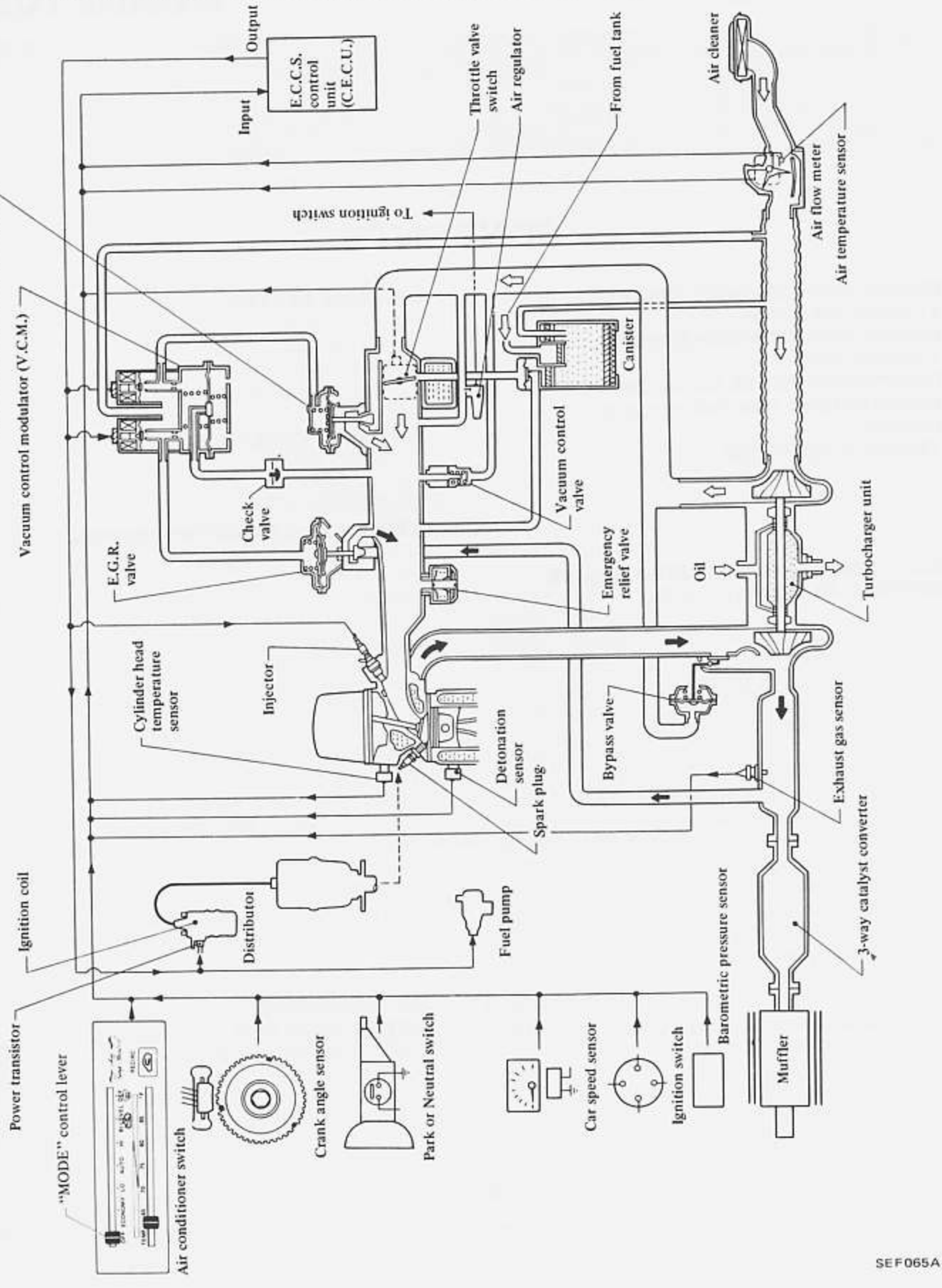
SECTION EF

CONTENTS

ENGINE AND EMISSION CONTROL SYSTEM DIAGRAM



ENGINE AND EMISSION CONTROL SYSTEM CHART

Electronic Concentrated Engine Control System (E.C.C.S.)

Sensors & Switches:

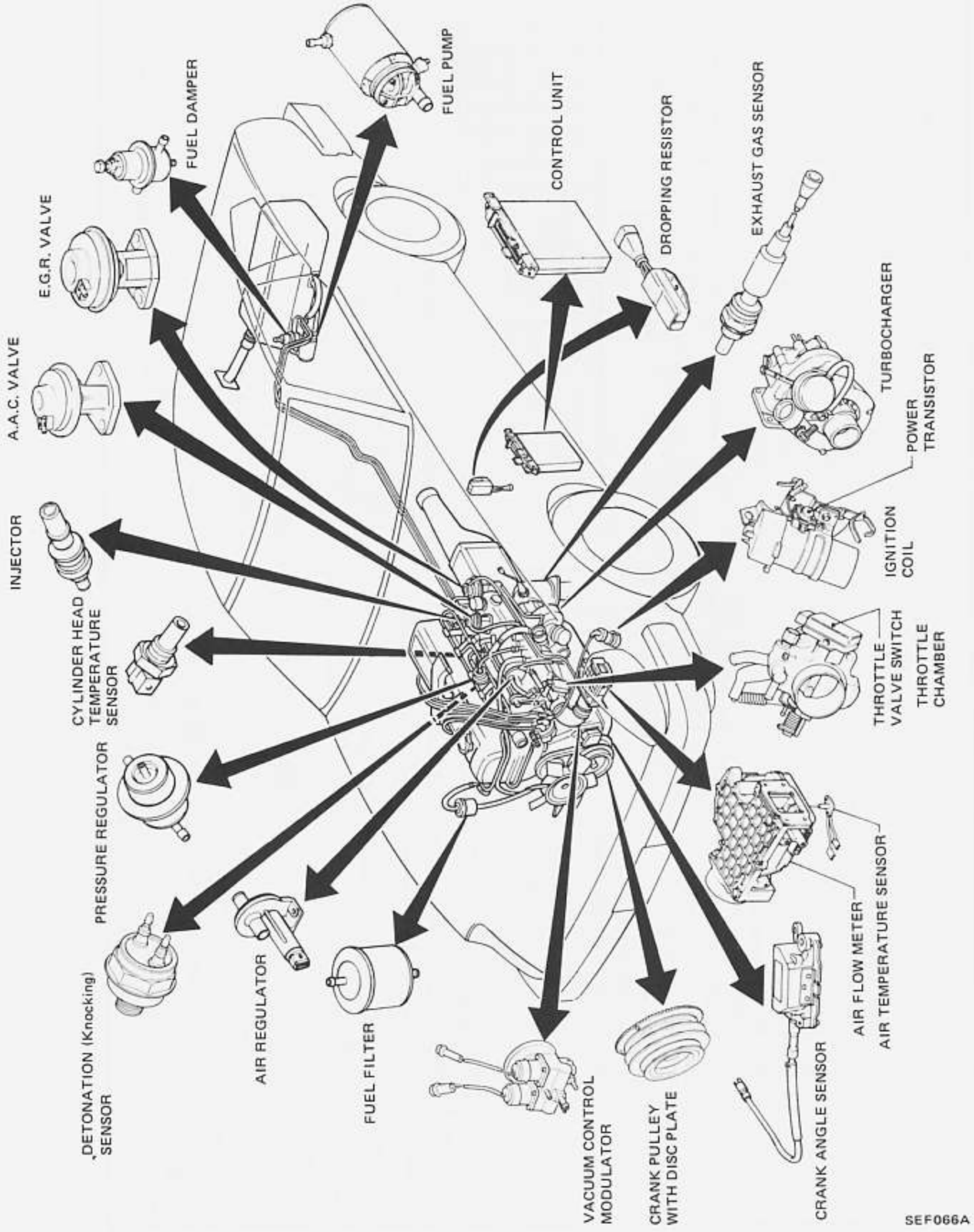
① Crank angle sensor
② Cylinder head temperature sensor
③ Car speed sensor
④ Throttle valve switch (Idle switch)
⑤ Ignition switch (ON, START signal)
⑥ Air flow meter
⑦ Exhaust gas sensor
⑧ Park/Neutral switch
⑨ Air conditioner switch
⑩ Battery voltage
⑪ Detonation sensor
⑫ Air temperature sensor
⑬ Barometric pressure sensor

Input ⇨ E.C.C.S. control unit (C.E.C.U.) ⇨ Output

Controlled Item	Actuators	Related Sensors & Switches
Fuel injection control & Mixture ratio feedback control	Injector	① ② ④ ⑤ ⑥ ⑦ ⑩ ⑫ ⑬
	Fuel pump relay	① ⑤
	Exhaust gas sensor monitor lamp	⑦
Spark timing control	Ignition coil (Power transistor)	① ② ④ ⑤ ⑥ ⑩ ⑪ ⑫ ⑬
Idle speed control	V.C.M. → A.A.C. valve	① ② ③ ④ ⑤ ⑧ ⑨ ⑩
E.G.R. control	V.C.M. → E.G.R. control valve	① ② ④ ⑤ ⑥ ⑩ ⑫ ⑬

System	Components
Fuel flow system	Fuel tank ⇨ Electric fuel pump ⇨ Fuel damper ⇨ Fuel filter ⇨ Pressure regulator ⇨ Injector
Air flow system	Turbocharger system (Air cleaner ⇨ Air flow meter ⇨ Turbocharger ⇨ Throttle chamber / Air regulator ⇨ Intake manifold)
Evaporative control system	Fuel tank ⇨ Fuel check valve ⇨ Canister ⇨ Engine (Refer to Section EC.)
Crankcase ventilation system	Positive crankcase ventilation (P.C.V.) valve (Refer to Section EC.)
Catalyzer	3-way catalytic converter (Refer to Section EC.)

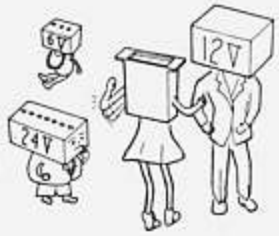
COMPONENT PARTS LOCATION



PRECAUTIONS FOR THE E.C.C.S. ENGINE

Pay close attention to the following points when inspecting or servicing an E.C.C.S. car.

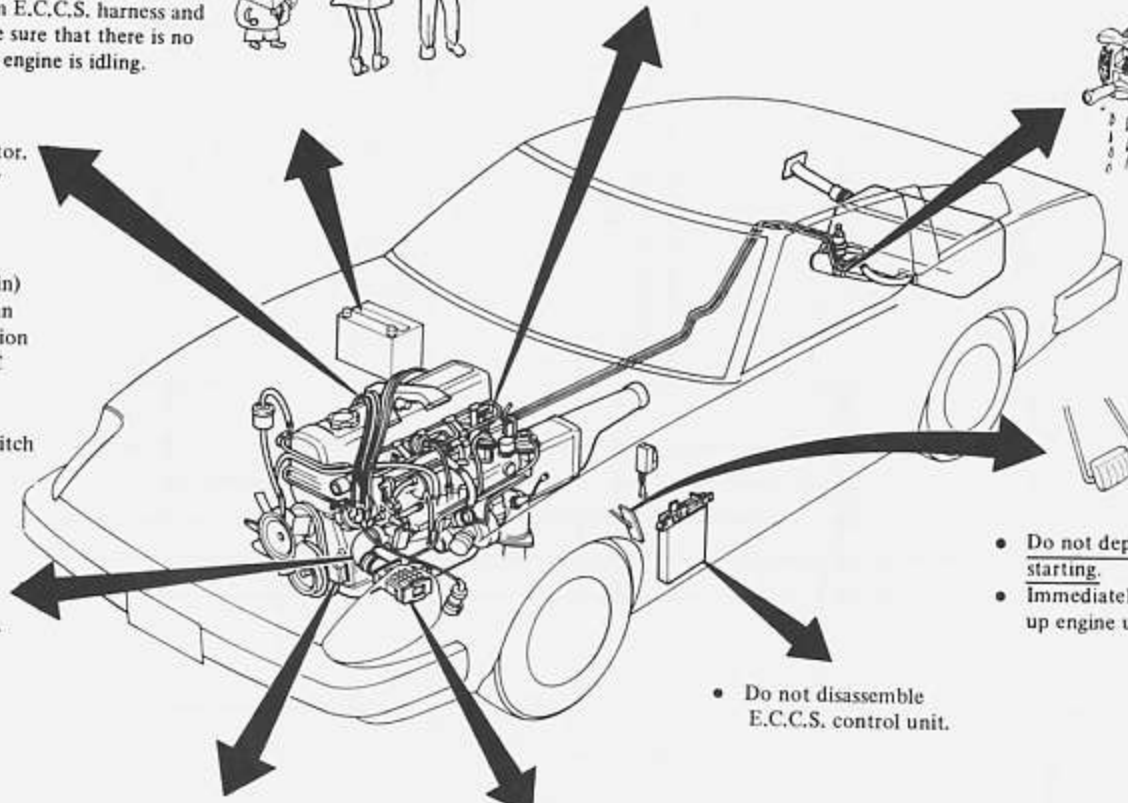
- Always use 12-volt batteries as power source.
- Do not attempt to disconnect battery cables while engine is operating.
- If a receiver-transmitter is installed, route antenna feeder cable along opposite side from E.C.C.S. harness and control unit. Make sure that there is no interference while engine is idling.



- Do not operate fuel pump when there is no fuel in lines.
- Do not use anti-freeze agents in fuel.
- Do not reuse fuel hose clamps.
- Tighten fuel hose clamps sufficiently.

- Do not apply battery power directly to injectors.

- Securely connect E.C.C.S. harness connector. A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to IC circuit.
- 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 malfunction due to reception of external noise, degraded operation of IC circuit, etc.
- Keep E.C.C.S. parts and harnesses dry.
- Before removing parts, turn off ignition switch and then disconnect battery ground cable.



- Do not depress accelerator pedal when starting.
- Immediately after starting, do not rev up engine unnecessarily.

- Do not disassemble V.C.M. (Vacuum control modulator).

- Do not disassemble E.C.C.S. control unit.

- Do not shock or jar the crank angle sensor.

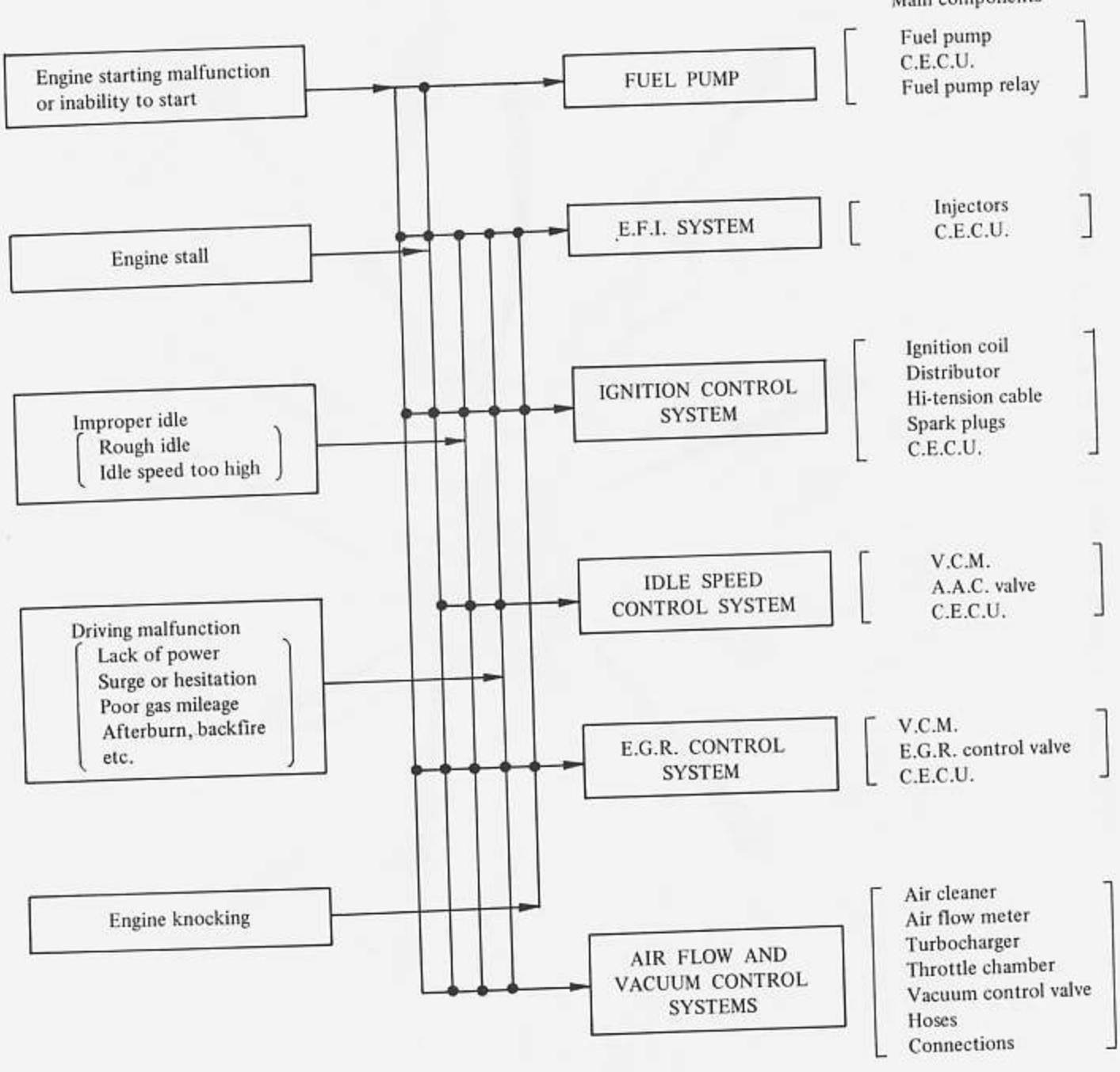
- Handle air flow meter carefully to avoid damage.
- There should not occur even a slight leak in air intake system.

TROUBLE-SHOOTING

OUTLINE

Use the chart below to easily determine in what portion the malfunction is taking place, what is malfunctioning, what to check and how to cope with the problems.

TROUBLE-SHOOTING CHART



Use E.C.C.S. analyzer when checking each component and other parts of E.C.C.S. using the above chart.

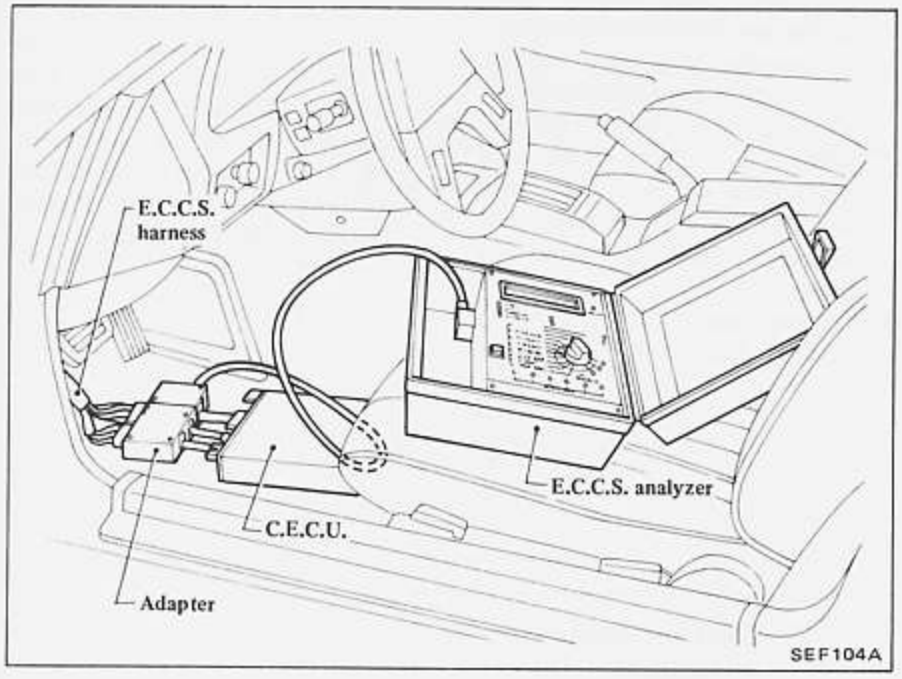
E.C.C.S. ANALYZER INSPECTION

Electronic Concentrated engine Control System (E.C.C.S.) controls the engine operating conditions (Fuel injection, Idle rpm, Ignition timing, E.G.R., etc.) with the Central Electronic Control Unit (C.E.C.U.), Sensors, Switches and so forth.

Therefore, when engine malfunctions occur, the causes cannot be found by a visual inspection, etc. Then, use an E.C.C.S. analyzer to diagnose of the problem.

E.C.C.S. ANALYZER

The E.C.C.S. analyzer monitors several input and output signals that are emitted in response to various engine operating conditions and when the engine stops. Input signals are compared to computerized signal values stored in the C.E.C.U. (Central Electronic Control Unit) while output signals are monitored to ensure they are properly attuned before they are emitted from the C.E.C.U. unit to actuators. In other words, this analyzer analyzes all electrical signals that are transmitted to and emitted from the C.E.C.U. unit. For this reason, if system or unit abnormalities which are not related to these signals are discovered, reference to the "Trouble-shooting" chart must be made for remedial action.



Operation

1. Make sure ignition switch is "OFF".
2. Remove C.E.C.U. unit and connect both adapter and analyzer.

CAUTION:
Make sure parking brake has been applied and selector lever is in "P" or "N".

3. Turn ignition switch "ON", and check the following:

(1) Switches

- Idle switch (Throttle valve switch)
  Check idle switch while depressing and releasing accelerator pedal repeatedly.
- Neutral switch (Transmission switch)
  Check neutral switch while repeatedly shifting selector lever to "N" (or: "P") from other positions.
- Air conditioner switch
  Check air conditioner switch by turning/moving it on and off repeatedly.
- Starter switch
  Turn ignition switch to "START". In these cases, make sure each monitor lamp illuminates.

(2) Actuators and sensors

Use rotary switch to check.

During the following checks, turn rotary switch to the next position after the previous check.

- IGN. (Ignition system)
  Depress CHECK button and make sure monitor lamp illuminates.

After checking ignition system, be sure to return ignition switch from "ON" to "ACC" or "OFF".

- Fuel pump
  Before checking, return ignition switch to "ON".
  Depress CHECK button and make sure monitor lamp turns on and off alternately. Also check fuel pump relay's operating sound when monitor lamp illuminates.

Fuel pump always operates for five seconds after ignition switch has been turned to "ON".

- E.G.R.
  Depress CHECK button and make sure monitor lamp brightens and dims alternately. At this point, make sure V.C.M. solenoid valve is functioning properly.
- Idle speed control
  Follow same procedure used for E.G.R. checks above.
- Battery and air flow meter
  Depress CHECK button and make sure O.K. monitor lamp illuminates.

(3) Turn rotary switch to "E.G.R." position. Start engine, warm it up sufficiently, and then check the following:

When turning rotary switch for the following checks, accelerator pedal may be depressed slightly to avoid engine stall.

- E.G.R.
  Slightly depress accelerator pedal before CHECK button is depressed. Monitor lamp should brighten and dim alternately and engine speed should vary.
- Idle speed control
  Follow same procedure used for E.G.R. checks above.
- Battery
  Depress CHECK button and make sure O.K. monitor lamp illuminates.
- Air flow meter
  Depress CHECK button, then gradually increase engine speed. In this case, O.K. monitor lamp should illuminate and then go out. Also make sure that O.K. monitor lamp illuminates and goes out as engine speed decreases.
- Air temperature, altitude and cylinder head temperature sensors
  Depress CHECK button and make sure O.K. monitor lamp illuminates.
- Knocking sensor
  Depress CHECK button and then depress accelerator pedal forcibly so engine knocks. In this case, O.K. monitor lamp should illuminate. If engine does not knock, repeat above procedure until it does.

CAUTION:
Be sure parking brake has been applied firmly before conducting above tests.

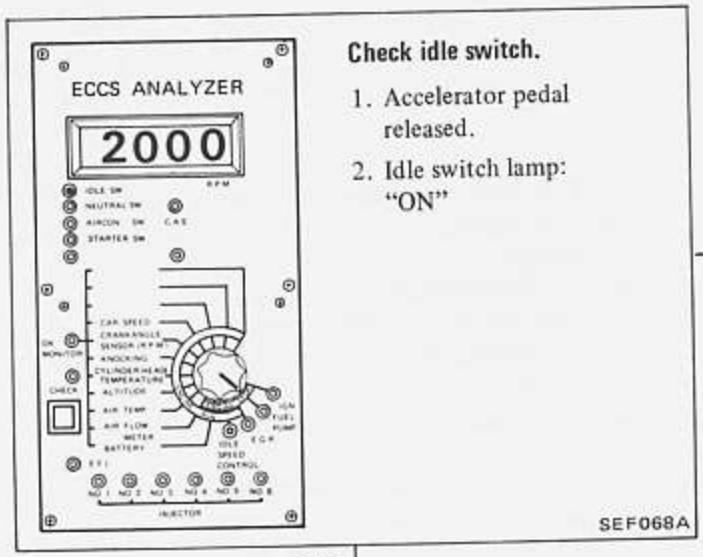
- Crank angle sensor
  Depress CHECK button, and gradually increase engine speed. When engine speed reaches approximately 1,800 rpm, O.K. monitor lamp will illuminate; when engine speed reaches approximately 2,200 rpm, O.K. monitor lamp will extinguish. O.K. monitor lamp will remain off while engine speed exceeds approximately 2,200 rpm. Decreasing engine speed will cause O.K. monitor lamp to activate completely differently from the above sequence.
- Car speed sensor
  Conduct this test by one of the following two methods:

a. Raise the rear wheels clear of the floor. Block front wheels securely. Use floor stands to support the side member.
b. Chassis dynamometer test.
   Depress CHECK button and increase vehicle speed. As vehicle speed reaches approximately 10 km/h (6 MPH), O.K. monitor lamp will illuminate. The lamp will extinguish when car speed reaches approximately 30 km/h (19 MPH).

- C.A.S. (Crank angle sensor)
  O.K. monitor lamp remains on as long as the crank angle sensor emits a signal (engine continues to run).
- E.F.I. and injectors
  When fuel is being supplied (engine is operating), E.F.I. monitor lamp brightens and dims alternately and all injector monitor lamps are "ON". If an injector monitor lamp fails to illuminate, it means that particular injector is malfunctioning. These monitor lamps are also used to check the fuel shut-off system operating condition.

Inspection

While engine is not running:



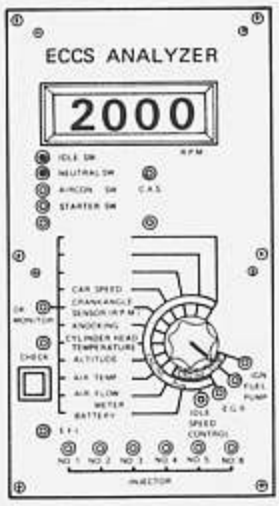
Check idle switch.

1. Accelerator pedal released.
2. Idle switch lamp: "ON"

N.G. → Ⓐ (See EF-16.)

O.K. → ⓐ

Ⓐ



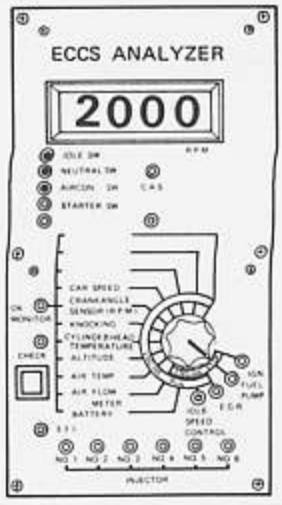
Check neutral switch.

1. Put in "Neutral position.
2. Neutral switch lamp: "ON"

N.G. → Ⓑ (See EF-17.)

SEF069A

O.K.



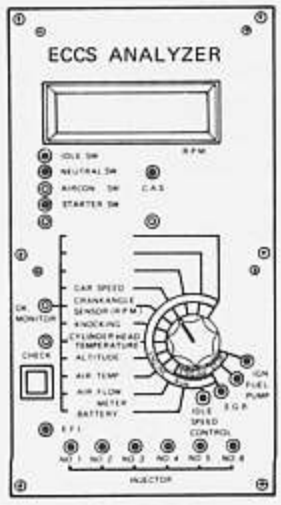
Check air conditioner switch.

1. Switch air conditioner "ON"
2. *Air conditioner switch* lamp: "ON"

N.G. → Ⓒ (See EF-17.)

SEF070A

O.K.



Check starter switch.

1. Turn ignition switch to "START".
2. Starter switch lamp: "ON"

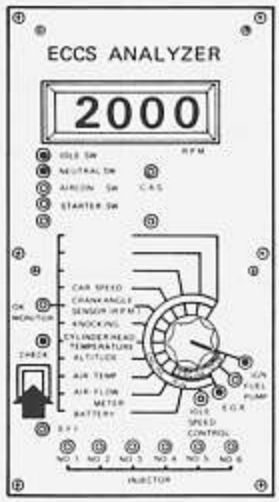
N.G. → Ⓓ (See EF-18.)

SEF071A

O.K.

Ⓑ

Ⓑ



Check ignition system.

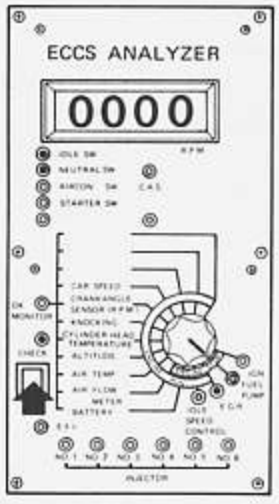
1. Push check button.
2. IGN. monitor lamp: "ON"

N.G. → Ⓔ (See EF-19.)

After checking ignition system, return ignition switch to "ACC" or "OFF".

SEF072A

O.K. ↓



Check fuel pump control system.

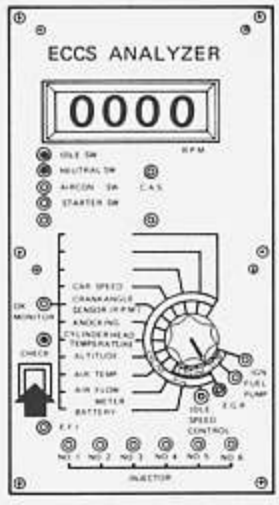
1. Push check button.
2. Fuel pump lamp: goes on and off alternately.

N.G. → Ⓕ (See EF-20.)

Before checking, return ignition switch to "ON".

SEF073A

O.K. ↓



Check E.G.R. control system.

1. Push check button.
2. E.G.R. lamp: brightens and dims alternately.
3. At the same time check operating sound of V.C.M. solenoid valve.

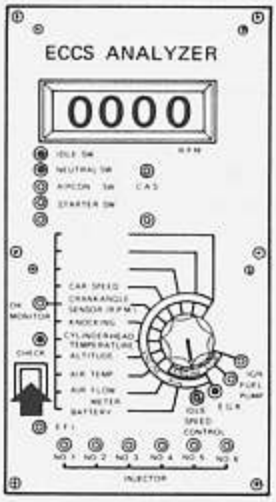
N.G. → Ⓖ (See EF-21.)

