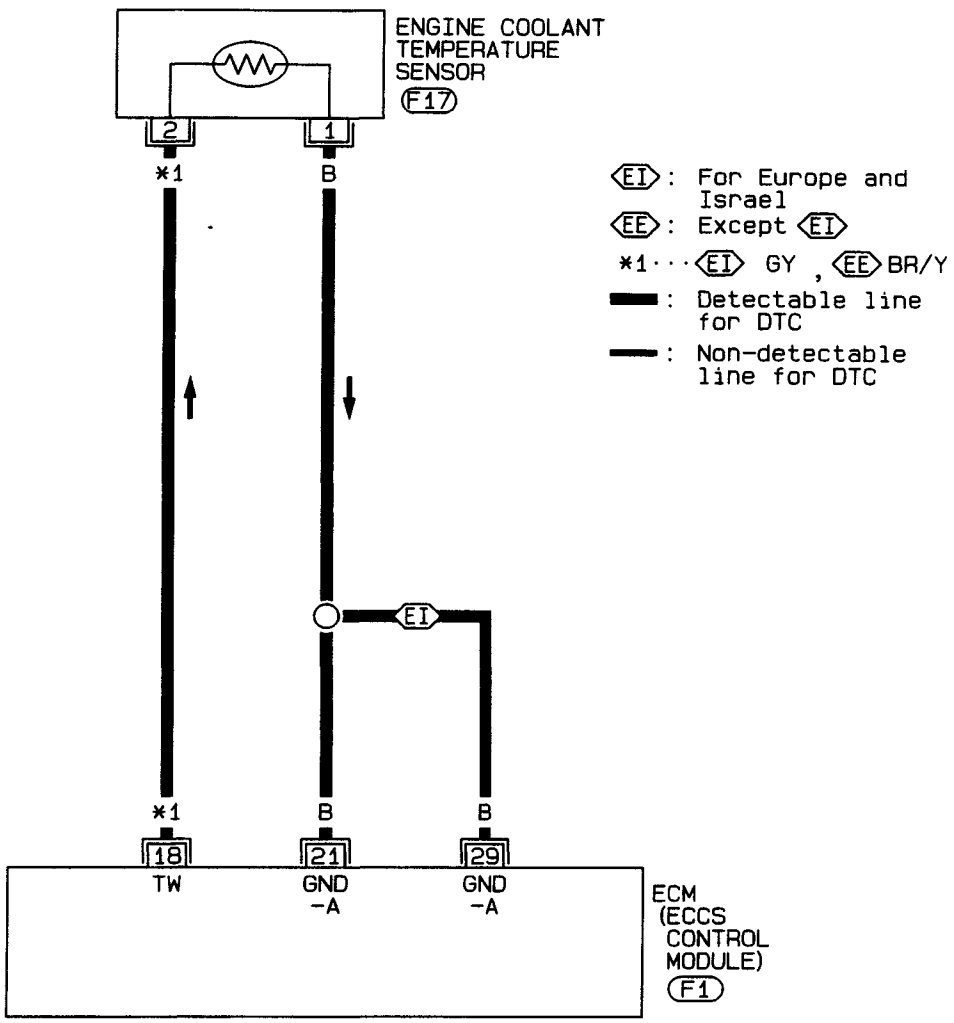
1) Turn ignition switch "ON".
2) Select "DATA MONITOR" mode with CONSULT.
3) Wait for at least 5 seconds.

OR

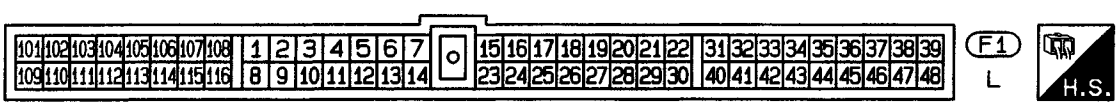
1) Turn ignition switch "ON" and wait for at least 5 seconds.
2) Turn ignition switch "OFF", wait for at least 5 seconds and then turn "ON".
3) Perform "Diagnostic Test Mode II" (Self-diagnostic results) with ECM.

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

EC-ECTS-01



F17
1 2 GY

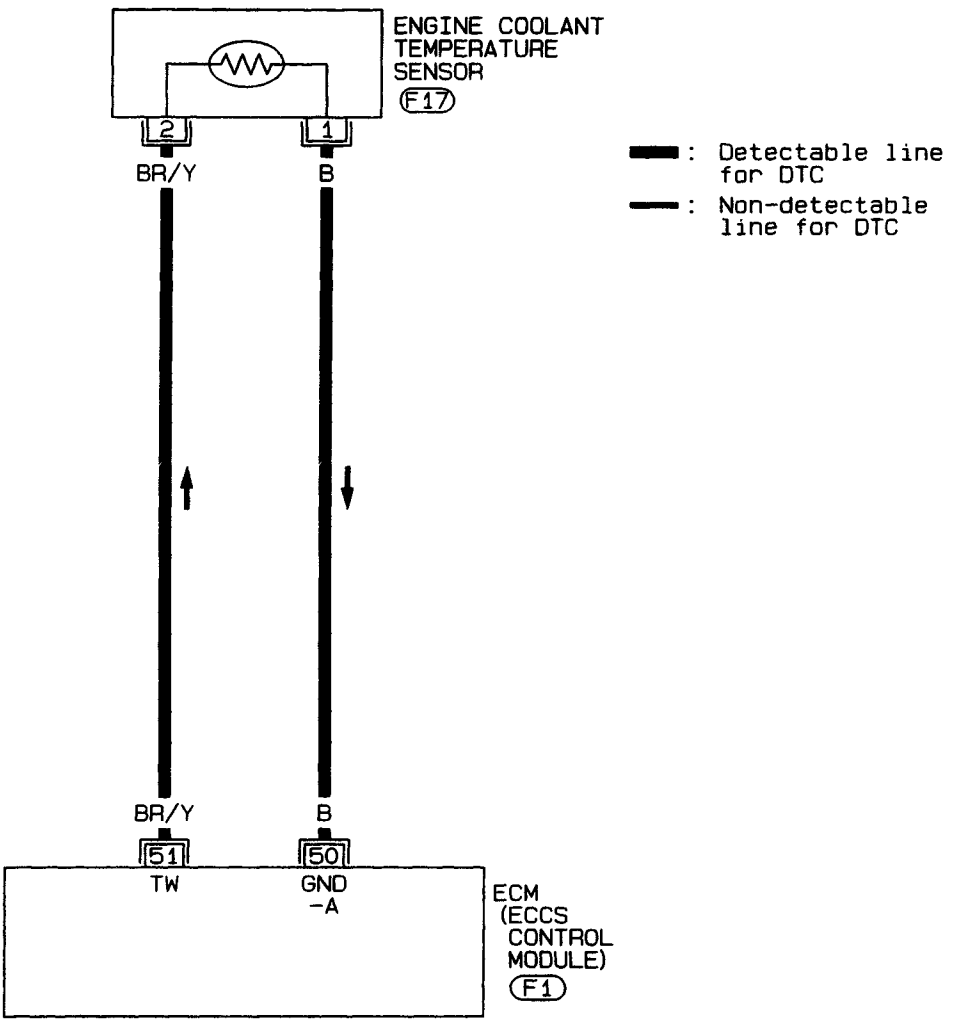


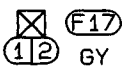
HEC032

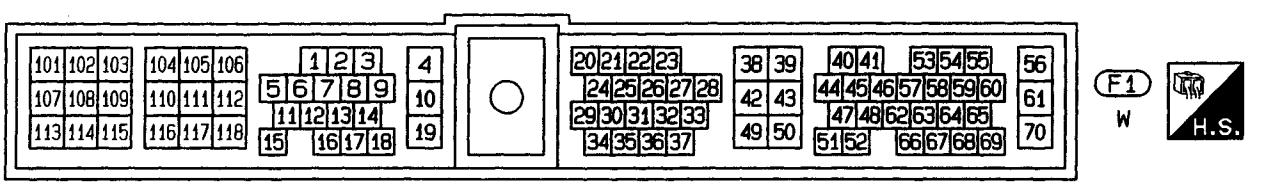
Engine Coolant Temperature Sensor (ECTS) (Cont'd)

GA16DE for Australia

EC-ECTS-01



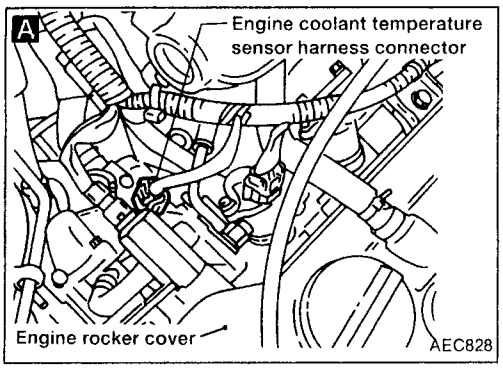


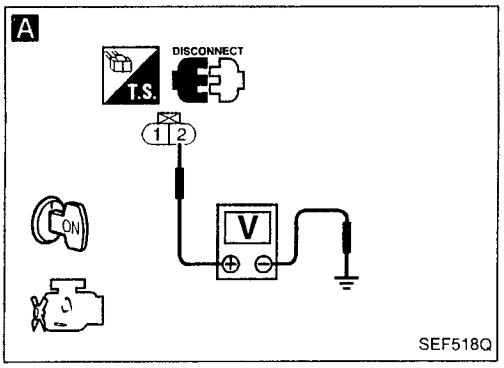


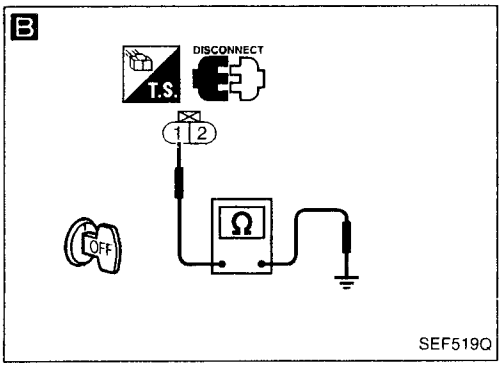
HEC065

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

DIAGNOSTIC PROCEDURE







INSPECTION START

A

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect engine coolant temperature sensor harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ② and ground with CONSULT or tester.

Voltage:
Approximately 5V

NG → Check the following.
- Harness for open or short between ECM and engine coolant temperature sensor

If NG, repair harness or connectors.

OK

B

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Check harness continuity between terminal ① and engine ground.

Continuity should exist.

If OK, check harness for short.

NG → Check the following.
- Harness for open or short between ECM and engine coolant temperature sensor

If NG, repair harness or connectors.

OK

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

NG → Replace engine coolant temperature sensor.

OK

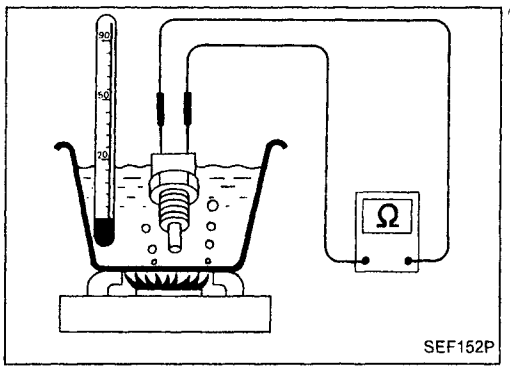
Disconnect and reconnect harness connectors in the circuits. Then retest.

Trouble is not fixed.

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

INSPECTION END

EC



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

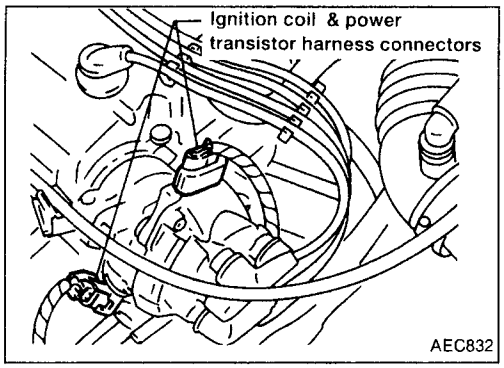
COMPONENT INSPECTION

Engine coolant temperature sensor

Check resistance as shown in the figure.

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

If NG, replace engine coolant temperature sensor.



Ignition Signal

COMPONENT DESCRIPTION

Ignition coil & power transistor (Built into distributor)

The ignition coil is built into distributor. The ignition signal from the ECM is sent to the power transistor. The power transistor switches on and off the ignition coil primary circuit. As the primary circuit is turned on and off, the proper high voltage is induced in the coil secondary circuit.

EC

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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

Note: If both DTC 11 and 21 are displayed, perform TROUBLE DIAGNOSIS FOR DTC 11 first. Refer to EC-94.

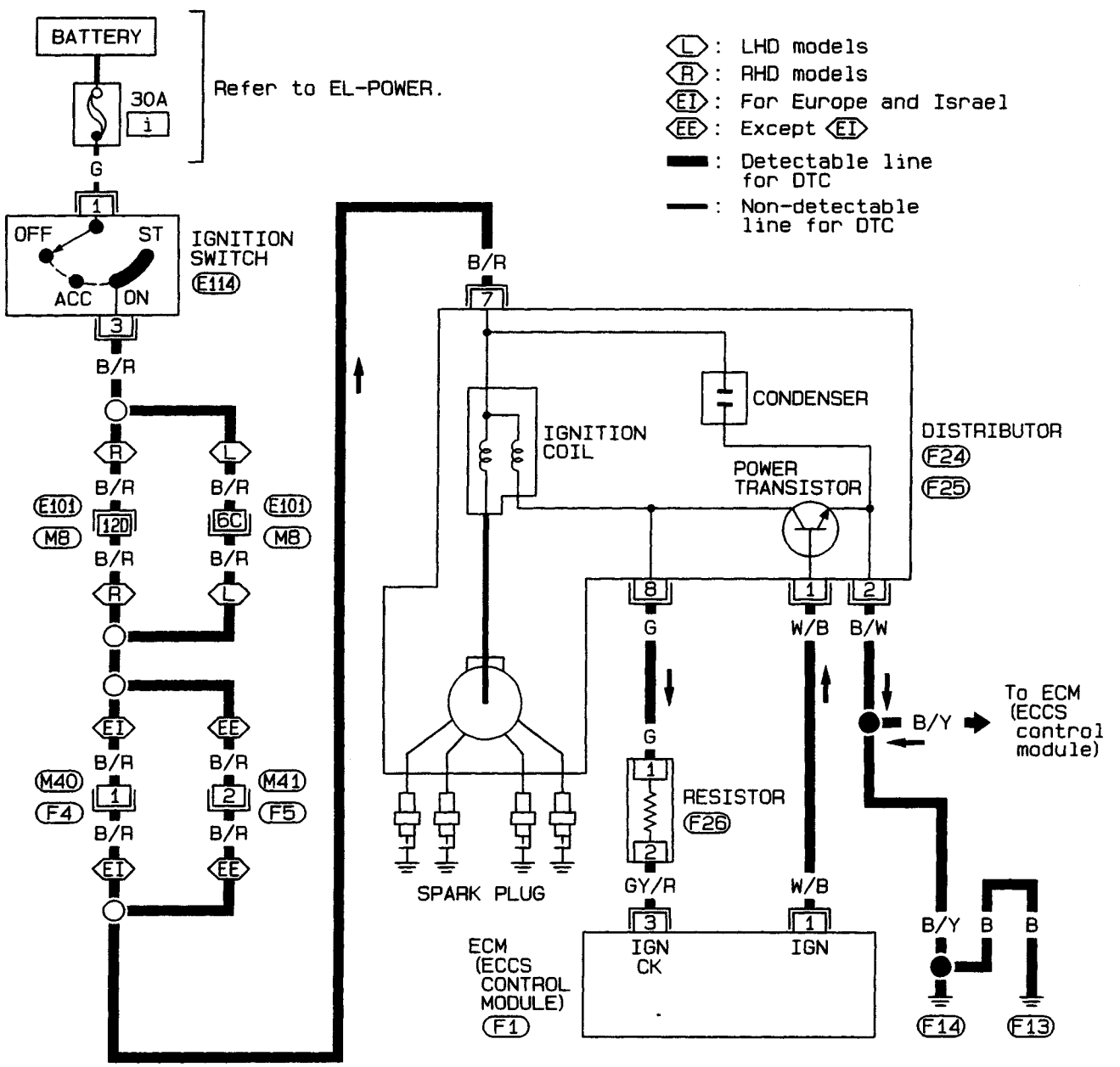
1) Turn ignition switch "ON".
2) Select "DATA MONITOR" mode with CONSULT.
3) Start engine.

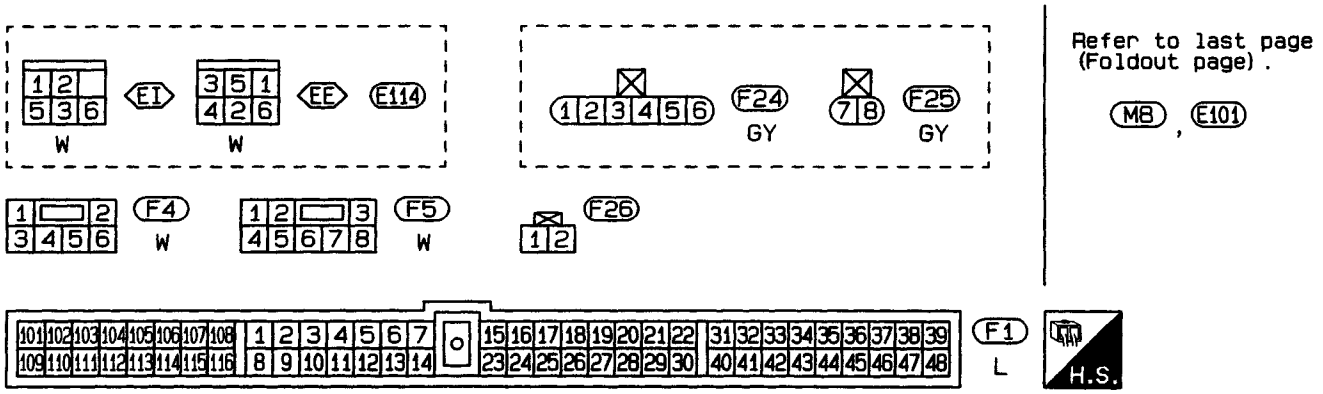
OR

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

Ignition Signal (Cont'd)

EC-IGN/SG-01

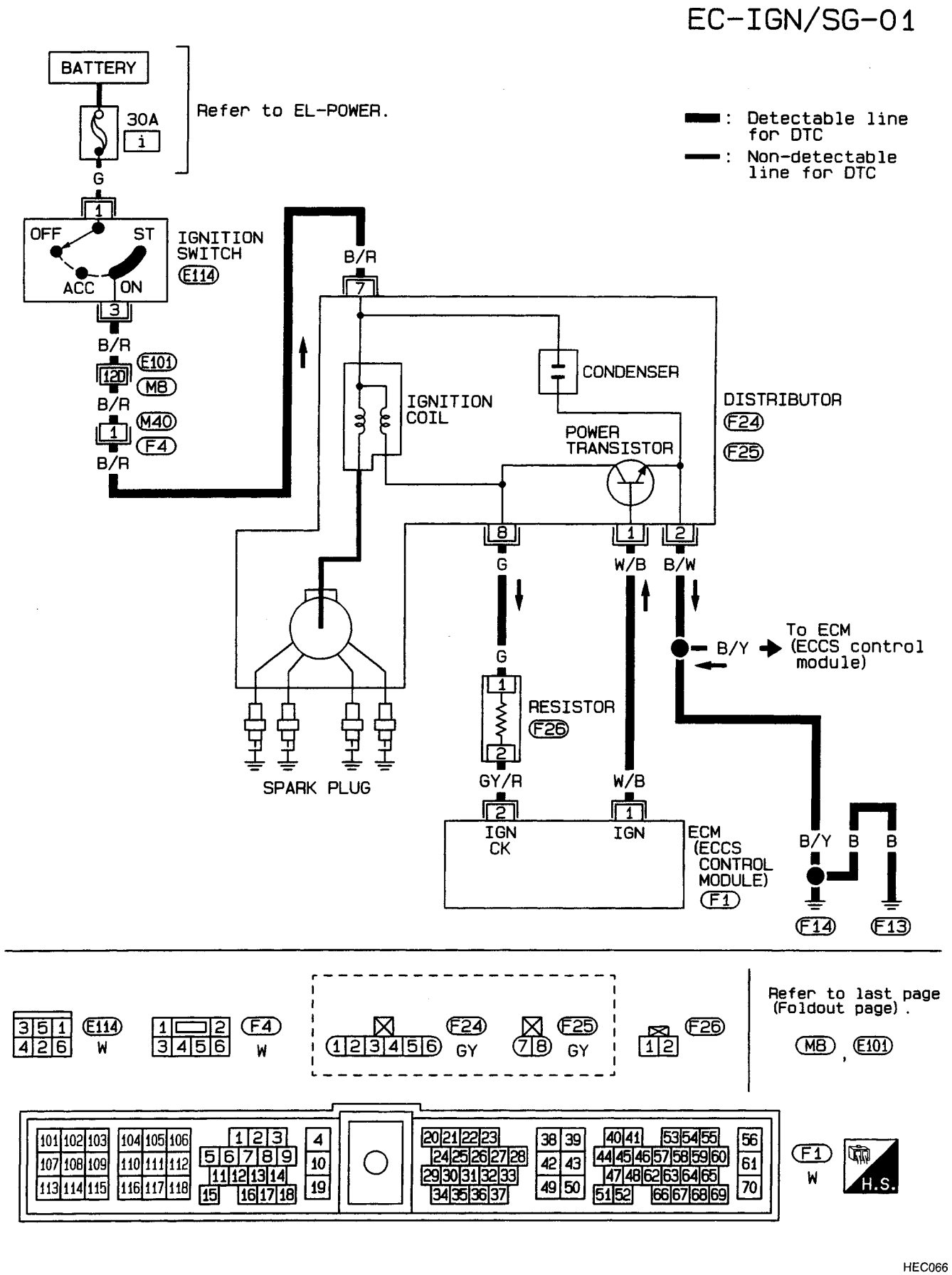




HEC033

Ignition Signal (Cont'd)

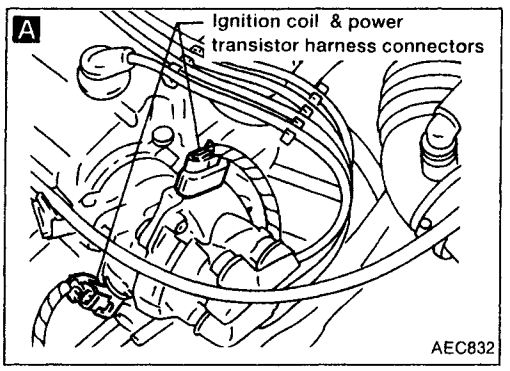
GA16DE for Australia

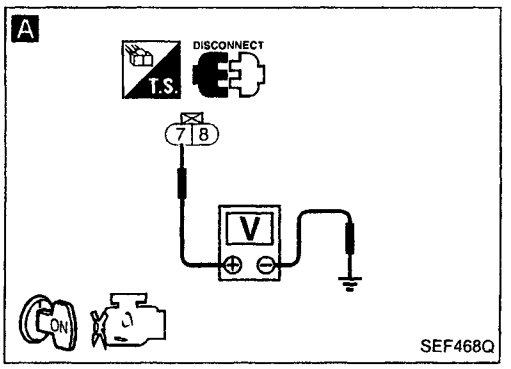


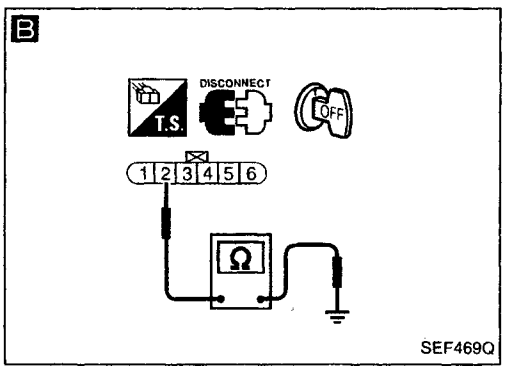
HEC066

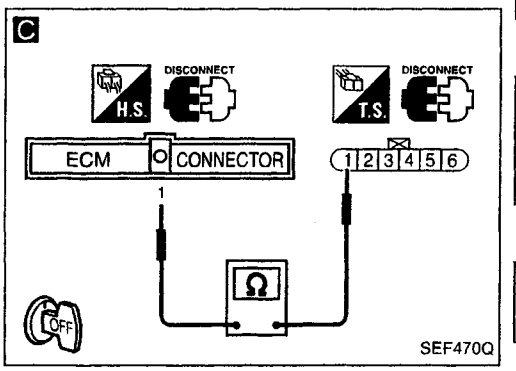
Ignition Signal (Cont'd)

DIAGNOSTIC PROCEDURE









INSPECTION START

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

Yes → Ⓐ

No

A

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

NG → Check the following.
- Harness connectors (F4), (M40) or (F5), (M41)
- Harness connectors (M8), (E101)
- Harness for open or short between ignition coil and ignition switch

If NG, repair harness or connectors.

OK

B

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

NG → Repair harness or connectors.

OK

C

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ① and power transistor terminal ①.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK

CHECK COMPONENTS (Ignition coil, power transistor).
Refer to "COMPONENT INSPECTION", EC-118.

NG → Replace malfunctioning component(s).

OK

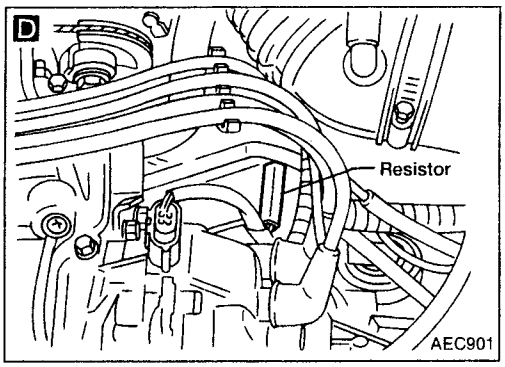
Disconnect and reconnect harness connectors in the circuit. Then retest.

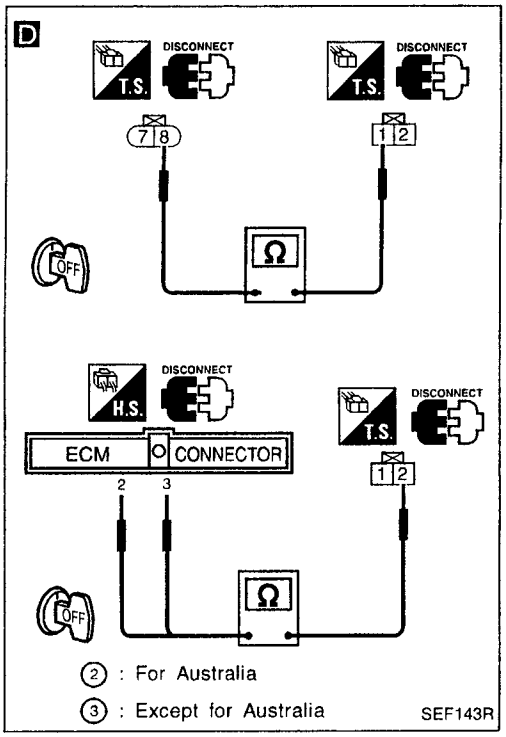
Trouble is not fixed.

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

INSPECTION END

Ignition Signal (Cont'd)





Ⓐ

D

CHECK INPUT SIGNAL CIRCUIT.
1. Stop engine.
2. Disconnect ignition coil harness connector.
3. Strip tape covering resistor and disconnect the connector.
4. Disconnect ECM harness connector.
5. Check harness continuity between ignition coil terminal ⑧ and resistor terminal ①, resistor terminal ② and ECM terminal ③ or ②.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

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

NG → Replace resistor.

OK ↓

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

Trouble is not fixed. ↓

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

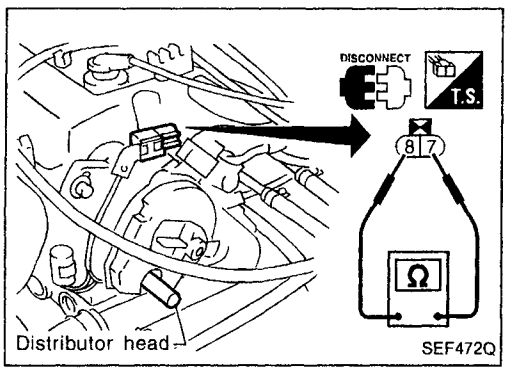
↓

INSPECTION END

EC

Ignition Signal (Cont'd)

COMPONENT INSPECTION



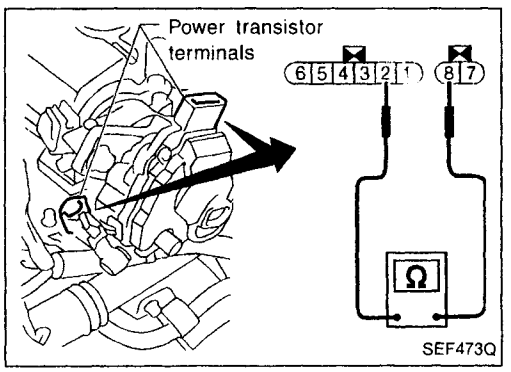
Ignition coil

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

Terminal	Resistance [at 25°C (77°F)]
⑦ - ⑧ (Primary coil)	Approximately 1 Ω
⑦ - secondary terminal on distributor head (Secondary coil)	Approximately 10 kΩ

If NG, replace ignition coil.

3. For checking secondary coil, remove distributor cap.
4. Check resistance between ignition coil harness connector terminal ⑦ and the secondary terminal on the distributor head.
   If NG, replace distributor.

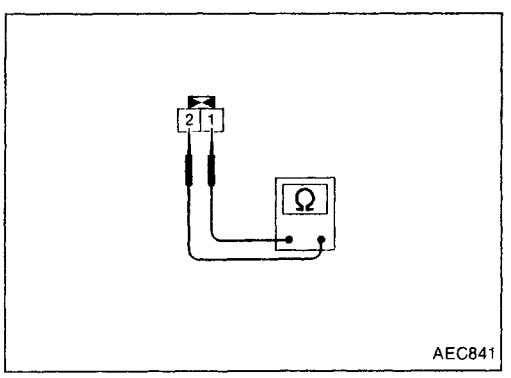


Power transistor

1. Disconnect power transistor harness connector.
2. Check power transistor resistance between terminals ② and ⑧ .

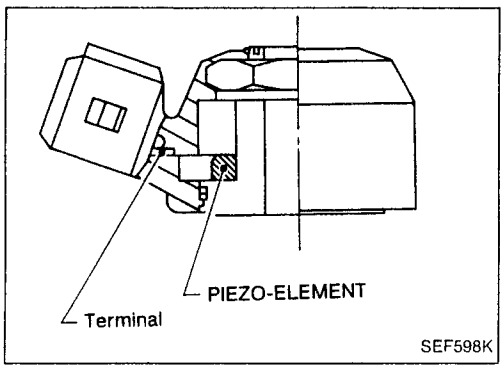
Terminals	Resistance	Result
② and ⑧	Not 0Ω	OK
	0Ω	NG

If NG, replace distributor.



Resistor

1. Disconnect resistor harness connector.
2. Check resistance between terminals ① and ② .
   Resistance: Approximately 2.2 kΩ [at 25°C (77°F)]
   If NG, replace resistor.



Knock Sensor (KS)

The knock sensor is attached to the cylinder block. It senses engine knocking using a piezoelectric element. A knocking vibration from the cylinder block is sensed as vibrational pressure. This pressure is converted into a voltage signal and sent to the ECM.

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible Cause)
34	• An excessively low or high voltage from the knock sensor is entered to ECM.	• Harness or connectors (The knock sensor circuit is open or shorted.) • Knock sensor

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

1) Turn ignition switch "ON" and select "DATA MONITOR" mode with CONSULT.
2) Start engine and run it for at least 5 seconds at idle speed.

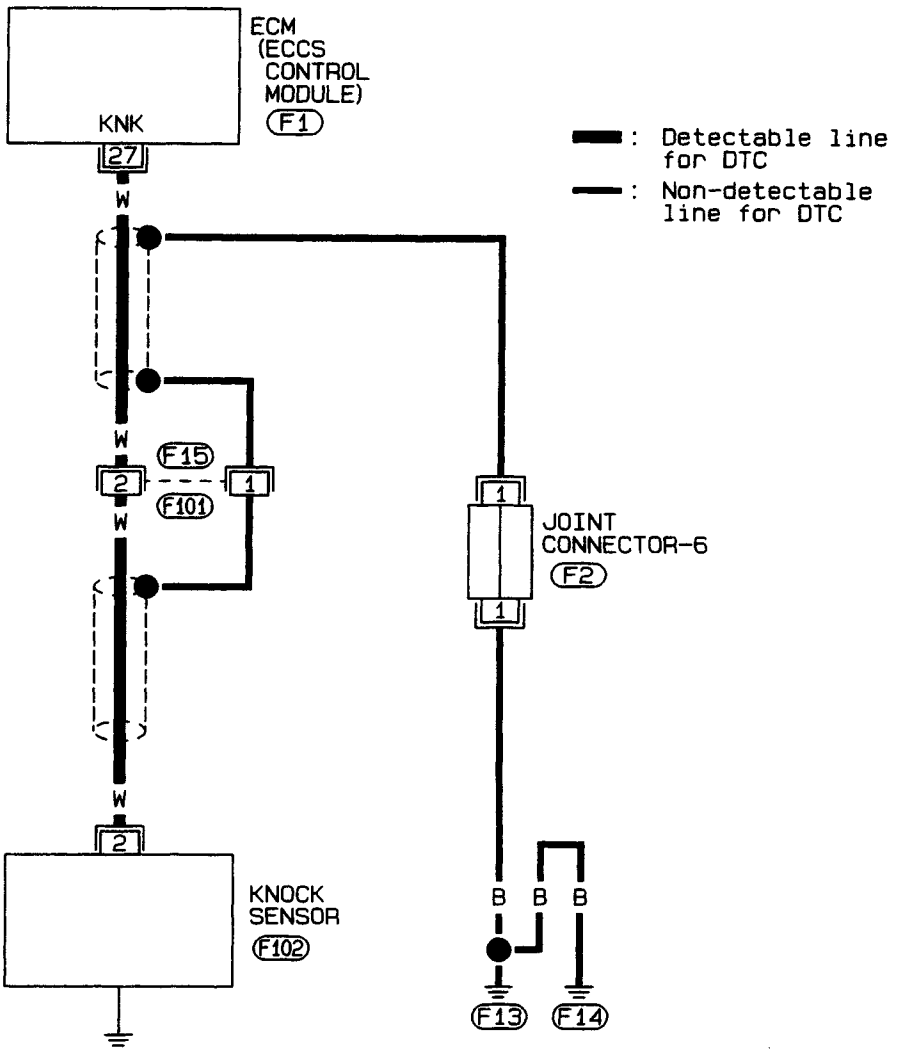
OR

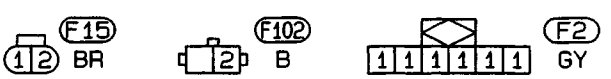
1) Start engine and run it for at least 5 seconds at idle speed.
2) Turn ignition switch "OFF", wait for at least 5 seconds and then turn "ON".
3) Perform "Diagnostic Test Mode II" (Self-diagnostic results) with ECM.

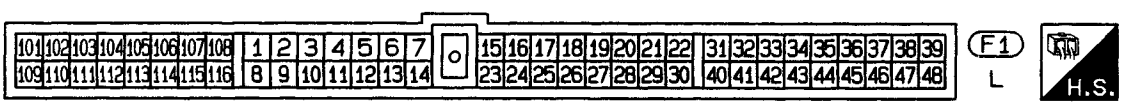
Knock Sensor (KS) (Cont'd)

Except for Europe and Israel

EC-KS-01



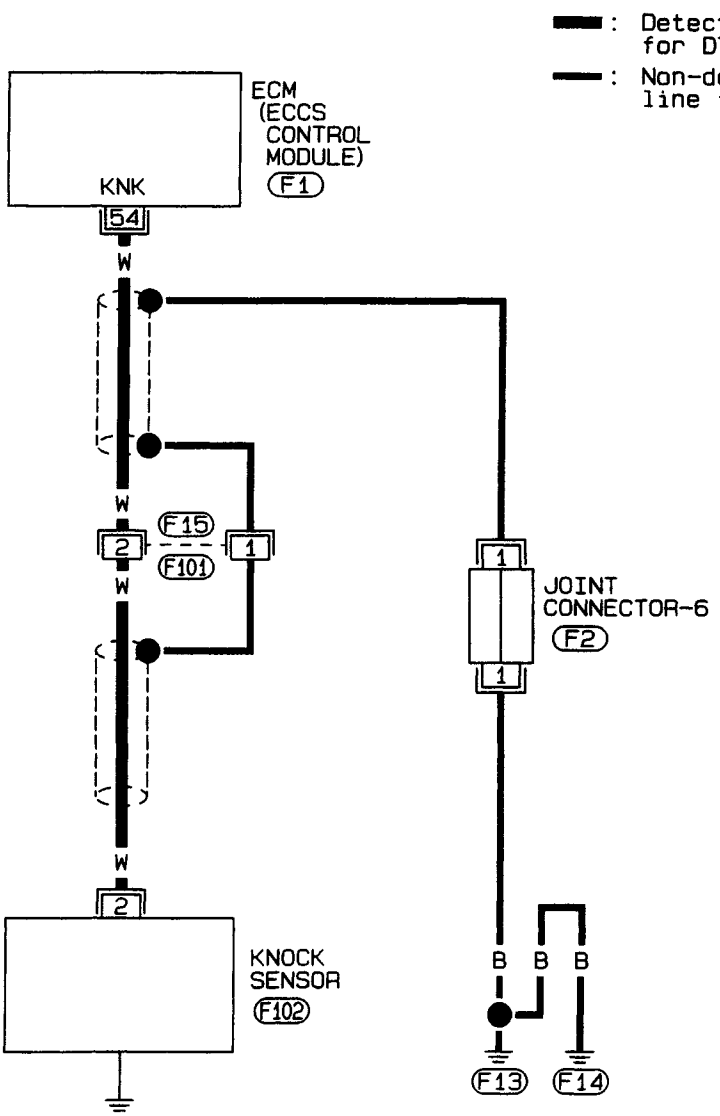


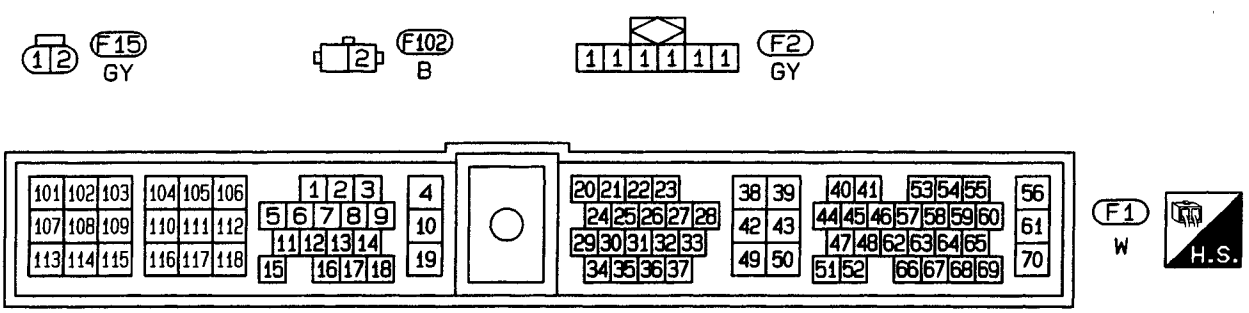


HEC034

GA16DE for Australia

EC-KS-01

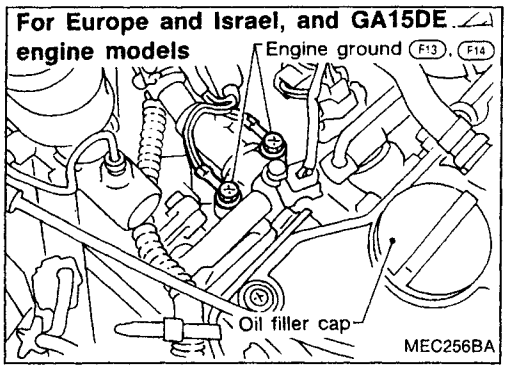


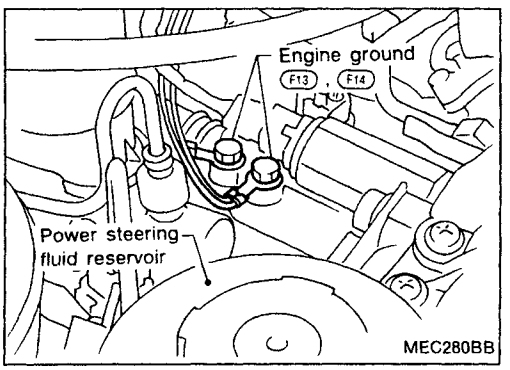


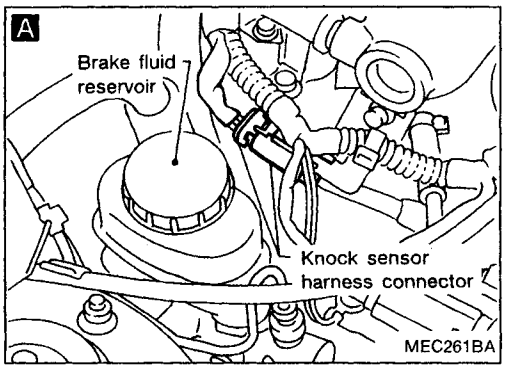
HEC067

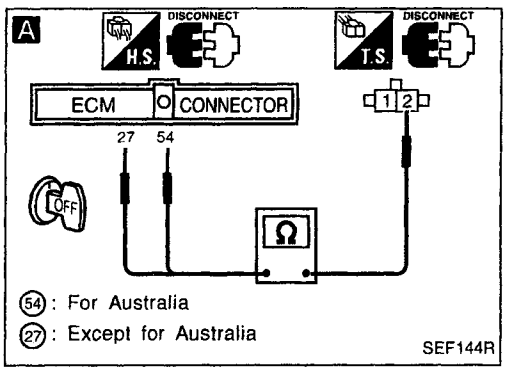
Knock Sensor (KS) (Cont'd)

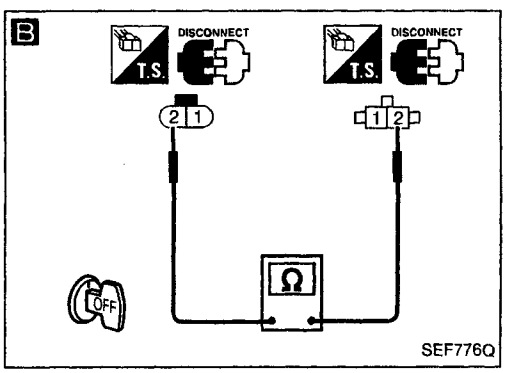
DIAGNOSTIC PROCEDURE











INSPECTION START

↓

Loosen and retighten engine ground screws.

↓

A

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector and knock sensor sub-harness connector.
3. Check harness continuity between terminal ② and ECM terminal ㉗ or ㊹.

Continuity should exist.

If OK, check harness for short.

NG → Repair harness or connectors.

↓ OK

B

CHECK SUB-HARNESS CIRCUIT.
1. Disconnect knock sensor harness connector.
2. Check harness continuity between knock sensor harness connector terminal ② and knock sensor sub-harness connector terminal ②.

Continuity should exist.

If OK, check harness for short.

NG → Check the following.
- Harness connectors (F15), (F101)

If NG, repair harness or connectors.

↓ OK

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

NG → Replace knock sensor.

↓ OK

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

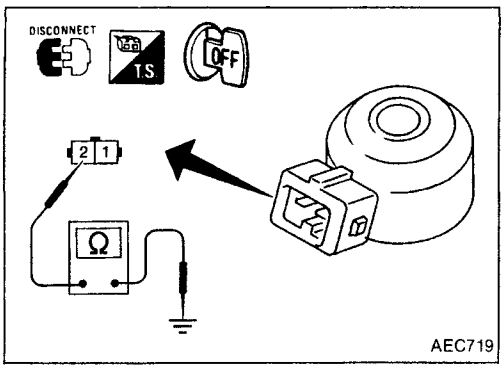
↓ Trouble is not fixed.

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

↓

INSPECTION END

Knock Sensor (KS) (Cont'd)



COMPONENT INSPECTION

Knock sensor

- Use an ohmmeter which can measure more than 10 MΩ.

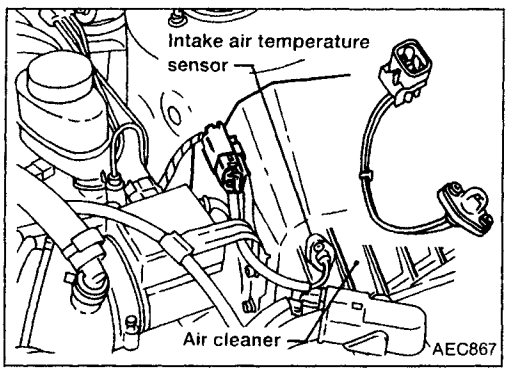
1. Disconnect knock sensor harness connector.
2. Check resistance between terminal ② and ground.

Resistance: 500 - 620 kΩ [at 25°C (77°F)]

CAUTION:

Discard any knock sensor which has been dropped or undergone shocks; use a new one.

EC



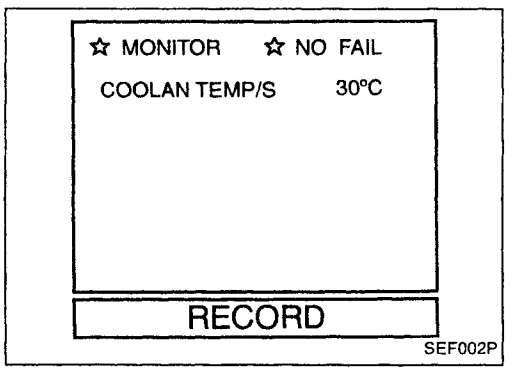
Intake Air Temperature Sensor (IATS)

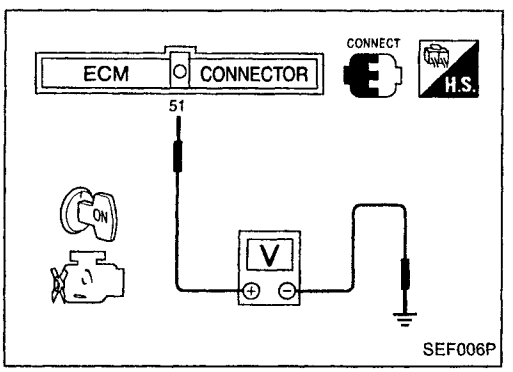
The intake air temperature sensor mounted to the air cleaner housing, detects intake air temperature and transmits a signal to the ECM.

The temperature sensing unit uses a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the temperature rise.

This sensor is not directly used to control the engine system. It is used only for the on-board diagnosis.

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
41	a) An excessively low or high voltage from the sensor is entered to ECM. ..... b) Voltage sent to ECM is not practical when compared with the engine coolant temperature sensor signal.	• Harness or connectors (The sensor circuit is open or shorted.) • Intake air temperature sensor.





DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

For the malfunction a) and b)

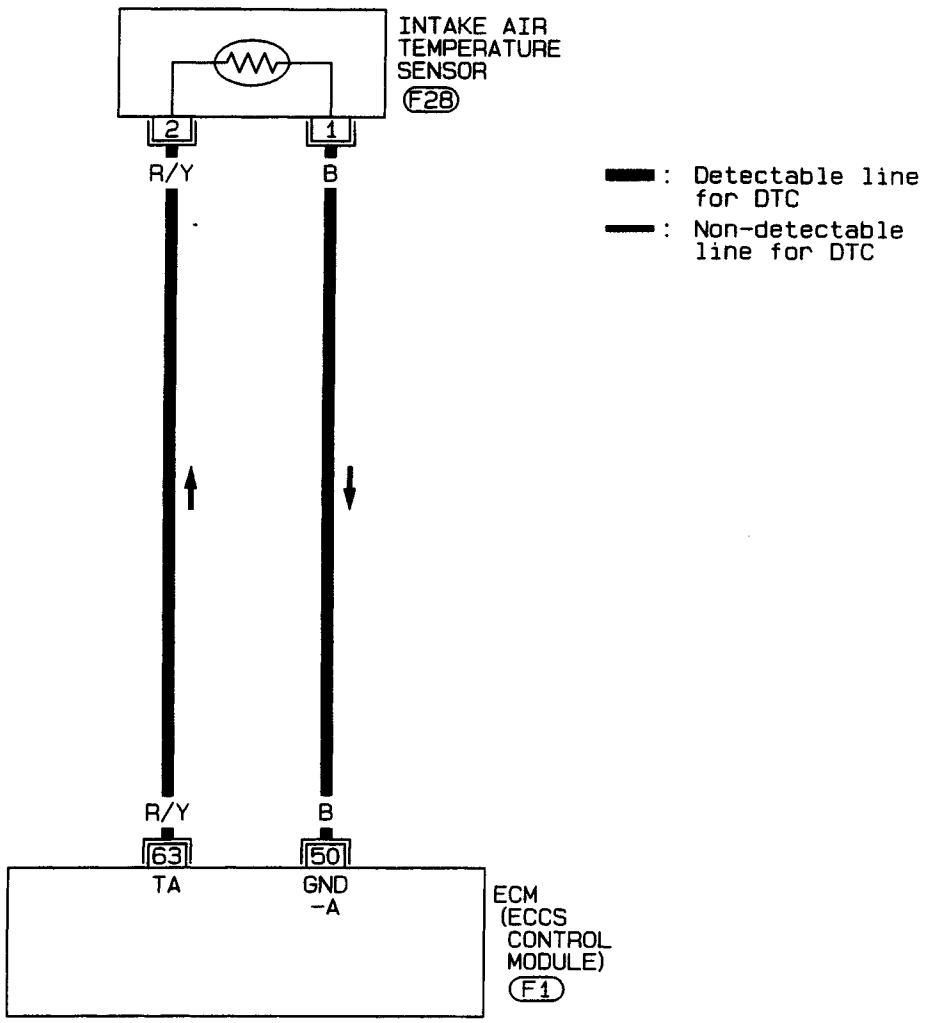
1) Wait until engine coolant temperature is less than 90°C (194°F).
   (a) Turn ignition switch "ON".
   (b) Select "DATA MONITOR" mode with CONSULT.
   (c) Check the engine coolant temperature.
   (d) If the engine coolant temperature is not less than 90°C (194°F), turn ignition switch "OFF" and cool down engine.
2) Turn ignition switch "ON".
3) Select "DATA MONITOR" mode with CONSULT.
4) Wait for at least 5 seconds.

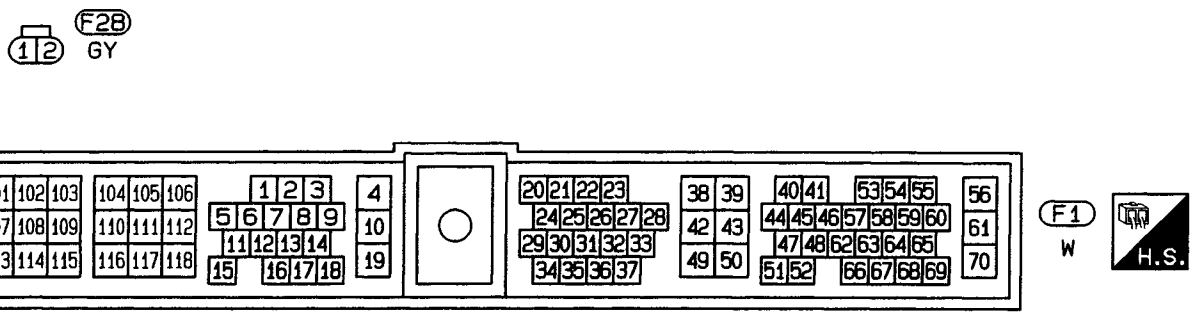
OR

1) Wait until engine coolant temperature is less than 90°C (194°F).
   (a) Turn ignition switch "ON".
   (b) Check voltage between ECM terminal ⑤① and ground.
   Voltage: More than 1.2 (V)
   (c) If the voltage is not more than 1.2V, turn ignition switch "OFF" and cool down engine.
2) Turn ignition switch "ON" wait for at least 5 seconds.
3) Turn ignition switch "OFF", wait for at least 3 seconds and then turn "ON".
4) Perform "Diagnostic Test Mode II" (Self-diagnostic results) with ECM.

GA16DE for Australia

EC-IATS-01

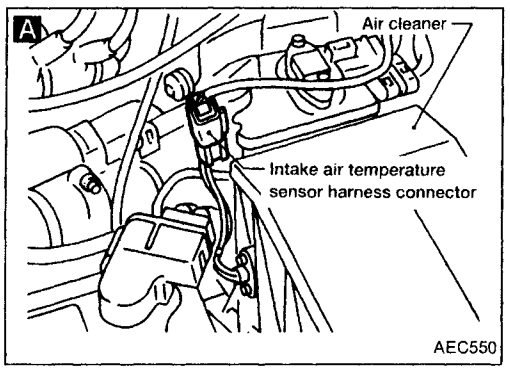


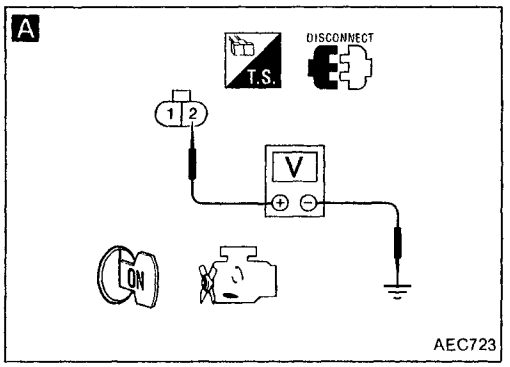


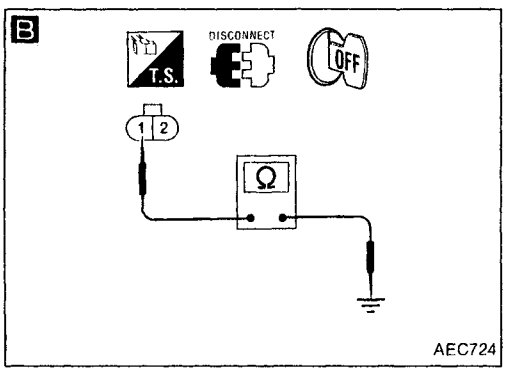
HEC073

Intake Air Temperature Sensor (IATS) (Cont'd)

DIAGNOSTIC PROCEDURE







INSPECTION START

A

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect intake air temperature sensor harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ② and ground.
   Voltage:
   Approximately 5V

NG → Check the following.
- Harness continuity between ECM and intake air temperature sensor

If NG, repair harness or connectors.

OK ↓

B

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

NG → Check the following.
- Harness continuity between ECM and intake air temperature sensor

If NG, repair harness or connectors

OK ↓

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

NG → Replace intake air temperature sensor.

OK ↓

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

Trouble is not fixed. ↓

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

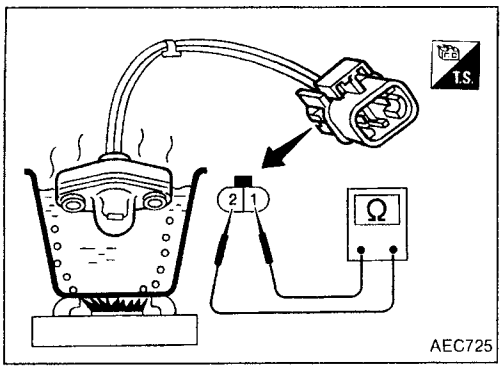
INSPECTION END

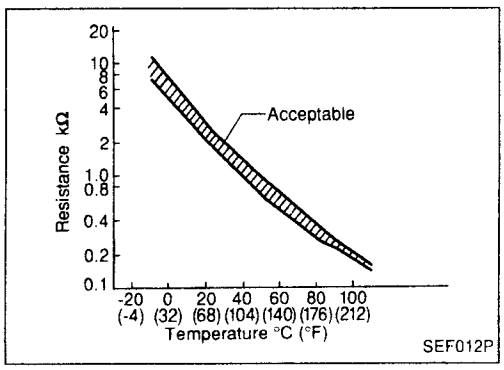
Intake Air Temperature Sensor (IATS) (Cont'd)

COMPONENT INSPECTION

Intake air temperature sensor

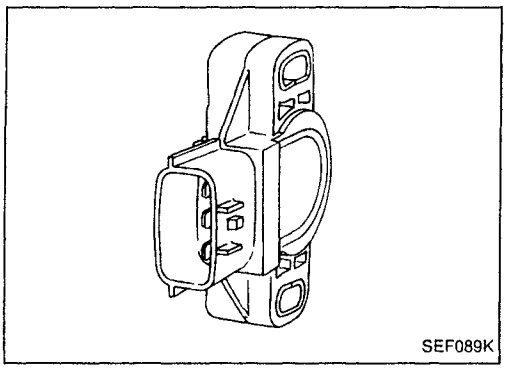
Check resistance as shown in the figure.





Intake air temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.0

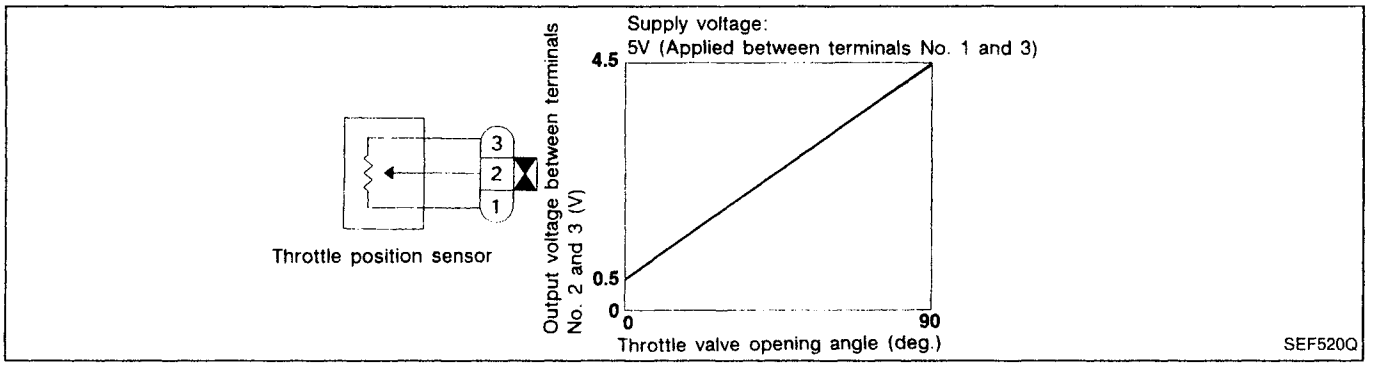
EC


SEF089K

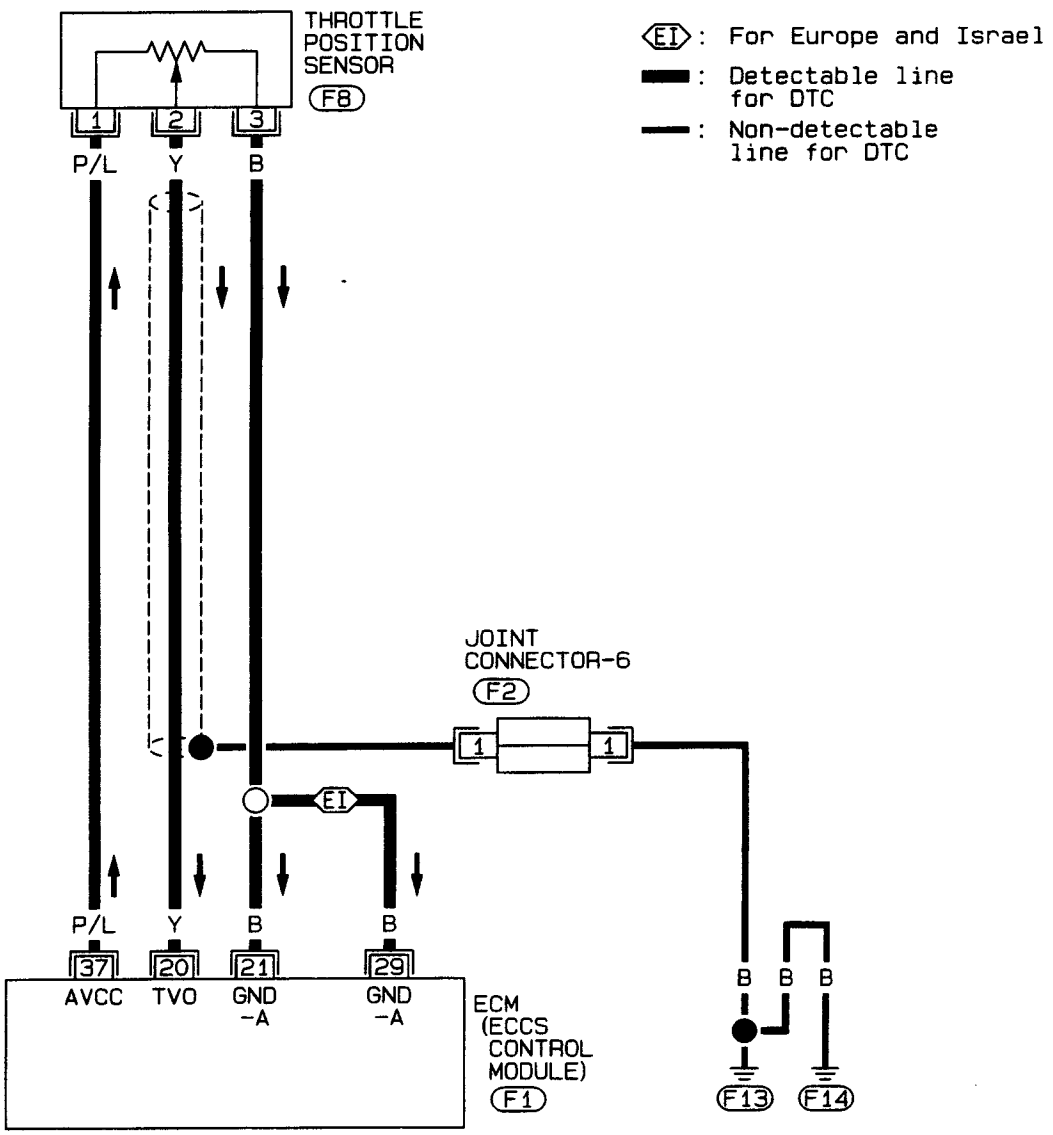
Throttle Position Sensor

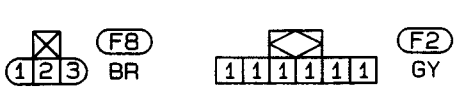
The throttle position sensor responds to the accelerator pedal movement. This sensor is a kind of potentiometer which transforms the throttle position into output voltage, and emits the voltage signal to the ECM. In addition, the sensor detects the opening and closing speed of the throttle valve and feeds the voltage signal to the ECM.

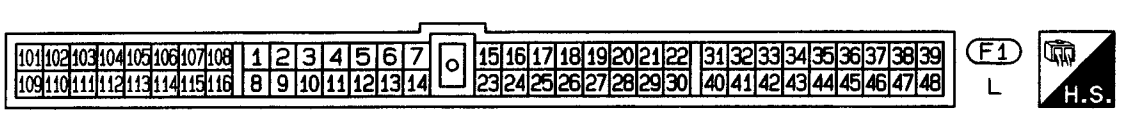
Idle position of the throttle valve is determined by the ECM receiving the signal from the throttle position sensor. This one controls engine operation such as fuel cut.



EC-TPS-01





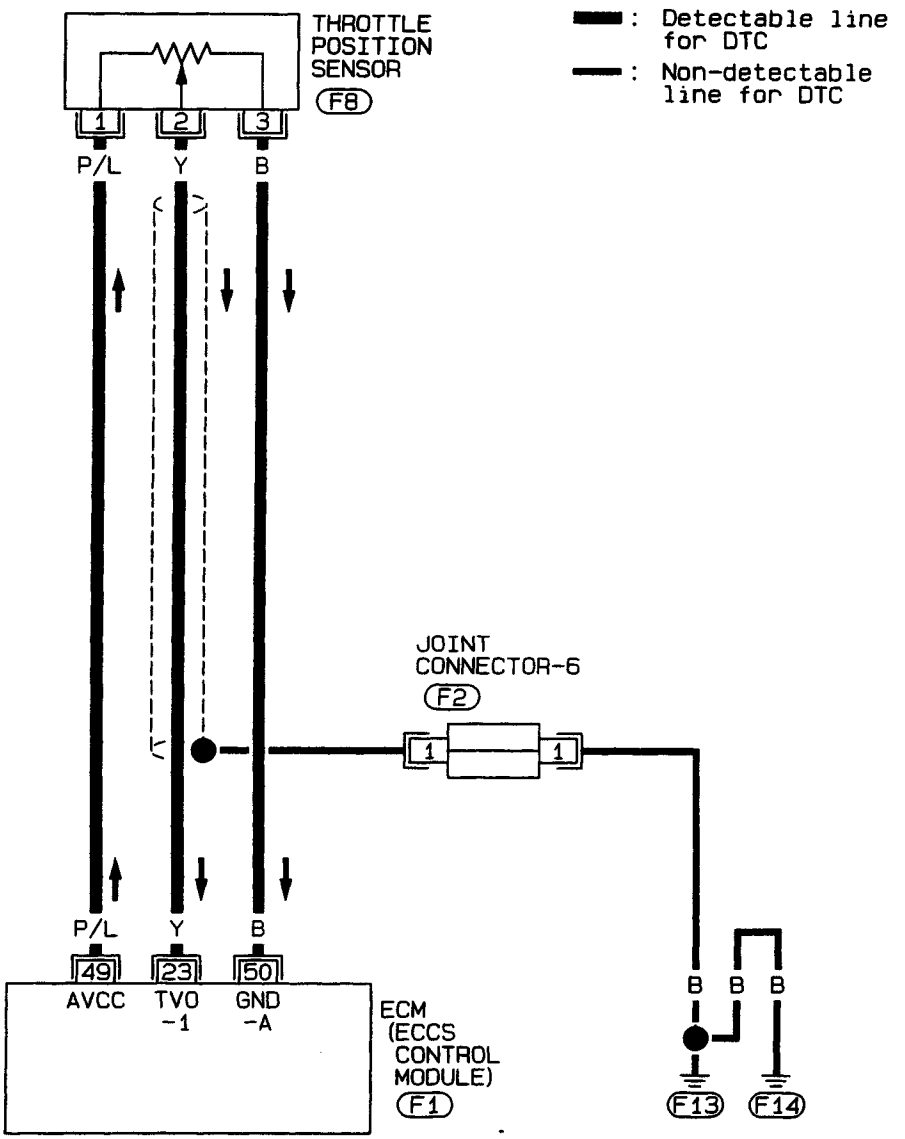


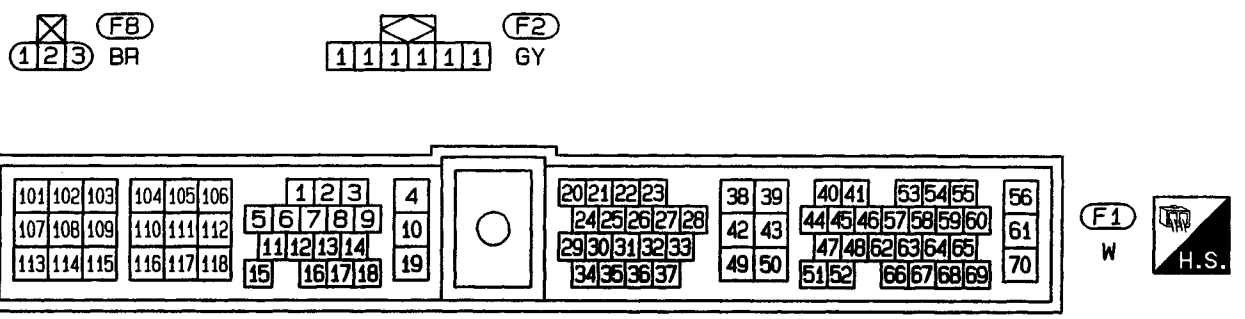
HEC035

Throttle Position Sensor (Cont'd)

GA16DE for Australia

EC-TPS-01

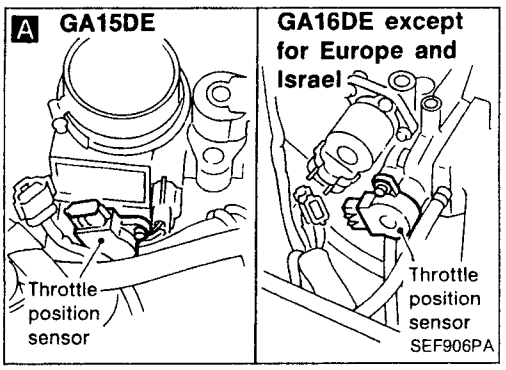


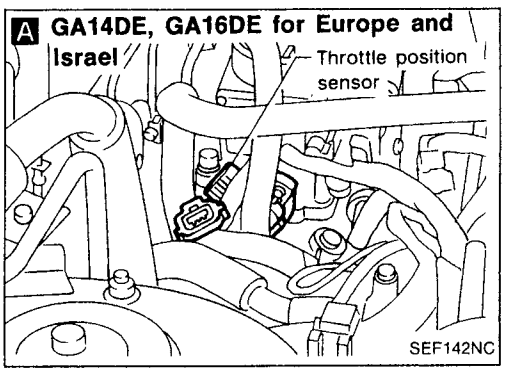


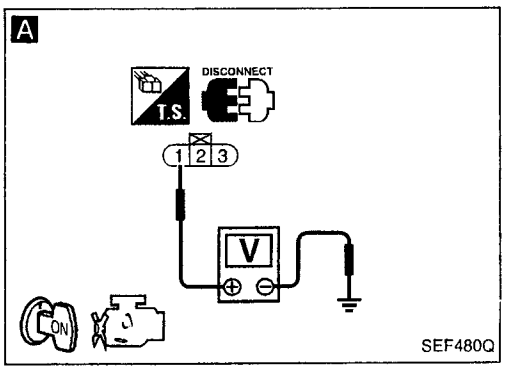
HEC068

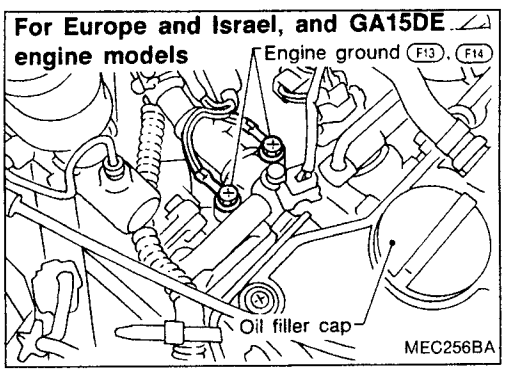
Throttle Position Sensor (Cont'd)

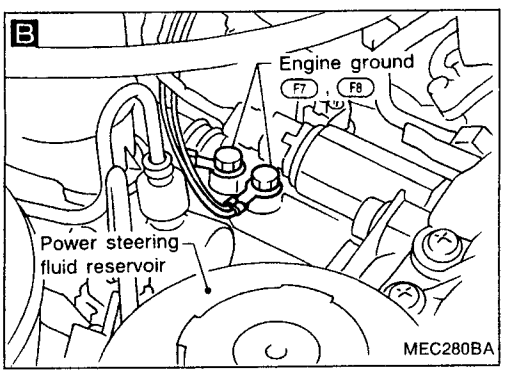
DIAGNOSTIC PROCEDURE











INSPECTION START

A

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

NG → Repair harness or connectors.

OK

B

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

NG → Check the following.
- Harness for open or short between ECM and throttle position sensor

If NG, repair harness or connectors.

OK

C

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ⑳ or ㉓ and terminal ②.
Continuity should exist.
If OK, check harness for short.

NG → Repair harness or connectors.

OK

ADJUST THROTTLE POSITION SENSOR.
Perform "Basic Inspection", EC-65.

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

NG → Replace throttle position sensor. To adjust it, perform "Basic Inspection", EC-65.

OK

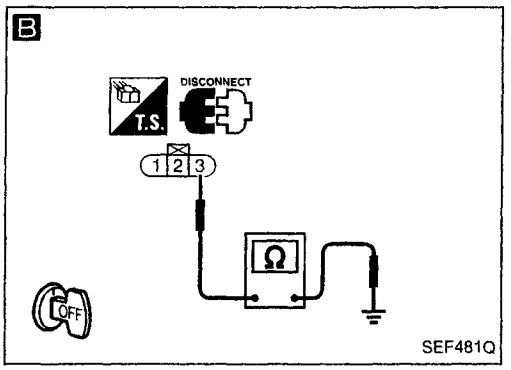
Disconnect and reconnect harness connectors in the circuit. Then retest.

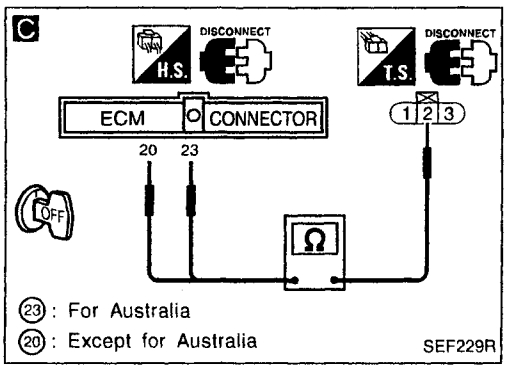
Trouble is not fixed.

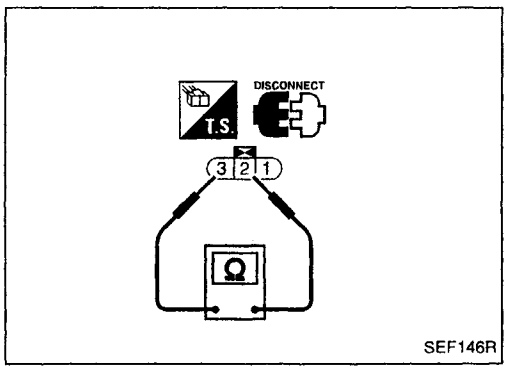
Check ECM pin terminals for damage or the connection of ECM harness connector. Reconnect ECM harness connector and retest.

INSPECTION END

Throttle Position Sensor (Cont'd)







COMPONENT INSPECTION

Throttle position sensor

1. Disconnect throttle position sensor harness connector.
2. Make sure that resistance between terminals ② and ③ changes when opening throttle valve manually.

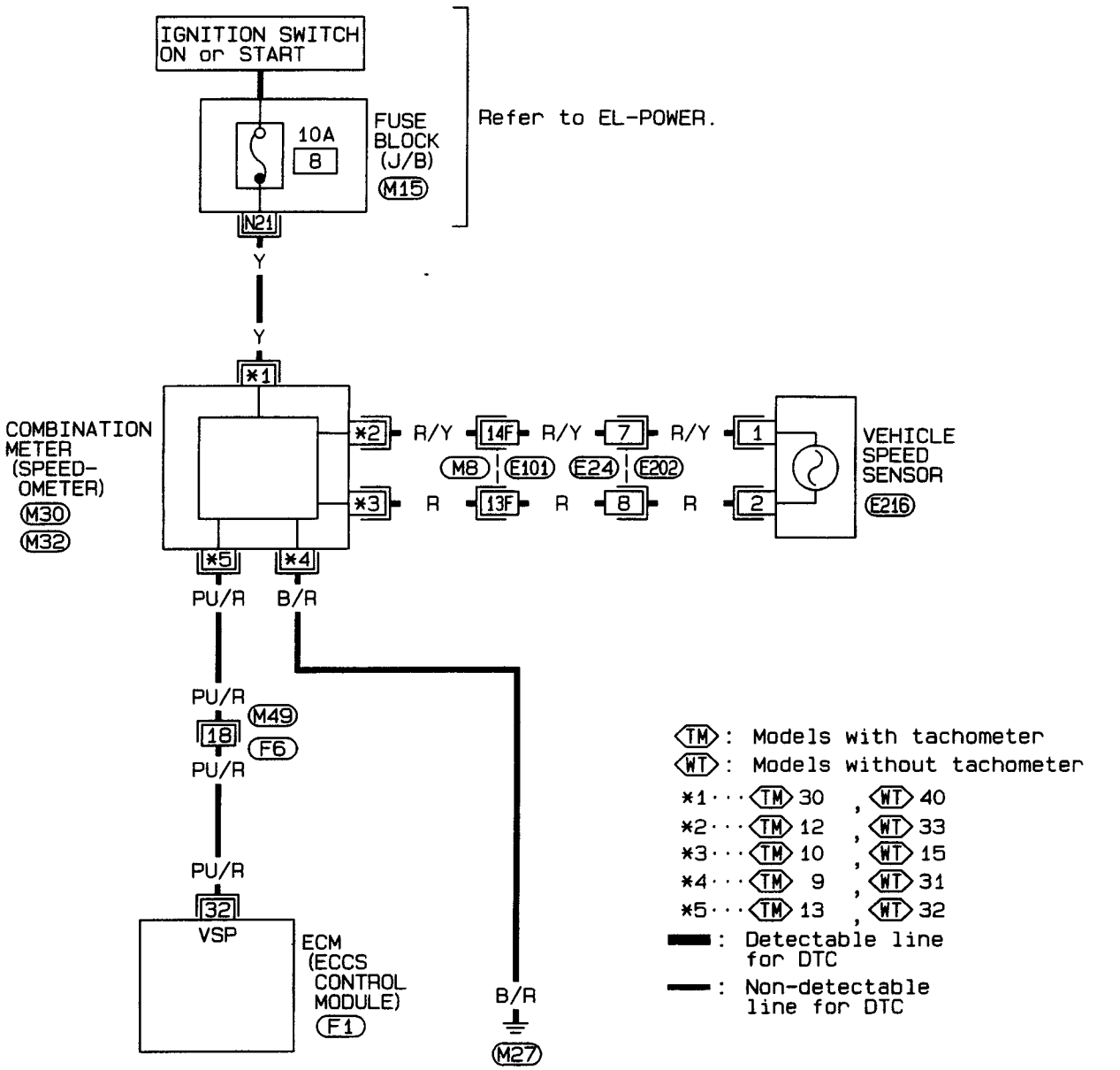
Throttle valve conditions	Resistance [at 25°C (77°F)]
Completely closed	Approximately 0.5 kΩ
Partially open	0.5 - 4.0 kΩ
Completely open	Approximately 4.0 kΩ

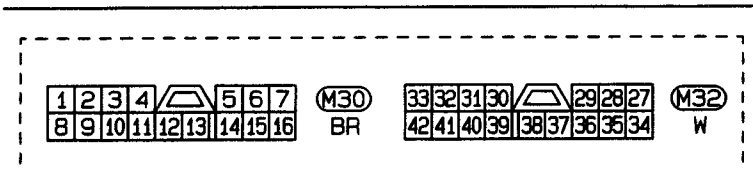
If NG, replace throttle position sensor. To adjust it, perform "Basic Inspection", EC-65.

Vehicle Speed Sensor (VSS)

LHD models

EC-VSS-01

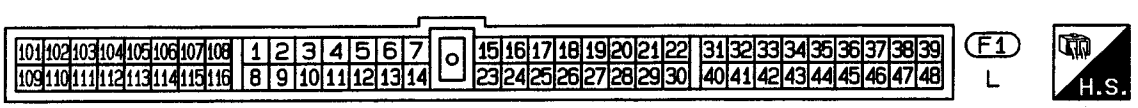




Refer to last page (Foldout page).

M8, E101
M15



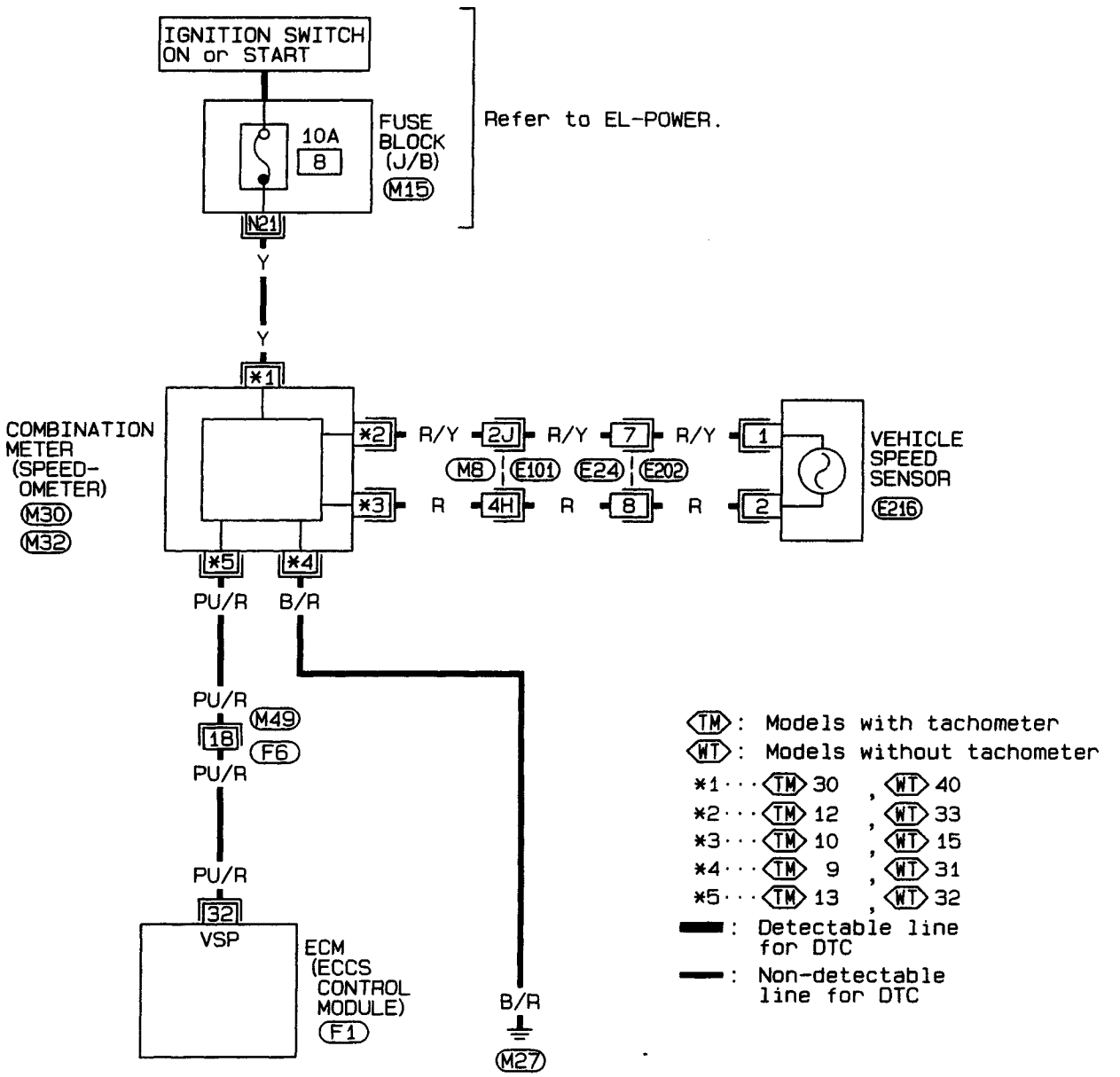


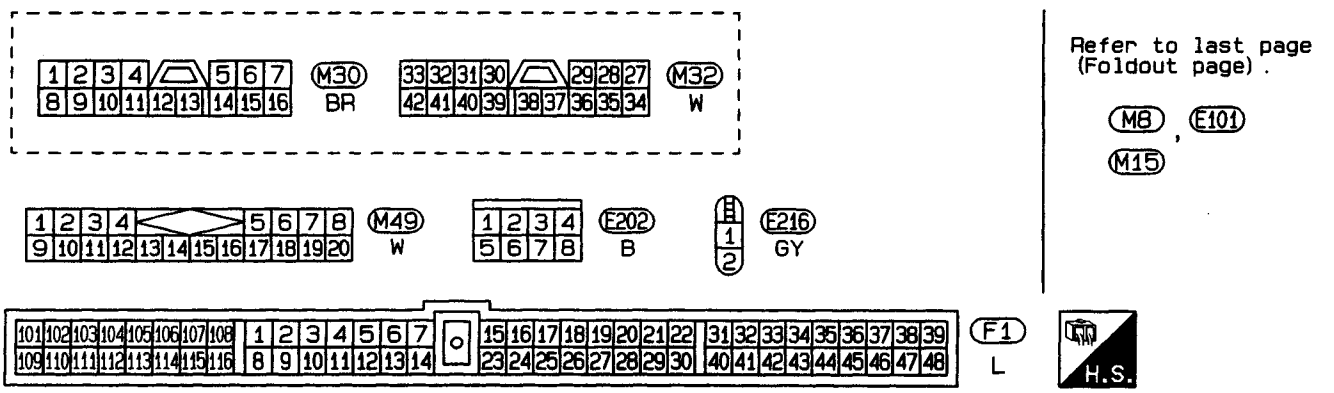
HEC036

Vehicle Speed Sensor (VSS) (Cont'd)

RHD models

EC-VSS-02



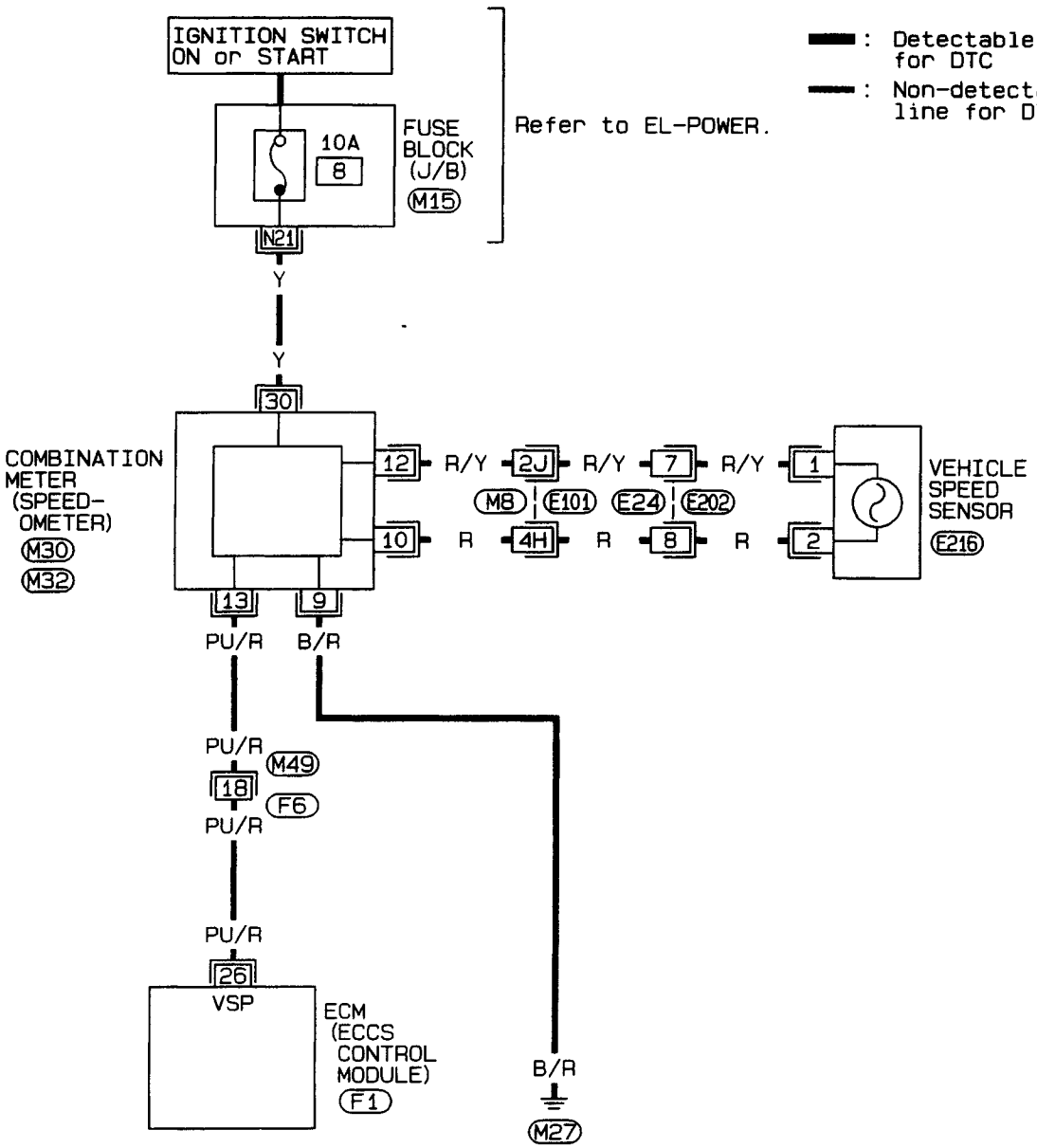


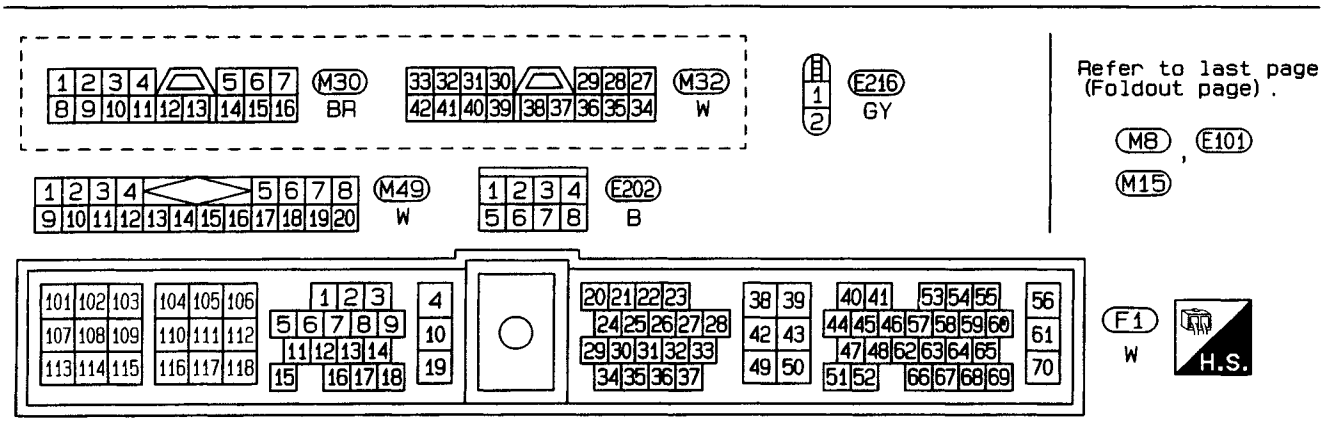
Refer to last page (Foldout page).
M8, E101
M15

HEC037

GA16DE for Australia

EC-VSS-01

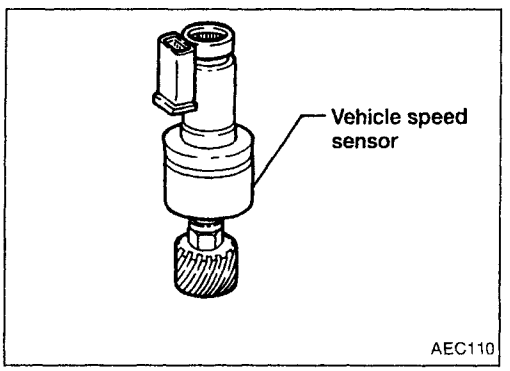


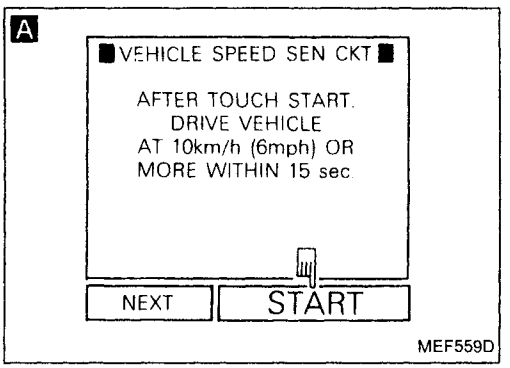


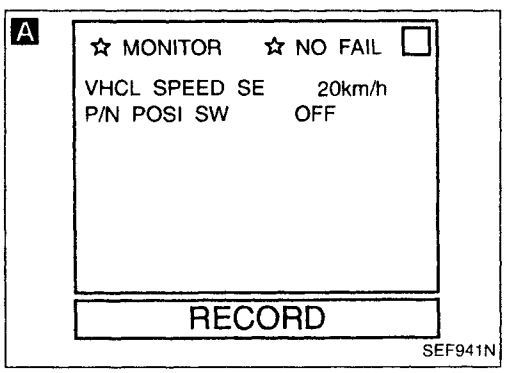
HEC069

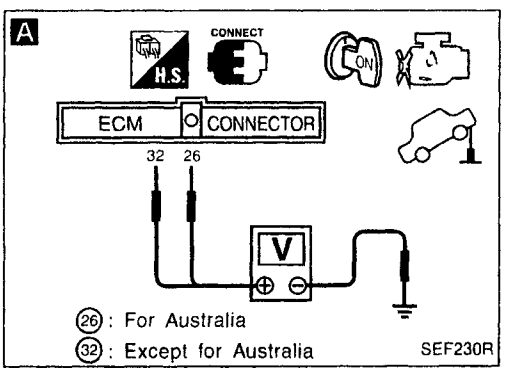
Vehicle Speed Sensor (VSS) (Cont'd)

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









DIAGNOSTIC PROCEDURE

INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Jack up drive wheels.
2. Perform "CAR SPEED SEN CIRCUIT" or "VEHICLE SPEED SEN CKT" in "FUNCTION TEST" mode with CONSULT.

OK → INSPECTION END

OR

2. Read "CAR SPEED SEN" or "VHCL SPEED SE" signal in "DATA MONITOR" mode with CONSULT.
CONSULT value should be the same as the speedometer indication.

OR

2. Turn ignition switch "ON".
3. Rotate drive wheel by hand.
4. Check voltage between ECM terminal ㉜ or ㉖ and body ground.
Voltage should vary between approx. 0 - 5V.

NG

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

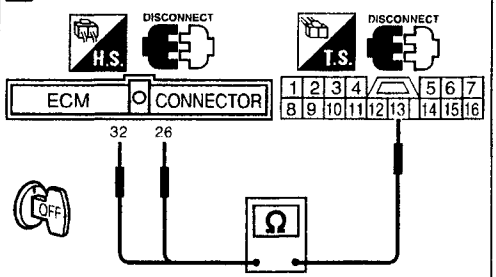
NG → Check vehicle speed sensor and circuit. (Refer to "Inspection/ Speedometer and Vehicle Speed Sensor" of "METER AND GAUGES" in EL section.)

OK

Ⓐ

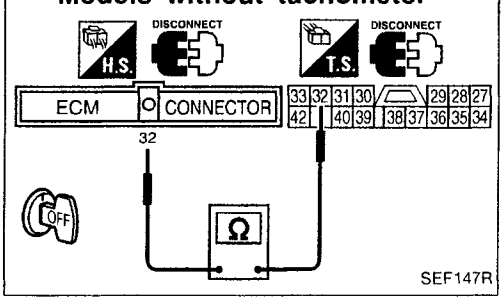
Vehicle Speed Sensor (VSS) (Cont'd)

B **Models with tachometer**



(26) : For Australia
(32) : Except for Australia

Models without tachometer



Ⓐ

B

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector and combination meter harness connector.
3. Check harness continuity between ECM terminal (32) and terminal (13) or (32), ECM terminal (26) and terminal (13).
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness for open or short between ECM and combination meter

If NG, repair harness or connectors.

OK ↓

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

Trouble is not fixed. ↓

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

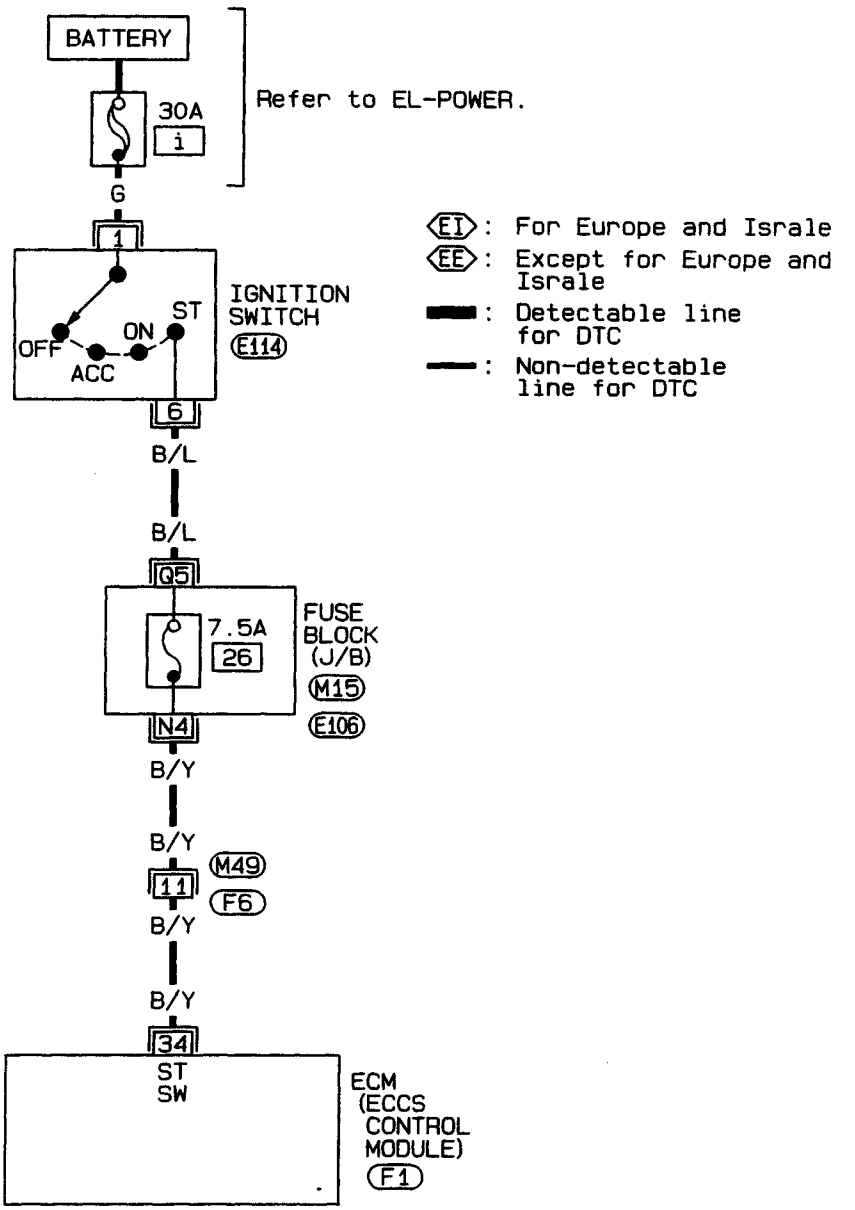
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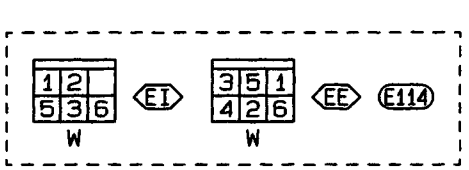
INSPECTION END

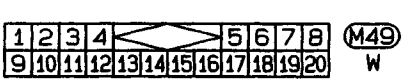
EC

Start Signal

EC-S/SIG-01

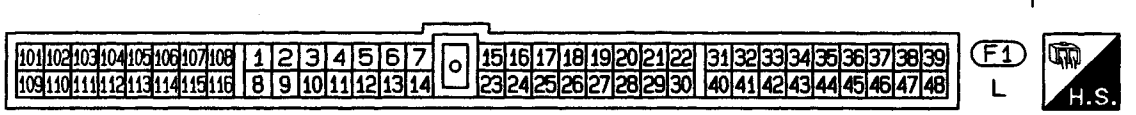






Refer to last page (Foldout page).

M15, E106

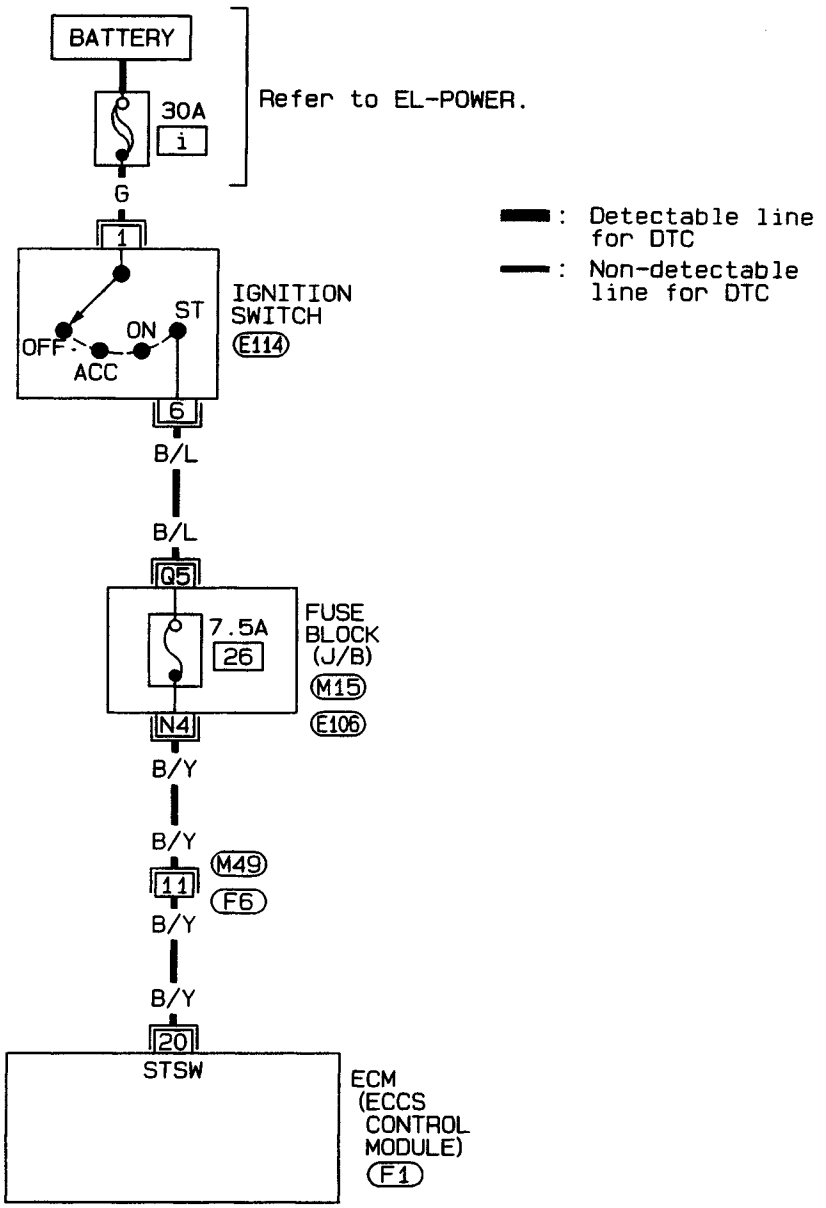


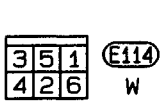
HEC038

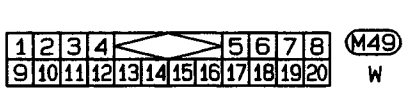
Start Signal (Cont'd)

GA16DE for Australia

EC-S/SIG-01

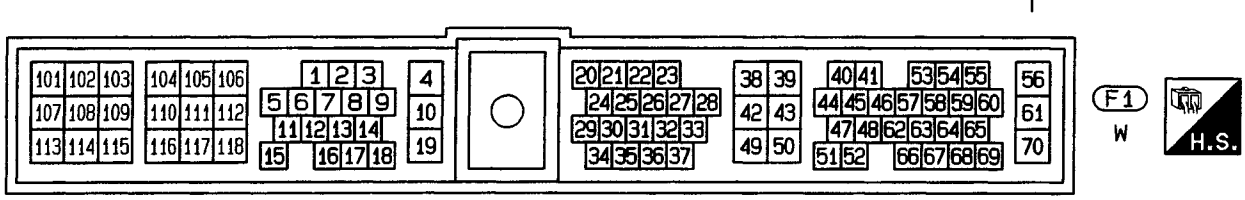






Refer to last page (Foldout page).

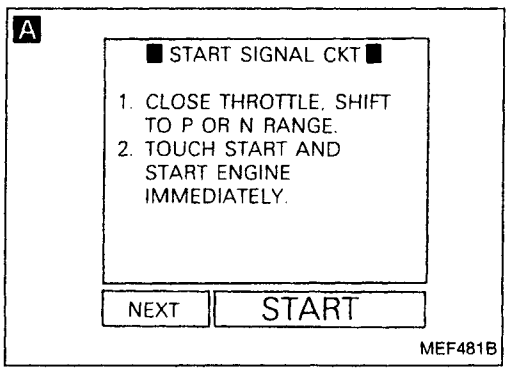
M15, E106

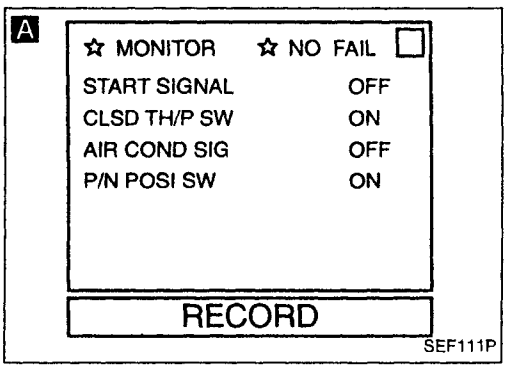


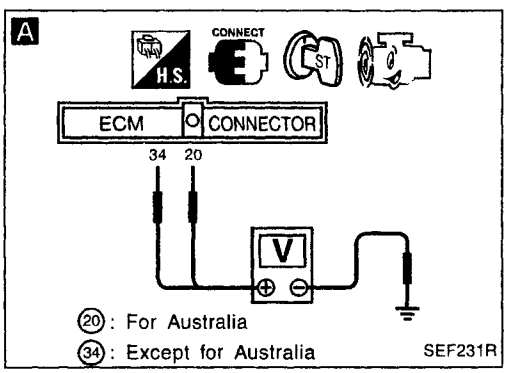
HEC070

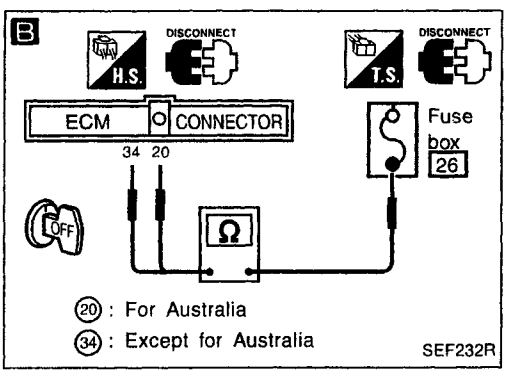
Start Signal (Cont'd)

DIAGNOSTIC PROCEDURE









INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Turn ignition switch "ON".
2. Perform "START SIGNAL CKT" in "FUNCTION TEST" mode with CONSULT.

OK → INSPECTION END

OR

2. Check "START SIGNAL" in "DATA MONITOR" mode with CONSULT.

IGN "ON"	OFF
IGN "START"	ON

OR

1. Turn ignition switch to "START".
2. Check voltage between ECM terminal ㉞ or ⑳ and ground.

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

NG

Check if 7.5A fuse is OK. → NG → Replace 7.5A fuse.

OK

B

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector and 7.5A fuse.
3. Check harness continuity between ECM terminal ㉞ or ⑳ and fuse block.

Continuity should exist.

If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness for open or short between ECM and fuse block

If NG, repair harness or connectors.

OK

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

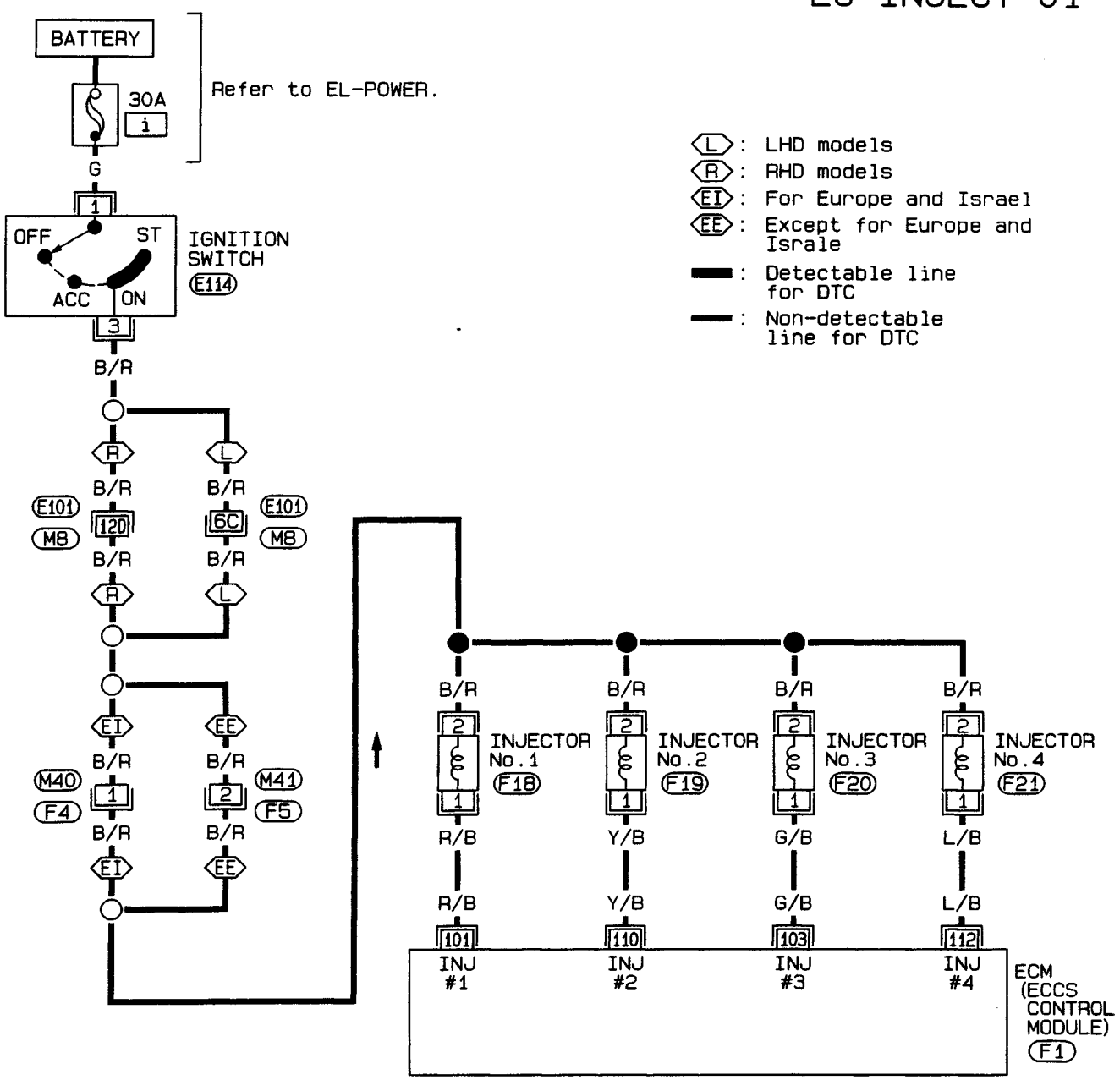
Trouble is not fixed.

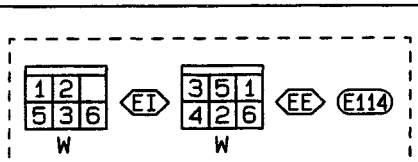
Check ECM pin terminals for damage or the connection of ECM harness connector. Reconnect ECM harness connector and retest.

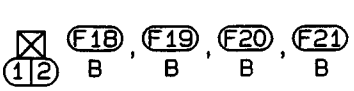
INSPECTION END

Injector

EC-INJECT-01

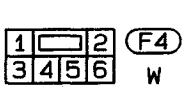


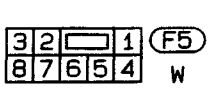


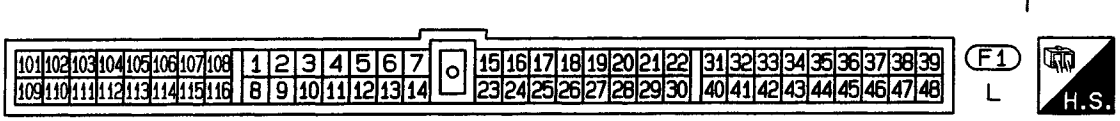


Refer to last page (Foldout page).

M8, E101





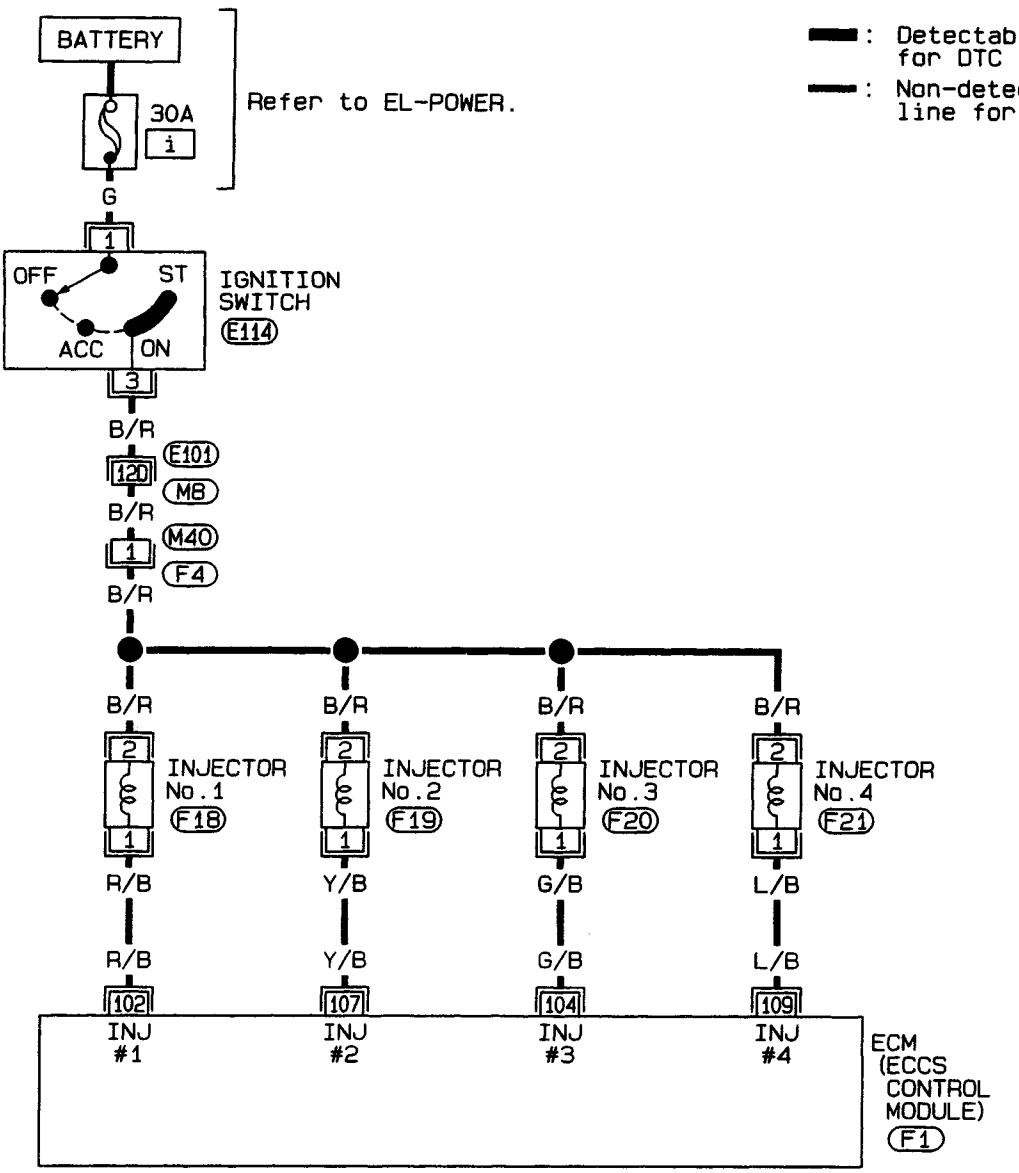


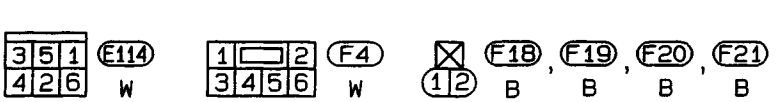
HEC039

Injector (Cont'd)

GA16DE for Australia

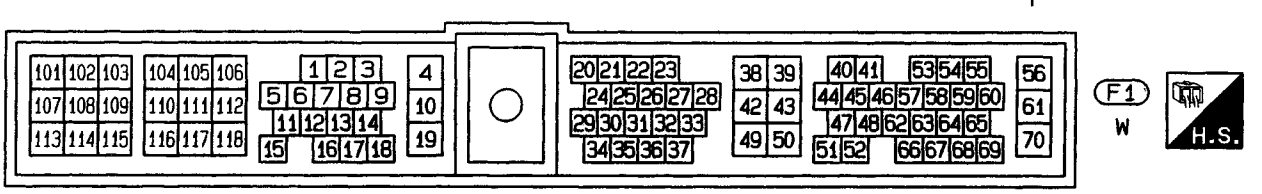
EC-INJECT-01





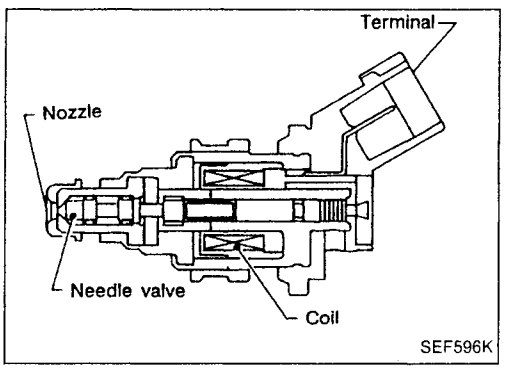
Refer to last page (Foldout page).

M8, E101



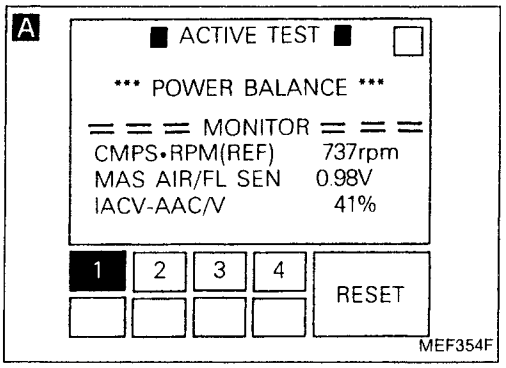
HEC071

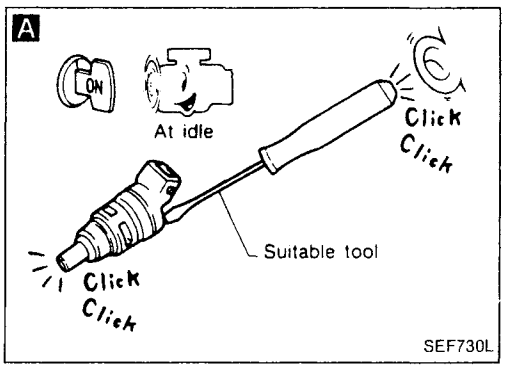
Injector (Cont'd)

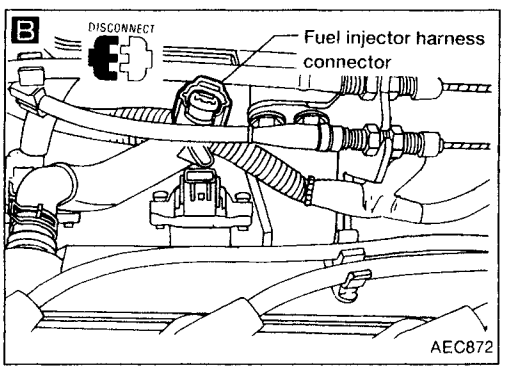


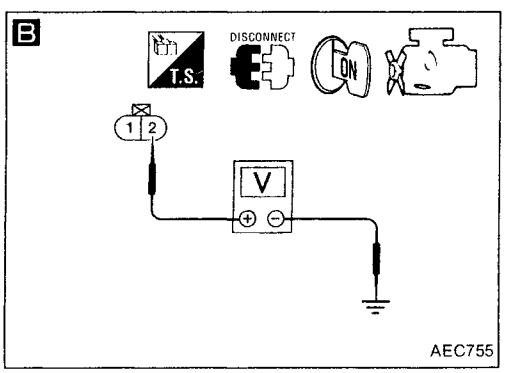
COMPONENT DESCRIPTION

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









DIAGNOSTIC PROCEDURE

EC

INSPECTION START

A

CHECK OVERALL FUNCTION.

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

OR

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

OK → INSPECTION END

NG ↓

B

CHECK POWER SUPPLY.

1. Stop engine.
2. Disconnect injector harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ② and ground with CONSULT or tester.
   Voltage: Battery voltage

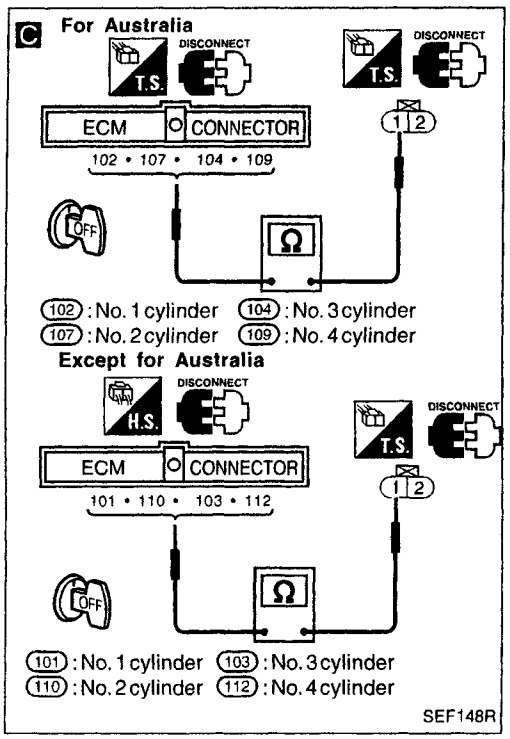
NG → Check the following.
- Harness connectors (F4), (M40) or (F5), (M41)
- Harness connectors (M8), (E101)
- Harness for open or short between injector and ignition switch

If NG, repair harness or connectors.

OK ↓

Ⓐ

Injector (Cont'd)



Ⓐ

C

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between injector harness connector terminal ① and ECM terminals (101), (110), (103), (112) or (102), (107), (104), (109).
   Continuity should exist.
   If OK, check harness for short.

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

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT (Injector).
Refer to "COMPONENT INSPECTION" below.

NG → Replace injector.

OK ↓

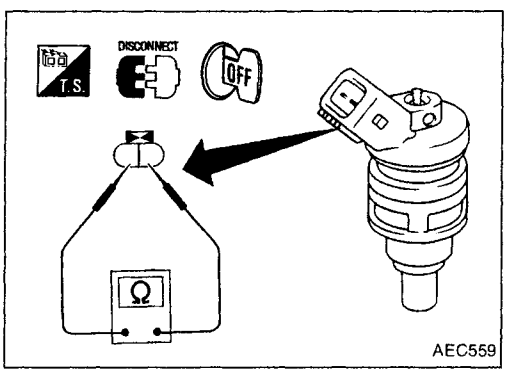
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

↓

INSPECTION END



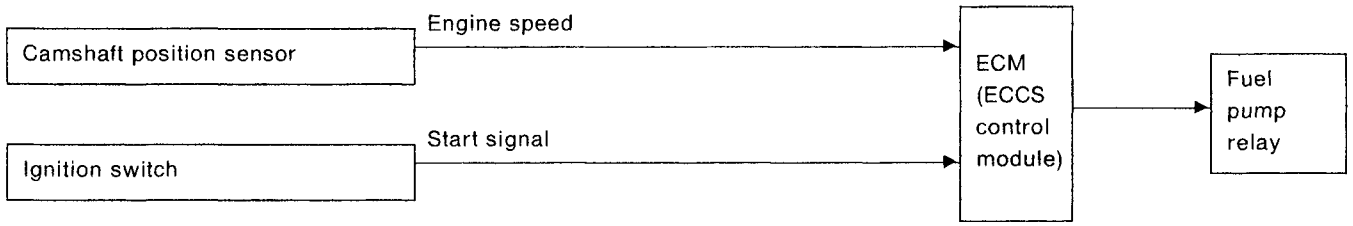
COMPONENT INSPECTION

Injector

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

Fuel Pump

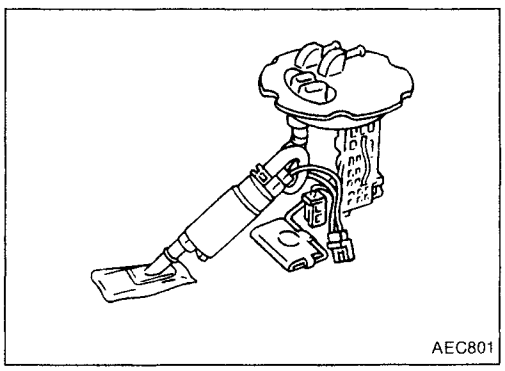
SYSTEM DESCRIPTION



The ECM activates the fuel pump for several seconds after the ignition switch is turned on to improve engine startability. If the ECM receives a 180° signal from the camshaft position sensor, it knows that the engine is rotating, and causes the pump to perform. If the 180° signal is not received when the ignition switch is on, the engine stalls. The ECM stops pump operation and prevents battery discharging, thereby improving safety. The ECM does not directly drive the fuel pump. It controls the ON/OFF fuel pump relay, which in turn controls the fuel pump.

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

EC

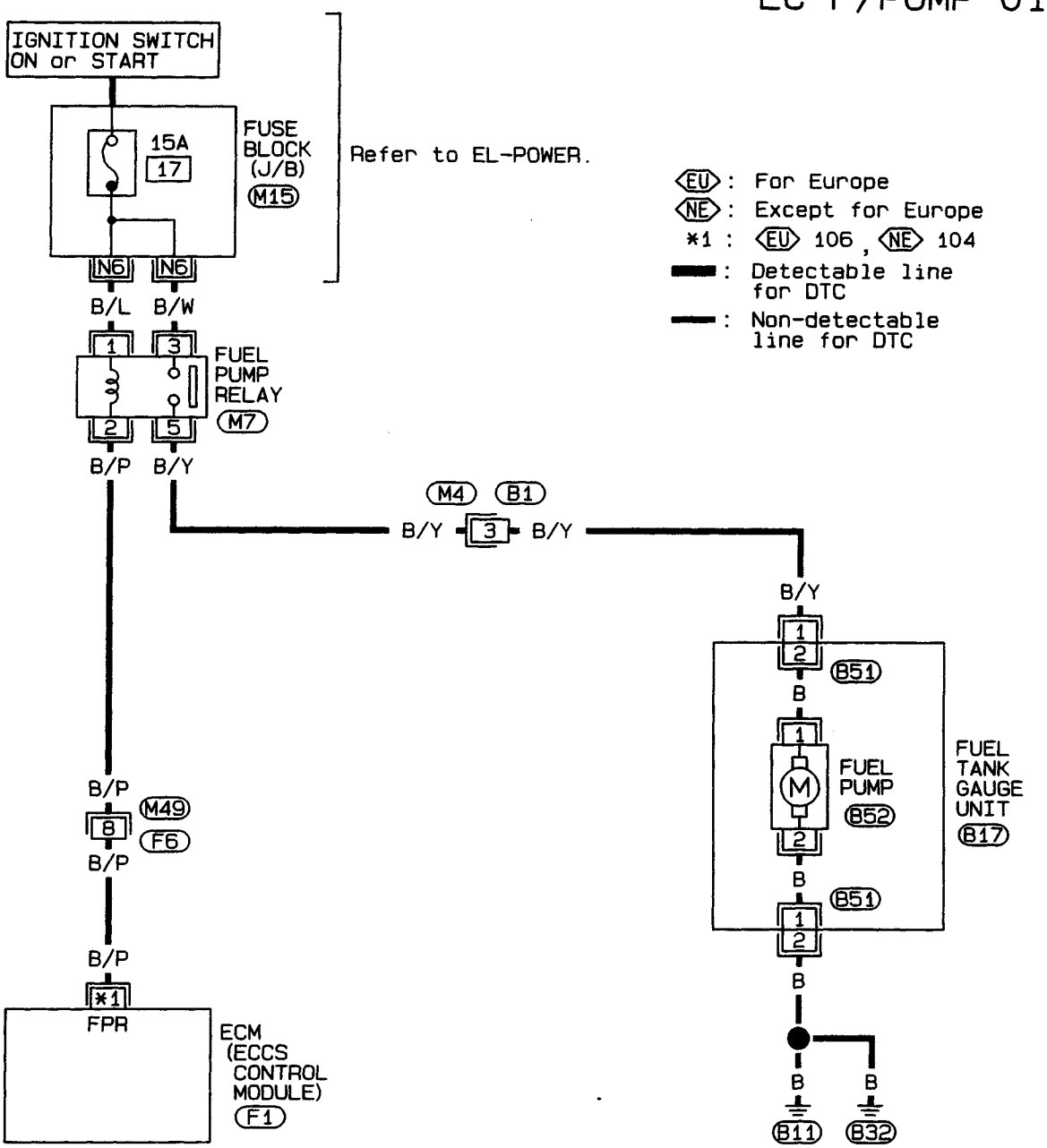


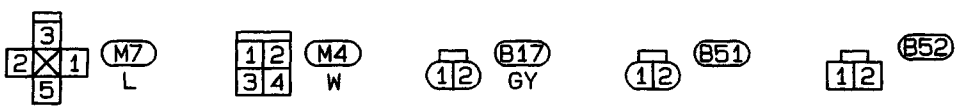
COMPONENT DESCRIPTION

A turbine type design fuel pump is used in the fuel tank.

Fuel Pump (Cont'd)

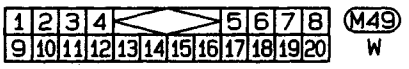
EC-F/PUMP-01





Refer to last page (Foldout page).

