ENGINE FUEL & EMISSION CONTROL SYSTEM

SECTION EF&EC

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EF & EC

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For assistance with 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".

PREPARATION

SPECIAL SERVICE TOOLS

| Tool number Tool name | Description | |
|--|-------------|--|
| KV109D0010 Ignition timing adapter coil KV10114200 Adapter harness | | Measuring ignition timing |
| KV10114400 Exhaust gas sensor wrench | | Loosening or tightening exhaust gas sensor |

E.C.U.

- Do not disassemble E.C.C.S. control unit (E.C.U.).
- Do not turn diagnosis mode selector forcibly.
- If a battery terminal is disconnected, the memory will return to the ROM value. The E.C.C.S. 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.
- Keep the antenna as far as possible from the electronic control units.
- 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.
- Adjust the antenna and feeder line so that the standing-wave ratio can be kept smaller.
- Be sure to ground the radio to vehicle body.

Always use a 12 volt battery as power source. Do not attempt to disconnect battery cables white engine is running. INJECTOR Do not disconnect injector harness connectors with engine running. Do not apply battery power directly to injectors.

E.C.C.S. PARTS HANDLING

BATTERY

- Handle air flow meter carefully to avoid damage.
- Do not disassemble air flow meter.
- Do not clean air flow meter with any type of detergent.
- Do not disassemble auxiliary air control valve.
- Even a slight leak in the air intake system can cause serious problems
- Do not shock or jar the crank angle sensor.

WHEN STARTING

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

FUEL PUMP

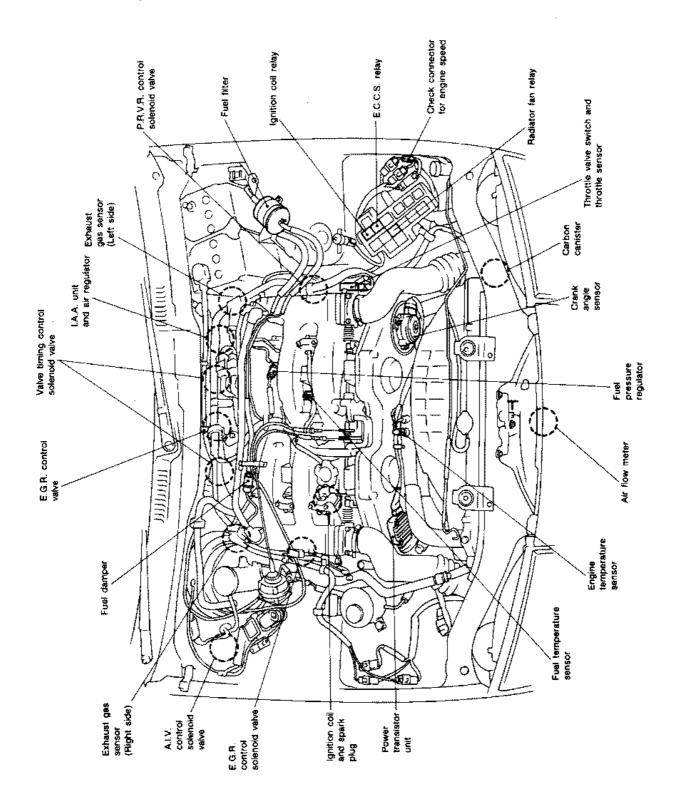
- Do not operate fuel pump when there is no fuel in lines.
- Tighten fuel hose clamps to the specified torque.

E.C.C.S. HARNESS HANDLING

- Securely connect E.C.C.S. 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 E.C.C.S. harness at least 10 cm (3.9 in) away from adjacent harnesses, to prevent an E.C.C.S. system mailunction due to receiving external noise, degraded operation of ICs, etc.
- Keep E.C.C.S. parts and harnesses dry.
- Before removing parts, turn off ignition switch and then disconnect battery ground cable.

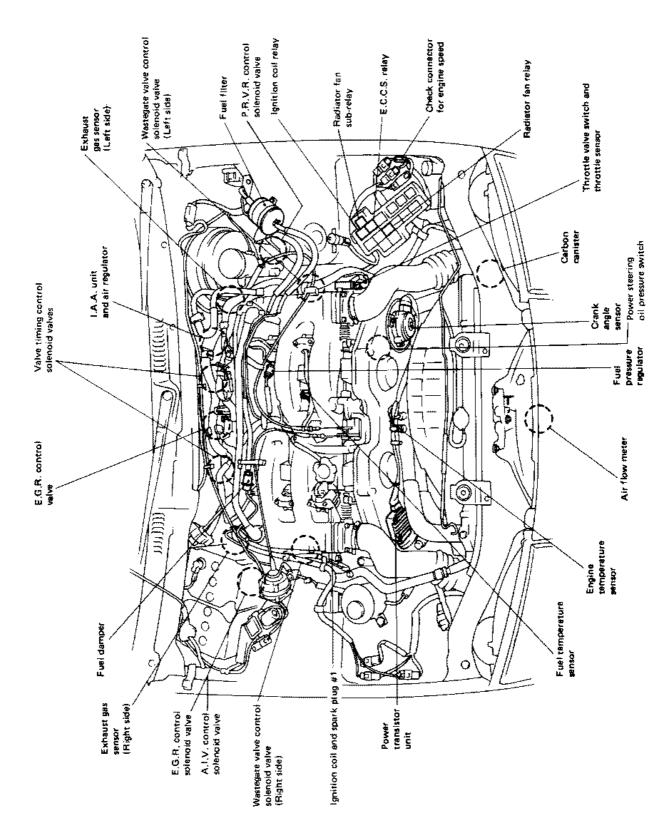
E.C.C.S. Component Parts Location

NON-TURBO MODEL



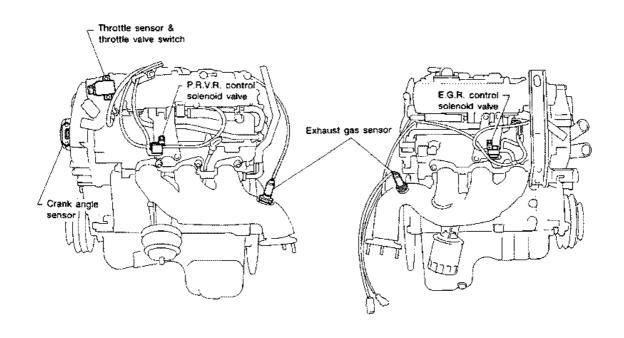
E.C.C.S. Component Parts Location (Cont'd)

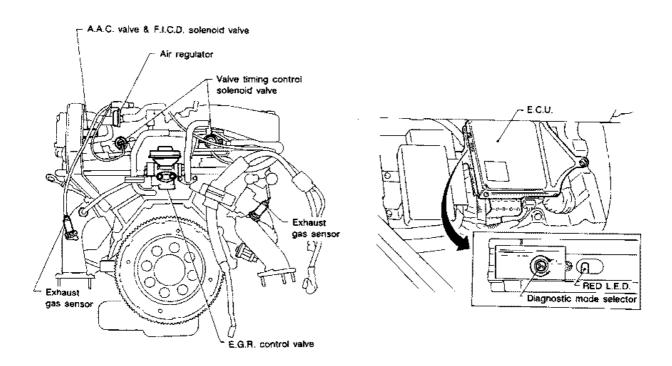
TURBO MODEL



E.C.C.S. Component Parts Location (Cont'd)

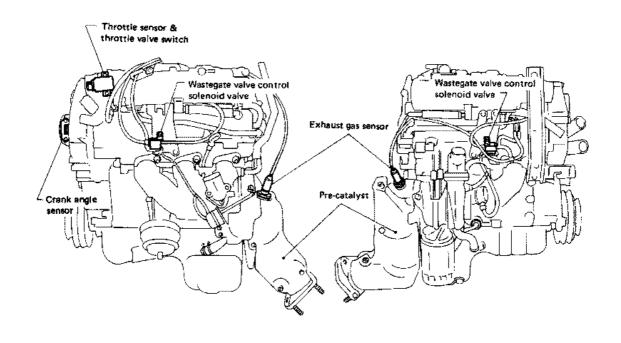
NON-TURBO MODEL

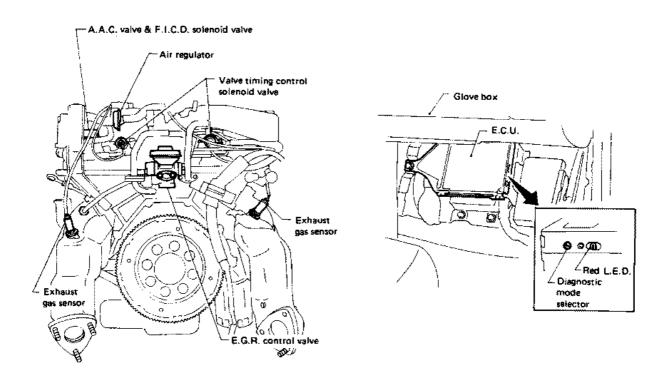


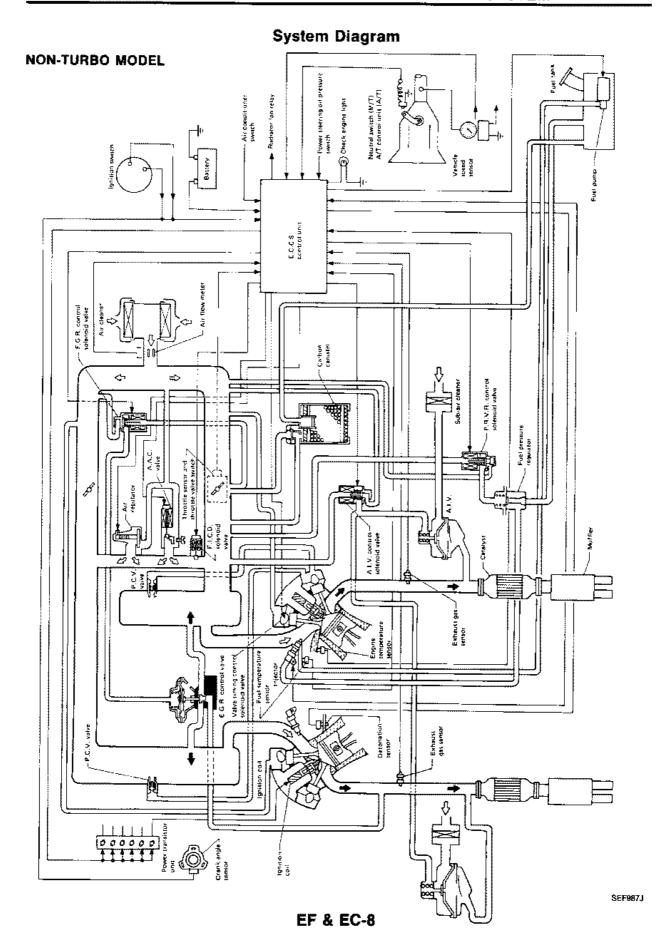


E.C.C.S. Component Parts Location (Cont'd)

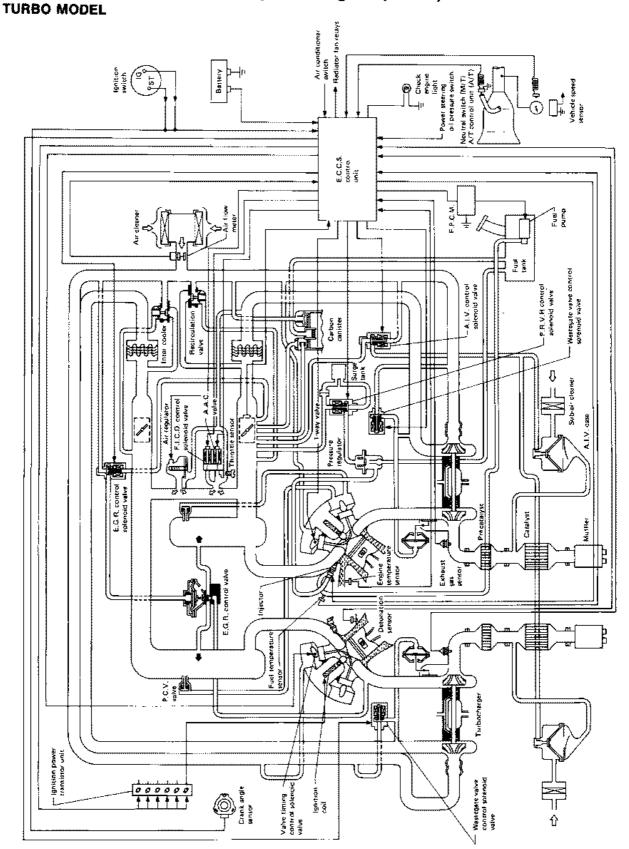
TURBO MODEL







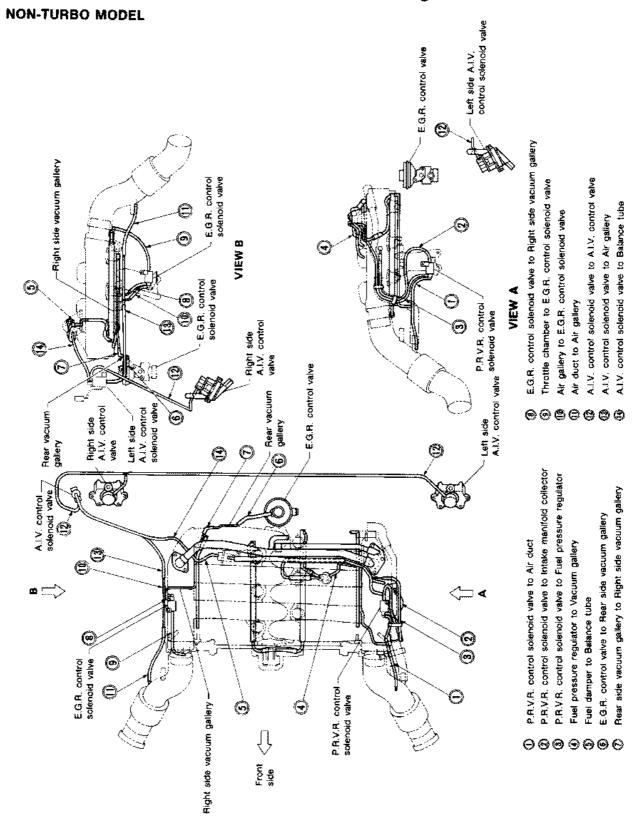
System Diagram (Cont'd)

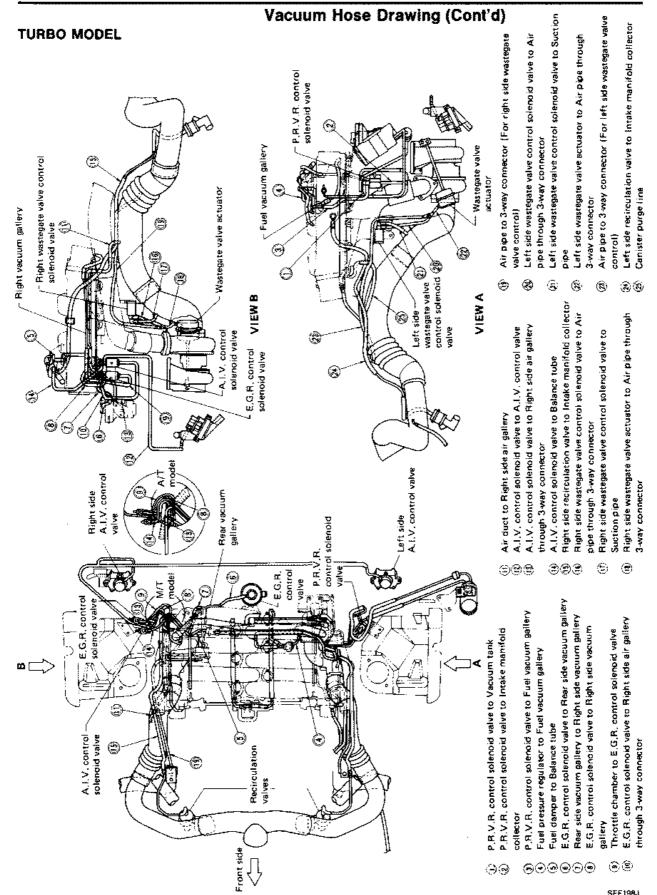


System Chart Crank angle sensor Fuel injection & Injectors mixture ratio control Air flow meter Ignition timing control Power transistors Engine temperature sensor Auxiliary air control (A.A.C.) Exhaust gas sensors Idle speed control valve, F.I.C.D. solenoid valve and Air regulator Ignition switch E.G.R. control solenoid valve E.G.R. control Throttle valve switch (Idle position) A.I.V. control A.I.V. control solenoid valve Throttle sensor Neutral switch/A/T control unit E.C.C.S. (Gear position) control Valve timing control V.T.C. solenoid valves unit Vehicle speed sensor Fuel pump and Fuel pump control Air conditioner switch Fuel pump control unit Check engine light Detonation sensor (On the instrument panel) or Exhaust gas sensor monitor & self-diagnosis Inspection lamp (On the control unit) Fuel temperature sensor Air conditioner relay Acceleration cut control Battery voltage Radiator fan control Power steering oil pressure switch Radiator fan control relay(s) P.R.V.R. control solenoid Pressure regulator control valve * Turbo model only *Wastegate valve control *Wastegate valve solenoid valves control

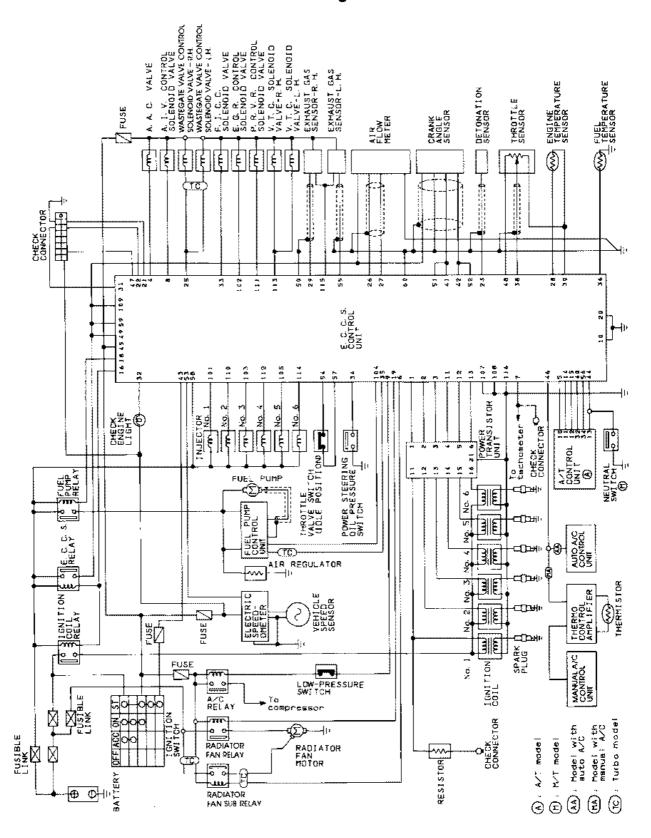
EF & EC-10

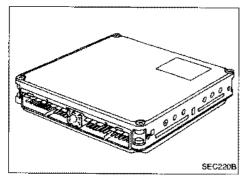
Vacuum Hose Drawing





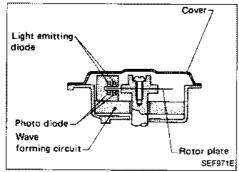
Circuit Diagram





E.C.C.S. Control Unit (E.C.U.)

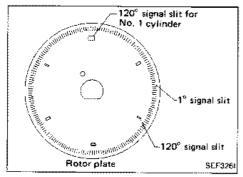
The E.C.U. consists of a microcomputer, an inspection lamp, a diagnostic mode selector, and connectors for signal input and output and for power supply. The unit controls the engine.



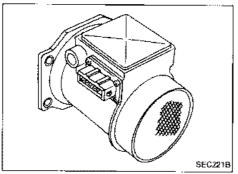
Crank Angle Sensor

The crank angle sensor is a basic component of the E.C.C.S. It monitors engine speed and piston position, and sends signals to the E.C.U. to control fuel injection, ignition timing and other functions.

The crank angle sensor has a rotor plate and a wave-forming circuit. The rotor plate has 360 slits for 1° signal and 6 slits for 120° signal. Light Emitting Diodes (L.E.D.) and photo diodes are built in the wave-forming circuit.



When the rotor plate passes between the L.E.D. and the photo diode, the slits in the rotor plate continually cut the light being transmitted to the photo diode from the L.E.D. This generates rough-shaped pulses which are converted into on-off pulses by the wave-forming circuit, which are sent to the E.C.U.

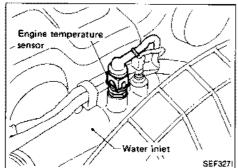


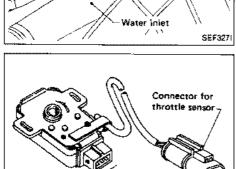
Air Flow Meter

The air flow meter measures the intake air flow rate by measuring a part of the entire flow. Measurements are made in such a way that the E.C.U. receives electrical output signals varied by the amount of heat emitting from the hot film placed in the stream of the intake air.

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

Therefore, it is necessary to supply the hot film with more electric current in order to maintain the temperature of the hot film. The E.C.U. detects the air flow by means of this current change.





Cannector for

hard idle switch

SEF286D

Engine Temperature Sensor

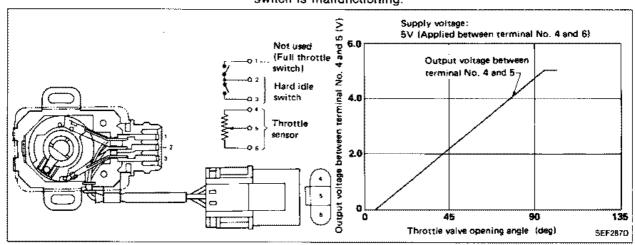
The engine temperature sensor, located on the top of water inlet housing, detects engine coolant temperature and transmits a signal to the E.C.U.

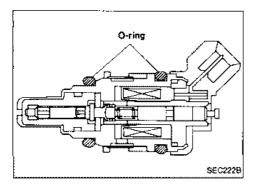
The temperature sensing unit employs a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the temperature rise.

Throttle Sensor & Soft/Hard Idle Switch

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

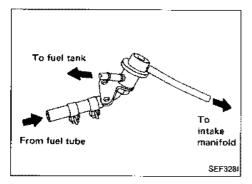
Idle position of the throttle valve is determined by the E.C.U. receiving the signal from the throttle sensor. This system is called "soft idle switch". It controls engine operation such as fuel cut. On the other hand, "hard idle switch", which is built in the throttle sensor unit, is used for engine control when soft idle switch is malfunctioning.





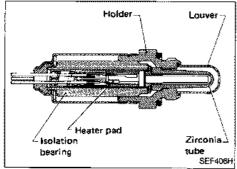
Fuel Injector

The fuel injector is a small, elaborate solenoid valve. As the E.C.U. sends injection signals to the injector, the coil in the injector pulls the needle valve back and fuel is released into the intake manifold through the nozzle. The injected fuel is controlled by the E.C.U. in terms of injection pulse duration.



Pressure Regulator

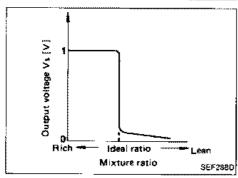
The pressure regulator maintains the fuel pressure at 299.1 kPa (2.991 bar, 3.05 kg/cm², 43.4 psi). Since the injected fuel amount depends on injection pulse duration, it is necessary to maintain the pressure at the above value.



Exhaust Gas Sensor

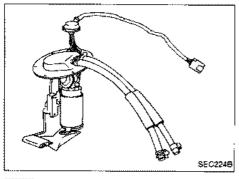
The exhaust gas sensor, which is placed into the exhaust outlet, monitors the amount of oxygen in the exhaust gas.

The sensor has a closed-end tube made of ceramic zirconia. The outer surface of the tube is exposed to exhaust gas, and the inner surface to atmosphere. The zirconia of the tube compares the oxygen density of exhaust gas with that of atmosphere, and generates electricity. In order to improve generating power of the zirconia, its tube is coated with platinum. The voltage is approximately 1V in a richer condition of the mixture ratio than the ideal air-fuel ratio, while approximately 0V in leaner conditions. The radical change from 1V to 0V occurs at around the ideal mixture ratio. In this way, the exhaust gas sensor detects the amount of oxygen in the exhaust gas and sends the signal of approximately 1V or 0V to the E.C.U. A heater is used to activate the sensor.



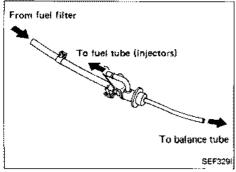
Fuel Pump

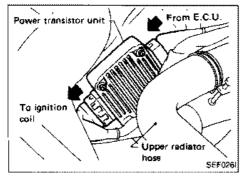
The fuel pump is an in-tank type with a fuel damper. Both the pump and damper are located in the fuel tank.



Fuel Damper

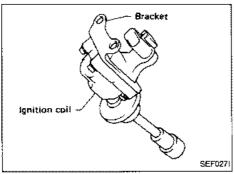
The fuel damper, which consists of a diagram, reduces fuel pressure pulsation in the fuel feed line between the fuel filter and injectors.





Power Transistor Unit & Ignition Coil

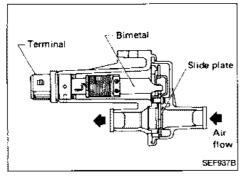
The ignition signal from the E.C.U. is amplified by the power transistor, which turns the ignition coil primary circuit on and off, inducing the proper high voltage in the secondary circuit. The ignition coil is a small, molded type.



Air Regulator

The air regulator provides an air by-pass when the engine is cold for a fast idle during warm-up.

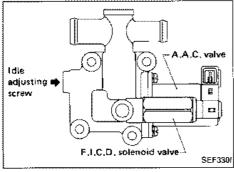
A bimetal, heater and rotary shutter are built into the air regulator. When the bimetal temperature is low, the air by-pass port opens. As the engine starts and electric current flows through a heater, the bimetal begins to turn the shutter to close the by-pass port. The air passage remains closed until the engine stops and the bimetal temperature drops.



Idle Air Adjusting (I.A.A.) Unit

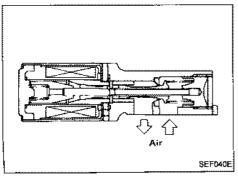
The I.A.A. unit is made up of the A.A.C. valve, F.I.C.D. solenoid valve and idle adjust screw. It receives the signal from the E.C.U. and controls the idle speed at the preset value.

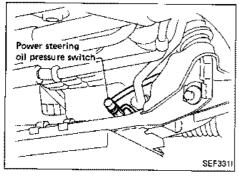
The F.I.C.D. solenoid valve compensates for changes in idle speed caused by the operation of the air compressor.



Auxiliary Air Control (A.A.C.) Valve

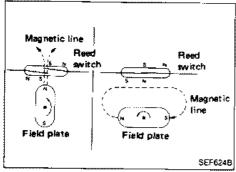
The E.C.U. actuates the A.A.C. valve by an ON/OFF pulse. The longer that ON duty is left on, the larger the amount of air that will flow through the A.A.C. valve.





Power Steering Oil Pressure Switch

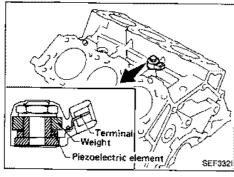
The power steering oil pressure switch is attached to the power steering high-pressure tube and detects the power steering load, sending the load signal to the E.C.U. The E.C.U. then sends the idle-up signal to the A.A.C. valve.



Vehicle Speed Sensor

The vehicle speed sensor provides a vehicle speed signal to the E.C.U.

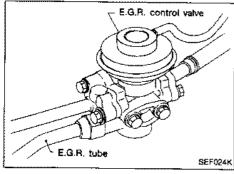
The speed sensor consists of a reed switch, which is installed in the speedometer unit and transforms vehicle speed into a pulse signal.



Detonation Sensor

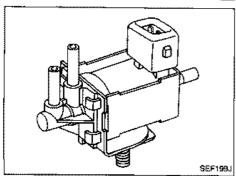
The detonation sensor is attached to the cylinder block and senses engine knocking conditions.

A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. This vibrational pressure is then converted into a voltage signal which is sent to the E.C.U.



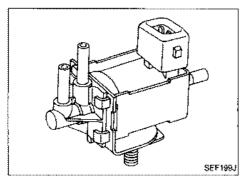
E.G.R. Control Valve

The E.G.R. control valve controls the quantity of exhaust gas to be diverted to the intake manifold through vertical movement of a taper valve connected to the diaphragm. Vacuum is applied to the diaphragm in response to the opening of the throttle valve.



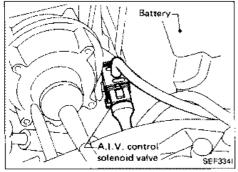
E.G.R. Control Solenoid Valve

The solenoid valve responds to the ON/OFF signal from the E.C.U. When it is off, a vacuum signal from the throttle chamber is fed into the E.G.R. control valve. When the control unit sends an ON signal, the coil pulls the plunger downward and cuts the vacuum signal.



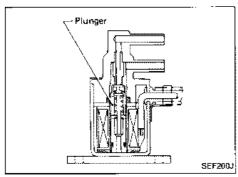
Pressure Regulator Vacuum Relief (P.R.V.R.) Control Solenoid Valve

The solenoid valve responds to the ON/OFF signal from the E.C.U. When it is off, a vacuum signal from the intake manifold is fed into the pressure regulator. When the control unit sends an ON signal, the coil pulls the plunger downward and cuts the vacuum signal.



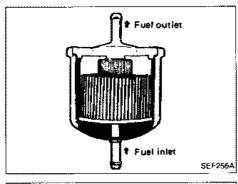
A.I.V. Control Solenoid Valve

The solenoid valve responds to the ON/OFF signal from the E.C.U. When it is ON, a vacuum signal from the intake manifold is fed into the A.I.V. control valve. When the control unit sends an OFF signal, the coil pulls the plunger downward and cuts the vacuum signal.



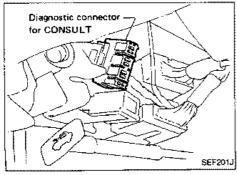
Wastegate Valve Control Solenoid Valve

The solenoid valve responds to the ON/OFF signal from the E.C.U. When it is ON, a vacuum signal from the suction pipe or compressor outlet is fed into the wastegate valve actuator. The actuator is hard to open at this time. When the control unit sends an OFF signal, the coil pulls the plunger upward and cuts the route to the suction pipe.



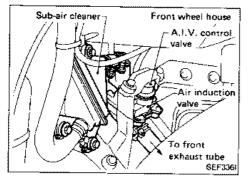
Fuel Filter

The specially designed fuel filter has a metal case in order to withstand high fuel pressure.



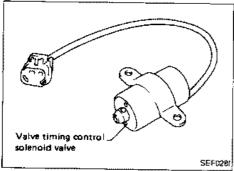
Diagnostic Connector for CONSULT

The diagnostic connector for CONSULT is located above the hood release handle.



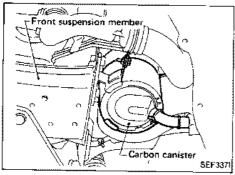
Air Induction Valve (A.I.V.)

The air induction valve sends secondary air to the exhaust manifold, using a vacuum created by exhaust pulsation in the exhaust manifold. When the exhaust pressure is below atmospheric pressure (negative pressure), secondary air is sent to the exhaust manifold. When the exhaust pressure is above atmospheric pressure, the reed valves prevent secondary air from being sent back to the sub-air cleaner.



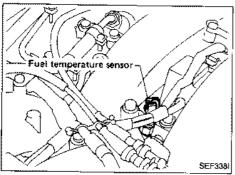
Valve Timing Control (V.T.C.) Solenoid Valve

The valve timing control solenoids are installed at the rear end of the intake camshafts, and control oil pressure which regulates the position of the intake camshafts.



Carbon Canister

The carbon canister is filled with active charcoal to absorb evaporative gases produced in the fuel tank. These absorbed gases are then delivered to the intake manifold by manifold vacuum for combustion purposes.

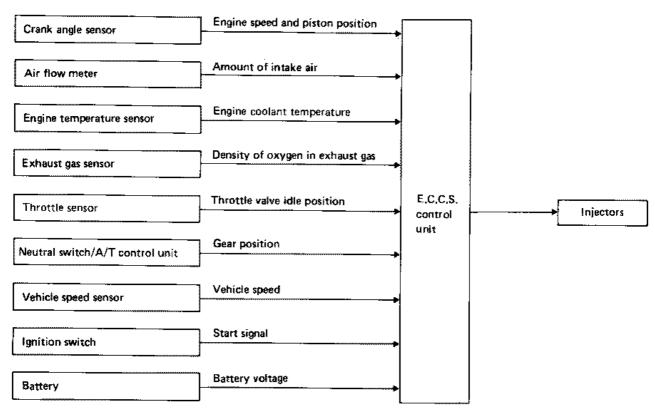


Fuel Temperature Sensor

The fuel temperature sensor, built into the fuel tube, senses fuel temperature. When the fuel temperature is higher than specified, the E.C.C.S. control unit turns the P.R.V.R. control solenoid valve ON and raises fuel pressure.

Fuel Injection Control

INPUT/OUTPUT SIGNAL LINE



BASIC FUEL INJECTION CONTROL

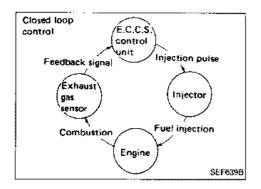
The amount of fuel injected from the fuel injector, or the length of time the valve remains open, is determined by the E.C.U. The basic amount of fuel injected is a program value mapped in the E.C.U. ROM memory. In other words, the program value is preset by engine operating conditions determined by input signals (for engine rpm and air intake) from both the crank angle sensor and the air flow meter.

VARIOUS FUEL INJECTION INCREASE/DECREASE COMPENSATION

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

< Fuel increase >

- 1) During warm-up
- 2) When starting the engine
- 3) During acceleration
- 4) Hot-engine operation
- < Fuel decrease >
- 1) During deceleration



Fuel Injection Control (Cont'd) MIXTURE RATIO FEEDBACK CONTROL

The mixture ratio feedback system is used for precise control of the mixture ratio to the stoichiometric point, so that the three-way catalyst can reduce CO, HC and NOx emissions. This system uses an exhaust gas sensor in the exhaust manifold to check the air-fuel ratio. The control unit adjusts the injection pulse width according to the sensor voltage so the mixture ratio will be within the range of the stoichiometric air-fuel ratio.

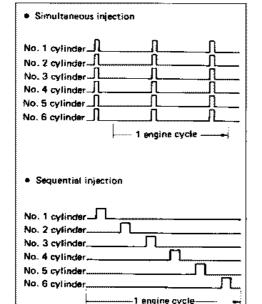
This stage refers to the closed-loop control condition. The open-loop control condition refers to that under which the E.C.U. detects any of the following conditions and feedback control stops in order to maintain stabilized fuel combustion.