SEF074A

O.K. ↓

Ⓒ

Ⓒ



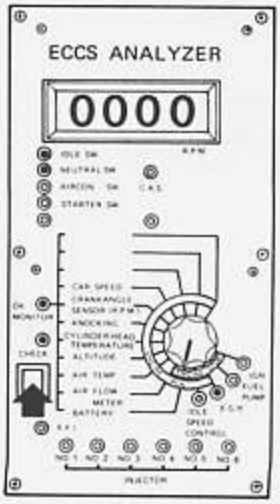
Check idle speed control system.

1. Push check button.
2. Idle speed control lamp: brightens and dims alternately.
3. At the same time check operating sound of V.C.M. solenoid valve.

N.G. → Ⓗ (See EF-22.)

SEF075A

O.K. ↓



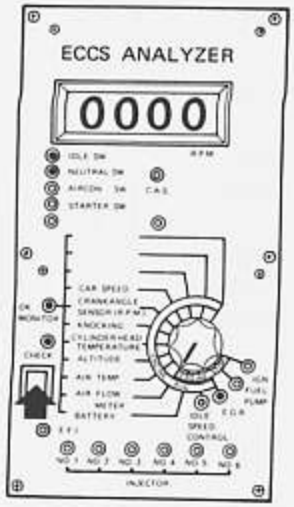
Check Battery voltage.

1. Push check button.
2. O.K. monitor lamp: "ON"

N.G. → Ⓙ (See EF-23.)

SEF076A

O.K. ↓



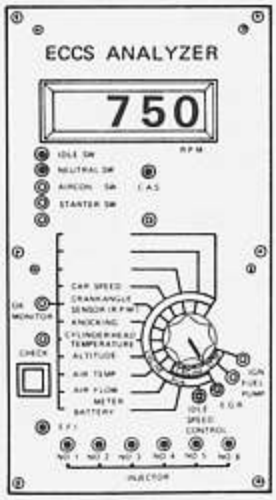
Check air flow meter.

1. Push check button.
2. *O.K. monitor lamp:* "ON"

N.G. → Ⓚ (See EF-23.)

SEF077A

After engine start:



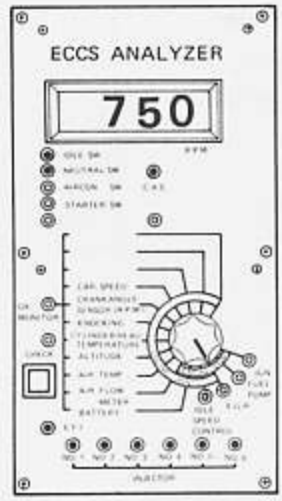
Check C.A.S. signal.

1. Start engine.
2. C.A.S. lamp: "ON"

Before starting engine, return rotary switch to "E.G.R." position.

N.G. → Ⓛ (See EF-24.)

O.K. ↓



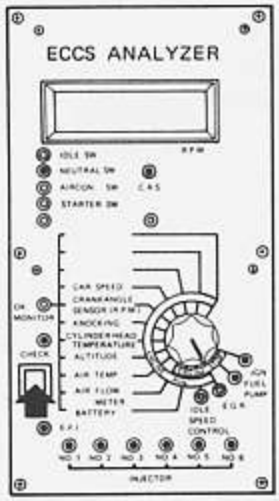
Check E.F.I. and injectors.

1. Start engine.
2. E.F.I. lamp: brightens and dims alternately. Injector lamps: "ON"

N.G. → Ⓜ (See EF-24.)

O.K. ↓

After warming up and still running:



Check E.G.R. control system.

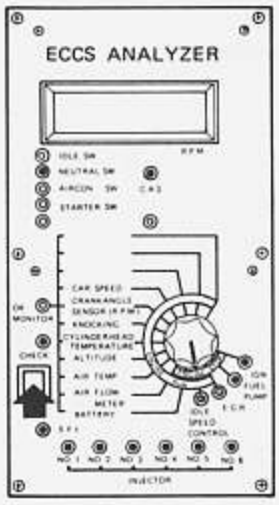
1. Depress accelerator pedal slightly.
2. Push check button.
3. Engine speed should vary.
4. E.G.R. lamp: brightens and dims alternately (during engine speed change).

N.G. → Ⓖ (See EF-21.)

O.K. ↓

Ⓓ

Ⓓ



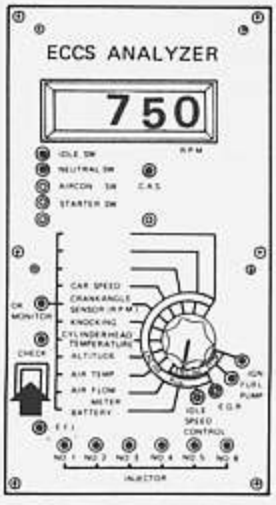
Check idle speed control system.

1. Depress accelerator pedal slightly.
2. Push check button.
3. Engine speed should vary.
4. Idle speed control lamp: brightens and dims alternately (during engine speed change).

SEF135A

N.G. → Ⓗ (See EF-22.)

O.K.



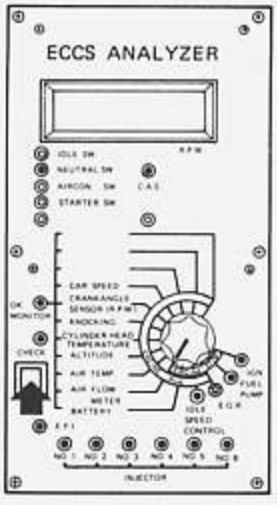
Check battery voltage.

1. Push check button.
2. O.K. monitor lamp: "ON"

SEF176A

N.G. → Ⓙ (See EF-23.)

O.K.



Check air flow meter.

1. Push check button and increase engine speed.
2. O.K. monitor lamp: "OFF" → "ON" → "OFF"

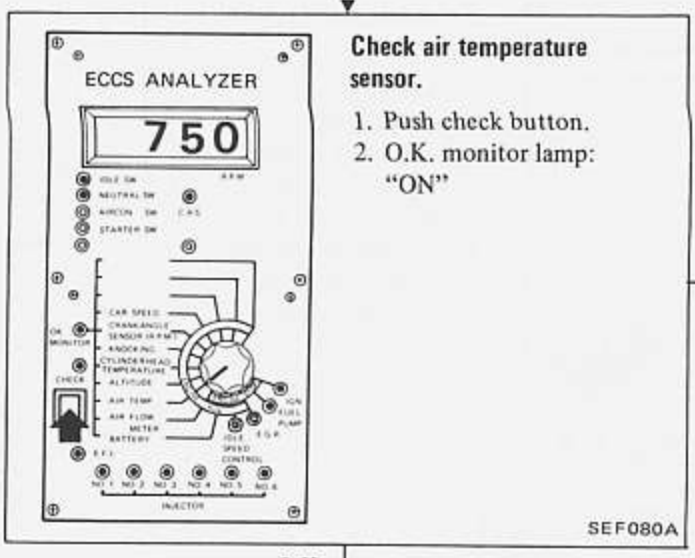
SEF177A

N.G. → Ⓚ (See EF-23.)

O.K.

Ⓔ

Ⓔ

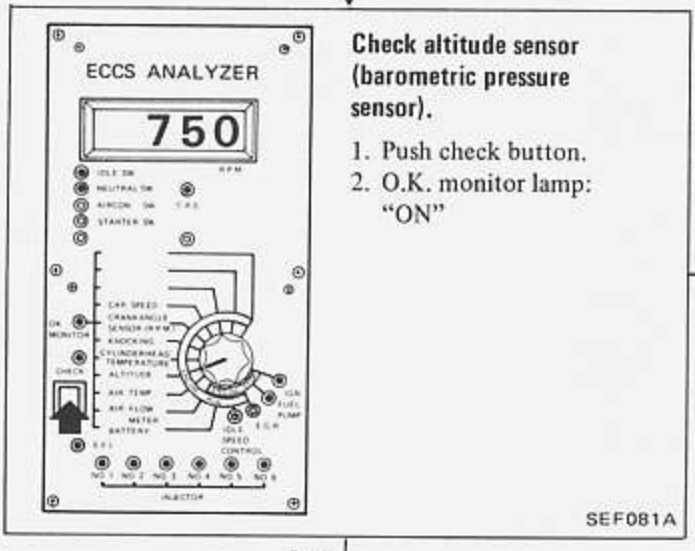


Check air temperature sensor.

1. Push check button.
2. O.K. monitor lamp: "ON"

N.G. → Ⓝ (See EF-25.)

O.K.

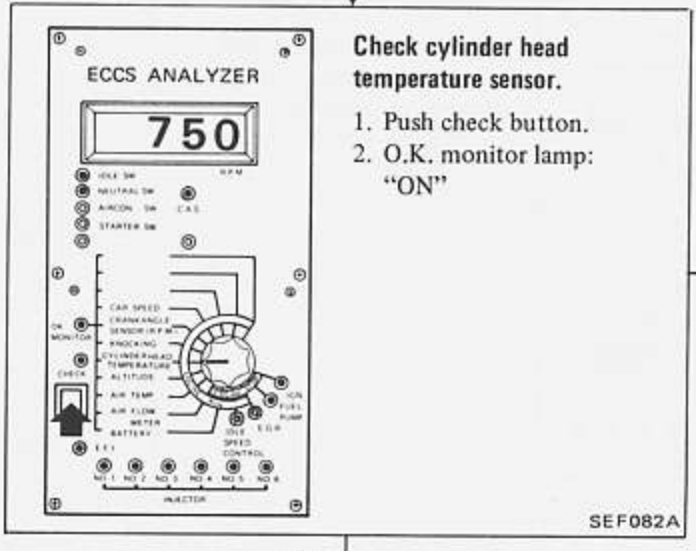


Check altitude sensor (barometric pressure sensor).

1. Push check button.
2. O.K. monitor lamp: "ON"

N.G. → Ⓟ (See EF-26.)

O.K.



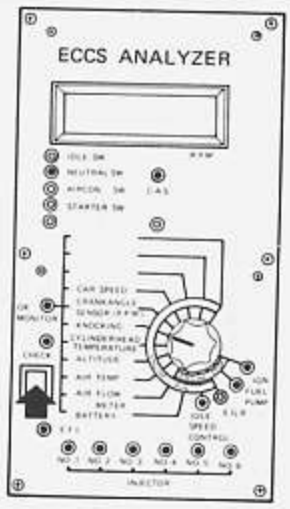
Check cylinder head temperature sensor.

1. Push check button.
2. O.K. monitor lamp: "ON"

N.G. → Ⓠ (See EF-26.)

O.K. → Ⓕ

Ⓕ



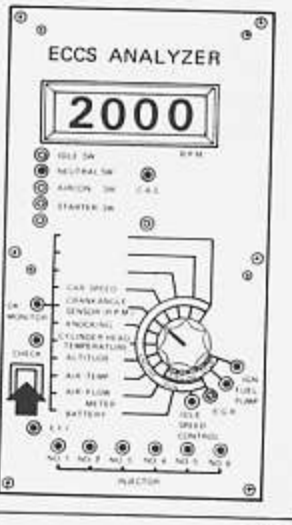
Check knocking sensor.

1. Push check button.
2. Depress accelerator pedal forcibly until engine knocks.
3. O.K. monitor lamp: "ON" (after knocking)

N.G. → Ⓡ (See EF-27.)

SEF083A

O.K. ↓



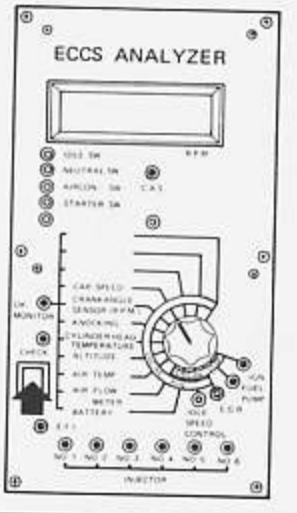
Check crank angle sensor.

1. Push check button and increase engine speed.
2. O.K. monitor lamp: "OFF" → "ON" → "OFF" ("ON": 1,800 to 2,200 rpm)

N.G. → Ⓛ (See EF-24.)

SEF084A

O.K. ↓



Check car speed sensor.

1. Push check button.
2. Increase car speed.
3. O.K. monitor lamp: "ON" [car speed 10 km/h (6 MPH) to 30 km/h (19 MPH)]

N.G. → Ⓢ (See EF-27.)

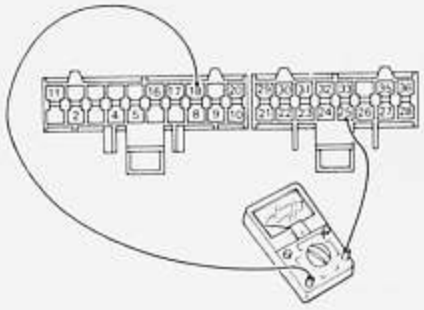
SEF085A

TROUBLE-SHOOTING DIAGNOSIS

ELECTRONIC CONTROL SYSTEM INSPECTION

Ⓐ Idle switch (Throttle valve switch)

Disconnect 20-pin and 16-pin connectors and measure the resistance between ⑱ and ㉕.

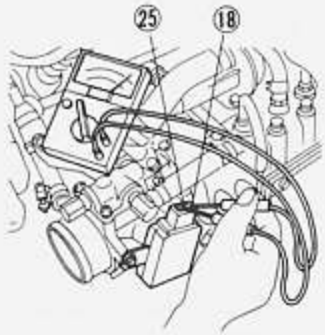


Throttle	Resistance
released	0Ω
depressed	∞Ω

SEF086A

N.G.

Measure the throttle valve switch resistance between ⑱ and ㉕.



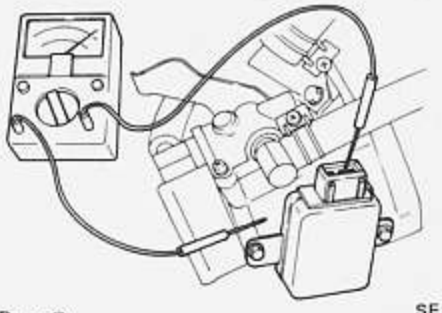
R = 0Ω

SEF116A

N.G. → Adjust idle switch. → N.G.

O.K.

Measure the resistance between ⑱, ㉕ and body ground.



R: ∞Ω

SEF087A

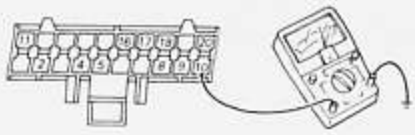
O.K. → Check harness and correct or repair it as necessary.

N.G.

Replace idle switch.

Ⓑ Neutral/Parking switch

Disconnect 20-pin connector and measure the voltage between ⑩ and body voltage ground.



T/M position	Voltage
"N" or "P"	12V
Others	0V

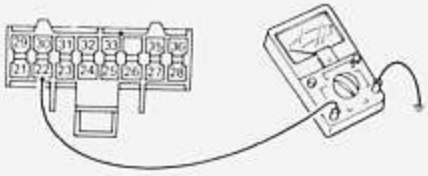
SEF088A

N.G.

- V = 0V (Constant)
  - Check harness.
    - N.G. → Correct or replace it.
    - O.K. → Replace control unit.
- V = 12V (Constant)
  - Check inhibitor switch and/or relay. (Refer to Sections AT & EL.)
    - N.G. → Replace it.
    - O.K. → Check harness.
      - N.G. → Correct or replace it.

Ⓒ Air conditioner switch

Disconnect 16-pin connector and measure the resistance between ㉒ and body ground.



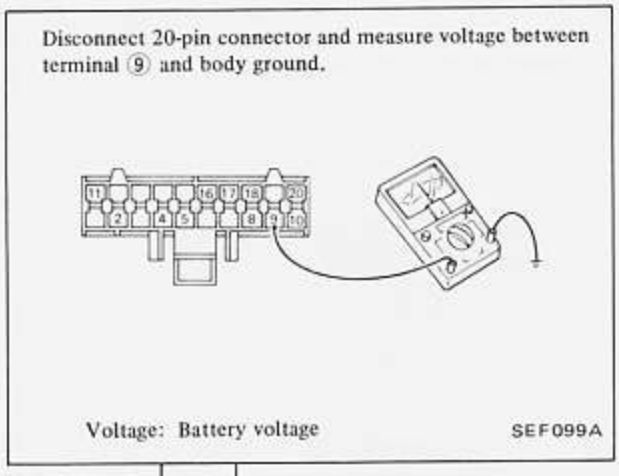
Air conditioner switch	Resistance
ON	0Ω
OFF	∞Ω

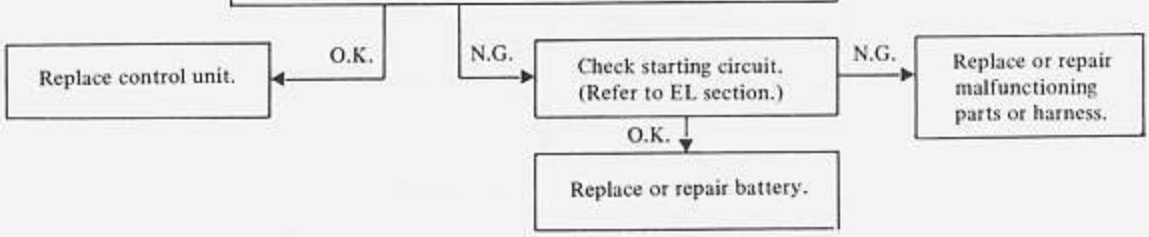
SEF089A

N.G.

- Inspect harness.
  - N.G. → Correct or replace it.
  - O.K. → Check air conditioner switch. (Refer to HA section.)
    - O.K. → Replace control unit.
    - N.G. → Replace air conditioner switch.

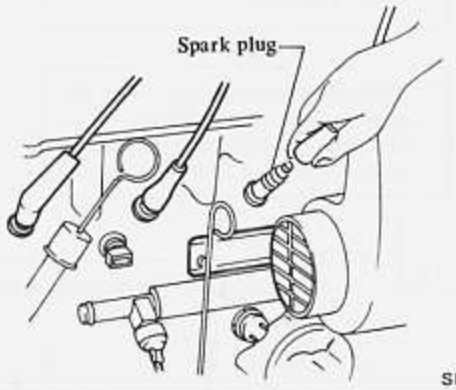
Ⓓ Starter switch





Ⓔ IGN. (Ignition system)

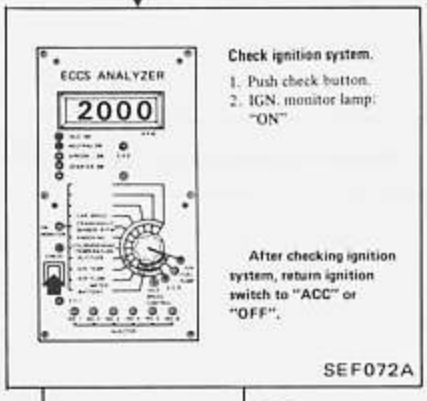
Disconnect high tension calbe from one spark plug and check for hot spark during cranking.



O.K. → Replace or repair spark plug.

N.G. → Check distributor, ignition coil and high tension cable.

O.K. → N.G. → Replace or repair them if available.



N.G. → O.K. → Replace power transistor of ignition coil.

Disconnect 20-pin connector and measure the resistance between terminal ⑤ and ground.

R: Except 0 or ∞ Ω

SEF091A

N.G. → Check harness and replace or correct as necessary.

O.K. → Replace control unit.

Ⓕ Fuel pump

Check crank angle sensor, signal disc plate, harness, etc. and replace or adjust as necessary.

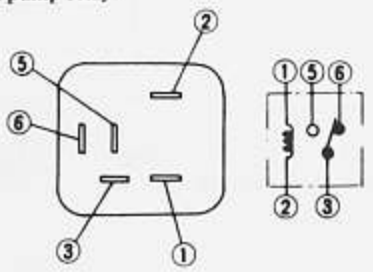
O.K.

Check fuel pump operation when the ignition switch is turned from "OFF" to "ON". Make sure that the fuel pump operates for 5 seconds.

O.K. → Replace control unit.

N.G.

Check fuel pump relay.



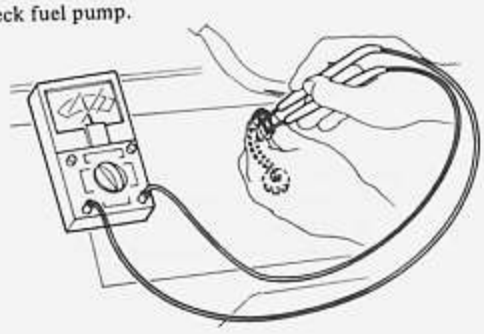
SEF703

Check terminal	Normal	When 12 volts are applied between ① and ②
① – ②	Continuity provided	–
③ – ⑤	No continuity	Continuity provided
③ – ⑥	Continuity provided	No continuity

N.G. → Replace fuel pump relay.

O.K.

Check fuel pump.



Check the resistance between the fuel pump's connector plus (+) and minus (–) terminals.

Normal resistance: 0.5 - 3Ω

SEF178A

N.G. → Replace fuel pump.

O.K. → Check harness circuit for fuel pump.

O.K. → Replace control unit.

N.G. → Correct harness circuit.

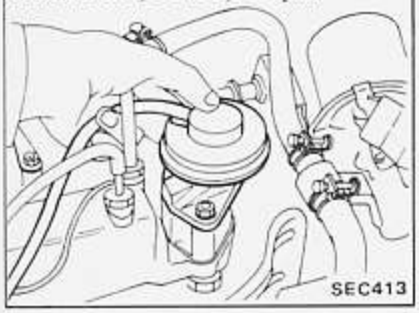
⑥ E.G.R.

With engine stopped, inspect E.G.R. control valve for any indication of finding or sticking by moving valve diaphragm.

N.G. → Clean, correct or replace it as necessary.

O.K. ↓

With engine running after being warmed up, inspect E.G.R. control valve operation by placing a finger on the valve diaphragm while engine speed is increased from idle to 2,000 to 3,000 rpm.

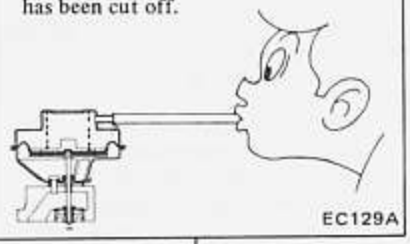

SEC413

N.G. → Make a thorough visual check of vacuum hoses for E.G.R. control system.

N.G. → Replace or correct them as necessary.

O.K. ↓

Check E.G.R. control valve. Apply vacuum to it and check that it moves to full position.
Then, plug hose with applied vacuum and check that it will remain open for more than 30 seconds after vacuum has been cut off.


EC129A

N.G. → Replace E.G.R. control valve.

O.K. ↓

Check E.G.R. control system.

1. Push check button.
2. E.G.R. lamp: brightens and dims alternately.
3. At the same time check operating sound of V.C.M. solenoid valve.

SEF074A

N.G. ↓

Disconnect 20-pin connector and measure the resistance between terminal ④ and ground.

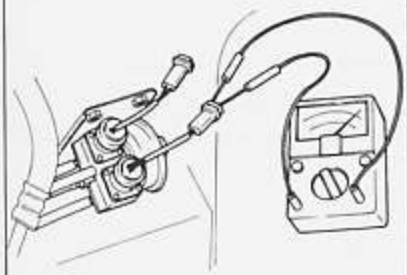
R: 38 - 42Ω

SEF092A

N.G. → Replace V.C.M.

O.K. ↓

Disconnect a connector of V.C.M. solenoid valve for E.G.R. control and check the resistance between each terminal of the connector.



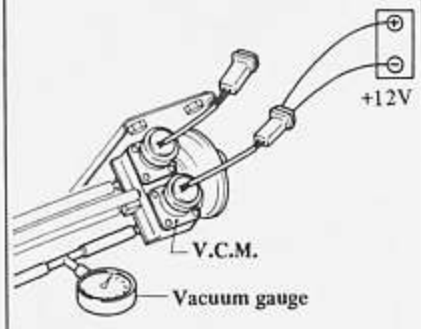
R: 38 - 42Ω

SEF093A

O.K. ↓

Check harness and correct or replace it as necessary.

Disconnect a connector of E.G.R. solenoid valve and remove a vacuum hose from V.C.M. to E.G.R. control valve. Check the pressure by using a vacuum gauge when DC12V is applied to the connector.



SEF094A

DC12V	Vacuum gauge
ON	−1.3 - −2.7 kPa (−10 - −20 mmHg, −0.39 - −0.79 inHg)
OFF	−16.0 kPa (−120 mmHg, −4.72 inHg) and increases gradually.

O.K. → Replace control unit.

N.G. → Replace V.C.M.

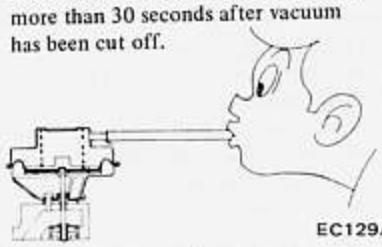
Ⓗ Idle speed control

After warming up sufficiently, make a thorough visual check of vacuum hoses for idle speed control system.

N.G. → Replace or correct them as necessary.

O.K. ↓

Check A.A.C. valve. Apply vacuum to it and check that it moves to full position.
Then, plug hose with applied vacuum and check that it will remain open for more than 30 seconds after vacuum has been cut off.

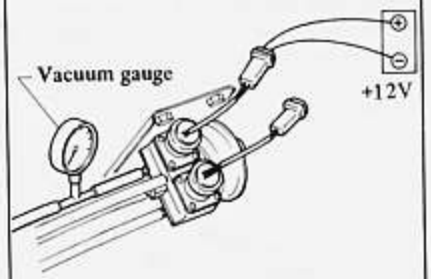


EC129A

N.G. → Replace A.A.C. valve.

O.K. ↓

Disconnect a connector of I.S.C. solenoid valve and remove a vacuum hose from V.C.M. to A.A.C. valve.
Check the pressure by using a vacuum gauge when DC12V is applied to the connector.

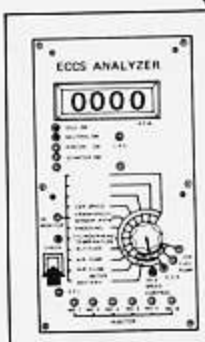


SEF173A

DC12V	Vacuum gauge
ON	−1.3 - −2.7 kPa (−10 - −20 mmHg, −0.39 - −0.79 inHg)
OFF	−16.0 kPa (−120 mmHg, −4.72 inHg) and increases gradually.

N.G. → Replace V.C.M.

O.K. ↓



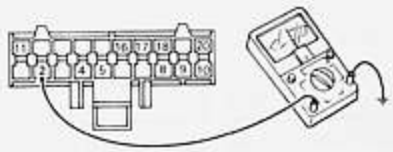
Check idle speed control system.
1. Push check button.
2. Idle speed control lamp: brightens and dims alternately.
3. At the same time check operating sound of V.C.M. solenoid valve.

SEF075A

N.G. ↓

Disconnect 20-pin connector and measure the resistance between terminal ② and ground.

O.K. → Replace control unit.



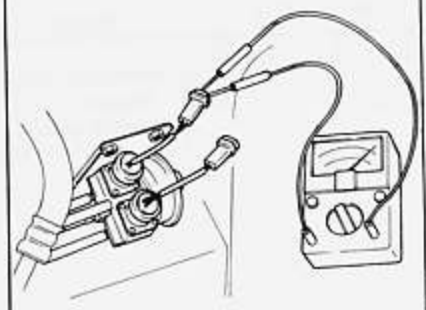
R: 38 - 42Ω

SEF179A

N.G. ↓

Disconnect a connector of V.C.M. solenoid valve for I.S.C. control and check the resistnace between each terminal of the connector.

N.G. → Replace V.C.M.



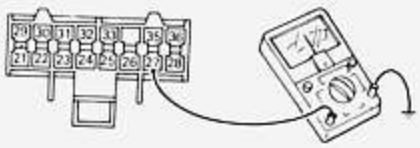
R: 38 - 42Ω

SEF180A

O.K. → Check harness and correct or replace it as necessary.

ⓙ Battery

Disconnect 16-pin connector and measure the voltage between terminal ㉗ and body ground.



V: Battery voltage

SEF095A

O.K. → Replace control unit.

N.G. → Check harness and battery.

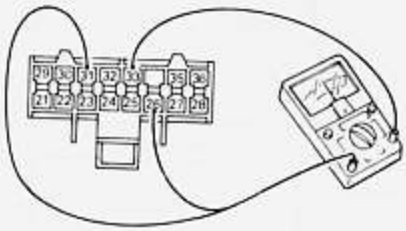
Check harness and battery. O.K. → Replace control unit.

Check harness and battery. N.G. → Replace or correct them as necessary.

ⓚ Air flow meter

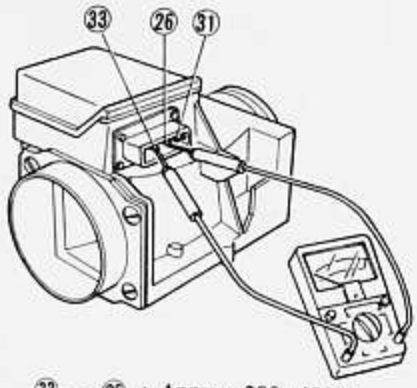
Disconnect 16-pin connector and measure the resistance between terminals ㉝ and ㉖, ㉛.

㉝ – ㉖ : Approx. 280 - 400Ω
㉝ – ㉛ : Except 0 and ∞ Ω



SEF096A

N.G. → Check air flow meter resistance between terminals ㉝ and ㉖, ㉛.



㉝ – ㉖ : Approx. 280 - 400Ω
㉝ – ㉛ : Except 0 and ∞ Ω

SEF097A

O.K. → Check air flow meter flap.

Check air flow meter flap. O.K. → Replace control unit.

Check air flow meter flap. N.G. → Replace air flow meter.

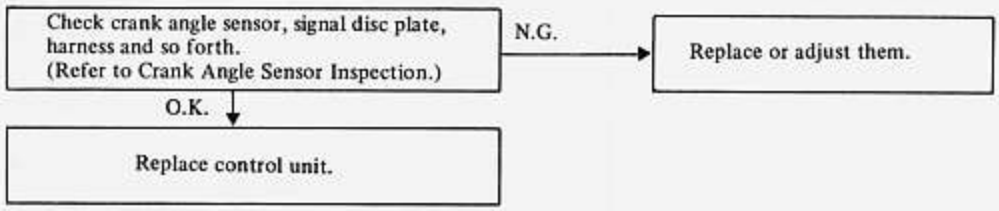
N.G. → Replace air flow meter.