M15

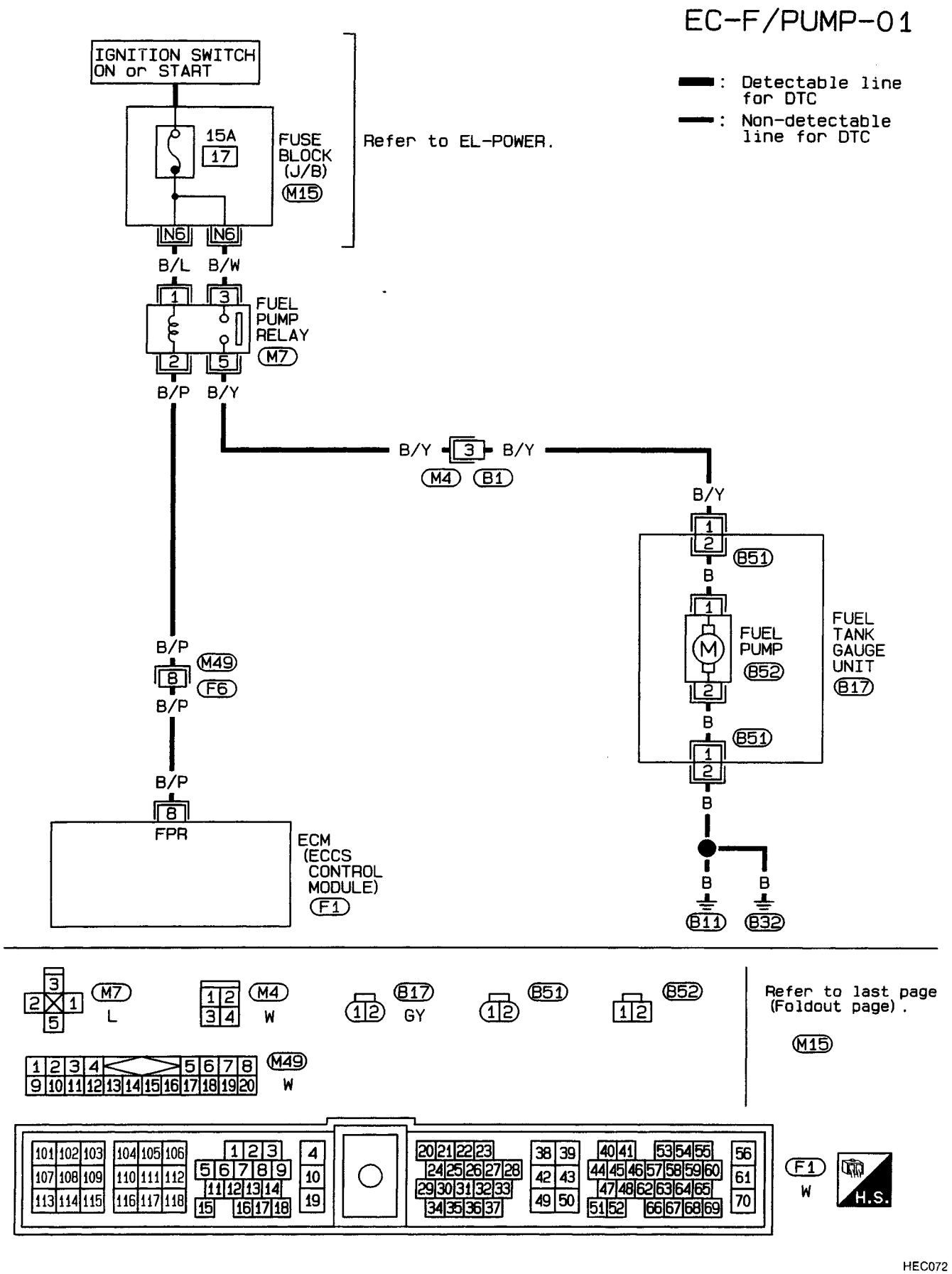




HEC040

Fuel Pump (Cont'd)

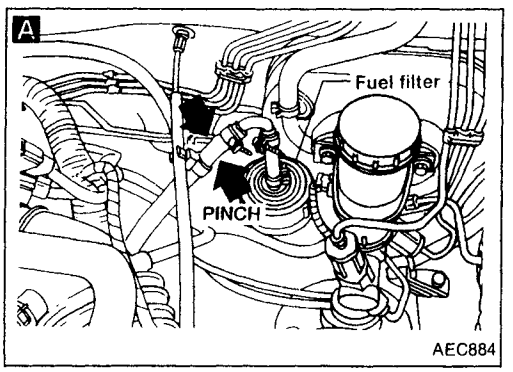
GA16DE for Australia

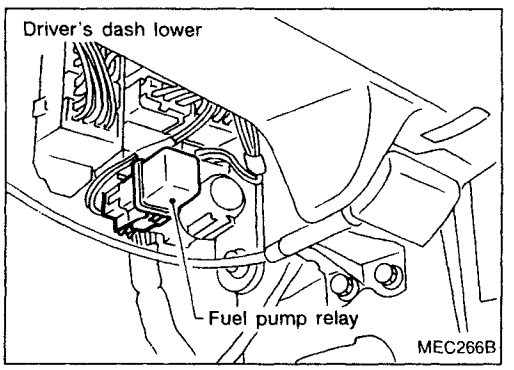


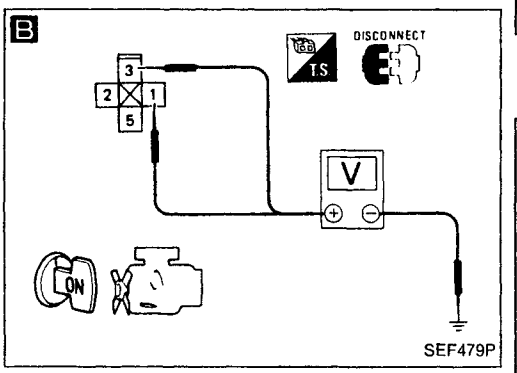
HEC072

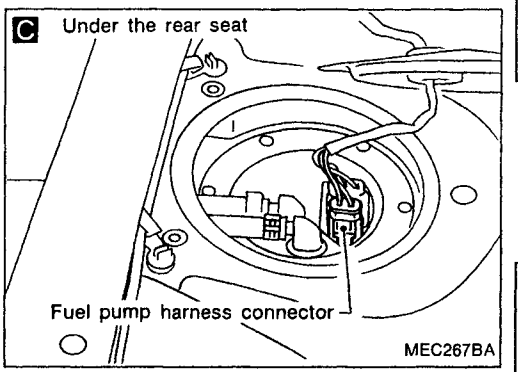
Fuel Pump (Cont'd)

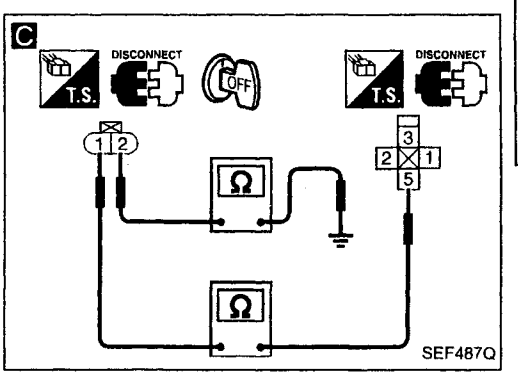
DIAGNOSTIC PROCEDURE











INSPECTION START

A

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

OK → INSPECTION END

NG ↓

B

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

NG → Check the following.
- 15A fuse
- Harness for open or short between fuse and fuel pump relay

If NG, repair harness or connectors.

OK ↓

C

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

NG → Check the following.
- Harness connectors (M4), (B1)
- Harness connectors (B17), (B51)
- Harness for open or short between fuel pump and body ground
- Harness for open or short between fuel pump and fuel pump relay

If NG, repair harness or connectors.

OK ↓

D

CHECK OUTPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal (104), (106) or (108) and fuel pump relay connector terminal ②.
   Continuity should exist.
   If OK, check harness for short.

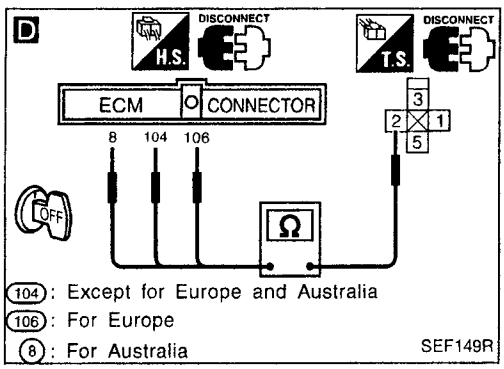
NG → Check the following.
- Harness connectors (F6), (M49)
- Harness for open or short between ECM and fuel pump relay

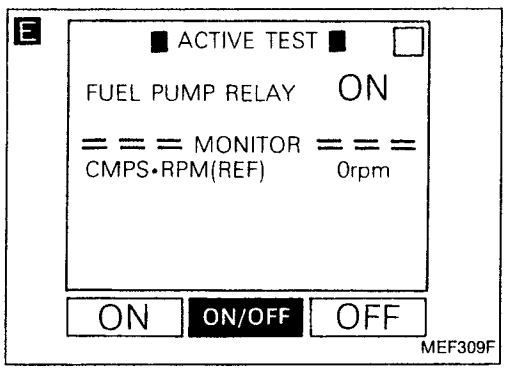
If NG, repair harness or connectors.

OK ↓

Ⓐ

Fuel Pump (Cont'd)





Ⓐ

E

CHECK COMPONENT
(Fuel pump relay).
Refer to "Component Inspection" below.
NG → Replace fuel pump relay.

OK ↓

CHECK COMPONENT
(Fuel pump).
Refer to "COMPONENT INSPECTION" below.
NG → Replace fuel pump.

OK ↓

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

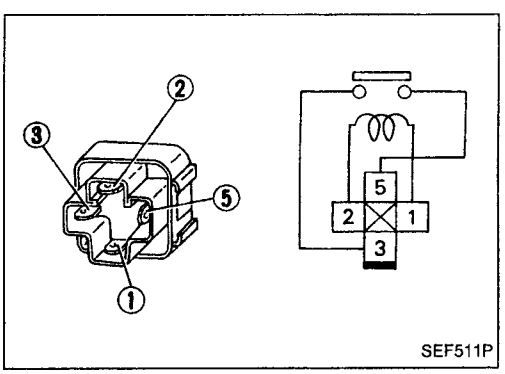
Trouble is not fixed. ↓

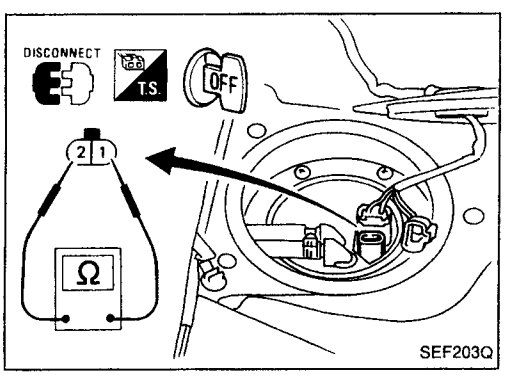
Check ECM pin terminals for damage or the connection of ECM harness connector. Reconnect ECM harness connector and retest.

↓

INSPECTION END

EC





COMPONENT INSPECTION

Fuel pump relay

Check continuity between terminals ③ and ⑤.

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

If NG, replace relay.

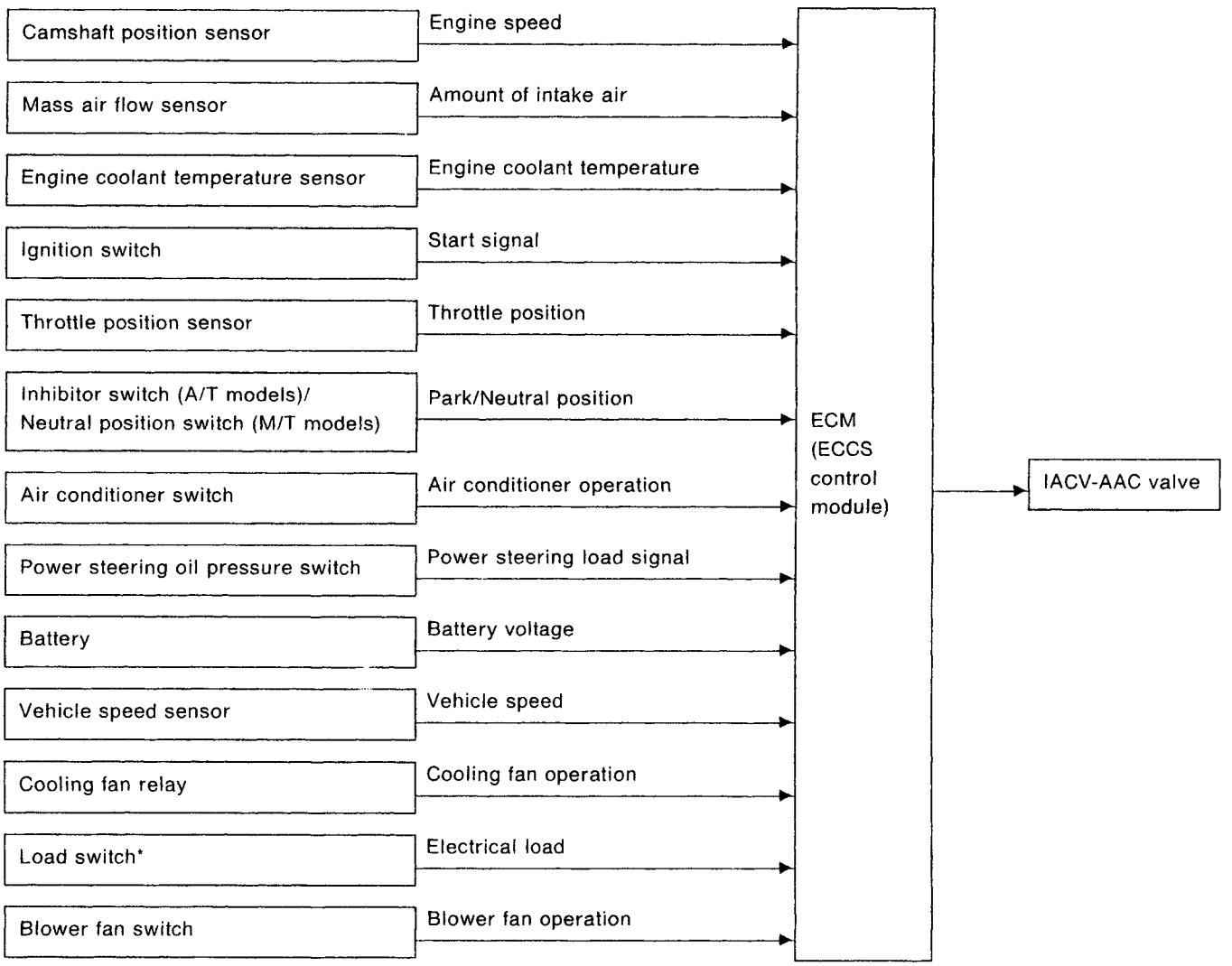
Fuel pump

1. Disconnect fuel pump harness connector.
2. Check resistance between terminals ① and ②.
   Resistance: 0.2 - 5.0Ω [at 25°C (77°F)]

If NG, replace fuel pump.

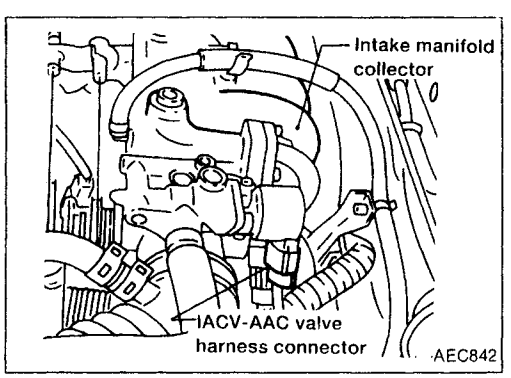
Idle Air Control Valve (IACV) — Auxiliary Air Control (AAC) Valve

SYSTEM DESCRIPTION



*: Rear window defogger switch and headlamp switch.

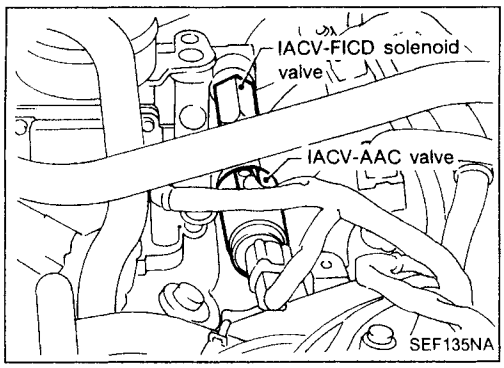
This system automatically controls engine idle speed to a specified level. Idle speed is controlled through fine adjustment of the amount of air which bypasses the throttle valve via IACV-AAC valve. The IACV-AAC valve opens and closes (except for Europe and Israel), or repeats ON/OFF operation (for Europe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



COMPONENT DESCRIPTION

IACV-AAC valve — Except for Europe and Israel

The IACV-AAC valve is moved by open and close signals from the ECM. When the open signal is sent to the valve, the amount of air that will flow through the valve increases. The more air that flows through the valve, the higher the idle speed. When the close signal is sent to the valve, the amount of air decreases.



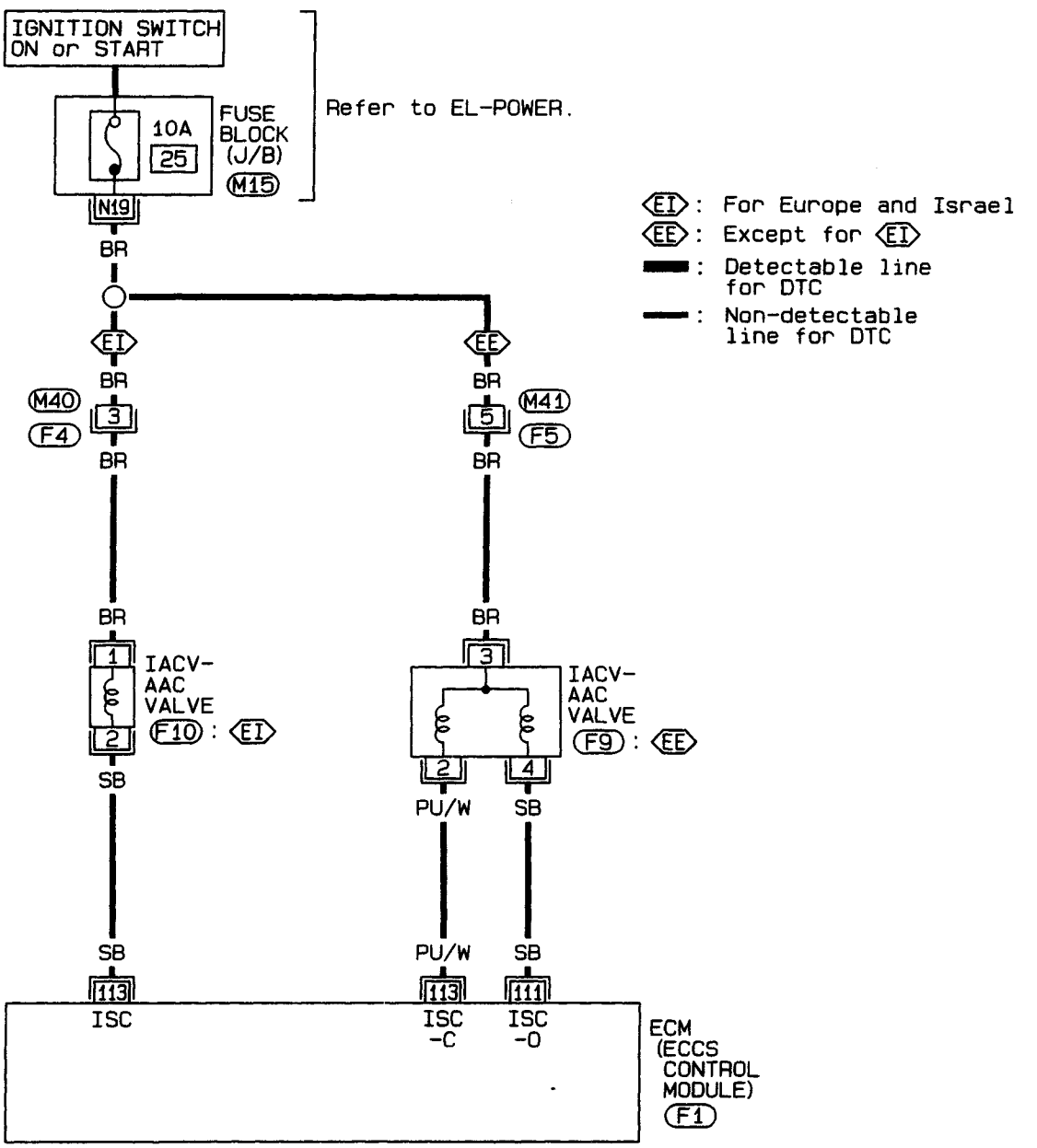
Idle Air Control Valve (IACV) — Auxiliary Air Control (AAC) Valve (Cont'd)

IACV-AAC valve — For Europe and Israel

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

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

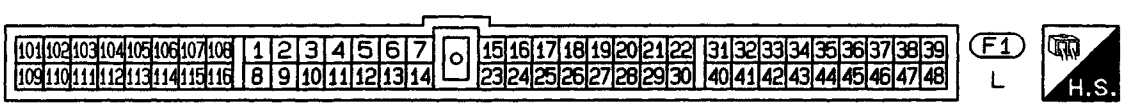
EC-AAC/V-01





Refer to last page (Foldout page).

M15

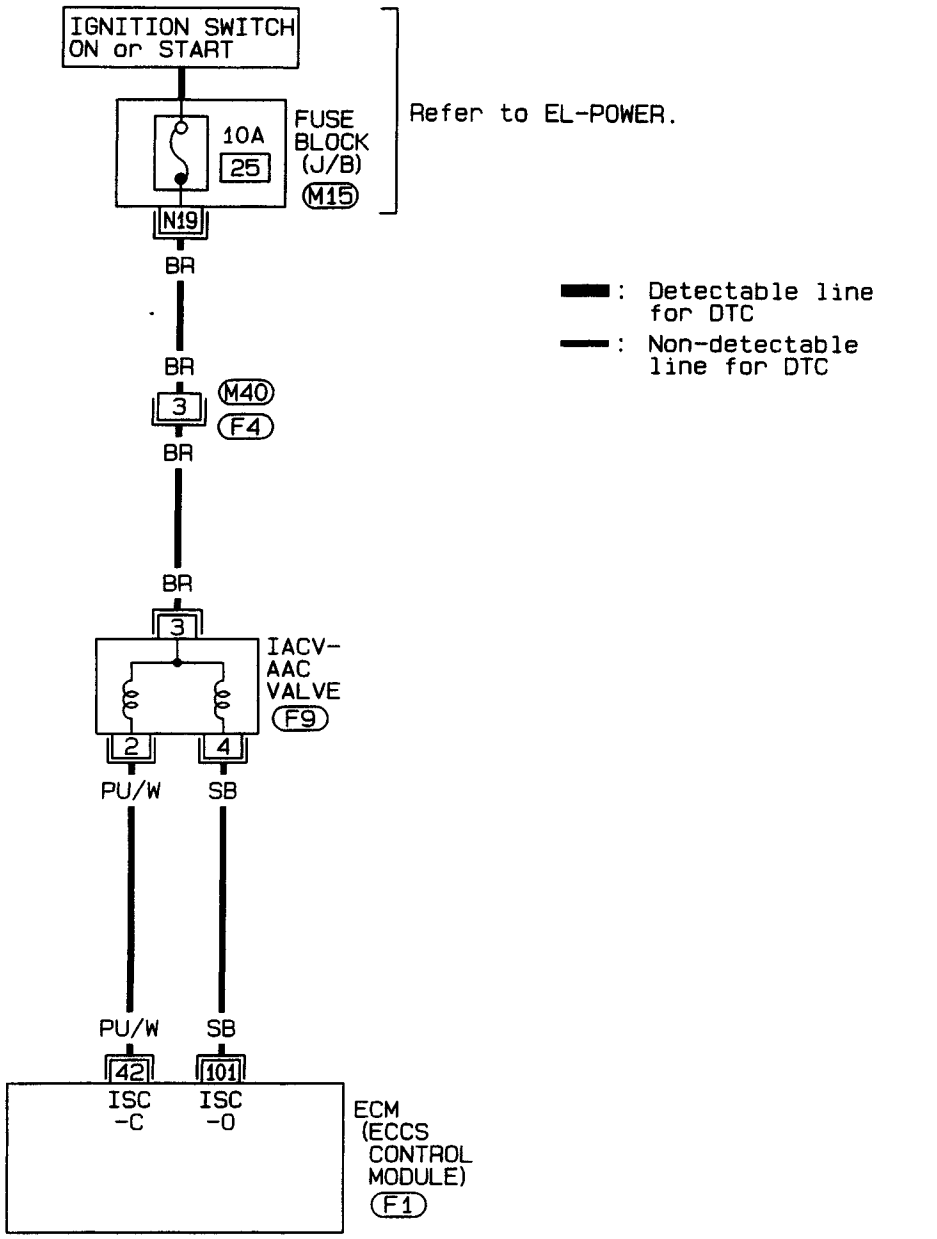


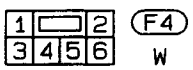
HEC043

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

GA16DE for Australia

EC-AAC/V-01

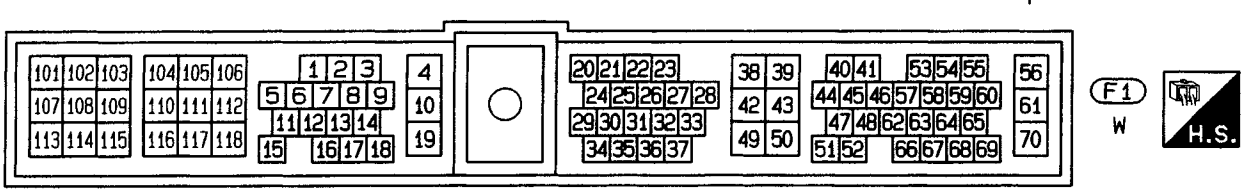






Refer to last page (Foldout page).

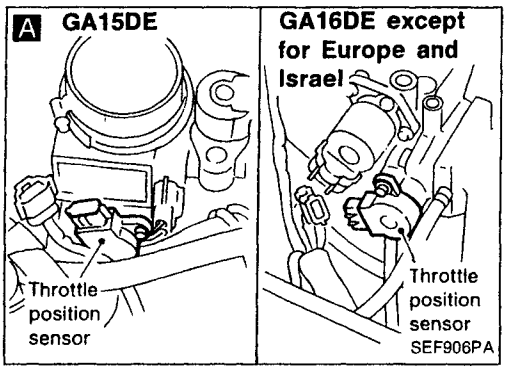
M15

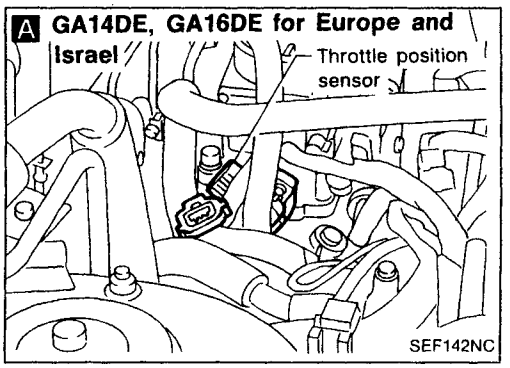


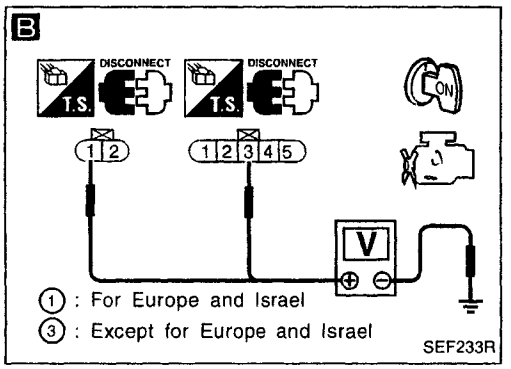
HEC075

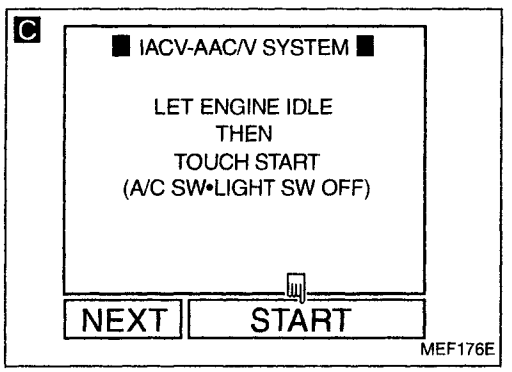
Idle Air Control Valve (IACV) — Auxiliary Air Control (AAC) Valve (Cont'd)

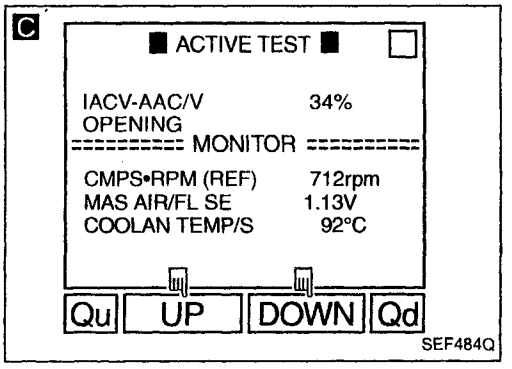
DIAGNOSTIC PROCEDURE











INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Start engine and warm it up sufficiently.
2. Check idle speed.
   If NG, adjust idle speed.
   3. • Perform "AAC VALVE ADJ" or "IACV-AAC/V ADJ" in "WORK SUPPORT" mode with CONSULT.
      • Disconnect throttle position sensor harness connector.
4. Make sure that idle speed drops.

OK → INSPECTION END

NG

B

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

NG → Check the following.
- Harness connectors (F4), (M40) or (F5), (M41)
- 10A fuse
- Harness for open or short between IACV-AAC valve and fuse

If NG, repair harness or connectors.

OK

C

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
   2. Reconnect IACV-AAC valve harness connector and then start engine.
   3. Perform "IACV-AAC/V SYSTEM" in "FUNCTION TEST" mode with CONSULT.

OR

   3. Perform "IACV-AAC/V OPENING" in "ACTIVE TEST" mode with CONSULT.

OR

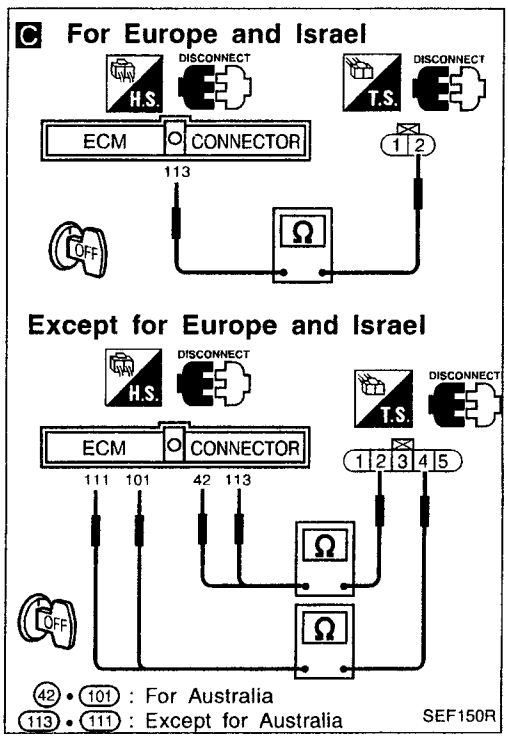
   2. Disconnect ECM harness connector.
   3. Check harness continuity between ECM terminal (113) or (42) and terminal ②, ECM terminal (111) or (101) and terminal ④.
      Continuity should exist.
      If OK, check harness for short.

NG → Repair harness or connectors.

OK

Ⓐ

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



Ⓐ

CHECK COMPONENT (IACV-AAC valve). Refer to "COMPONENT INSPECTION" below.

NG → Replace IACV-AAC valve.

OK ↓

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

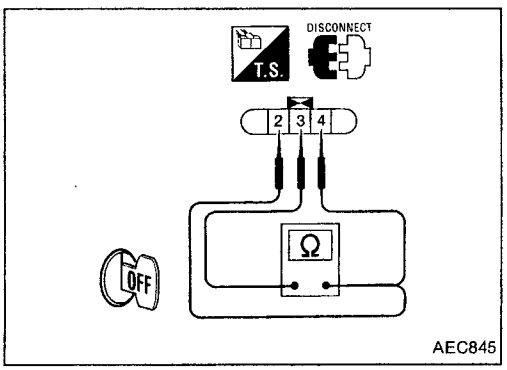
Trouble is not fixed. ↓

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

EC

COMPONENT INSPECTION

IACV-AAC valve — Except for Europe and Israel

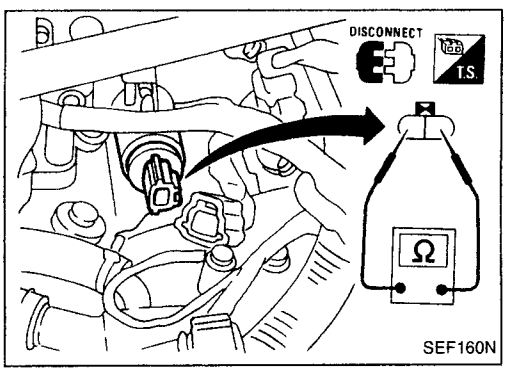


Disconnect IACV-AAC valve harness connector.

- Check resistance between terminals ② and ③, ③ and ④.

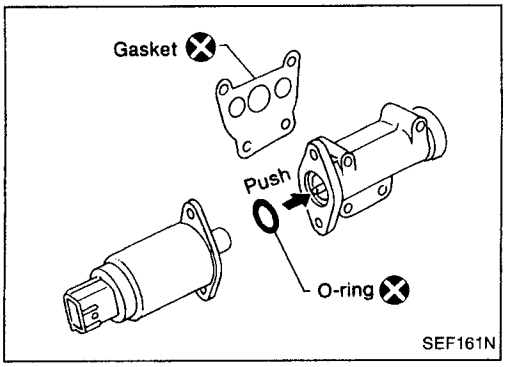
Resistance:
50 - 100Ω [at 25°C (77°F)]

IACV-AAC VALVE — For Europe and Israel



- Check IACV-AAC valve resistance.

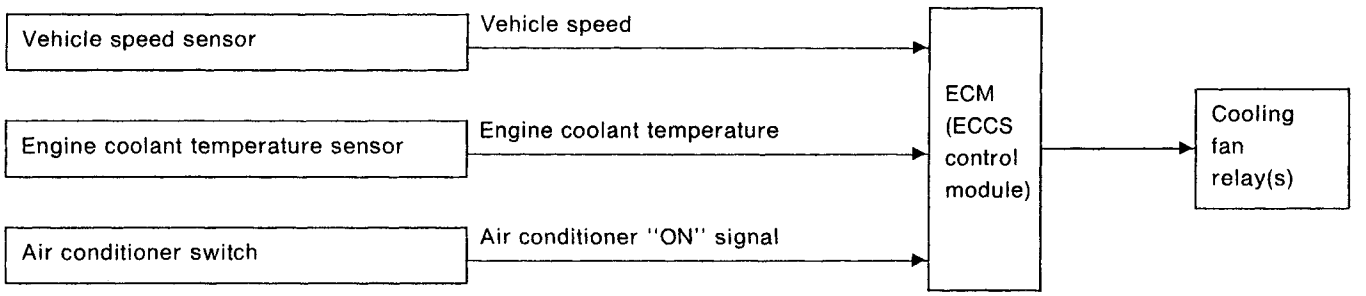
Resistance:
Approximately 10Ω [at 25°C (77°F)]



- Check plunger for seizing or sticking.

Cooling Fan Control

SYSTEM DESCRIPTION

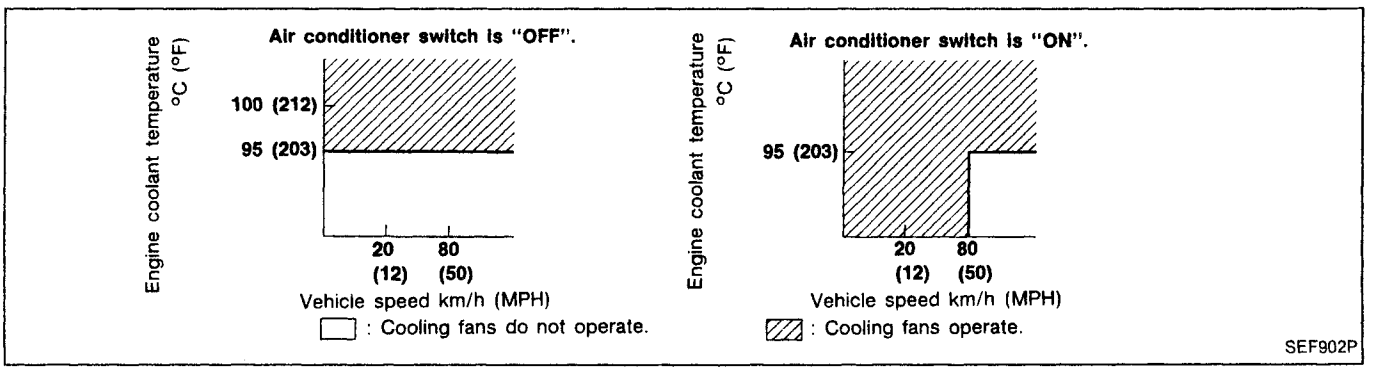


M/T MODELS

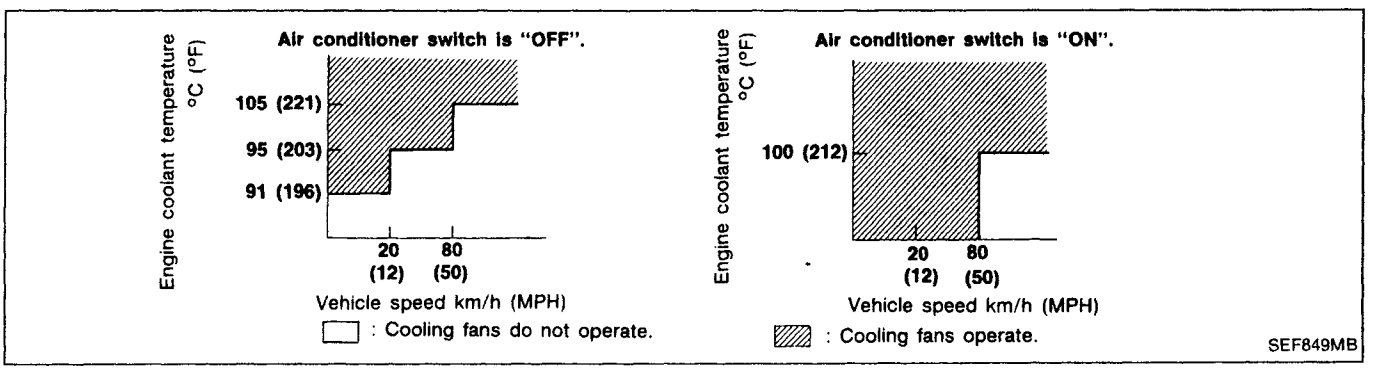
The ECM controls the cooling fan corresponding to the vehicle speed, engine coolant temperature, and air conditioner ON signal. The control system has 2-step control [ON/OFF].

Operation

For Europe with daytime light system



For Europe without daytime light system and Australia



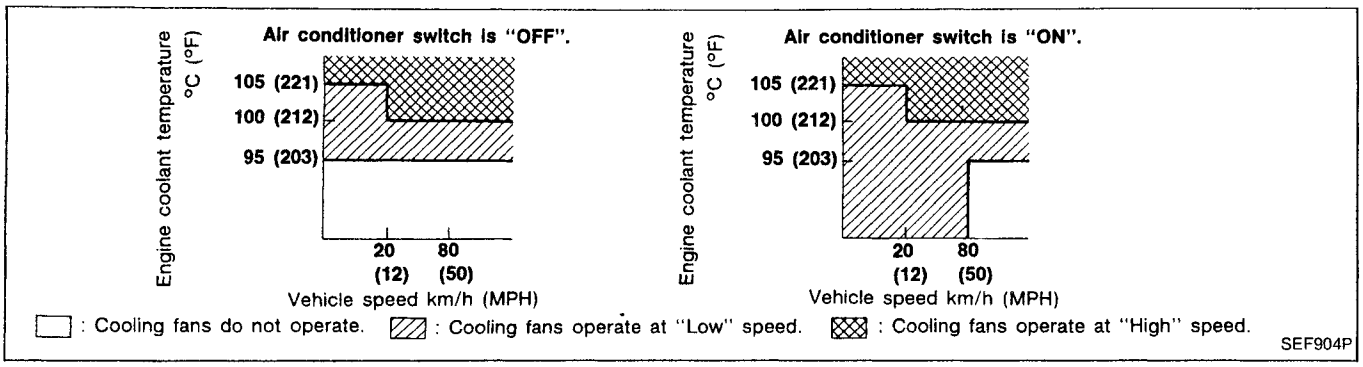
Cooling Fan Control (Cont'd)

A/T MODELS

The ECM controls the cooling fan corresponding to the vehicle speed, engine coolant temperature, and air conditioner ON signal. The control system has 3-step control [HIGH/LOW/OFF].

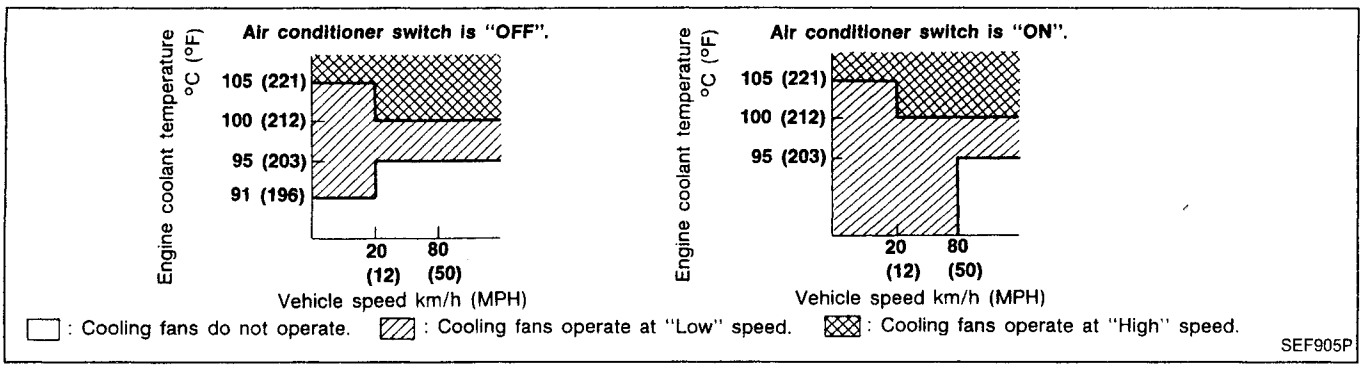
Operation

For Europe with daytime light system



SEF904P

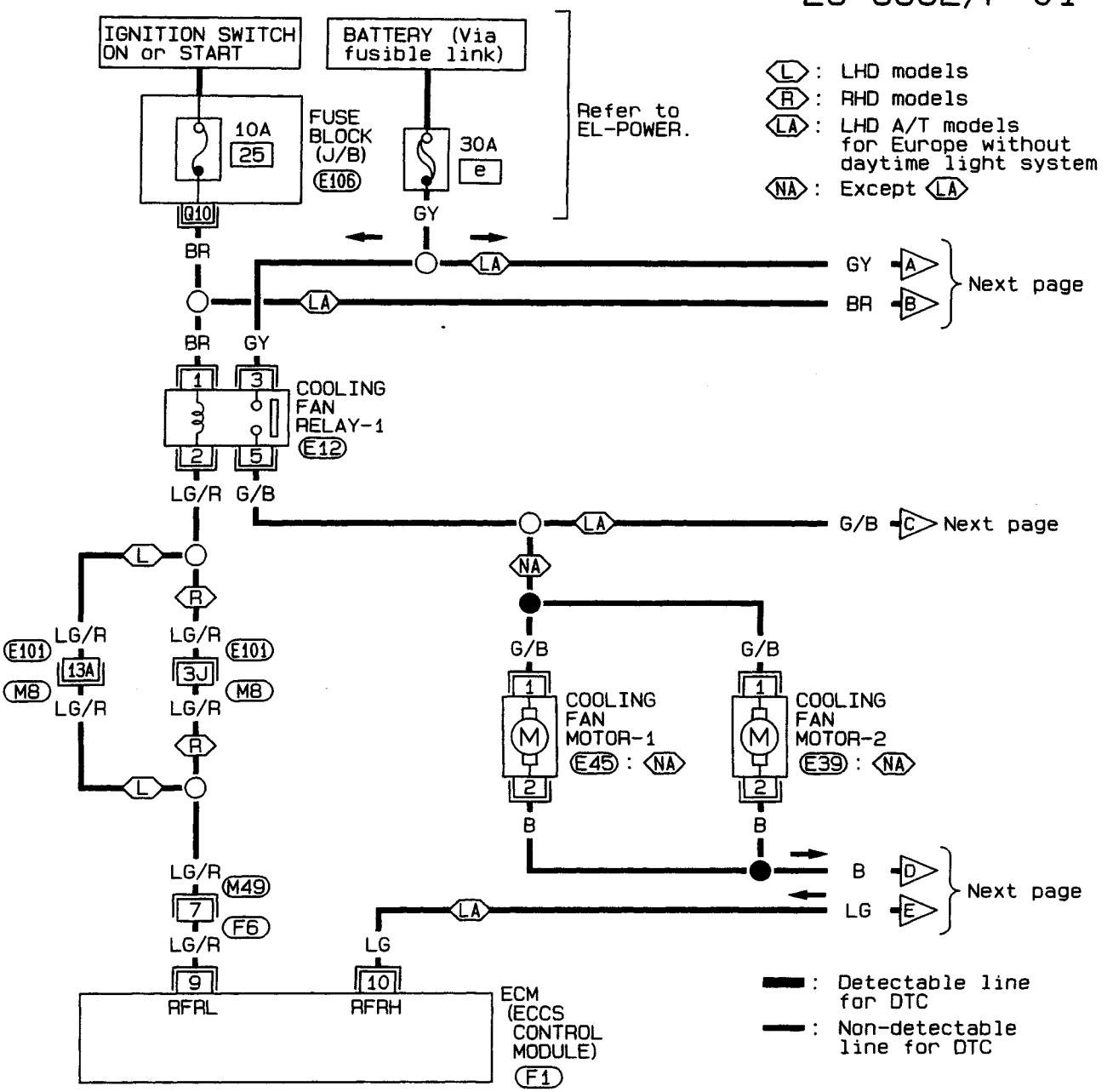
For Europe without daytime light system and Australia

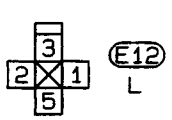


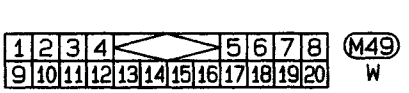
SEF905P

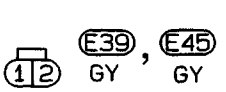
Cooling Fan Control (Cont'd)

EC-COOL/F-01



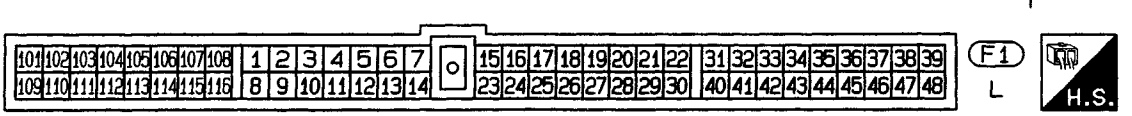






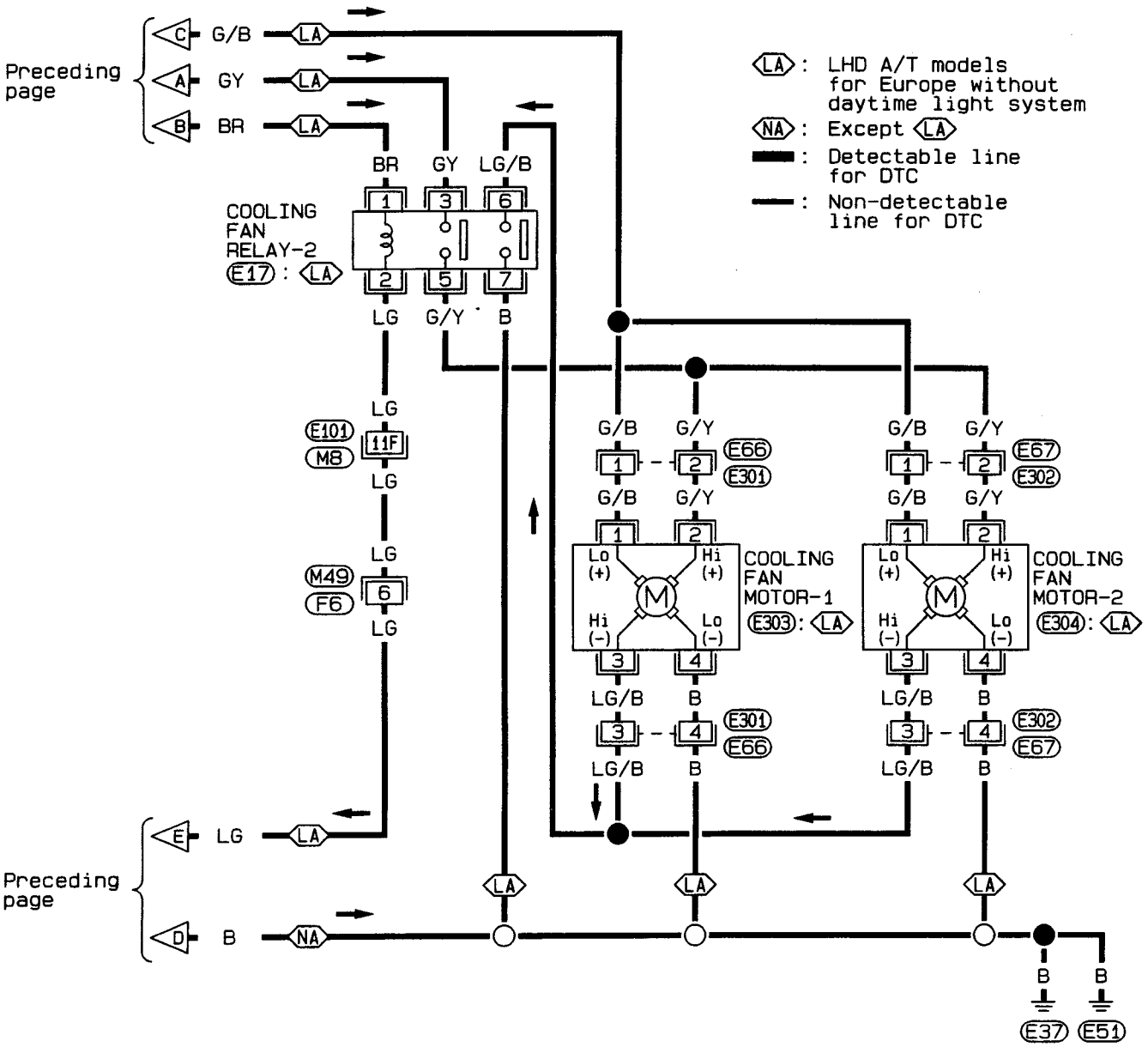
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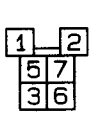
M8, E101
E106



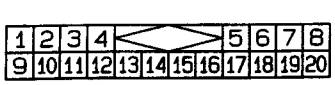
HEC044

EC-COOL/F-02




E17 BR


E66 GY, E67 GY, E303 GY, E304 GY


M49 W

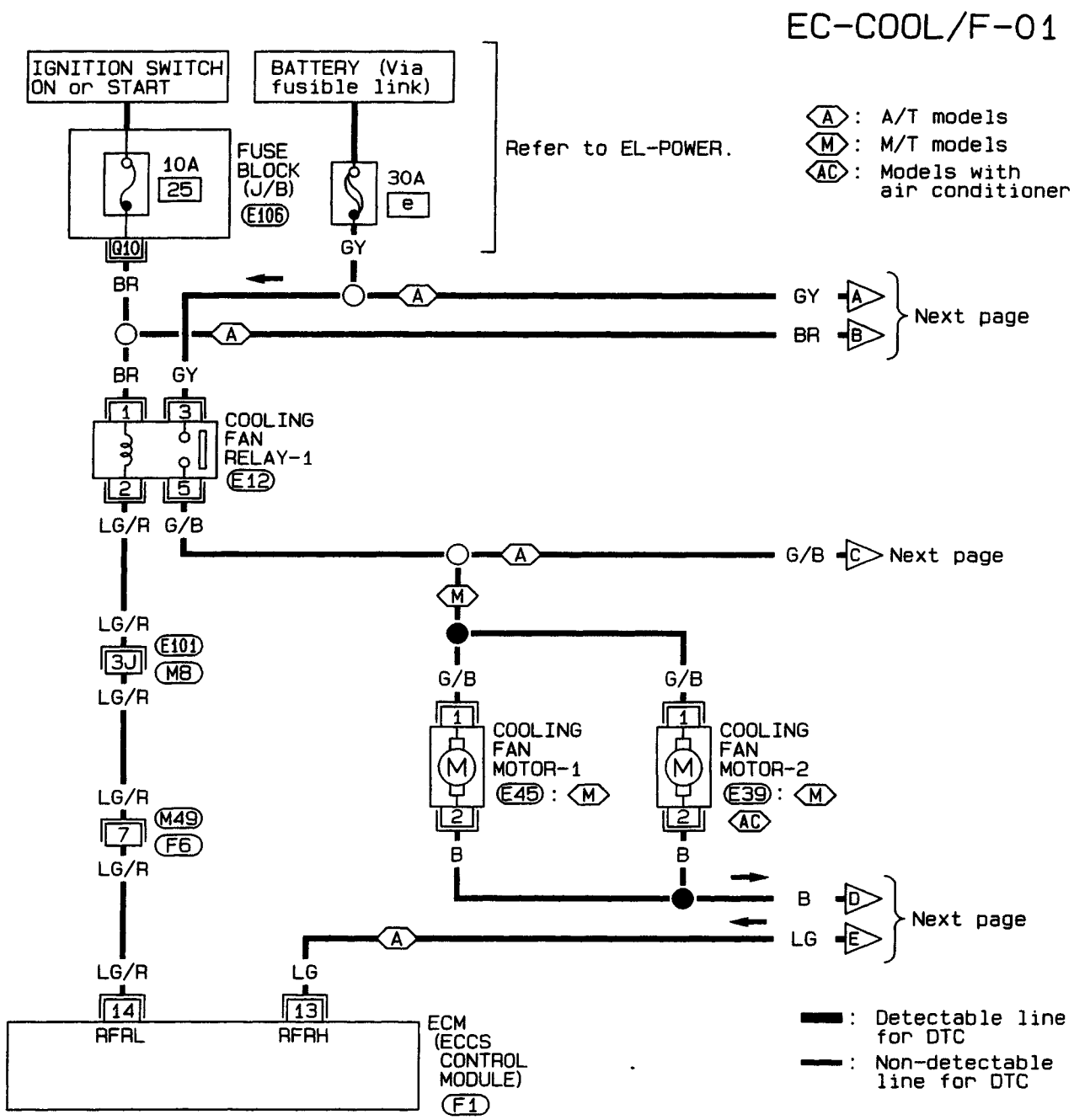
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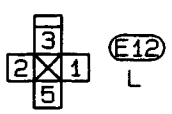
M8, E101

HEC045

Cooling Fan Control (Cont'd)

GA16DE for Australia



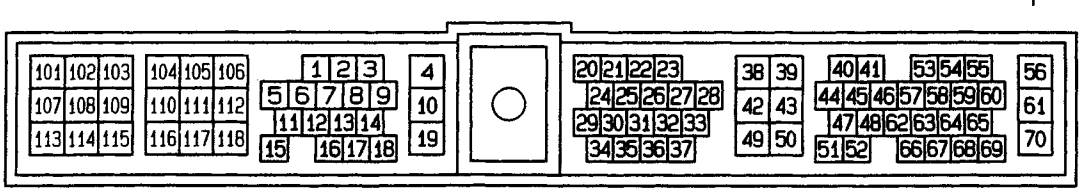






Refer to last page (Foldout page).

M8, E101
E106

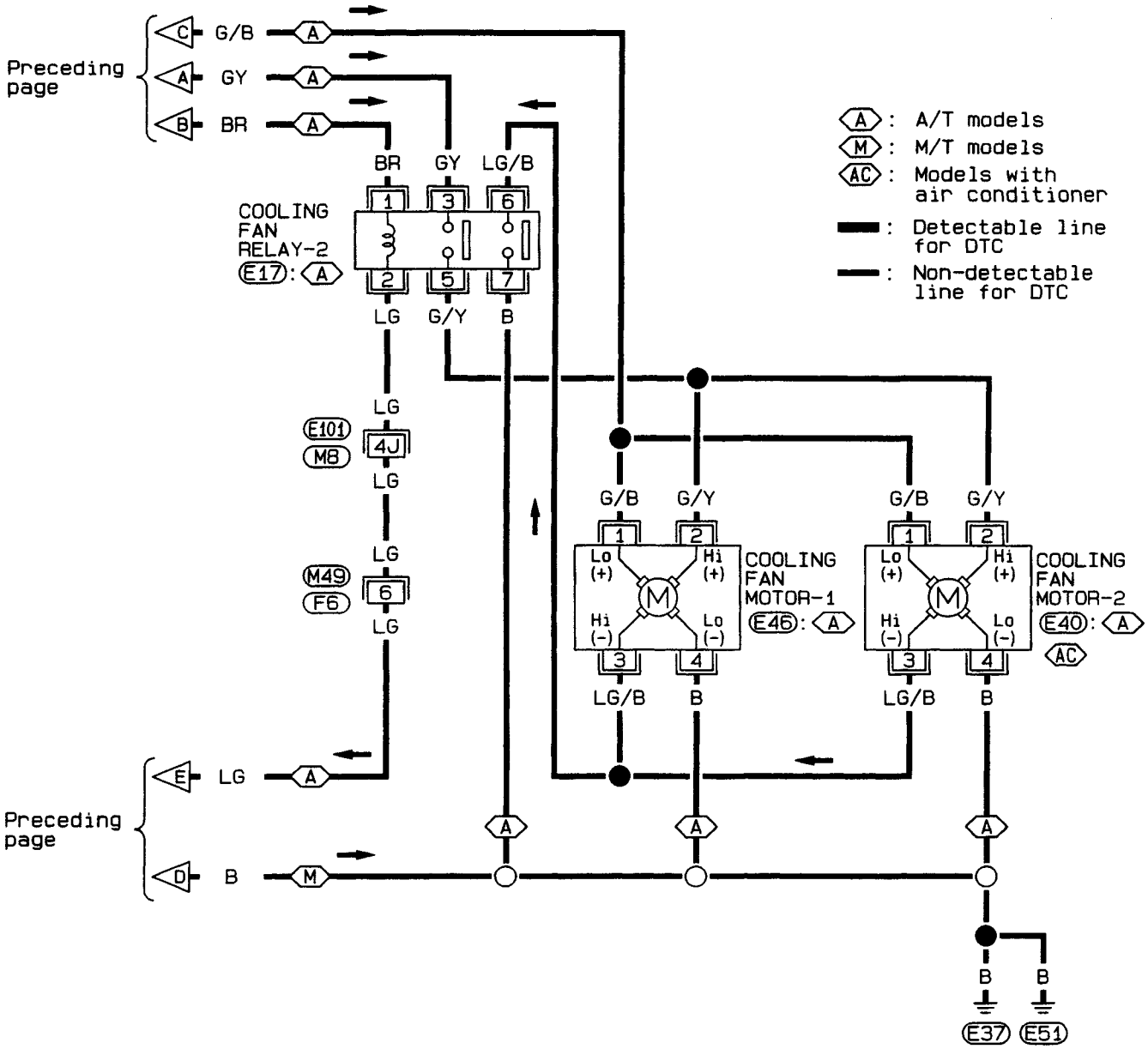


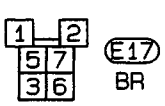
HEC076

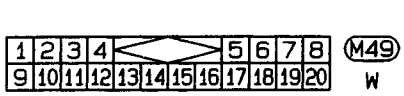
Cooling Fan Control (Cont'd)

GA16DE for Australia

EC-COOL/F-02









Refer to last page (Foldout page).

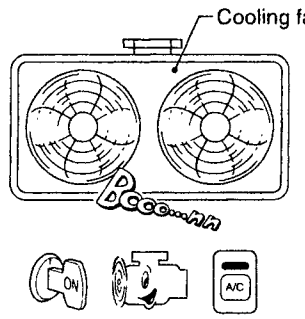
M8, E101

HEC077

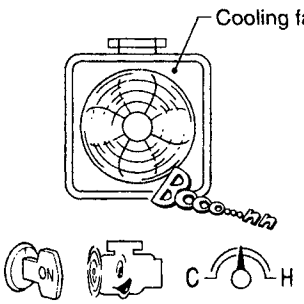
Cooling Fan Control (Cont'd)

DIAGNOSTIC PROCEDURE

A **With air conditioner**

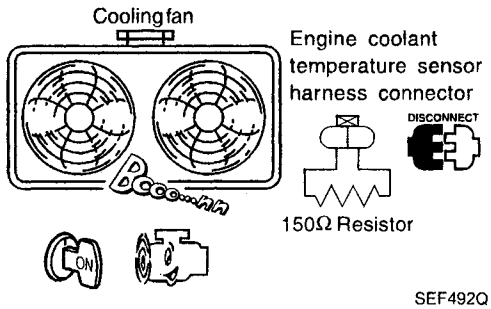


Without air conditioner



MEC340B

B



SEF492Q

INSPECTION START

A

CHECK COOLING FAN LOW SPEED OPERATION.

With air conditioner

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

Without air conditioner

1. Start engine.
2. Keep engine speed at about 2,000 rpm until engine is warmed up sufficiently.
3. Make sure that cooling fan begins to operate at low speed during warm-up.

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

OK

B

CHECK COOLING FAN HIGH SPEED OPERATION.

1. Turn air conditioner switch "OFF".
2. Turn blower fan switch "OFF". (Steps 1) and 2) are only performed for models with air conditioner.)
3. Stop engine.
4. Disconnect engine coolant temperature sensor harness connector.
5. Connect 150Ω resistor to engine coolant temperature sensor harness connector.
6. Restart engine and make sure that cooling fan operates at high speed.

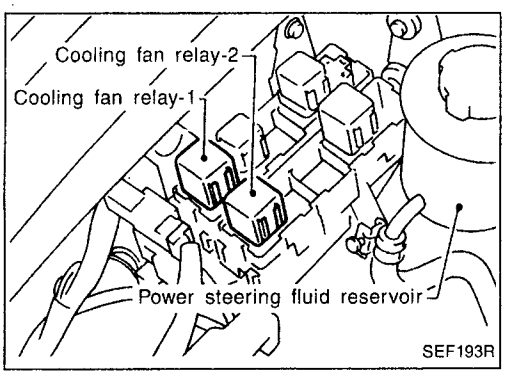
NG → Check cooling fan high speed control circuit. (Go to PROCEDURE B .)

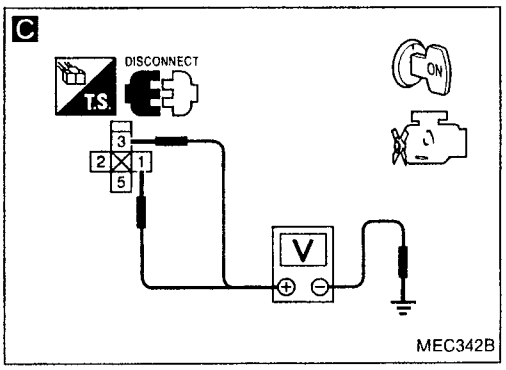
OK

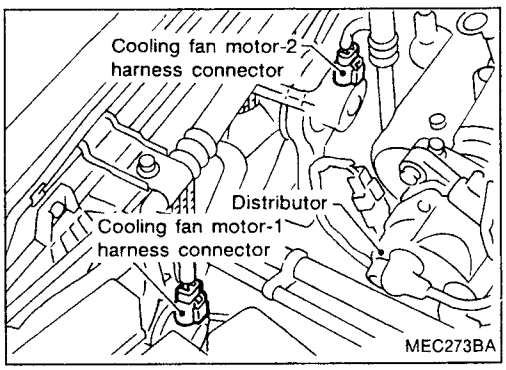
INSPECTION END

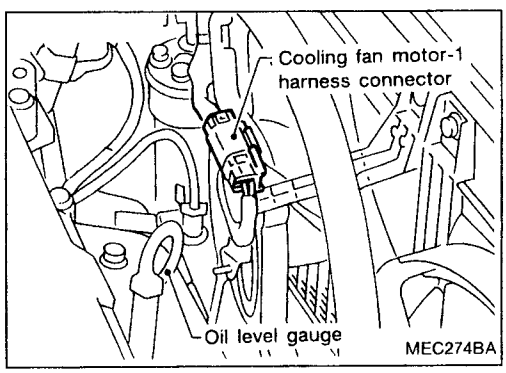
Cooling Fan Control (Cont'd)

DIAGNOSTIC PROCEDURE









PROCEDURE A

INSPECTION START

C

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect cooling fan relay-1.
3. Turn ignition switch "ON".
4. Check voltage between terminals ①, ③ and ground.
   Voltage: Battery voltage

NG → Check the following.
- 10A fuse
- 30A fusible link
- Harness for open or short between cooling fan relay-1 and fuse
- Harness for open or short between cooling fan relay-1 and battery

If NG, repair harness or connectors.

OK

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect cooling fan motor-1 harness connector and cooling fan motor-2 harness connector.

D 3. Check harness continuity between terminal ① and terminal ⑤.
   Continuity should exist.
   If OK, check harness for short.

E 4. Check harness continuity between terminal ② and body ground or terminal ④ and body ground.
   Continuity should exist.
   If OK, check harness for short.

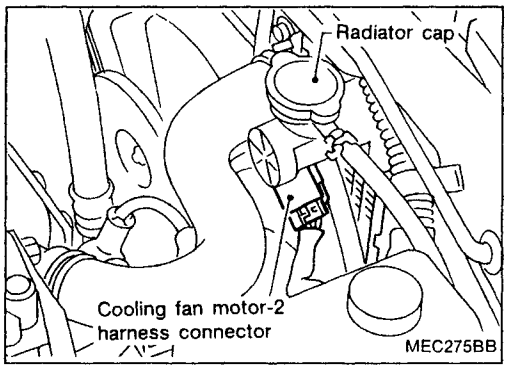
NG → Repair harness or connectors.

OK

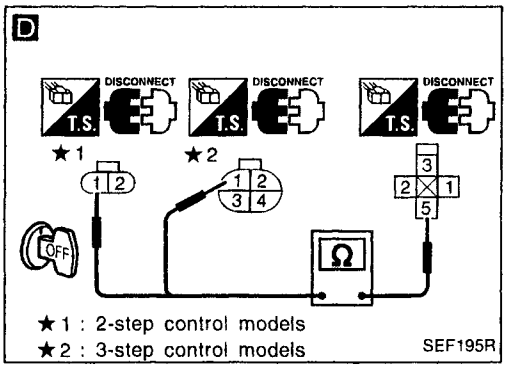
Ⓐ

EC

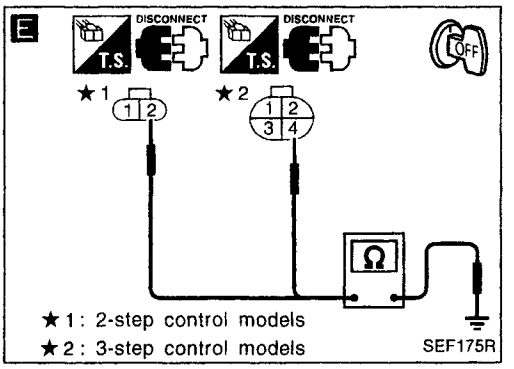
Cooling Fan Control (Cont'd)



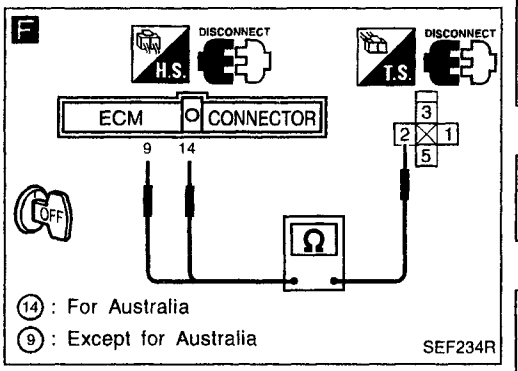
D



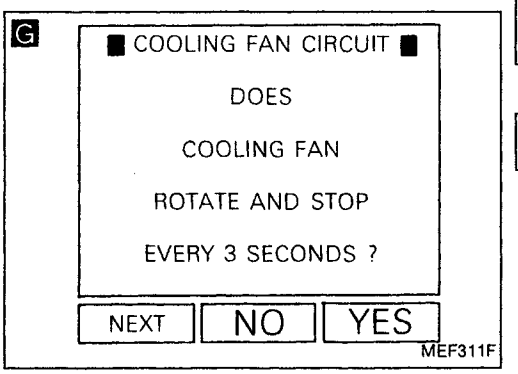
E



F



G



Ⓐ

F

CHECK OUTPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ⑨ or ⑭ and terminal ②.
Continuity should exist.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness connectors (M8), (E101)
- Harness for open or short between cooling fan relay-1 and ECM

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Cooling fan relay-1).
Refer to "COMPONENT INSPECTION".
(See page EC-167.)

NG → Replace cooling fan relay.

OK ↓

G

CHECK COMPONENTS
(Cooling fan motors-1 and -2).

1. Reconnect cooling fan relay-1, cooling fan motor harness connectors and ECM harness connector.
2. Turn ignition switch "ON".
3. Perform "COOLING FAN CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

3. Perform "COOLING FAN" in "ACTIVE TEST" mode with CONSULT.

OR

Refer to " COMPONENT INSPECTION". (See page EC-167.)

NG → Replace cooling fan motors.

OK ↓

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

Trouble is not fixed. ↓

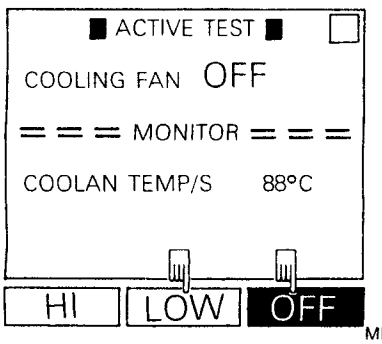
Check ECM pin terminals for damage or the connection of ECM harness connector. Reconnect ECM harness connector and retest.

↓

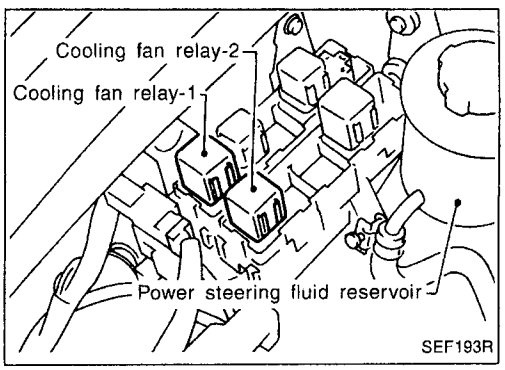
INSPECTION END

Cooling Fan Control (Cont'd)

G

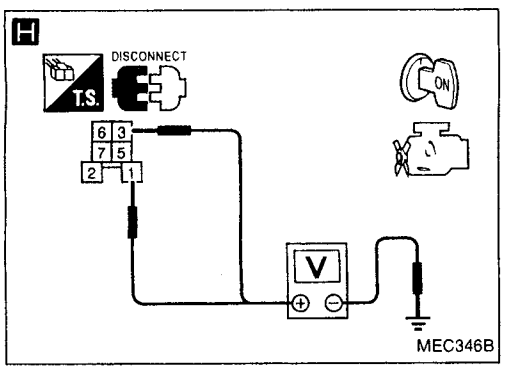


MEF313F

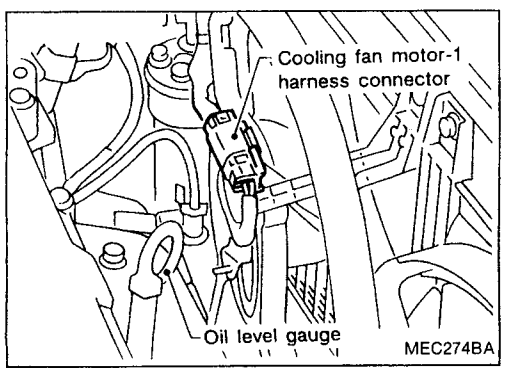


SEF193R

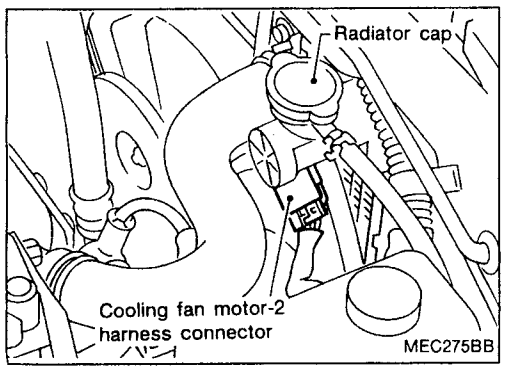
H



MEC346B



MEC274BA



MEC275BB

PROCEDURE B

INSPECTION START

H

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect cooling fan relay-2.
3. Turn ignition switch "ON".
4. Check voltage between terminals ①, ③ and ground.
   Voltage: Battery voltage

NG → Check the following.
- Harness for open or short between cooling fan relay-2 and fuse
- Harness for open or short between cooling fan relay-2 and fusible link

If NG, repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect cooling fan motor-1 harness connector and cooling fan motor-2 harness connector.

I 3. Check harness continuity between terminal ⑤ and terminal ②.
   Continuity should exist.
   If OK, check harness for short.

J 4. Check harness continuity between terminal ⑥ and terminal ③, terminal ⑦ and body ground.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

K

CHECK OUTPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ⑬ or ⑩ and terminal ②.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness connectors (M8), (E101)
- Harness for open or short between ECM and cooling fan relay-2

If NG, repair harness or connectors.

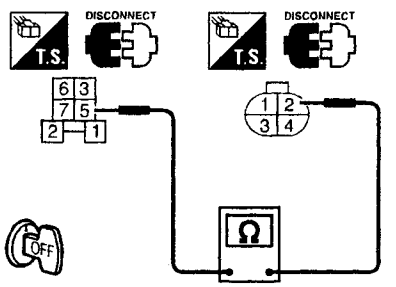
OK ↓

⑧

EC

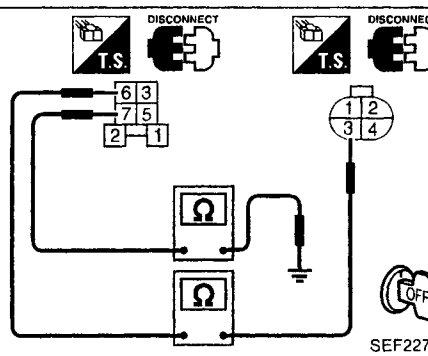
Cooling Fan Control (Cont'd)

I



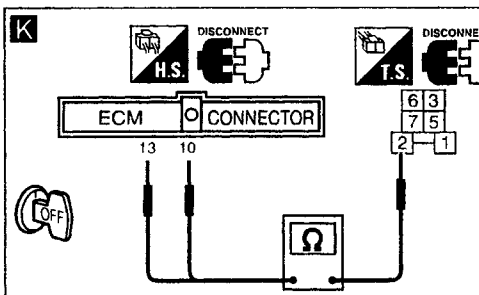
SEF226R

J



SEF227R

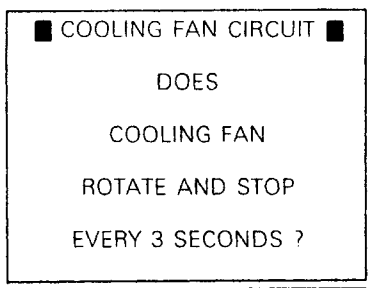
K



⑬: For Australia
⑩: Except for Australia

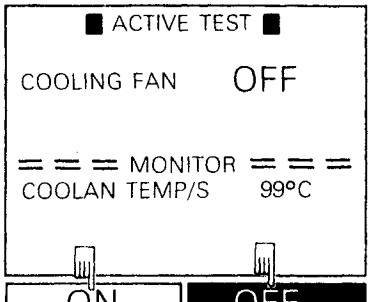
SEF196R

L



MEF311F

L



MEF312F

Ⓑ

CHECK COMPONENT
(Cooling fan relay-2).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace cooling fan relay.

OK

L

CHECK COMPONENTS
(Cooling fan motors-1 and -2).

1. Reconnect cooling fan relay-2, cooling fan motor harness connectors, engine coolant temperature sensor harness connector and ECM harness connector.
2. Turn ignition switch "ON".
3. Perform "COOLING FAN CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

3. Perform "COOLING FAN" in "ACTIVE TEST" mode with CONSULT.

OR

Refer to " COMPONENT INSPECTION" on next page.

NG → Replace cooling fan motors.

OK

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

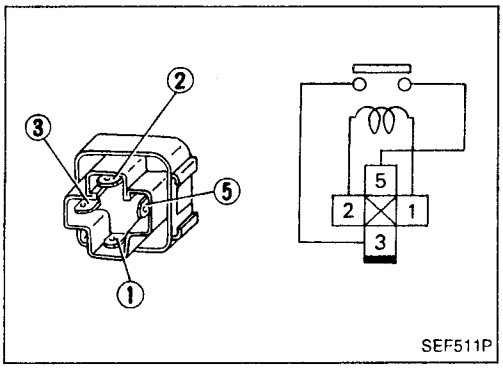
Trouble is not fixed.

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

INSPECTION END

Cooling Fan Control (Cont'd)

COMPONENT INSPECTION



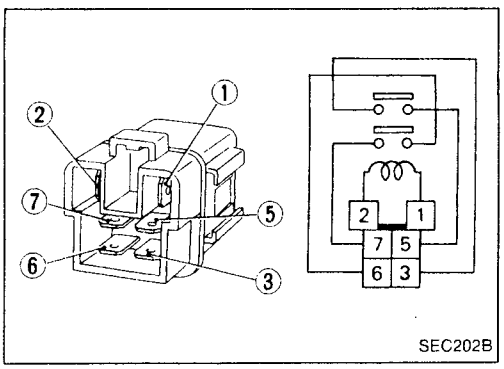
SEF511P

Cooling fan relay-1

Check continuity between terminals ③ and ⑤.

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

If NG, replace relay.



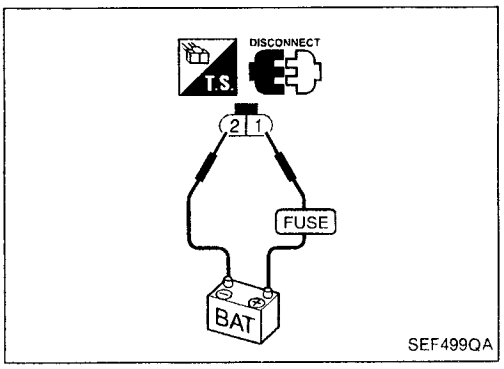
SEC202B

Cooling fan relay-2

Check continuity between terminals ③ and ⑤, ⑥ and ⑦.

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

If NG, replace relay.



SEF499QA

Cooling fan motors-1 and -2

M/T models:

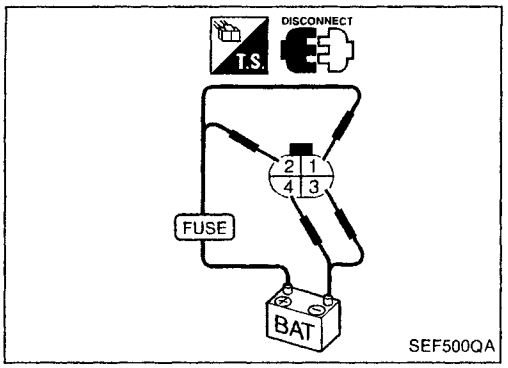
1. Disconnect cooling fan motor harness connectors.
2. Supply cooling fan motor terminals with battery voltage and check operation.

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

Cooling fan motor should operate.

If NG, replace cooling fan motor.

Cooling Fan Control (Cont'd)



A/T models for Australia and LHD A/T models for Europe without daytime light system

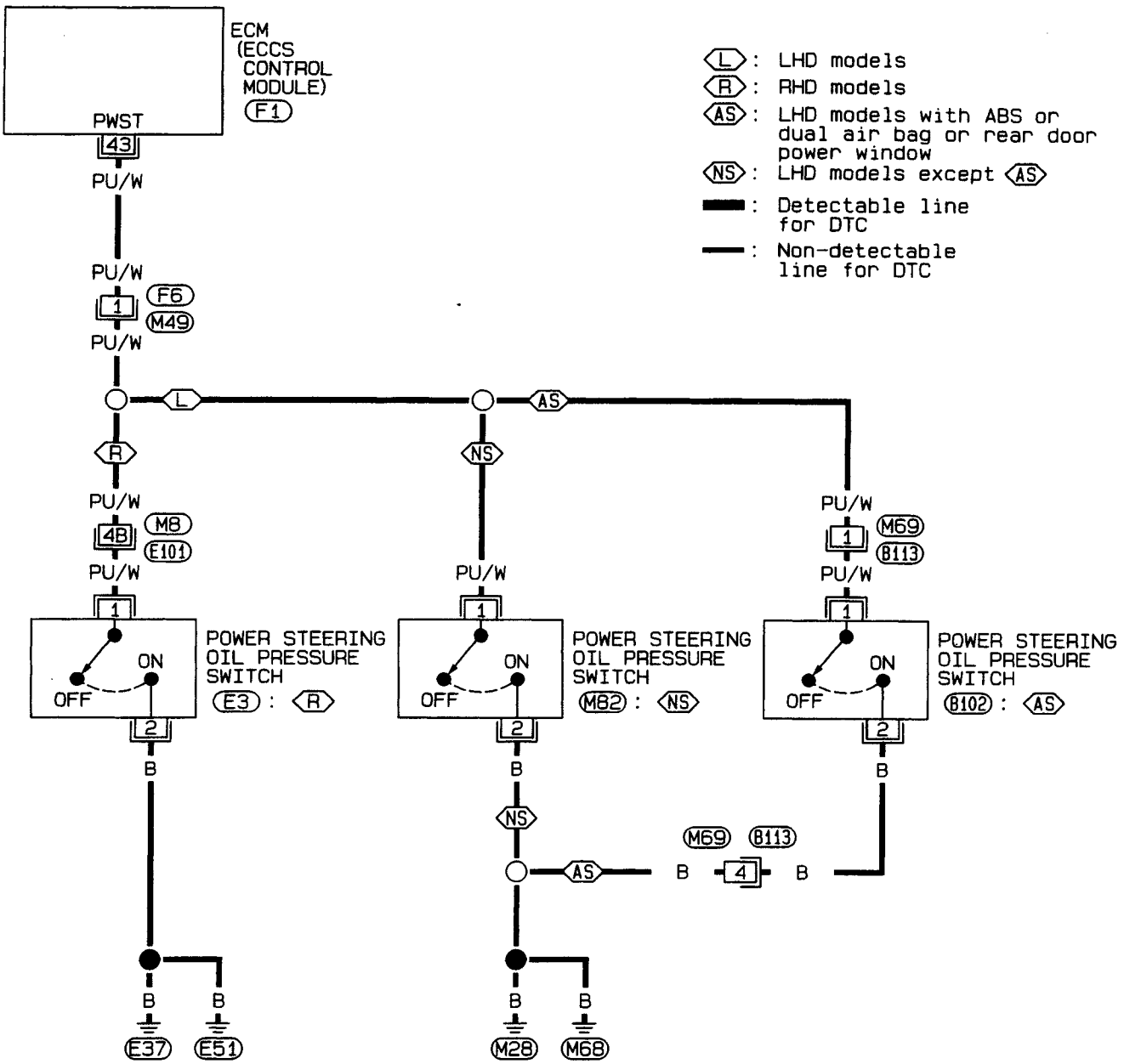
1. Disconnect cooling fan motor harness connectors.
2. Supply cooling fan motor terminals with battery voltage and check operation.

	Speed	Terminals	
		(⊕)	(⊖)
Cooling fan motor-1	Low	①	④
	High	②	③
Cooling fan motor-2	Low	①	④
	High	②	③

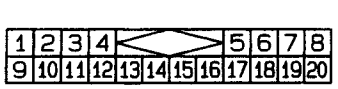
Cooling fan motor should operate.
If NG, replace cooling fan motor.

Power Steering Oil Pressure Switch

EC-PST/SW-01



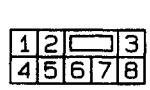
EC



M49
W



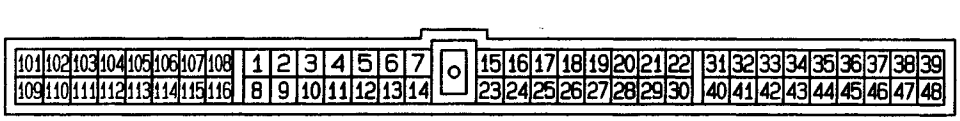
E3 , M82 , B102
GY GY GY



B113
W

Refer to last page (Foldout page).

M8 , E101



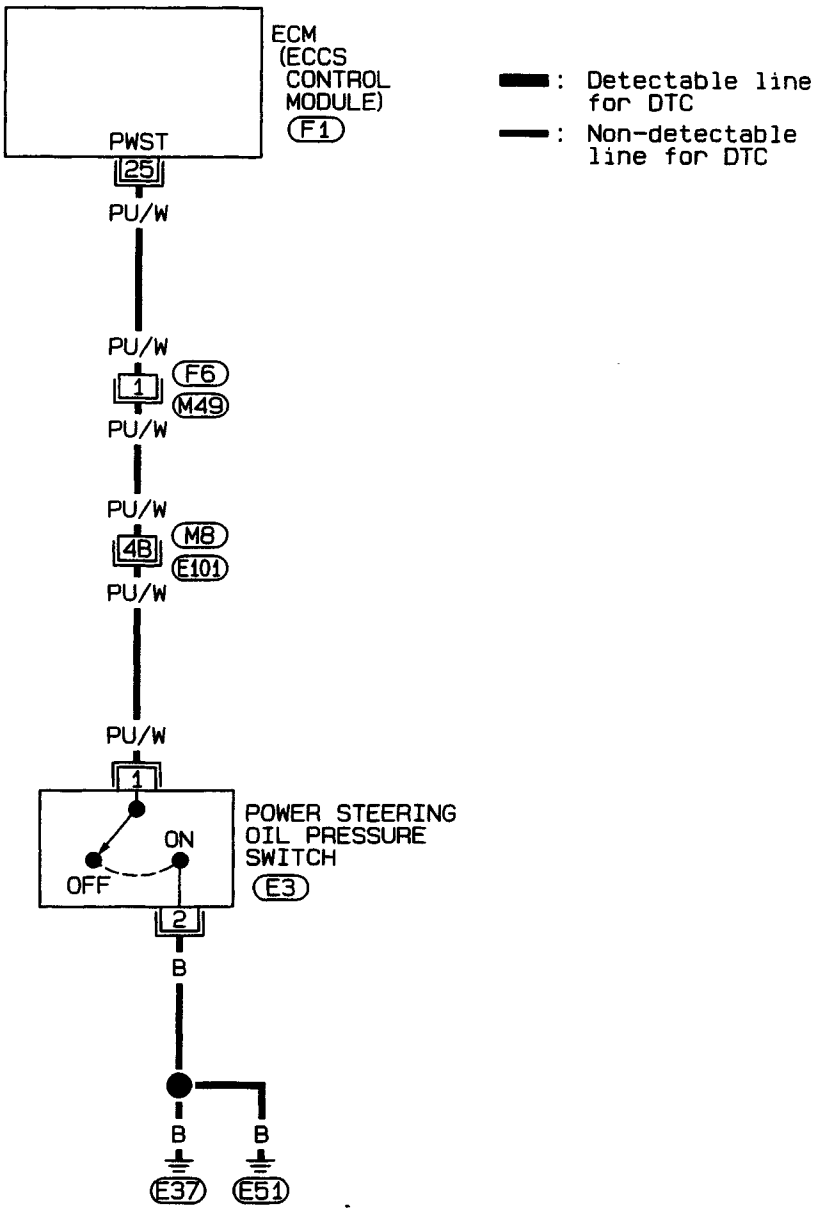
F1
L

H.S.

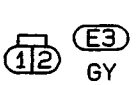
HEC046

GA16DE for Australia

EC-PST/SW-01

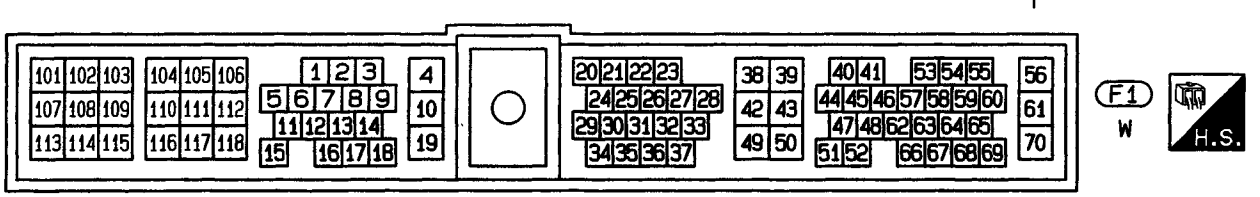






Refer to last page (Foldout page).

M8, E101

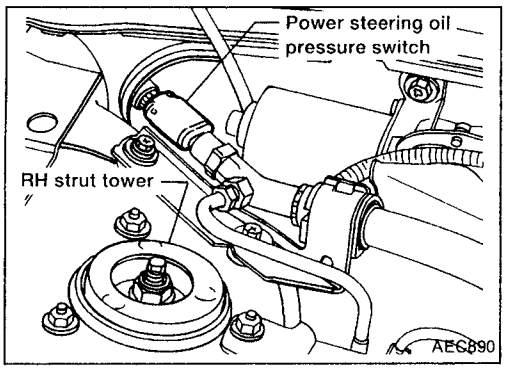


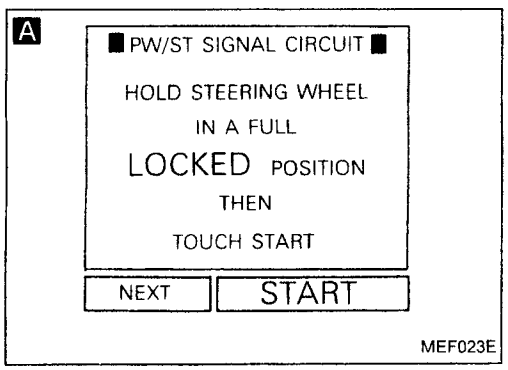
HEC078

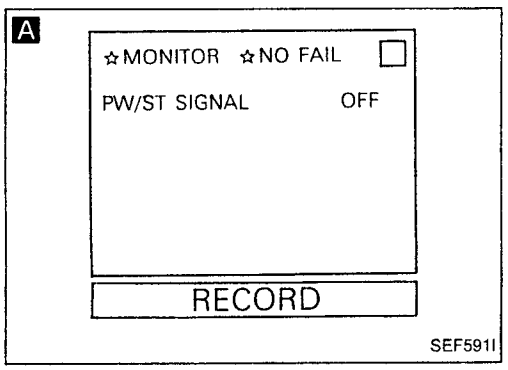
Power Steering Oil Pressure Switch (Cont'd)

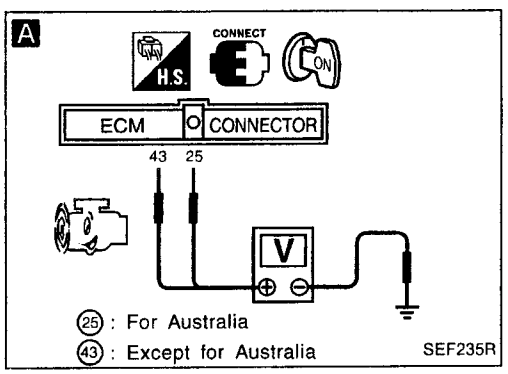
COMPONENT DESCRIPTION

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









DIAGNOSTIC PROCEDURE

INSPECTION START

A

CHECK OVERALL FUNCTION.

1. Turn ignition switch "ON".
2. Perform "PW/ST SIGNAL CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

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

Steering is in neutral position:
OFF
Steering is turned:
ON

OR

1. Start engine.
2. Check voltage between ECM terminal ㊸ or ㉕ and ground.

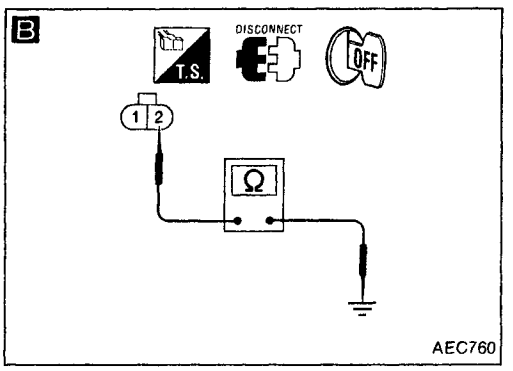
Voltage:
When steering wheel is turned quickly.
Approximately 0V
Except above
Approximately 5V

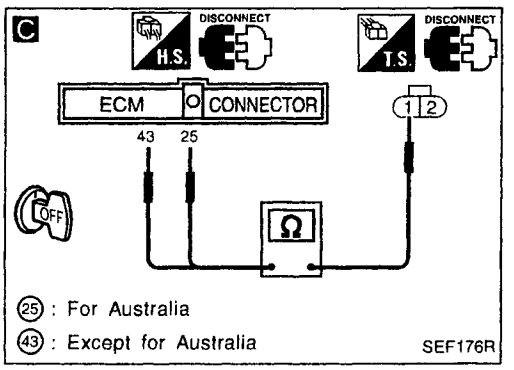
OK → INSPECTION END

NG → Ⓐ

EC

Power Steering Oil Pressure Switch (Cont'd)





Ⓐ

B

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

NG → Repair harness or connectors.

OK ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ㊸ or ㉕ and terminal ①.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness connectors (M8), (E101) or (M69), (B113)
- Harness for open or short between ECM and power steering oil pressure switch

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Power steering oil pressure switch).
Refer to "COMPONENT INSPECTION" below.

NG → Replace power steering oil pressure switch.

OK ↓

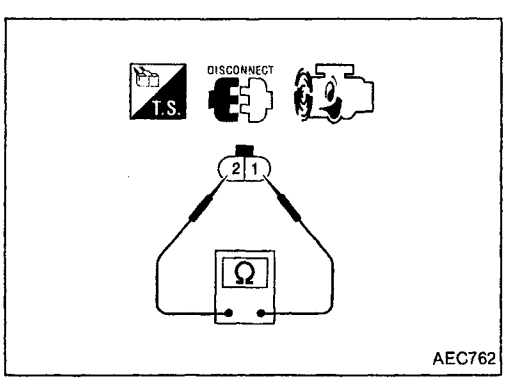
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

↓

INSPECTION END



COMPONENT INSPECTION

Power steering oil pressure switch

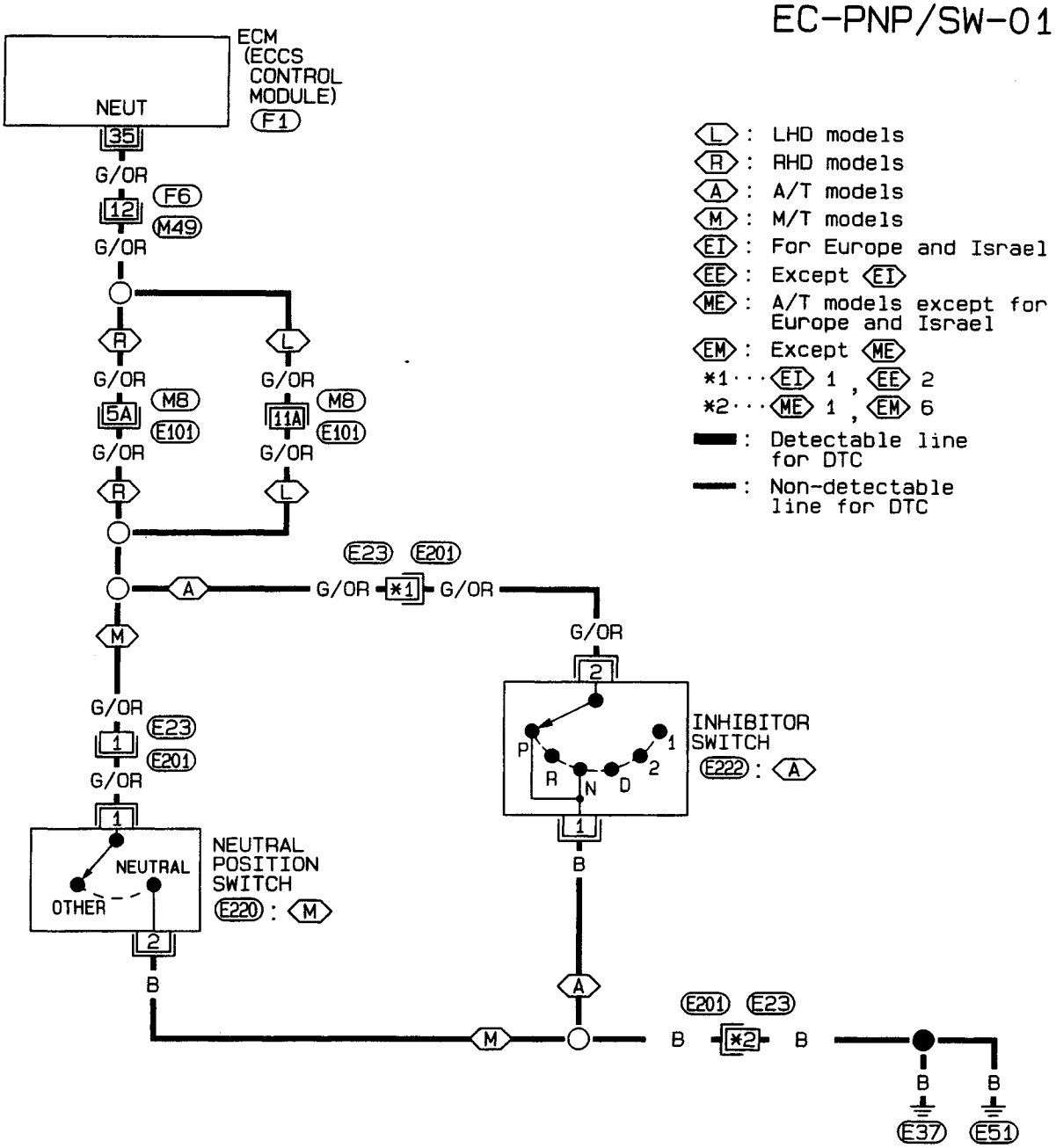
1. Disconnect power steering oil pressure switch harness connector then start engine.
2. Check continuity between terminals ① and ②.

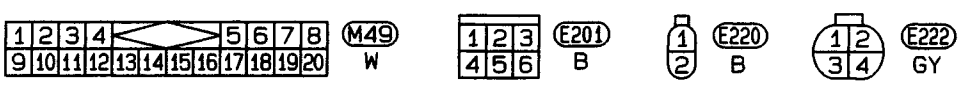
Conditions	Continuity
Steering wheel is being turned	Yes
Steering wheel is not being turned	No

If NG, replace power steering oil pressure switch.

Park/Neutral Position Switch

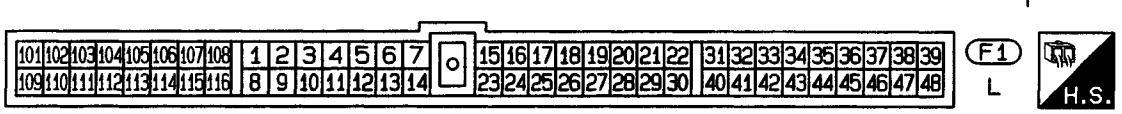
EC-PNP/SW-01





Refer to last page (Foldout page).

M8, E101

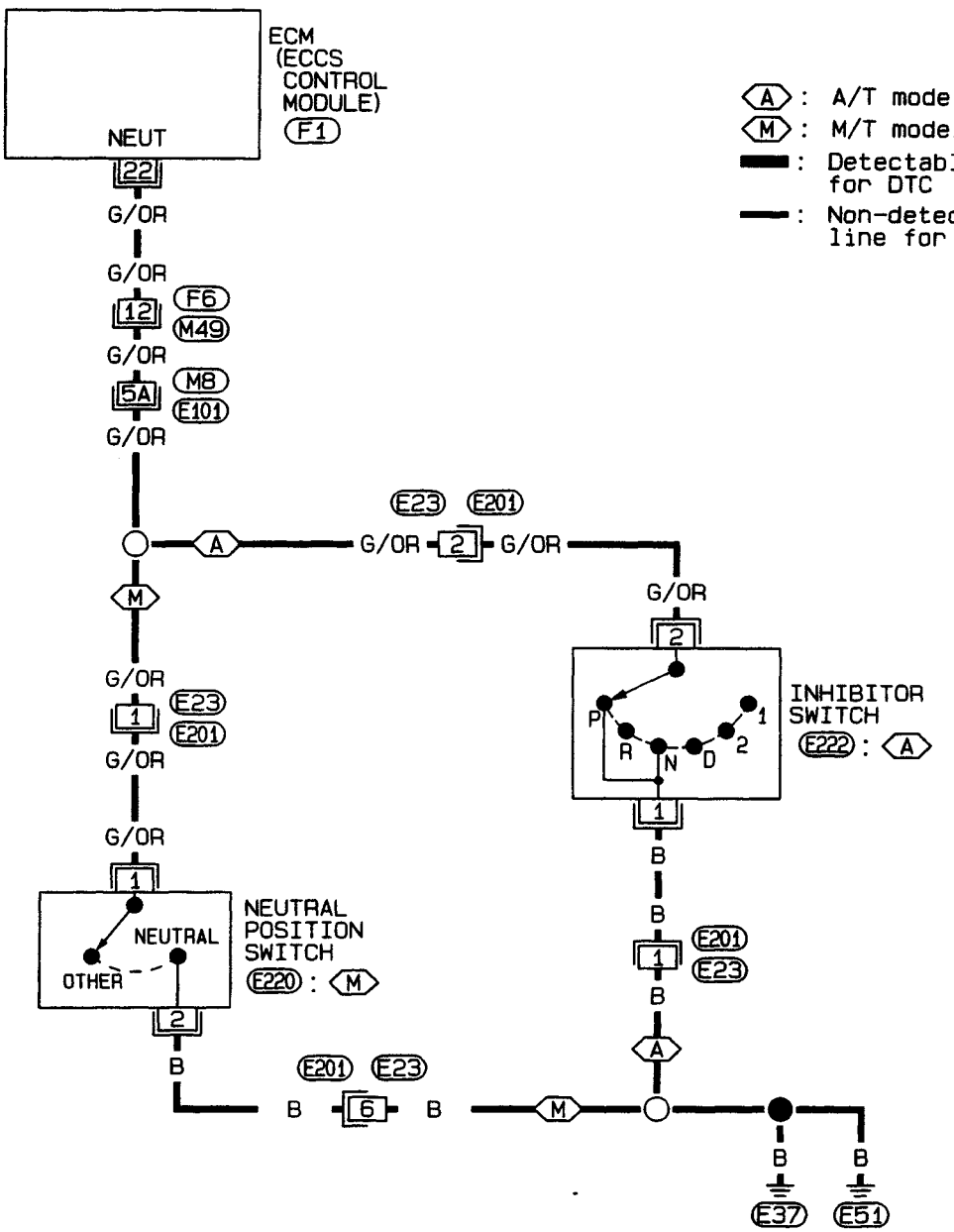


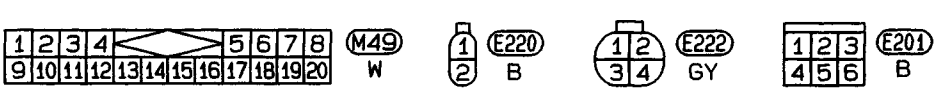
HEC047

Park/Neutral Position Switch (Cont'd)

GA16DE for Australia

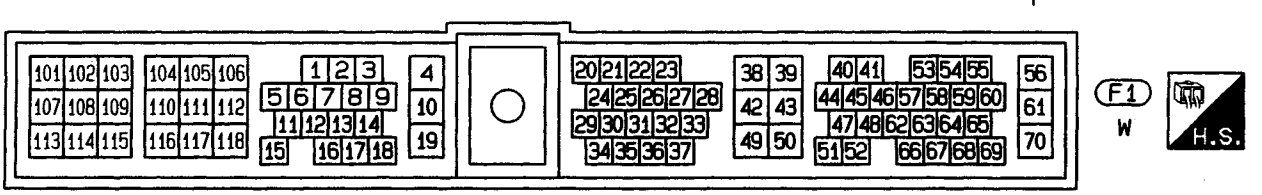
EC-PNP/SW-01





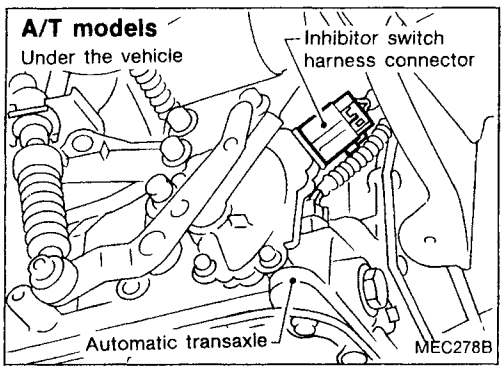
Refer to last page (Foldout page).

M8, E101

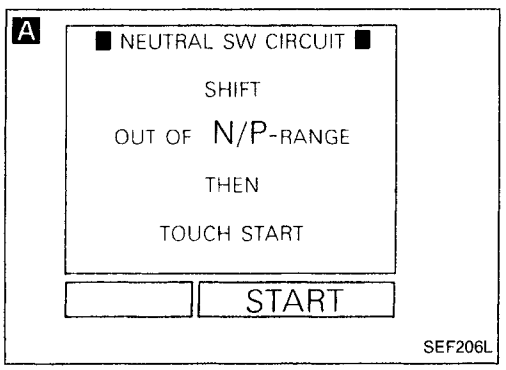


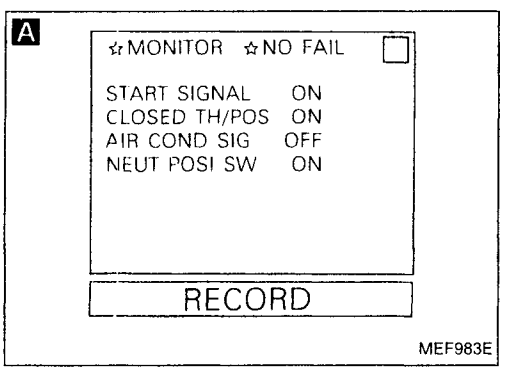
HEC079

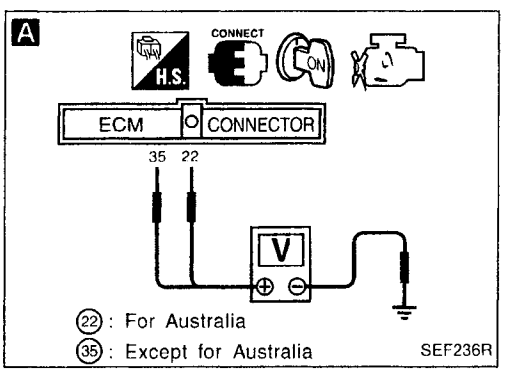
Park/Neutral Position Switch (Cont'd)

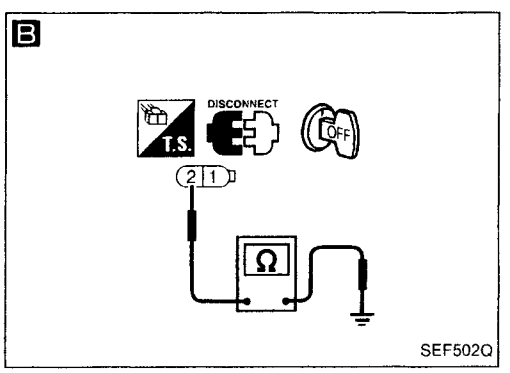


When the gear position is "P" (A/T models only) or "N", park/neutral position switch is "ON".
ECM detects the park/neutral position when continuity with ground exists.









DIAGNOSTIC PROCEDURE

Neutral position switch

INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Turn ignition switch "ON".
2. Perform "NEUTRAL SW CIRCUIT" or "NEUTRAL POSI SW CKT" in "FUNCTION TEST" mode with CONSULT.

OK → INSPECTION END

OR

2. Check "NEUTRAL SW" or "NEUT POSI SW" signal in "DATA MONITOR" mode with CONSULT.
Neutral position: ON
Except above: OFF

OR

1. Set shift lever to the neutral position.
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal (35) or (22) and body ground.
Continuity should exist.
If OK, check harness for short.

NG

Turn ignition switch "OFF".

B

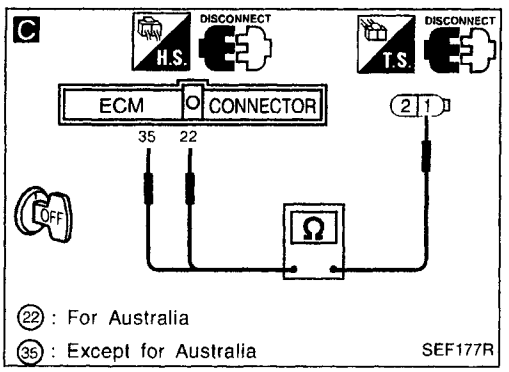
CHECK GROUND CIRCUIT.
1. Disconnect neutral position switch harness connector.
2. Check harness continuity between terminal (2) and body ground.
Continuity should exist.
If OK, check harness for short.

NG → Check the following.
- Harness connectors (E23), (E201)
- Harness for open or short between neutral position switch and body ground

If NG, repair harness or connectors.

OK → (A)

Park/Neutral Position Switch (Cont'd)



Ⓐ

Disconnect ECM harness connector.

C

CHECK INPUT SIGNAL CIRCUIT.
1. Check harness continuity between ECM terminal ㉟ or ㉒ and terminal ①.
Continuity should exist.
If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness connectors (M8), (E101)
- Harness connectors (E23), (E201)
- Harness for open or short between ECM and neutral position switch

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Neutral position switch).
Refer to "Check of Position Switch" of "ON-VEHICLE SERVICE" in MT section.

NG → Replace neutral position switch.

OK ↓

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

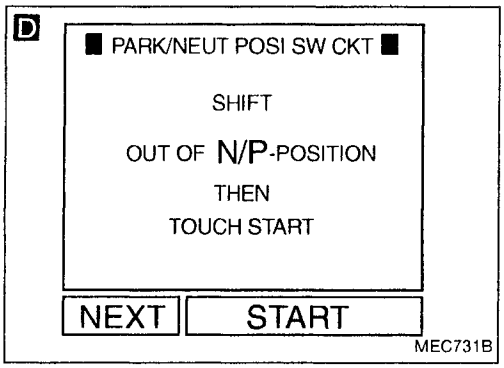
Trouble is not fixed. ↓

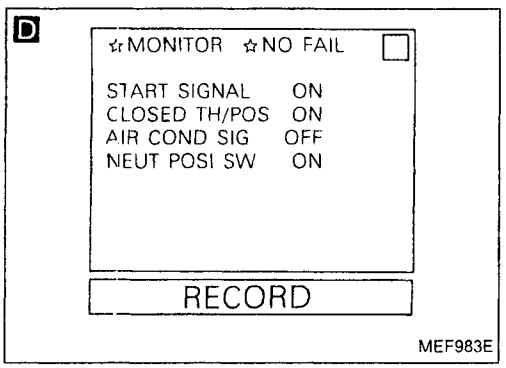
Check ECM pin terminals for damage or the connection of ECM harness connector. Reconnect ECM harness connector and retest.

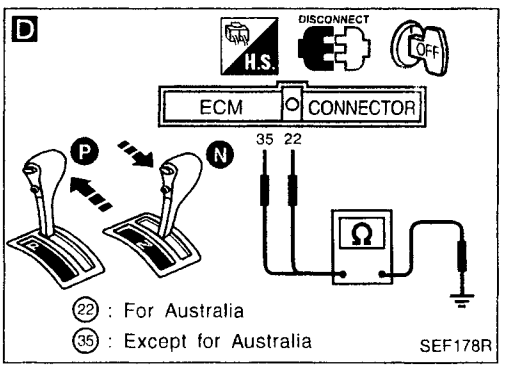
↓

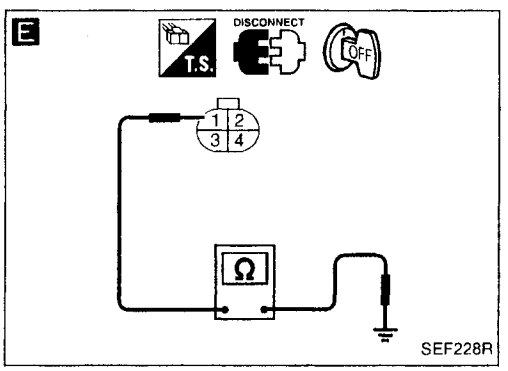
INSPECTION END

Park/Neutral Position Switch (Cont'd)









Inhibitor switch

INSPECTION START

D

CHECK OVERALL FUNCTION.

1. Turn ignition switch "ON".
2. Perform "NEUTRAL POSI SW CKT" in "FUNCTION TEST" mode with CONSULT.

OK → INSPECTION END

OR

2. Check "NEUTRAL SW" or "NEUT POSI SW" signal in "DATA MONITOR" mode with CONSULT.
   "N" or "P": ON
   Except above: OFF

OR

1. Shift selector lever to "P" position.
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal ㉟ or ㉒ and body ground.
   Continuity should exist.
   If OK, check harness for short.
4. Shift selector lever to "N" position.
5. Check harness continuity between ECM terminal ㉟ or ㉒ and body ground.
   Continuity should exist.
   If OK, check harness for short.

NG

Turn ignition switch "OFF".

E

CHECK GROUND CIRCUIT.

1. Disconnect inhibitor switch harness connector.
2. Check harness continuity between terminal ① and body ground.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (E23), (E201)
- Harness for open or short between inhibitor switch and body ground

If NG, repair harness or connectors.

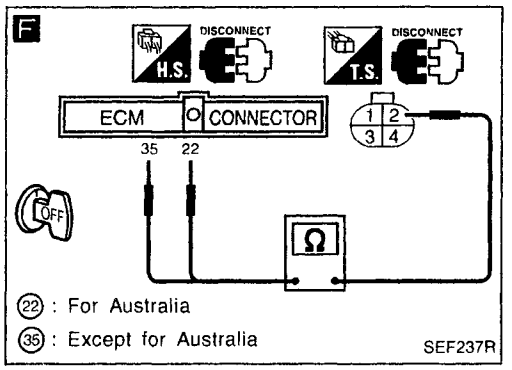
OK

Disconnect ECM harness connector.

Ⓐ

EC

Park/Neutral Position Switch (Cont'd)



Ⓐ

F

CHECK INPUT SIGNAL CIRCUIT.
1. Check harness continuity between ECM terminal 35 or 22 and terminal 2.
Continuity should exist.
If OK, check harness for short.

NG → Check the following.
- Harness connectors F6, M49
- Harness connectors M8, E101
- Harness connectors E23, E201
- Harness for open or short between ECM and inhibitor switch

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT (Inhibitor switch).
Refer to "Electrical Components Inspection" of "TROUBLE DIAGNOSES" in AT section.

NG → Replace inhibitor switch.

OK ↓

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

Trouble is not fixed. ↓

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

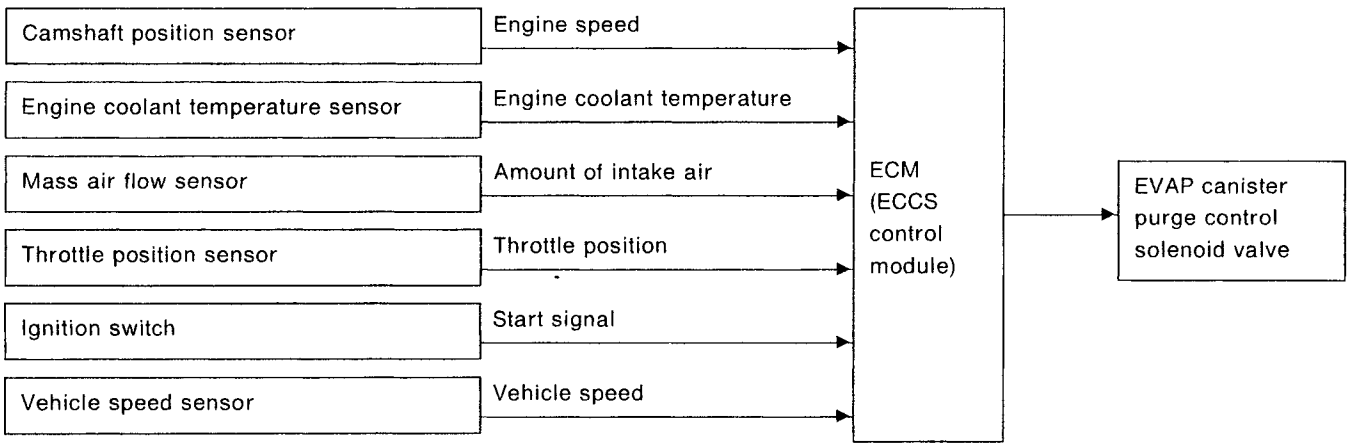
↓

INSPECTION END

EVAP Canister Purge Control Solenoid Valve

GA16DE M/T models except for Europe, Israel and Australia

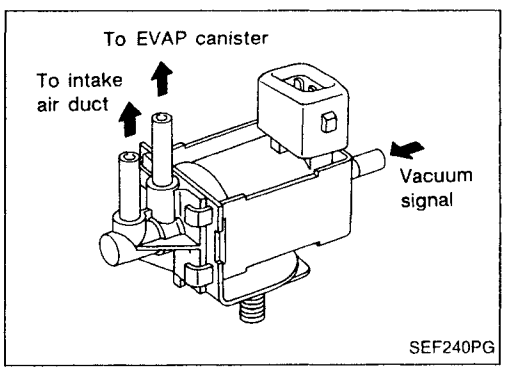
SYSTEM DESCRIPTION



This system cuts and controls the port vacuum applied to the EVAP canister purge control solenoid valve to suit engine operating conditions.
This cut-and-control operation is accomplished through the ECM. When the ECM detects any of the following conditions, current flows through the solenoid valve in the EVAP canister purge control solenoid valve control vacuum line.

This causes the port vacuum to be discharged into the atmosphere so that the EVAP canister purge line remains closed.

- Engine starting
- Closed throttle position
- Low and high engine coolant temperature
- During deceleration
- Engine stopped
- Vehicle speed: below 10 km/h (6 MPH)
- Mass air flow sensor malfunction



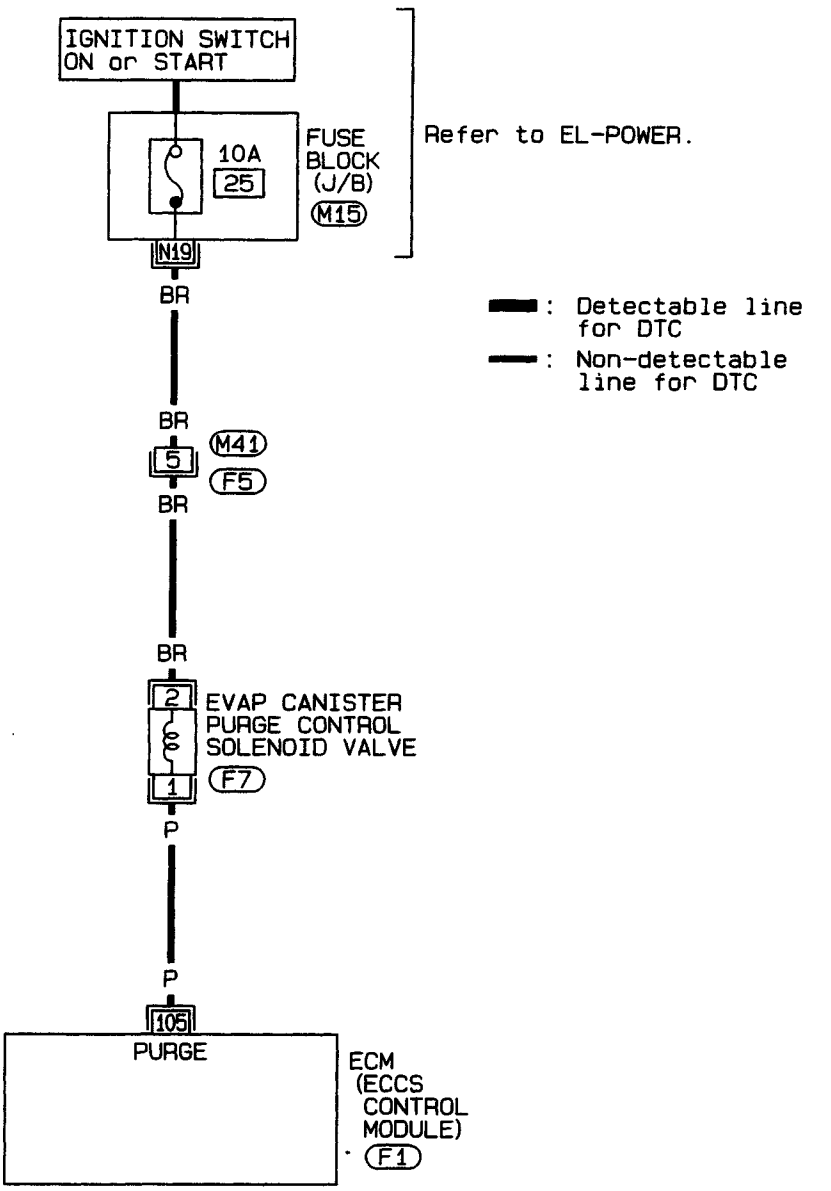
COMPONENT DESCRIPTION

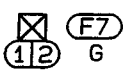
The EVAP canister purge control solenoid valve responds to signals from the ECM. When the ECM sends an ON (ground) signal, the coil in the solenoid valve is energized. A plunger will then move to cut the vacuum signal (from the intake manifold to the EVAP canister purge control solenoid valve).
When the ECM sends an OFF signal, the vacuum signal passes through the solenoid valve. The signal then reaches the EVAP canister purge control solenoid valve.

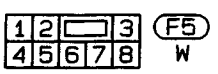
EVAP Canister Purge Control Solenoid Valve (Cont'd)

M/T models except for Europe and Israel

EC-PGC/V-01

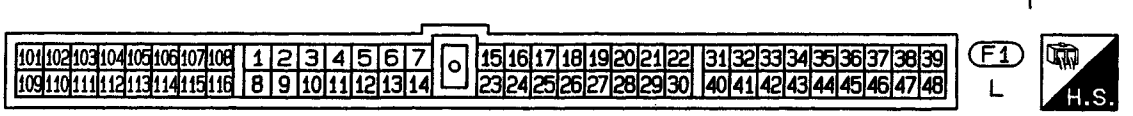






Refer to last page (Foldout page).

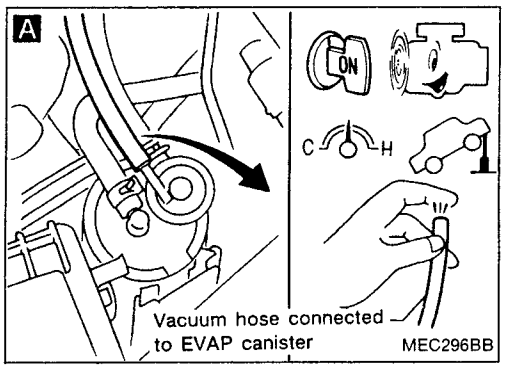
M15

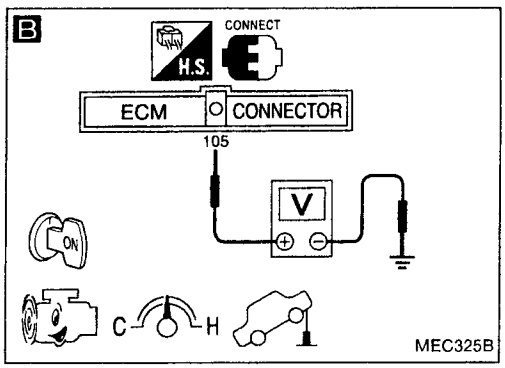


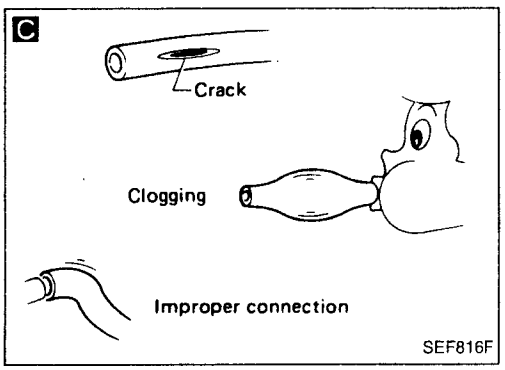
HEC041

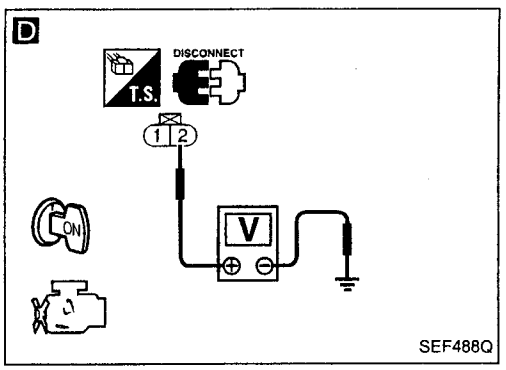
EVAP Canister Purge Control Solenoid Valve (Cont'd)

DIAGNOSTIC PROCEDURE









INSPECTION START

A

CHECK VACUUM SOURCE TO EVAP CANISTER.
1. Jack up drive wheels.
2. Start engine and warm it up sufficiently.
3. Perform diagnostic test mode II (Self-diagnostic results). Make sure that diagnostic trouble code No. 55 is displayed.
4. Disconnect vacuum hose to EVAP canister.
5. Set shift lever to 1st position.
6. Make sure that vacuum exists under the following conditions.

At idle:
Vacuum should not exist.
Racing engine from idle to 3,000 rpm:
Vacuum should exist.

OK → CHECK COMPONENT (EVAP canister). (See page EC-29.) If NG, replace EVAP canister.

NG

B

CHECK CONTROL FUNCTION.
1. Check voltage between ECM terminal (105) and ground with CONSULT or tester under the following conditions.

Voltage:
At idle
Approximately 0V
Engine speed is about 2,000 rpm
Battery voltage

OK → **C** Check vacuum hose for clogging, cracks or improper connection.

NG

D

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect EVAP canister purge control solenoid valve harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ② and ground with CONSULT or tester.

Voltage: Battery voltage

NG → Check the following.
- Harness connectors (F5), (M41)
- 10A fuse
- Harness for open or short between EVAP canister purge control solenoid valve and fuse

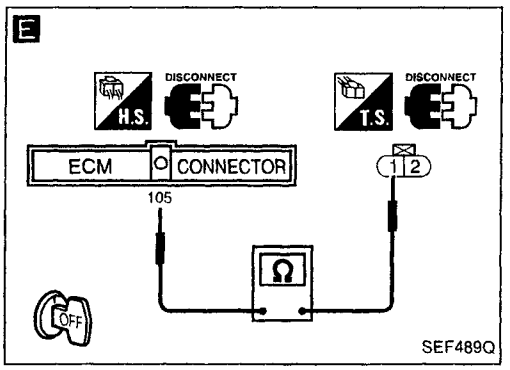
If NG, repair harness or connectors.

OK

Ⓐ

EC

EVAP Canister Purge Control Solenoid Valve (Cont'd)



Ⓐ

E

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal (105) and terminal ①.
Continuity should exist.
If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

CHECK COMPONENT
(EVAP canister purge control solenoid valve).
Refer to "COMPONENT INSPECTION".

NG → Replace EVAP canister purge control solenoid valve.

OK ↓

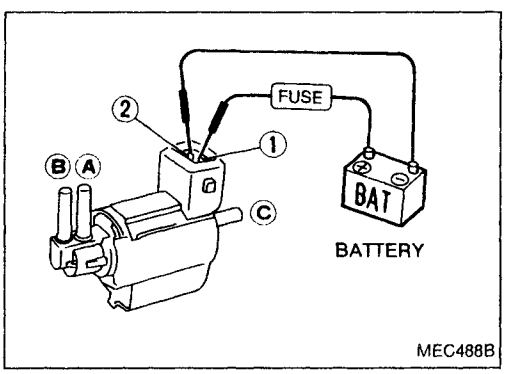
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

↓

INSPECTION END



COMPONENT INSPECTION

EVAP canister purge control solenoid valve

Check air passage continuity.

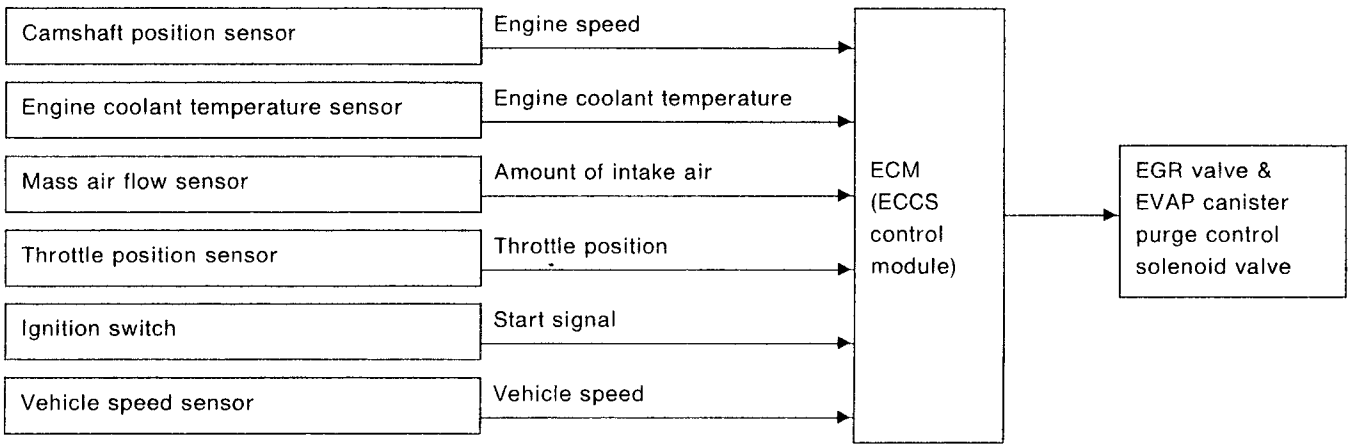
Condition	Air passage continuity between Ⓐ and Ⓑ	Air passage continuity between Ⓐ and Ⓒ
12V direct current supply between terminals ① and ②	Yes	No
No supply	No	Yes

If NG, replace solenoid valve.