- Deceleration
- 2) High-load, high-speed operation
- 3) Engine idling
- 4) Malfunction of exhaust gas sensor or its circuit
- Insufficient activation of exhaust gas sensor at low engine temperature
- Engine starting

MIXTURE RATIO SELF-LEARNING CONTROL

The mixture ratio feedback control system monitors the mixture ratio signal transmitted from the exhaust gas sensor. This feedback signal is then sent to the E.C.U. to control the amount of fuel injection to provide a basic mixture ratio as close to the theoretical mixture ratio as possible. However, the basic mixture ratio is not necessarily controlled as originally designed. This is due to manufacturing errors (e.g., air flow meter hot wire) and changes during operation (injector clogging, etc.) of E.C.C.S. parts which directly affect the mixture ratio.

Accordingly, a difference between the basic and theoretical mixture ratios is monitored in this system. It is then computed in terms of "fuel injection duration" to automatically compensate for the difference between the two ratios.



FUEL INJECTION TIMING

Two types of fuel injection systems are used — simultaneous injection and sequential injection. In the former, fuel is injected into all six cylinders simultaneously twice each engine cycle. In other words, pulse signals of the same width are simultaneously transmitted from the E.C.U. to the six injectors two times for each engine cycle.

In the sequential injection system, fuel is injected into each cylinder during each engine cycle according to the firing order. When engine is starting, fuel is injected into all six cylinders simultaneously twice per cycle.

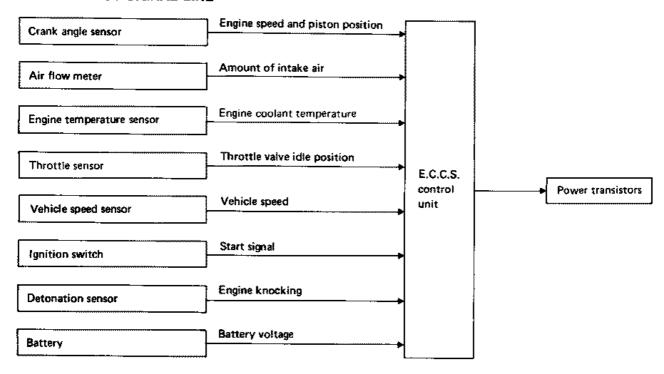
SEC2548

Fuel Injection Control (Cont'd) FUEL SHUT-OFF

Fuel to each cylinder is cut off during deceleration or high-speed operation.

Ignition Timing Control

INPUT/OUTPUT SIGNAL LINE



Ignition Timing Control (Cont'd)

SYSTEM DESCRIPTION

The ignition timing is controlled by the E.C.U. in order to maintain the best air-fuel ratio in response to every running condition of the engine. The ignition timing data is stored in the ROM located in the E.C.U. This data forms the map shown below.

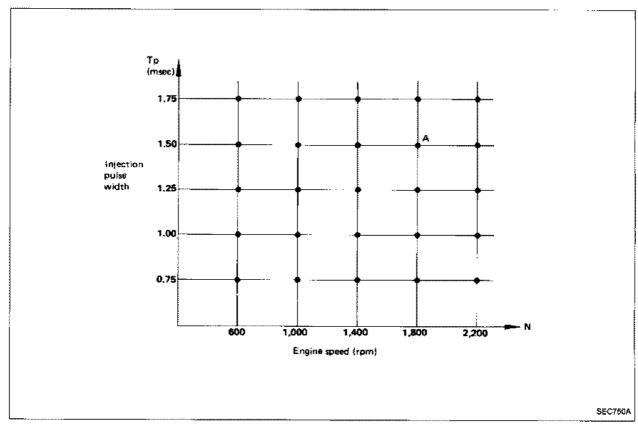
The E.C.U. detects information such as the injection pulse width and crank angle sensor signal which varies every moment. Then responding to this information, ignition signals are transmitted

to the power transistor.

e.g. N: 1,800 rpm, Tp: 1.50 msec A *B.T.D.C.

In addition to this,

- 1) At starting
- 2) During warm-up
- 3) At idle
- 4) At low battery voltage the ignition timing is revised by the E.C.U. according to the other data stored in the ROM.

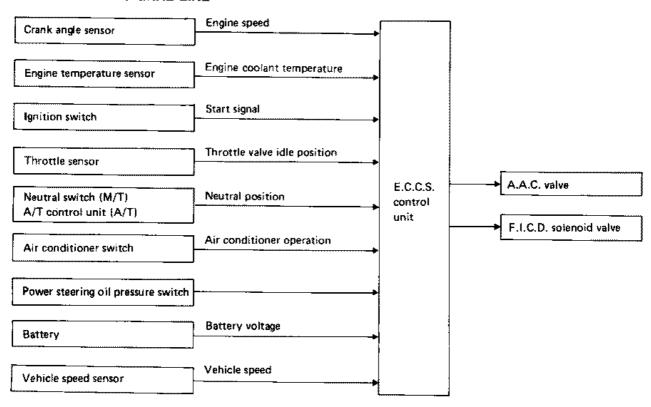


The retard system, actuated by the detonation sensor, is designed only for emergencies. The basic ignition timing is pre-programmed within the anti-knocking zone, even if recommended fuel is used under dry conditions. Consequently, the retard system does not operate under normal driving conditions.

However, if engine knocking occurs, the detonation sensor monitors the condition and the signal is transmitted to the E.C.C.S. control unit. After receiving it, the control unit retards the ignition timing to eliminate the knocking condition.

Idle Speed Control

INPUT/OUTPUT SIGNAL LINE



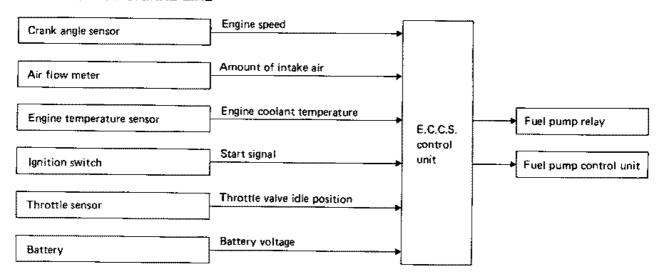
SYSTEM DESCRIPTION

This system automatically controls engine idle speed to a specified level. Idle speed is controlled through fine adjustment of the amount of air which by-passes the throttle valve via A.A.C. valve. The A.A.C. valve repeats ON/OFF operation according to the signal sent from the E.C.U. The crank angle sensor detects the actual engine speed and sends a signal to the E.C.U. The E.C.U.

then controls the ON/OFF time of the A.A.C. valve so that engine speed coincides with the target value memorized in ROM. The target engine speed is the lowest speed at which the engine can operate steadily. The optimum value stored in the ROM is determined by taking into consideration various engine conditions, such as noise and vibration transmitted to the vehicle interior, fuel consumption, and engine load.

Fuel Pump Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

Fuel pump and air regulator ON-OFF control

The E.C.U. activates the fuel pump for several seconds after the ignition switch is turned on to improve engine start-up. If the E.C.U. receives a 1° signal from the crank angle sensor, it knows that the engine is rotating, and causes the pump to activate. If the 1° signal is not received when the ignition switch is on, the engine stalls. The E.C.U. stops pump operation and prevents battery discharging, thereby improving safety. The E.C.U. 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 1 second |
| Engine running and cranking | Operates |
| When engine is stopped | Stops in 1.5 seconds |
| Except as shown above | Stops |

Fuel pump voltage control

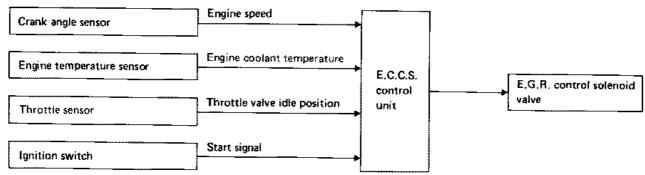
The fuel pump is controlled by the fuel pump control unit adjusting the voltage supplied to the fuel pump.

| Condition | Supplie | d voltage |
|---|-----------------|-----------------|
| | Turbo model | Non-turbo mode |
| 1 second after ignition switch is turned ON Engine cranking 30 (*NA)/5 (**TC) seconds after engine start [above 50°C (122°F)] Engine temperature below 10°C (50°F) Engine is running under heavy load | Battery voltage | Battery voltage |
| Engine is running under middle load | Approx. 7V | Battery voltage |
| ● Except the above | Approx. 6V | Approx. 8V |

^{*}NA: Non-turbo model **TC: Turbo model

E.G.R. (Exhaust Gas Recirculation) Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

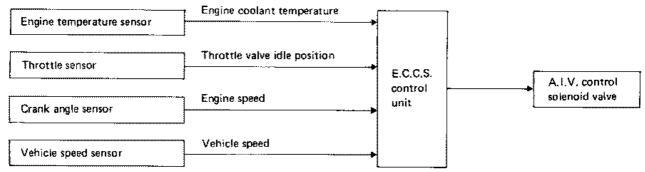
In addition, a system is provided which precisely cuts and controls port vacuum applied to the E.G.R. valve to suit engine operating conditions. This cut-and-control operation is accomplished through the E.C.U. When the E.C.U. detects any of the following conditions, current flows through the solenoid valve in the E.G.R. control vacuum line.

This causes the port vacuum to be discharged into the atmosphere so that the E.G.R. control valve remains closed.

- 1) Low engine temperature
- 2) Engine starting
- 3) High-speed engine operation
- 4) Engine idling
- 5) Excessively high engine temperature

Air Induction Valve (A.I.V.) Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

The air induction system is designed to send secondary air to the exhaust manifold, utilizing the vacuum caused by exhaust pulsation in the exhaust manifold.

The exhaust pressure in the exhaust manifold usually pulsates in response to the opening and closing of the exhaust valve and decreases below atmospheric pressure periodically.

If a secondary air intake pipe is opened to the

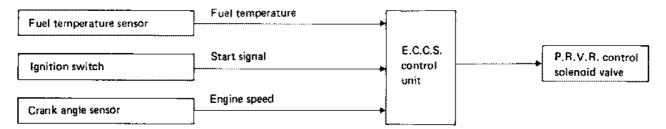
atmosphere under vacuum conditions, secondary air can be drawn into the exhaust manifold in proportion to the vacuum.

The air induction valve is controlled by the E.C.C.S. control unit, corresponding to the engine temperature. When the engine is cold, the A.I.V. control system operates to reduce HC and CO. This system also operates during deceleration for the purpose of blowing off water around the air induction valve.

| Engine condition | Engine coolant temperature °C (°F) | Vehicle speed km/h (MPH) | A.I.V. control solenoid valve | A.I.V. control system |
|---------------------------|---------------------------------------|-----------------------------|-------------------------------|--------------------------|
| Throttle valve is at idle | Below 64 (147) | Any condition | | |
| position | Above 65 (149) | Below 24 (15) | ON | Operates |

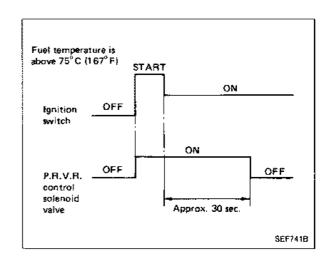
Fuel Pressure Regulator Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

The fuel "pressure-up" control system briefly increases fuel pressure for improved starting performance of a hot engine. Under normal operating conditions, manifold vacuum is applied to the fuel pressure regulator. When starting the engine, however, the E.C.U. allows current to flow through the ON/OFF solenoid valve in the control vacuum line, opening this line to the atmosphere. As a result, atmospheric pressure is applied, restricting the fuel return line so as to increase fuel pressure.



Acceleration Cut Control

INPUT/OUTPUT SIGNAL LINE

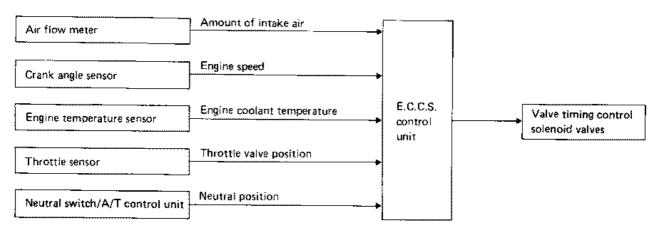


SYSTEM DESCRIPTION

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

Valve Timing Control

INPUT/OUTPUT SIGNAL LINE

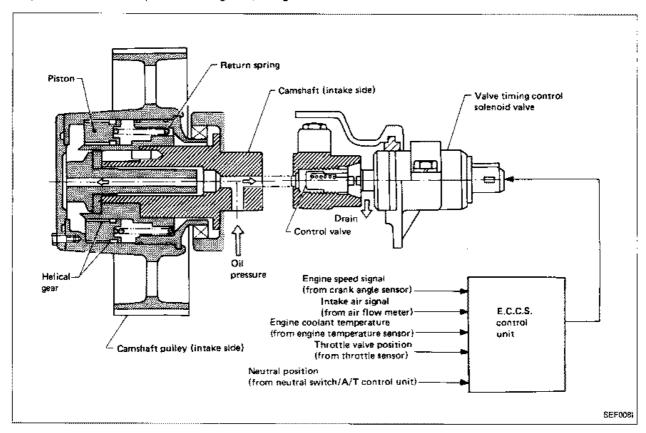


SYSTEM DESCRIPTION

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 E.C.U. Engine coolant temperature signals, engine

speed, amount of intake air, throttle valve position and gear position are used to determine intake valve timing.

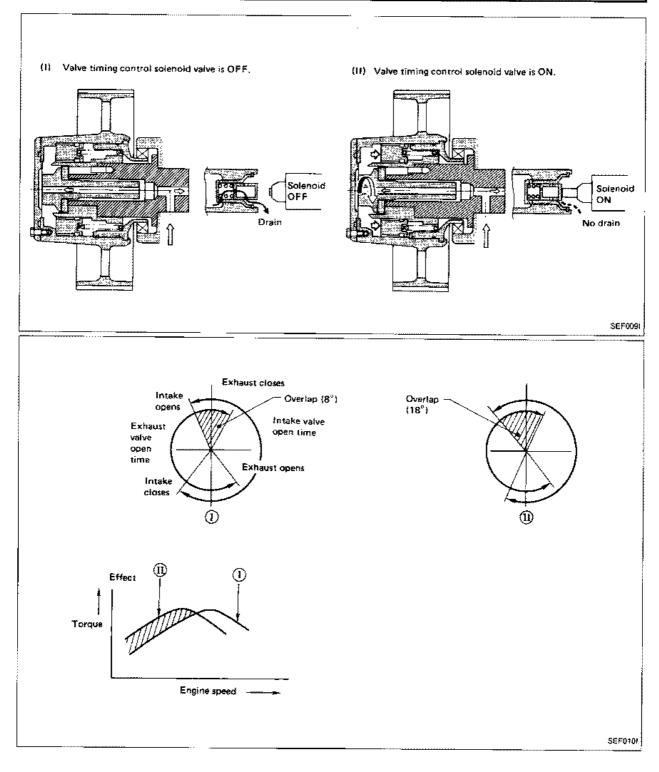
The intake camshaft pulley position is regulated by oil pressure, which is controlled by the valve timing control solenoid valve.



Valve Timing Control (Cont'd)

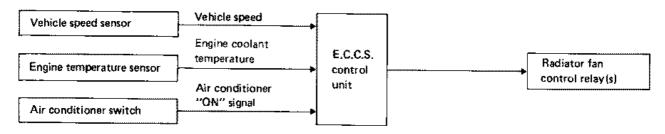
OPERATION

| Engine operating condition | Valve timing control solenoid valve | Intake valve opening and closing time | Valve overlap | Engine torque curve |
|----------------------------|-------------------------------------|---------------------------------------|---------------|---------------------|
| Idling, high speed | OFF | Retard | Decreased | 1 |
| Low to medium speed | ON | Advance | Increased | (1) |



Radiator Fan Control

INPUT/OUTPUT SIGNAL LINE



The E.C.U. controls the radiator fan corresponding to the vehicle speed, engine temperature, and air conditioner ON signal. The non-turbo model has 2-step control [ON (HIGH)/OFF], and the turbo model 3-step control [HIGH/LOW/OFF].

OPERATION

[Non-turbo model]

Air conditioner switch is "OFF"

| Engine coolant temperature °C (°F) | Radiator fan |
|------------------------------------|--------------|
| Below 104 (219) | OFF |
| Above 105 (221) | ON |

[Turbo model] Air conditioner switch is "OFF"

| Engine coolant temperature °C (°F) | Radiator fan |
|------------------------------------|--------------|
| Below 104 (219) | OFF |
| Above 105 (221) | ON |

Air conditioner switch is "ON"

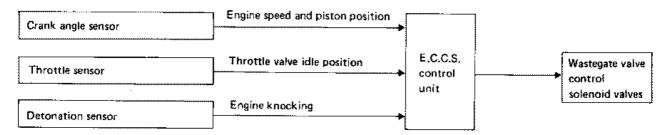
| Vehicle speed km/ħ (MPH) | Engine coolant temperature °C (°F) | Radiator fan |
|-----------------------------|--|-----------------|
| | Below 94 (201) | OFF |
| Below 39 (24) | Above 95 (203) | ON (HIGH) |
| | Below 104 (219) | OFF |
| Above 40 (25) | Above 105 (221) | ON (HIGH) |

Air conditioner switch is "ON"

| Vehicle speed km/h (MPH) | Engine coolant temperature °C (°F) | Radiator fan |
|-----------------------------|--|-----------------|
| Below 39 (24) | Below 89 (192) | OFF |
| | Between 90 (194) and 99 (210) | LOW |
| | Above 100 (212) | HIGH |
| Above 40 (25) | Below 104 (219) | OFF |
| | Above 105 (221) | HIGH |

Wastegate Valve Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

The wastegate valve control solenoid valve changes the source vacuum which activates the actuator. This results in a suitable turbo-pressure.

When detonation signs are detected, which means a low octane fuel is being used, the solenoid valve turns OFF, and turbocharger pressure becomes low.

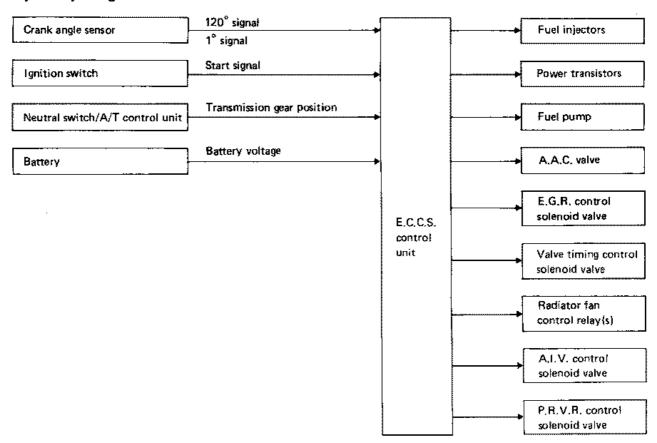
OPERATION

| Engine condition | Wastegate valve control solenoid valves | Wastegate valve actua- tors | Turbocharger pressure |
|--|---|--|--------------------------|
| Engine running or cranking Throttle sensor output voltage: more than 0.1V Judged fuel quality: high octane (Detecting no sign of detonation) | ON | Lead to suction pipe or turbocharger compressor outlet | HIGH |
| ● Except the above | OFF | Lead to turbocharger compressor outlet | LOW |

Fail-safe System

C.P.U. MALFUNCTION OF E.C.U.

Input/output signal line



Outline

The fail-safe system makes engine starting possible if there is something malfunctioning in the E.C.U.'s C.P.U. circuit.

In former models, engine starting was difficult under the previously mentioned conditions. But with the provisions in this fail-safe system, it is possible to start the engine.

Fail-safe System (Cont'd)

Fall-safe system activating condition when E.C.U. is malfunctioning

The fail-safe mode operation starts when the computing function of the E.C.U. is judged to be malfunctioning.

When the fail-safe system activates, i.e. if a malfunction condition is detected in the C.P.U. of the E.C.U., the CHECK ENGINE LIGHT on the instrument panel lights to warn the driver.

Engine control, with fail-safe system, operates when E.C.U. is malfunctioning

When the fail-safe system is operating, fuel injection, ignition timing, fuel pump operation, engine idle speed, E.G.R. operation, and so on are controlled under certain limitations.

Cancellation of fall-safe system when E.C.U. is malfunctioning

Activation of the fail-safe system is canceled each time the ignition switch is turned OFF. The system is reactivated if all of the activating conditions are satisfied after turning the ignition switch from OFF to ON.

AIR FLOW METER MALFUNCTION

If the air flow meter output voltage is above or below the specified value, the E.C.U. senses an air flow meter malfunction. In case of a malfunction, the throttle sensor substitutes for the air flow meter.

Although the air flow meter is malfunctioning, it is possible to start the engine and drive the vehicle. But engine speed will not rise more than 2,400 rpm in order to inform the driver of fail-safe system operation while driving.

Operation

| Engine condition | Starter switch | Fail-safe system | Fail-safe functioning |
|------------------|----------------|------------------|---|
| Stopped | ANY | Does not operate | |
| Cranking | ON | Operates | Engine will be started by a pre-determined in- lection pulse on E.C.U. |
| Running | OFF | | Engine speed will not rise above 2,400 rpm |

ENGINE TEMPERATURE SENSOR MAL-FUNCTION

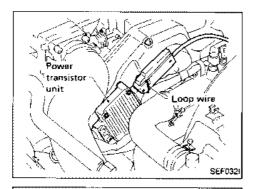
When engine temperature sensor output voltage is below or above the specified value, engine coolant temperature is fixed at the preset value as follows:

| Engine condition | Engine coolant temperature preset value °C (°F) |
|------------------|---|
| Start | 20 (68) |
| Running | 80 (176) |

FUEL TEMPERATURE SENSOR MALFUNCTION

When fuel temperature sensor output voltage is below or above the specified value, fuel temperature is fixed at the preset value as follows:

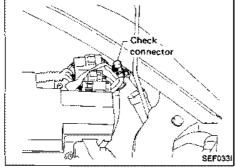
| Engine condition | Fuel temperature preset value °C (°F) |
|------------------|--|
| Start | 20 (68) |
| Running | 80 (176) |
| | |



Direct Ignition System CHECKING IDLE SPEED AND IGNITION TIMING Idle speed

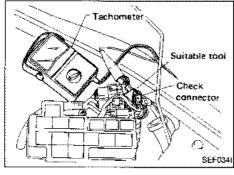
Method A (With pulse type tachometer)

Clamp loop wire as shown.

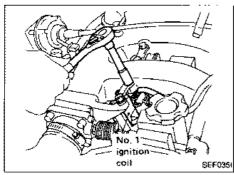


Method B (With voltage type tachometer)

 Disconnect check connector (Harness color: Y/R) for tachometer.

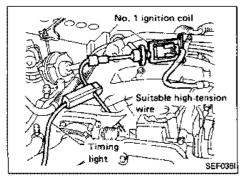


2. Connect tachometer using a suitable tool.



Ignition timing

- Method A (Without S.S.T.)
- 1. Remove No. 1 ignition coil.

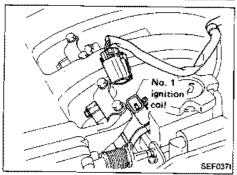


- Connect No. 1 ignition coil and No. 1 spark plug with a suitable high-tension wire as shown, and attach timing light clamp to this wire.
- 3. Check ignition timing.

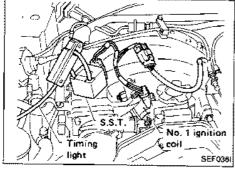
Suitable Electrode high-tension wire Approx. 12 (0.47) Approx. 30 (1.18) Approx. 14 (0.55) Unit: mm (in)

Direct Ignition System (Cont'd)

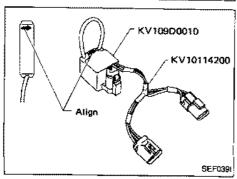
4. For above procedures, enlarge the end of a suitable high-tension wire with insulating tape as shown.



- Method B (With S.S.T.)
- 1. Disconnect connector of No. 1 ignition coil.



- 2. Connect S.S.T. and clamp wire with timing light as shown.
- 3. Check ignition timing.



Align direction marks on S.S.T. and timing light clamp if aligning mark is punched.

PREPARATION

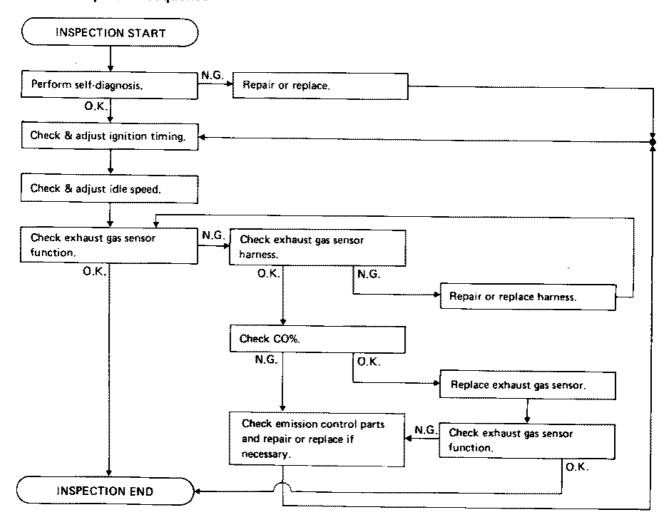
- Make sure that the following parts are in good order.
- Battery
- Ignition system
- Engine oil and coolant levels
- Fuses
- E.C.U. harness connector
- Vacuum hoses
- Air intake system (Oil filler cap, oil level gauge, etc.)
- Fuel pressure
- Engine compression
- · E.G.R. control valve operation
- Throttle valve
- 2. On air conditioner equipped models, checks

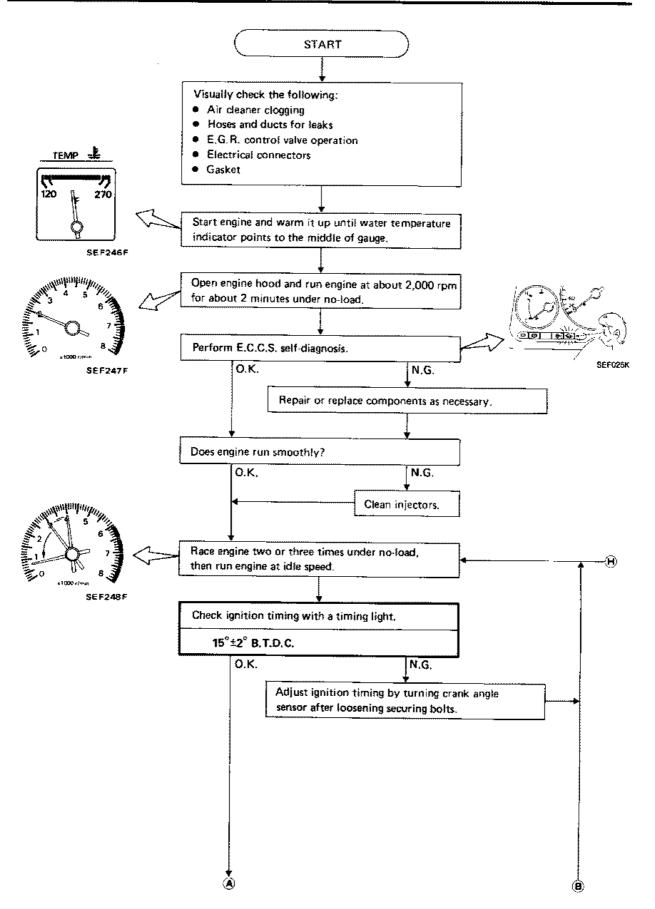
- should be carried out while the air conditioner is "OFF".
- On automatic transmission equipped models, when checking idle rpm, ignition timing and mixture ratio, checks should be carried out while shift lever is in "N" position.
- 4. When measuring "CO" percentage, insert probe more than 40 cm (15.7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

WARNING:

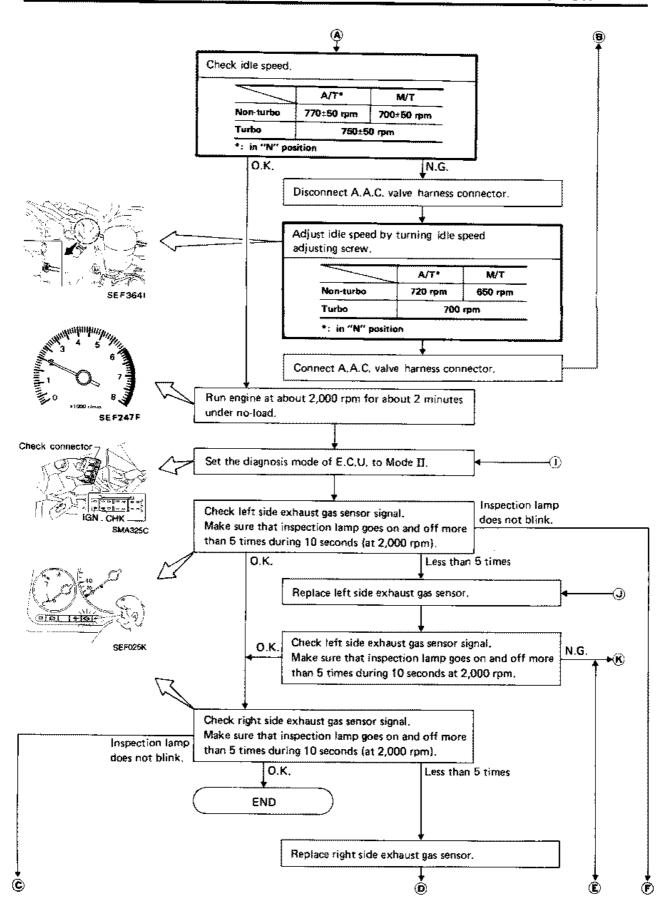
Apply parking brake and block both front and rear wheels with chocks.

Overall inspection sequence

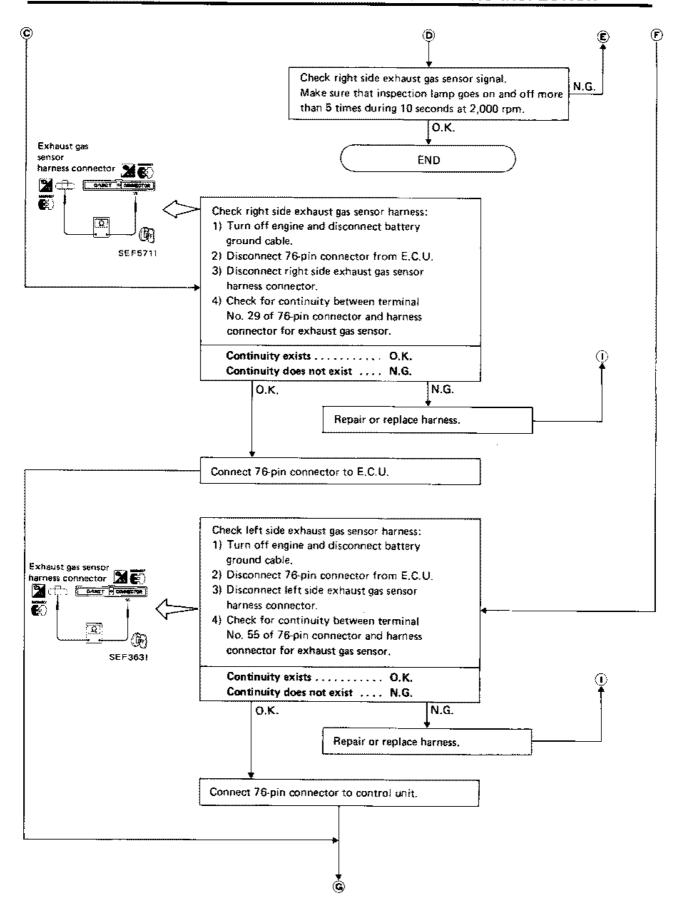




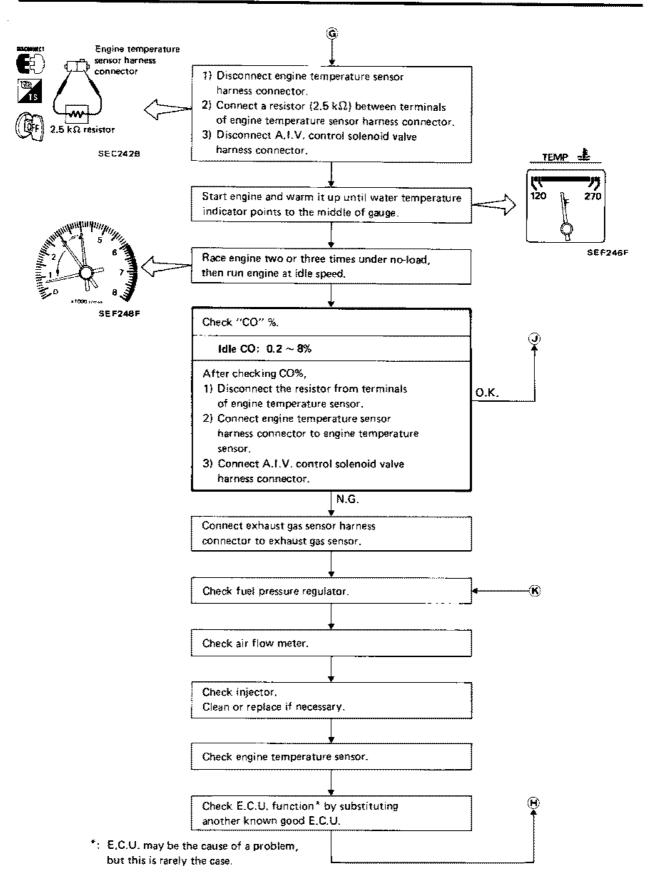
EF & EC-38



EF & EC-39



EF & EC-40

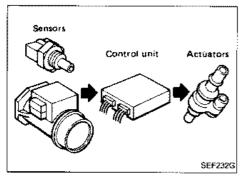


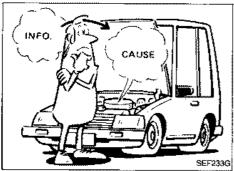
EF & EC-41

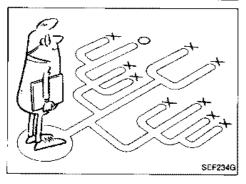
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How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

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

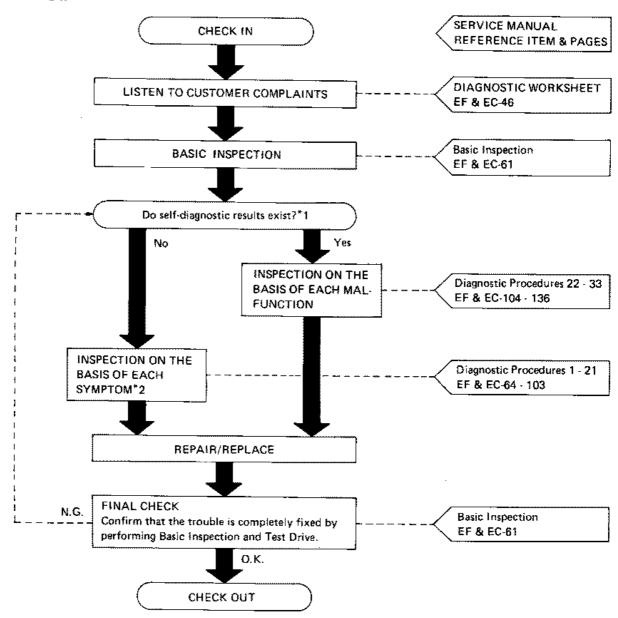
It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or improper wiring. In this case, careful checking of suspected circuits may help prevent the replacement of good parts.