O.K. → Check the resistance between terminals ㉝, ㉖, ㉛ and ground.
Resistance: ∞Ω

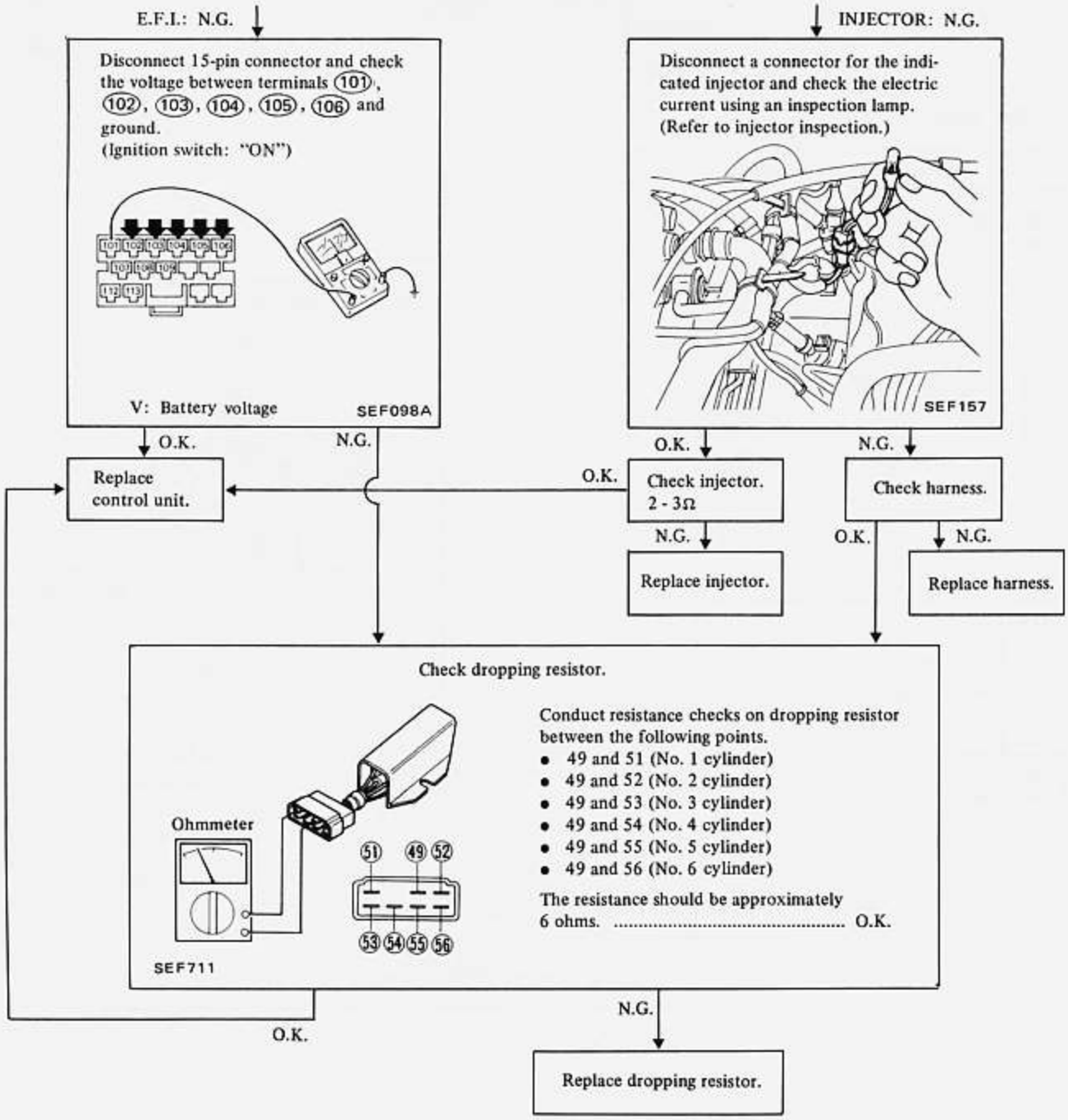
Check the resistance between terminals ㉝, ㉖, ㉛ and ground. N.G. → Replace air flow meter.

Check the resistance between terminals ㉝, ㉖, ㉛ and ground. O.K. → Replace control unit.

Ⓛ C.A.S. (Crank angle sensor)

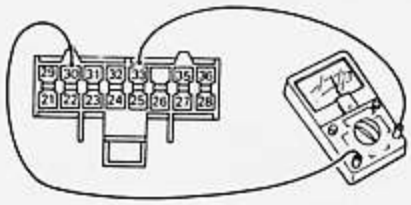


Ⓜ E.F.I. & Injector



Ⓝ Air temperature

Disconnect 16-pin connector and measure terminals ㉝ and ㉚.



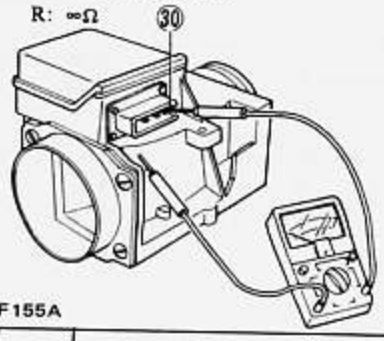
SEF100A

Intake air temperature	Resistance
Above 20°C (68°F)	Below 2.9 kΩ
Below 20°C (68°F)	Above 2.1 kΩ

O.K. → Replace control unit.

N.G. → Check air temperature sensor between terminal ㉚ and ground.

R: ∞Ω



SEF155A

O.K. → *Check harness.*

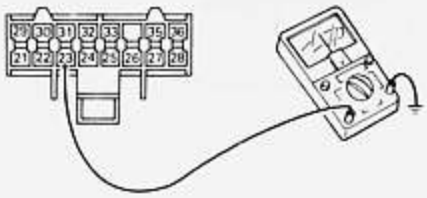
N.G. → Replace or correct harness.

O.K. → *Replace air temperature sensor as an air flow meter assembly.*

Ⓟ **Altitude (Barometric pressure sensor)**
If O.K. monitor lamp does not come on, replace control unit.

Ⓠ **Cylinder head temperature sensor**

Disconnect 16-pin connector and measure the resistance between terminal ㉓ and body ground.



SEF101A

Cylinder head temperature	Resistance
Above 20°C (68°F)	Below 2.9 kΩ
Below 20°C (68°F)	Above 2.1 kΩ

N.G.

O.K.

Check harness.

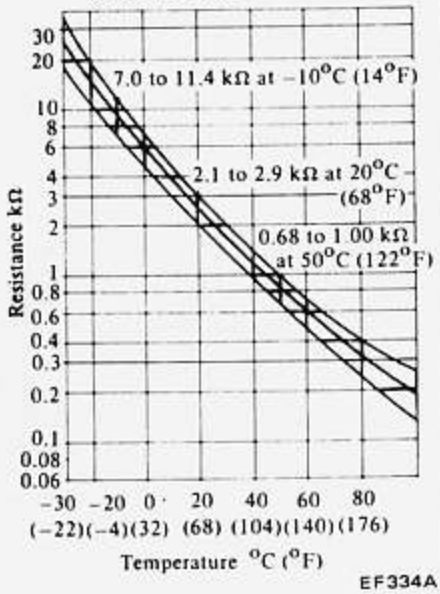
O.K.

Replace control unit.

Dip the sensor into water maintained at a temperature of 20°C (68°F), 80°C (176°F), etc., and read its resistance.

EF329A

CHARACTERISTIC CURVE



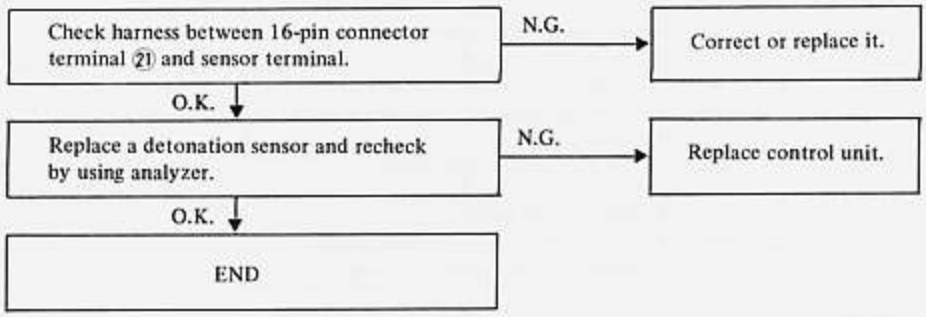
EF334A

O.K.

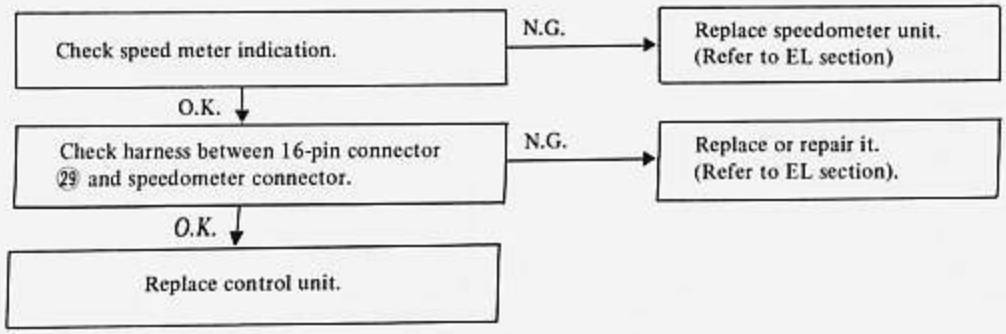
N.G.

Replace cylinder head temperature sensor.

Ⓡ Knocking (Detonation sensor)



Ⓢ Car speed sensor



EXHAUST GAS SENSOR INSPECTION

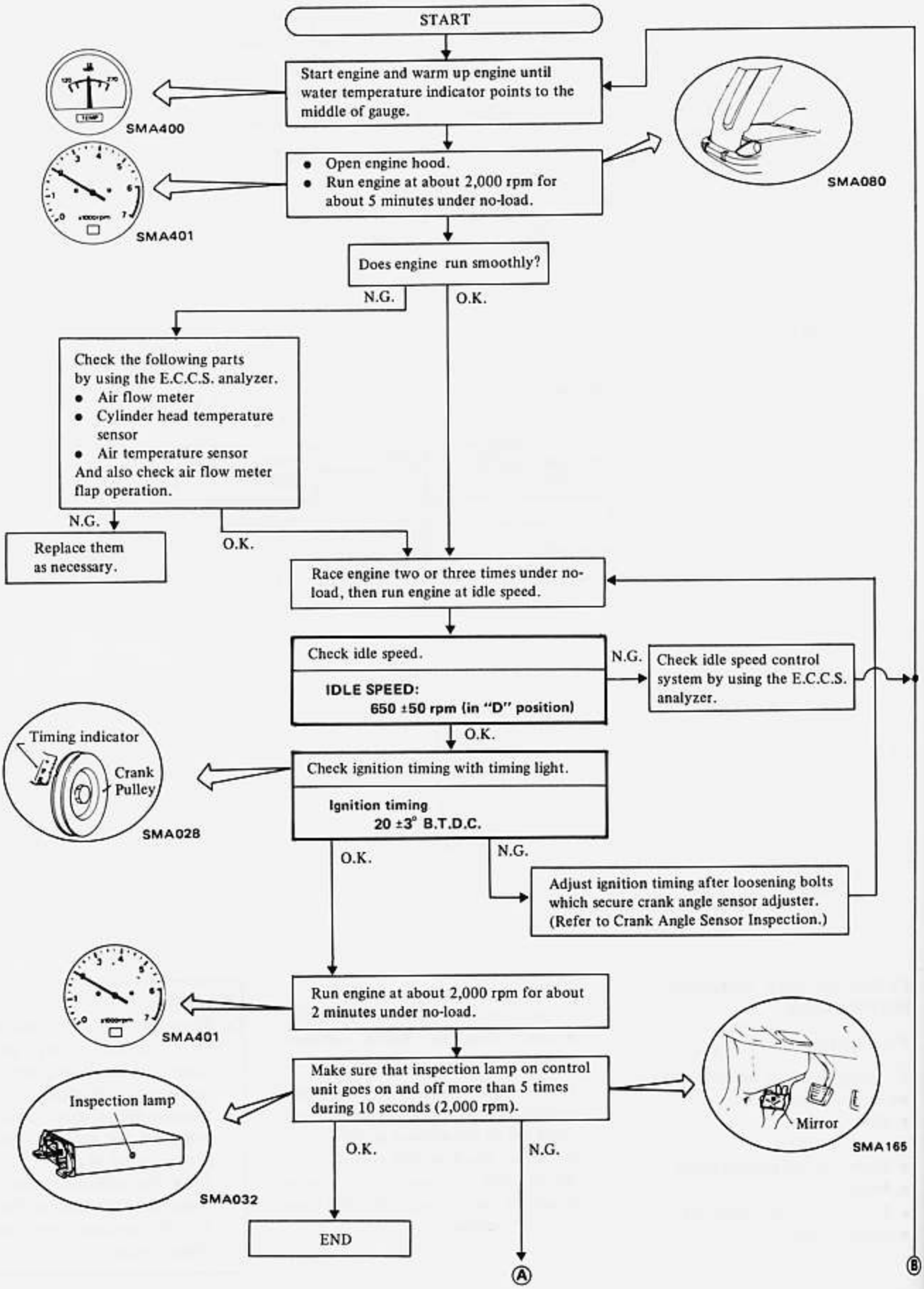
Preparation

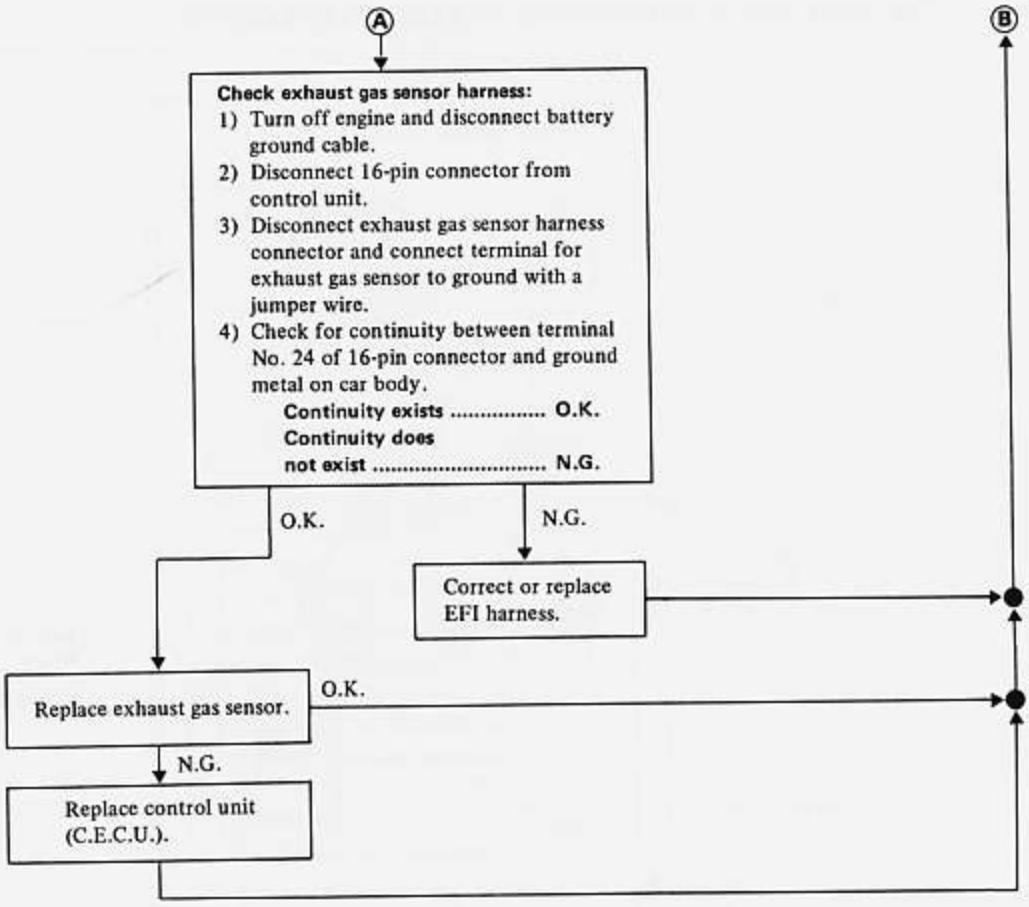
1. Make sure that the following parts are in good order.
- Battery
- Ignition system
- Engine oil and coolant levels
- Fuses
- E.C.C.S. harness connectors
- Vacuum hoses
- Air intake system (oil filler cap, oil level gauge, etc.)
- Valve clearance, engine compression

2. On air conditioner equipped models, checks should be carried out while the air conditioner is "OFF".
3. When checking idle rpm, ignition timing and mixture ratio, checks should be carried out while shift lever is in "D" position.

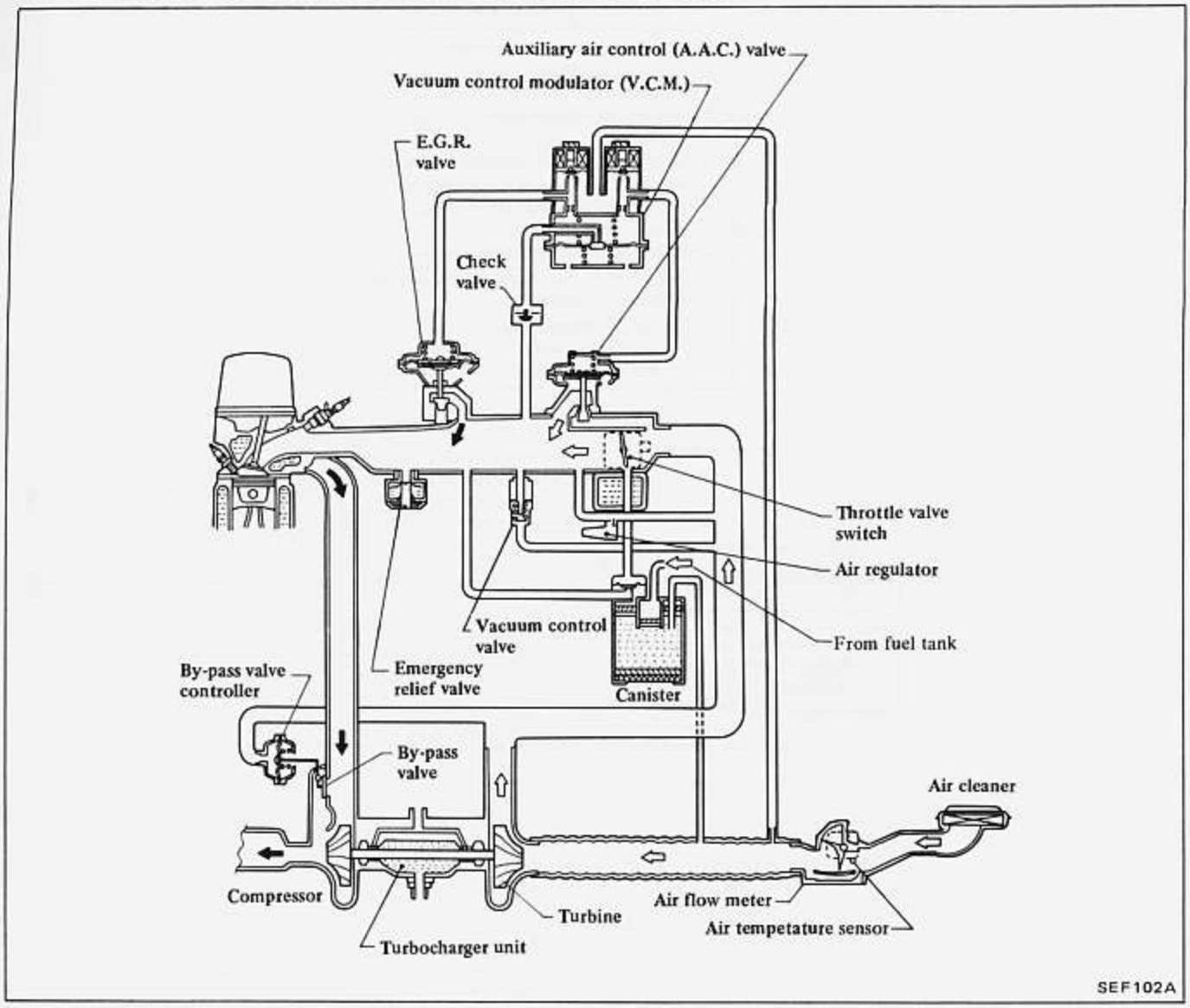
WARNING:
a. When selector lever is shifted to "D" position, apply parking brake and block both front and rear wheels with chocks.
b. Depress brake pedal while accelerating the engine to prevent forward surge of car.
c. After the adjustment has been made, shift the lever to the "N" or "P" position and remove wheel chocks.

Inspection procedure




A
B
Check exhaust gas sensor harness:
1) Turn off engine and disconnect battery ground cable.
2) Disconnect 16-pin connector from control unit.
3) Disconnect exhaust gas sensor harness connector and connect terminal for exhaust gas sensor to ground with a jumper wire.
4) Check for continuity between terminal No. 24 of 16-pin connector and ground metal on car body.
Continuity exists ..... O.K.
Continuity does not exist ..... N.G.
O.K.
N.G.
Correct or replace EFI harness.
Replace exhaust gas sensor.
O.K.
N.G.
Replace control unit (C.E.C.U.).

AIR FLOW AND VACUUM CONTROL SYSTEM INSPECTION



Check hoses, pipes, connections, etc. depending on the problem using air flow and vacuum control systems.

1) Engine starting malfunction or inability to start

- Intake air leakage ...
  P.C.V. valve and hoses (Refer to EC section.)
  Air flow meter hoses and connections
  V.C.M. hoses
  Canister purge and control hoses
  Vacuum control valve hose
  Vacuum control valve (V.C.V.) operation (Refer to EC section.)
  Oil filler cap seals and dipstick
- A.A.C. valve ...
  V.C.M. hose and connection
  A.A.C. valve hose and connection
  A.A.C. valve operation

2) Engine stall

- Air regulator ...
  Air regulator hoses and connections
  Air regulator operation
- Intake air leakage ...
  V.C.V. hose and connection
  V.C.V. operation
  Canister hose
- E.G.R. control valve ...
  V.C.M. hose and connection
  Check valve
  E.G.R. valve hose
  E.G.R. valve operation

3) Improper idle

- Intake air leakage (Refer to the item above.)
- Air regulator (Refer to the item above.)
- E.G.R. control valve (Refer to the item above.)
- V.C.M. hoses
- A.A.C. valve hose
- etc.

4) Driving malfunction

- Throttle chamber operation
- Air flow meter operation
- Air cleaner filter (Refer to MA section.)
- Air regulator and hoses
- Intake air leakage (Refer to the item above.)
- Turbocharger (Refer to TURBOCHARGER.) ...
  By-pass valve controller
  By-pass valve
  Emergency relief valve, etc.

When malfunctions are found in hoses and connections, they should be replaced with new ones.

ELECTRONIC CONCENTRATED ENGINE CONTROL SYSTEM (E.C.C.S.)

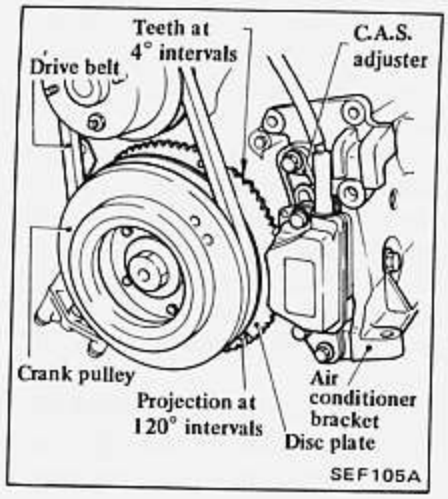
OUTLINE

In the Electronic Concentrated Engine Control System (E.C.C.S.), the control unit employs a micro-computer. This micro-computer controls fuel injection, spark timing, exhaust gas recirculation (E.G.R.), idle speed, fuel pump operation and mixture ratio feedback.

It is unnecessary to adjust idle CO%, idle rpm and ignition timing.

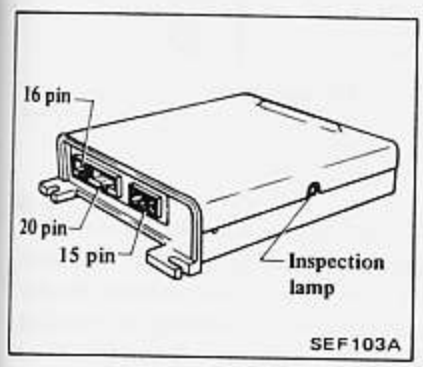
Electrical signals from each sensor are fed into the micro-computer and each actuator is controlled by an electrical pulse with a duration that is computed in the micro-computer.

WARNING:
If your car is equipped with electronic controls, use of a transmitter, such as a radio transmitter (but not a receiver, such as a radio) may interfere with unshielded electronic controls and cause them to malfunction. Car manufacturers do not necessarily use electronic controls in the same ways or for the same operations. Examples of vehicle functions which may involve electronic controls include fuel delivery systems, engine timing, brakes, emission control and cruise control. Definite information regarding the type of electronic controls in your car can only be obtained from the manufacturer. Consult your NISSAN/DATSUN dealer regarding the need for modifications to your car's electronic controls before installation or use of a transmitter.



E.C.C.S. CONTROL UNIT

The E.C.C.S. control unit consists of a micro-computer, connectors for signal input and output and power supply, and an exhaust gas sensor monitor lamp. The control unit controls the quantity of fuel that is injected, ignition timing, idle speed, E.G.R. quantity, fuel pump operation, and feedback of the mixture ratio.



CRANK ANGLE SENSOR

The crank angle sensor detects engine rpms and the crank angle (piston position). It also sends a signal to the control unit to control various operations.

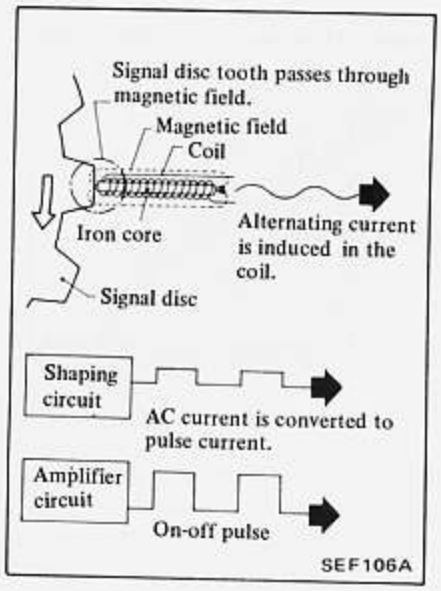
SIGNAL DISC PLATE

The signal disc plate has 90 teeth at 4° intervals on its outer periphery. It also has three projections at 120° intervals.

These three projections are used to detect the crank angle, that is, the position of each piston. The teeth are used to provide the 1° signal that is necessary to control engine rpms and ignition timing.

CRANK ANGLE SENSOR OPERATION

The crank angle sensor has three pick-up heads, each of which consists of a coil wound around a magnetized iron core. When a signal disc plate tooth or projection passes in front of one of these heads and AC current is induced in the coil. This current is then converted into on-off pulse, which is sent to the control unit.

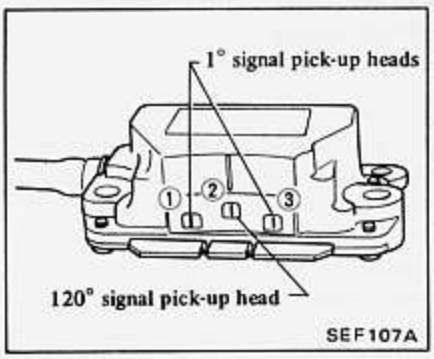


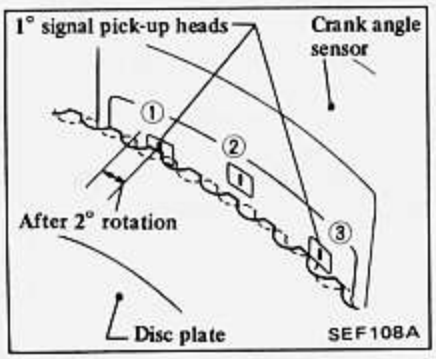
Detection of 1° signal (For detecting of engine rpms and ignition timing control)

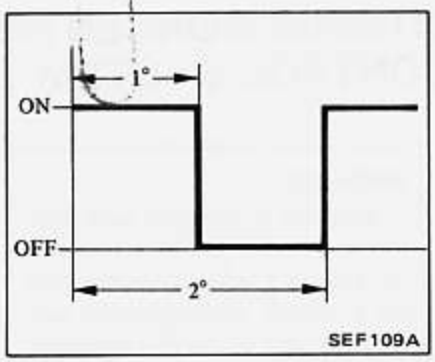
Heads ① and ③ in the picture are used to detect the 1° signal. This signal is created by the teeth that are located at 4° intervals on the signal disc plate.

When a tooth reaches the position indicated by the solid line in the picture, head ① generates an on-off pulse. When the signal disc turns another 2° and the tooth moves to the position represented by the dotted line, head ③ generates an on-off pulse.

This means that, as the signal disc plate turns, heads ① and ③ alternately generate an on-off pulse every 2° of rotation. The width of this on-off pulse is predetermined so that its on and off periods both have a pulse width that corresponds to 1° of rotation of the signal disc plate. This 1° on-off signal is sent to the control unit.

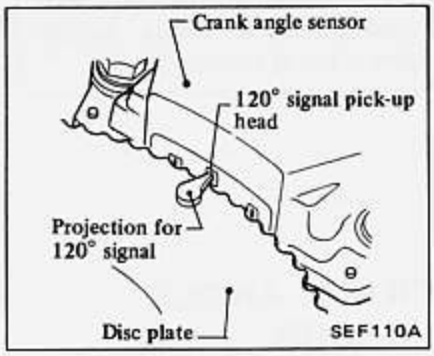






Detection of 120° signal (For detecting piston T.D.C.)

Head ② which is shown in the picture, is used to detect 120° signal. When a projection on the signal disc plate passes in front of head ②, a single on-off pulse is generated. Since the plate has three projections at 120° intervals, the pulse-to-pulse distance corresponds to 120° rotation of the crankshaft. This 120° signal is sent to the control unit.



INSPECTION AND ADJUSTMENT

Inspection

1. Check the functions using the E.C.C.S. analyzer. (See pages EF-11, 15 and 24.)

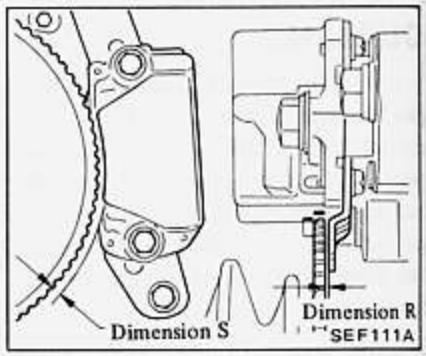
This process cannot be completed with a circuit tester.

2. If any abnormality is found, check the installed dimensions of the crank angle sensor with respect to the signal disc plate, proceeding as follows:

(1) Use thickness gauges.

Remove the car's under cover, and check or adjust it from below.

(2) The installed dimensions both in the radial and thrust directions must be within the limits that are specified.

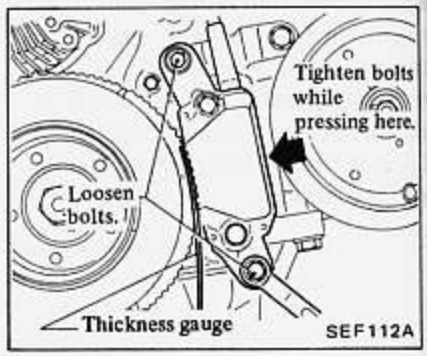


Specification for crank angle sensor installed dimension:
R (radial direction)
1.0 - 1.4 mm
(0.039 - 0.055 in)
S (thrust direction)
1.0 - 1.4 mm
(0.039 - 0.055 in)

Adjustment

1. To adjust the dimension in the radial direction, loosen two crank angle sensor adjuster mounting bolts, then using the proper 1.2 mm (0.047 in) thickness gauge, secure the specified dimension and retighten the two mounting bolts.

