

# ENGINE FUEL

## SECTION EF

EF

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## PRECAUTIONS

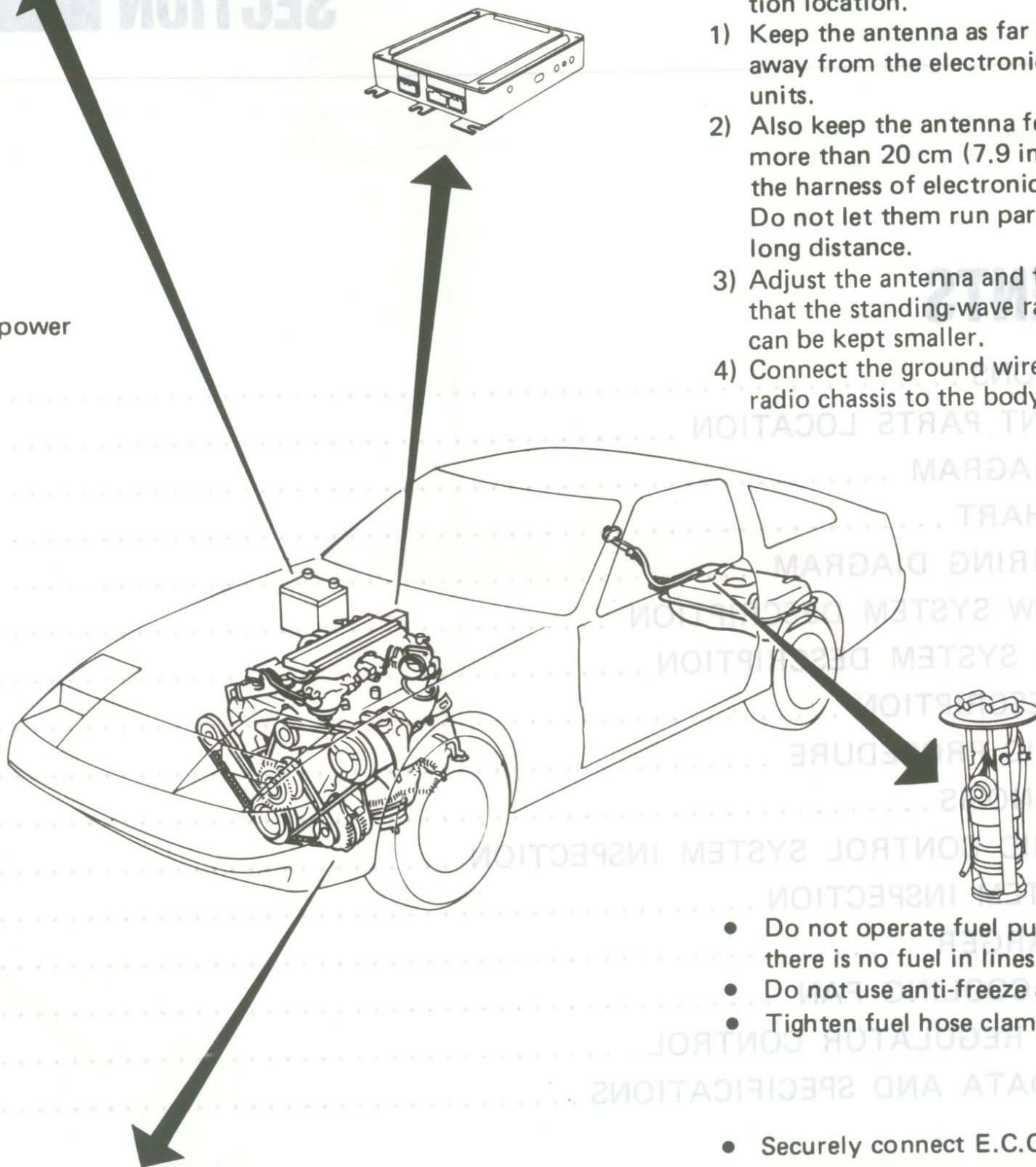
- Always use 12 volt batteries as power source.
- Do not attempt to disconnect battery cables while engine is operating.

- Do not disassemble E.C.C.S. control unit.
- Do not turn diagnosis mode selector forcibly.

- When installing large capacity wireless equipment or a vehicle phone, be sure to observe the following as it may adversely affect electronic control systems depending on its installation location.

- 1) Keep the antenna as far as possible away from the electronic control units.
- 2) Also keep the antenna feeder line more than 20 cm (7.9 in) away from the harness of electronic controls. Do not let them run parallel for a long distance.
- 3) Adjust the antenna and feeder line so that the standing-wave ratio (S.W.R.) can be kept smaller.
- 4) Connect the ground wire from the radio chassis to the body.

- Do not apply battery power directly to injectors.



- Handle air flow meter carefully to avoid damage.
- Do not disassemble air flow meter.
- Do not clean air flow meter with any type of detergent.
- Even a slight leak in the air intake system can cause serious problems.

- Do not disassemble auxiliary air control valve (VG30ET engine).



- Do not shock or jar the crank angle sensor.

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

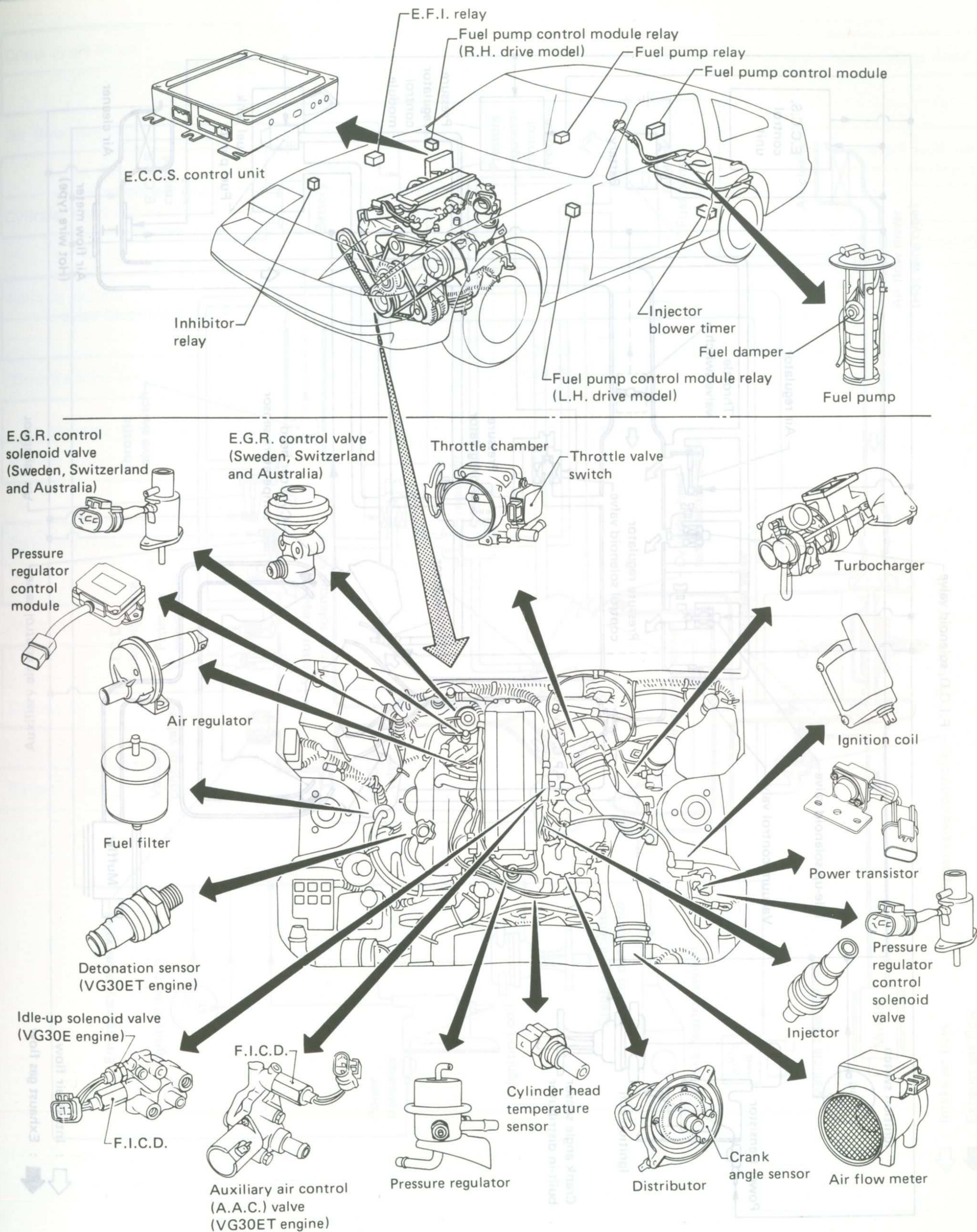
- Do not operate fuel pump when there is no fuel in lines.
- Do not use anti-freeze agents in fuel.
- Tighten fuel hose clamps sufficiently.

- Securely connect E.C.C.S. harness connectors. A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to 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.