A visual check only may not find the cause of the problems, so a road test with a circuit tester connected to a suspected circuit should be performed.

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a driveability complaint. The customer is a very good supplier of information on such problems, especially intermittent ones. Through interaction with the customer, find out what symptoms are present and under what conditions they occur.

Start your diagnosis by looking for "conventional" problems first. This is one of the best ways to troubleshoot driveability problems on an electronically controlled engine vehicle.

How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd) WORK FLOW



^{*1:} If the self-diagnosis cannot be performed, check main power supply and ground circuit. (See Diagnostic Procedure 22.)

^{*2:} If the trouble is not duplicated, see INTERMITTENT PROBLEM SIMULATION (EF & EC-47).

How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

KEY POINTS

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

DIAGNOSTIC WORKSHEET

There are many kinds of operating conditions that lead to malfunctions on engine components.

A good grasp of such conditions can make trouble-shooting faster and more accurate.

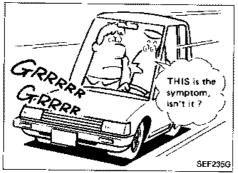
In general, feelings for a problem depend on each customer. It is important to fully understand the symptoms or under what conditions a customer complains.

Make good use of a diagnostic worksheet such as the one shown below in order to utilize all the complaints for troubleshooting.

Worksheet cample

| Customer name MR/MS | | Model & Year VIN |
|---------------------|----------------|--|
| Engine # | Trans. Mileage | |
| Incident Date | | Manuf. Date In Service Date |
| | ☐ 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 [|
| Symptoms | □ Idling | ☐ No fast idle ☐ Unstable ☐ High idle ☐ Low idle ☐ Others [] |
| оутрюн э | ☐ Driveability | ☐ Stumble ☐ Surge ☐ Detonation ☐ 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 occu | rrence | ☐ Just after delivery ☐ Recently ☐ In the morning ☐ At night ☐ In the daytime |
| Frequency | | ☐ All the time ☐ Under certain conditions ☐ Sometimes |
| Weather con | ditions | C Not affected |
| | Weather | ☐ Fine ☐ Raining ☐ Snowing ☐ Others [] |
| | Temperature | ☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ Humid *F |
| | | ☐ Cold ☐ During warm-up ☐ After warm-up |
| Engine condi | itions | Engine speed 2,000 4,000 6,000 8,000 rpm |
| Road condition | วกร | ☐ In town ☐ In suburbs ☐ Highway ☐ Off road (up/down) |
| Driving cond | itions | □ Not affected □ At starting □ While idling □ At racing □ While accelerating □ While cruising □ While decelerating □ While turning (RH/LH) Vehicle speed □ 1 □ 1 □ 1 □ 1 □ 1 □ 1 □ 1 □ 1 □ 1 □ |
| Check engine | —— ₃light | ☐ Turned on ☐ Not turned on |

How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

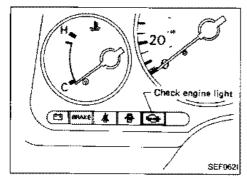


INTERMITTENT PROBLEM SIMULATION

In order to duplicate an intermittent problem, it is effective to create similar conditions for component parts, under which the problem might occur.

Perform the activity listed under Service procedure and note the result.

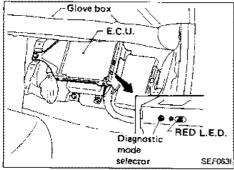
| $\overline{}$ | Variable factor | Influential part | Target condition | Service procedure |
|---------------|------------------------|---|-------------------------|--|
| 1 | Mixture ratio | Pressure regulator | Made lean | Remove vacuum hose and apply vacuum. |
| | | r ressure regulator | Made rich | Remove vacuum hose and apply pressure. |
| 2 | Ignition timina | Crank angle sensor | Advanced | Rotate distributor counterclockwise. |
| | | CIZIIN ZIIGIE SEIISOI | Retarded | Rotate distributor clockwise. |
| 3 | Mixture ratio feedback | Exhaust gas sensor | Suspended | Disconnect exhaust gas sensor harness con- nector. |
| | O THE O | Control unit | Operation check | Perform self-diagnosis (Mode II) at 2,000 rpm. |
| 4 | ldle speed | A.A.C. valve | Raised | Turn idle adjusting screw counterclockwise. |
| | Toto speed | A.A.O. Valve | Lowered | Turn idle adjusting screw clockwise. |
| | Electrical connection | arness connectors Poor electrical connec- | | Tap or wiggle. |
| 5 | (Electric continuity) | and wires | tion or improper wiring | Race engine rapidly. See if the torque reaction of the engine unit causes electric breaks. |
| | | | Cooled | Cool with an icing spray or similar device. |
| 6 | Temperature | Control unit | Warmed | Heat with a hair drier. [WARNING: Do not overheat the unit.] |
| 7 | Moisture | Electric parts | Damp | Wet. [WARNING: Do not directly pour water on components. Use a mist sprayer.] |
| 8 | Electric loads | Load switches | Loaded | Turn on headlamps, air conditioner, rear de- fogger, etc. |
| 9 | Idle switch condition | Control unit | ON-OFF switching | Rotate throttle sensor body. |
| 10 | Ignition spark | Timing light | Spark power check | Try to flash timing light for each cylinder using ignition coil adapter (S.S.T.). |



Self-diagnosis

CHECK ENGINE LIGHT

A check engine light has been adopted. This light blinks simultaneously with the RED L.E.D. on the E.C.U.

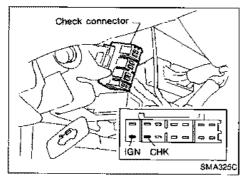


E.C.U. L.E.D.

in the E.C.U., the Green and Red L.E.D.'s have now been permanently changed to one RED L.E.D.

DIAGNOSTIC MODE SELECTOR

The diagnostic mode selector is on the side of the E.C.U.



CHECK CONNECTOR

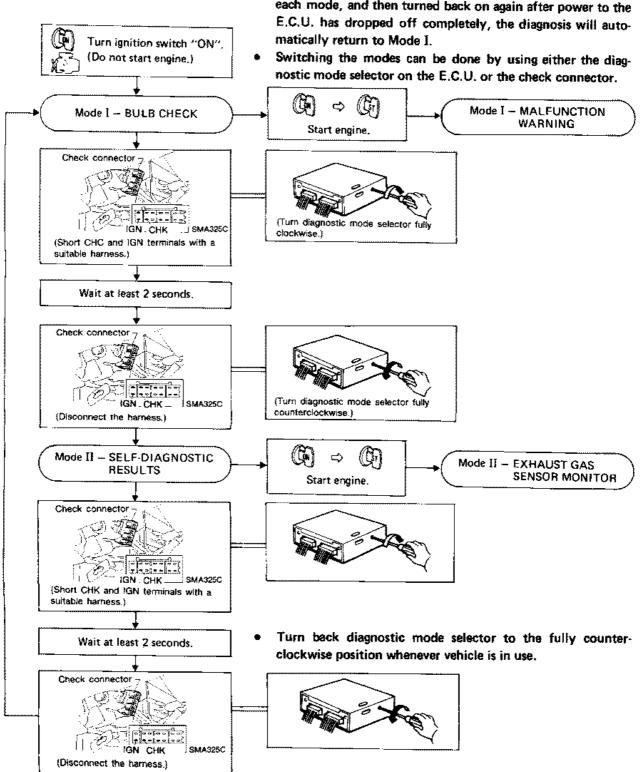
The check connector is under the driver's side dash.

SELF-DIAGNOSTIC FUNCTION

| Condition | Mode | Mode I | Mode II |
|-------------------------------------|----------------|------------------------|-------------------------------|
| Ignition switch in "ON" posi- | Engine stopped | BULB CHECK | SELF-DIAGNOSTIC RESULTS |
| tion (F) | Engine running | MALFUNCTION WARNING | EXHAUST GAS SENSOR MONITOR |

Self-diagnosis (Cont'd) HOW TO SWITCH MODES

- Switching the modes is not possible when the engine is running.
- When the ignition switch is turned off during diagnosis in each mode, and then turned back on again after power to the



EF & EC-49

Self-diagnosis — Mode I

MODE I --- BULB CHECK

In this mode, the RED L.E.D. in the E.C.U. and the CHECK ENGINE LIGHT in the instrument panel stay "ON". If either remain "OFF", check the bulb in the CHECK ENGINE LIGHT or the RED L.E.D.

MODE I --- MALFUNCTION WARNING

| CHECK ENGINE LIGHT and AED L.E.D. | Condition |
|---|---|
| | When the E.C.U.'s C.P.U. is malfunctioning. |
| OFF | О.К. |

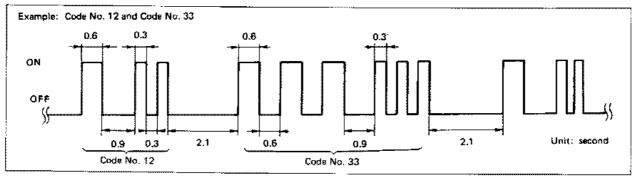
Self-diagnosis — Mode II (Self-diagnostic results)

CAUTION:

The mode selector on the E.C.U. must be returned to the fully counterclockwise position, except when switching the modes.

DESCRIPTION

In this mode, a malfunction code is indicated by the number of flashes from the RED L.E.D. or the CHECK ENGINE LIGHT 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 red L.E.D. flashes once for 0.6 seconds and then it flashes twice for 0.3 seconds. This indicates the number "12" and refers to a malfunction in the air flow meter. In this way, all the problems are classified by their code numbers.

Self-diagnosis — Mode II (Self-diagnostic results) (Cont'd) Display code table

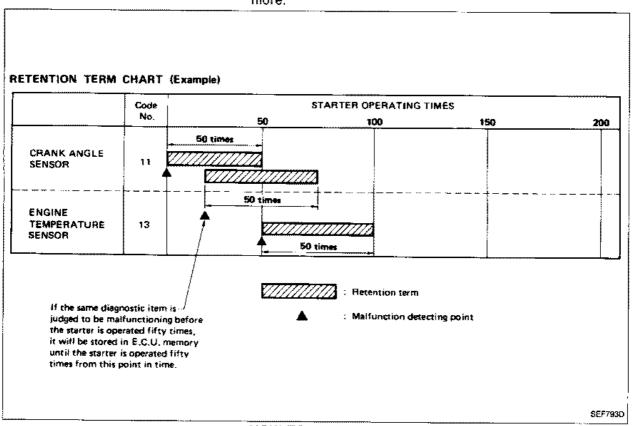
| Code No. | Detected items |
|------------|---|
| 11 | Crank angle sensor circuit |
| 12 | Air flow meter circuit |
| 13 | Engine temperature sensor circuit |
| 21 | Ignition signal circuit |
| 34 | Detonation sensor circuit |
| 42 | Fuel temperature sensor circuit |
| 43 | Throttle sensor circuit |
| 54 | Signal circuit from A/T centrol unit to E.C.U. (A/T only) |
| 5 5 | No malfunction in the above circuits |

| Code No. | Detected items | Malfunction is detected when | Check item (remedy) |
|----------|---|--|--|
| *11 | Crank angle sensor cir- cuit | Either 1° or 120° signal is not entered for the first few seconds during engine cranking. Either 1° or 120° signal is not input often enough while the engine speed is higher than the specified rpm. | Harness and connector (If harness and connector are normal, replace crank angle sensor.) |
| 12 | Air flow meter circuit | The air flow meter circuit is open or shorted. (An abnormally high or low voltage is entered.) | Harness and connector (if harness and connector are normal, replace air flow meter.) |
| 13 | Engine temperature sensor circuit | The engine temperature sensor circuit is open or shorted. (An abnormally high or low output voltage is en- tered.) | Harness and connector Engine temperature sensor |
| *21 | Ignition signal circuit | The ignition signal in the primary circuit is not entered during engine cranking or running. | Harness and connector Power transistor unit |
| 34 | Detonation sensor cir- cuit | The detonation circuit is open or shorted. (An abnormally high or low voltage is entered.) | Harness and connector Detonation sensor |
| 42 | Fuel temperature sen- sor circuit | The fuel temperature sensor circuit is open or shorted. (An abnormally high or low voltage is entered.) | Harness and connector Fuel temperature sensor |
| 43 | Throttle sensor circuit | The throttle sensor circuit is open or shorted. (An abnormally high or low voltage is entered.) | Harness and connector Throttle sensor |
| 54 | Signal circuit from A/T control unit to E.C.U. (A/T only) | The A/T communication line is open or shorted. | Harness and connector |

^{*:} Check items causing a malfunction of crank angle sensor circuit first, if both code No. 11 and 21 are displayed at the same time.

Self-diagnosis — Mode II (Self-diagnostic results) (Cont'd) RETENTION OF DIAGNOSTIC RESULTS

The diagnostic results will remain in E.C.U. memory until the starter is operated fifty times after a diagnostic item has been judged to be malfunctioning. The diagnostic result will then be cancelled automatically. If a diagnostic item which has been judged to be malfunctioning and stored in memory is again judged to be malfunctioning before the starter is operated fifty times, the second result will replace the previous one. It will be stored in E.C.U. memory until the starter is operated fifty times more.



HOW TO ERASE SELF-DIAGNOSTIC RESULTS

The malfunction code is erased from the backup memory on the E.C.U. when the diagnostic mode is changed from Mode II to Mode I. (Refer to "HOW TO SWITCH MODES".)

- When the battery terminal is disconnected, the malfunction code will be lost from the backup memory within 24 hours.
- Before starting self-diagnosis, do not erase the stored memory before beginning self-diagnosis.

Self-diagnosis — Mode II (Exhaust gas sensor monitor)

DESCRIPTION

In this mode, the CHECK ENGINE LIGHT and RED L.E.D. display the condition of the fuel mixture (lean or rich) which is monitored by the exhaust gas sensor.

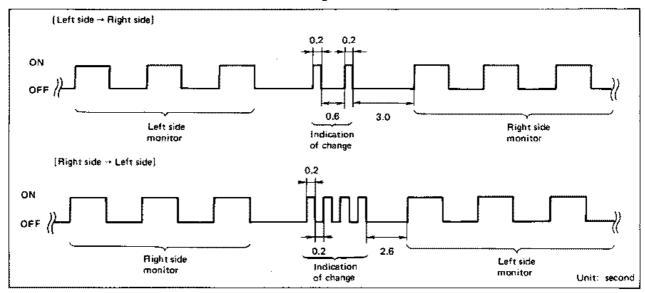
| CHECK ENGINE LIGHT and RED L.E.D. | Fuel mixture condition in the exhaust gas | Air fuel ratio feedback control condition | |
|--------------------------------------|---|---|--|
| ON | Lean | | |
| OFF | Rich | Closed loop control | |
| *Remains ON or OFF | Any condition | Open loop control | |

^{*:} Maintains conditions just before switching to open loop.

If two exhaust gas sensors (right side and left side) are fitted on the engine, the left side exhaust gas sensor monitor operates first, when selecting this mode.

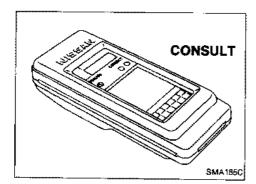
HOW TO CHANGE MONITOR FROM LEFT SIDE (Right side) TO RIGHT SIDE (Left side)

- 1. Turn diagnostic mode selector on E.C.U. fully clockwise.
- 2. Wait at least 2 seconds.
- Turn diagnostic mode selector on E.C.U. fully counterclockwise.
- These procedures should be carried out when the engine is running.



HOW TO CHECK EXHAUST GAS SENSOR

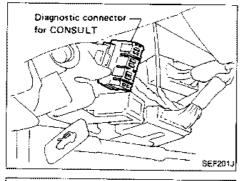
- Set Mode II. (Refer to "HOW TO SWITCH MODES".)
- 2. Start engine and warm it up until engine coolant temperature indicator points to the middle of the gauge.
- Run engine at about 2,000 rpm for about 2 minutes under no-load conditions.
- Make sure RED L.E.D. or CHECK ENGINE LIGHT goes ON and OFF more than 5 times every 10 seconds; measured at 2,000 rpm under no-load.



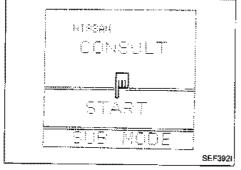
Consult

CONSULT INSPECTION PROCEDURE

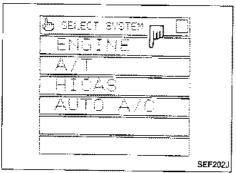
- 1. Turn off ignition switch.
- Connect "CONSULT" to diagnostic connector. (Diagnostic connector is located in left dash side panel.)



- Turn on ignition switch.
- 4. Touch "START",

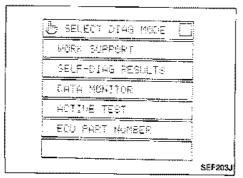


5. Touch "ENGINE".



Perform each diagnostic mode according to the inspection sheet as follows:

For further information, see the CONSULT Operation Manual.



Consult (Cont'd)

E.C.C.S. COMPONENT PARTS APPLICATION

| | MODE | WORK SUPPORT | SELF- DIAGNOS- TIC | DATA MONITOR | ACTIVE TEST | |
|--------------------------|---|---------------------|-----------------------|---------------------|-------------|--|
| E.C.C.S. COMPONENT PARTS | | | RESULTS | | ACTIVE TEST | |
| | Control unit (E.C.U.) | | × | | | |
| | Crank angle sensor | | X | x | | |
| | Air flow meter | | X | х | * | |
| | Engine temperature sensor | | X | х | Х | |
| | Exhaust gas sensors | | X* | x | | |
| | Vehicle speed sensor | | х• | x | | |
| | Throttle sensor | × | x | х | | |
| INPUT | Fuel temperature sensor | | X | X | | |
| | Detonation sensor | | × | | | |
| | Ignition switch (start signal) | | | х | | |
| | Air conditioner switch | | | х | | |
| | Neutral switch | | · · · · <u>-</u> | х | | |
| | Power steering oil pressure switch | | | х | | |
| | Battery | | | x | | |
| | A/T signat | | Х | х | | |
| • | Exhaust gas temperature sensor | | X* | X* | | |
| | Injectors | | . X* | х | Х | |
| | Power transistors (ignition signal) | X (ignition timing) | × | X (Ignition timing) | X | |
| | A.A.C. valve | х | | x | × | |
| | F.I.C.D. solenoid valve | | | × | X | |
| | Valve timing control solenoid valve | | | X | × | |
| | A.I.V. control solenoid valve | | | х | × | |
| OUTPUT | P.R.V.R. control solenoid valve | | X* | | × | |
| | E.G.R. control solenoid valve | | | Х | х | |
| | Wastegate valve control solenoid valves | | | х | | |
| | Air conditioner relay | | | × | | |
| | Fuel pump relay | x | | x | X | |
| | Radiator fan | | | х | X | |

X: Applicable *: U.S.A. model

Consult (Cont'd)

FUNCTION

| Diagnostic mode | Function | |
|-------------------------|--|--|
| Work support | This mode enables a technician to adjust some devices faster and more accurately by following the indications on the CONSULT unit. | |
| Self-diagnostic results | Self-diagnostic results can be read and erased quickly. | |
| Data monitor | Input/Output data in the control uni can be read. | |
| Active test | Mode in which CONSULT drives some actuators apart from the control units and also shifts some parameters in a specified range. | |
| E.C.U. part numbers | E.C.U. part number can be read. | |

WORK SUPPORT MODE

| WORK ITEM | CONDITION | USAGE |
|--------------------------------|---|--|
| THROTTLE SENSOR ADJUSTMENT | CHECK THE THROTTLE SENSOR SIGNAL. ADJUST IT TO THE SPECIFIED VALUE BY ROTATING THE SEN- SOR BODY UNDER THE FOLLOWING CONDITIONS. • IGN SW "ON" • ENG NOT RUNNING • ACC PEDAL NOT PRESSED | When adjusting throttle sensor initial position. |
| IGNITION TIMING ADJUSTMENT* | ◆ IGNITION TIMING FEEDBACK CONTROL WILL BE HELD BY TOUCHING "START". AFTER DOING SO, ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CRANK ANGLE SENSOR. | When adjusting initial ignition timing. |
| AAC VALVE ADJUSTMENT | SET ENGINE RPM 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. |

^{*:} The ignition timing feedback control is not adopted on model 300ZX, so it is not necessary to perform IGNITION TIMING ADJUSTMENT.

Consult (Cont'd)

SELF-DIAGNOSTIC RESULTS MODE

| DIAGNOSTIC ITEM | DIAGNOSTIC ITEM IS DETECTED WHEN | CHECK ITEM (REMEDY) |
|---------------------|--|--|
| CRANK ANGLE SENSOR* | Either 1° or 120° signal is not entered for the first few seconds during engine cranking. Either 1° or 120° signal is not input often enough while the engine speed is higher than the specified rpm. | Harness and connector (If harness and connector are normal, replace crank angle sensor.) |
| AIR FLOW METER | The air flow meter circuit is open or shorted. (An abnormally high or low voltage is entered.) | Harness and connector (if harness and connector are normal, replace air flow meter.) |
| ENGINE TEMP SENSOR | The engine temperature sensor circuit is open or shorted. (An abnormally high or low output voltage is en- tered.) | Harness and connector Engine temperature sensor |
| IGN SIGNAL-PRIMARY | The ignition signal in primary circuit is not entered during engine cranking or running. | Harness and connector Power transistor unit |
| CONTROL UNIT | E.C.U. calculation function is malfunctioning. | (Replace E.C.C.S. control unit.) |
| DETONATION SENSOR | The detonation circuit is open or shorted. (An abnormally high or low voltage is entered.) | Harness and connector Detonation sensor |
| FUEL TEMP SENSOR | The fuel temperature sensor circuit is open or shorted. (An abnormally high or low voltage is entered.) | Harness and connector Fuel temperature sensor |
| THROTTLE SENSOR | The throttle sensor circuit is open or shorted. (An abnormally high or low voltage is entered.) | Harness and connector Throttle sensor |
| A/T COMM LINE | The A/T communication line is open or shorted. | Harness and connector |

^{*:} Check items causing a malfunction of crank angle sensor circuit first, if both "CRANK ANGLE SENSOR" and "IGN SIGNAL—PRIMARY" are displayed at the same time.

Consult (Cont'd)

DATA MONITOR MODE

Remarks; • The monitor item marked "**" Is applicable to vehicles for the U.S.A. only.

Specification data are reference values.

Specification data are output/input values which are detected or supplied by E.C.U. at the connector.
 Specification data may not be directly related to their components signals/values/operations.

ie. Adjust ignition timing with a timing light before monitoring IGN TIMING, because the monitor may show the specification data in spite of the ignition timing being not adjusted to the specification data. This IGN TIMING monitors the calculated data by E.C.U. according to the input signals from crank angle sensor and other ignition timing related sensors.

| MONITOR ITEM | CON | DITION | ······ | ICATION | CHECK ITEM | |
|------------------|---|---|---------------------------------------|----------------------------|---|--|
| CAS-RPM (POS) | Tachometer: Connect | <u>, </u> | Non-turbo | Turbo | WHEN OUTSIDE SPEC. | |
| CAS-RPM (REF) | Run engine and compar with the CONSULT value | | | ame speed as ULT value. | Harness and connector Crank angle sensor | |
| AIR FLOW | Engine: After warming up, idle the engine A/C switch "OFF" | ldle | 0.8 - 1.5V | 0.9 - 1.4V | Harness and connector | |
| | Shift lever "N" No-load | F | Air flow meter | | | |
| ENG TEMP SEN | Engine: After warming u | ρ | More than | 70°C (158°F) | Harness and connector Engine temperature sensor | |
| EXH GAS SEN | | | | | | |
| EXH GAS SEN-R | Engine: After warming | Maintaining engine speed | 0 - 0.3V + | • 0.6 - 1.0V | Harness and connector Exhaust gas sensor | |
| M/R F/C MNT | up | at 2,000 rpm LEAN ↔ RICH Changes more than 5 times during 10 seconds. | ■ Intake air leaks | | | |
| M/R F/C MNT-R | | | - | | | |
| CAR SPEED SEN | Turn drive wheels and consult cation with the CONSULT | | Almost the sa | | Harness and connector Vehicle speed sensor | |
| BATTERY VOLT | Ignition switch: ON (Engi | ne stopped) | 11 + | 14V | Battery E.C.U. power supply circuit | |
| THROTTLE | Ignition switch: ON | Throttle valve fully closed | U.4 - U.5V | | Harness and connector Throttle sensor | |
| SEN | (Engine stopped) | Throttle valve fully opened | Approx. 4.0V | | Throttle sensor adjust- ment | |
| FUEL TEMP SEN | Engine: After warming up |) | 20 - 60°C (6 | 58 - 140°F\ | Harness and connector Fuel temp, sensor | |
| START SIGNAL | Ignition switch: ON → ST | | OFF - | + ON | Harness and connector Starter switch | |
| | Ignition switch: ON | vitch: ON Idle position Throttl | Harness and connector Throttle sensor | | | |
| POSITION | 1 | Throttle valve: Slightly open | OFF | | Throttle sensor adjust- ment | |

| | | Consult (Con | at'd) | | | |
|--------------------|---|---|--|--------------------|---|--|
| MONITOR | CON | DITION | SPECIF | ICATION | CHECK ITEM | |
| ITEM | GONDATION | | Non-turbo | Turbo | WHEN OUTSIDE SPEC. | |
| | ● Engine: After warming | A/C switch "OFF" | C | FF | Harness and connector | |
| | up, idle the engine | A/C switch "ON" | ON | | Air conditioner switch | |
| NEUTRAL | • ignition switch: ON | Shift lever "P" or "N" | |)N | Harness and connector | |
| SW Ignal | agnition switch. ON | Except above | OFF | | Neutral switch | |
| PW/ST | Engine: After warming | Steering wheel in neutral (forward direction) | OFF | | Harness and connector | |
| SIGNAL up, idle th | up, idle the engine | The steering wheel is turned | ON | | Power steering oil pres sure switch | |
| INJ PULSE | Engine: After warming up A/C switch "OFF" | ldie | 2.0 - 3.0 msec. | 1.8 - 2.5 msec. | Harness and connector Injector | |
| INJ PULSE-R | Shift lever "N" No-load | 2,000 rpm | 2.0 - 3.0 msec. | 1.8 - 2.2 msec. | Air flow meter Intake air system | |
| | | ldle | 15° B.T.D.C. 15° B.T.D.C. | | | |
| IGN TIMING | ditto | Mary than Mary than | Harness and connector Crank angle sensor | | | |
| AAC VALVE | ditto | ldle | 15 - 40% | 15 - 35% | Harness and connector | |
| AAC VALVE | GINO | 2,000 rpm | T - | - | A.A.C. valve | |
| EGR TEMP SEN" | ● Engine: After warming ι | p | Less th | an 4.5V | Harness and connector Exhaust gas temperature sensor | |

Consult (Cont'd)

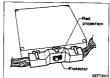
| TEST ITEM | CONDITION | JUDGMENT | CHECK ITEM (REMEDY) |
|------------------------|--|---|---|
| FUEL INJECTION TEST | Engine: Return to the original trouble condition Change the amount of fuel injection with the CONSULT. | If trouble symptom disappears, see CHECK ITEM. | Harness and connector Fuel injectors Exhaust gas sensor |
| AAC/V OPENING TEST | Engine: After warming up, idle the engine. Change the AAC valve opening percent with the CONSULT. | Engine speed changes according to the opening percent. | Harness and connector AAC valve |
| ENGINE TEMP TEST | Engine: Return to the original trouble condition Change the engine coolant temperature with the CONSULT. | If trouble symptom disappears, see CHECK ITEM. | Harness and connector Engine temperature sensor Fuel injectors |
| IGN TIMING TEST | Engine: Return to the original trou- ble condition Timing light: Set Retard the ignition timing with the CONSULT. | If frouble symptom disappears, see CHECK (TEM. | Adjust initial ignition timing |
| POWER BALANCE TEST | Engine: After warming up, idle the engine. AIC switch "OFF" Shift lever "N" Cut off each injector signal one at a time with the CONSULT. | Engine runs rough or dies. | Harness and connector Compression Injectors Power transistor Spark plugs Ignition coils |
| RADIATOR FAN TEST | Ignition switch: ON Turn the radiator fan "ON" and "OFF" with the CONSULT. | Radiator fan moves and stops. | Harness and connector Radiator fan motor |
| FICD SOL/V TEST | Engine: After warming up, idle the engine. A/C switch "OFF" Shift lever "N" Turn the FICD solenoid valve "ON" with the CONSULT. | Engine speed will increase momen- tarily by approx. 200 rpm. | Harness and connector FICD solenoid valve |
| FUEL PUMP FILY TEST | Ignition switch: ON (Engine stopped) Turn the fuel pump relay "ON" and "OFF" with the CONSULT and listen to operating sound. | | Harness and connector Fuel pump relay |
| EGR CONT SOL/V | | | |
| PRVR CONT SOL/V | Ignition switch: ON Turn solenoid valve "ON" and | Each solenoid valve makes an operat- ing sound. | a Harness and connecto- |
| AIV CONT SOL/V TEST | "OFF" with the CONSULT and listen to operating sound. | | Solenoid valve |
| VALVE TIM SOL TEST | | | |
| SELF-LEARN CONT | In this test, the coefficient of self-lear "CLEAR" on the screen. | ning control mixture ratio returns to the | original coefficient by touching |

TROUBLE DIAGNOSES



Diagnostic Procedure
CAUTION:

1. Before connecting or disconnecting the E.C.U. harness connector to or from any E.C.U., be sure to turn the tignition switch to the "OFF" position and disconnect the negative battley member in order not to damage E.C.U. as bettery voltage is applied to E.C.U. even if ignition switch is turned off. Failure to do so may damage the E.C.U.



When connecting E.C.U. harness connector, tighten secur-ing bolt until red projection is in line with connector face.



- When connecting or disconnecting pin connectors into or from E.C.U., take care not to damage pin terminals (bend or break).
 Make sure that there are not any bends or breaks on E.C.U. pin terminal, when connecting pin connectors.



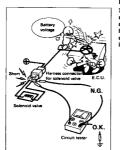
Before replacing E.C.U., perform E.C.U. input/output signal inspection and make sure whether E.C.U. functions prop-erly or not. (See page EF & EC-174.)



After performing this "Diagnostic Procedure", perform E.C.C.S. self-diagnosis and driving test.



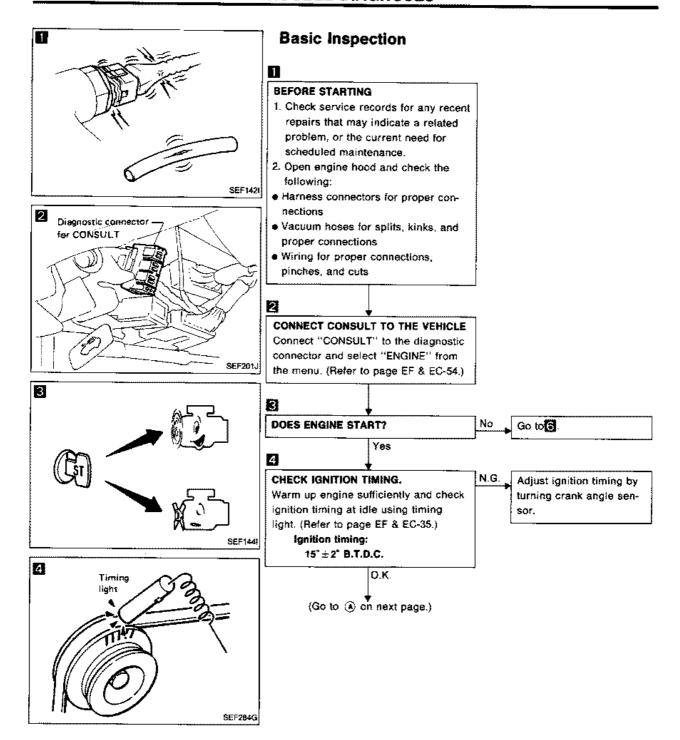
TROUBLE DIAGNOSES

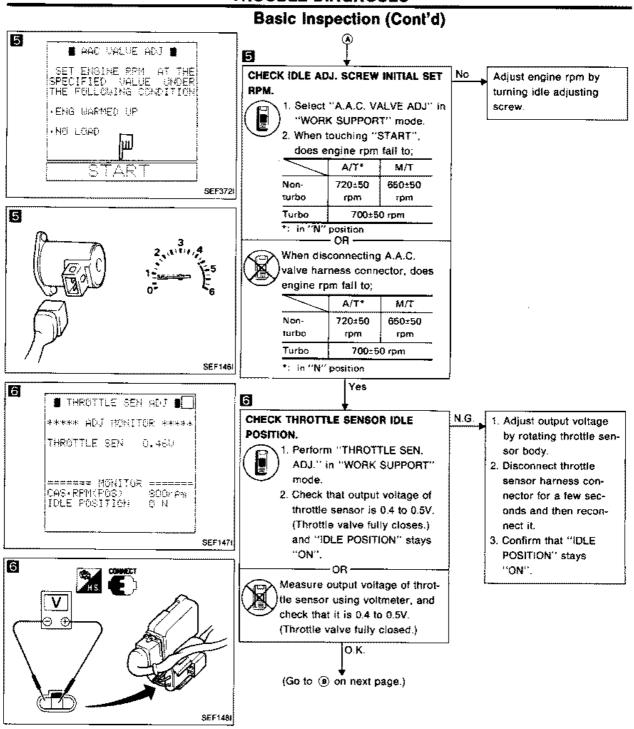


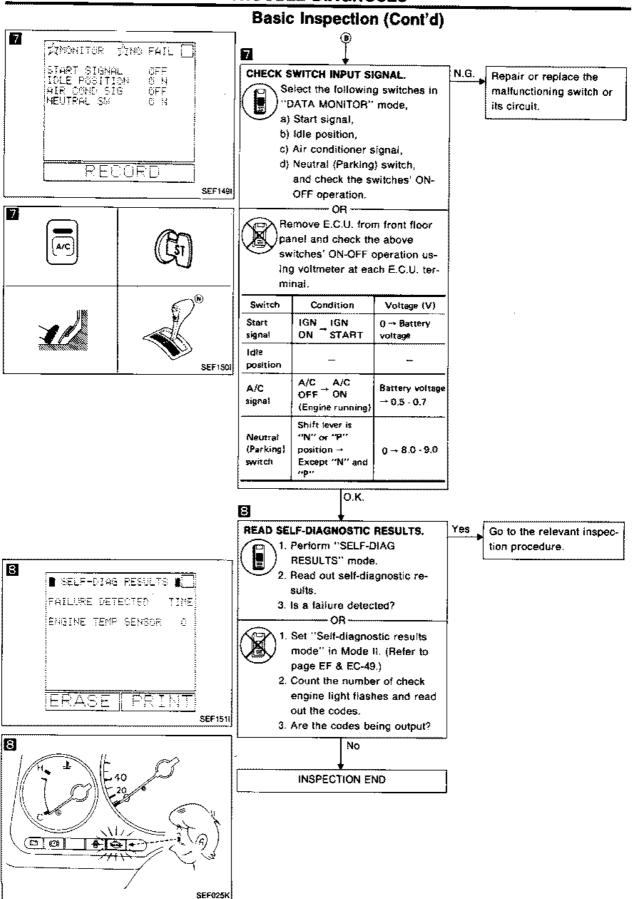
Diagnostic Procedure (Cont'd)

7. When measuring E.C.U. controlled components supply voltage with a circuit tester, separate one tester probe from the other.