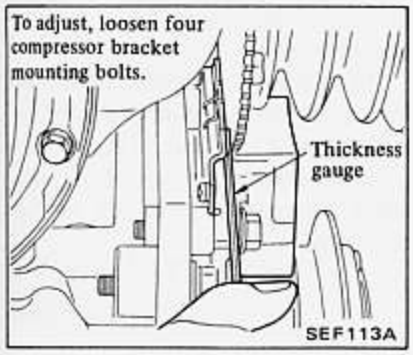
Adjustment dimension in radial direction:
1.2 mm (0.047 in)



2. To adjust the thrust direction, loosen the compressor, and then loosen the four compressor bracket mounting bolts. Securing the specified dimension with the 1.2 mm (0.047 in)

thickness gauge and then retighten the bolts.

Adjustment dimension in thrust direction:
1.2 mm (0.047 in)



REPLACEMENT

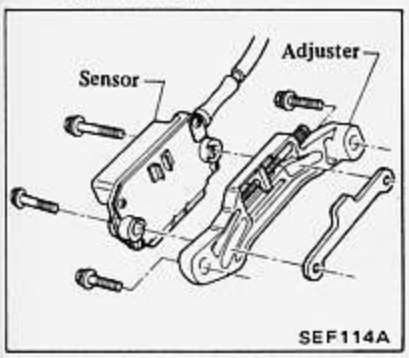
1. Remove the connector, and then remove the crank angle sensor together with the crank angle sensor adjuster.

Slightly loosen the crank angle sensor mounting bolts before beginning this operation.

2. Remove crank angle sensor from the crank angle sensor adjuster, and replace it with a new one. Attach the crank angle sensor to compressor bracket while maintaining the above specified dimension.

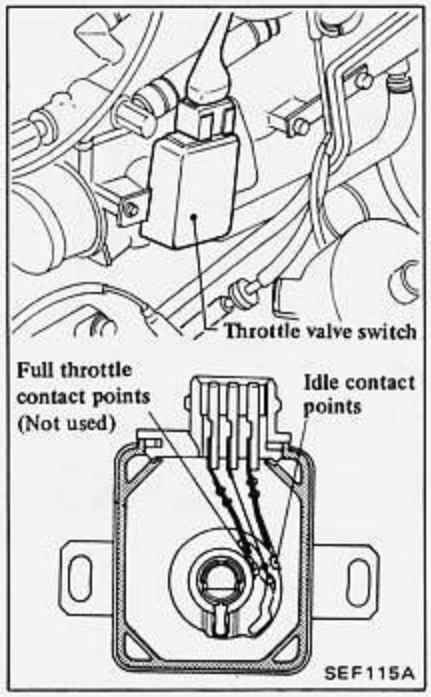
Attach the compressor to the engine, and then tighten four bolts (Compressor bracket, crank angle sensor adjuster) to the specified torque.

Ⓣ: Compressor bracket side
43 - 58 N·m
(4.4 - 5.9 kg-m,
32 - 43 ft-lb)
Sensor adjuster side
9 - 12 N·m
(0.9 - 1.2 kg-m,
6.5 - 8.7 ft-lb)



THROTTLE VALVE SWITCH

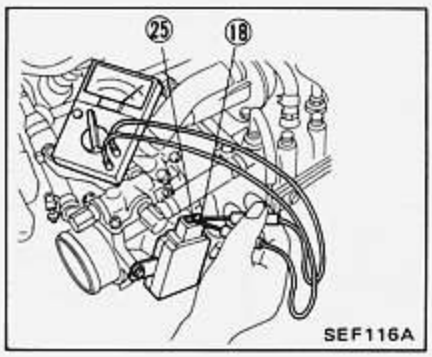
The throttle valve switch is attached to the throttle chamber and actuates in response to accelerator pedal movement.
This switch has the idle contact.
The idle contact closes when the throttle valve is positioned at idle and opens when it is at any other position.



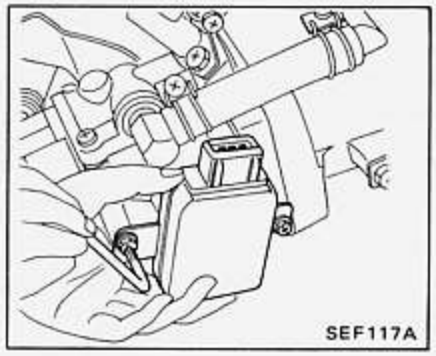
ADJUSTMENT

Ohmmeter method

1. Disconnect throttle valve switch connector.
2. Connect ohmmeter between terminals ⑱ and ㉕, and make sure continuity exists.



3. Adjust throttle valve switch position, with retaining screw, so that idle switch may be changed from "ON" to "OFF" when engine speed is about 750 rpm under no load.

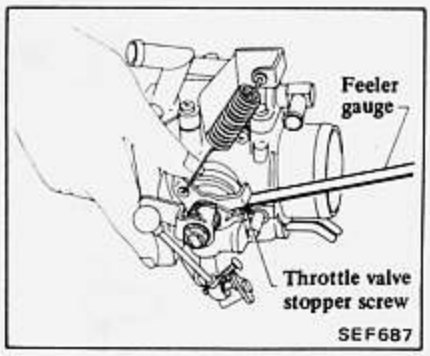


Feeler gauge method

To adjust position of throttle valve switch with engine off, proceed as follows:

When clearance "A" between throttle valve stopper screw and throttle valve shaft lever is 0.3 mm (0.012 in), adjust throttle valve switch position so that idle switch is changed from "ON" to "OFF".

If clearance between throttle valve stopper screw and throttle valve shaft lever is 0.3 mm (0.012 in), engine speed will become about 900 rpm.



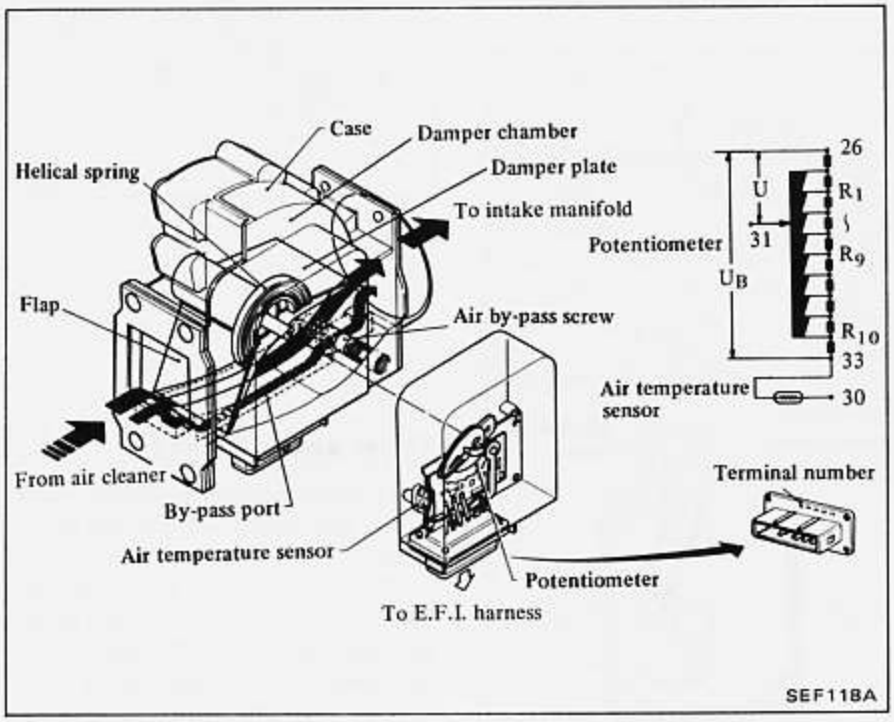
Changing idle switch from "ON" to "OFF" corresponds to change from 0 to ∞ (infinite) ohms in resistance between terminals ⑱ and ㉕.

AIR FLOW METER

The air flow meter measures the quantity of intake air, and sends a signal to the control unit so that the base pulse width can be determined for correct fuel injection by the injector. The air flow meter is provided with a flap in the air passage. As the air flows through the passage, the flap rotates and its angle of rotation electronically signals the control unit.

During idling operation when the amount of intake air is extremely small, the air flows parallel with the flap through the by-pass port so that the specified intake air flow can be provided correctly.

An air temperature sensor is installed in the air passage.



CYLINDER HEAD TEMPERATURE SENSOR

The cylinder head temperature sensor, built into the cylinder head, monitors change in cylinder head temperature.

The temperature sensing unit employs a thermistor which is very sensitive in the low temperature range.

The electrical resistance of the thermistor decreases in response to the temperature rise.

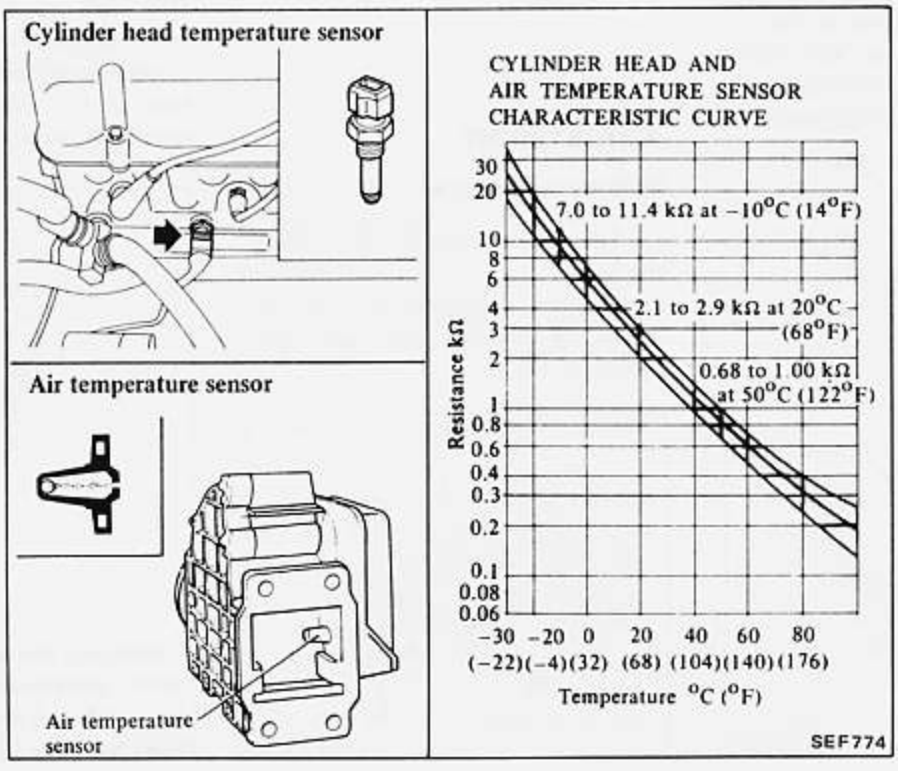
AIR TEMPERATURE SENSOR

The air temperature sensor, built into the air flow meter, monitors change in the intake air temperature.

The temperature sensing unit employs a thermistor which is very sensitive in the low temperature range.

The electrical resistance of the thermistor decreases in response to air temperature rise.

Air temperature sensor cannot be removed as a single unit.



BAROMETRIC PRESSURE SENSOR

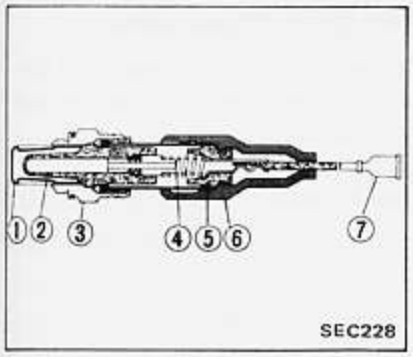
This sensor is built into the control unit and senses the barometric pressure in order to compensate for the density of the intake air.

This sensor cannot be replaced, adjusted or checked as a single unit.

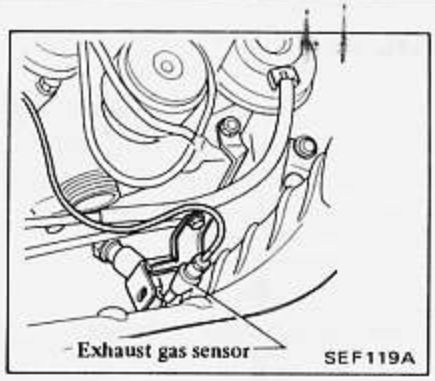
If it malfunctions, replace control unit.

EXHAUST GAS SENSOR

The exhaust gas sensor, which is built into the exhaust manifold, monitors the density of oxygen in the exhaust gas. It consists of a closed-end tube made of ceramic zirconia and other components. Porous platinum electrodes cover the tubes inner and outer surfaces. The closed-end of the tube is exposed to the exhaust gas in the exhaust manifold. The tubes outer surface contacts the exhaust gas while the inner surface contacts the air.

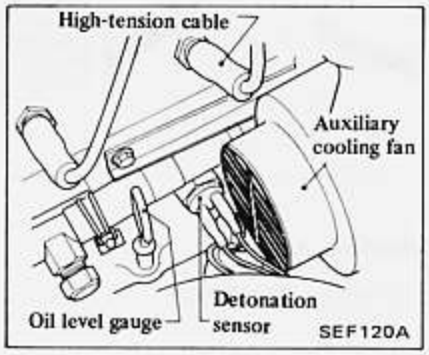


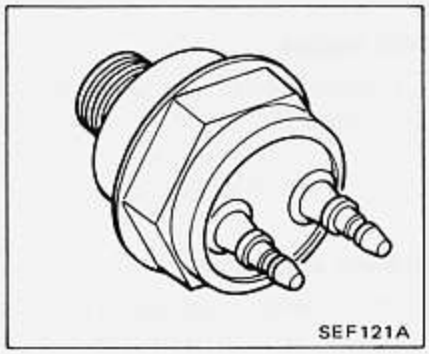
1 Louver
2 Zirconia tube
3 Holder
4 Spring
5 Terminal support
6 Boots
7 Connector



DETONATION SENSOR

The detonation sensor is attached to the cylinder block and senses engine knocking conditions. The sensor monitors the knocking from each combustion chamber and sends an electric signal to the control unit where it is changed to a knocking signal.





PARK/NEUTRAL SWITCH

The park/neutral switch detects the transmission gear selector's position and transmits an electric signal to the control unit.

CAR SPEED SENSOR

The car speed sensor provides a car speed signal to the control unit.

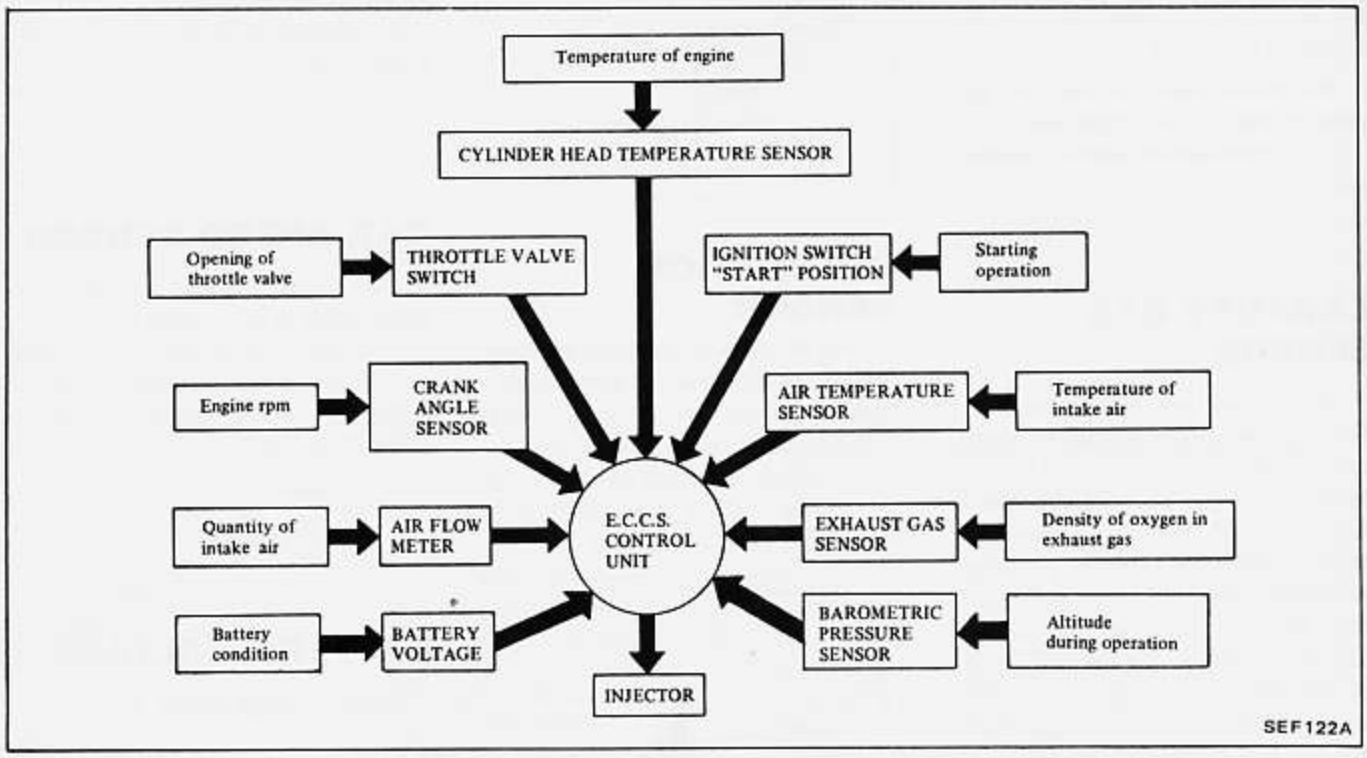
The speed sensor consists of a reed switch, which is installed in the speed meter unit and transforms car speed into a pulse signal.

BATTERY VOLTAGE

Battery voltage is sent to the control unit, which then function to compensate the variability in it.

FUEL INJECTION CONTROL

There are two ways to control fuel injection: open-loop control and closed-loop control. Which one is used depends on the cylinder head temperature, engine rpm, engine load, exhaust gas sensor signal and so forth.



The control unit determines the proper quantity of fuel to be injected from each signal input and then operates the injector. Injections are timed for each rotation of the engine by the crank angle sensor signal and are made simultaneously in every cylinder.

OPEN-LOOP CONTROL

For improved driveability, fuel injection is controlled by open-loop control when the engine is cold, when driving at high speeds or under heavy load and when the fuel shut-off system is in operation. With open-loop control, the mixture ratio is determined by the Central Electronic Control Unit (C.E.C.U.) to correspond to the engine rpm, engine load and engine warm-up conditions.

Open-loop control will activate under the following conditions:

In the following instances, the control unit emits a signal that will return mixture ratio to the best point which will keep a good driving condition.

Starting engine

When starting engine.

Cold engine

Cylinder head temperature is below 40°C (104°F).

Driving condition

When driving at high speeds (about 3,600 rpm) or under heavy load.

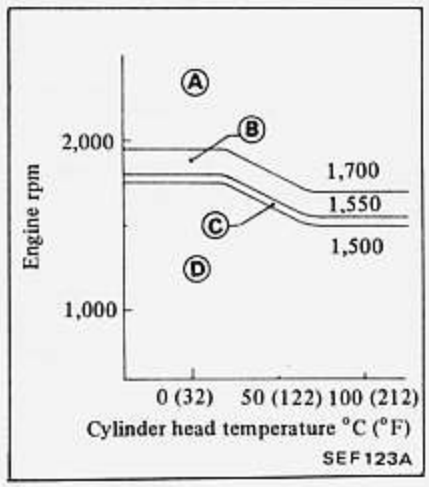
Exhaust gas sensor time monitor

- When an exhaust gas sensor monitors a too rich condition for more than 6.4 seconds.
- When an exhaust gas sensor monitors a too lean condition for more than 10 seconds.

Fuel shut-off operation

Fuel shut-off is accomplished during deceleration when the engine does not require fuel.

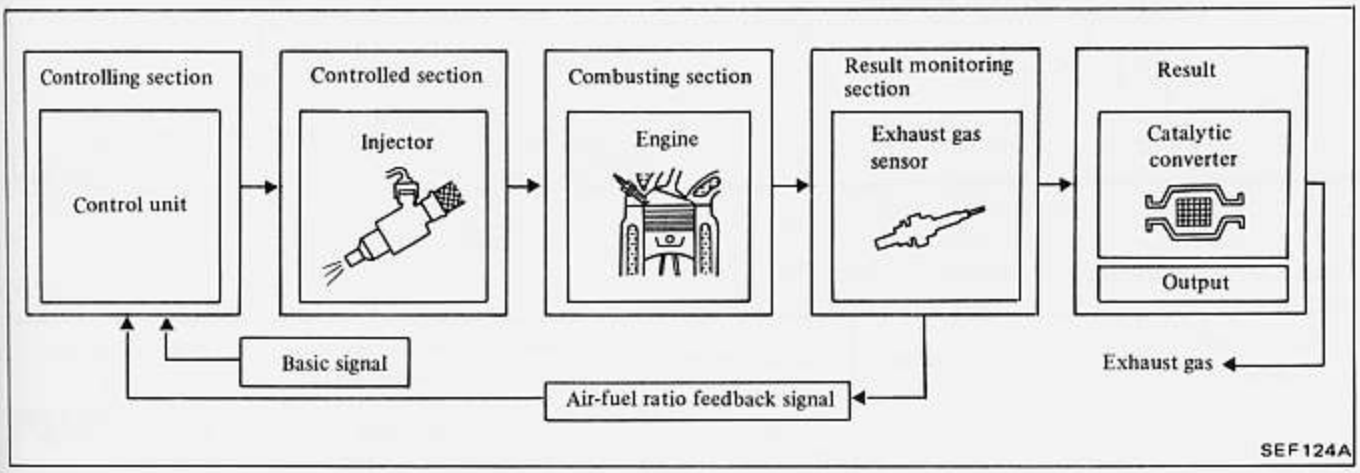
The graph below shows the fuel shut off range.



Deceleration from zone "Ⓐ"	Fuel is shut off; and fuel is injected again in zone "Ⓓ".
Deceleration from zone "Ⓑ"	Fuel is shut off; and fuel is injected again in zone "Ⓓ".
Deceleration from zone "Ⓒ" and "Ⓓ"	Fuel is not shut off.
Engine rpm increased in the order of "Ⓓ", "Ⓒ", "Ⓑ" and "Ⓐ". (Idle switch ON, downhill driving, etc.)	Fuel is not shut off in zones "Ⓓ", "Ⓒ" and "Ⓑ"; in zone "Ⓐ", fuel is shut off.

MIXTURE RATIO FEEDBACK CONTROL (Closed-loop control)

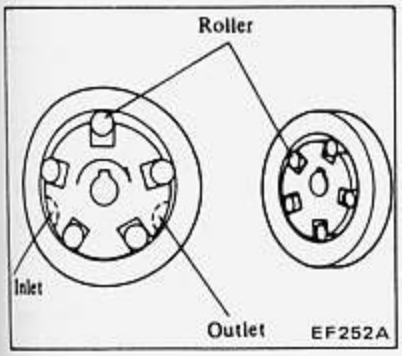
This system is designed to control the mixture ratio precisely to the stoichiometric point so that the three-way catalyst can minimize CO, HC and NOx emissions simultaneously. The system uses the oxygen sensor located in the exhaust manifold to give an indication of whether the inlet mixture ratio is richer or leaner than the stoichiometric point. The sensor transmits a nonlinear voltage to the electronic control unit. The control unit adjusts the injection pulse width according to the sensor voltage so the mixture ratio will be within the narrow window of the three-way catalyst. During engine warm-up period, however, this system becomes open until the sensor reaches the operating temperature.

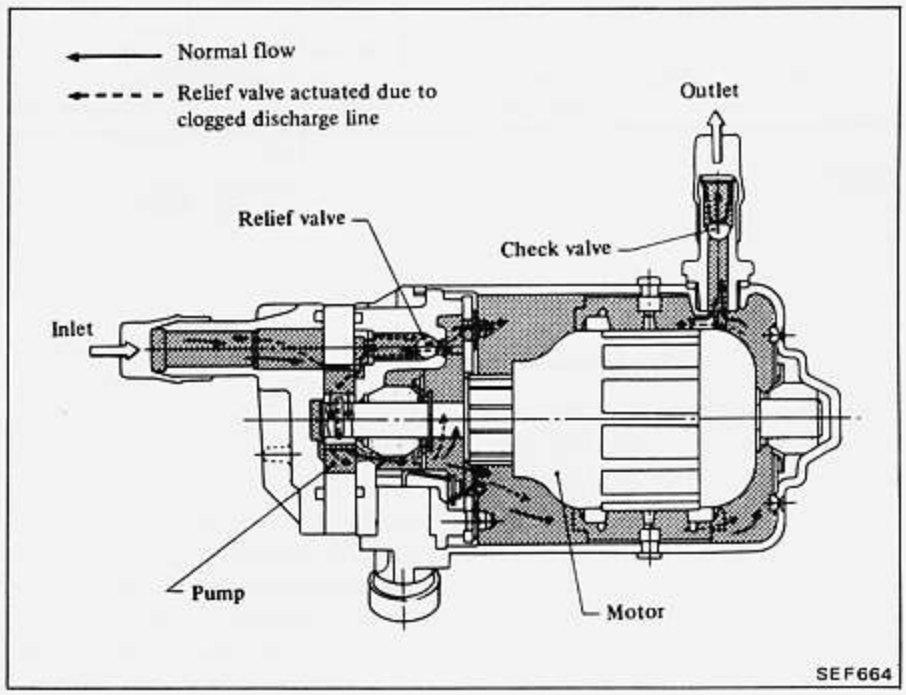


FUEL PUMP CONTROL

The fuel pump is controlled by the central electronic control unit adjusting to the engine conditions. The signals from engine crank angle and ignition switch are used for the fuel pump operation.

FUEL PUMP

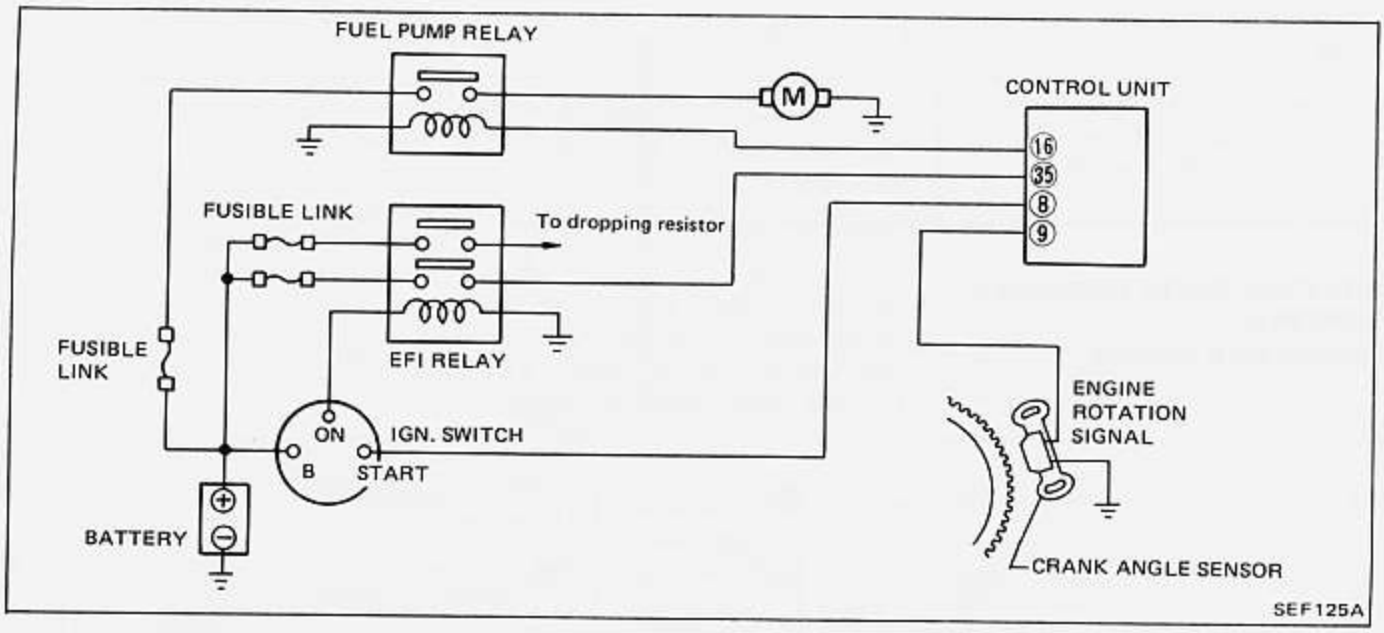




A relief valve in the pump is designed to open when the pressure in the fuel line rises over 294 to 441 kPa (3.0 to 4.5 kg/cm², 43 to 64 psi) due to malfunction in the pressure system.

The check valve prevents abrupt drop of pressure in the fuel pipe when stopping the engine.

FUEL PUMP ELECTRICAL CIRCUIT



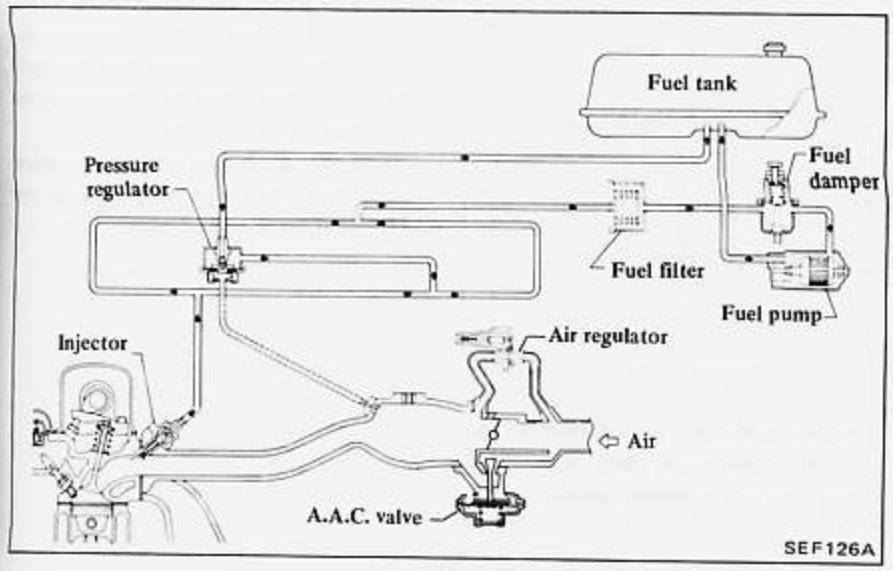
Fuel pump operation

Ignition switch position	Fuel pump operation	Engine speed	Crank angle sensor signal (received by control unit)	Fuel pump relay state
ON	Operates for 5 seconds	Stops	120° signal: None	ON for 5 seconds
START	Stops	Below 20 rpm	120° signal: None for 1 second	OFF
	Operates	Above 20 rpm	120° signal: Provided in 1 second	ON
ON	Stops	Below 20 rpm	120° signal: None for 1 second	OFF
	Operates	Above 20 rpm	120° signal: Provided in 1 second	ON

FUEL FLOW SYSTEM

Fuel is drawn from the fuel tank into the fuel pump, from which it is discharged under pressure. As it flows through the mechanical fuel damper, pulsation in the fuel flow is damped. Then, the fuel is filtered in the fuel filter, goes through the fuel line, and is injected into the intake port.