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# COMPONENT PARTS LOCATION

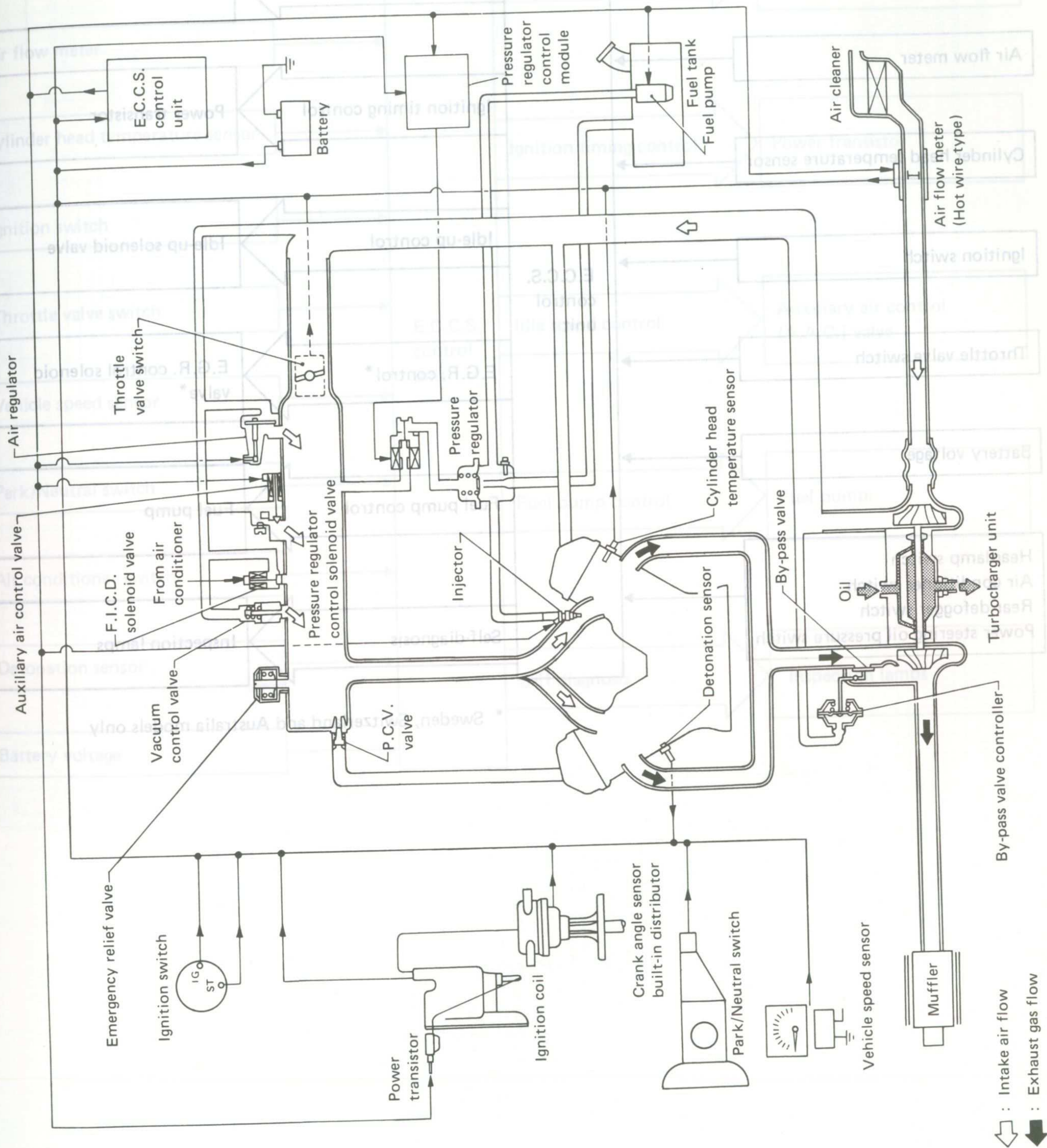


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# E.C.C.S. DIAGRAM

## VG30ET Engine (With turbocharger)

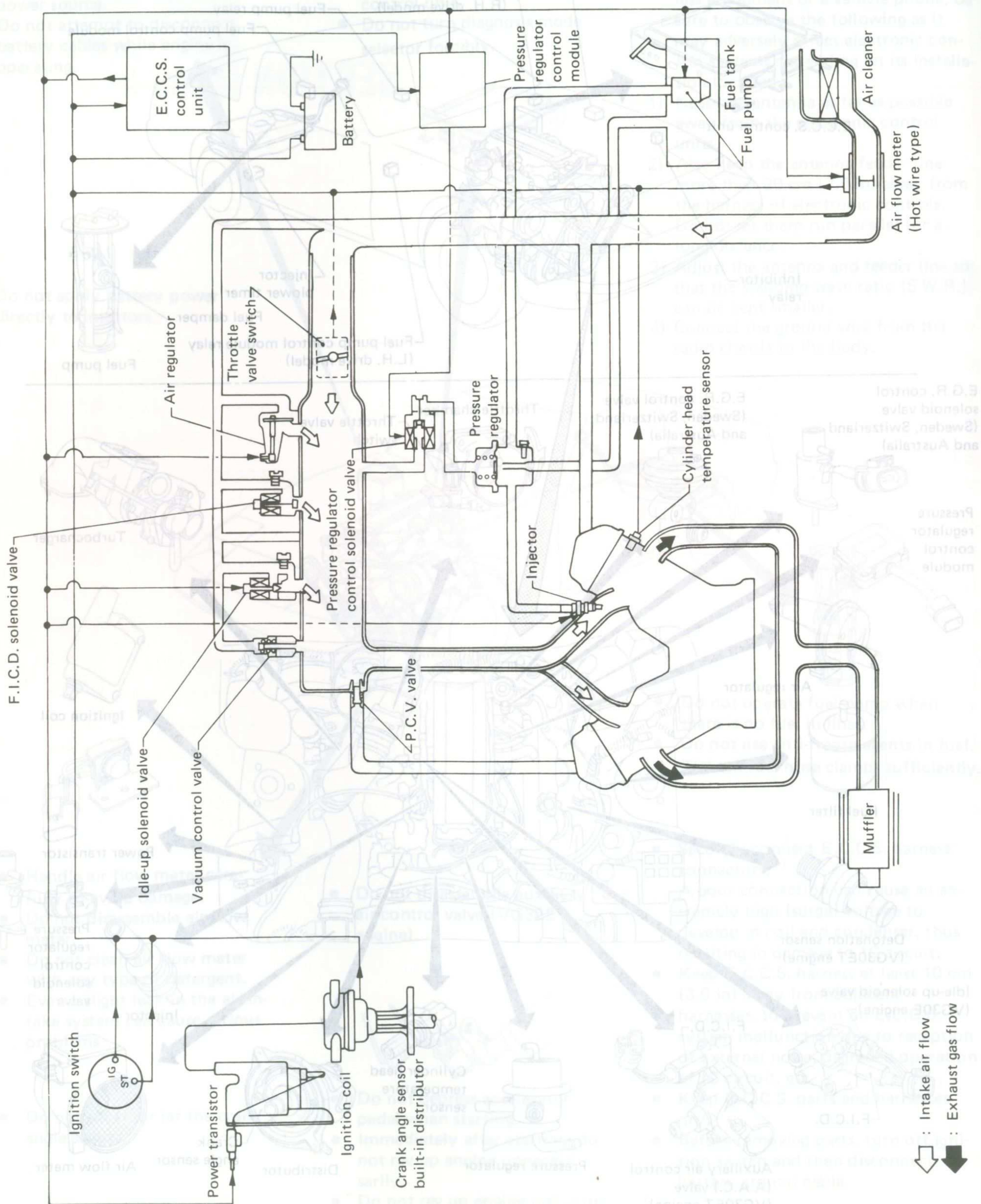


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# COMPONENT E.C.C.S. DIAGRAM