EGR Valve and EVAP Canister Purge Control Solenoid Valve

For Europe, Israel and Australia, and GA15DE M/T models

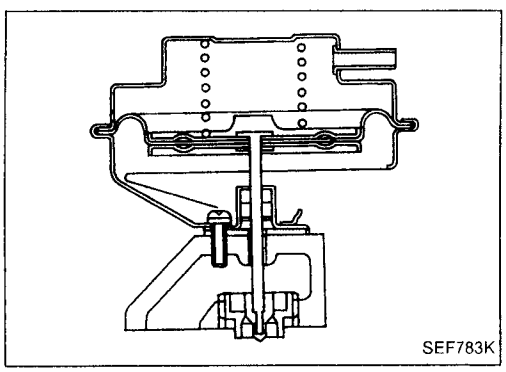
SYSTEM DESCRIPTION

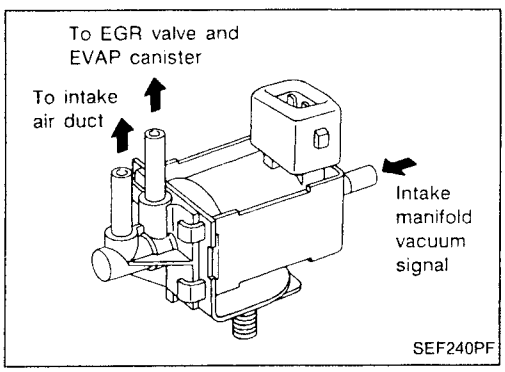


This system cuts and controls the port vacuum applied to the EGR valve and EVAP canister purge control solenoid valve to suit engine operating conditions.
This cut-and-control operation is accomplished through the ECM. When the ECM detects any of the following conditions, current flows through the solenoid valve in the EGR valve and EVAP canister purge control solenoid valve control vacuum line.

This causes the port vacuum to be discharged into the atmosphere so that the EGR valve and EVAP canister purge line remains closed.

- Engine starting
- Closed throttle position
- Low and high engine coolant temperature
- During deceleration
- Engine stopped
- Vehicle speed: below 10 km/h (6 MPH)
- Mass air flow sensor malfunction





COMPONENT DESCRIPTION

Exhaust gas recirculation (EGR) valve

The EGR valve controls the amount of exhaust gas routed to the intake manifold. Vacuum is applied to the EGR valve in response to throttle valve opening. The vacuum controls the movement of a taper valve connected to the vacuum diaphragm in the EGR valve.

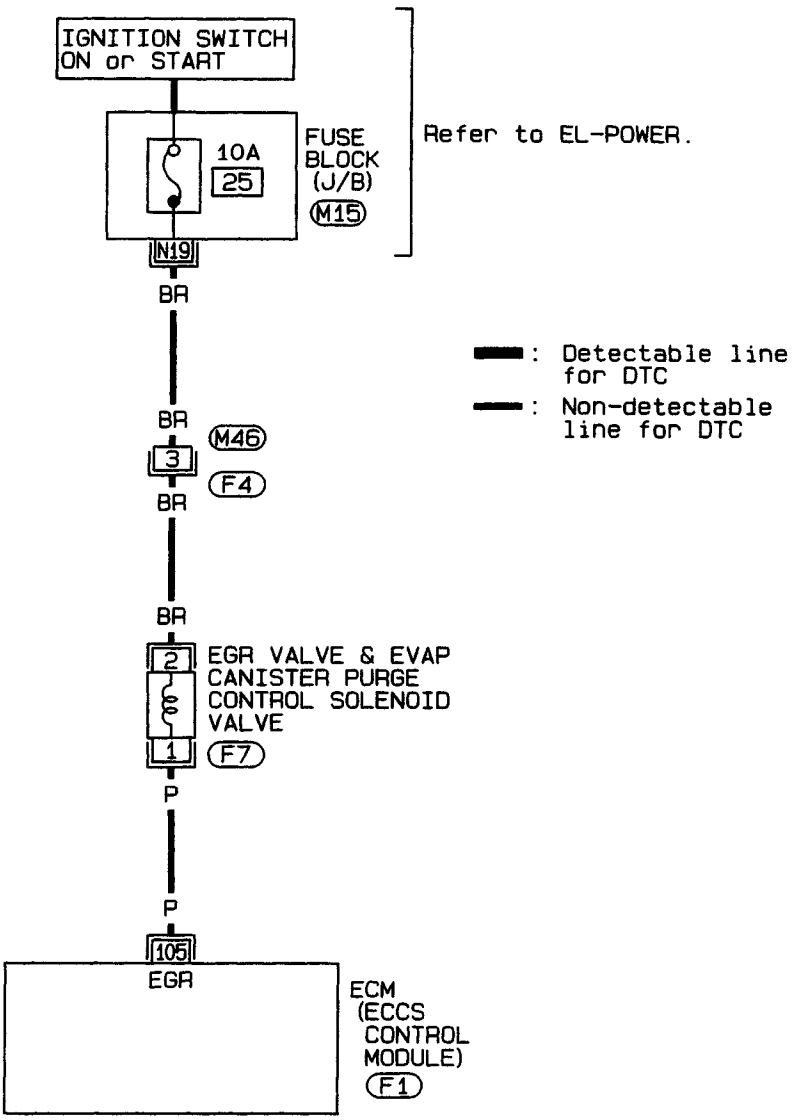
EGR valve and EVAP canister purge control solenoid valve

The EGR valve and EVAP canister purge control solenoid valve responds to signals from the ECM. When the ECM sends an ON (ground) signal, the coil in the solenoid valve is energized. A plunger will then move to cut the vacuum signal (from the throttle body to the EGR valve and EVAP canister purge valve). When the ECM sends an OFF signal, the vacuum signal passes through the solenoid valve. The signal then reaches the EGR valve and EVAP canister.

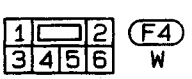
EGR Valve and EVAP Canister Purge Control Solenoid Valve (Cont'd)

For Europe and Israel

EC-EGRC/V-01

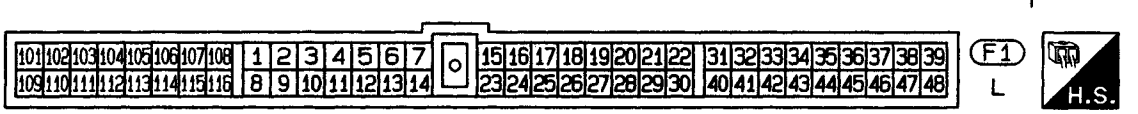






Refer to last page (Foldout page).

M15

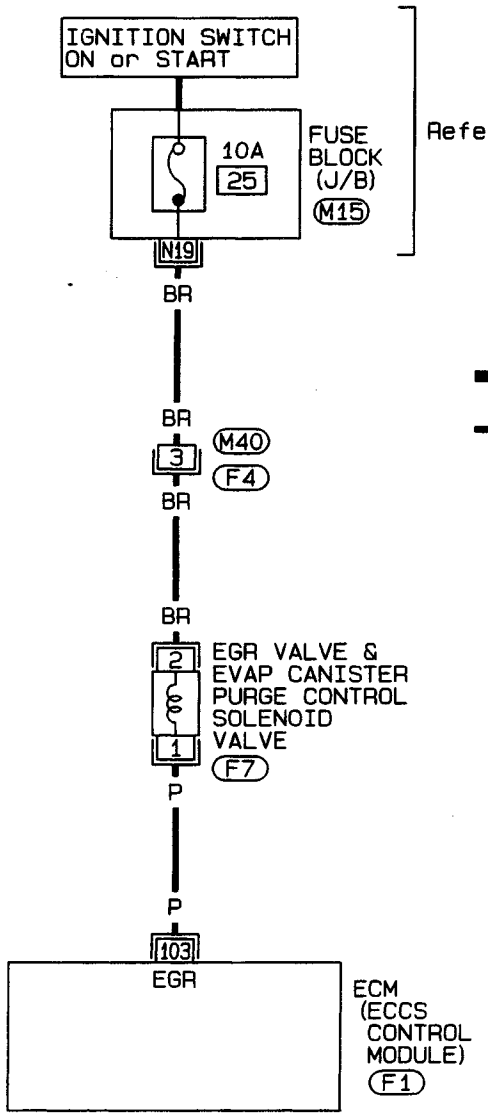


HEC042

EGR Valve and EVAP Canister Purge Control Solenoid Valve (Cont'd)

GA16DE for Australia

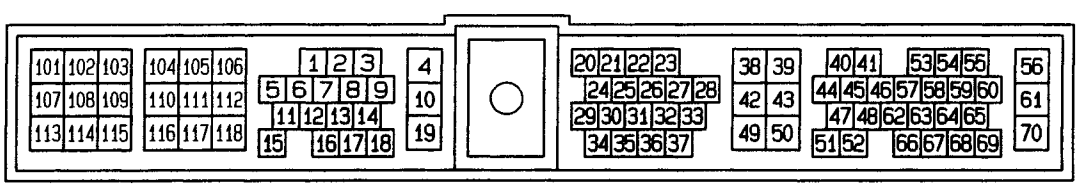
EC-EGRC/V-01





Refer to last page (Foldout page).

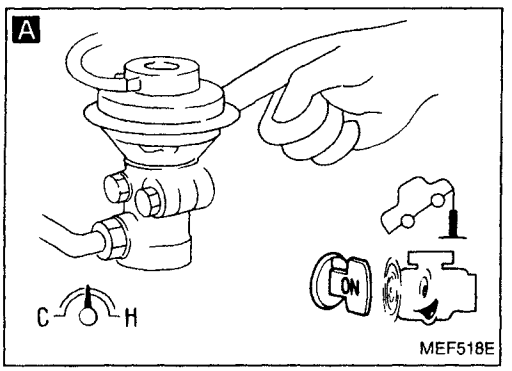
M15

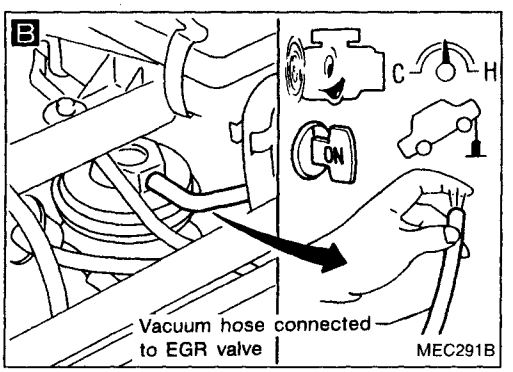


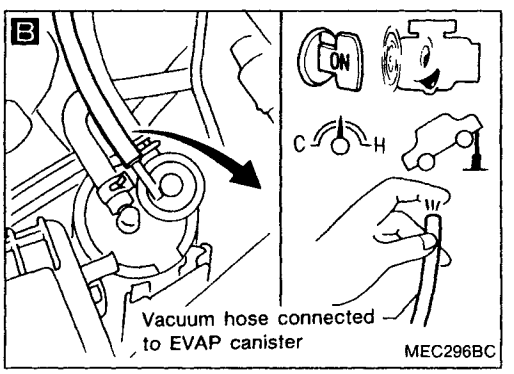
HEC074

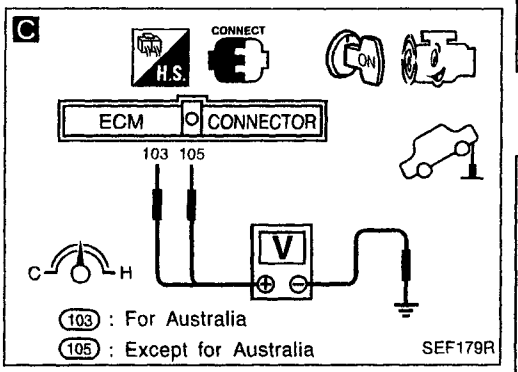
EGR Valve and EVAP Canister Purge Control Solenoid Valve (Cont'd)

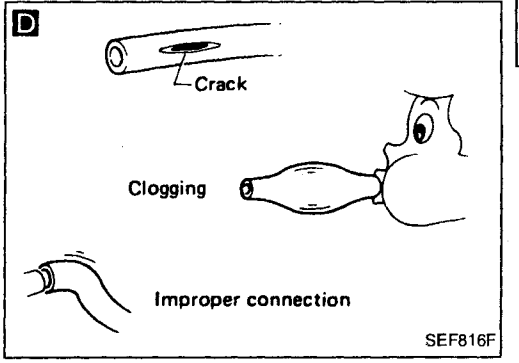
DIAGNOSTIC PROCEDURE











INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Jack up drive wheels.
2) Start engine and warm it up sufficiently.
3) Perform diagnostic test mode II (Self-diagnostic results).
Make sure that diagnostic trouble code No. 55 is displayed.
4) Set the shift lever to 1st position.
5) Make sure that EGR valve spring moves up and down (Use your finger) under the following conditions.
At idle:
Spring does not move.
Racing engine from idle to 3,000 rpm:
Spring moves up and down.

OK → INSPECTION END

NG ↓

B

CHECK VACUUM SOURCES TO EGR VALVE AND EVAP CANISTER.
1) Disconnect vacuum hoses to EGR valve and EVAP canister.
2) Make sure that vacuum exists under the following conditions.
At idle:
Vacuum should not exist.
Racing engine from idle to 3,000 rpm:
Vacuum should exist.

OK → CHECK COMPONENTS (EGR valve, EGRC-BPT valve and activated EVAP canister).
Refer to "COMPONENT INSPECTION". (See page EC-188.)

NG → Replace malfunctioning component(s).

NG ↓

C

CHECK CONTROL FUNCTION.
1) Check voltage between ECM terminal (105) or (103) and ground under the following conditions.
Voltage:
At idle
Approximately 0V
Engine speed is 2,500 rpm
Battery voltage

OK → D

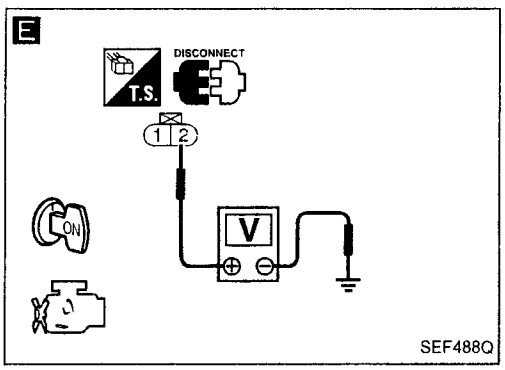
D

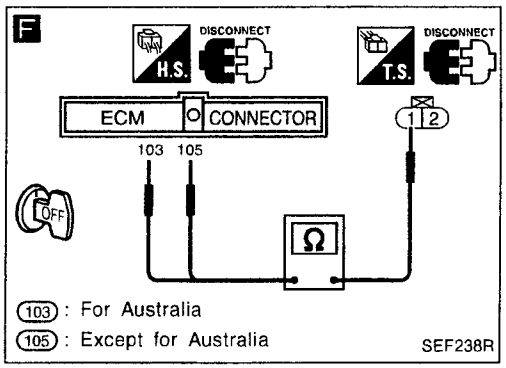
CHECK VACUUM HOSE.
1) Check vacuum hose for clogging, cracks or improper connection.

NG ↓

Ⓐ

EGR Valve and EVAP Canister Purge Control Solenoid Valve (Cont'd)





Ⓐ

E

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect EGR valve & EVAP canister purge control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ② and ground.
Voltage: Battery voltage

NG → Check the following.
- Harness connectors (F4), (M40)
- 10A fuse
- Harness continuity between EGR valve & EVAP canister purge control solenoid valve and fuse

If NG, repair harness or connectors.

OK ↓

F

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect ECM harness connector.
3) Check harness continuity between ECM terminal (105) or (103) and terminal ①.
Continuity should exist.

NG → Repair harness or connectors.

OK ↓

CHECK COMPONENT
(EGR valve & EVAP canister purge control solenoid valve).
Refer to "COMPONENT INSPECTION".

NG → Replace EGR valve & EVAP canister purge control solenoid valve.

OK ↓

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

Trouble is not fixed. ↓

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

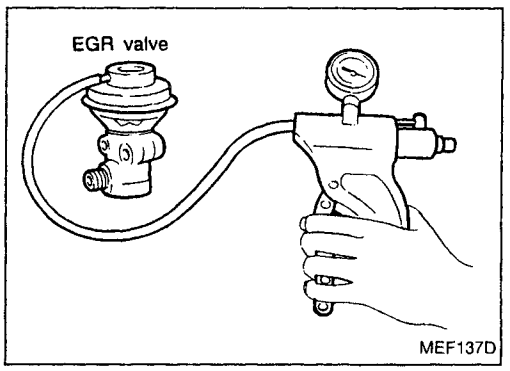
↓

INSPECTION END

EC

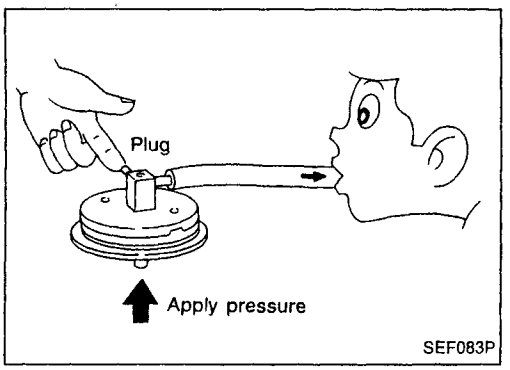
EGR Valve and EVAP Canister Purge Control Solenoid Valve (Cont'd)

COMPONENT INSPECTION



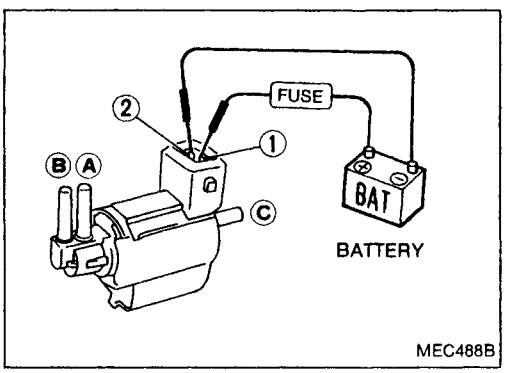
EGR valve

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



EGRC-BPT valve

1) Plug one of two ports of EGRC-BPT valve.
2) Vacuum from the other port and check for leakage while applying a pressure above 0.981 kPa (100 mmH_2O, 3.94 inH_2O) from under EGRC-BPT valve.
3) If a leakage is noted, replace the valve.



EGR valve and EVAP canister purge control solenoid valve

Check air passage continuity.

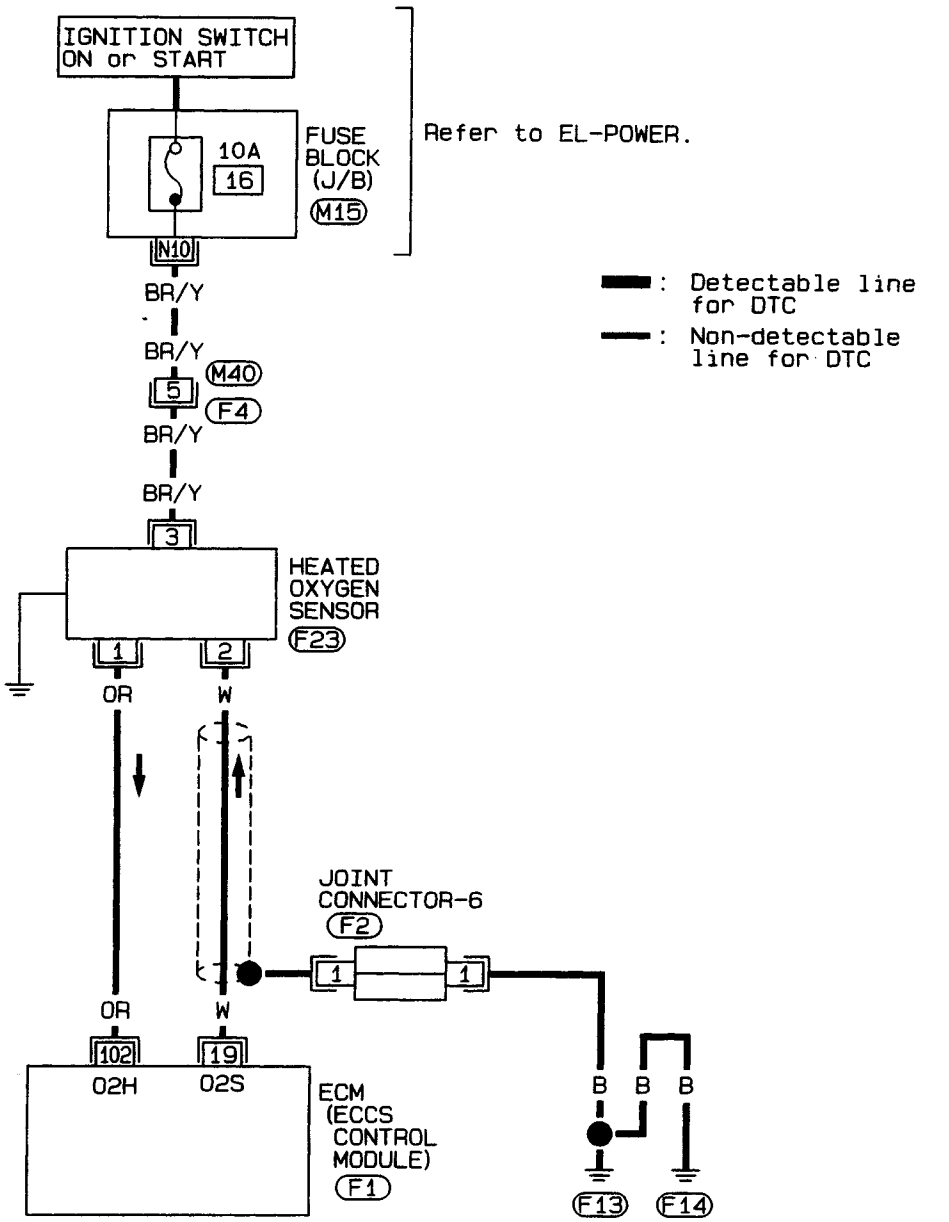
Condition	Air passage continuity between Ⓐ and Ⓑ	Air passage continuity between Ⓐ and Ⓒ
12V direct current supply between terminals ① and ②	Yes	No
No supply	No	Yes

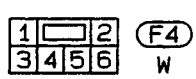
If NG, replace solenoid valve.

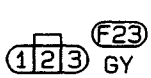
Heated Oxygen Sensor (HO2S)

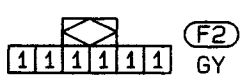
For Europe and Israel

EC-H02S-01



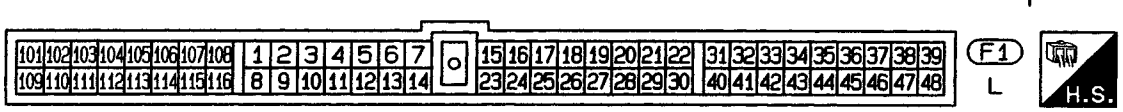






Refer to last page (Foldout page).

M15

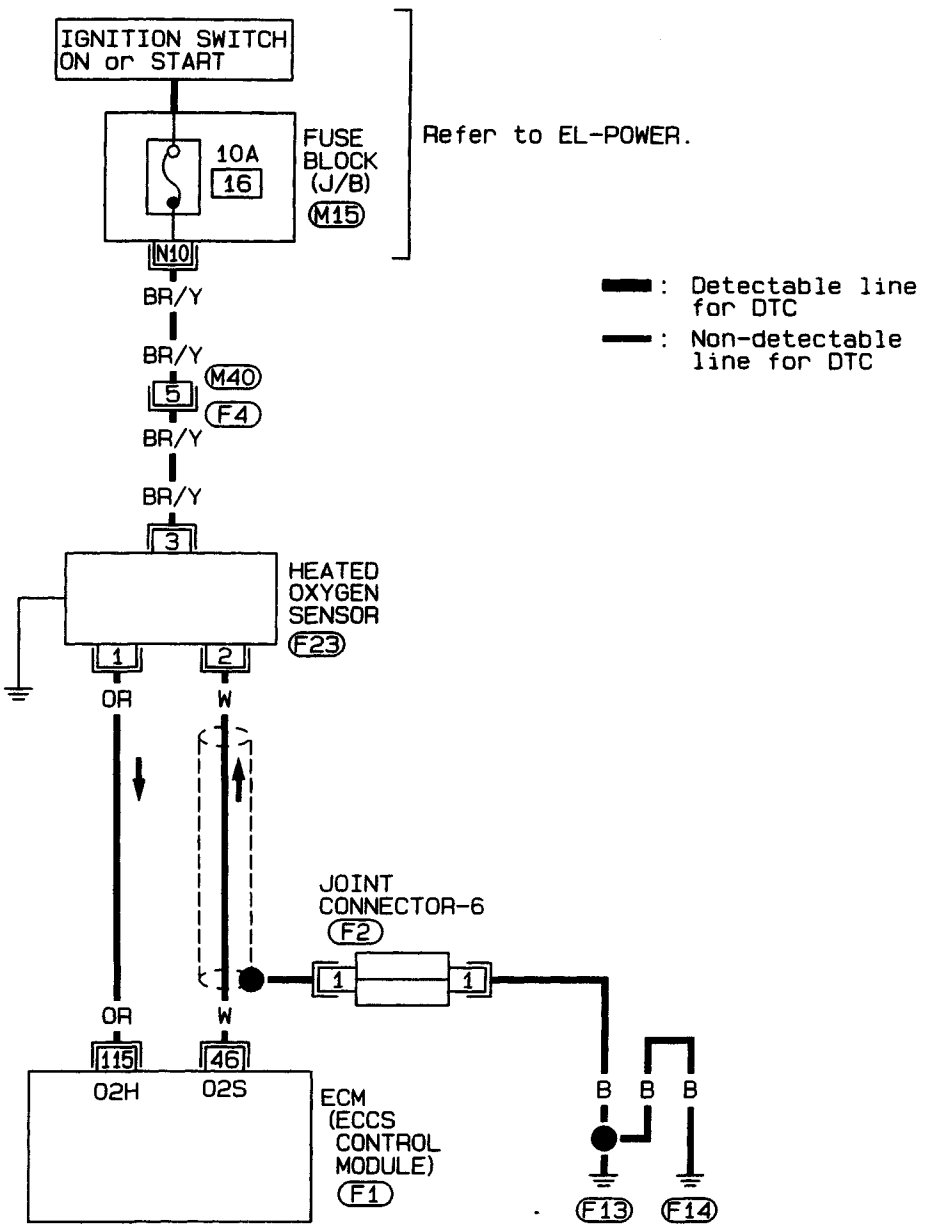


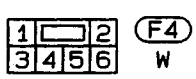
HEC048

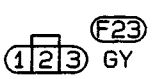
Heated Oxygen Sensor (HO2S) (Cont'd)

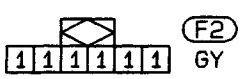
GA16DE for Australia (A/T models)

EC-H02S-01



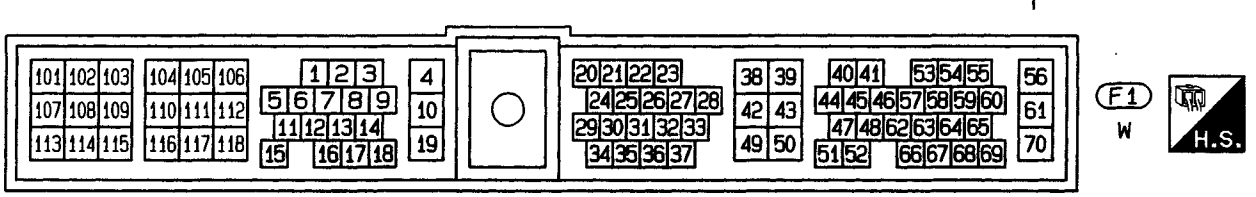






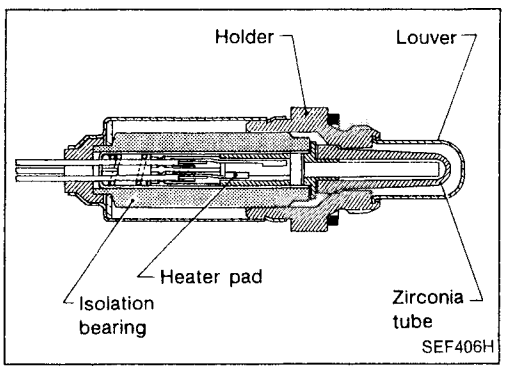
Refer to last page (Foldout page).

M15

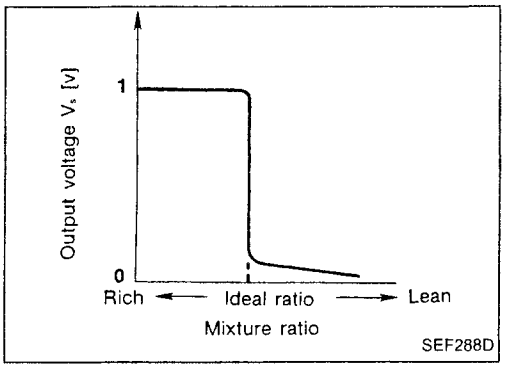


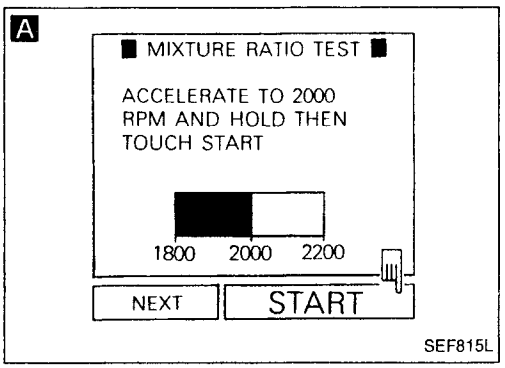
HEC080

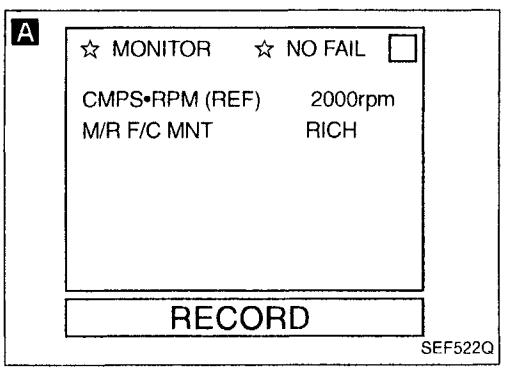
Heated Oxygen Sensor (HO2S) (Cont'd)

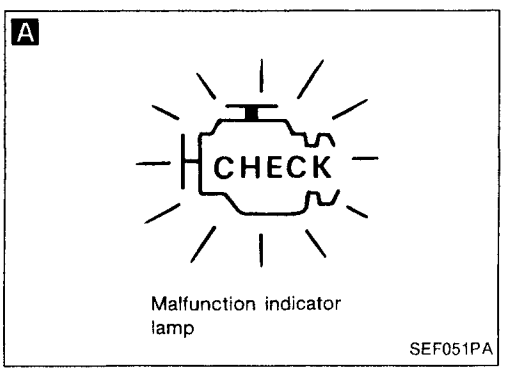


The heated oxygen sensor is placed into the exhaust manifold. It detects the amount of oxygen in the exhaust gas compared to the outside air. The heated oxygen sensor has a closed-end tube made of ceramic zirconia. The zirconia generates voltage from approximately 1V in richer conditions to 0V in leaner conditions. The heated oxygen sensor signal is sent to the ECM. The ECM adjusts the injection pulse duration to achieve the ideal air-fuel ratio. The ideal air-fuel ratio occurs near the radical change from 1V to 0V.









DIAGNOSTIC PROCEDURE

INSPECTION START

A

CHECK OXYGEN SENSOR CIRCUIT.
1) Start engine and warm it up sufficiently.
2) Perform "MIXTURE RATIO TEST" in "FUNCTION TEST" mode with CONSULT.

OR

2) Make sure that "M/R F/C MNT" in "DATA MONITOR" mode indicates "RICH" and "LEAN" periodically more than 5 times during 10 seconds at 2,000 rpm.

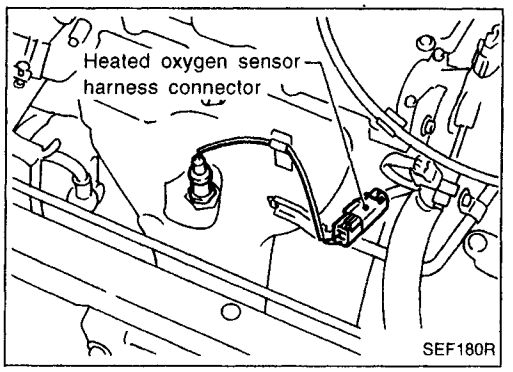
OR

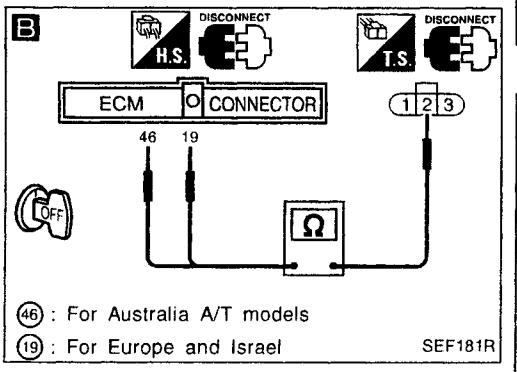
2) Stop engine and set ECM Diagnostic Test Mode II (Heated oxygen sensor monitor).
3) Restart engine and run it at about 2,000 rpm for about 2 minutes under no-load.
4) Keep engine speed at 2,000 rpm and make sure that the malfunction indicator lamp on the instrument panel goes on and off more than 5 times during 10 seconds.

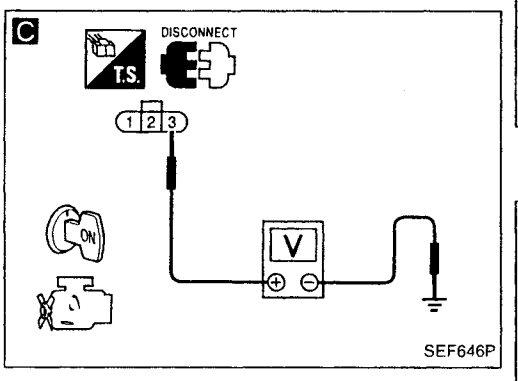
OK → INSPECTION END

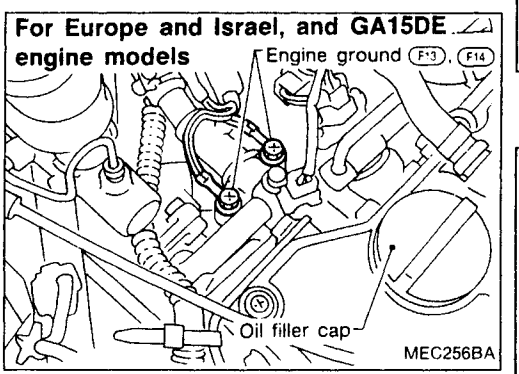
NG → Ⓐ

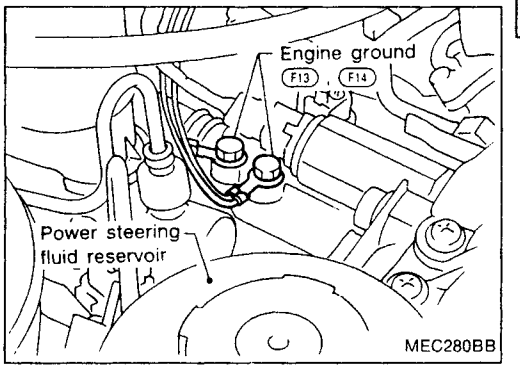
Heated Oxygen Sensor (HO2S) (Cont'd)











Ⓐ

B

CHECK INPUT SIGNAL CIRCUIT.
1. Stop engine.
2. Disconnect ECM harness connector and heated oxygen sensor harness connector.
3. Check harness continuity between ECM terminal ⑲ or ㊻ and terminal ②.

Continuity should exist.

If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

CHECK HEATED OXYGEN SENSOR HEATER CIRCUIT.
1. Reconnect harness connectors.
2. Start engine.
3. Check voltage between ECM terminal 102 (For Europe and Israel) or 115 (For Australia A/T models) and ground with CONSULT or tester under the following conditions.

Voltage:
Engine speed is below 3,200 rpm
Approximately 0V
Engine speed is above 3,200 rpm
Battery voltage

OK → Go to "CHECK COMPONENT".

NG ↓

C

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect heated oxygen sensor harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ③ and ground.

Voltage: Battery voltage

NG → Check the following.
- Harness connectors F4, M40
- 10A fuse
- Harness for open or short between heated oxygen sensor and fuse

If NG, repair harness or connectors.

OK ↓

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between terminal ① and ECM terminal 102 (For Europe and Israel) or 115 (For Australia A/T models).

Continuity should exist.

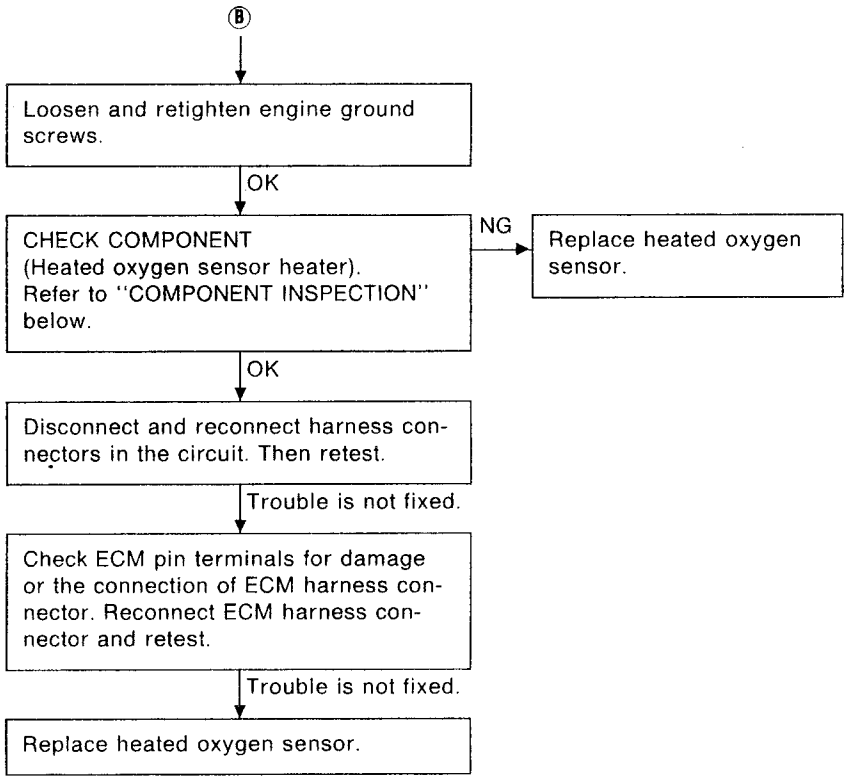
If OK, check harness for short.

NG → Repair harness or connectors.

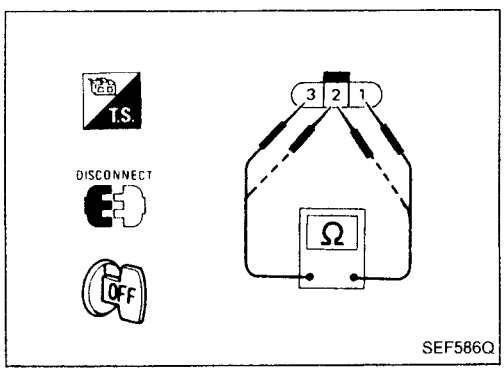
OK ↓

Ⓑ

Heated Oxygen Sensor (HO2S) (Cont'd)



EC



COMPONENT INSPECTION

Heated oxygen sensor heater

Check resistance between terminals ③ and ①.

Resistance: 2.3 - 4.3Ω at 25°C (77°F)

Check continuity between terminals ② and ①, ③ and ②.

Continuity should not exist.

If NG, replace the heated oxygen sensor.

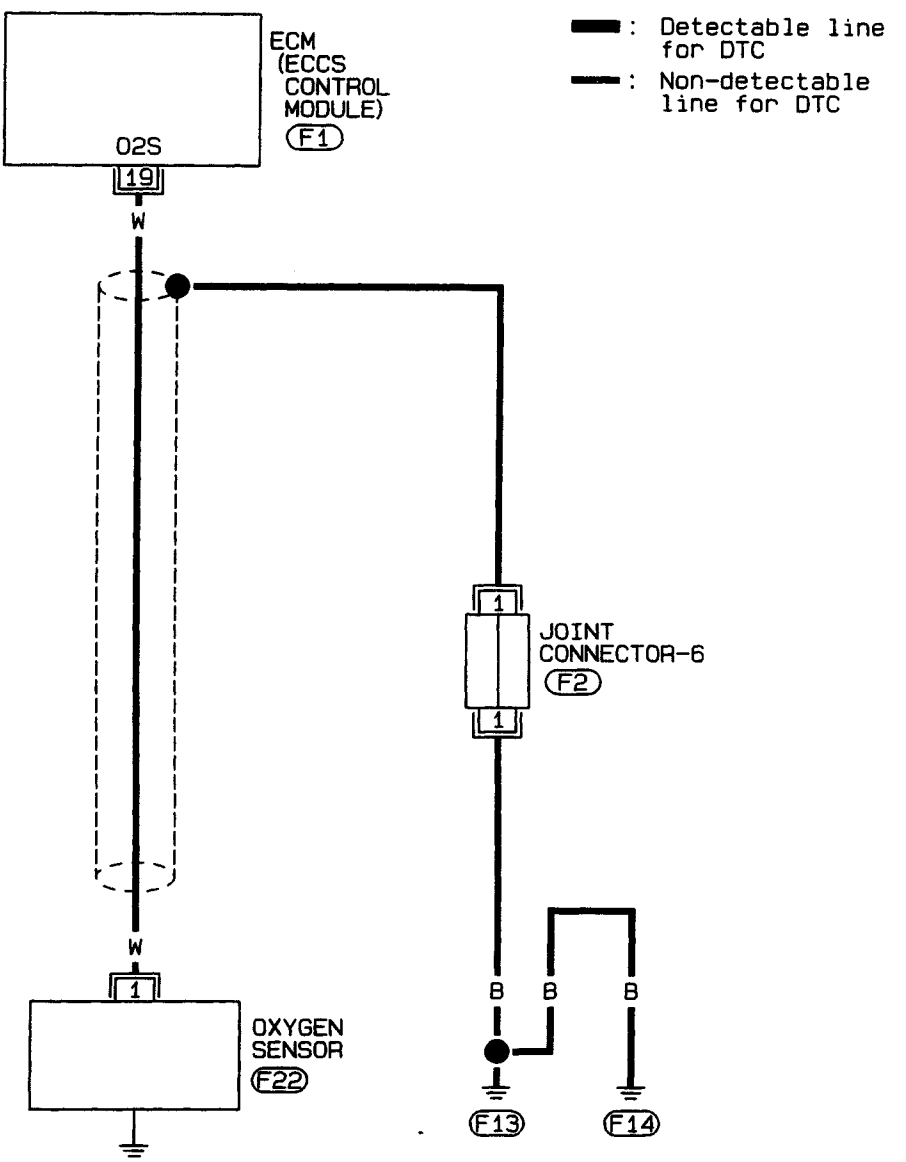
CAUTION:

- **Discard any oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**

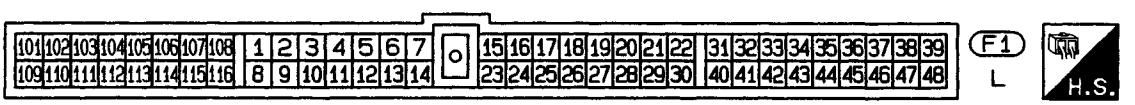
Oxygen Sensor (O2S)

Except for Europe and Israel

EC-02S-01





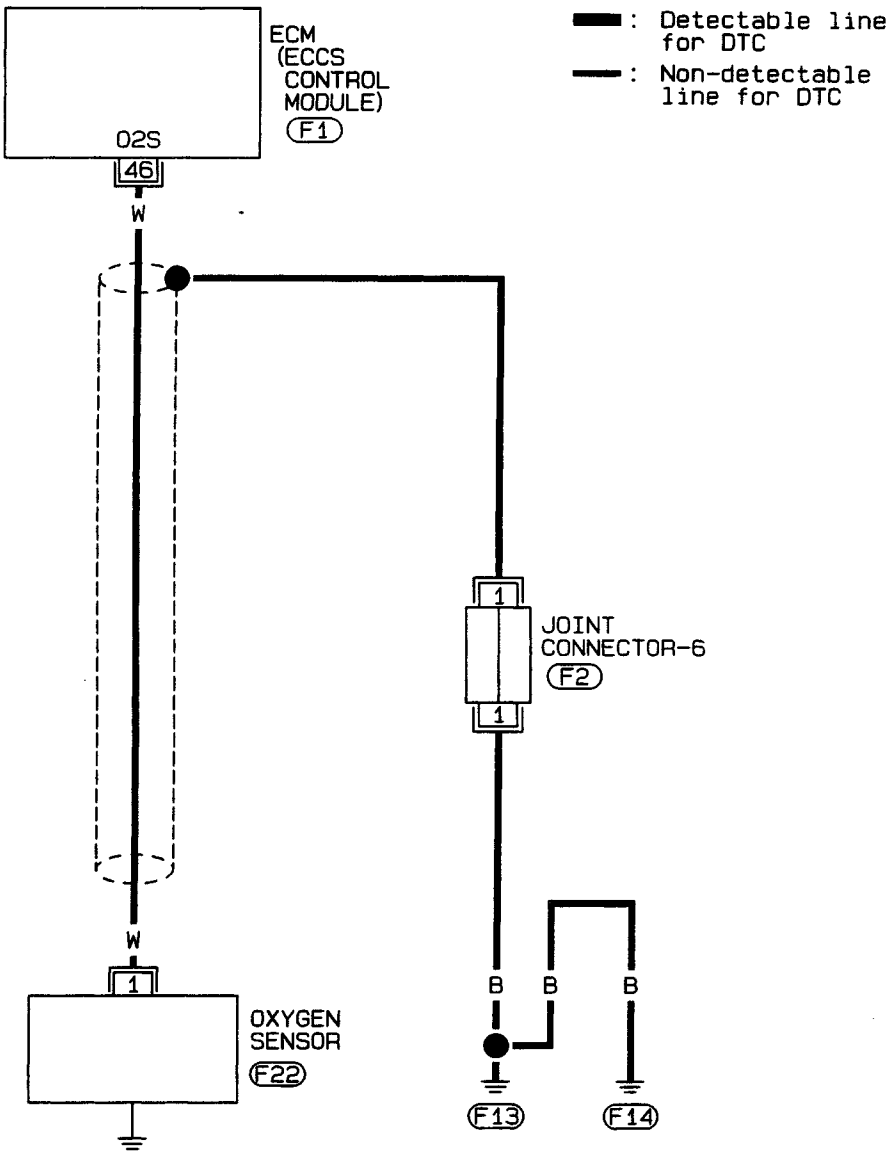


HEC049

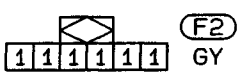
Oxygen Sensor (O2S) (Cont'd)

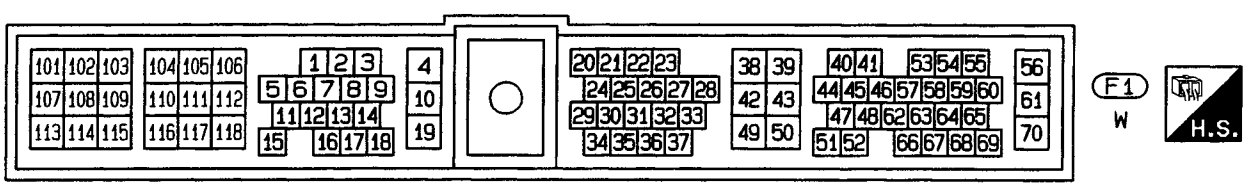
GA16DE for Australia (M/T models)

EC-02S-01





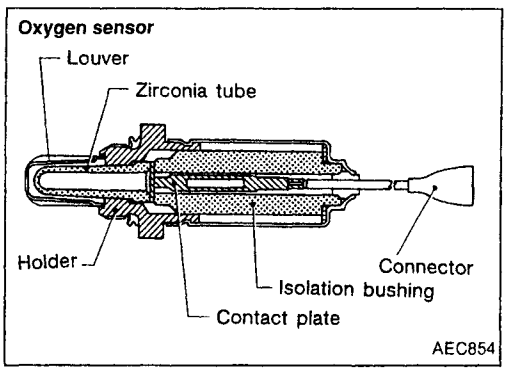


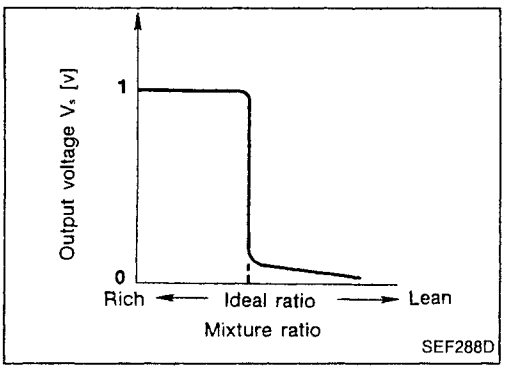


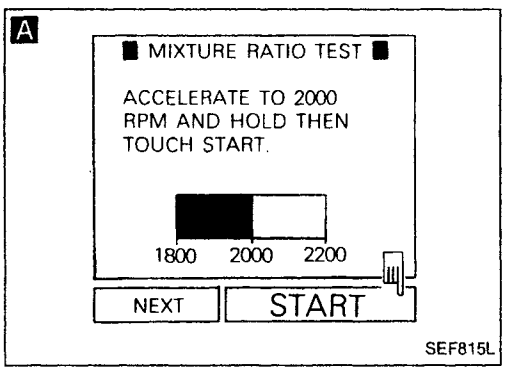
HEC081

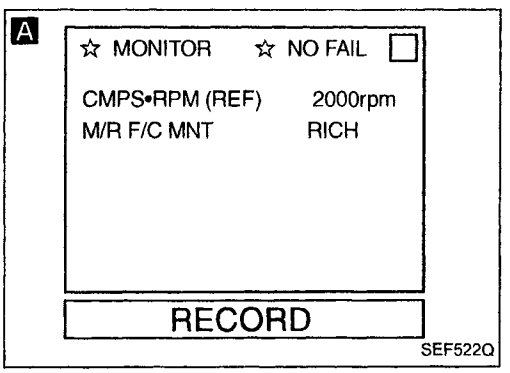
Oxygen Sensor (O2S) (Cont'd)

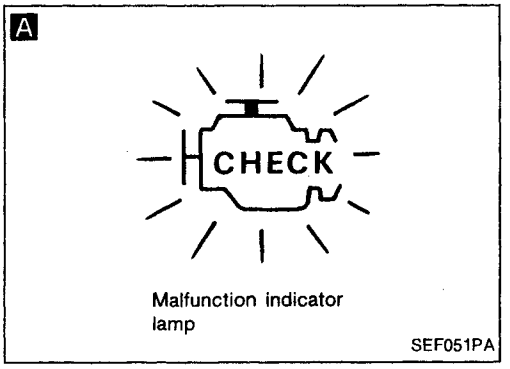
The O2S is placed into the exhaust manifold. It detects the amount of oxygen in the exhaust gas compared to the outside air. The sensor has a closed-end tube made of ceramic zirconia. The zirconia generates voltage from approximately 1V in richer conditions to 0V in leaner conditions. The sensor signal is sent to the ECM. The ECM adjusts the injection pulse duration to achieve the ideal air-fuel ratio. The ideal air-fuel ratio occurs near the radical change from 1V to 0V.











DIAGNOSTIC PROCEDURE

INSPECTION START

A

CHECK OXYGEN SENSOR CIRCUIT.
1. Start engine and warm it up sufficiently.
2. Perform "MIXTURE RATIO TEST" in "FUNCTION TEST" mode with CONSULT.

OR

2. Make sure that "M/R F/C MNT" in "DATA MONITOR" mode indicates "RICH" and "LEAN" periodically more than 5 times during 10 seconds at 2,000 rpm.

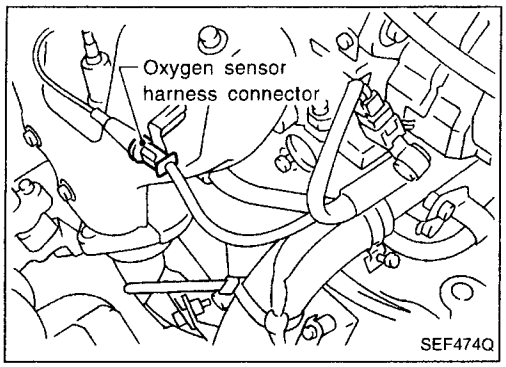
OR

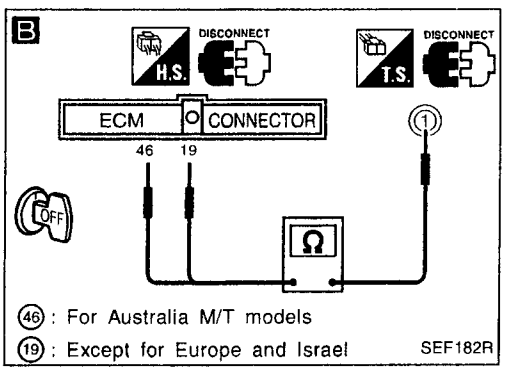
2. Stop engine and set ECM Diagnostic Test Mode II (Oxygen sensor monitor).
3. Restart engine and run it at about 2,000 rpm for about 2 minutes under no-load.
4. Keep engine speed at 2,000 rpm and make sure that the malfunction indicator lamp on the instrument panel goes on and off more than 5 times during 10 seconds.

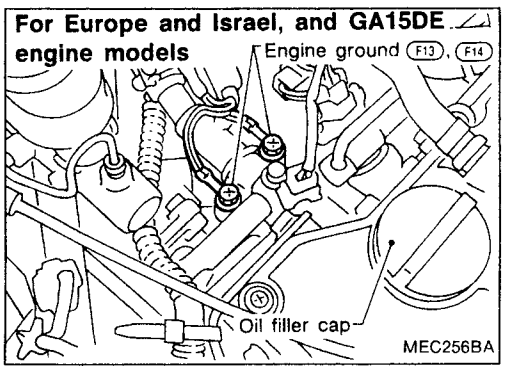
OK → INSPECTION END

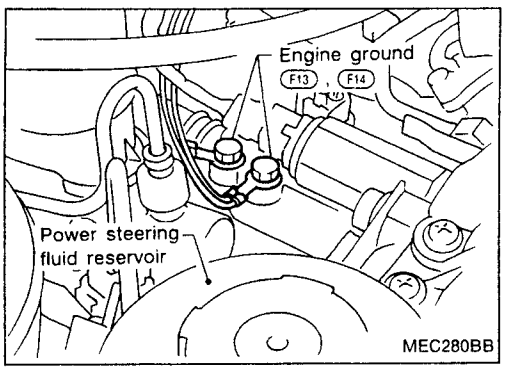
NG → Ⓐ

Oxygen Sensor (O2S) (Cont'd)









Ⓐ

B

CHECK INPUT SIGNAL CIRCUIT.
1. Stop engine.
2. Disconnect ECM harness connector and oxygen sensor harness connector.
3. Check harness continuity between ECM terminal ⑲ or ㊻ and terminal ①.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

Loosen and retighten engine ground screws.

OK ↓

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

Trouble is not fixed. ↓

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

Trouble is not fixed. ↓

Replace oxygen sensor.

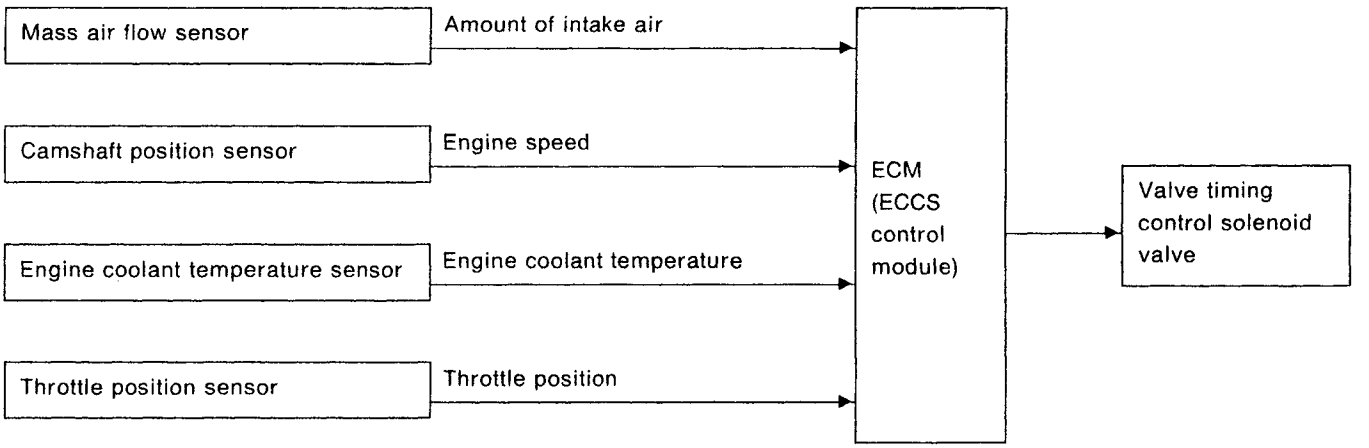
CAUTION:

- **Discard any oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**

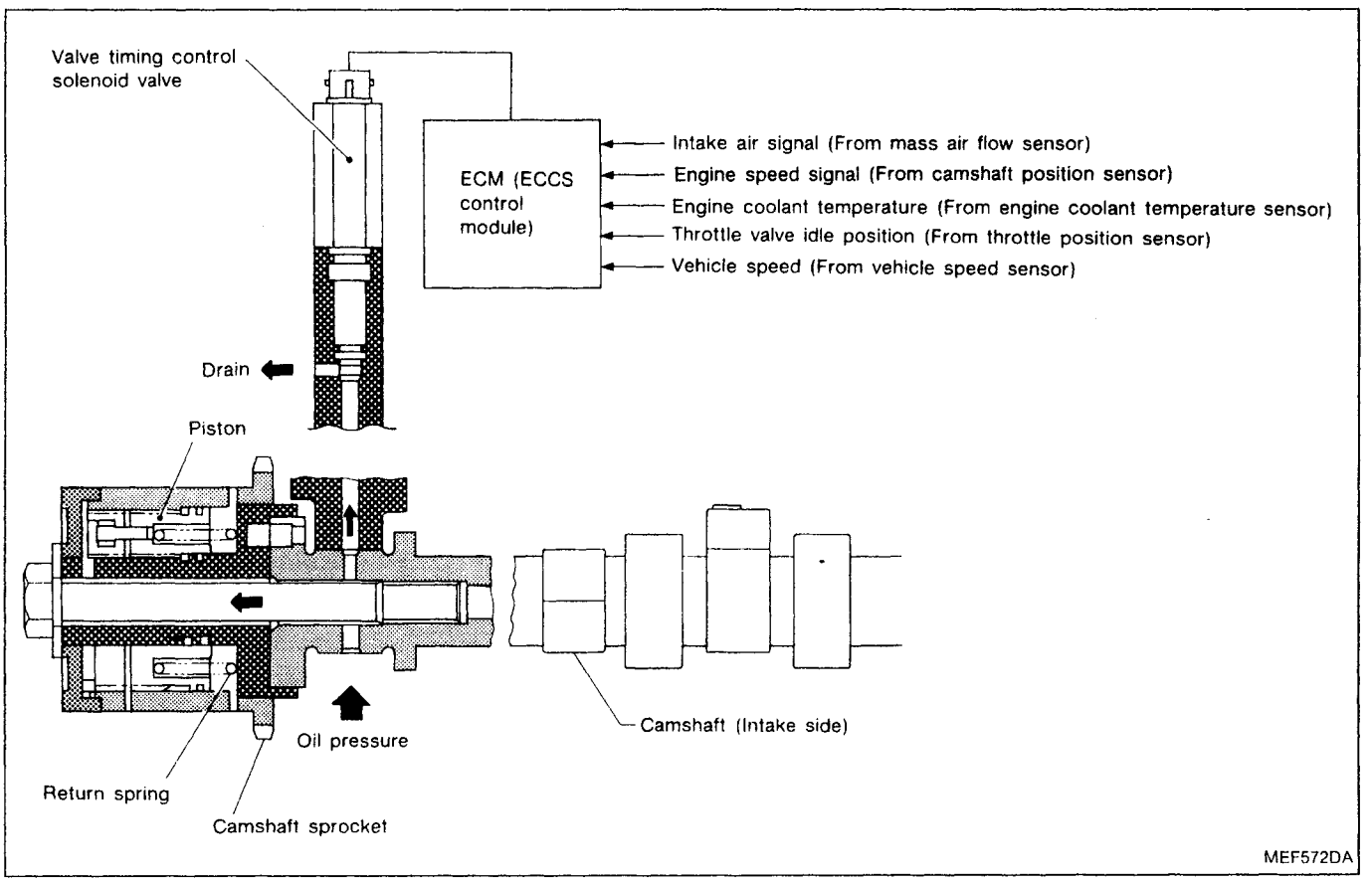
EC

Valve Timing Control (VTC)

SYSTEM DESCRIPTION



The valve timing control system is utilized to increase engine performance. Intake valve opening and closing time is controlled, according to the engine operating conditions, by the ECM.
Engine coolant temperature signals, engine speed, amount of intake air, throttle position, vehicle speed and gear position are used to determine intake valve timing.
The intake camshaft pulley position is regulated by oil pressure, which is controlled by the valve timing control solenoid valve.



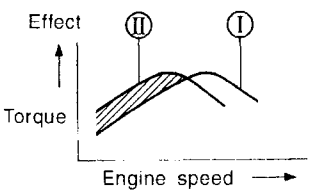
Valve Timing Control (VTC) (Cont'd)

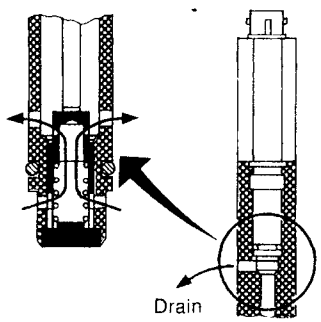
OPERATION

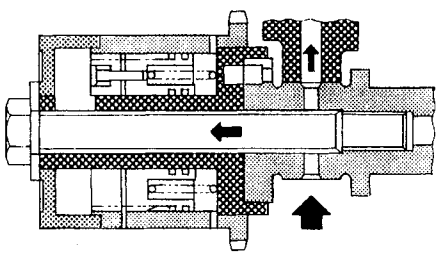
Engine operating condition	Valve timing control solenoid valve	Intake valve opening and closing time	Valve overlap	Engine torque curve
• Engine coolant temperature is 70°C (158°F) or more. • Engine load is high. • Engine speed is between 1,500 rpm and 5,100 rpm.	ON	Advance	Increased	Ⅱ
• Engine speed is 6,800 rpm or more.				
Those other than above	OFF	Normal	Normal	Ⅰ

EC

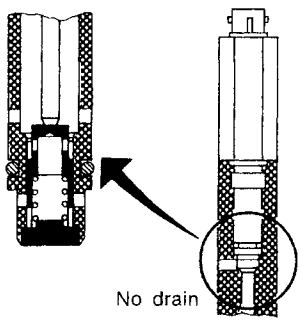
Ⅰ Valve timing control (VTC) solenoid valve is OFF.

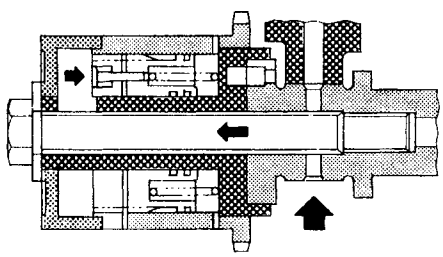




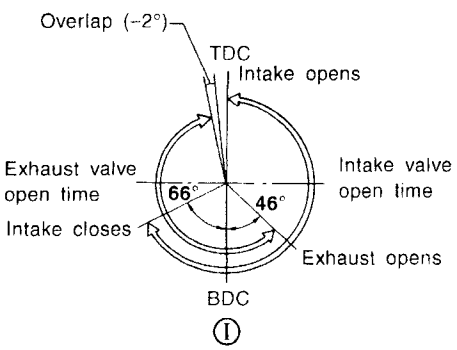


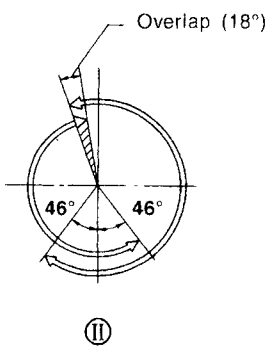
Ⅱ Valve timing control (VTC) solenoid valve is ON.



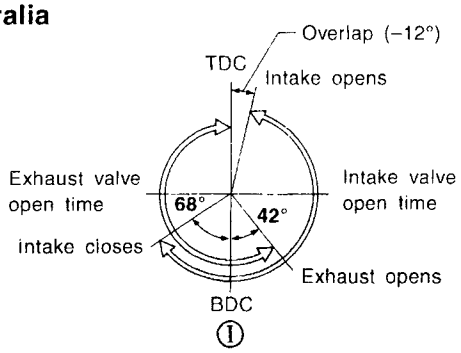


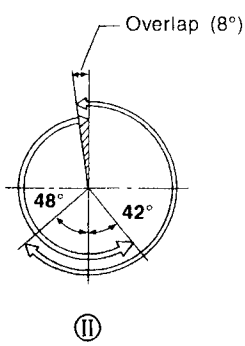
Except for Australia





For Australia



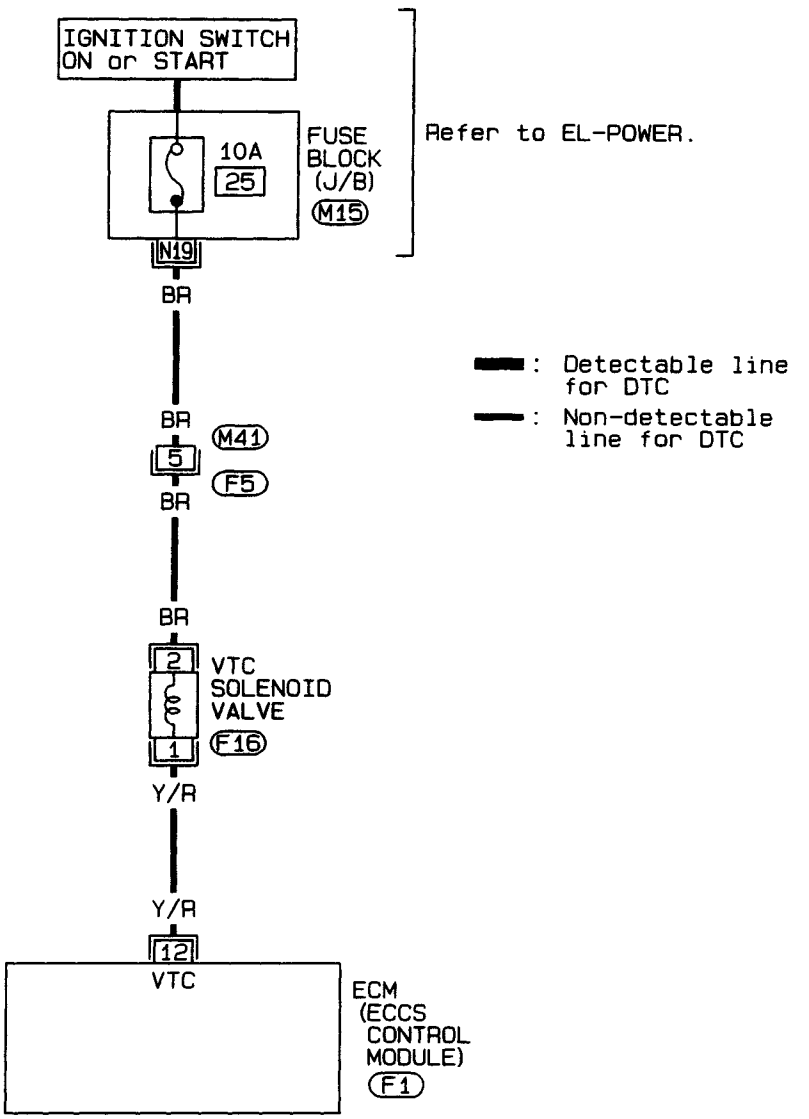


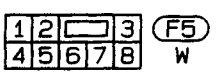
SEF183R

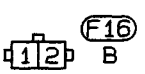
Valve Timing Control (VTC) (Cont'd)

GA16DE engine models except for Europe and Israel

EC-VTC-01

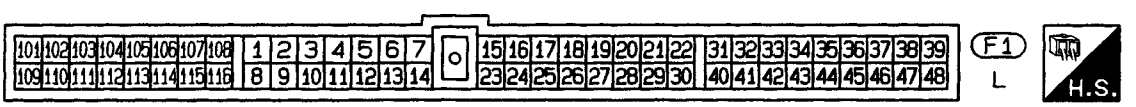






Refer to last page (Foldout page).

M15

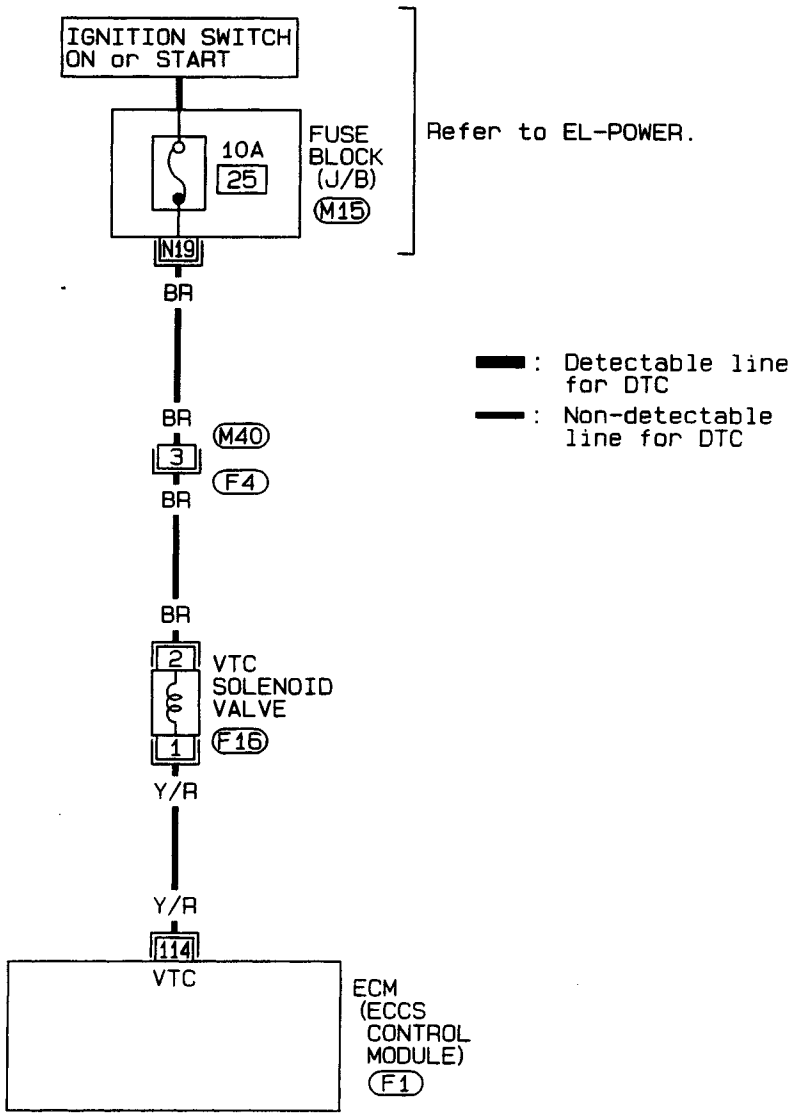


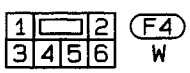
HEC050

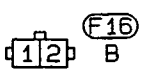
Valve Timing Control (VTC) (Cont'd)

GA16DE for Australia

EC-VTC-01

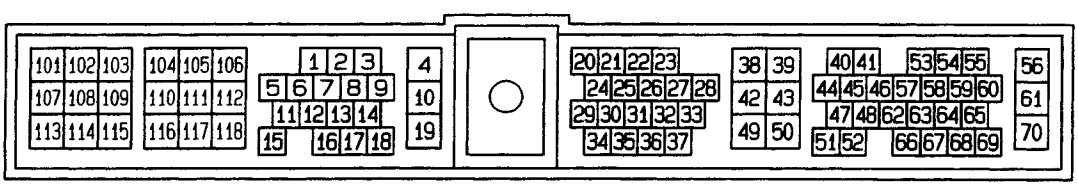






Refer to last page (Foldout page).

M15

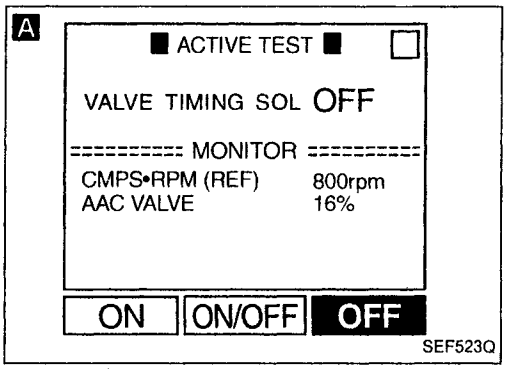


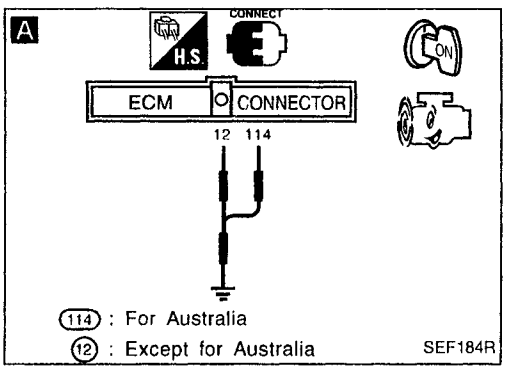


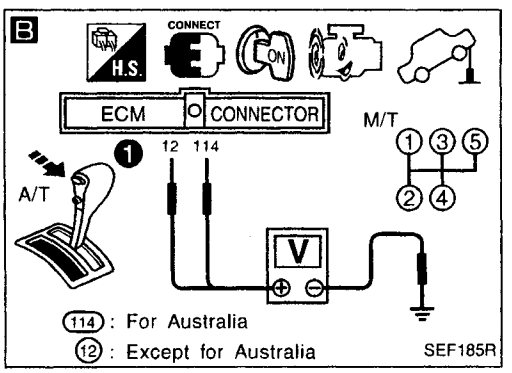
HEC082

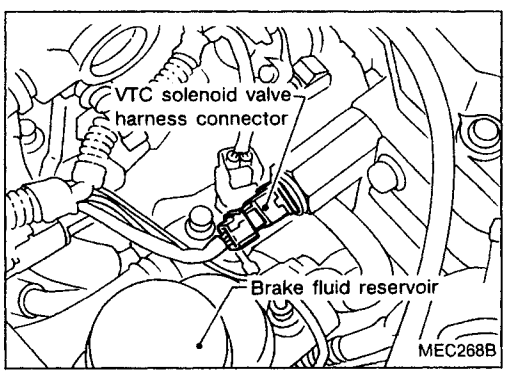
Valve Timing Control (VTC) (Cont'd)

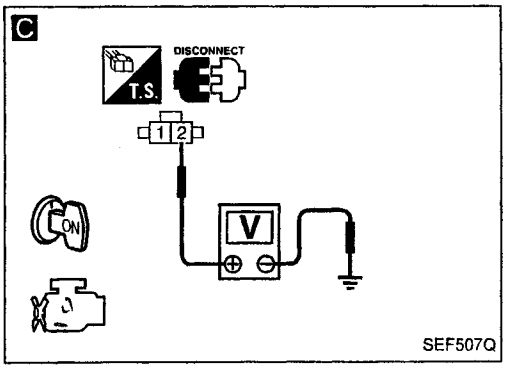
DIAGNOSTIC PROCEDURE











INSPECTION START

A

CHECK OVERALL FUNCTION.

1. Start engine and run it at idle.
2. Perform "VALVE TIMING SOL" in "ACTIVE TEST" mode with CONSULT and make sure that improper idle condition occurs.

OR

1. Connect a suitable jumper wire between ECM terminal (12) or (114) and body ground.
2. Start engine and make sure that improper idle condition occurs.

OK → INSPECTION END

NG

B

CHECK ELECTRICAL CONTROL FUNCTION.

1. Stop engine.
2. Jack up drive wheels.
3. Start engine and warm it up sufficiently.
4. Shift gear to 1st position.
5. Check voltage between ECM terminal (12) or (114) and ground under the following conditions.

Voltage:

Racing engine quickly from idle to 4,000 rpm
Approximately 0V
At idle
Battery voltage

OK → CHECK COMPONENTS (VTC solenoid valve and VTC valve).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace malfunctioning component(s).

NG

C

CHECK POWER SUPPLY.

1. Stop engine.
2. Disconnect VTC solenoid valve harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal (2) and ground.

Voltage: Battery voltage

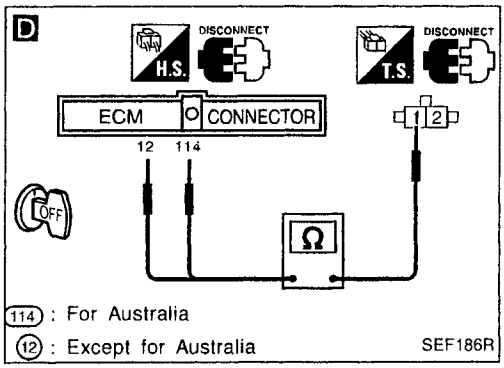
NG → Check the following.
- Harness connectors (F5), (M41) or (F4), (M40)
- 10A fuse
- Harness for open or short between VTC solenoid valve and fuse

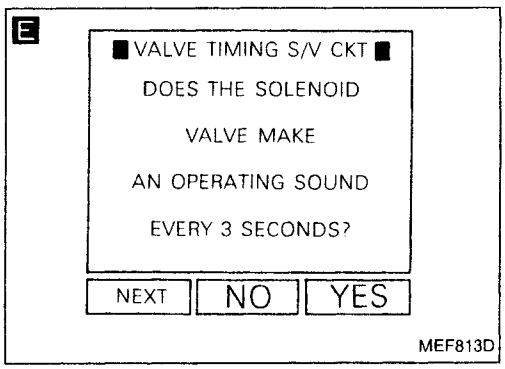
If NG, repair harness or connectors.

OK

Ⓐ

Valve Timing Control (VTC) (Cont'd)





Ⓐ

D

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal ⑫ or (114) and terminal ①.

Continuity should exist.

If OK, check harness for short.

NG → Repair harness or connectors.

OK

E

CHECK COMPONENT (VTC solenoid valve).

Perform "VALVE TIMING S/V CKT" in "FUNCTION TEST" mode with CONSULT.

OR

Refer to "COMPONENT INSPECTION" below.

NG → Replace VTC solenoid valve.

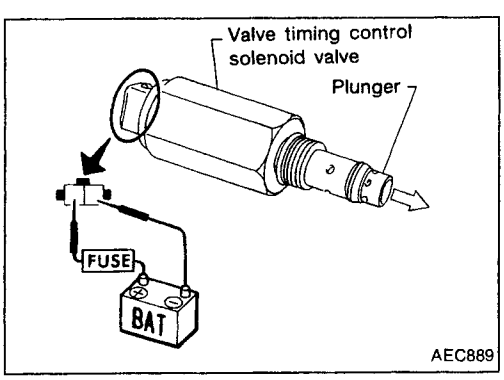
OK

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

Trouble is not fixed.

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

INSPECTION END



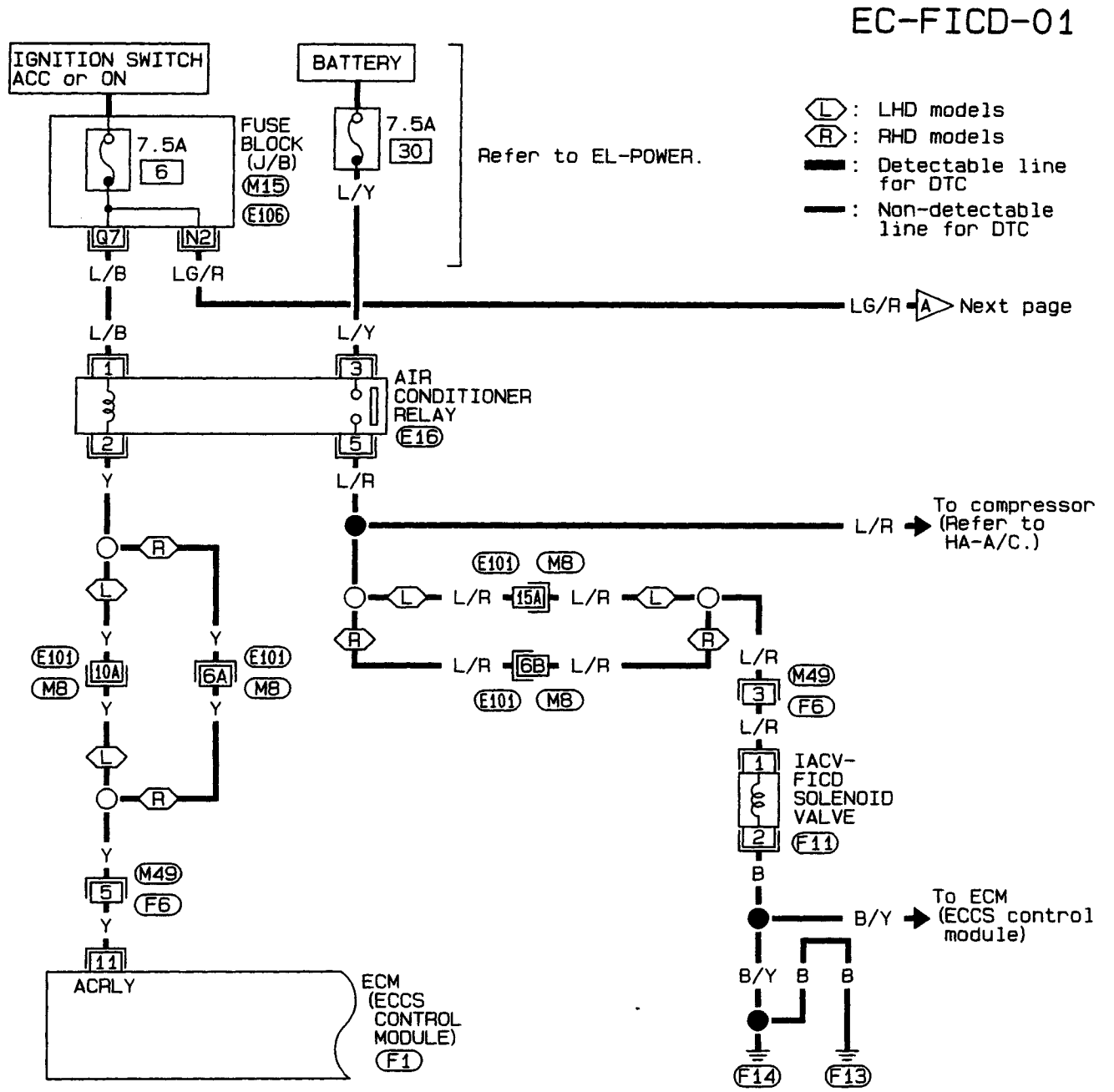
COMPONENT INSPECTION

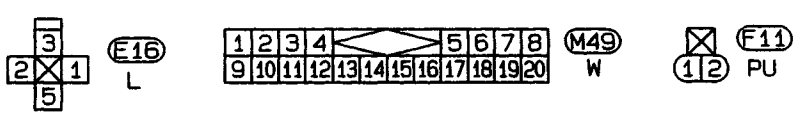
VTC solenoid valve

1. Supply VTC solenoid valve terminals with battery voltage.
2. Make sure that inside plunger protrudes.
   If NG, replace VTC solenoid valve.

IACV-FICD Solenoid Valve

LHD models

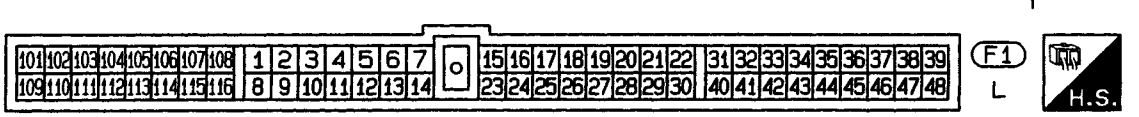




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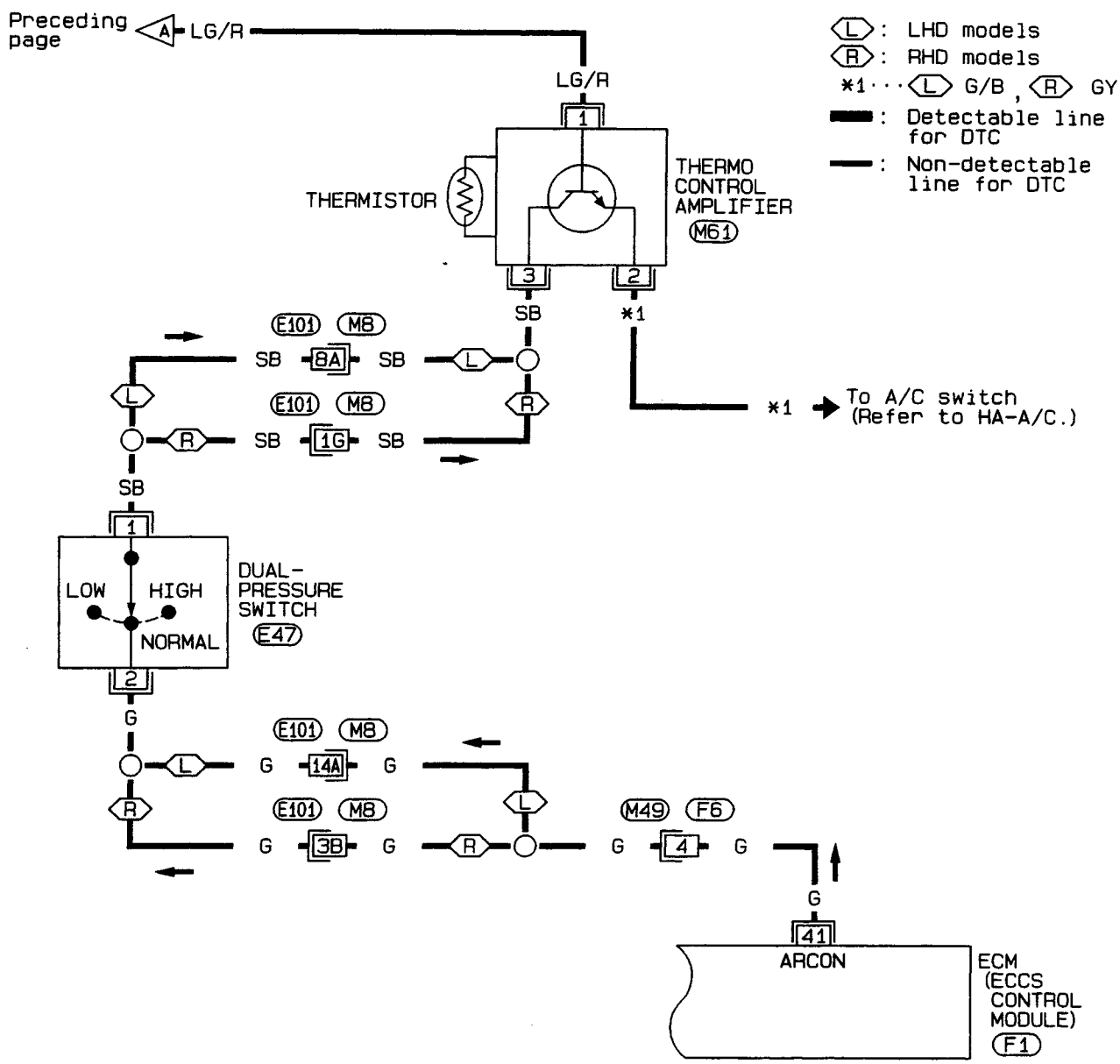
M8, E101

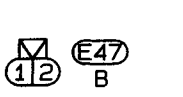
M15, E106

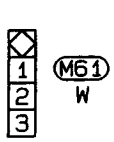


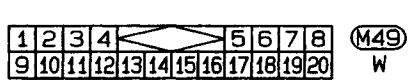
HEC051

EC-FICD-02



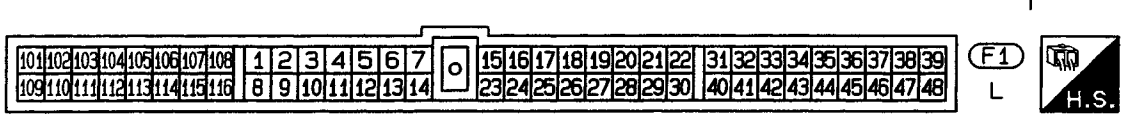






Refer to last page (Foldout page).

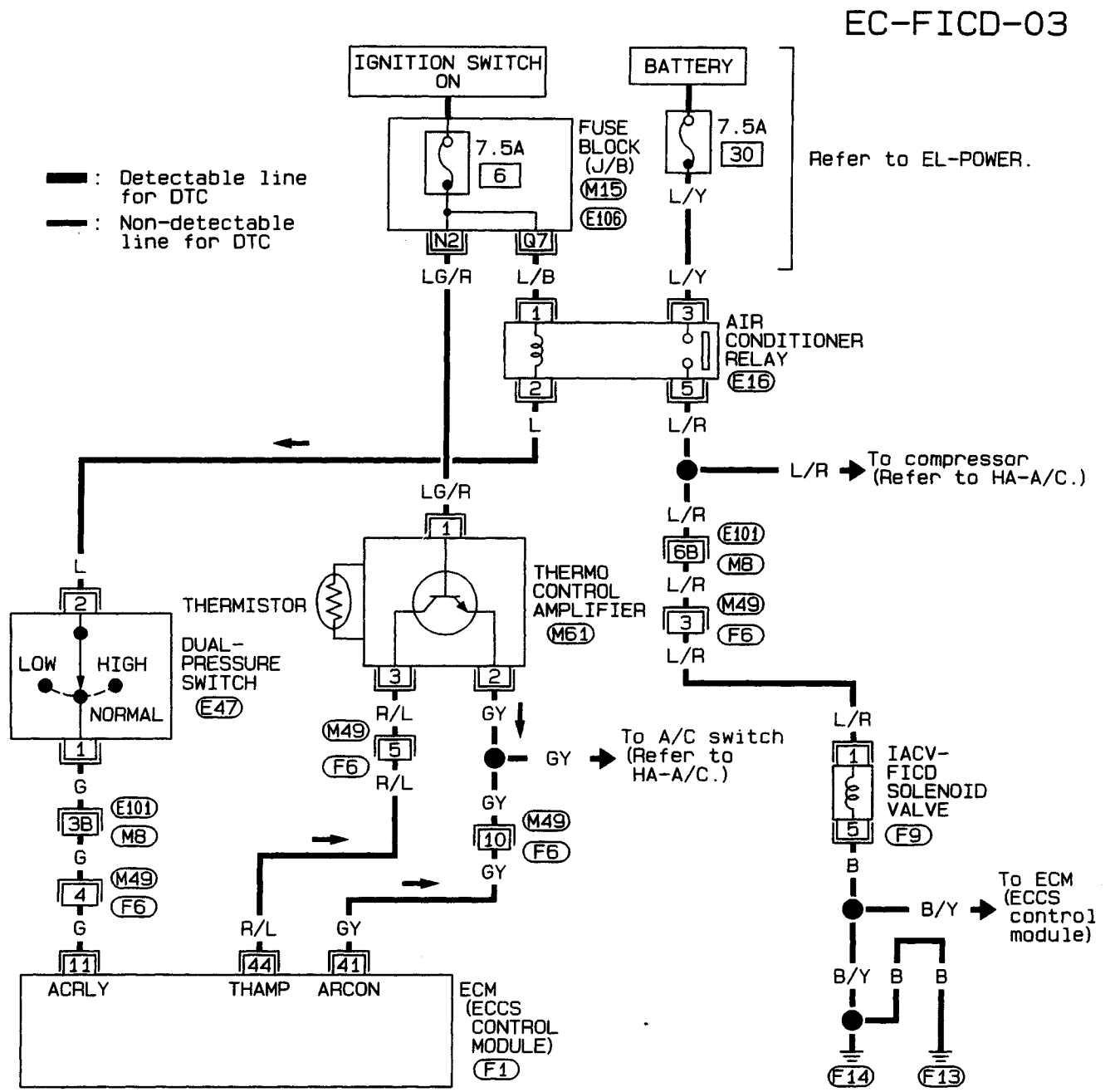
M8 , E101

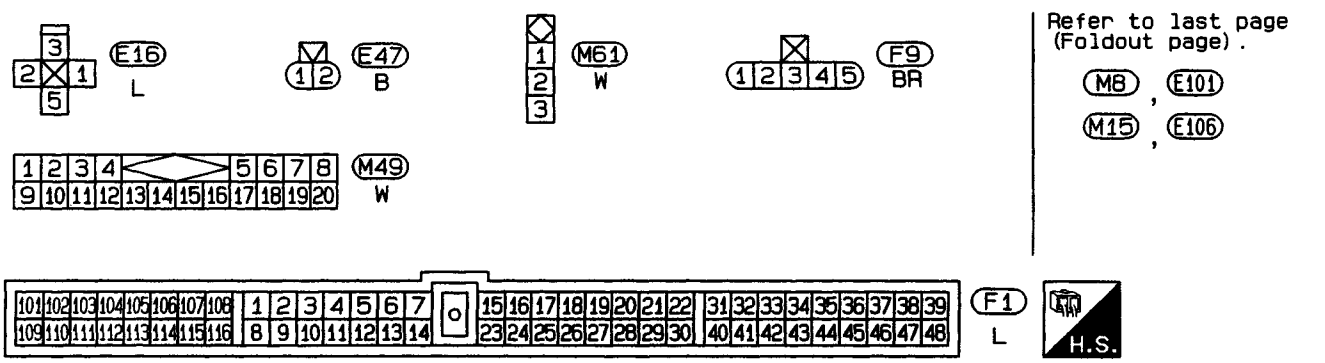


HEC052

IACV-FICD Solenoid Valve (Cont'd)

RHD models





Refer to last page (Foldout page).

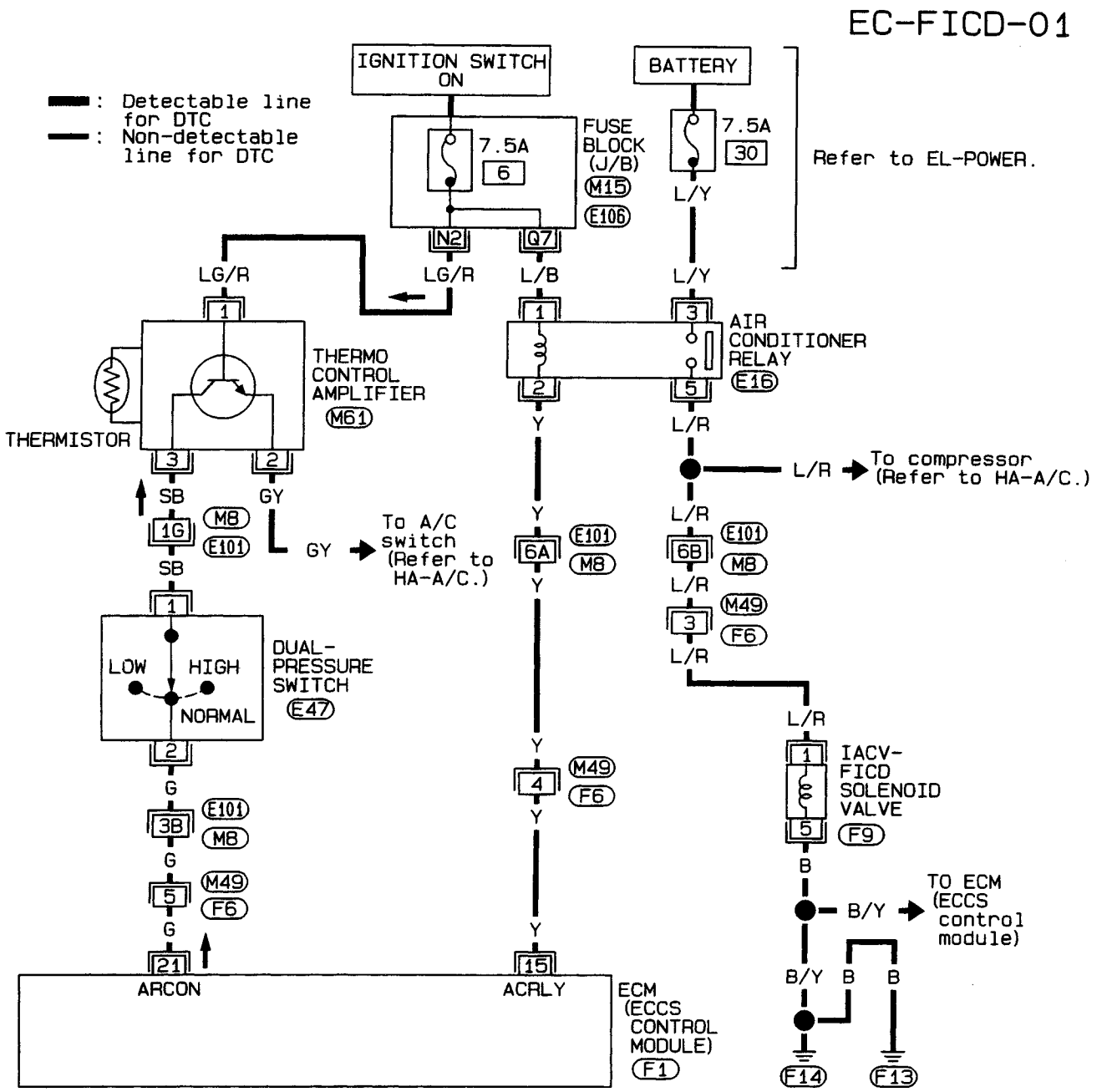
M8, E101

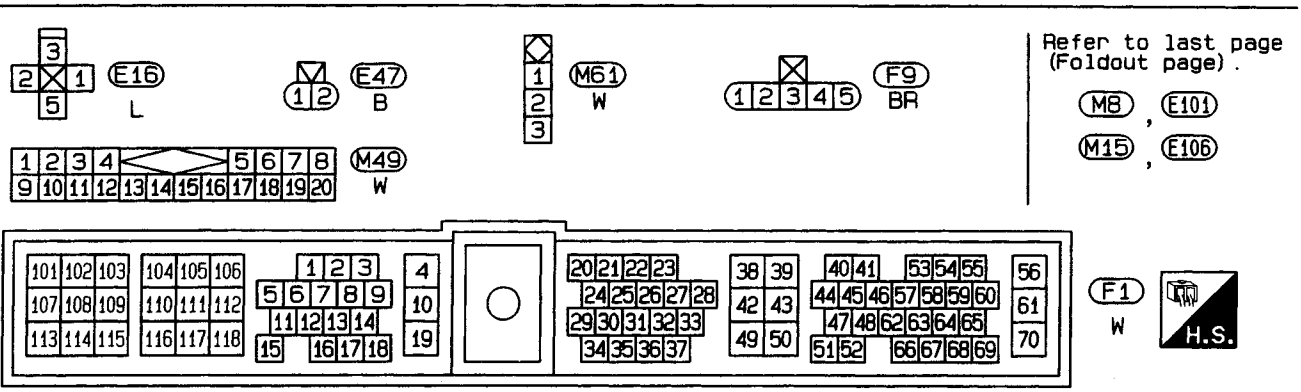
M15, E106

HEC053

IACV-FICD Solenoid Valve (Cont'd)

GA16DE for Australia





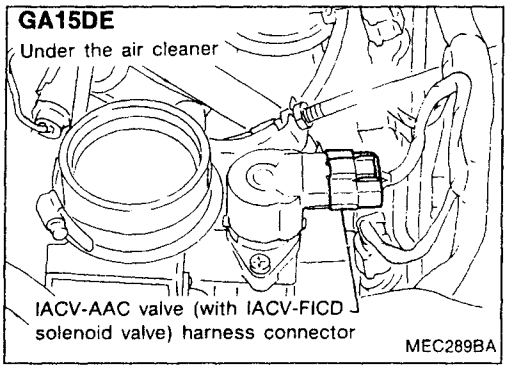
HEC083

IACV-FICD Solenoid Valve (Cont'd)

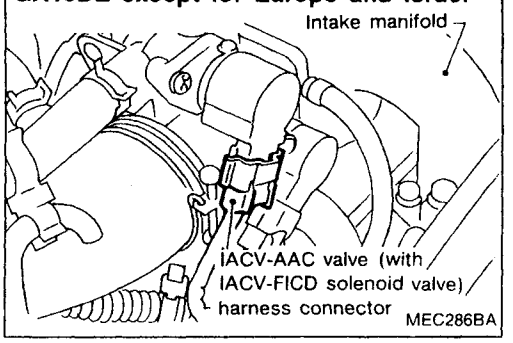
COMPONENT DESCRIPTION

When the air conditioner is on, the IACV-FICD solenoid valve supplies additional air to adjust to the increased load.

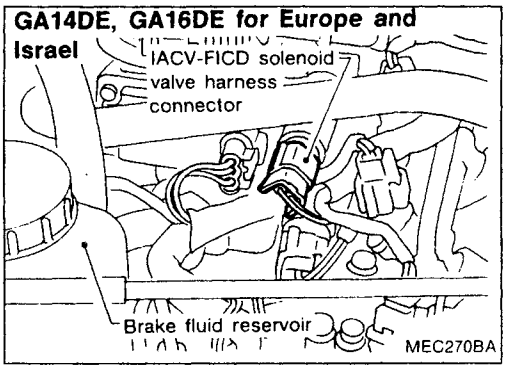
GA15DE



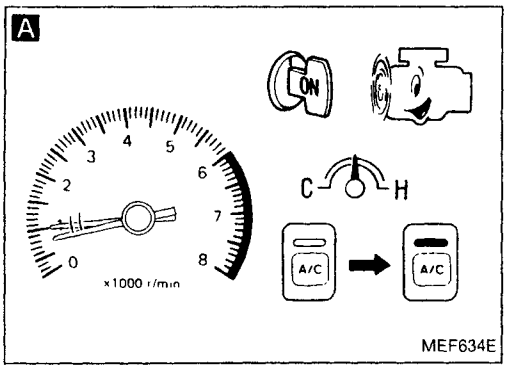
GA16DE except for Europe and Israel



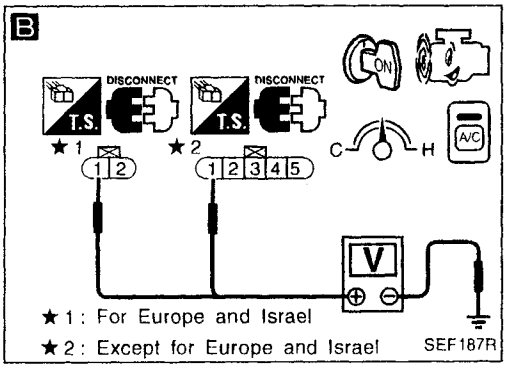
GA14DE, GA16DE for Europe and Israel



A



B



DIAGNOSTIC PROCEDURE

INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Start engine and warm it up sufficiently.
2. Check idle speed.
   Refer to EC-36.
   If NG, adjust idle speed.
3. Turn air conditioner switch and blower fan switch "ON".
4. Recheck idle speed.
   900 rpm or more (A/T in "N" position)

OK → INSPECTION END

NG

Check if air conditioner compressor functions normally.

NG → Refer to "TROUBLE DIAGNOSES" in HA section.

OK

B

CHECK POWER SUPPLY.
1. Turn air conditioner switch "OFF" and stop engine.
2. Disconnect IACV-AAC valve or IACV-FICD solenoid valve harness connector.
3. Restart engine, then turn air conditioner switch and blower fan switch "ON".
4. Check voltage between terminal ① and ground with CONSULT or tester.
   Voltage: Battery voltage

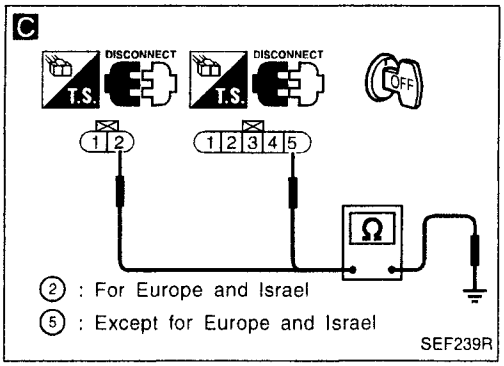
NG → Check the following.
- Harness connectors (F6), (M49)
- Harness connectors (M8), (E101)
- Harness for open or short between IACV-AAC valve or IACV-FICD solenoid valve harness connector and air conditioner relay

If NG, repair harness or connectors.

OK

Ⓐ

IACV-FICD Solenoid Valve (Cont'd)



Ⓐ

C

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Check harness continuity between terminal ⑤ or ② and body ground.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

CHECK COMPONENT (IACV-FICD solenoid valve).
Refer to "COMPONENT INSPECTION" below.

NG → Replace IACV-FICD solenoid valve.

OK ↓

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

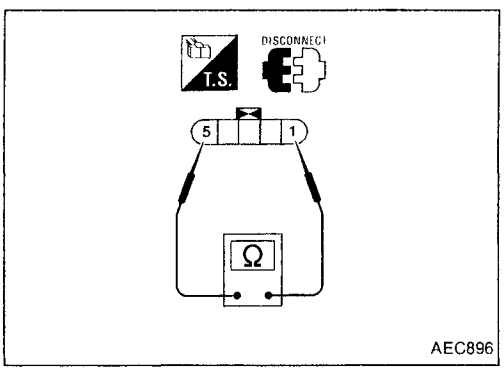
Trouble is not fixed. ↓

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

↓

INSPECTION END

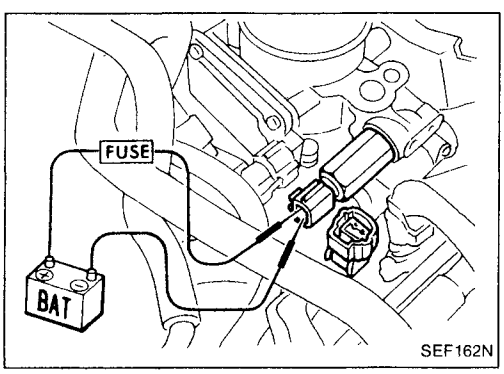
EC



COMPONENT INSPECTION

IACV-FICD solenoid valve — Except for Europe and Israel

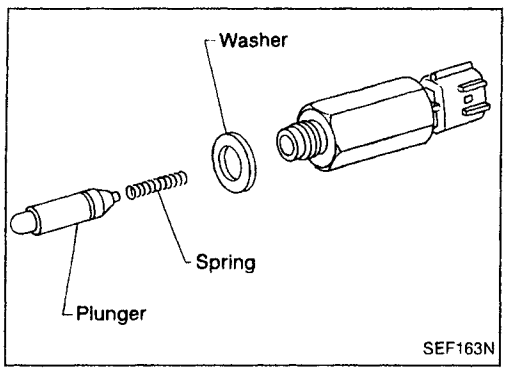
1. Disconnect IACV-AAC valve harness connector.
2. Check resistance between terminals ① and ⑤.
   Resistance: 75 - 125Ω [at 25°C (77°F)]
   If NG, replace the solenoid valve.



IACV-FICD solenoid valve — Europe and Israel

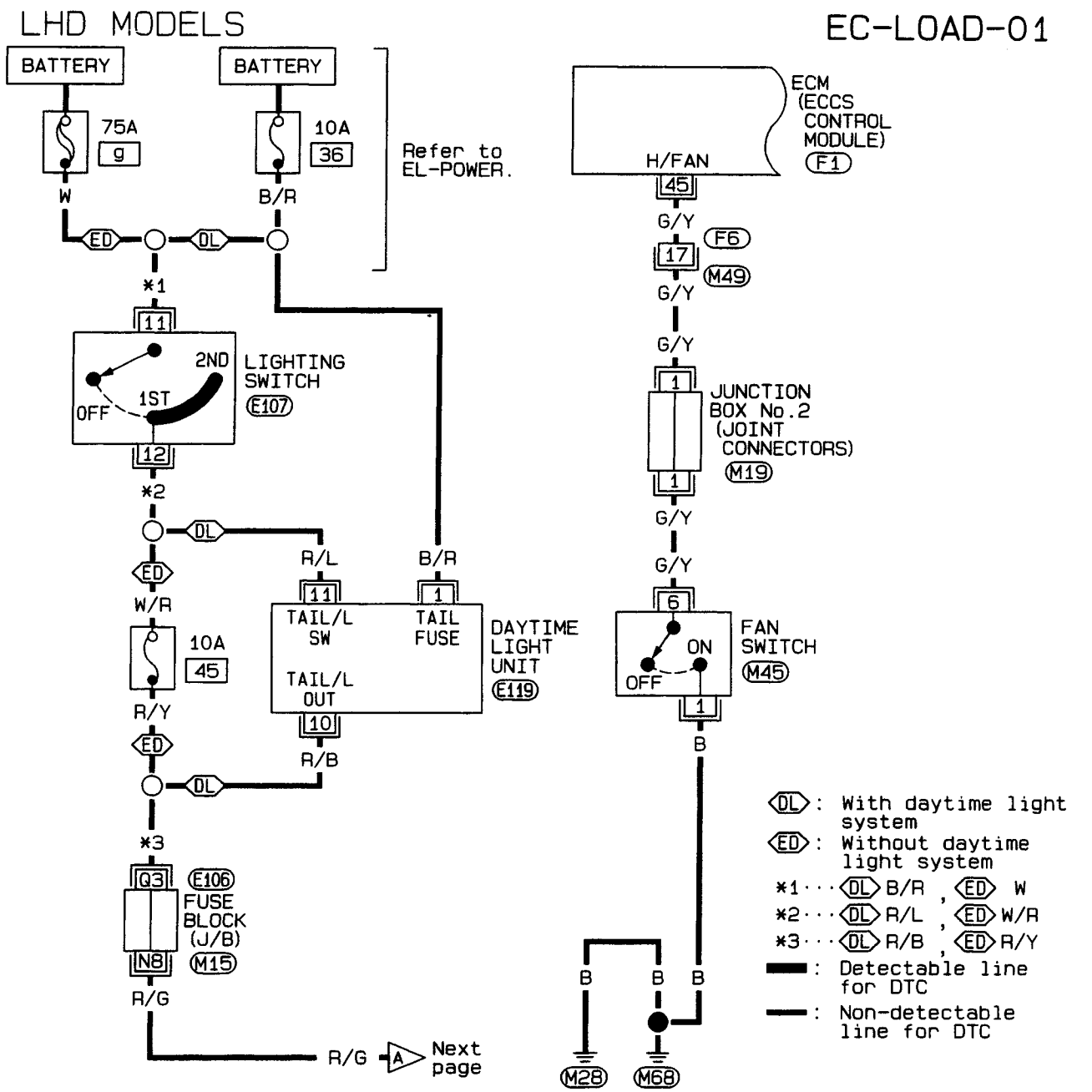
- Check for clicking sound when applying 12V direct current to terminals.

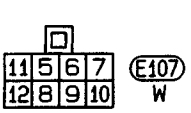
IACV-FICD Solenoid Valve (Cont'd)

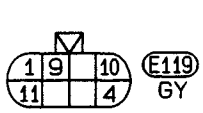


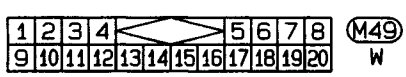
- Check plunger for seizing or sticking.
- Check for broken spring.

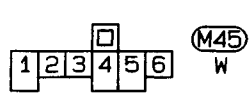
Electrical Load Signal







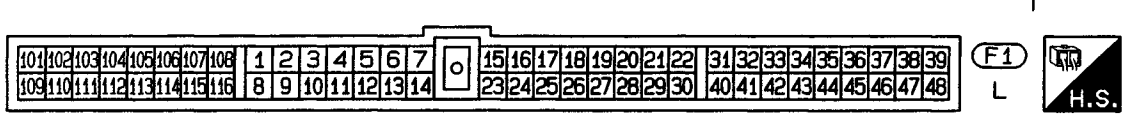




Refer to last page (Foldout page).

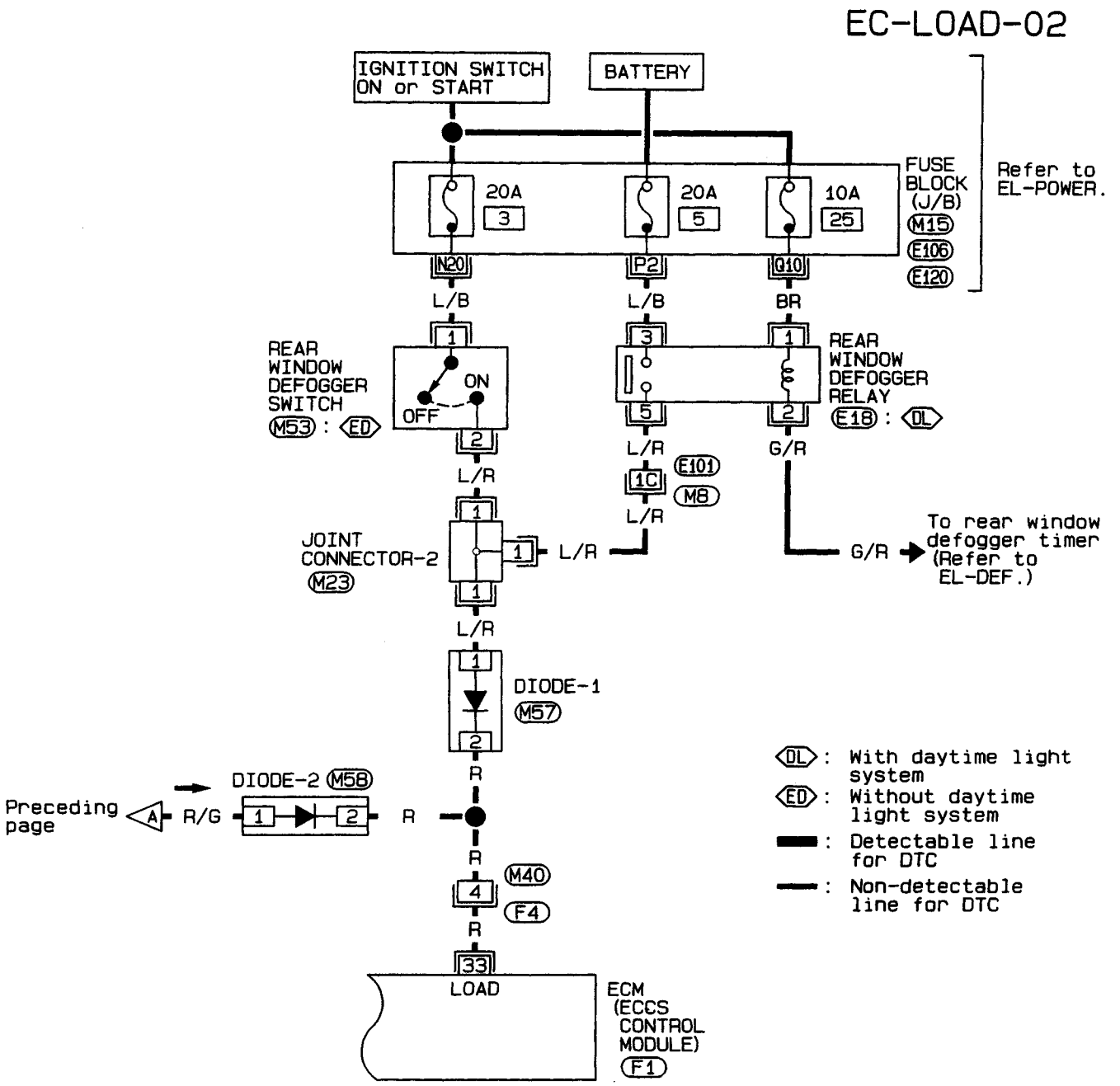
M15 , E106

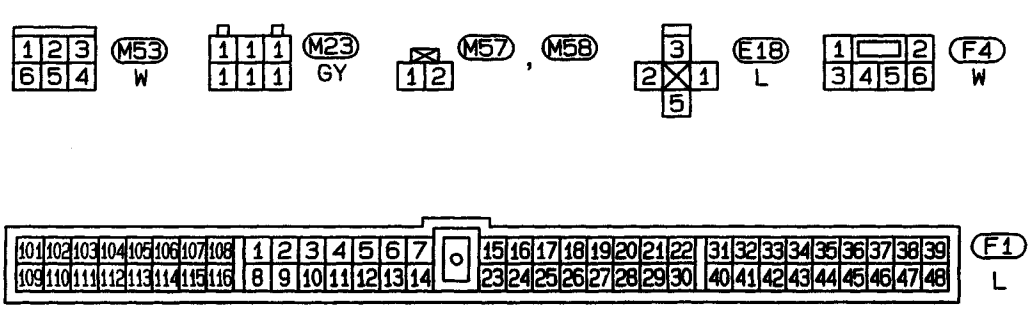
M19



HEC054

Electrical Load Signal (Cont'd)

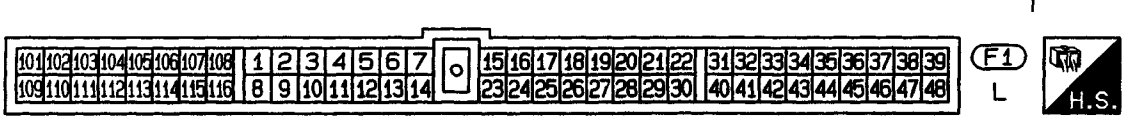




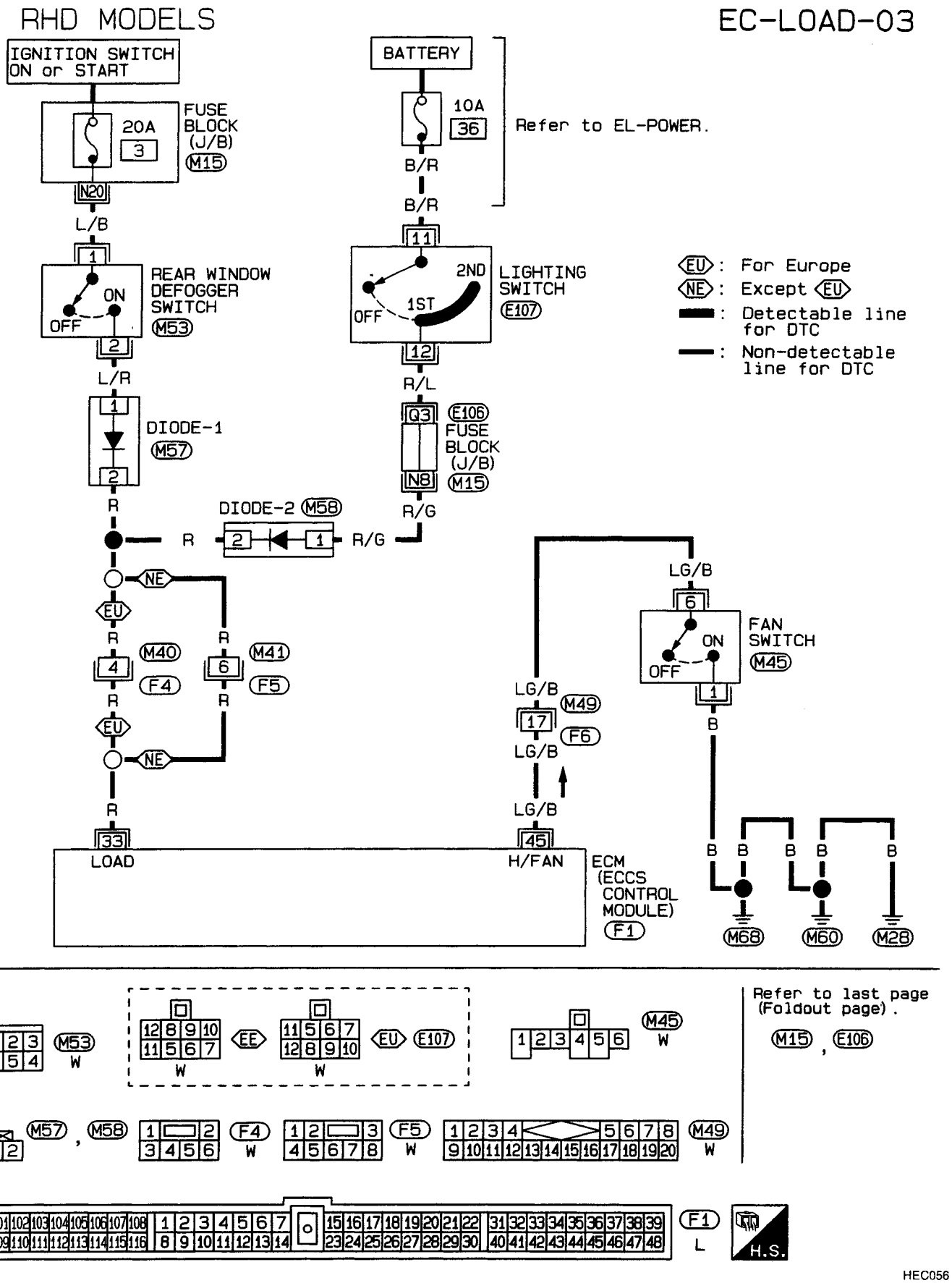
Refer to last page (Foldout page).

M8 , E101

M15 , E106 , E120



HEC055

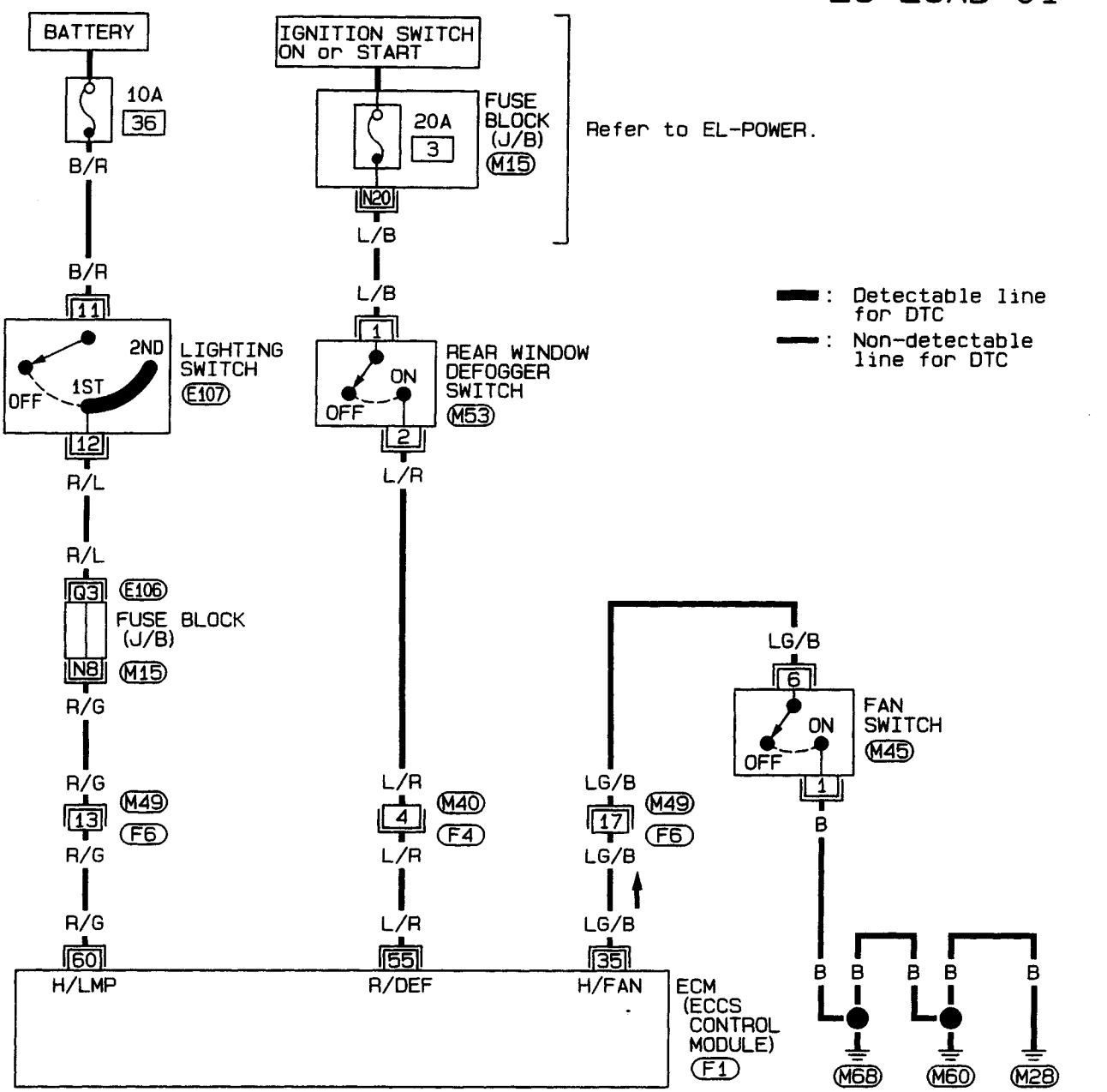

RHD MODELS
EC-LOAD-03
IGNITION SWITCH ON or START
FUSE BLOCK (J/B) M15
20A
3
N20
L/B
1
REAR WINDOW DEFOGGER SWITCH M53
ON
OFF
2
L/R
DIODE-1 M57
R
DIODE-2 M58
R
2
1
R/G
NE
EU
M40
4
F4
M41
6
F5
33
LOAD
BATTERY
10A
36
Refer to EL-POWER.
B/R
11
LIGHTING SWITCH E107
2ND
1ST
OFF
12
R/L
Q3
E106
FUSE BLOCK (J/B) M15
N8
R/G
LG/B
6
FAN SWITCH M45
ON
OFF
1
B
LG/B M49
17
F6
LG/B
45
H/FAN
ECM (ECCS CONTROL MODULE) F1
B
M68
M60
M28
EU: For Europe
NE: Except EU
Detectable line for DTC
Non-detectable line for DTC
M53
W
EE
EU
E107
M45
W
Refer to last page (Foldout page).
M15, E106
M57, M58
F4
W
F5
W
M49
W
F1
L
H.S.

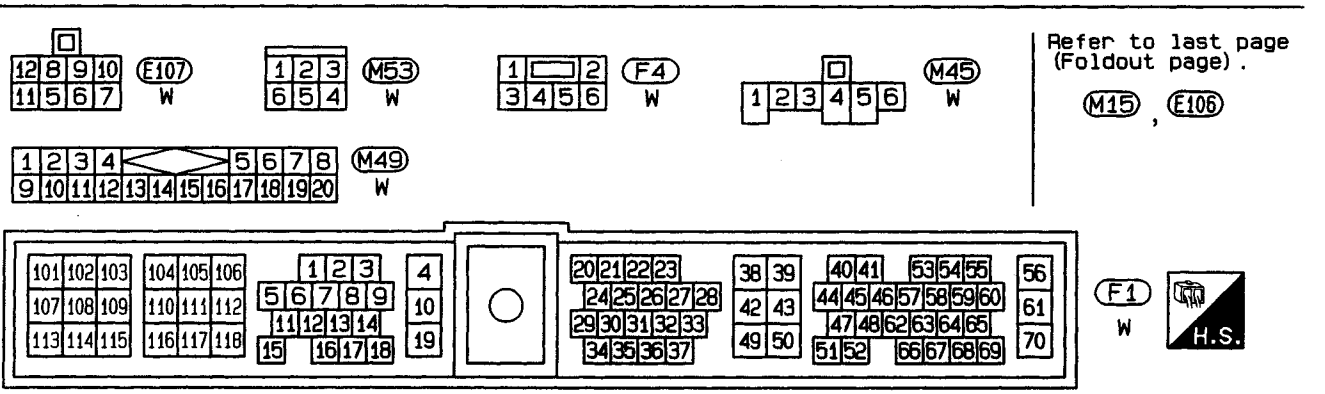
HEC056

Electrical Load Signal (Cont'd)

GA16DE for Australia

EC-LOAD-01

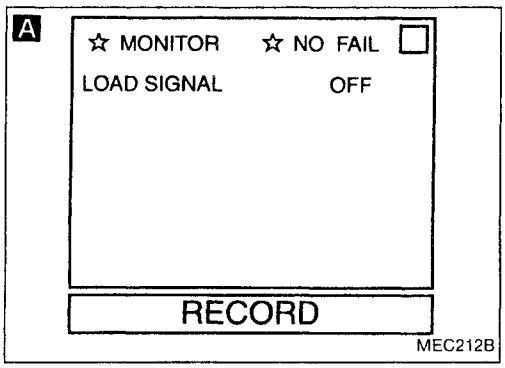


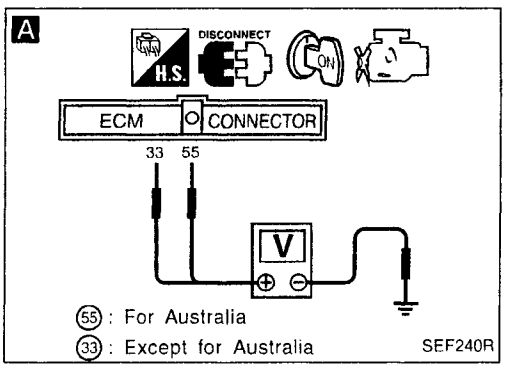


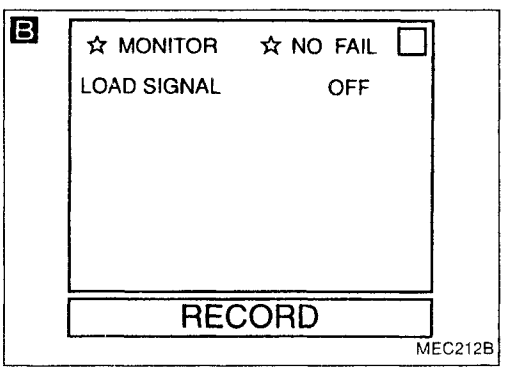
HEC084

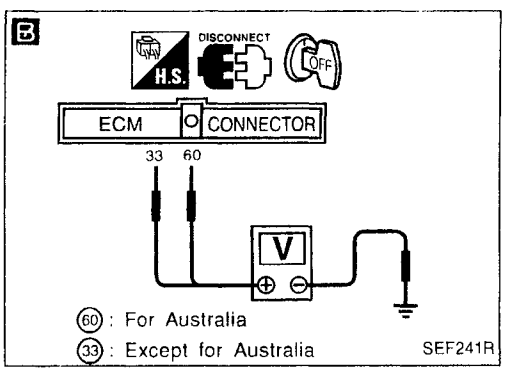
Electrical Load Signal (Cont'd)

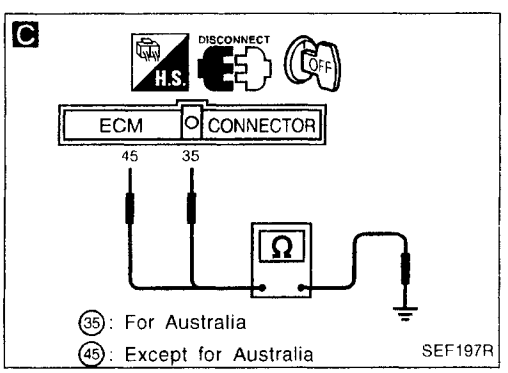
DIAGNOSTIC PROCEDURE











INSPECTION START

A

CHECK OVERALL FUNCTION-I.
1) Turn ignition switch "ON".
2) Check "LOAD SIGNAL" in "DATA MONITOR" mode with CONSULT.
Rear window defogger switch is "ON": ON
Rear window defogger switch is "OFF": OFF

OR

2) Check voltage between ECM terminal 55 or 33 and ground under the following conditions.
Voltage:
Rear window defogger switch is "ON".
Battery voltage
Rear window defogger switch is "OFF".
Approximately 0V

NG → Check rear window defogger circuit. (Go to Procedure A.)