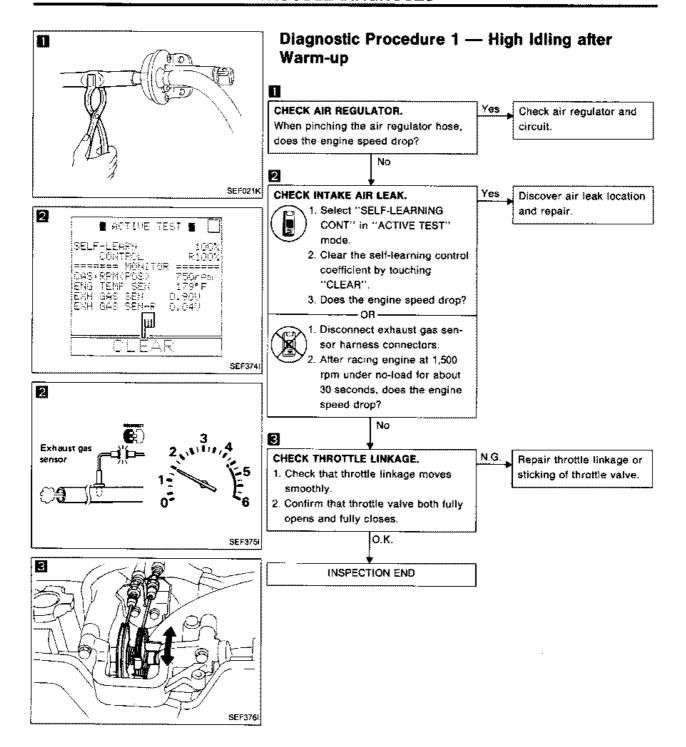
If the two tester probes accidentally make contact with each other during measurement, the circuit will be shorted, resulting in damage to the control unit power transistor.

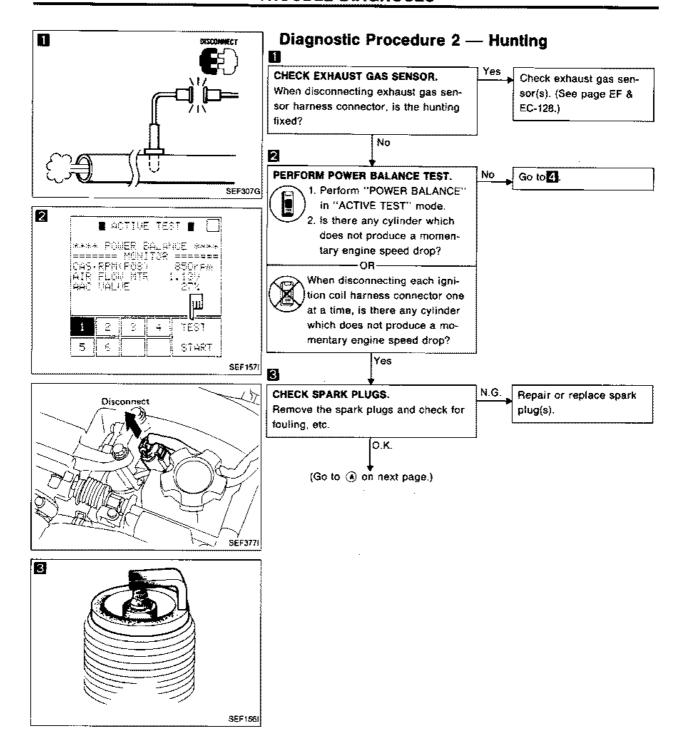


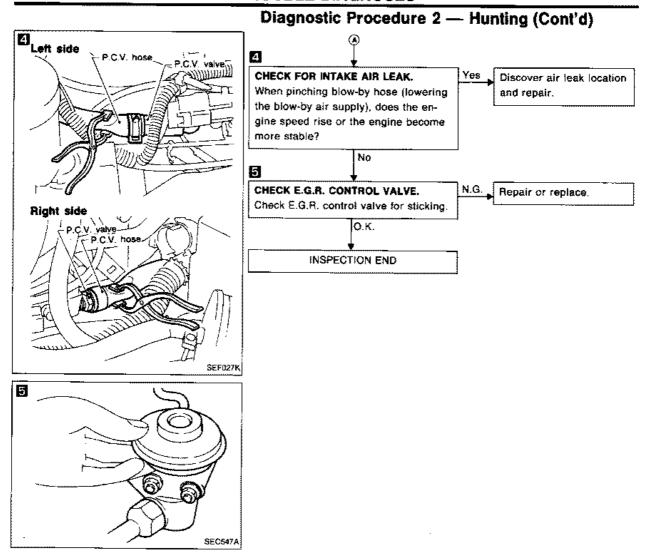


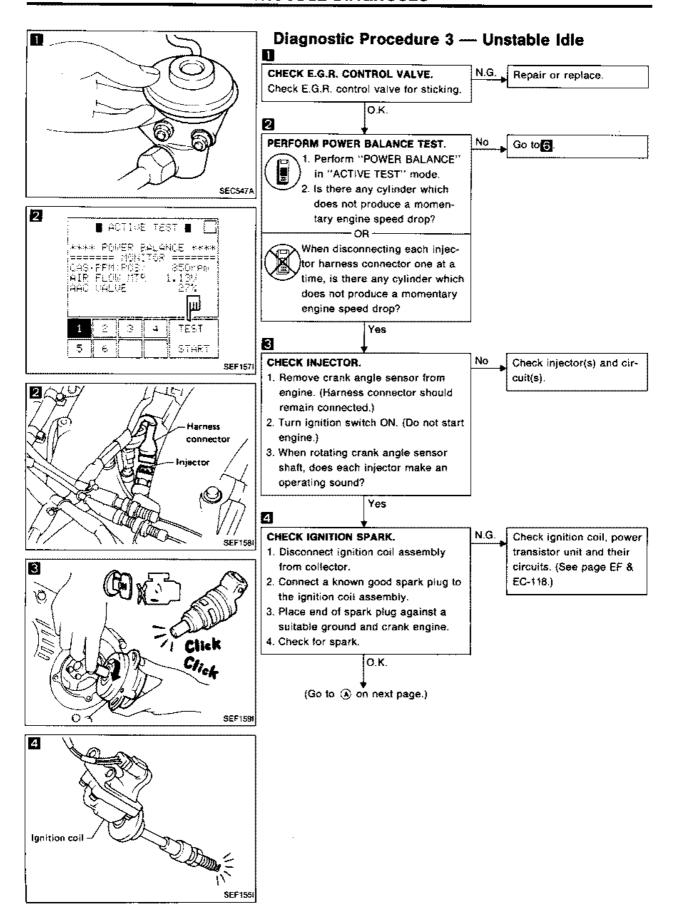


EF & EC-63

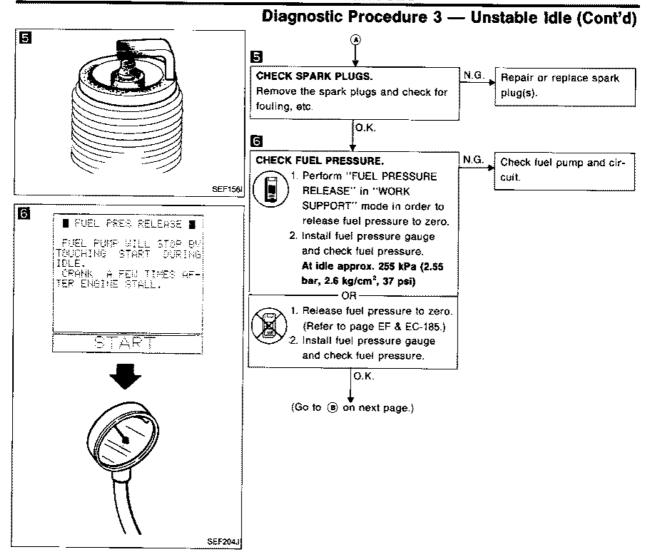


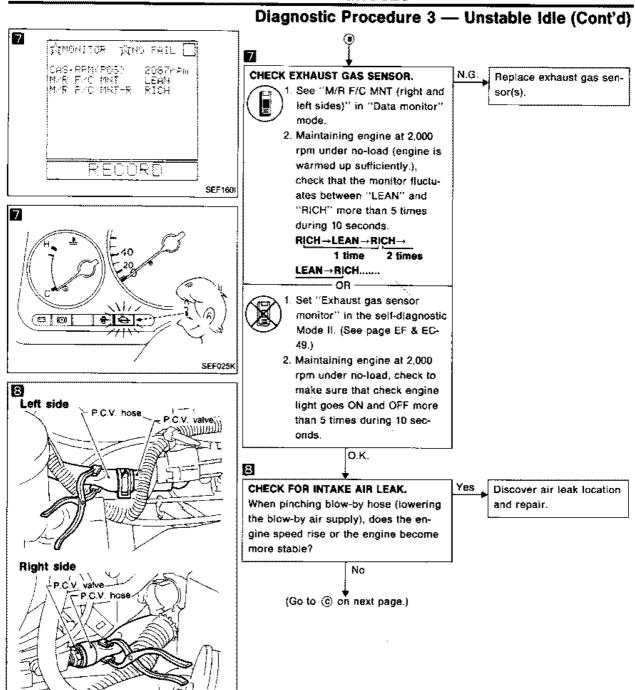


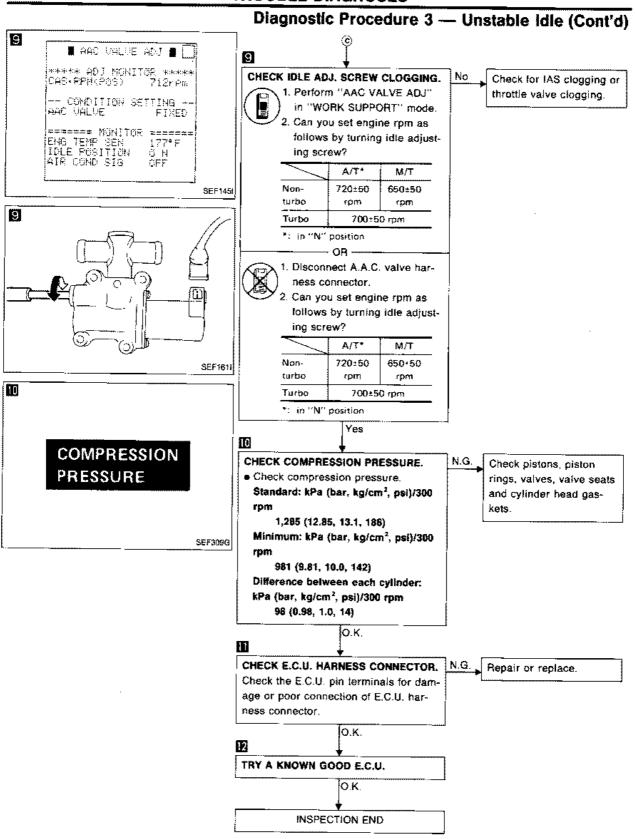


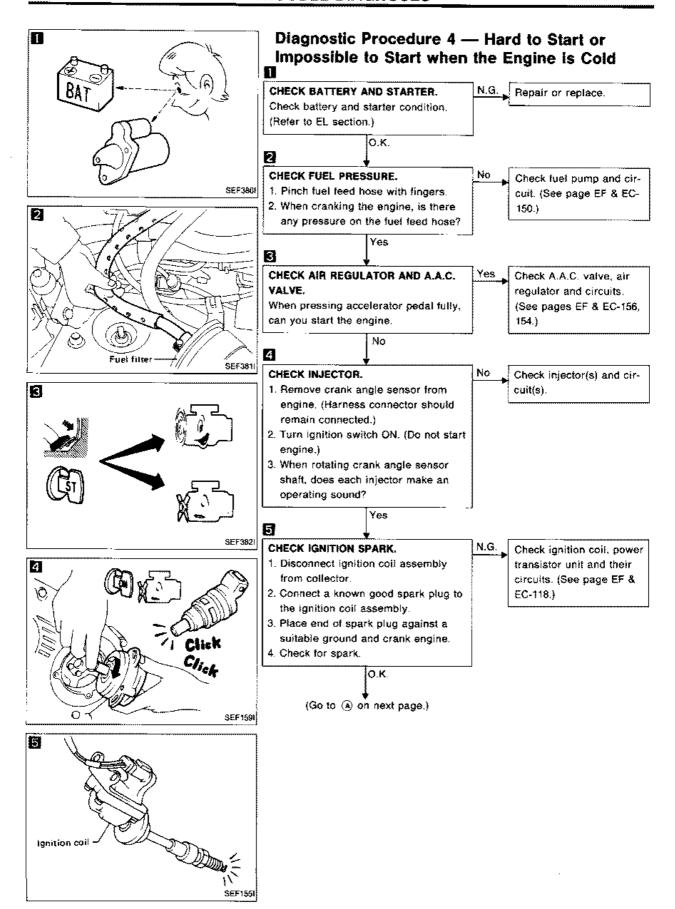


EF & EC-67

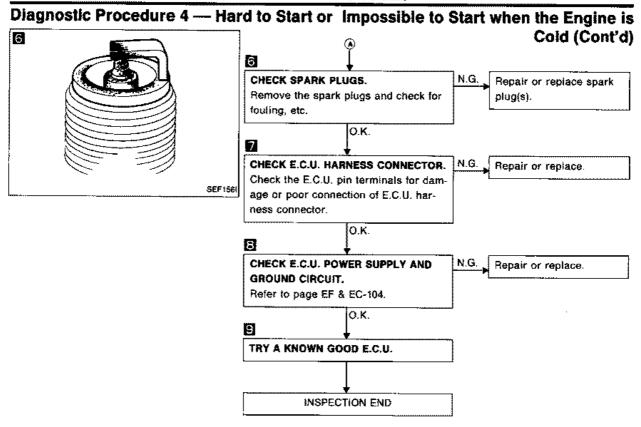


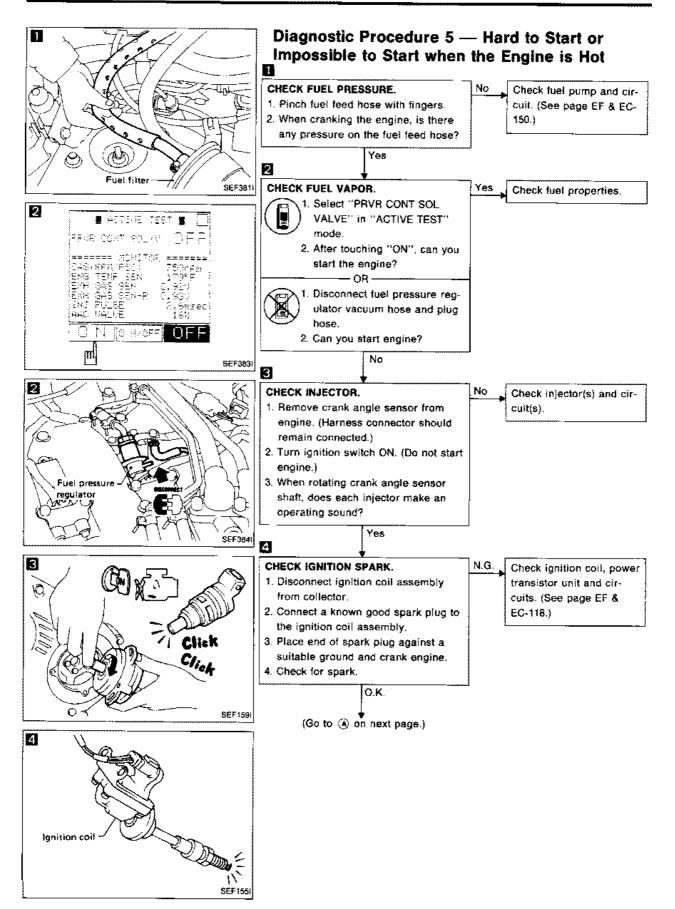






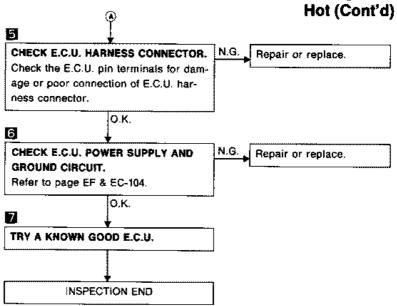
EF & EC-71

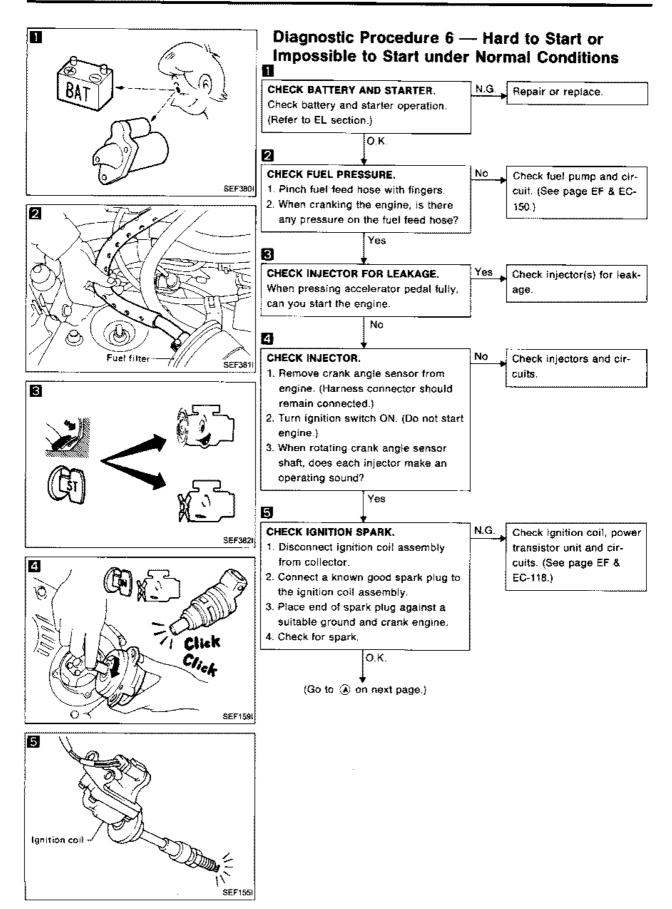




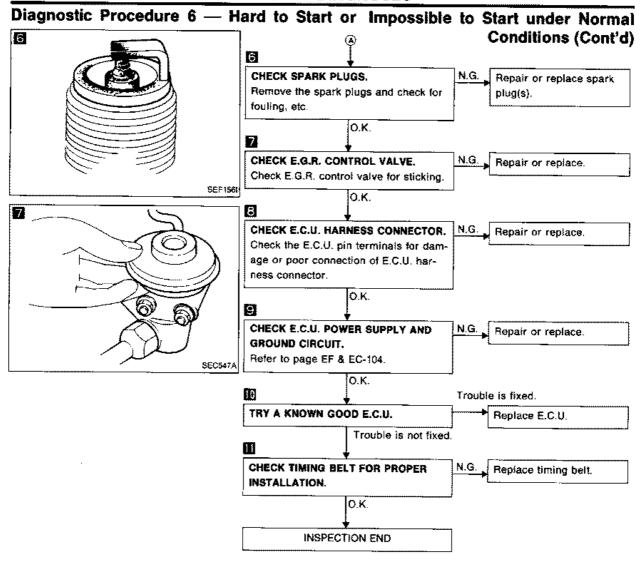
EF & EC-73

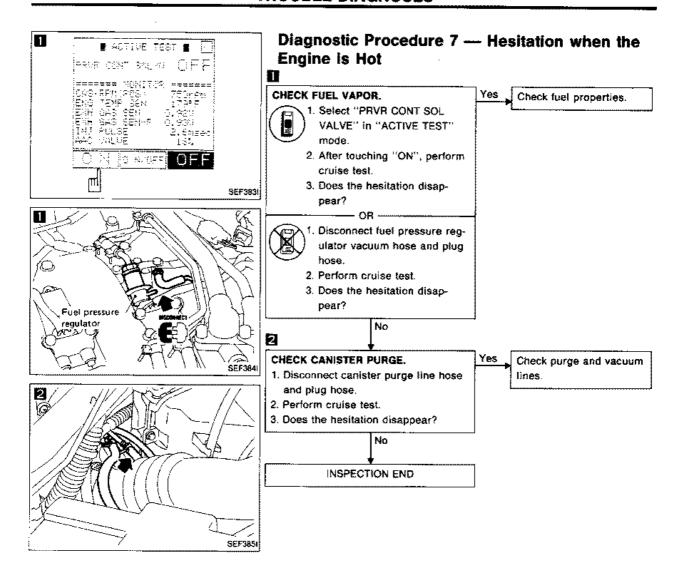
Diagnostic Procedure 5 — Hard to Start or Impossible to Start when the Engine is

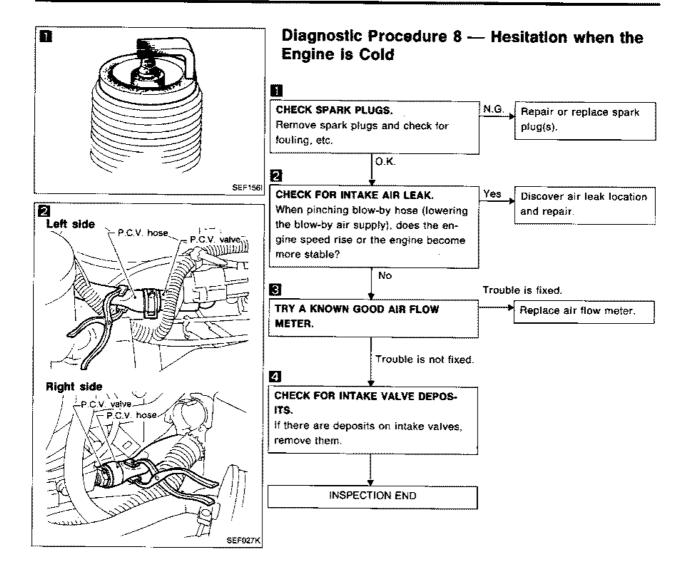


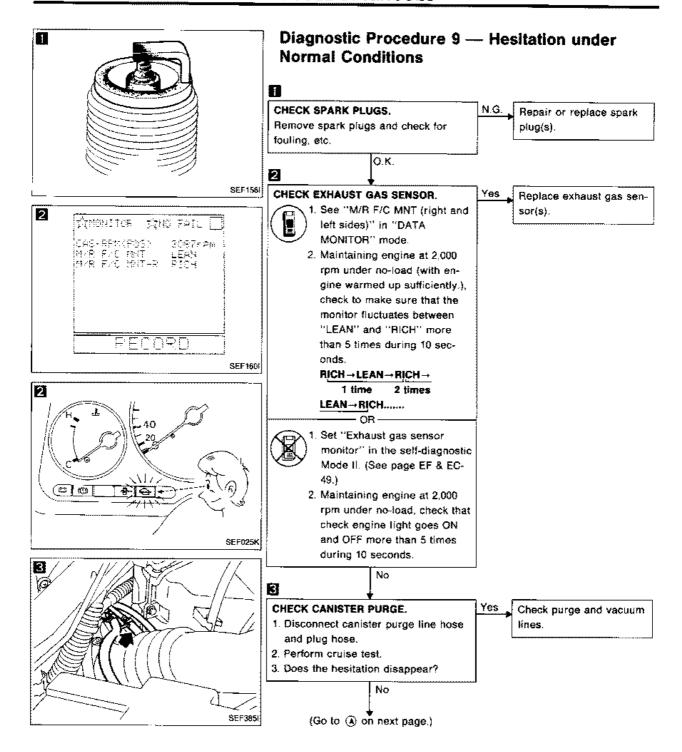


EF & EC-75

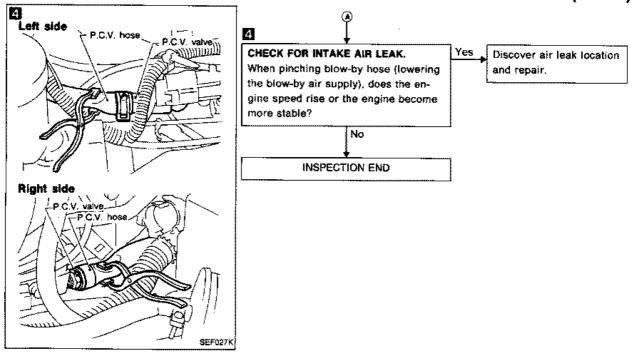


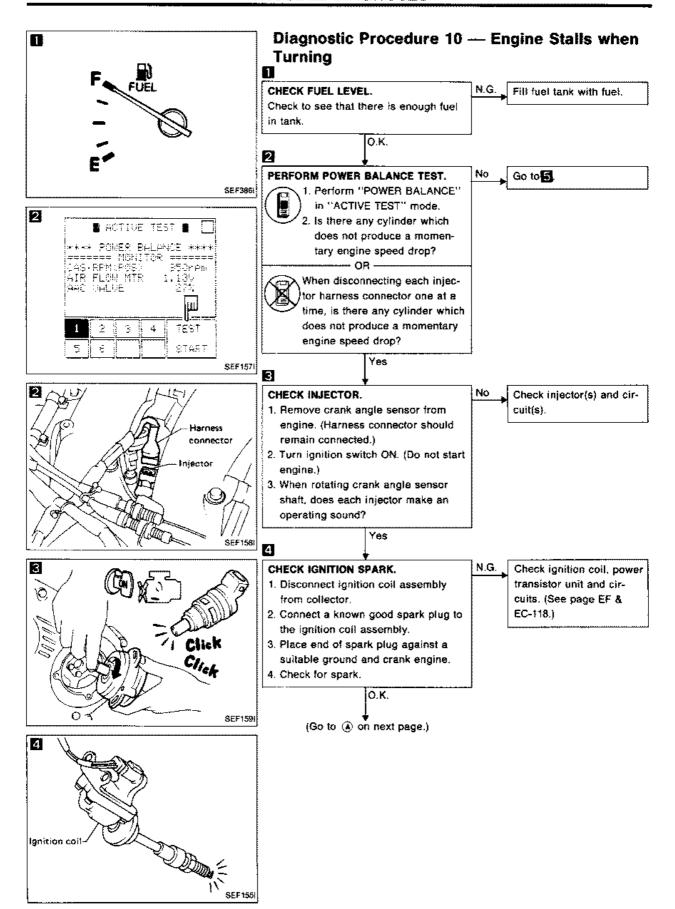






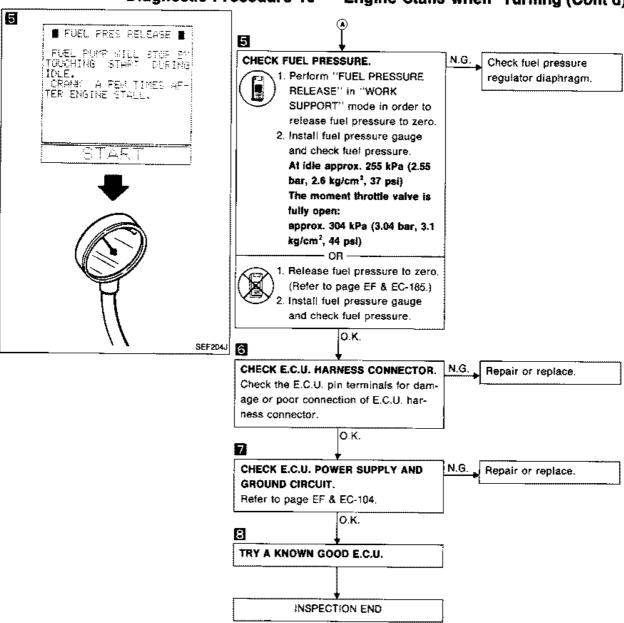
Diagnostic Procedure 9 — Hesitation under Normal Conditions (Cont'd)

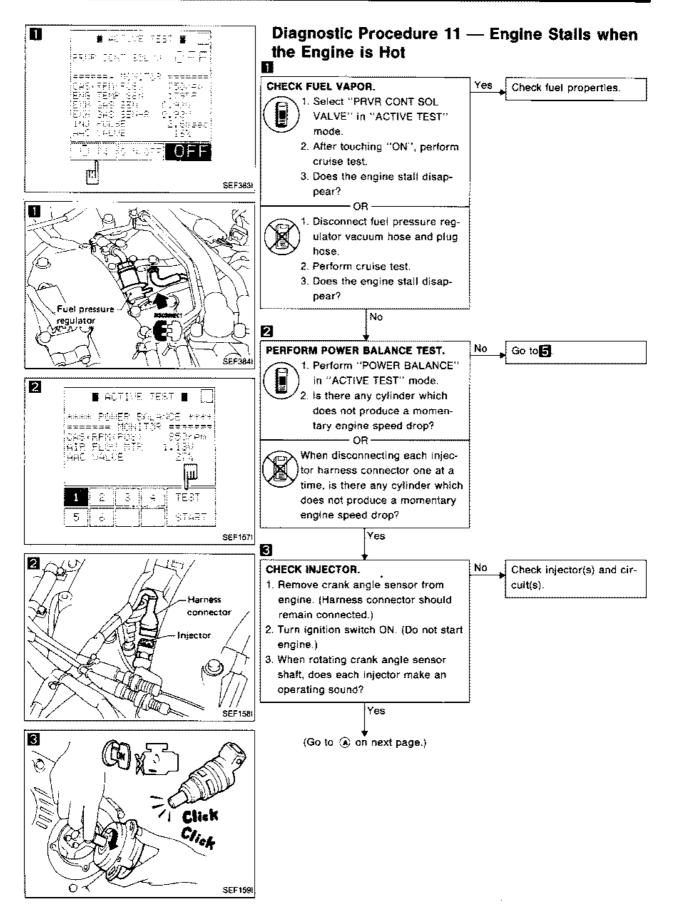




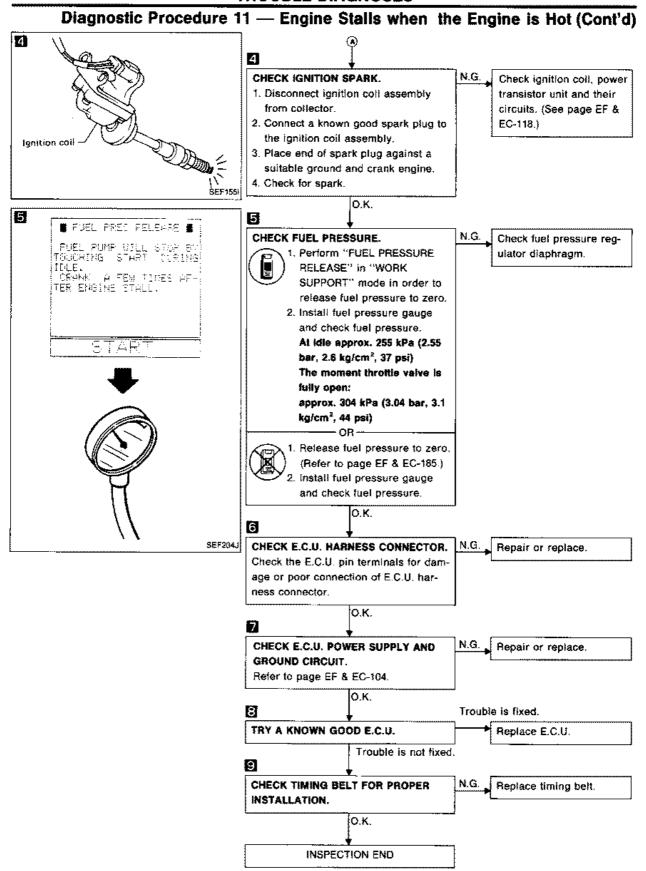
EF & EC-81

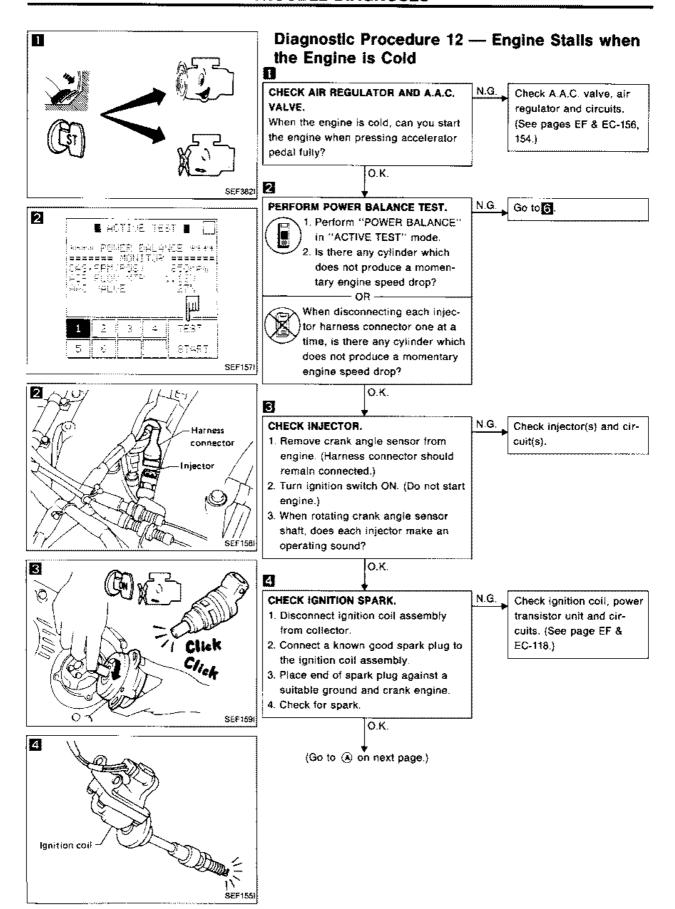
Diagnostic Procedure 10 — Engine Stalls when Turning (Cont'd)