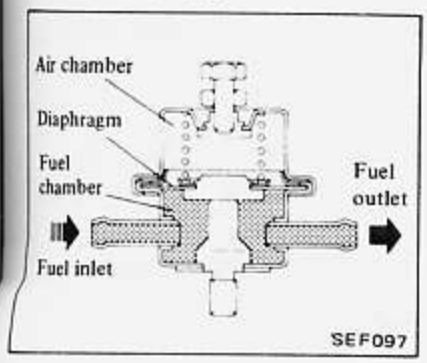
Surplus fuel is led through the pressure regulator and is returned to the fuel tank. The pressure regulator controls the injection pressure in such a manner that the pressure difference between the fuel pressure and the intake manifold vacuum is always 250 kPa (2.55 kg/cm², 36.3 psi).



FUEL PUMP

Refer to FUEL PUMP CONTROL.

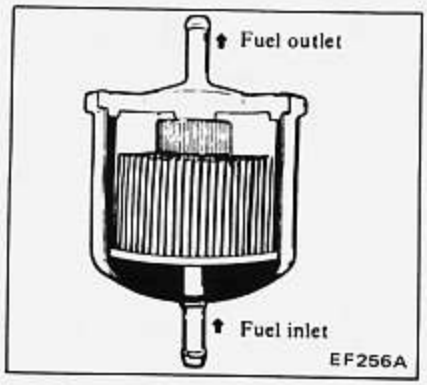
FUEL DAMPER



The fuel damper acts like a shock absorber in fuel flow discharged from the fuel pump. There are not adjustments on this damper.

Change in the pump discharge pressure is monitored by the diaphragm and spring, which vary the volume of the fuel chamber.

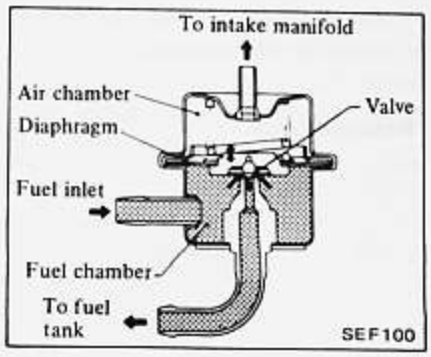
FUEL FILTER



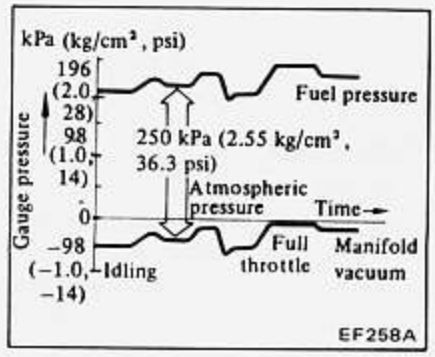
The fuel filter is placed between the fuel damper and the injector, and is used to remove foreign matter in the fuel. Water in the fuel is collected at the bottom of the filter casing.

If car is operated under extreme adverse weather conditions or in areas where ambient temperatures are either extremely low or extremely high, the filter might become clogged. In such an event, replace it immediately.

PRESSURE REGULATOR



The pressure regulator controls the pressure of fuel so that a pressure difference of 250 kPa (2.55 kg/cm², 36.3 psi) can be maintained between the fuel pressure and intake manifold vacuum. The pressure regulator is divided into the air chamber and fuel chamber by the diaphragm. Intake manifold vacuum is introduced into the air chamber, thereby keeping differential pressure constant causing excessive fuel to return to the fuel tank through the return side port. This constant differential pressure provides optimum fuel injection in every mode of engine operation.



Inspection

If the fuel pressure is other than that specified, first check the fuel pump and then check the following items:

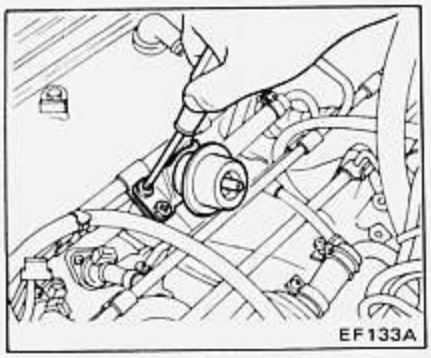
If fuel pressure is too high:

Vacuum hose connected to pressure regulator poorly, clogged fuel return piping, or faulty pressure regulator.

If fuel pressure is too low:

Clogged fuel pump, fuel filter, or fuel tank; leak in the fuel system, or faulty pressure regulator.

Replacement


EF133A

1. Reduce fuel line pressure to zero.
2. Disengage vacuum tube connecting regulator to intake manifold from pressure regulator.
3. Remove screws securing pressure regulator.
4. Unfasten hose clamps, and disconnect pressure regulator from fuel hose.

Place a rag under pressure regulator to prevent splashing of fuel.

5. To install pressure regulator, reverse the order of removal.
6. For installation of fuel hose, refer to Fuel Hose.

FUEL HOSE

Make sure that all low pressure fuel hoses are fully inserted and are free from undue strain before clamping.

When removing or installing high pressure fuel hose, observe the following.

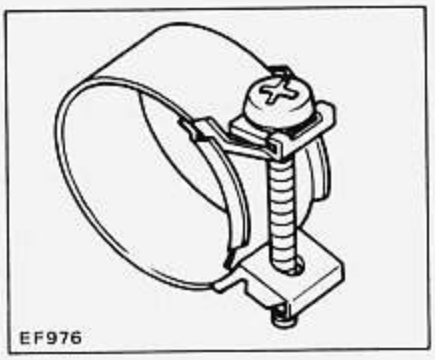
CAUTION:

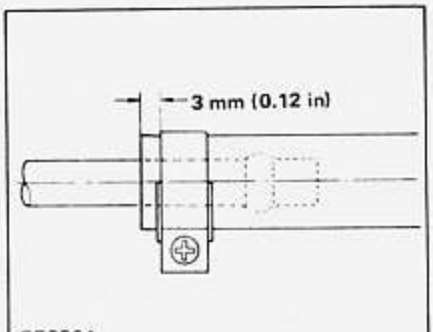
a. Do not reuse fuel hose clamps after loosening.

b. Clean dust and dirt from parts with compressed air when assembling.

c. Tighten high pressure rubber hose clamp so that clamp end is 3 mm (0.12 in) from hose end or screw position (wider than other portions of clamp) is flush with hose end.

Ⓣ: Fuel hose clamps
1.0 - 1.5 N·m
(0.10 - 0.15 kg-m,
0.7 - 1.1 ft-lb)


EF976



EF336A

d. When tightening hose clamp, ensure that screw does not come into contact with adjacent parts.

Insert high pressure fuel hoses into their proper positions as instructed below.

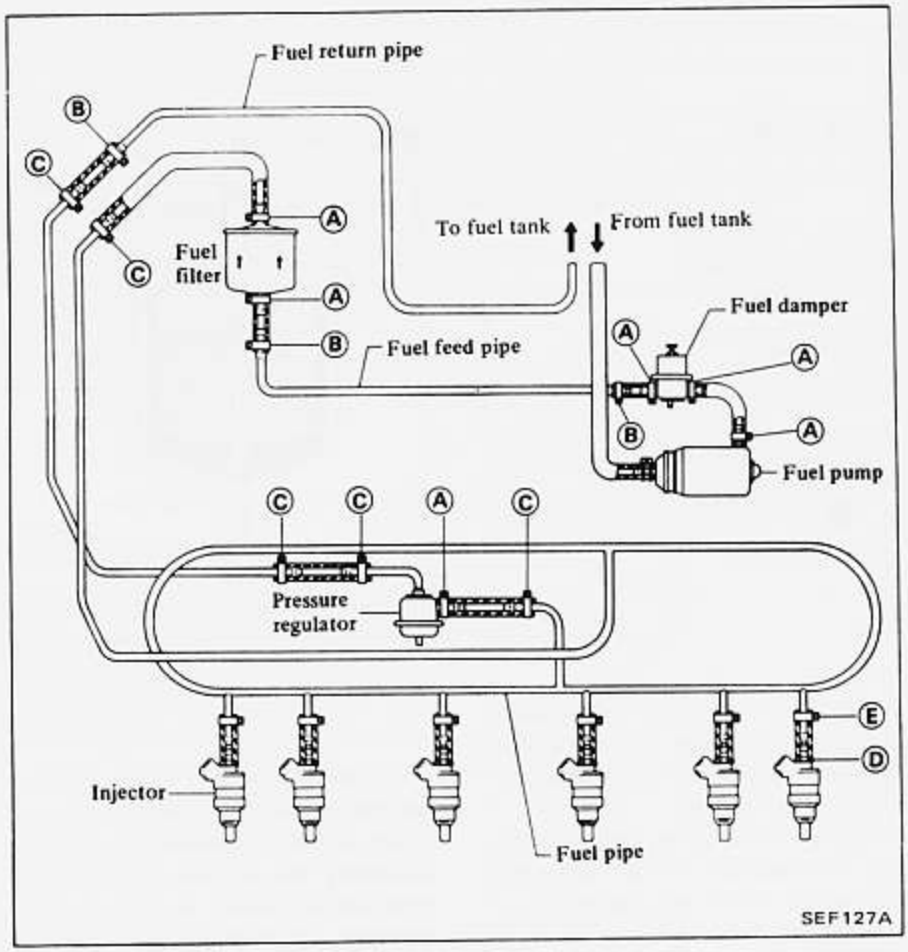
Type Ⓐ: Insert rubber hose until its end contacts unit.

Type Ⓑ: Push end of rubber hose onto fuel pipe until it contacts inner bulge.

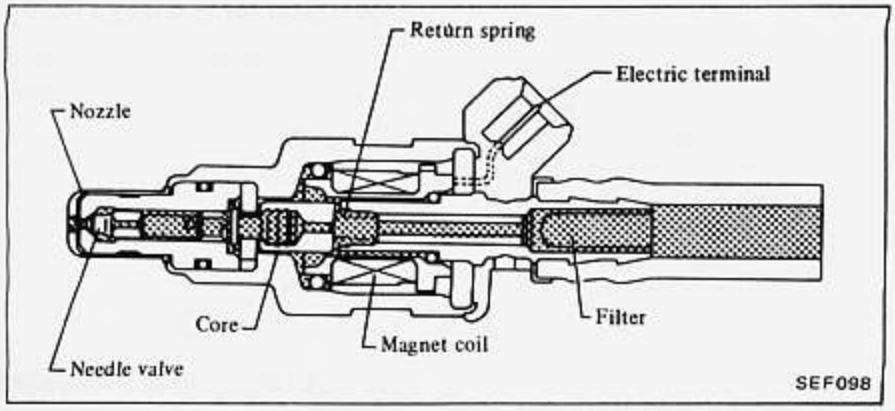
Type Ⓒ: Push end of rubber hose onto fuel pipe until it is 33 mm (1.30 in) from end of pipe.

Type Ⓓ: Push end of rubber hose with hose socket onto unit by hand as far as they will go. Clamp is not necessary at this connection.

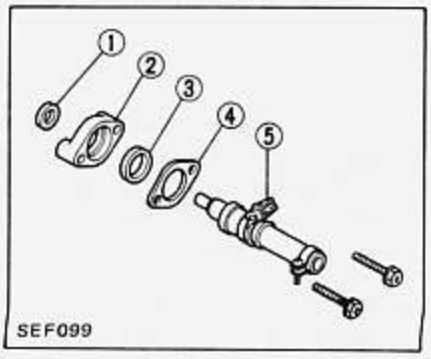
Type Ⓔ: Push end of injector rubber hose onto fuel pipe until it is 28 mm (1.10 in) from end of pipe.



INJECTOR

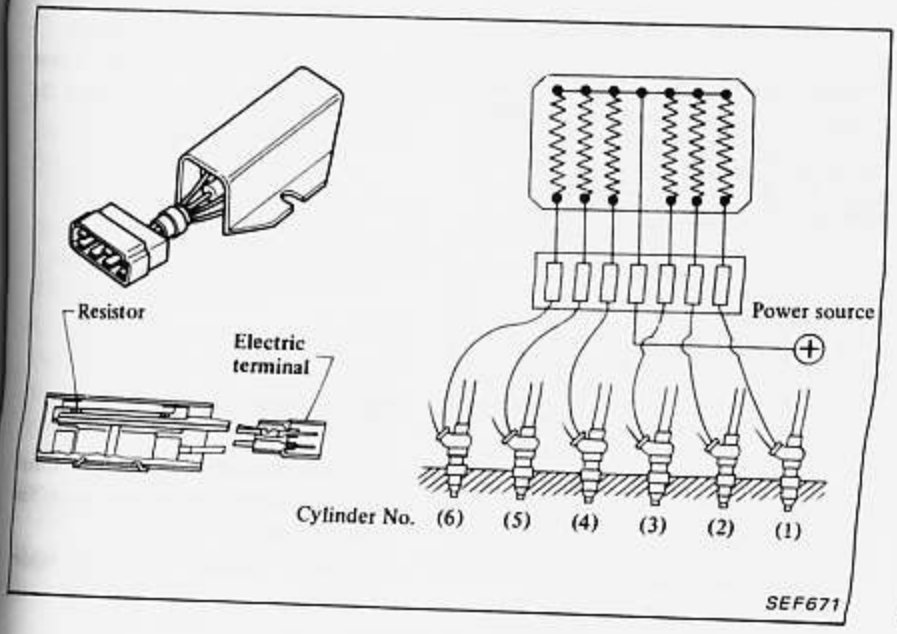


The injector operates on the solenoid valve principle. When an electric signal is applied to the coil built into the injector, the plunger is pulled into the solenoid, thereby opening the needle valve for fuel injection. The quantity of injected fuel is in proportion to the duration of the pulse applied from the control unit.



1 Injector lower rubber insulator
2 Injector lower holder
3 Injector upper rubber insulator
4 Injector upper holder
5 *Injector*

Dropping resistor



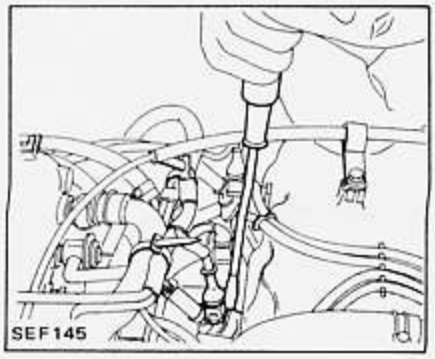
The dropping resistor is used to lower the source voltage to a level suitable for the injector.

The dropping resistor is connected in series with the injector. It reduces the voltage to approximately 1/4 of the source voltage.

INSPECTION

When engine rotates

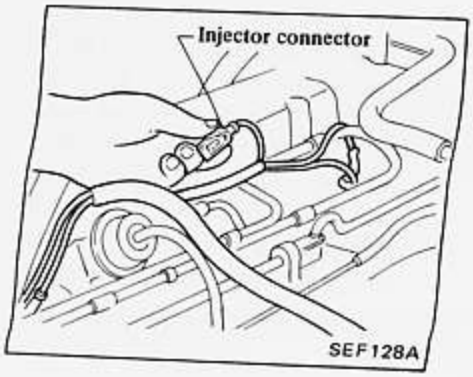
1. Start the engine and, using a screwdriver, determine whether operating noises can be heard from each injector.



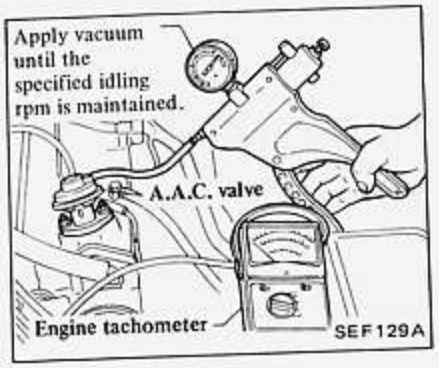
2. Release the idle and air-fuel ratio feedback controls. While the engine is idling, disconnect the injector wiring connectors one by one, beginning with No. 1, to determine whether any changes occur in idling speed or stability.

(1) The injection can be considered faulty if the idle does not change when the connector is disconnected.

(2) If the changes in the idle are even for each cylinder, the injector's operation can be considered normal.

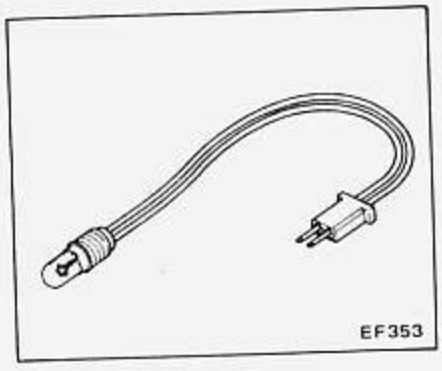


a. Disconnect the exhaust gas sensor's harness to release the air-fuel ratio feedback control.
b. To release the idle control, attach a vacuum handy pump to the A.A.C. valve hose, and adjust until the specified idle speed is reached.



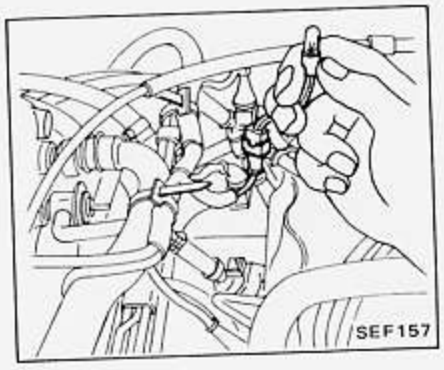
Engine will not start

1. Inspection lamp, as shown in figure below, is required for this test.



Make inspection lamp as follows:
1) Prepare 12V-3W lamp.
2) Prepare socket and set lamp in it.
3) Use flat plate terminals 3 mm (0.12 in) wide, 0.8 mm (0.031 in) thick as male terminals. Place flat plate terminals parallel with each other and keep distance between inside faces 2 mm (0.08 in). Then secure terminals by wrapping insulation tape or with suitable terminal body.

2. Disconnect injector harness connector.
3. Connect inspection lamp to injector harness connector.

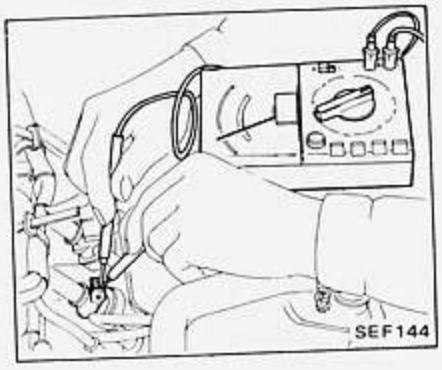


4. After starting engine or cranking engine, check inspection lamp to see if it flashes at regular intervals. If so, electric signals are being properly transmitted to injectors.

a. The engine should be cranked at a speed of more than 80 rpm.
b. The control unit may fail to generate a correct pulse signal at an excessively low battery voltage. It is recommended, therefore, that a battery voltage of more than 9 volts be applied during the cranking operation.

5. If the inspection light illuminates, determine whether the electrical resistance between the injector terminals is normal.

Normal value: 2 - 3 ohms



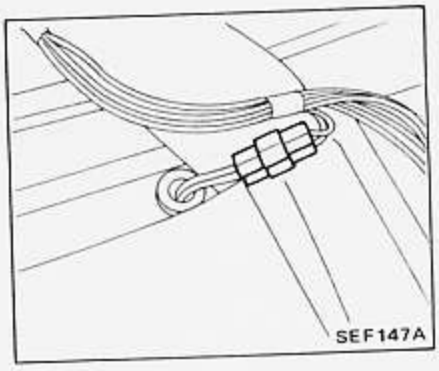
6. If the resistance value is abnormal, replace the injector.

FUEL SYSTEM PRESSURE CHECK

Before disconnecting fuel hose, release fuel pressure from fuel line for safety reasons.

RELEASING FUEL PRESSURE

1. Start the engine.
2. Open back door and remove center tonneau cover.
3. Disconnect fuel pump connector.



4. After the engine stalls, crank the engine two or three times.
5. Turn the ignition switch "OFF".
6. Connect fuel pump connector.

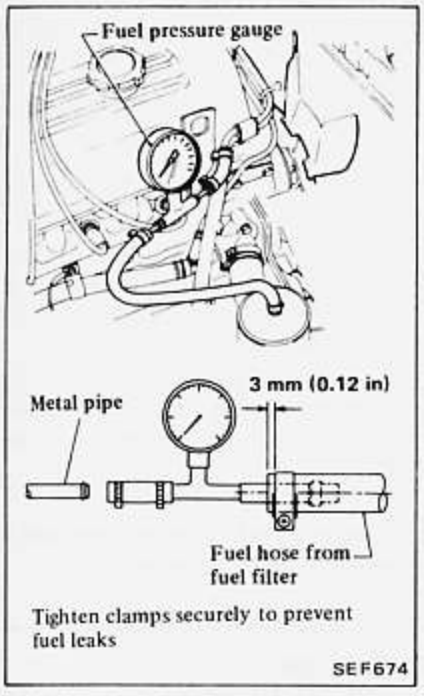
If engine does not start, remove fuel pump connector and crank the engine for about 5 seconds.

FUEL PRESSURE CHECK

When reconnecting the lines, always use new clamps and be sure to position them correctly.

Use a torque driver to tighten clamps.

1. Install Pressure Gauge (J 25400-34) between fuel filter hose and metal pipe at point shown. For convenience in later tests, position gauge so that it can be read from driver's seat.



2. Start engine and read fuel pressure gauge.

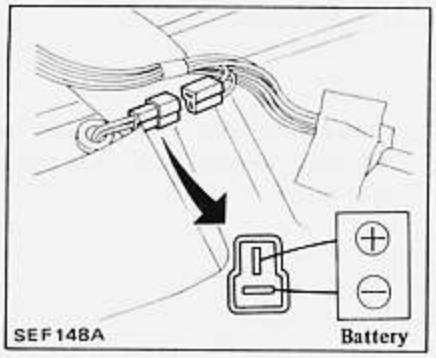
At idling:
Approximately 206 kPa (2.1 kg/cm², 30 psi)
The moment accelerator pedal is fully depressed:
Approximately 255 kPa (2.6 kg/cm², 37 psi)

3. If fuel pressure is not as specified, replace pressure regulator, and repeat fuel pressure check.

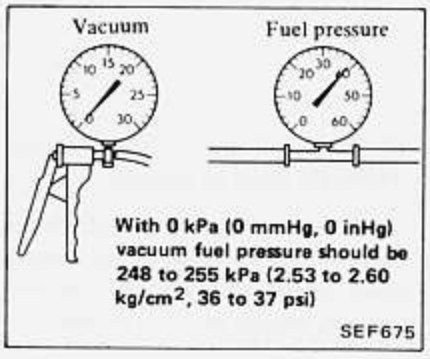
If below the specified value, check for clogged or deformed fuel lines, and if necessary, replace fuel pump as an assembly or check valve.

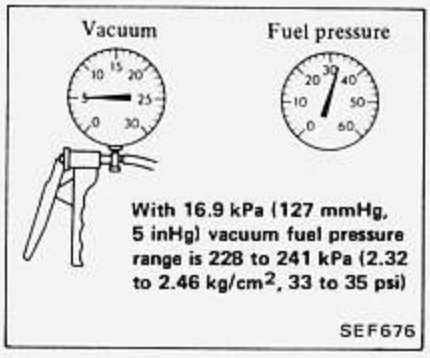
4. Connect variable vacuum source, J 23738 or equivalent to fuel regulator. Disconnect fuel pressure regulator vacuum hose from intake manifold and attach hose to variable vacuum source.

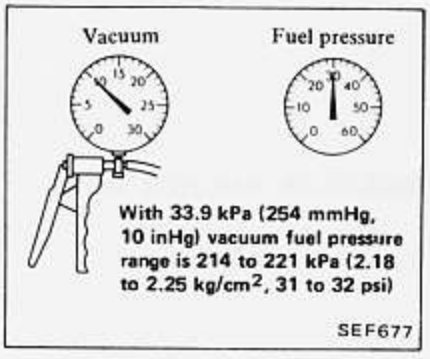
5. Disconnect fuel pump connector and apply battery voltage when checking the following.

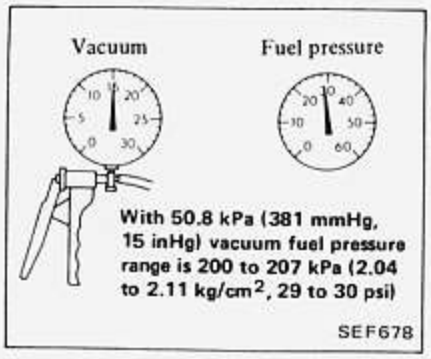


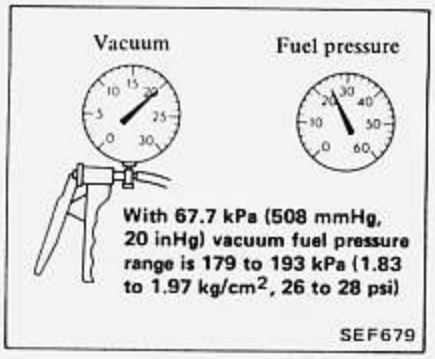
6. Observe fuel pressure readings as vacuum is changed.











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

7. Reconnect fuel pump connector.
8. Disconnect variable vacuum source and connect fuel pressure regulator vacuum hose to intake manifold.

REPLACEMENT

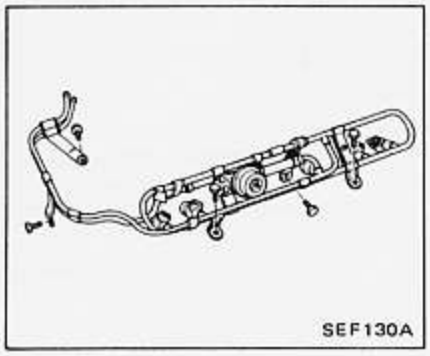
1. Lower fuel pressure.

Refer to FUEL PRESSURE CHECK.

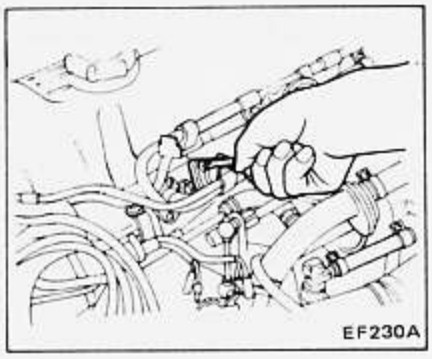
2. Disconnect electric connector from injector.
3. Disengage harness from fuel pipe wire clamp.
4. Disconnect blow-by hose at rocker cover side.
5. Disconnect vacuum tube (connecting pressure regulator to intake manifold) from pressure regulator.
6. Remove air regulator pipe.
7. Disconnect fuel feed hose and fuel return hose from fuel pipe.

Place a rag under fuel pipe to prevent splashing of fuel.

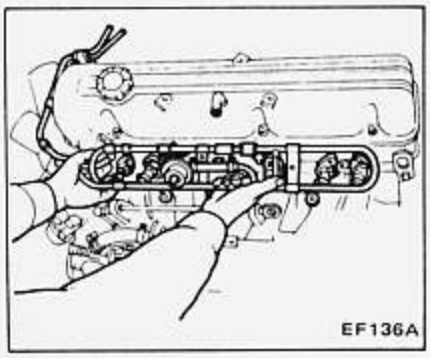
8. Remove bolts securing fuel pipe.



9. Remove screws securing fuel injectors.

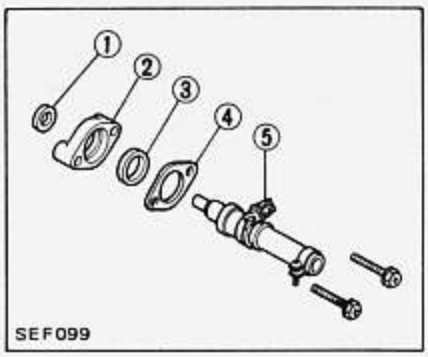


10. Remove fuel pipe assembly by pulling out fuel pipe, injector and pressure regulator as an assembly.



11. Unfasten hose clamp on fuel injector and remove fuel injector from fuel pipe.

Place a rag under injector when disconnecting fuel pipe to prevent splashing of fuel.



1 Injector lower rubber insulator
2 Injector lower holder
3 Injector upper rubber insulator
4 Injector upper holder
5 Injector

12. To install injector and fuel pipe, reverse the order of removal.

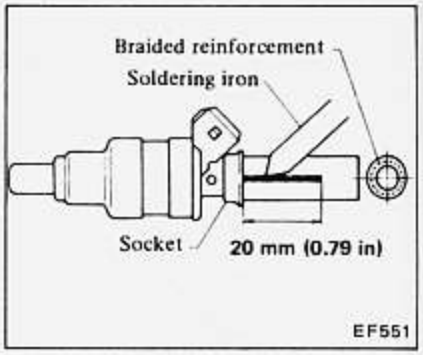
When installing injector, check that there are no scratches or abrasion at lower rubber insulator, and securely install it, making sure it is air-tight.

13. For installation of fuel hose, refer to Fuel Hose.

INJECTOR RUBBER HOSE

If necessary, replace injector rubber hose. Proceed as follows:

Removal



1. On injector rubber hose, measure off a point approx. 20 mm (0.79 in) from socket end.
2. Heat soldering iron (150 watt) for 15 minutes. Cut hose into braided reinforcement from mark to socket end.

Do not feed soldering iron until it touches injector tail piece.

CAUTION:
a. Be careful not to damage socket, plastic connector, etc. with soldering iron.
b. Never place injector in a vise when disconnecting rubber hose.

3. Then pull rubber hose out with hand.

Installation

1. Clean exterior of injector tail piece.
2. Wet inside of new rubber hose with fuel.
3. Push end of rubber hose with hose socket onto injector tail piece by hand as far as they will go.

Clamp is not necessary at this connection.