## VG30E Engine (Without turbocharger)

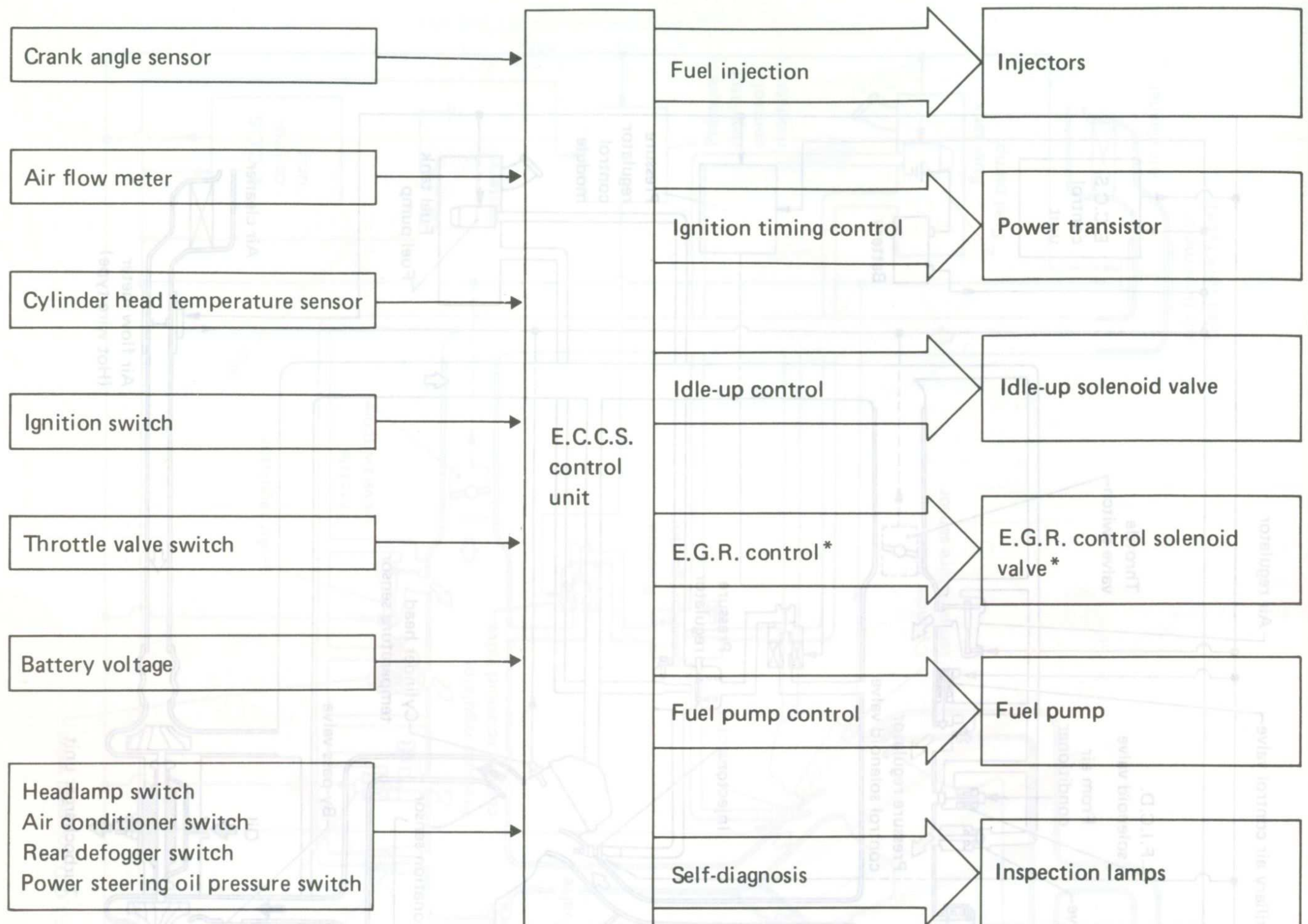


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# E.C.C.S. CHART

## VG30E Engine (Without turbocharger)

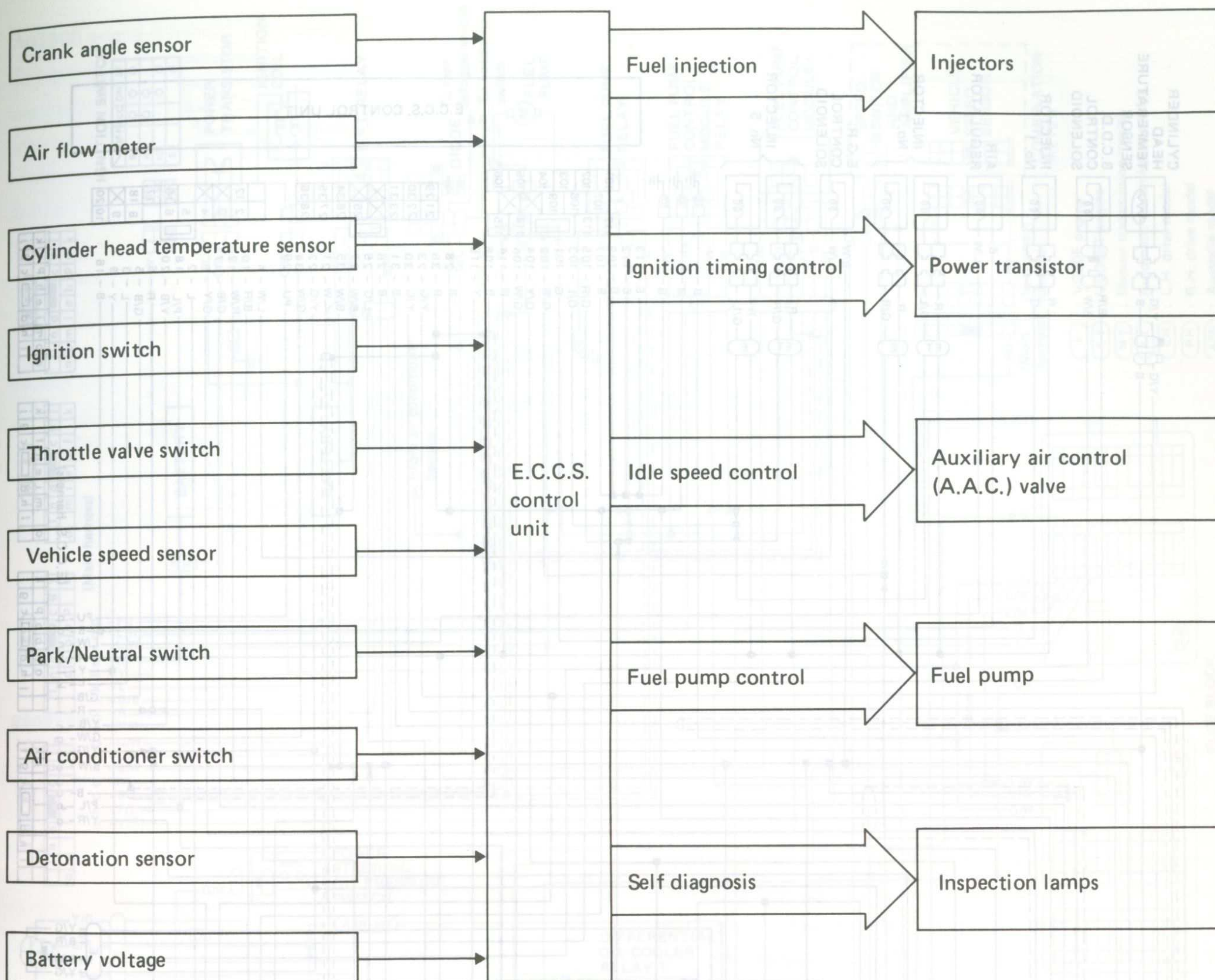


\* Sweden, Switzerland and Australia models only



# E.C.C.S. CHART

## VG30ET Engine (With turbocharger)

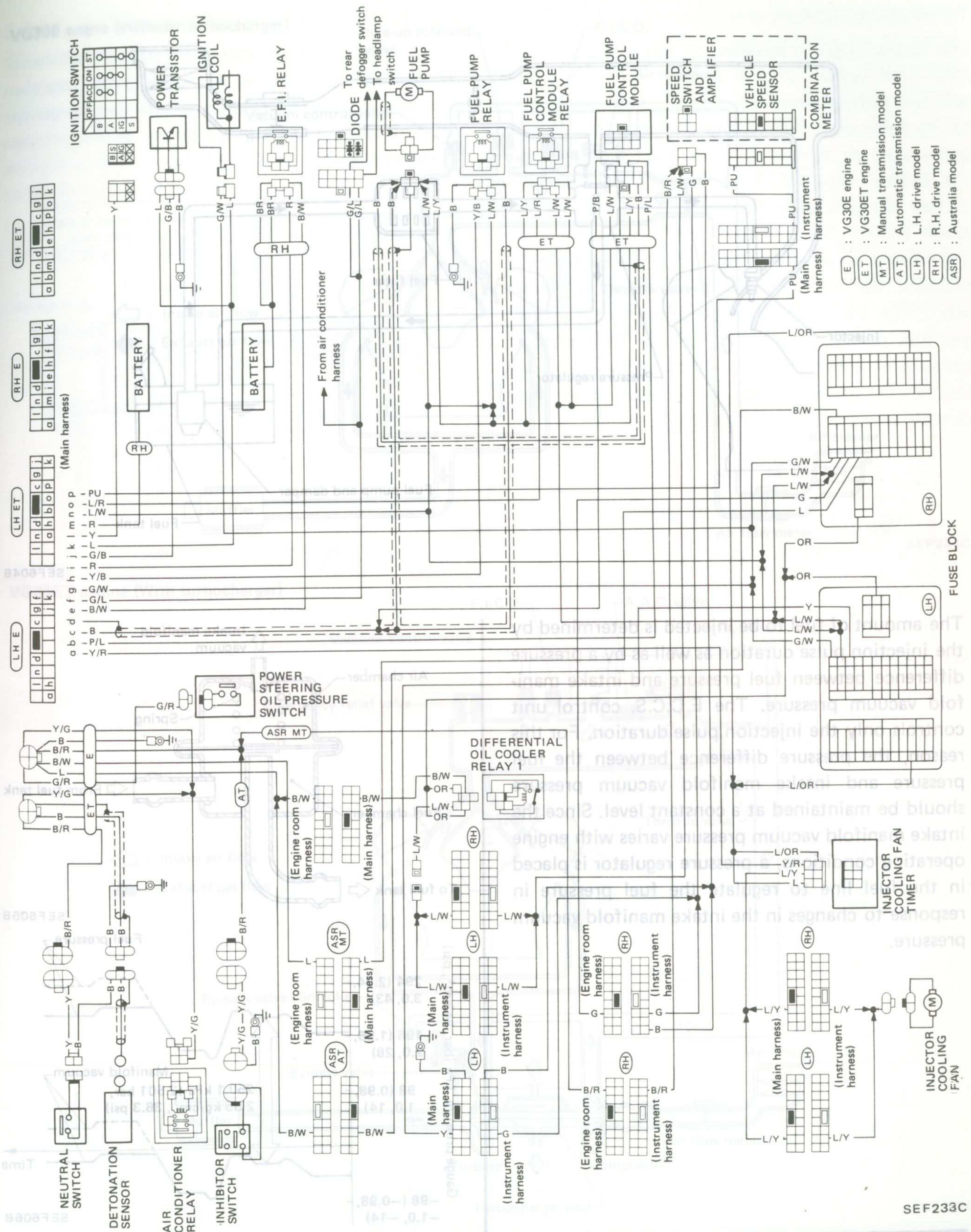






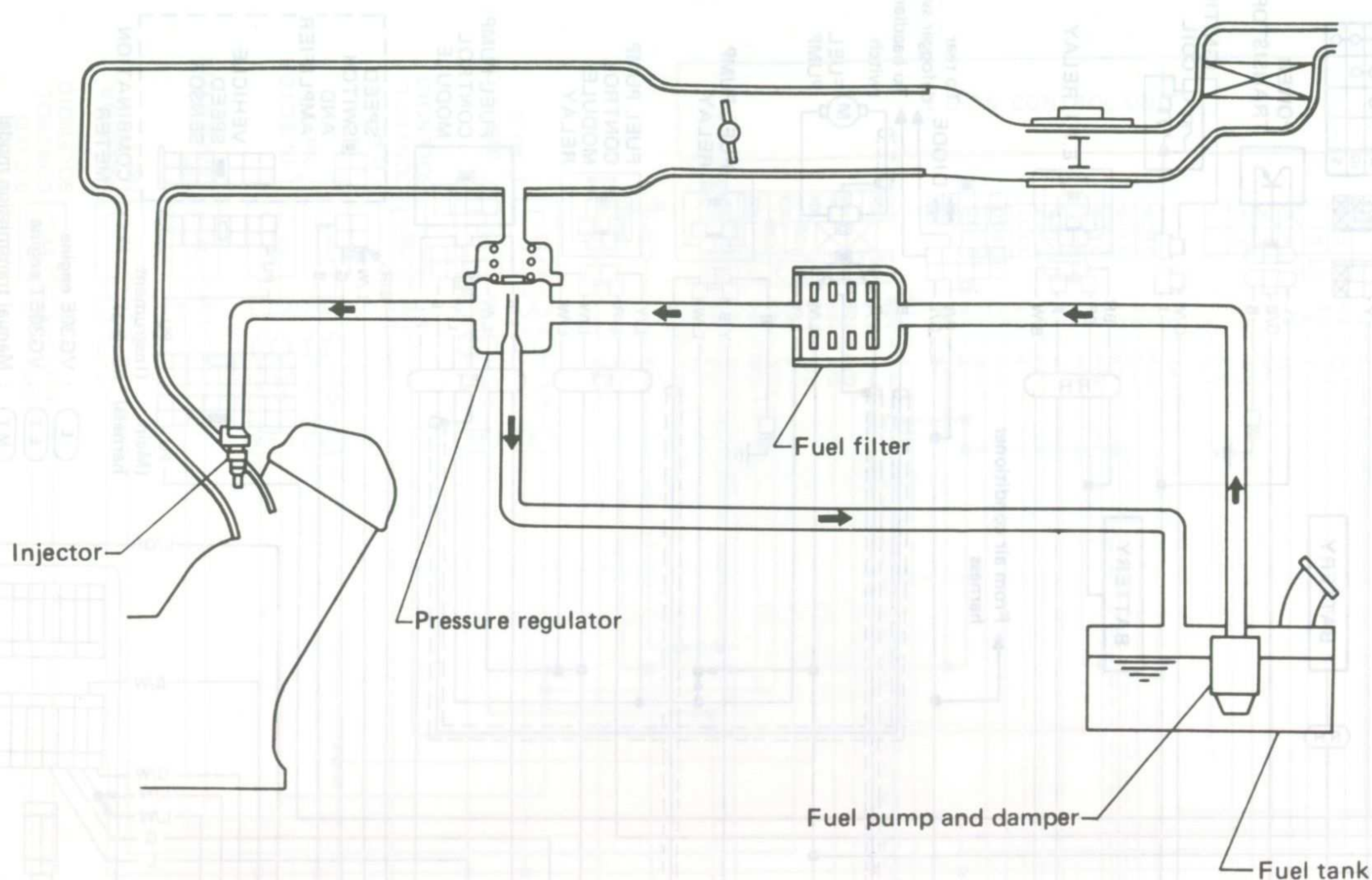


# E.C.C.S. WIRING DIAGRAM



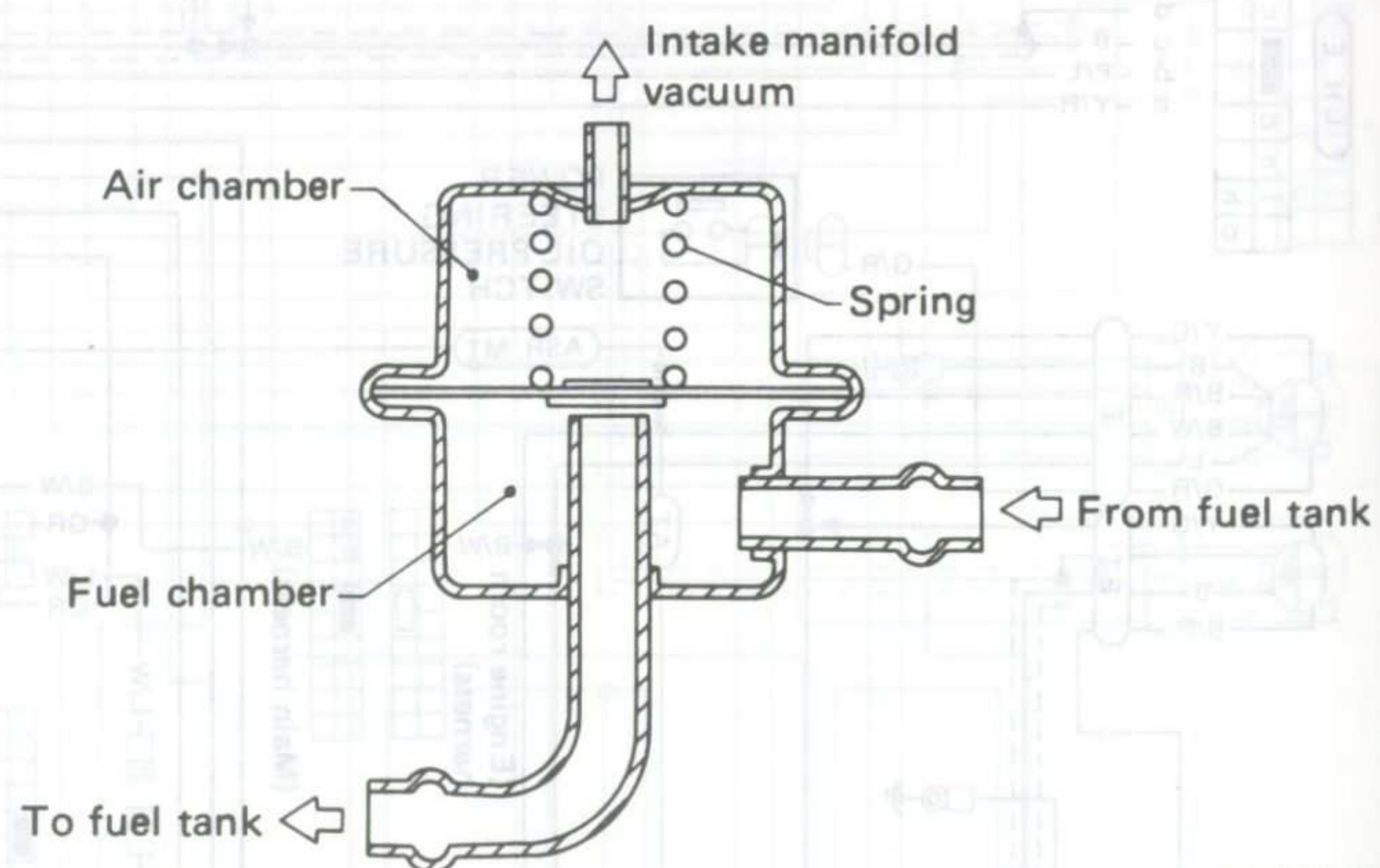


# FUEL FLOW SYSTEM DESCRIPTION

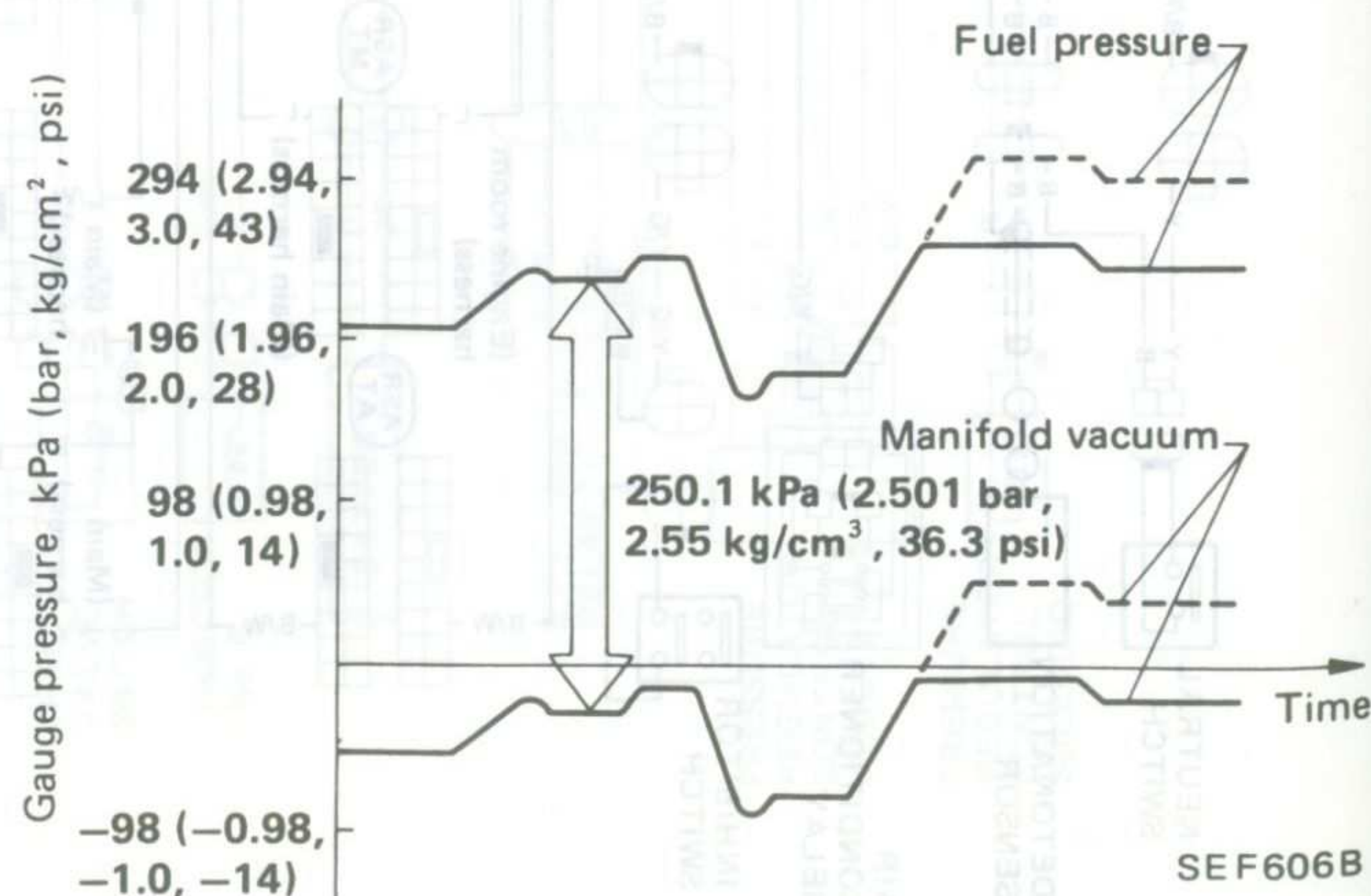


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The amount of fuel to be injected is determined by the injection pulse duration as well as by a pressure difference between fuel pressure and intake manifold vacuum pressure. The E.C.C.S. control unit controls only the injection pulse duration. For this reason, the pressure difference between the fuel pressure and intake manifold vacuum pressure should be maintained at a constant level. Since the intake manifold vacuum pressure varies with engine operating conditions, a pressure regulator is placed in the fuel line to regulate the fuel pressure in response to changes in the intake manifold vacuum pressure.



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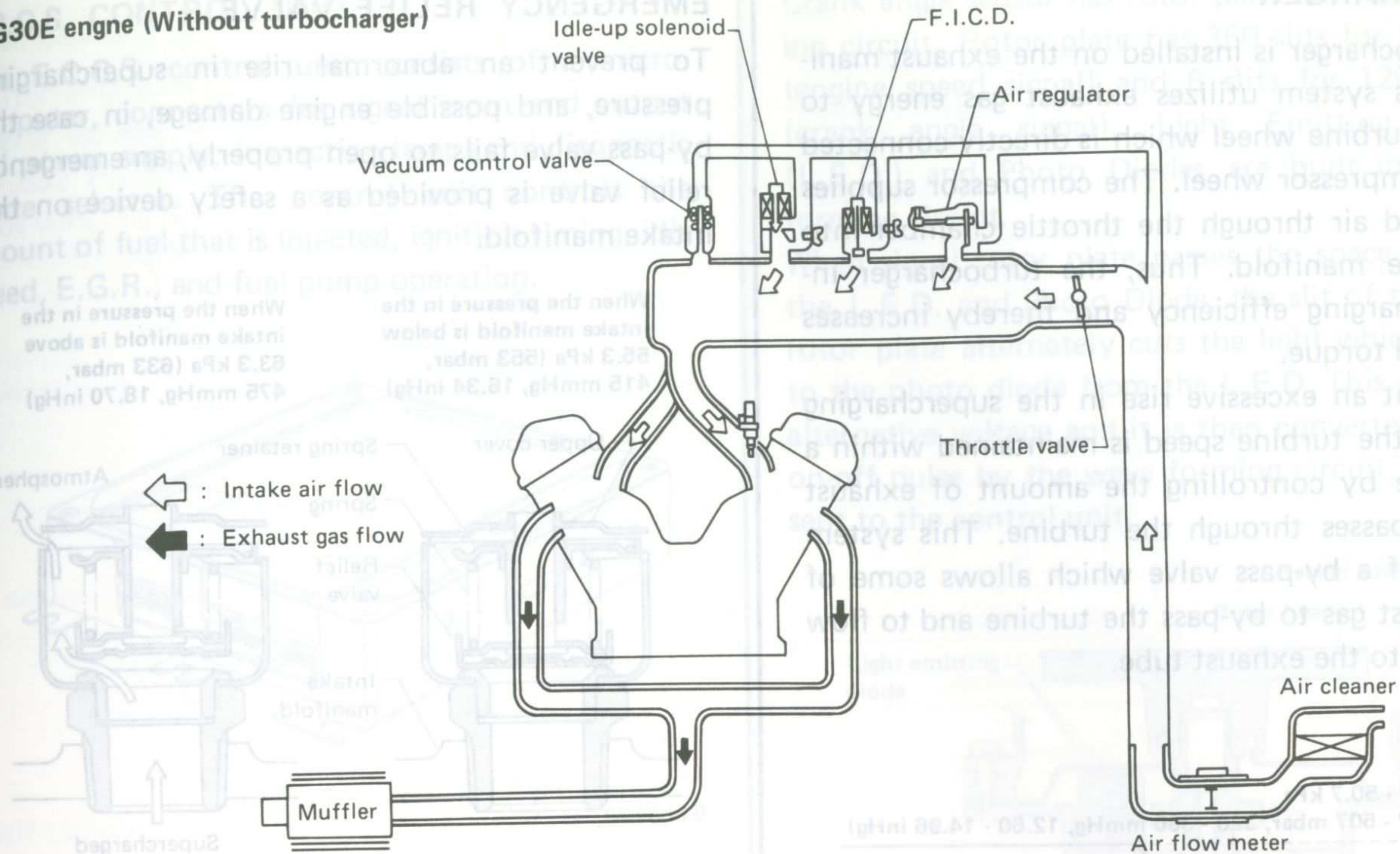