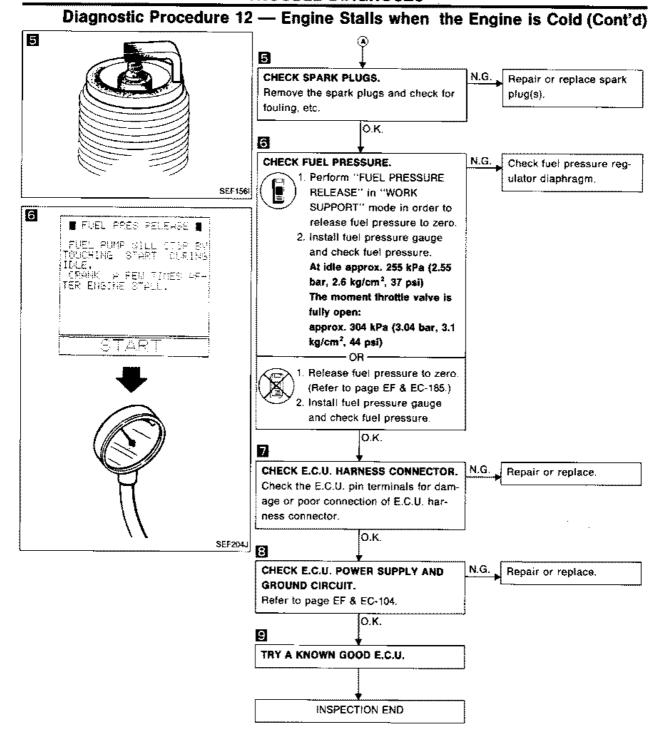


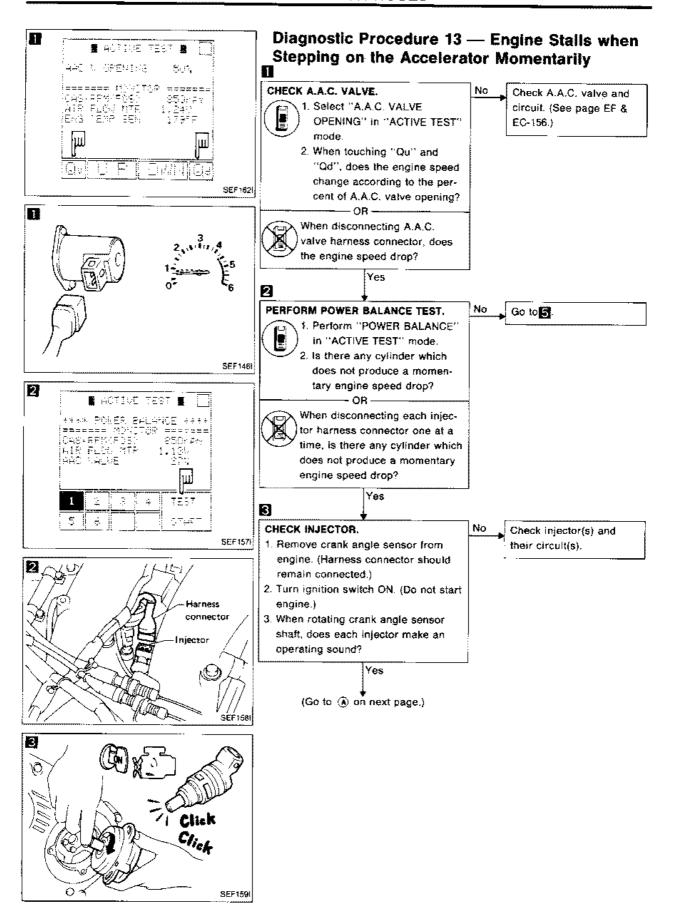
EF & EC-83



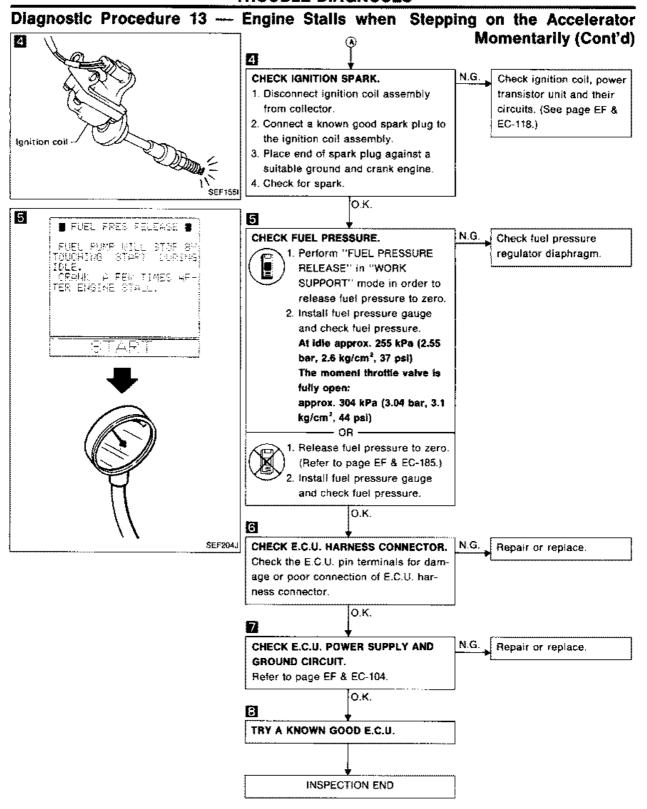


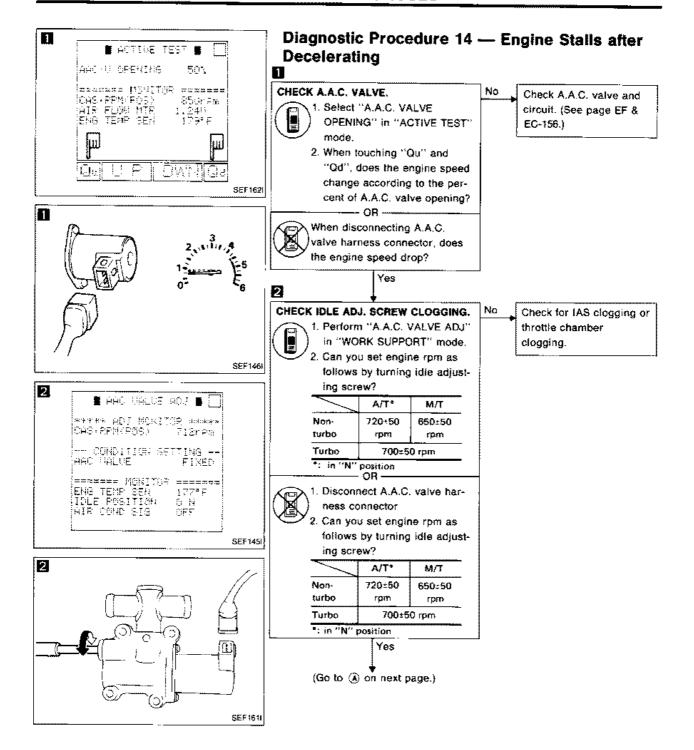
EF & EC-85

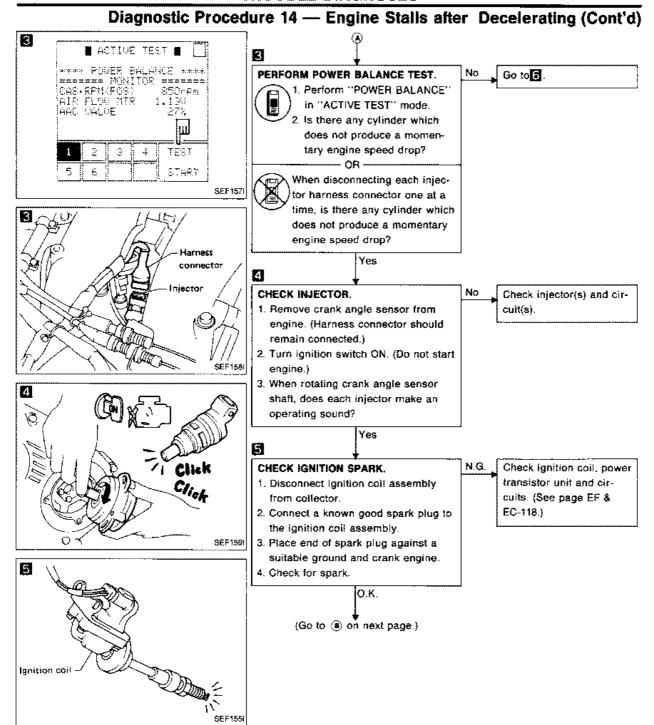


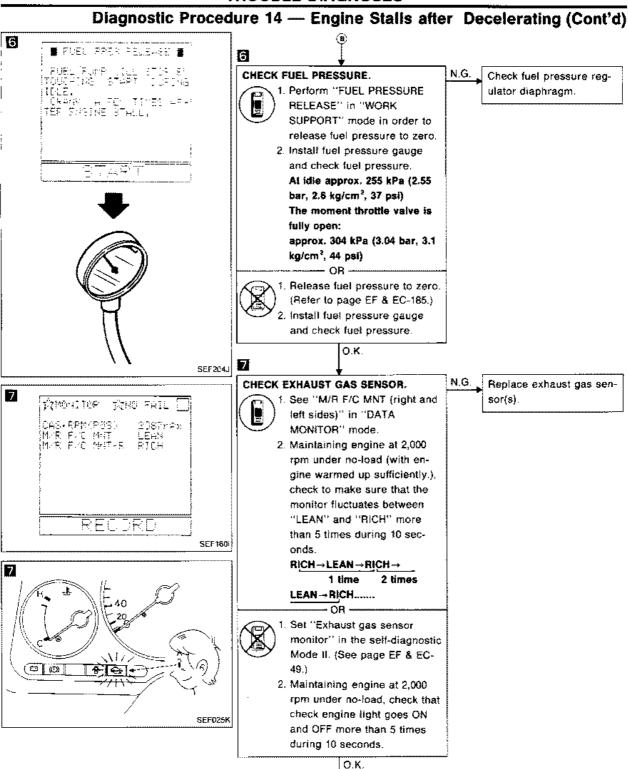


EF & EC-87



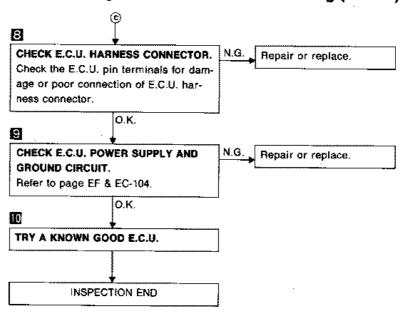


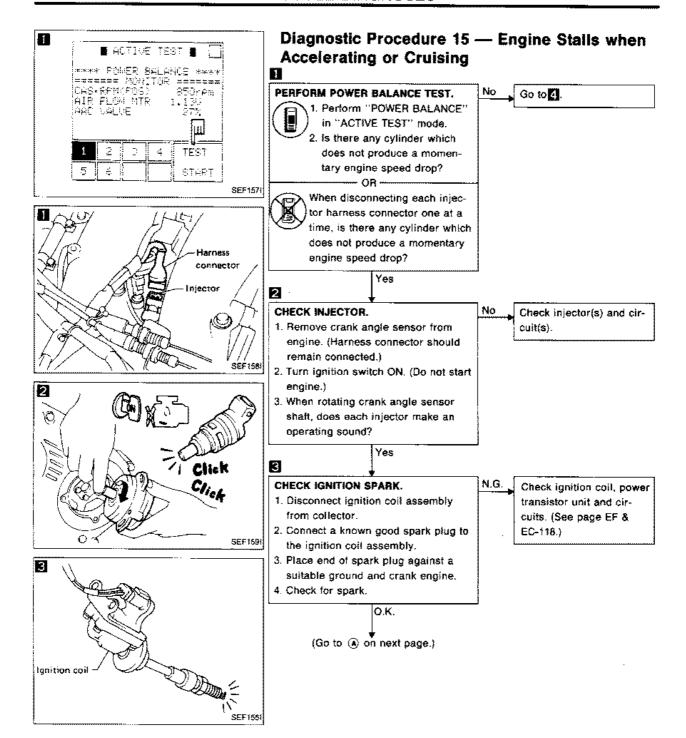


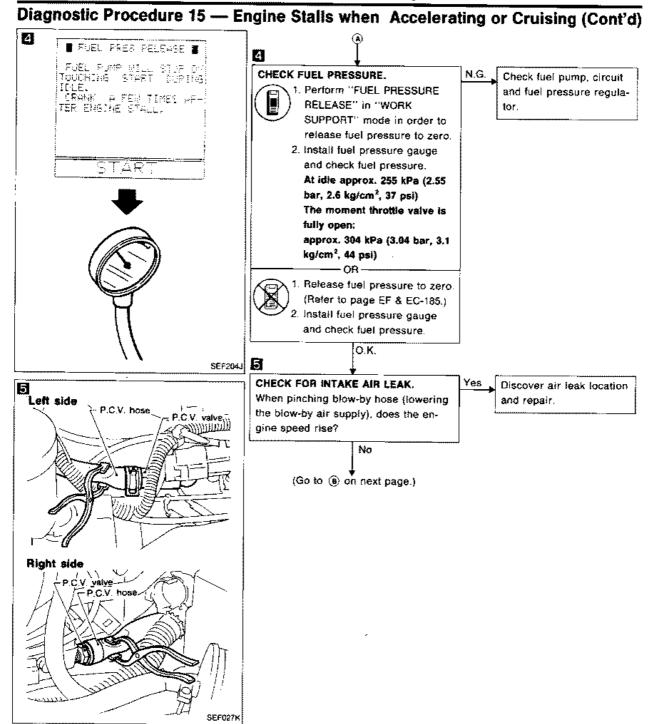


(Go to @ on next page.)

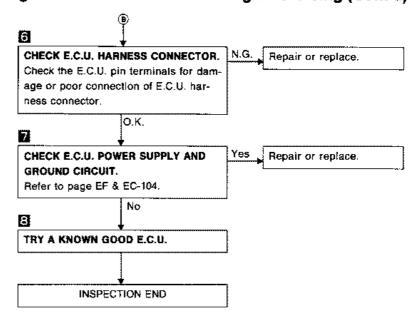
Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)

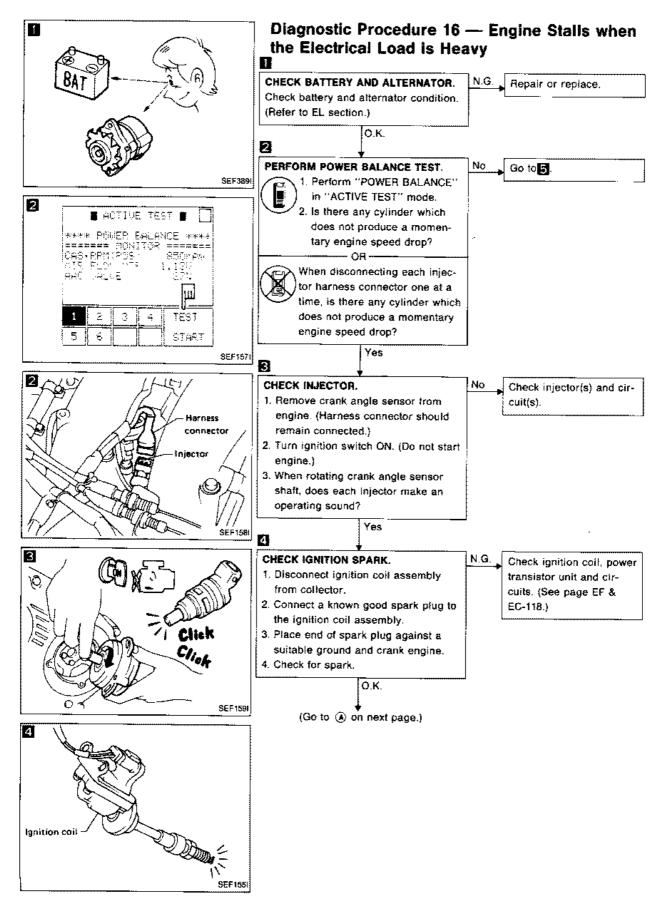




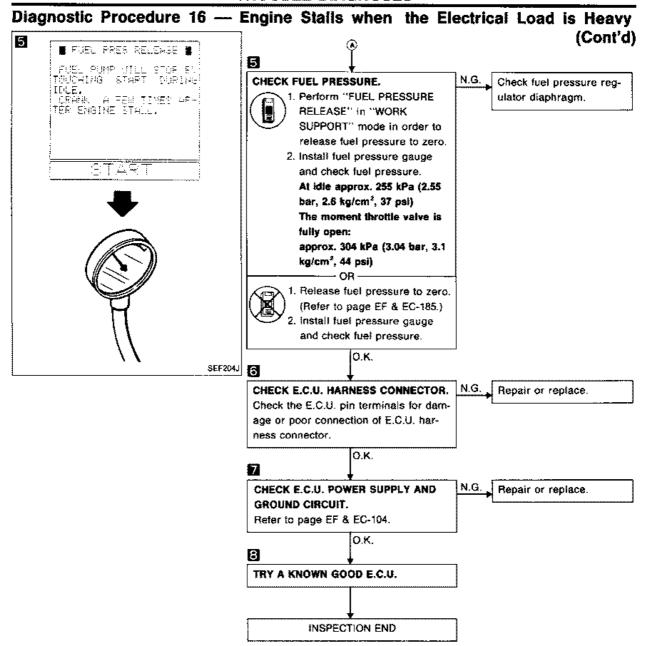


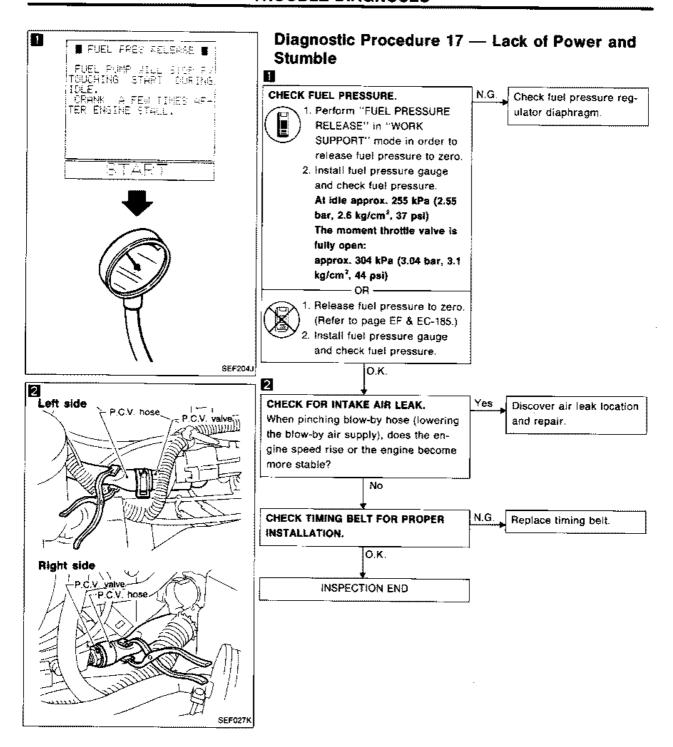
Diagnostic Procedure 15 — Engine Stalls when Accelerating or Cruising (Cont'd)

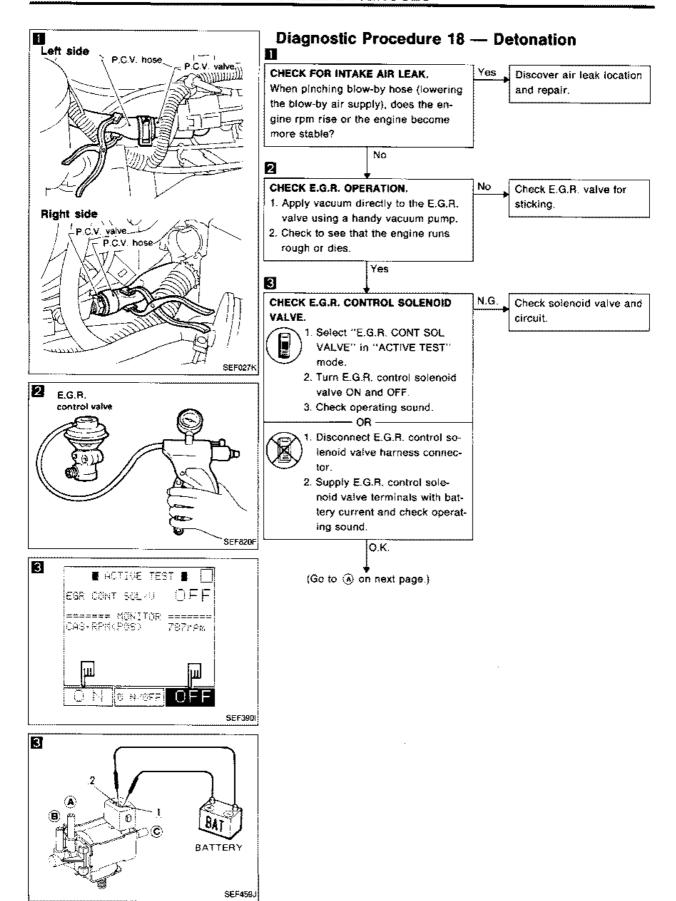




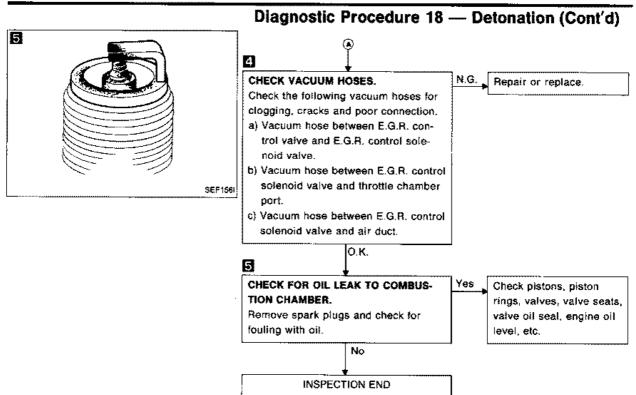
EF & EC-96

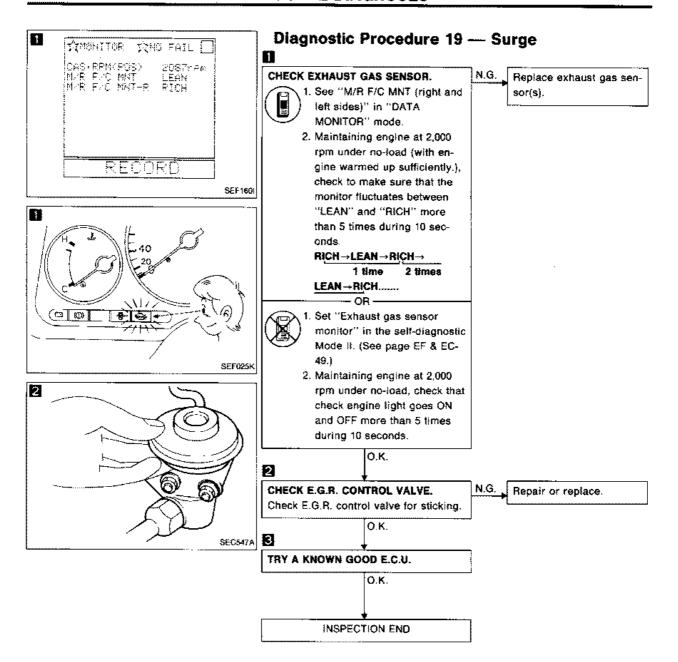


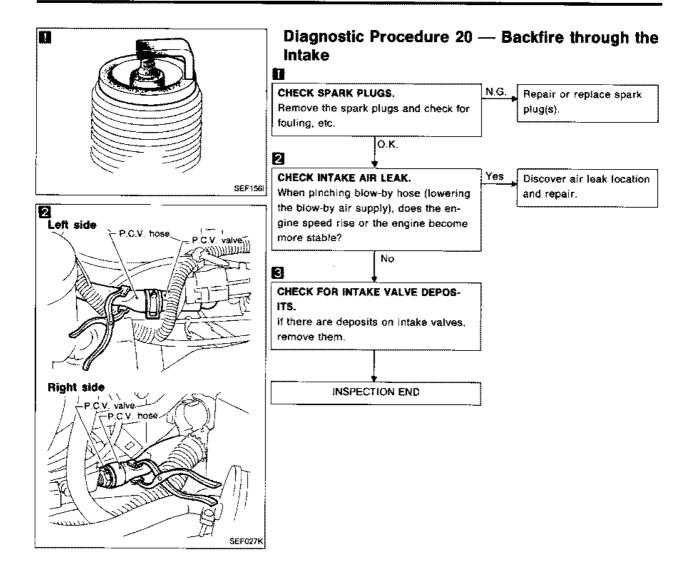




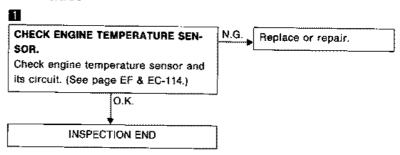
EF & EC-99





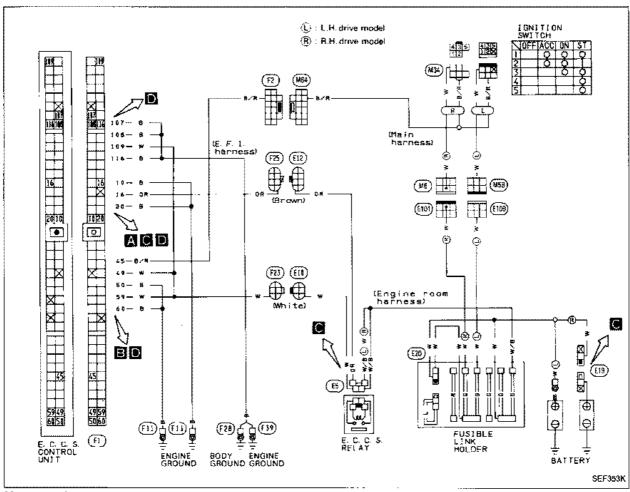


Diagnostic Procedure 21 — Backfire through the Exhaust

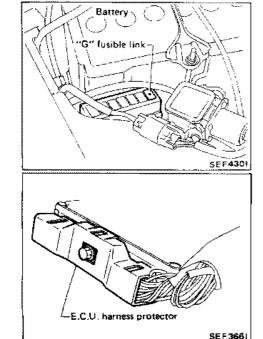


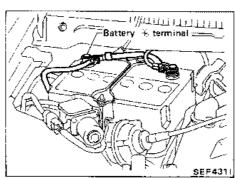
Diagnostic Procedure 22

MAIN POWER SUPPLY AND GROUND CIRCUIT

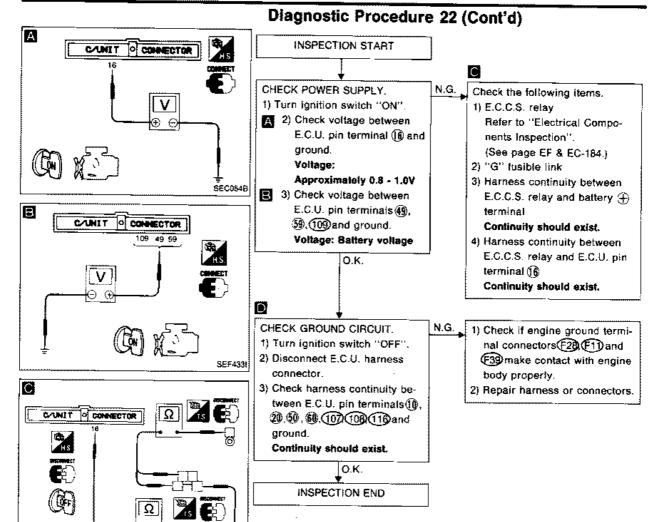


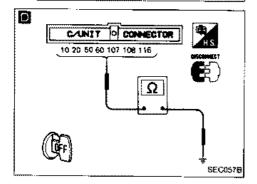
Harness layout





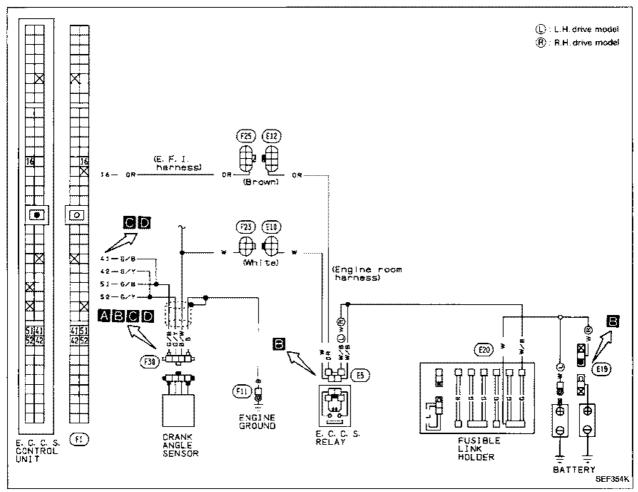
EF & EC-104



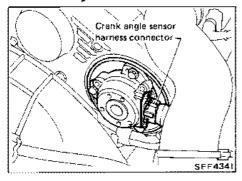


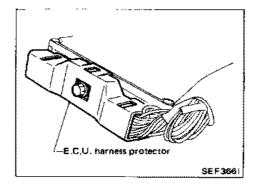
Diagnostic Procedure 23

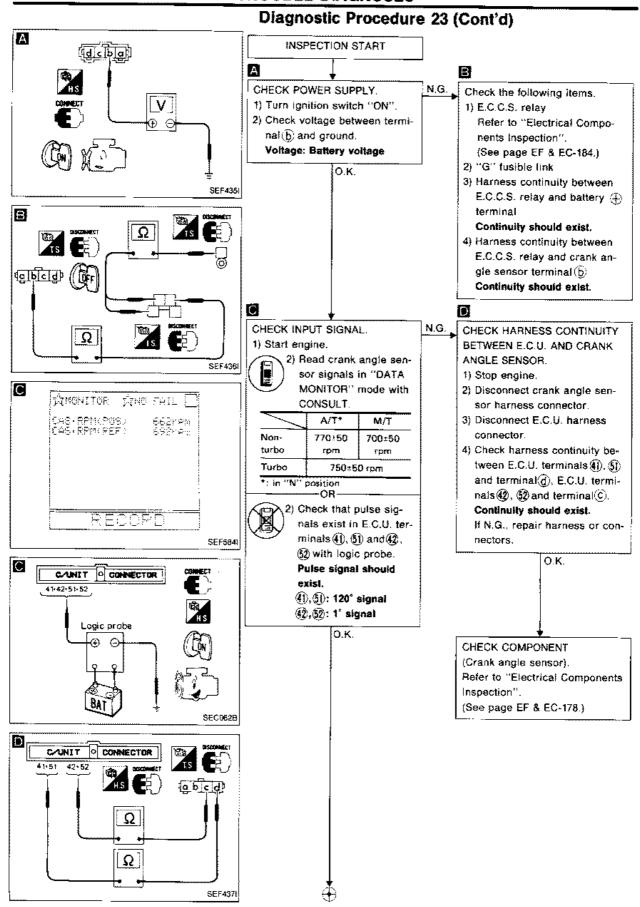
CRANK ANGLE SENSOR (Code No. 11)



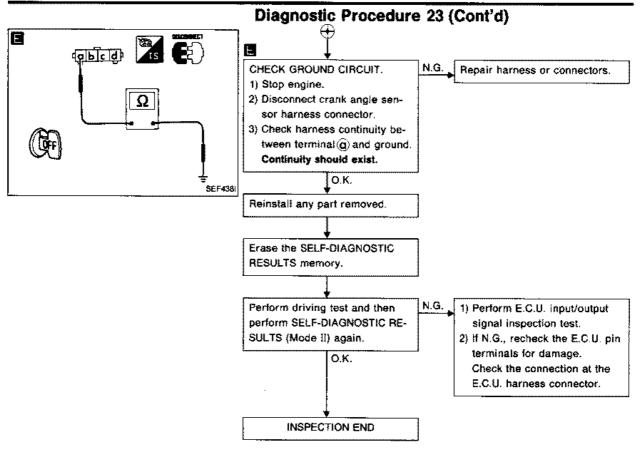
Harness layout







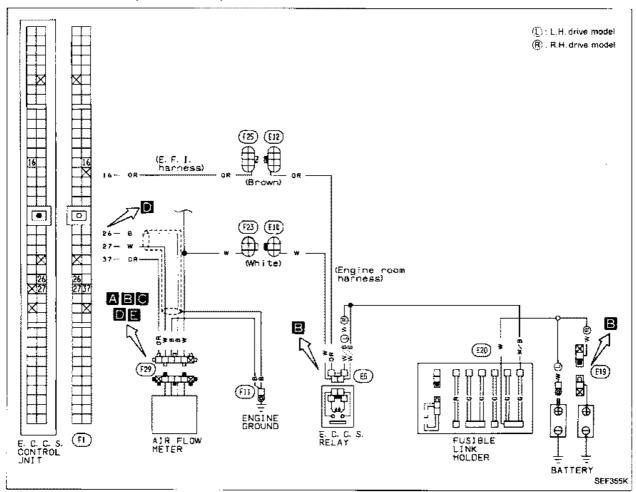
EF & EC-107

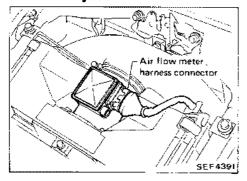


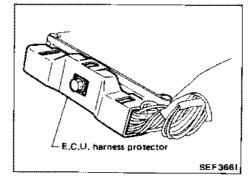
NOTE

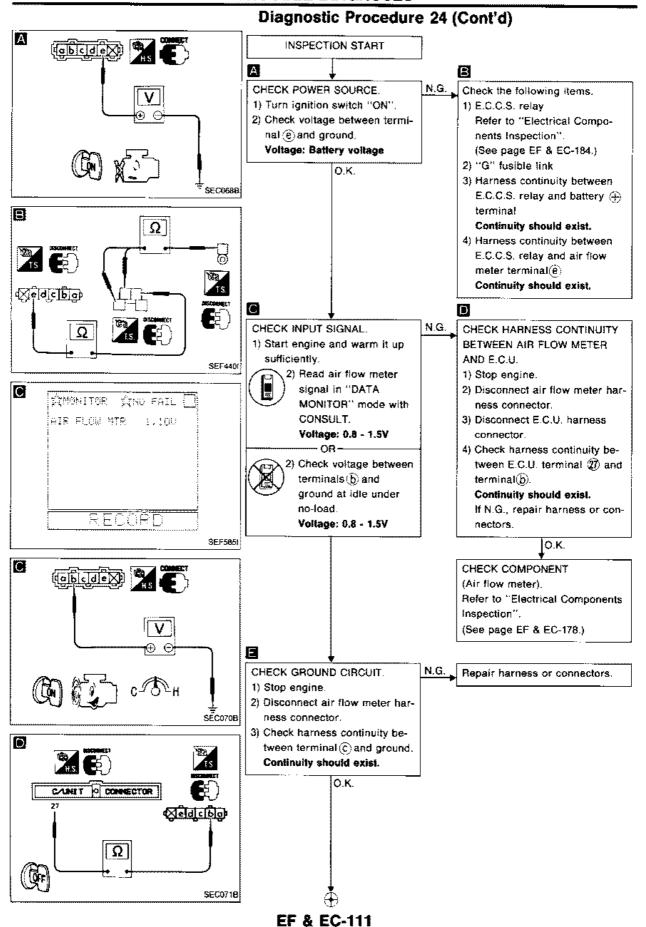
Diagnostic Procedure 24

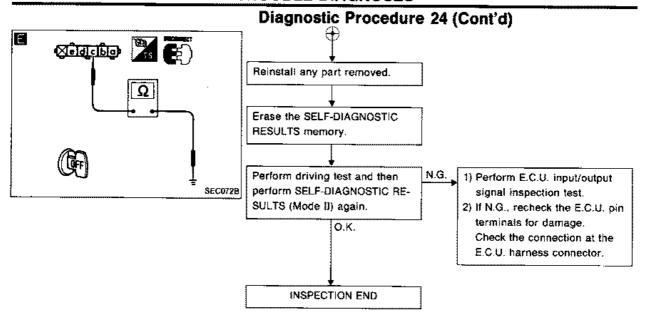
AIR FLOW METER (Code No. 12)