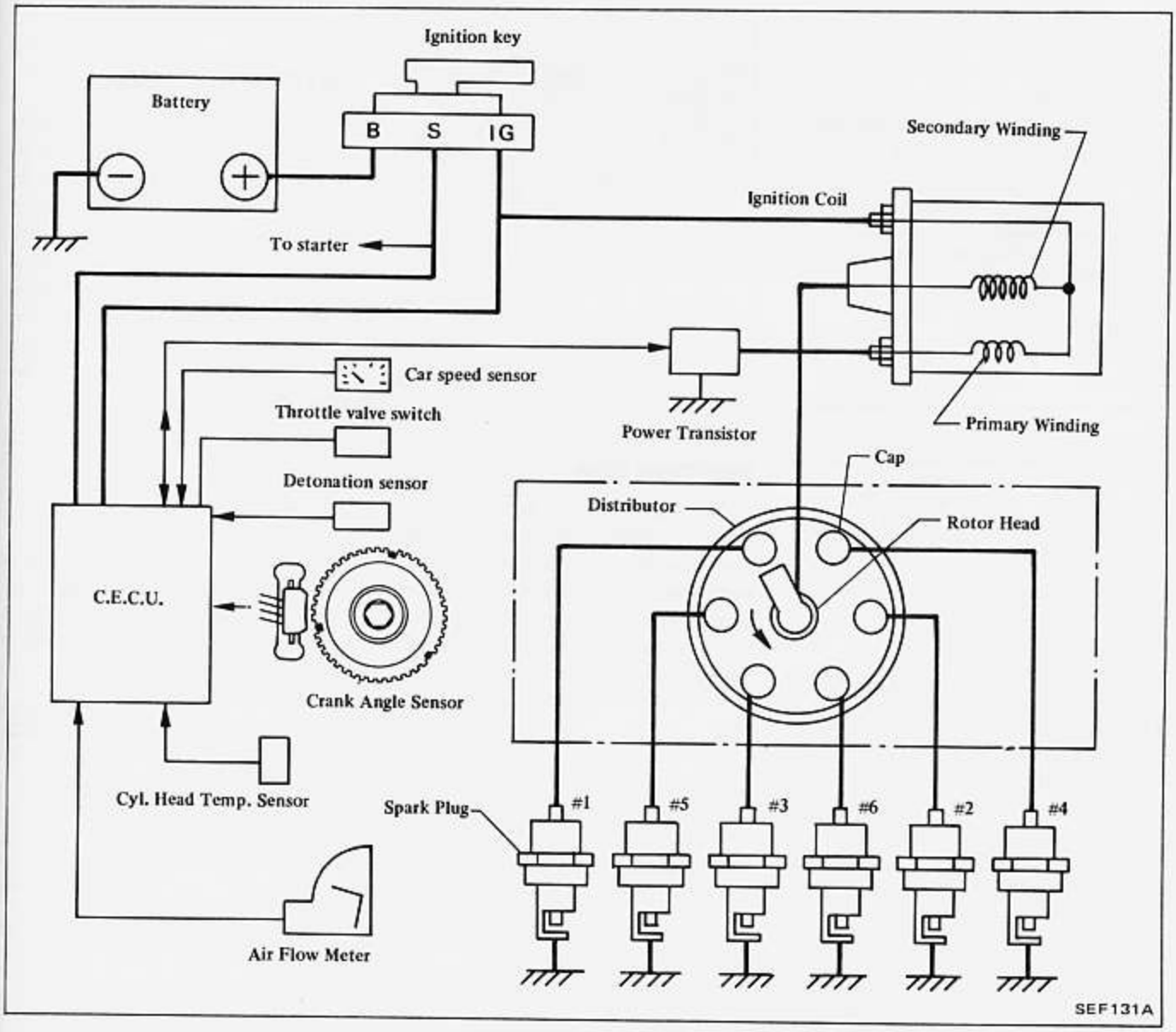
CAUTION:
After properly connecting fuel hose to injector, check connection for fuel leakage.

ELECTRONIC IGNITION TIMING CONTROL

The ignition timing is controlled by the central electronic control unit adjusting to the engine operating conditions: that is, as the best ignition timing in each driving condition has been memorized in the unit, the ignition timing is determined by the electric signal calculated in the unit.

The signals used for the determination of ignition timing are cylinder head temperature, engine rpm, engine load, engine crank angle, detonation sensor and so forth.

Then, the signal from the central electronic control unit is transmitted to the power transistor of the ignition coil, and controls the ignition timing. If there is engine knocking, a detonation sensor monitors its condition and the signal is transmitted to the central electronic control unit. After receiving it, the control unit controls the ignition timing to avoid the knocking condition.



ADJUSTMENT

Ignition timing is automatically controlled by the control unit, and it is usually unnecessary to adjust it. However, the ignition timing can go wrong if the crank angle sensor mounting position gets out of alignment. When this happens, the crank angle sensor must be adjusted.

Adjusting procedure

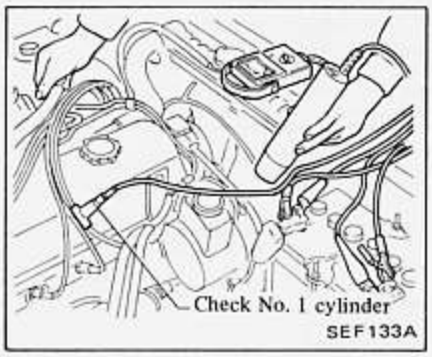
1. Loosen two crank angle sensor mounting bolts (the bolts that secure the sensor to adjuster), and adjust ignition timing to the specified value by turning adjusting screw.

Ignition timing	Adjusting screw	Crank angle sensor
To advance:	Tighten	Move upward.
To retard:	Loosen	Move downward.

a. Ignition timing cannot be adjusted on the distributor.

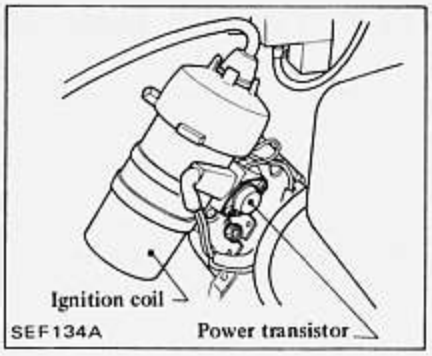
b. Note that the ignition timing value of the whole operating range will be changed if the ignition timing at idle is not within the specified values.

2. After adjustments are completed, retighten the crank angle sensor mounting bolts, and recheck the radial direction adjusting dimension of the crank angle sensor and idling ignition timing. (Refer to crank angle sensor.)



IGNITION COIL

The ignition coil has a built-in power transistor. The signal from the control unit is amplified by the power transistor. This amplified signal is used to connect and disconnect the ignition coil's primary current to generate high voltage across the secondary coil, and thereby create a spark in the spark plug.



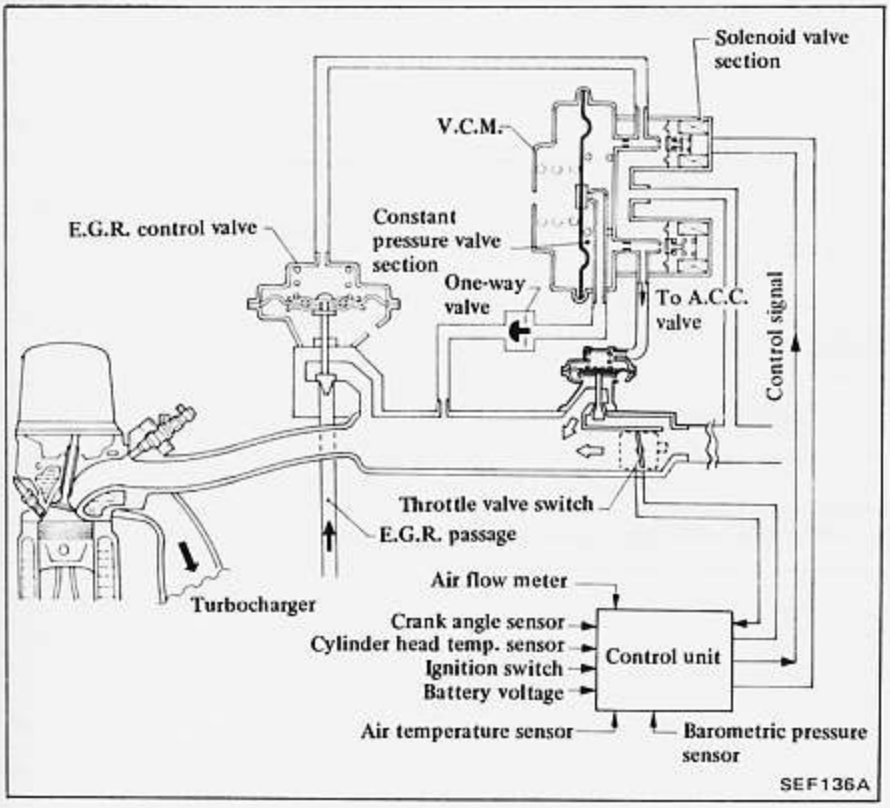
DETONATION SENSOR

The detonation sensor is installed in the side face of the cylinder block. It converts the vibrations caused by pressure in the combustion chamber into electrical signals. If the engine knocks while operating, the abnormal vibration will be detected by the detonation sensor. This signal is then sent to the control unit to retard the ignition timing to prevent further knocking.

EXHAUST GAS RECIRCULATION (E.G.R.) CONTROL

E.G.R. is controlled by the central electronic control unit adjusting to the engine operating conditions.

Cylinder head temperature, engine rpm, engine load, air temperature and barometric pressure are used for the determination of the E.G.R. amount.



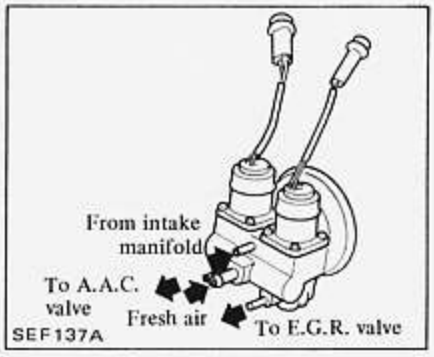
These signals are transmitted to the control unit where optimum E.G.R. quantities are recorded. To obtain the optimum E.G.R. quantity that corresponds to the engine operating conditions at the time, an electric signal is sent to the vacuum control modulator (V.C.M.). The vacuum control modulator transforms the electric signal to a vacuum signal, which in turn controls the E.G.R. valve.

OPERATION

Cylinder head temperature °C (°F)	Throttle valve switch	Starter switch	V.C.M. valve solenoid valve	E.G.R. control valve	E.G.R.
Below 57 (135)	ON	ON	ON	Closed	Not actuated
	OFF	OFF			
57 - 115 (135 - 239)	ON	ON	ON	Closed	Not actuated
	OFF	OFF	ON-OFF (control vacuum)	Open	Actuated
Above 115 (239)	ON	ON	ON	Closed	Not actuated
	OFF	OFF			

VACUUM CONTROL MODULATOR (V.C.M.)

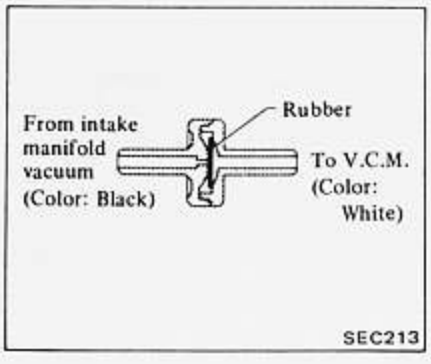
The vacuum control modulator is composed of a pressure regulator and solenoid valve. Intake manifold vacuum is used as the vacuum source for the pressure regulator. The passage leading to the atmosphere is controlled by solenoid valves. Using these components, the vacuum control modulator provides vacuum to the E.G.R. valve and A.A.C. valve (for idle speed control) following the electric signal from the control unit.



ONE-WAY VALVE

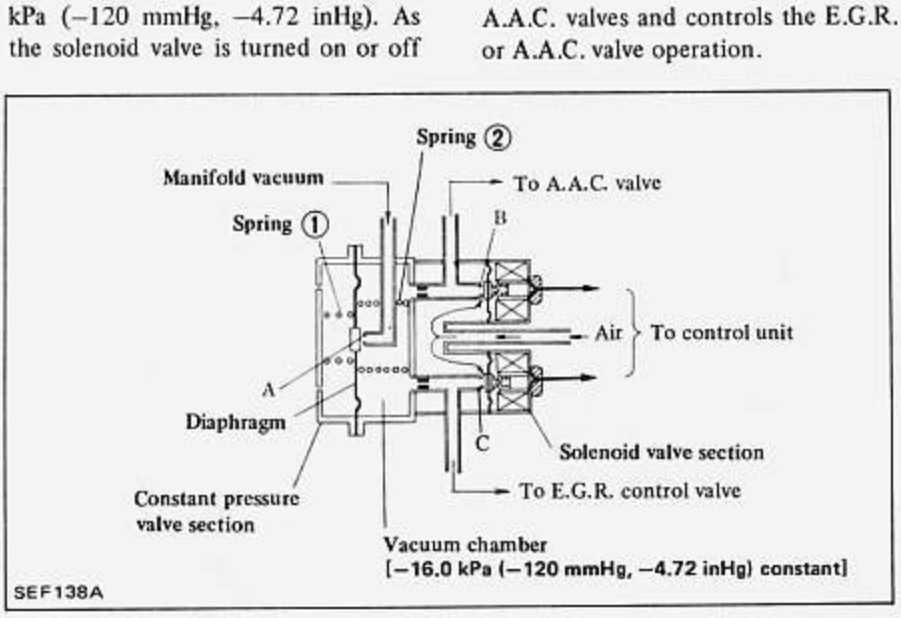
The one-way valve is utilized for the purpose of preventing the V.C.M. from applying positive pressure in high speed conditions.

This valve is installed in the vacuum line leading to V.C.M.



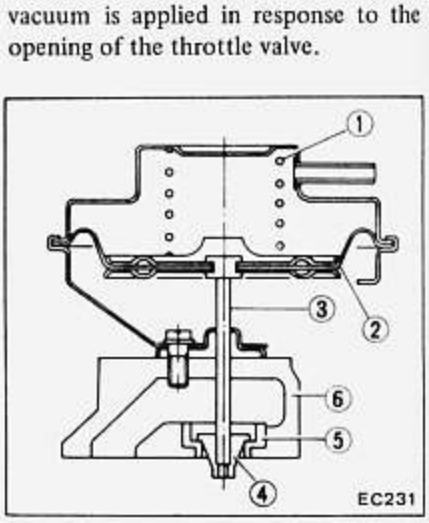
Operation

If the intake manifold vacuum exceeds −16.0 kPa (−120 mmHg, −4.72 inHg), portion A of the vacuum chamber is closed, and the vacuum in the chamber is kept at a constant −16.0 kPa (−120 mmHg, −4.72 inHg). As the solenoid valve is turned on or off by the signal from the control unit, portion B or C opens or closes to allow a controlled amount of air to enter the −16.0 kPa (−120 mmHg, −4.72 inHg) vacuum passage. A properly controlled vacuum is thus sent to the E.G.R. or A.A.C. valves and controls the E.G.R. or A.A.C. valve operation.



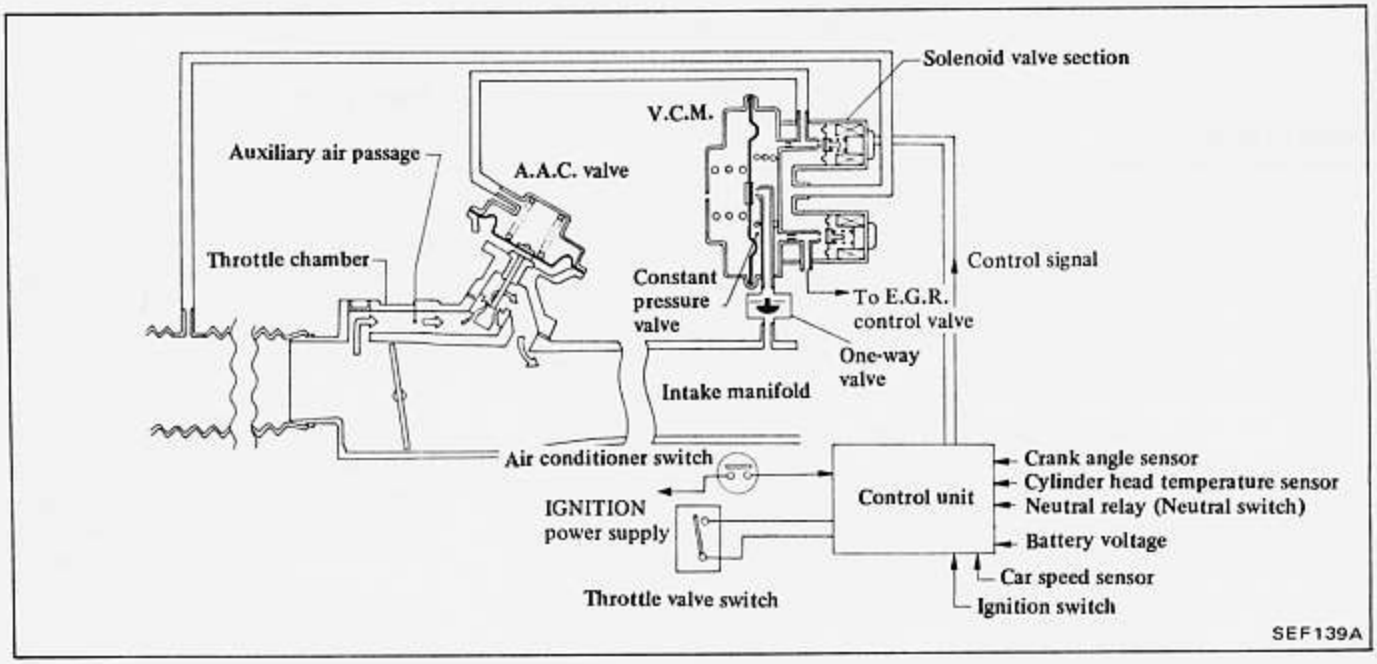
E.G.R. CONTROL VALVE

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



1 Diaphragm spring
2 Diaphragm
3 Valve shaft
4 Valve
5 Valve seat
6 Valve chamber

IDLE SPEED CONTROL



The idle speed is controlled by the central electronic control unit adjusting to the engine operating conditions.

Cylinder head temperature, engine rpm, engine load, throttle valve and gear positions are used for the determination of idle speed.

The central electronic control unit senses the idle conditions, and determines the appropriate idle speed at each gear position and cylinder head temperature, and sends the electric signal corresponding to the difference of the best idle speed and actual idle speed to the vacuum control modulator.

The vacuum control modulator transforms the electric signal into a vacuum signal and transmits it to the A.A.C. valve

The A.A.C. valve has a feedback control system which controls the idle speed by the vacuum signal.

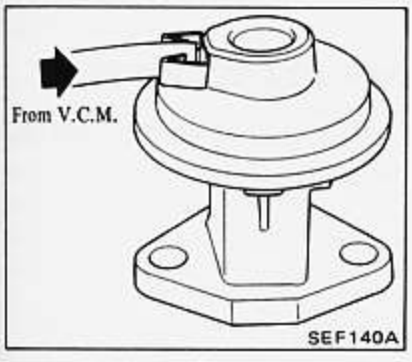
It is unnecessary to adjust the idle speed because of the idle speed feedback control.

Operation

Input		V.C.M. valve open period	A.A.C. valve open angle	Idle rpm
Cylinder head temperature sensor	Hot	Decreases	Decreases	Decreases
	Cold	Increases	Increases	Increases
Air conditioner switch	ON	Increases	Increases	Increases
	OFF	Decreases	Decreases	Decreases
Crank angle sensor (Engine rpm)	High	Decreases	Decreases	Decreases
	Low	Increases	Increases	Increases
Throttle valve switch (Idle switch)	OFF → ON	Increases	Increases	Decreases gradually
Neutral relay	N → D position	Increases	Increases	Constant
	D → N position	Decreases	Decreases	Constant

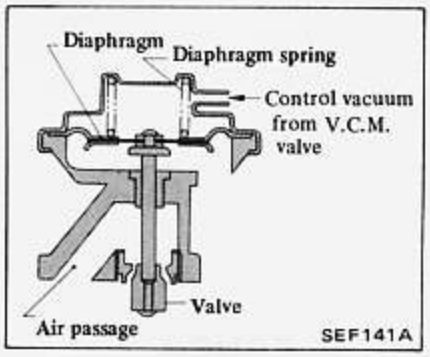
A.A.C. VALVE

The A.A.C. valve is attached to the intake manifold. It controls the quantity of air that flows through the bypass port of the throttle chamber in response to the control vacuum from the V.C.M. valve.



Operation

Control vacuum from V.C.M. valve kPa (mmHg, inHg)	Opening of A.A.C. valve's air passage
0 (0, 0)	Fully open
0 (0, 0) → −16.0 (−120, −4.72)	Open to close
−16.0 (−120, −4.72)	Fully closed



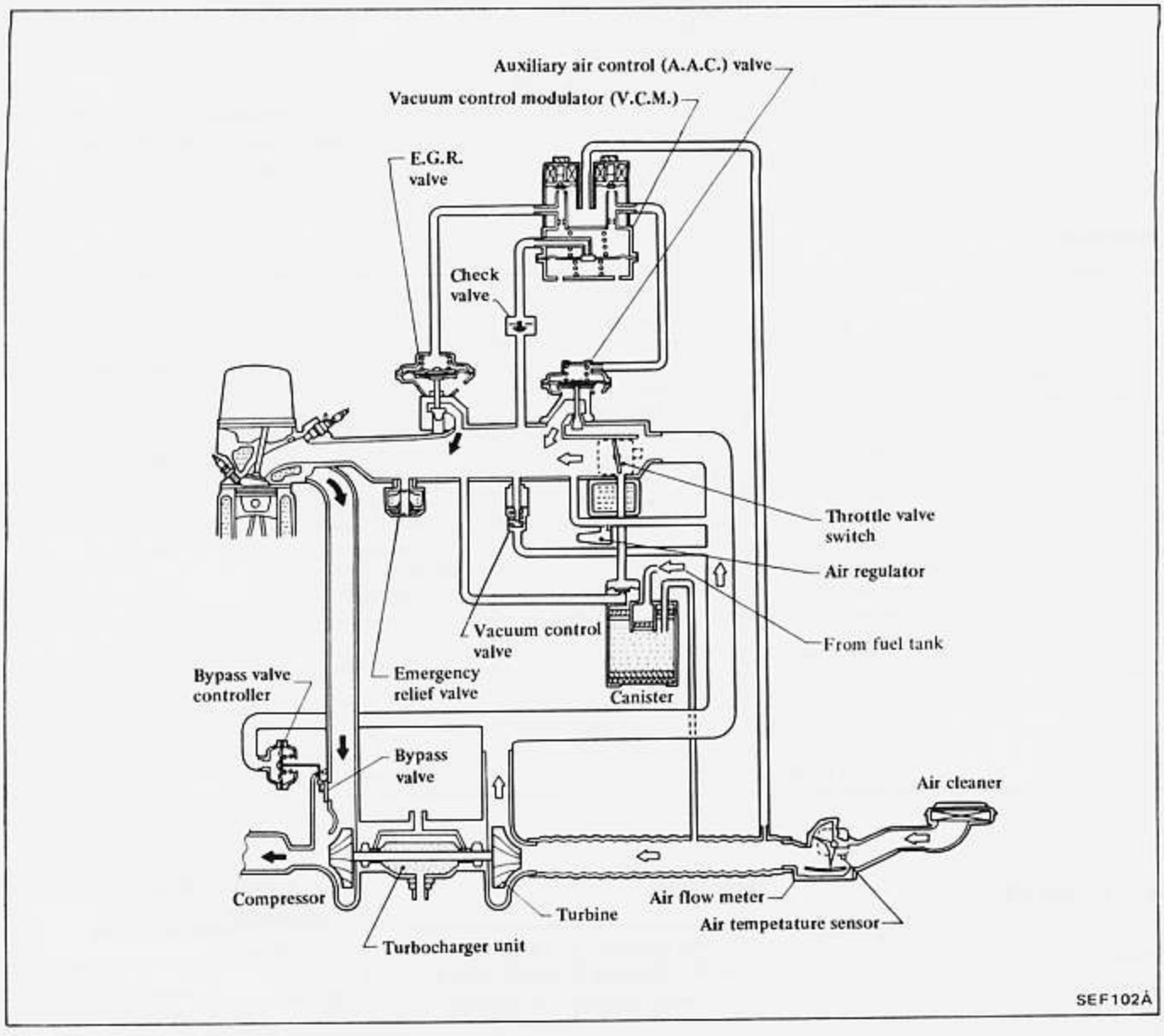
VACUUM CONTROL MODULATOR

Refer to E.G.R. CONTROL.

ONE-WAY VALVE

Refer to E.G.R. CONTROL.

AIR FLOW SYSTEM



AIR CLEANER

INSPECTION

Replace filter more frequently under dusty driving conditions.

AIR FLOW METER

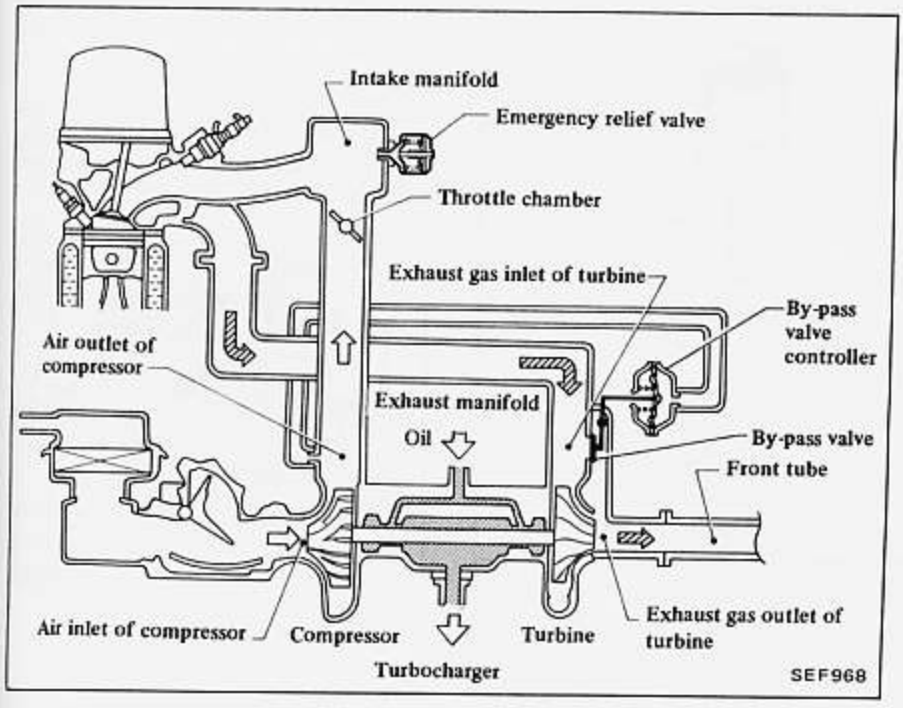
Refer to FUEL INJECTION CONTROL.

TURBOCHARGER

The turbocharger is installed on the exhaust manifold. This system utilizes exhaust gas energy to rotate the turbine wheel which drives the compressor turbine installed on the other end of the turbine wheel shaft. The compressor supplies compressed air to the engine to increase the charging efficiency so as to improve engine output and torque.

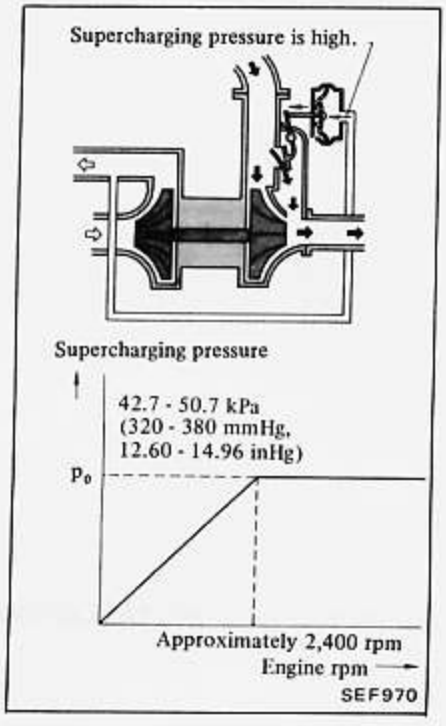
To prevent an excessive rise in the supercharging pressure, a system is adopted which maintains the turbine speed within a certain range by controlling the quantity of exhaust gas that passes through the turbine. This system consists of a by-pass valve controller which detects the supercharged pressure and activates a by-pass valve that allows a part of exhaust gas to be discharged without passing through the turbine.

To prevent an abnormal rise in supercharging pressure and possible engine damage in case of a malfunction, an emergency relief valve is provided as a safety device in the intake manifold.



As the engine speed increases and the supercharging pressure approaches the specified pressure value P_0, it exerts a force on the diaphragm of the by-pass valve controller, thereby opening the by-pass valve.

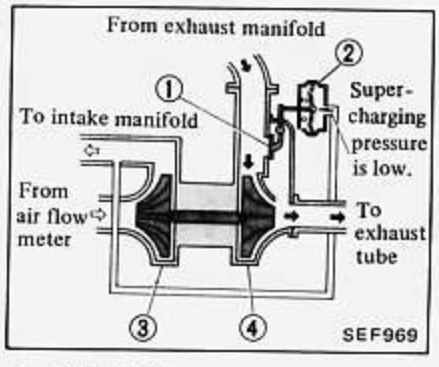
As the valve opens, part of the exhaust gas by-passes the turbine and goes directly to the exhaust tube. As a result, the turbine speed is kept constant and the supercharging pressure maintained at the specified pressure level.



OPERATION

The by-pass valve controller normally detects the supercharging pressure at the outlet of the compressor housing. All exhaust gas flows through the turbine when the supercharging pressure is below the specified pressure P_0.

Specified supercharging pressure P_0:
42.7 - 50.7 kPa
(320 - 380 mmHg,
12.60 - 14.96 inHg)



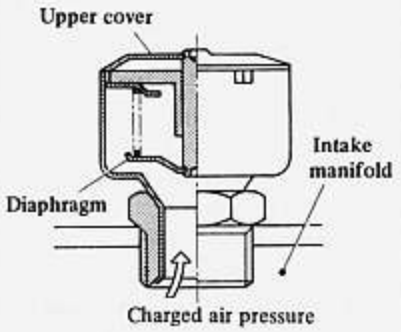
1 By-pass valve
2 By-pass valve controller
3 Compressor
4 Turbine

The emergency relief valve operates as follows:

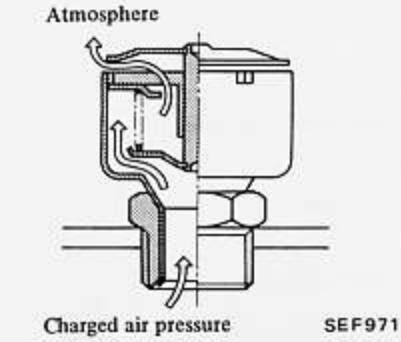
When the pressure in the intake manifold exceeds Pmax, it exerts a force on diaphragm. Then the upper cover, connected to the diaphragm by a shaft, is pushed open, and the excess pressure in the intake manifold is released into the atmosphere.