OK

B

CHECK OVERALL FUNCTION-II.
1) Turn rear window defogger switch "OFF".
2) Check "LOAD SIGNAL" in "DATA MONITOR" mode with CONSULT.
Lighting switch is "ON": ON
Lighting switch is "OFF": OFF

OR

2) Turn ignition switch "OFF".
3) Check voltage between ECM terminal 60 or 33 and ground under the following conditions.
Voltage:
Lighting switch is "ON".
Battery voltage
Lighting switch is "OFF".
Approximately 0V

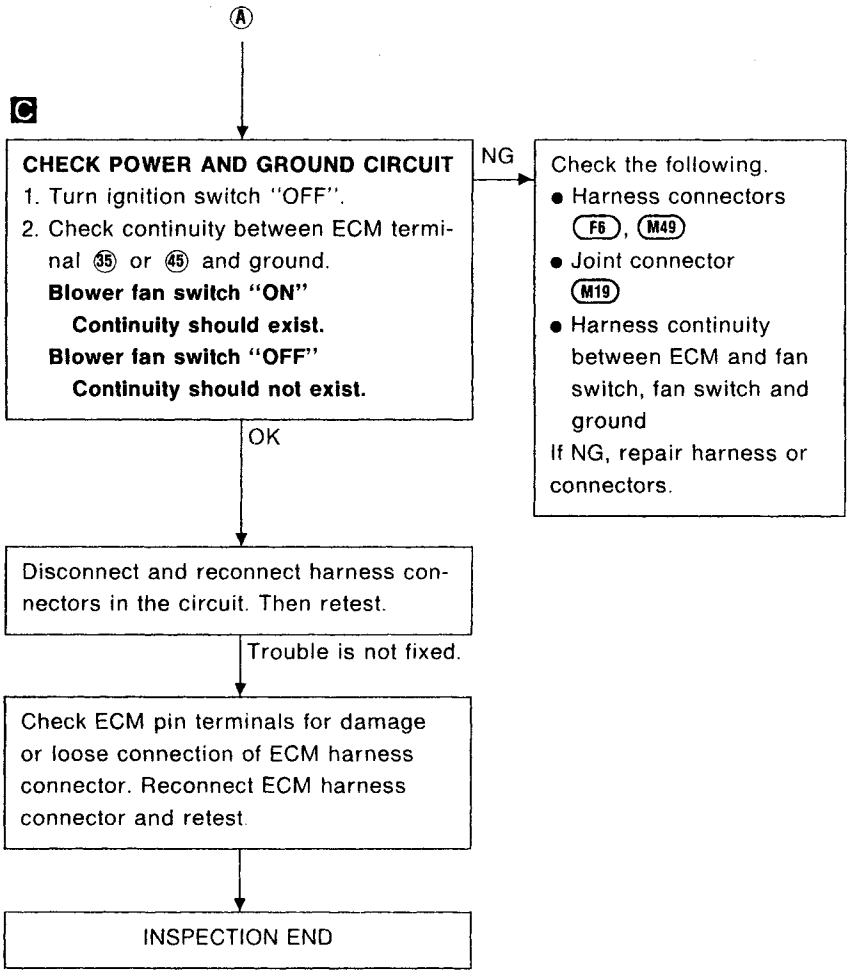
NG → Check lighting switch circuit. (Go to Procedure B.)

OK

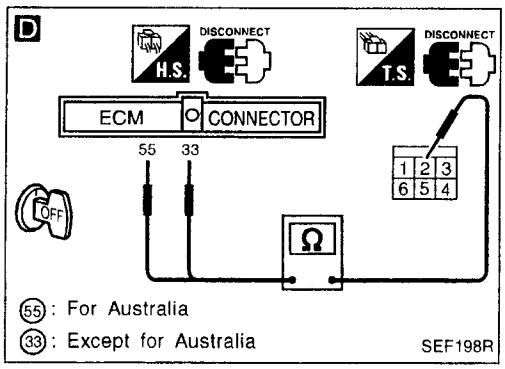
Ⓐ

EC

Electrical Load Signal (Cont'd)



Electrical Load Signal (Cont'd)



PROCEDURE A

INSPECTION START

Check if rear window defogger functions normally.

NG → Check rear window defogger circuit. (Refer to "REAR WINDOW DEFOGGER" in EL section.)

OK

D

CHECK INPUT SIGNAL CIRCUIT.
1. Turn rear window defogger switch "OFF".
2. Turn ignition switch "OFF".
3. Disconnect ECM harness connector and rear window defogger switch harness connector.
4. Check harness continuity between ECM terminal (33) or (55) and terminal (2).

Continuity should exist.

If OK, check harness for short.

NG → Check the following.
- Harness connectors (F4), (M40) or (F5), (M41)
- Diode (M57)
- Joint connector (M23)
- Harness for open or short between ECM and rear window defogger switch

If NG, repair harness or connectors.

OK

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

Trouble is not fixed.

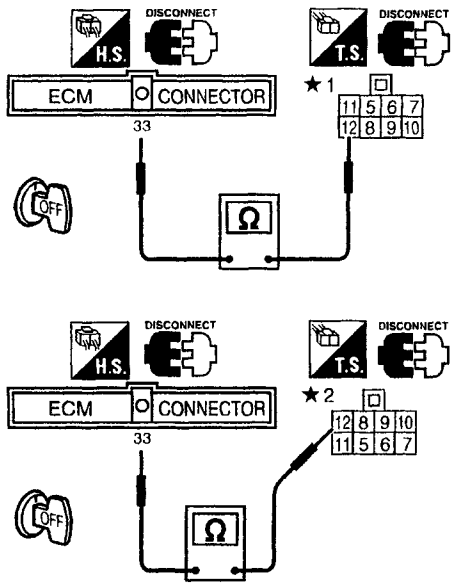
Check ECM pin terminals for damage or the connection of ECM harness connector. Reconnect ECM harness connector and retest.

INSPECTION END

EC

Electrical Load Signal (Cont'd)

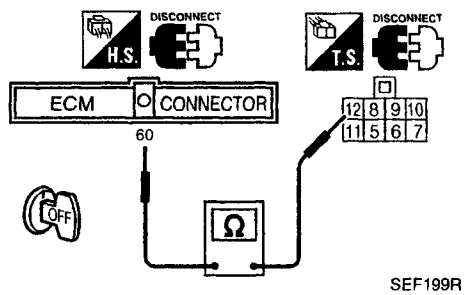
E **Except for Australia**



★1 : LHD models and RHD models for Europe
★2 : RHD models except for Europe

SEF188R

E **For Australia**



SEF199R

PROCEDURE B

INSPECTION START

Check if lamps light when lighting switch is turned "ON".

NG → Check lighting switch circuit. (Refer to "COMBINATION SWITCH" in EL section.)

OK

E

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector and lighting switch harness connector.
3. Check harness continuity between ECM terminal ㉝ or ㊿ and terminal ⑫.

Continuity should exist.

If OK, check harness for short.

NG → Check the following.
- Harness connectors (F4), (M40) or (F5), (M41) or (F6), (M49)
- Harness connectors (M15), (E106)
- Diode (M58)
- 10A fuse
- Daytime light unit
- Harness for open or short between lighting switch and diode

If NG, repair harness or connectors.

OK

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

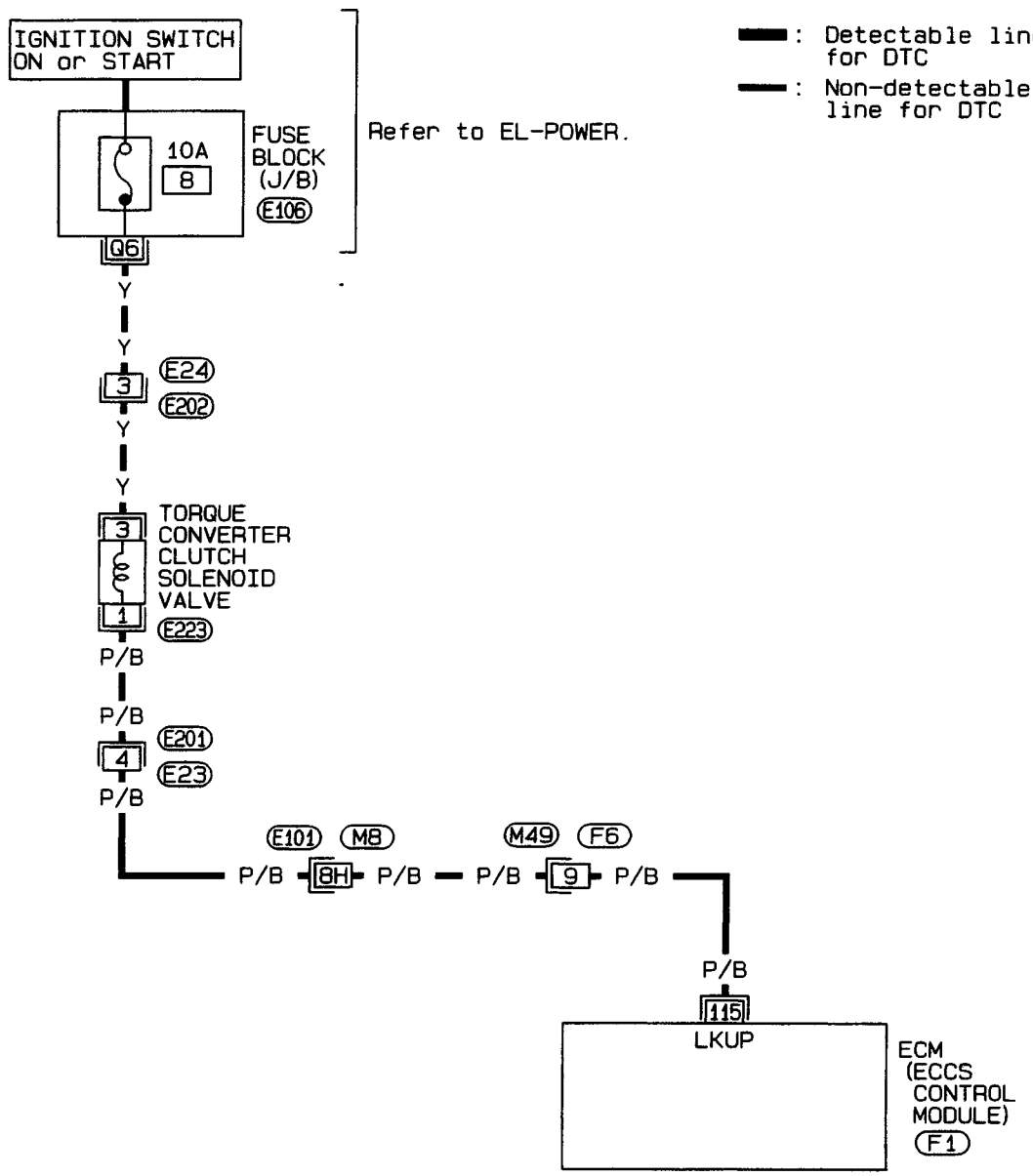
Trouble is not fixed.

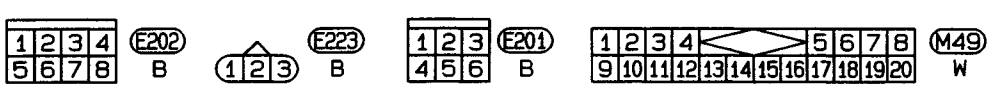
Check ECM pin terminals for damage or the connection of ECM harness connector. Reconnect ECM harness connector and retest.

INSPECTION END

Torque Converter Clutch Solenoid Valve

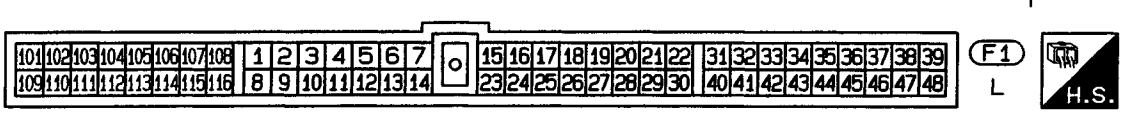
EC-LKUP-01





Refer to last page (Foldout page).

M8, E101
E106

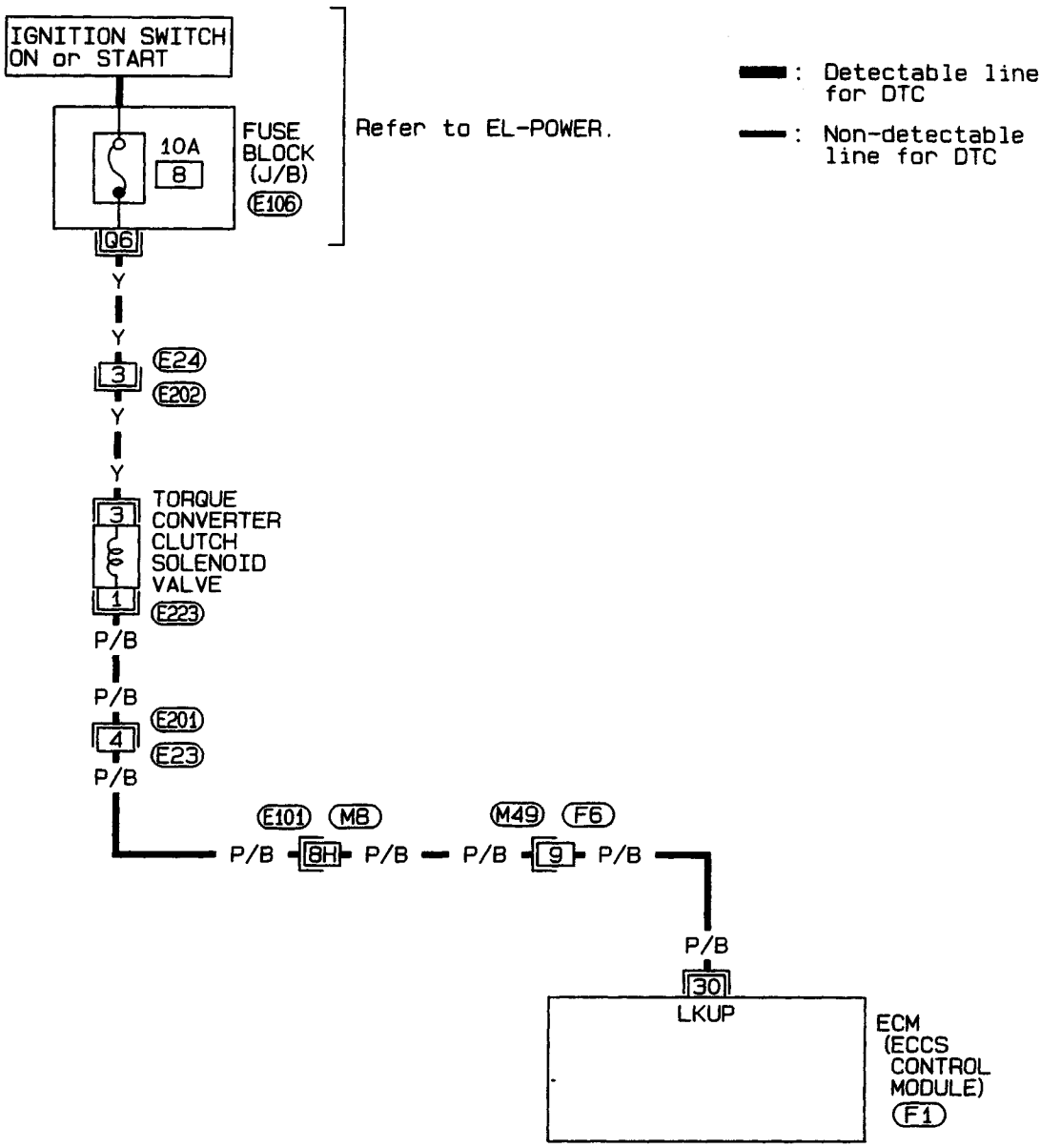


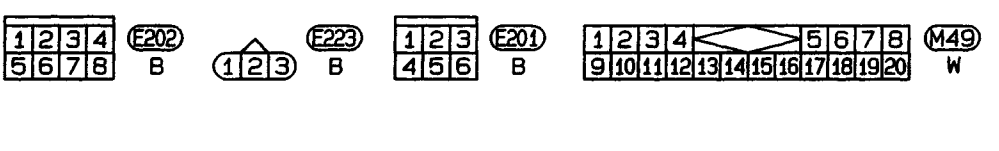
HEC057

Torque Converter Clutch Solenoid Valve (Cont'd)

GA16DE for Australia (A/T models)

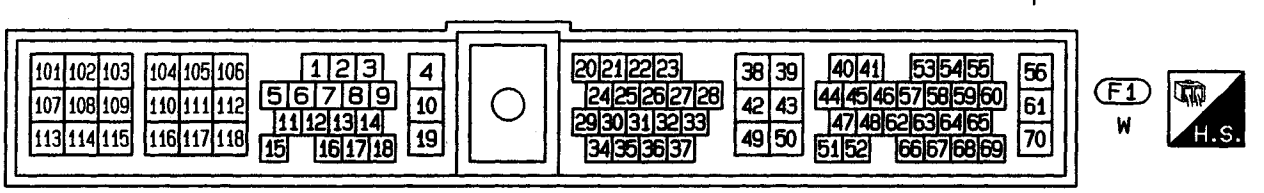
EC-LKUP-01





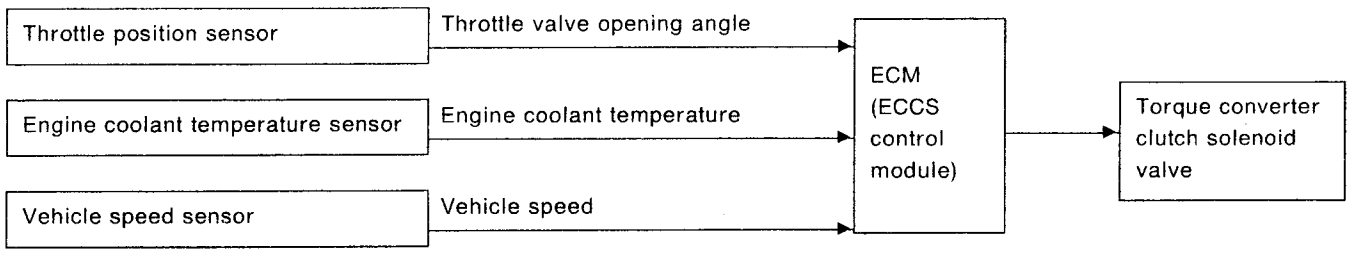
Refer to last page (Foldout page).

M8, E101, E106



HEC085

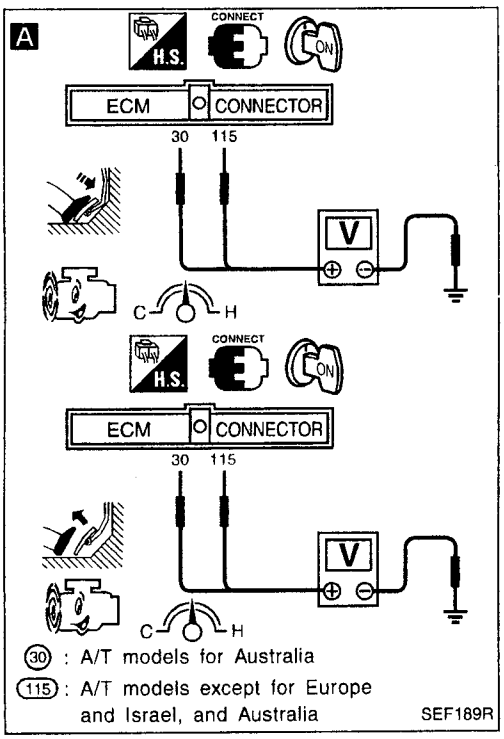
SYSTEM DESCRIPTION

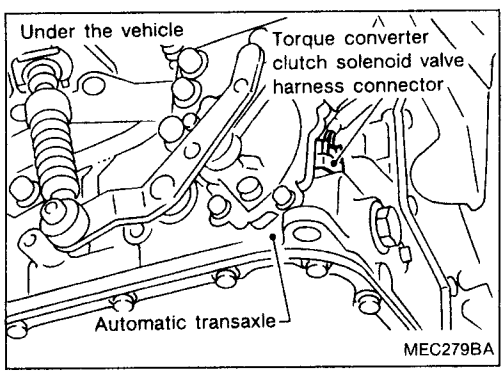


The A/T lock-up is controlled by the ECM through the torque converter clutch solenoid valve. When the ECM detects any of the following conditions, the ECM switches the torque converter clutch solenoid valve OFF to accomplish lock-up operation. While the vehicle is in conditions other than below, the torque converter clutch solenoid valve is always set to ON, releasing the lock-up operation.

- Throttle position is open.
- Engine coolant temperature is 60°C (140°F) or more.
- Vehicle speed is 58 km/h (36 MPH) or more.

EC





DIAGNOSTIC PROCEDURE

INSPECTION START

A

CHECK CONTROL FUNCTION.
1. Jack up drive wheels.
2. Start engine and warm it up sufficiently.
3. Shift selector lever to "D" position.
4. Check voltage between ECM terminal (115) or (30) and ground under the following conditions.

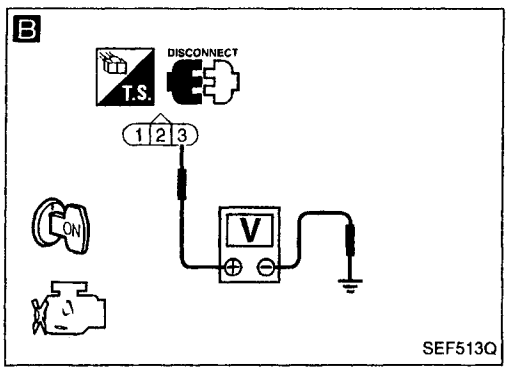
Voltage:
Accelerator pedal is depressed [Vehicle speed is above 58 km/h (36 MPH).]
Battery voltage
Accelerator pedal is fully released
Approximately 0V

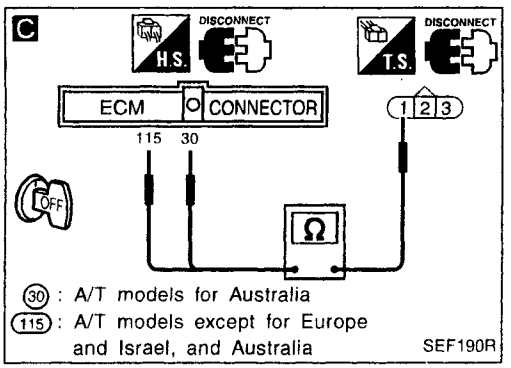
OK → CHECK COMPONENT (Torque converter clutch solenoid valve).
Refer to "Electrical Components Inspection" in AT section.
If NG, replace torque converter clutch solenoid valve.

OK → INSPECTION END

NG → (A)

Torque Converter Clutch Solenoid Valve (Cont'd)





Ⓐ

B

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect torque converter clutch solenoid valve harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ③ and ground.
   Voltage: Battery voltage

NG → Check the following.
- Harness connectors E24, E202
- 10A fuse
- Harness for open or short between torque converter clutch solenoid valve and fuse

If NG, repair harness or connectors.

OK ↓

C

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal 115 or 30 and terminal ①.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors F6, M49
- Harness connectors M8, E101
- Harness connectors E23, E201
- Harness for open or short between ECM and torque converter clutch solenoid valve

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Torque converter clutch solenoid valve).
Refer to "Electrical Components Inspection" in AT section.

NG → Replace torque converter clutch solenoid valve.

OK ↓

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

Trouble is not fixed. ↓

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

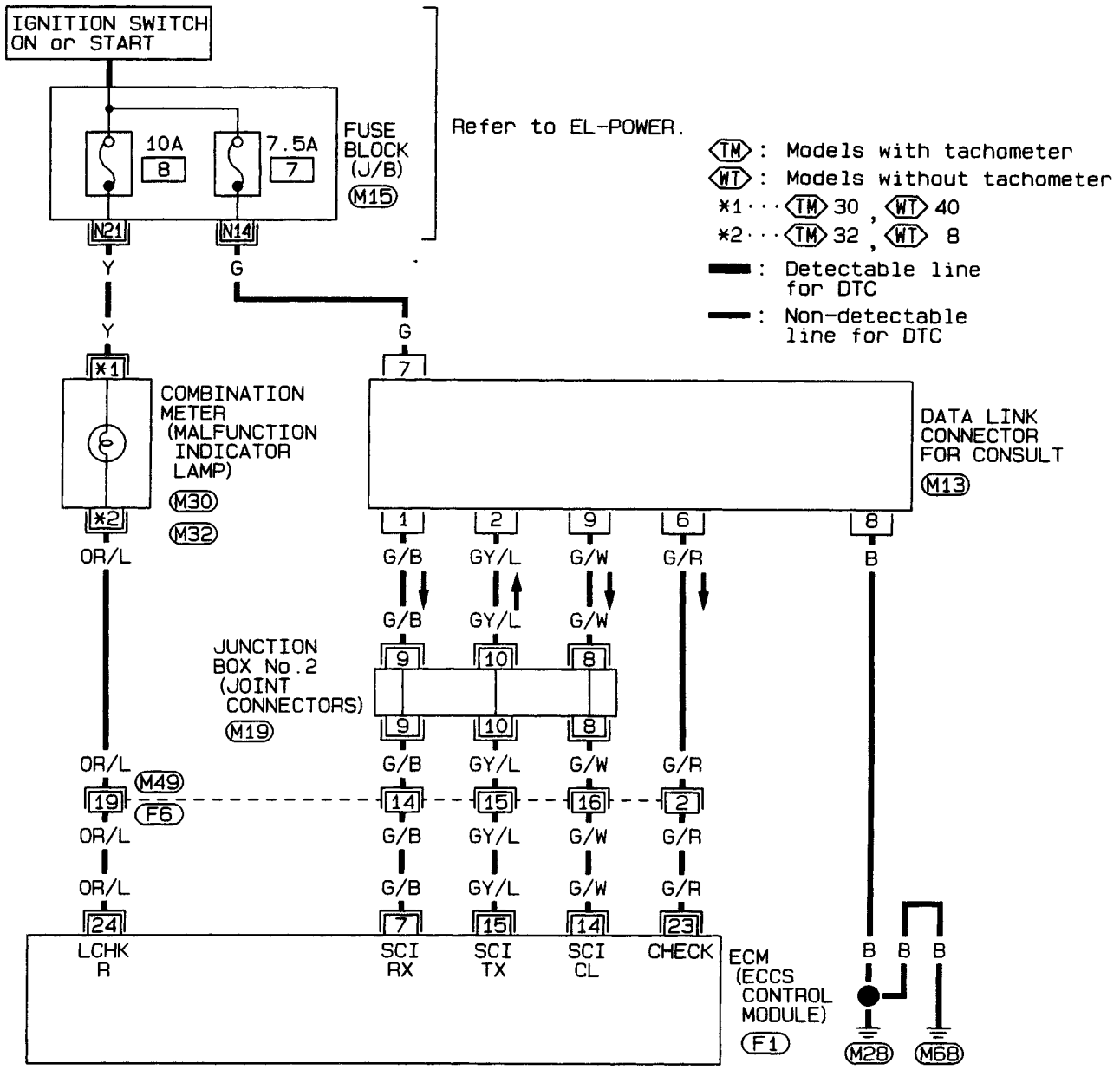
↓

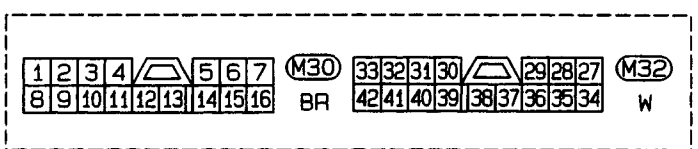
INSPECTION END

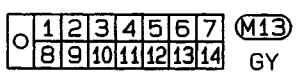
MIL & Data Link Connectors

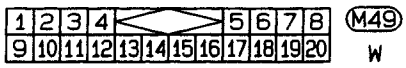
LHD models

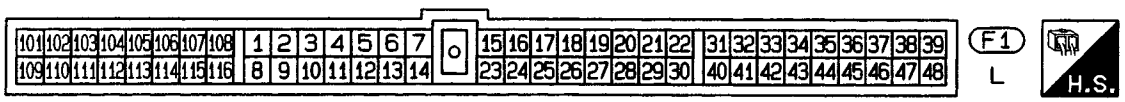
EC-MIL-01











Refer to last page (Foldout page).

M15

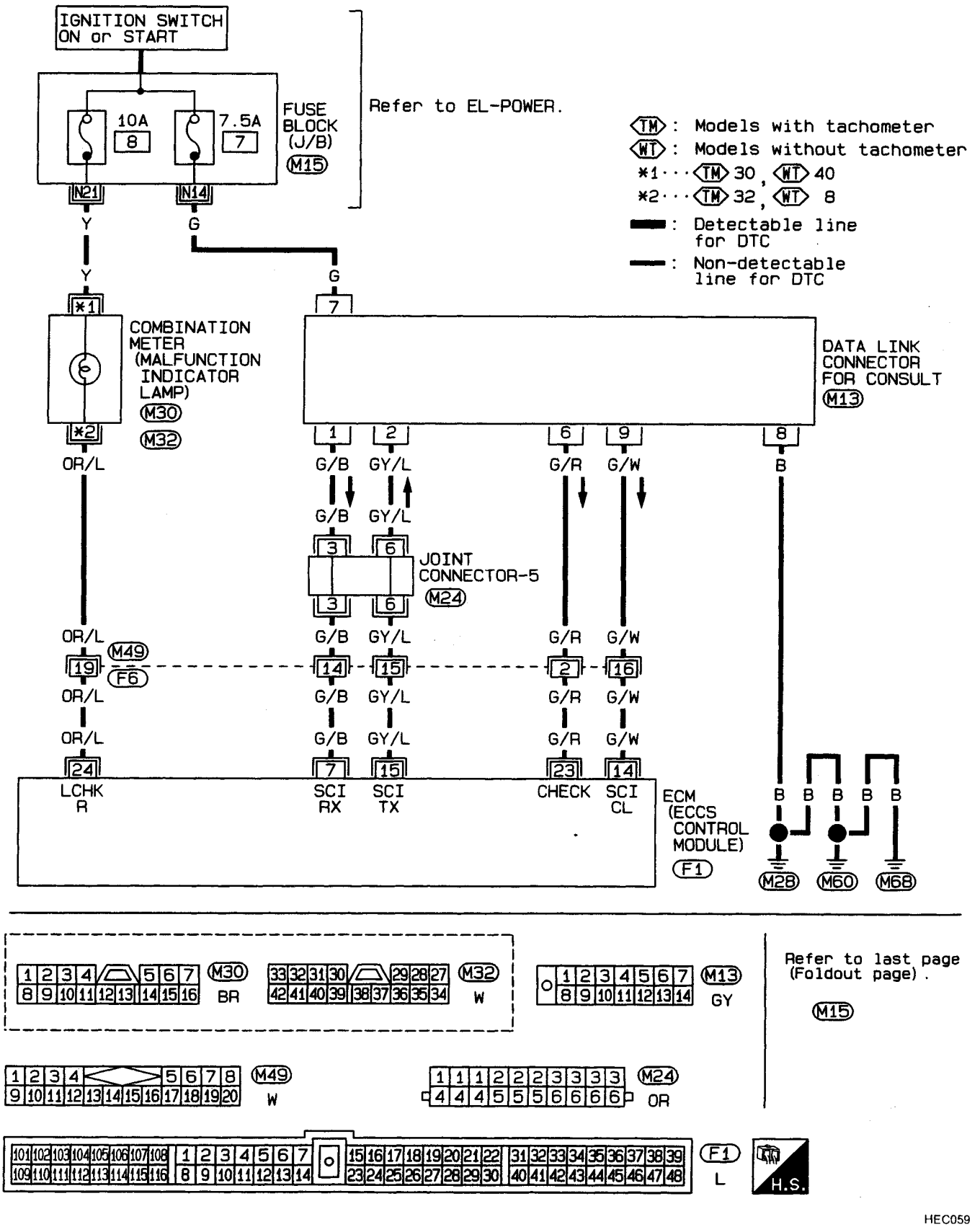
M19

HEC058

MIL & Data Link Connectors (Cont'd)

RHD models

EC-MIL-02



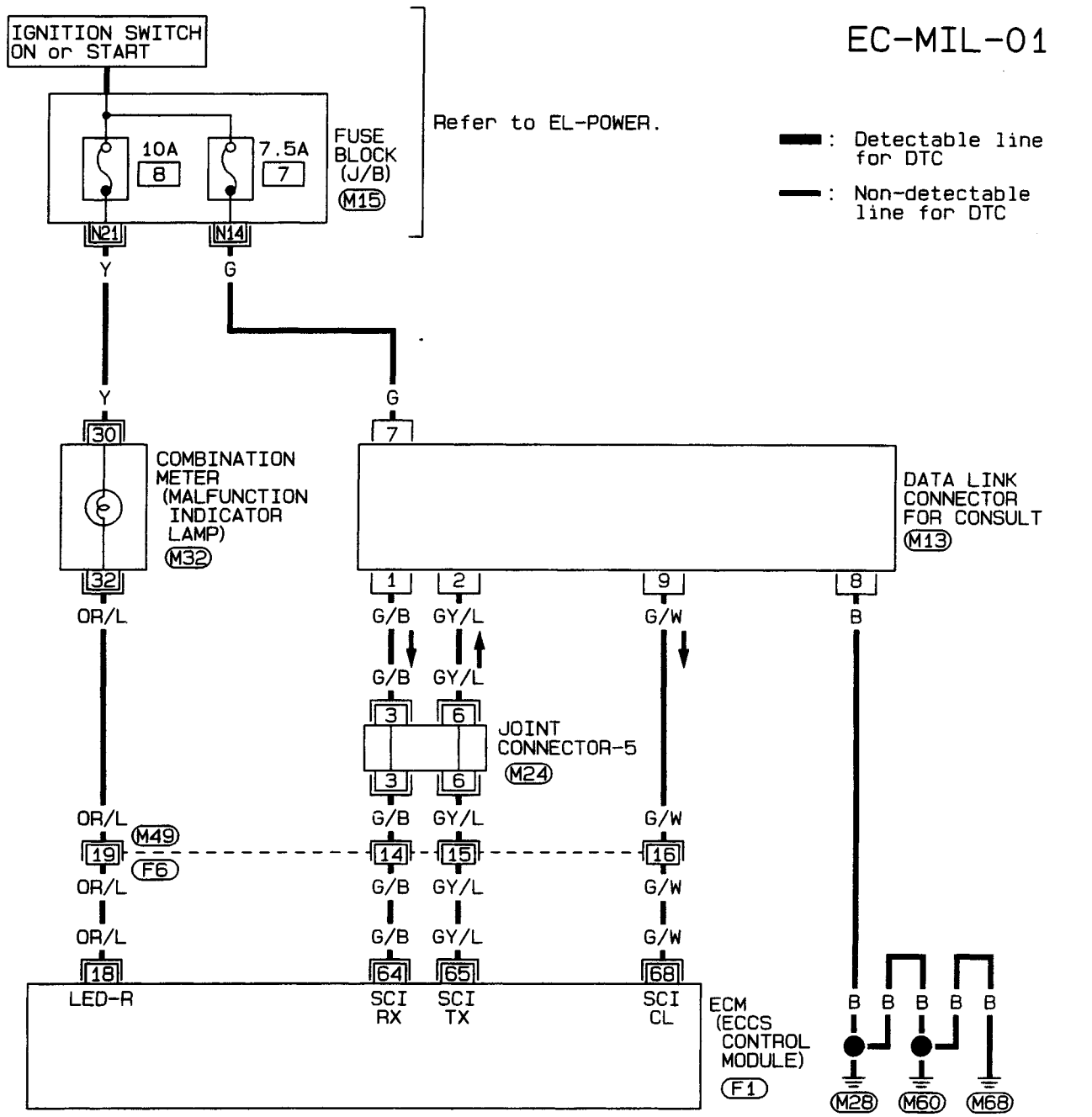
Refer to last page (Foldout page).

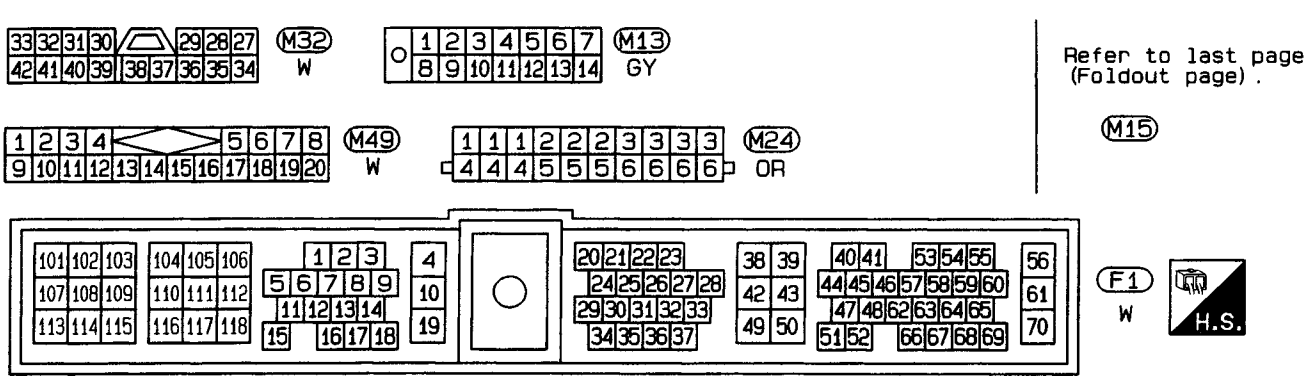
M15

HEC059

MIL & Data Link Connectors (Cont'd)

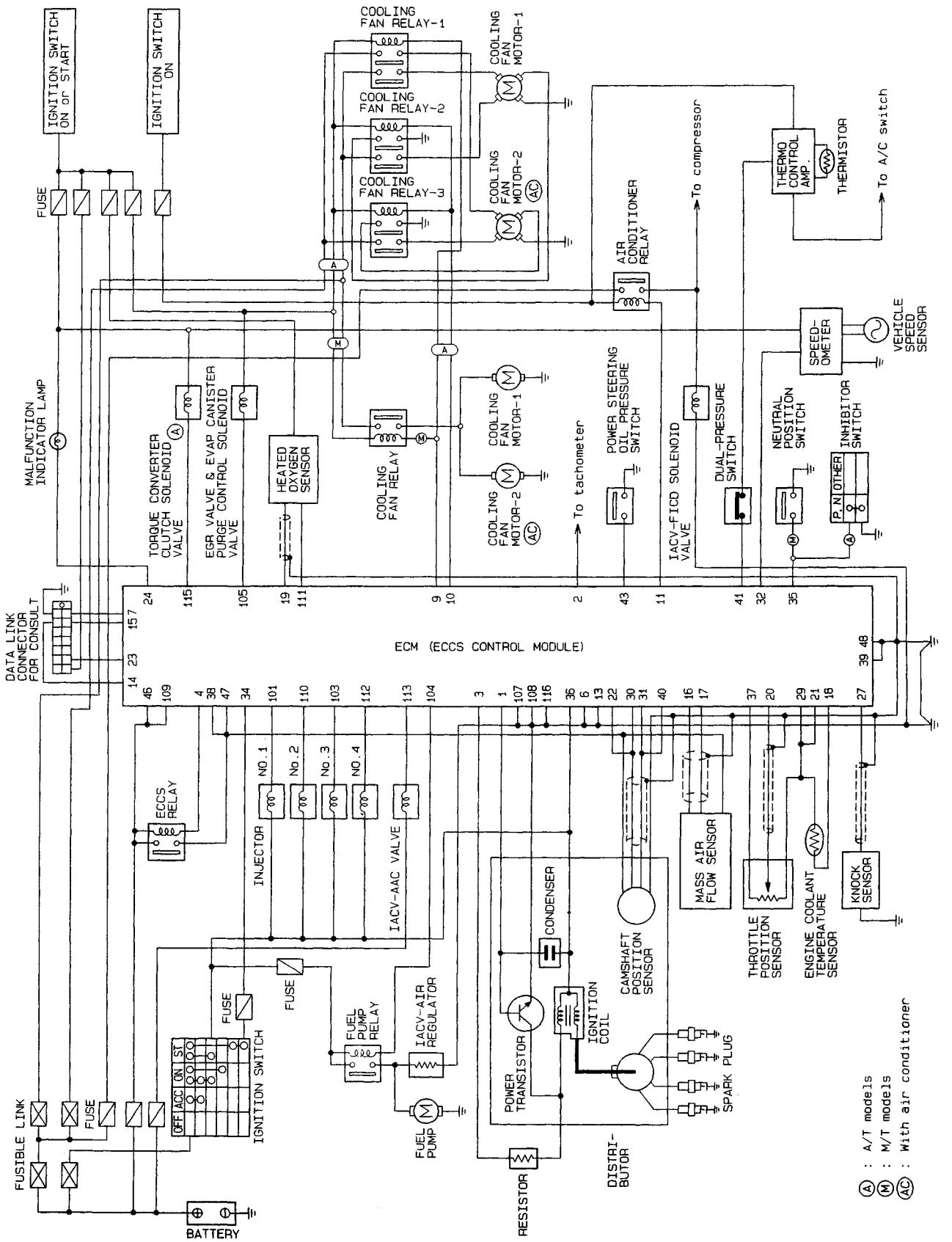
GA16DE for Australia





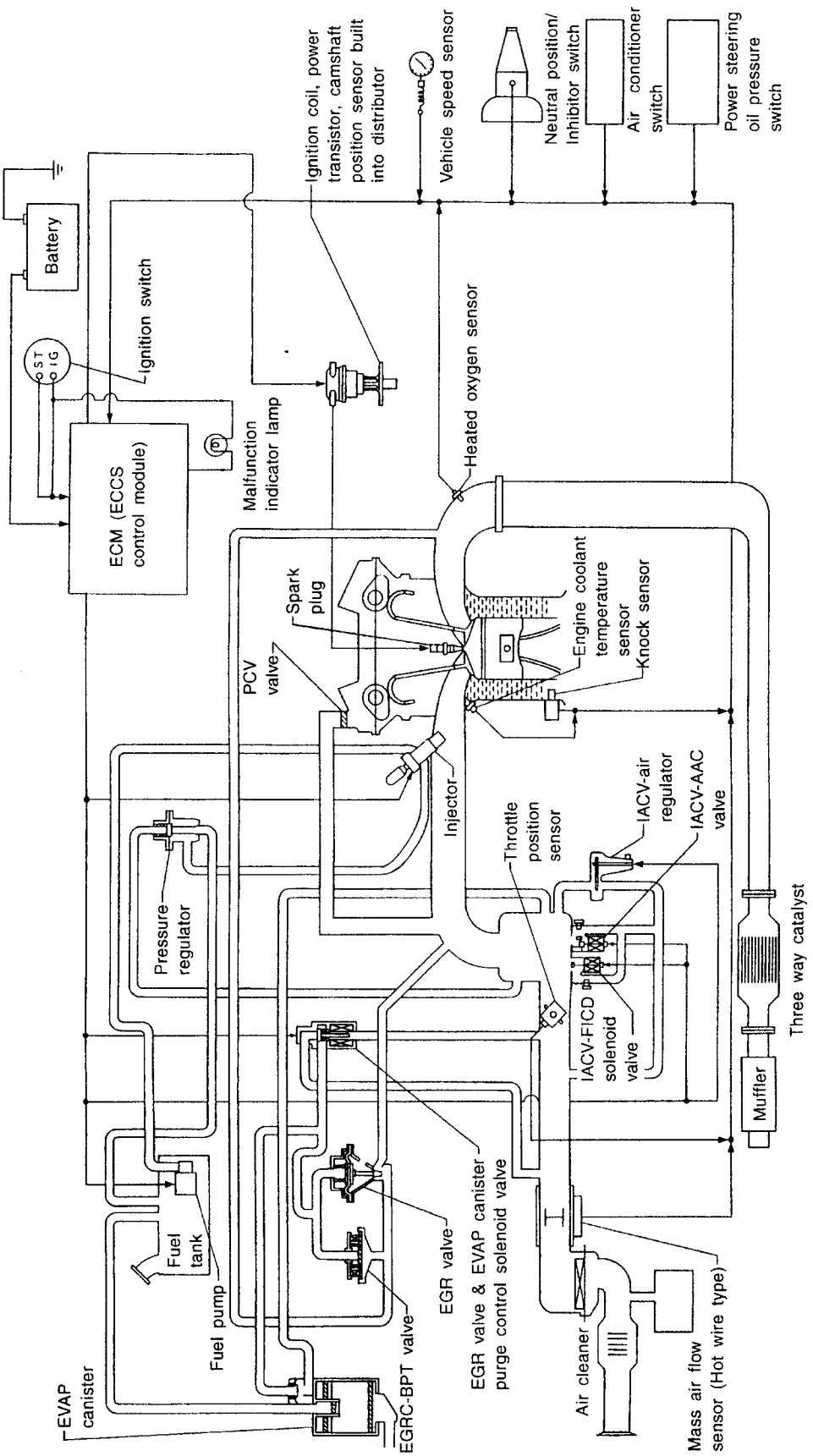
HEC086

Circuit Diagram



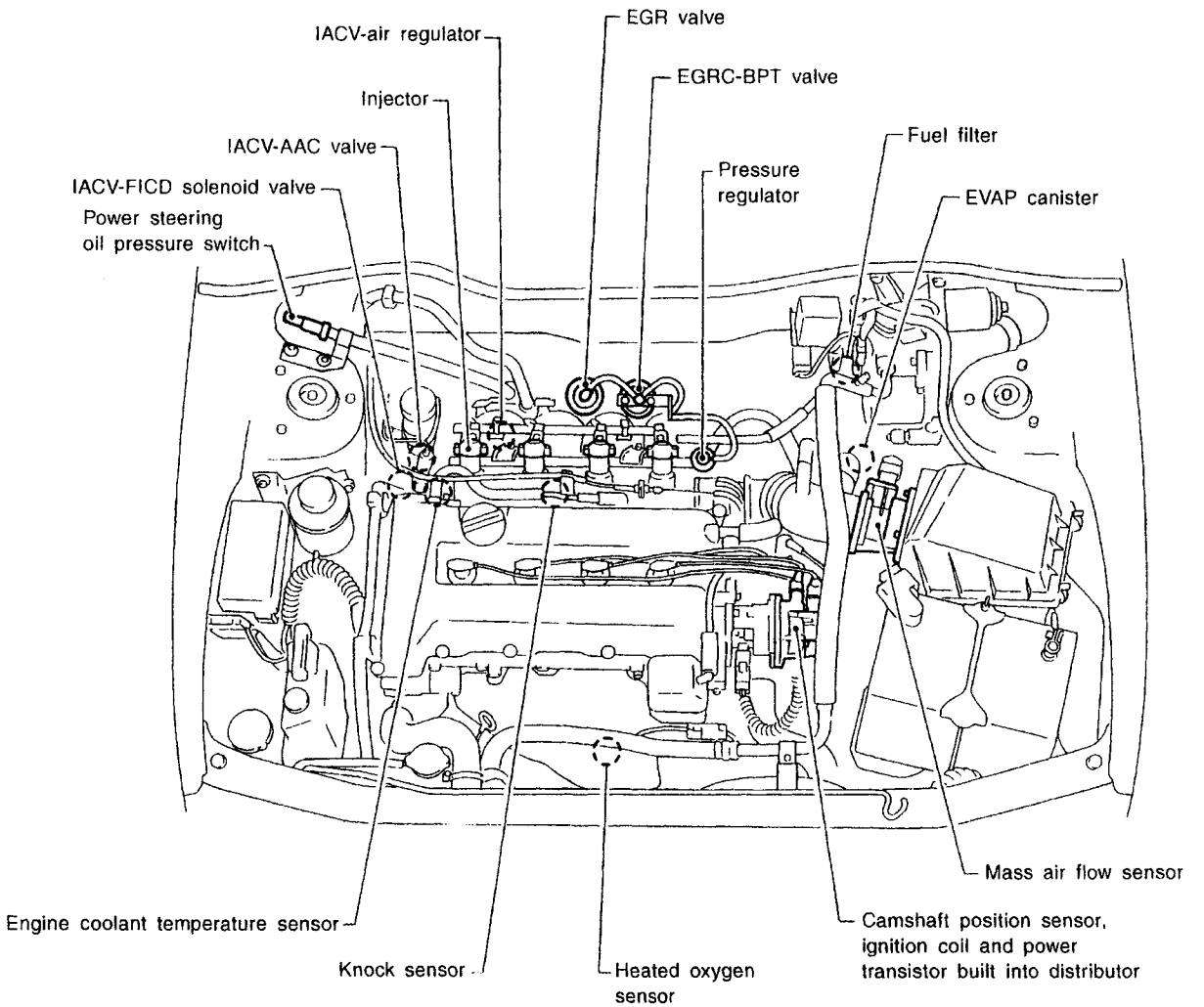
HEC001

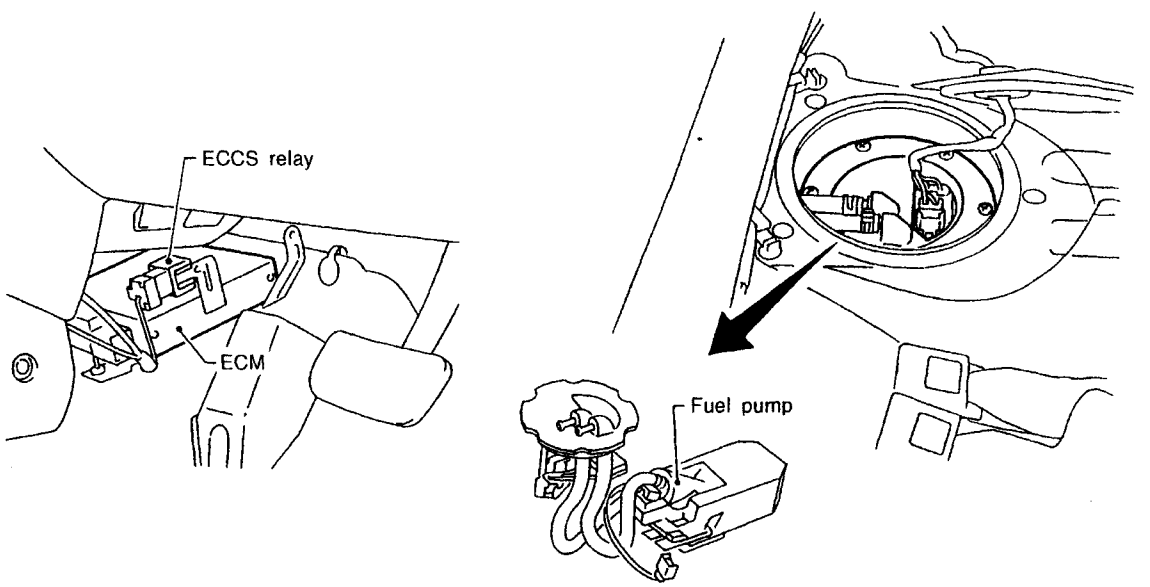
System Diagram



SEF306R

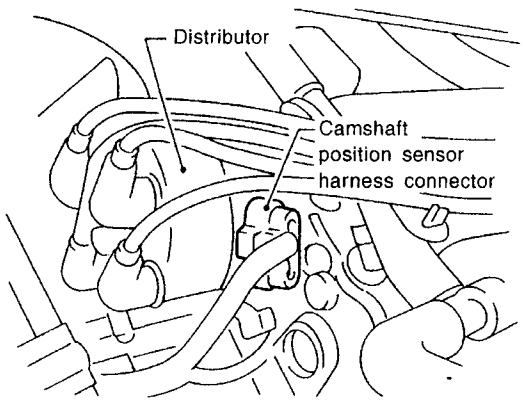
ECCS Component Parts Location

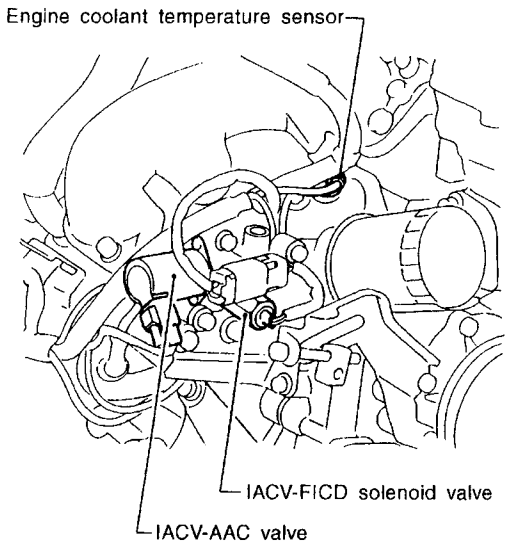


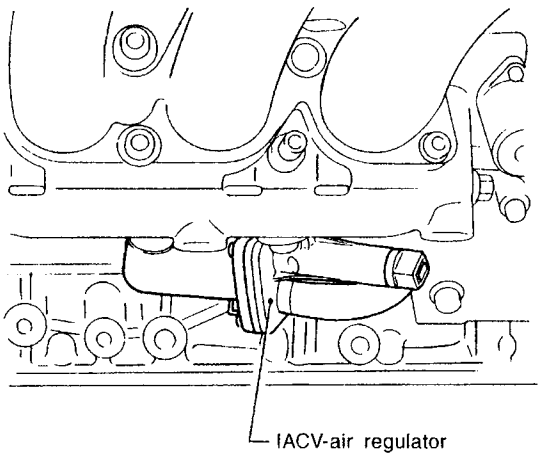


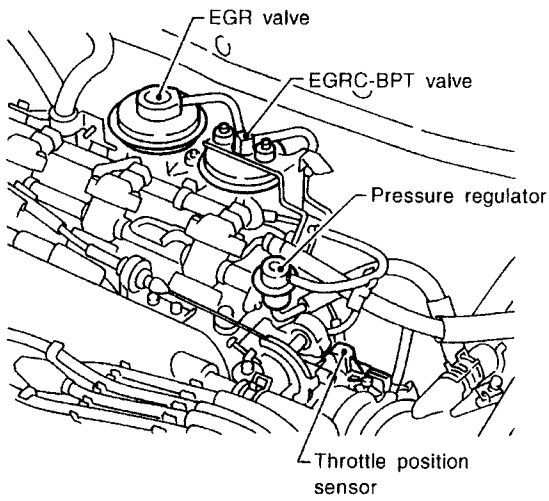
SEF307R

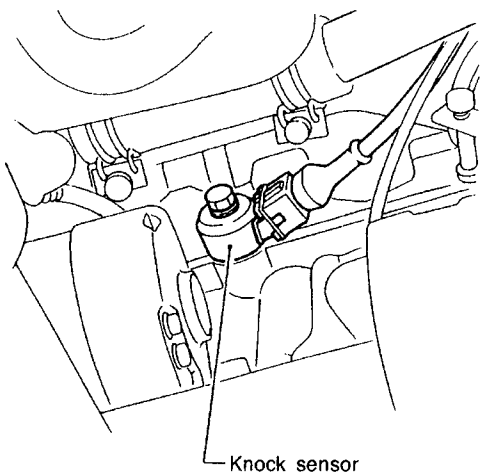
ECCS Component Parts Location (Cont'd)







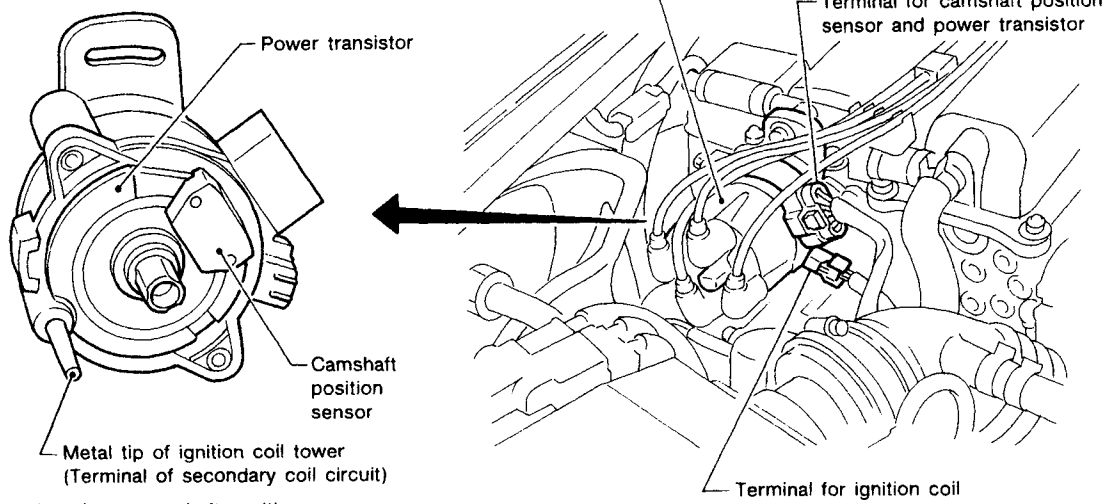




EC

SEF308R

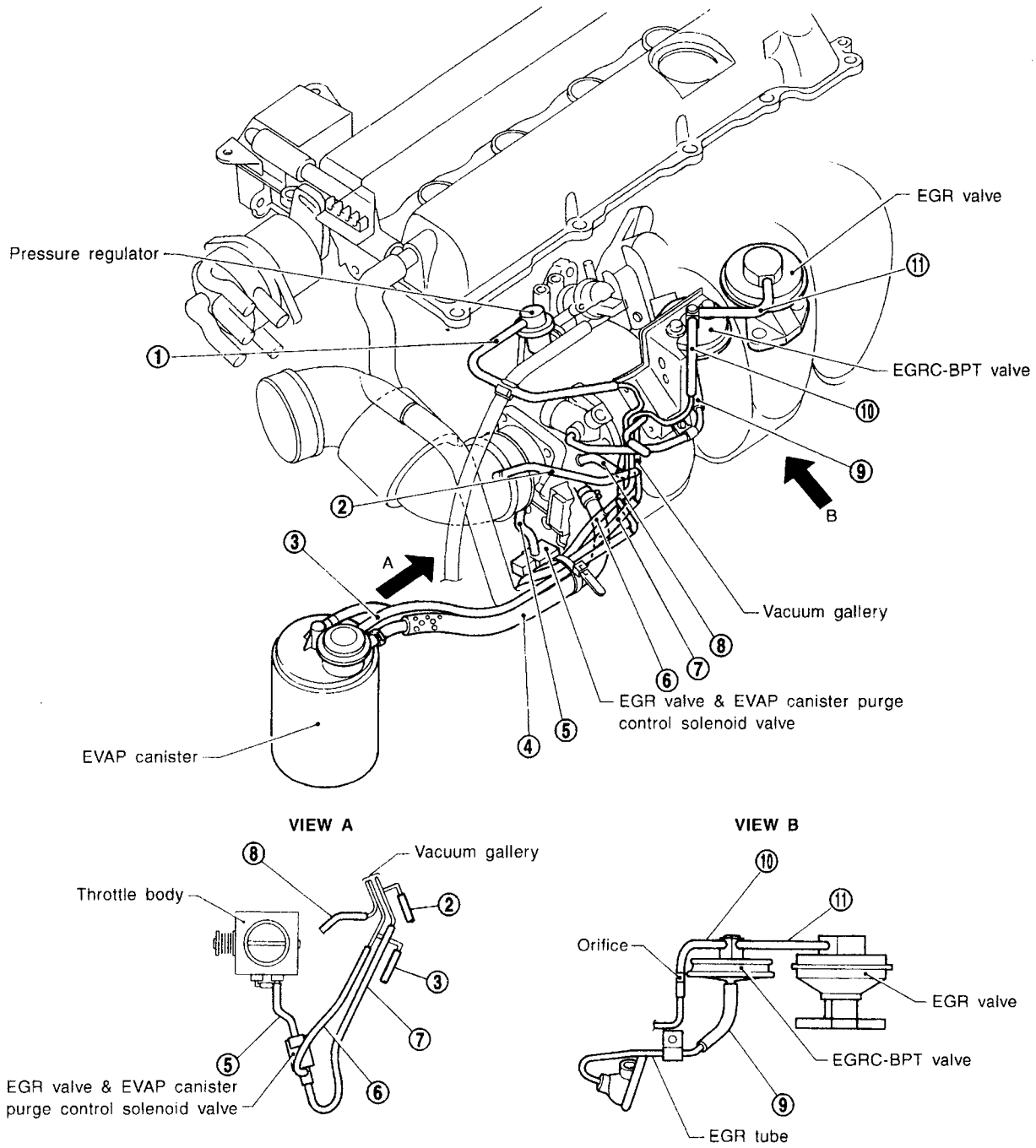
ECCS Component Parts Location (Cont'd)



NOTE: Power transistor, camshaft position sensor, and ignition coil have to be replaced as a distributor assembly.

SEF853NA

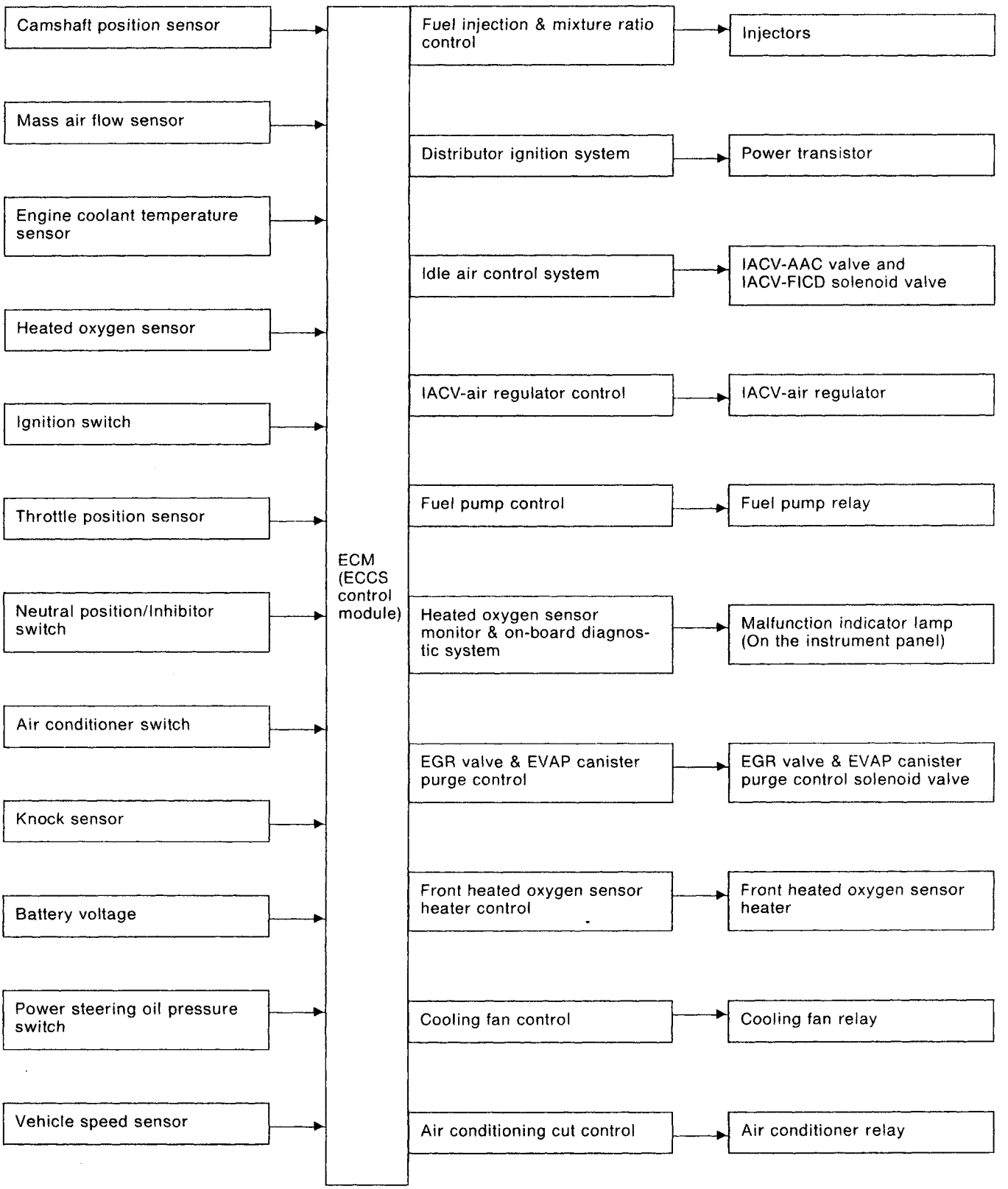
Vacuum Hose Drawing



SEF309R

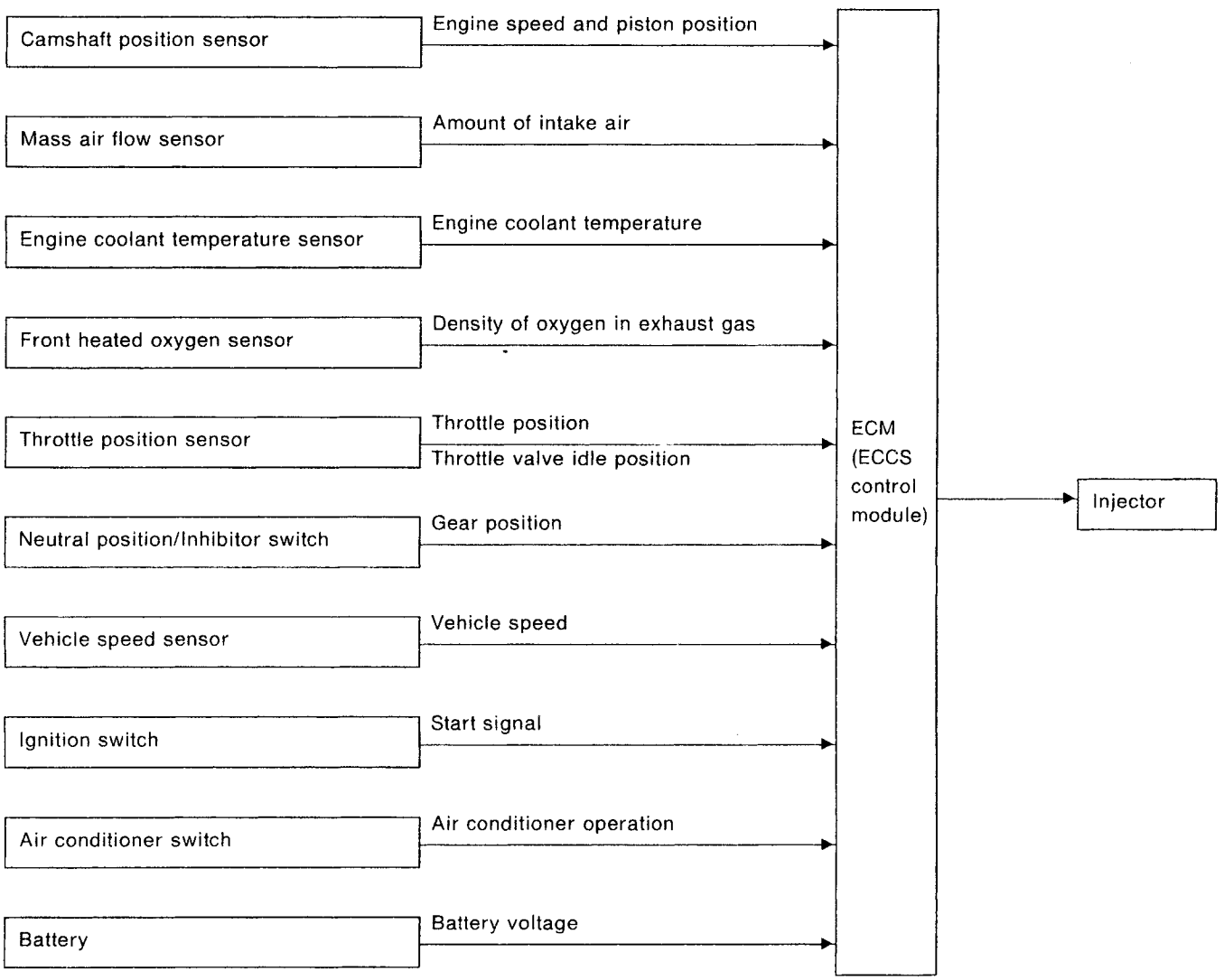
① Pressure regulator to vacuum gallery
② Air duct to vacuum gallery
③ EVAP canister (vacuum line) to vacuum gallery
④ EVAP canister (purge line) to intake manifold collector
⑤ Throttle body to EGR valve & EVAP canister purge control solenoid valve
⑥ EGR valve & EVAP canister purge control solenoid valve to vacuum gallery
⑦ EGR valve & EVAP canister purge control solenoid valve to vacuum gallery
⑧ Intake manifold collector to vacuum gallery
⑨ EGRC-BPT valve to EGR tube
⑩ EGRC-BPT valve to vacuum gallery
⑪ EGR valve to EGRC-BPT valve

System Chart



Multiport Fuel Injection (MFI) System

INPUT/OUTPUT SIGNAL LINE



EC

BASIC MULTIPORT FUEL INJECTION SYSTEM

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

VARIOUS FUEL INJECTION INCREASE/DECREASE COMPENSATION

In addition, the amount of fuel injected is compensated to improve engine performance under various operating conditions as listed below.

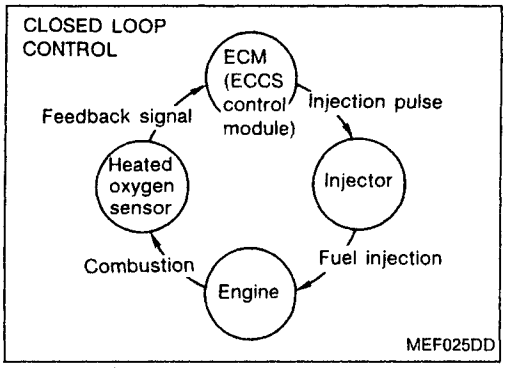
<Fuel increase>

- During warm-up
- When starting the engine
- During acceleration
- Hot-engine operation
- When selector lever is changed from "N" to "D" (A/T models only)
- High-load operation

<Fuel decrease>

- During deceleration

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



MIXTURE RATIO FEEDBACK CONTROL (CLOSED LOOP CONTROL)

The mixture ratio feedback system provides the best air-fuel mixture ratio for driveability and emission control. The three way catalyst can then better reduce CO, HC and NOx emissions. This system uses a heated oxygen sensor in the exhaust manifold to monitor if the engine operation is rich or lean. The ECM adjusts the injection pulse width according to the sensor voltage signal. For more information about the heated oxygen sensor, refer to EC-362. This maintains the mixture ratio within the range of stoichiometric (ideal air-fuel mixture).
This stage is referred to as the closed loop control condition.

OPEN LOOP CONTROL

The open loop system condition refers to when the ECM detects any of the following conditions. Feedback control stops in order to maintain stabilized fuel combustion.

- Deceleration and acceleration
- High-load, high-speed operation
- Engine idling
- Malfunction of heated oxygen sensor or its circuit
- Insufficient activation of heated oxygen sensor at low engine coolant temperature
- High-engine coolant temperature
- After shifting from "N" to "D"
- During warm-up
- When starting the engine

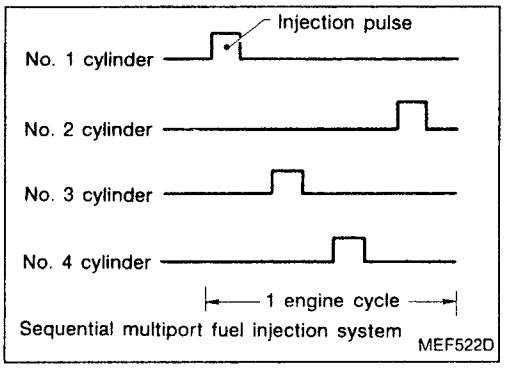
MIXTURE RATIO SELF-LEARNING CONTROL

The mixture ratio feedback control system monitors the mixture ratio signal transmitted from the heated oxygen sensor. This feedback signal is then sent to the ECM. The ECM controls the basic mixture ratio as close to the theoretical mixture ratio as possible. However, the basic mixture ratio is not necessarily controlled as originally designed. Both manufacturing differences (i.e., mass air flow sensor hot wire) and characteristic changes during operation (i.e., injector clogging) directly affect mixture ratio.
Accordingly, the difference between the basic and theoretical mixture ratios is monitored in this system. This is then computed in terms of "injection pulse duration" to automatically compensate for the difference between the two ratios.

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

FUEL INJECTION TIMING

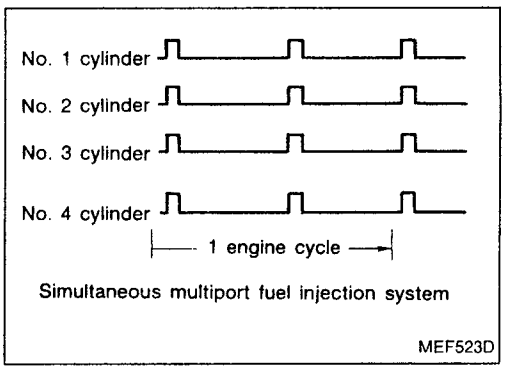
Two types of systems are used.



Sequential multiport fuel injection system
MEF522D

Sequential multiport fuel injection system

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



Simultaneous multiport fuel injection system
MEF523D

Simultaneous multiport fuel injection system

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

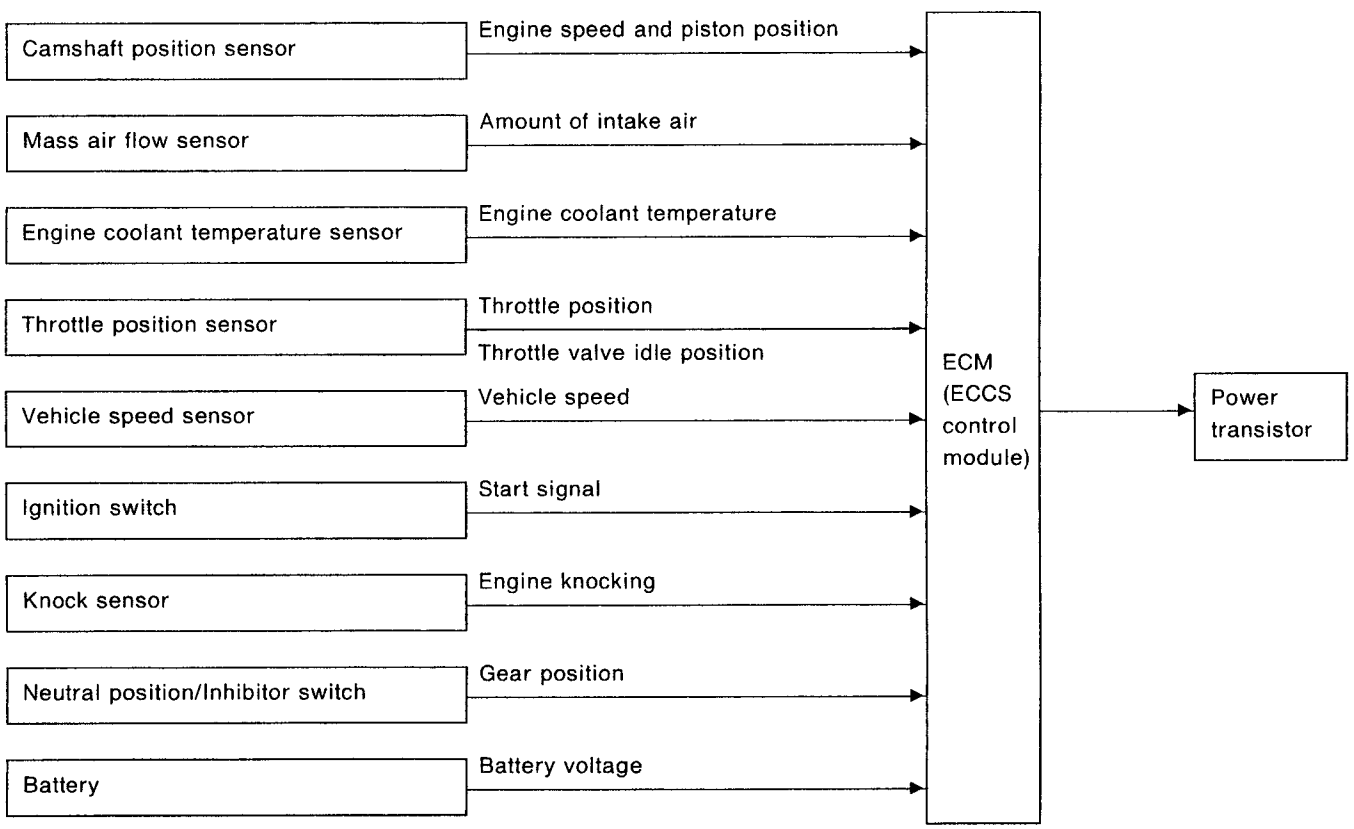
EC

FUEL SHUT-OFF

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

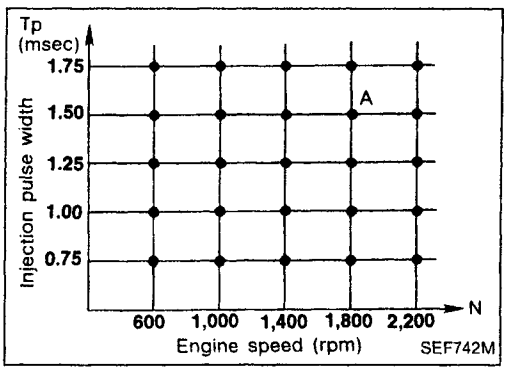
Distributor Ignition (DI) System

INPUT/OUTPUT SIGNAL LINE



Distributor Ignition (DI) System (Cont'd)

SYSTEM DESCRIPTION



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

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

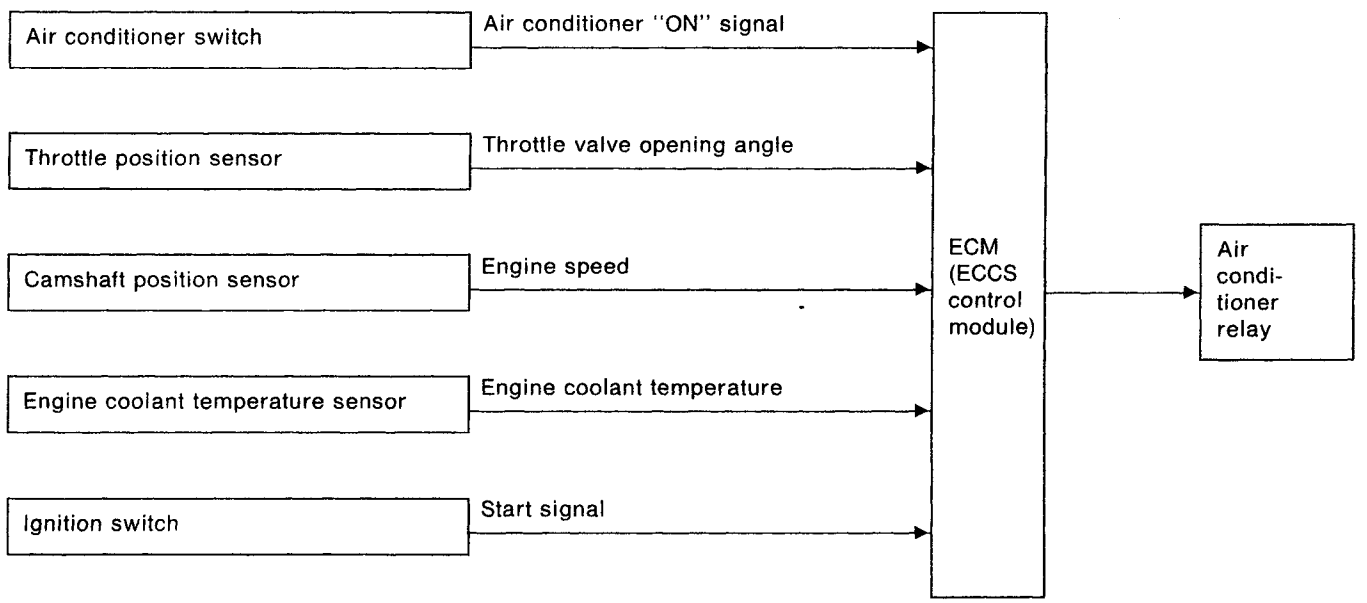
During the following conditions, the ignition timing is revised by the ECM according to the other data stored in the ECM.

- At starting
- During warm-up
- At idle
- Hot engine operation
- During acceleration

The knock sensor retard system is designed only for emergencies. The basic ignition timing is programmed within the anti-knocking zone, if recommended fuel is used under dry conditions. The retard system does not operate under normal driving conditions.
If engine knocking occurs, the knock sensor monitors the condition. The signal is transmitted to the ECM (ECCS control module). The ECM retards the ignition timing to eliminate the knocking condition.

Air Conditioning Cut Control

INPUT/OUTPUT SIGNAL LINE

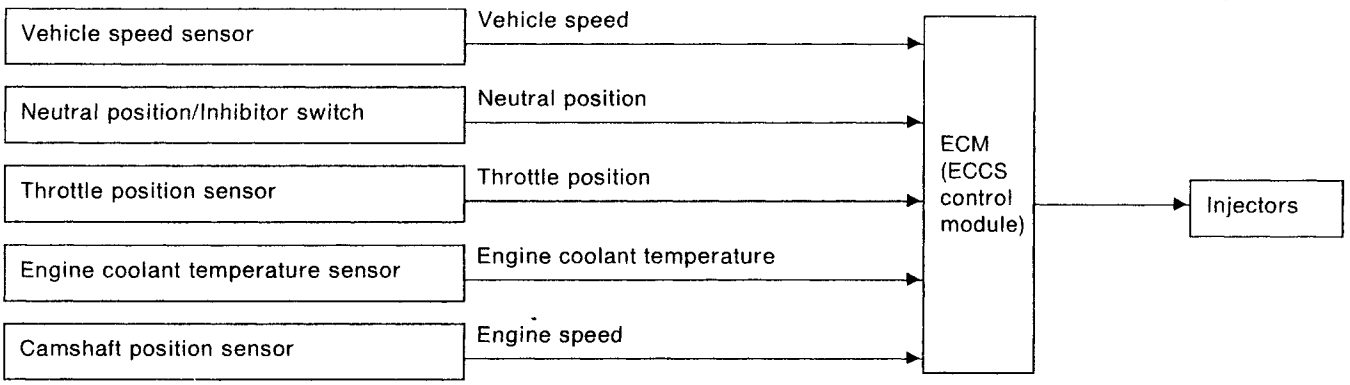


SYSTEM DESCRIPTION

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

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

INPUT/OUTPUT SIGNAL LINE

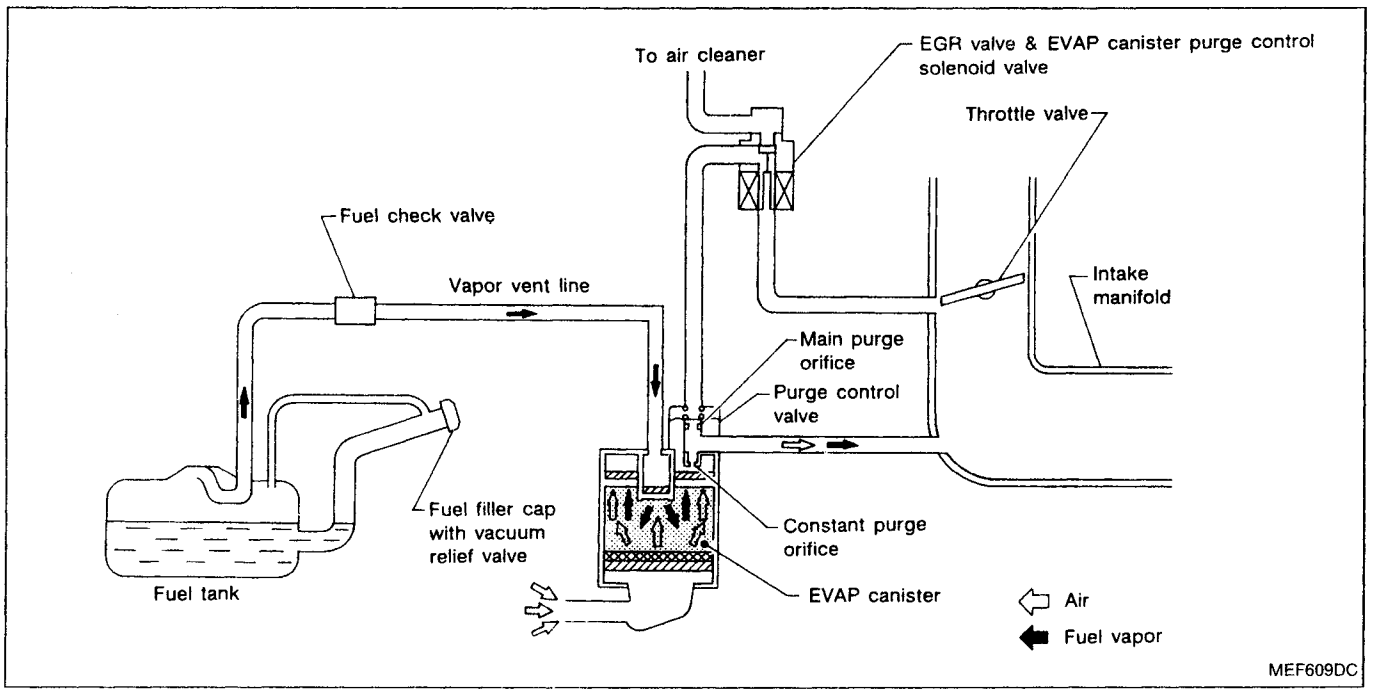


If the engine speed is above 3,950 rpm with no load (for example, in neutral and engine speed over 3,950 rpm) fuel will be cut off after some time. The exact time when the fuel is cut off varies based on engine speed.
Fuel cut will operate until the engine speed reaches 1,150 rpm, then fuel cut is cancelled.

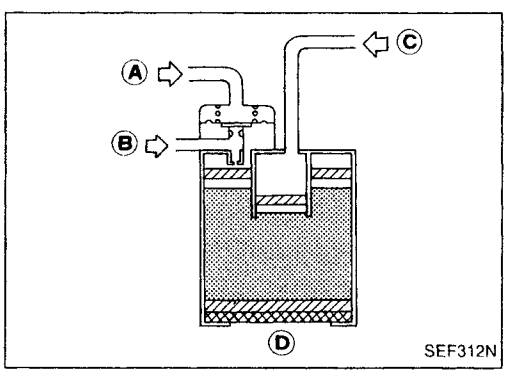
NOTE:
This function is different than deceleration control listed under "Multiport Fuel Injection (MFI) System" on EC-233.

EC

Description



The evaporative emission system is used to reduce hydrocarbons emitted into the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the EVAP canister.
The fuel vapor from sealed fuel tank is led into the EVAP canister when the engine is off. The fuel vapor is then stored in the EVAP canister. The EVAP canister retains the fuel vapor until the EVAP canister is purged by air.
When the engine is running, the air is drawn through the bottom of the EVAP canister. The fuel vapor will then be led to the intake manifold.
When the engine runs at idle, the purge control valve is closed. Only a small amount of vapor flows into the intake manifold through the constant purge orifice.
As the engine speed increases and the throttle vacuum rises, the purge control valve opens. The vapor is sucked through both main purge and constant purge orifices.

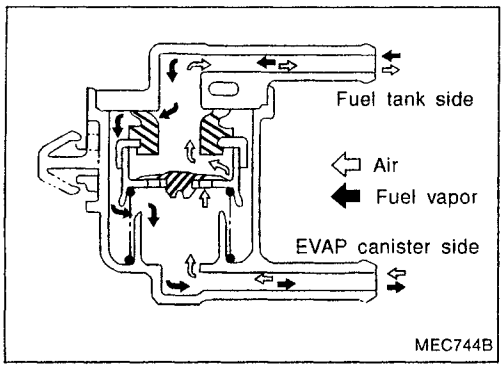


Inspection

EVAP CANISTER

Check EVAP canister as follows:
1. Blow air in port Ⓐ and ensure that there is no leakage.
2.
- Apply vacuum to port Ⓐ. [Approximately –13.3 to –20.0 kPa (–133 to –200 mbar, –100 to –150 mmHg, –3.94 to –5.91 inHg)]
- Cover port Ⓓ with hand.
- Blow air in port Ⓒ and ensure free flow out of port Ⓑ.

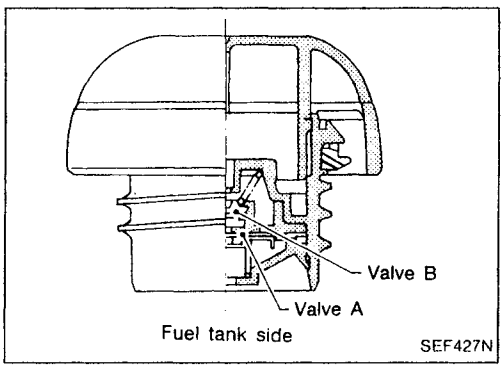
Inspection (Cont'd)



FUEL CHECK VALVE

Check valve operation

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



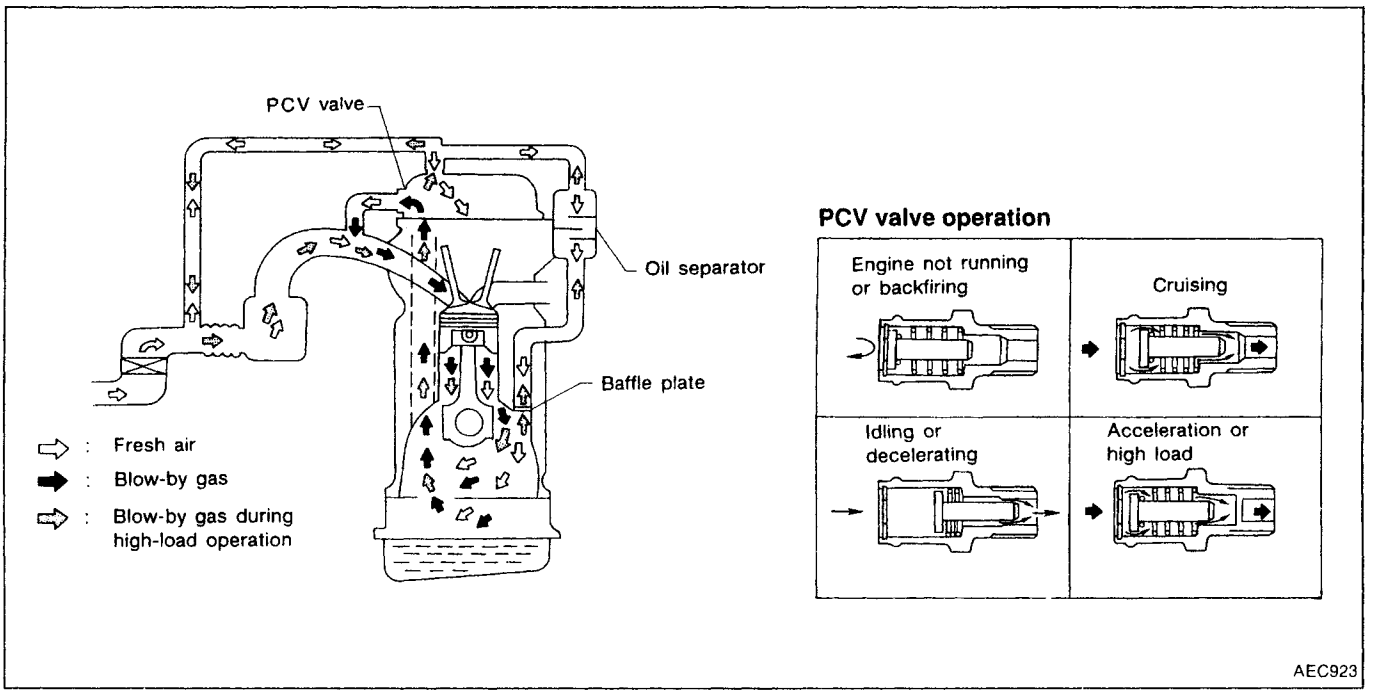
FUEL TANK VACUUM RELIEF VALVE

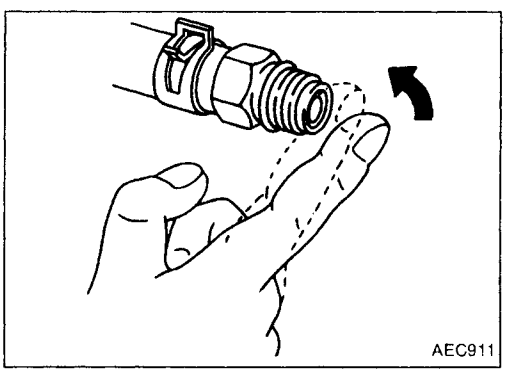
1. Wipe clean valve housing.
2. Suck air through the cap. A slight resistance accompanied by valve clicks indicates that valve A is in good mechanical condition. Note also that, by further sucking air, the resistance should disappear with valve clicks.
3. Blow air on fuel tank side and ensure that continuity of air passage exists through valve B.
4. If valve is clogged or if no resistance is felt, replace cap as an assembly.

EC

Description

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

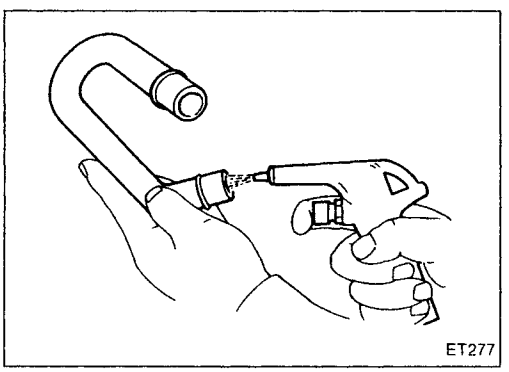




Inspection

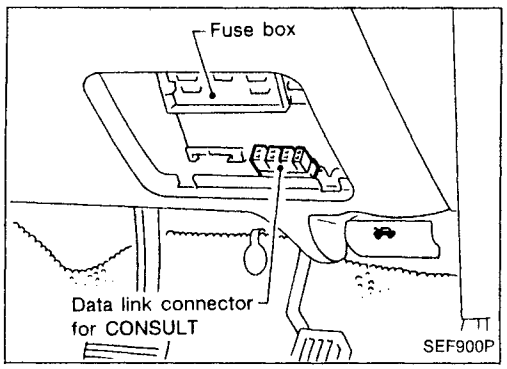
PCV (Positive Crankcase Ventilation)

With engine running at idle, remove PCV valve from rocker cover. A properly working valve makes a hissing noise as air passes through it. A strong vacuum should be felt immediately when a finger is placed over the valve inlet.



VENTILATION HOSE

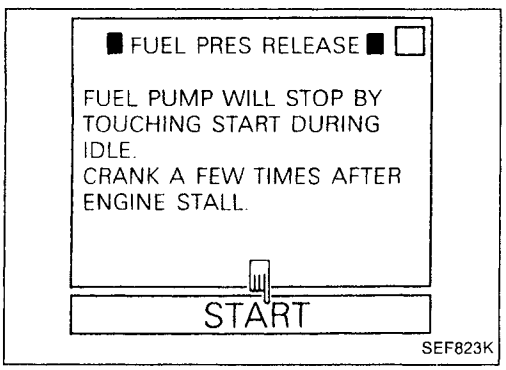
1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air. If any hose cannot be freed of obstructions, replace.

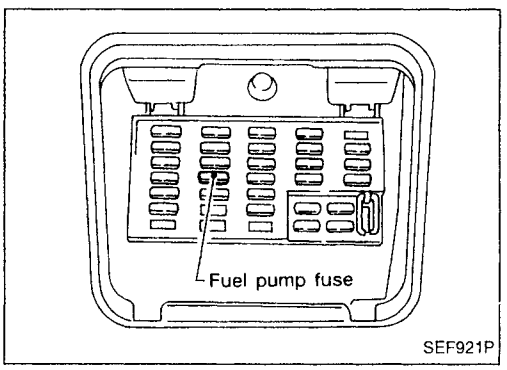


Fuel Pressure Release

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

1. Turn ignition switch "ON".
2. Perform "FUEL PRESSURE RELEASE" in "WORK SUPPORT" mode with CONSULT.
3. Start engine.
4. After engine stalls, crank it two or three times to release all fuel pressure.
5. Turn ignition switch "OFF".



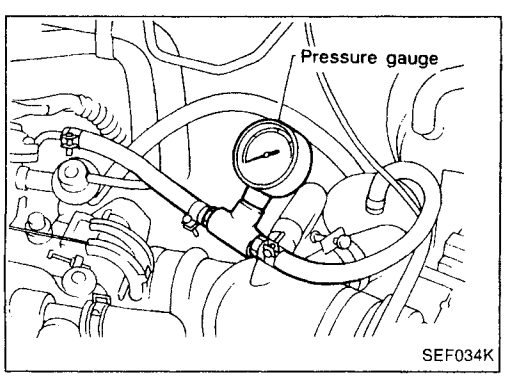


1. Remove fuse for fuel pump.
2. Start engine.
3. After engine stalls, crank it two or three times to release all fuel pressure.
4. Turn ignition switch off and reconnect fuel pump fuse.

Fuel Pressure Check

- **When reconnecting fuel line, always use new clamps.**
- **Make sure that clamp screw does not contact adjacent parts.**
- **Use a torque driver to tighten clamps.**
- **Use Pressure Gauge to check fuel pressure.**
- **Do not perform fuel pressure check with system operating. Fuel pressure gauge may indicate false readings.**

1. Release fuel pressure to zero.
2. Disconnect fuel hose between fuel filter and fuel tube (engine side).
3. Install pressure gauge between fuel filter and fuel tube.
4. Start engine and check for fuel leakage.
5. Read the indication of fuel pressure gauge.



At idling:

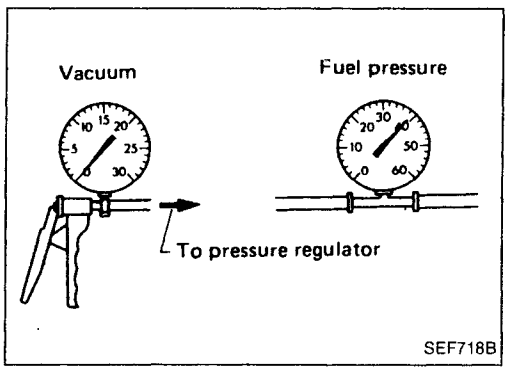
With vacuum hose connected

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

With vacuum hose disconnected

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

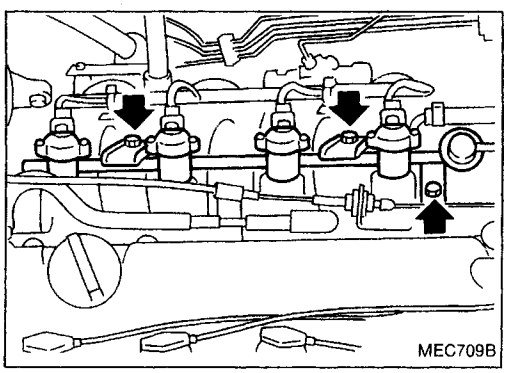
If results are unsatisfactory, perform Fuel Pressure Regulator Check.



Fuel Pressure Regulator Check

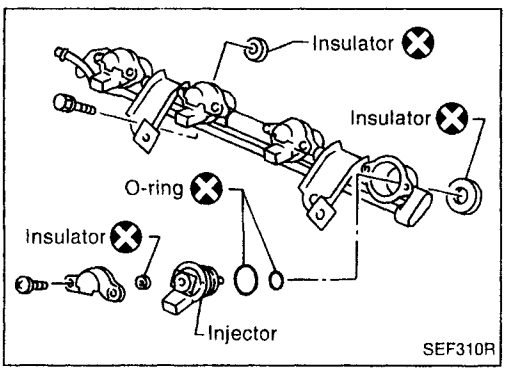
1. Stop engine and disconnect fuel pressure regulator vacuum hose from intake manifold.
2. Plug intake manifold with a rubber cap.
3. Connect variable vacuum source to fuel pressure regulator.
4. Start engine and read indication of fuel pressure gauge as vacuum is changed.

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

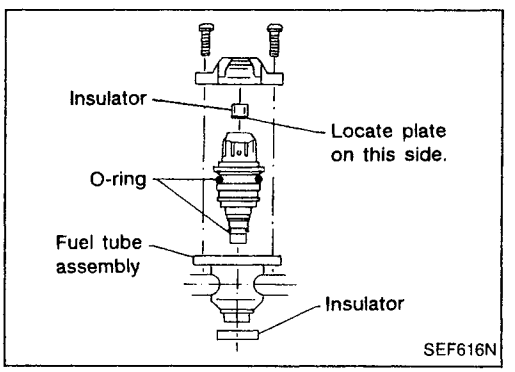


Injector Removal and Installation

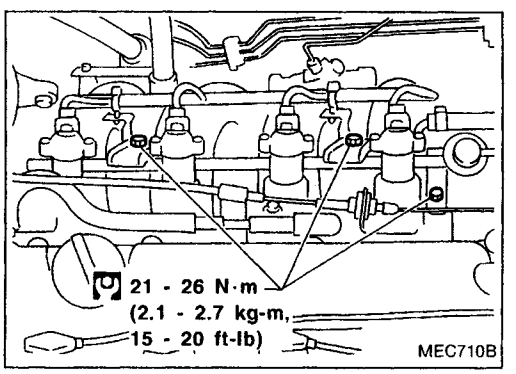
1. Release fuel pressure to zero.
2. Disconnect vacuum hose from pressure regulator.
3. Disconnect fuel hoses from fuel tube assembly.
4. Disconnect injector harness connectors.
5. Remove injectors with fuel tube assembly.



- Push injector tail piece.
- Do not pull on the connector.



6. Install injectors.
- Clean exterior of injector tail piece.
- Use new O-rings.



7. Install injectors with fuel tube assembly to intake manifold.
8. Install fuel hoses to fuel tube assembly.
9. Reinstall any parts removed in reverse order of removal.

CAUTION:

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

Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment

PREPARATION

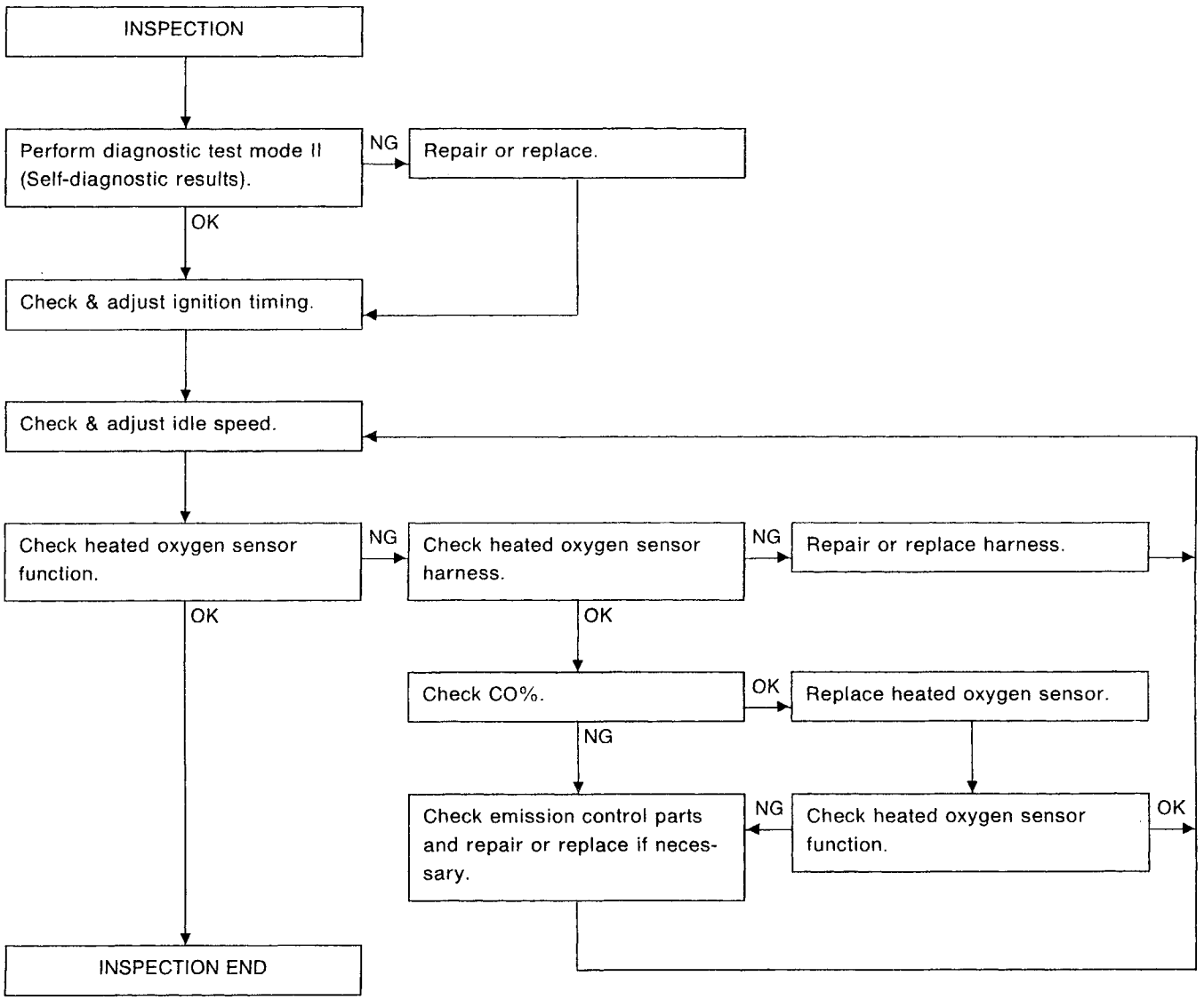
- Make sure that the following parts are in good order.

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

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

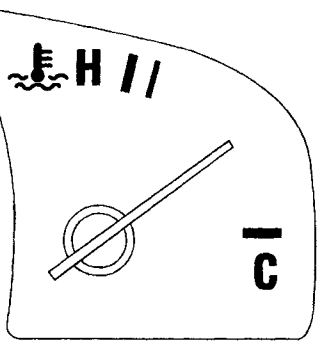
EC

Overall inspection sequence



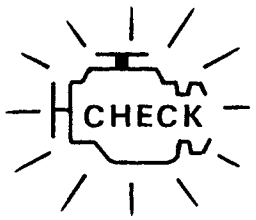
Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

A



SEF455Q

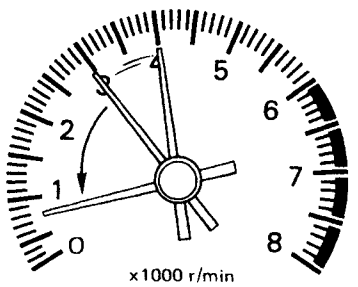
B



Malfunction indicator lamp

SEF051PA

C



SEF248F

D

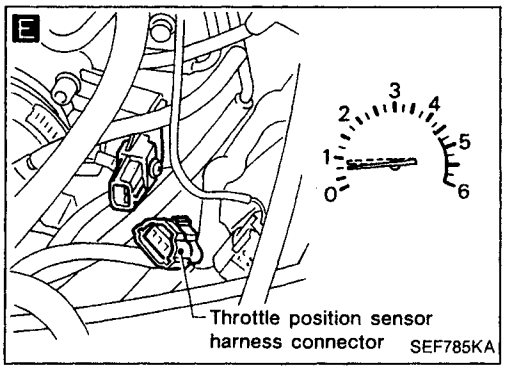
■ IGN TIMING ADJ ■ □

IGNITION TIMING FEEDBACK CONTROL WILL BE HELD BY TOUCHING START.
AFTER DOING SO, ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CAMSHAFT POSITION SENSOR.

START

SEF546N

E



SEF785KA

START

Visually check the following:
- Air cleaner clogging
- Hoses and duct for leaks
- Electrical connectors
- Gasket (intake manifold, cylinder head, exhaust system)
- Throttle valve and throttle position sensor operation

A

Start engine and warm it up until engine coolant temperature indicator points to the middle of gauge.
Ensure engine speed stays below 1,000 rpm.

Open engine hood and run engine at about 2,000 rpm for about 2 minutes under no-load.

B

Perform the Diagnostic Test Mode II (Self-diagnostic results).

OK

NG

Repair or replace components as necessary.

C

Run engine at about 2,000 rpm for about 2 minutes under no-load.
Rev engine two or three times under no-load, then run engine at idle speed for about 1 minute.

D E

1. Select "IGNITION TIMING ADJ" in WORK SUPPORT mode.
2. Touch "START".

OR

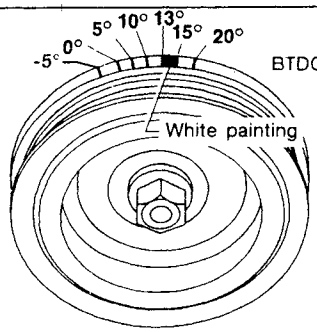
1. Turn off engine and disconnect throttle position sensor harness connector.
2. Start engine.

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

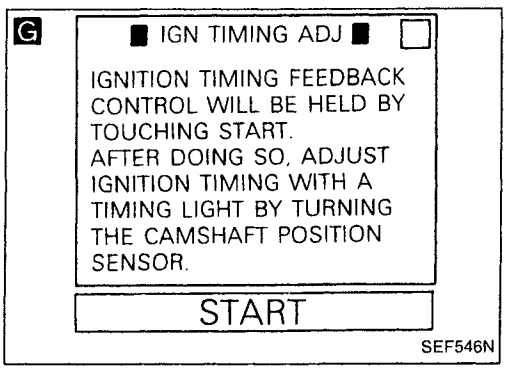
Ⓐ

Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

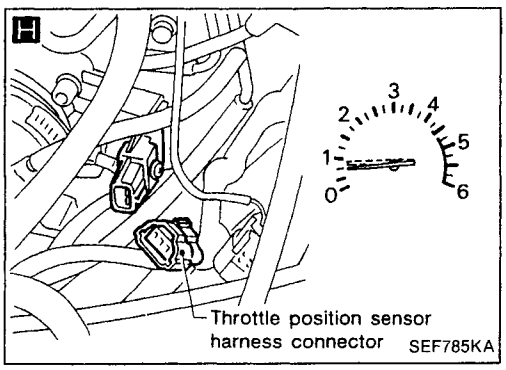
F



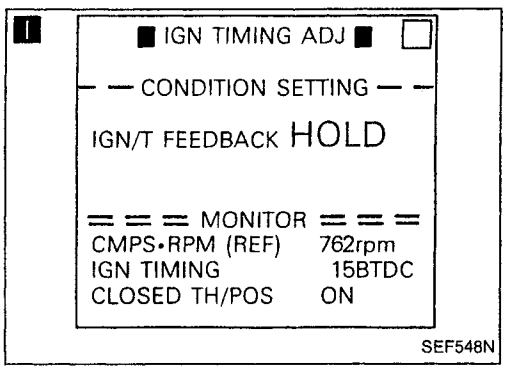
G



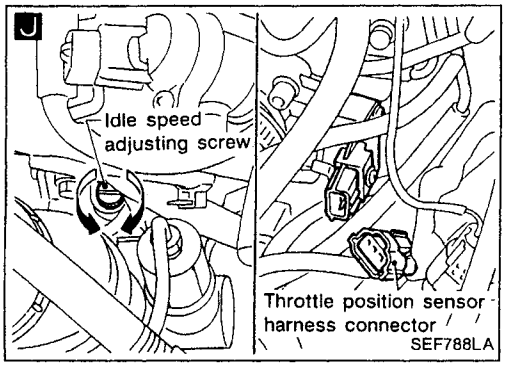
H



I



J



Ⓐ

F

Check ignition timing with a timing light.

M/T: 15° ± 2° BTDC
A/T: 15° ± 2° BTDC (in "N" position)

NG

Adjust ignition timing to the specified value by turning distributor after loosening bolts which secure distributor.

M/T: 15° ± 2° BTDC
A/T: 15° ± 2° BTDC (in "N" position)

Ⓑ

G H

1. Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. Touch "START".

OR

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

I

Check idle speed.

Read idle speed in "IGN TIMING ADJ" in "WORK SUPPORT" mode.

OR

Check idle speed.

M/T: 750 ± 50 rpm
A/T: 750 ± 50 rpm (in "N" position)

OK

NG

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

J

Adjust idle speed by turning idle speed adjusting screw.

M/T: 750 ± 50 rpm
A/T: 750 ± 50 rpm (in "N" position)

K

Touch "BACK".

OR

1. Turn off engine and connect throttle position sensor harness connector.
2. Start engine.

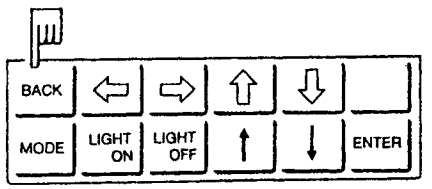
Rev engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle speed.

Ⓒ

EC

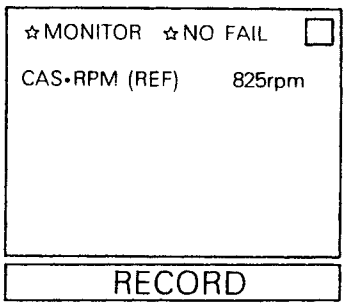
Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

K



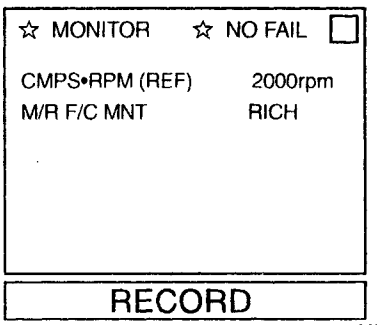
SEF913J

L



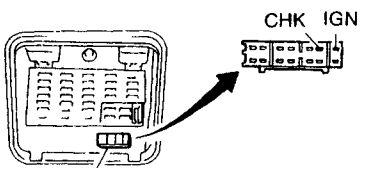
SEF135K

M



MEC711B

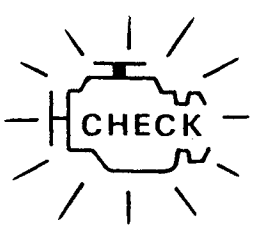
N



Data link connector for CONSULT (Connect CHK and IGN terminals with a suitable harness.)

SEF909P

O



SEF051P

Ⓒ

L

Check idle speed.

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

OR

Check idle speed.

M/T: 800 ± 50 rpm
A/T: 800 ± 50 rpm (in "N" position)

OK

NG

Check IACV-AAC valve and replace if necessary.

Check IACV-AAC valve harness and repair if necessary.

Check ECM function* by substituting another known good ECM.

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

M N O

1. See "M/R F/C MNT" in "DATA MONITOR" mode.
2. Run engine at about 2,000 rpm for about 2 minutes under no-load.
3. Maintain engine at 2,000 rpm under no-load (engine is warmed up sufficiently). Check that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.
   1 cycle: RICH → LEAN → RICH
   2 cycles: RICH → LEAN → RICH → LEAN → RICH

OR

1. Set "Heated oxygen sensor monitor" in the Diagnostic Test Mode II. (See page EC-252.)
2. Run engine at about 2,000 rpm for about 2 minutes under no-load.
3. Maintain engine at 2,000 rpm under no-load. Check that the malfunction indicator lamp goes on and off more than 5 times during 10 seconds.

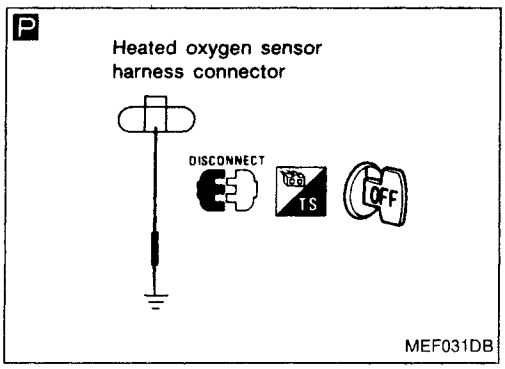
NG → Ⓓ

OK

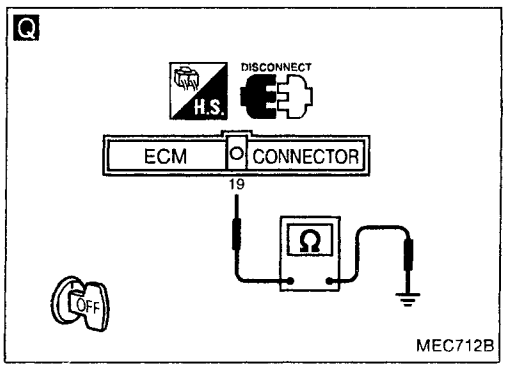
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Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

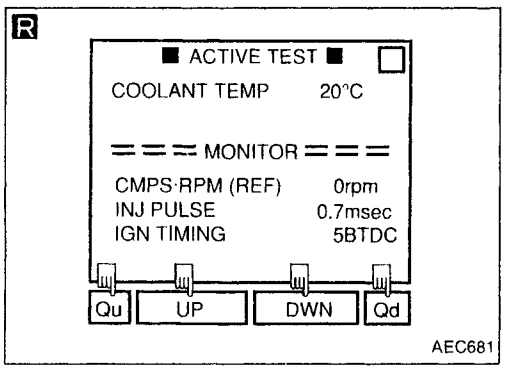
P



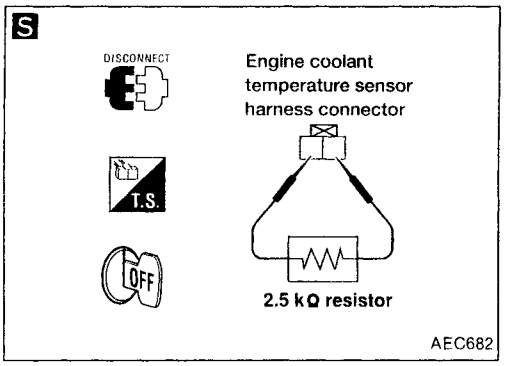
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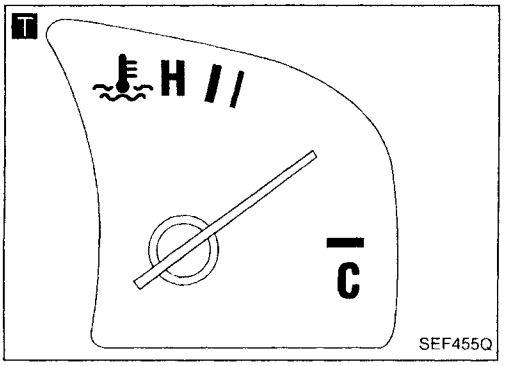
R



S



T



Ⓓ

P Q

Check heated oxygen sensor harness:
1. Turn off engine and disconnect battery ground cable.
2. Disconnect ECM harness connector from ECM.
3. Disconnect heated oxygen sensor harness connector. Then connect harness side terminal for heated oxygen sensor to ground with a jumper wire.
4. Check for continuity between terminal ⑲ of ECM harness connector and body ground.

Continuity exists .....OK
Continuity does not exist.....NG

OK / NG

Repair or replace harness. → Ⓑ

Connect ECM harness connector to ECM.

R S

1. Connect battery ground cable.
2. Select "ENG COOLANT TEMP" in "ACTIVE TEST" mode.
3. Set "COOLANT TEMP" to 20°C (68°F) by touching "Qu" and "Qd" and "UP", "DWN".

OR

1. Disconnect engine coolant temperature sensor harness connector.
2. Connect a resistor (2.5 kΩ) between terminals of engine coolant temperature sensor harness connector.
3. Connect battery ground cable.

T

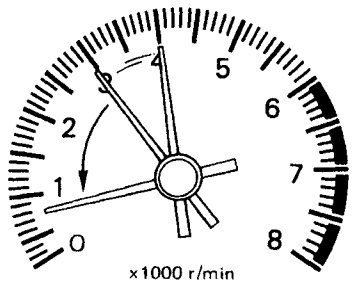
Start engine and warm it up until engine coolant temperature indicator points to middle of gauge. (Be sure to start engine after setting "COOLANT TEMP" or installing a 2.5 kΩ resistor.)

Ⓔ

EC

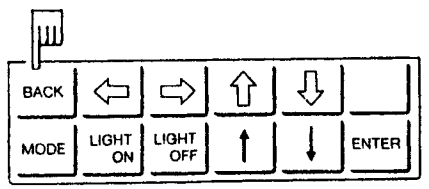
Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)

U



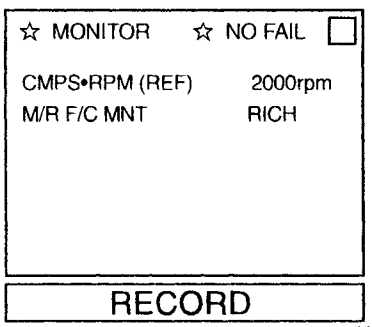
SEF248F

V



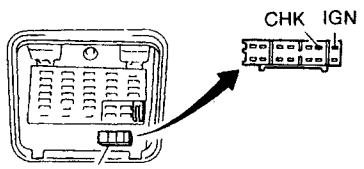
SEF913J

W



MEC711B

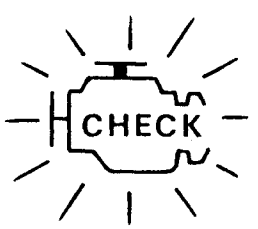
X



Data link connector for CONSULT (Connect CHK and IGN terminals with a suitable harness.)

SEF909P

Y



SEF051P

Ⓔ

U

Rev engine two or three times under no-load, then run engine at idle speed.

V

Check "CO"%.

Idle CO: Less than 10% and engine runs smoothly.

After checking CO%,

1. Touch "BACK".

OR

1. Disconnect the resistor from terminals of engine coolant temperature sensor harness connector.
2. Connect engine coolant temperature sensor harness connector to engine coolant temperature sensor.

NG

OK

Replace heated oxygen sensor.

W X Y

1. See "M/R F/C MNT" in "Data monitor" mode.
2. Maintain engine at 2,000 rpm under no-load (engine is warmed up sufficiently.). Check that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.
   1 cycle: RICH → LEAN → RICH
   2 cycles: RICH → LEAN → RICH → LEAN → RICH

OR

1. Set "Heated oxygen sensor monitor" in the Diagnostic Test Mode II. (Refer to EC-253.)
2. Maintain engine at 2,000 rpm under no-load. Check that the malfunction indicator lamp goes ON and OFF more than 5 times during 10 seconds.

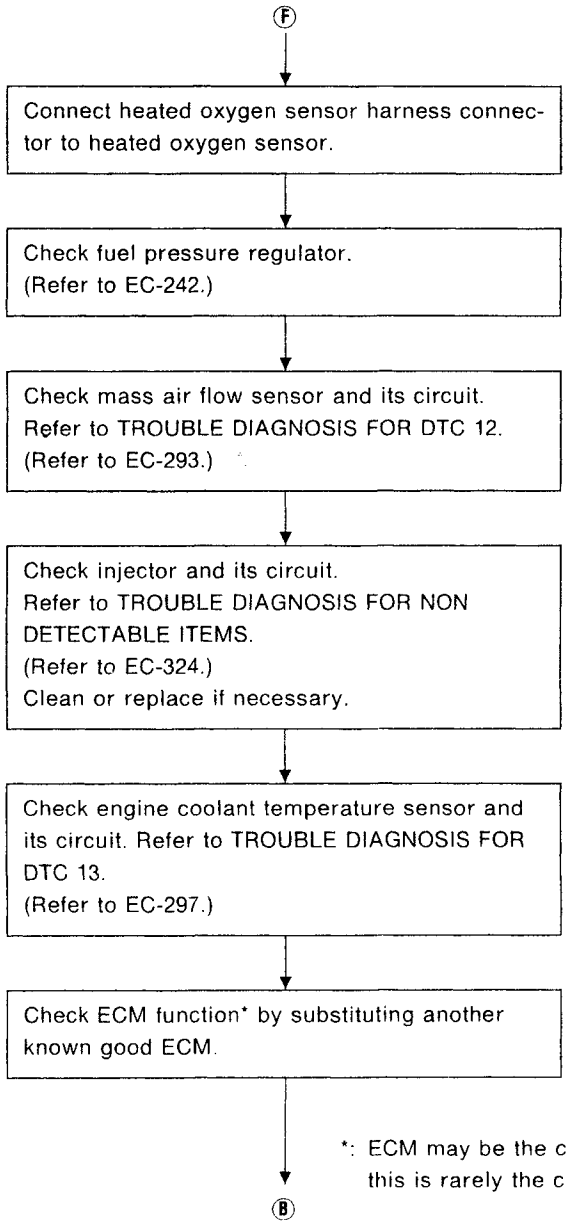
NG

OK

Ⓕ

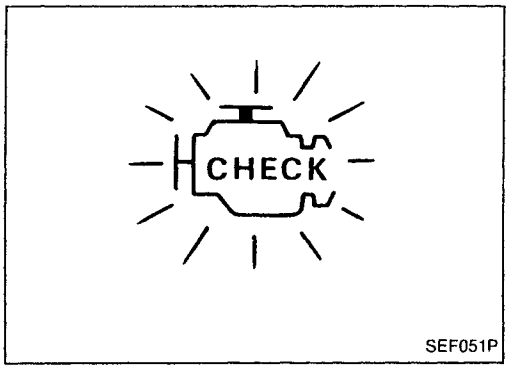
Ⓑ

Idle Speed/Ignition Timing/Idle Mixture Ratio Adjustment (Cont'd)



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

EC



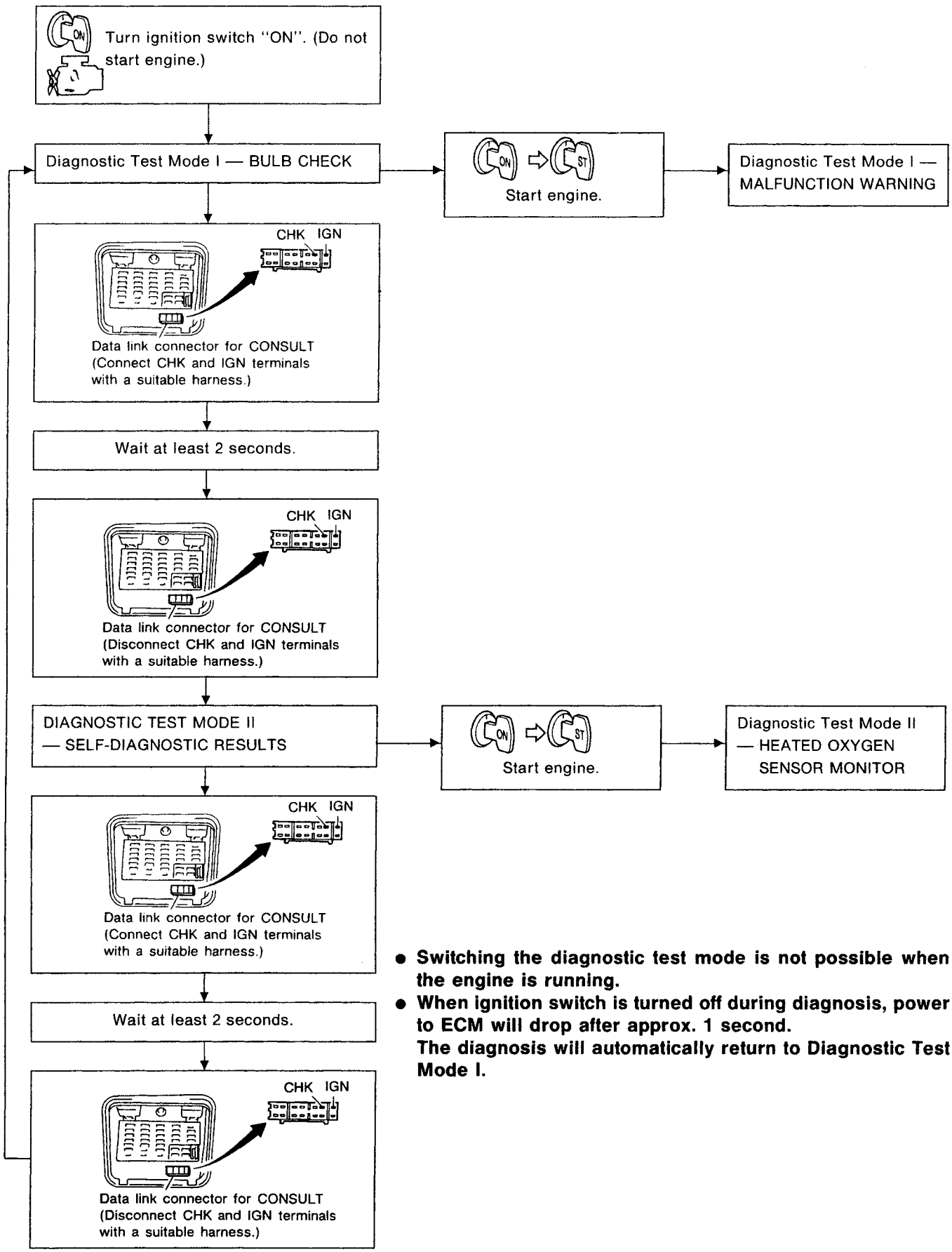
Malfunction Indicator Lamp (MIL)

1. The malfunction indicator lamp will light up when the ignition switch is turned ON without the engine running. This is a bulb check.
- If the malfunction indicator lamp does not light up, refer to EL section ("WARNING LAMPS AND CHIME") or see EC-370.
2. When the engine is started, the malfunction indicator lamp should go off.

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

Malfunction Indicator Lamp (MIL) (Cont'd)

HOW TO SWITCH DIAGNOSTIC TEST MODES



- **Switching the diagnostic test mode is not possible when the engine is running.**
- **When ignition switch is turned off during diagnosis, power to ECM will drop after approx. 1 second. The diagnosis will automatically return to Diagnostic Test Mode I.**

Malfunction Indicator Lamp (MIL) (Cont'd)

DIAGNOSTIC TEST MODE I—BULB CHECK

In this mode, the MALFUNCTION INDICATOR LAMP on the instrument panel should stay ON. If it remains OFF, check the bulb. Refer to EL section ("WARNING LAMPS AND CHIME") or see EC-370.

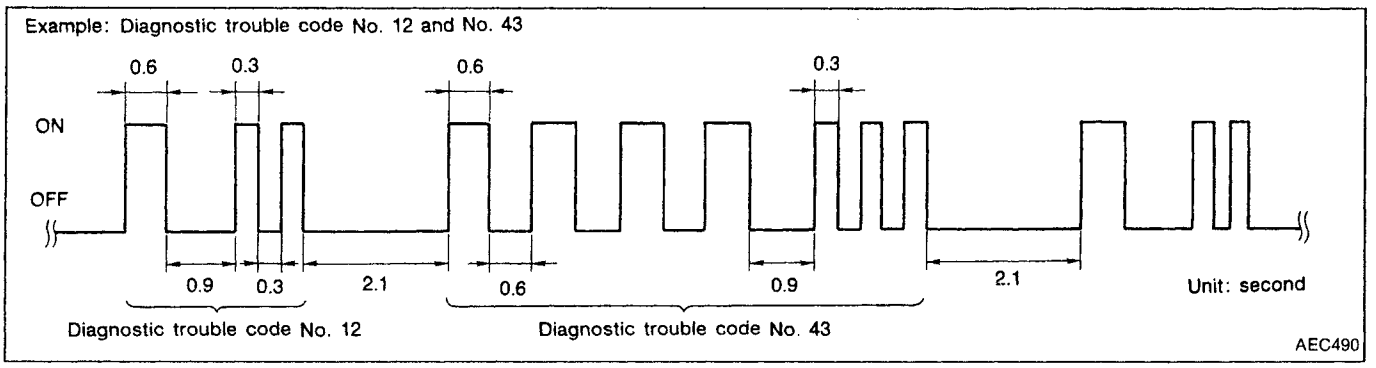
DIAGNOSTIC TEST MODE I—MALFUNCTION WARNING

MALFUNCTION INDICATOR LAMP	Condition
ON	Engine coolant temperature sensor circuit malfunction is detected, or the ECM's CPU is malfunctioning.
OFF	No malfunction.