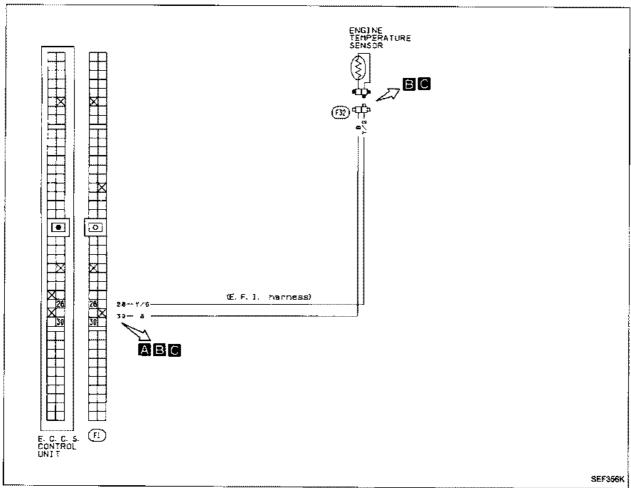


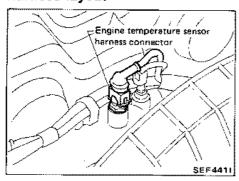
| TROI | 101 | IAC | MA | CEC |
|------|--------|------|------|-----|
| 180 | .J D L | | :NLI | |

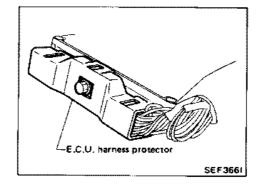
NOTE

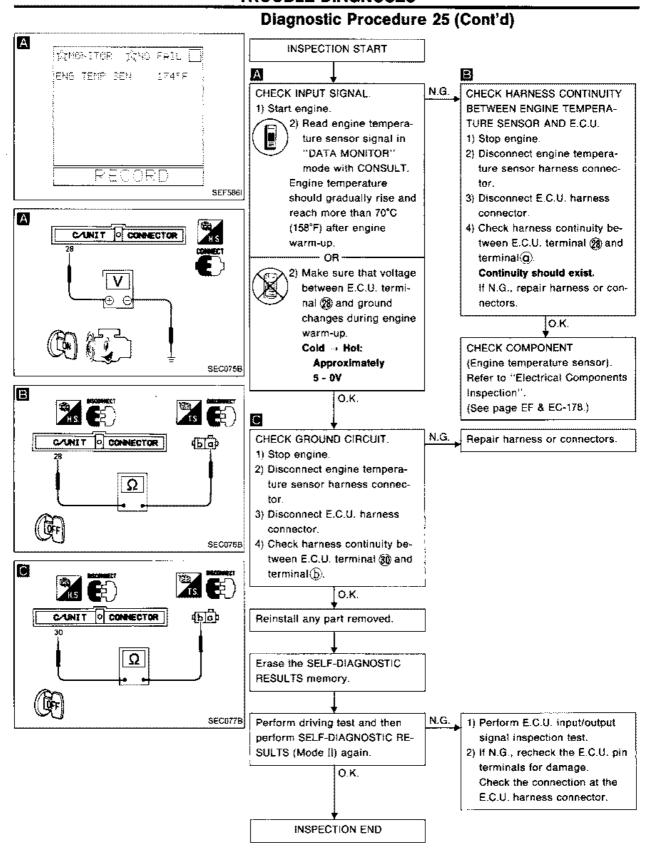
Diagnostic Procedure 25

ENGINE TEMPERATURE SENSOR (Code No. 13)



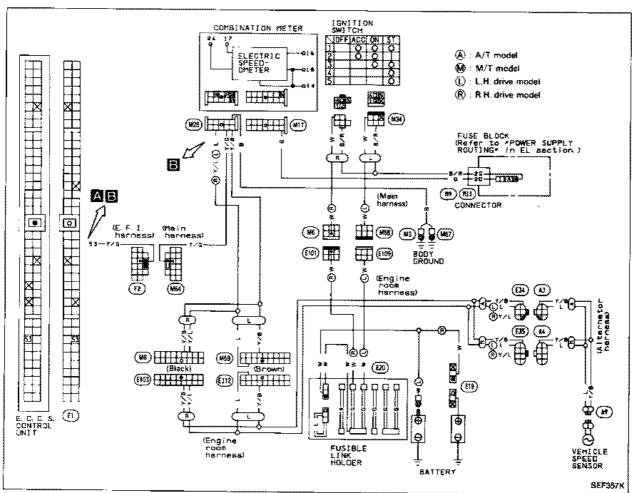


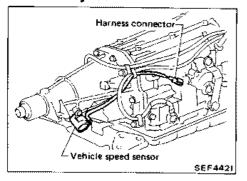


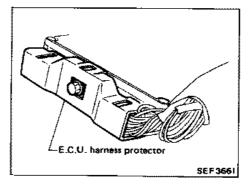


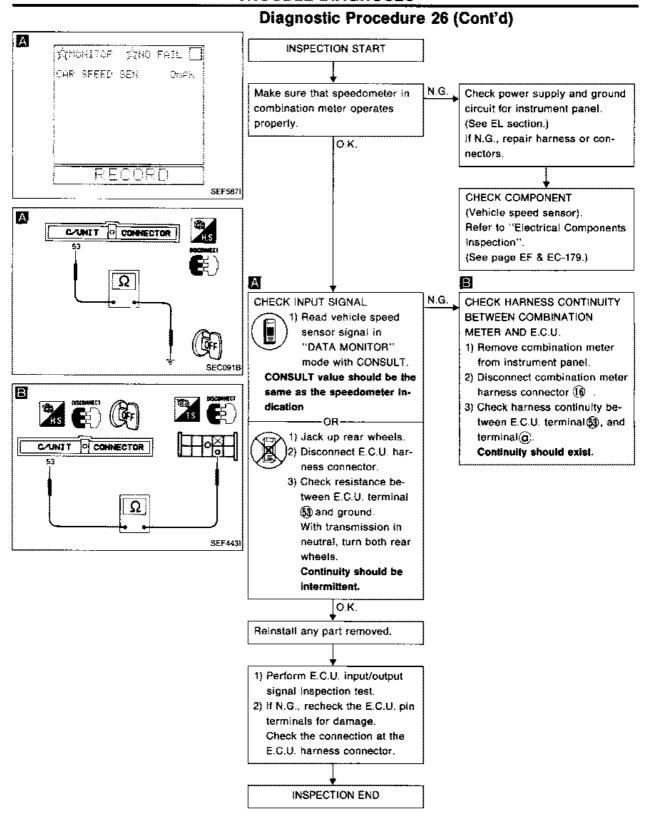
Diagnostic Procedure 26

VEHICLE SPEED SENSOR



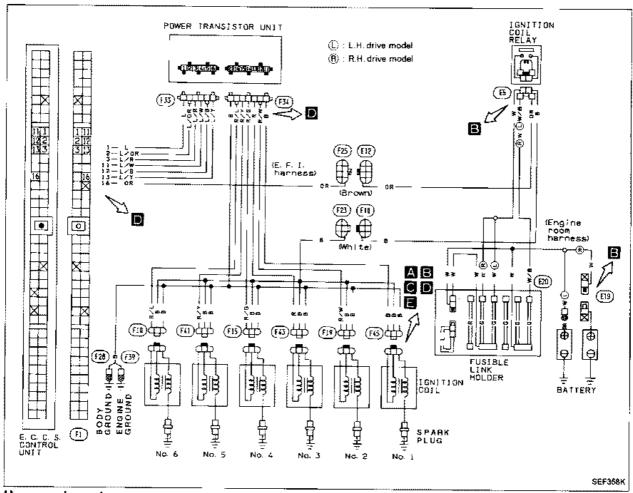


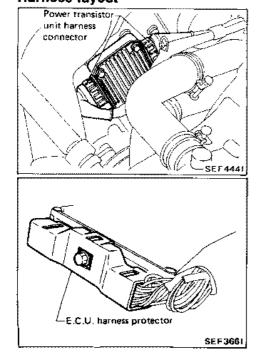


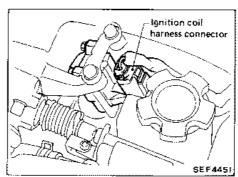


Diagnostic Procedure 27

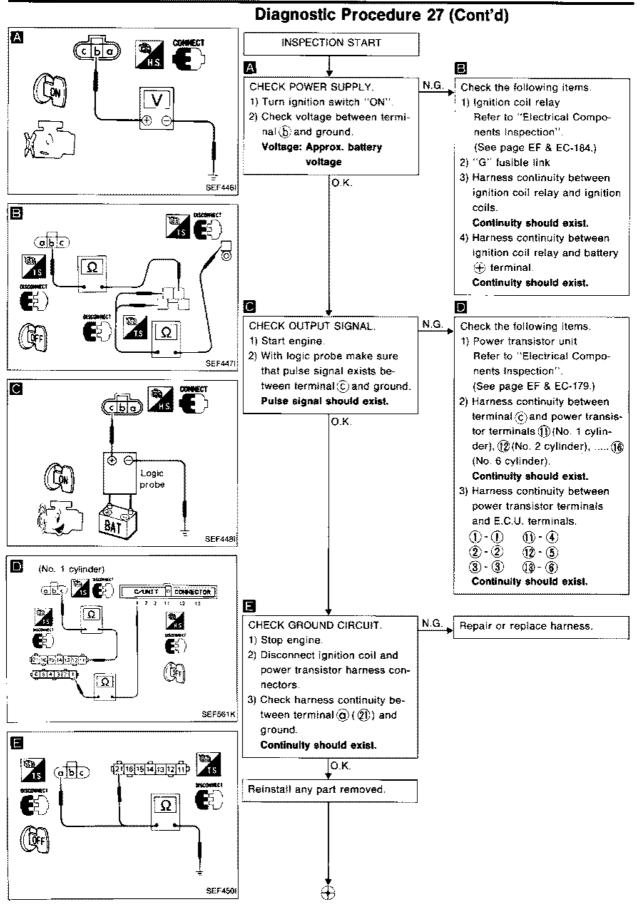
IGNITION SIGNAL (Code No. 21)



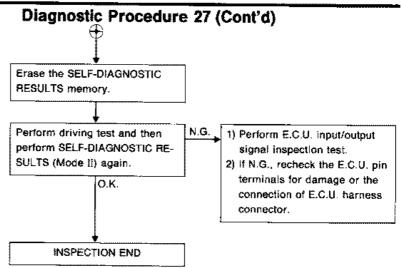




EF & EC-118



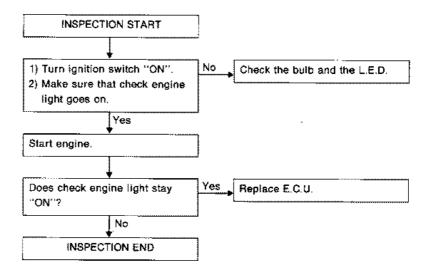
EF & EC-119



NOTE

Diagnostic Procedure 28

ENGINE CONTROL UNIT

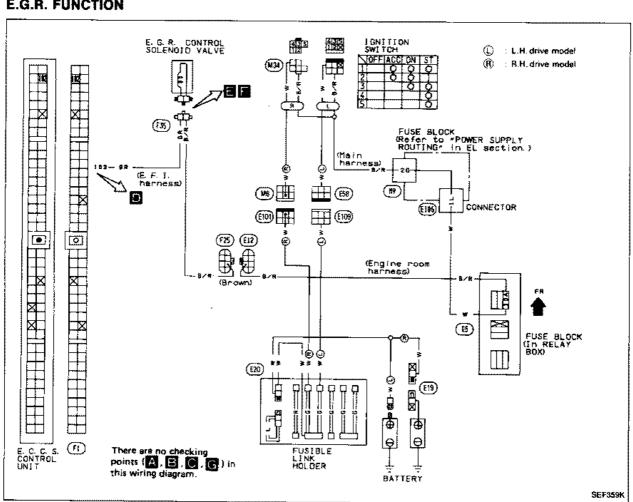


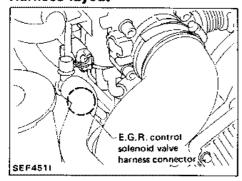
| TRO | HRI | F | DIA | GN | ins | FS |
|------------|-----|---|-----|----|-----|----|
| 1110 | UBL | _ | | | | |

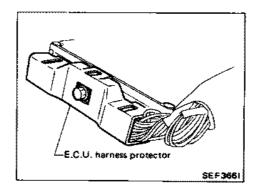
NOTE

Diagnostic Procedure 29

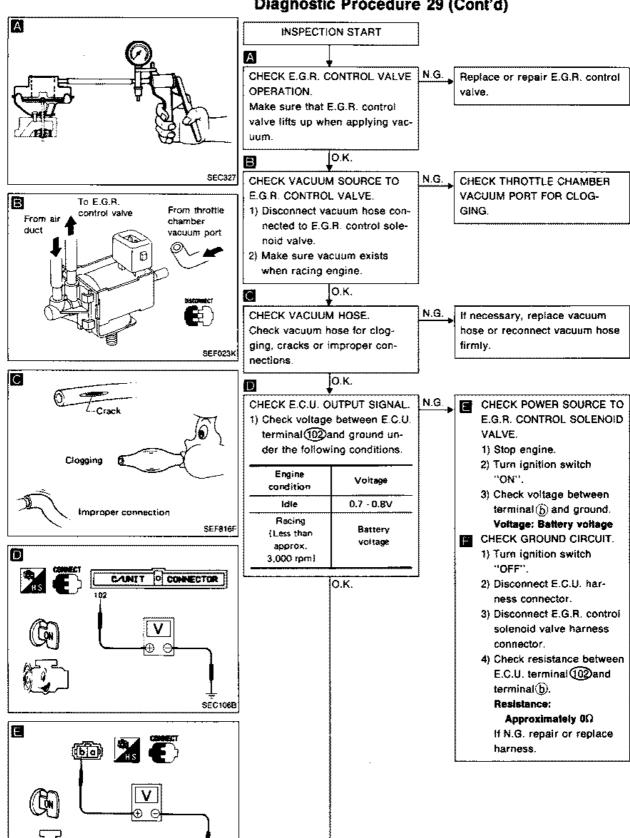
E.G.R. FUNCTION





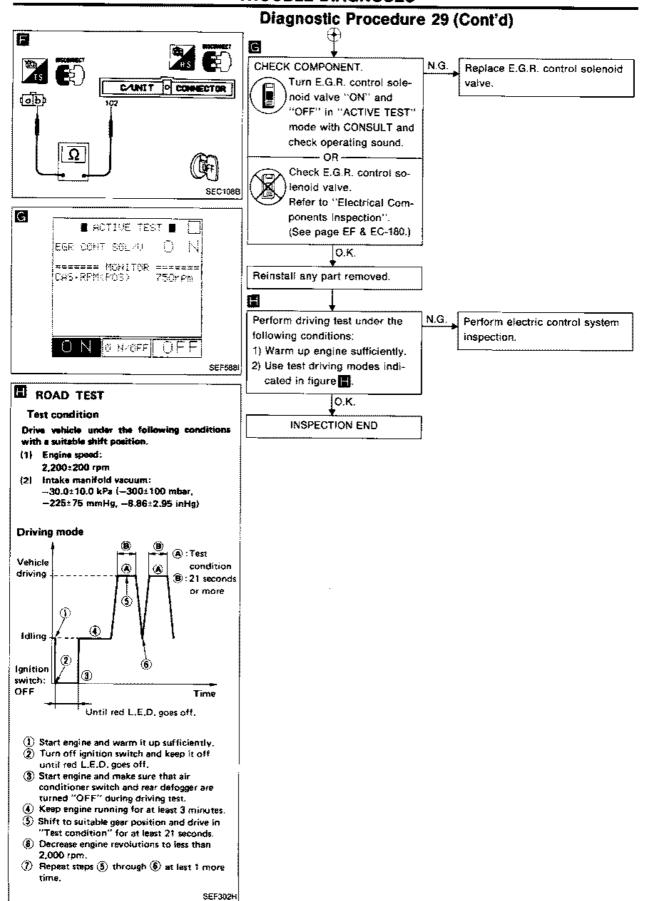


Diagnostic Procedure 29 (Cont'd)



EF & EC-125

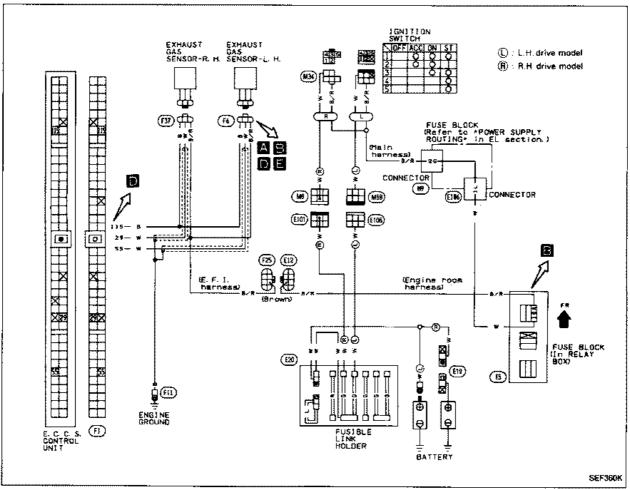
SEC107B

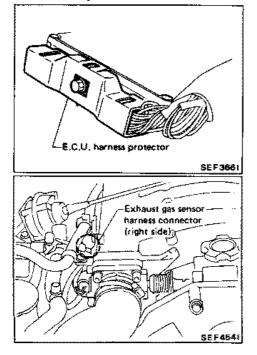


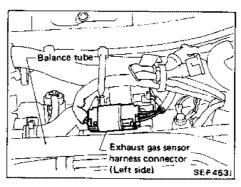
NOTE

Diagnostic Procedure 30

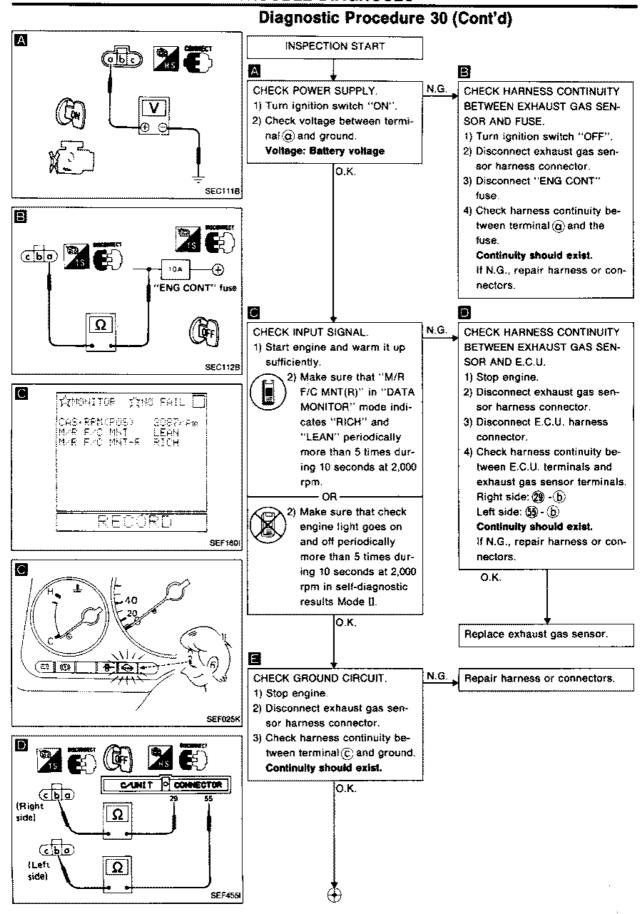
EXHAUST GAS SENSOR



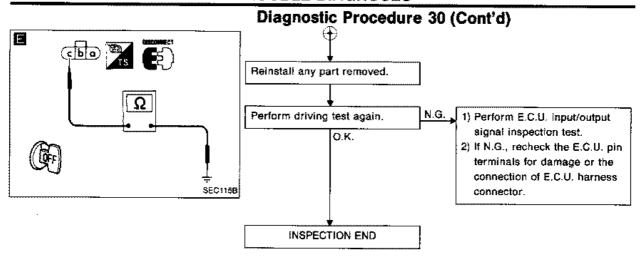




EF & EC-128



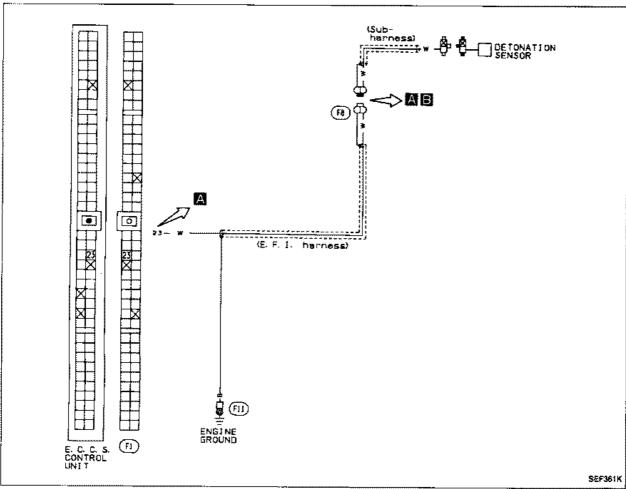
EF & EC-129

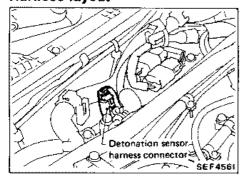


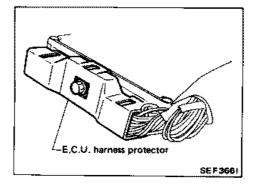
NOTE

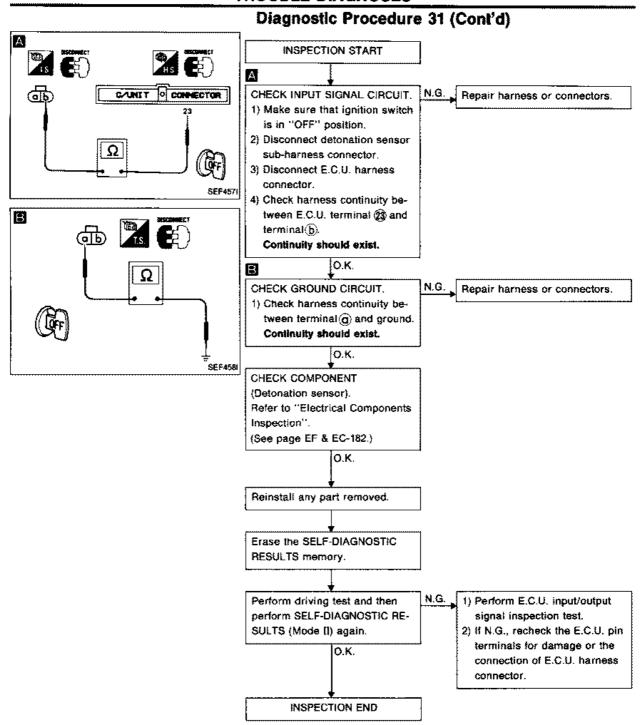
Diagnostic Procedure 31

DETONATION SENSOR (Code No. 34)



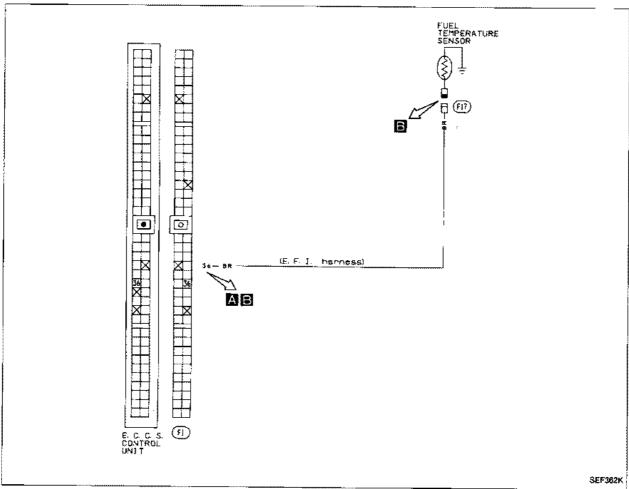


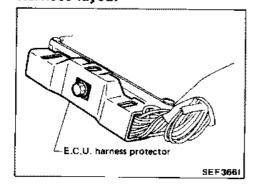


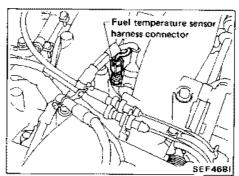


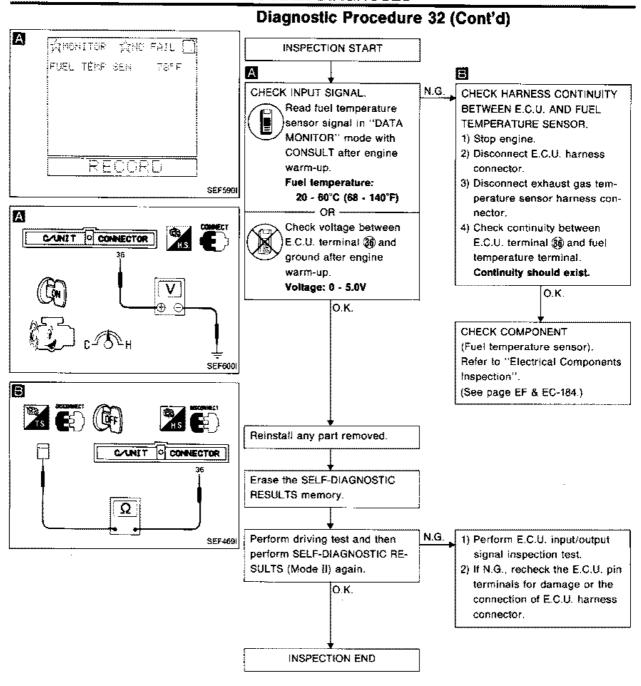
Diagnostic Procedure 32

FUEL TEMPERATURE SENSOR (Code No. 42)



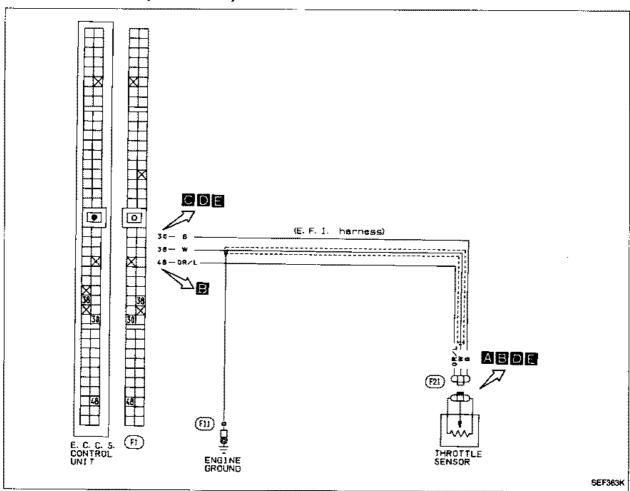


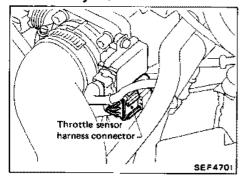


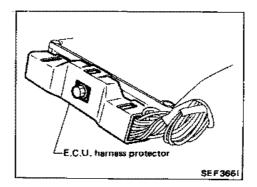


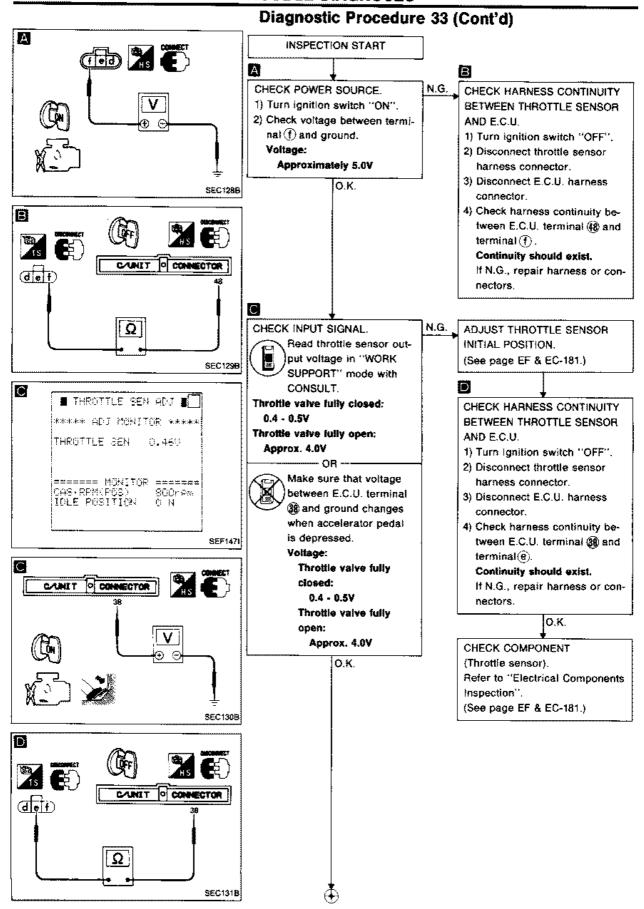
Diagnostic Procedure 33

THROTTLE SENSOR (Code No. 43)

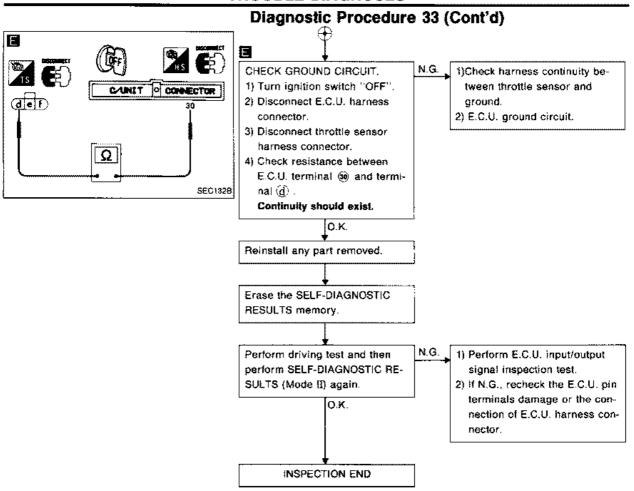








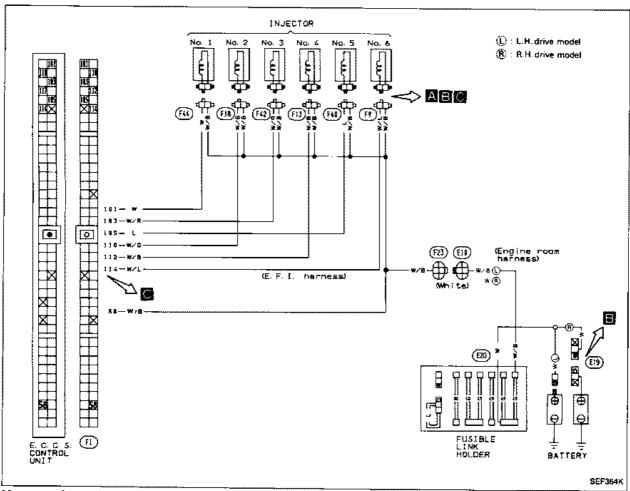
EF & EC-137

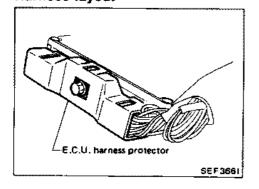


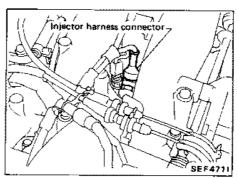
NOTE

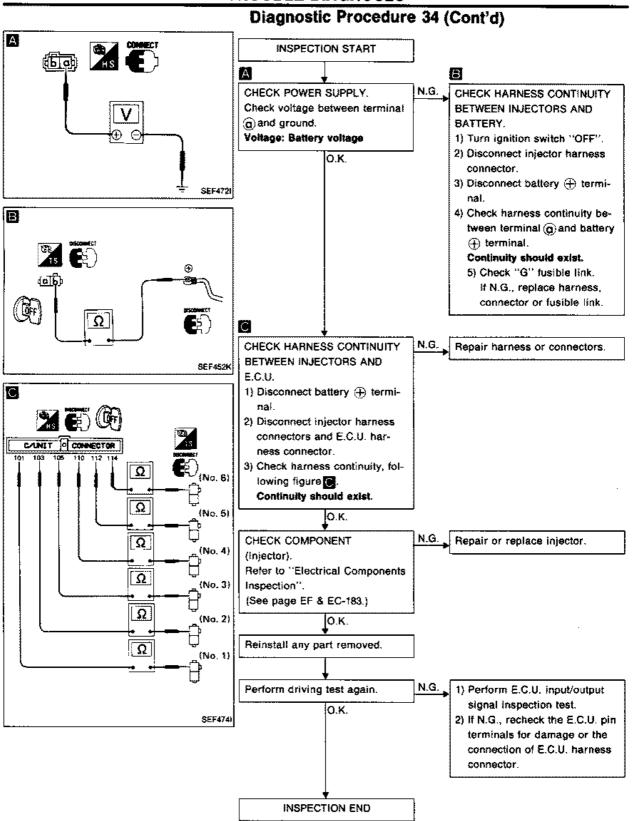
Diagnostic Procedure 34

INJECTOR CIRCUIT



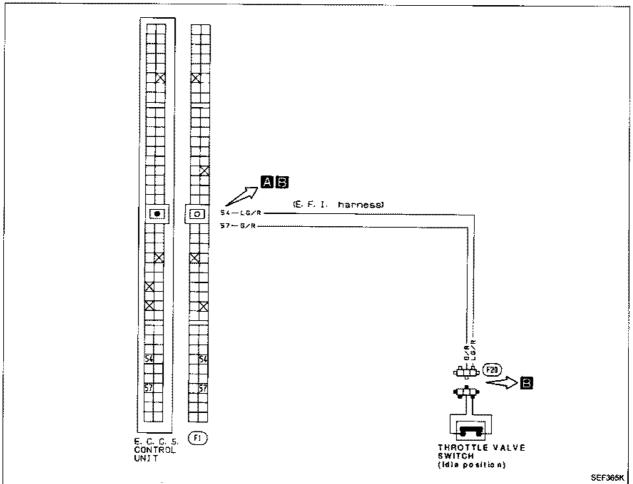


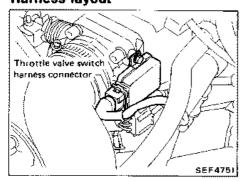


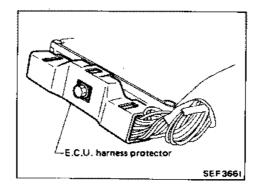


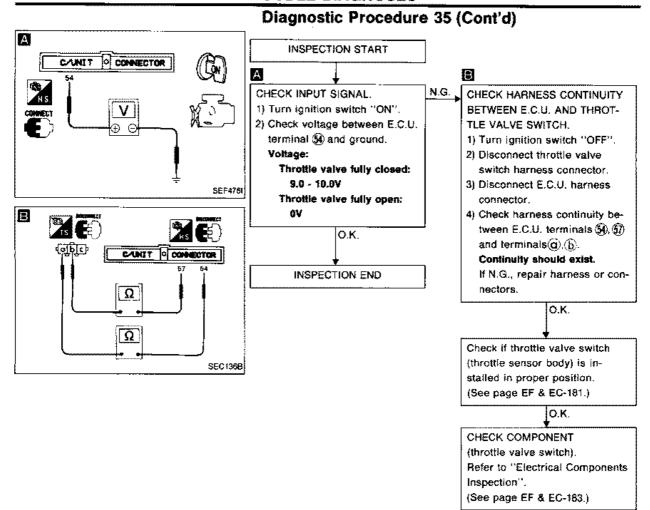
Diagnostic Procedure 35

THROTTLE VALVE SWITCH (Idle position)