Pmax:
50.7 - 53.3 kPa
(380 - 400 mmHg,
14.96 - 15.75 inHg)

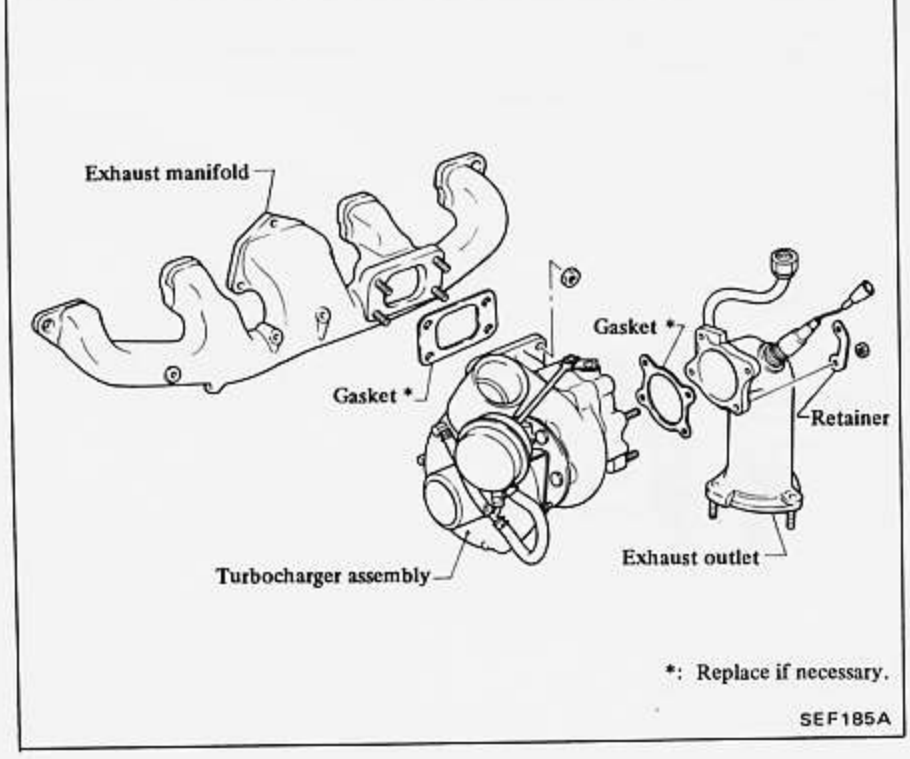
When the pressure in the intake manifold is below P max.



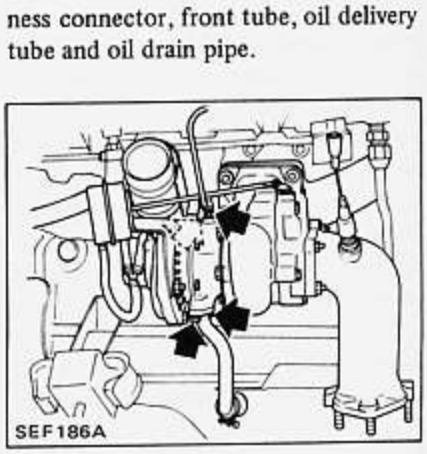
When the pressure in the intake manifold is above P max.



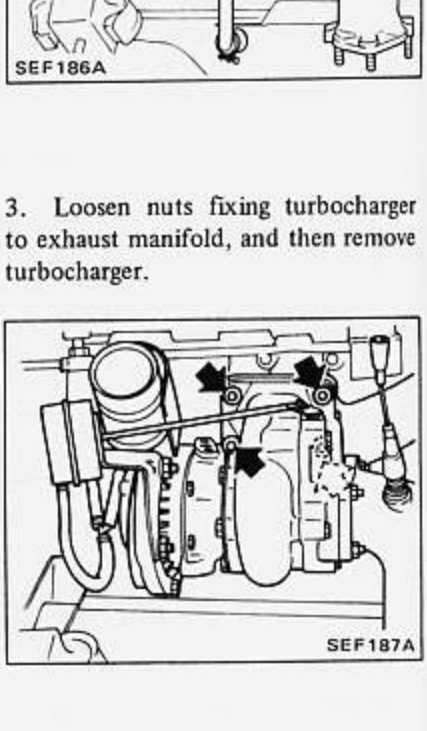
REMOVAL AND INSTALLATION



1. Remove heat insulator, inlet tube, air duct hose and suction air pipe.
2. Disconnect exhaust gas sensor harness connector, front tube, oil delivery tube and oil drain pipe.



3. Loosen nuts fixing turbocharger to exhaust manifold, and then remove turbocharger.



4. Install in the reverse order of removal.

DISASSEMBLY AND ASSEMBLY

Turbocharger should not be disassembled.

INSPECTION

1. Inspect turbine and compressor wheels for cracks, clogging, deformity or other damage.
2. Revolve wheels to make sure that they turn freely without any abnormal noise.
3. Measure play in axial direction.

Play (Axial direction):
0.013 - 0.091 mm
(0.0005 - 0.0036 in)

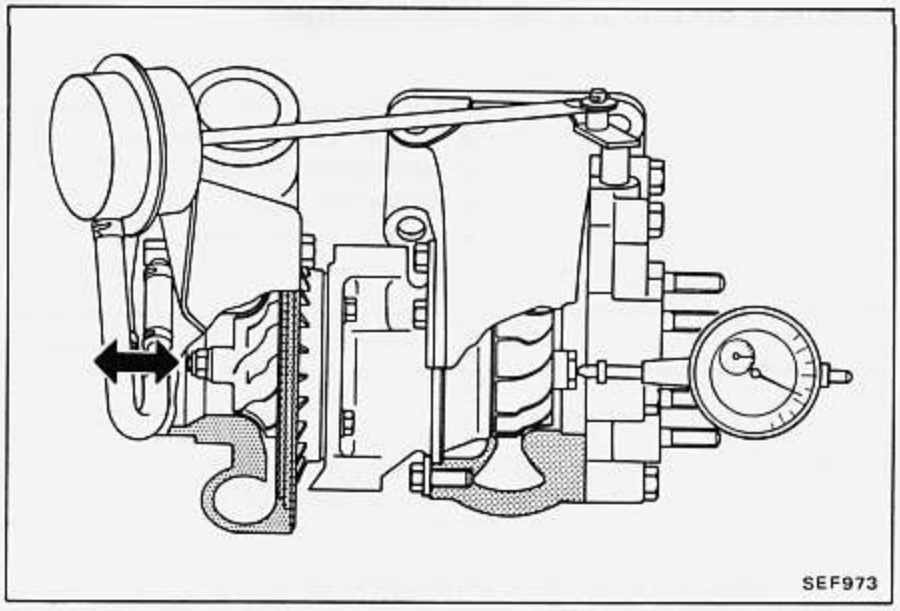
Do not allow wheels to turn when axial play is being measured.

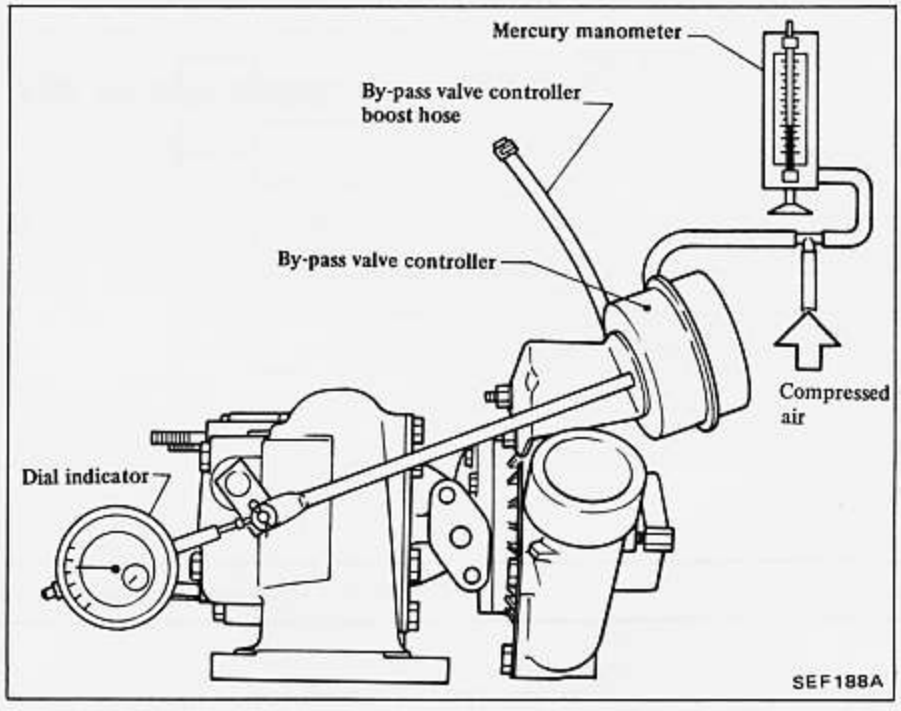
4. Check operation of by-pass valve controller.

Do not apply more than 66.7 kPa (500 mmHg, 19.69 inHg) pressure to controller diaphragm.

By-pass valve controller stroke/ pressure:
0.38 mm (0.0150 in)/
41.9 - 47.2 kPa
(314 - 354 mmHg,
12.36 - 13.94 inHg)

5. Move by-pass valve to make sure that it is not sticked or scratched.
6. Always replace turbocharger as an assembly if any of the above items shows abnormalities.


SEF973



SEF188A

TROUBLE DIAGNOSES AND CORRECTIONS

Before using this chart, check the following items.
- **Vacuum hoses and connections**
- **Wires and connections**
- **Engine fuel system**
- **Emission control system**

Condition 1: Low engine power

Probable cause	Corrective action
Air leak at the connection of compressor housing and suction hose/inlet tube, or inlet tube and intake manifold.	Correct the connection.
Exhaust gas leak at the connection of turbine housing and exhaust manifold, or exhaust outlet	Correct the connection or replace gasket.
By-pass valve is stuck open.	Replace turbocharger assembly.
Stuck or worn journal or bearing	
Broken shaft	
Sludge on back of turbine wheel	
Broken turbine wheel	

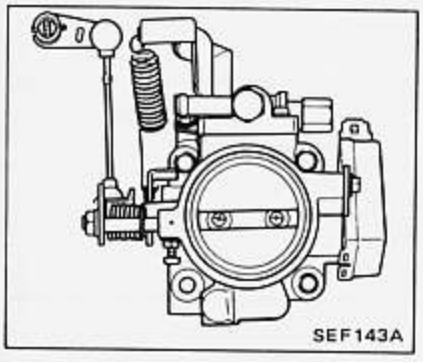
Condition 2: Excessively high engine power

Probable cause	Corrective action
Disconnected or cracked rubber hose	Correct or replace rubber hose.
By-pass valve is stuck closed.	Replace turbocharger assembly.
Controller diaphragm is broken.	

Condition 3: Excessively high oil consumption or exhaust shows pale blue smoke	
Probable cause	**Corrective action**
Oil leak at the connection of lubricating oil passage	Correct the connection.
Oil leak at oil seal of turbine	Replace turbocharger assembly.
Oil leak at oil seal of compressor	
Worn journal or bearing	

THROTTLE CHAMBER

The throttle chamber, located between the turbo charger and the intake manifold, is equipped with a valve. This valve controls the intake air flow in response to accelerator pedal movement. The rotary shaft of this valve is connected to the throttle valve switch.

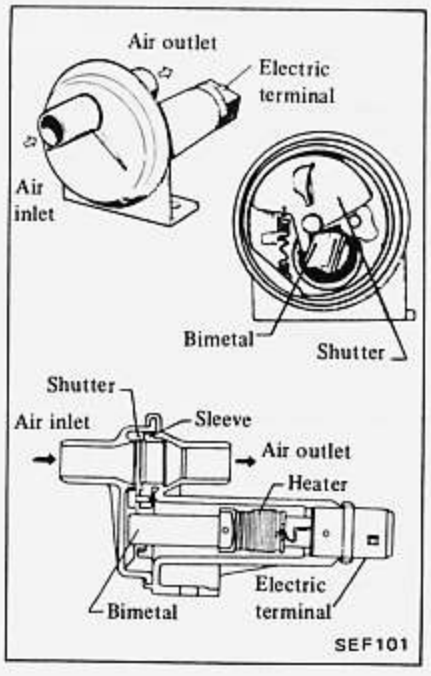


INSPECTION

The throttle valve must move smoothly when the throttle lever is operated by hand.

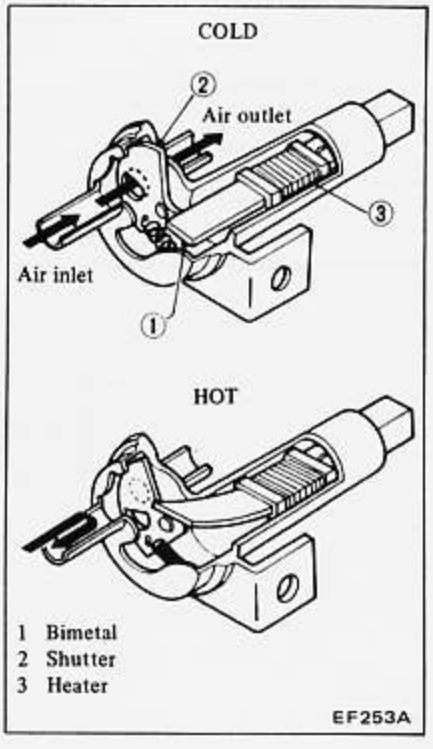
AIR REGULATOR

The air regulator by-passes the throttle valve to control the quantity of air for increasing the engine idle speed when starting the engine at a bimetal temperature of below 65°C (149°F).



INSPECTION

A bimetal and a heater are built into the air regulator. When the ignition switch is turned to the "START" position or engine running, electric current flows through the heater, and the bimetal, as it is heated by the heater, begins to move and closes the air passage in a few minutes. The air passage remains closed until the engine is stopped and the bimetal temperature drops to below 65°C (149°F).

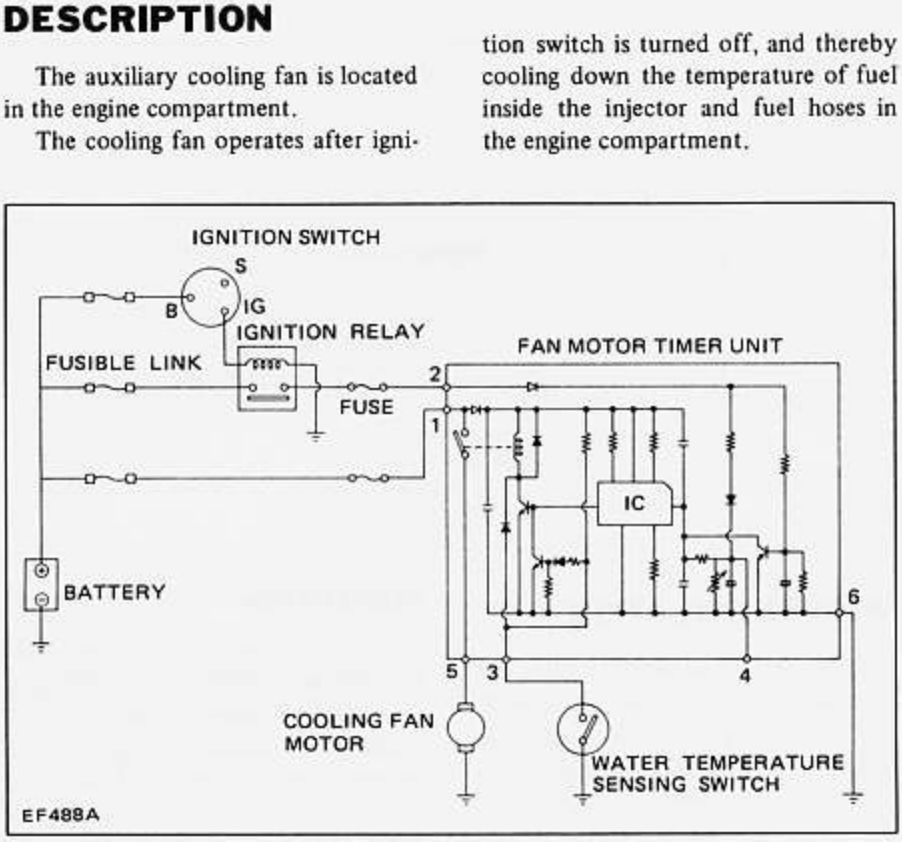


AUXILIARY COOLING FAN

DESCRIPTION

The auxiliary cooling fan is located in the engine compartment.

The cooling fan operates after ignition switch is turned off, and thereby cooling down the temperature of fuel inside the injector and fuel hoses in the engine compartment.



OPERATION

- As soon as the ignition switch is turned off at an engine coolant temperature of above about 105°C (221°F), the cooling fan operates.
- When the ignition switch is turned off at an engine coolant temperature of below about 105°C (221°F), the cooling fan operates when the engine coolant temperature rises above about 105°C (221°F).

a. The cooling fan operates for about 17 minutes after the ignition switch is turned off.

b. When the ignition switch is turned to the "ON" or "START" position, the cooling fan will stop even though it is in operation.

Auxiliary cooling fan operation chart

Cooling water temperature °C (°F)	Water temperature sensing switch	Ignition switch	Auxiliary cooling fan
above about 105 (221)	ON	"OFF" "ACC"	Operates
below about 105 (221)	OFF		Does not operate
–	–	"ON" "START"	

INSPECTION

ENTIRE CHECK

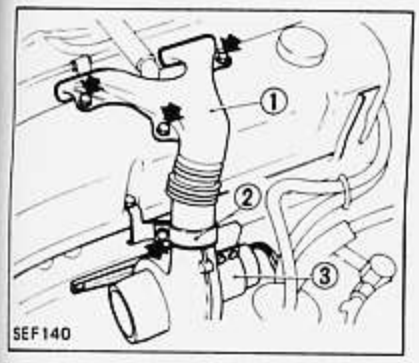
This check can be made at water temperatures below 105°C (221°F).

1. After turning ignition switch "ON", set it at "OFF" position and operate timer.
2. Disconnect harness connector of water temperature sensing switch and make a signal which indicates that water temperature has exceeded 105°C (221°F), by grounding connector terminal at harness side.

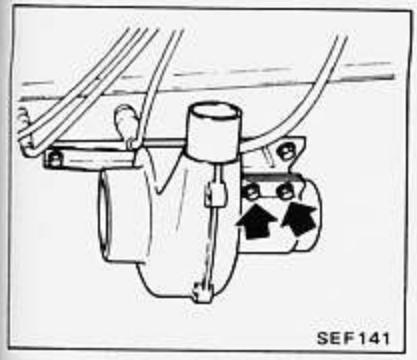
- Cooling fan operates .....O.K.
- Cooling fan does not operate ..... N.G.

3. If cooling fan does not operate, check fan motor timer unit and fan motor as a part.

FAN MOTOR

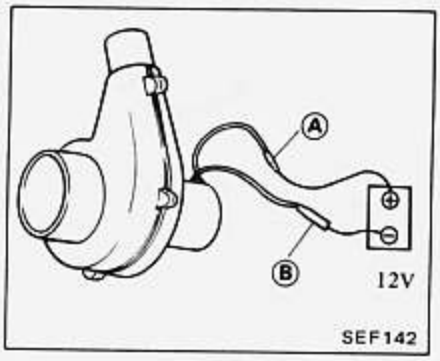


1 Air duct
2 Clamp
3 Cooling fan



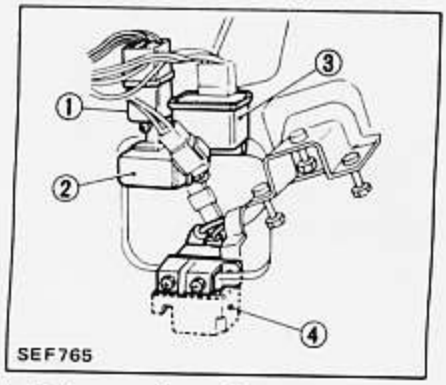
1. Make sure continuity exists between connector terminals Ⓐ and Ⓑ.
2. Then securely connect positive terminal of a 12-volt d.c. power supply to terminal Ⓐ, and ground terminal Ⓑ.

Fan motor should run. If not running, the motor is out of order.



FAN MOTOR TIMER UNIT

The fan motor timer unit is located inside the R.H. dash side panel.



1 Fuel pump relay
2 Seat belt warning timer unit
3 Ignition accessory relay
4 Fan motor timer unit

Test timer unit with a power source of 12-volt DC and test lamp following the procedure below.

Prepare 12V-3W lamp.

1. Connect terminal ⑥ to negative terminal of power source, terminal ⑤ to test lamp terminal and the other test lamp terminal to negative terminal of the power source.
2. Connect terminal ① to positive terminal of power source.

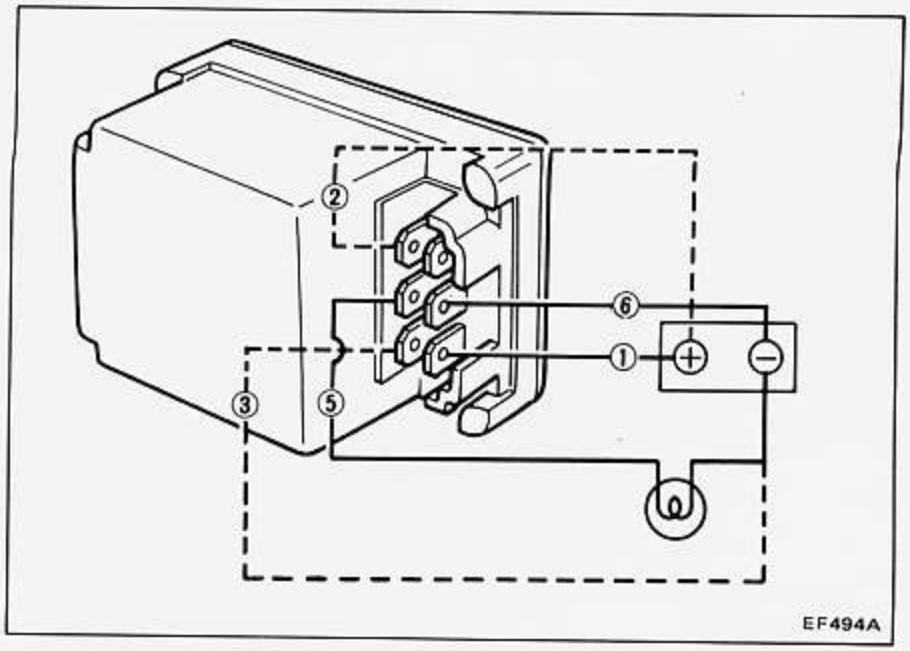
- Test lamp does not glow .....O.K.
- Test lamp glows ..... N.G.

3. Connect terminal ② to positive terminal of power source and disconnect it. (Operate timer)
4. Connect terminal ③ to negative terminal of power source.

- Test lamp glows .....O.K.
- Test lamp does not glow ..... N.G.

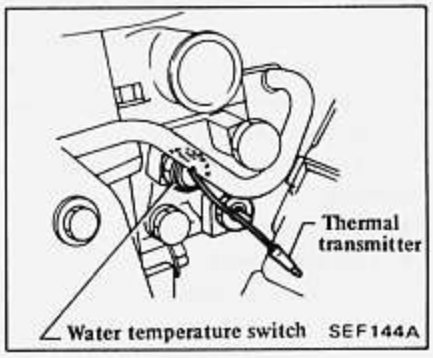
5. Make sure that test lamp should remain on for about 17 minutes after step 3 is performed, and then go out.
6. While test lamp is on, connect terminal ② to positive terminal of power source.

- Test lamp goes out .....O.K.
- Test lamp does not go out .....N.G.

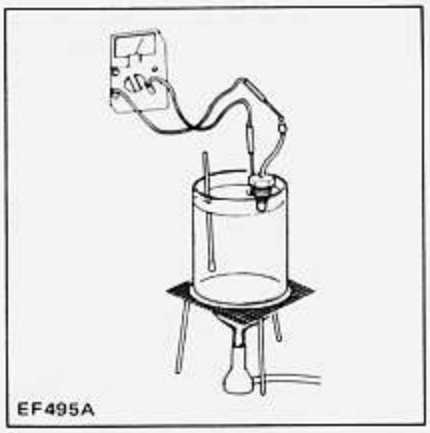


WATER TEMPERATURE SENSING SWITCH

The water temperature sensing switch is located in the thermostat housing.



1 Thermotime switch
2 Water temperature sensing switch
3 Thermal transmitter

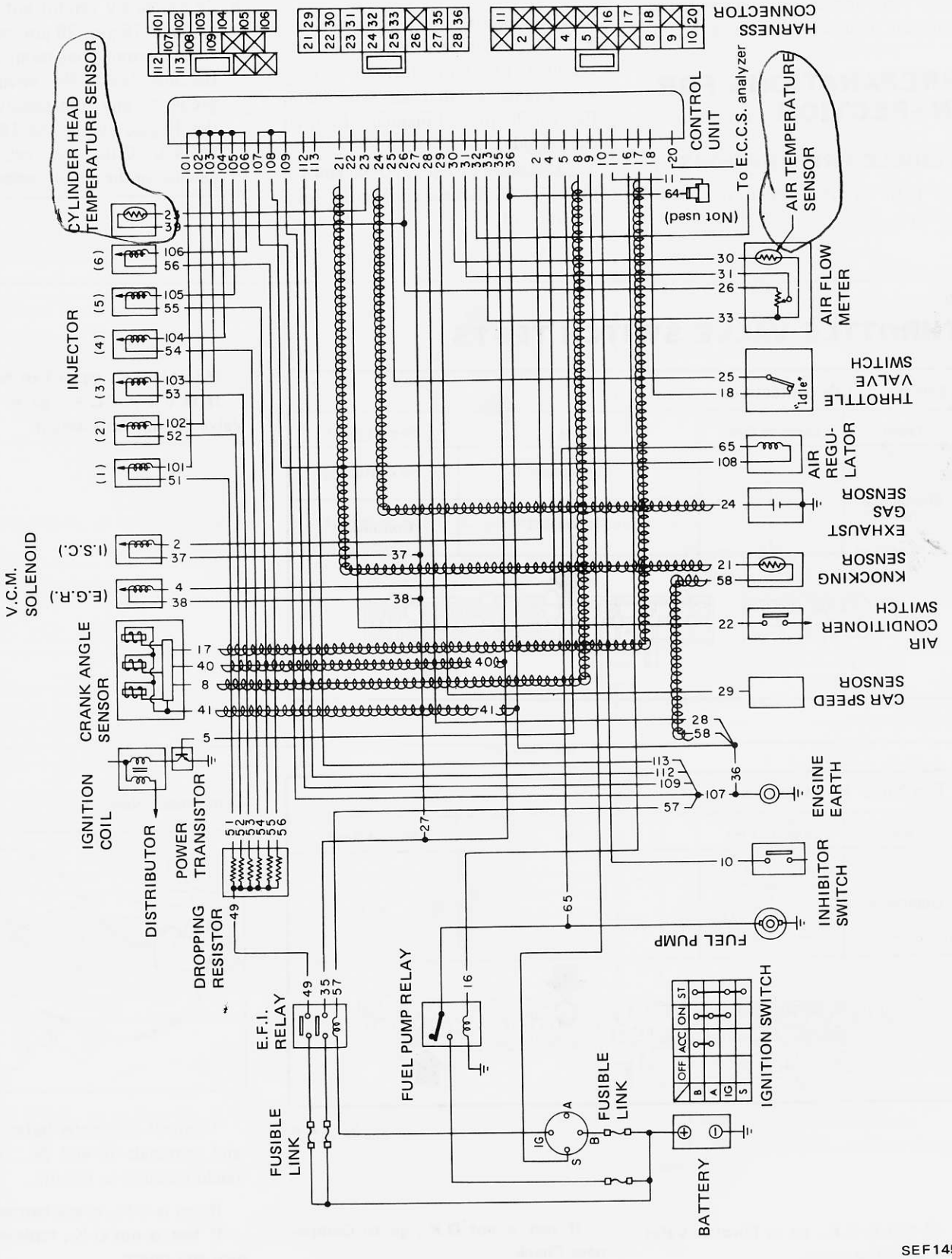


1. Dip sensing portion of water temperature sensing switch into proper solution maintained at 80°C (176°F).
2. Measure resistance between terminal of lead wire and switch body.
   - Resistance is infinite ..... O.K.
3. Increase solution temperature, then check continuity between terminal of lead wire and switch body.
   - Resistance varies to zero at a temperature about 105°C (221°F) ..... O.K.

   If not, replace switch with a new one.

ELECTRICAL SYSTEM INSPECTION

E.C.C.S. CIRCUIT DIAGRAM



SEF145A

DESCRIPTION

Electrical system inspection should be performed by using the E.C.C.S. ANALYZER.

If the analyzer is not available, some components can be inspected by using the following procedures.

PREPARATIONS FOR INSPECTION

VEHICLE PREPARATIONS

1. Turn ignition switch to "OFF" position.

CAUTION:
Before disconnecting and connecting electrical connectors, ensure that ignition switch is in the "OFF" position.

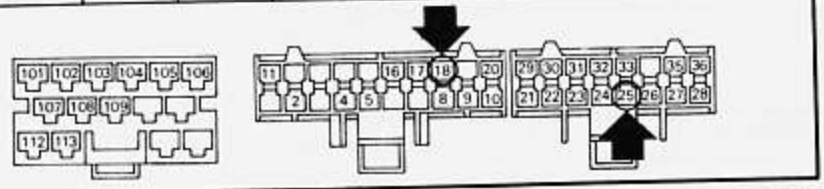
2. Disconnect battery ground cable.
3. Disconnect lead wire from "S" terminal of starter motor.
4. Arrange so that air flow meter flap can be pushed manually from air cleaner side.
5. Disconnect 15-pin, 20-pin and 16-pin E.C.C.S. harness connectors from control unit.

CAUTION:
a. Before disconnecting ECCS harness at 15-pin, 20-pin and 16-pin connectors, ensure that ignition switch is in the "OFF" position.
b. Be extremely careful not to break or bend 15-pin, 20-pin and 16-pin when disconnecting terminal.
Do not touch the circuit tester probe to any unnecessary pin on the 15-pin, 20-pin and 16-pin connectors. Doing so could cause damage to the circuit tester.

THROTTLE VALVE SWITCH TESTS

Test No. 1 Idle contacts

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Ohmmeter	18	25	Throttle depressed	No continuity
			Throttle released	Continuity

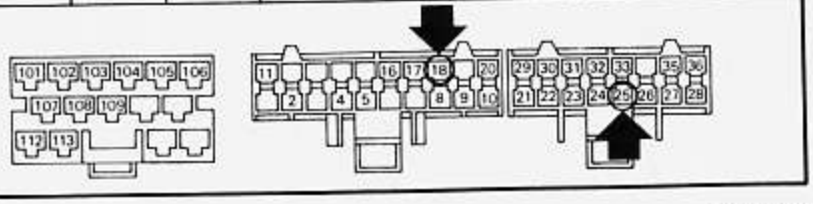


SEF146A

If test is O.K., go to Test No. 2.
If test is not O.K., go to Throttle Valve Switch Adjustment.

Test No. 2 Insulation test

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Ohmmeter	18 25	Body ground		∞Ω

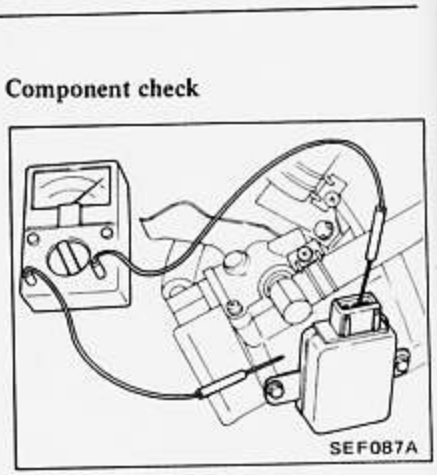


SEF146A

If test is O.K., go to Throttle Valve Switch Adjustment.

If test is not O.K., go to Component Check.

Component check



SEF087A

Connect ohmmeter between engine and terminals ⑱ and ㉕. Ohmmeter reading should be infinite.

If test is O.K., check harness.
If test is not O.K., replace component and retest.

ADJUSTMENT

Refer to THROTTLE VALVE SWITCH.