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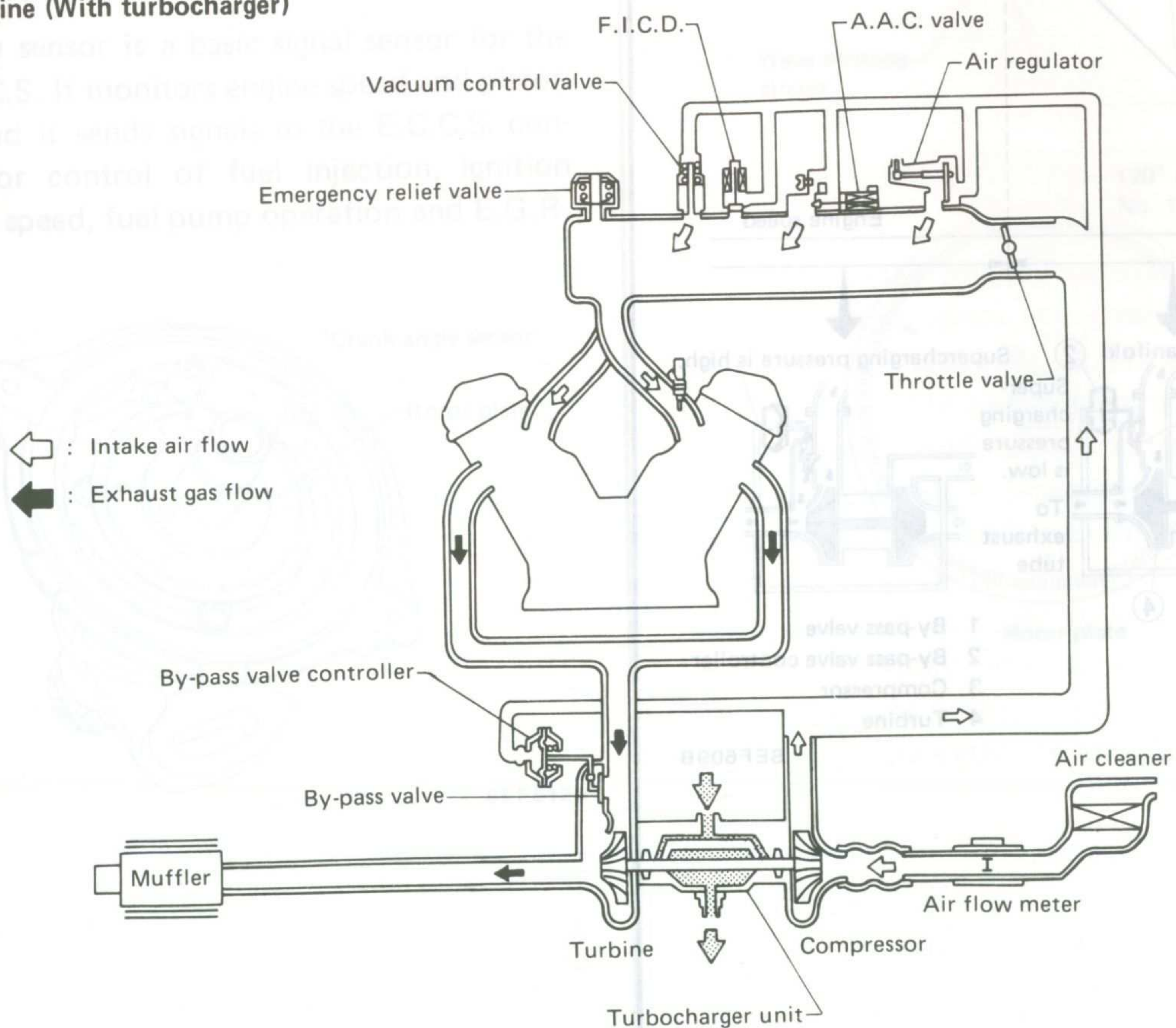
# AIR FLOW SYSTEM DESCRIPTION

## VG30E engine (Without turbocharger)



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## VG30ET engine (With turbocharger)



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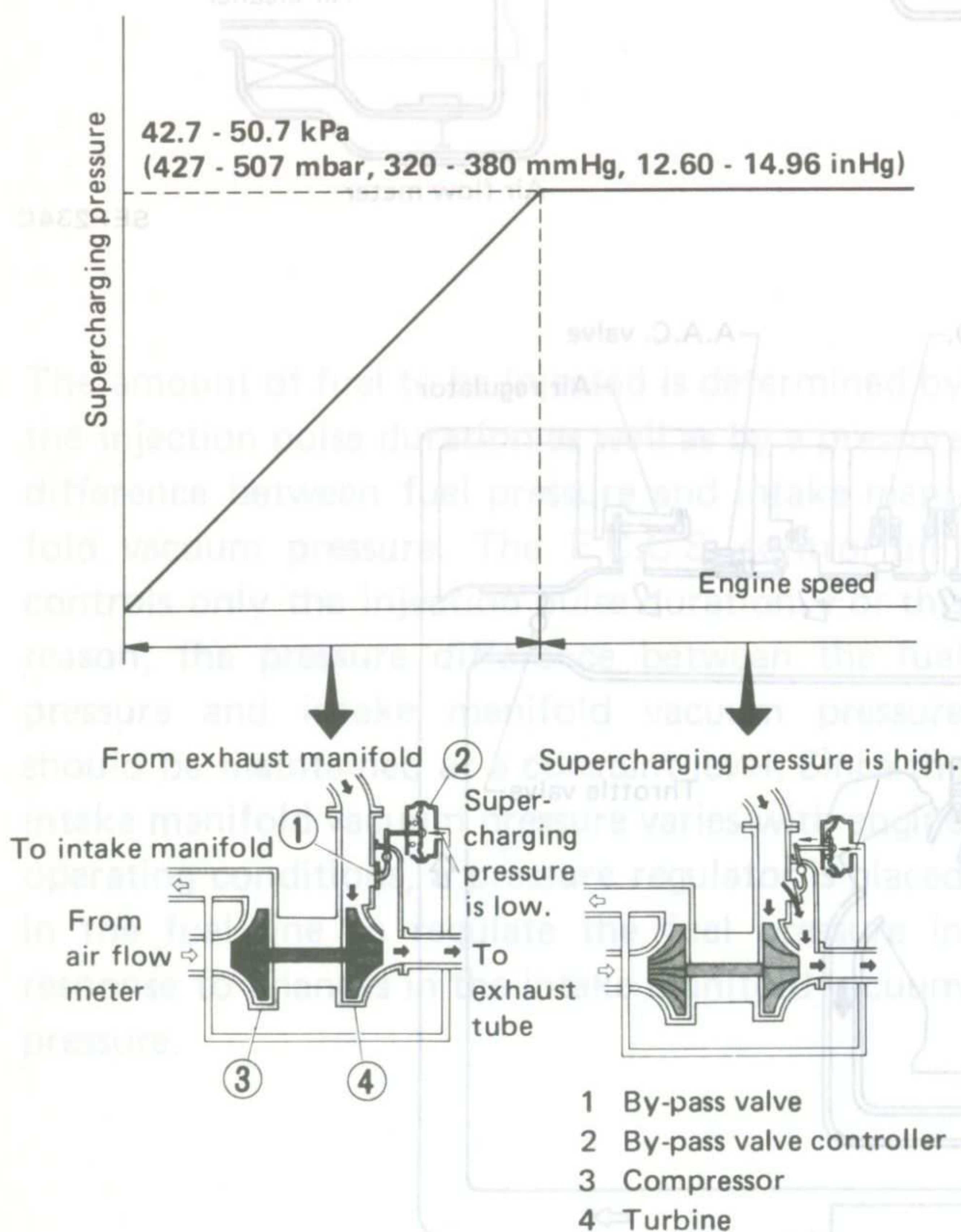


# AIR FLOW SYSTEM DESCRIPTION

## TURBOCHARGER

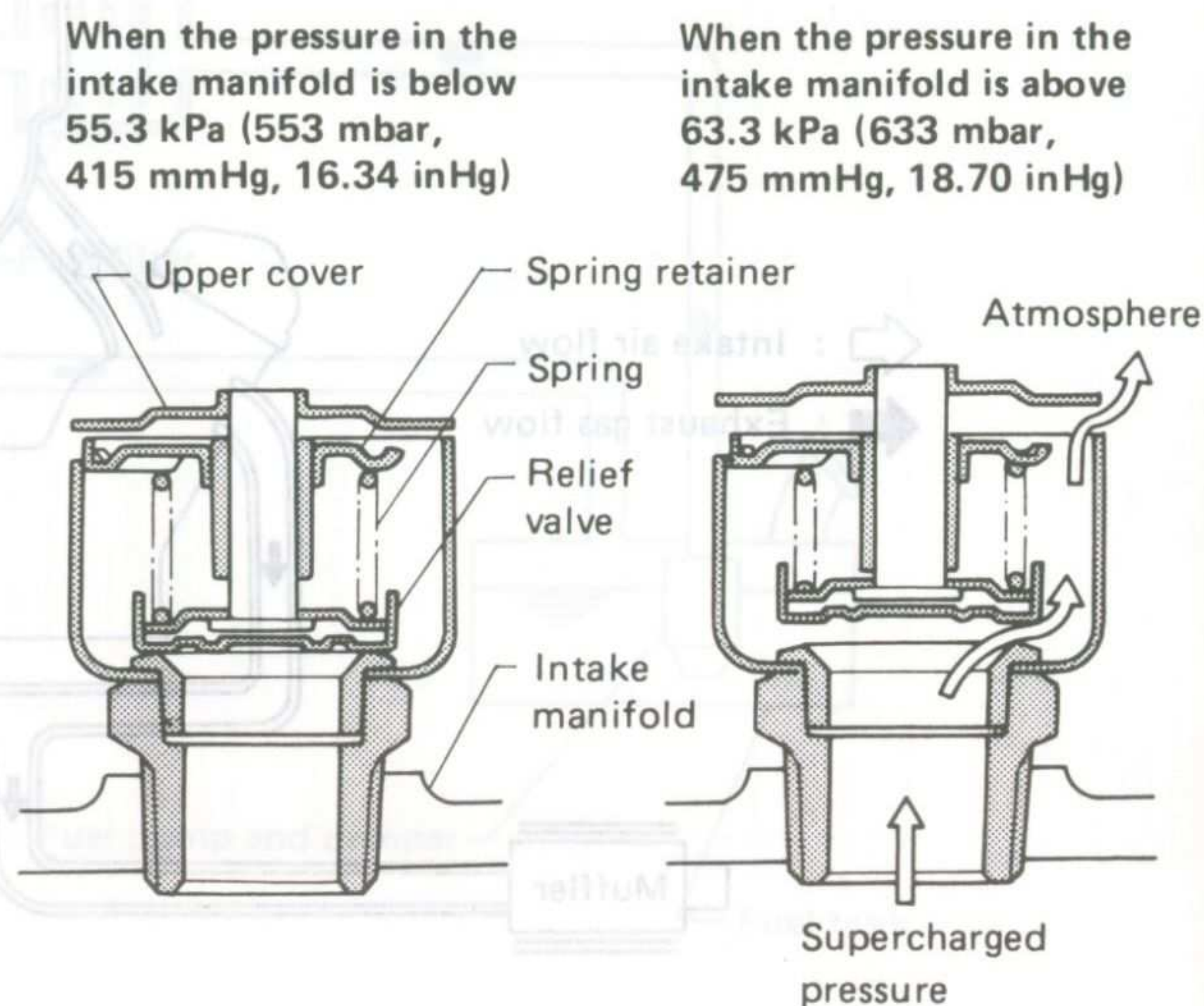
The turbocharger is installed on the exhaust manifold. This system utilizes exhaust gas energy to spin the turbine wheel which is directly connected to the compressor wheel. The compressor supplies pressurized air through the throttle chamber into the intake manifold. Thus, the turbocharger increases charging efficiency and thereby increases power and torque.

To prevent an excessive rise in the supercharging pressure, the turbine speed is maintained within a safe range by controlling the amount of exhaust gas that passes through the turbine. This system consists of a by-pass valve which allows some of the exhaust gas to by-pass the turbine and to flow directly into the exhaust tube.



## EMERGENCY RELIEF VALVE

To prevent an abnormal rise in supercharging pressure, and possible engine damage, in case the by-pass valve fails to open properly, an emergency relief valve is provided as a safety device on the intake manifold.