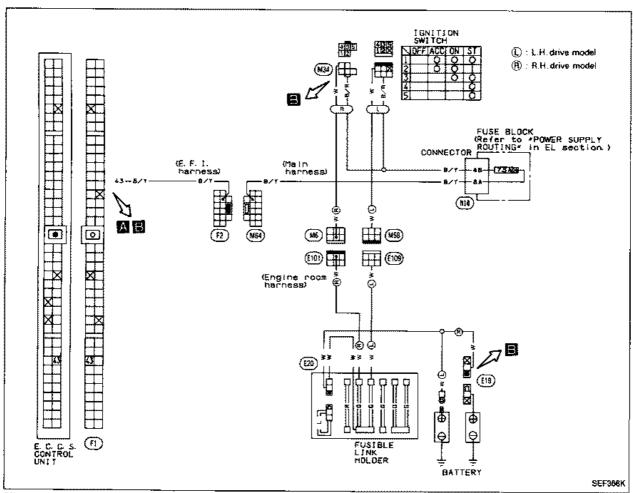


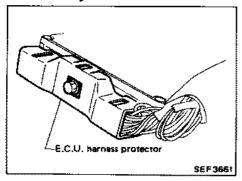


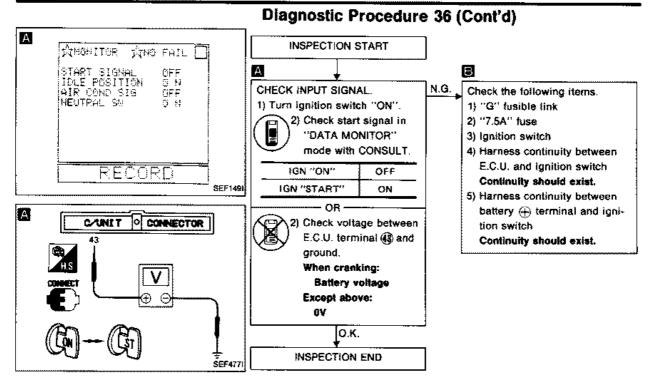


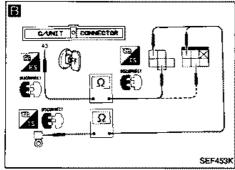
Diagnostic Procedure 36

START SIGNAL



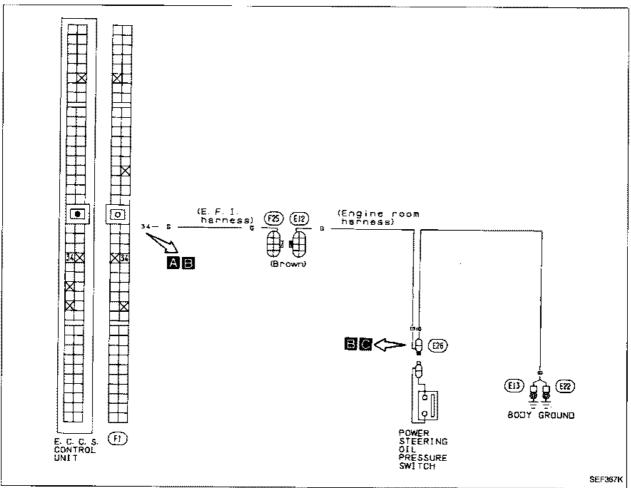




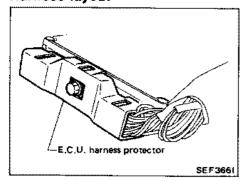


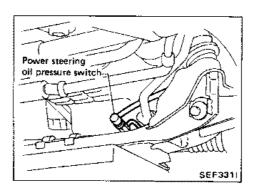
Diagnostic Procedure 37

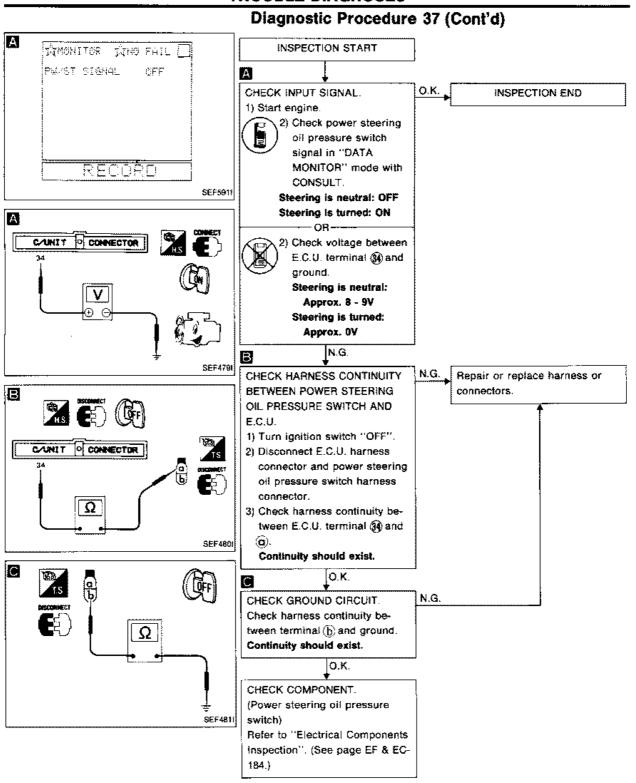
POWER STEERING OIL PRESSURE SWITCH



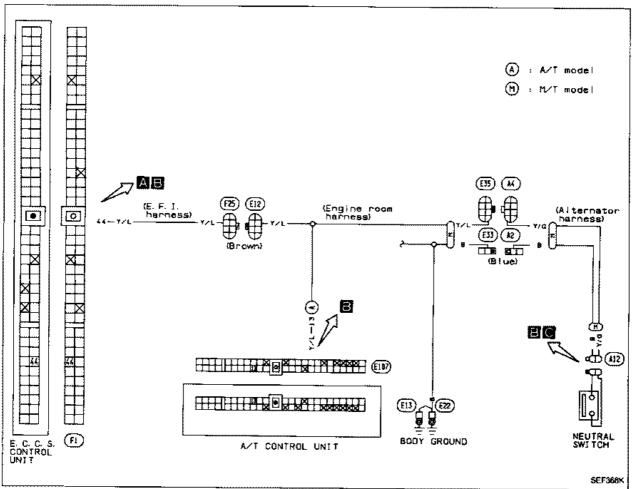
Harness layout



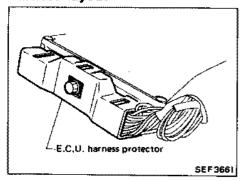


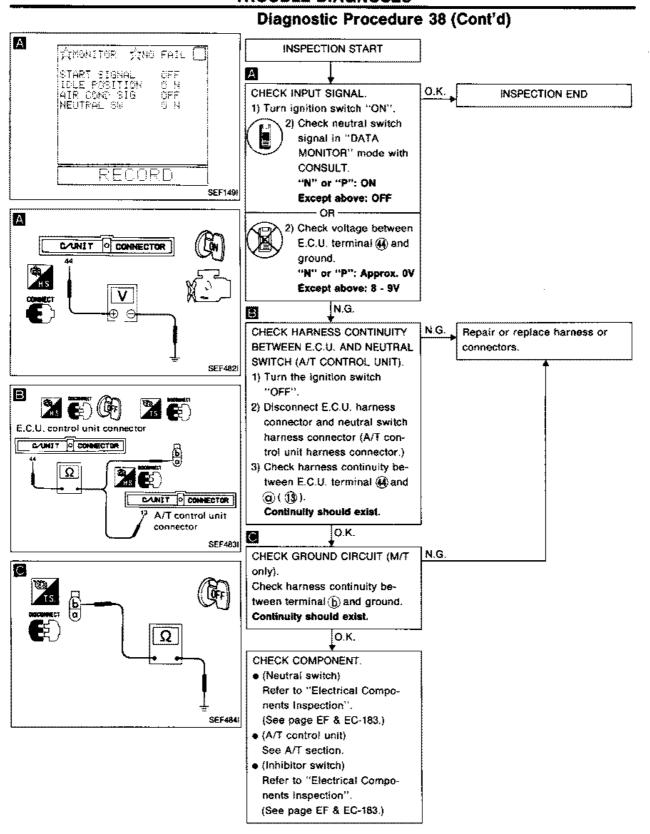


Diagnostic Procedure 38 NEUTRAL SWITCH & A/T CONTROL UNIT (NEUTRAL SIGNAL) CIRCUIT



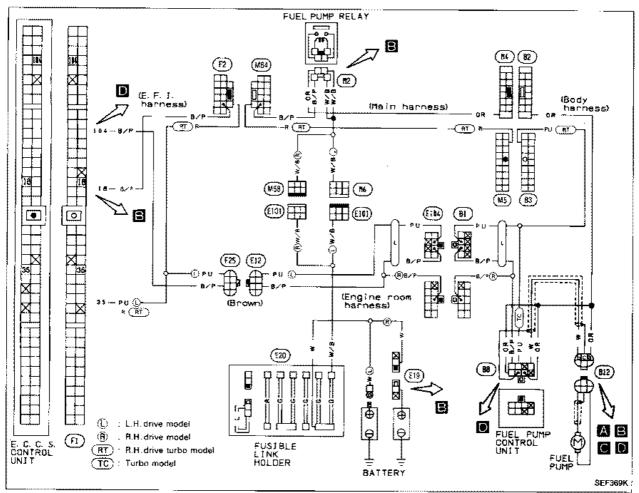
Harness layout



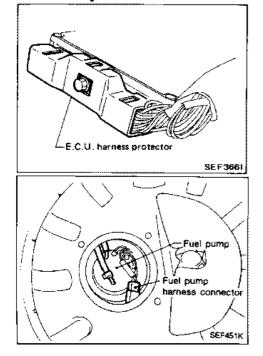


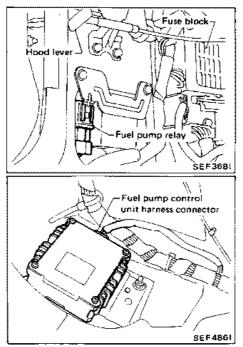
Diagnostic Procedure 39

FUEL PUMP

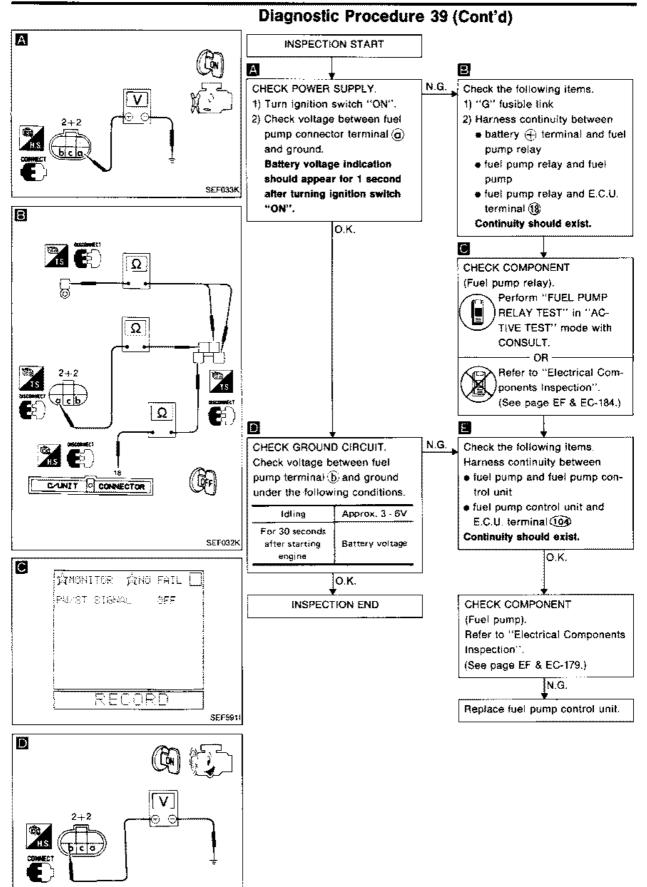


Harness layout





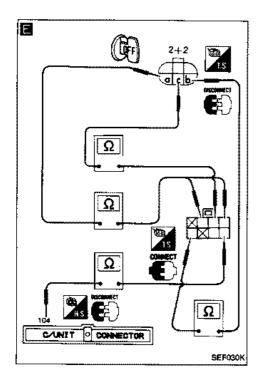
EF & EC-150



EF & EC-151

SEF031K

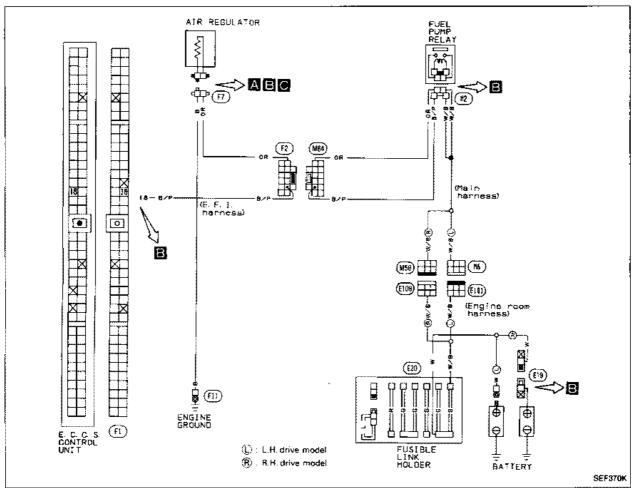
Diagnostic Procedure 39 (Cont'd)



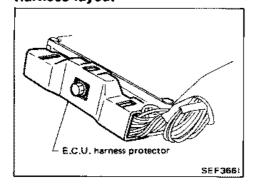
NOTE

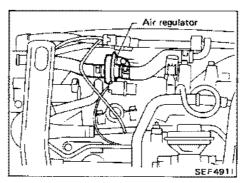
Diagnostic Procedure 40

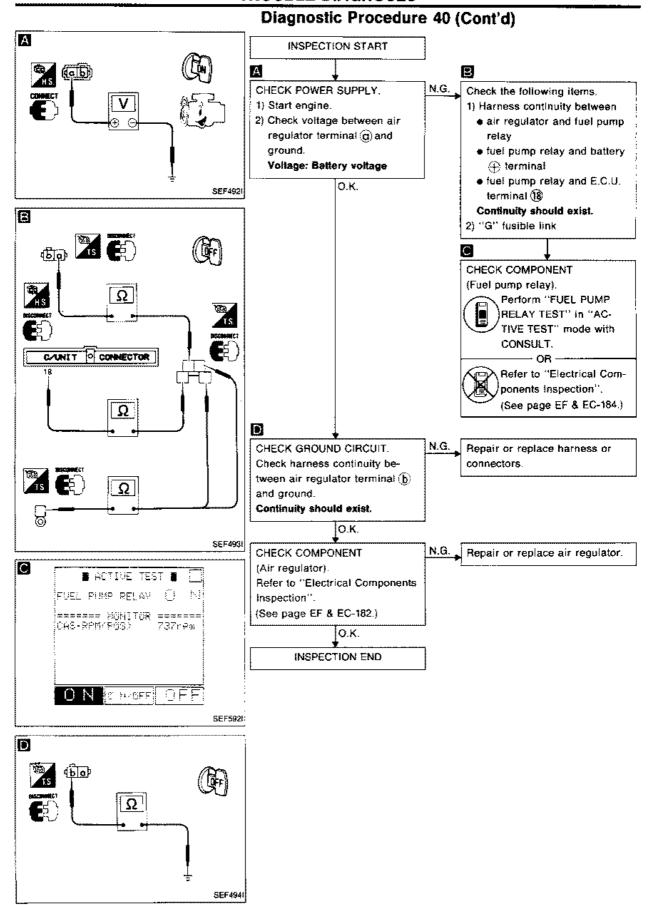
AIR REGULATOR



Harness layout



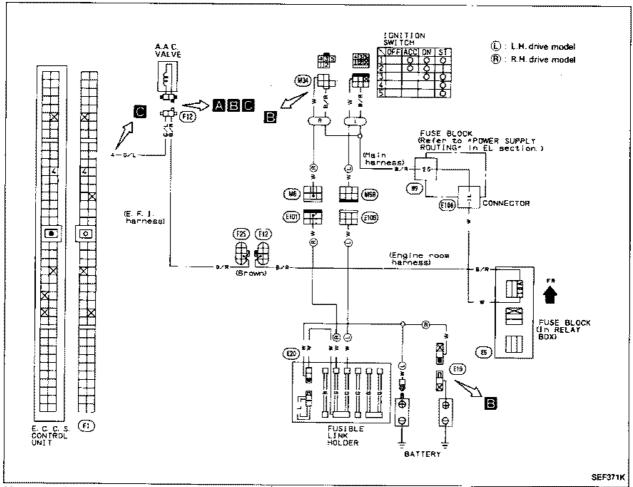




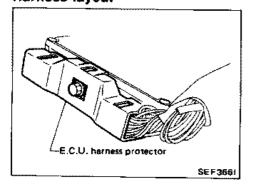
EF & EC-155

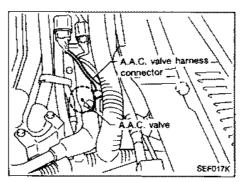
Diagnostic Procedure 41

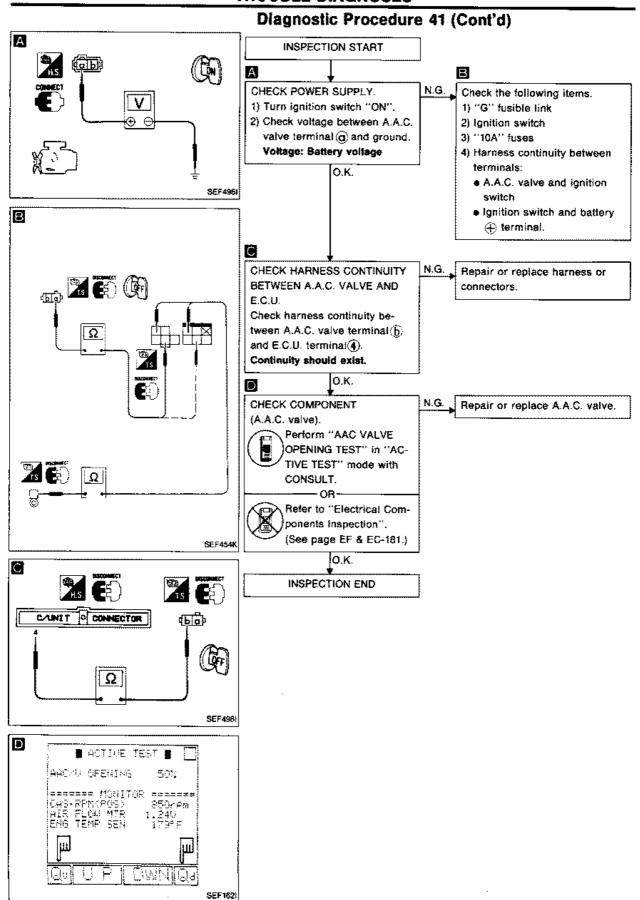
A.A.C. VALVE



Harness layout



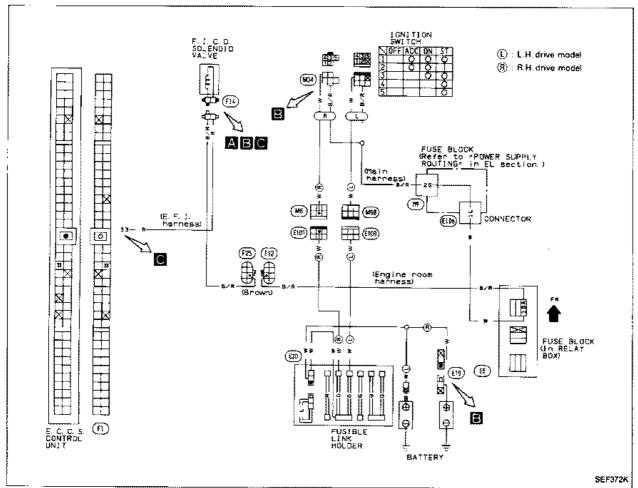




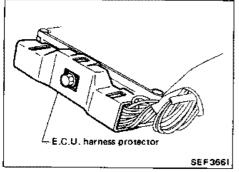
EF & EC-157

Diagnostic Procedure 42

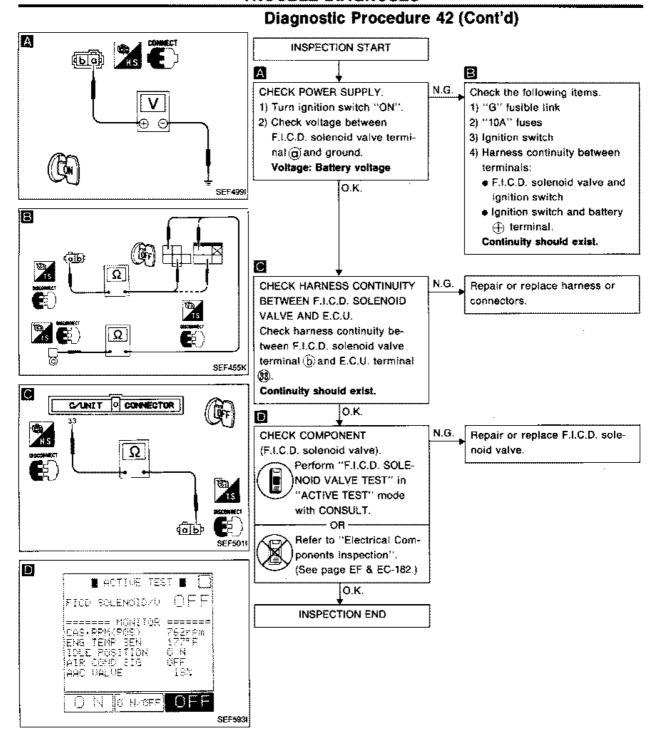
F.I.C.D. SOLENOID VALVE



Harness layout

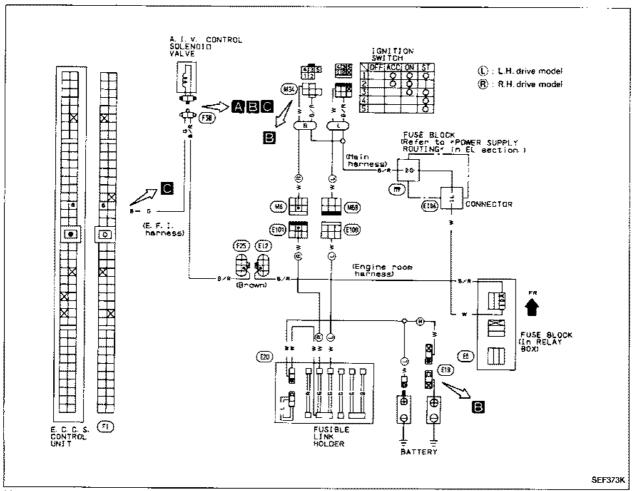


F.I.C.D. solenoid valve harness connector is located near A.A.C. valve harness connector.

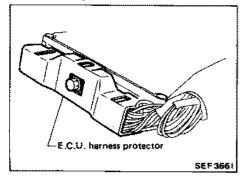


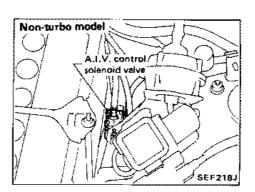
Diagnostic Procedure 43

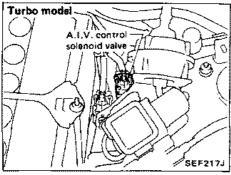
A.I.V. CONTROL SOLENOID VALVE



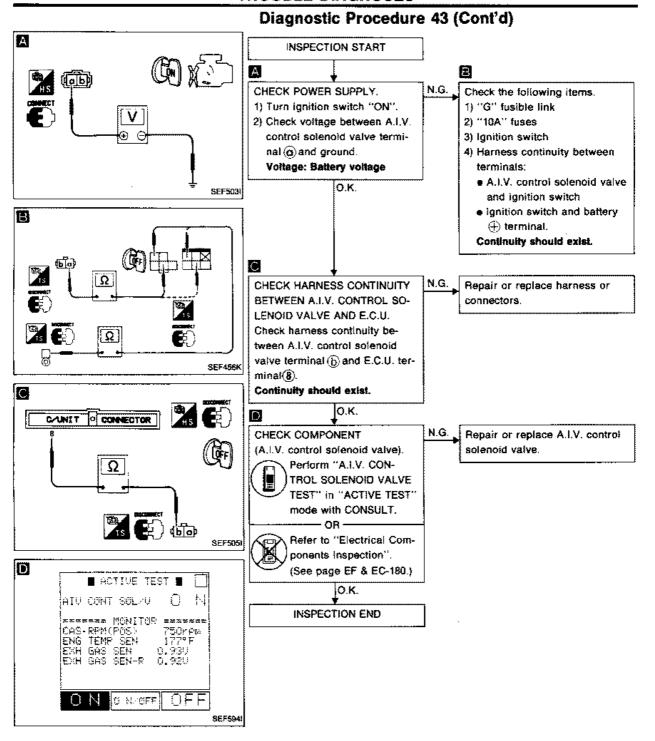
Harness layout





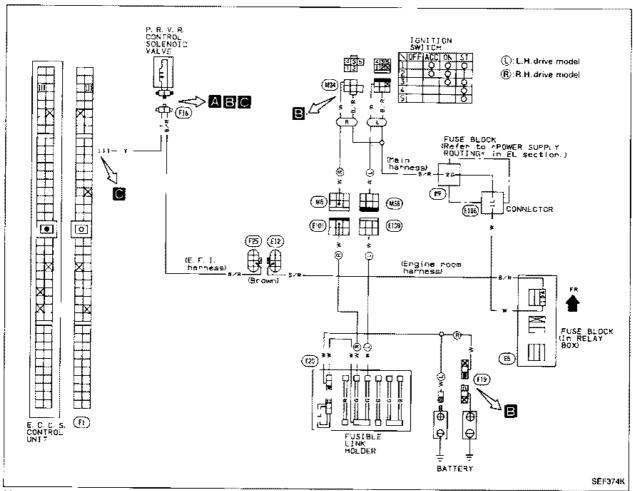


EF & EC-160

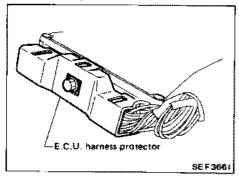


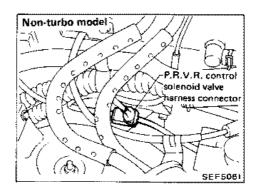
Diagnostic Procedure 44

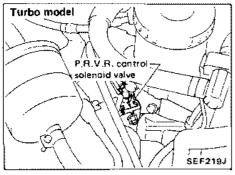
P.R.V.R. CONTROL SOLENOID VALVE



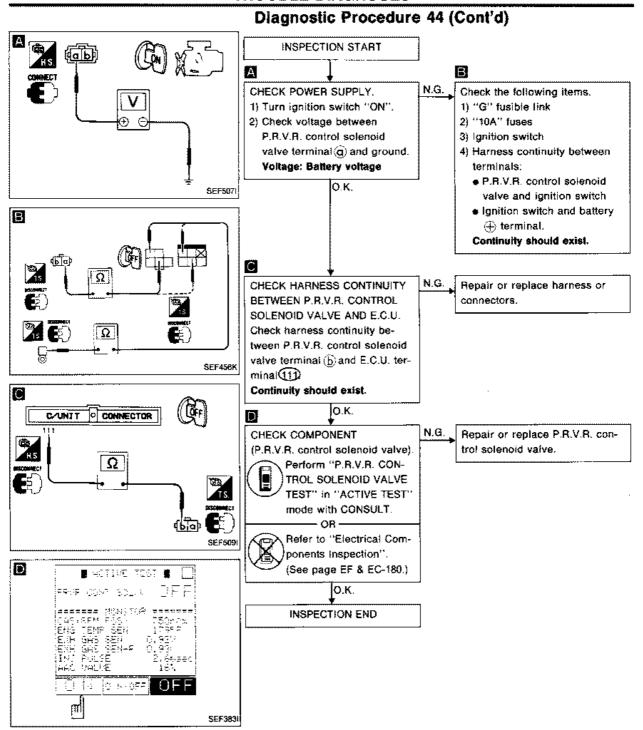
Harness layout





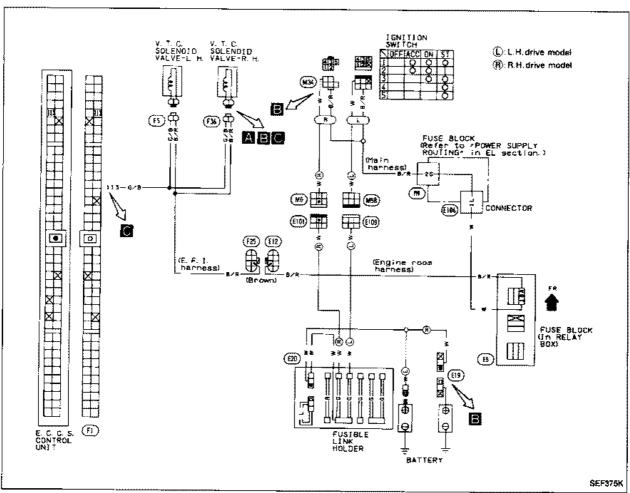


EF & EC-162

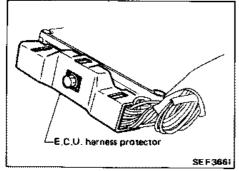


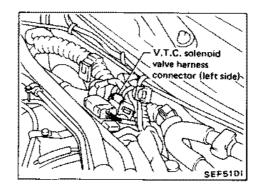
Diagnostic Procedure 45

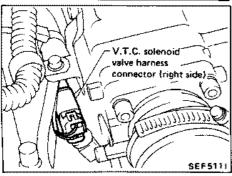
V.T.C. SOLENOID VALVE



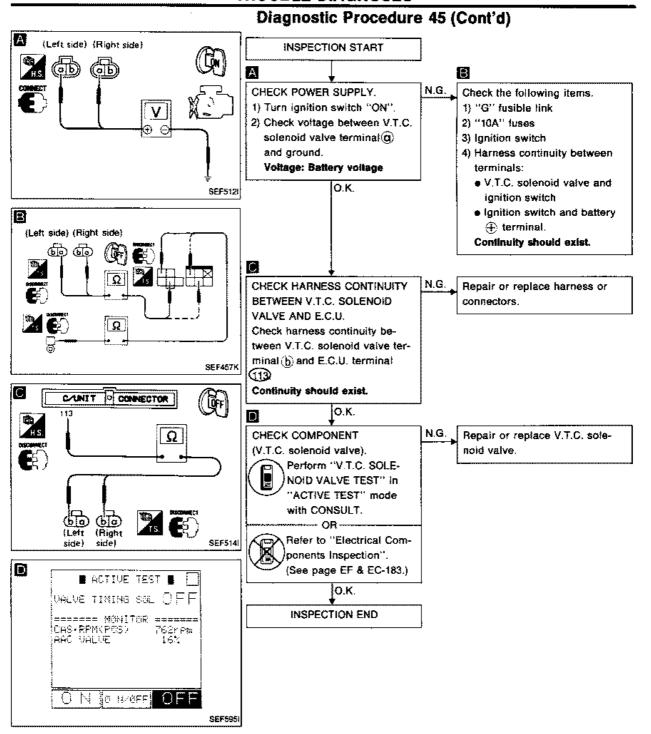
Harness layout





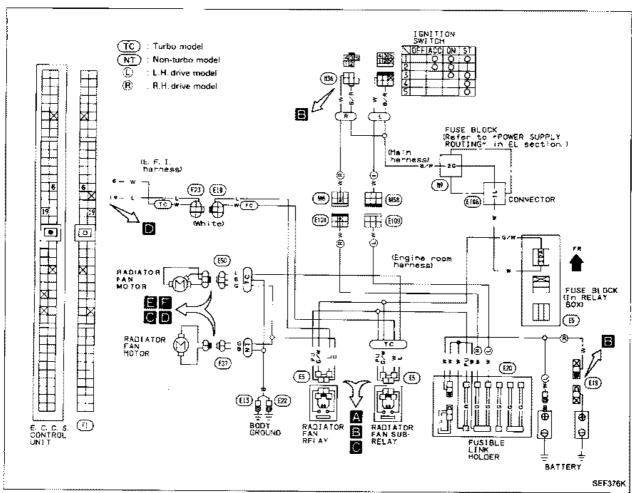


EF & EC-164

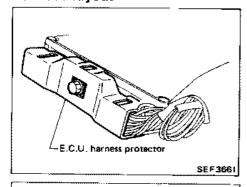


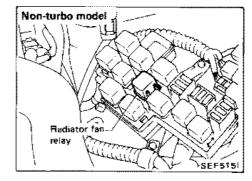
Diagnostic Procedure 46

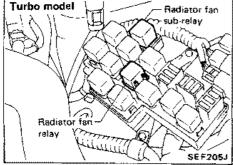
RADIATOR FAN CONTROL



Harness layout

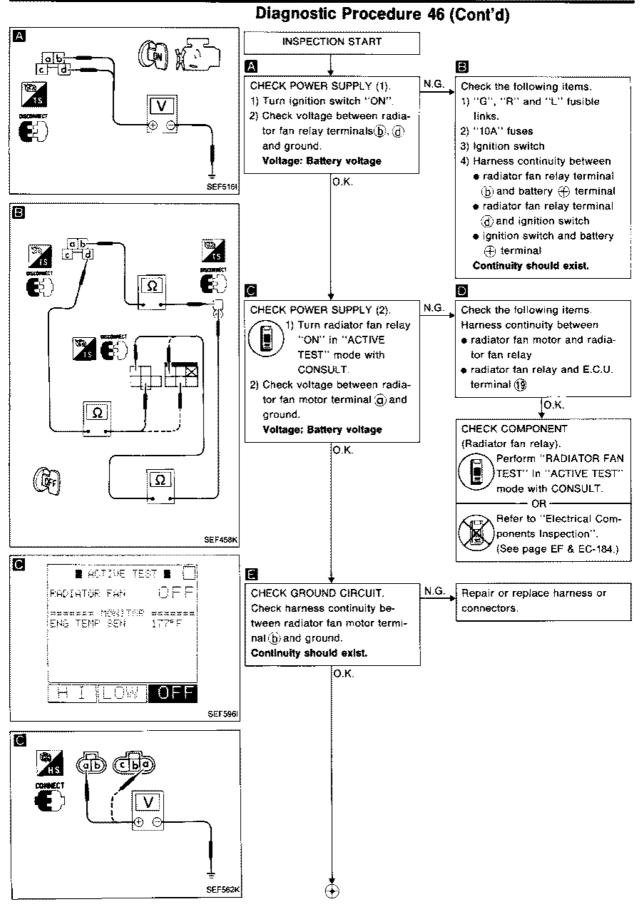




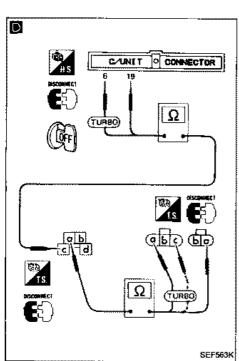


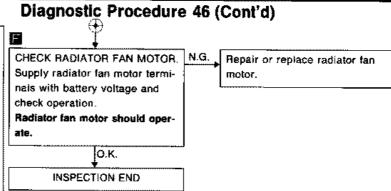
For radiator fan motor harness connector, see "HARNESS LAYOUT" in EL section.