AIR FLOW METER TESTS

Test No. 1 Air flow meter resistance

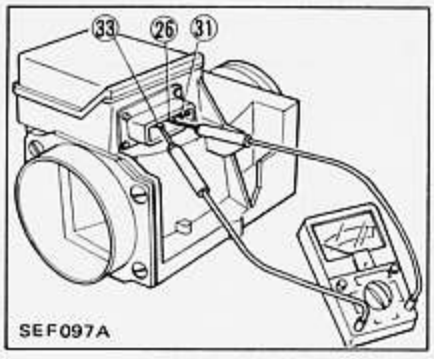
Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Ohmmeter	33	26		Approx. 280 to 400Ω

SEF149A

If test is O.K., go to Test No. 2.

If test is not O.K., perform component check.

Component check



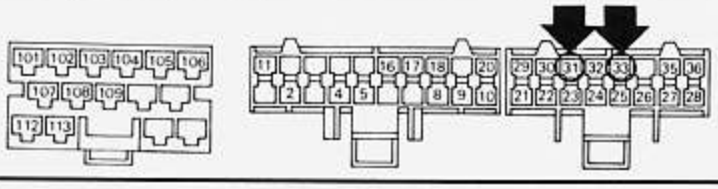
Measure the resistance between terminals ㉖ and ㉝. The standard resistance is approximately 280 to 400 ohm.

If test is O.K., check harness.

If test is not O.K., replace component.

Test No. 2 Air flow meter resistance

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Ohmmeter	33	31		Except 0 and ∞Ω

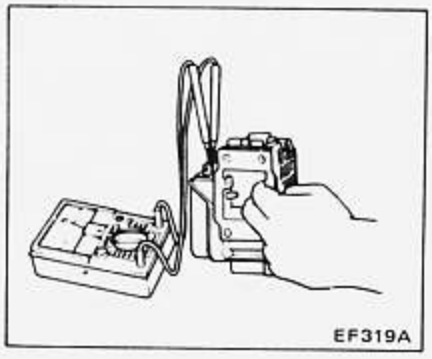


SEF150A

If test is O.K., go to Test No. 3.

If test is not O.K., perform component check.

Component check

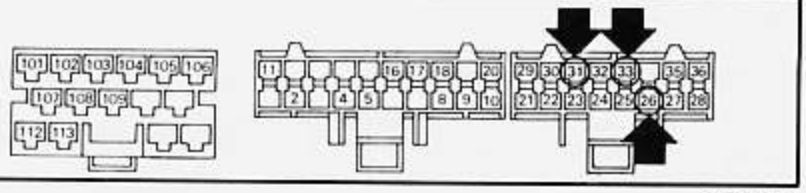


While sliding flap, measure resistance between terminals ㉝ and ㉛. If resistance is at any value other than 0 and ∞ ohm, air flow meter is normal.

If test is O.K., check harness.

If test is not O.K., replace component.

Test No. 3 Insulation resistance				
Tester	**Leads to Pins**		**Notes**	**Should Read**
	(+)	(−)		
Ohmmeter	26 31 33	Body ground		∞Ω

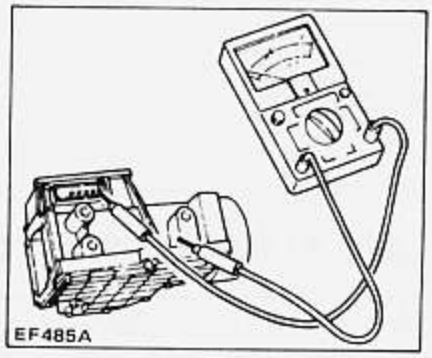


SEF151A

If test is O.K., go to Test No. 4.

If test is not O.K., perform component check.

Component check



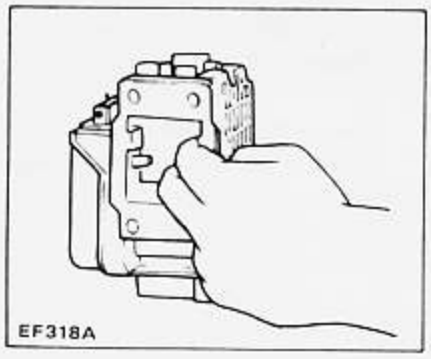
EF485A

Check insulation resistance between the air flow meter body and any one of the terminals ㉖, ㉛ and ㉝. If continuity exists, the air flow meter is out of order.

If test is O.K., check harness.

If test is not O.K., replace component.

Test No. 4 air flow meter flap



EF318A

Fully open the flap by hand to check that it opens smoothly without binding. If it doesn't, it is out of order.

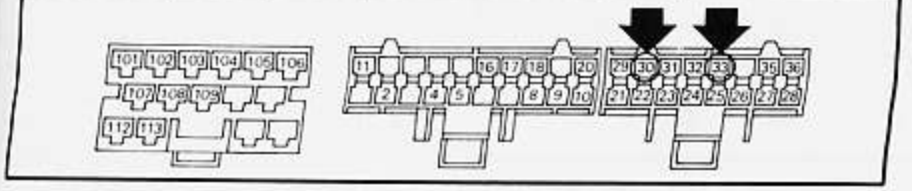
If test is O.K., air flow meter is O.K.

If test is not O.K., replace air flow meter.

AIR TEMPERATURE SENSOR TESTS

Test No. 1 Air Temperature Sensor

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Ohmmeter	33	30	Intake air temperature	
			20°C (68°F) or above	Below 2.9 kΩ
			Below 20°C (68°F)	2.1 kΩ or above

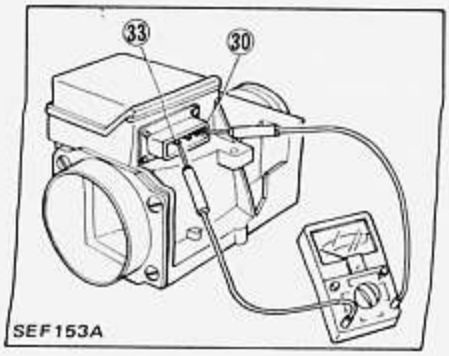


SEF152A

If test is O.K., go to Test No. 2.

If test is not O.K., perform component check.

Component check



SEF153A

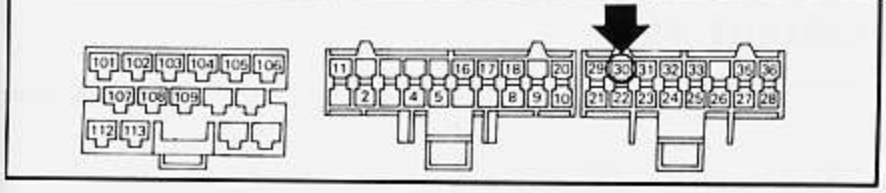
1. Measure the outside air temperature.
2. Measure resistance between terminals 33 and 30 of the air flow meter connector.

If test is O.K., check harness.

If test is not O.K., replace component.

Test No. 2 Insulation Resistance

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Ohmmeter	30	Body ground		∞Ω

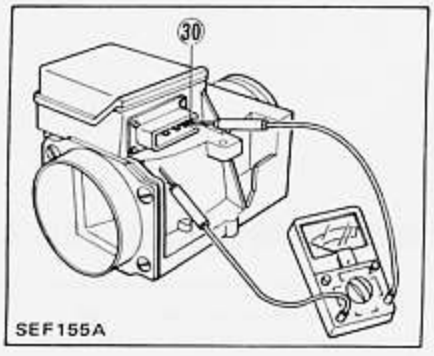


SEF154A

If test is O.K., air temperature sensor is O.K.

If test is not O.K., perform component check.

Component check



SEF155A

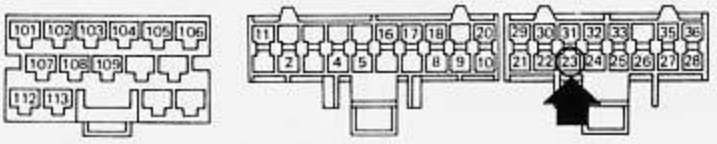
Check insulation resistance between terminal 30 and air flow meter body.

If test is O.K., check harness.

If test is not O.K., replace component.

CYLINDER HEAD TEMPERATURE SENSOR TEST

Cylinder head temperature sensor test				
Tester	**Leads to Pins**		**Notes**	**Should Read**
Ohmmeter	(+)	(–)	20°C (68°F) or above	Below 2.9 kΩ
	23	Body ground	Below 20°C (68°F)	2.1 kΩ or above

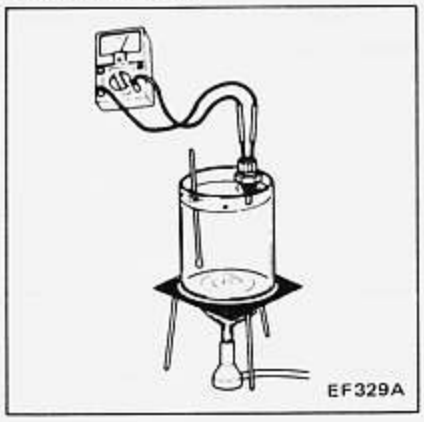


SEF156A

If test is O.K., test is complete.

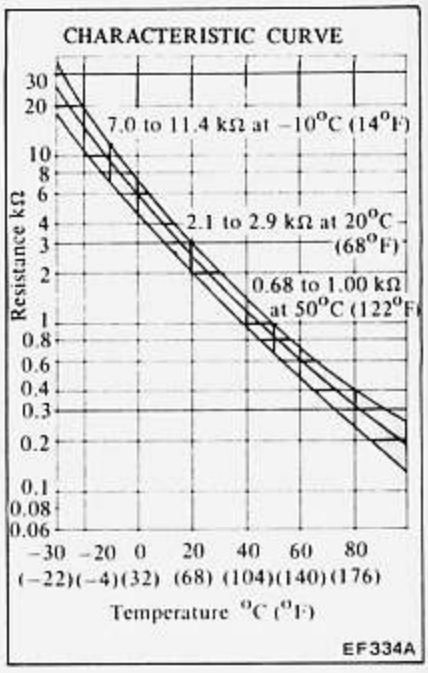
If test is not O.K., perform component check.

Component check



EF329A

Dip the sensor into water maintained at a temperature of 20°C (68°F), 80°C (176°F), etc., and read its resistance.



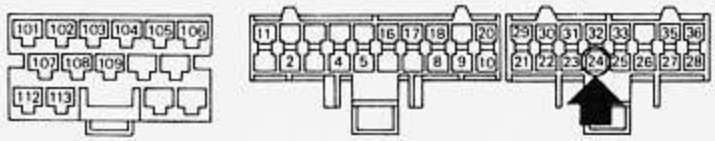
EF334A

If test matches curve, sensor is O.K. Check harness.

If test does not match curve, replace sensor.

EXHAUST GAS SENSOR CIRCUIT TEST

Exhaust gas sensor circuit test				
Tester	**Leads to Pins**		**Notes**	**Should Read**
Ohmmeter	(+)	(–)	Disconnect exhaust gas sensor harness connector, and connect EF1 harness terminal for exhaust gas sensor to ground with a jumper wire.	0Ω
	24	Body ground		



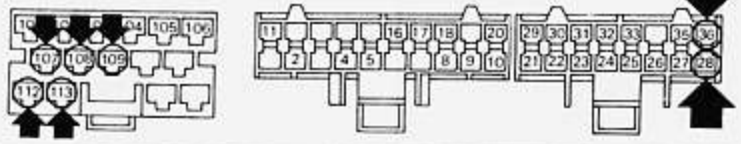
SEF157A

If test is O.K., exhaust gas sensor circuit is O.K.

CONTROL UNIT GROUND CIRCUIT TESTS

Control unit ground circuit tests

Tester	Leads to Pins		Notes	Should Read
	(+)	(–)		
Ohmmeter	28 109 36 112 107 113 108	Body ground		Continuity



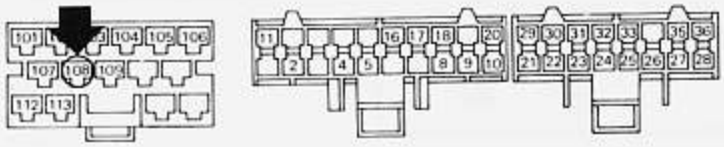
SEF158A

If tests are O.K., ground circuits are O.K.

If tests are not O.K., check wiring diagram and harness.

AIR REGULATOR AND FUEL PUMP RELAY TESTS

Test No. 1 Air regulator resistance				
Tester	**Leads to Pins**		**Notes**	**Should Read**
	(+)	(–)		
Ohmmeter	108	Body ground		25 to 90Ω

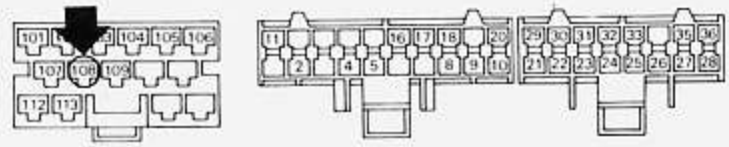


SEF159A

If test is O.K., go to Test No. 2.

If test is not O.K., check air regulator.

Test No. 2 Air regulator power circuit				
Tester	**Leads to Pins**		**Notes**	**Should Read**
	(+)	(–)		
Voltmeter	108	Body ground	1. Disconnect starter motor "S" terminal. 2. Connect battery ground cable. 3. Ignition "START"	Battery voltage



SEF159A

If test is O.K., air regulator is O.K.

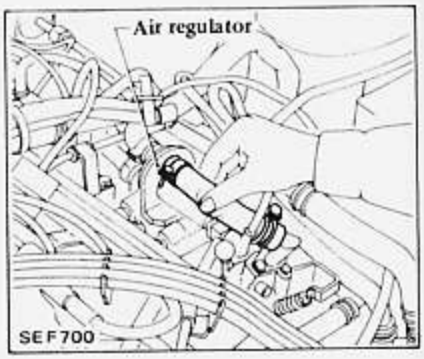
If test is not O.K., listen for operating sound of fuel pump.

If no sound is heard with ignition "ON", check fuel pump relay.

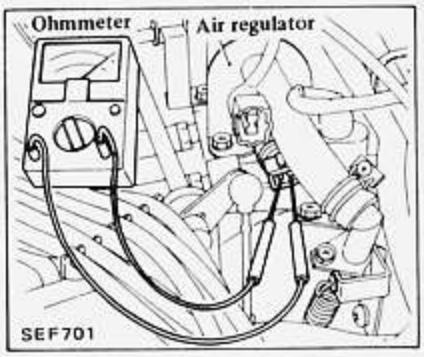
If fuel pump operates with ignition "ON", check air regulator.

Fuel pump operates for 5 seconds with ignition "ON" when engine is not running.

CHECKING AIR REGULATOR



1. Starting engine, and pinch rubber hose between throttle chamber and air regulator.
   - Engine speed decreases during warm-up. . . . . O.K.
   - Engine speed remains unchanged after warm-up. . . . . O.K.
2. Disconnect hoses from both ends of air regulator, and visually check to see if air regulator shutter opens.
3. Disconnect electric connector of air regulator, and check continuity. Continuity should exist. If not, air regulator is faulty.



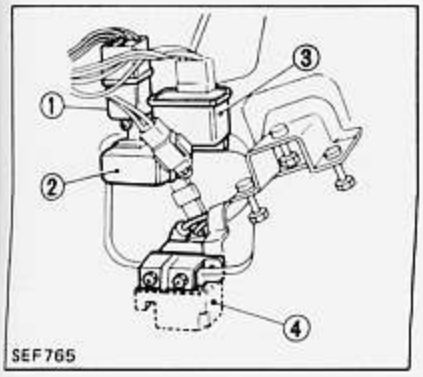
4. Pry air regulator shutter to open with a flat-blade screwdriver, then close. If shutter opens and closes smoothly, it is operating properly.

If test is O.K., check harness.

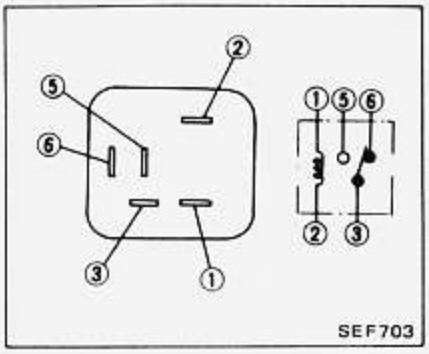
If test is not O.K., replace component and retest.

CHECKING FUEL PUMP RELAY

The fuel pump relay is installed on the dash right side.



1 Fuel pump relay
2 Seat belt warning timer unit
3 Ignition accessory relay
4 Fan motor timer unit



Check terminals	Normal condition	12V direct current is applied between terminals ① and ②
① - ②	Continuity	–
③ - ⑤	No continuity	Continuity
③ - ⑥	Continuity	No continuity

If test is O.K., check harness.
If test is not O.K., replace relay and retest.

INJECTOR CIRCUIT TESTS

Test No. 1 Cylinder No. 1

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Voltmeter	101	Body ground	1. Connect battery ground cable. 2. Ignition "ON".	Battery voltage

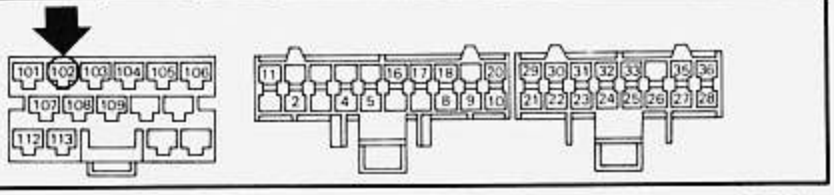
SEF163A

If test is O.K., go to Test No. 2.

If test is not O.K., go to Component Check.

Test No. 2 Cylinder No. 2

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Voltmeter	102	Body ground	Ignition "ON".	Battery voltage



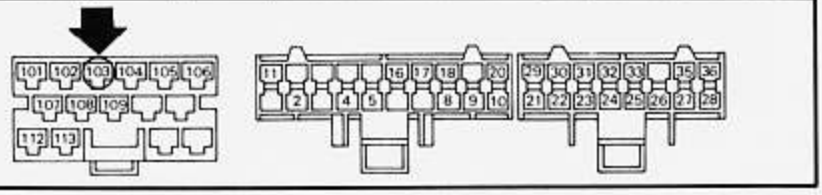
SEF164A

If test is O.K., go to Test No. 3.

If test is not O.K., perform component check.

Test No. 3 Cylinder No. 3

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Voltmeter	103	Body ground	Ignition "ON"	Battery voltage

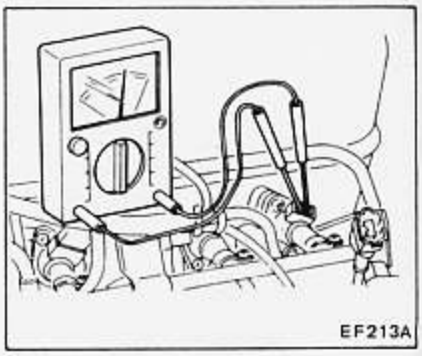


SEF165A

If test is O.K., go to Test No. 4.

If test is not O.K., go to Component Check.

Component check



EF213A

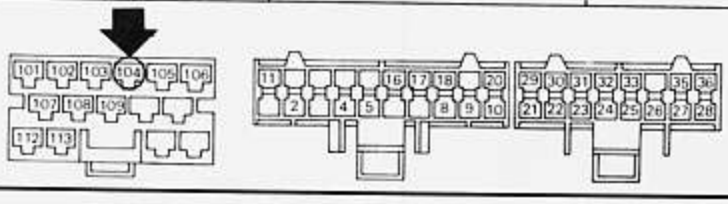
1. Disconnect ground cable from battery.
2. Disconnect electric connectors from injectors.
3. Check continuity between the two terminals. Continuity should exist. If not, injector(s) are faulty.

If test is O.K., go to Dropping Resistor Check.

If test is not O.K., replace injectors.

Test No. 4 Cylinder No. 4

Tester	Leads to Pins		Notes	Should Read
	(+)	(–)		
Voltmeter	104	Body ground	Ignition "ON".	Battery voltage

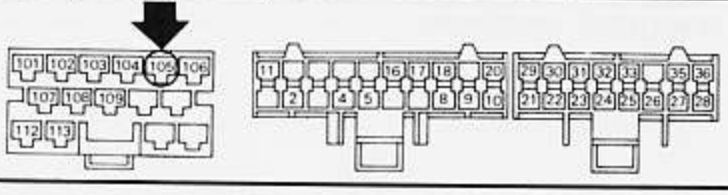


SEF166A

If test is O.K., go to Test No. 5. **If test is not O.K., go to Component Check.**

Test No. 5 Cylinder No. 5

Tester	Leads to Pins		Notes	Should Read
	(+)	(–)		
Voltmeter	105	Body ground	Ignition "ON".	Battery voltage

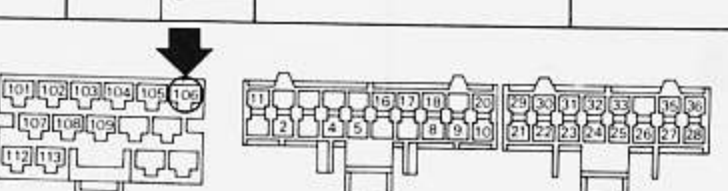


SEF167A

If test is O.K., go to Test No. 6. **If test is not O.K., go to Component Check.**

Test No. 6 Cylinder No. 6

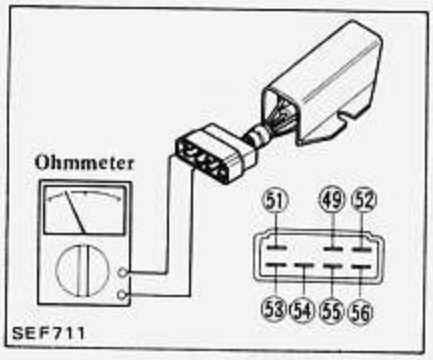
Tester	Leads to Pins		Notes	Should Read
	(+)	(–)		
Voltmeter	106	Body ground	Ignition "ON".	Battery voltage



SEF168A

If test is O.K., all injectors are O.K. **If test is not O.K., perform component check.**

DROPPING RESISTOR CHECK



Conduct resistance checks on dropping resistor between the following points.

- 49 and 51 (No. 1 cylinder)
- 49 and 52 (No. 2 cylinder)
- 49 and 53 (No. 3 cylinder)
- 49 and 54 (No. 4 cylinder)
- 49 and 55 (No. 5 cylinder)
- 49 and 56 (No. 6 cylinder)

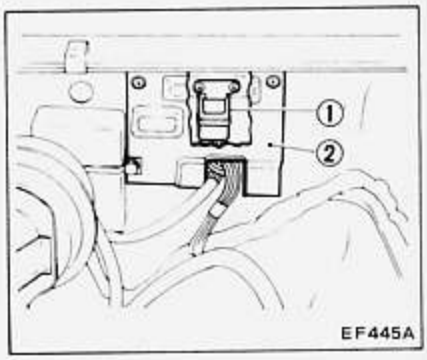
The resistance should be approximately 6 ohms. . . . . O.K.

If test is O.K., check harness.

If test is not O.K., replace dropping resistors.

E.F.I. RELAY

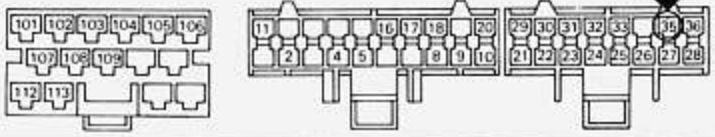
Component check



1 E.F.I. relay
2 Relay cover

E.F.I. relay test (Control unit power input circuit test)

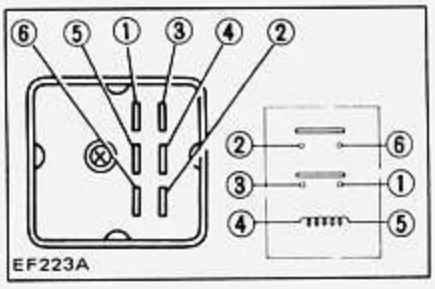
Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Voltmeter	35	Body ground	1. Connect battery ground cable. 2. Ignition "ON".	Battery voltage



SEF169A

If test is O.K., E.F.I. relay is O.K.

If test is not O.K., perform component check.



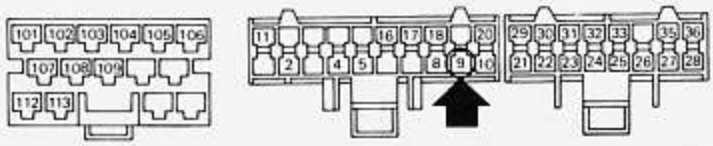
Check terminals	Normal condition	12V direct current is applied between terminals ④ and ⑤
④ - ⑤	Continuity	–
① - ③	No continuity	Continuity
② - ⑥	No continuity	Continuity

If test is O.K., check harness. **If test is not O.K., replace relay and retest.**

IGNITION START SIGNAL TEST

Ignition start signal test

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Voltmeter	9	Body ground	1. Disconnect starter motor "S" terminal. 2. Connect battery ground cable. 3. Ignition "START".	Battery voltage



SEF170A

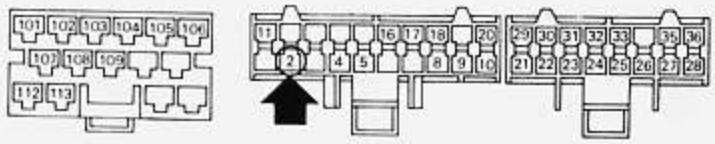
If test is O.K., ignition start signal is O.K.

If test is not O.K., inspect ignition coil and harness.

VACUUM CONTROL MODULATOR (V.C.M.) TEST

Test No. 1 Solenoid valve for I.S.C.

Tester	Leads to Pins (+)	Leads to Pins (−)	Notes	Should Read
Voltmeter	2	Body ground	1. Connect battery ground cable. 2. Ignition "ON".	Battery voltage



SEF171A

If test is O.K., go to Test No. 2.

If test is not O.K., check solenoid valve for I.S.C.

Test No. 2 Solenoid valve for E.G.R.

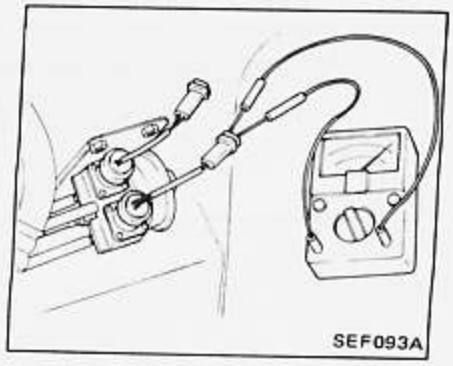
Tester	Leads to Pins (+)	Leads to Pins (−)	Notes	Should Read
Voltmeter	4	Body ground	1. Connect battery ground cable. 2. Ignition "ON".	Battery voltage

SEF172A

If test is O.K., solenoid valves of V.C.M. are O.K.

If test is not O.K., go to Component Check and Harness Check.

Component check



SEF093A

1. Disconnect two electric connectors from V.C.M.
2. Check resistance between two terminals. Resistance should be approximately 40 ohms. ... O.K.

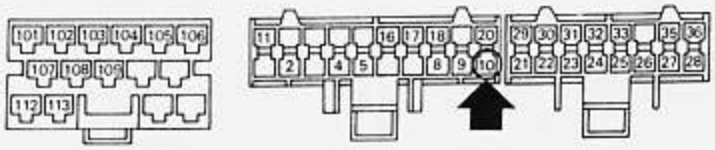
If test is O.K., go to Harness Check.

If test is not O.K., replace V.C.M. assembly.

PARK/NEUTRAL SWITCH

Park/neutral switch test

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Voltmeter	10	Body ground	1. Connect battery ground cable. 2. Ignition "ON". 3. Transmission gear position "N" or "P".	Battery voltage



SEF174A

If test is O.K., the park/neutral switch is O.K.

If test is not O.K., check harness and/or inhibitor switch. (Refer to AT section.)

AIR CONDITIONER SWITCH

Air conditioner switch

Tester	Leads to Pins (+)	Leads to Pins (–)	Notes	Should Read
Ohmmeter	22	Body ground	Air conditioner switch "ON" "OFF"	0Ω ∞Ω

SEF175A

If test is O.K., the air conditioner switch is O.K.

If test is not O.K., check harness and/or air conditioner switch. (Refer to HA section.)

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

GENERAL SPECIFICATIONS

FUEL PUMP

Design voltage	V	12
Cut-off discharge pressure	kPa (kg/cm^2, psi)	294 - 441 (3.0 - 4.5, 43 - 64)
Design current	A	5.1

PRESSURE REGULATOR

Regulated pressure	kPa (kg/cm^2, psi)	250 (2.55, 36.3)

AIR FLOW METER

Design voltage	V	12

AIR REGULATOR

Design voltage	V	12
Air flow quantity [at 20°C (68°F)]	m^3 (cu ft)/hr	27.5 (971)

CONTROL UNIT

Design voltage	V	12

INSPECTION AND ADJUSTMENT

FUEL PRESSURE

Unit: kPa (kg/cm^2, psi)

(Measuring point: between fuel filter and fuel pipe) At idling	Approximately 206 (2.1, 30)
The moment accelerator pedal is fully depressed	Approximately 255 (2.6, 37)

FUEL INJECTOR

Coil resistance	Ω	2.35

CRANK ANGLE SENSOR

Unit: mm (in)

Dimension in radial direction	1.2 (0.047)
Dimension in thrust direction	1.2 (0.047)

AIR FLOW METER

Unit: Ω

Potentiometer resistance between terminals ㉝ and ㉖	Approx. 280 - 400
between terminals ㉝ and ㉛	*Except 0 and ∞*

AIR TEMPERATURE SENSOR

Unit: kΩ

Thermistor resistance at −10°C (14°F)	7.0 - 11.4
at 20°C (68°F)	2.1 - 2.9
at 50°C (122°F)	0.68 - 1.00

THROTTLE VALVE SWITCH

Engine speed when idle switch is changed from "ON" to "OFF"	rpm	Approximately 750

CYLINDER HEAD TEMPERATURE SENSOR

Unit: kΩ

Thermistor resistance at −10°C (14°F)	7.0 - 11.4
at 20°C (68°F)	2.1 - 2.9
at 50°C (122°F)	0.68 - 1.0

V.C.M. SOLENOID VALVE

Coil resistance	Ω	40

DROPPING RESISTOR

Resistance (per resistor)	Ω	Approximately 6

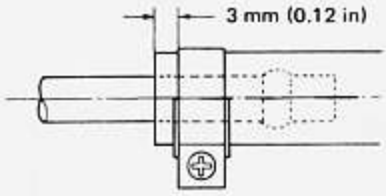
WATER TEMPERATURE SENSING SWITCH (For Auxiliary Cooling Fan)

Cooling water temperature below about 105°C(221°F)	OFF
above about 105°C (221°F)	ON

FAN MOTOR TIMER UNIT (For Auxiliary Cooling Fan)

Operating period minutes	about 17

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Throttle chamber securing screw	15 - 20	1.5 - 2.0	11 - 14
Exhaust gas sensor	39 - 49	4.0 - 5.0	29 - 36
Fuel hose clamp	1.0 - 1.5	0.10 - 0.15	0.7 - 1.1
 Fuel hose clamping position EF336A			
Crank angle sensor Compressor bracket	43 - 58	4.4 - 5.9	32 - 43
Sensor adjuster	9 - 12	0.9 - 1.2	6.5 - 8.7