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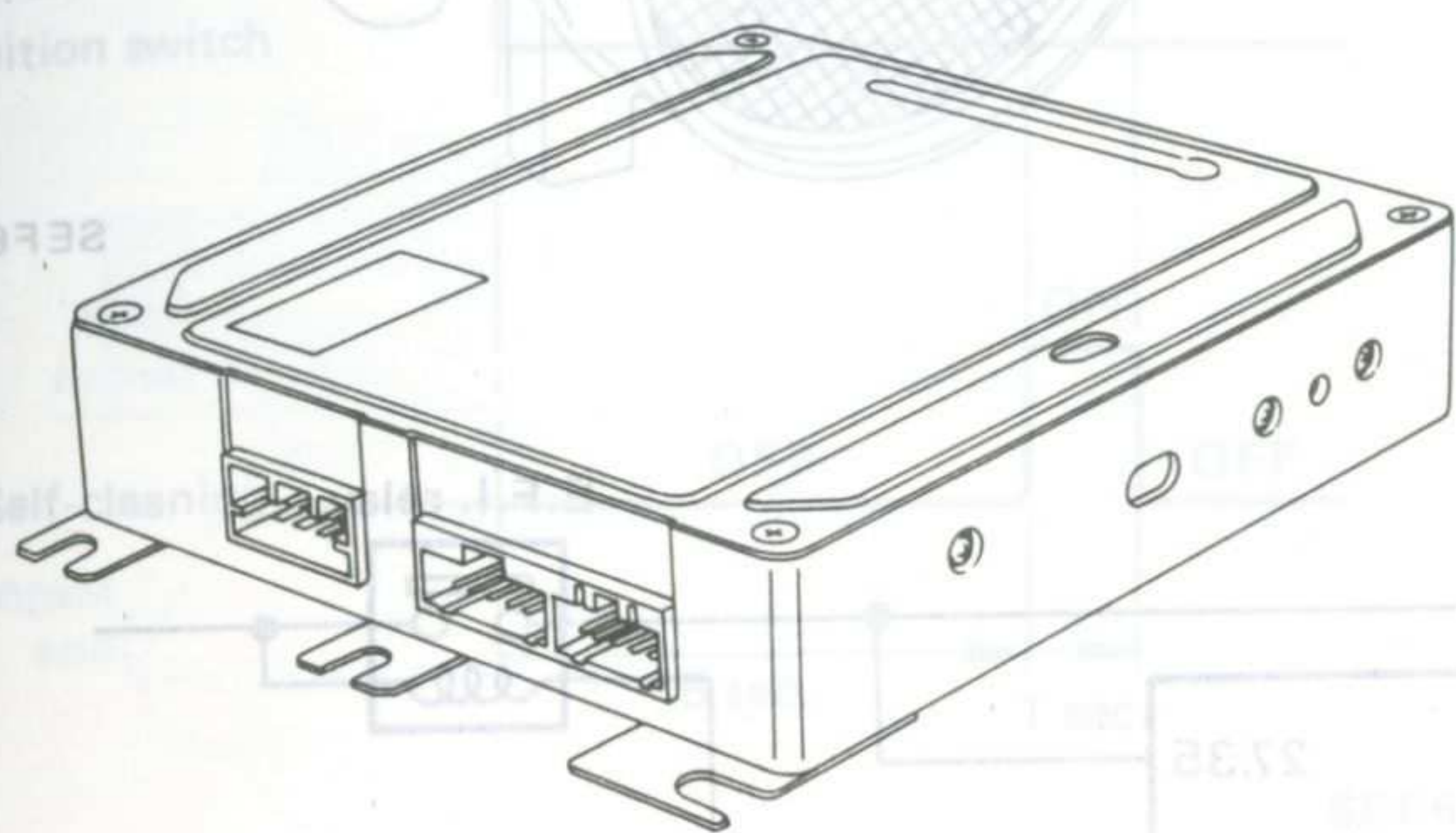


# E.C.C.S. DESCRIPTION

## E.C.C.S. Components

### E.C.C.S. CONTROL UNIT

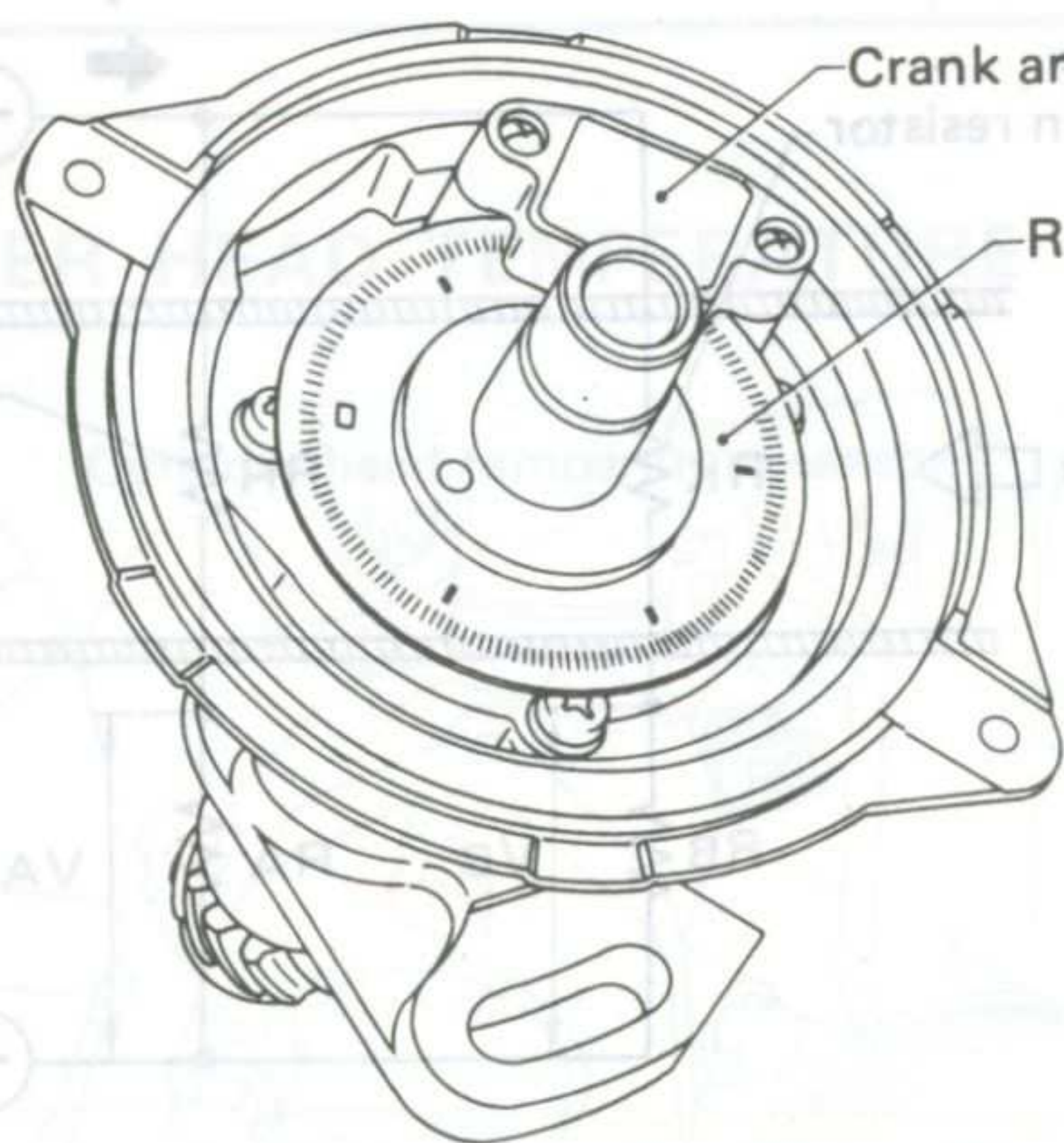
The E.C.C.S. control unit consists of a micro-computer, connectors for signal input and output and power supply, inspection lamps and diagnostic mode selector. The control unit controls the amount of fuel that is injected, ignition timing, idle speed, E.G.R., and fuel pump operation.



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### CRANK ANGLE SENSOR

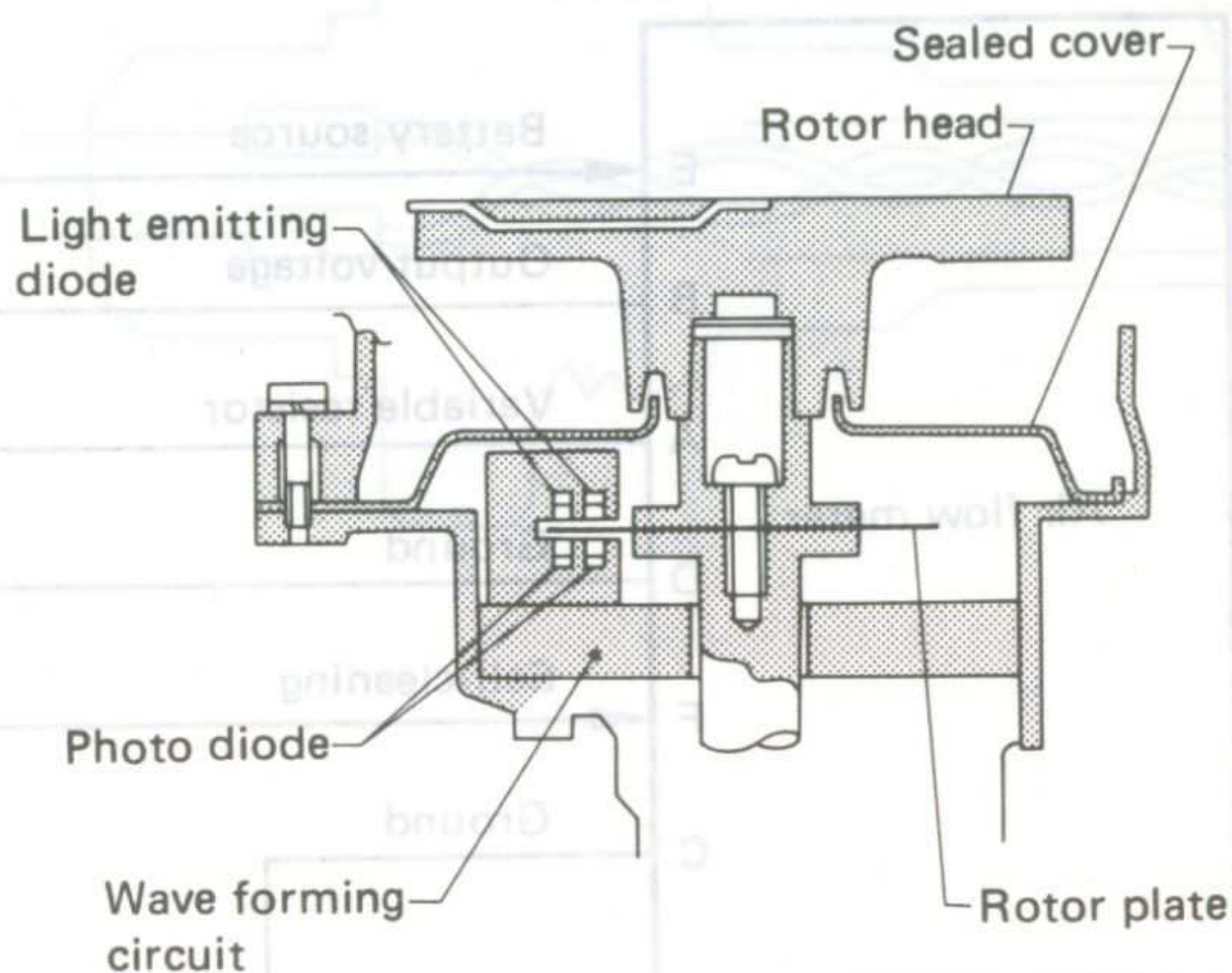
Crank angle sensor is a basic signal sensor for the entire E.C.C.S. It monitors engine speed and piston position, and it sends signals to the E.C.C.S. control unit for control of fuel injection, ignition timing, idle speed, fuel pump operation and E.G.R. operation.



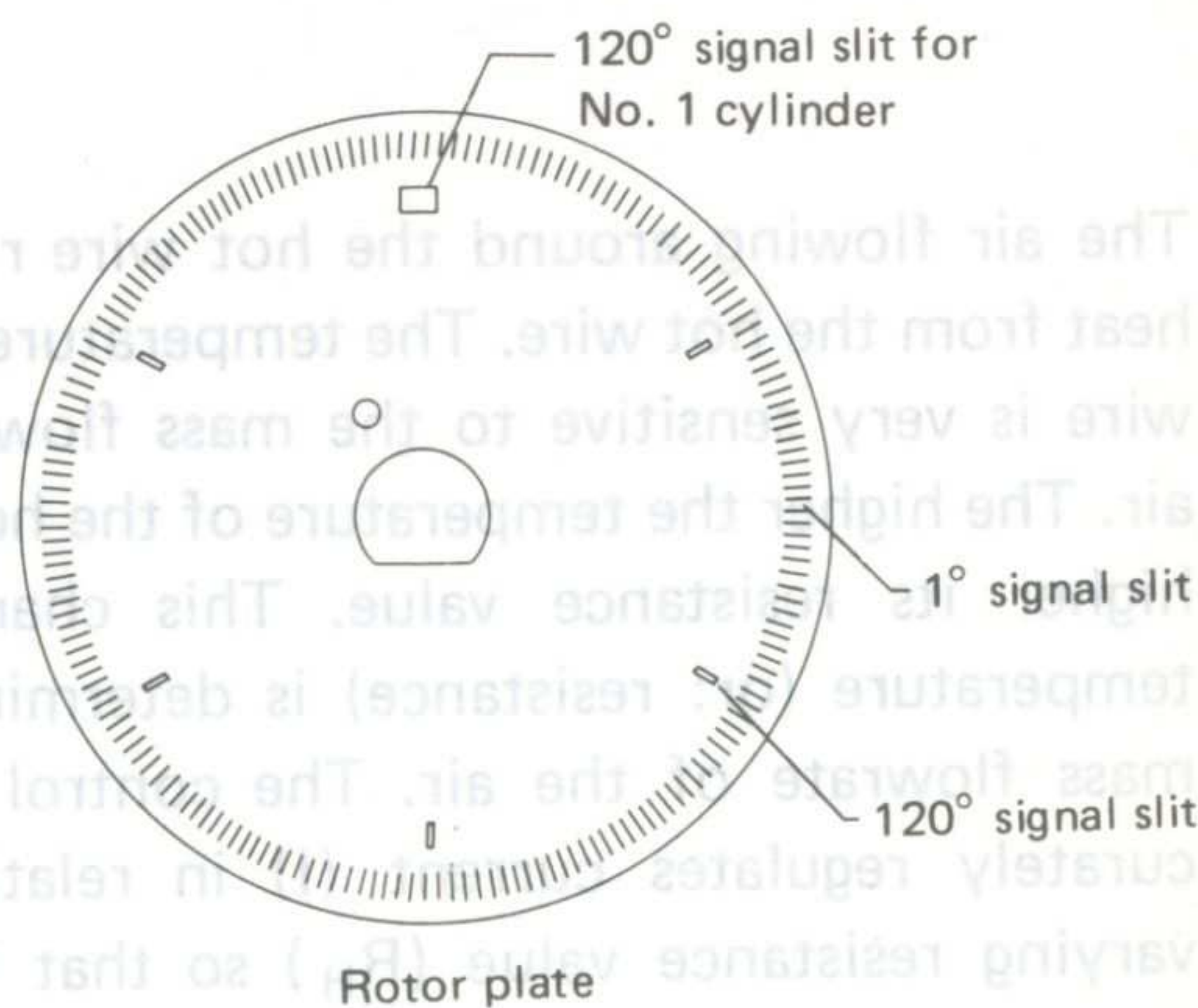
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Crank angle sensor has rotor plate and wave forming circuit. Rotor plate has 360 slits for 1° signal (engine speed signal) and 6 slits for 120° signal (crank angle signal). Light Emitting Diodes (L.E.D.) and Photo Diodes are built into wave forming circuit.