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

DIAGNOSTIC TEST MODE II—SELF-DIAGNOSTIC RESULTS

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

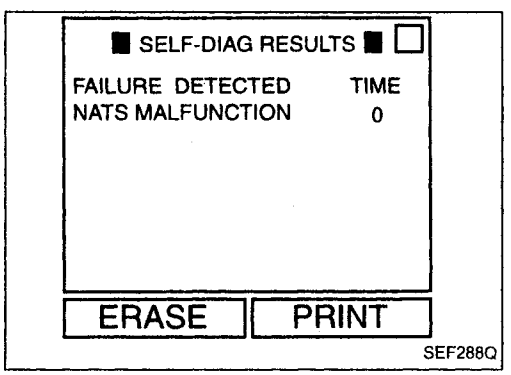


Long (0.6 second) blinking indicates the number of ten digits, and short (0.3 second) blinking indicates the number of single digits. For example, the malfunction indicator lamp blinks 4 times for about 2.5 seconds (0.6 sec x 4 times) and then it blinks three times for about 1 second (0.3 sec x 3 times). This indicates the DTC "43" and refers to the malfunction of the throttle position sensor.
In this way, all the detected malfunctions are classified by their diagnostic trouble code numbers. The DTC "55" refers to no malfunction. (See DIAGNOSTIC TROUBLE CODE CHART, refer to EC-268.)

HOW TO ERASE DIAGNOSTIC TEST MODE II (Self-diagnostic results)

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

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



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

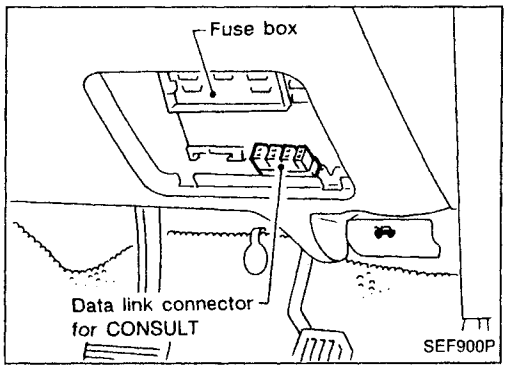
Malfunction Indicator Lamp (MIL) (Cont'd)

DIAGNOSTIC TEST MODE II—HEATED OXYGEN SENSOR MONITOR

In this mode, the MALFUNCTION INDICATOR LAMP displays the condition of the fuel mixture (lean or rich) which is monitored by the heated oxygen sensor.

MALFUNCTION INDICATOR LAMP	Fuel mixture condition in the exhaust gas	Air fuel ratio feedback control condition
ON	Lean	Closed loop system
OFF	Rich	
Remains ON or OFF	Any condition	Open loop system

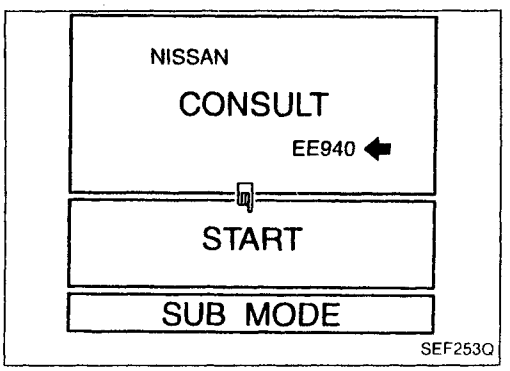
To check the heated oxygen sensor function, start engine in Diagnostic Test Mode II. Then warm it up until engine coolant temperature indicator points to middle of gauge.
Next run engine at about 2,000 rpm for about 2 minutes under no-load conditions. Make sure that the MALFUNCTION INDICATOR LAMP comes ON more than 5 times within 10 seconds with engine running at 2,000 rpm under no-load.



CONSULT

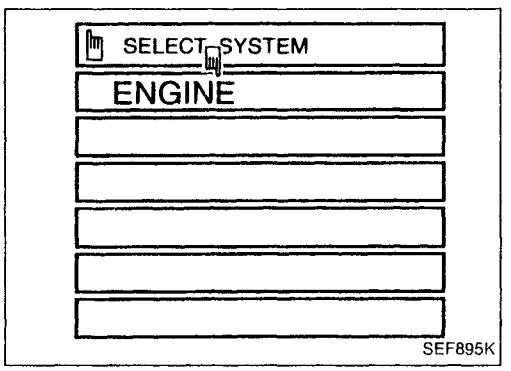
CONSULT INSPECTION PROCEDURE

1. Turn off ignition switch.
2. Connect "CONSULT" to Data link connector for CONSULT. (Data link connector for CONSULT is located behind the fuse box cover.)

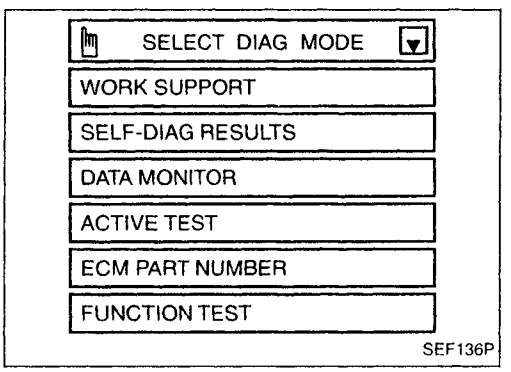


3. Turn on ignition switch.
4. Touch "START".

⬅: Program card
AE930: For Australia



5. Touch "ENGINE".



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

For further information, see the CONSULT Operation Manual.

CONSULT (Cont'd)

ECCS COMPONENT PARTS/CONTROL SYSTEMS APPLICATION

Item			DIAGNOSTIC TEST MODE				
			WORK SUPPORT	SELF-DIAG-NOSTIC RESULTS	DATA MONITOR	ACTIVE TEST	FUNCTION TEST
ECCS COMPONENT PARTS	INPUT	Camshaft position sensor		X	X		
		Mass air flow sensor		X	X		
		Engine coolant temperature sensor		X	X	X	
		Heated oxygen sensor			X		X
		Vehicle speed sensor			X		X
		Throttle position sensor	X	X	X		X
		Knock sensor		X			
		Ignition switch (start signal)			X		X
		Air conditioner switch			X		
		Park/Neutral position switch			X		X
		Power steering oil pressure switch			X		X
		Battery voltage			X		
	OUTPUT	Injectors			X	X	X
		Power transistor (Ignition timing)	X	X (Ignition signal)	X	X	X
		IACV-AAC valve	X		X	X	X
		Air conditioner relay			X		
		Fuel pump relay	X		X	X	X
		Cooling fan			X	X	X
		EGR valve & EVAP canister purge control solenoid valve			X	X	X

X: Applicable

EC

CONSULT (Cont'd)

FUNCTION

Diagnostic test mode	Function
Work support	A technician can adjust some devices faster and more accurately by following indications on CONSULT.
Self-diagnostic results	Self-diagnostic results can be read and erased quickly.
Data monitor	Input/Output data in the ECM can be read.
Active test	CONSULT drives some actuators apart from the ECM's and also shifts some parameters in a specified range.
ECM part numbers	ECM part numbers can be read.
Function test	Conducted by CONSULT instead of a technician to determine whether each system is "OK" or "NG".

WORK SUPPORT MODE

WORK ITEM	CONDITION	USAGE
THRTL POS SEN ADJ	CHECK THE THROTTLE POSITION SENSOR SIGNAL. ADJUST IT TO THE SPECIFIED VALUE BY ROTATING THE SENSOR BODY UNDER THE FOLLOWING CONDITIONS. • IGN SW "ON" • ENG NOT RUNNING • ACC PEDAL NOT PRESSED	When adjusting throttle position sensor initial position
IGNITION TIMING ADJ	• IGNITION TIMING FEEDBACK CONTROL WILL BE HELD BY TOUCHING "START". AFTER DOING SO, ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CAMSHAFT POSITION SENSOR.	When adjusting initial ignition timing
IACV-AAC VALVE ADJ	SET ENGINE SPEED AT THE SPECIFIED VALUE UNDER THE FOLLOWING CONDITIONS. • ENGINE WARMED UP • NO-LOAD	When adjusting idle speed
FUEL PRESSURE RELEASE	• FUEL PUMP WILL STOP BY TOUCHING "START" DURING IDLING. CRANK A FEW TIMES AFTER ENGINE STALLS.	When releasing fuel pressure from fuel line

CONSULT (Cont'd)

SELF-DIAGNOSTIC MODE

Regarding items detected in "SELF-DIAG RESULTS" mode, refer to "Diagnostic Trouble Code (DTC) Chart". (See page EC-268.)

DATA MONITOR MODE

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
CMPS·RPM (REF) [rpm]	○	○	• Indicates the engine speed computed from the REF signal (180° signal) of the camshaft position sensor.	• Accuracy becomes poor if engine speed drops below the idle rpm. • If the signal is interrupted while the engine is running, an abnormal value may be indicated.
MAS AIR/FL SE [V]	○	○	• The signal voltage of the mass air flow sensor is displayed.	• When the engine is stopped, a certain value is indicated.
COOLAN TEMP/S [°C] or [°F]	○	○	• The engine coolant temperature (determined by the signal voltage of the engine coolant temperature sensor) is displayed.	• When the engine coolant temperature sensor is open or short-circuited, ECM enters fail-safe mode. The engine coolant temperature determined by the ECM is displayed.
O2 SEN [V]	○	○	• The signal voltage of the heated oxygen sensor is displayed.	
M/R F/C MNT [RICH/LEAN]	○	○	• Display of heated oxygen sensor signal during air-fuel ratio feedback control: RICH ... means the mixture became "rich", and control is being affected toward a leaner mixture. LEAN ... means the mixture became "lean", and control is being affected toward a rich mixture.	• After turning ON the ignition switch, "RICH" is displayed until air-fuel mixture ratio feedback control begins. • When the air-fuel ratio feedback is clamped, the value just before the clamping is displayed continuously.
VHCL SPEED SE [km/h] or [mph]	○	○	• The vehicle speed computed from the vehicle speed sensor signal is displayed.	
BATTERY VOLT [V]	○	○	• The power supply voltage of ECM is displayed.	
THRTL POS SEN [V]	○	○	• The throttle position sensor signal voltage is displayed.	
START SIGNAL [ON/OFF]	○	○	• Indicates [ON/OFF] condition from the starter signal.	• After starting the engine, [OFF] is displayed regardless of the starter signal.
CLSD THL/POSI [ON/OFF]	○	○	• Indicates the closed throttle position [ON/OFF] determined by the throttle position sensor signal. ON: Closed throttle position OFF: Other than closed throttle position	

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

EC

CONSULT (Cont'd)

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
AIR COND SIG [ON/OFF]	○	○	• Indicates [ON/OFF] condition of the air conditioner switch as determined by the air conditioning signal.	
P/N POSI SW [ON/OFF]	○	○	• Indicates [ON/OFF] condition from the park/neutral position switch signal.	
PW/ST SIGNAL [ON/OFF]	○	○	• Indicates [ON/OFF] condition of the power steering oil pressure switch determined by the power steering oil pressure signal.	
INJ PULSE [msec]		○	• Indicates the actual fuel injection pulse width compensated by ECM according to the input signals.	• When the engine is stopped, a certain computed value is indicated.
IGN TIMING [BTDC]		○	• Indicates the ignition timing computed by ECM according to the input signals.	
IACV-AAC/V [%]		○	• Indicates the idle air control valve (AAC valve) control value computed by ECM according to the input signals.	
A/F ALPHA [%]		○	• Indicates the mean value of the air-fuel ratio feedback correction factor per cycle.	• When the engine is stopped, a certain value is indicated. • This data also includes the data for the air-fuel ratio learning control.
AIR COND RLY [ON/OFF]		○	• Indicates the air conditioner relay control condition (determined by ECM according to the input signal).	
FUEL PUMP RLY [ON/OFF]		○	• Indicates the fuel pump relay control condition determined by ECM according to the input signals.	
COOLING FAN [HI/LOW/OFF]		○	• Indicates the control condition of the cooling fans (determined by ECM according to the input signal). HI ... High speed operation LOW ... Low speed operation OFF ... Stopped	
EGRC SOL/V [ON/OFF]		○	• Indicates the control condition of the EGR valve & EVAP canister purge control solenoid valve (determined by ECM according to the input signal). ON ... EGR and EVAP canister purge operation cut-off OFF ... EGR and EVAP canister purge operation not cut-off	
VOLTAGE [V]			• Voltage measured by the voltage probe.	
PULSE [msec] or [Hz] or [%]			• Pulse width, frequency or duty cycle measured by the pulse probe.	• Only "#" is displayed if item is unable to be measured. • Figures with "#"s are temporary ones. They are the same figures as an actual piece of data which was just previously measured.

CONSULT (Cont'd)

ACTIVE TEST MODE

TEST ITEM	CONDITION	JUDGEMENT	CHECK ITEM (REMEDY)
FUEL INJECTION	• Engine: Return to the original trouble condition • Change the amount of fuel injection using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Harness and connector • Fuel injectors • Heated oxygen sensor
IACV-AAC/V OPENING	• Engine: After warming up, idle the engine. • Change the IACV-AAC valve opening percent using CONSULT.	Engine speed changes according to the opening percent.	• Harness and connector • IACV-AAC valve
ENG COOLANT TEMP	• Engine: Return to the original trouble condition • Change the engine coolant temperature indication using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Harness and connector • Engine coolant temperature sensor • Fuel injectors
IGNITION TIMING	• Engine: Return to the original trouble condition • Timing light: Set • Retard the ignition timing using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Adjust initial ignition timing
POWER BALANCE	• Engine: After warming up, idle the engine. • A/C switch "OFF" • Shift lever "N" • Cut off each injector signal one at a time using CONSULT.	Engine runs rough or dies.	• Harness and connector • Compression • Injectors • Power transistor • Spark plugs • Ignition coils
COOLING FAN	• Ignition switch: ON • Turn the cooling fan "ON" and "OFF" using CONSULT.	Cooling fan moves and stops.	• Harness and connector • Cooling fan motor
FUEL PUMP RELAY	• Ignition switch: ON (Engine stopped) • Turn the fuel pump relay "ON" and "OFF" using CONSULT and listen to operating sound.	Fuel pump relay makes the operating sound.	• Harness and connector • Fuel pump relay
EGRC SOLENOID VALVE	• Ignition switch: ON • Turn solenoid valve "ON" and "OFF" with the CONSULT and listen to operating sound.	Solenoid valve makes an operating sound.	• Harness and connector • Solenoid valve
SELF-LEARNING CONT	• In this test, the coefficient of self-learning control mixture ratio returns to the original coefficient by touching "CLEAR" on the screen.		

EC

CONSULT (Cont'd)

FUNCTION TEST MODE

FUNCTION TEST ITEM	CONDITION	JUDGEMENT		CHECK ITEM (REMEDY)
SELF-DIAG RESULTS	• Ignition switch: ON (Engine stopped) • Displays the results of on-board diagnostic system.	—		Objective system
CLOSED THROTTLE POSI	• Ignition switch: ON (Engine stopped) • Closed throttle position is tested when throttle is opened and closed fully. (Closed throttle position is selected by throttle position sensor.)	Throttle valve: opened	OFF	• Harness and connector • Throttle position sensor • Throttle position sensor adjustment • Throttle linkage • Verify operation in DATA MONITOR mode.
		Throttle valve: closed	ON	
THROTTLE POSI SEN CKT	• Ignition switch: ON (Engine stopped) • Throttle position sensor circuit is tested when throttle is opened and closed fully.	Range (Throttle valve fully opened — Throttle valve fully closed)	More than 3.0V	• Harness and connector • Throttle position sensor • Throttle position sensor adjustment • Throttle linkage • Verify operation in DATA MONITOR mode.
PARK/NEUT POSI SW CKT	• Ignition switch: ON (Engine stopped) • Inhibitor/Neutral position switch circuit is tested when shift lever is manipulated.	Out of N/P positions	OFF	• Harness and connector • Neutral position switch or inhibitor switch • Linkage or inhibitor switch adjustment
		In N/P positions	ON	
FUEL PUMP CIRCUIT	• Ignition switch: ON (Engine stopped) • Fuel pump circuit is tested by checking the pulsation in fuel pressure when fuel tube is pinched.	There is pressure pulsation on the fuel feed hose.		• Harness and connector • Fuel pump • Fuel pump relay • Fuel filter clogging • Fuel level
EGRC SOL/V CIRCUIT	• Ignition switch: ON (Engine stopped) • EGR valve & EVAP canister purge control solenoid valve circuit is tested by checking solenoid valve operating noise.	The solenoid valve makes an operating sound every 3 seconds.		• Harness and connector • EGR valve & EVAP canister purge control solenoid valve
COOLING FAN CIRCUIT	• Ignition switch: ON (Engine stopped) • Cooling fan circuit is tested when cooling fan is rotated.	The cooling fan rotates and stops every 3 seconds.		• Harness and connector • Cooling fan motor • Cooling fan relay

CONSULT (Cont'd)

FUNCTION TEST ITEM	CONDITION	JUDGEMENT		CHECK ITEM (REMEDY)
START SIGNAL CIRCUIT	• Ignition switch: ON → START • Start signal circuit is tested when engine is started by operating the starter. Before cranking, battery voltage and engine coolant temperature are displayed. During cranking, average battery voltage, mass air flow sensor output voltage and cranking speed are displayed.	Start signal: OFF → ON		• Harness and connector • Ignition switch
PW/ST SIGNAL CIRCUIT	• Ignition switch: ON (Engine running) • Power steering circuit is tested when steering wheel is rotated fully and then set to a straight line running position.	Locked position	ON	• Harness and connector • Power steering oil pressure switch • Power steering oil pump
		Neutral position	OFF	
VEHICLE SPEED SEN CKT	• Vehicle speed sensor circuit is tested when vehicle is running at a speed of 10 km/h (6 MPH) or higher.	Vehicle speed sensor input signal is greater than 4 km/h (2 MPH)		• Harness and connector • Vehicle speed sensor • Electric speedometer
IGN TIMING ADJ	• After warming up, idle the engine. • Ignition timing adjustment is checked by reading ignition timing with a timing light and checking whether it agrees with specifications.	The timing light indicates the same value on the screen.		• Adjust ignition timing (by moving crankshaft position sensor or distributor) • Camshaft position sensor drive mechanism
MIXTURE RATIO TEST	• Air-fuel ratio feedback circuit (injection system, ignition system, vacuum system, etc.) is tested by examining the heated oxygen sensor output at 2,000 rpm under non-loaded state.	Heated oxygen sensor COUNT: More than 5 times during 10 seconds		• INJECTION SYS (Injector, fuel pressure regulator, harness or connector) • IGNITION SYS (Spark plug, power transistor, ignition coil, harness or connector) • VACUUM SYS (Intake air leaks) • Heated oxygen sensor circuit • Heated oxygen sensor operation • Fuel pressure high or low • Mass air flow sensor

EC

CONSULT (Cont'd)

FUNCTION TEST ITEM	CONDITION	JUDGEMENT	CHECK ITEM (REMEDY)
POWER BALANCE	• After warming up, idle the engine. • Injector operation of each cylinder is stopped one after another, and resultant change in engine rotation is examined to evaluate combustion of each cylinder. (This is only displayed for models where a sequential multiport fuel injection system is used.)	Difference in engine speed is greater than 25 rpm before and after cutting off the injector of each cylinder.	• Injector circuit (Injector, harness or connector) • Ignition circuit (Spark plug, power transistor, ignition coil, harness or connector) • Compression • Valve timing
IACV-AAC/V SYSTEM	• After warming up, idle the engine. • IACV-AAC valve system is tested by detecting change in engine speed when IACV-AAC valve opening is changed to 0%, 20% and 80%.	Difference in engine speed is greater than 150 rpm between when valve opening is at 80% and at 20%.	• Harness and connector • IACV-AAC valve • Air passage restriction between air inlet and IACV-AAC valve • IAS (Idle adjusting screw) adjustment

CONSULT (Cont'd)

REAL TIME DIAGNOSIS IN DATA MONITOR MODE

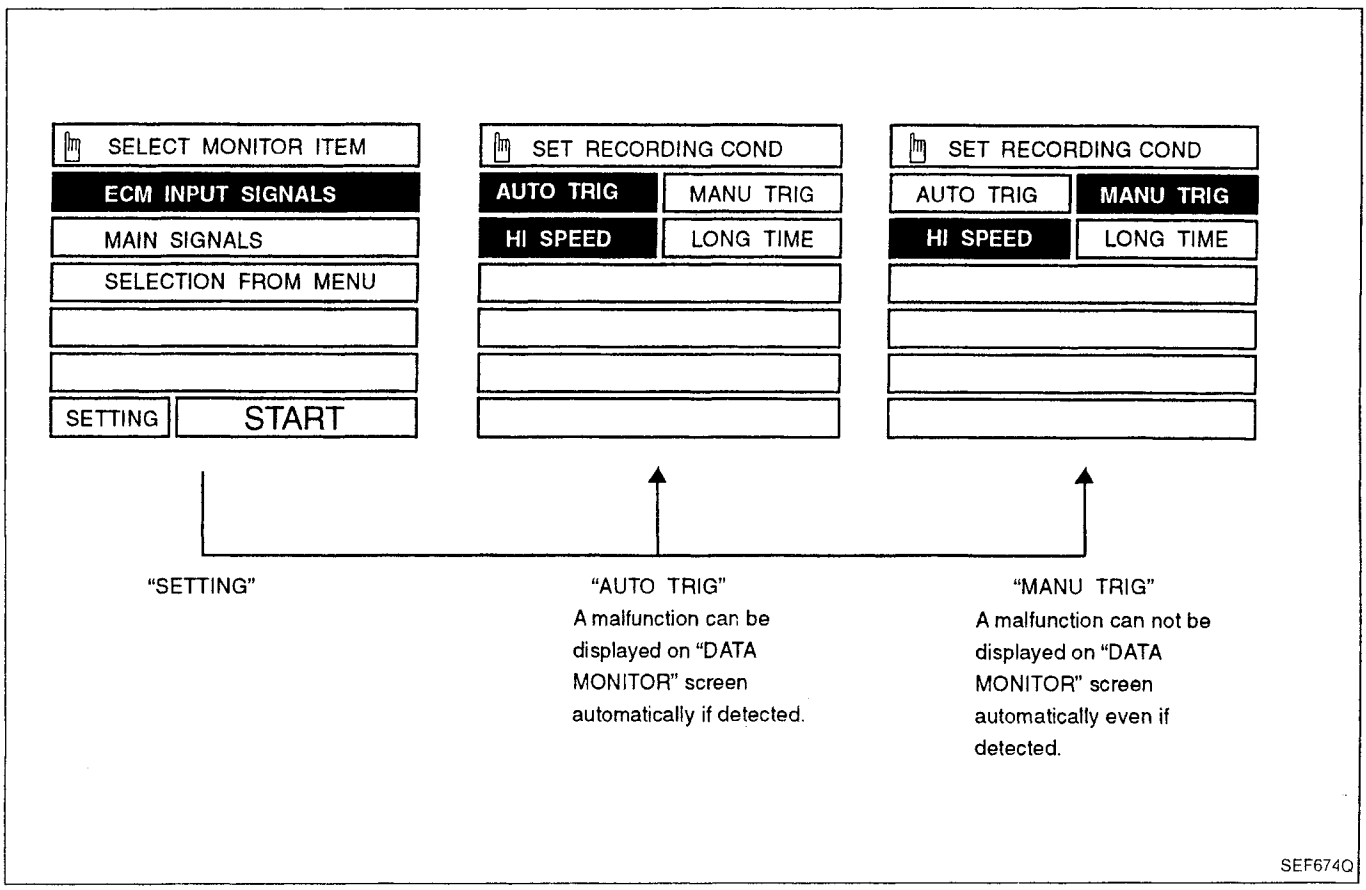
CONSULT has two kinds of triggers and they can be selected by touching "SETTING" in "DATA MONITOR" mode.

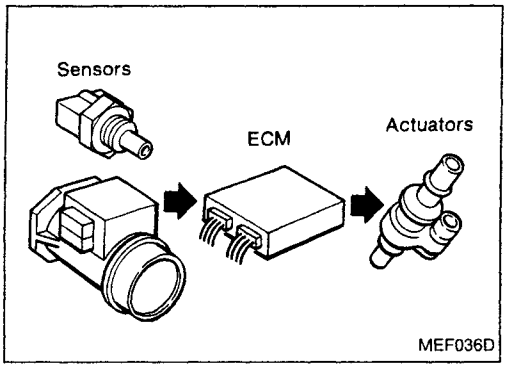
1. "AUTO TRIG" (Automatic trigger):
   - The malfunction will be identified on the CONSULT screen in real time.
     In other words, DTC and malfunction item will be displayed at the moment the malfunction is detected by ECM.
     DATA MONITOR can be performed continuously until a malfunction is detected.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

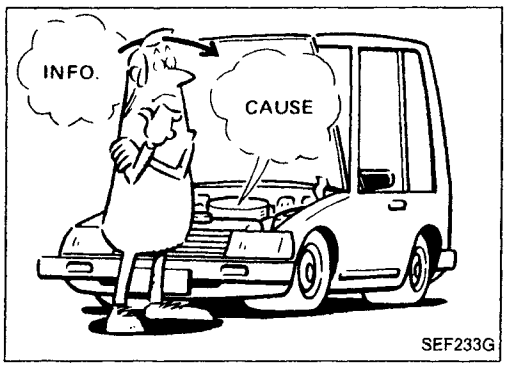
EC

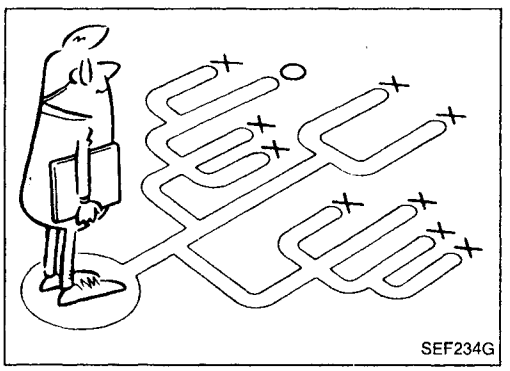
Use these triggers as follows:

1. "AUTO TRIG"
   - While trying to detect the DTC by performing the "DTC CONFIRMATION PROCEDURE", be sure to select to "DATA MONITOR (AUTO TRIG)" mode. You can confirm the malfunction at the moment it is detected.
   - While narrowing down the possible causes, CONSULT should be set in "DATA MONITOR (AUTO TRIG)" mode, especially in case the incident is intermittent.
     Inspect the circuit by gently shaking (or twisting) suspicious connectors, components and harness in the "DTC CONFIRMATION PROCEDURE". The moment a malfunction is found the DTC will be displayed. (Refer to GI section, "Incident Simulation Tests" in "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT".)
2. "MANU TRIG"
   - If the malfunction is displayed as soon as "DATA MONITOR" is selected, reset CONSULT to "MANU TRIG". By selecting MANU TRIG you can monitor and store the data. The data can be utilized for further diagnosis, such as a comparison with the value for the normal operating condition.









Introduction

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

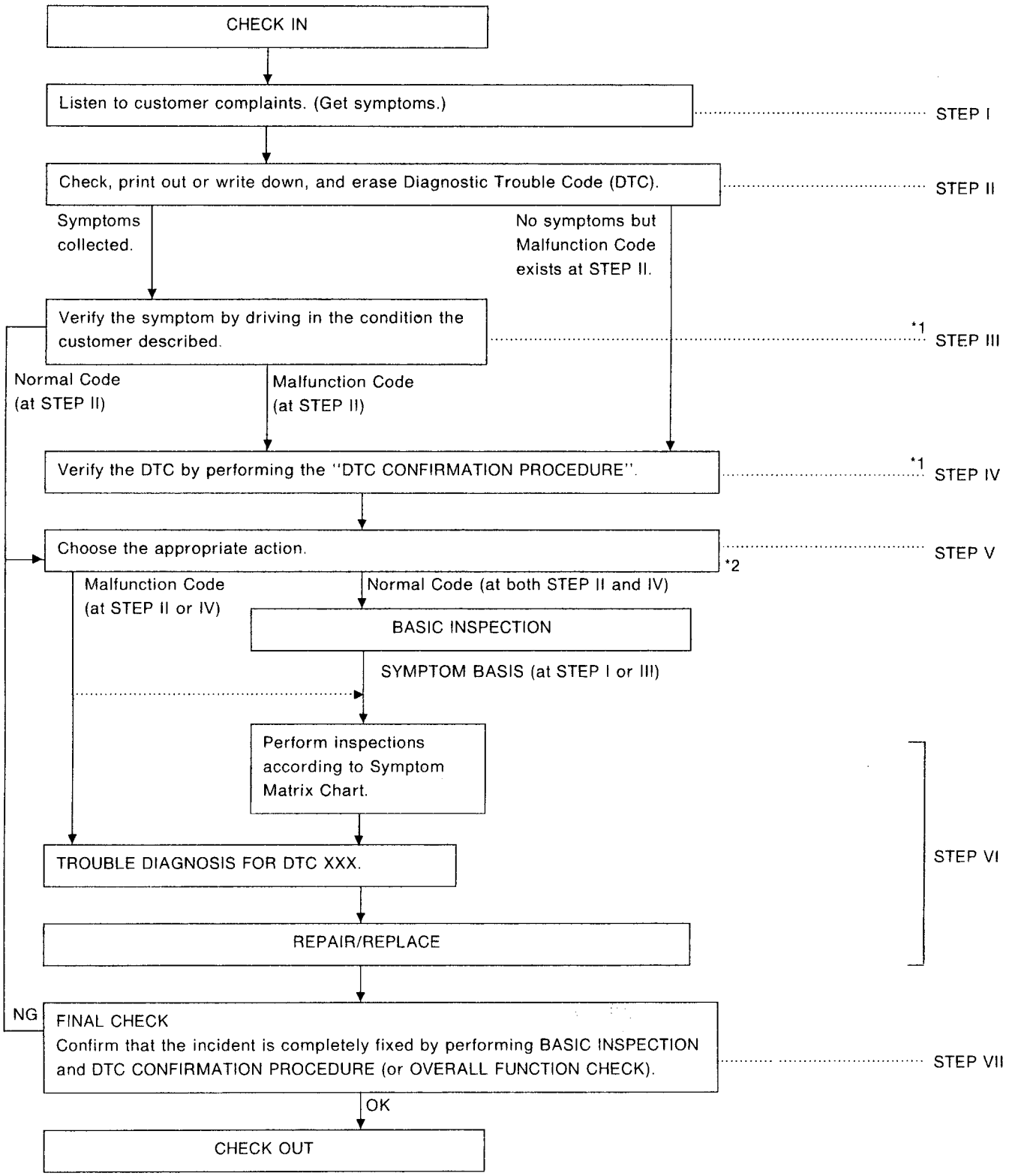
It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or improper wiring. In this case, careful checking of suspected circuits may help prevent the replacement of good parts.

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

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a driveability complaint. The customer can supply good information about such problems, especially intermittent ones. Find out what symptoms are present and under what conditions they occur. A "Diagnostic Worksheet" like the example on EC-267 should be used.

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

Work Flow



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

***2: If the on-board diagnostic system cannot be performed, check main power supply and ground circuit. Refer to "TROUBLE DIAGNOSIS FOR POWER SUPPLY", EC-286.**

Description for Work Flow

STEP	DESCRIPTION
STEP I	Get detailed information about the conditions and the environment when the incident/symptom occurred using the "DIAGNOSTIC WORKSHEET" as shown on the next page.
STEP II	Before confirming the concern, check and write down (print out using CONSULT) the Diagnostic Trouble Code (DTC), then erase the code. The DTC can be used when duplicating the incident at STEP III & IV. Study the relationship between the cause, specified by DTC, and the symptom described by the customer. (The "Symptom Matrix Chart" will be useful. Refer to EC-274.)
STEP III	Try to confirm the symptom and under what conditions the incident occurs. The "DIAGNOSTIC WORK SHEET" is useful to verify the incident. Connect CONSULT to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results. If the incident cannot be verified, perform INCIDENT SIMULATION TESTS. Refer to GI section. If the malfunction code is detected, skip STEP IV and perform STEP V.
STEP IV	Try to detect the Diagnostic Trouble Code (DTC) by driving in (or performing) the "DTC CONFIRMATION PROCEDURE". Check and read the DTC by using CONSULT. During the DTC verification, be sure to connect CONSULT to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results. If the incident cannot be verified, perform INCIDENT SIMULATION TESTS. Refer to GI section. In case the "DTC CONFIRMATION PROCEDURE" is not available, perform the "OVERALL FUNCTION CHECK" instead. The DTC cannot be displayed by this check, however, this simplified "check" is an effective alternative. The "NG" result of the "OVERALL FUNCTION CHECK" is the same as the DTC detection.
STEP V	Take the appropriate action based on the results of STEP I through IV. If the malfunction code is indicated, proceed to TROUBLE DIAGNOSIS FOR DTC XX. If the normal code is indicated, proceed to the BASIC INSPECTION. Refer to EC-271. Then perform inspections according to the Symptom Matrix Chart. Refer to EC-274.
STEP VI	Identify where to begin diagnosis based on the relationship study between symptom and possible causes. Inspect the system for mechanical binding, loose connectors or wiring damage using (tracing) "Harness Layouts". Gently shake the related connectors, components or wiring harness with CONSULT set in "DATA MONITOR (AUTO TRIG)" mode. Check the voltage of the related ECM terminals or monitor the output data from the related sensors with CONSULT. Refer to EC-277. The "DIAGNOSTIC PROCEDURE" in EC section contains a description based on open circuit inspection. A short circuit inspection is also required for the circuit check in the DIAGNOSTIC PROCEDURE. For details, refer to GI section ("HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT", "Circuit Inspection"). Repair or replace the malfunction parts.
STEP VII	Once you have repaired the circuit or replaced a component, you need to run the engine in the same conditions and circumstances which resulted in the customer's initial complaint. Perform the "DTC CONFIRMATION PROCEDURE" and confirm the normal code (Diagnostic trouble code No. 55) is detected. If the incident is still detected in the final check, perform STEP VI by using a different method from the previous one. Before returning the vehicle to the customer, be sure to erase the unnecessary (already fixed) DTC in ECM. (Refer to EC-252.)

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.

EC

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

Diagnostic Trouble Code (DTC) Chart

ENGINE RELATED ITEMS

Diagnostic trouble code No. / MIL	Detected items (Screen terms for CONSULT, "SELF-DIAG RESULTS" mode)	Malfunction is detected when ...
11	Camshaft position sensor circuit (CAMSHAFT POSI SEN)	• Either 1° or 180° signal is not detected by the ECM for the first few seconds during engine cranking. • Either 1° or 180° signal is not detected by the ECM often enough while the engine speed is higher than the specified rpm. • The relation between 1° and 180° signals is not in the normal range during the specified rpm.
12	Mass air flow sensor circuit (MASS AIR FLOW SEN)	• An excessively high or low voltage is entered to ECM. • Voltage sent to ECM is not practical when compared with the camshaft position sensor signal and throttle position sensor signal.
13	Engine coolant temperature sensor circuit (COOLANT TEMP SEN)	• An excessively high or low voltage from the sensor is detected by the ECM.
21	Ignition signal circuit (IGN SIGNAL-PRIMARY)	• The ignition signal in the primary circuit is not detected by the ECM during engine cranking or running.
34	Knock sensor circuit (KNOCK SENSOR)	• An excessively low or high voltage from the sensor is detected by the ECM.
43	Throttle position sensor circuit (THROTTLE POSI SEN)	• An excessively low or high voltage from the sensor is detected by the ECM. • Voltage sent to ECM is not practical when compared with the mass air flow sensor and camshaft position sensor signals.
55	No failure (NO SELF DIAGNOSTIC FAILURE INDICATED...)	• No malfunction related to OBD system is detected by either ECM or A/T control unit.

*1: This is Quick Reference of "DTC CONFIRMATION PROCEDURE".
Details are described in each TROUBLE DIAGNOSIS FOR DTC XX.
Abbreviations are as follows:
IGN: ON : Turning the ignition switch ON is required for the ECM to detect a malfunction (if one exists).
RUNNING : Running engine is required for the ECM to detect a malfunction (if one exists).

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

X: Applicable
—: Not applicable

Check Items (Possible Cause)	"DTC CONFIRMATION PROCEDURE" Quick Ref. *1	"OVERALL FUNCTION CHECK" Quick Ref. *2	Fail Safe System	Reference Page
• Harness or connectors (The sensor circuit is open or shorted.) • Camshaft position sensor • Starter motor • Starting system circuit (EL section) • Dead (Weak) battery	RUNNING	—	—	EC-289
• Harness or connectors (The sensor circuit is open or shorted.) • Mass air flow sensor	RUNNING	RUNNING	X	EC-293
• Harness or connectors (The sensor circuit is open or shorted.) • Engine coolant temperature sensor	IGN: ON	—	X	EC-297
• Harness or connectors (The ignition primary circuit is open or shorted.) • Power transistor unit • Camshaft position sensor • Camshaft position sensor circuit	RUNNING	—	—	EC-301
• Harness or connectors (The sensor circuit is open or shorted.) • Knock sensor	RUNNING	—	—	EC-306
• Harness or connectors (The sensor circuit is open or shorted.) • Throttle position sensor	—	IGN: ON	X	EC-309
• No failure	—	—	—	—

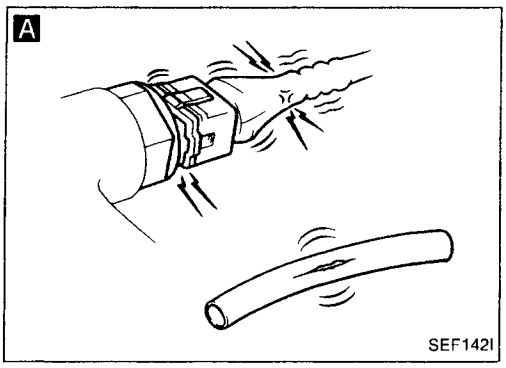
*2: • The "OVERALL FUNCTION CHECK" is a simplified and effective way to inspect a component or circuit. In some cases, the "OVERALL FUNCTION CHECK" is used rather than a "DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE".
When no DTC CONFIRMATION PROCEDURE is available, the "NG" result of the OVERALL FUNCTION CHECK can be considered to mean the same as a DTC detection.
• During an "NG" OVERALL FUNCTION CHECK, the DTC might not be confirmed.

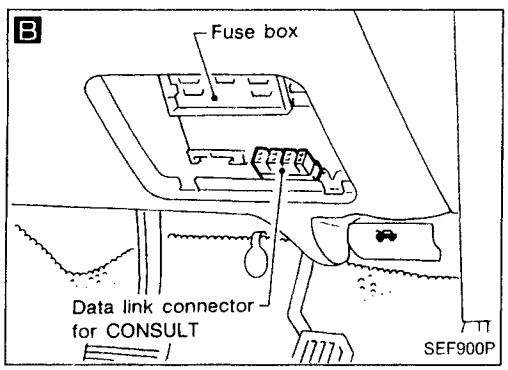
EC

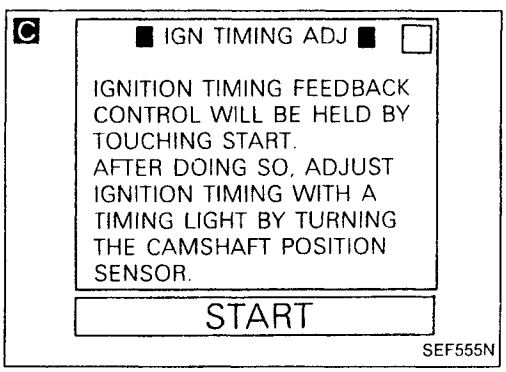
Fail-Safe Chart

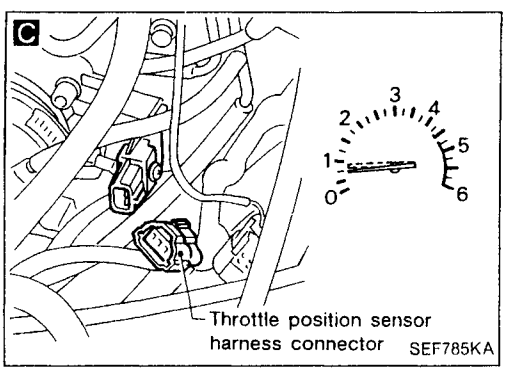
The ECM enters fail-safe mode, if any of the following DTCs is recorded due to the open or short circuit.

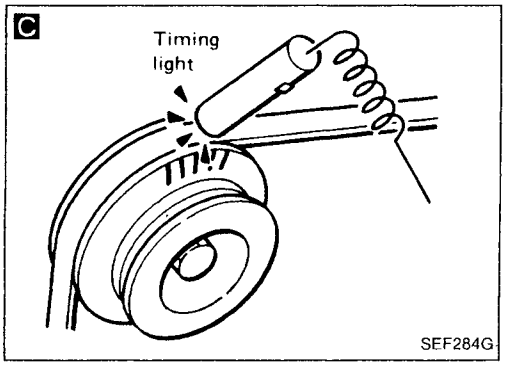
<table>
<tr><th>DTC No.
MIL</th><th>Detected items</th><th>Engine operating condition in fail-safe mode</th></tr>
<tr><td>12</td><td>Mass air flow sensor circuit</td><td>Engine speed will not rise more than 2,400 rpm due to the fuel cut.</td></tr>
<tr><td>13</td><td>Engine coolant temperature sensor circuit</td><td>Engine coolant temperature will be determined based on the time after turning ignition switch "ON" or "START".
<table><tr><th>Condition</th><th>Engine coolant temperature decided</th></tr><tr><td>Just as ignition switch is turned ON or Start</td><td>30°C (86°F)</td></tr><tr><td>More than 4 minutes after ignition ON or Start</td><td>80°C (176°F)</td></tr><tr><td>Except as shown above</td><td>30 - 80°C (86 - 176°F)
(Depends on the time)</td></tr></table></td></tr>
<tr><td>43</td><td>Throttle position sensor circuit</td><td>Throttle position will be determined based on the injected fuel amount and the engine speed.
Therefore, acceleration will be poor.
<table><tr><th>Condition</th><th>Driving condition</th></tr><tr><td>When engine is idling</td><td>Normal</td></tr><tr><td>When accelerating</td><td>Poor acceleration</td></tr></table></td></tr>
<tr><td>—</td><td>Start signal circuit</td><td>If the ECM always receives a start signal, the ECM will judge the start signal "OFF" when engine speed is above 1,000 rpm.
This prevents extra enrichment.
After the engine speed is below 200 rpm, start-up enrichment will be allowed until the engine speed reaches 1,000 rpm.</td></tr>
<tr><td>—</td><td>ECM</td><td>Fail-safe system activating condition when ECM is malfunctioning
The computing function of the ECM was judged to be malfunctioning.
When the fail-safe system activates (i.e., if the ECM detects a malfunction condition in the CPU of ECM), the MALFUNCTION INDICATOR LAMP on the instrument panel lights to warn the driver.
Engine control, with fail-safe system, operates when ECM is malfunctioning
When the fail-safe system is operating, fuel injection, ignition timing, fuel pump operation, IACV-AAC valve operation and cooling fan operation are controlled under certain limitations.
<table><tr><th></th><th>Operation</th></tr><tr><td>Engine speed</td><td>Engine speed will not rise more than 3,000 rpm</td></tr><tr><td>Fuel injection</td><td>Simultaneous multiport fuel injection system</td></tr><tr><td>Ignition timing</td><td>Ignition timing is fixed at the preset valve</td></tr><tr><td>Fuel pump</td><td>Fuel pump relay is "ON" when engine is running and "OFF" when engine stalls</td></tr><tr><td>IACV-AAC valve</td><td>Full open</td></tr><tr><td>Cooling fans</td><td>Cooling fan relay "ON" (High speed condition) when engine is running, and "OFF" when engine stalls</td></tr></table></td></tr>
</table>











Basic Inspection

Precaution:

Perform Basic Inspection without electrical or mechanical loads applied;

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

A

BEFORE STARTING

1. Check service records for any recent repairs that may indicate a related problem, or the current need for scheduled maintenance.
2. Open engine hood and check the following:

- Harness connectors for improper connections
- Vacuum hoses for splits, kinks, or improper connections
- Wiring for improper connections, pinches, or cuts

B

CONNECT CONSULT TO THE VEHICLE.

Connect "CONSULT" to the data link connector for CONSULT and select "ENGINE" from the menu. Refer to EC-254.

DOES ENGINE START? — No → Go to E.

Yes

C

CHECK IGNITION TIMING.

1. Warm up engine sufficiently.
2. Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
3. Touch "START".
4. Check ignition timing at idle using timing light.

Ignition timing:
15° ± 2° BTDC

NG → Adjust ignition timing by turning distributor.

1. Warm up engine sufficiently.
2. Stop engine and disconnect throttle position sensor harness connector.
3. Start engine.
4. Check ignition timing at idle using timing light.

Ignition timing:
15° ± 2° BTDC

OK

(Go to Ⓐ on next page.)

EC

Basic Inspection (Cont'd)

D

■ IGN TIMING ADJ ■ □

IGNITION TIMING FEEDBACK CONTROL WILL BE HELD BY TOUCHING START.
AFTER DOING SO, ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CAMSHAFT POSITION SENSOR.

START

SEF546N

E

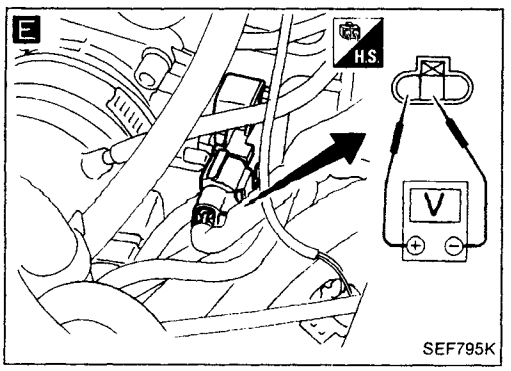
■ THRTL POS SEN ADJ ■□

*** ADJ MONITOR ***

THRTL POS SEN	0.52V
======== MONITOR ========	
CMPS•RPM (REF)	0rpm
CLSD THL/P	ON

SEF165P

E



SEF795K

Ⓐ

D

CHECK IDLE ADJ. SCREW INITIAL SET RPM.

1. Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. When touching "START", does engine speed fall to **750 ± 50 rpm (A/T in "N" position)?**

NG → Adjust engine speed by turning idle adjusting screw.

OR

Does engine run at **750 ± 50 rpm (A/T in "N" position)?**

OK

Reconnect throttle position sensor harness connector.

E

CHECK THROTTLE POSITION SENSOR IDLE POSITION.

1. Perform "THRTL POS SEN ADJ" in "WORK SUPPORT" mode.
2. Check that output voltage of throttle position sensor is approx. 0.35 to 0.65V (Throttle valve fully closes.) and "CLSD THL/POSI" stays "ON".

NG → Adjust output voltage to 0.50V by rotating throttle position sensor body.

RESET IDLE POSITION MEMORY.

1. Warm up engine sufficiently.
2. Turn ignition switch "OFF" and wait at least 5 seconds.
3. Disconnect throttle position sensor harness connector.
4. Start engine and wait at least 5 seconds in "N" position.
5. Reconnect throttle position sensor harness connector while running engine.

OR

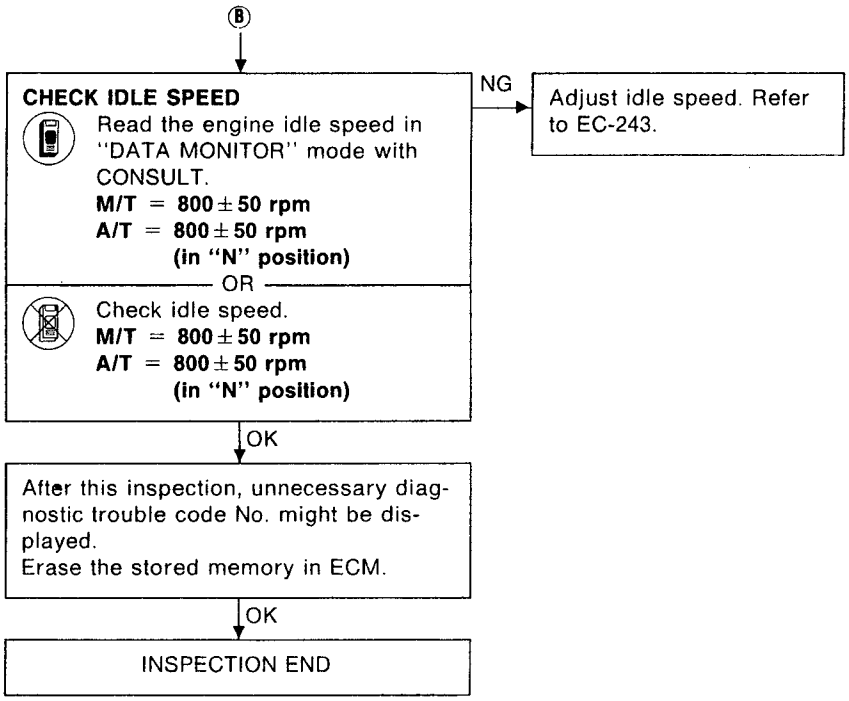
Measure output voltage of throttle position sensor using voltmeter, and check that it is approx. 0.35 to 0.65V. (Throttle valve fully closed.)

OK

Ⓑ

(Go to next page)

Basic Inspection (Cont'd)



EC

Symptom Matrix Chart

SYSTEM — Basic engine control system		SYMPTOM																		Reference page
		HARD/NO START (COLD)	HARD/NO RE-START (HOT)	ROUGH IDLE	ENGINE STALL	HESITATION/FLAT SPOT/SURGE	LACK OF POWER/POOR ACCELERATION	NO RETURN TO IDLE/HIGH IDLE	SPARK KNOCK (PINGING)	BACK FIRE	AFTER FIRE	ENGINE RUN ON (DIESELING)	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	OVERHEATS	OVERCOOLS	OVERCHARGING	BATTERY DEAD (UNDER CHARGE)	
		1A	1B	1C	1F	1H	1R	1S	1M	1J	1L	1K	1T	1V	1N	1P	1X	1Y	
Fuel	Fuel pump circuit	●	●	●	●	●	●		○	○			●					○	EC-327
	Fuel pressure regulator system	●	●	●	●	●	●	○	○	○	○		●						EC-241
	Injector circuit	●	●	●	●	●	●		○	○	○		●						EC-324
	Evaporative emission system	○	○	○	○	○	○	○	○	○	○		○						EC-238
Air	Positive crankcase ventilation system	○	○	●	○	●	○	○	○	○	○		○	○					EC-240
	IACV-Air regulator	●	●	●	●	●	●	●	○	○			○						EC-332
	Incorrect idle speed adjustment	○	○	○	○			○					○						EC-243
	IACV-AAC valve circuit	●	●	●	●	●	●	●	○	●	○		●					○	EC-335
	IACV-FICD solenoid valve circuit	○	○	○	○	○	○	○	○	○			○						EC-339
Ignition	Incorrect ignition timing adjustment	○	○	●	○	●	●		●	○	○		●						EC-243
	Ignition circuit	●	●	●	●	●	●		●		●		●						EC-301
EGR	EGR valve & EVAP canister purge control solenoid valve circuit				●	●	○		●		○		●						EC-319
	EGR system	○	○	●	●	●	○	○	●	○			○						EC-319
Main power supply and ground circuit		○	○	○	○	○	○		○	○			○		○			○	EC-286
Cooling	Cooling fan circuit	○	○	○	○	○	○	○	○				○		○	○		○	EC-343
Air conditioner circuit		○	○	○	○	○	○	○	○				○					○	HA section

● ; High Possibility Item
○; Low Possibility Item

(continued on next page)

Symptom Matrix Chart (Cont'd)

SYSTEM — ECCS system		SYMPTOM																		Reference page
		HARD/NO START (COLD)	HARD/NO RE-START (HOT)	ROUGH IDLE	ENGINE STALL	HESITATION/FLAT SPOT/SURGE	LACK OF POWER/POOR ACCELERATION	NO RETURN TO IDLE/HIGH IDLE	SPARK KNOCK (PINGING)	BACK FIRE	AFTER FIRE	ENGINE RUN ON (DIESELING)	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	OVERHEATS	OVERCOOLS	OVERCHARGING	BATTERY DEAD (UNDER CHARGE)	
		1A	1B	1C	1F	1H	1R	1S	1M	1J	1L	1K	1T	1V	1N	1P	1X	1Y	
ECCS	Camshaft position sensor circuit	●	○	○	●	●	○		○	○	○		○						EC-289
	Mass air flow sensor circuit	●	●	●	●	●	●		○	○	○		●						EC-293
	Heated oxygen sensor circuit			●	●	●	●		○	○	○		●						EC-362
	Engine coolant temperature sensor circuit	●	●	●	●	●	●	●	○	○	○		●						EC-297
	Throttle position sensor circuit			●	●	●	●	●					●						EC-309
	Incorrect throttle position sensor adjustment			○	●	○	○	●			○		○						EC-272
	Vehicle speed sensor circuit				○	○	○						○						EC-314
	Knock sensor circuit					○	○		○				○						EC-306
	ECM	○	○	○	○	○	○	○	○	○	○	○	○		○				EC-270
	Start signal circuit	○	○																EC-317
	Park/Neutral position switch circuit			○		○	○						○						EC-357
	Power steering oil pressure switch circuit			○	○														EC-354

● ; High Possibility Item
○; Low Possibility Item

(continued on next page)

EC

Symptom Matrix Chart (Cont'd)

SYSTEM — Engine mechanical & other		SYMPTOM																		Reference page
		HARD/NO START (COLD)	HARD/NO RE-START (HOT)	ROUGH IDLE	ENGINE STALL	HESITATION/FLAT SPOT/SURGE	LACK OF POWER/POOR ACCELERATION	NO RETURN TO IDLE/HIGH IDLE	SPARK KNOCK (PINGING)	BACK FIRE	AFTER FIRE	ENGINE RUN ON (DIESELING)	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	OVERHEATS	OVERCOOLS	OVERCHARGING	BATTERY DEAD (UNDER CHARGE)	
		1A	1B	1C	1F	1H	1R	1S	1M	1J	1L	1K	1T	1V	1N	1P	1X	1Y	
Fuel	Fuel tank	○	○		○														—
	Fuel piping	○	○	○	○	○	○		○	○	○		○						
	Vapor lock		○		○														
	Valve deposit	○	○	○	○	○	○		○	○			○						
	Poor fuel (Heavy weight gasoline, Low octane)	○	○	○	○	○	○		○	○			○						
Air	Air duct			○	○	○	○						○						
	Air cleaner			○	○	○	○						○						
	Air leakage from air duct (Mass air flow sensor — throttle body)	○	○	○	○	○	○	○	○	○			○						
	Throttle body, Throttle wire	●		●	●	●	●	●					●						FE section
	Air leakage from intake manifold/ Collector/Gasket	○	○	○	●	○	○	○	○	○			○						—
Cranking	Battery	○	○	○	○	○	○						○				○	○	EL section
	Alternator circuit	○	○	○	○	○	○						○				○	○	
	Starter circuit	●	●																
	Flywheel	●	○																—
	Inhibitor switch	○	○																AT section
Engine	Cylinder head	●	○	●	●	●	●		●	○			○						—
	Cylinder head gasket	●	○	○	●	○	●		○				○	○	○				
	Cylinder block	●	○	○	○	○	○		○				○	○					
	Piston	●	○	○	●	○	○		●				○	○					
	Piston ring	●	○	○	○	○	○		○				○	○					
	Connecting rod	○	○	○	○	○	○		○				○						
	Bearing	○	○	○	○	○	○		○				○						
	Crankshaft	○	○	○	○	○	○		○				○						
Valve mechanism	Timing chain	●	○	○	●	●	●		○	○			○						
	Camshaft	●	○	●	●	●	○		○				○						
	Intake valve	●	○	○	○	○	○		●	○			○	○					
	Exhaust valve	●	○	○	○	○	○		○		○		○	○					
	Hydraulic lash adjuster			○	○	○	○		○	○			○						
Exhaust	Exhaust manifold/Tube/Muffler/Gasket	○	○	○	○	○	○		○	○	○		○						
	Three way catalyst	●	○	○	●	○	○		○	○	○		○						
Lubrication	Oil pan/Oil strainer/Oil pump/Oil filter/ Oil gallery	●	○	●	○	○	○		○				○	○					
	Oil level (Low)/Filthy oil	○	○	○	○	○	○		○				○	○					
Cooling	Radiator/Hose/Radiator filler cap	○	○	○	○	○	○		○				○		○				
	Thermostat	○	○	○	○	○	○	○	○				○		○	○			
	Water pump	○	○	○	○	○	○		○				○		○				
	Water gallery	○	○	○	○	○	○		○				○		○				
	Cooling fan	○	○	○	○	○	○	○	○				○		○	○			
	Coolant level (low)/Contaminated coolant	○	○	○	○	○	○		○				○		○				

● ; High Possibility Item
○; Low Possibility Item

CONSULT Reference Value in Data Monitor Mode

Remarks:

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

EC

MONITOR ITEM	CONDITION		SPECIFICATION
CMPS·RPM (REF)	• Tachometer: Connect • Run engine and compare tachometer indication with the CONSULT value.		Almost the same speed as the CONSULT value.
MAS AIR/FL SE	• Engine: After warming up • Air conditioner switch: OFF • Shift lever: "N" • No-load	Idle	1.3 - 1.7V
		2,000 rpm	1.7 - 2.1V
COOLAN TEMP/S	• Engine: After warming up		More than 70°C (158°F)
O2 SEN	• Engine: After warming up	Maintaining engine speed at 2,000 rpm	0 - 0.3V ↔ 0.6 - 1.0V
M/R F/C MNT			LEAN ↔ RICH Changes more than 5 times during 10 seconds.
VHCL SPEED SE	• Turn drive wheels and compare speedometer indication with the CONSULT value		Almost the same speed as the CONSULT value
BATTERY VOLT	• Ignition switch: ON (Engine stopped)		11 - 14V
THRTL POS SEN	• Ignition switch: ON (Engine stopped)	Throttle valve fully closed	0.35 - 0.65V
		Throttle valve fully opened	Approx. 4.0V
START SIGNAL	• Ignition switch: ON → START → ON		OFF → ON → OFF
CLSD THL/POSI	• Ignition switch: ON (Engine stopped)	Throttle valve: Idle position	ON
		Throttle valve: Slightly open	OFF
AIR COND SIG	• Engine: After warming up, idle the engine	Air conditioner switch: OFF	OFF
		Air conditioner switch: ON (Compressor operates)	ON
P/N POSI SW	• Ignition switch: ON	Shift lever "P" or "N"	ON
		Except above	OFF

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

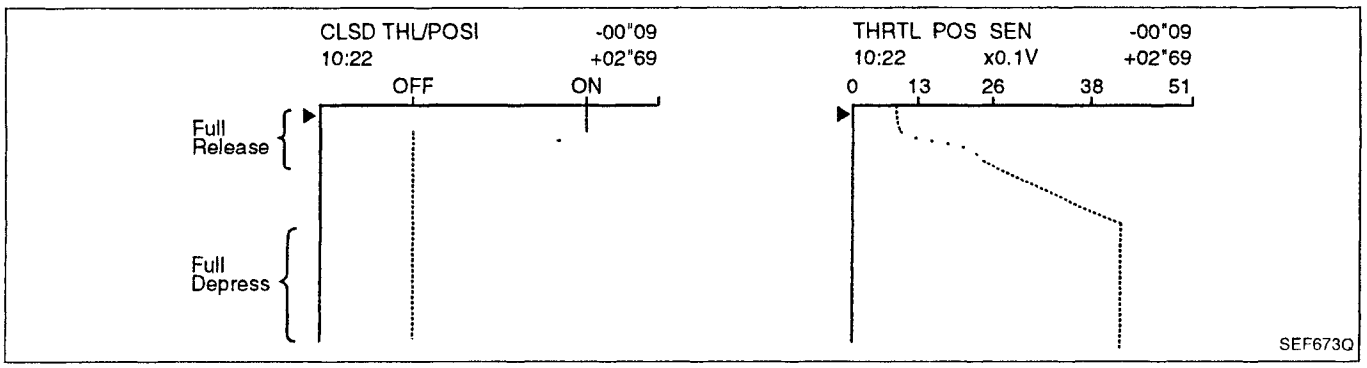
MONITOR ITEM	CONDITION		SPECIFICATION
PW/ST SIGNAL	• Engine: After warming up, idle the engine	Steering wheel in neutral position (forward direction)	OFF
		The steering wheel is turned	ON
INJ PULSE	• Engine: After warming up • Air conditioner switch: OFF • Shift lever: "N" • No-load	Idle	2.5 - 3.7 msec.
		2,000 rpm	1.9 - 2.8 msec.
IGN TIMING	ditto	Idle	13 - 15° BTDC
		2,000 rpm	More than 25° BTDC
IACV-AAC/V	ditto	Idle	20 - 40%
		2,000 rpm	—
A/F ALPHA	• Engine: After warming up	Maintaining engine speed at 2,000 rpm	53 - 155%
AIR COND RLY	• Air conditioner switch: OFF → ON		OFF → ON
FUEL PUMP RLY	• Ignition switch is turned to ON (Operates for 5 seconds) • Engine running and cranking • When engine is stopped (stops in 1.0 seconds)		ON
	• Except as shown above		OFF
COOLING FAN	• After warming up engine, idle the engine. • Air conditioner switch: OFF • Vehicle stopped	Engine coolant temperature is 94°C (201°F) or less for A/T models, and 99°C (210°F) or less for M/T models	OFF
		Engine coolant temperature is between 95°C (203°F) and 104°C (219°F) for A/T models only	LOW
		Engine coolant temperature is 105°C (221°F) or more for A/T models, and 100°C (212°F) or more for M/T models	HIGH
EGRC SOL/V	• Engine: After warming up • Air conditioner switch: OFF • Shift lever: "N" • No-load	Idle	ON
		2,000 rpm	OFF

Major Sensor Reference Graph in Data Monitor Mode

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

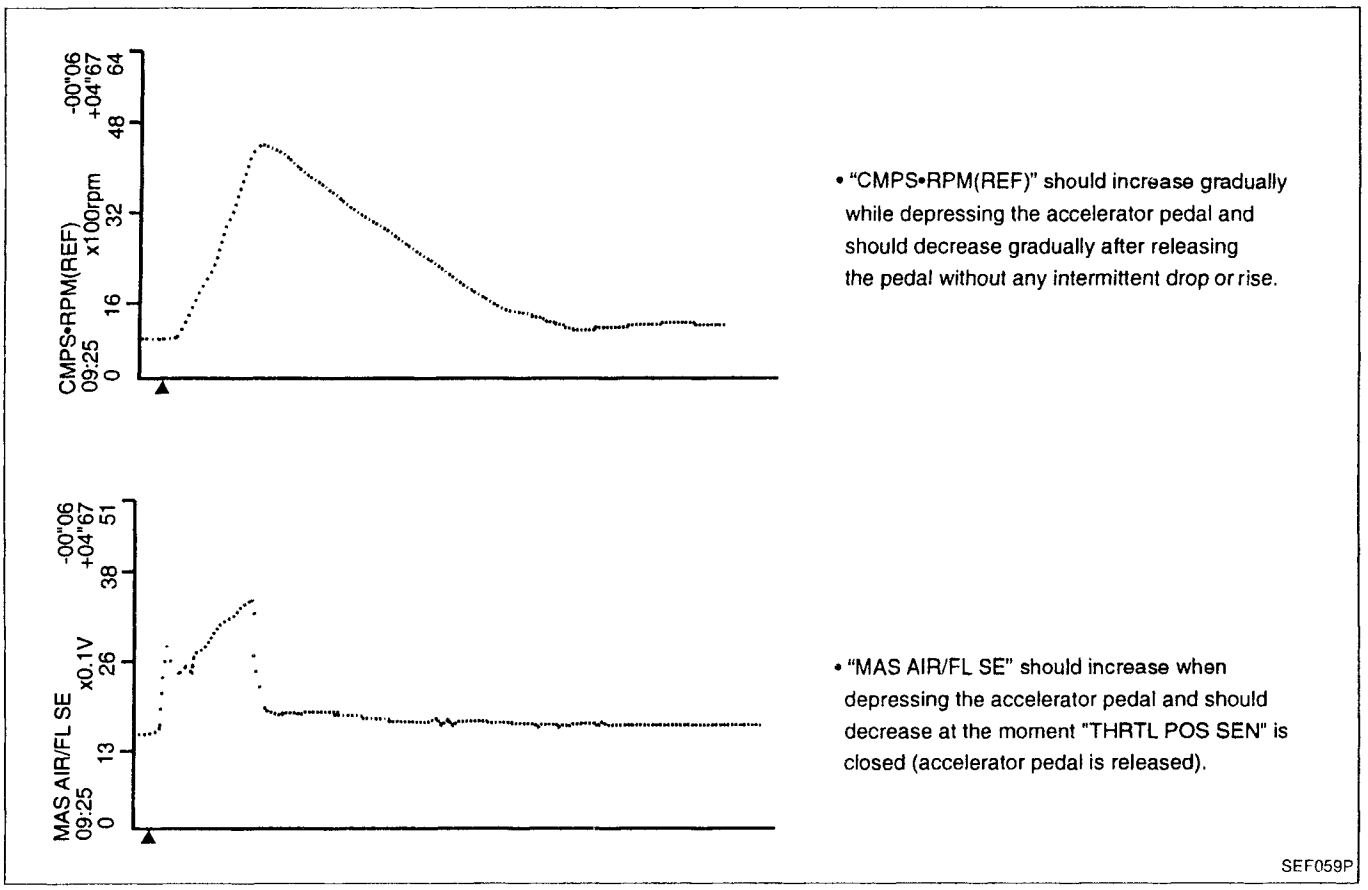
THRTL POS SEN, CLSD THL/POSI

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

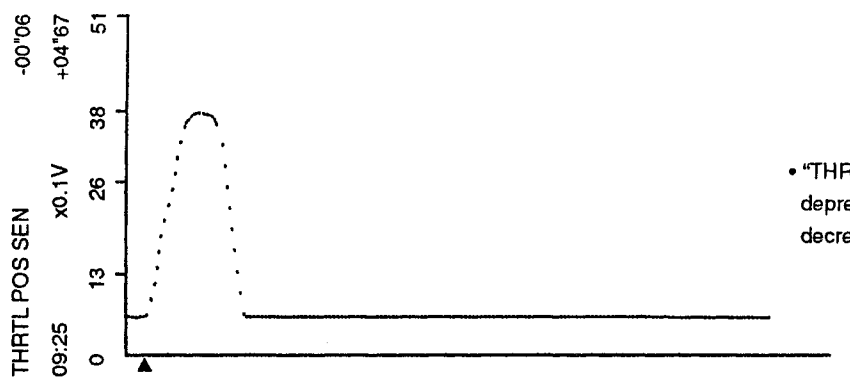


CMPS·RPM (REF), MAS AIR/FL SE, THRTL POS SEN, O2 SEN, INJ PULSE

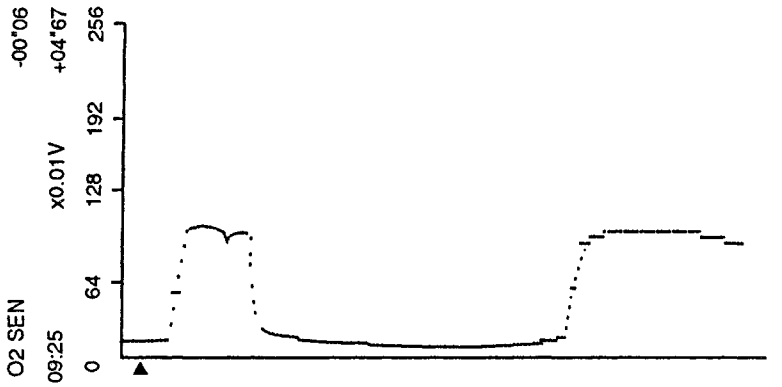
Below is the data for "CMPS·RPM (REF)", "MAS AIR/FL SE", "THRTL POS SEN", "O2 SEN" and "INJ PULSE" when revving quickly up to 4,800 rpm under no load after warming up engine sufficiently.
Each value is for reference, the exact value may vary.



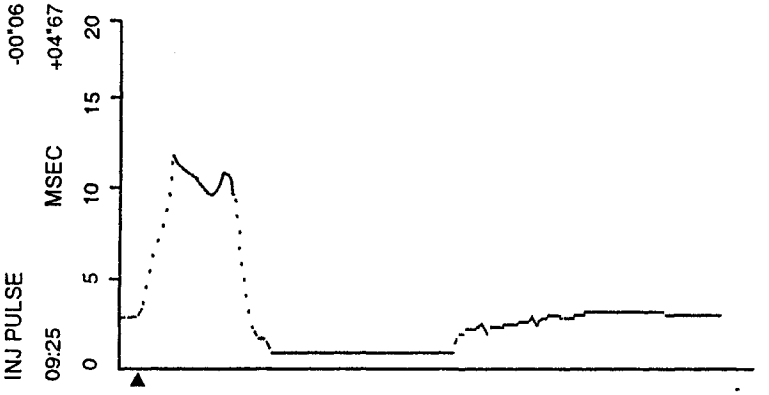
Major Sensor Reference Graph in Data Monitor Mode (Cont'd)



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

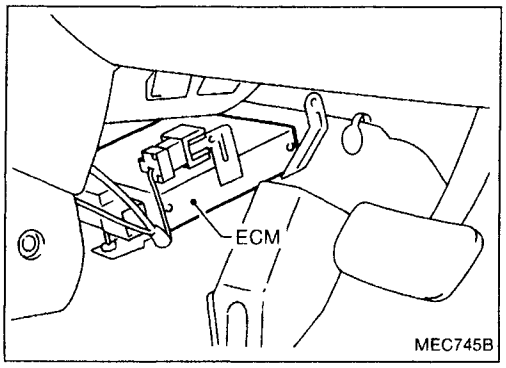


• "O2 SEN" may increase immediately after depressing the accelerator pedel and may decrease after releasing the pedal.



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

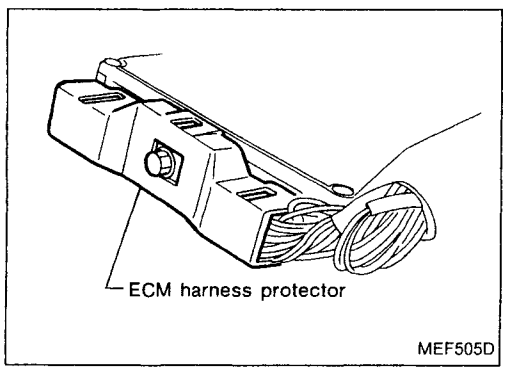
SEF259QA



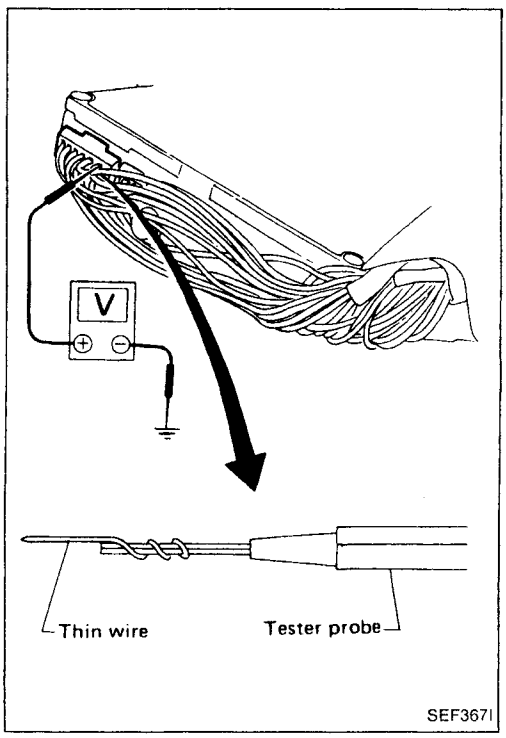
ECM Terminals and Reference Value

PREPARATION

1. ECM is located behind the center console. For this inspection, remove the front passenger center console panel.

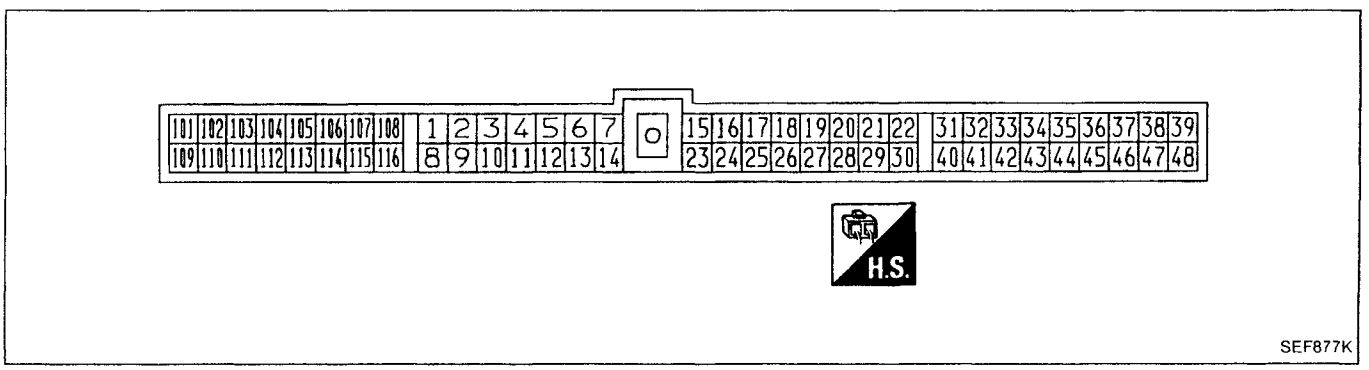


2. Remove ECM harness protector.



3. Perform all voltage measurements with the connectors connected. Extend tester probe as shown to perform tests easily.

ECM HARNESS CONNECTOR TERMINAL LAYOUT



ECM Terminals and Reference Value (Cont'd)

ECM inspection table

*Data are reference values.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	*DATA
1	W/B	Ignition signal	Engine is running. └ Idle speed	0.2 - 0.3V
			Engine is running. └ Engine speed is 2,000 rpm.	Approximately 0.7V
2	L/OR	Tachometer	Engine is running. └ Idle speed	Approximately 0.9V
3	GY/R	Ignition check	Engine is running. └ Idle speed	Approximately 13V
4	W/G	ECCS relay (Self-shut-off)	Engine is running. Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	0 - 1V
			Ignition switch "OFF" └ A few seconds after turning ignition switch "OFF" and thereafter	BATTERY VOLTAGE (11 - 14V)
6	B/W	ECCS ground	Engine is running. └ Idle speed	Engine ground
7	G/B	Data link connector for CONSULT	Engine is running. └ Idle speed	Approximately 13.5V
14	G/W			Approximately 0V
15	GY/L			Approximately 2.5V
23	G/R			Approximately 0V
9	LG/R	Cooling fan relay (Low speed)	Engine is running. └ Cooling fan is not operating.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating.	Approximately 0V
10	LG	Cooling fan relay (High speed)	Engine is running. ├ Cooling fan is not operating. └ Cooling fan is operating at low speed.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating at high speed.	Approximately 0V
11	Y	Air conditioner relay	Engine is running. └ Both A/C switch and blower fan switch are "ON".	Approximately 0V
			Engine is running. └ A/C switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
13	B/W	ECCS ground	Engine is running. └ Idle speed	Engine ground

ECM Terminals and Reference Value (Cont'd)

*Data are reference values.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	*DATA
16	OR	Mass air flow sensor	Engine is running. (Warm-up condition) └ Idle speed	1.3 - 1.7V
			Engine is running. (Warm-up condition) └ Engine speed is 2,000 rpm.	1.7 - 2.1V
17	W	Mass air flow sensor ground	Engine is running. └ Idle speed	Approximately 0V
18	BR/Y	Engine coolant temperature sensor	Engine is running.	0 - 5.0V Output voltage varies with engine coolant temperature.
19	W	Heated oxygen sensor	Engine is running. └ After warming up sufficiently	0 - Approximately 1.0V
20	Y	Throttle position sensor	Ignition switch "ON" (Warm-up condition) └ Accelerator pedal released	0.35 - 0.65V
			Ignition switch "ON" └ Accelerator pedal fully depressed	Approximately 4V
21	B	Sensor's ground	Engine is running. └ Idle speed	Approximately 0V
22 30	L	Camshaft position sensor (Reference signal)	Engine is running.	0.1 - 0.4V
24	OR/L	Malfunction indicator lamp	Ignition switch "ON"	Approximately 1.5V
			Engine is running.	BATTERY VOLTAGE (11 - 14V)
27	W	Knock sensor	Engine is running. └ Idle speed	Approximately 2.5V
29	B	Sensor's ground	Engine is running. └ Idle speed	Approximately 0V
31 40	B/W	Camshaft position sensor (Position signal)	Engine is running.	2.0 - 3.0V
32	PU/R	Vehicle speed sensor	Ignition switch "ON" ├ Engine stopped and gear position is "Neutral position". └ While rotating drive wheel by hand	Varies from 0 to 5V
34	B/Y	Start signal	Ignition switch "ON"	Approximately 0V
			Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)

EC

ECM Terminals and Reference Value (Cont'd)

*Data are reference values.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	*DATA
35	G/OR	Neutral position switch/Inhibitor switch	Ignition switch "ON" "N" or "P" position (A/T) Neutral position (M/T)	0V
			Ignition switch "ON" Except the above gear position	BATTERY VOLTAGE (11 - 14V)
36	B/R	Ignition switch	Ignition switch "OFF"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
37	P/L	Throttle position sensor power supply	Ignition switch "ON"	Approximately 5V
38 47	W/R	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
39	B	ECCS ground	Engine is running. Idle speed	Engine ground
41	G	Air conditioner switch	Engine is running. Both air conditioner switch and blower fan switch are "ON".	Approximately 0V
			Engine is running. Air conditioner switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
43	PU/W	Power steering oil pressure switch	Engine is running. Steering wheel is being turned.	0V
			Engine is running. Steering wheel is not being turned.	7 - 9V
46	W/L	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
48	B	ECCS ground	Engine is running. Idle speed	Engine ground
109	W/L	Current return	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
101	R/B	Injector No. 1	Engine is running.	BATTERY VOLTAGE (11 - 14V)
103	G/B	Injector No. 3		
110	Y/B	Injector No. 2		
112	L/B	Injector No. 4		

ECM Terminals and Reference Value (Cont'd)

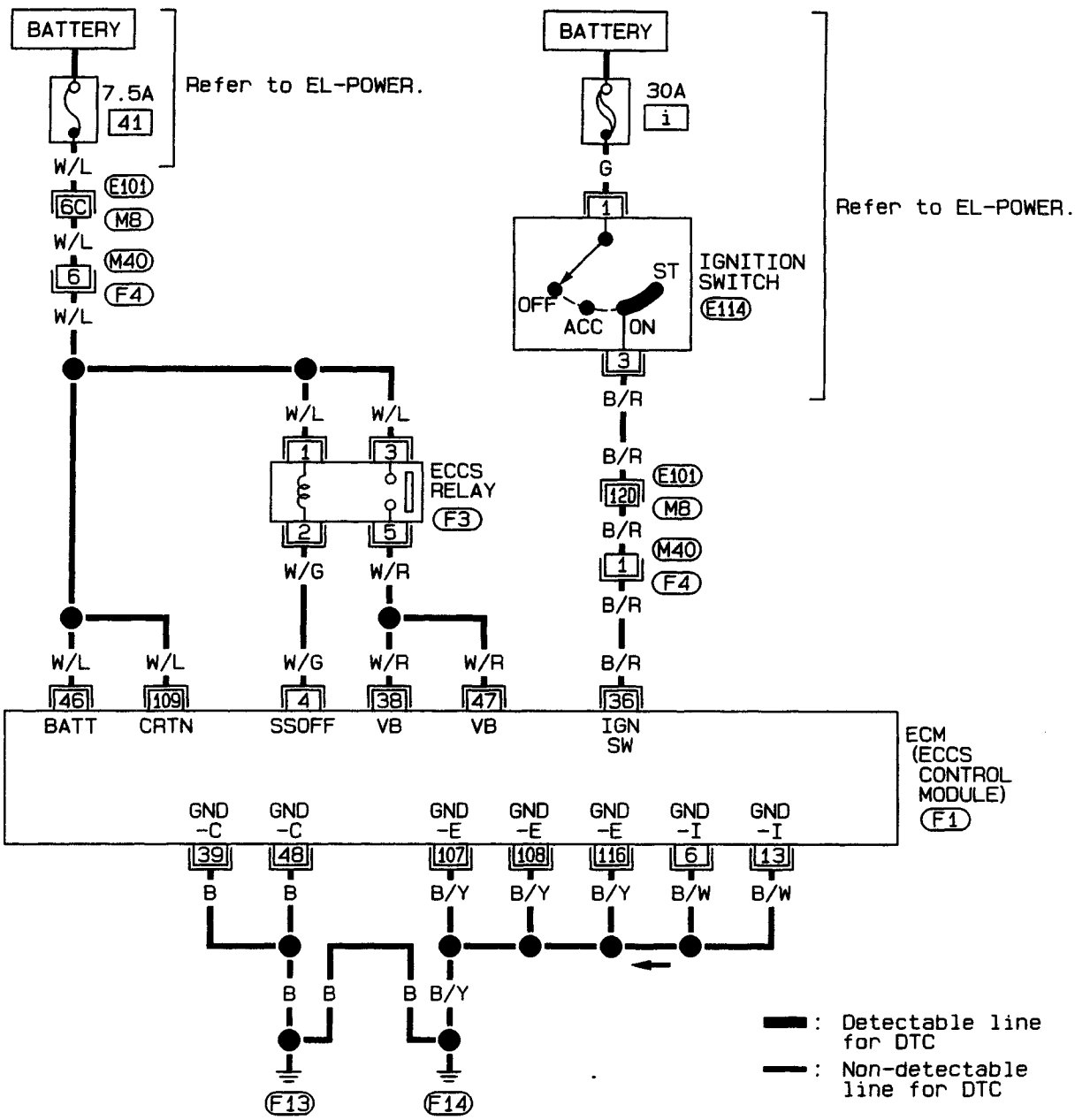
*Data are reference values.

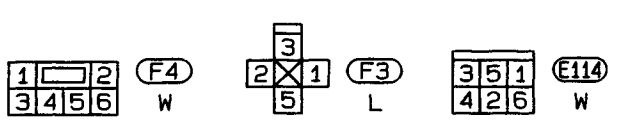
TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	*DATA
104	B/P	Fuel pump relay	Ignition switch "ON" └ For 5 seconds after turning ignition switch "ON" Engine is running.	Approximately 0V
			Ignition switch "ON" └ 5 seconds after turning ignition switch "ON" and thereafter	BATTERY VOLTAGE (11 - 14V)
105	P	EGR valve & EVAP canister purge control solenoid valve	Engine is running. └ Engine speed is 4,000 rpm.	0.6 - 0.8V
			Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
107 108	B/Y	ECCS ground	Engine is running. └ Idle speed	Engine ground
111	OR	Heated oxygen sensor heater	Engine is running. └ Engine speed is below 3,200 rpm.	Approximately 0.2V
			Engine is running. └ Engine speed is above 3,200 rpm.	BATTERY VOLTAGE (11 - 14V)
113	SB	IACV-AAC valve	Engine is running. └ Idle speed	11 - 14V
			Engine is running. ├ Steering wheel is being turned. ├ Air conditioner is operating. ├ Rear window defogger switch is "ON". └ Lighting switch is "ON".	2 - 11V
115	P/B	Torque converter clutch solenoid valve (A/T models)	Engine is running. └ Idle speed	Approximately 0V
			Engine is running. (Warm-up condition) └ Vehicle speed is 60 km/h (37 MPH) or more in "D" position	BATTERY VOLTAGE (11 - 14V)
116	B/Y	ECCS ground	Engine is running. └ Idle speed	Engine ground

EC

Main Power Supply and Ground Circuit

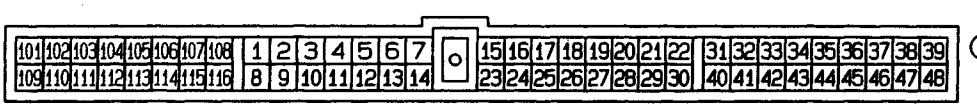
EC-MAIN-01





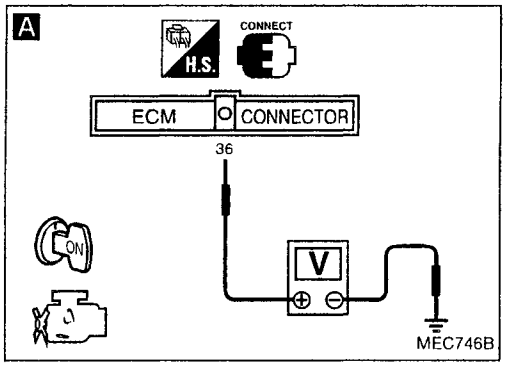
Refer to last page (Foldout page).

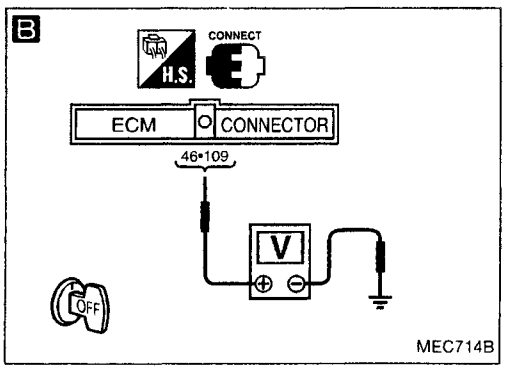
M8, E101

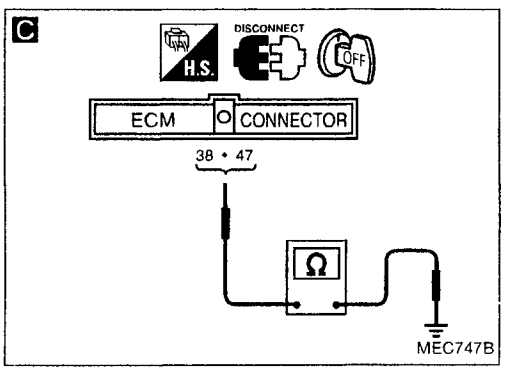


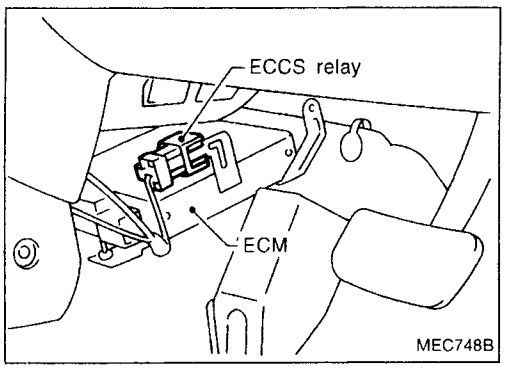
HEC002

Main Power Supply and Ground Circuit (Cont'd)









INSPECTION START

Start engine.
Is engine running?

No → **A**

CHECK POWER SUPPLY-I.
1. Turn ignition switch "ON".
2. Check voltage between ECM terminal (36) and ground with CONSULT or tester.
   Voltage: Battery voltage

If NG, check the following.
- Harness connectors (F4), (M40)
- Harness connectors (M8), (E101)
- Harness for open or short between ECM and ignition switch

If NG, repair harness or connectors.

OK → Go to H "CHECK GROUND CIRCUIT" on next page.

Yes → **B**

CHECK POWER SUPPLY-II.
1. Stop engine.
2. Check voltage between ECM terminals (46), (109) and ground with CONSULT or tester.
   Voltage: Battery voltage

NG → Check the following.
- Harness connectors (F4), (M40)
- Harness connectors (M8), (E101)
- 7.5A fuse
- Harness for open or short between ECM and battery

If NG, repair harness or connectors.

OK → **C**

CHECK POWER SUPPLY-III.
1. Turn ignition switch "ON" and then "OFF".
2. Check voltage between ECM terminals (38), (47) and ground with CONSULT or tester.
   Voltage:
   After turning ignition switch "OFF", battery voltage will exist for a few seconds, then drop to approximately 0V.

OK → Go to H "CHECK GROUND CIRCUIT" on next page.

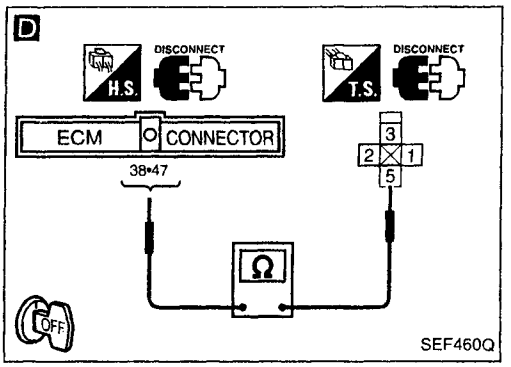
Case-1: Battery voltage does not exist.
Case-2: Battery voltage exists for more than a few seconds.

NG
Case-2 → Go to G "CHECK ECCS RELAY" on next page.
Case-1 → Ⓐ

EC

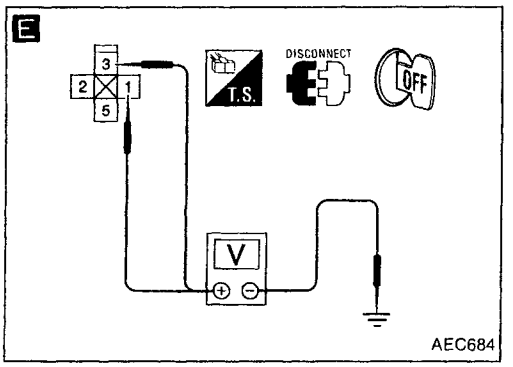
Main Power Supply and Ground Circuit (Cont'd)

D



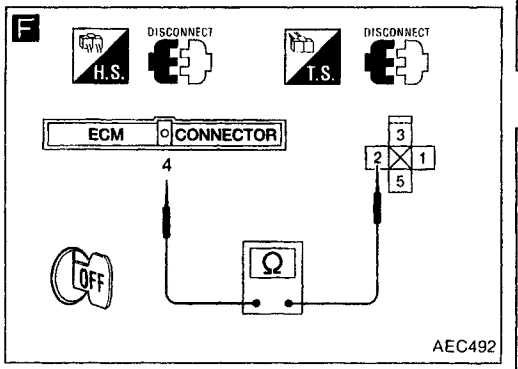
SEF460Q

E



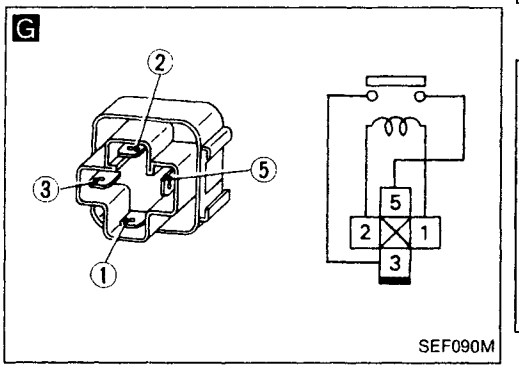
AEC684

F



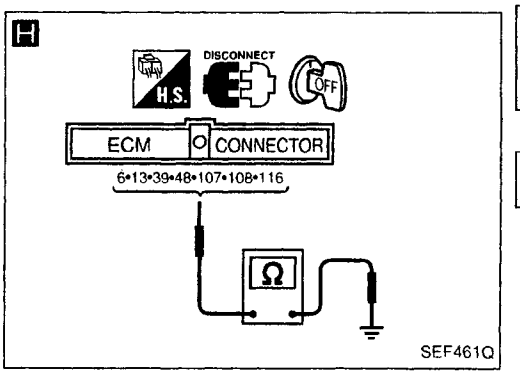
AEC492

G



SEF090M

H



SEF461Q

Ⓐ

D

CHECK HARNESS CONTINUITY BETWEEN ECCS RELAY AND ECM
1. Disconnect ECM harness connector.
2. Disconnect ECCS relay harness connector.
3. Check harness continuity between ECM terminals (38), (47) and terminal (5).

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

NG → Repair harness or connectors.

OK ↓

E

CHECK VOLTAGE BETWEEN ECCS RELAY AND GROUND.
Check voltage between terminals (1), (3) and ground with CONSULT or tester.
Voltage: Battery voltage

NG → Check the following.
- Harness connectors (F4), (M4D)
- Harness connectors (M8), (E101)
- Harness for open or short between ECCS relay and battery

If NG, repair harness or connectors.

OK ↓

F

CHECK OUTPUT SIGNAL CIRCUIT.
Check harness continuity between ECM terminal (4) and terminal (2).
Continuity should exist.
If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

G

CHECK ECCS RELAY.
1. Apply 12V direct current between relay terminals (1) and (2).
2. Check continuity between relay terminals (3) and (5).

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

NG → Replace ECCS relay.

OK ↓

H

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Loosen and retighten engine ground screws.
3. Disconnect ECM harness connector.
4. Check harness continuity between ECM terminals (6), (13), (39), (48), (107), (108), (116) and engine ground.

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

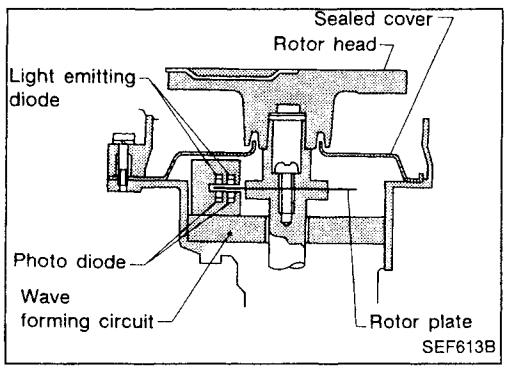
NG → Repair harness or connectors.

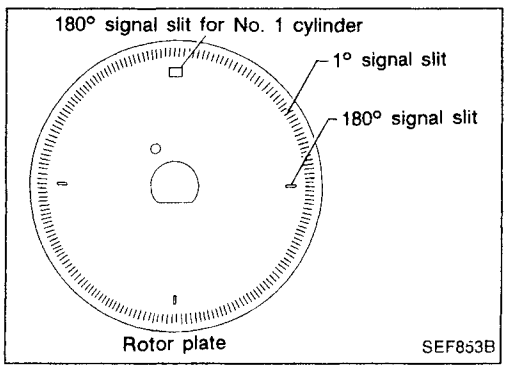
OK ↓

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

↓

INSPECTION END





Camshaft Position Sensor (CMPS)

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

The camshaft position sensor has a rotor plate and a wave-forming circuit. The rotor plate has 360 slits for a 1° (POS) signal and 4 slits for a 180° (REF) signal. The wave-forming circuit consists of Light Emitting Diodes (LED) and photo diodes.

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

EC

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible Cause)
11	• Either 1° or 180° signal is not sent to ECM for the first few seconds during engine cranking. • Either 1° or 180° signal is not sent to ECM often enough while the engine speed is higher than the specified engine speed. • The relation between 1° and 180° signal is not in the normal range during the specified engine speed.	• Harness or connectors (The camshaft position sensor circuit is open or shorted.) • Camshaft position sensor • Starter motor (Refer to EL section.) • Starting system circuit (Refer to EL section.) • Dead (Weak) battery

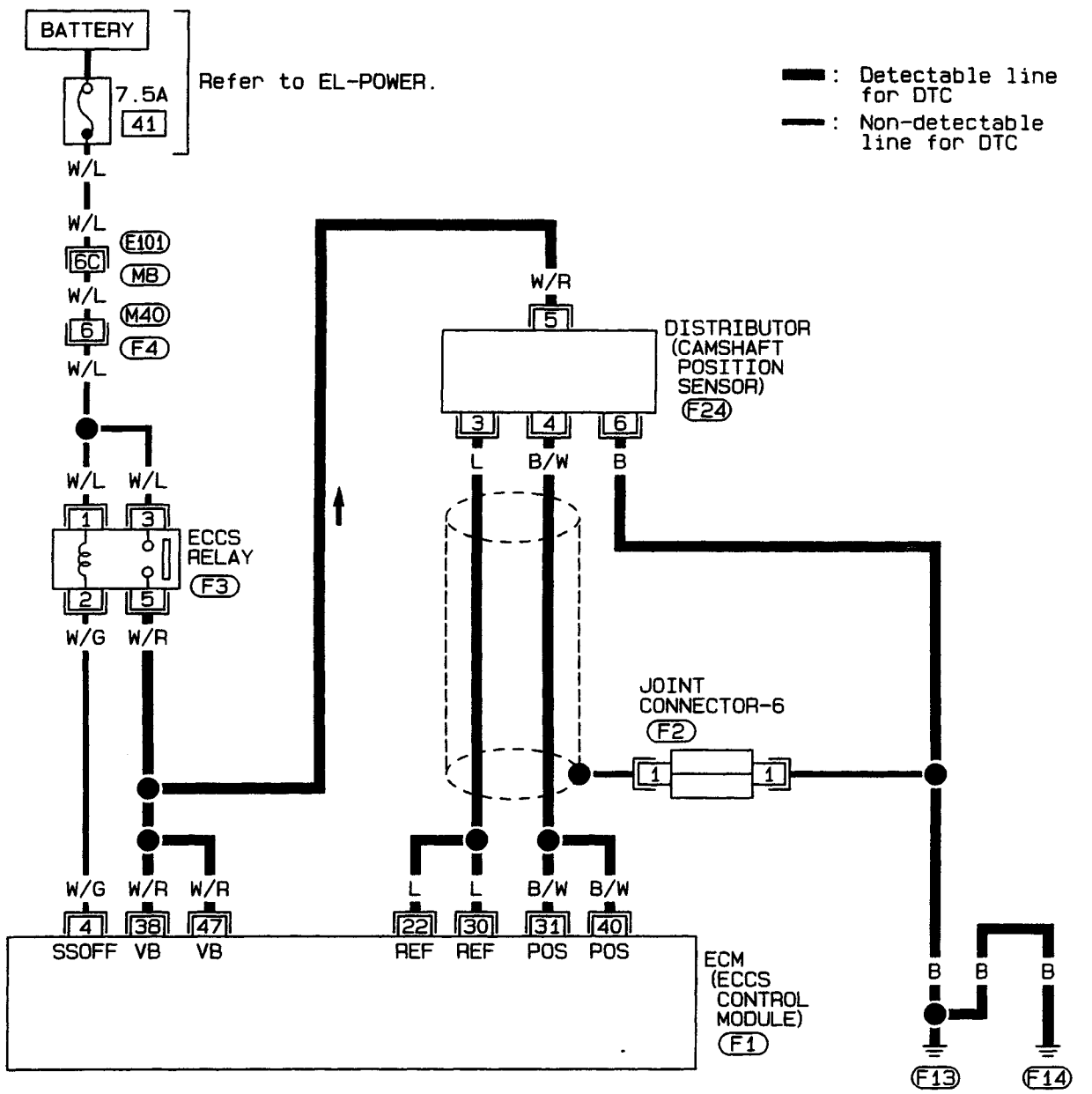
DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

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

OR

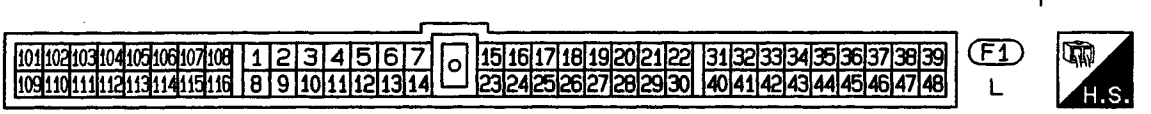
1) Start engine and run it for at least 2 seconds at idle speed.
2) Turn ignition switch "OFF", wait at least 7 seconds and then turn "ON".
3) Perform "Diagnostic Test Mode II" (Self-diagnostic results) with ECM.

EC-CMPS-01





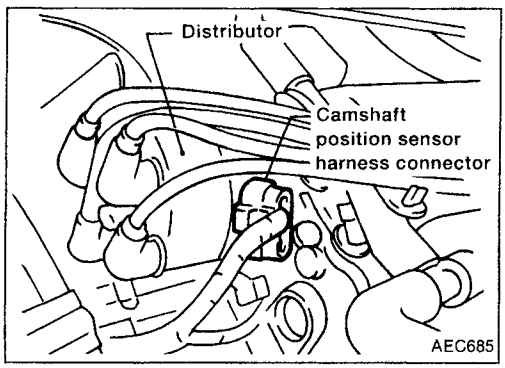
Refer to last page (Foldout page).
M8, E101

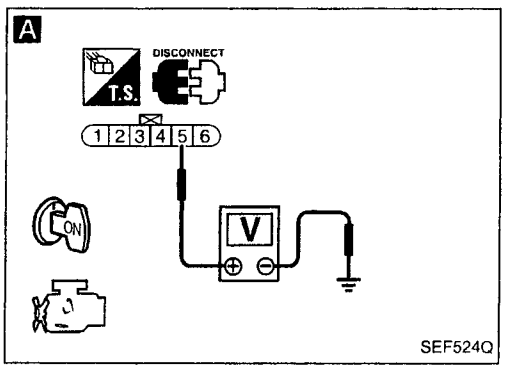


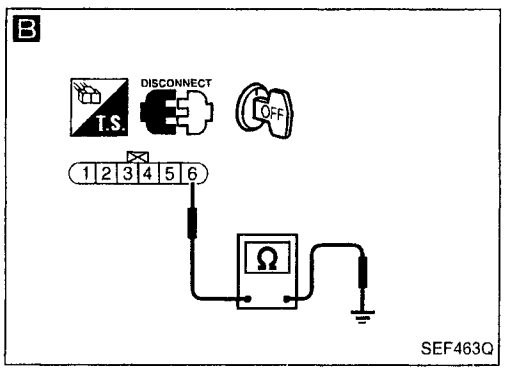
HEC003

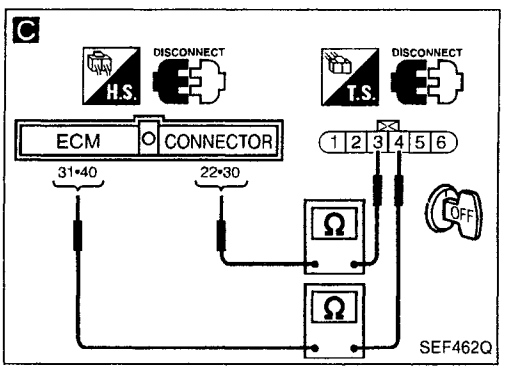
Camshaft Position Sensor (CMPS) (Cont'd)

DIAGNOSTIC PROCEDURE (DETECTABLE CIRCUIT)









INSPECTION START

A

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

NG → Check the following.
- Harness for open or short between camshaft position sensor and ECCS relay

If NG, repair harness or connectors.

OK ↓

B

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Loosen and retighten engine ground screws.
3. Check harness continuity between terminal ⑥ and engine ground.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connector.

OK ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between terminal ④ and ECM terminals ㉛, ㊵, terminal ③ and ECM terminals ㉒, ㉚.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

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

NG → Replace camshaft position sensor.

OK ↓

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

Trouble is not fixed. ↓

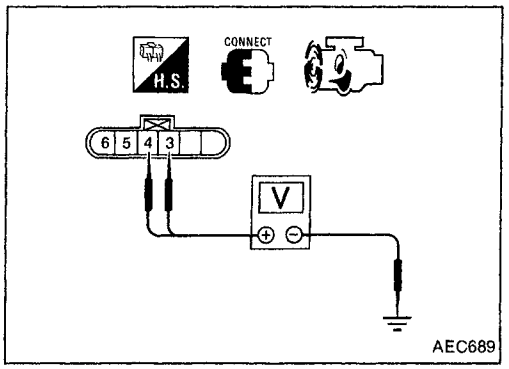
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

INSPECTION END

EC

Camshaft Position Sensor (CMPS) (Cont'd)

COMPONENT INSPECTION

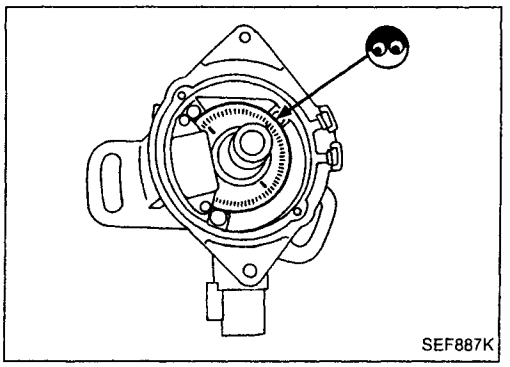


Camshaft position sensor

1. Start engine.
2. Check voltage between camshaft position sensor terminals ③, ④ and ground with AC range.

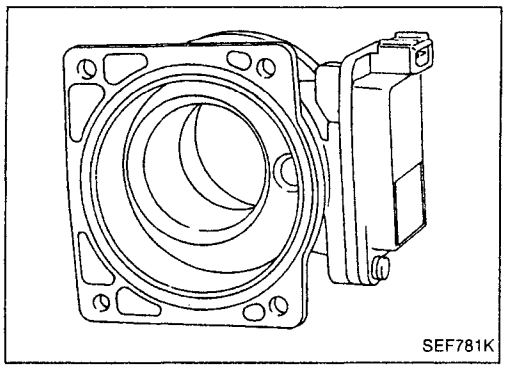
Condition	Terminal	Voltage (AC range)
Engine running at idle	③ and ground ④ and ground	Approximately 2.7V*

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



3. If NG, replace distributor assembly with camshaft position sensor.
4. Remove distributor cap. Visually check signal plate for damage or dust.

After this inspection, diagnostic trouble code No. 11 might be displayed with camshaft position sensor functioning properly. Erase the stored memory.


SEF781K

Mass Air Flow Sensor (MAFS)

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

EC

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

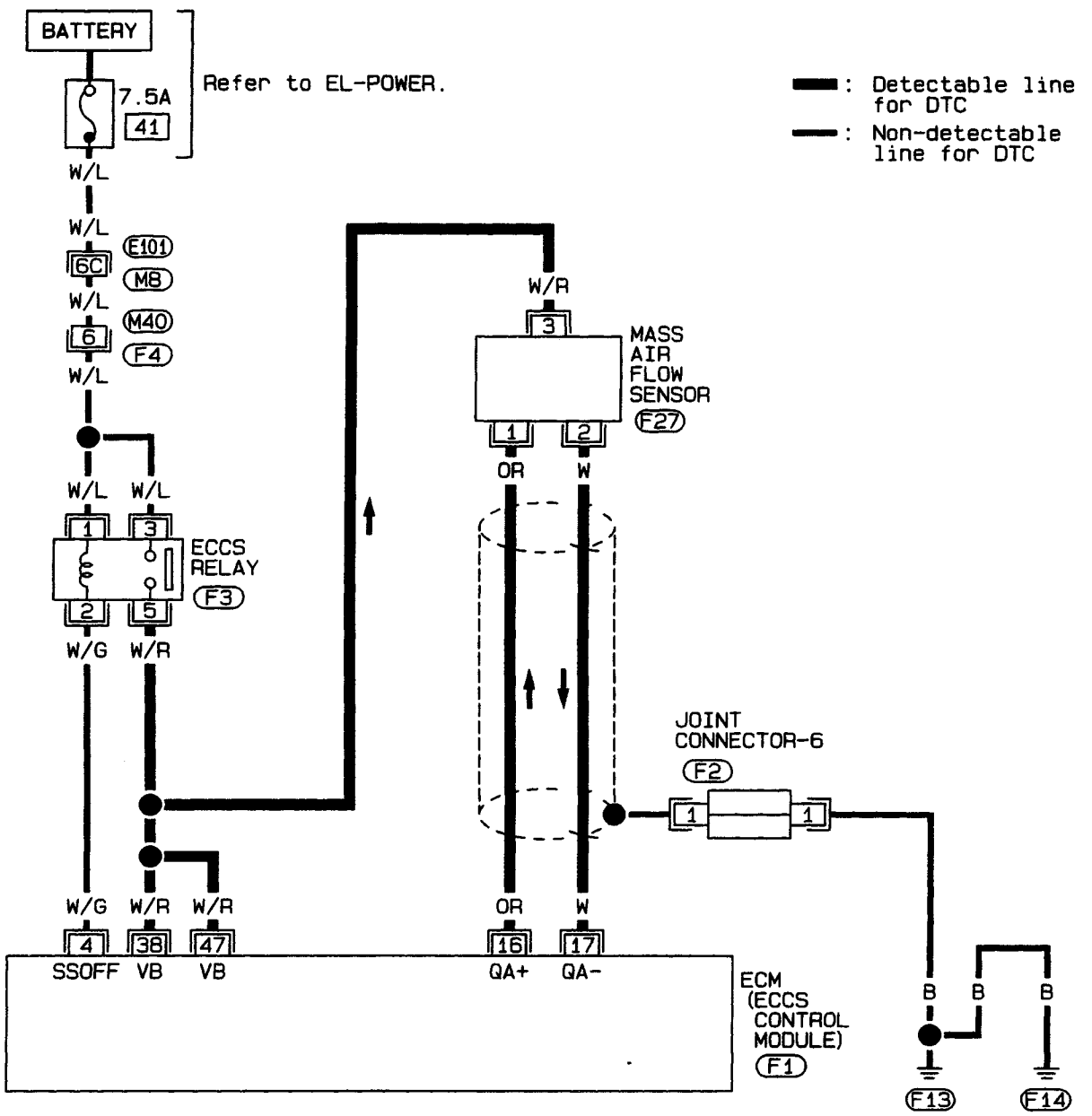
DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

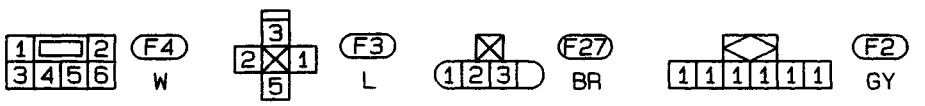
1) Turn ignition switch "ON", and wait at least 6 seconds.
2) Select "DATA MONITOR" mode with CONSULT.
3) Start engine and wait at least 3 seconds.

OR

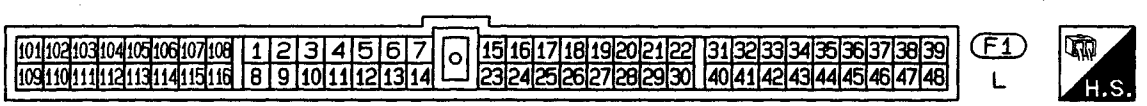
1) Turn ignition switch "ON", and wait at least 6 seconds.
2) Start engine and wait at least 3 seconds.
3) Turn ignition switch "OFF", wait at least 7 seconds and then turn "ON".
4) Perform "Diagnostic Test Mode II" (Self-diagnostic results) with ECM.

EC-MAFS-01





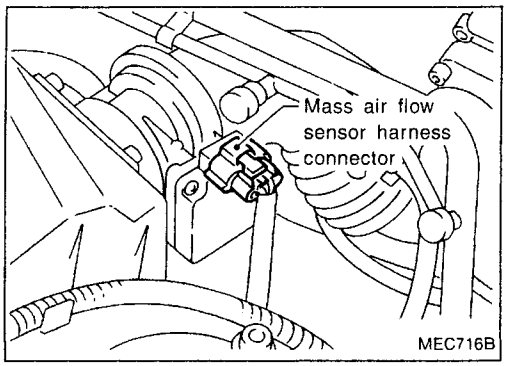
Refer to last page (Foldout page).
M8, E101



HEC004

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

DIAGNOSTIC PROCEDURE



INSPECTION START

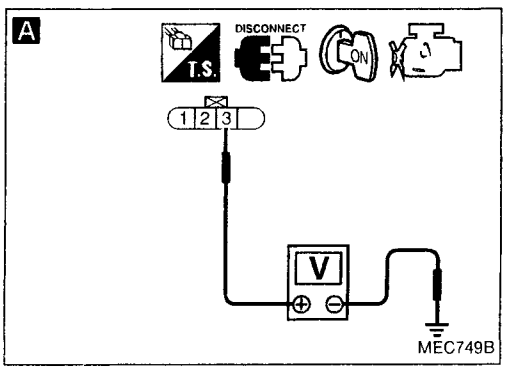
A

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect mass air flow sensor harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ③ and ground with CONSULT or tester.

Voltage: Battery positive voltage

NG → Repair harness or connectors.

OK



B

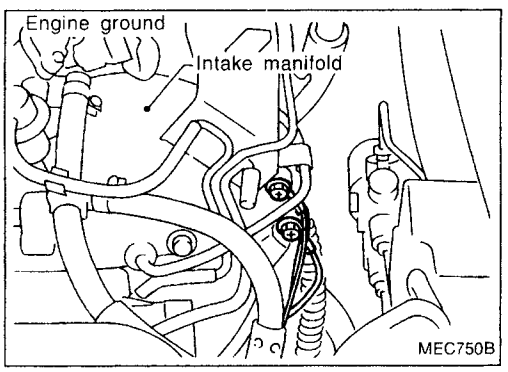
CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Loosen and retighten engine ground screws.
4. Check harness continuity between terminal ② and ECM terminal ⑰.

Continuity should exist.

If OK, check harness for short.

NG → Repair harness or connectors.

OK



C

CHECK INPUT SIGNAL CIRCUIT.

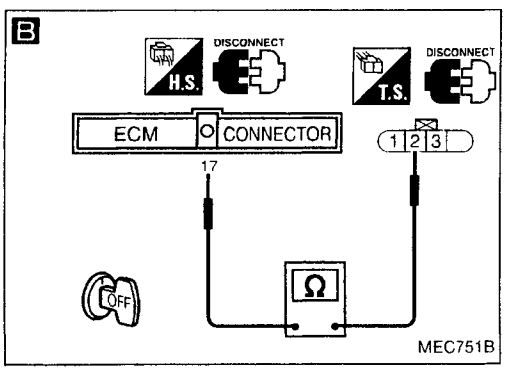
Check harness continuity between terminal ① and ECM terminal ⑯.

Continuity should exist.

If OK, check harness for short.

NG → Repair harness or connectors.

OK



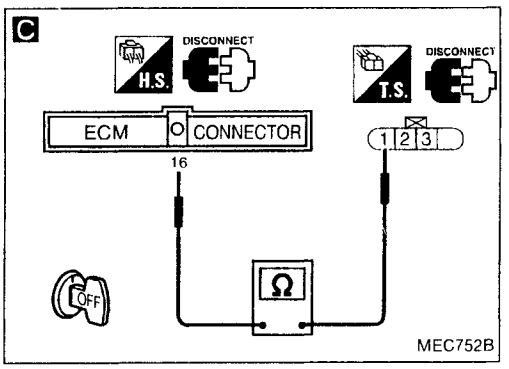
CHECK COMPONENT
(Mass air flow sensor).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace mass air flow sensor.

OK

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

Trouble is not fixed.



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

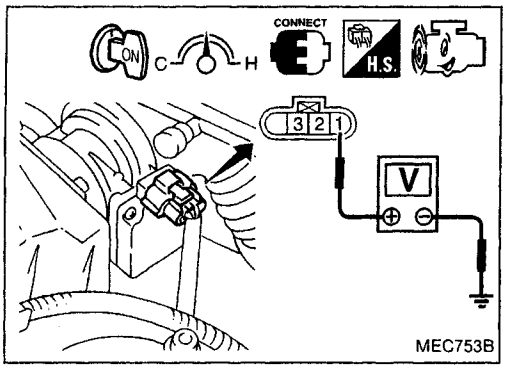
INSPECTION END

EC

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

COMPONENT INSPECTION

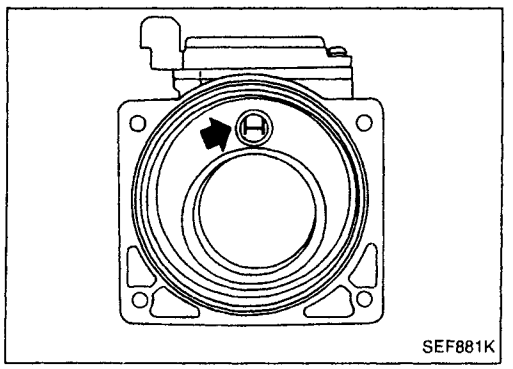
Mass air flow sensor

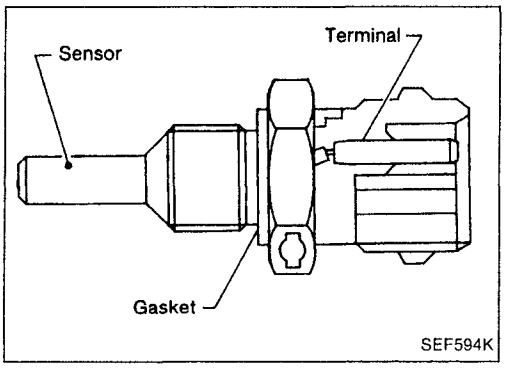


1. Turn ignition switch "ON".
2. Start engine and warm it up sufficiently.
3. Check voltage between terminal ① and ground.

Conditions	Voltage V
Ignition switch "ON" (Engine stopped.)	Less than 1.0
Idle (Engine is warmed-up sufficiently.)	1.3 - 1.7

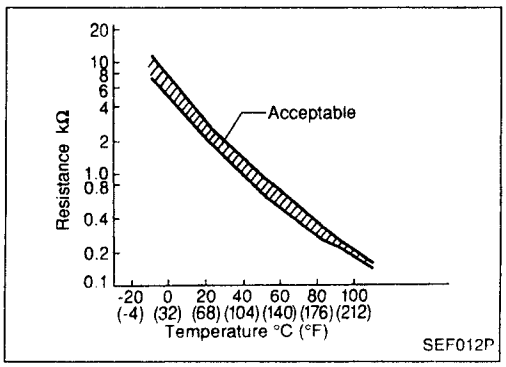
4. If NG, remove mass air flow sensor from air duct. Check hot wire for damage or dust.





Engine Coolant Temperature Sensor (ECTS)

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



<Reference data>

Engine coolant temperature °C (°F)	Voltage (V)	Resistance (kΩ)
–10 (14)	4.4	7.0 - 11.4
20 (68)	3.5	2.1 - 2.9
50 (122)	2.2	0.68 - 1.00
90 (194)	0.9	0.236 - 0.260

EC

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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

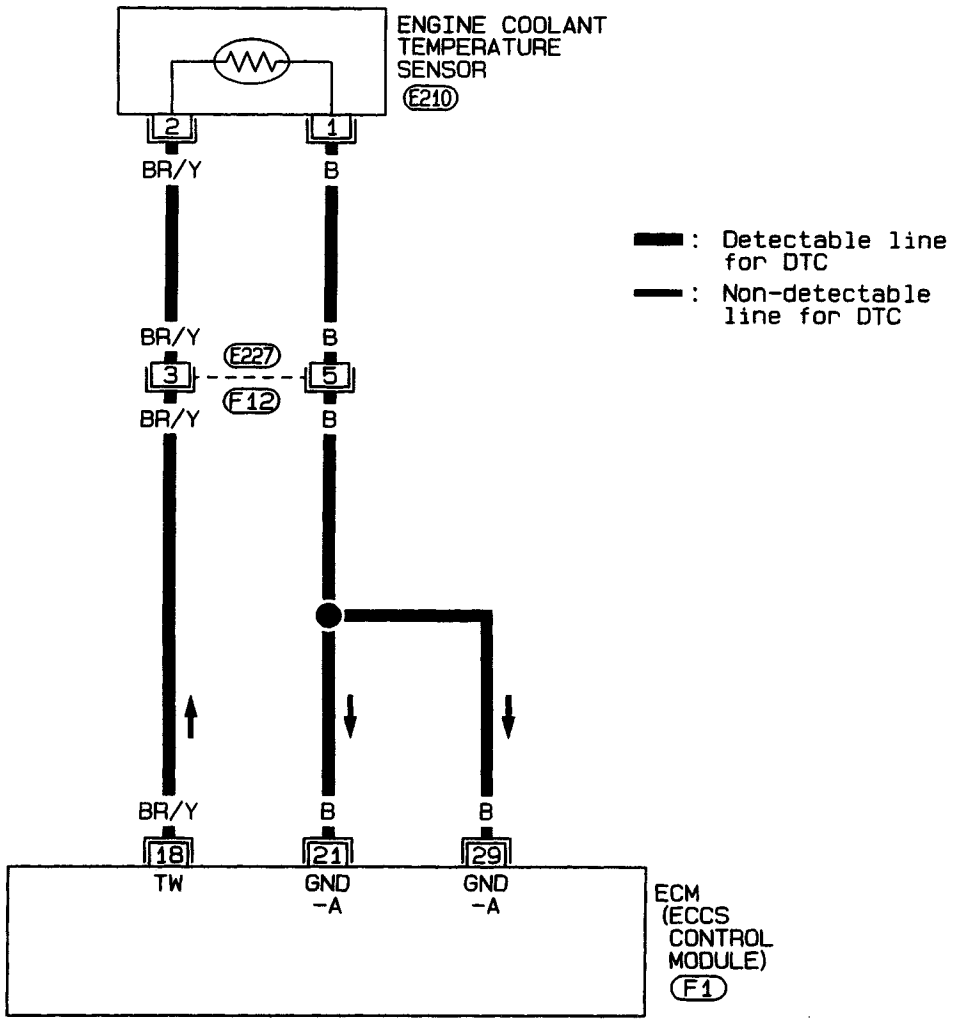
1) Turn ignition switch "ON".
2) Select "DATA MONITOR" mode with CONSULT.
3) Wait at least 5 seconds.

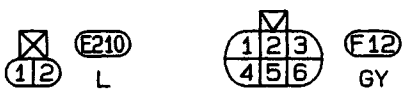
OR

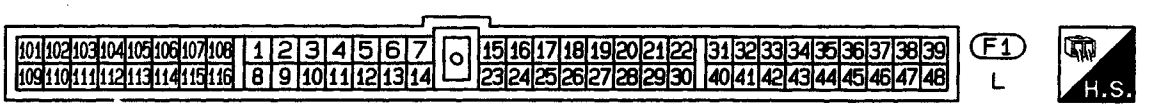
1) Turn ignition switch "ON" and wait at least 5 seconds.
2) Turn ignition switch "OFF", wait at least 7 seconds and then turn "ON".
3) Perform "Diagnostic Test Mode II" (Self-diagnostic results) with ECM.

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

EC-ECTS-01



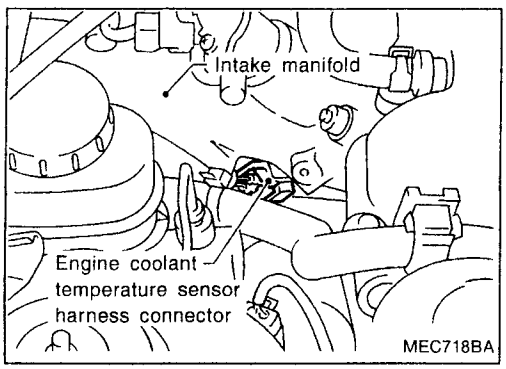


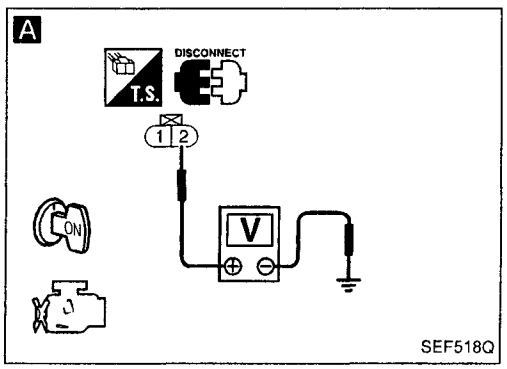


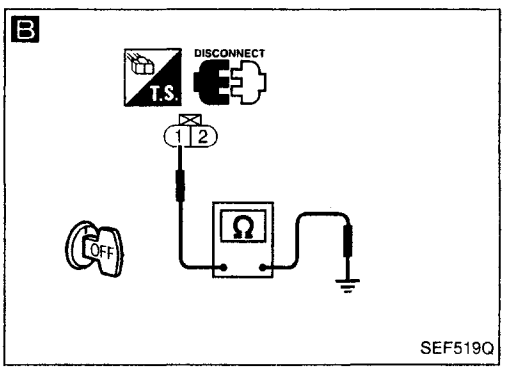
HEC005

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

DIAGNOSTIC PROCEDURE







INSPECTION START

A

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect engine coolant temperature sensor harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ② and ground with CONSULT or tester.

Voltage:
Approximately 5V

NG → Check the following.
- Harness for open or short between ECM and engine coolant temperature sensor
- Harness connectors (E227), (F12)

If NG, repair harness or connectors.

OK ↓

B

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Check harness continuity between terminal ① and engine ground.

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

NG → Check the following.
- Harness for open or short between ECM and engine coolant temperature sensor
- Harness connectors (E227), (F12)

If NG, repair harness or connectors.

OK ↓

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

NG → Replace engine coolant temperature sensor.

OK ↓

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

Trouble is not fixed. ↓

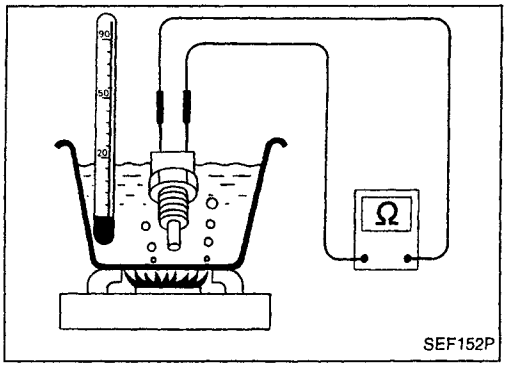
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

INSPECTION END

EC

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

COMPONENT INSPECTION

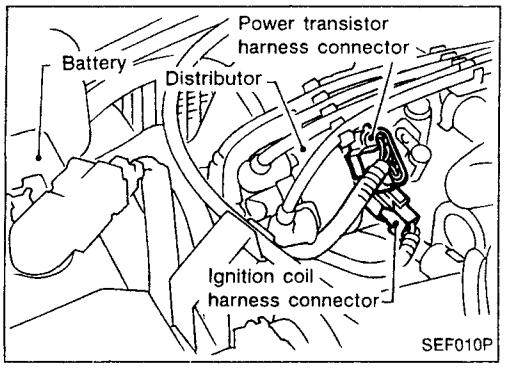


Engine coolant temperature sensor

Check resistance as shown in the figure.

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

If NG, replace engine coolant temperature sensor.



Ignition Signal

COMPONENT DESCRIPTION

Ignition coil & power transistor (Built into distributor)

The ignition coil is a small molded type. The ignition signal from the ECM is sent to the power transistor. The power transistor switches on and off the ignition coil primary circuit. As the primary circuit is turned on and off, the proper high voltage is induced in the coil secondary circuit.

EC

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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

Note: If both DTC 11 and 21 are displayed, perform TROUBLE DIAGNOSIS FOR DTC 11 first. Refer to EC-289.

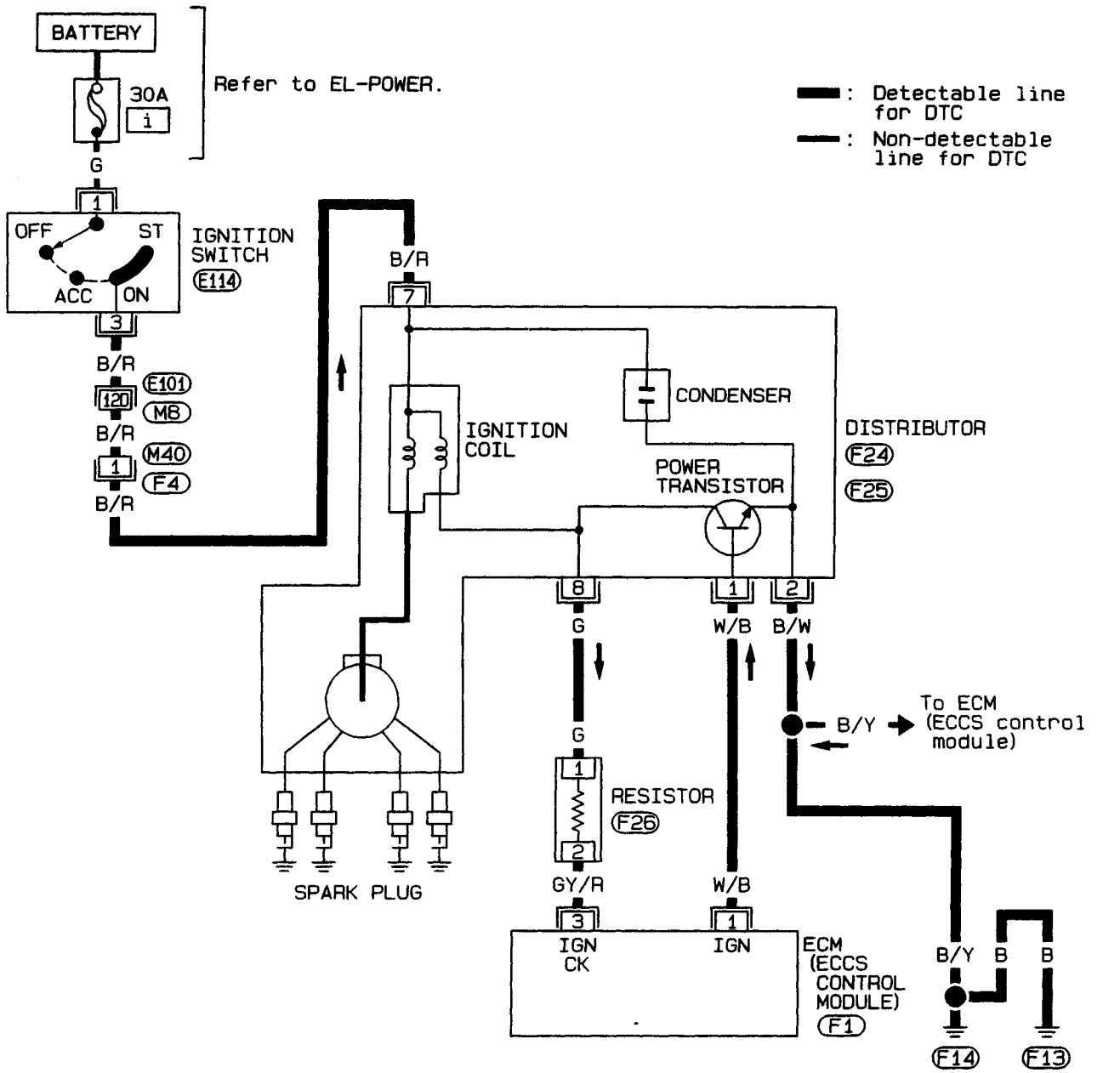
1) Turn ignition switch "ON".
2) Select "DATA MONITOR" mode with CONSULT.
3) Start engine. (If engine does not run, turn ignition switch to "START" for at least 5 seconds.)