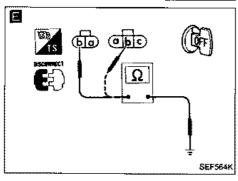
EF & EC-166

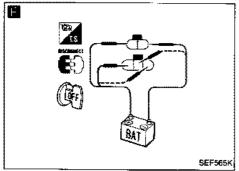


EF & EC-167





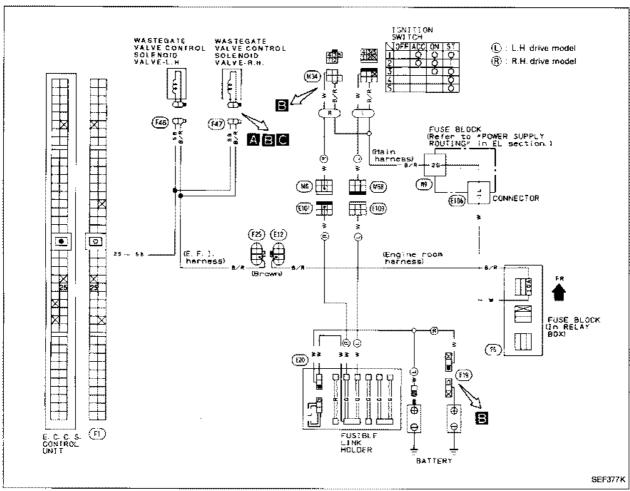




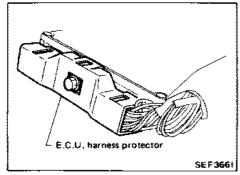
NOTE

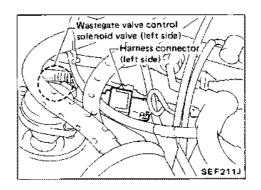
Diagnostic Procedure 47

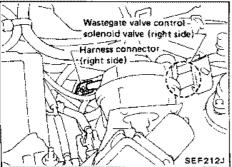
WASTEGATE VALVE CONTROL SOLENOID VALVE



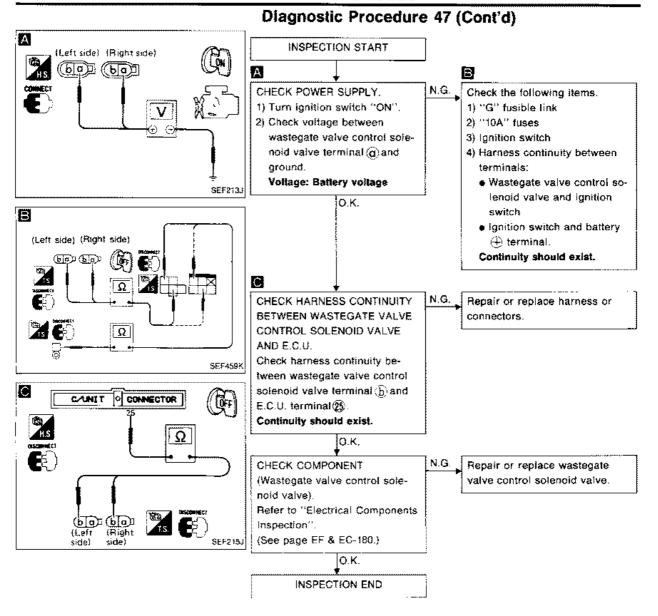
Harness layout

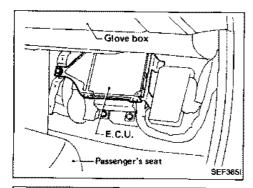






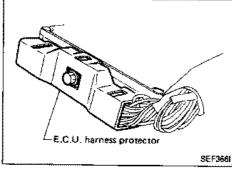
EF & EC-170



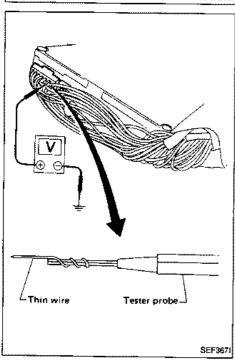


Electrical Components Inspection E.C.U. INPUT/OUTPUT SIGNAL INSPECTION

 E.C.U. is located behind front passenger side floor board. For this inspection, remove the front passenger side floor board.



2. Remove E.C.U. harness protector.



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

Electrical Components Inspection (Cont'd)

E.C.U. inspection table

| *************************************** | | | |
|---|---------------------------------------|---|--|
| TER- MINAL NO. | ITEM | CONDITION | *DATA |
| 1 2 3 | Ignition signal | Engine is running. | Approx. 0.1V |
| 11 12 13 | igenout signal | Engine is running. Engine speed is 2,000 rpm. | Approx. 0.14V |
| 4 | A.A.C. valve | Engine is running. Racing condition | Voltage briefly decreases from battery voltage (11 - 14V). |
| 6 | Radiator fan | Engine is running. -Radiator fan is not operating. | BATTERY VOLTAGE (11 - 14V) |
| | sub-relay (Turbo model) | Engine is running. Radiator fan is operating. | 0.1 ~ 0.3V |
| 7 | Tachometer | Engine is running. | Approx. 0.7V |
| , | , actionicion | Engine is running. Engine speed is 2,000 rpm. | Approx. 1.2V |
| _ | | Engine is running. | Approx. 0V |
| | A.I.V. control solenoid valve | Engine is running. Engine speed is 2,000 rpm. | BATTERY VOLTAGE (11 - 14V) |
| 9 | Air conditioner relay | Engine is running. Air conditioner switch "OFF" | BATTERY VOLTAGE (11 - 14V) |
| 9 | Air conditioner relay | Engine is running. Air conditioner switch "ON" | Approx. 0V |
| | ECH | Engine is running. | 0.8 - 1.0V |
| 16 | E.C.U. power source (Self-shutoff) | Engine is not running. For a few seconds after turning ignition switch "OFF" | BATTERY VOLTAGE (11 - 14V) |

Electrical Components Inspection (Cont'd)

| | | | *Data are reference values. | |
|----------------------|---|--|--|--|
| TER- MINAL NO. | ITEM | CONDITION | *DATA | |
| 18 | Fuel pump relay | For 5 seconds after turning ignition switch "ON" [Engine is running.] [Ignition switch "ON"] | 0.7 - 0.9V BATTERY VOLTAGE | |
| | | *In 5 seconds after turning ignition switch "ON" Engine is running. | (11 - 14V) BATTERY VOLTAGE | |
| 19 | Radiator fan relay | Engine is running. Endiator fan is not operating. Radiator fan is operating. | (11 - 14V) 0.1 - 0.3V | |
| 23 | Detonation sensor | Engine is running. Idle speed | Approx. 2.5V | |
| 25 | Wastegate valve control solenoid valves (Turbo model) | Engine is running. Engine is racing. Engine speed is up to 2,000 rpm | BATTERY VOLTAGE (11 - 14V) Approx. 9.2V | |
| 27 | Air flow meter | Engine is running.(Warm-up condition) | 0.8 + 1.5V | |
| | An now meter | Engine is running. (Warm-up condition) Engine speed is 2,000 rpm. | 1.0 ~ 1.6V | |
| 28 | Engine temperature sensor | Engine is running. | 0 - 5.0V Output voltage varies with engine temperature. | |
| 29 | Right side exhaust gas sensor | Engine is running. | | |
| 55 | Left side exhaust gas sensor | After warming up sufficiently and engine speed is 2,000 rpm. | 0 ↔ Approx. 1.0V | |
| 33 | F.I.C.D. solenoid valve | Engine is running. A/C compressor is not operating. | BATTERY VOLTAGE (11 - 14V) | |
| | | Engine is running. A/C compressor is operating. | 0.7 - 0.8V | |

Electrical Components Inspection (Cont'd)

| | | | Data are reference talues. |
|----------------------|---|---|---|
| TER- MINAL NO. | (TEM | CONDITION | ¹DATA |
| 34 | Power steering oil pressure switch | Engine is running. Steering wheel is in the "straight ahead" position. | 8.0 ~ 9.0V |
| | SWILETT | Engine is running. Steering wheel is turned. | Approx. 0V |
| 36 | Fuel temperature sensor | Engine is running. | 0 - 5.0V Output voltage varies with fuel temperature. |
| 38 | Throttle sensor | Ignition switch "ON" | 0.4 - 4.0V Output voltage varies with throttle valve opening angle. |
| 41 51 | Crank angle sensor (Reference signal) | Engine is running. Do not run engine at high speed under no-load. | 1.2 - 1.4V Output voltage varies slightly with engine speed. |
| 42 52 | Crank angle sensor (Position signal) | Do not run engine at high speed under no- load. | 2.5 - 2.7V Output voltage varies slightly with engine speed. |
| 43 | Start signal | [gnition switch "ON"] | Approx. 0V BATTERY VOLTAGE (11 - 14V) |
| 44 | Neutral switch (M/T model) A/T control unit (A/T model) | Ignition switch 'ON' | Approx. 0V |
| | | Ignition switch "ON" Except the above conditions | 8.0 - 9.0V |
| 45 | Ignition switch | Ignition switch "ON" Engine stopped | BATTERY VOLTAGE (11 - 14V) |
| | | Engine is running. Air conditioner switch "OFF" | BATTERY VOLTAGE (11 - 14V) |
| 46 | Air conditioner switch | Engine is running. Air conditioner switch "ON" | 0.5 - 0.7V |

Electrical Components Inspection (Cont'd)

| | | *Data are reference values. |
|---|--|--|
| ITEM | CONDITION | *DATA |
| Power source for sensors | Ignition switch "ON" Engine stopped | Approximately 5.0V |
| Battery source | Ignition switch "ON" Engine stopped | BATTERY VOLTAGE (11 - 14V) |
| Throttle valve switch | [gnition switch "ON"] Accelerator pedal is fully released (engine running). | 9.0 - 10.0V |
| (Idle position) | Accelerator pedal is depressed (engine running). | ov |
| Power source for throttle valve switch | Ignition switch "ON" Engine running | BATTERY VOLTAGE (11 - 14V) |
| Power supply | Ignition switch "ON" Engine running | BATTERY VOLTAGE (11 - 14V) |
| Injectors | gnition switch "OFF" | BATTERY VOLTAGE (11 - 14V) |
| E.G.R. control solenoid valve | Engine is running. (Warm-up condition) Idle speed Engine is running. (Warm-up condition) | 0.7 - 0.8V |
| | Engine speed is 2,000 rpm. | BATTERY VOLTAGE (11 - 14V) |
| Fuel pump voltage control | Ignition switch "ON" -Engine stopped | BATTERY VOLTAGE (11 - 14V) |
| (so. Turbu moder) | Engine is running. (Warm-up condition) | Approx. 0V |
| | Stop and restart engine after warming it up. | 0 - 1.0V (for 30 seconds after ignition switch is turned off.) |
| P.R.V.R. control LFuel temperature is above 75°C (167°F) solenoid valve | | BATTERY VOLTAGE (After 30 seconds) |
| | Stop and restart engine after warming it up. Fuel temperature is below 75°C (167°F) | BATTERY VOLTAGE (11 - 14V) |
| | Power source Throttle valve switch (Idle position) Power source for throttle valve switch Power supply Injectors E.G.R. control solenoid valve Fuel pump voltage control (35: Turbo model) P.R.V.R. control | Power source for sensors Battery source Ignition switch "ON" Engine stopped Ignition switch "ON" Accelerator pedal is fully released (engine running). Ignition switch "ON" Accelerator pedal is depressed (engine running). Ignition switch "ON" Accelerator pedal is depressed (engine running). Ignition switch "ON" Engine running Ignition switch "ON" Engine sunning Ignition switch "ON" Engine sunning Ignition switch "ON" Engine is running Ignition switch "ON" Engine is running Ignition switch "ON" Ignition switch " |

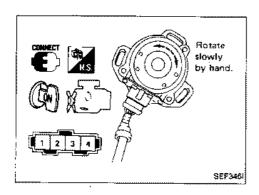
Electrical Components Inspection (Cont'd)

*Date are reference values.

| TER- MINAL NO. | ITEM | CONDITION | .*DATA |
|----------------------|-------------------------------|--|-------------------------------|
| 113 | Valve timing control solenoid | Engine is running. | BATTERY VOLTAGE (11 - 14V) |
| | valves | Engine is running. Engine speed is 3,000 rpm. | 0.2 - 0.5V |

E.C.U. HARNESS CONNECTOR TERMINAL LAYOUT

| 10)) 122113414551 1411571 14 [19914411112113414115014 | 1 2 3 4 5 6 7 8 9 1 6 11 12 13 14 15 16 17 18 19 2 0 | © 21122123124251262712812 3113213313435336371383 | 930 41 42 43 44 45 46 47 48 49 50 940 51 52 53 54 55 56 57 58 59 60 | H.S. |
|--|---|---|--|---------|
| | | | | SEC2508 |



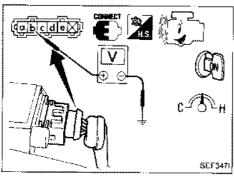
Electrical Components Inspection (Cont'd) CRANK ANGLE SENSOR

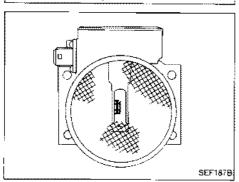
- 1. Remove crank angle sensor from engine. (Crank angle sensor harness connector should remain connected.)
- 2. Turn ignition switch "ON",
- 3. Rotate crank angle sensor shaft slowly by hand and check voltage between terminals ①, ② and ground.

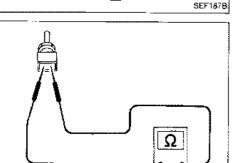
| Terminal | Voltage |
|-----------------|--|
| ② (120° signal) | Market Alexander by the state of the state o |
| ① (1" signal) | Voltage fluctuates between 5V and 0V. |

If N.G., replace crank angle sensor.

After this inspection, malfunction code No. 11 might be displayed though the crank angle sensor is functioning properly. In this case erase the stored memory.







AIR FLOW METER

- Fold back air flow meter harness connector rubber as shown in the figure if the harness connector is connected.
- 2. Turn ignition switch "ON".
- Start engine and warm it up sufficiently.
- 4. Check voltage between terminal (b) and ground.

| Conditions | Voltage V | |
|--|-------------------------|--|
| Ignition switch "ON" (Engine stopped.) | Approximately 0.8 | |
| ldle (Engine is warm-up sufficiently.) | Approximately 0.8 - 1.5 | |

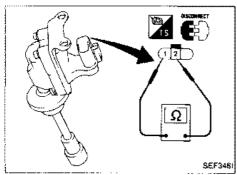
If N.G., remove air flow meter from air duct. Check hot wire for damage or dust.

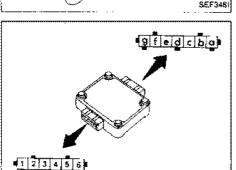
ENGINE TEMPERATURE SENSOR

- 1. Disconnect engine temperature sensor harness connector.
- 2. Check resistance as shown in the figure.

| Temperature °C (°F) | Resistance kΩ |
|---------------------|---------------|
| 20 (68) | 2.1 - 2.9 |
| 50 (122) | 0.68 - 1.00 |
| 80 (176) | 0.30 - 0.33 |

If N.G., replace engine temperature sensor.





Electrical Components Inspection (Cont'd) IGNITION COIL

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

| Terminal | Resistance | |
|----------|--------------------|--|
| ① - ② | Approximately 0.7Ω | |

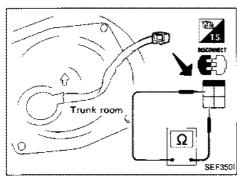
If N.G., replace ignition coil.

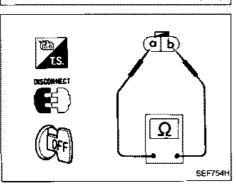
POWER TRANSISTOR

- 1. Disconnect power transistor harness connector.
- 2. Check power transistor continuity between terminals as shown in the figure.

| Te | rm | ina nat | _ | | bi- | Tester polarity | Con- tinuity | Tester polarity | Con- tinuity |
|----|----|------------|---|---|-----|--------------------|-----------------|--------------------|-----------------|
| g | g | g | g | 9 | g | \oplus | No | Θ | Yes |
| æ | b | c | d | ÷ | f | \oplus | | ⊕ | |
| g | 9 | g | g | g | g | \oplus | Yes | Θ | Yes |
| 1 | 2 | 3 | 4 | 5 | 6 | \ominus | 162 | ⊕ | . 85 |
| a | b | С | d | e | ŧ | (+) | . | 9 | 41- |
| 1 | 2 | 3 | 4 | 5 | 6 | Θ | Yes | • | No |

If N.G., replace power transistor.





FUEL PUMP

SEF3491

- 1. Disconnect fuel pump harness connector.
- 2. Check resistance between terminals (a) and (c). Resistance: Approximately 0.5 Ω

If N.G., replace fuel pump.

VEHICLE SPEED SENSOR

- 1. Jack up rear wheels. Use stands to support vehicle.
- 2. Disconnect vehicle speed sensor harness connector.
- 3. Check continuity between terminals @ and b while rotating rear wheel by hand.

Continuity should come and go.

If N.G., replace vehicle speed sensor.

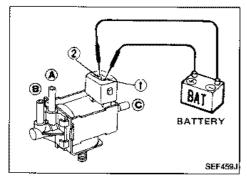
BATTERY SEF216J

Electrical Components Inspection (Cont'd) WASTEGATE VALVE CONTROL SOLENOID VALVE

Check air passage continuity.

| Condition | Air passage continuity between (a) and (b) | |
|---|--|--|
| 12V direct current supply between terminals @ and @ | Yes | |
| No supply | No | |

If N.G., replace solenoid valve.



E.G.R. CONTROL SOLENOID VALVE

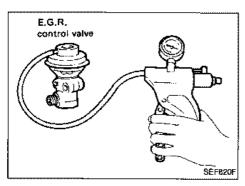
A.I.V. CONTROL SOLENOID VALVE

P.R.V.R. CONTROL SOLENOID VALVE

Check air passage continuity.

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

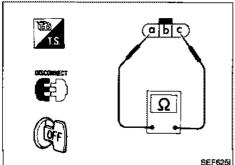
If N.G., replace solenoid valve.



E.G.R. CONTROL VALVE

Apply vacuum to E.G.R. vacuum port with a hand vacuum pump. E.G.R. control valve spring should lift.

If N.G., replace E.G.R. control valve.

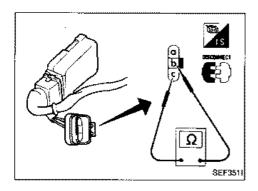


EXHAUST GAS SENSOR

Refer to "Diagnostic Procedure 30". (See page EF & EC-128.)

EXHAUST GAS SENSOR HEATER

Check resistance between terminals @ and @. Resistance: 3 - 1,000 Ω If N.G., replace exhaust gas sensor.



Electrical Components Inspection (Cont'd) THROTTLE SENSOR

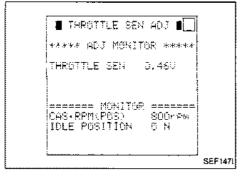
- 1. Disconnect throttle sensor harness connector.

| Accelerator pedal conditions | Resistance kΩ |
|------------------------------|-----------------|
| Completely released | Approximately 1 |
| Partially released | 1.9 |
| Completely depressed | Approximately 9 |

If N.G., replace throttle sensor.

Adjustment

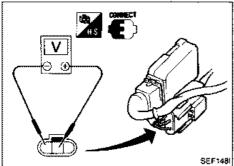
If throttle sensor is replaced or removed, it is necessary to install it in the proper position, by following the procedure as shown below:



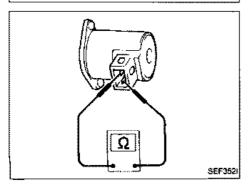
- 1. Install throttle sensor body in throttle chamber. Do not tighten bolts.
- 2. Connect throttle sensor and idle switch harness connector.
- 3. Start engine and warm it up sufficiently.
- 4. Perform "THROTTLE SEN ADJ" in "WORK SUPPORT" mode.



Measure output voltage of throttle sensor using voltmeter.



- 5. Adjust by rotating throttle sensor body so that output voltage is 0.4 to 0.5V.
- 6. Tighten mounting bolts.
- Disconnect throttle sensor harness connector for a few seconds and then reconnect it.



A.A.C. VALVE

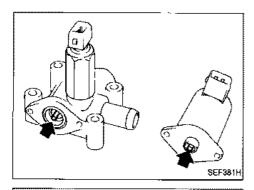
Check A.A.C. valve resistance.

Resistance:

Approximately 10 Ω

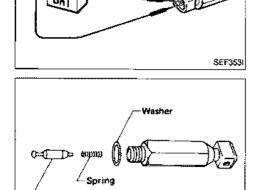
Electrical Components Inspection (Cont'd)

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



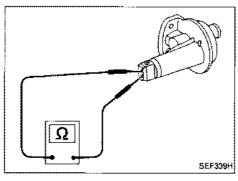
F.I.C.D. SOLENOID VALVE

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



– Plunger

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



AIR REGULATOR

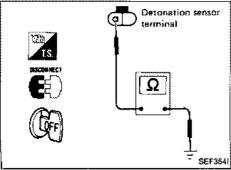
SEF342H

· Check air regulator resistance.

Resistance:

Approximately 70 - 80Ω

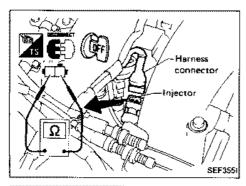
· Check air regulator for clogging.



DETONATION SENSOR

- 1. Disconnect detonation sensor sub-harness connector.
- 2. Check continuity between terminal @ and ground.

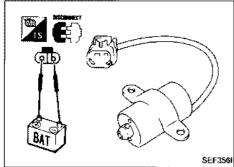
Continuity should exist.



Electrical Components Inspection (Cont'd) INJECTOR

- 1. Disconnect injector harness connector.
- 2. Check resistance between terminals as shown in the figure. Resistance: 10 14Ω

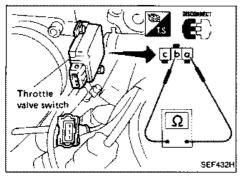
If N.G., replace injector.



VALVE TIMING CONTROL SOLENOID VALVE

Check valve timing control solenoid valve for normal operation by supplying it with battery voltage between terminals (a) and (b).

If N.G., replace solenoid valve.

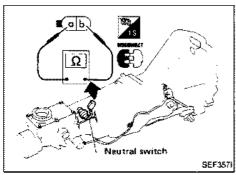


THROTTLE VALVE SWITCH (Idle position)

- 1. Disconnect idle switch harness connector.
- 2. Check continuity between terminals @ and b.

| Accelerator pedal condition | Continuity |
|-----------------------------|------------|
| Released | Yes |
| Depressed | No |

If N.G., replace throttle valve switch.

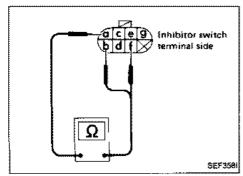


NEUTRAL SWITCH

Check continuity between terminals @ and ...

| Conditions | Continuity |
|-------------------------|------------|
| Shift to Neutral | Yes |
| Shift to other position | No |

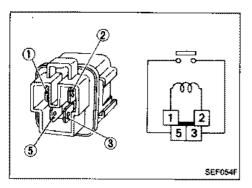
If N.G., replace neutral switch.



INHIBITOR SWITCH

Check continuity between terminals @ and . . .

| Conditions | Continuity between terminals (a) and (b) | Continuity between terminals @ and ① |
|---|--|--------------------------------------|
| Shift to "P" position | Yes | No |
| Shift to "N" position | No | Yes |
| Shift to positions other than "P" and "N" | No | No |



Electrical Components Inspection (Cont'd) E.C.C.S. RELAY, FUEL PUMP RELAY, RADIATOR FAN RELAY AND IGNITION COIL RELAY

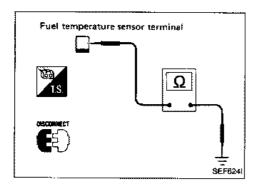
Check continuity between terminals 3 and 5.

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

If N.G., replace relay.

POWER STEERING OIL PRESSURE SWITCH

- Disconnect power steering oil pressure switch harness connector.
- 2. Check resistance between terminals. Resistance: Approximately 2 - 3Ω



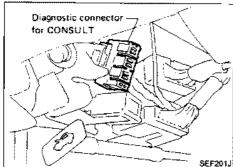
FUEL TEMPERATURE SENSOR

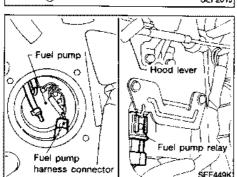
- 1. Disconnect fuel temperature sensor harness connector.
- 2. Check resistance between terminal and ground as shown in the figure.

| Temperature °C (°F) | Resistance kΩ |
|---------------------|---------------|
| 20 (68) | 2.1 - 2.9 |
| 50 (122) | 0.68 - 1.00 |
| 80 (176) | 0.30 - 0.33 |

If N.G., replace fuel inhibitor switch.

FUEL INJECTION CONTROL SYSTEM INSPECTION





Releasing Fuel Pressure

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



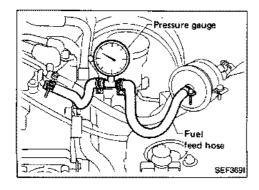
Perform "FUEL PRESSURE RELEASE" in "WORK SUPPORT" mode with CONSULT.



- Remove fuel pump relay or disconnect fuel pump connector.
- 2. Start engine.
- After engine stalls, crank it two or three times to release all fuel pressure.
- 4. Turn ignition switch off and reconnect fuel pump relay or fuel pump connector.

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.
- d. Use Pressure Gauge to check fuel pressure.
- Do not perform fuel pressure check while fuel pressure regulator control system is operating; otherwise, fuel pressure gauge might indicate incorrect readings.
- 1. Release fuel pressure to zero.
- 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.



Read the indication of fuel pressure gauge. At idling:

When fuel pressure regulator valve vacuum hose is connected.

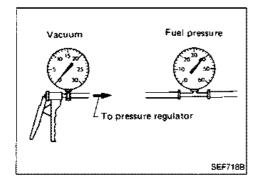
Approximately 250.1 kPa
(2.501 bar, 2.55 kg/cm², 36.3 psi)
When fuel pressure regulator valve vacuum hose is disconnected.

Approximately 299.1 kPa
(2.991 bar, 3.05 kg/cm², 43.4 psi)

FUEL INJECTION CONTROL SYSTEM INSPECTION

Fuel Pressure Check (Cont'd)

- Stop engine and disconnect fuel pressure regulator vacuum hose from intake manifold.
- 7. Plug intake manifold with a rubber cap.
- 8. Connect variable vacuum source to fuel pressure regulator.



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. Drain coolant from radiator drain cock.
- 3. Remove or disconnect the following:
- · Related harnesses, wires and tubes
- Intake manifold collector
 For details, refer to EM section.
- 4. Remove injectors with fuel tube assembly.
- 5. Remove injectors from fuel tube assembly.
- 6. Install injectors as follows:
- 1) Clean exterior of injector tail piece.
- 2) Use new O-rings.

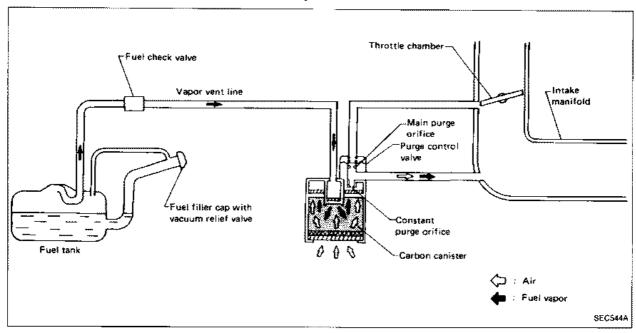
CAUTION:

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

Assemble injectors with fuel tube assembly to intake manifold.

EVAPORATIVE EMISSION CONTROL SYSTEM

Description

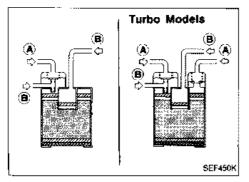


The evaporative emission control system is used to reduce hydrocarbons emitted into the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the carbon canister.

The fuel vapor from the sealed fuel tank is led into the canister which contains activated carbon and the vapor is stored there when the engine is not running.

The canister retains the fuel vapor until the canister is purged by the air drawn through the bottom of the canister to the intake manifold when the engine is running. When the engine runs at idle, the purge control valve is closed.

Only a small amount of stored vapor flows into the intake manifold through the constant purge orifice. As the engine speed increases, and the throttle vacuum rises higher, the purge control valve opens and the vapor is sucked into the intake manifold through both the main purge orifice and the constant purge orifice.



Inspection

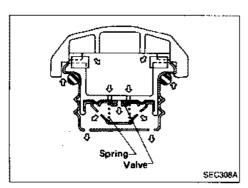
CARBON CANISTER

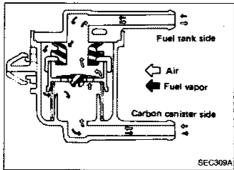
Check carbon canister as follows:

A : Blow air and ensure that there is no leakage.

B): Blow air and ensure that there is leakage.

EVAPORATIVE EMISSION CONTROL SYSTEM





Inspection (Cont'd)

FUEL TANK VACUUM RELIEF VALVE

- Wipe clean valve housing.
- Suck air through the cap. A slight resistance accompanied by valve clicks indicates that valve is in good mechanical condition. Note also that, by further sucking air, the resistance should disappear with valve clicks.
- If valve is clogged or if no resistance is felt, replace cap as an assembly.

FUEL CHECK VALVE

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

CRANKCASE EMISSION CONTROL SYSTEM

Description

This system returns blow-by gas to both the intake manifold and air inlet tubes.

The positive crankcase ventilation (P.C.V.) valve is provided to conduct crankcase blow-by gas to the intake manifold.

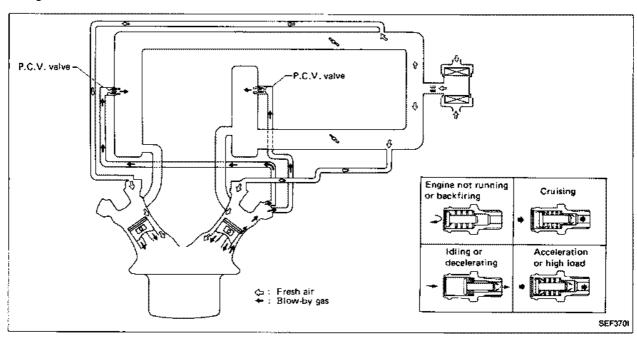
During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the P.C.V. valve.

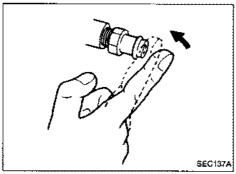
Normally, the capacity of the valve is sufficient to handle any blow-by and a small amount of ventilating air.

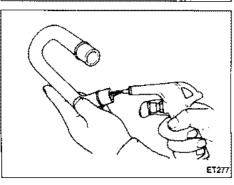
The ventilating air is then drawn from the air inlet tubes, through the hose connecting air inlet tubes to rocker cover, into the crankcase.

Under full-throttle condition, the manifold vacuum is insufficient to draw the blow-by flow through the valve, and its flow goes through the hose connection in the reverse direction.

On vehicles with an excessively high blow-by some of the flow will go through the hose connection to the air inlet tubes under all conditions.







Inspection

P.C.V. (Positive Crankcase Ventilation)

With engine running at idle, remove ventilation hose from P.C.V. valve; if the valve is working properly, a hissing noise will be heard as air passes through it and a strong vacuum should be felt immediately when a finger is placed over valve inlet.

VENTILATION HOSE

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

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

General Specifications

| PRESSURE REGULATOR |
|-----------------------|
| Regulated pressure |
| kPa (bar, kg/cm², psi |

299.1 (2.991, 3.05, 43.4)

Inspection and Adjustment

| Idle speed*1 | rpm | |
|-------------------------------|--------|-----------------|
| No-load*2 | | |
| M/T | | 700 ± 50 |
| A/T (in "N" position) | | |
| Non-turbo | | 770 ± 50 |
| Turbo | | 750 ± 50 |
| Air conditioner: ON | | |
| Non-turbo | | 800 ± 50 |
| Turbo | | 850 ± 50 |
| Ignition timing | degree | 15 ± 2 B.T.D.C. |
| Throttle sensor idle position | ٧ | 0.4 - 0.5 |

^{1:} Feedback controlled and needs no adjustments

- 2: Under the following conditions:
 - Air conditioner switch: OFF
 - · Steering wheel: Kept straight
 - Electric load: OFF (Lights, heater, fan & rear defogger)
 - Radiator fan: OFF

IGNITION COIL

| Primary voltage | ٧ | 12 |
|--|----|-------------------|
| Primary resistance [at 20°C (68°F)] | Ω | Approximately 0.7 |
| Secondary resistance [at 20°C (68°F)] | kΩ | Approximately 8 |

ENGINE TEMPERATURE SENSOR AND FUEL TEMPERATURE SENSOR

| Temperature °C (°F) | Resistance kΩ |
|---------------------|---------------|
| 20 (68) | 2.1 - 2.9 |
| 50 (122) | 0.68 - 1.00 |
| 80 (176) | 0.30 - 0.33 |

FUEL PUMP

| Resistance | Ω | Approximately 0.5 |
|------------|---|-------------------|
| | | |

EXHAUST GAS TEMPERATURE SENSOR

| Resistance [at 100°C (212°F)] | kΩ | 85.3 ± 6.53 |
|----------------------------------|-----|-------------|
| • • • | - 1 | |

EXHAUST GAS SENSOR HEATER

| | | |
|------------|---|-------------|
| Resistance | Ω | 3 - 1,000 |

A.A.C. VALVE

| Resistance | Ω | Approximately 10 |
|------------|---|------------------|
| | | |

INJECTOR

| Resistance | Ω | 10 - 14 | |
|------------|---|---------|--|

THROTTLE SENSOR

| Accelerator pedal conditions | Resistance kΩ |
|------------------------------|-----------------|
| Completely released | Approximately 1 |
| Partially released | 1 - 9 |
| Completely depressed | Approximately 9 |

AIR REGULATOR

| • | | |
|------------|---|---------|
| Resistance | Ω | 70 - 80 |
| | | |

POWER STEERING OIL PRESSURE SWITCH

| Resistance | Ω | Approximately 2 - 3 |
|-------------|-----|---------------------|
| 1100 SIGNAG | **1 | Approximatery 2 - 3 |