When signal rotor plate passes the space between the L.E.D. and Photo Diode, the slit of the signal rotor plate alternately cuts the light which is sent to the photo diode from the L.E.D. This causes an alternative voltage and it is then converted into an on-off pulse by the wave forming circuit, which is sent to the control unit.



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SEF614B

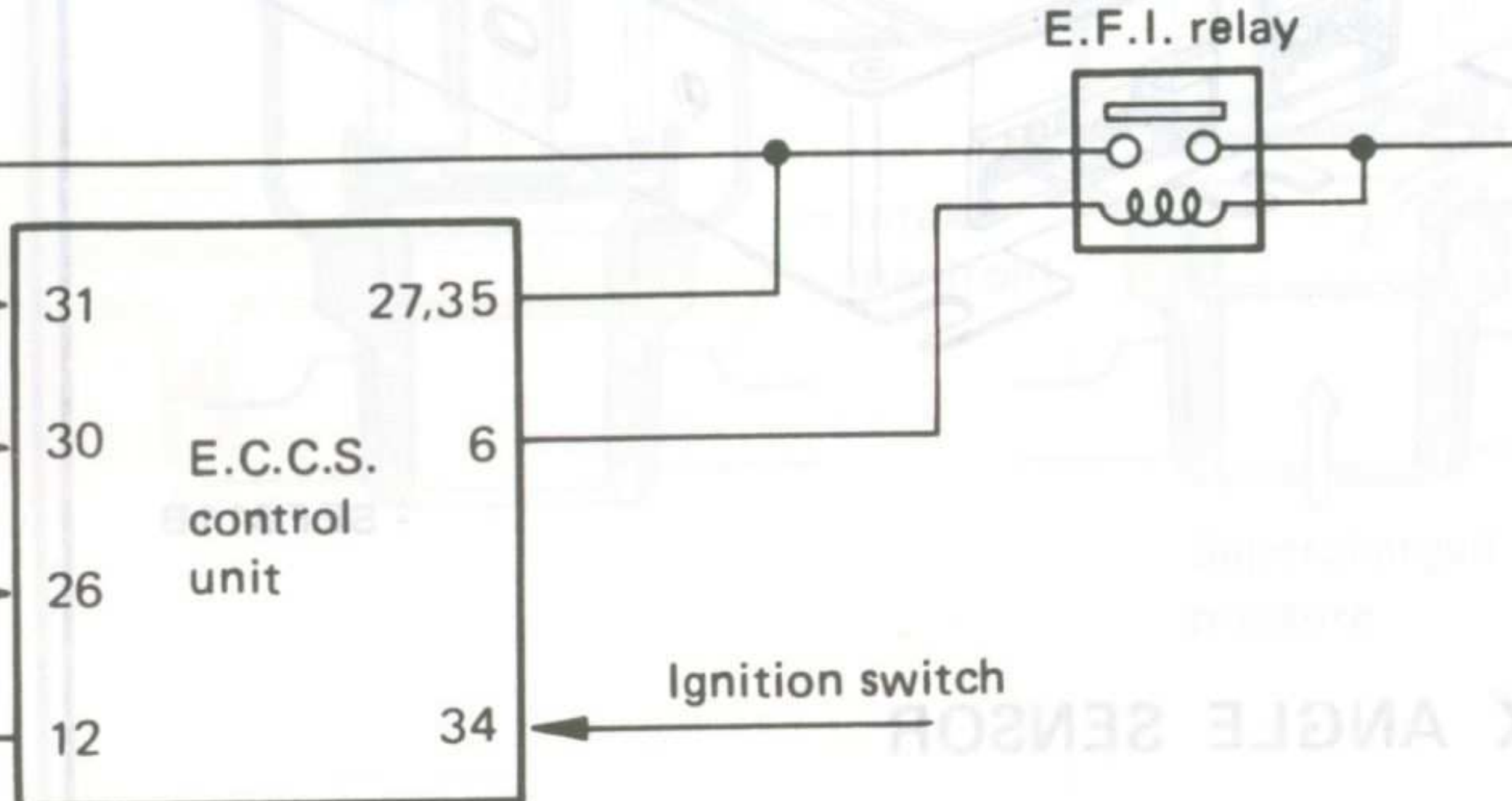
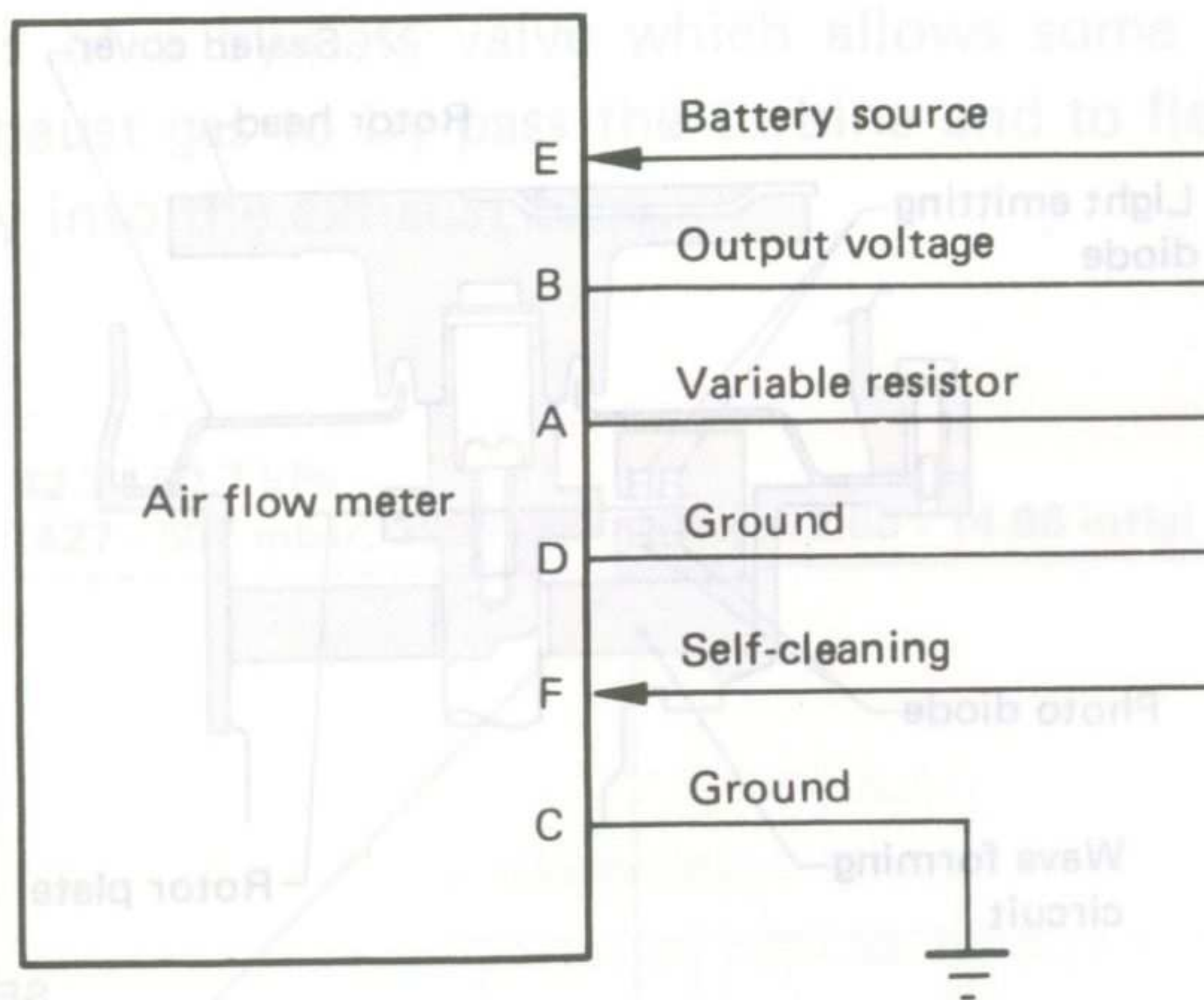


# E.C.C.S. DESCRIPTION

## E.C.C.S. Components (Cont'd)

### AIR FLOW METER

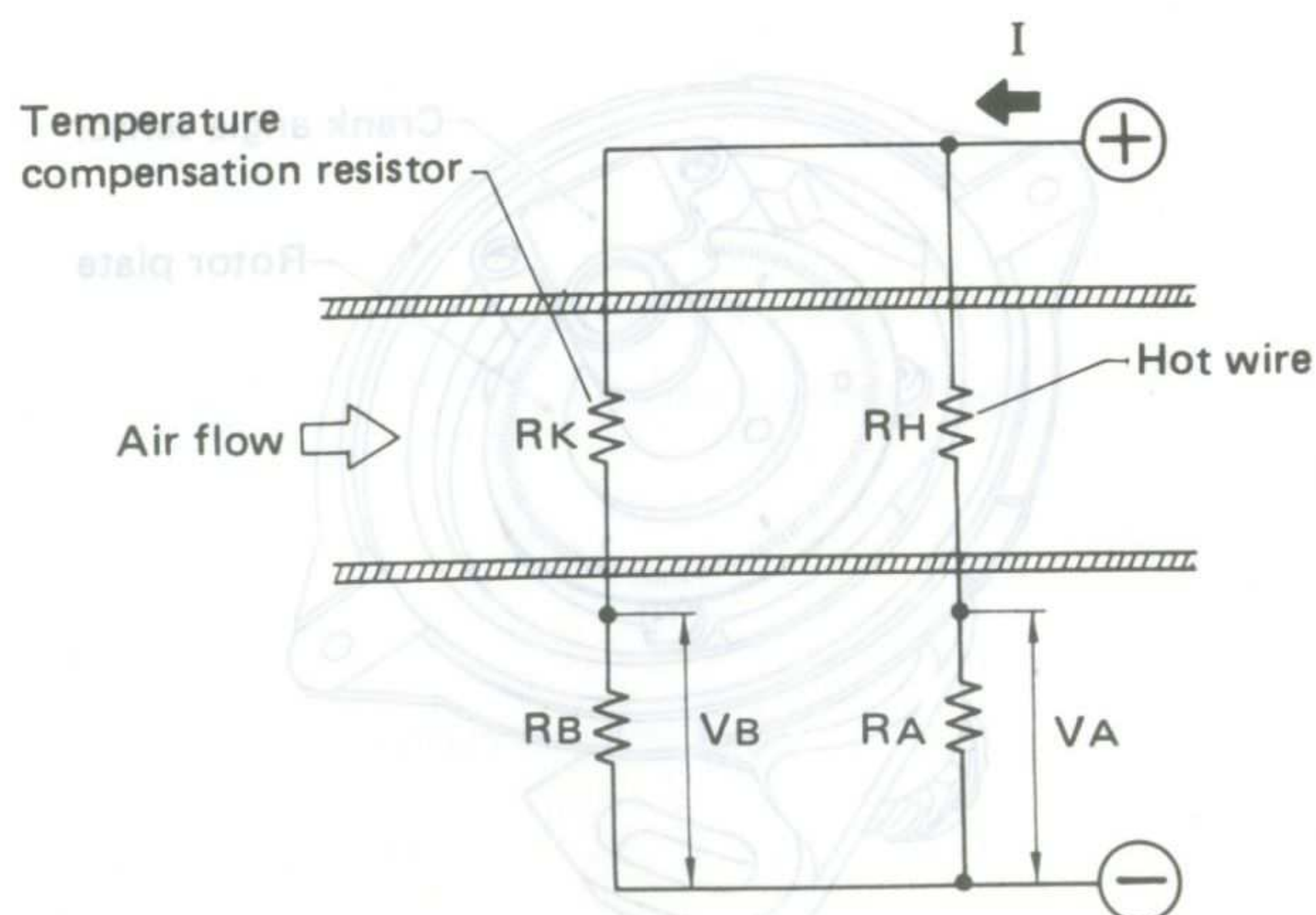
The air flow meter measures the mass flowrate of intake air. Measurements are made in such a manner that the control circuit emits an electrical output signal in relation to the amount of heat dissipated from the hot wire placed in the stream of intake air.



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The air flowing around the hot wire removes the heat from the hot wire. The temperature of the hot wire is very sensitive to the mass flowrate of the air. The higher the temperature of the hot wire, the higher its resistance value. This change in the temperature (or: resistance) is determined by the mass flowrate of the air. The control circuit accurately regulates current ( $I$ ) in relation to the varying resistance value ( $R_H$ ) so that  $V_A$  always equals  $V_B$ . The air flow meter transmits an output for voltage  $V_A$  to the control unit where the output is converted into an intake air signal.