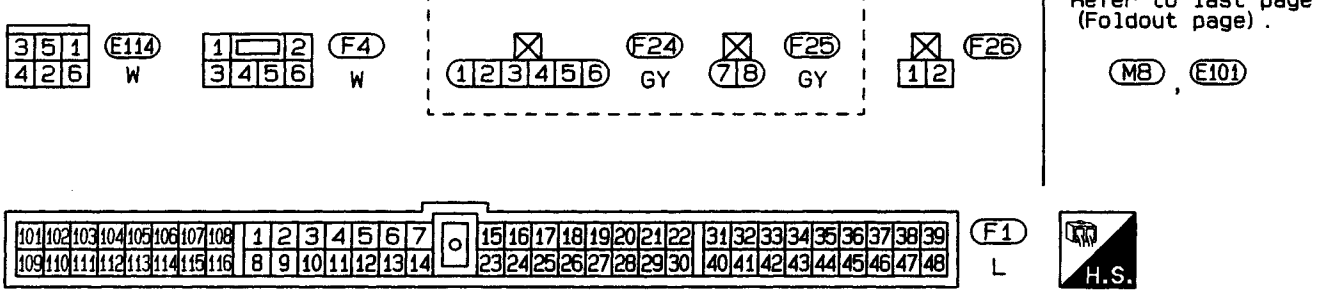
OR

1) Turn ignition switch "ON".
2) Start engine. (If engine does not run, turn ignition switch to "START" for at least 5 seconds.)
3) Turn ignition switch "OFF", wait at least 7 seconds and then turn "ON".
4) Perform "Diagnostic Test Mode II" (Self-diagnostic results) with ECM.

Ignition Signal (Cont'd)

EC-IGN/SG-01

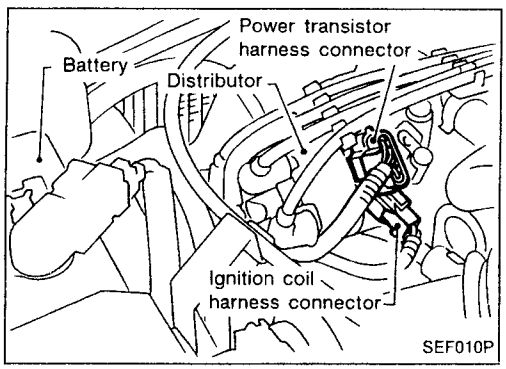


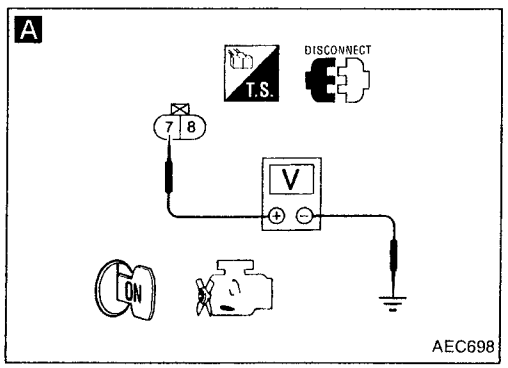


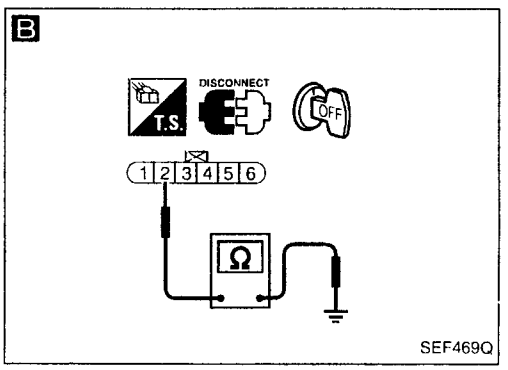
HEC006

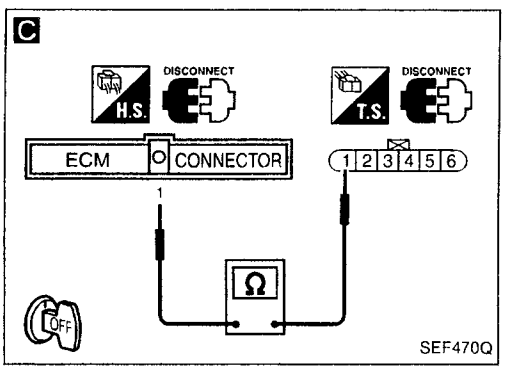
Ignition Signal (Cont'd)

DIAGNOSTIC PROCEDURE









INSPECTION START

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

Yes → Ⓐ

No

A

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

NG → Check the following.
- Harness connectors (F4), (M40)
- Harness connectors (M8), (E101)
- Harness for open or short between ignition coil and ignition switch

If NG, repair harness or connectors.

OK

B

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

NG → Repair harness or connectors.

OK

C

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ① and power transistor terminal ①.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK

CHECK COMPONENTS
(Ignition coil, power transistor).
Refer to "COMPONENT INSPECTION", EC-305.

NG → Replace malfunctioning component(s).

OK

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

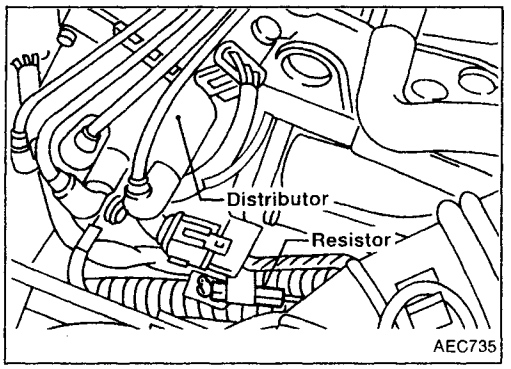
Trouble is not fixed.

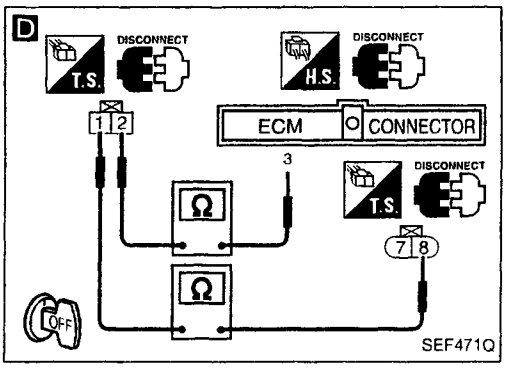
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

INSPECTION END

EC

Ignition Signal (Cont'd)





Ⓐ

D

CHECK INPUT SIGNAL CIRCUIT.

1. Stop engine.
2. Disconnect ignition coil harness connector.
3. Strip tape covering resistor.
4. Disconnect ECM harness connector.
5. Check harness continuity between ignition coil terminal ⑧ and resistor terminal ①, resistor terminal ② and ECM terminal ③.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

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

NG → Replace resistor.

OK ↓

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

Trouble is not fixed. ↓

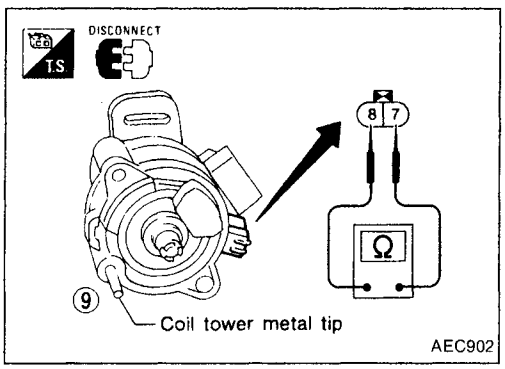
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

↓

INSPECTION END

Ignition Signal (Cont'd)

COMPONENT INSPECTION



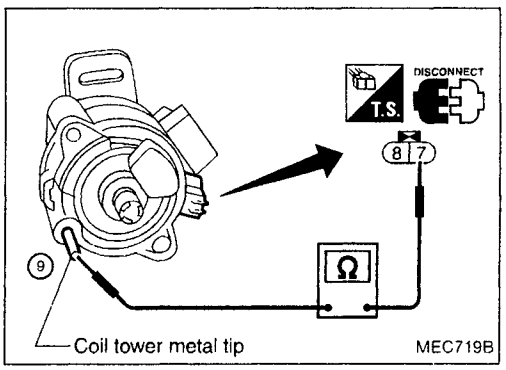
Ignition coil

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

Terminal	Resistance [at 25°C (77°F)]
⑦ - ⑧ (Primary coil)	0.5 - 1.0Ω
⑦ - ⑨ (Secondary coil)	Approximately 25 kΩ

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

If NG, replace distributor assembly as a unit.

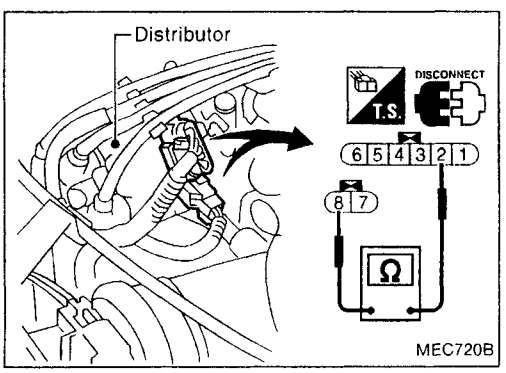


Power transistor

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

Terminals	Resistance	Result
② and ⑧	Not 0Ω	OK
	0Ω	NG

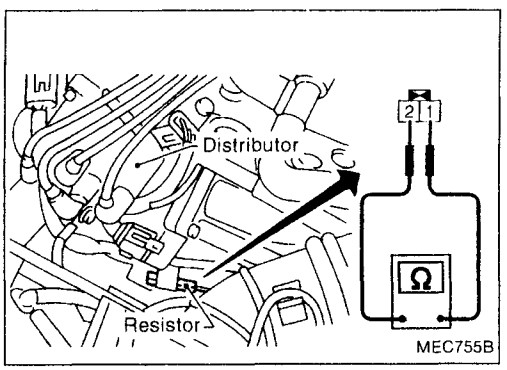
If NG, replace distributor assembly.



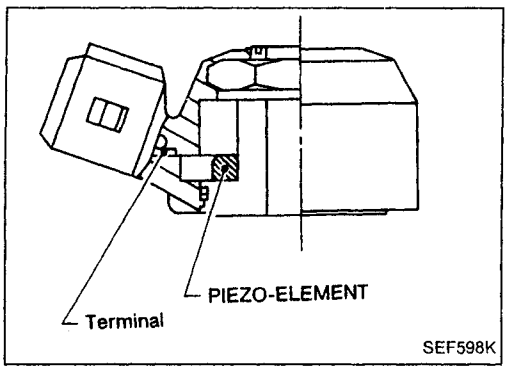
Resistor

1. Disconnect resistor harness connector.
2. Check resistance between terminals ① and ②
   Resistance: Approximately 2.2 kΩ [at 25°C (77°F)]

If NG, replace resistor.



EC



Knock Sensor (KS)

The knock sensor is attached to the cylinder block. It senses engine knocking using a piezoelectric element. A knocking vibration from the cylinder block is sensed as vibrational pressure. This pressure is converted into a voltage signal and sent to the ECM.

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible Cause)
34	• An excessively low or high voltage from the knock sensor is sent to ECM.	• Harness or connectors (The knock sensor circuit is open or shorted.) • Knock sensor

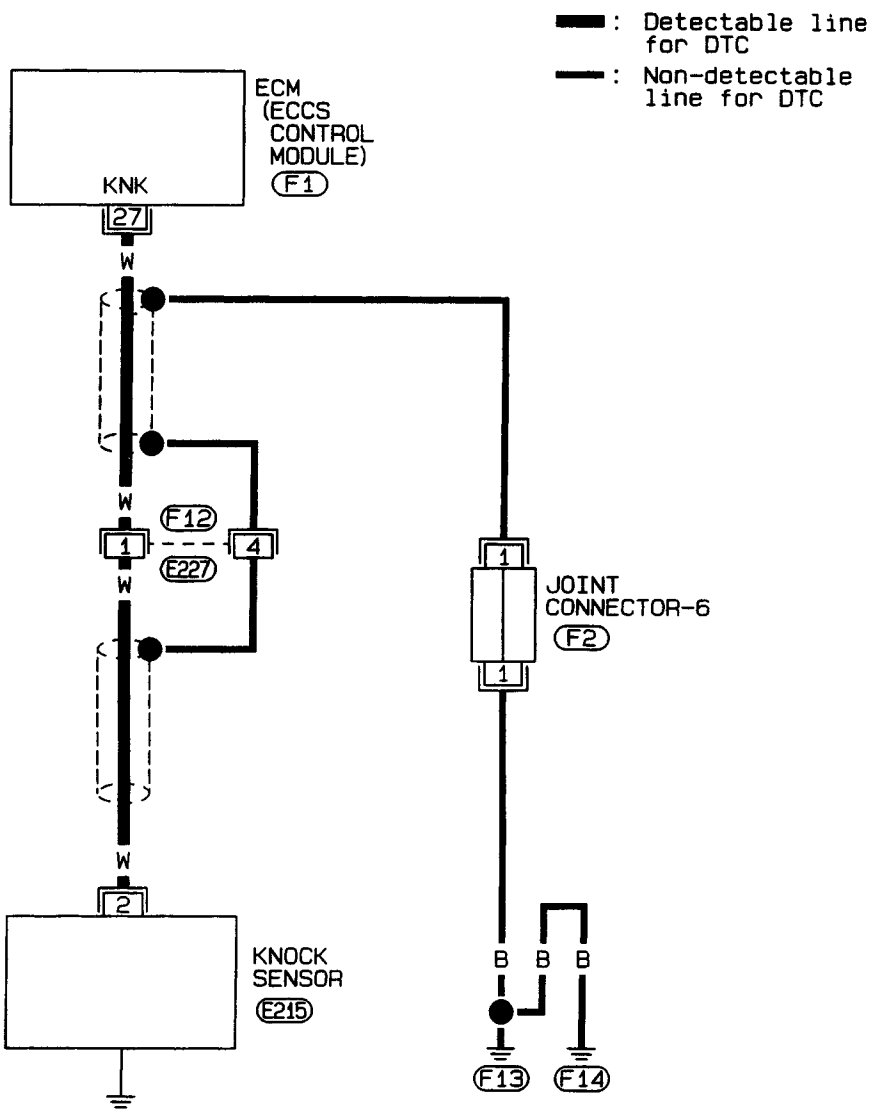
DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

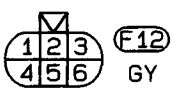
1) Turn ignition switch "ON" and select "DATA MONITOR" mode with CONSULT.
2) Start engine and run it for at least 5 seconds at idle speed.

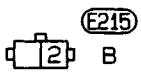
OR

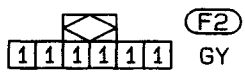
1) Start engine and run it for at least 5 seconds at idle speed.
2) Turn ignition switch "OFF", wait at least 7 seconds and then turn "ON".
3) Perform "Diagnostic Test Mode II" (Self-diagnostic results) with ECM.

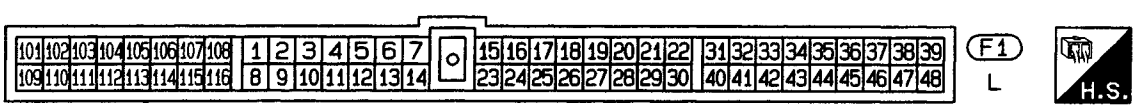
EC-KS-01







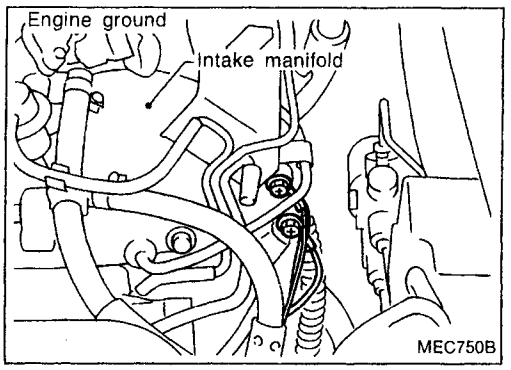


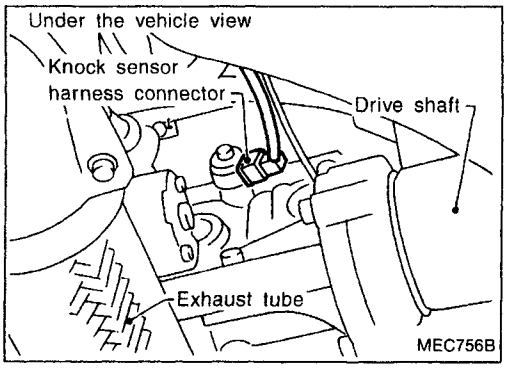


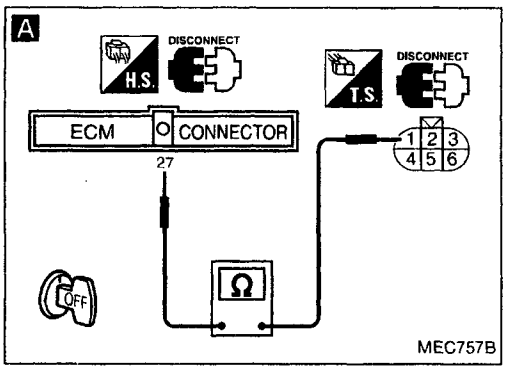
HEC007

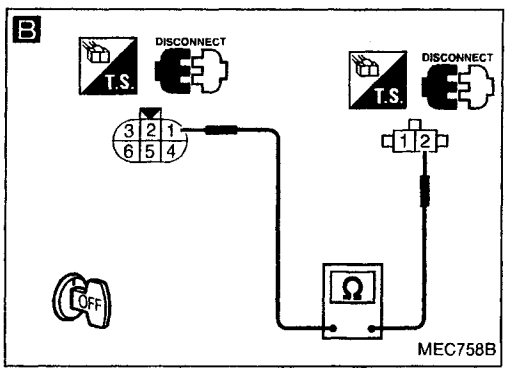
Knock Sensor (KS) (Cont'd)

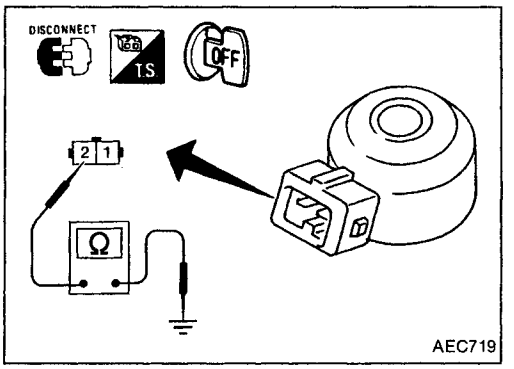
DIAGNOSTIC PROCEDURE











INSPECTION START

↓

Loosen and retighten engine ground screws.

↓

A

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector and knock sensor harness connector.
3. Disconnect sub-harness connectors (F12), (E227).
4. Check harness continuity between terminal ① and ECM terminal ㉗.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

B

CHECK SUB-HARNESS CIRCUIT.
1. Disconnect knock sensor harness connector.
2. Check harness continuity between knock sensor harness connector terminal ② and knock sensor sub-harness connector terminal ①.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

CHECK COMPONENT
(Knock sensor).
Refer to "COMPONENT INSPECTION" below.

NG → Replace knock sensor.

OK ↓

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

Trouble is not fixed. ↓

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

↓

INSPECTION END

COMPONENT INSPECTION

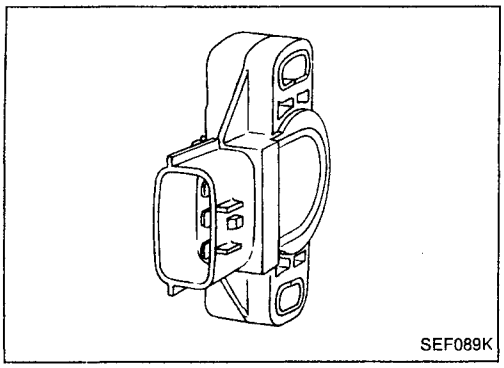
Knock sensor

- Use an ohmmeter which can measure more than 10 MΩ.

1. Disconnect knock sensor harness connector.
2. Check resistance between terminal ② and ground.
   Resistance: 500 - 620 kΩ [at 25°C (77°F)]

CAUTION:

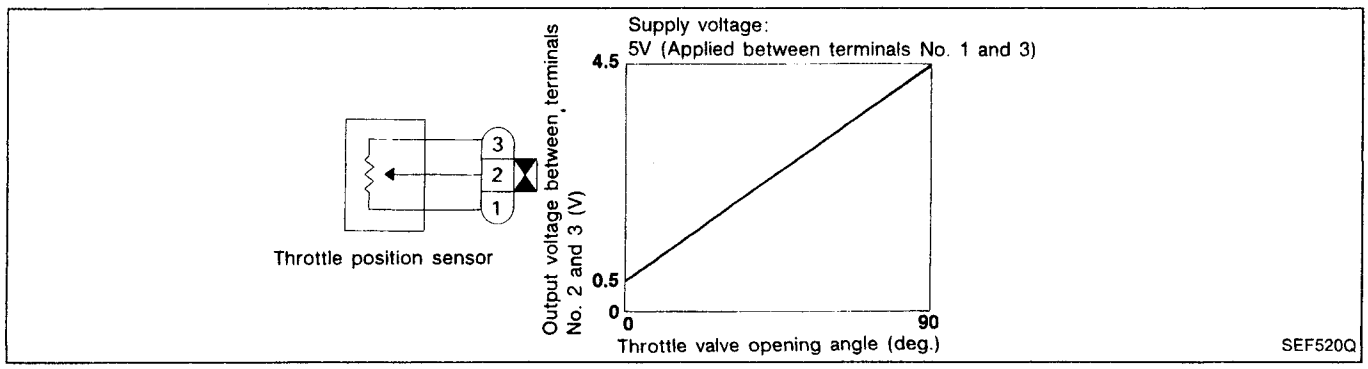
Do not use any knock sensors that have been dropped or physically damaged. Use only new ones.


SEF089K

Throttle Position Sensor

The throttle position sensor responds to the accelerator pedal movement. This sensor is a kind of potentiometer which transforms the throttle position into output voltage, and emits the voltage signal to the ECM. In addition, the sensor detects the opening and closing speed of the throttle valve and feeds the voltage signal to the ECM.

Idle position of the throttle valve is determined by the ECM receiving the signal from the throttle position sensor. This one controls engine operation such as fuel cut.

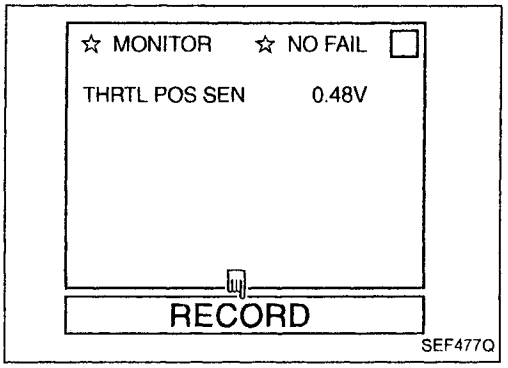


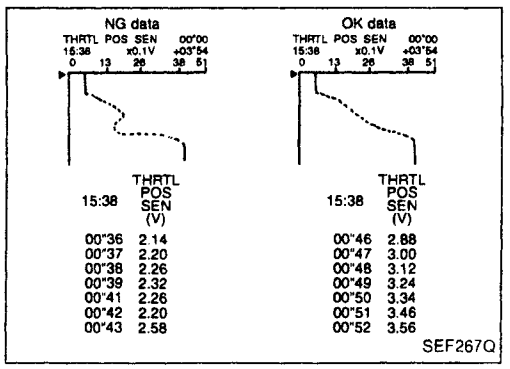
Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
43	• An excessively low or high voltage from the sensor is sent to ECM.	• Harness or connectors (The sensor circuit is open or shorted.) • Throttle position sensor

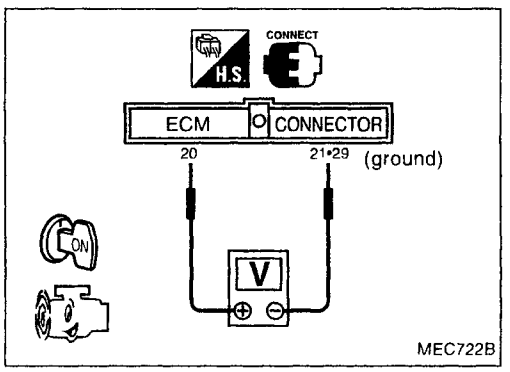
Throttle Position Sensor (Cont'd)

OVERALL FUNCTION CHECK

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





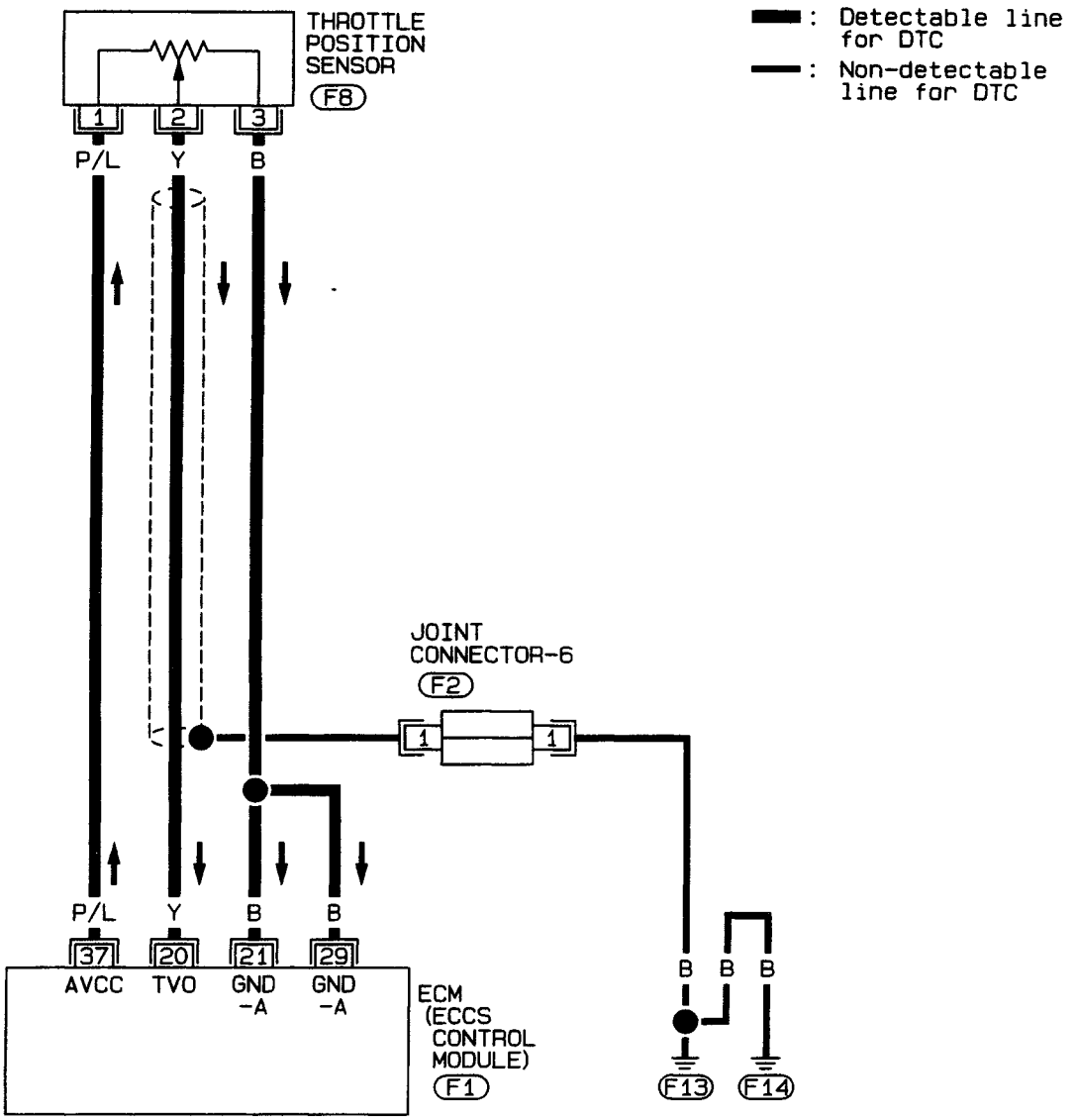


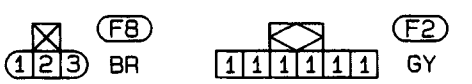
1) Turn ignition switch "ON".
2) Select "MANU TRIG" and "HI SPEED" in "DATA MONITOR" mode with CONSULT.
3) Select "THRTL POS SEN" in "DATA MONITOR" mode with CONSULT.
4) Press RECORD on CONSULT SCREEN at the same time accelerator pedal is depressed.
5) Print out the recorded data and check the following:
   - The voltage when accelerator pedal fully released is approximately 0.35 - 0.65V.
   - The voltage rise is linear in response to accelerator pedal depression.
   - The voltage when accelerator pedal fully depressed is approximately 4V.

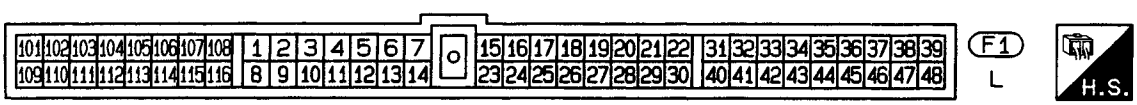
OR

1) Turn ignition switch "ON".
2) Check the voltage between ECM terminals ⑳ and ㉑, ㉙ (ground) and check the following:
   - The voltage when accelerator pedal fully released is approximately 0.35 - 0.65V.
   - The voltage rise is linear in response to accelerator pedal depression.
   - The voltage when accelerator pedal fully depressed is approximately 4V.

EC-TPS-01



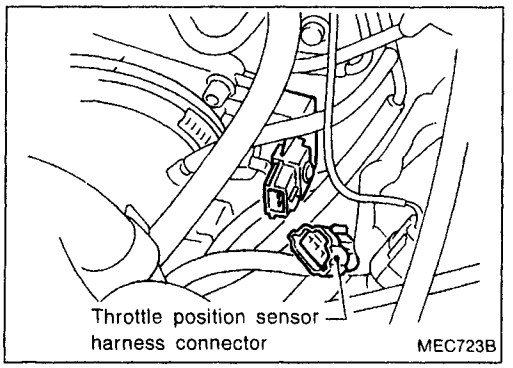


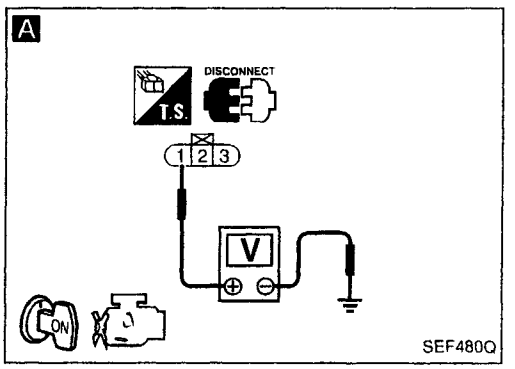


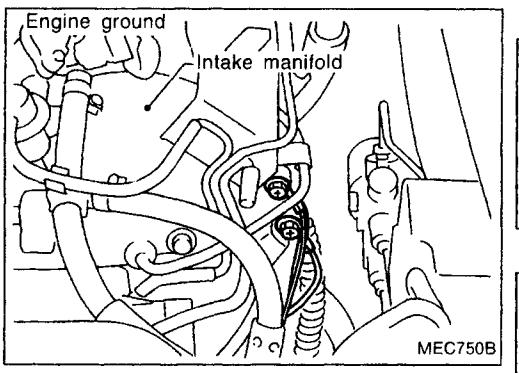
HEC008

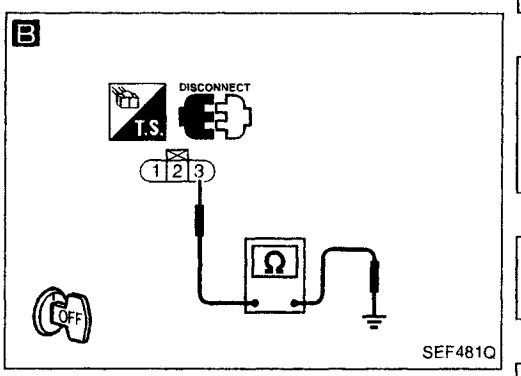
Throttle Position Sensor (Cont'd)

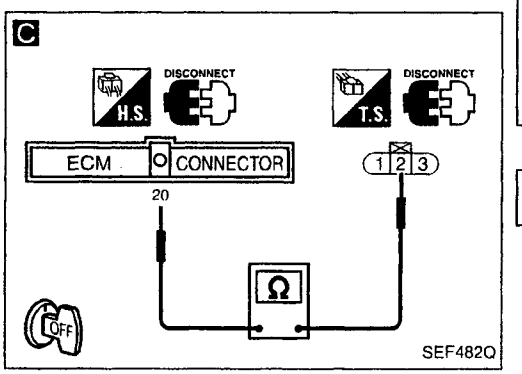
DIAGNOSTIC PROCEDURE











INSPECTION START

A

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

NG → Repair harness or connectors.

OK ↓

B

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

NG → Check the following.
- Harness for open or short between ECM and throttle position sensor

If NG, repair harness or connectors.

OK ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ⑳ and terminal ②.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

ADJUST THROTTLE POSITION SENSOR.
Perform "Basic Inspection", EC-271.

OK ↓

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

NG → Replace throttle position sensor. To adjust it, perform "Basic Inspection", EC-271.

OK ↓

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

Trouble is not fixed. ↓

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

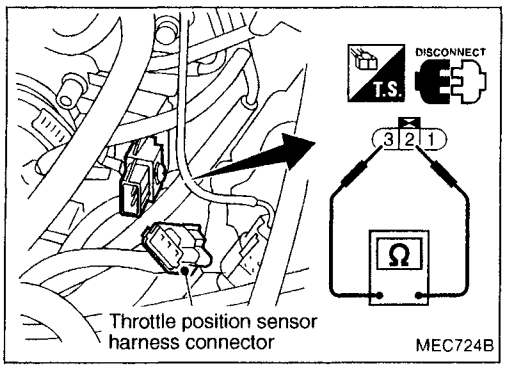
↓

INSPECTION END

Throttle Position Sensor (Cont'd)

COMPONENT INSPECTION

Throttle position sensor



1. Disconnect throttle position sensor harness connector.
2. Make sure that resistance between terminals ② and ③ changes when opening throttle valve manually.

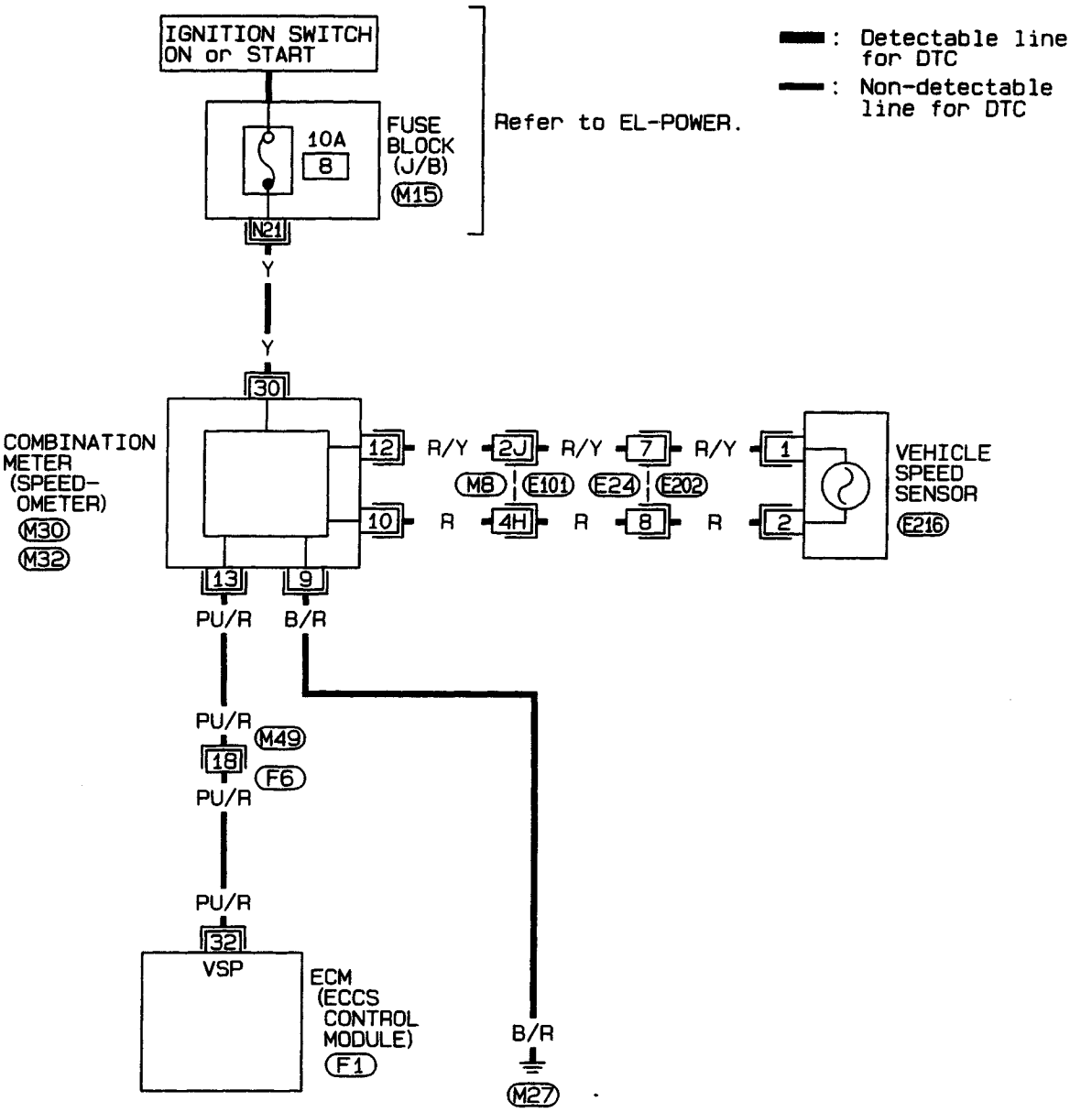
Throttle valve conditions	Resistance [at 25°C (77°F)]
Completely closed	Approximately 1 kΩ
Partially open	1 - 10 kΩ
Completely open	Approximately 10 kΩ

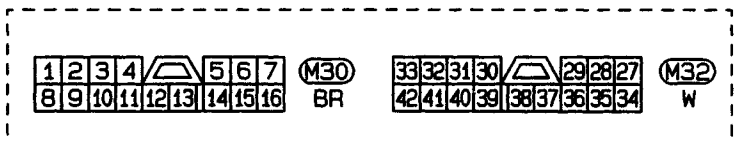
If NG, replace throttle position sensor.
To adjust it, perform "Basic Inspection", EC-271.

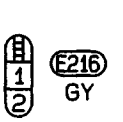
EC

Vehicle Speed Sensor (VSS)

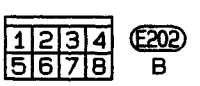
EC-VSS-01

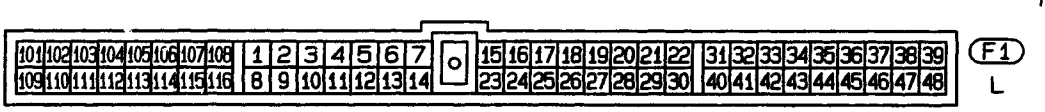














Refer to last page (Foldout page).

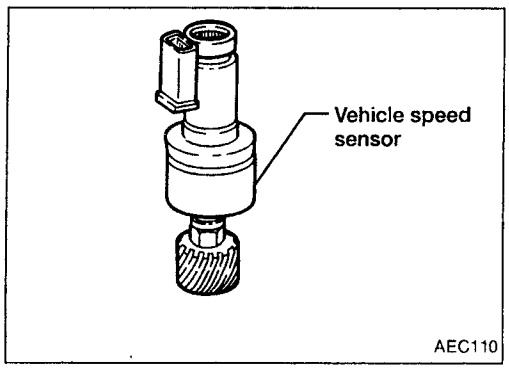
M8, E101
M15

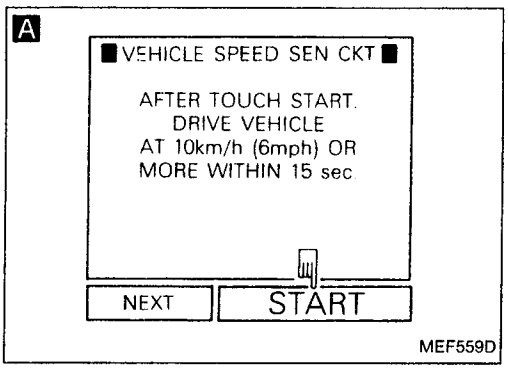
HEC009

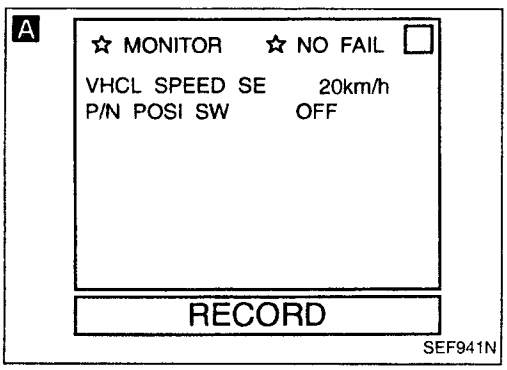
Vehicle Speed Sensor (VSS) (Cont'd)

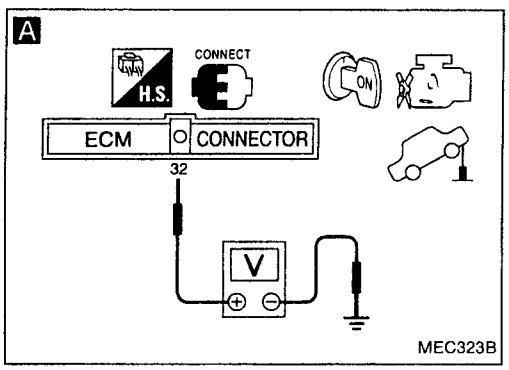
COMPONENT DESCRIPTION

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.









DIAGNOSTIC PROCEDURE

INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Jack up drive wheels.
2. Perform "VEHICLE SPEED SEN CKT" in "FUNCTION TEST" mode with CONSULT.

OR

2. Read "VHCL SPEED SE" signal in "DATA MONITOR" mode with CONSULT.
CONSULT value should be the same as the speedometer indication.

OR

2. Turn ignition switch "ON".
3. Rotate drive wheel by hand.
4. Check voltage between ECM terminal ㉜ and body ground.
Voltage should vary between approx. 0 - 5V.

OK → INSPECTION END

NG

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

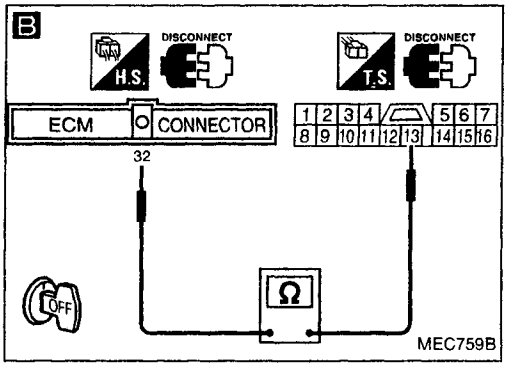
NG → Check vehicle speed sensor and circuit. (Refer to "Inspection/ Speedometer and Vehicle Speed Sensor" of "METER AND GAUGES" in EL section.)

OK

Ⓐ

EC

Vehicle Speed Sensor (VSS) (Cont'd)



Ⓐ

B

CHECK INPUT SIGNAL CIRCUIT.

1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector and combination meter harness connector.
3. Check harness continuity between ECM terminal ㉜ and terminal ⑬.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness for open or short between ECM and combination meter

If NG, repair harness or connectors.

OK ↓

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

Trouble is not fixed. ↓

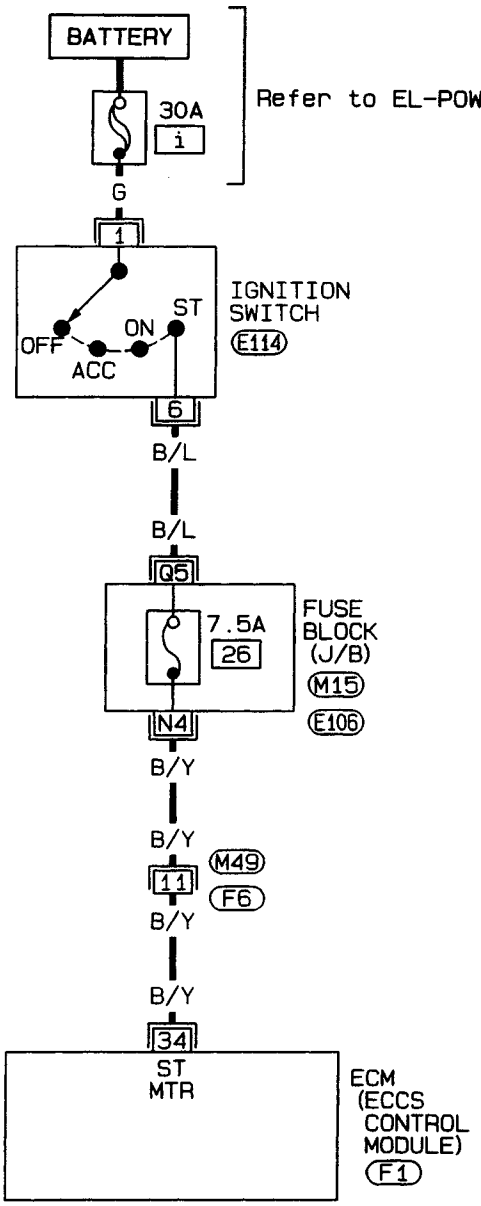
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

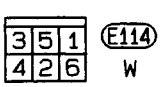
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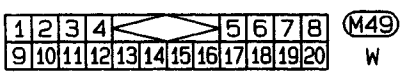
INSPECTION END

Start Signal

EC-S/SIG-01

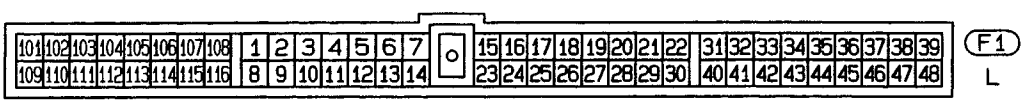






Refer to last page (Foldout page).

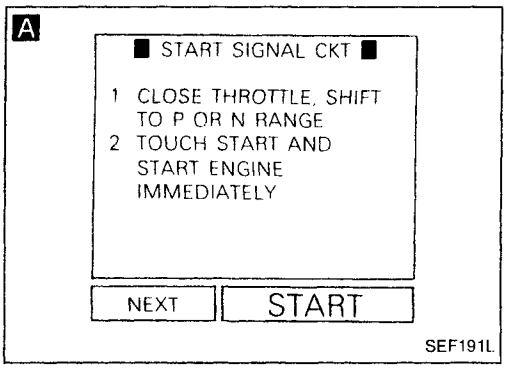
M15, E106

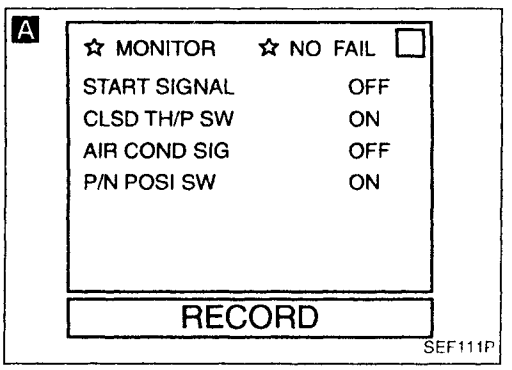


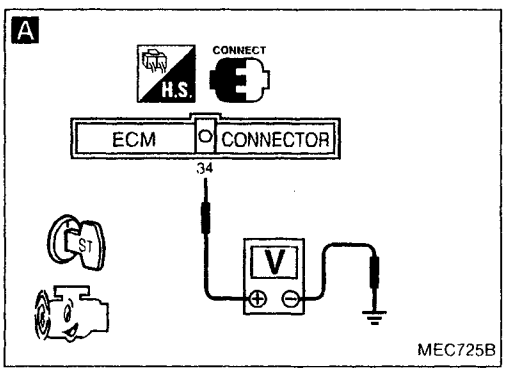
HEC010

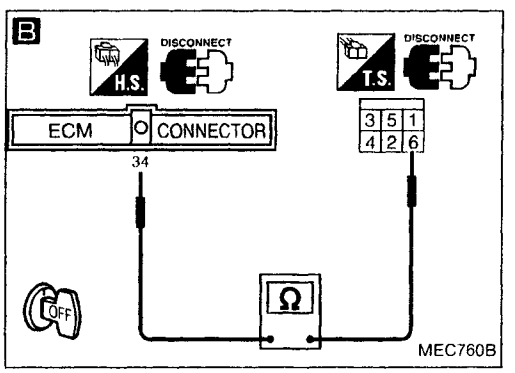
Start Signal (Cont'd)

DIAGNOSTIC PROCEDURE









INSPECTION START

A

CHECK OVERALL FUNCTION.

1. Turn ignition switch "ON".
2. Perform "START SIGNAL CKT" in "FUNCTION TEST" mode with CONSULT.

OR

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

IGN "ON"	OFF
IGN "START"	ON

OR

1. Turn ignition switch to "START".
2. Check voltage between ECM terminal (34) and ground.

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

OK → INSPECTION END

NG

B

CHECK 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 (34) and terminal (6).
Continuity should exist.
If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- 7.5A fuse
- Harness for open or short between ECM and ignition switch

If NG, repair harness or connectors.

OK

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

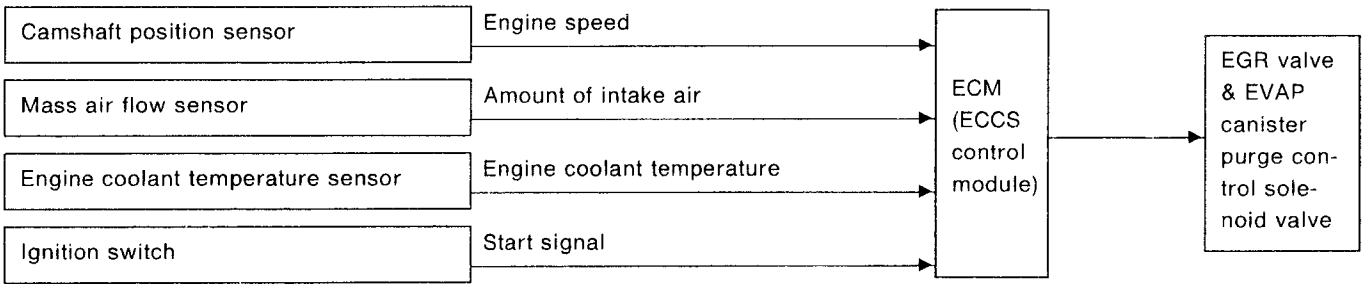
Trouble is not fixed.

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

INSPECTION END

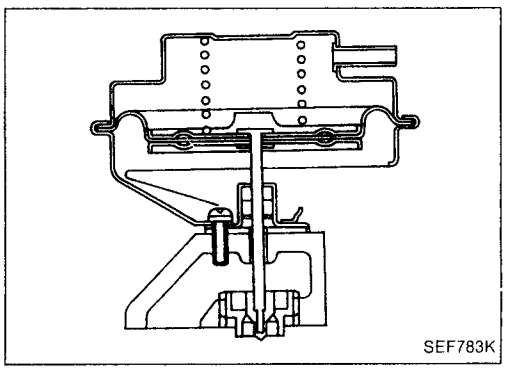
Exhaust Gas Recirculation (EGR) Valve and EVAP Canister Purge Control

SYSTEM DESCRIPTION



This system cuts and controls vacuum applied to EGR valve and EVAP canister to suit engine operating conditions. This cut-and-control operation is accomplished through the ECM and the EGR valve & EVAP canister purge control solenoid valve. When the ECM detects any of the following conditions, current flows through the solenoid valve. This causes the port vacuum to be discharged into the atmosphere. The EGR valve and EVAP canister remain closed.

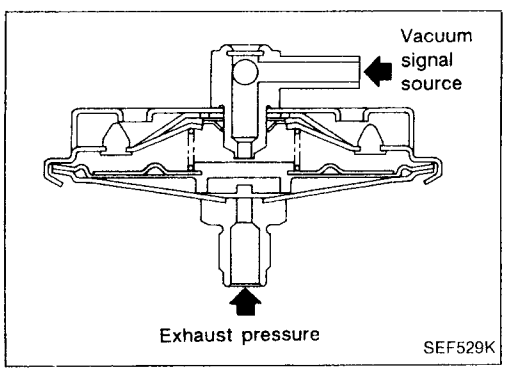
- Low engine coolant temperature
- Engine starting
- High-speed engine operation
- Engine idling
- Excessively high engine coolant temperature
- Mass air flow sensor malfunction



COMPONENT DESCRIPTION

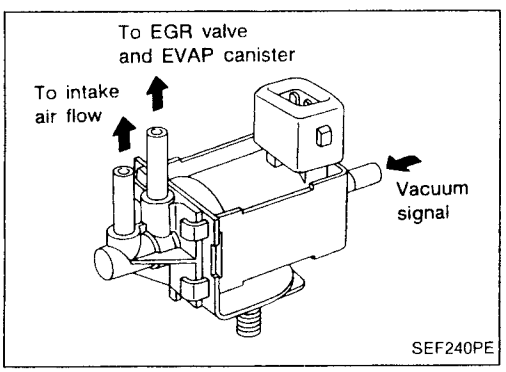
EGR valve

The EGR valve controls the amount of exhaust gas routed to the intake manifold. Vacuum is applied to the EGR valve in response to throttle valve opening. The vacuum controls the movement of a taper valve connected to the vacuum diaphragm in the EGR valve.



EGRC-BPT valve

The EGRC-BPT valve monitors exhaust pressure to activate the diaphragm, controlling throttle body vacuum applied to the EGR valve. In other words, recirculated exhaust gas is controlled in response to positioning of the EGR valve or to engine operation.

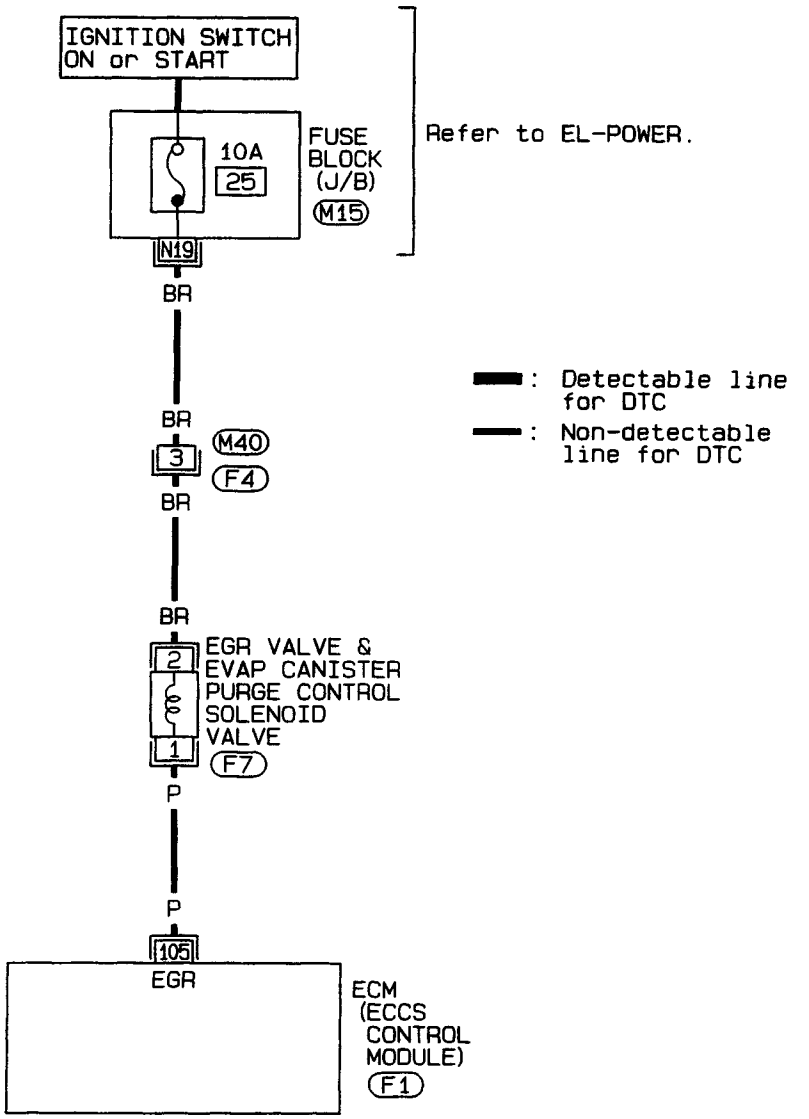


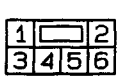
EGR valve & EVAP canister purge control solenoid valve

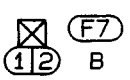
The EGR valve & EVAP canister purge control solenoid valve responds to signals from the ECM. When the ECM sends an ON (ground) signal, the coil in the solenoid valve is energized. A plunger will then move to cut the vacuum signal (from the throttle body to the EGR valve and EVAP canister purge valve). When the ECM sends an OFF signal, the vacuum signal passes through the solenoid valve. The signal then reaches the EGR valve and EVAP canister.

Exhaust Gas Recirculation (EGR) Valve and EVAP Canister Purge Control (Cont'd)

EC-EGRC/V-01

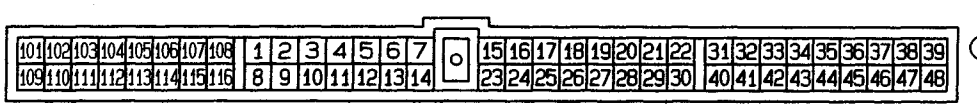






Refer to last page (Foldout page).

M15

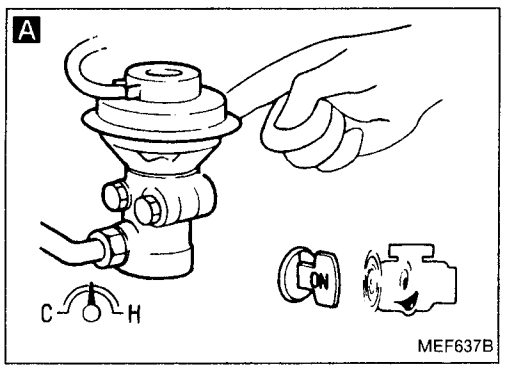


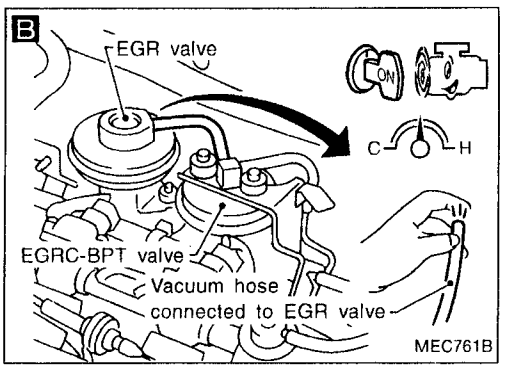


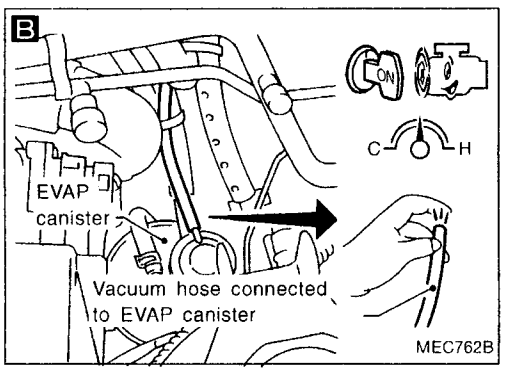
HEC014

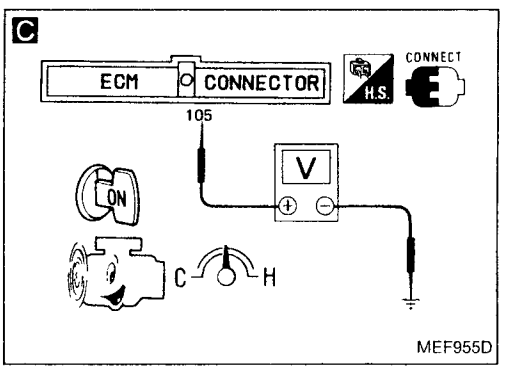
Exhaust Gas Recirculation (EGR) Valve and EVAP Canister Purge Control (Cont'd)

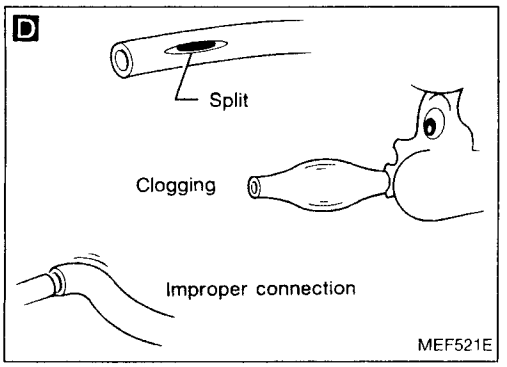
DIAGNOSTIC PROCEDURE











INSPECTION START

A

CHECK OVERALL FUNCTION.

1. Start engine and warm it up sufficiently.
2. Perform diagnostic test mode II (Self-diagnostic results).
   Make sure that Diagnostic trouble code No. 12 is not displayed.
3. Keep engine speed at about 2,000 rpm. Make sure that EGR valve spring moves up and down when engine is raced to about 4,000 rpm. (Use your finger.)

OK → INSPECTION END

NG ↓

B

CHECK VACUUM SOURCE TO EGR VALVE.

1. Disconnect vacuum hose to EGR valve.
2. Disconnect vacuum hose to EVAP canister.
3. Check vacuum existence under the following conditions.

Engine speed is 4,000 rpm:
Vacuum should not exist.
Engine speed is 2,000 rpm:
Vacuum should exist.

OK → CHECK COMPONENTS (EGR valve and EGRC-BPT valve).
Refer to "COMPONENT INSPECTION", EC-323.

NG ↓

Replace malfunctioning component(s).

NG ↓

C

CHECK CONTROL FUNCTION.

Check voltage between ECM terminal (105) and ground under the following conditions.

Engine speed is 4,000 rpm
0.6 - 0.8V
Engine speed is 2,000 rpm
Battery voltage

OK → D

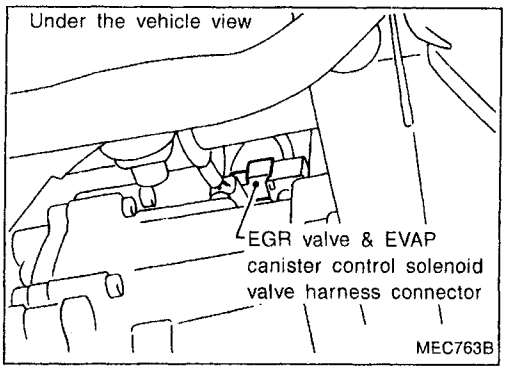
CHECK VACUUM HOSE.
Check vacuum hose for clogging, cracks or improper connection.

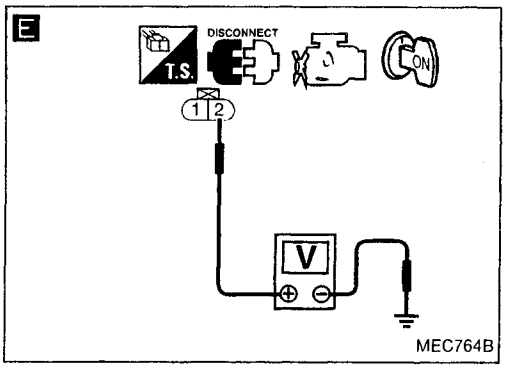
NG ↓

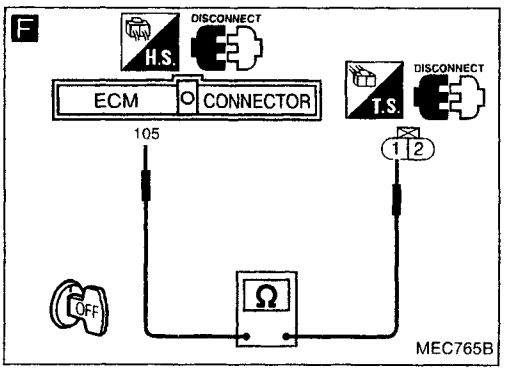
Ⓐ

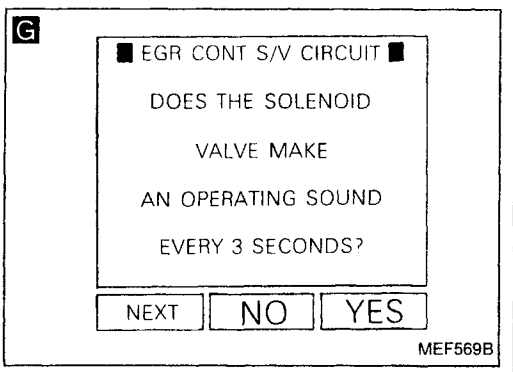
EC

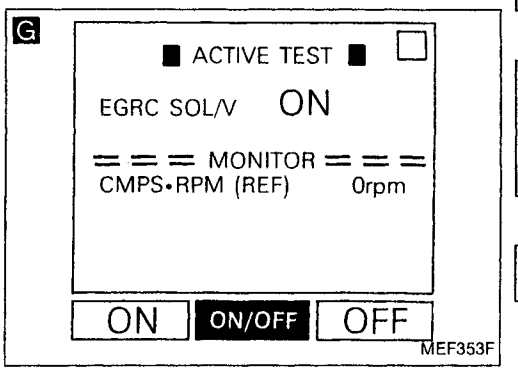
Exhaust Gas Recirculation (EGR) Valve and EVAP Canister Purge Control (Cont'd)











Ⓐ

E

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect EGR valve & EVAP canister purge control solenoid valve harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ② and ground.
   Voltage: Battery voltage

NG → Check the following.
- Harness connectors (F4), (M40)
- 10A fuse
- Harness open or short between EGR valve & EVAP canister purge control solenoid valve and fuse

If NG, repair harness or connectors.

OK ↓

F

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal (105) and terminal ①.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

G

CHECK COMPONENT
(EGR valve & EVAP canister purge control solenoid valve).

1. Reconnect ECM harness connector and EGR valve & EVAP canister purge control solenoid valve harness connector.
2. Turn ignition switch "ON".
3. Perform "EGRC SOL/V CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

NG → Replace EGR valve & EVAP canister purge control solenoid valve.

— OR —

3. Turn EGR valve & EVAP canister purge control solenoid valve "ON" and "OFF" in "ACTIVE TEST" mode with CONSULT and check operating sound.

— OR —

Refer to "COMPONENT INSPECTION" on next page.

OK ↓

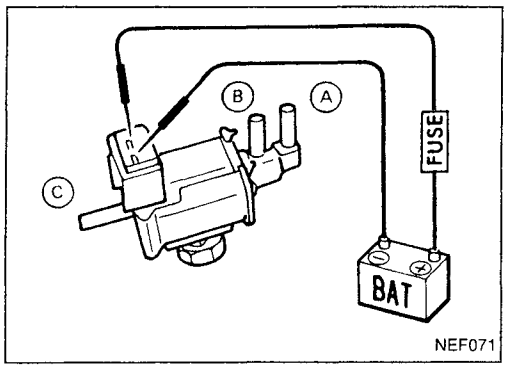
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

↓

INSPECTION END



Exhaust Gas Recirculation (EGR) Valve and EVAP Canister Purge Control (Cont'd)

COMPONENT INSPECTION

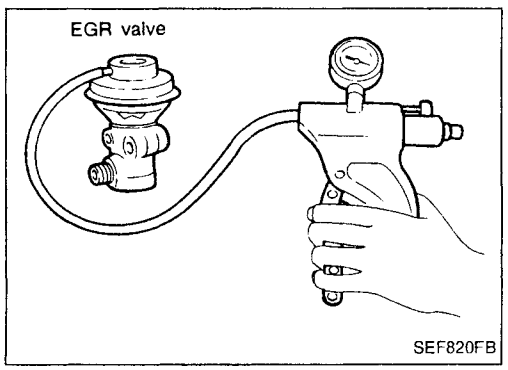
EGR valve & EVAP canister purge control solenoid valve

1. Disconnect EGR valve & EVAP canister purge control solenoid valve harness connector.
2. Check solenoid valve, following the table as shown below:

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

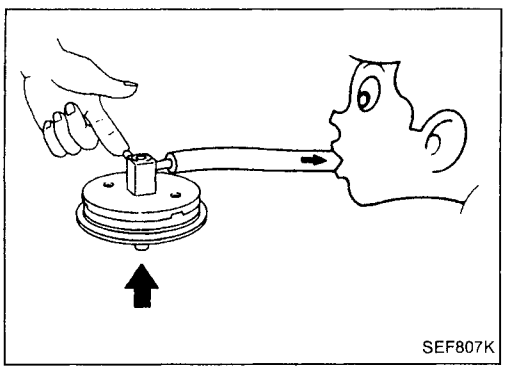
If NG, replace EGR valve & EVAP canister purge control solenoid valve.

EC



EGR valve

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

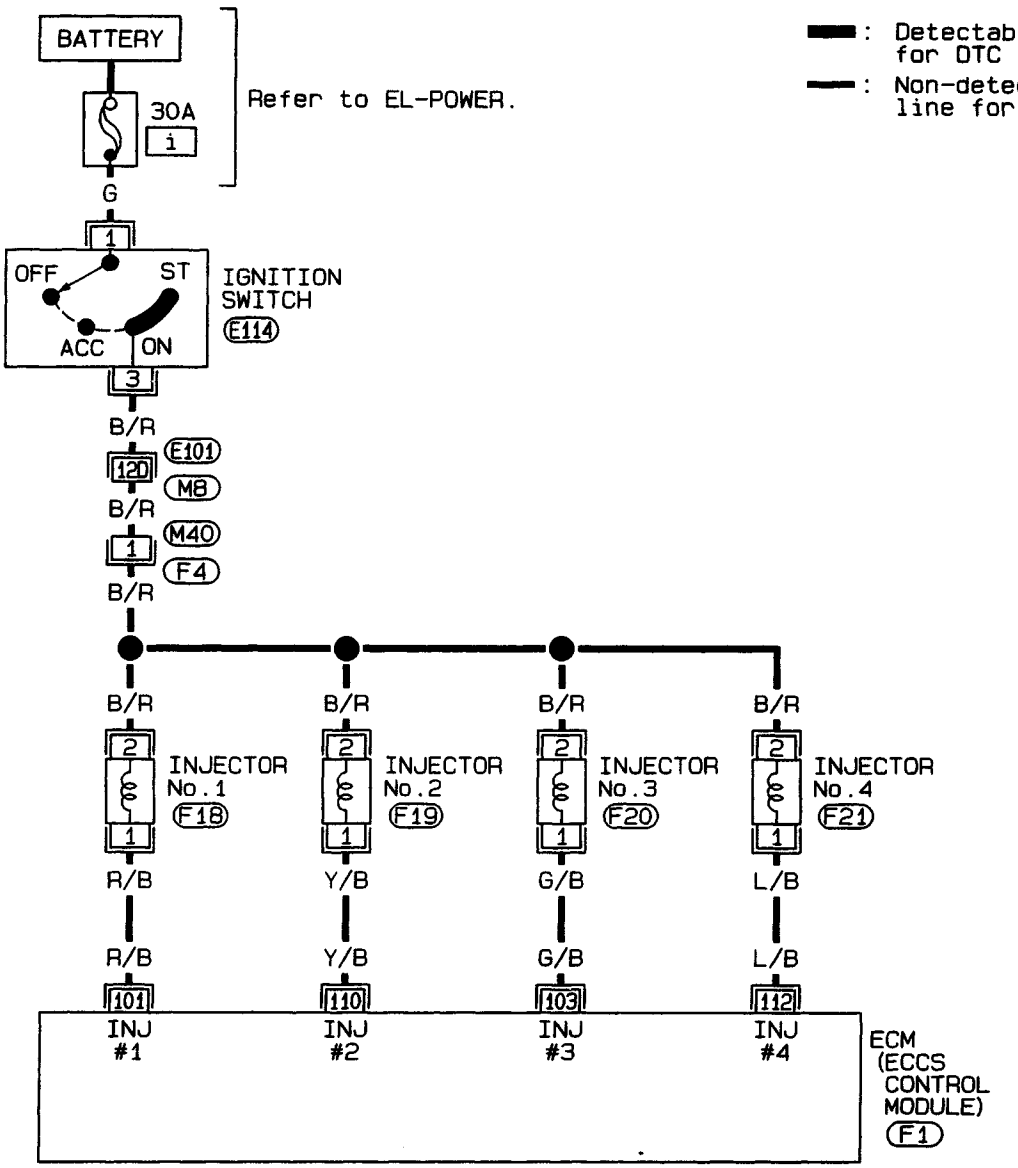


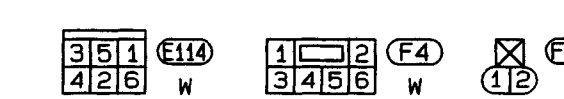
EGRC-BPT valve

Plug one of two ports of EGRC-BPT valve.
Apply a pressure above 0.490 kPa (4.90 mbar, 50 mmH_2O, 1.97 inH_2O) to check for leakage. If a leak is noted, replace valve.

Injector

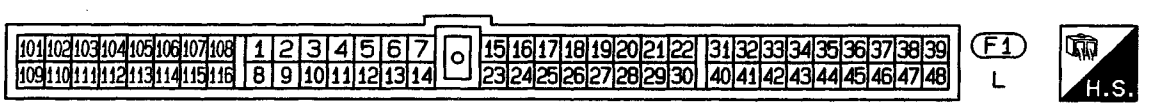
EC-INJECT-01





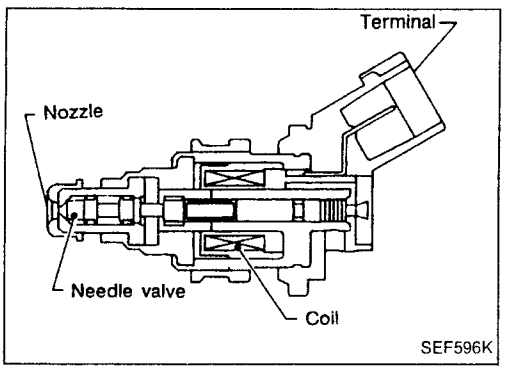
Refer to last page (Foldout page).

M8, E101



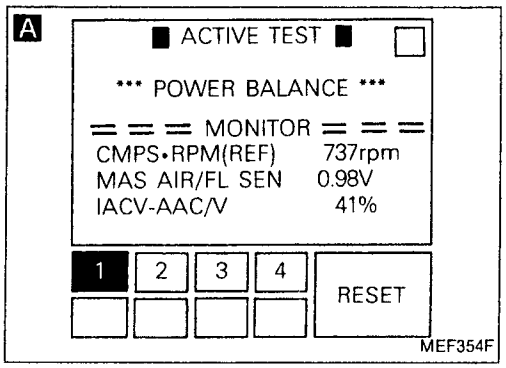
HEC011

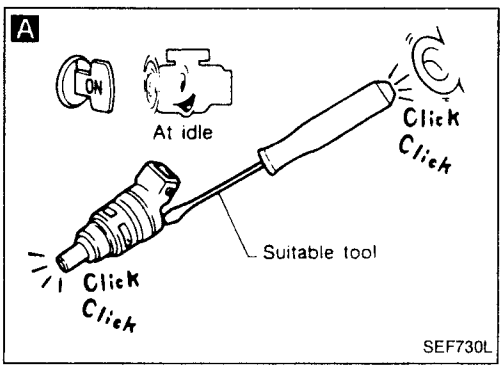
Injector (Cont'd)

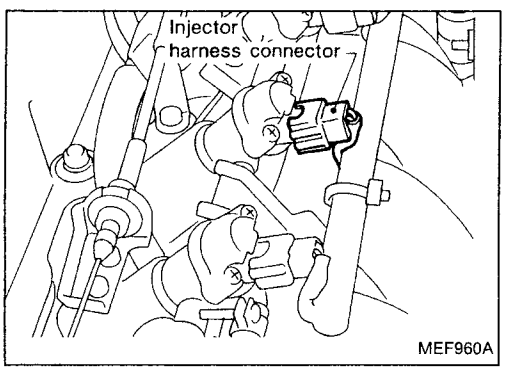


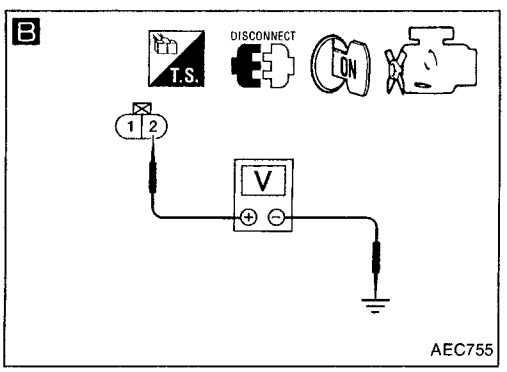
COMPONENT DESCRIPTION

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









DIAGNOSTIC PROCEDURE

EC

INSPECTION START

A

CHECK OVERALL FUNCTION.

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

OR

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

OK → INSPECTION END

NG

B

CHECK POWER SUPPLY.

1. Stop engine.
2. Disconnect injector harness connector.
3. Turn ignition switch "ON".
4. Check voltage between injector harness connector terminal ② and ground with CONSULT or tester.
   Voltage: Battery voltage

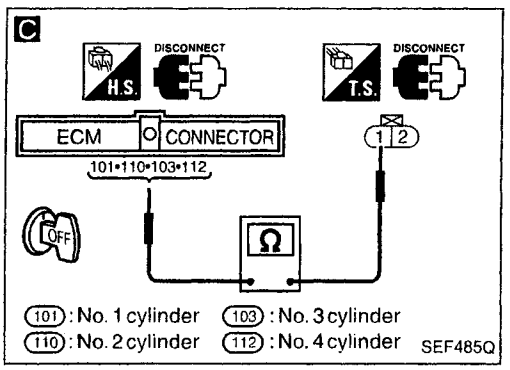
NG → Check the following.
- Harness connectors (F4), (M40)
- Harness connectors (M8), (E101)
- Harness for open or short between injector and ignition switch

If NG, repair harness or connectors.

OK

Ⓐ

Injector (Cont'd)



Ⓐ

C

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between injector harness connector terminal ① and ECM terminals (101), (110), (103), (112).

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

NG → Repair harness or connectors.

OK ↓

CHECK COMPONENT (Injector).
Refer to "COMPONENT INSPECTION" below.

NG → Replace injector.

OK ↓

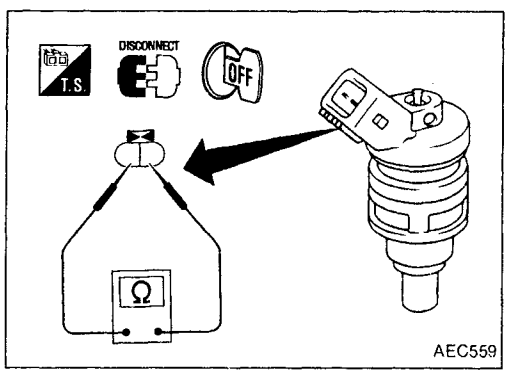
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

↓

INSPECTION END



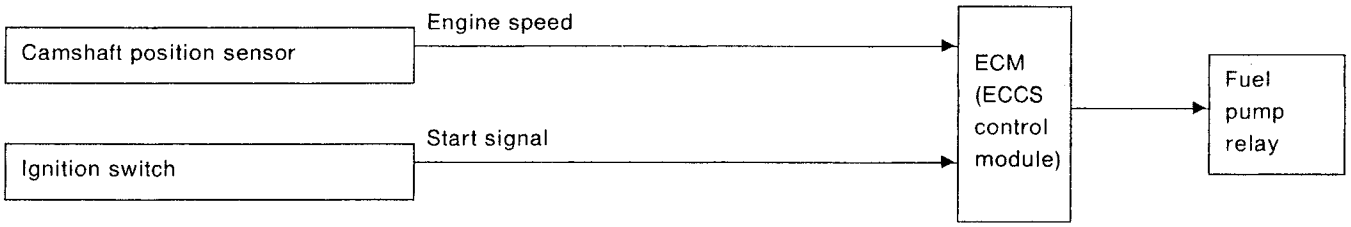
COMPONENT INSPECTION

Injector

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

Fuel Pump

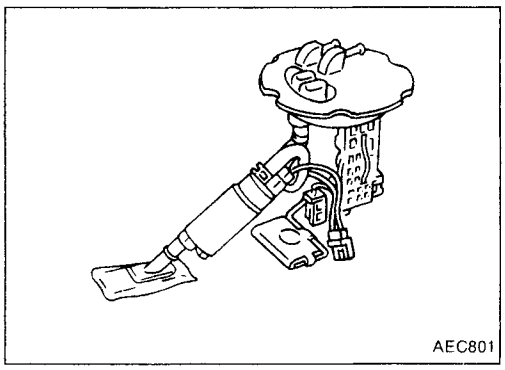
SYSTEM DESCRIPTION



The ECM activates the fuel pump for several seconds after the ignition switch is turned on to improve engine startability. If the ECM receives a 180° signal from the camshaft position sensor, it knows that the engine is rotating, and causes the pump to perform. If the 180° signal is not received when the ignition switch is on, the engine stalls. The ECM stops pump operation and prevents battery discharging, thereby improving safety. The ECM does not directly drive the fuel pump. It controls the ON/OFF fuel pump relay, which in turn controls the fuel pump.

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

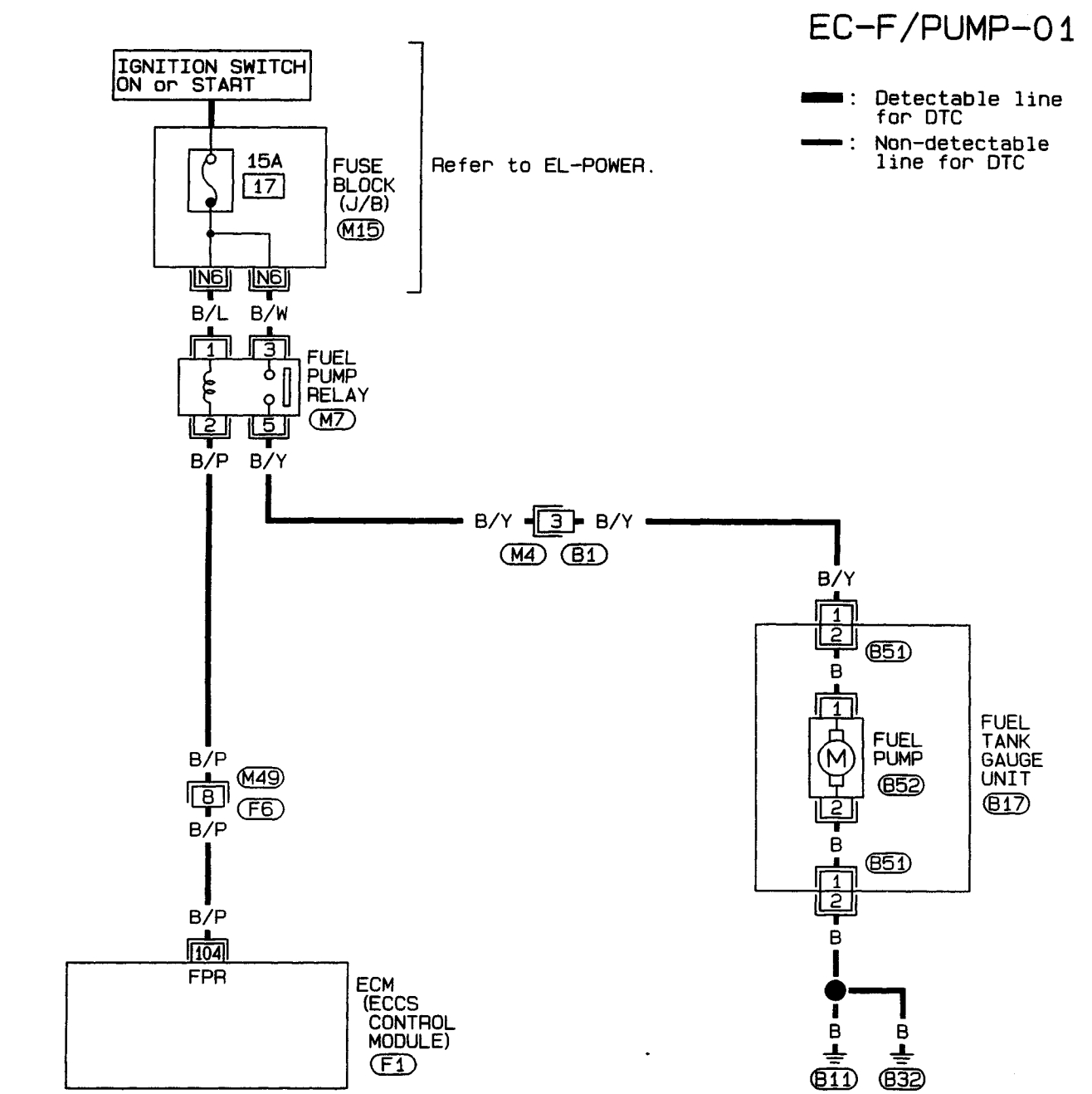
EC

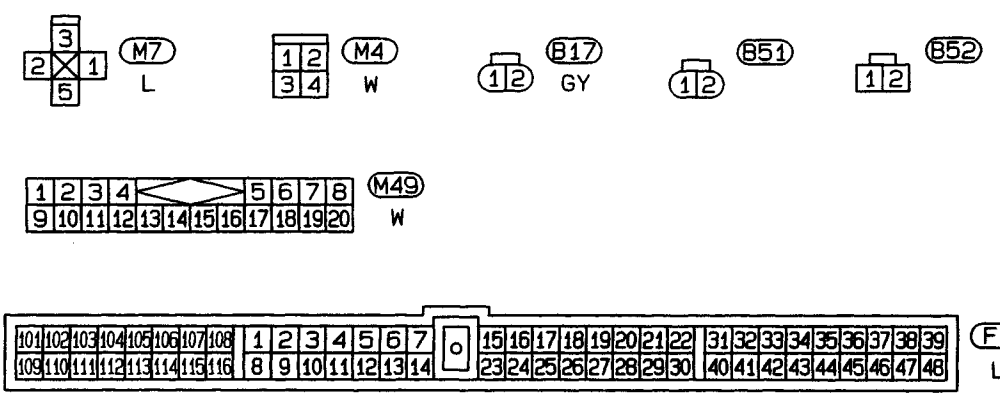


COMPONENT DESCRIPTION

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

Fuel Pump (Cont'd)





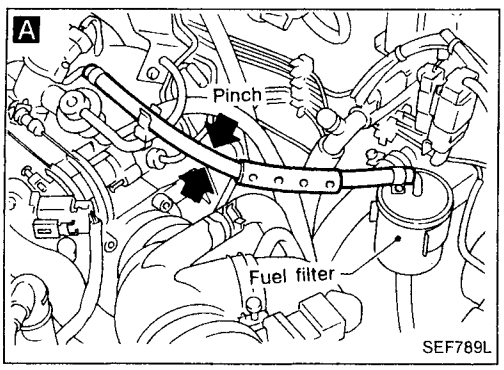
Refer to last page (Foldout page).

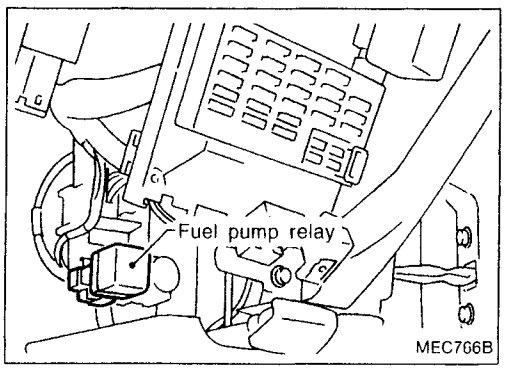
M15

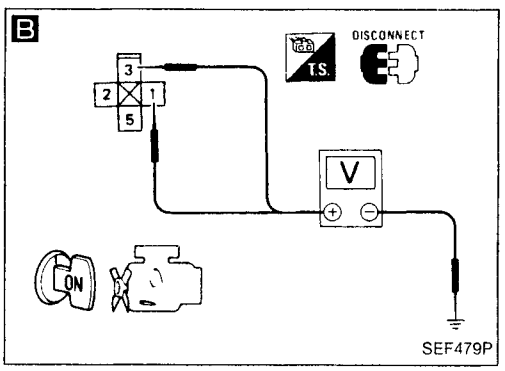
HEC012

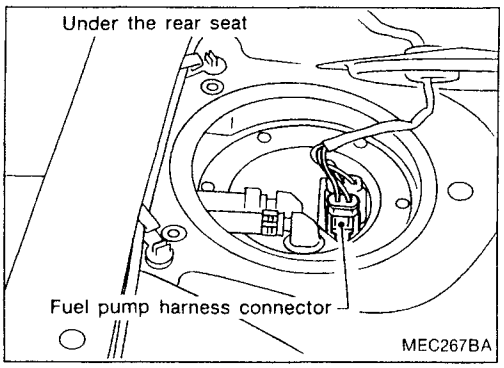
Fuel Pump (Cont'd)

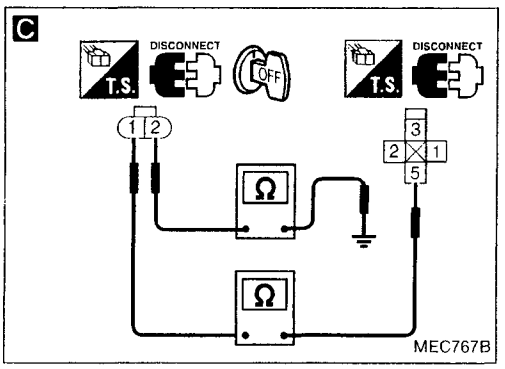
DIAGNOSTIC PROCEDURE











INSPECTION START

A

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

OK → INSPECTION END

NG

B

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

NG → Check the following.
- 15A fuse
- Harness for open or short between fuse and fuel pump relay

If NG, repair harness or connectors.

OK

C

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

NG → Check the following.
- Harness connectors (M4), (B1)
- Harness for open or short between fuel pump and body ground
- Harness for open or short between fuel pump and fuel pump relay

If NG, repair harness or connectors.

OK

D

CHECK OUTPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal (104) and fuel pump relay connector terminal ②.
   Continuity should exist.
   If OK, check harness for short.

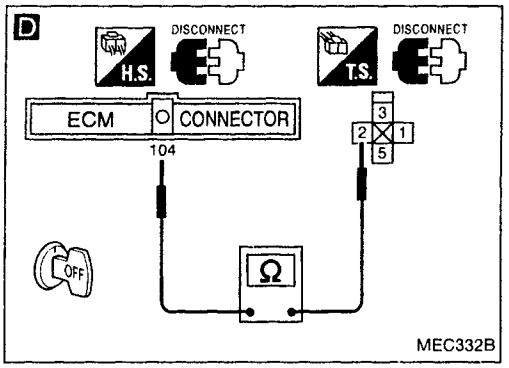
NG → Check the following.
- Harness connectors (M49), (F6)
- Harness for open or short between ECM and fuel pump relay

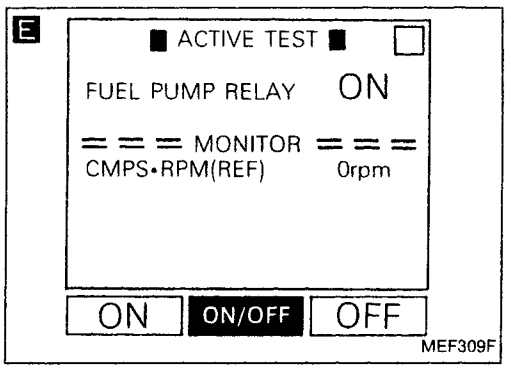
If NG, repair harness or connectors.

OK → Ⓐ

EC

Fuel Pump (Cont'd)





Ⓐ

E

CHECK COMPONENT
(Fuel pump relay).

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

NG → Replace fuel pump relay.

OR

Refer to "COMPONENT INSPECTION" on next page.

OK ↓

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

NG → Replace fuel pump.

OK ↓

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

Trouble is not fixed. ↓

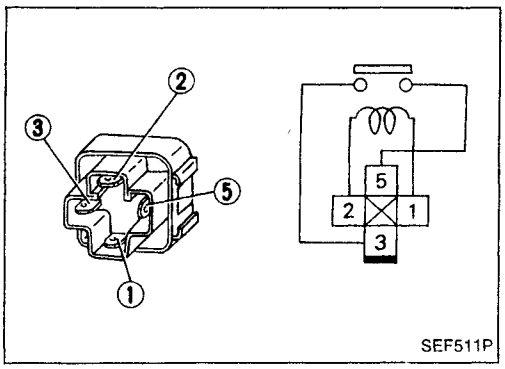
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

↓

INSPECTION END

Fuel Pump (Cont'd)

COMPONENT INSPECTION

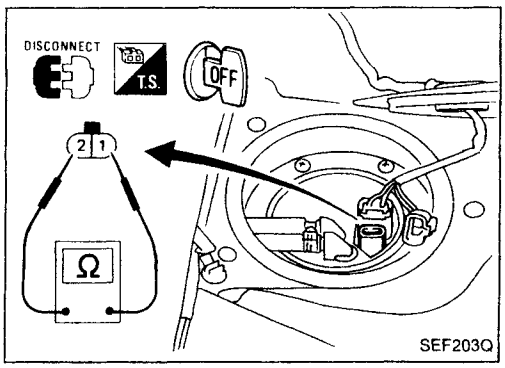


Fuel pump relay

Check continuity between terminals ③ and ⑤.

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

If NG, replace relay.



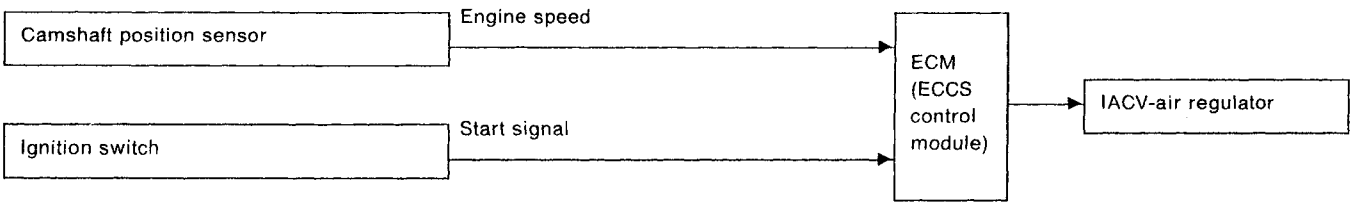
Fuel pump

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

EC

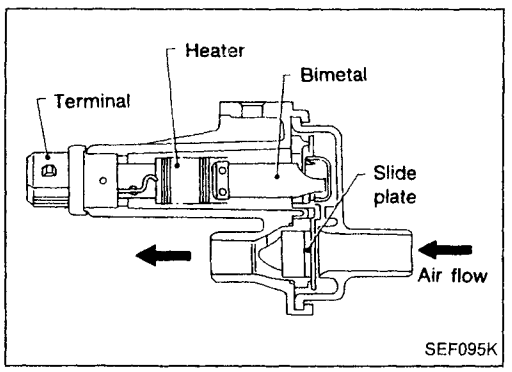
Idle Air Control Valve (IACV)-Air Regulator

SYSTEM DESCRIPTION



The IACV-air regulator is controlled by the ECM at the same time as fuel pump ON-OFF control.

Condition	IACV-air regulator operation
Ignition switch is turned to "ON"	Operates for 5 seconds
Engine running and cranking	Operates
When engine is stopped	OFF in 1 second
Except as shown above	OFF

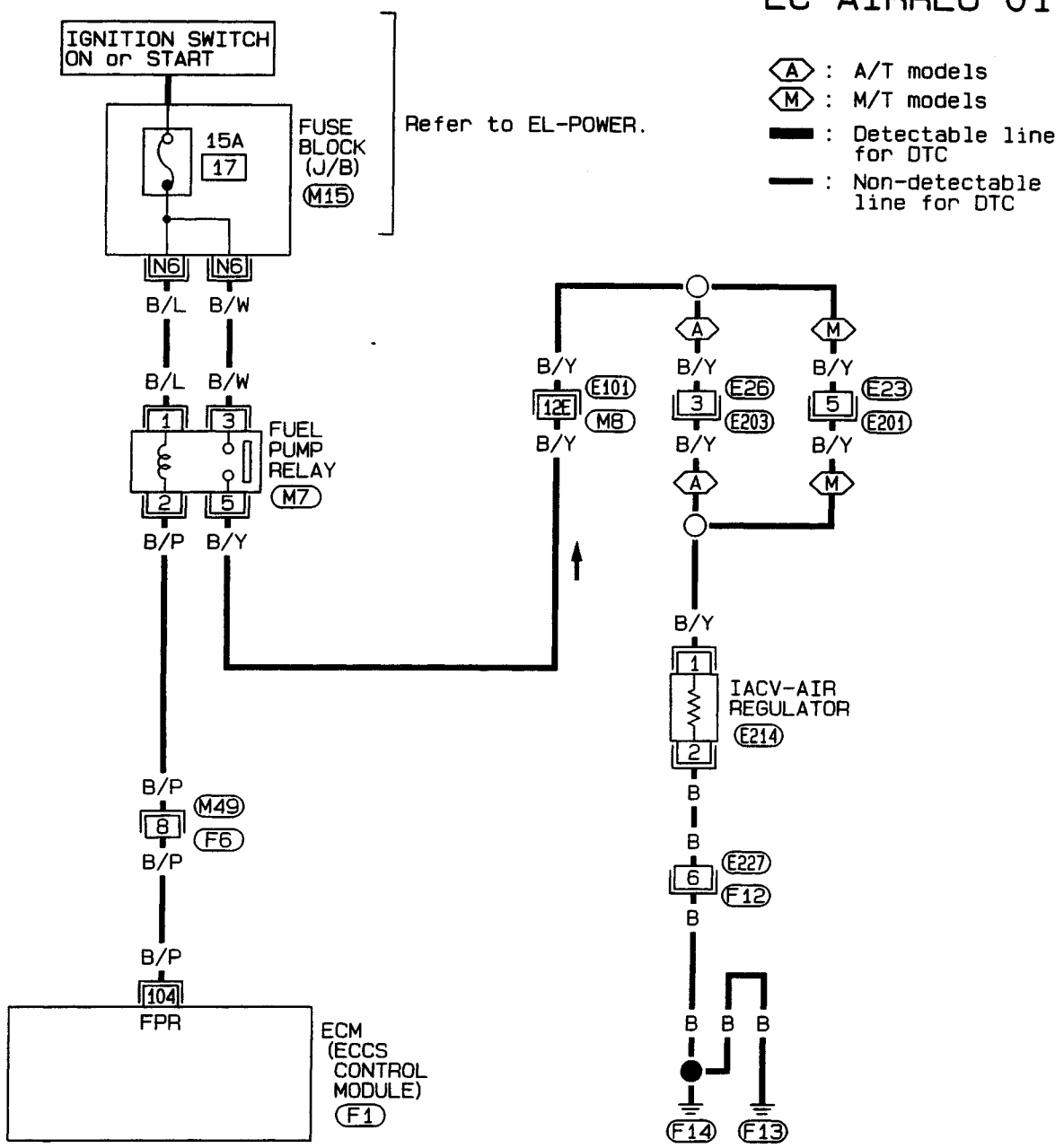


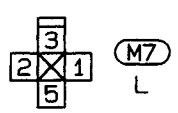
COMPONENT DESCRIPTION

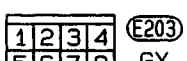
IACV-air regulator provides an air bypass when the engine is cold for a fast idle during warm-up.
A bimetal, heater and rotary shutter are built into the IACV-air regulator. When the bimetal temperature is low, the air bypass port opens. As the engine starts and electric current flows through a heater,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

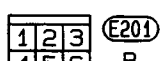
Idle Air Control Valve (IACV)-Air Regulator (Cont'd)

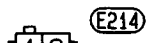
EC-AIRREG-01

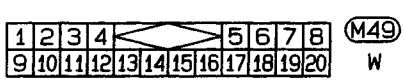


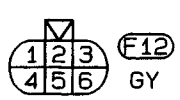








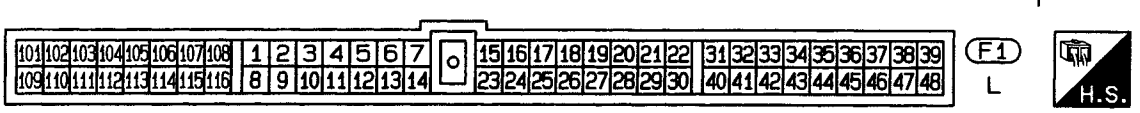




Refer to last page (Foldout page).

M8, E101

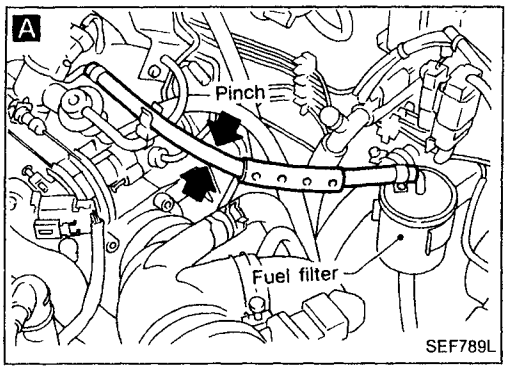
M15

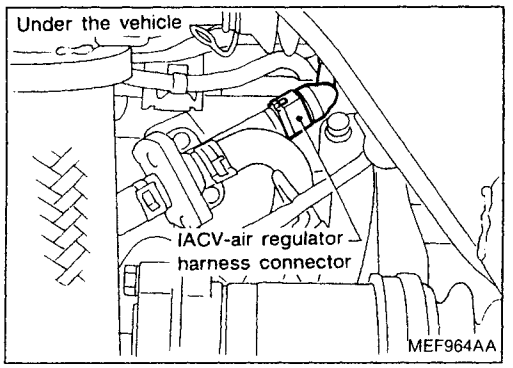


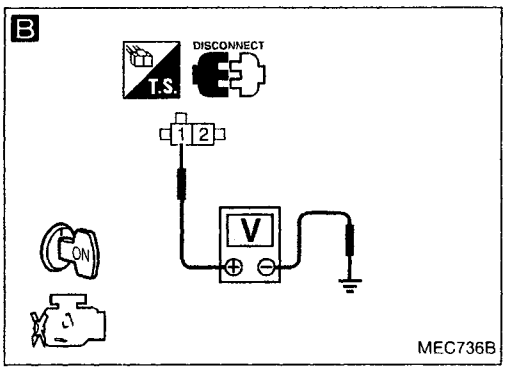
HEC013

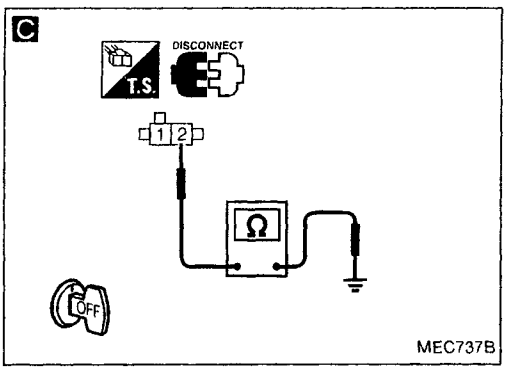
Idle Air Control Valve (IACV)-Air Regulator (Cont'd)

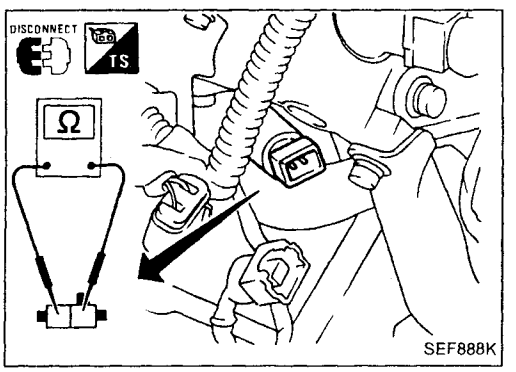
DIAGNOSTIC PROCEDURE











INSPECTION START

A

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

NG → Check fuel pump control circuit. (See page EC-327.)

OK ↓

B

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

NG → Check the following.
- Harness connectors (M8), (E101)
- Harness connectors (E23), (E201) (M/T models)
- Harness connectors (E26), (E203) (A/T models)
- Harness for open or short between IACV-air regulator and fuel pump relay

If NG, repair harness or connectors.

OK ↓

C

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Check harness continuity between terminal ② and body ground.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (F12), (E227)
- Harness for open or short between IACV-air regulator and body ground

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT (IACV-air regulator).
Refer to "COMPONENT INSPECTION" below.

NG → Replace IACV-air regulator.

OK ↓

INSPECTION END

COMPONENT INSPECTION

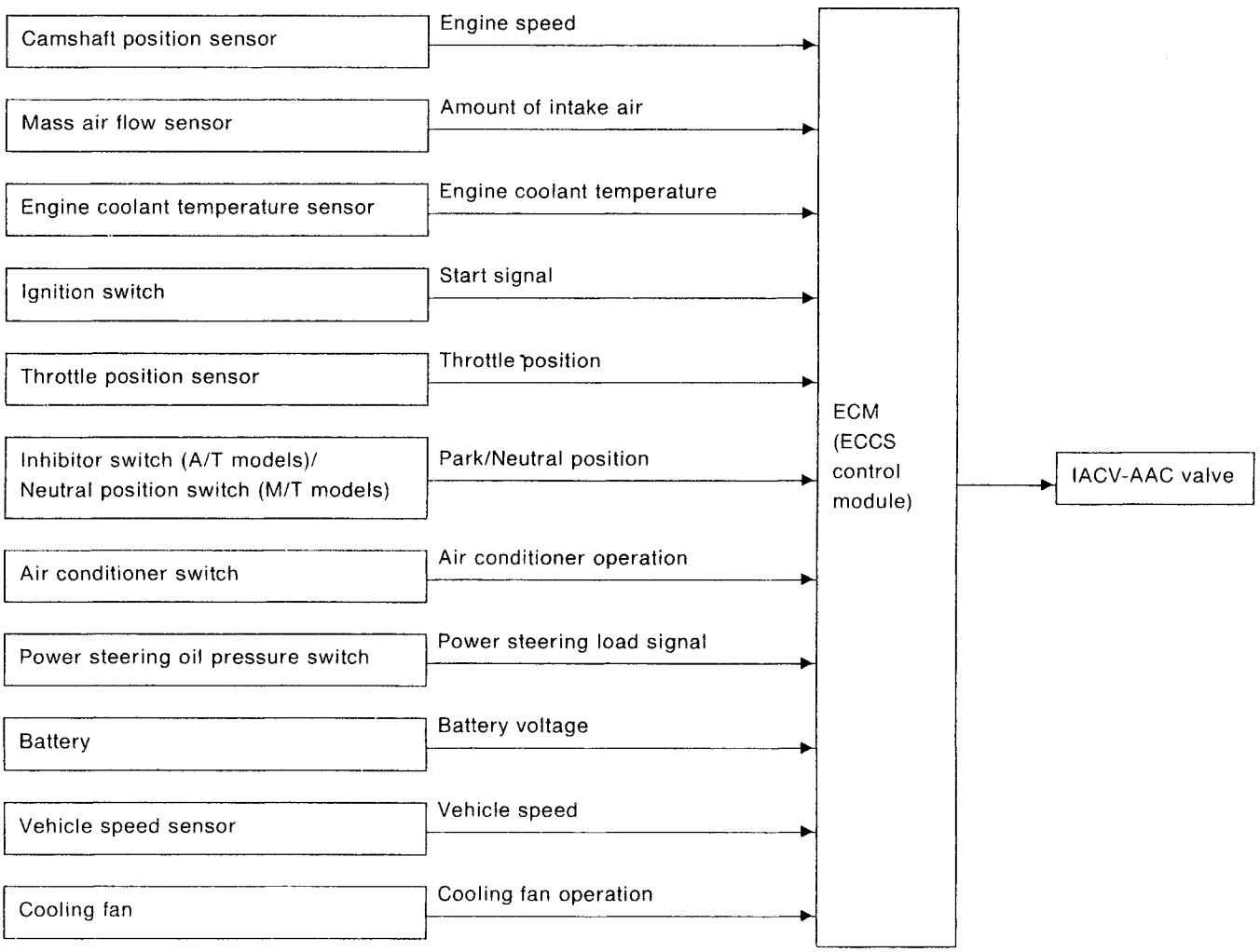
IACV-air regulator

Disconnect IACV-air regulator harness connector.

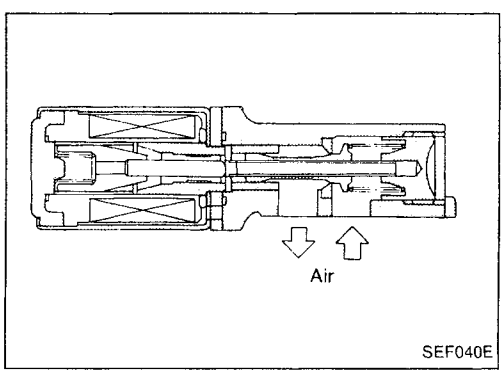
- Check IACV-air regulator resistance.
  Resistance:
  Approximately 70 - 80Ω [at 25°C (77°F)]
- Check IACV-air regulator for clogging.

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

SYSTEM DESCRIPTION



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



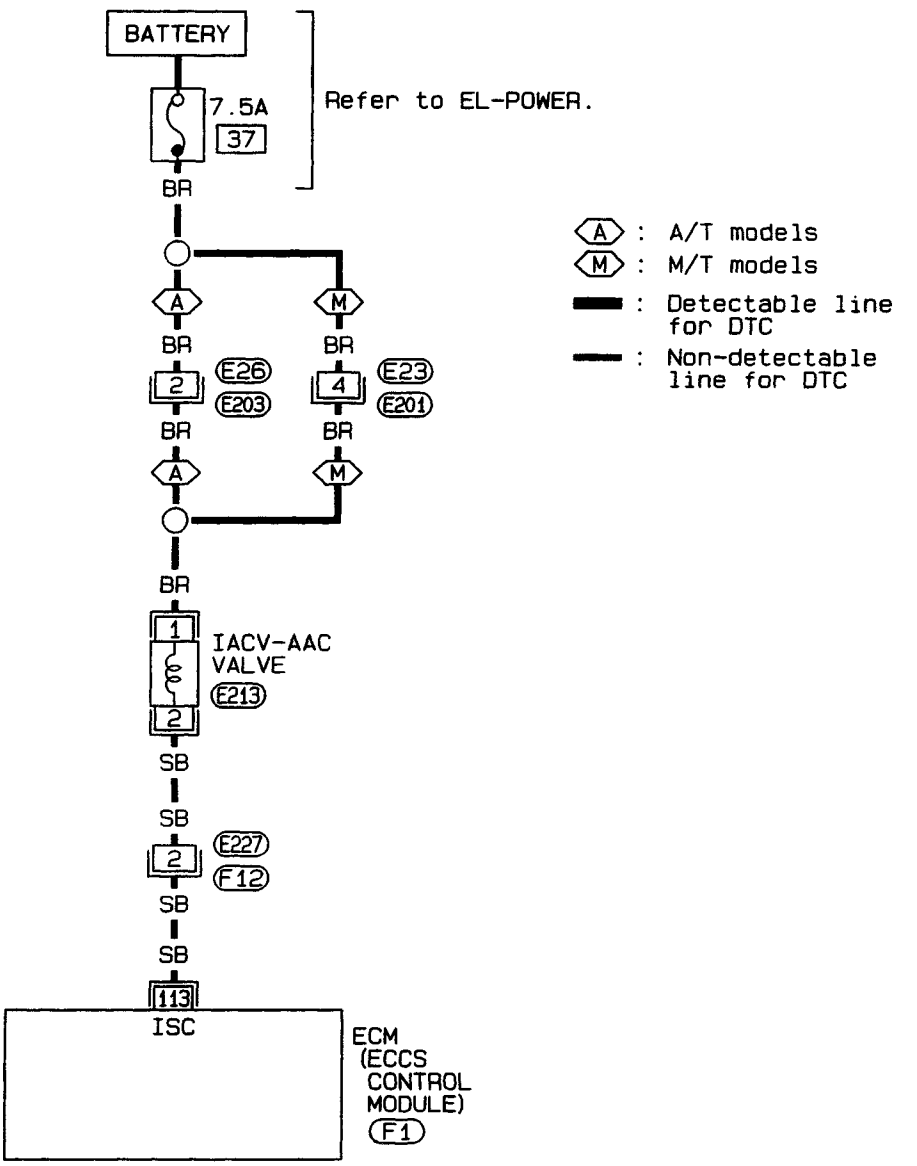
COMPONENT DESCRIPTION

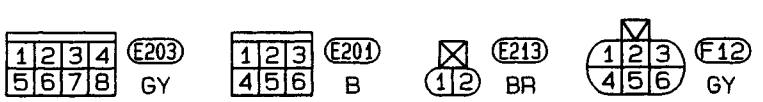
IACV-AAC valve

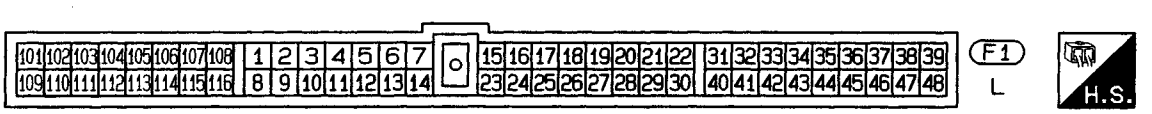
The IACV-AAC valve is moved by ON/OFF pulses from the ECM. The longer the ON pulse, the greater the amount of air that will flow through the valve. The more air that flows through the valve, the higher the idle speed.

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

EC-AAC/V-01



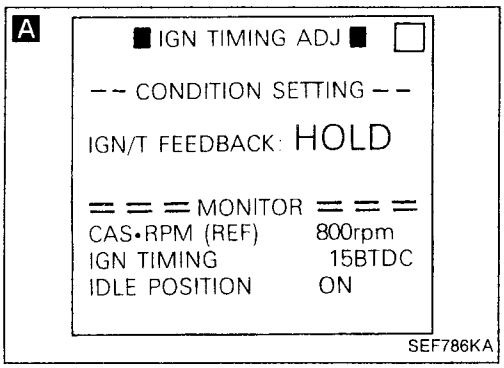


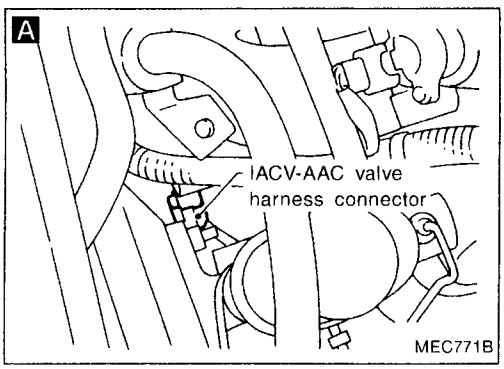


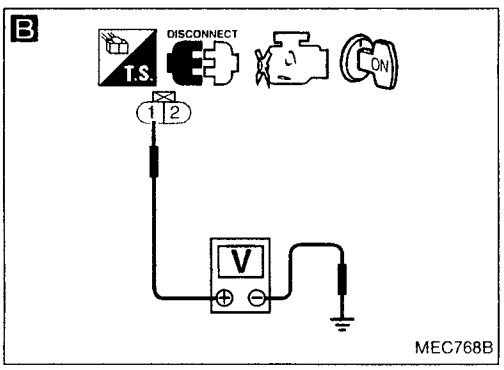
HEC015

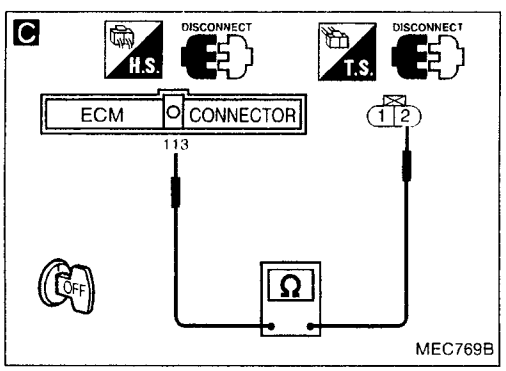
Idle Air Control Valve (IACV) — Auxiliary Air Control (AAC) Valve (Cont'd)

DIAGNOSTIC PROCEDURE









INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Start engine and warm it up sufficiently.
2. Check idle speed.
   800 ± 50 rpm
   If NG, adjust idle speed. (Refer to page EC-243.)
3. • Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode with CONSULT.
   • Disconnect IACV-AAC valve harness connector.
4. Make sure that idle speed drops.

Drops → INSPECTION END

Does not drop ↓

B

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

NG → Check the following.
- Harness connectors E23, E201 (M/T models)
- Harness connectors E26, E203 (A/T models)
- 7.5A fuse
- Harness for open or short between IACV-AAC valve harness connector and fuse

If NG, repair harness or connectors.

OK ↓

C

CHECK OUTPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal 113 and terminal ②.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors F12, E227
- Harness for open or short between ECM and IACV-AAC valve

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT (IACV-AAC valve).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace IACV-AAC valve.

OK ↓

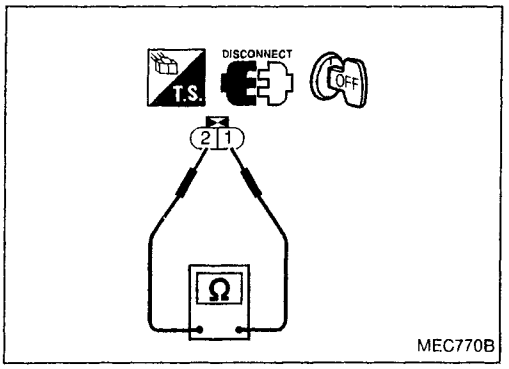
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

INSPECTION END

EC



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

COMPONENT INSPECTION

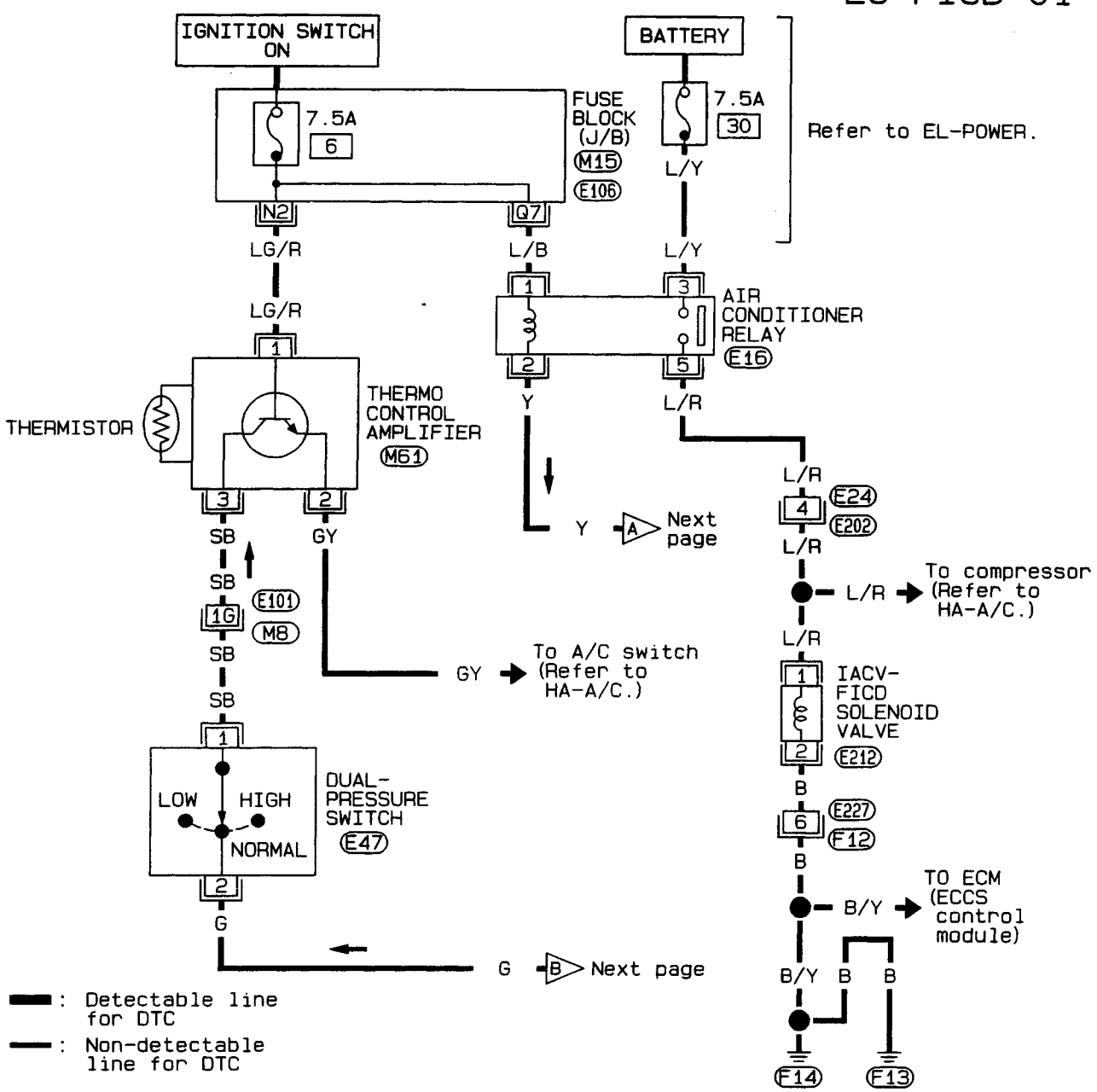
IACV-AAC valve

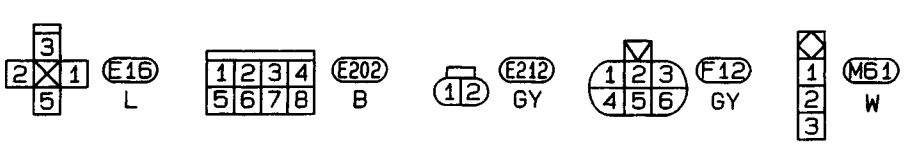
Disconnect IACV-AAC valve harness connector.

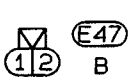
- Check IACV-AAC valve resistance.
  Resistance:
  Approximately 10Ω [at 25°C (77°F)]
- Check plunger for seizing or sticking.
- Check for broken spring.

Idle Air Control Valve (IACV)-FICD Solenoid Valve

EC-FICD-01







Refer to last page (Foldout page).

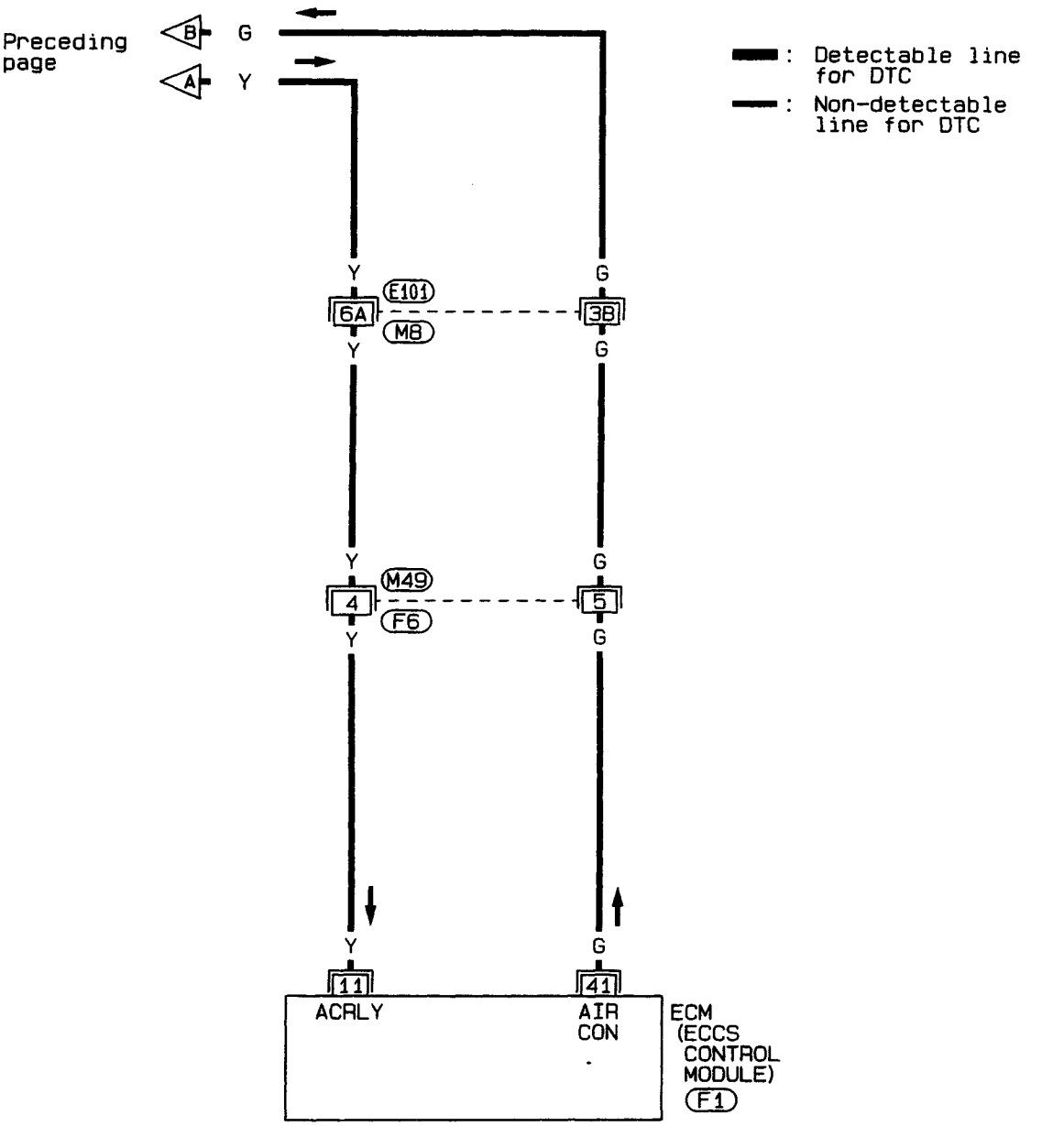
M8, E101

M15, E106

HEC021

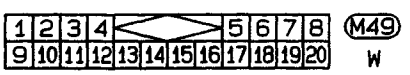
Idle Air Control Valve (IACV)-FICD Solenoid Valve (Cont'd)

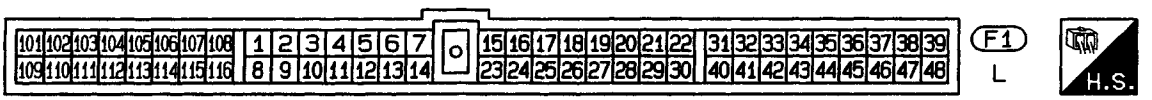
EC-FICD-02



Refer to last page (Foldout page).

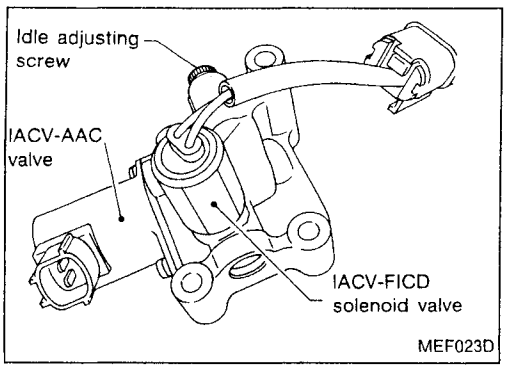
M8, E101





HEC022

Idle Air Control Valve (IACV)-FICD Solenoid Valve (Cont'd)

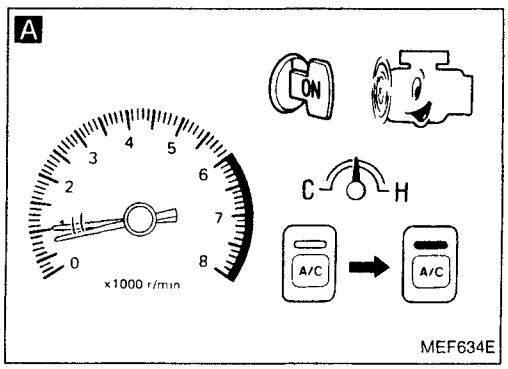


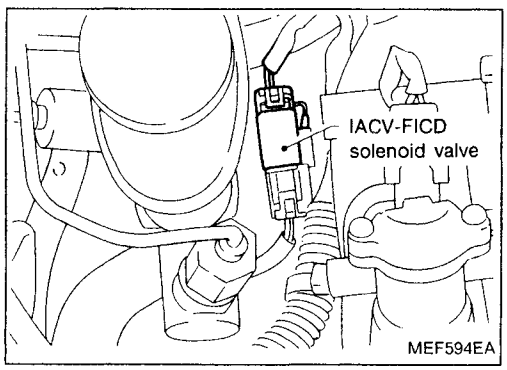
COMPONENT DESCRIPTION

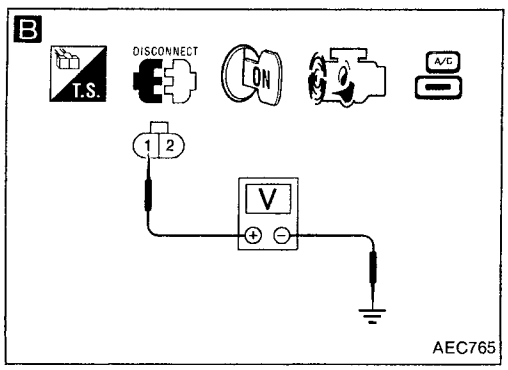
When the air conditioner is on, the IACV-FICD solenoid valve supplies additional air to adjust to the increased load.

EC

DIAGNOSTIC PROCEDURE







INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Start engine and warm it up sufficiently.
2. Check idle speed.
   800 ± 50 rpm
   If NG, adjust idle speed.
3. Turn air conditioner switch and blower fan switch "ON".
4. Recheck idle speed.
   850 rpm or more

OK → INSPECTION END

NG

Check if air conditioner compressor functions normally.

NG → Refer to "TROUBLE DIAGNOSES" in HA section.

OK

B

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect IACV-FICD solenoid valve harness connector.
3. Start engine, then turn air conditioner switch and blower fan "ON".
4. Check voltage between terminal ① and ground with CONSULT or tester.
   Voltage: Battery voltage

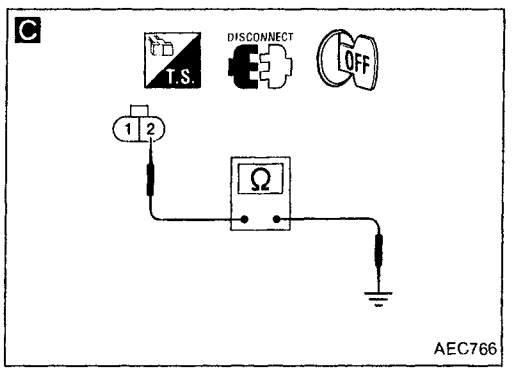
NG → Check the following.
- Harness connectors (E24), (E202)
- Harness for open or short between IACV-FICD solenoid valve harness connector and air conditioner relay

If NG, repair harness or connectors.