- $R_H$  : Hot wire resistance
- $R_K$  : Temperature compensation resistance
- $R_A, R_B$  : Constant resistance

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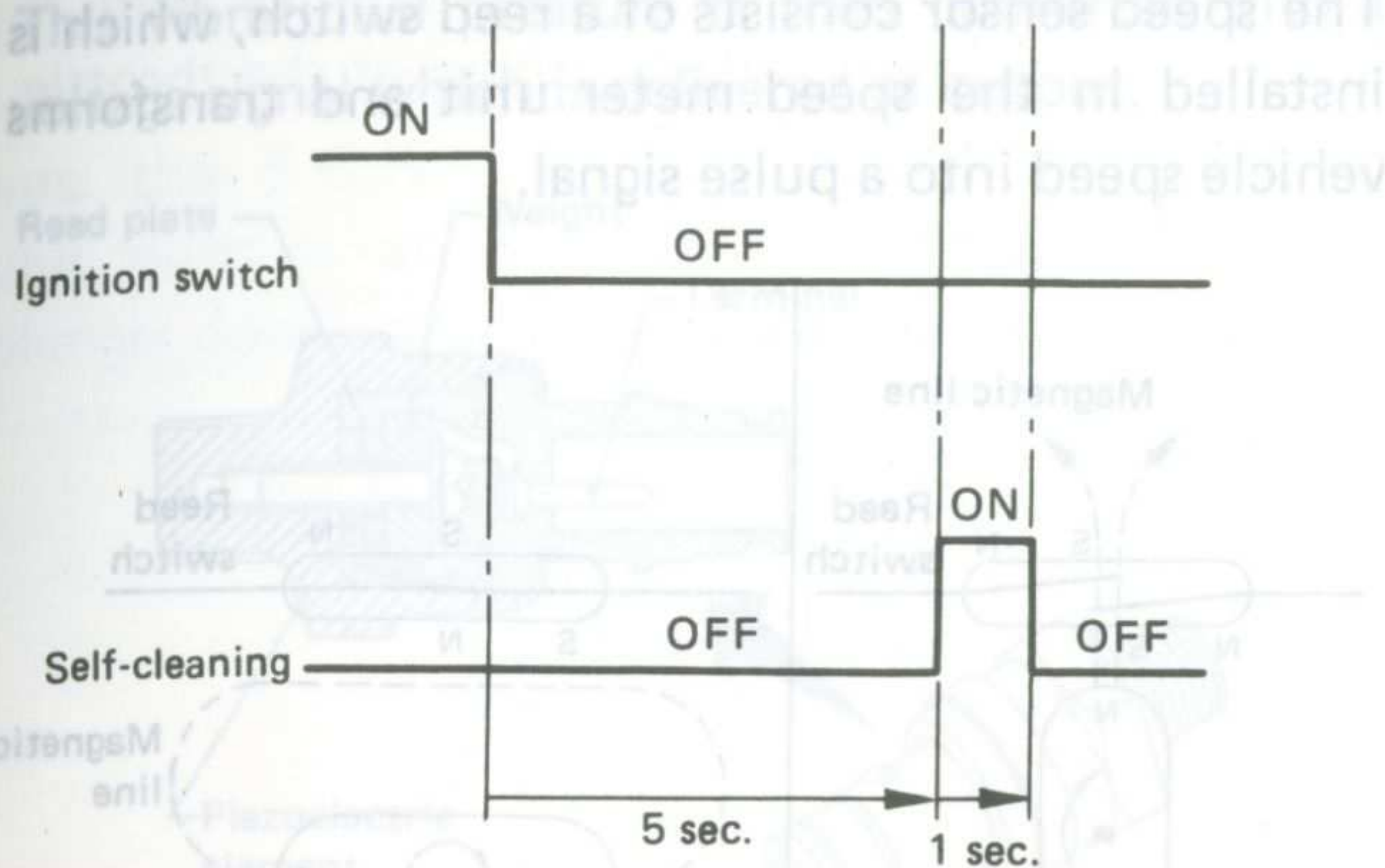


# E.C.C.S. DESCRIPTION

## E.C.C.S. Components (Cont'd)

### Self-cleaning

After engine is stopped, the E.C.C.S. control unit heats up the hot wire to approximately 1,000°C (1,832°F) to burn out dust which adhered to the hot wire.

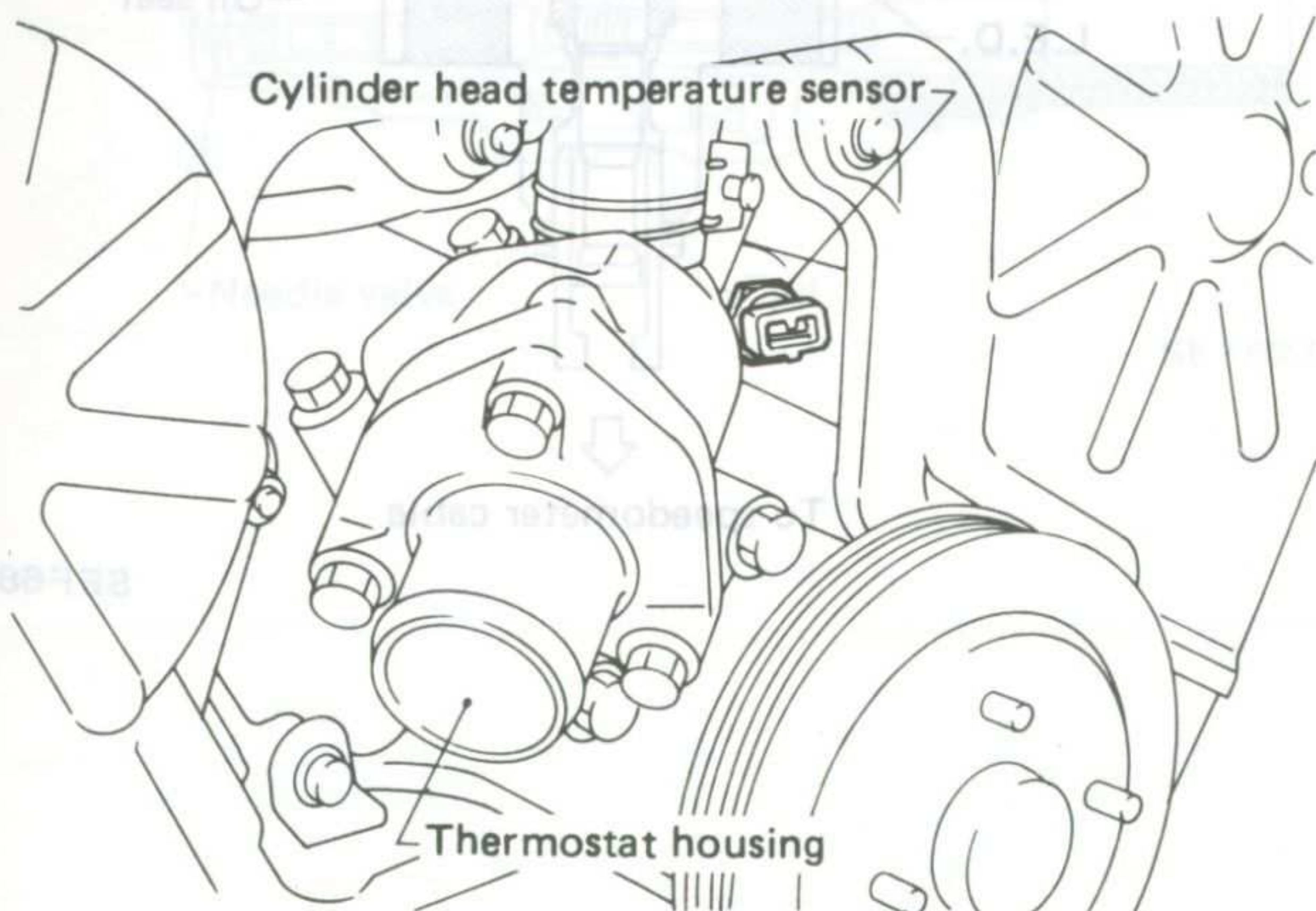


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### Self-cleaning operation

Condition	Operation
After running engine at above 1,500 rpm After driving vehicle at above 20 km/h (12 MPH) (VG30ET engine only) Cylinder head temperature is less than 115°C (239°F)	Operates
Except above	Does not operate

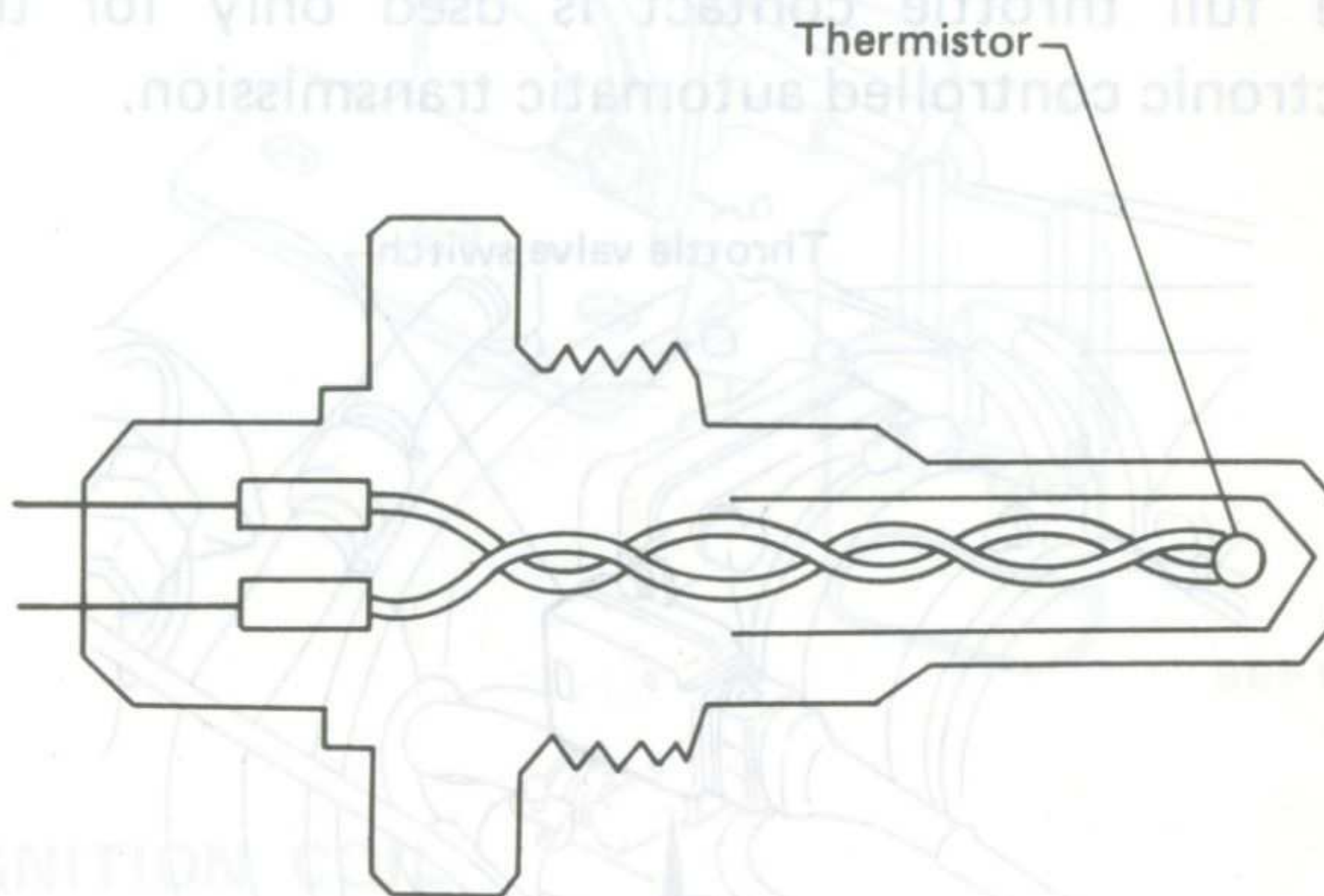
### CYLINDER HEAD TEMPERATURE SENSOR



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The cylinder head temperature sensor, built into the cylinder head, monitors changes in cylinder head temperature and transmits a signal to the E.C.C.S. control unit.