OK

Ⓐ

Idle Air Control Valve (IACV)-FICD Solenoid Valve (Cont'd)



Ⓐ

C

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Check harness continuity between terminal ② and body ground.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (E227), (F12)
- Harness for open or short between IACV-FICD solenoid valve and engine ground

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT (IACV-FICD solenoid valve). Refer to "COMPONENT INSPECTION" below.

NG → Replace IACV-FICD solenoid valve.

OK ↓

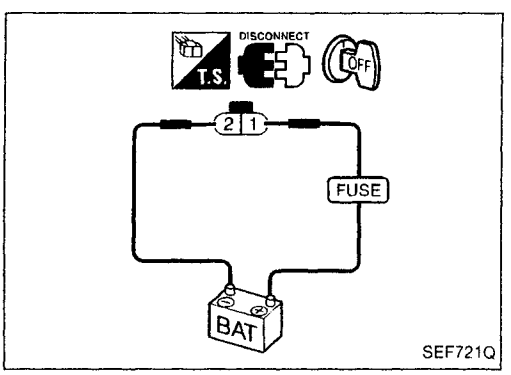
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

↓

INSPECTION END

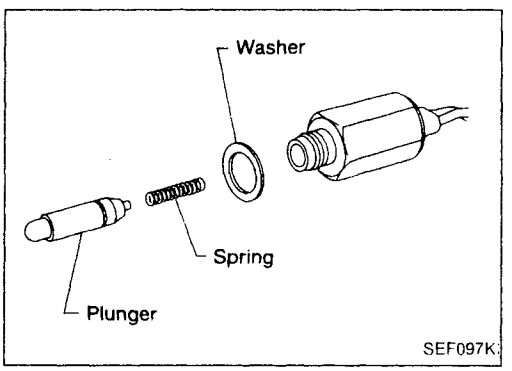


COMPONENT INSPECTION

IACV-FICD solenoid valve

Disconnect IACV-FICD solenoid valve harness connector.

- Check for clicking sound when applying 12V direct current to terminals.

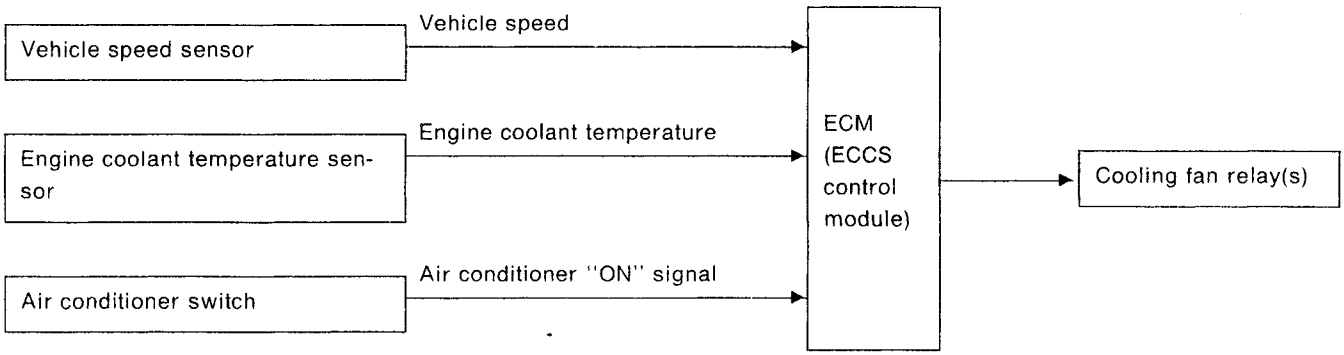


- Check plunger for seizing or sticking.
- Check for broken spring.

Cooling Fan Control

SYSTEM DESCRIPTION

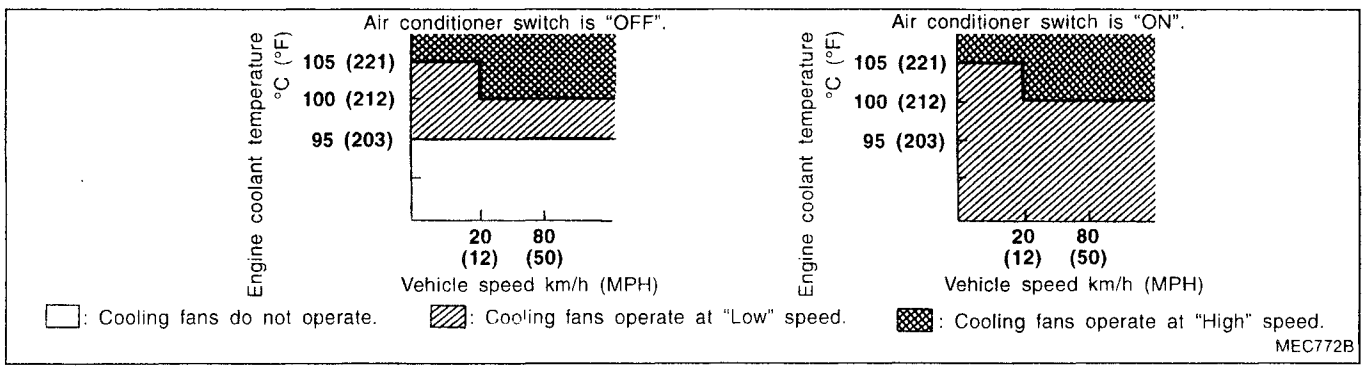
Cooling fan control



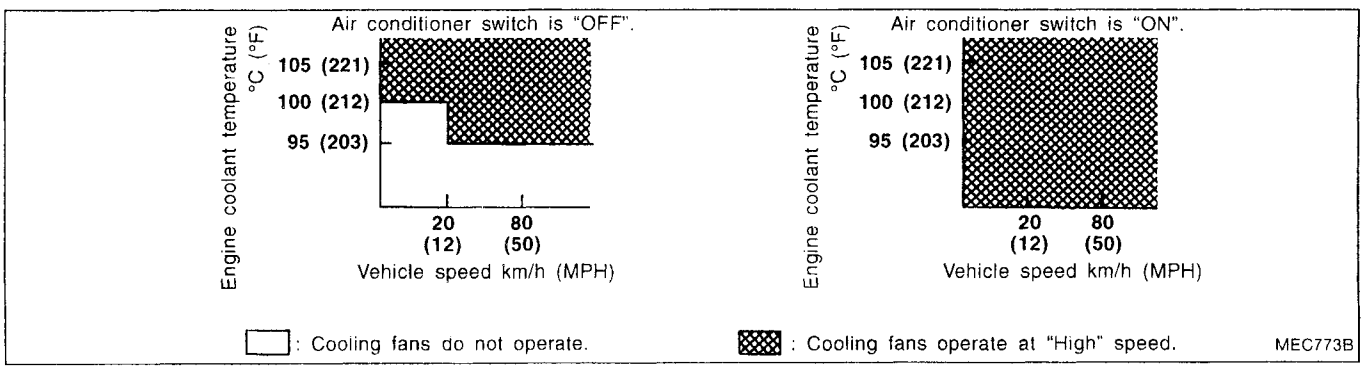
The ECM controls the cooling fan corresponding to the vehicle speed, engine coolant temperature, and air conditioner ON signal. The control system has 3-step control [HIGH/LOW/OFF] on A/T models and 2-step control [ON/OFF] on M/T models.

Operation

For A/T models

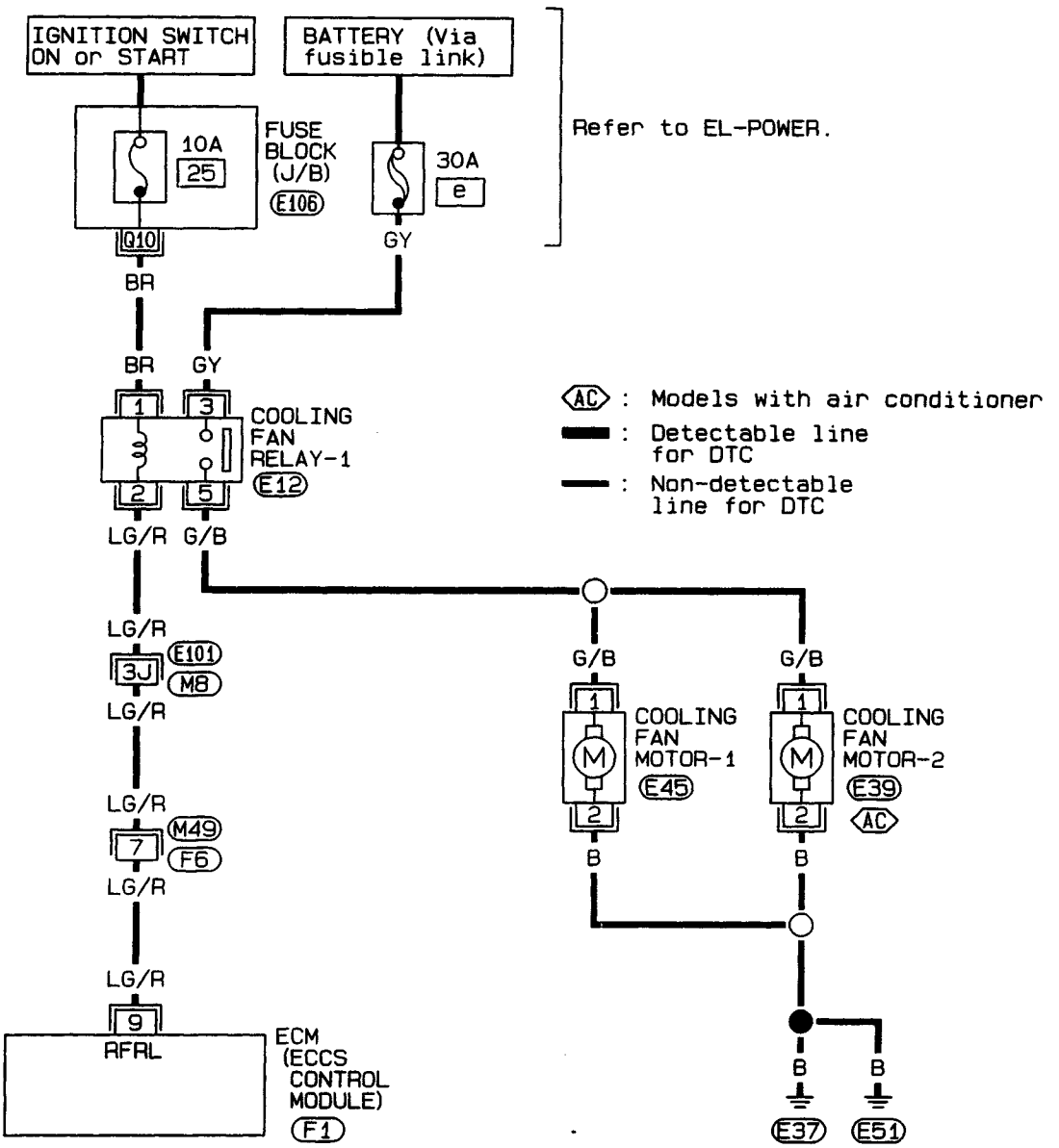


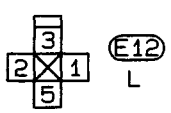
For M/T models



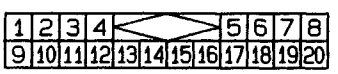
M/T models

EC-COOL/F-01





E12
L



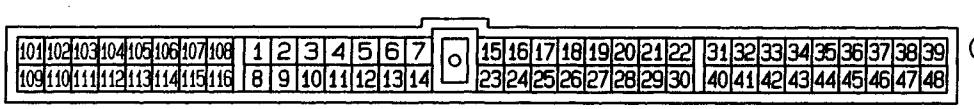
M49
W



E39, E45
GY GY

Refer to last page (Foldout page).

M8, E101
E106

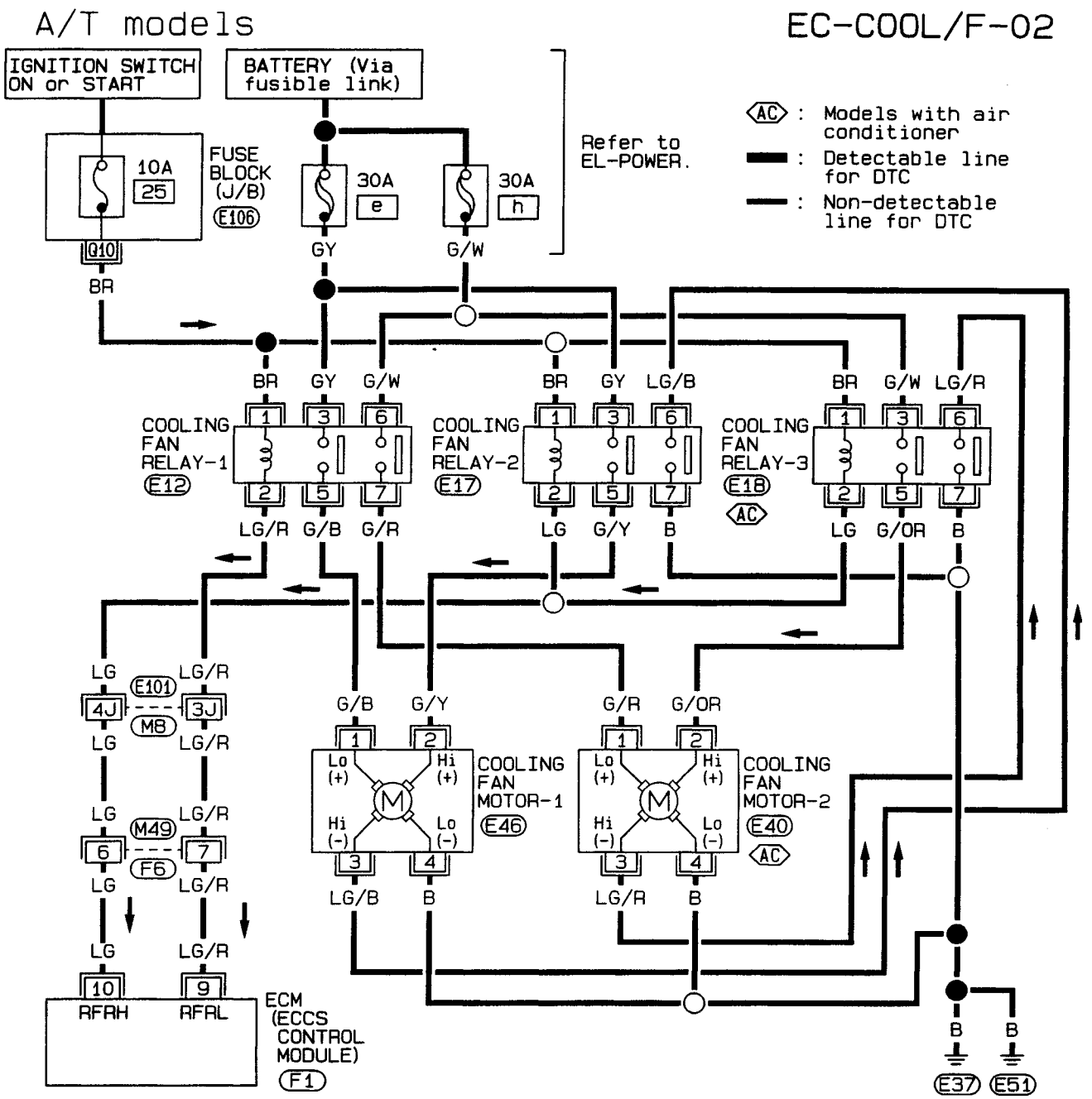


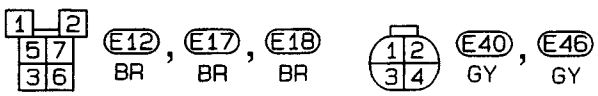
F1
L

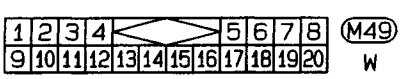
H.S.

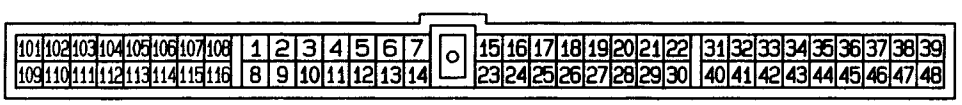
HEC016

Cooling Fan Control (Cont'd)









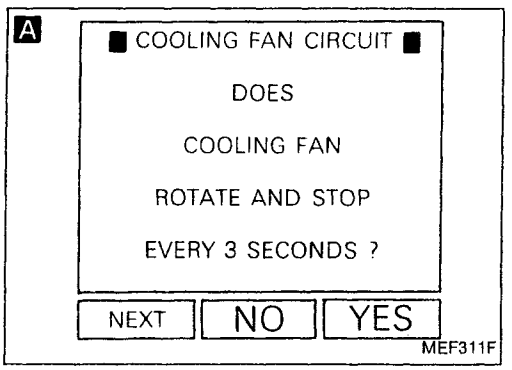
Refer to last page (Foldout page).

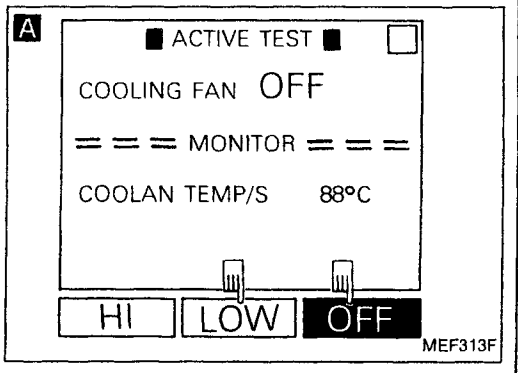
M8, E101
E106

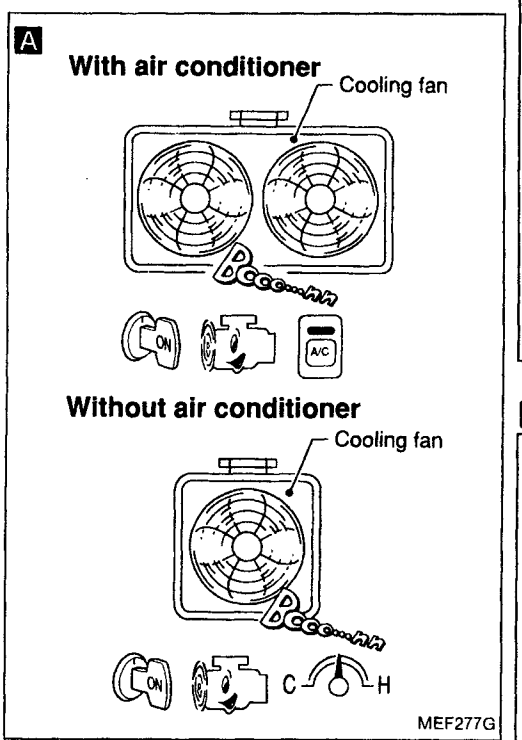
H.S.

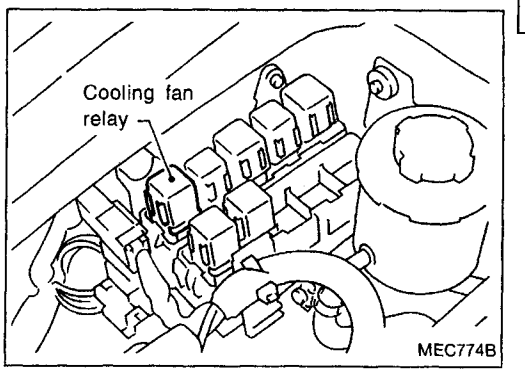
HEC017

Cooling Fan Control (Cont'd)









M/T models

INSPECTION START

A

CHECK OVERALL FUNCTION.

1. Turn ignition switch "ON".
2. Perform "COOLING FAN CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

1. Turn ignition switch "ON".
2. Select "COOLING FAN" in "ACTIVE TEST" mode with CONSULT.

OR

With air conditioner

1. Start engine.
2. Set temperature lever at full cold position.
3. Turn air conditioner switch "ON".
4. Turn blower fan switch "ON".
5. Run engine at idle for a few minutes with air conditioner operating.
6. Make sure that cooling fan operates.

Without air conditioner

1. Start engine.
2. Keep engine speed at about 2,000 rpm until engine is warmed up sufficiently.
3. Make sure that cooling fan begins to operate during warm-up.

OK → INSPECTION END

NG

B

CHECK POWER SUPPLY.

1. Turn air conditioner switch "OFF".
2. Turn blower fan switch "OFF". (Step 1 and 2 are only performed for models with air conditioner.)
3. Stop engine.
4. Disconnect cooling fan relay.
5. Turn ignition switch "ON".
6. Check voltage between terminals ①, ③ and ground.

Voltage: Battery voltage

NG → Check the following.
- 30A fusible link
- 10A fuse
- Harness for open or short between fuse and cooling fan relay
- Harness for open or short between battery and cooling fan relay

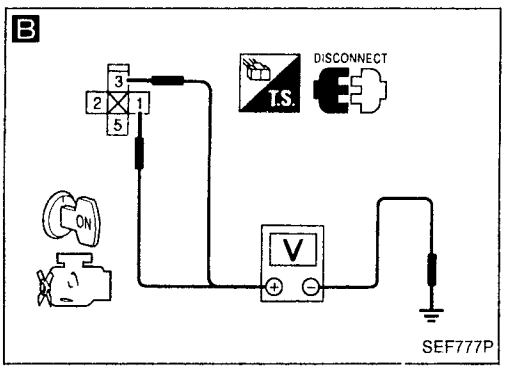
If NG, repair harness or connectors.

OK

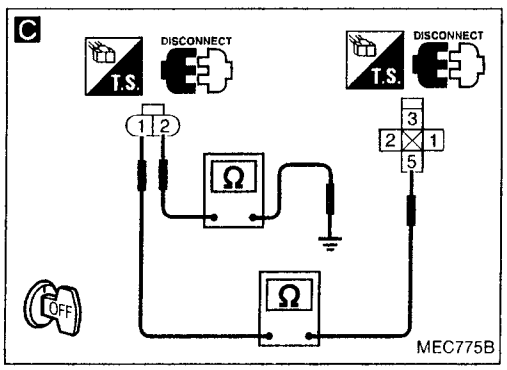
Ⓐ

Cooling Fan Control (Cont'd)

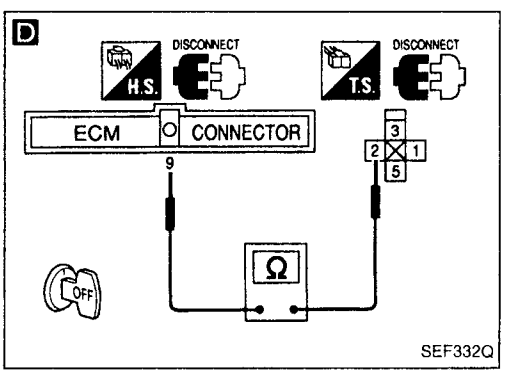
B



C



D



Ⓐ

C

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect cooling fan motor-1 harness connector and cooling fan motor-2 harness connector.
3. Check harness continuity between terminal ① and terminal ⑤, terminal ② and body ground.
Continuity should exist.

NG → Repair harness or connectors.

OK ↓

D

CHECK OUTPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ⑨ and terminal ②.
Continuity should exist.
If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness connectors (M8), (E101)
- Harness for open or short between ECM and cooling fan relay

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Cooling fan relay).
Refer to "COMPONENT INSPECTION", EC-353.

NG → Replace cooling fan relay.

OK ↓

CHECK COMPONENTS
(Cooling fan motors).
Refer to "COMPONENT INSPECTION", EC-353.

NG → Replace cooling fan motors.

OK ↓

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

Trouble is not fixed. ↓

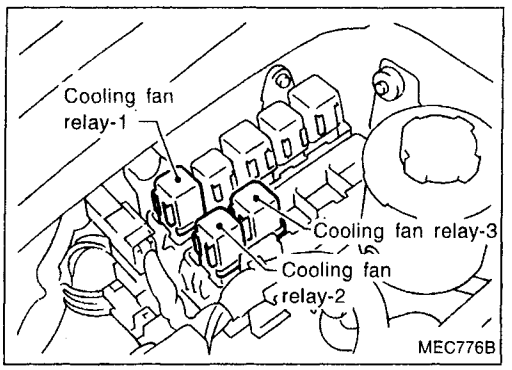
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

↓

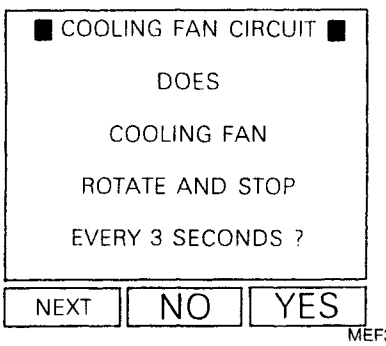
INSPECTION END

EC

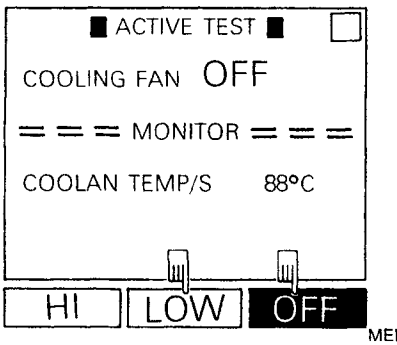
Cooling Fan Control (Cont'd)



E

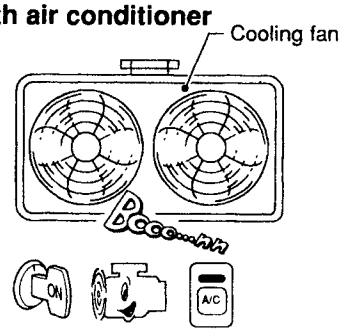


E

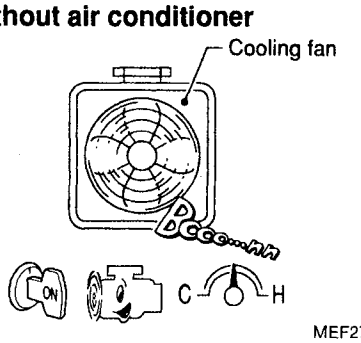


E

With air conditioner



Without air conditioner



A/T models

INSPECTION START

E

CHECK COOLING FAN LOW SPEED OPERATION.

1. Disconnect cooling fan relays-2 and -3.

2. Turn ignition switch "ON".
3. Perform "COOLING FAN CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

2. Turn ignition switch "ON".
3. Perform "COOLING FAN" in "ACTIVE TEST" mode with CONSULT.

OR

With air conditioner

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

Without air conditioner

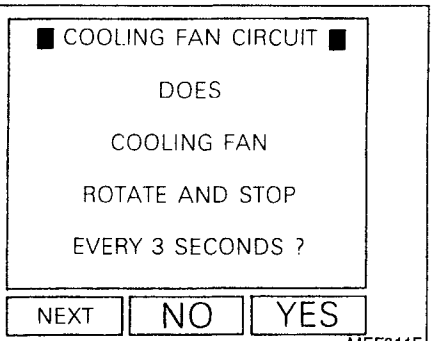
2. Start engine.
3. Keep engine speed at about 2,000 rpm until engine is warmed up sufficiently.
4. Make sure that cooling fan begins to operate at low speed during warm-up.

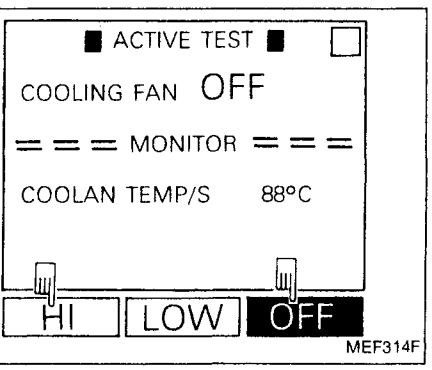
NG → Check cooling fan low speed control circuit. (Go to PROCEDURE A, EC-350.)

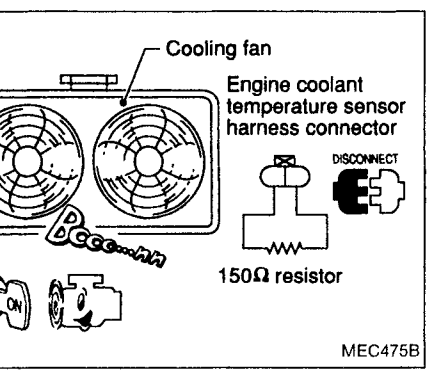
OK → Ⓑ

Cooling Fan Control (Cont'd)

F







Ⓑ

F

CHECK COOLING FAN HIGH SPEED OPERATION.

1. Turn ignition switch "OFF".
2. Reconnect cooling fan relays-2 and -3.
3. Disconnect cooling fan relay-1.

4. Turn ignition switch "ON".
5. Perform "COOLING FAN CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

4. Turn ignition switch "ON".
5. Perform "COOLING FAN" in "ACTIVE TEST" mode with CONSULT.

OR

4. Turn air conditioner switch and blower fan switch "OFF" (Models with air conditioner).
5. Disconnect engine coolant temperature sensor harness connector.
6. Connect 150Ω resistor to engine coolant temperature sensor harness connector.
7. Restart engine and make sure that cooling fan operates at higher speed than low speed.

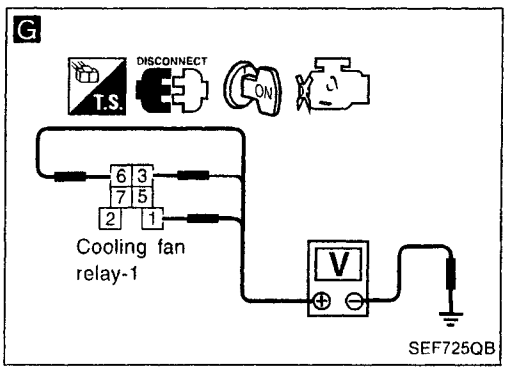
NG → Check cooling fan high speed control circuit. (Go to PROCEDURE B, EC-351.)

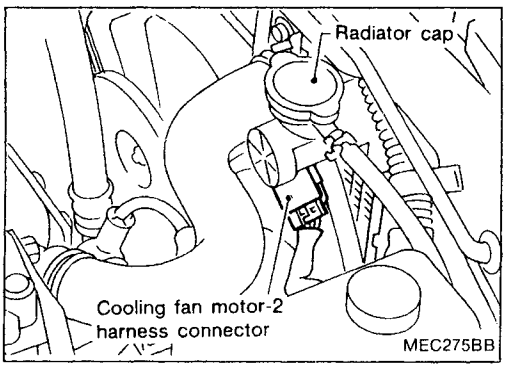
OK ↓

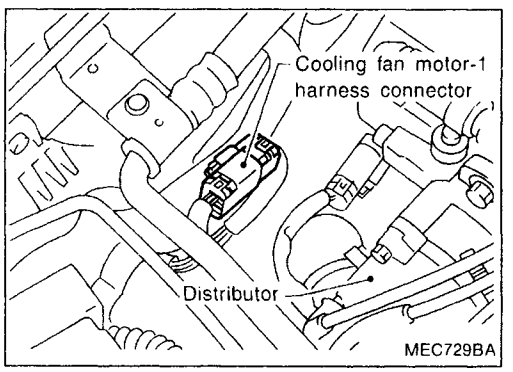
INSPECTION END

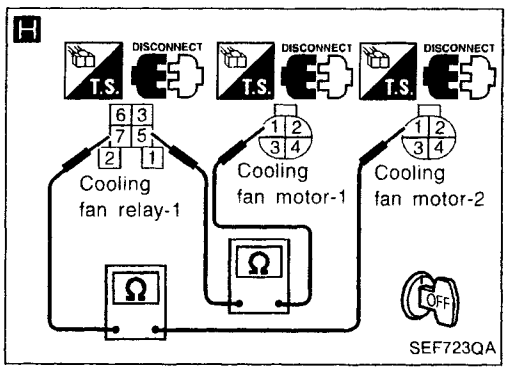
EC

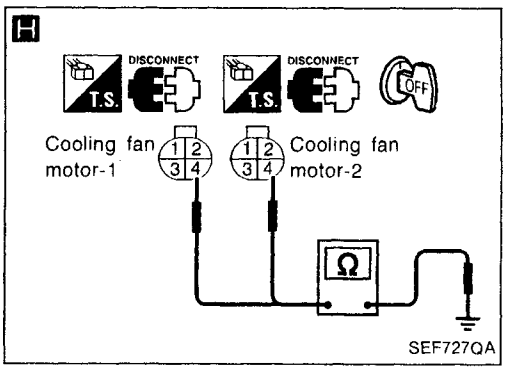
Cooling Fan Control (Cont'd)











PROCEDURE A

INSPECTION START

G

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect cooling fan relay-1.
3. Turn ignition switch "ON".
4. Check voltage between terminals ①, ③, ⑥ and ground with CONSULT or tester.
   Voltage: Battery voltage

NG → Check the following.
- 10A fuse
- 30A fusible link
- Harness for open or short between cooling fan relay-1 and fuse
- Harness for open or short between cooling fan relay-1 and battery

If NG, repair harness or connectors.

OK

H

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect cooling fan motor-1 harness connector and cooling fan motor-2 harness connector.
3. Check harness continuity between cooling fan relay-1 terminal ⑤ and cooling fan motor-1 terminal ①, cooling fan relay-1 terminal ⑦ and cooling fan motor-2 terminal ①.
   Continuity should exist.
   If OK, check harness for short.
4. Check harness continuity between terminal ④ and body ground.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair harness or connectors.

OK

I

CHECK OUTPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ⑨ and terminal ②.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (E101), (M8)
- Harness connectors (M49), (F6)
- Harness for open or short between cooling fan relay-1 and ECM

If NG, repair harness or connectors.

OK

CHECK COMPONENT (Cooling fan relay-1).
Refer to "COMPONENT INSPECTION", EC-353.

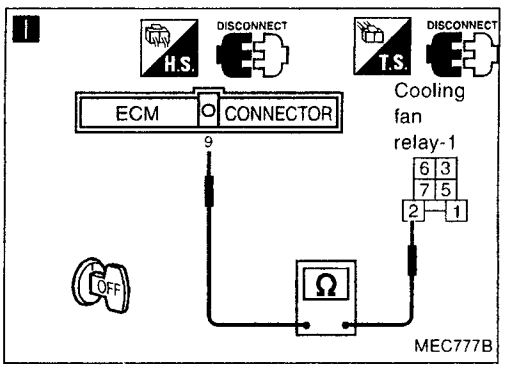
NG → Replace cooling fan relay.

OK

Ⓒ

Cooling Fan Control (Cont'd)

I



Ⓒ

CHECK COMPONENT
(Cooling fan motors-1 and -2).
Refer to "COMPONENT INSPECTION", EC-353.

NG → Replace cooling fan motors.

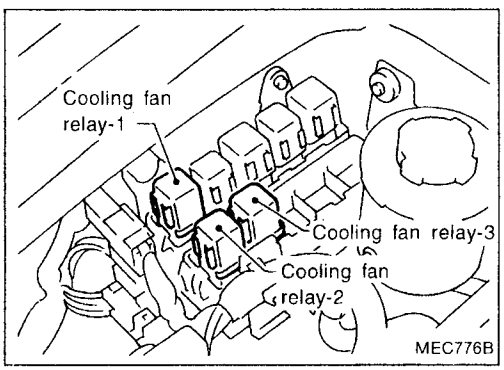
OK

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

Trouble is not fixed.

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

INSPECTION END



PROCEDURE B

INSPECTION START

J

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

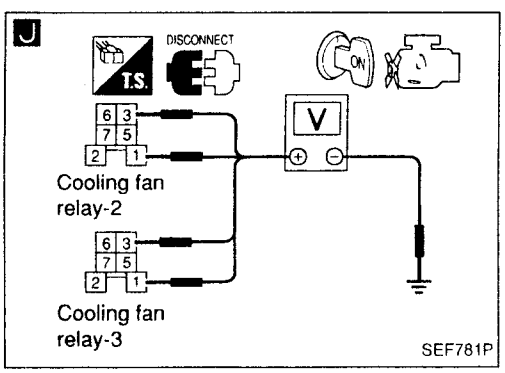
NG → Check the following.
- 10A fuse
- 30A fusible link
- Harness for open or short between cooling fan relays-2, -3 and fuse
- Harness for open or short between cooling fan relays-2, -3 and battery

If NG, repair harness or connectors.

OK

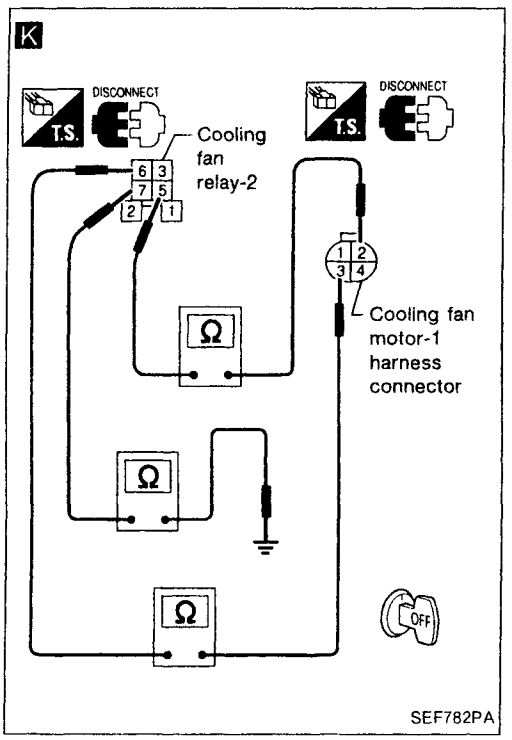
Ⓓ

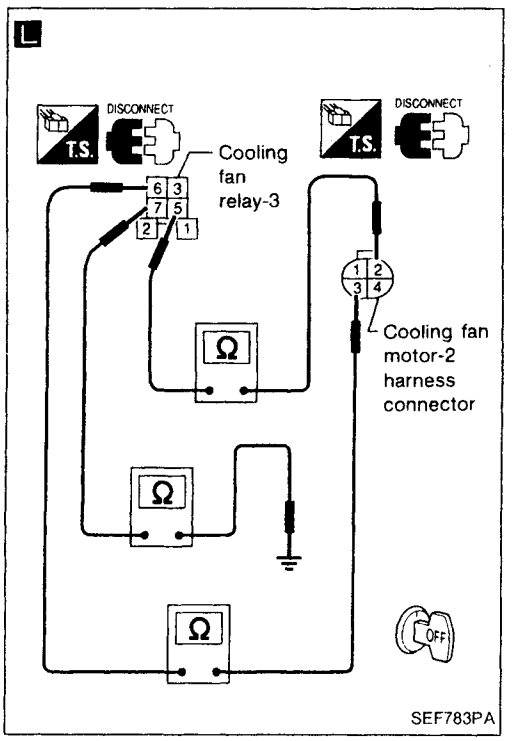
J

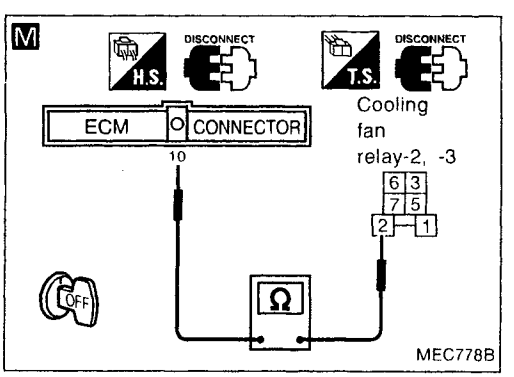


EC

Cooling Fan Control (Cont'd)







Ⓓ

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect cooling fan motor-1 harness connector and cooling fan motor-2 harness connector.

K 3. Check harness continuity between terminal ⑤ and terminal ②, terminal ⑥ and terminal ③, terminal ⑦ and body ground.
Continuity should exist.
If OK, check harness for short.

L 4. Check harness continuity between terminal ⑤ and terminal ②, terminal ⑥ and terminal ③, terminal ⑦ and body ground.
Continuity should exist.
If OK, check harness for short.

NG → Repair harness or connectors.

OK ↓

M

CHECK OUTPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ⑩ and terminal ②.
Continuity should exist.
If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness connectors (M8), (E101)
- Harness for open or short between cooling fan relays-2, 3 and ECM

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Cooling fan relays-2, 3).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace cooling fan relays.

OK ↓

CHECK COMPONENTS
(Cooling fan motors).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace cooling fan motors.

OK ↓

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

Trouble is not fixed. ↓

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

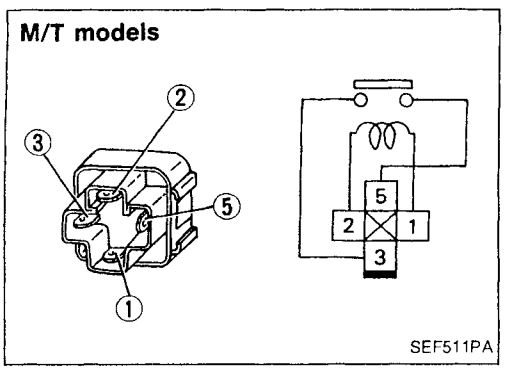
↓

INSPECTION END

Cooling Fan Control (Cont'd)

COMPONENT INSPECTION

M/T models



SEF511PA

Cooling fan relay (M/T models)

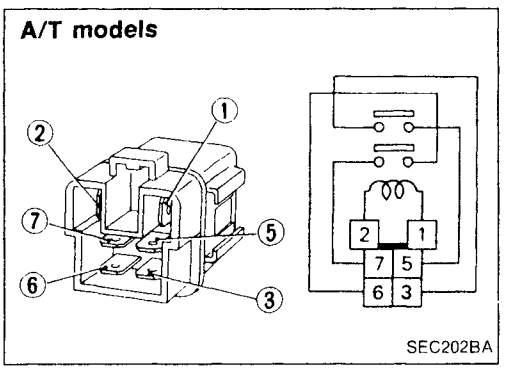
Check continuity between terminals ③ and ⑤.

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

If NG, replace relay.

EC

A/T models



SEC202BA

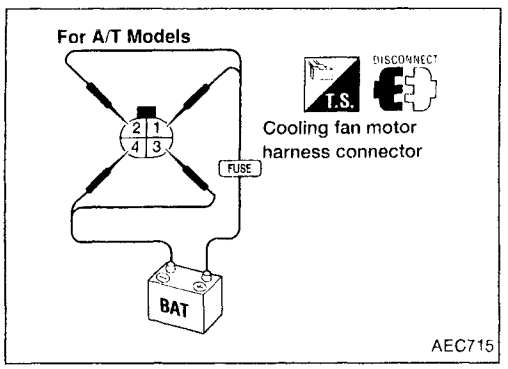
Cooling fan relays-1, -2 and -3 (A/T models)

Check continuity between terminals ③ and ⑤, ⑥ and ⑦.

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

If NG, replace relay.

For A/T Models



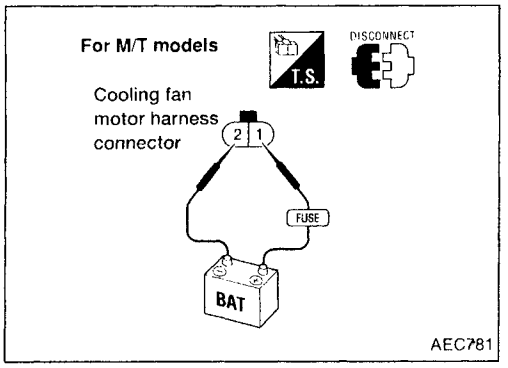
AEC715

Cooling fan motors-1 and -2

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

	Speed	Terminals	
		(⊕)	(⊖)
Cooling fan motor	Low (A/T models)	①	④
	High (A/T models)	①, ②	③, ④
	High (M/T models)	①	②

For M/T models

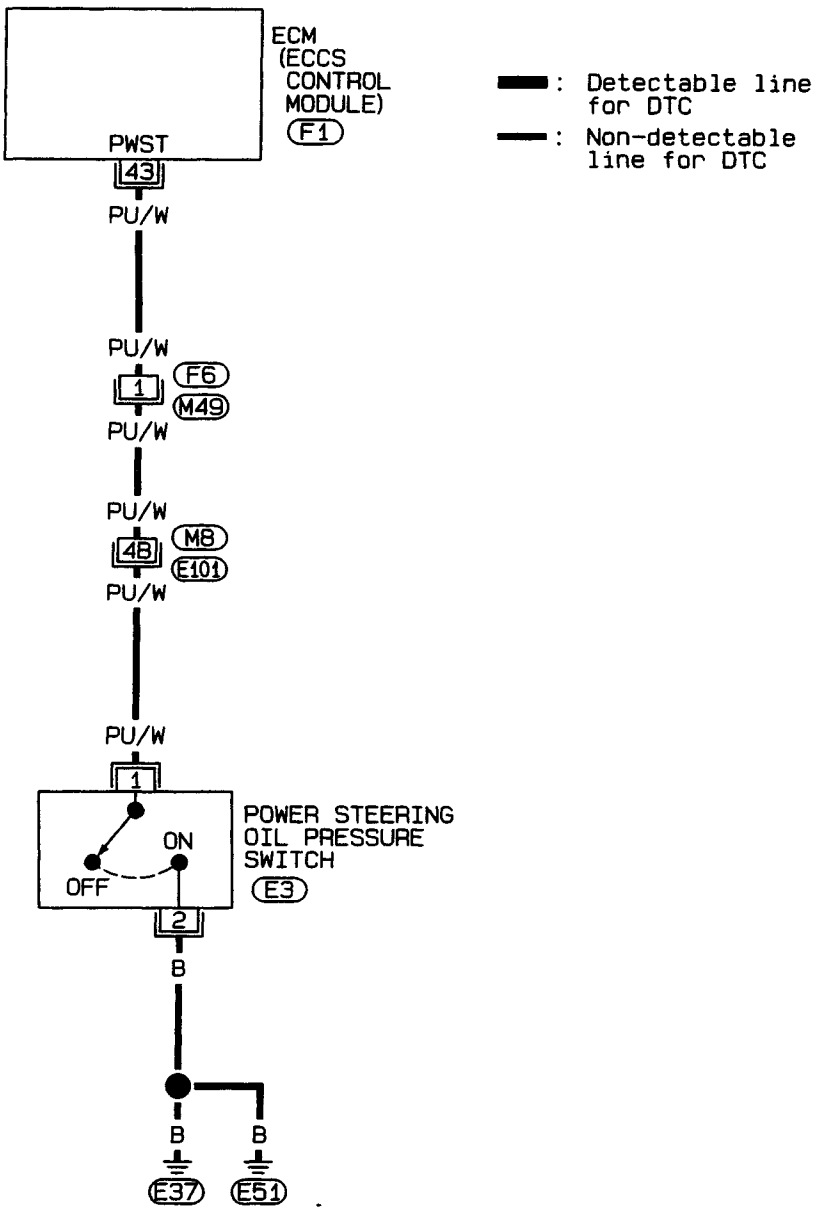


AEC781

Cooling fan motor should operate.
If NG, replace cooling fan motor.

Power Steering Oil Pressure Switch

EC-PST/SW-01





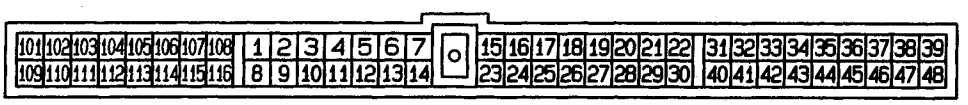
M49
W



E3
GY

Refer to last page
(Foldout page).

M8, E101



F1
L

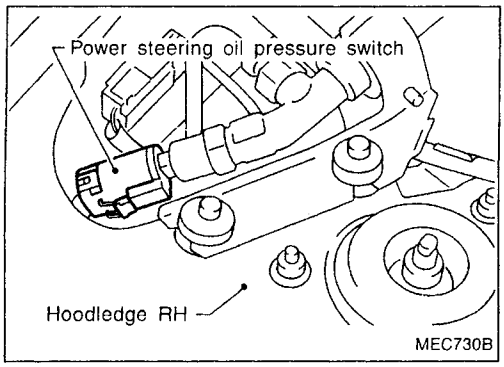
H.S.

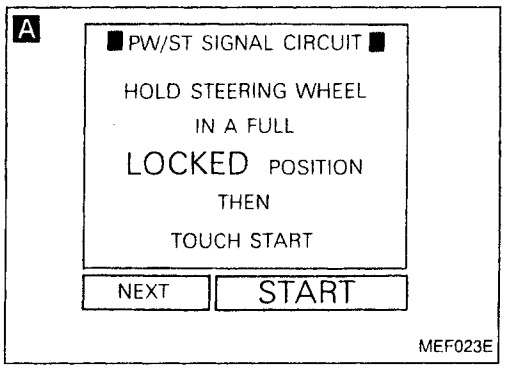
HEC018

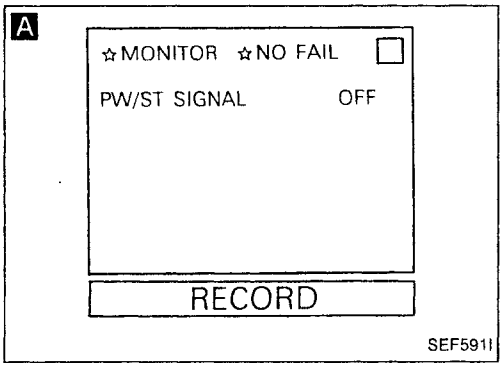
Power Steering Oil Pressure Switch (Cont'd)

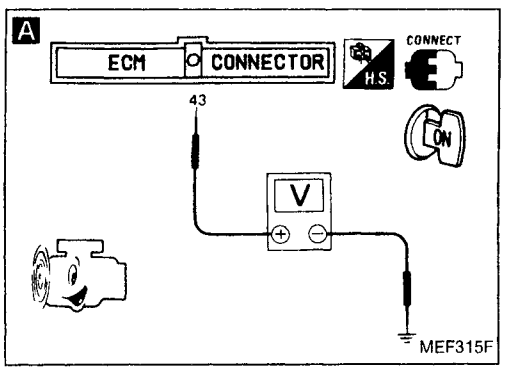
COMPONENT DESCRIPTION

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









DIAGNOSTIC PROCEDURE

INSPECTION START

A

CHECK OVERALL FUNCTION.

1. Start engine and warm it up sufficiently.
2. Perform "PW/ST SIGNAL CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

2. Check "PW/ST SIGNAL" in "DATA MONITOR" mode with CONSULT.

Steering is in neutral position:
OFF
Steering is turned:
ON

OR

2. Check voltage between ECM terminal ㊸ and ground.

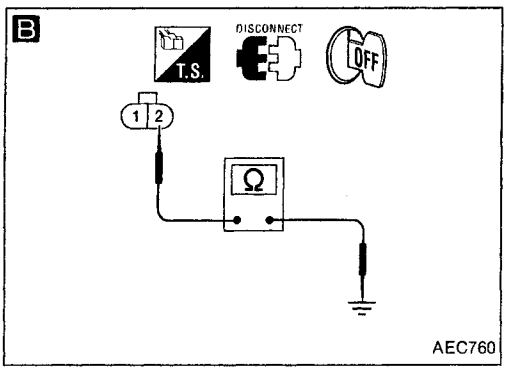
Voltage:
When steering wheel is turned quickly.
Approximately 0V
Except above
Approximately 8 - 10V

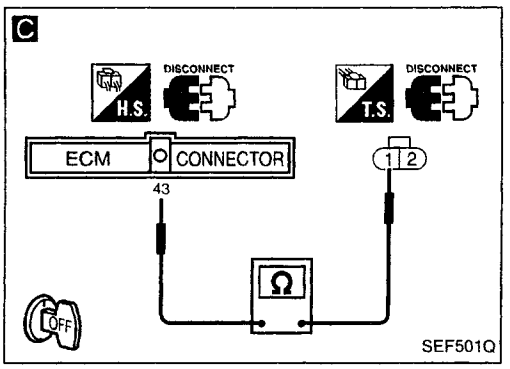
OK → INSPECTION END

NG → Ⓐ

EC

Power Steering Oil Pressure Switch (Cont'd)





Ⓐ

B

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

NG → Repair harness or connectors.

OK ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ㊸ and terminal ①.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness connectors (M8), (E101)
- Harness for open or short between ECM and power steering oil pressure switch

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Power steering oil pressure switch).
Refer to "COMPONENT INSPECTION" below.

NG → Replace power steering oil pressure switch.

OK ↓

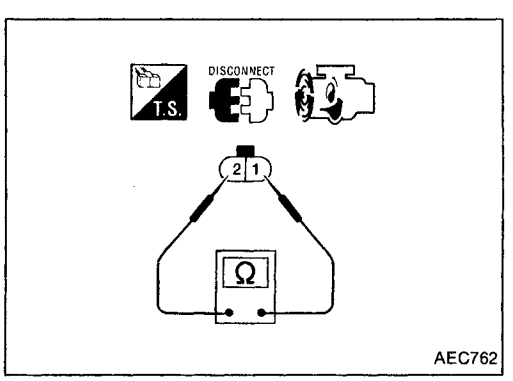
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

↓

INSPECTION END



COMPONENT INSPECTION

Power steering oil pressure switch

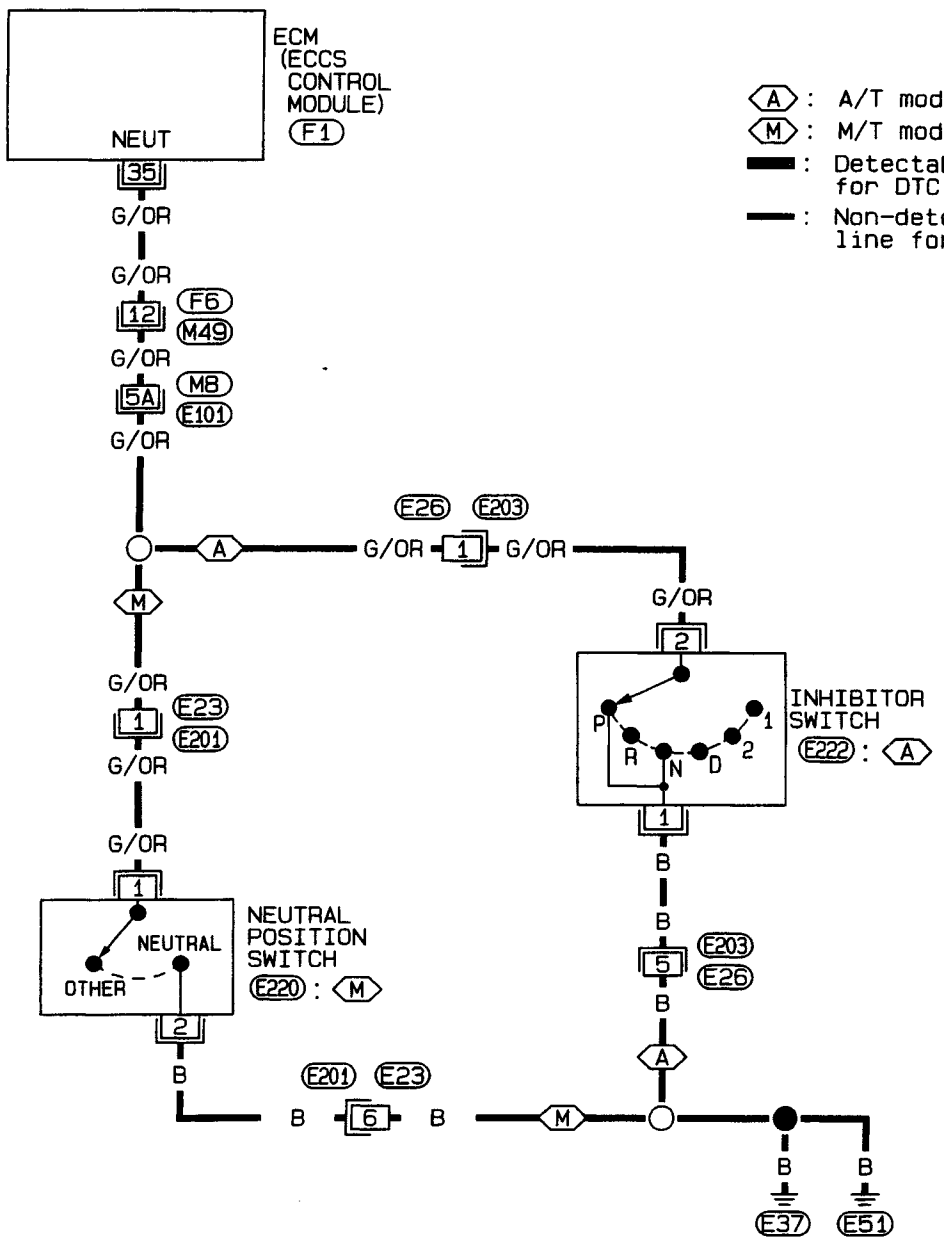
1. Disconnect power steering oil pressure switch harness connector then start engine.
2. Check continuity between terminals ① and ②.

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

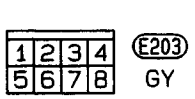
If NG, replace power steering oil pressure switch.

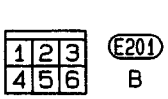
Park/Neutral Position Switch

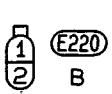
EC-PNP/SW-01

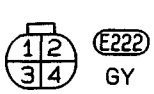


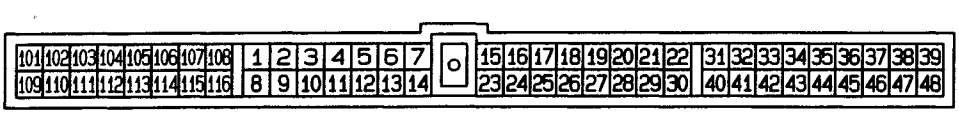












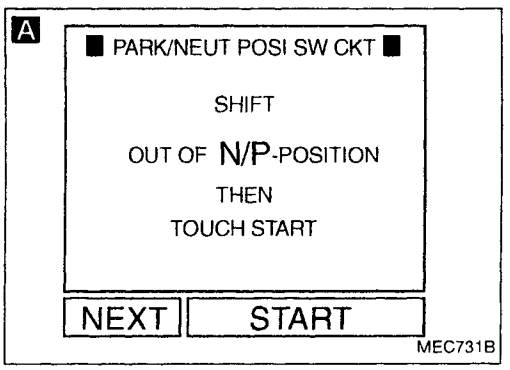
Refer to last page (Foldout page).

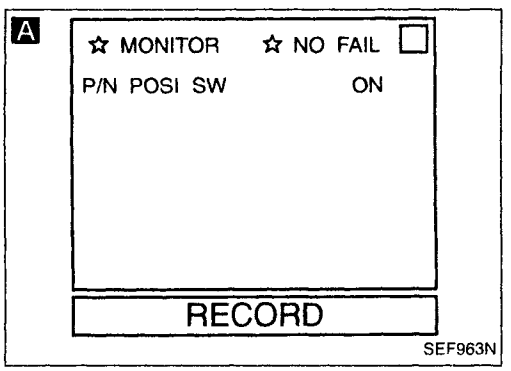
M8, E101

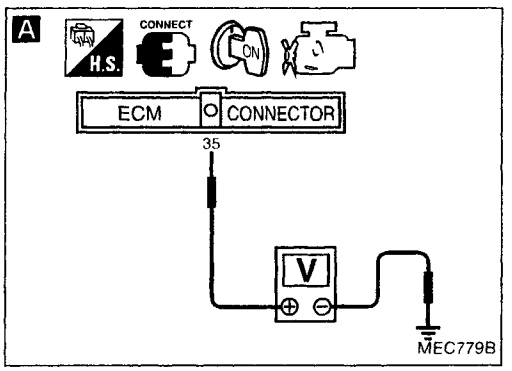
HEC019

Park/Neutral Position Switch (Cont'd)

When the gear position is in "P" (A/T models only) or "N", park/neutral position is "ON". ECM detects the position because the continuity of the line (the "ON" signal) exists.







DIAGNOSTIC PROCEDURE

Neutral position switch (M/T models)

INSPECTION START

A

CHECK OVERALL FUNCTION.

1 Turn ignition switch "ON".

2. Perform "PARK/NEUT POSI SW CKT" in "FUNCTION TEST" mode with CONSULT.

OR

2. Select "P/N POSI SW" in "DATA MONITOR" mode with CONSULT.
3. Check "P/N POSI SW" signal under the following conditions.

Neutral position: ON

Except neutral position: OFF

OR

2. Check voltage between ECM terminal ㉟ and ground under the following conditions.

Voltage:

Neutral position

Approximately 0V

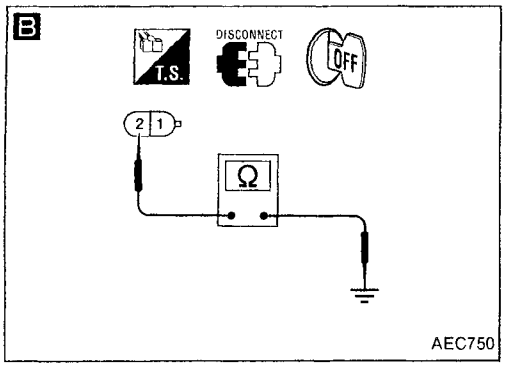
Except neutral position

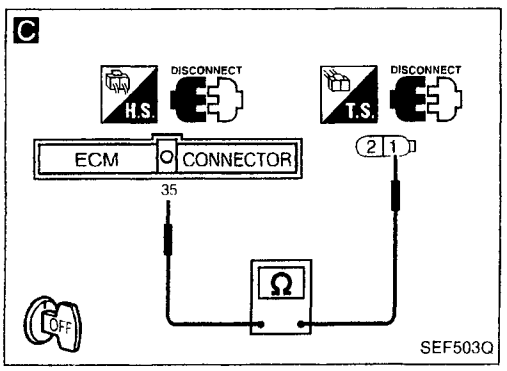
Battery voltage

OK → INSPECTION END

NG → Ⓐ

Park/Neutral Position Switch (Cont'd)





Ⓐ

B

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect neutral position switch harness connector.
3. Check harness continuity between terminal ② and body ground.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (E201), (E23)
- Harness for open or short between neutral position switch and body ground

If NG, repair harness or connectors.

OK ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ㉟ and terminal ①.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness connectors (M8), (E101)
- Harness connectors (E23), (E201)
- Harness for open or short between ECM and neutral position switch

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Neutral position switch).
Refer to MT section.

NG → Replace neutral position switch.

OK ↓

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

Trouble is not fixed. ↓

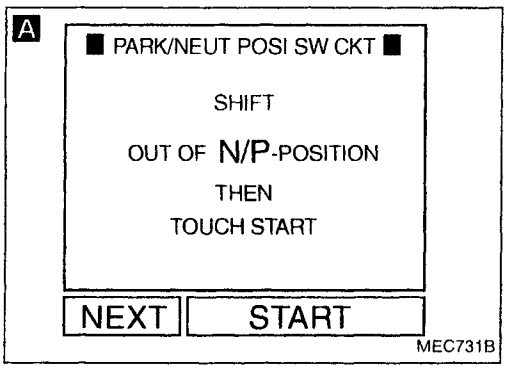
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

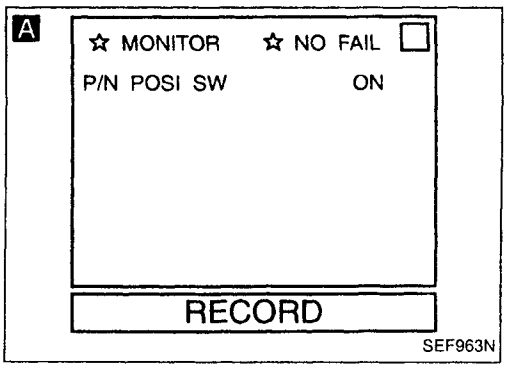
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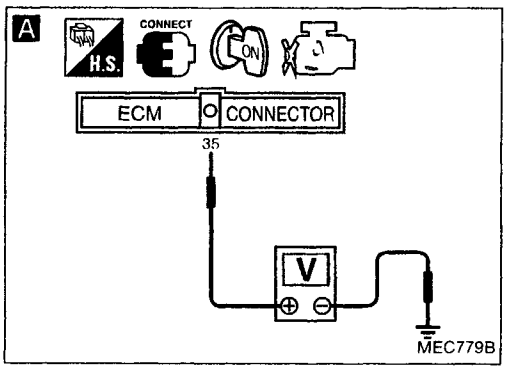
INSPECTION END

EC

Park/Neutral Position Switch (Cont'd)







Inhibitor switch (A/T models)

INSPECTION START

A

CHECK OVERALL FUNCTION.

1. Turn ignition switch "ON".
2. Perform "PARK/NEUT POSI SW CKT" in "FUNCTION TEST" mode with CONSULT.

OR

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

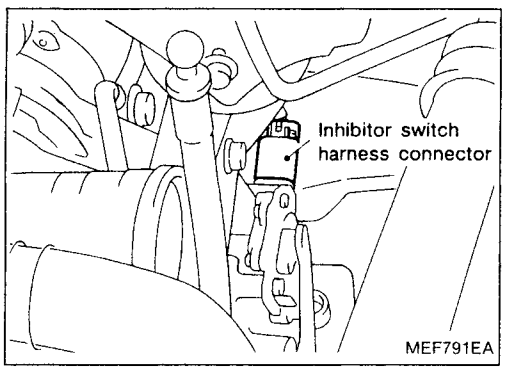
OR

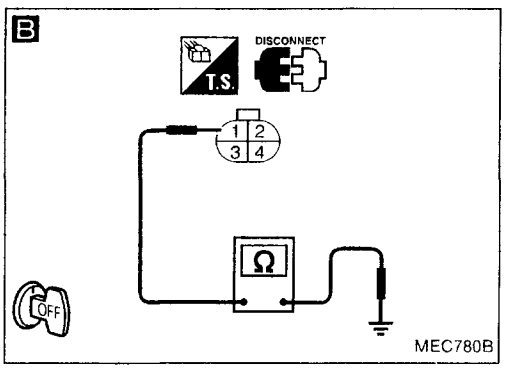
1. Make sure that inhibitor switch circuit functions properly. (Refer to AT section.)
2. Turn ignition switch "ON".
3. Check voltage between ECM terminal ㉟ and ground under the following conditions.
   Voltage:
   "N" or "P" position
   Approximately 0V
   Except above position
   Battery voltage

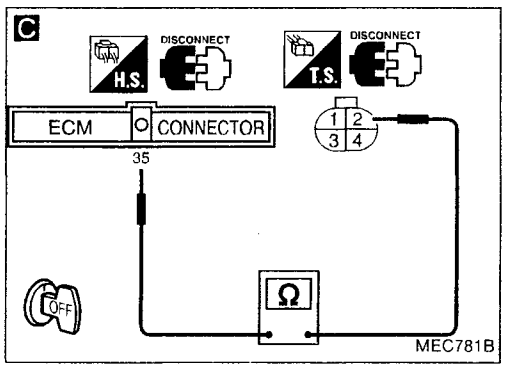
OK → INSPECTION END

NG → Ⓐ

Park/Neutral Position Switch (Cont'd)







Ⓐ

B

CHECK GROUND CIRCUIT.
1. Disconnect inhibitor switch harness connector.
2. Check harness continuity between terminals ① and body ground.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (E203), (E26)
- Harness for open or short between inhibitor switch and body ground

If NG, repair harness or connectors.

OK ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ㉟ and terminal ②.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (F6), (M49)
- Harness connectors (M8), (E101)
- Harness connectors (E26), (E203)
- Harness for open or short between ECM and inhibitor switch

If NG, repair harness or connectors.

OK ↓

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

NG → Replace inhibitor switch.

OK ↓

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

Trouble is not fixed. ↓

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

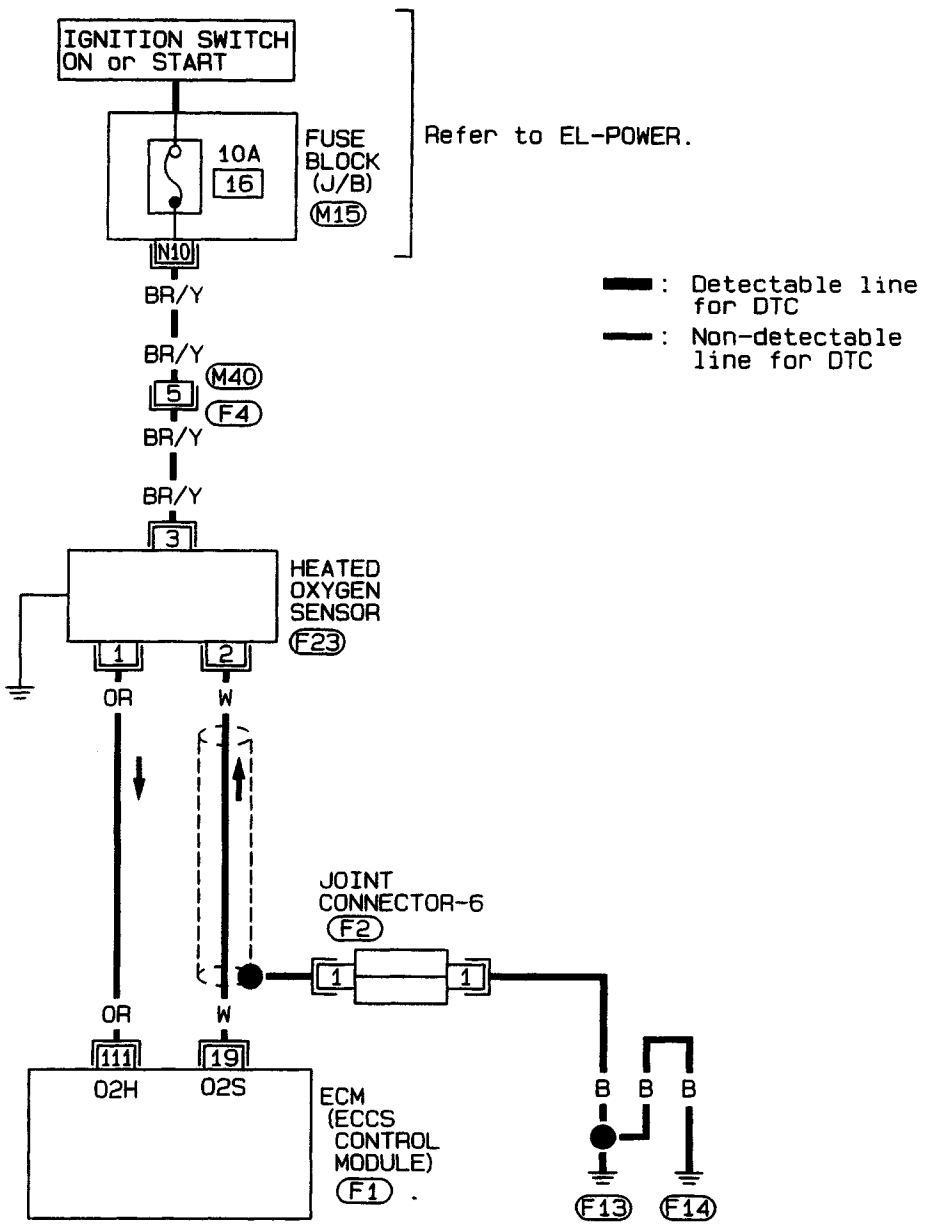
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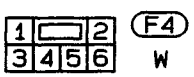
INSPECTION END

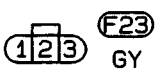
EC

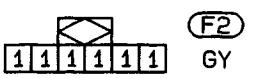
Heated Oxygen Sensor (HO2S)

EC-H02S-01



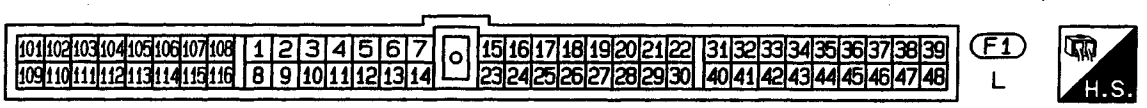






Refer to last page (Foldout page).

M15

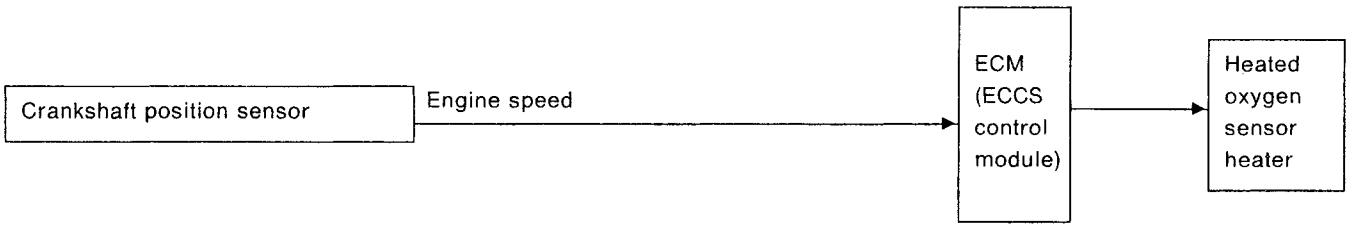


HEC020

Heated Oxygen Sensor (HO2S) (Cont'd)

SYSTEM DESCRIPTION

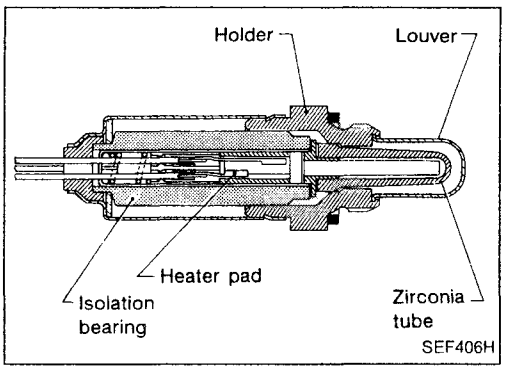
Heated oxygen sensor heater control

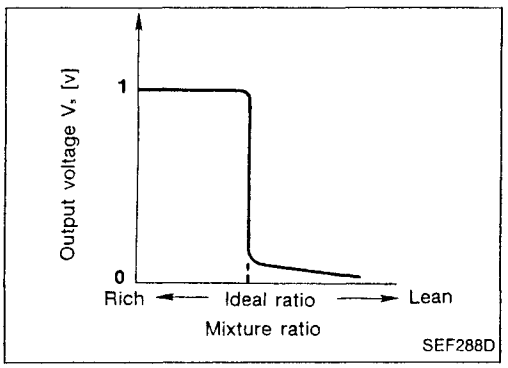


The ECM performs ON/OFF control of the heated oxygen sensor heater corresponding to the engine speed.

OPERATION

Engine speed rpm	Heated oxygen sensor heater
Above 3,200	OFF
Below 3,200	ON



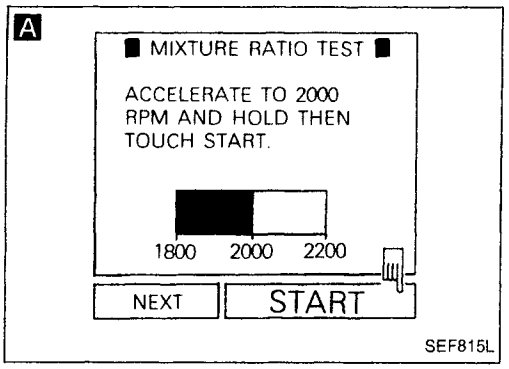


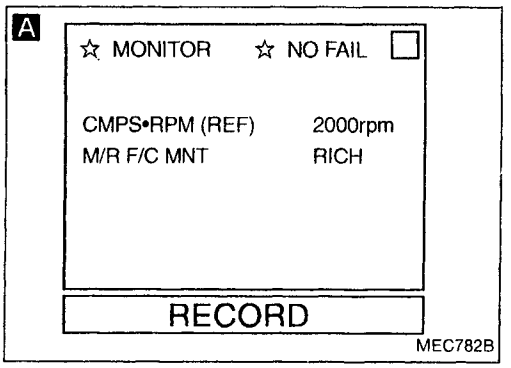
COMPONENT DESCRIPTION

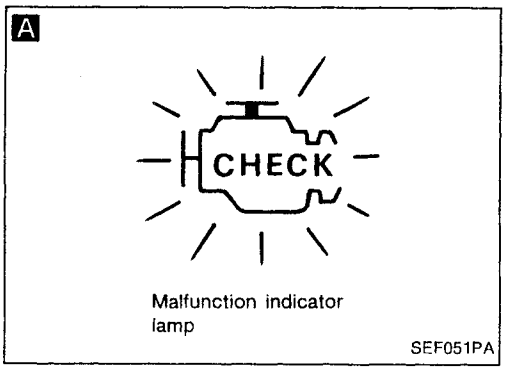
The heated oxygen sensor is placed into the front tube. It detects the amount of oxygen in the exhaust gas compared to the outside air. The heated oxygen sensor has a closed-end tube made of ceramic zirconia. The zirconia generates voltage from approximately 1V in richer conditions to 0V in leaner conditions. The heated oxygen sensor signal is sent to the ECM. The ECM adjusts the injection pulse duration to achieve the ideal air-fuel ratio. The ideal air-fuel ratio occurs near the radical change from 1V to 0V.

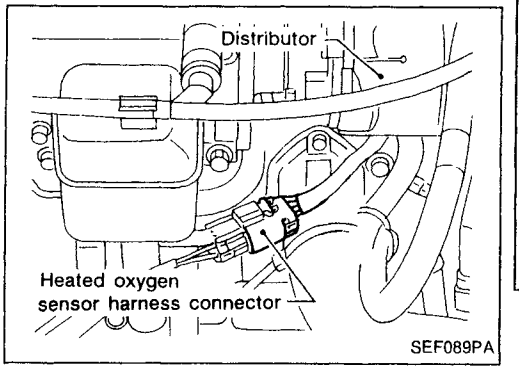
Heated Oxygen Sensor (HO2S) (Cont'd)

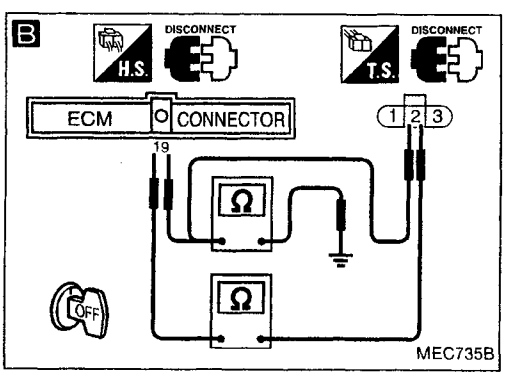
DIAGNOSTIC PROCEDURE











INSPECTION START

A

CHECK HEATED OXYGEN SENSOR CIRCUIT.

1. Start engine and warm it up sufficiently.
2. Perform "MIXTURE RATIO TEST" in "FUNCTION TEST" mode with CONSULT.

OR

2. Make sure that "M/R F/C MNT" in "DATA MONITOR" mode indicates "RICH" and "LEAN" periodically more than 5 times during 10 seconds at 2,000 rpm.

OR

2. Stop engine and set ECM Diagnostic Test Mode II (Heated oxygen sensor monitor).
3. Restart engine and run it at about 2,000 rpm for about 2 minutes under no-load.
4. Keep engine speed at 2,000 rpm and make sure that the malfunction indicator lamp on the instrument panel goes on and off more than 5 times during 10 seconds.

OK → INSPECTION END

NG

B

CHECK INPUT SIGNAL CIRCUIT.

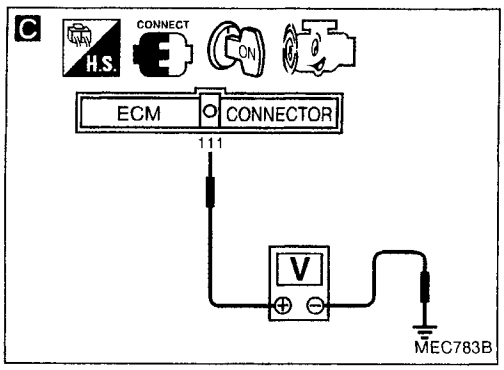
1. Turn ignition switch "OFF".
2. Disconnect heated oxygen sensor harness connector and ECM harness connector.
3. Check harness continuity between ECM terminal ⑲ and terminal ②.
   Continuity should exist.
4. Check harness continuity between ECM terminal ⑲ (or terminal ②) and ground.
   Continuity should not exist.
   If OK, check harness for short.

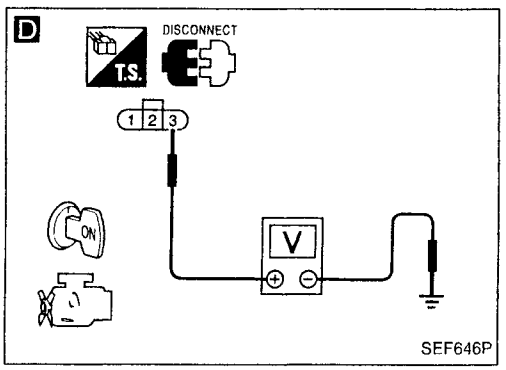
NG → Repair harness or connectors.

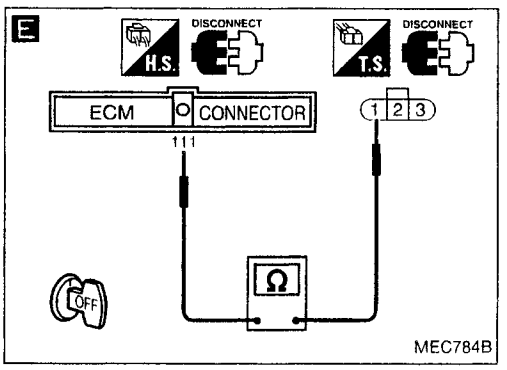
OK

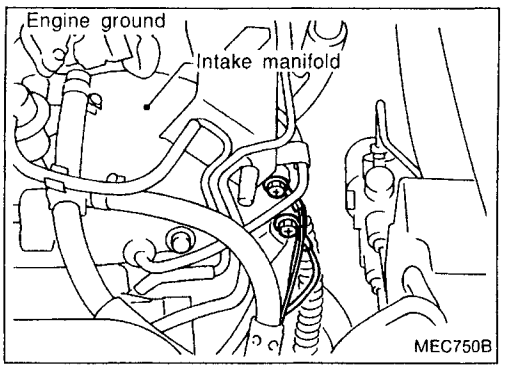
Ⓐ

Heated Oxygen Sensor (HO2S) (Cont'd)









Ⓐ

C

CHECK HEATED OXYGEN SENSOR HEATER CIRCUIT.
1. Reconnect harness connectors.
2. Start engine.
3. Check voltage between ECM terminal (111) and ground with CONSULT or tester under the following conditions.

Voltage:
Engine speed is below 3,200 rpm
Approximately 0V
Engine speed is above 3,200 rpm
Battery voltage

OK → Go to "CHECK COMPONENT".

NG ↓

D

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect heated oxygen sensor harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ③ and ground.

Voltage: Battery voltage

NG → Check the following.
- Harness connectors (F4), (M40)
- 10A fuse
- Harness for open or short between heated oxygen sensor and fuse

If NG, repair harness or connectors.

OK ↓

E

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between terminal ① and ECM terminal (111).

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

NG → Repair harness or connectors.

OK ↓

Loosen and retighten engine ground screws.

↓

CHECK COMPONENT
(Heated oxygen sensor heater).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace heated oxygen sensor.

OK ↓

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

Trouble is not fixed ↓

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

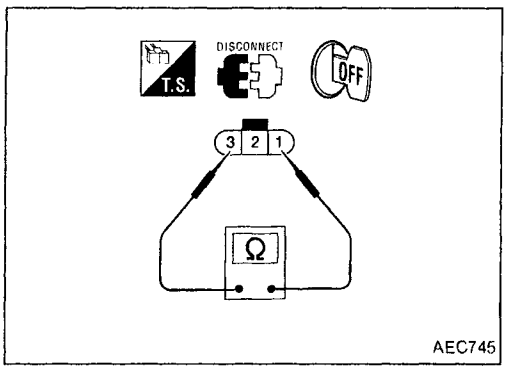
↓

INSPECTION END

EC

Heated Oxygen Sensor (HO2S) (Cont'd)

COMPONENT INSPECTION



Heated oxygen sensor heater

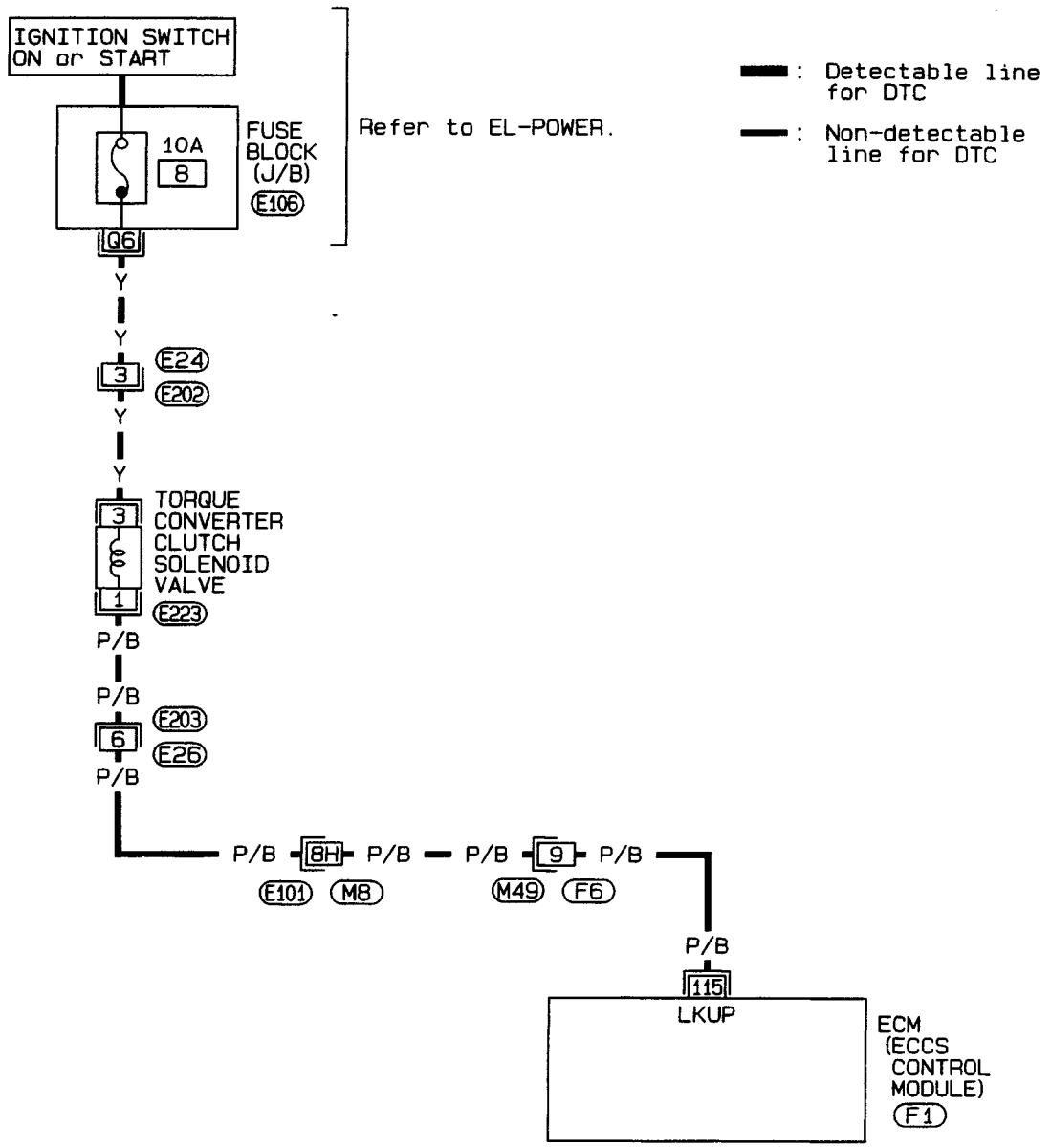
Check resistance between terminals ① and ③.

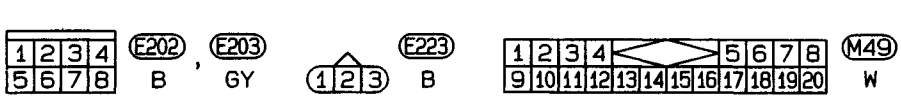
Resistance: 3.3 - 6.3Ω [at 25°C (77°F)]

If NG, replace the heated oxygen sensor.

Torque Converter Clutch Solenoid Valve

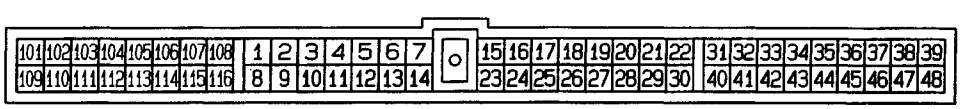
EC-LKUP-01





Refer to last page (Foldout page).

M8, E101, E106

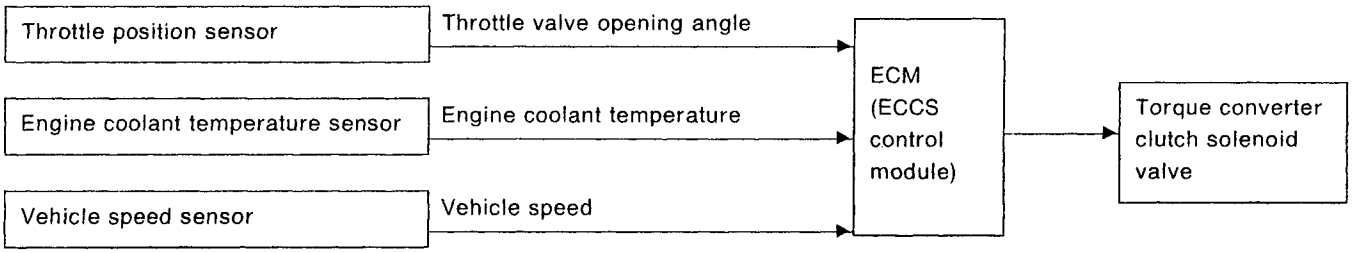




HEC023

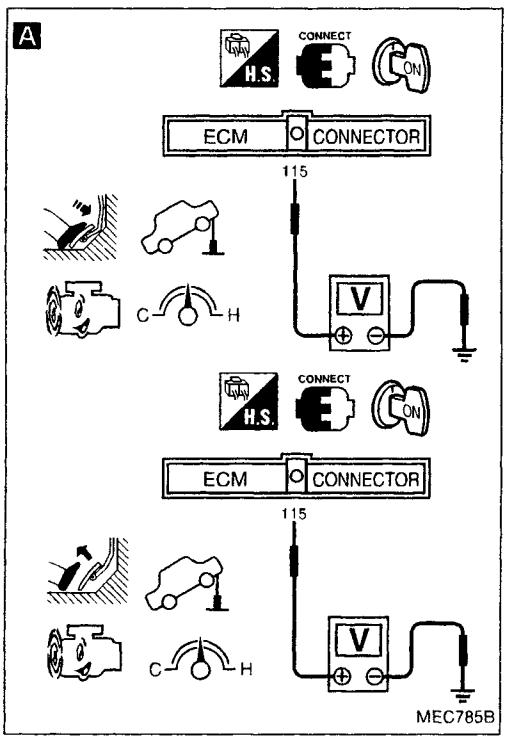
Torque Converter Clutch Solenoid Valve (Cont'd)

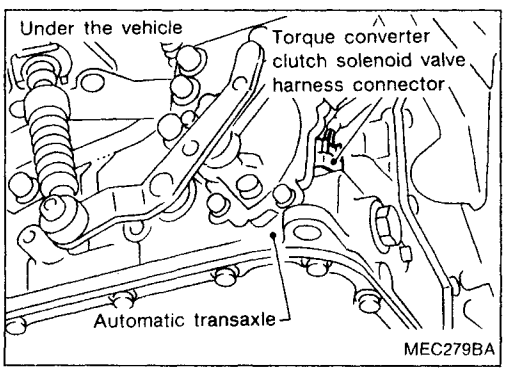
SYSTEM DESCRIPTION



The A/T lock-up is controlled by the ECM through the torque converter clutch solenoid valve. When the ECM detects any of the following conditions, the ECM switches the torque converter clutch solenoid valve OFF to accomplish lock-up operation. While the vehicle is in conditions other than below, the torque converter clutch solenoid valve is always set to ON, releasing the lock-up operation.

- Throttle position is open.
- Engine coolant temperature is 70°C (158°F) or more.
- Vehicle speed is 58 km/h (36 MPH) or more.





DIAGNOSTIC PROCEDURE

INSPECTION START

A

CHECK CONTROL FUNCTION.
1. Jack up drive wheels.
2. Start engine and warm it up sufficiently.
3. Shift selector lever to "D" position.
4. Check voltage between ECM terminal (115) and ground under the following conditions.

Voltage:
Accelerator pedal is depressed [Vehicle speed is above 58 km/h (36 MPH).]
Battery voltage
Accelerator pedal is fully released
Approximately 0V

OK → CHECK COMPONENT (Torque converter clutch solenoid valve).
Refer to "Electrical Components Inspection" in AT section.
If NG, replace torque converter clutch solenoid valve.

OK → INSPECTION END

NG

B

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect torque converter clutch solenoid valve harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ③ and ground.

Voltage: Battery voltage

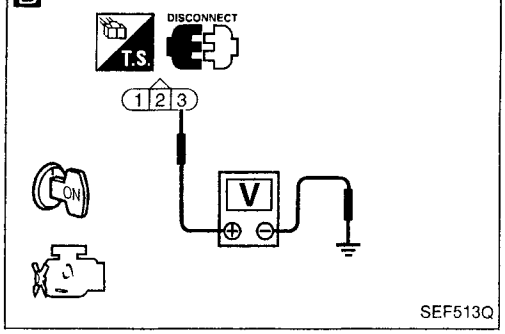
NG → Check the following.
- Harness connectors (E24), (E202)
- 10A fuse
- Harness for open or short between torque converter clutch solenoid valve and fuse

If NG, repair harness or connectors.

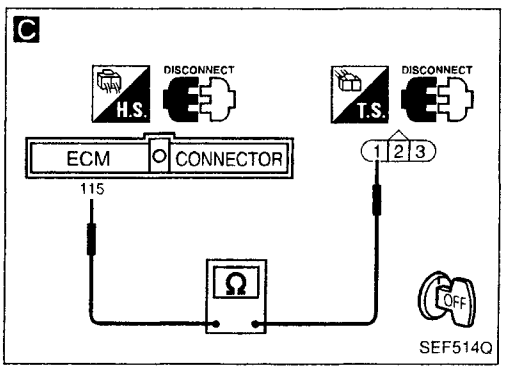
OK → Ⓐ

Torque Converter Clutch Solenoid Valve (Cont'd)

B



C



Ⓐ

C

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal (115) and terminal ①.
   Continuity should exist.
   If OK, check harness for short.

NG → Check the following.
- Harness connectors (E203), (E26)
- Harness connectors (E101), (M8)
- Harness connectors (M49), (F6)
- Harness for open or short between ECM and torque converter clutch solenoid valve

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Torque converter clutch solenoid valve).
Refer to "Electrical Components Inspection" in AT section.

NG → Replace torque converter clutch solenoid valve.

OK ↓

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

Trouble is not fixed. ↓

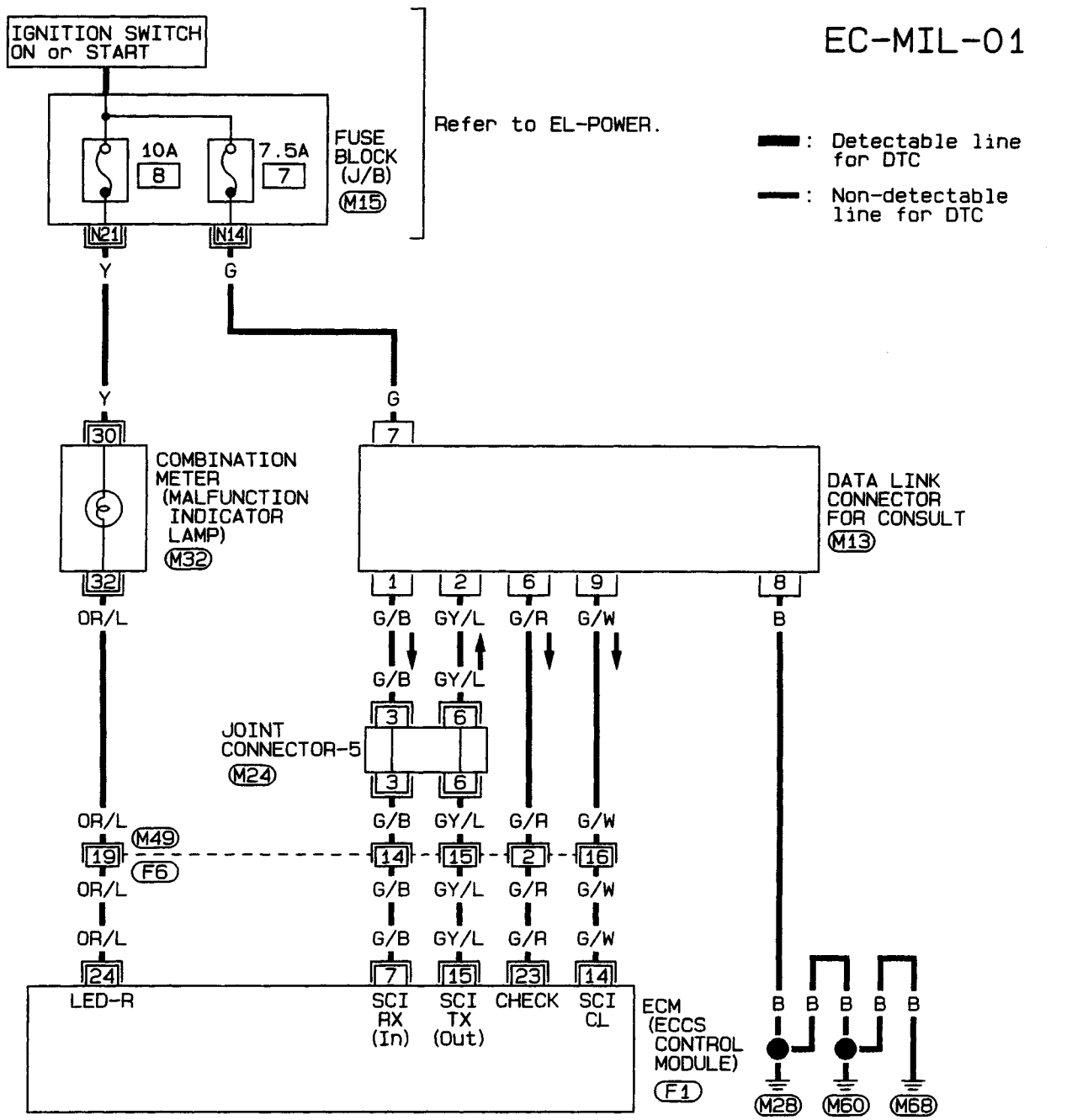
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

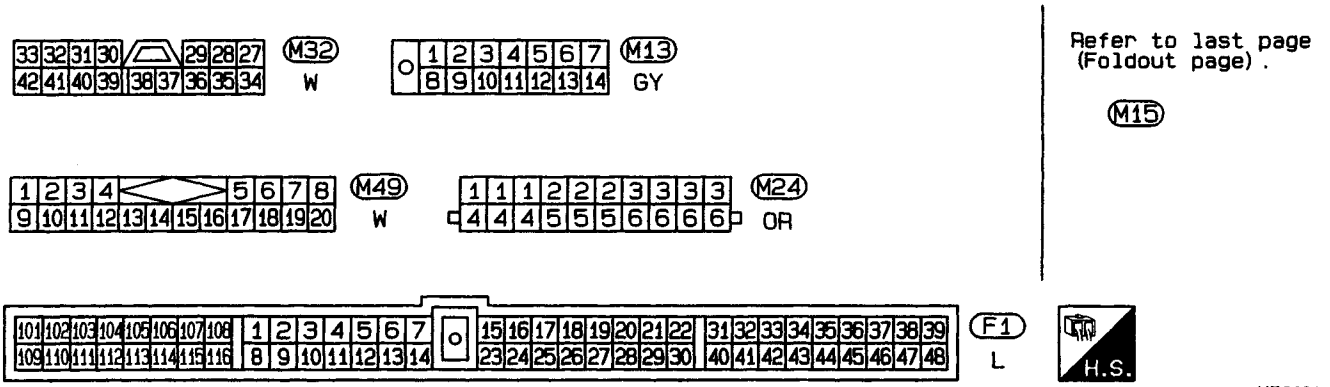
↓

INSPECTION END

EC

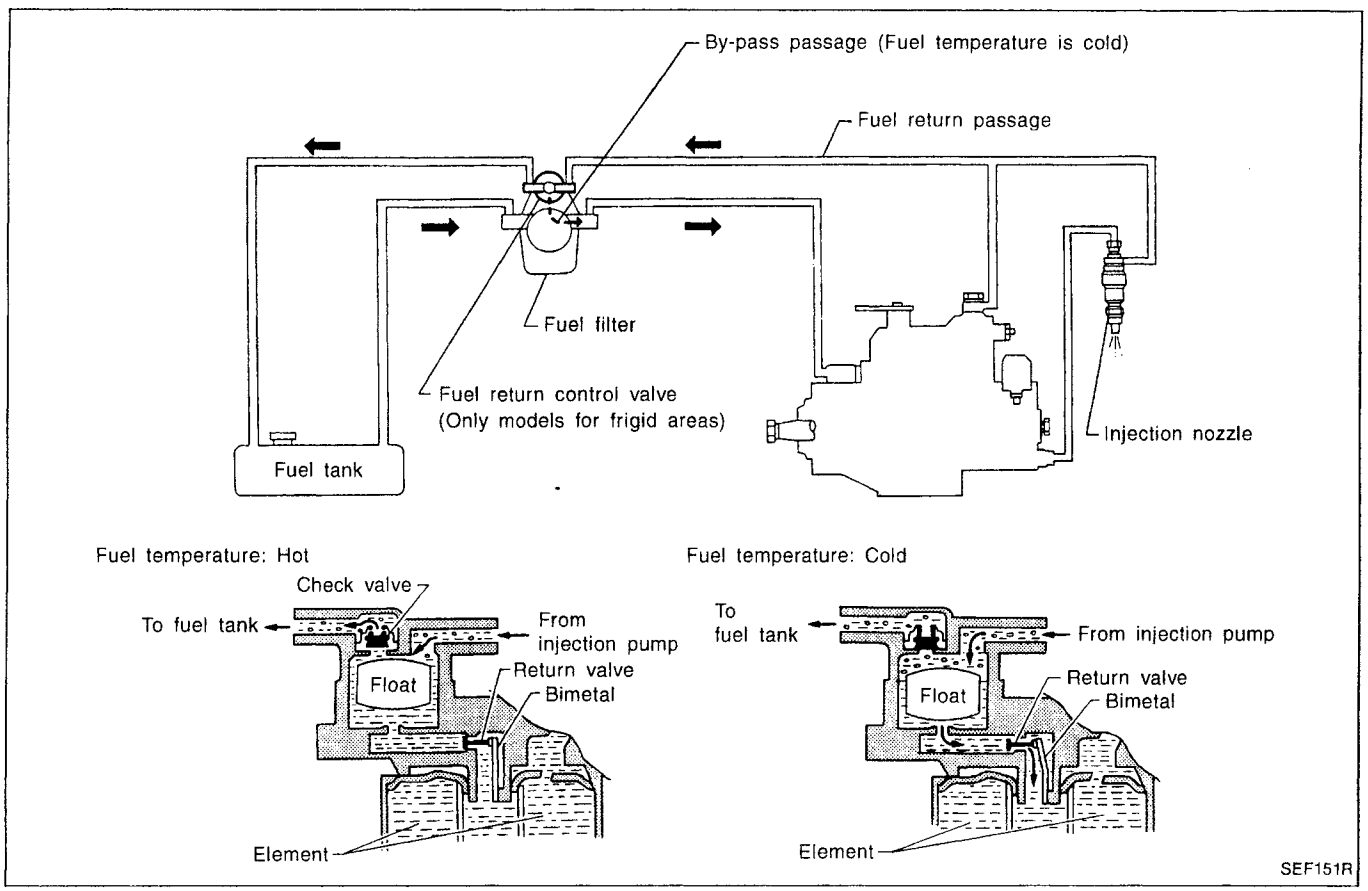
Malfunction Indicator Lamp (MIL) & Data Link Connector (DLC) for CONSULT

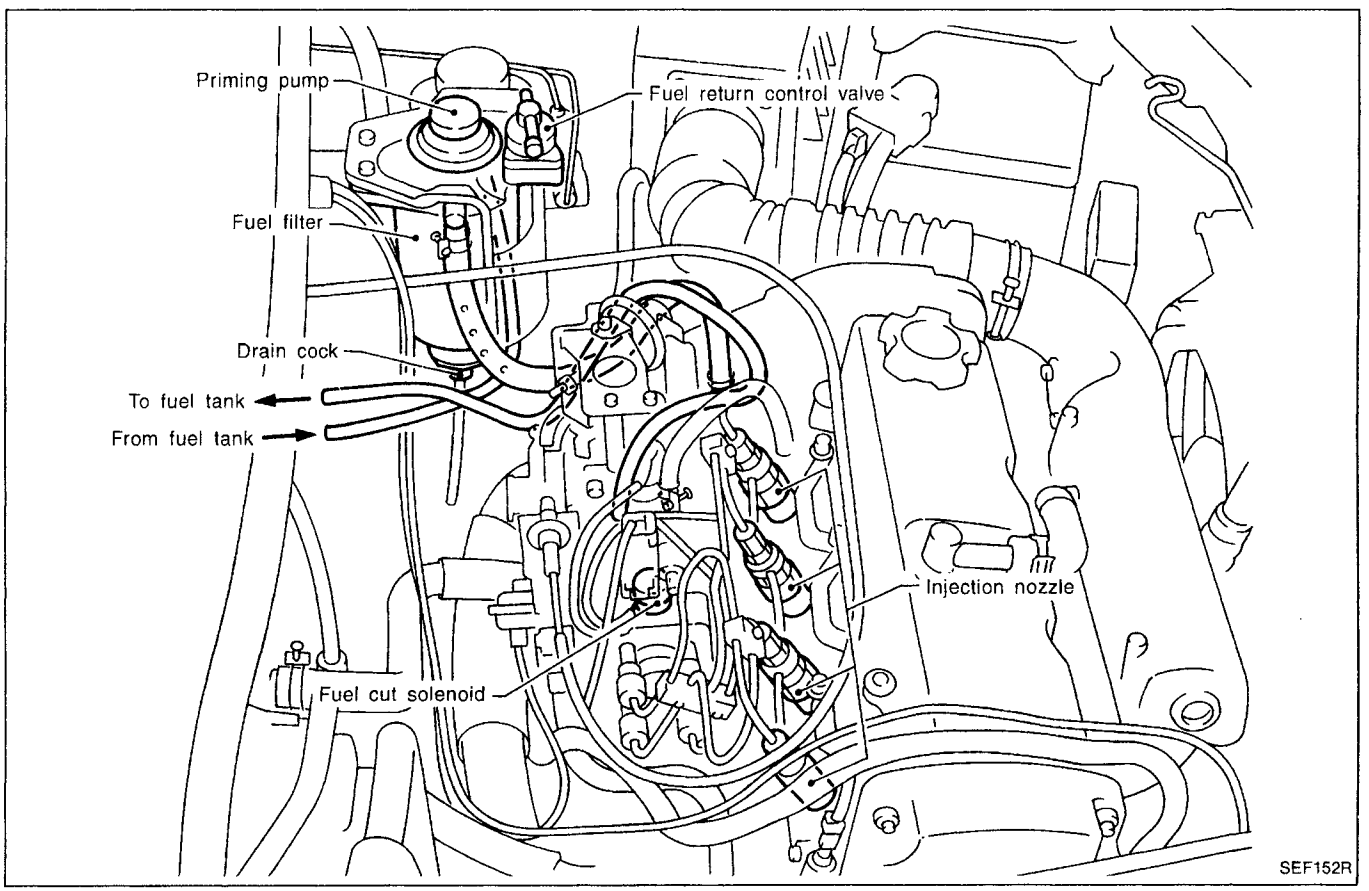


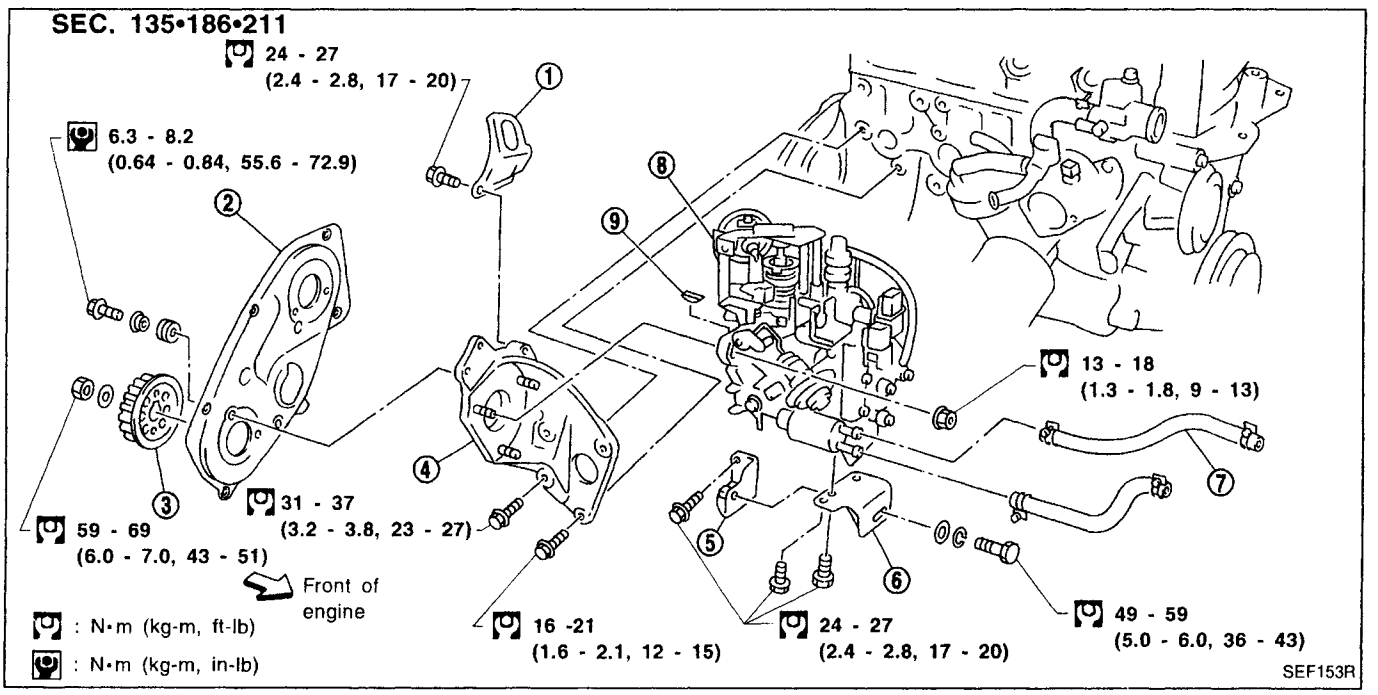


Refer to last page (Foldout page).
M15

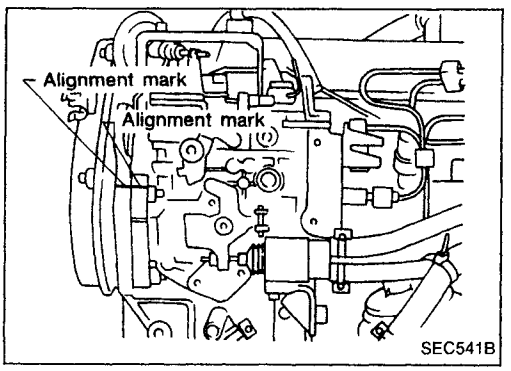
HEC024


By-pass passage (Fuel temperature is cold)
Fuel return passage
Fuel filter
Fuel return control valve
(Only models for frigid areas)
Fuel tank
Injection nozzle
Fuel temperature: Hot
Check valve
To fuel tank
From injection pump
Float
Return valve
Bimetal
Element
Fuel temperature: Cold
To fuel tank
From injection pump
Float
Return valve
Bimetal
Element
SEF151R


Priming pump
Fuel return control valve
Fuel filter
Drain cock
To fuel tank
From fuel tank
Injection nozzle
Fuel cut solenoid
SEF152R

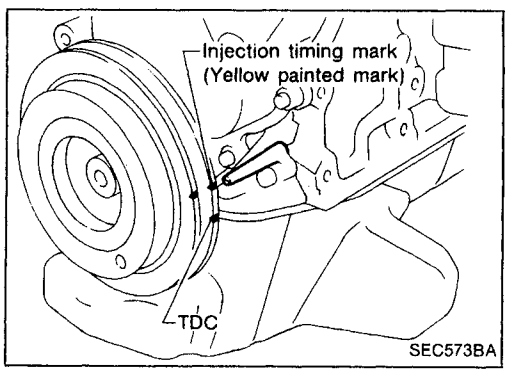


① Engine slinger
② Rear back cover
③ Injection pump sprocket
④ Injection pump bracket
⑤ Bracket
⑥ Bracket
⑦ Water hoses
⑧ Injection pump
⑨ Key



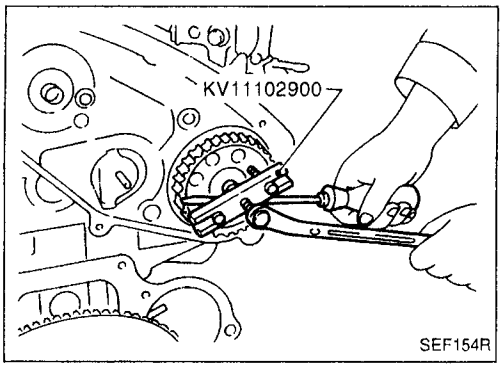
Removal

1. Put a matchmark across injection pump and injection pump bracket.
2. Disconnect battery ⊖ cable, electrical connectors and accelerator wire.

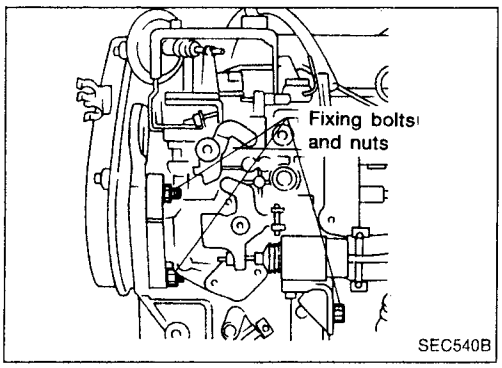


3. Set No. 1 piston at TDC on its compression stroke.
   TDC: Crankshaft pulley notch without painted mark
4. Disconnect water hoses for cold start device.
5. Remove fuel hoses (supply, return and spill) and injection tubes.
6. Remove air duct and injection pump timing belt cover.
7. Remove injection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

Removal (Cont'd)



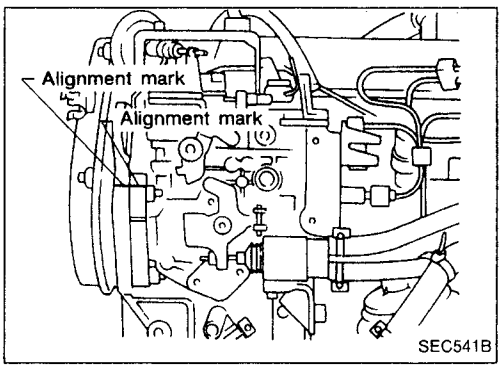
8. Remove injection pump sprocket with Tool.
- **Remove key from injection pump shaft and store safely.**



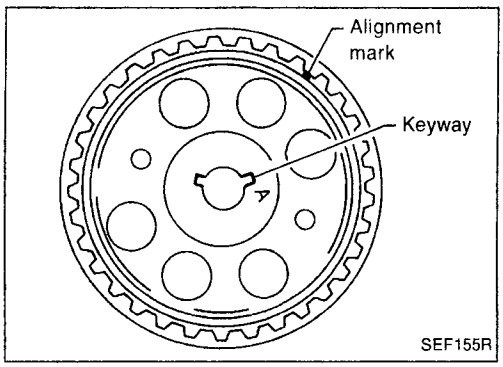
9. Remove injection pump assembly.

EC

Installation



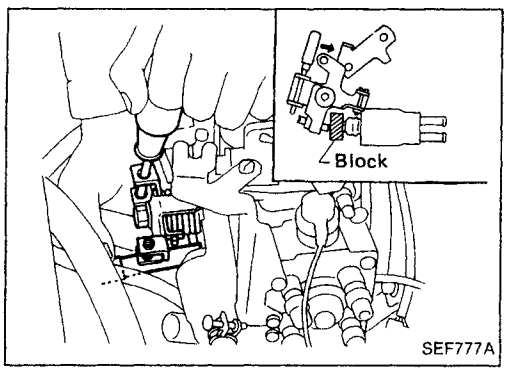
1. With matchmarks aligned, install injection pump.



2. Install key on injection pump shaft, then install injection pump sprocket.
- Use mark "A" on sprocket.

3. Install injection pump timing belt.
   Refer to EM section ("Injection Pump Timing Belt").

4. Adjust injection timing.
   Refer to "Adjustment" on the next page.
5. Install all parts removed.

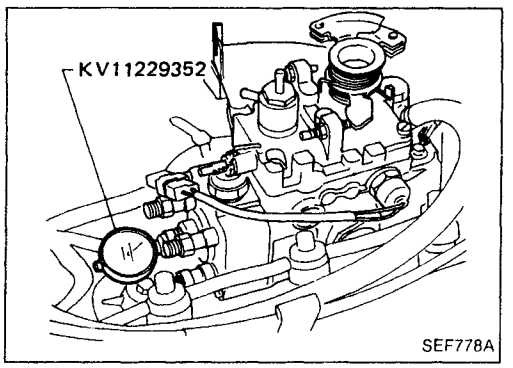


Adjustment

INJECTION TIMING ADJUSTMENT (Plunger lift adjustment)

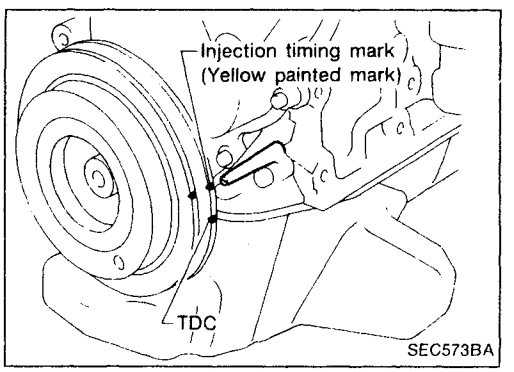
Preparation of cold start device

1. Turn cold start device linkage clockwise.
2. Set a suitable block [Thickness: about 15 mm (0.59 in)] between cold start device plunger and linkage rod.
3. Turn crankshaft 2 turns clockwise to set the device to normal position.



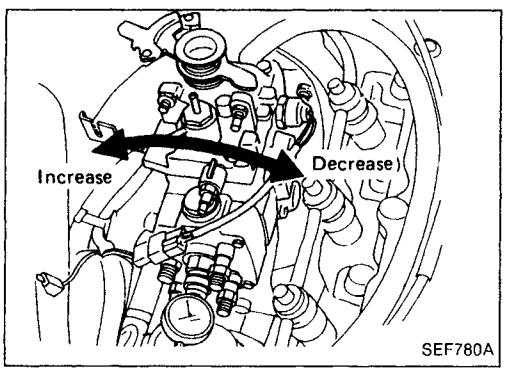
Checking

1. Set No. 1 piston at TDC on its compression stroke.
   TDC: Without painted mark
2. Remove injection tubes and air bleeder on the back of injection pump.
3. Set dial gauge so its indicator points to somewhere between 1.0 and 2.0 mm (0.039 and 0.079 in) on the scale.
4. Turn crankshaft 1 turn clockwise and check that dial gauge indicates the same value again.



5. Turn crankshaft counterclockwise about 20 to 25 degrees, then set dial gauge indicator to 0 mm (0 in).
6. Turn crankshaft clockwise and set the pump timing mark to the mark on the crankshaft pulley.
   Pump timing mark: Yellow painted mark
   Injection timing: 8° BTDC
7. Read plunger lift.
   Plunger lift:
   0.79 - 0.85 mm (0.0311 - 0.0335 in) at pump timing mark

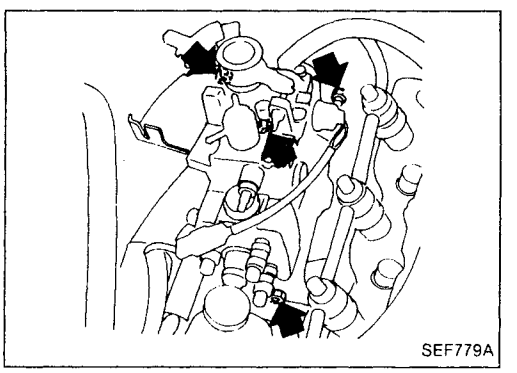
- **When repeating the checking, start with step 5.**



Adjusting

1. If plunger lift is not within the specified value, adjust by turning injection pump.

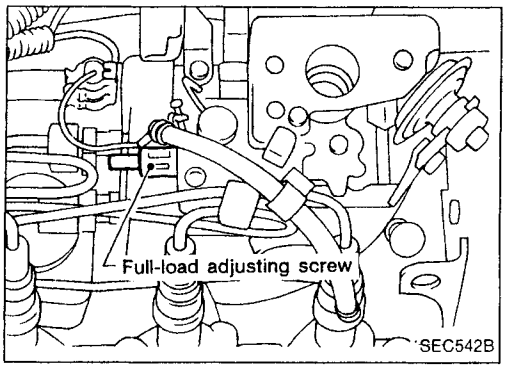
- **If indication is smaller than the specified value, turn pump body away from engine.**
- **If indication is larger than the specified value, turn pump body towards engine.**



2. Tighten injection pump securing bolts and nuts.
   Nut:
   : 13 - 18 N·m (1.3 - 1.8 kg-m, 9 - 13 ft-lb)
   Bolt:
   : 49 - 59 N·m (5.0 - 6.0 kg-m, 36 - 43 ft-lb)
3. Remove dial gauge and install air bleeder with new washer.
4. Install injection tubes.
   Flare nut:
   : 22 - 25 N·m (2.2 - 2.5 kg-m, 16 - 18 ft-lb)
5. Bleed air from fuel system.

Refer to "Water Draining, Fuel Filter Check and Replacement" of "ENGINE MAINTENANCE" in MA section.

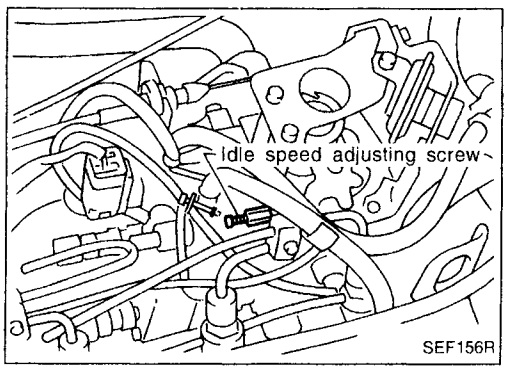
Adjustment (Cont'd)



IDLE SPEED AND MAXIMUM SPEED ADJUSTMENT

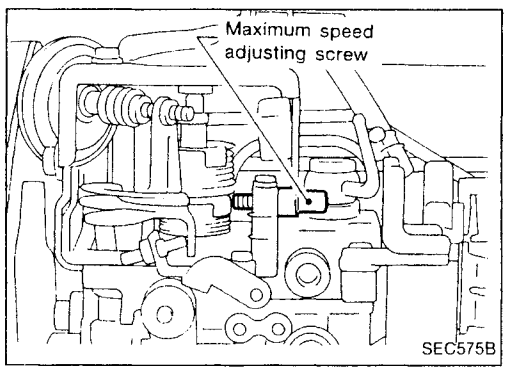
CAUTION:

- **Do not remove sealing caps unless absolutely necessary.**
- **Never disturb full-load adjusting screw because this alters the mixture ratio and may result in serious engine problems.**
- **Do not adjust maximum speed adjusting screw to a point exceeding specifications, because exceeding the maximum speed may cause engine damage.**
- **When attaching tachometer pickup, remove fuel tube clamps. (Refer to tachometer instructions.)**



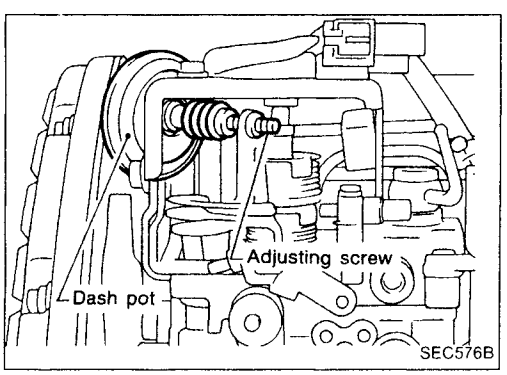
Idle speed adjustment

- Refer to MA section.
  Idle speed: 700^{+50}_{-0} rpm



Maximum speed adjustment

1. Start engine and warm it up until coolant temperature indicator points to middle of gauge.
2. Connect tachometer pickup to No. 1 fuel injection tube.
   - Refer to the instructions on tachometer.
3. Depress accelerator pedal fully under no-load and read the tachometer indication.
   Maximum engine speed (Under no-load):
   5,400 rpm
4. If indication is lower than specified maximum engine speed, adjust using maximum speed adjusting screw.
5. After adjustment, tighten lock nut securely and plug it with a sealing cap.

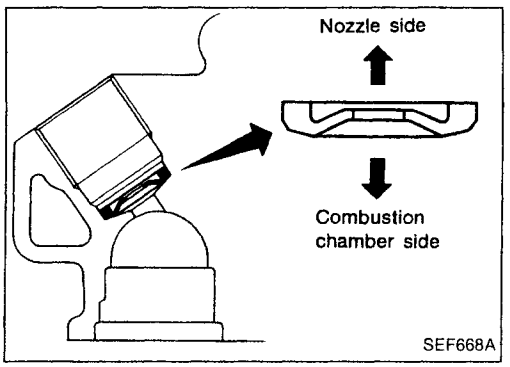


Dash pot adjustment

1. Warm up engine to normal operating temperature.
2. Attach tachometer and adjust touch speed using adjusting screw.
   Touch speed: 1,300 rpm

EC

CAUTION:
Plug flare nut with a cap or rag so that no dust enters the nozzle. Cover nozzle tip for protection of needle.



Removal and Installation

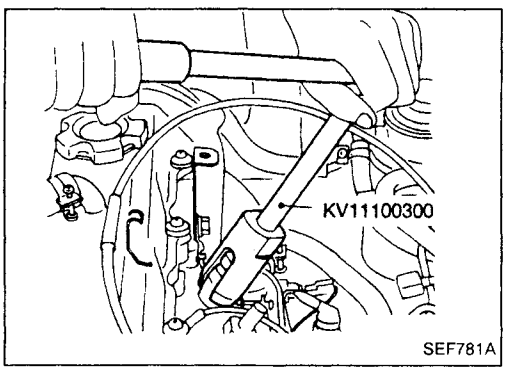
1. Remove fuel injection tube and spill tube.
2. Remove injection nozzle assembly.

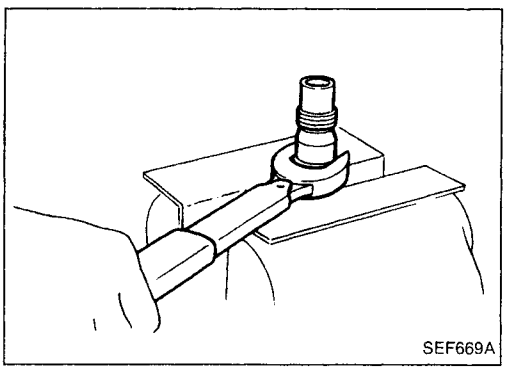
Also remove washers from nozzle end.

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

Injection nozzle to engine:
: 59 - 69 N·m (6.0 - 7.0 kg-m, 43 - 51 ft-lb)
Injection nozzle to tube:
: 22 - 25 N·m (2.2 - 2.5 kg-m, 16 - 18 ft-lb)
Spill tube:
: 39 - 49 N·m (4.0 - 5.0 kg-m, 29 - 36 ft-lb)

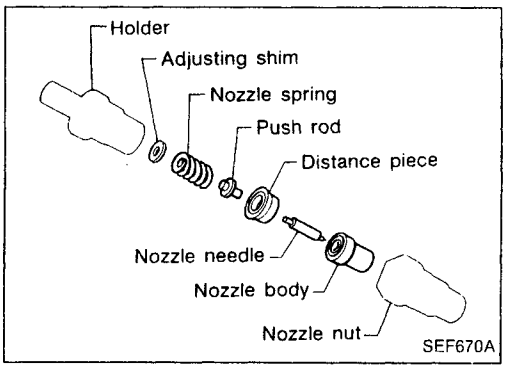
a. Always clean the nozzle holes.
b. Always use new injection nozzle gasket.
c. Note that small washer should be installed in specified direction.
d. Bleed air from fuel system.





Disassembly

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



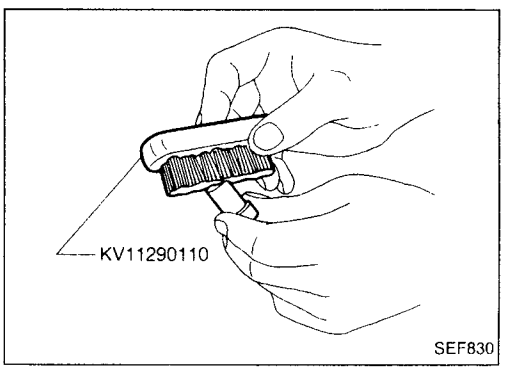
2. Arrange all disassembled parts in the order shown at left.

Inspection

Thoroughly clean all disassembled parts with fresh kerosene or solvent.

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

EC

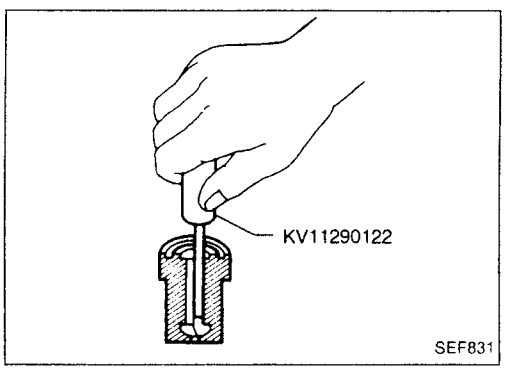


Cleaning

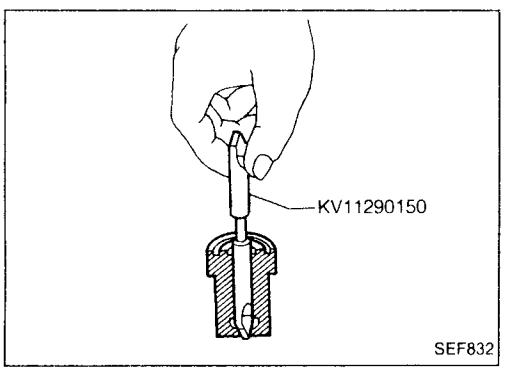
a. Do not touch the nozzle mating surface with your fingers.

b. To wash the nozzles, use a wooden stick and brass brush with clean diesel fuel.

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



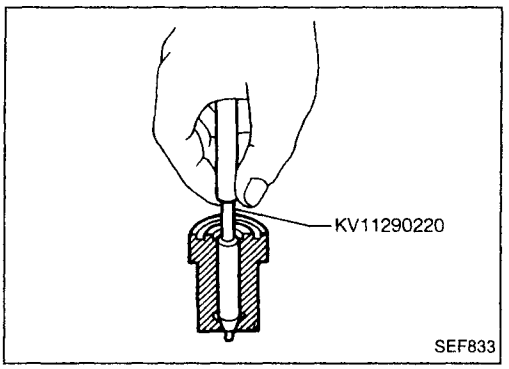
2. Clean oil sump of nozzle body using Tool.



3. Clean nozzle seat by using Tool.

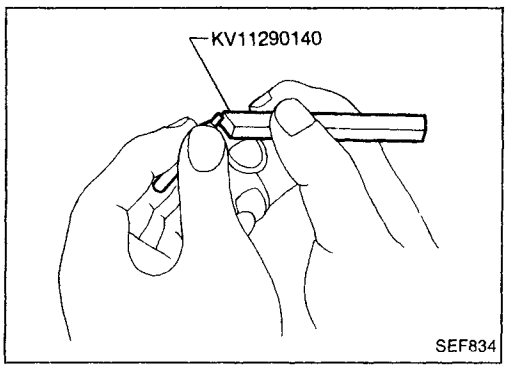
This job should be performed with extra precautions, since efficiency of nozzle depends greatly on a good nozzle seat.

Cleaning (Cont'd)

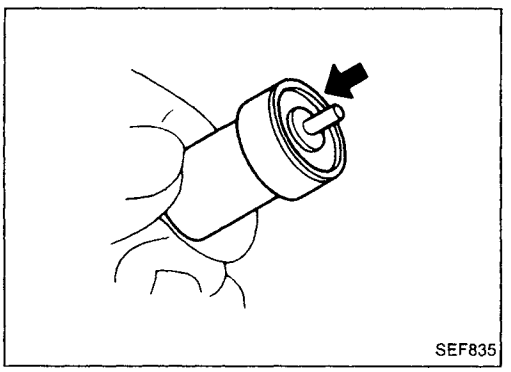


4. Clean spray hole of nozzle body by using Tool.

To prevent spray hole from canting, always clean it by starting with inner side and working towards outside.

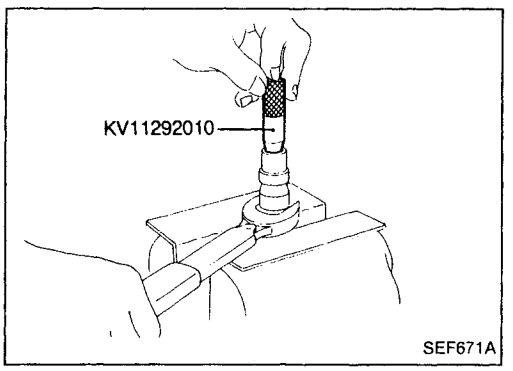


5. Decarbonate nozzle needle tip by using Tool.



6. Check needle sinking.
(1) Pull needle about halfway out from body and then release it.
(2) Needle should sink into body very smoothly from just its own weight.
(3) Repeat this test and rotate needle slightly each time.

If needle fails to sink smoothly from any position, replace both needle and body as a unit.



Assembly

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

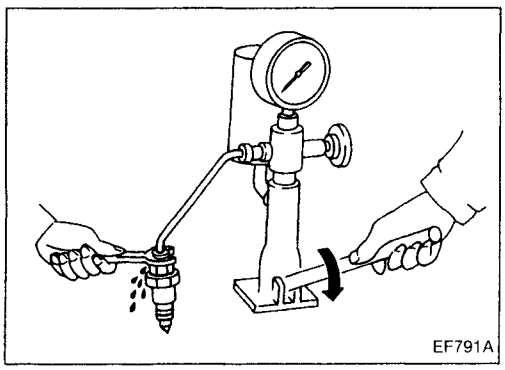
If nozzle body is not installed properly, Tool cannot be removed and nozzle body may be damaged.

Holder to nozzle nut:

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

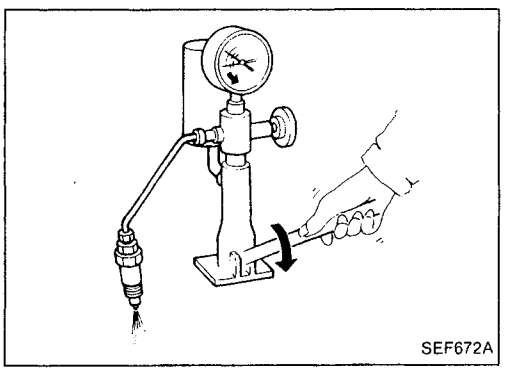
Test and Adjustment

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


EF791A

INJECTION PRESSURE TEST

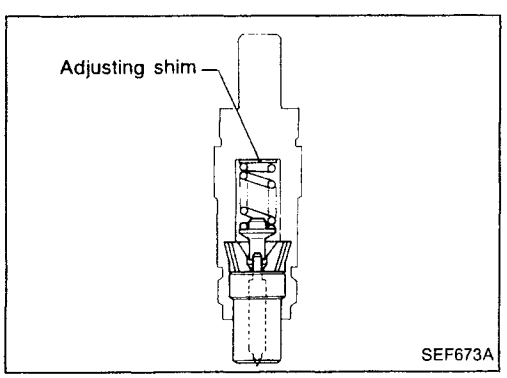
1. Install nozzle to injection nozzle tester and bleed air from flare nut.


SEF672A

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

Initial injection pressure:
Used
12,259 - 13,239 kPa (122.6 - 132.4 bar, 125 - 135 kg/cm^2, 1,778 - 1,920 psi)
New
12,749 - 13,534 kPa (127.5 - 135.3 bar, 130 - 138 kg/cm^2, 1,849 - 1,962 psi)

Always check initial injection pressure using a new nozzle.



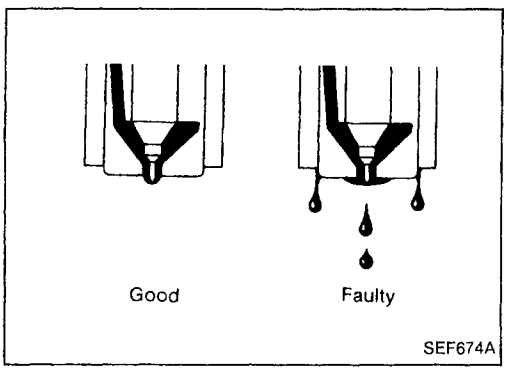
SEF673A

4. To adjust injection pressure, change adjusting shims.

a. Increasing the thickness of adjusting shims increases initial injection pressure. Decreasing thickness reduces initial pressure.
b. A shim thickness of 0.04 mm (0.0016 in) corresponds approximately to a difference of 471 kPa (4.71 bar, 4.8 kg/cm^2, 68 psi) in initial injection pressure.

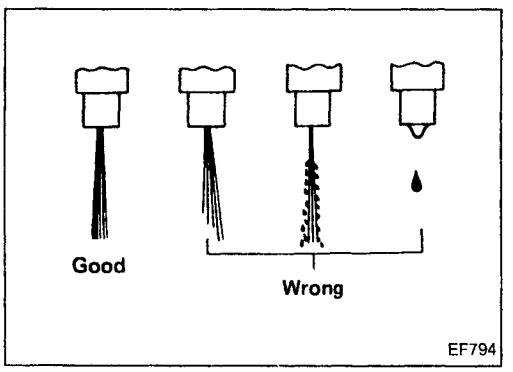
Refer to SDS for adjusting shim (EC-419).

Test and Adjustment (Cont'd)



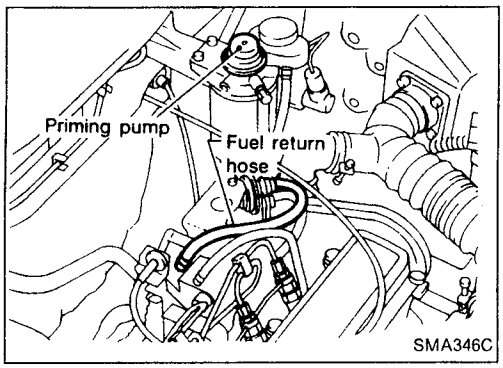
LEAKAGE TEST

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



SPRAY PATTERN TEST

1. Pump the tester handle one time per second.
2. Check the spray pattern.
3. If the spray pattern is not correct, clean or replace nozzle.



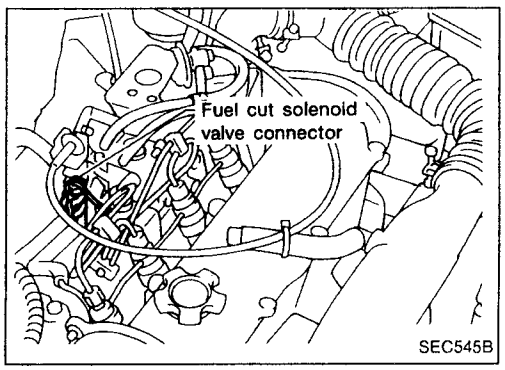
Priming Pump Check

Before checking priming pump, make sure that fuel filter is filled with fuel.

1. Disconnect fuel return hose.

Place a suitable container beneath hose end.

2. Pump priming pump and check that the fuel overflows from the hose end. If not, replace priming pump.



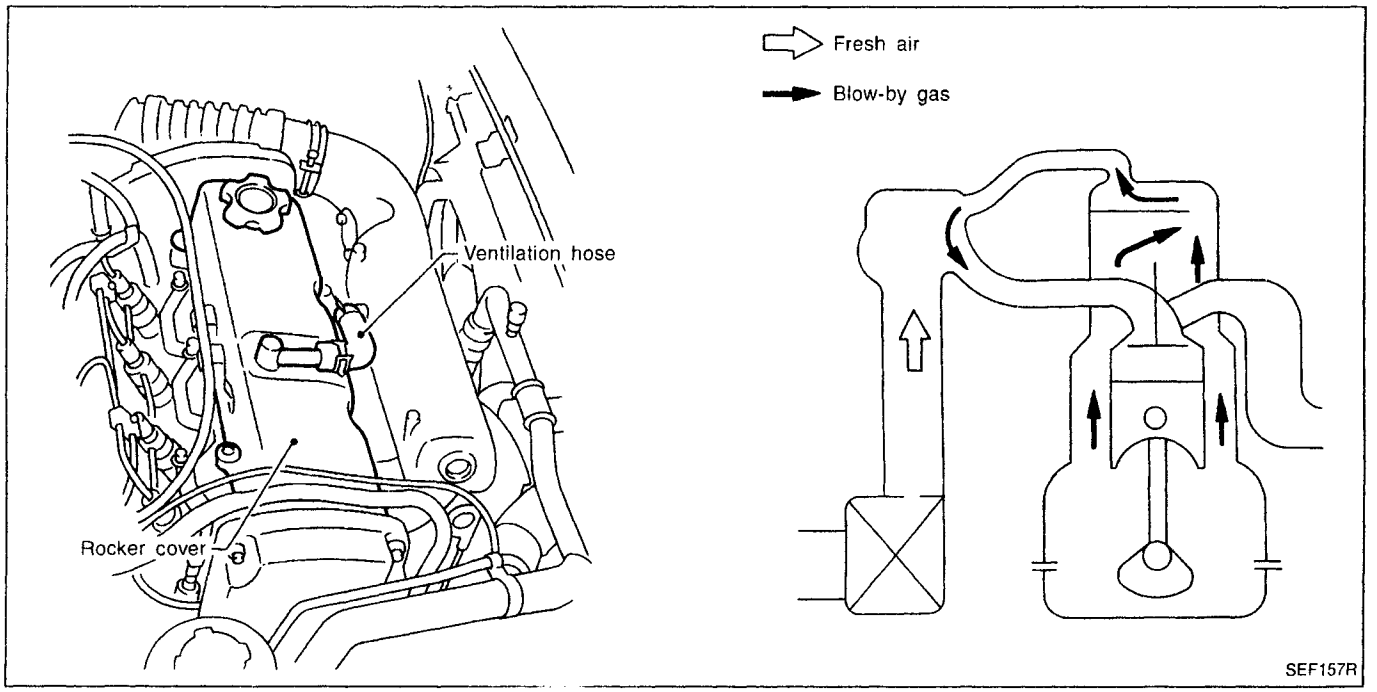
Fuel Cut Solenoid Valve

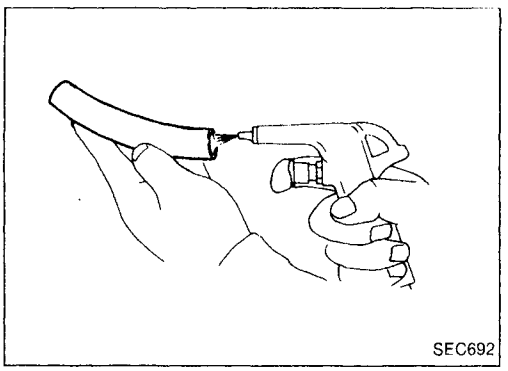
1. Disconnect fuel cut solenoid valve harness connector and check voltage.

Ignition switch	Voltage
OFF	0V
ON	Battery voltage

2. Check fuel cut solenoid valve for circuit continuity.
3. Remove fuel cut solenoid valve and check that plunger moves smoothly and that spring is normal.

EC

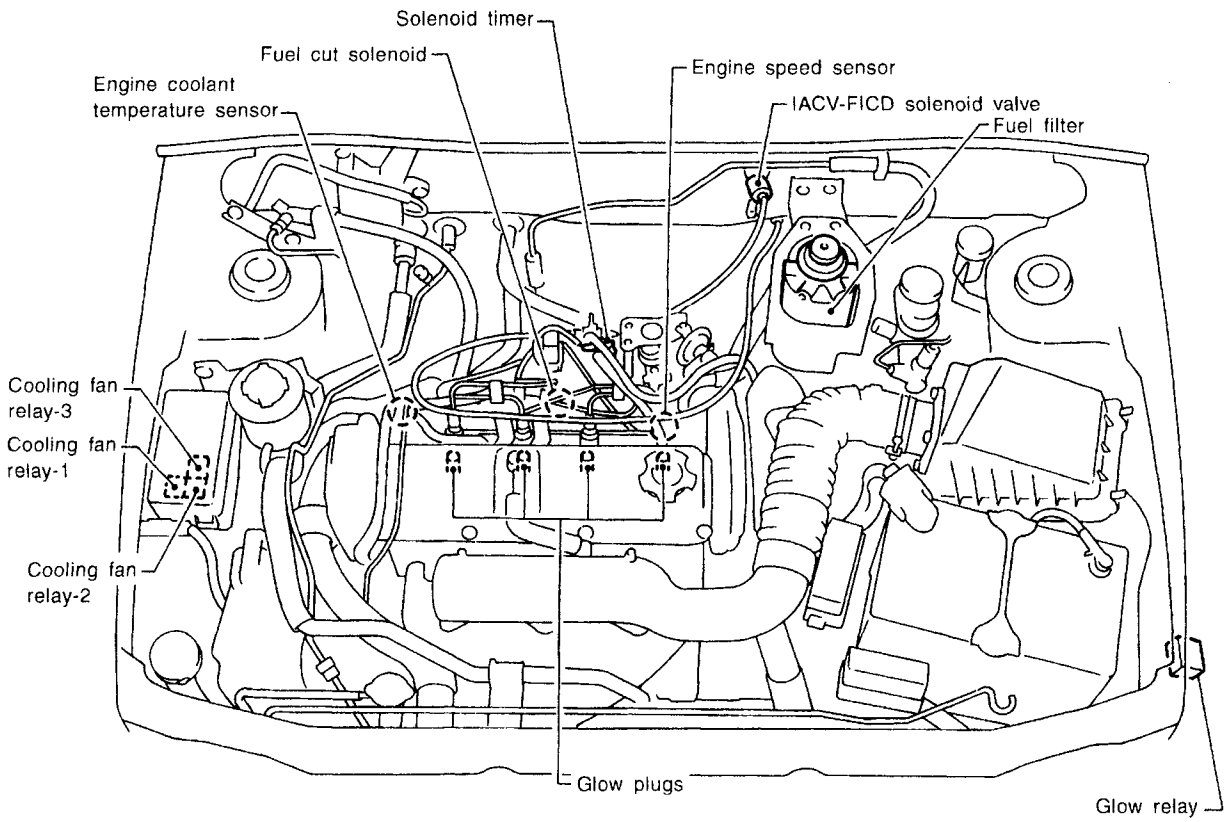


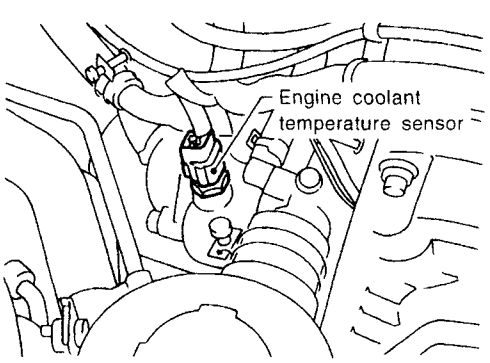


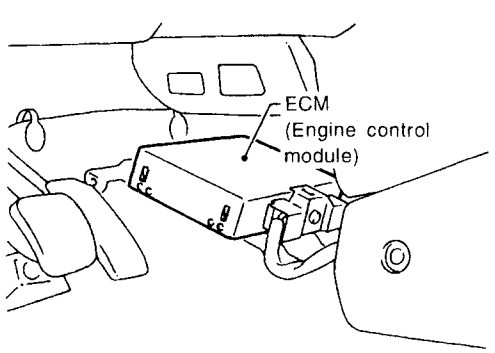
Ventilation Hose

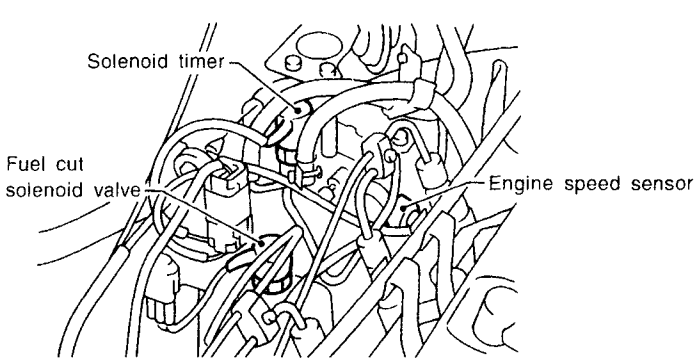
1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air. If any hose cannot be freed of obstructions, replace.

Component Parts Location

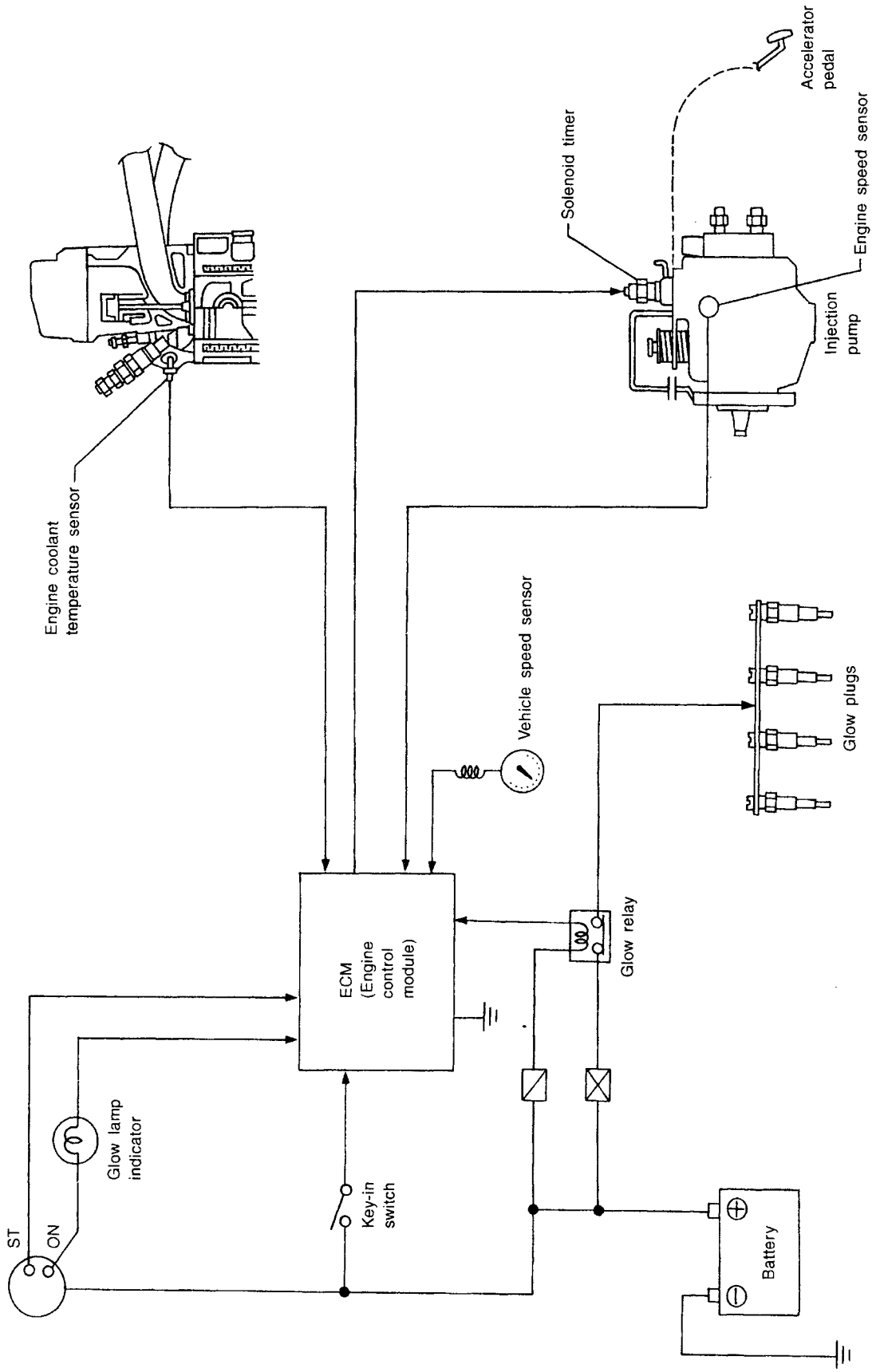






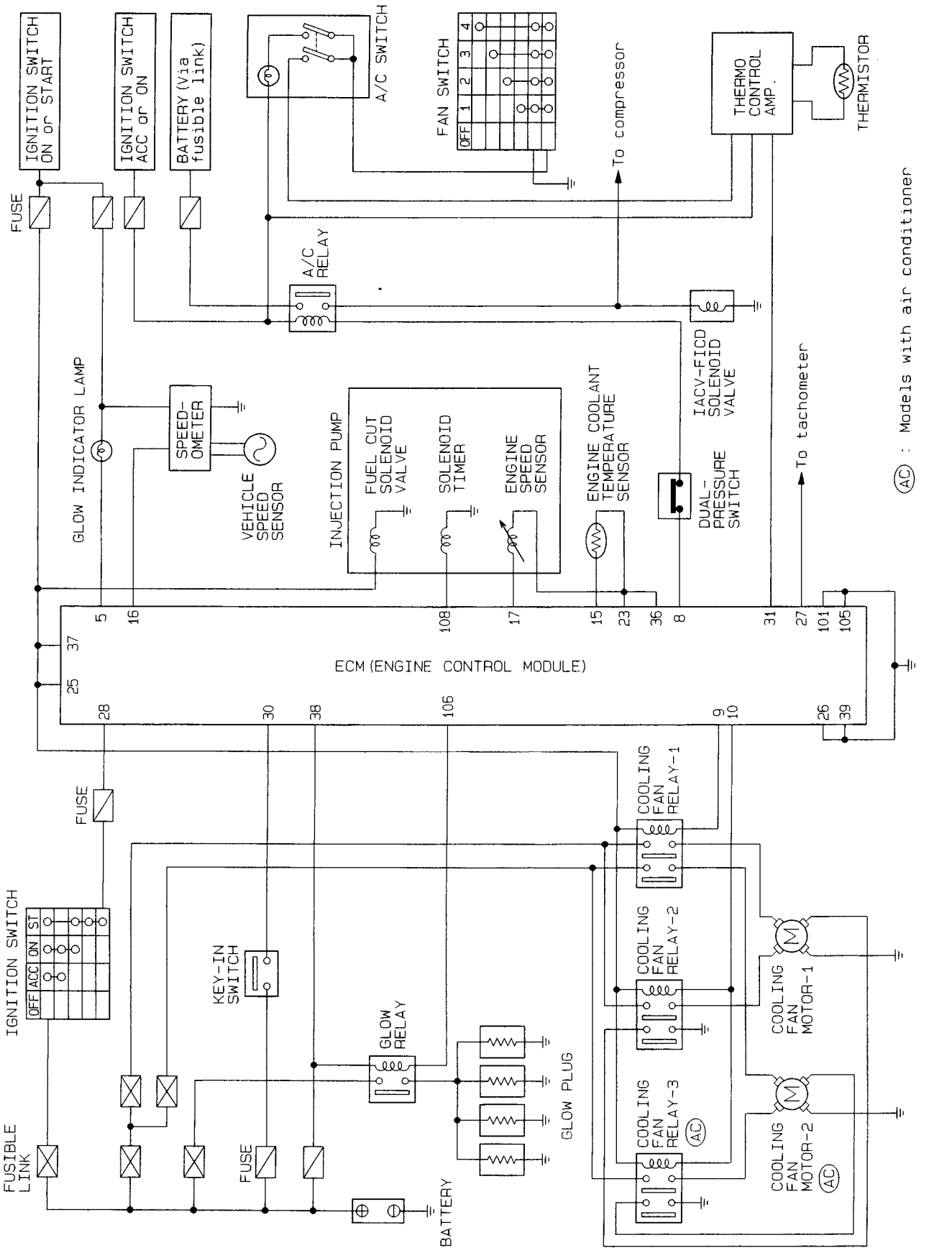


System Diagram



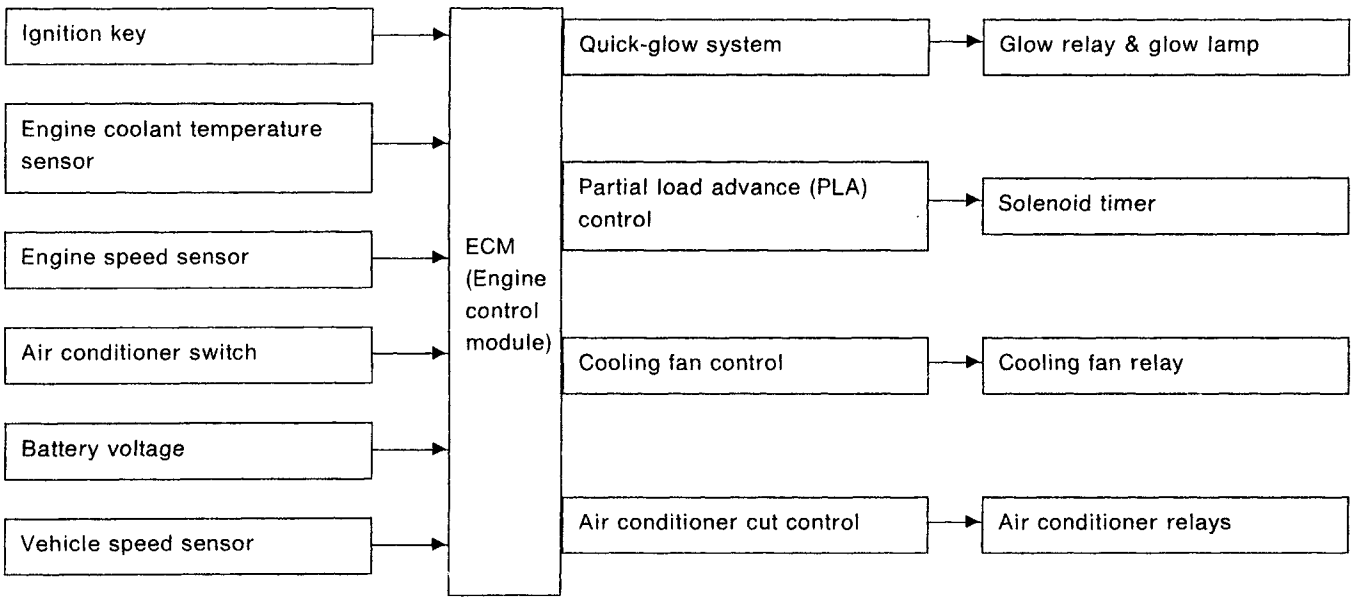
SEF160R

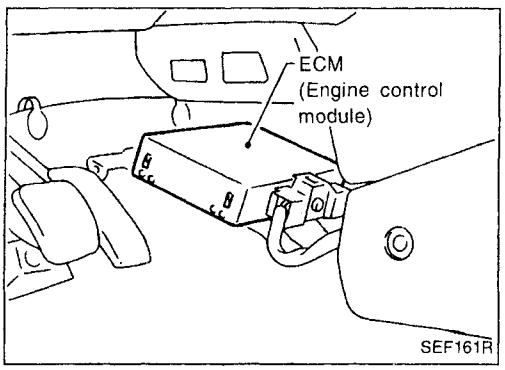
Circuit Diagram



HEC087

System Chart

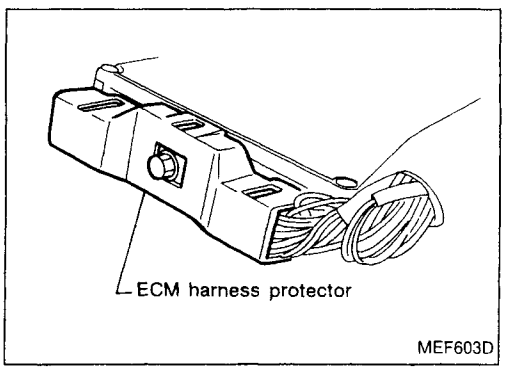




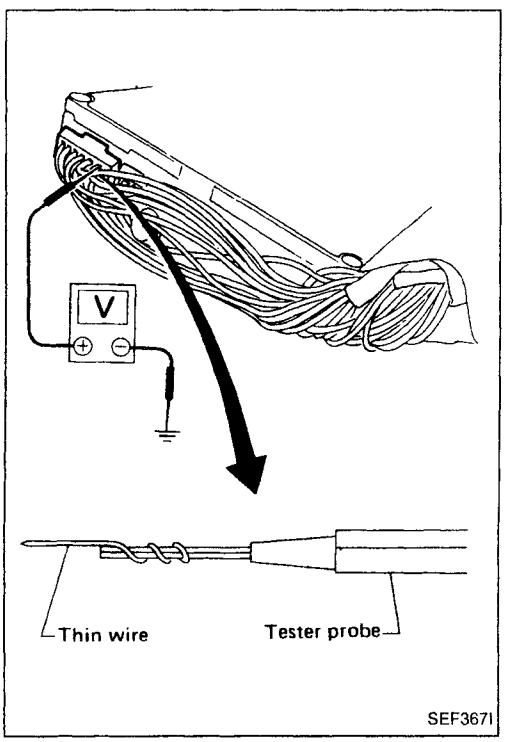
ECM Terminals and Reference Values

PREPARATION

1. ECM is located behind the center console panel. For this inspection, remove the center console under cover.

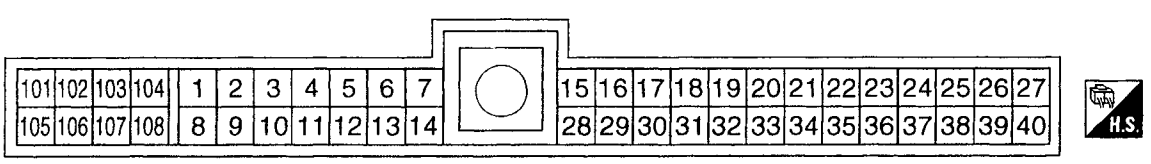


2. Remove ECM harness protector.



3. Perform all voltage measurements with the connectors connected. Extend tester probe as shown to perform tests easily.

ECM HARNESS CONNECTOR TERMINAL LAYOUT



ECM INSPECTION TABLE

*Data are reference values.

TER-MINAL NO.	ITEM	CONDITION	*DATA
8	Air conditioner relay	Engine is running. └ Both A/C switch and blower fan switch are "ON".	Approximately 0V
		Engine is running. └ A/C switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
9	Cooling fan relay (Low speed)	Engine is running. └ Cooling fan is not operating.	BATTERY VOLTAGE (11 - 14V)
		Engine is running. └ Cooling fan is operating.	1V
10	Cooling fan relay (High speed)	Engine is running. ├ Cooling fan is not operating. └ Cooling fan is operating at low speed.	BATTERY VOLTAGE (11 - 14V)
		Engine is running. └ Cooling fan is operating at high speed.	1V
15	Engine coolant temperature sensor	Engine is running.	0 - 5.0V Output voltage varies with engine coolant temperature.
25 37	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
28	Start signal	Ignition switch "ON"	Approximately 0V
		Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)
30	Key-in switch	Ignition key is not inserted.	0V
		Ignition key is inserted.	BATTERY VOLTAGE (11 - 14V) [for 3 seconds at engine coolant temperature of approx. 60°C (140°F) or less]
31	Air conditioner switch	Engine is running. └ Both air conditioner switch and blower fan switch are "ON".	Approximately 0V
		Engine is running. └ Air conditioner switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
38	Power supply	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
106	Glow relay	Refer to "Quick-glow System".	

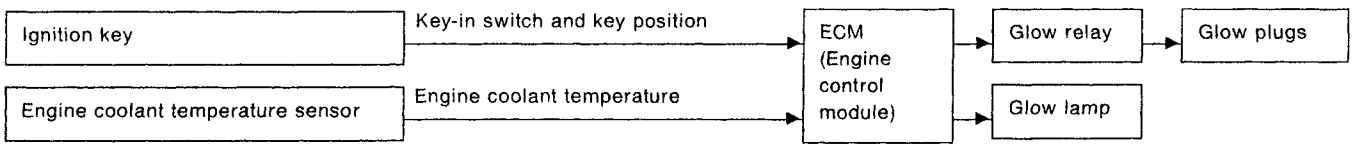
ECM Terminals and Reference Values (Cont'd)

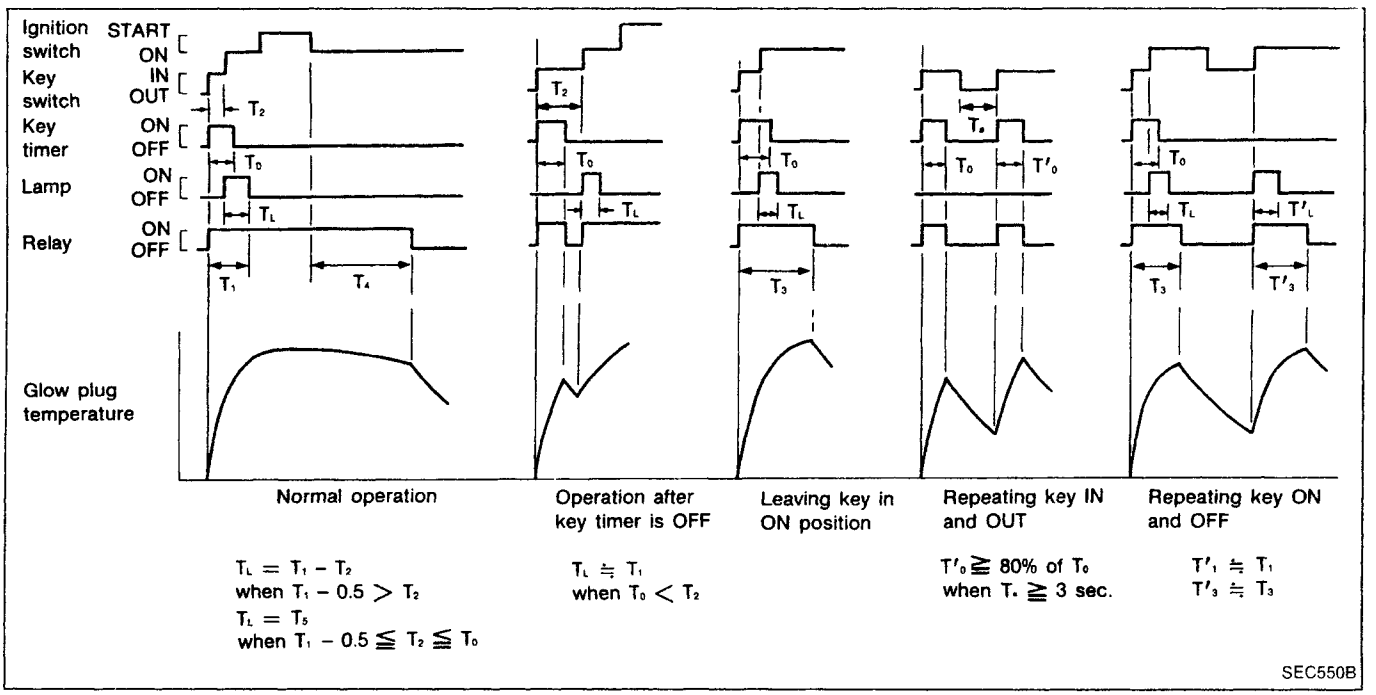
*Data are reference values.

TER-MINAL NO.	ITEM	CONDITION	*DATA
108	Solenoid timer	Engine is running. └ Engine coolant temperature is lower than 10°C (50°F).	BATTERY VOLTAGE (11 - 14V)
		Engine is running. └ Engine coolant temperature is higher than 10°C (50°F).	Approximately 0V

Quick-glow System

SYSTEM DESCRIPTION





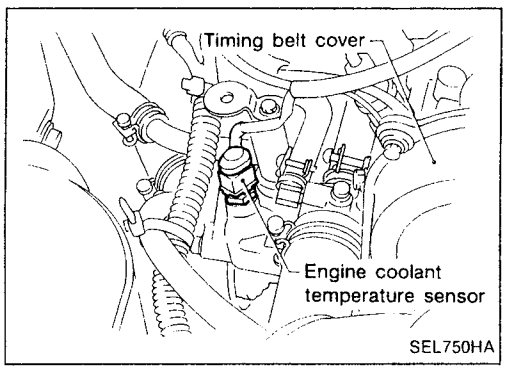
When the ignition key is inserted into the key cylinder, the engine control module turns on the relay and the "high-level" electric current flows through the glow plugs and heats them up quickly. When the ignition switch is turned on, the control module turns on the indicator. After T_1 seconds have passed from key in, the control module turns off the indicator.

While cranking, the relay remains on. The relay automatically turns off after T_4 seconds have passed from the engine start.

	Second	Engine coolant temperature sensor		Remarks
		Engine coolant temperature °C (°F)	Resistance (kΩ)	
T_0	3.1 - 3.9	—	—	
T_1	5.0 - 7.0	−25 (−13)	19.7	
	1.8 - 3.2	20 (68)	2.5	
	0.8 - 2.2	60 (140)	0.6	
T_3	17.0 - 23.0	Lower than 60 (140)	More than 0.6	
	4.0 - 6.0	Higher than 60 (140)	Less than 0.6	
T_4	255 - 345	Lower than 60 (140)	More than 0.6	When alternator is working
	Less than 10	Higher than 60 (140)	Less than 0.6	
(T_4)	15 - 25	Lower than 60 (140)	More than 0.6	When alternator is not working
	3 - 7	Higher than 60 (140)	Less than 0.6	
T_5	0.1 - 0.9	—	—	

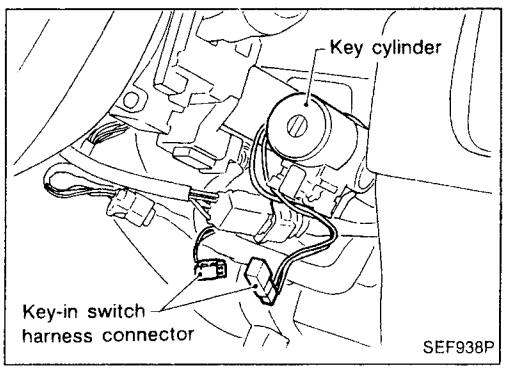
Quick-glow System (Cont'd)

DESCRIPTION



Engine coolant temperature sensor (ECTS)

The engine coolant temperature sensor detects engine coolant temperature and transmits a signal to the ECM.
Electrical resistance of the thermistor decreases in response to the temperature rise.



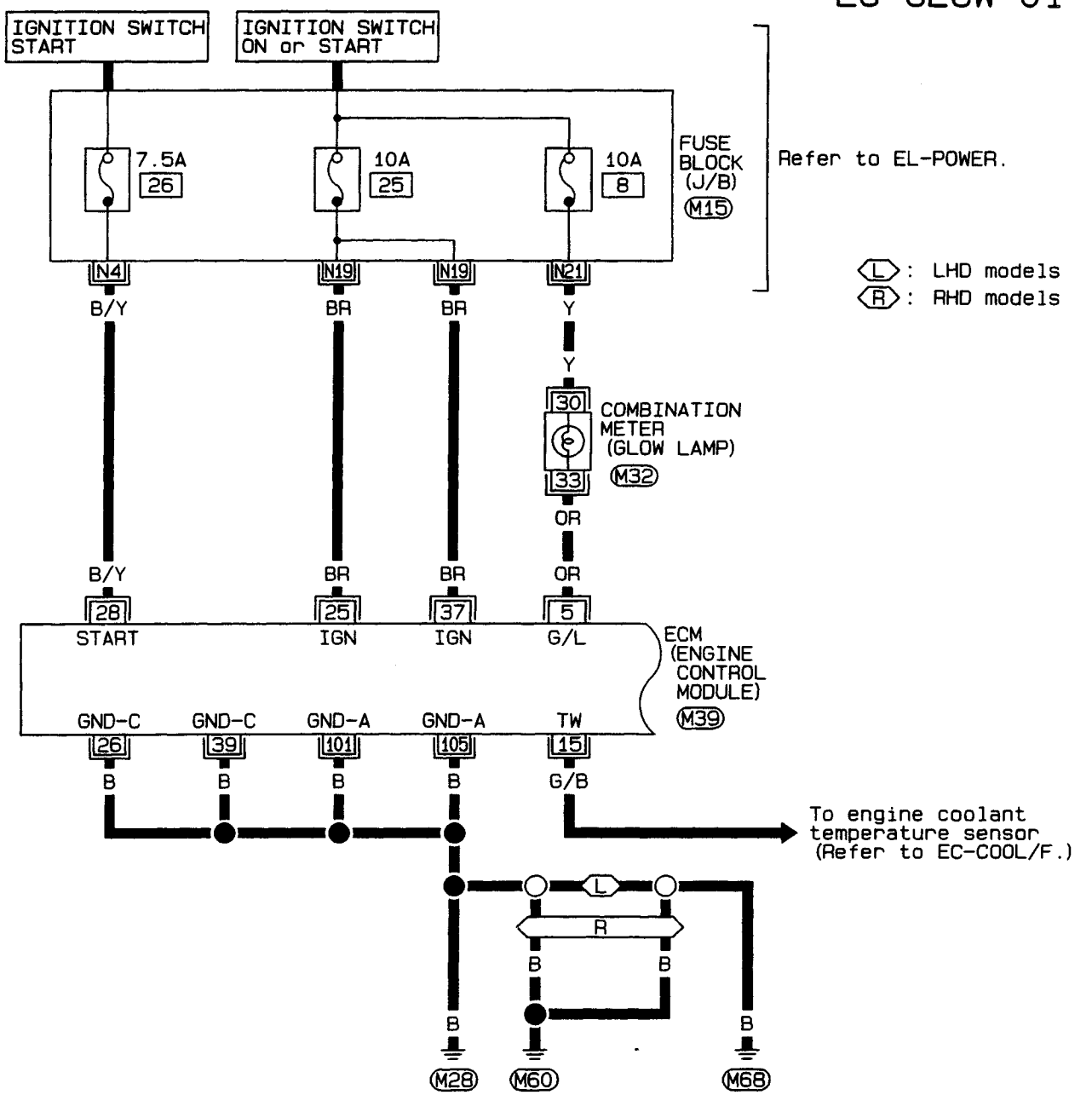
Key-in switch

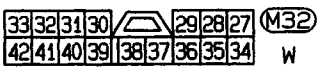
The key-in switch is built into the key cylinder. The ECM detects the key position and controls the key-in glow system.

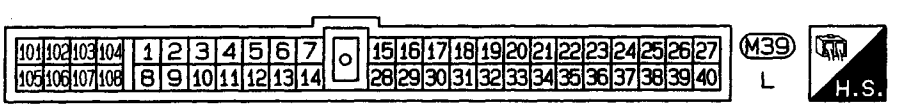
EC

Quick-glow System (Cont'd)

EC-GLOW-01





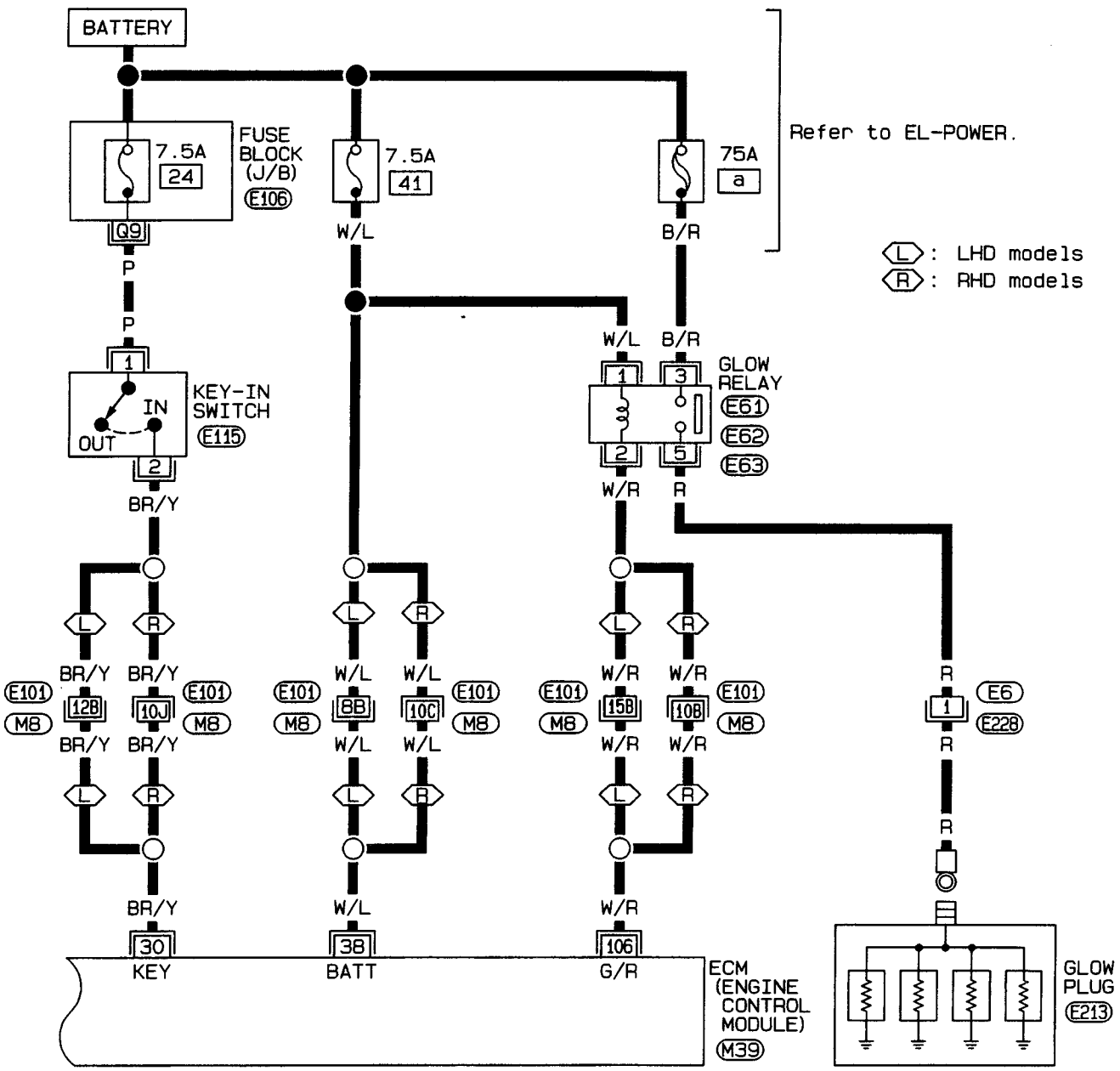


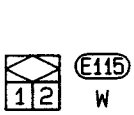
Refer to last page (Foldout page).

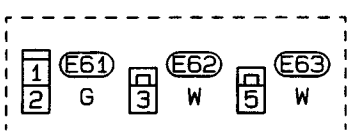
M15

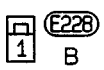
HEC088

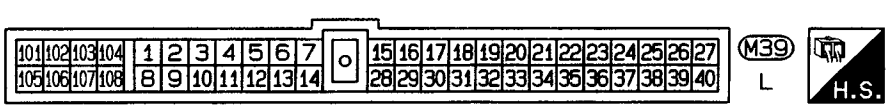
EC-GLOW-02











Refer to last page (Foldout page).

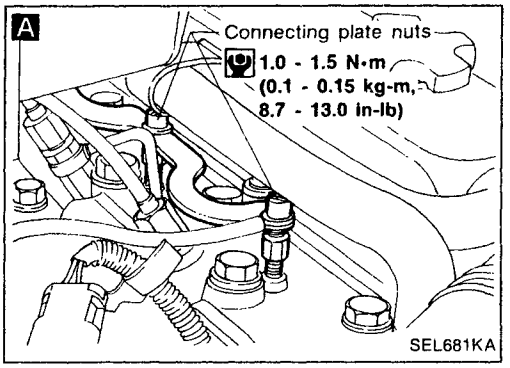
M8, E101

E106

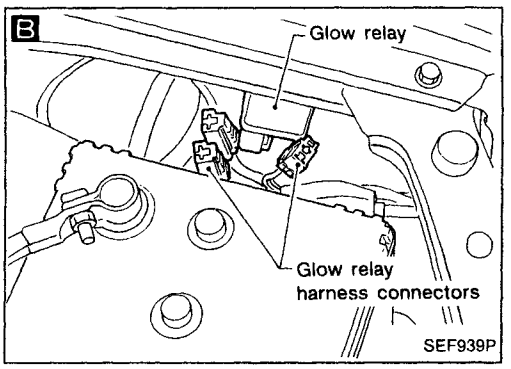
HEC089

Quick-glow System (Cont'd)

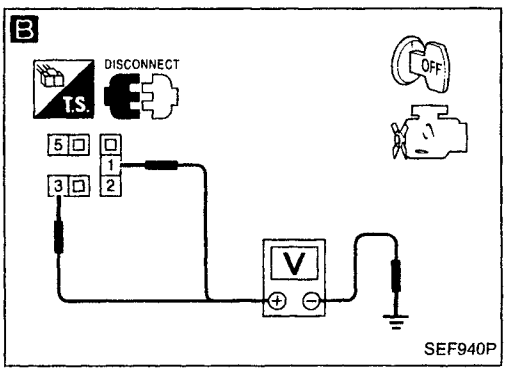
A



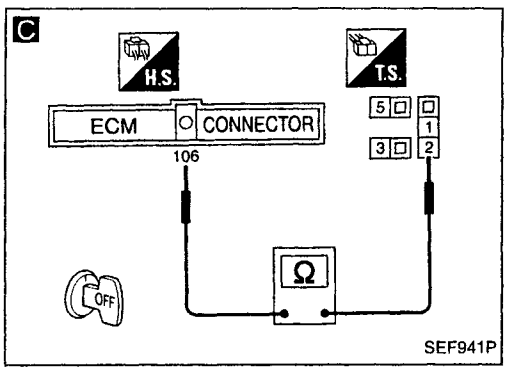
B



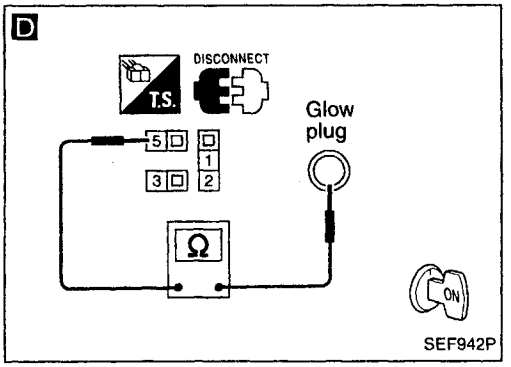
B



C



D



INSPECTION START

Check fuel level, fuel supplying system, starter motor, etc.
NG → Correct.

OK

A

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

OK

CHECK OVERALL FUNCTION.
Check entire quick-glow system. (Refer to "System Operation Check" on next page.)
OK → CHECK COMPONENT (Glow plug).
See page EC-397.

NG

CHECK POWER SUPPLY AND GROUND CIRCUIT.
(Refer to "Power Supply and ground circuit for ECM", EC-396).
NG → Repair harness or connector.

OK

B

CHECK VOLTAGE BETWEEN GLOW RELAY AND GROUND.
1) Check voltage between terminals ①, ③ and ground with tester.
Voltage: Battery voltage
NG → Check the following.
- 7.5A fuse
- 75A fusible link
- Harness continuity between glow relay and fuse

If NG, repair harness or connectors.

OK

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between ECM terminal (106) and terminal ②.
Continuity should exist.
NG → Repair harness or connectors.

OK

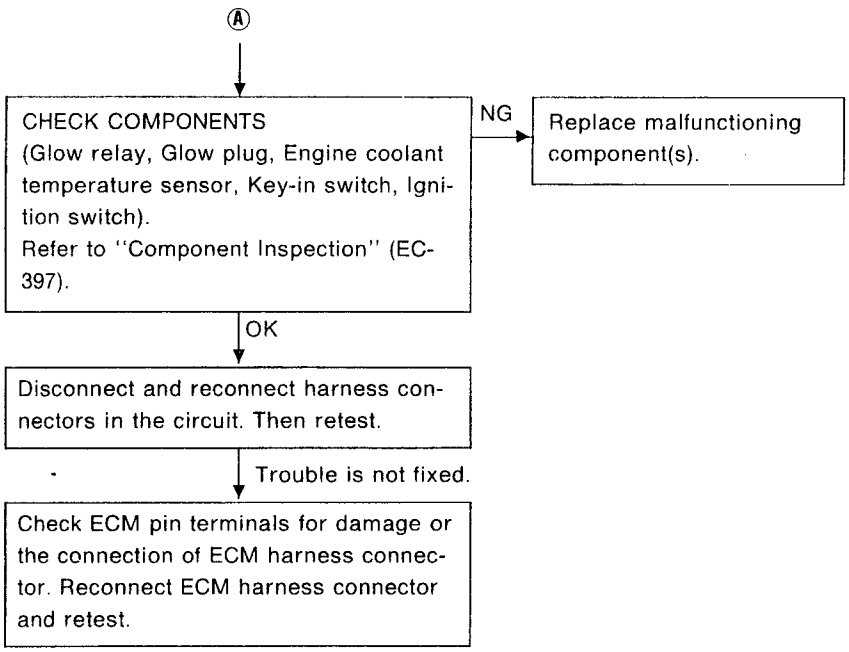
D

CHECK HARNESS CONTINUITY BETWEEN GLOW RELAY AND GLOW PLUG.
1) Disconnect ECM harness connector.
2) Disconnect glow relay.
3) Check harness continuity between glow relay terminal ⑤ and glow plug.
Continuity should exist.
NG → Repair harness or connectors.

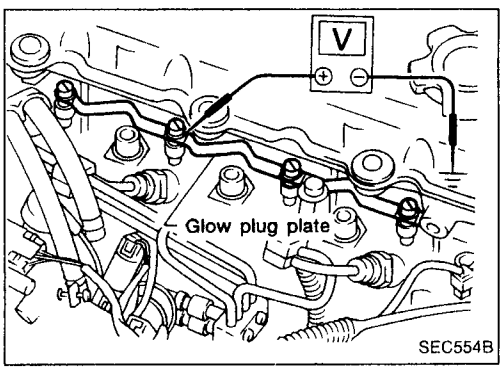
OK

Ⓐ

Quick-glow System (Cont'd)

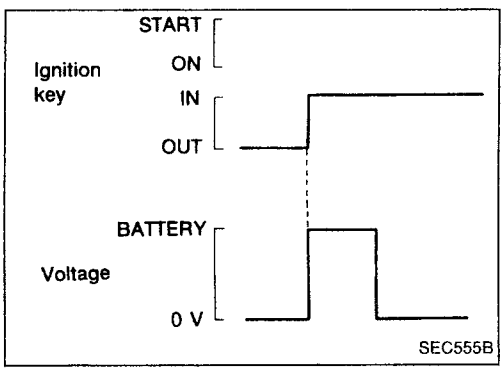


EC



SYSTEM OPERATION CHECK

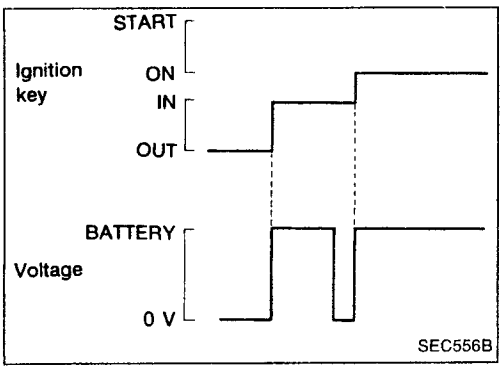
Set voltmeter between glow plug and engine body.



1. Key-in glow system
- Read voltage when ignition key is inserted into ignition switch.

Voltage:

Battery voltage for about 3 seconds



2. Quick-glow (Pre-glow) system

1) Turn ignition switch "ON" 3 or more seconds after key-in.
2) Read voltage.

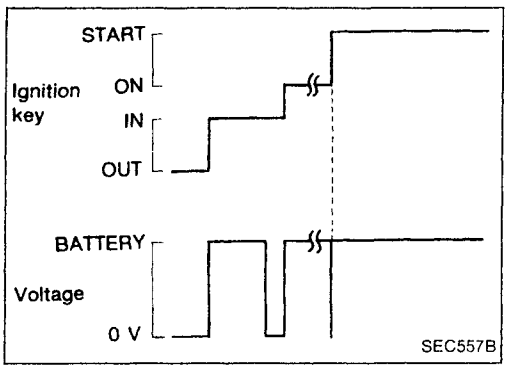
Voltage:

Battery voltage for about 20* seconds

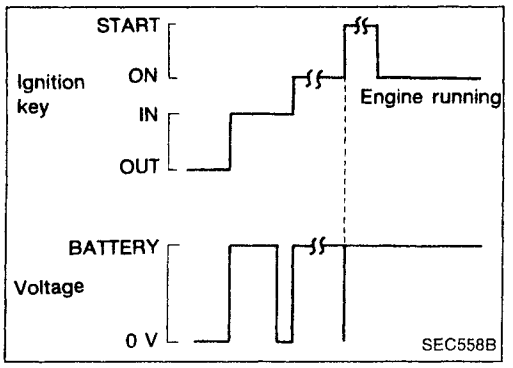
*** Coolant temperature is lower than 60°C (140°F).**

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

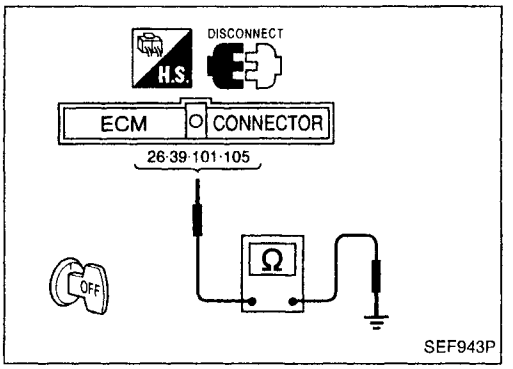
Quick-glow System (Cont'd)



3. Quick-glow (Cranking) system
1) Disconnect "S" terminal for starter motor to prevent engine from cranking.
2) Read voltage when ignition key is turned to "START".
Voltage:
Battery voltage*
*** For about 20 seconds after returning ignition switch to "ON".**



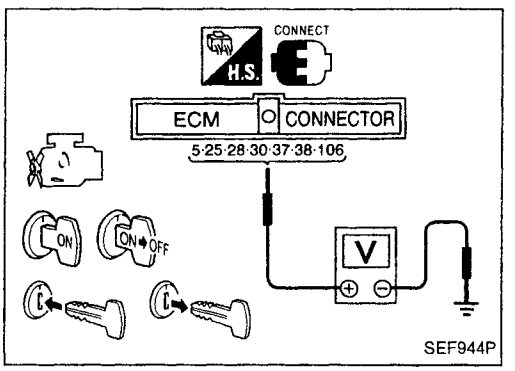
4. After-glow system
1) Connect "S" terminal to starter motor.
2) Start engine and read voltage.
Voltage:
Battery voltage for 5* minutes
*** Coolant temperature is lower than 60°C (140°F).**



POWER SUPPLY AND GROUND CIRCUIT FOR ECM

1. Disconnect "S" terminal for starter motor to prevent engine from cranking.
2. Disconnect ECM harness connector.
3. Check terminals (26), (39), (101), (105) for ground continuity.
Continuity should exist (0Ω).

- If NG, check ground harness.



4. Check voltage at each terminal according to the following chart.

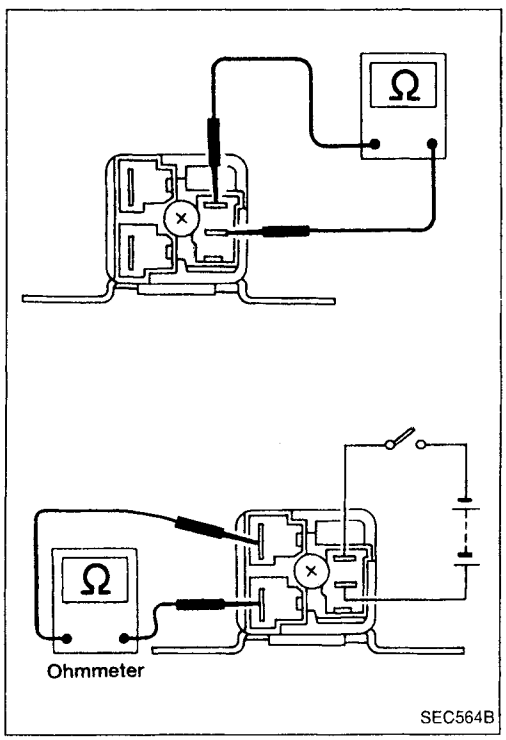
Terminal No.	Ignition switch position		Voltage
(38)	OFF (Not inserted)		Battery voltage
(106)	OFF (Not inserted)		
(30)	OFF (Not inserted)		0V
	OFF (Inserted)		Battery voltage
(25), (37)	OFF		0V
	ON	START	Battery voltage
(5)	OFF		0V
	ON	START	Battery voltage
(28)	OFF	ON	0V
	START		Battery voltage

Quick-glow System (Cont'd)

- If NG, check component parts and their related harness according to the following chart.

Terminal No.	Parts which should be checked						
	Battery	Fuse /Fusible link	Glow relay	Key-in switch	Ignition switch	Glow indicator bulb	Harness
㊳	X	X					X
106	X	X	X				X
㉚	X	X		X			X
㉕, ㊲	X	X			X		X
⑤	X	X			X	X	X
㉘	X	X			X		X

EC

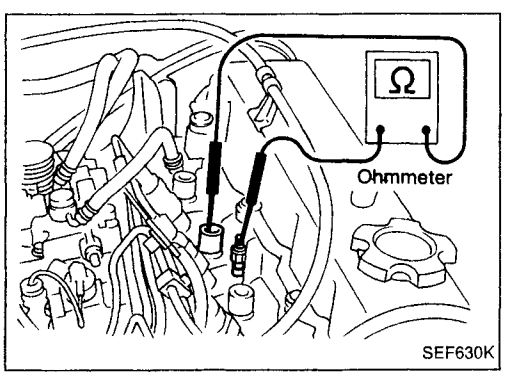


COMPONENT INSPECTION

Glow relay

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

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

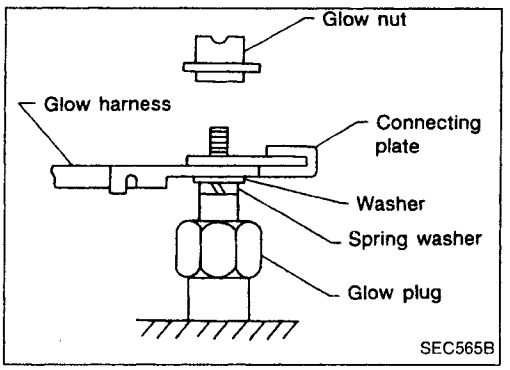


Glow plug

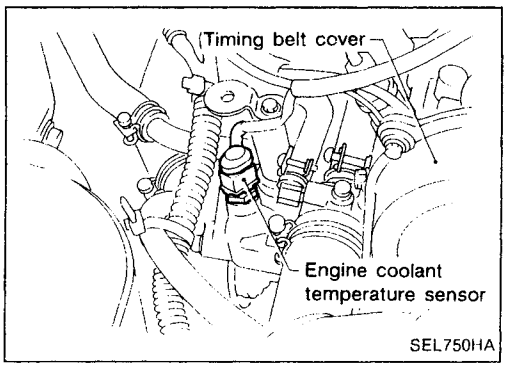
1. Remove glow plug connecting plate.
2. Check each glow plug for continuity.
   Continuity should exist:
   Approximately 0.65Ω

- If NG, replace glow plug.

Quick-glow System (Cont'd)



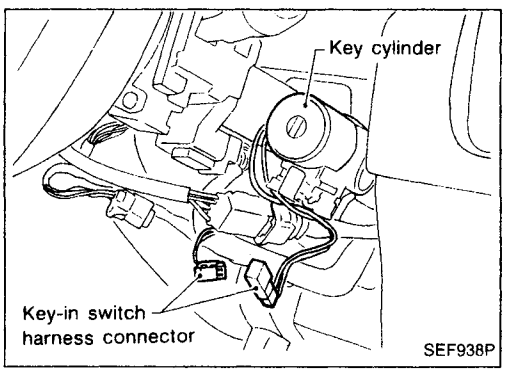
3. Install glow plug connecting plate securely.



Engine coolant temperature sensor

Check engine coolant temperature sensor resistance.

Coolant temp. °C (°F)	Resistance kΩ
−15 (5)	11.5
0 (32)	5.6
10 (50)	3.7
40 (104)	1.2



Key-in switch

Check continuity between terminals of key-in switch connector.

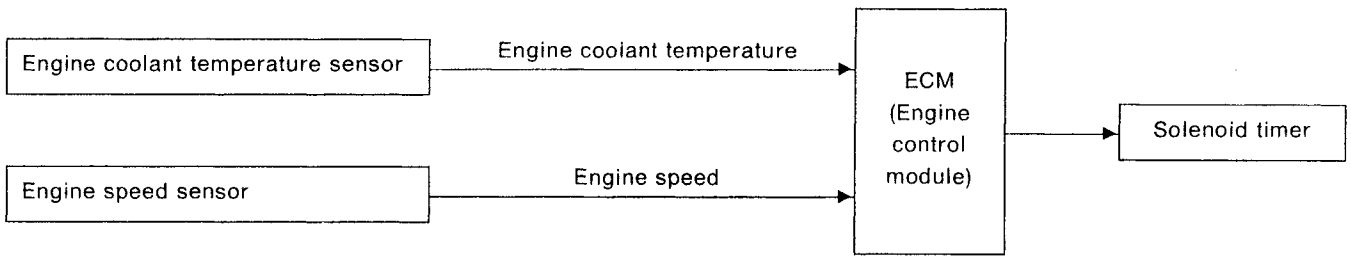
Ignition key	Continuity
Not inserted	No continuity
Inserted	Continuity should exist.

Alternator

Refer to "CHARGING SYSTEM" in EL section.

Partial Load Advance (PLA) Control

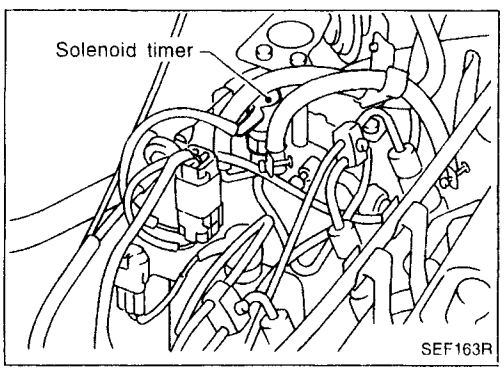
SYSTEM DESCRIPTION



This system switches the solenoid timer on and off corresponding to the engine coolant temperature and engine speed. The solenoid timer operation advances and retards the fuel injection timing as follows:

- The injection timing advances when the timer is ON, while it retards when the timer is OFF.
- When the engine stalls or the ignition switch is in the START position, the solenoid timer is set to OFF.
- When the engine coolant temperature is lower than 10°C (50°F), the timer is set to ON.

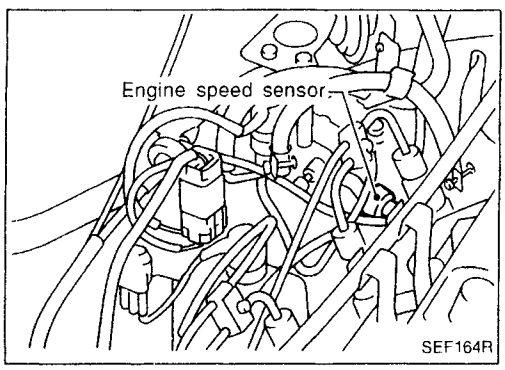
EC



DESCRIPTION

Solenoid timer

The solenoid timer switches on and off in accordance with a signal from the ECM. This timer operation changes the pressure in the injection pump, thereby controlling the fuel injection timing.



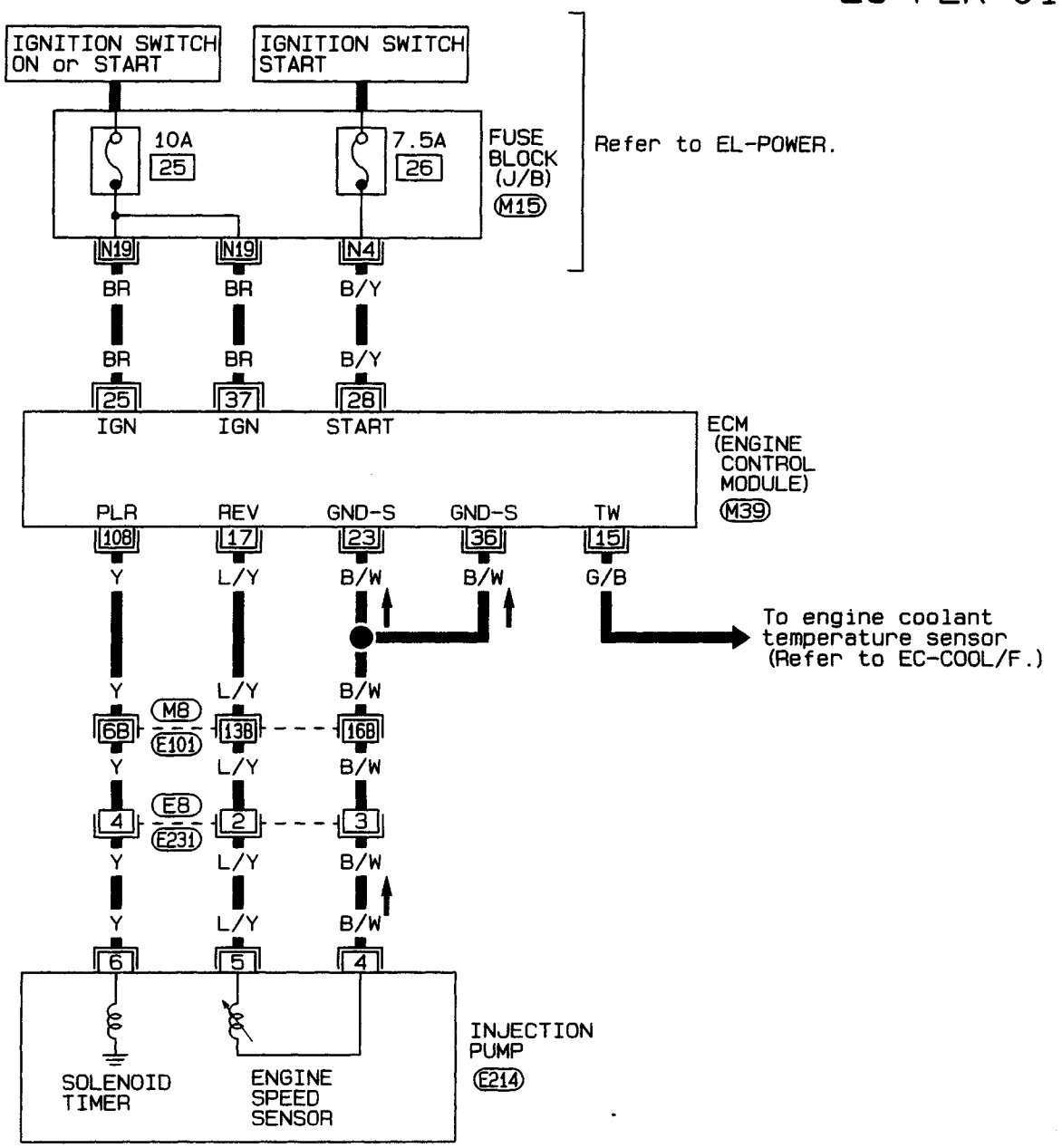
Engine speed sensor

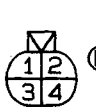
The engine speed sensor detects engine speed by monitoring the rotation of drive shaft gear in the injection pump. The sensor sends a signal of 37 pulses per drive shaft rotation to the ECM.

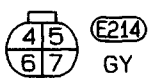
Partial Load Advance (PLA) Control (Cont'd)

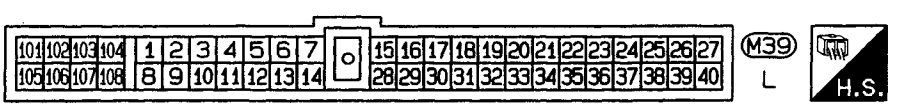
LHD models

EC-PLA-01







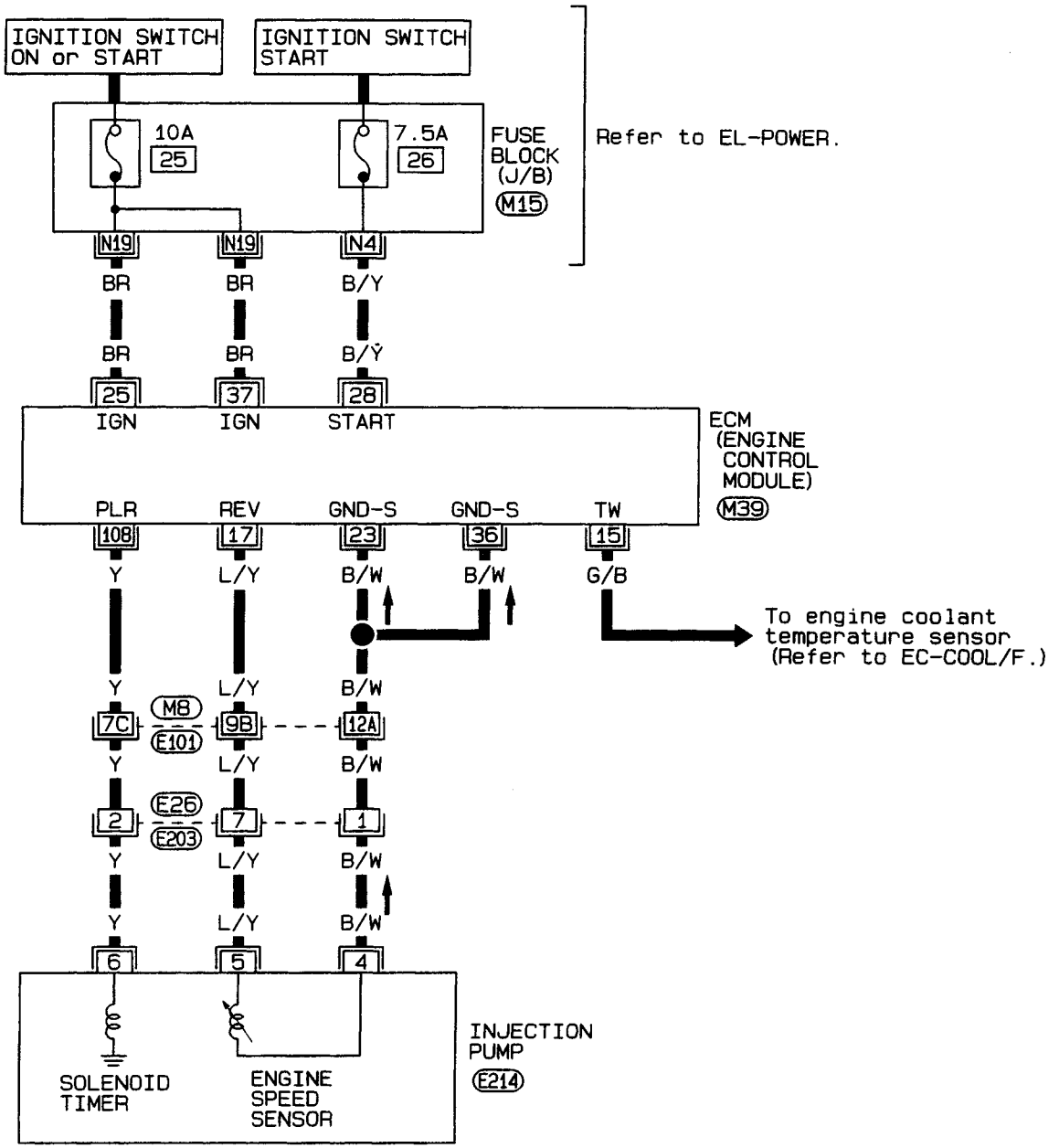


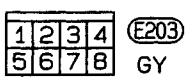
Refer to last page (Foldout page).
M8, E101
M15

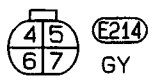
HEC090

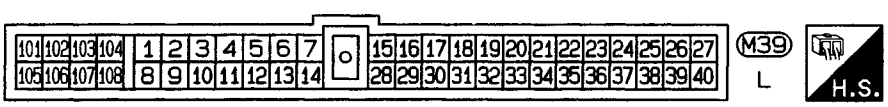
RHD models

EC-PLA-02









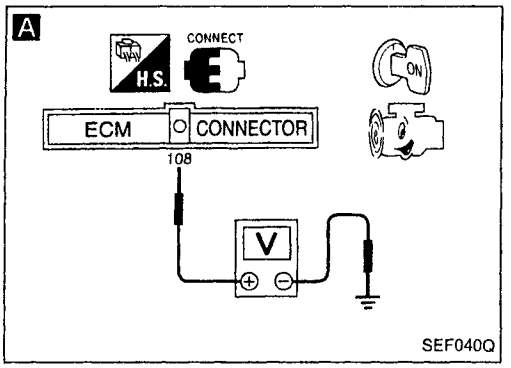
Refer to last page (Foldout page).

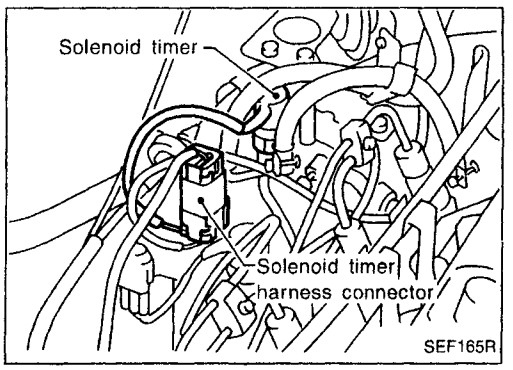
M8, E101

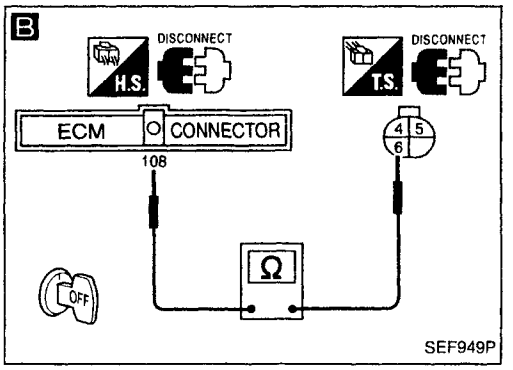
M15

HEC091

Partial Load Advance (PLA) Control (Cont'd)







INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine.
2) Check voltage between ECM terminal (108) and ground.
Voltage:
Engine coolant temperature is lower than 10°C (50°F)
Battery voltage
Engine coolant temperature is higher than 60°C (140°F)
0V

OK → INSPECTION END

NG ↓

B

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect ECM harness connector.
2) Disconnect injection pump harness connector.
3) Check harness continuity between ECM terminal (108) and terminal (6).
Continuity should exist.

NG → Repair harness or connectors.

OK ↓

CHECK COMPONENT
(Solenoid timer, engine speed sensor).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace solenoid timer, engine speed sensor.

OK ↓

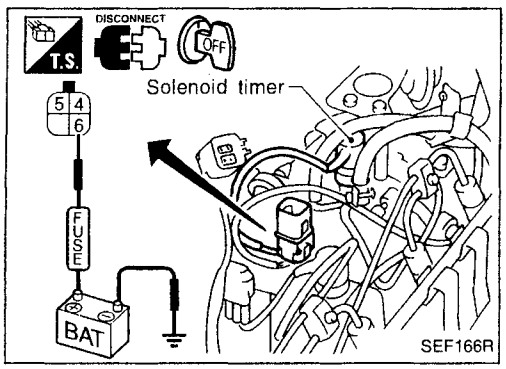
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

Partial Load Advance (PLA) Control (Cont'd)

COMPONENT INSPECTION



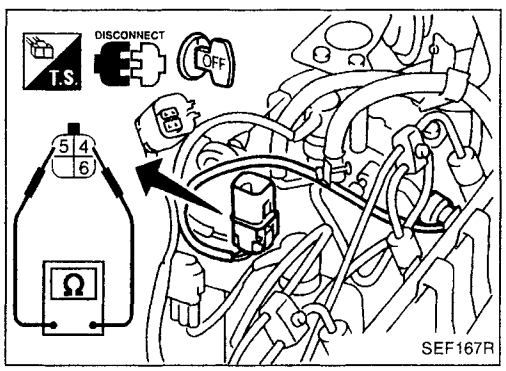
Solenoid timer

1. Disconnect solenoid timer harness connector.
2. Apply battery voltage to solenoid timer terminals and listen for operating sound.

Condition	Operating sound
With battery voltage applied	Yes
Without battery voltage applied	No

If NG, replace power steering oil pressure switch.

EC



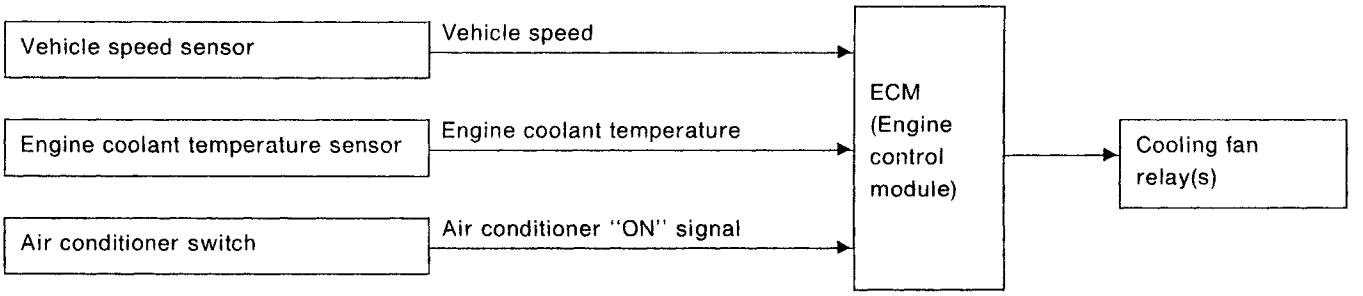
Engine speed sensor

1. Disconnect engine speed sensor harness connector.
2. Check resistance between terminals ④ and ⑤.
   Resistance: Approximately 1.6Ω

   If NG, replace fuel pump.

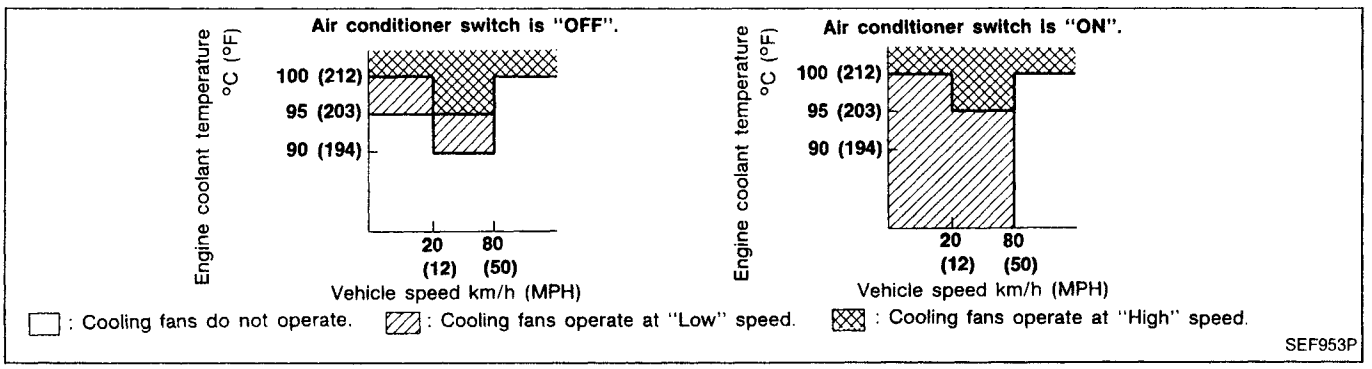
Cooling Fan Control

SYSTEM DESCRIPTION

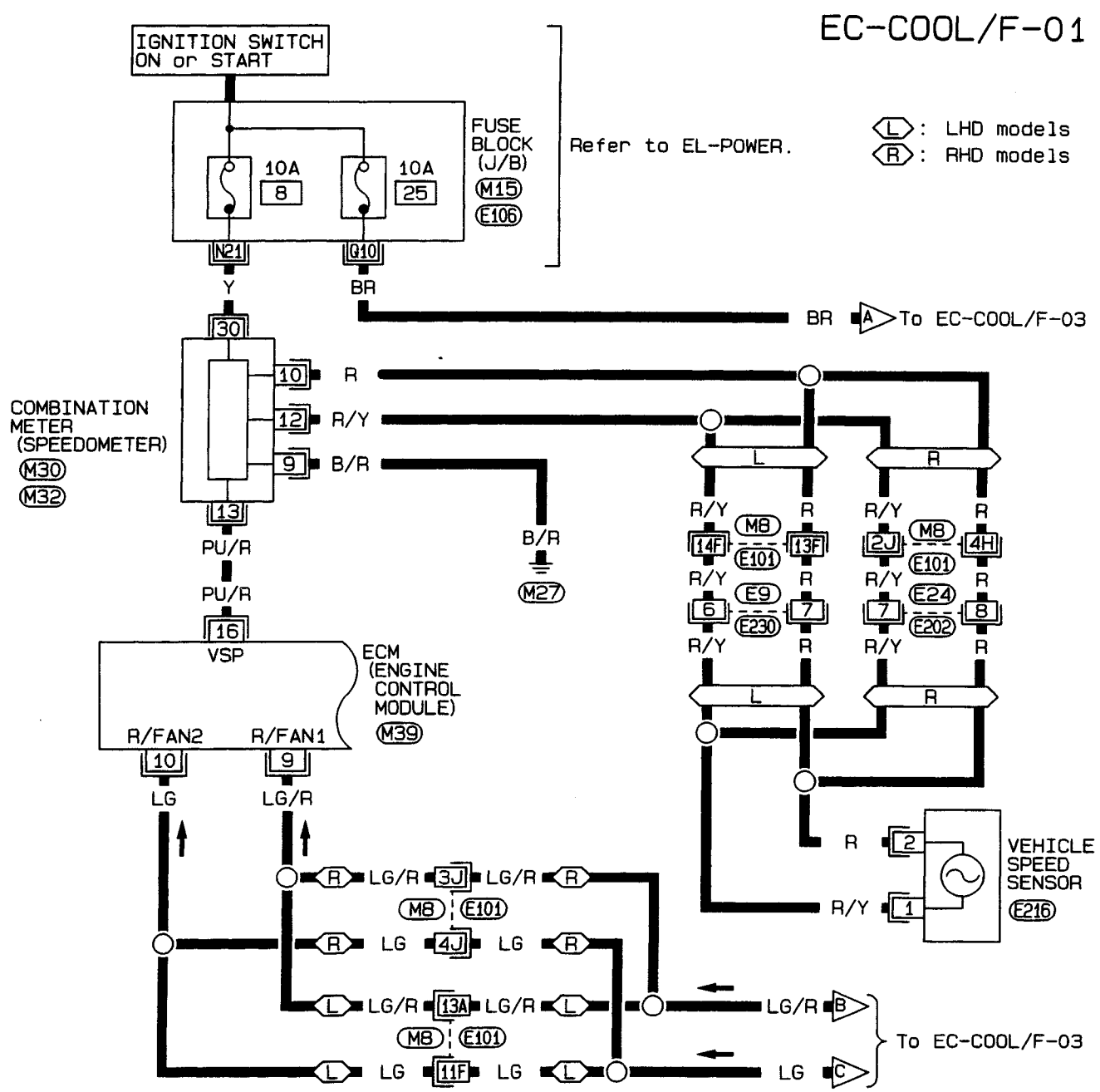


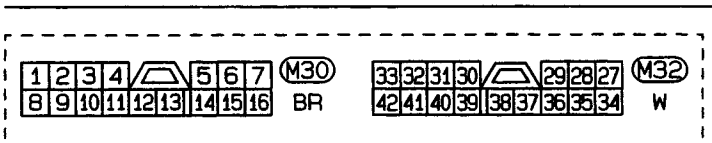
The ECM controls the cooling fan corresponding to the vehicle speed, engine coolant temperature, air conditioner system pressure and air conditioner ON signal. The control system has 3-step control [HIGH/LOW/OFF].

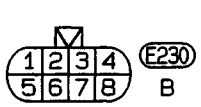
Operation

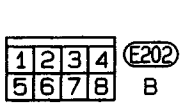


Cooling Fan Control (Cont'd)

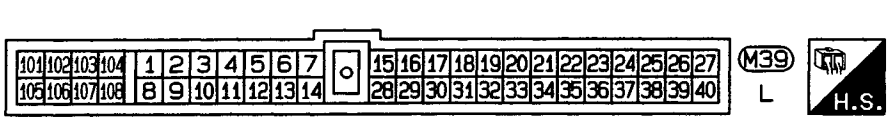












Refer to last page (Foldout page).

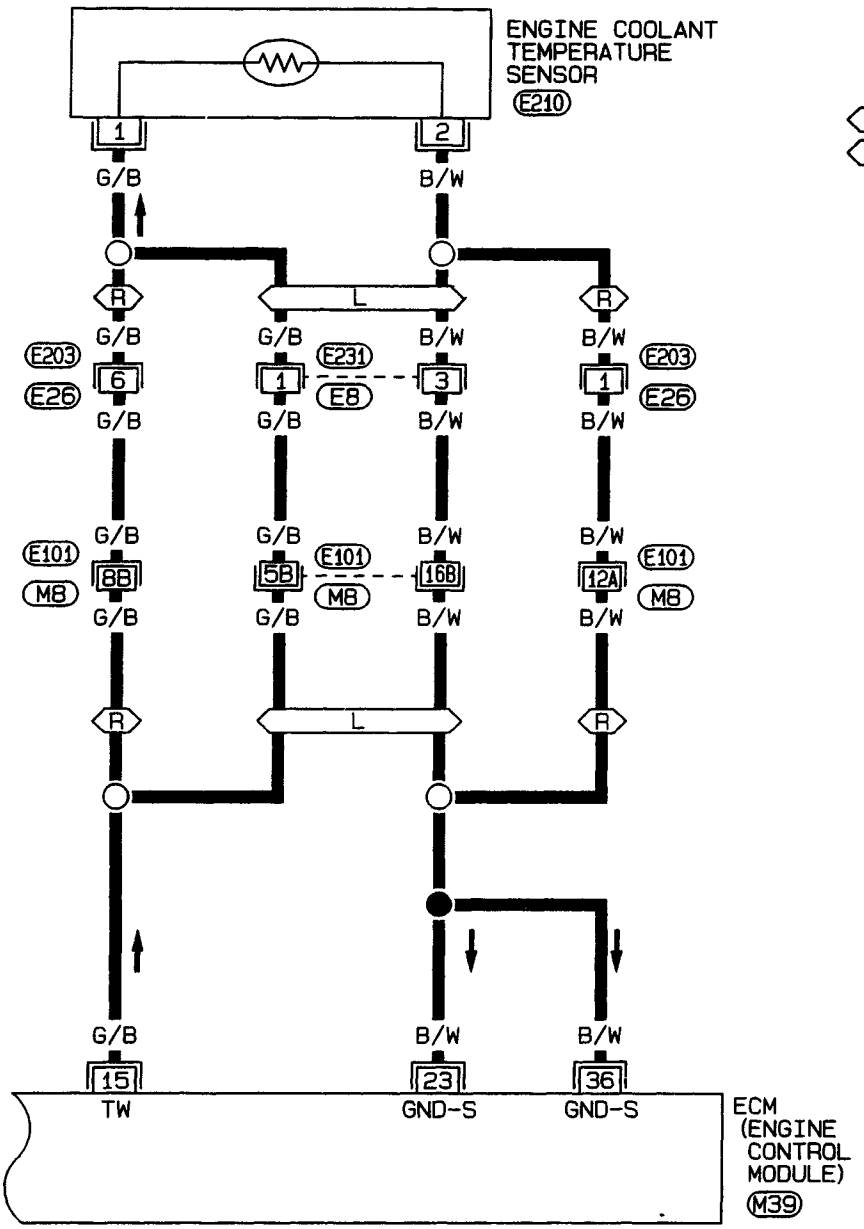
M8, E101

M15, E106

HEC092

Cooling Fan Control (Cont'd)

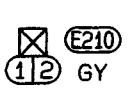
EC-COOL/F-02

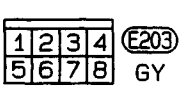


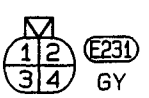
R : RHD models
L : LHD models

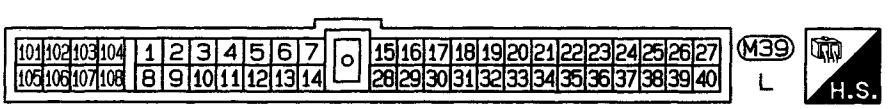
Refer to last page (Foldout page).

M8 , E101

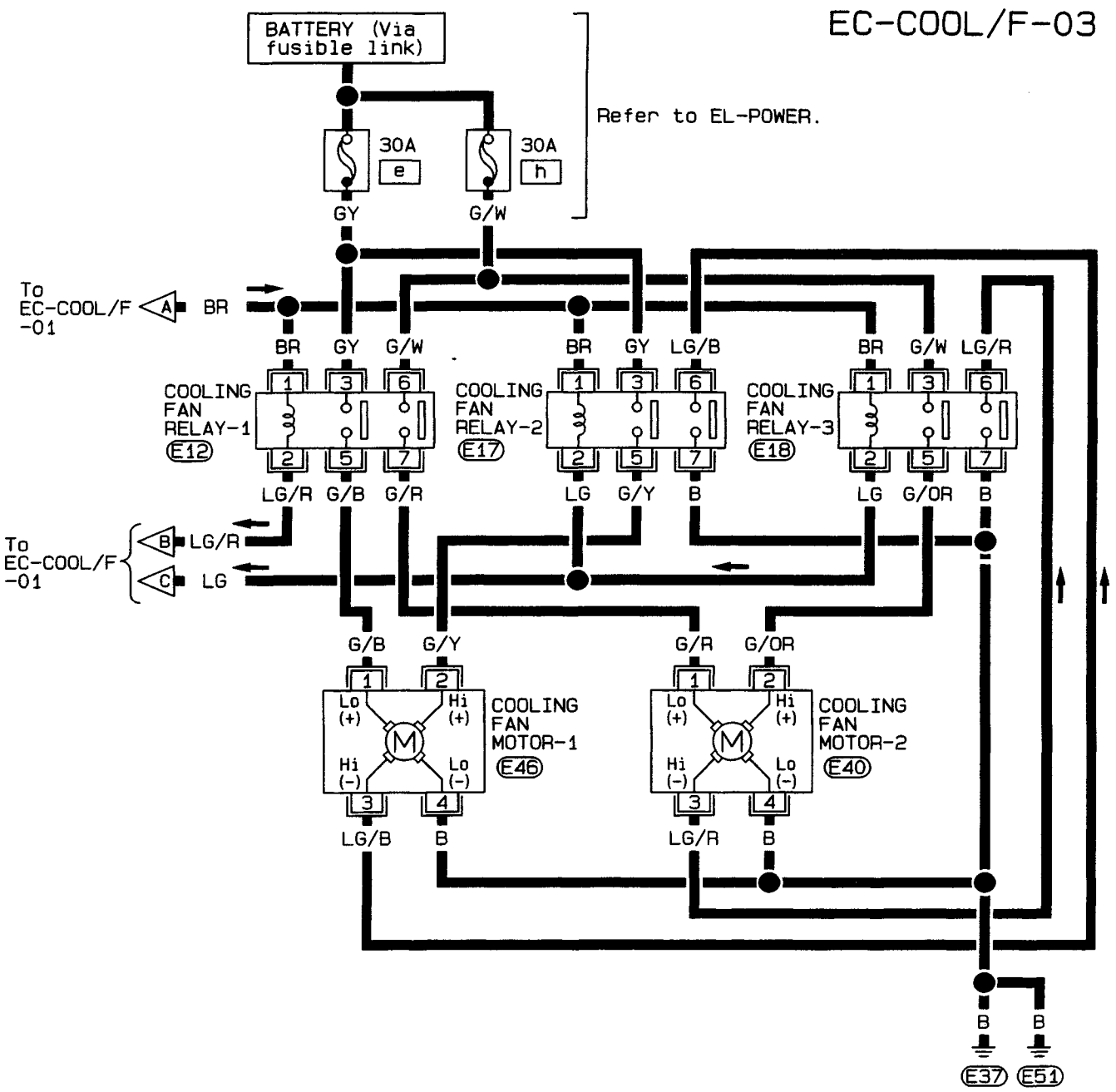








Cooling Fan Control (Cont'd)

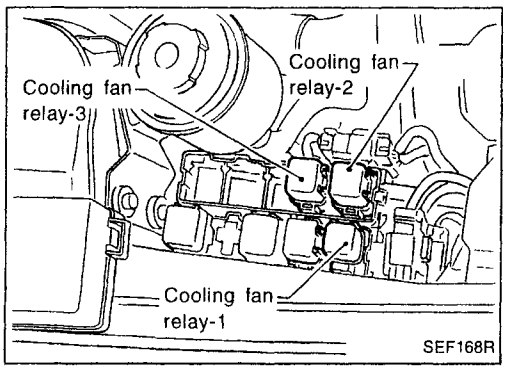


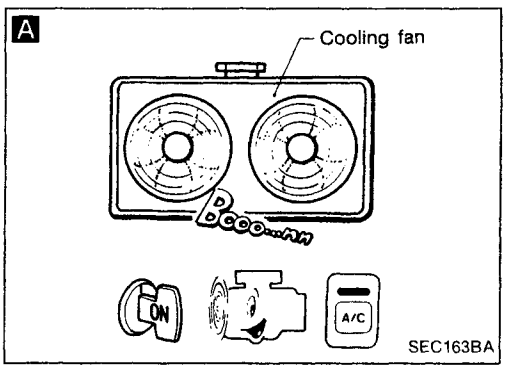
E12, E17, E18 BR BR BR

E40, E46 GY GY

HEC094

Cooling Fan Control (Cont'd)





INSPECTION START

A

CHECK COOLING FAN LOW SPEED OPERATION.
1) Turn ignition switch "OFF".
2) Disconnect engine coolant temperature sensor connector.
3) Disconnect cooling fan relays 1, 2 and 3.
4) Turn ignition switch "ON".
5) Reconnect cooling fan relay 1.
6) Make sure that cooling fan operates at low speed.

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

OK

B

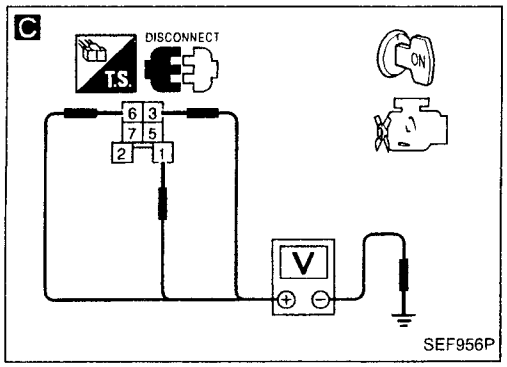
CHECK COOLING FAN HIGH SPEED OPERATION.
1) Turn ignition switch "OFF".
2) Reconnect cooling fan relay-2 and cooling fan relay-3.
3) Turn ignition switch "ON".
4) Make sure that cooling fan operates at high speed.

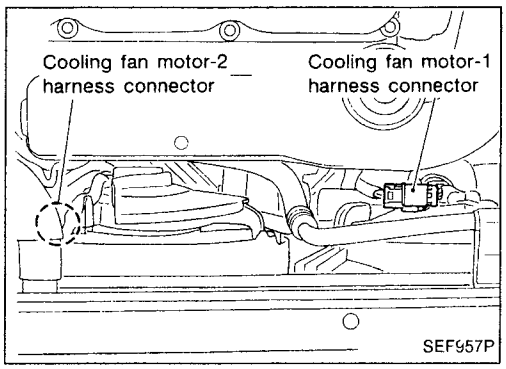
NG → Check cooling fan high speed control circuit. (Go to PROCEDURE D.)

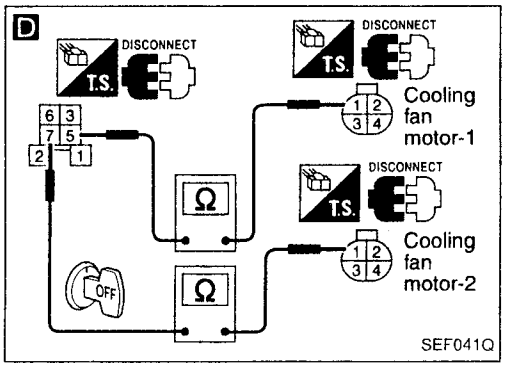
OK

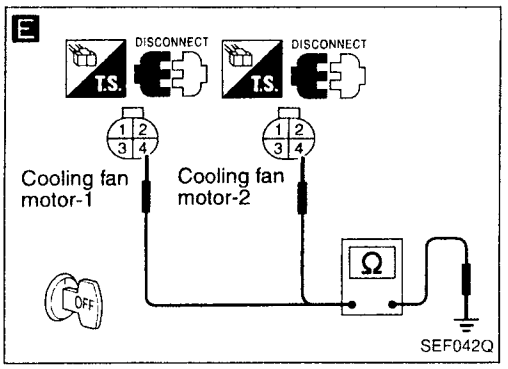
INSPECTION END

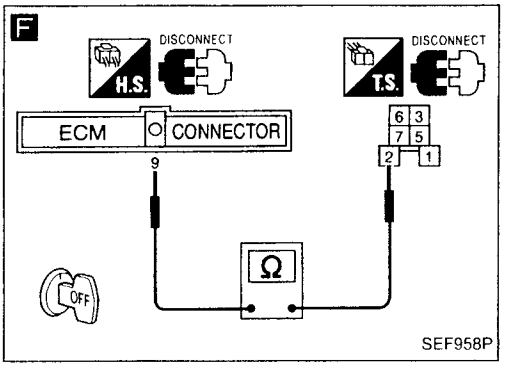
Cooling Fan Control (Cont'd)











PROCEDURE C

INSPECTION START

C

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect cooling fan relay-1.
3) Turn ignition switch "ON".
4) Check voltage between terminals ①, ③, ⑥ and ground.
Voltage: Battery voltage

NG → Check the following.
- Harness connector (E106)
- 10A fuse
- 30A fusible links
- 75A fusible link
- Harness continuity between cooling fan relay-1 and fuse
- Harness continuity between cooling fan relay-1 and battery

If NG, repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect cooling fan motor-1 harness connector and cooling fan motor-2 harness connector.
D 3) Check harness continuity between terminal ⑦ and terminal ① , terminal ⑤ and terminal ① .
Continuity should exist.
E 4) Check harness continuity between terminal ④ and body ground.
Continuity should exist.

NG → Repair harness or connectors.

OK ↓

F

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect ECM harness connector.
2) Check harness continuity between ECM terminal ⑨ and terminal ② .
Continuity should exist.

NG → Check the following.
- Harness connectors (E101), (M8)
- Harness continuity between cooling fan relay-1 and ECM

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Cooling fan relay-1).
Refer to "COMPONENT INSPECTION".
(See page EC-412.)

NG → Replace cooling fan relay.

OK ↓

Ⓐ

EC

Cooling Fan Control (Cont'd)

Ⓐ

CHECK COMPONENT
(Cooling fan motors).
Refer to "COMPONENT INSPECTION".
(See page EC-412.)

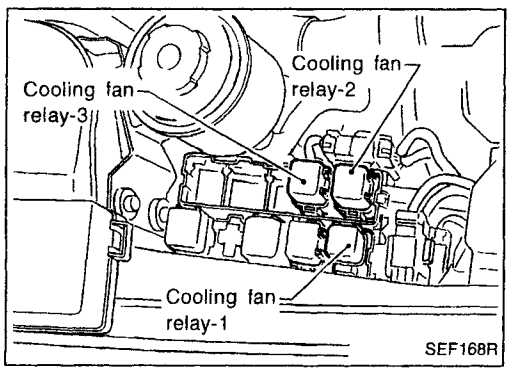
NG → Replace cooling fan motors.

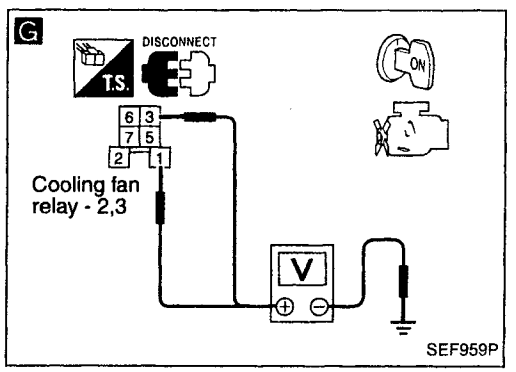
OK

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

Trouble is not fixed.

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





PROCEDURE D

INSPECTION START

G

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect cooling fan relay-2 and cooling fan relay-3.
3) Turn ignition switch "ON".
4) Check voltage between cooling fan relay-2, 3 terminals ①, ③ and ground.
Voltage: Battery voltage

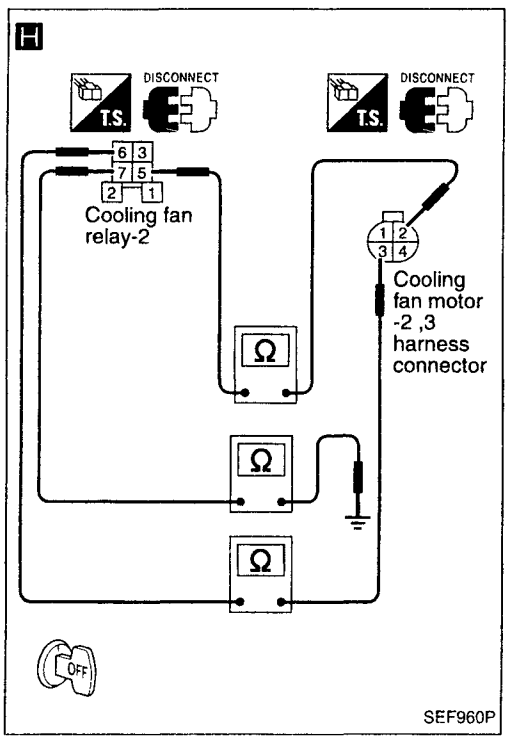
NG → Check the following.
- Harness connectors (E106)
- 10A fuse
- 30A fusible links
- 75A fusible link
- Harness continuity between cooling fan relay-2, 3 and fuse
- Harness continuity between cooling fan relay-2, 3 and battery

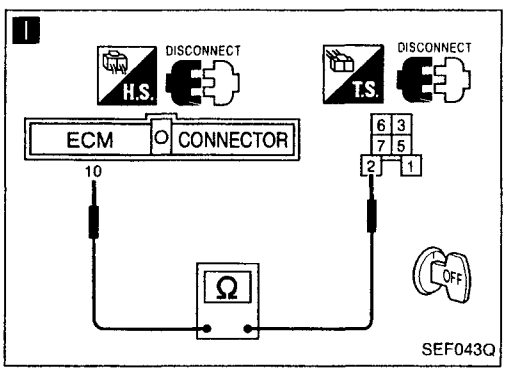
If NG, repair harness or connectors.

OK

Ⓑ

Cooling Fan Control (Cont'd)





Ⓑ

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect cooling fan motor-1 harness connector and cooling fan motor-2, 3 harness connectors.
H 3) Check harness continuity between terminal ⑤ and terminal ②, terminal ⑥ and terminal ③, terminal ⑦ and body ground.
Continuity should exist.

NG → Repair harness or connectors.

OK ↓

I

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect ECM harness connector.
2) Check harness continuity between ECM terminal ⑩ and terminal ②.
Continuity should exist.

NG → Check the following.
- Harness connectors (E101), (M8)
- Harness continuity between cooling fan relay-2, 3 and ECM

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
(Cooling fan relay-2, 3).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace cooling fan relays.

OK ↓

CHECK COMPONENTS
(Cooling fan motors).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace cooling fan motors.

OK ↓

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

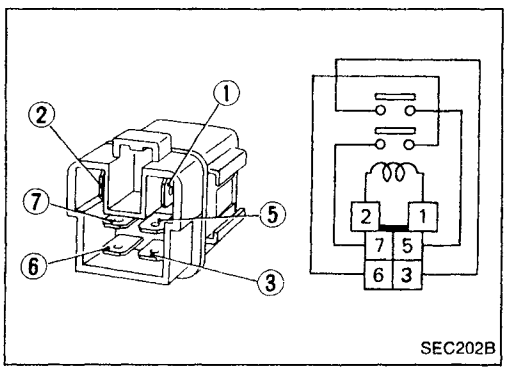
Trouble is not fixed. ↓

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

EC

Cooling Fan Control (Cont'd)

COMPONENT INSPECTION

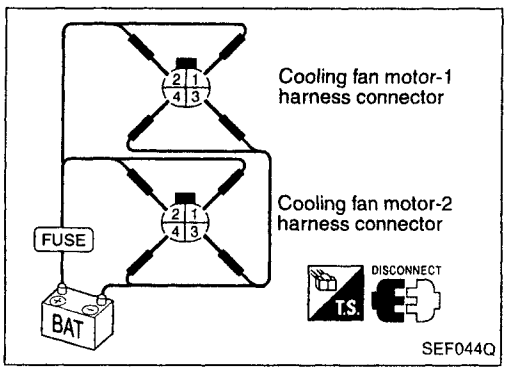


Cooling fan relays-1, -2 and -3

Check continuity between terminals ③ and ⑤, ⑥ and ⑦.

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

If NG, replace relay.



Cooling fan motors-1 and -2

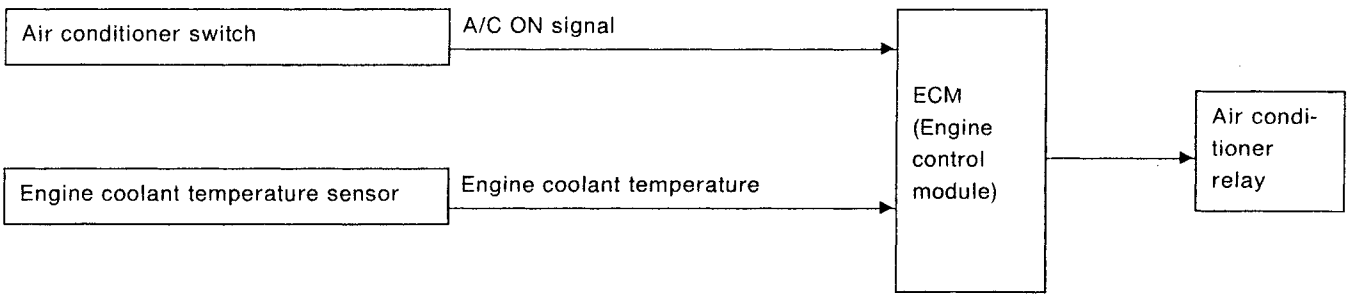
1. Disconnect cooling fan motor harness connectors.
2. Supply cooling fan motor terminals with battery voltage and check operation.

	Speed	Terminals	
		(⊕)	(⊖)
Cooling fan motor-1	Low	①	④
	High	②, ①	④, ③
Cooling fan motor-2	Low	①	④
	High	②, ①	④, ③

Cooling fan motor should operate.
If NG, replace cooling fan motor.

Air Conditioner Cut Control

SYSTEM DESCRIPTION



The air conditioner is turned off under the following conditions:
RHD models
- Engine coolant temperature is higher than 97°C (207°F)

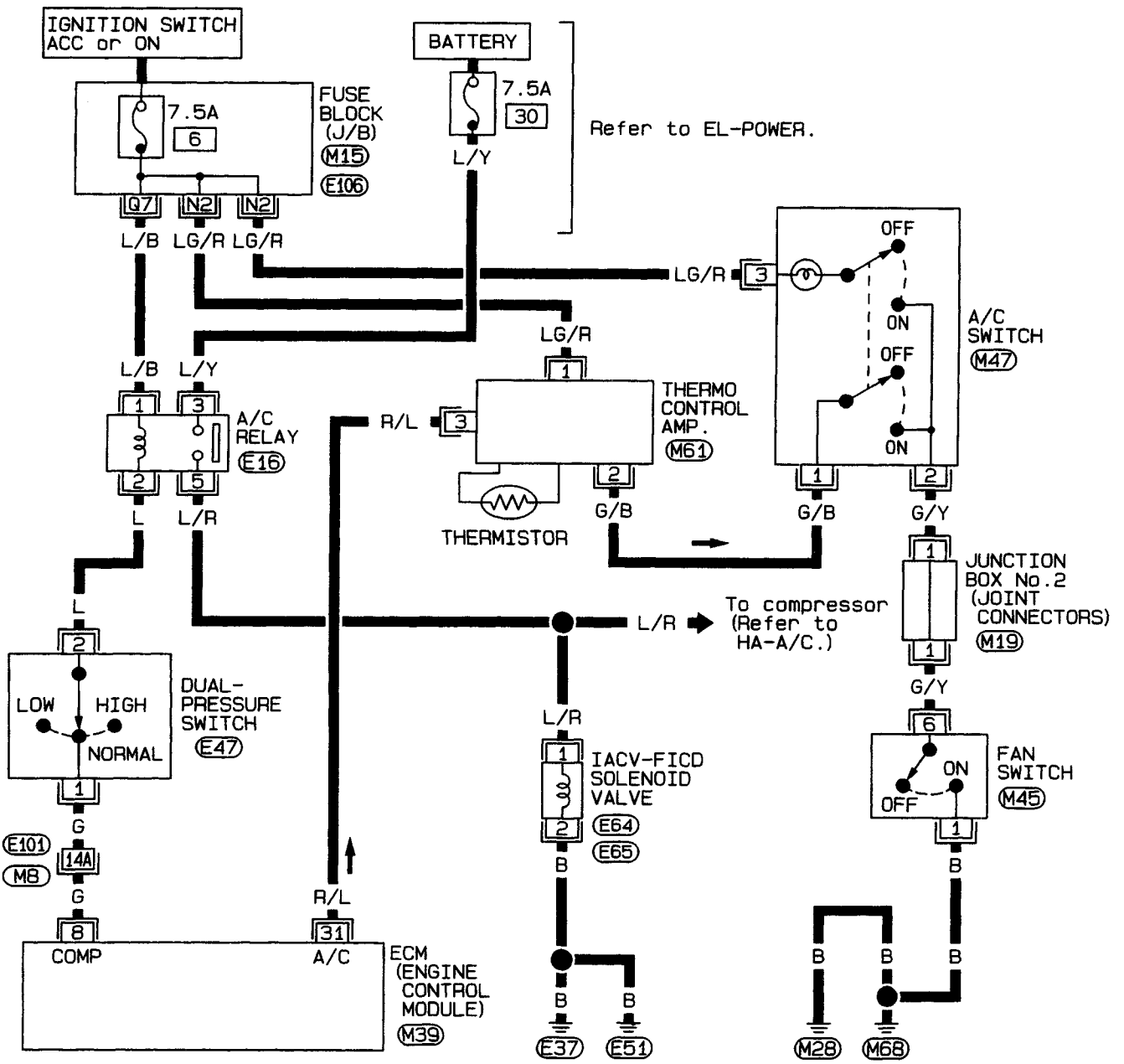
LHD models
- Engine coolant temperature is higher than 105°C (221°F)

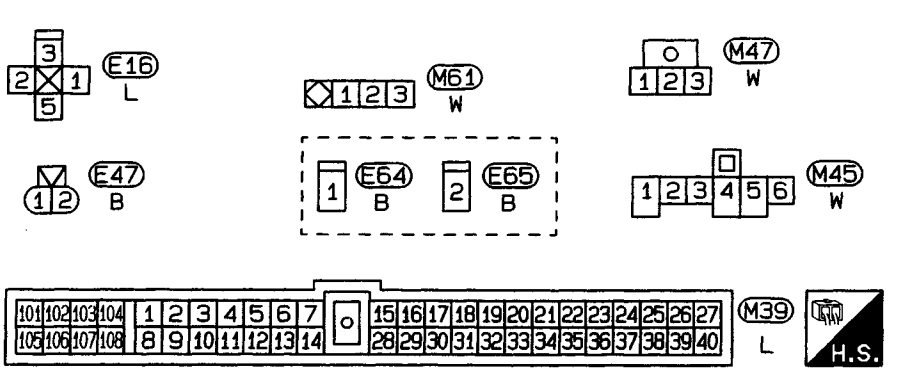
For trouble diagnoses, refer to "TROUBLE DIAGNOSES" in HA section.

Air Conditioner Cut Control (Cont'd)

LHD models

EC-A/CCUT-01





Refer to last page (Foldout page).

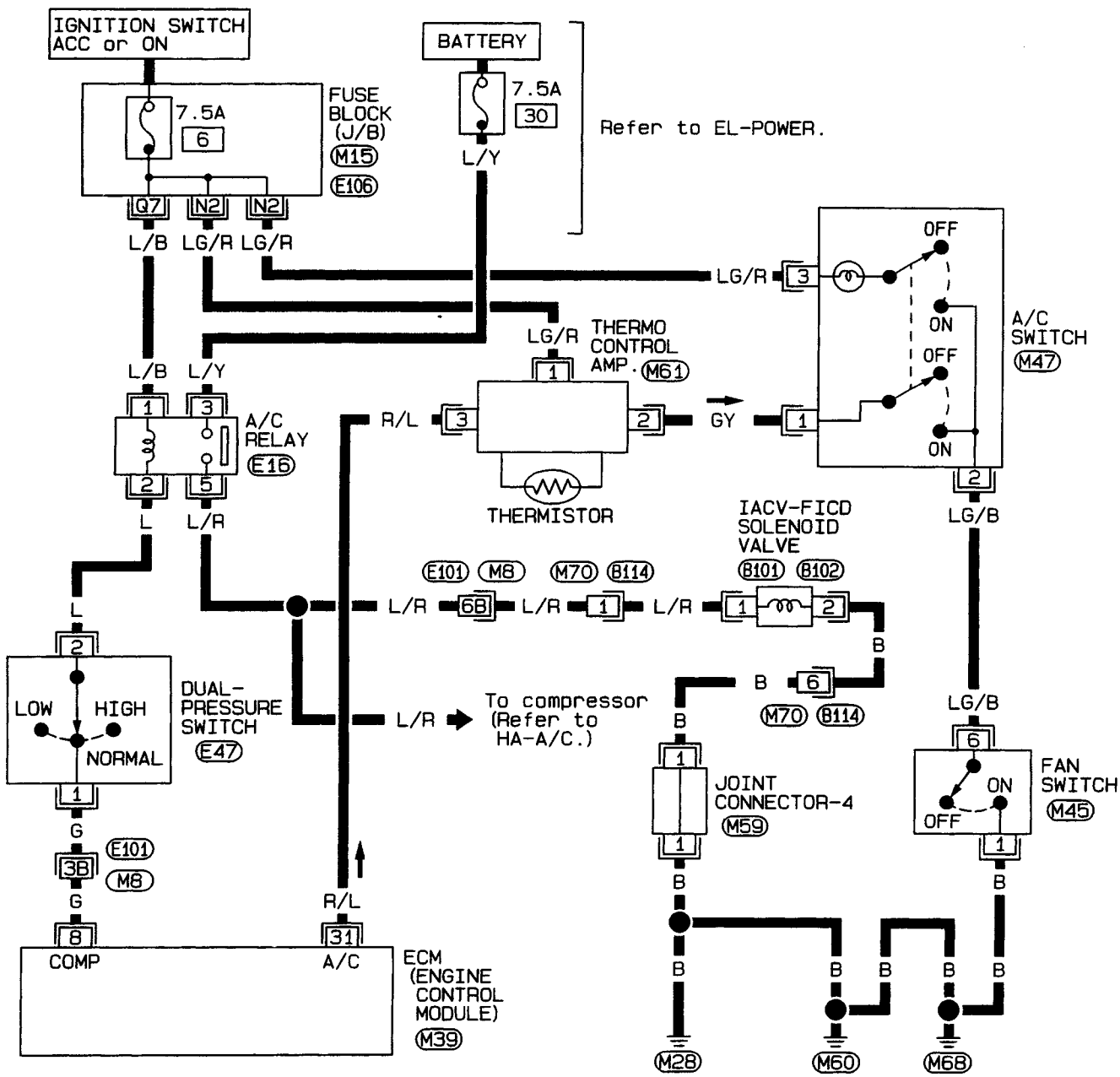
M8, E101
M15, E106
M19

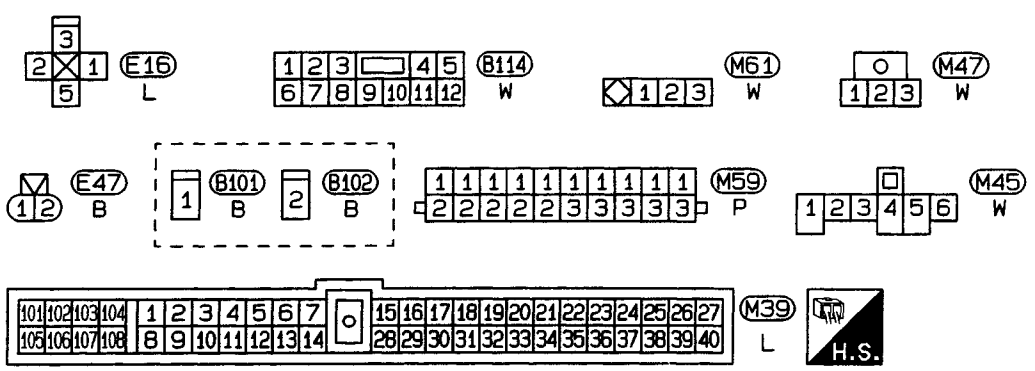
HEC095

Air Conditioner Cut Control (Cont'd)

RHD models

EC-A/CCUT-02





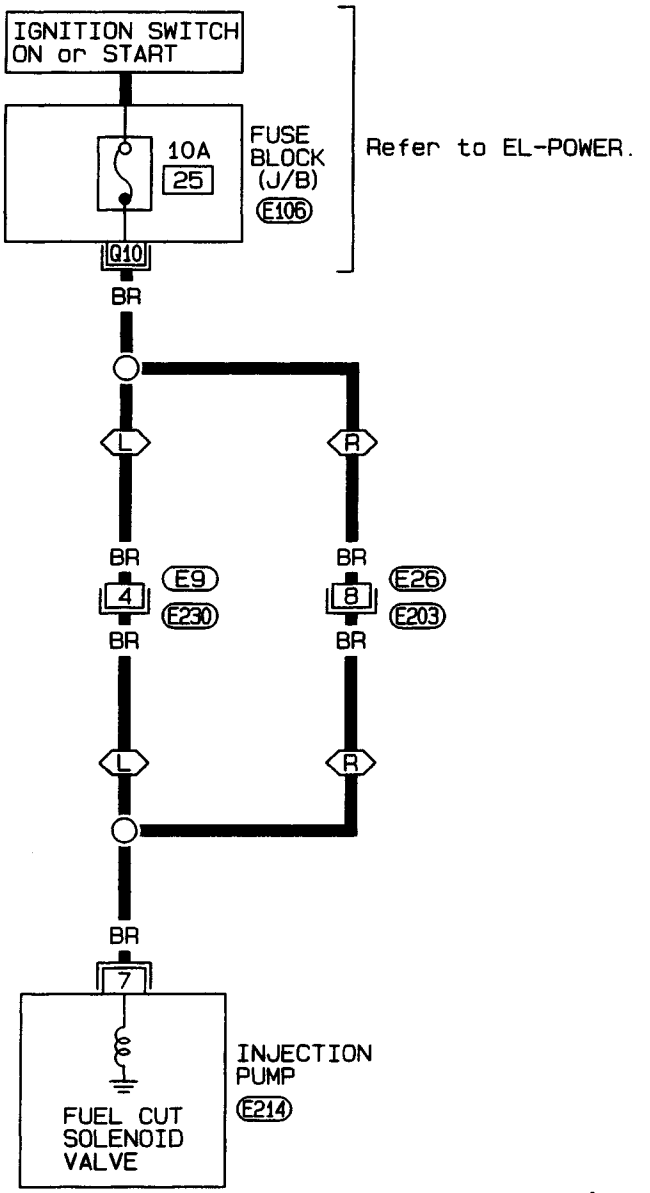
Refer to last page (Foldout page).

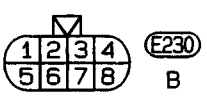
M8, E101
M15, E106

HEC096

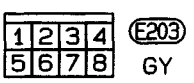
Fuel Cut Control

EC-FCUT-01





E230
B



E203
GY



E214
GY

Refer to last page
(Foldout page).

E106

HEC097

General Specifications

PRESSURE REGULATOR Regulated pressure kPa (bar, kg/cm^2, psi)	299 (2.99, 3.05, 43.4)

Inspection and Adjustment

Idle speed*1 rpm No-load*2	GA14DE, GA16DE for Europe and Israel A/T: 800 ± 50 Models with daytime light system M/T: 800 ± 50 Models without daytime light system M/T: 700 ± 50 GA15DE M/T: 630 ± 50 A/T: 750 ± 50 GA16DE for Australia M/T: 675 ± 50 A/T: 800 ± 50 GA16DE except for Europe and Israel, and Australia M/T: 650 ± 50 A/T: 800 ± 50
Air conditioner: ON	900 or more
Ignition timing	GA14DE, GA16DE for Europe and Israel and GA16DE except for Australia 10° ± 2° BTDC GA15DE 6° ± 2° BTDC GA16DE for Australia 8° ± 2° BTDC
Throttle position sensor idle position*3 V	0.40 - 0.60

*1: Feedback controlled and needs no adjustments
*2: Under the following conditions:
- Air conditioner switch: OFF
- Electric load: OFF (Lights, heater, fan & rear defogger)
- A/T models: in "N" position

*3: Engine is warmed up sufficiently.

IGNITION COIL

Primary voltage	V	12
Primary resistance [at 20°C (68°F)]	Ω	Approximately 0.5 - 1.0
Secondary resistance [at 20°C (68°F)]	kΩ	Approximately 12

MASS AIR FLOW SENSOR

Supply voltage	V	Battery voltage
Output voltage	V	1.2 - 1.8*

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

ENGINE COOLANT TEMPERATURE SENSOR

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
90 (194)	0.24 - 0.26
110 (230)	0.14 - 0.15

FUEL PUMP

Resistance [at 25°C (77°F)]	Ω	Approximately 0.2 - 5

IACV-AAC VALVE

Resistance [at 25°C (77°F)]	Ω	Approximately 10 (For Europe and Israel) 50 - 100 (Except for Europe and Israel)

INJECTOR

Resistance [at 25°C (77°F)]	Ω	Approximately 10 - 14

RESISTOR

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

THROTTLE POSITION SENSOR

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

*: Engine is warmed up sufficiently.

General Specifications

PRESSURE REGULATOR Fuel pressure at idling kPa (bar, kg/cm^2, psi)	
Vacuum hose is connected	Approximately 235 (2.35, 2.4, 34)
Vacuum hose is disconnected	Approximately 294 (2.94, 3.0, 43)

Inspection and Adjustment

Idle speed*1 rpm	
No-load*2 (in "N" position)	800 ± 50
Air conditioner: ON (in "N" position)	850 or more
Ignition timing	15° ± 2° BTDC
Throttle position sensor idle position V	0.35 - 0.65

*1: Feedback controlled and needs no adjustments
*2: Under the following conditions:
- Air conditioner switch: OFF
- Electric load: OFF (Lights, heater fan & rear defogger)

IGNITION COIL

Primary voltage V	12
Primary resistance [at 25°C (77°F)] Ω	0.5 - 1.0
Secondary resistance [at 25°C (77°F)] kΩ	Approximately 25

MASS AIR FLOW SENSOR

Supply voltage V	Battery voltage (11 - 14)
Output voltage V	1.3 - 1.7*

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

ENGINE COOLANT TEMPERATURE SENSOR

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

HEATED OXYGEN SENSOR HEATER

Resistance [at 25°C (77°F)] Ω	3.3 - 6.3

FUEL PUMP

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

IACV-AAC VALVE

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

INJECTOR

Resistance [at 25°C (77°F)] Ω	10 - 14

RESISTOR

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

THROTTLE POSITION SENSOR

Throttle valve conditions	Resistance kΩ [at 25°C (77°F)]
Completely closed	Approximately 1
Partially open	1 - 10
Completely open	Approximately 10

VE-type Injection Pump

GENERAL SPECIFICATIONS

Unit : rpm

Engine		CD20
Idle speed	FICD: OFF	700^{+50}_{-0}
	FICD: ON	800
Dash pot touch speed		1,300
Maximum engine speed		5,400

Pump numbers

Engine	Part number	Pump assembly number
CD20	16700-75J01	104740-2610

Pump data is not yet available.
(Pump data will be given by Technical Bulletin, or refer to CALIBRATION STANDARD published by ZEXEL.)

INSPECTION AND ADJUSTMENT

Installation of injection pump

Engine		CD20
Plunger lift (Injection timing)	mm (in)	0.79 - 0.85 (0.0311 - 0.0335) (equivalent to 8° BTDC)

Injection Nozzle

INSPECTION AND ADJUSTMENT

Injection nozzle assembly

Unit: kPa (bar, kg/cm^2, psi)

Initial injection pressure	
New	12,749 - 13,534 (127.5 - 135.3, 130 - 138, 1,849 - 1,962)
Used	12,259 - 13,239 (122.6 - 132.4, 125 - 135, 1,778 - 1,920)

Adjusting shims

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

EC