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



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# E.C.C.S. DESCRIPTION

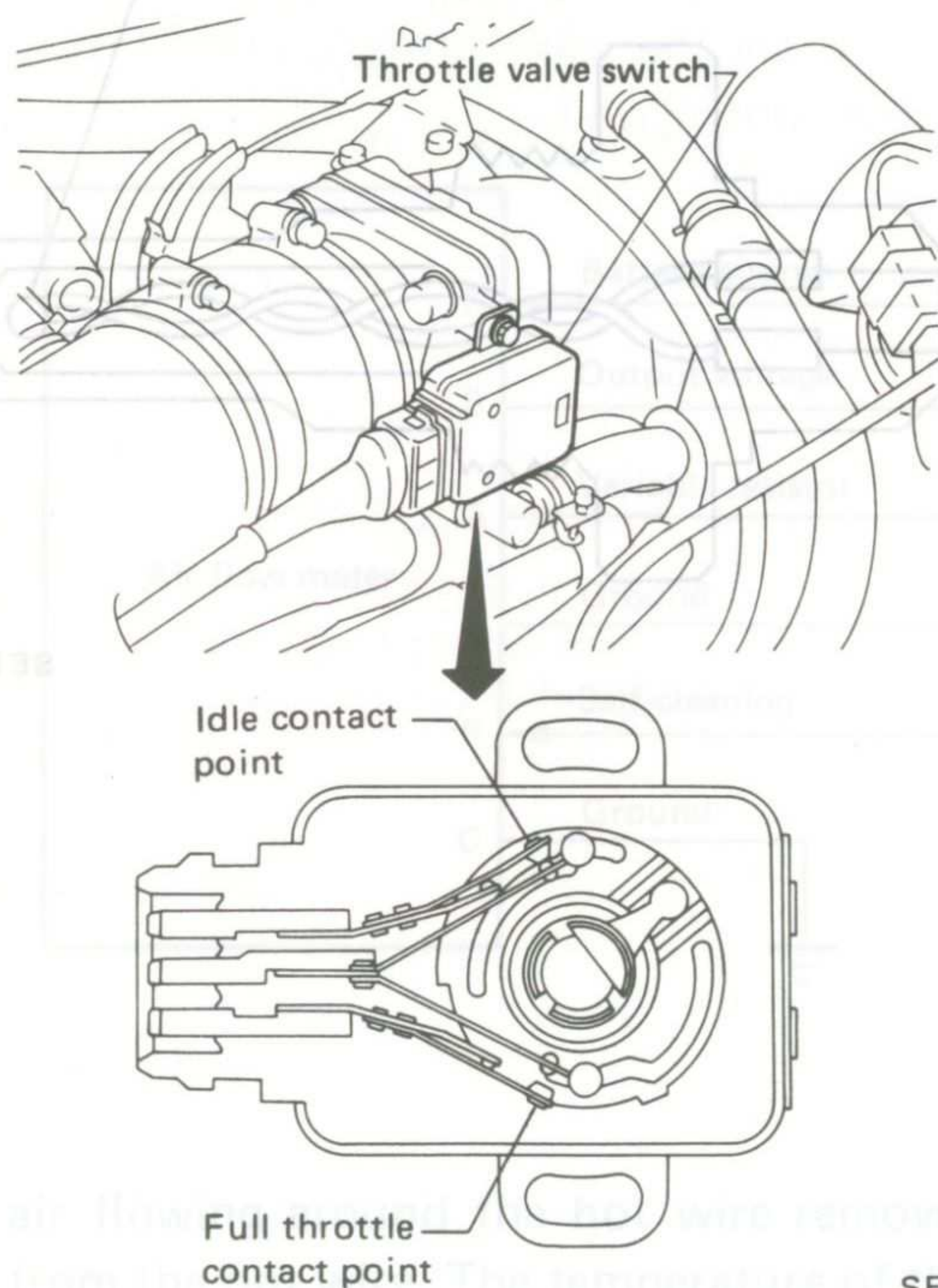
## E.C.C.S. Components (Cont'd)

### THROTTLE VALVE SWITCH

The throttle valve switch is attached to the throttle chamber and actuates in response to accelerator pedal movement.

This switch has idle contact and full throttle contact. The idle contact closes when the throttle valve is positioned at idle and opens when it is at any other position.

The full throttle contact is used only for the electronic controlled automatic transmission.



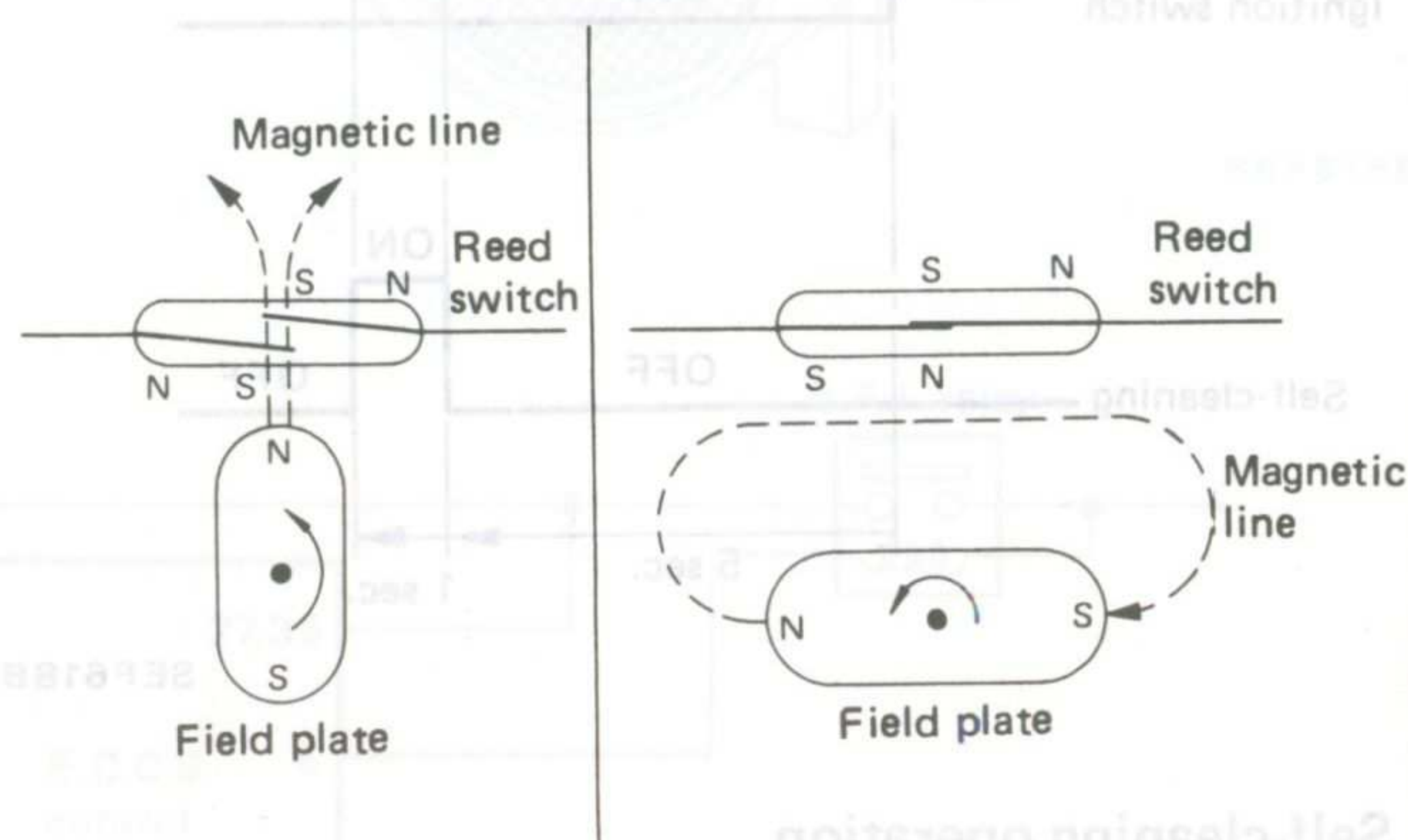
SEF623B

### VEHICLE SPEED SENSOR (VG30ET engine only)

The vehicle speed sensor provides a vehicle speed signal to the E.C.C.S. control unit.

#### • Needle type speedometer models

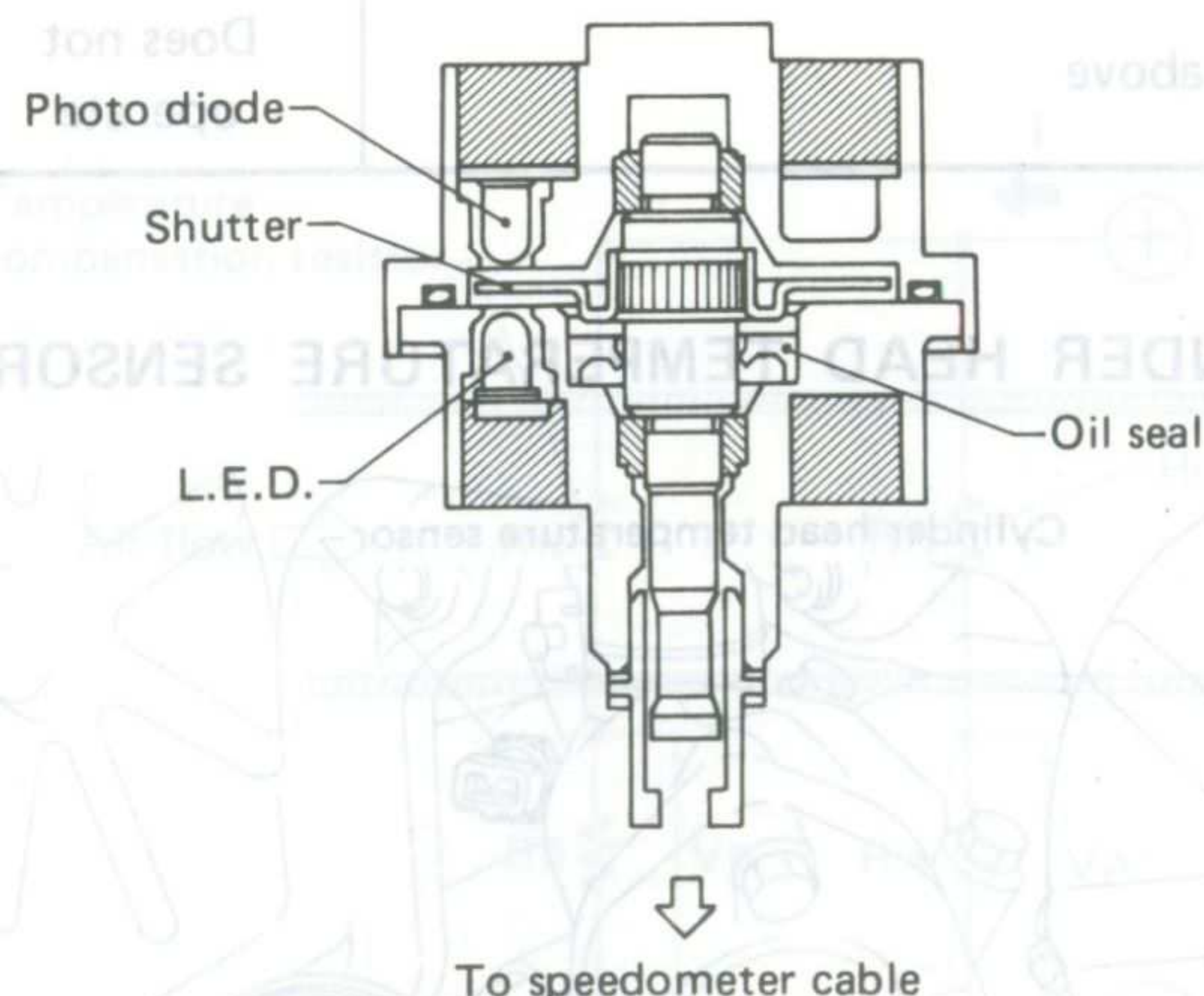
The speed sensor consists of a reed switch, which is installed in the speed meter unit and transforms vehicle speed into a pulse signal.



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#### • Digital type speedometer models

The speed sensor consists of an L.E.D., photo diode, shutter and wave forming circuit. Its principle is the same as that of the crank angle sensor.



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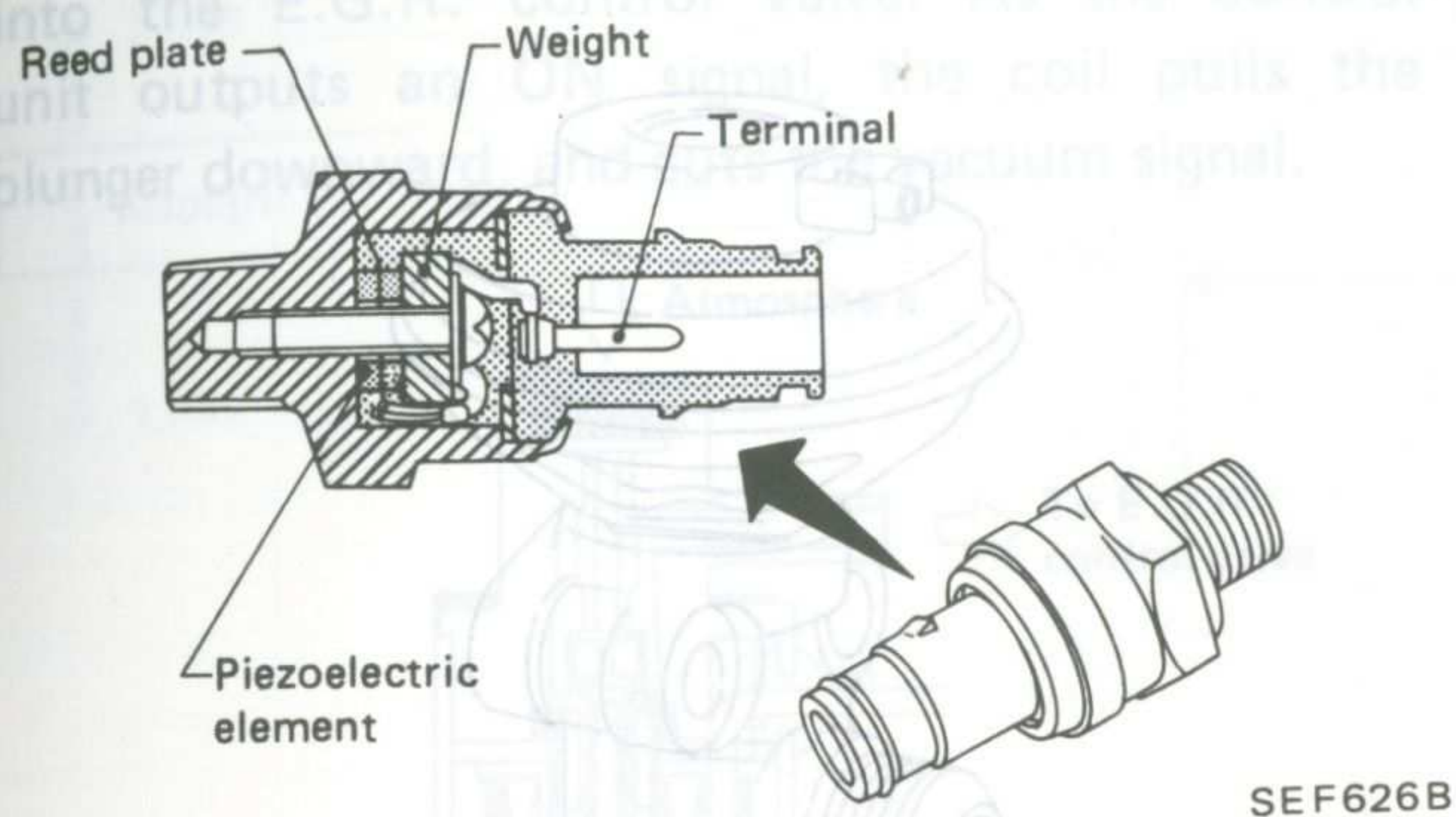


# E.C.C.S. DESCRIPTION

## E.C.C.S. Components (Cont'd)

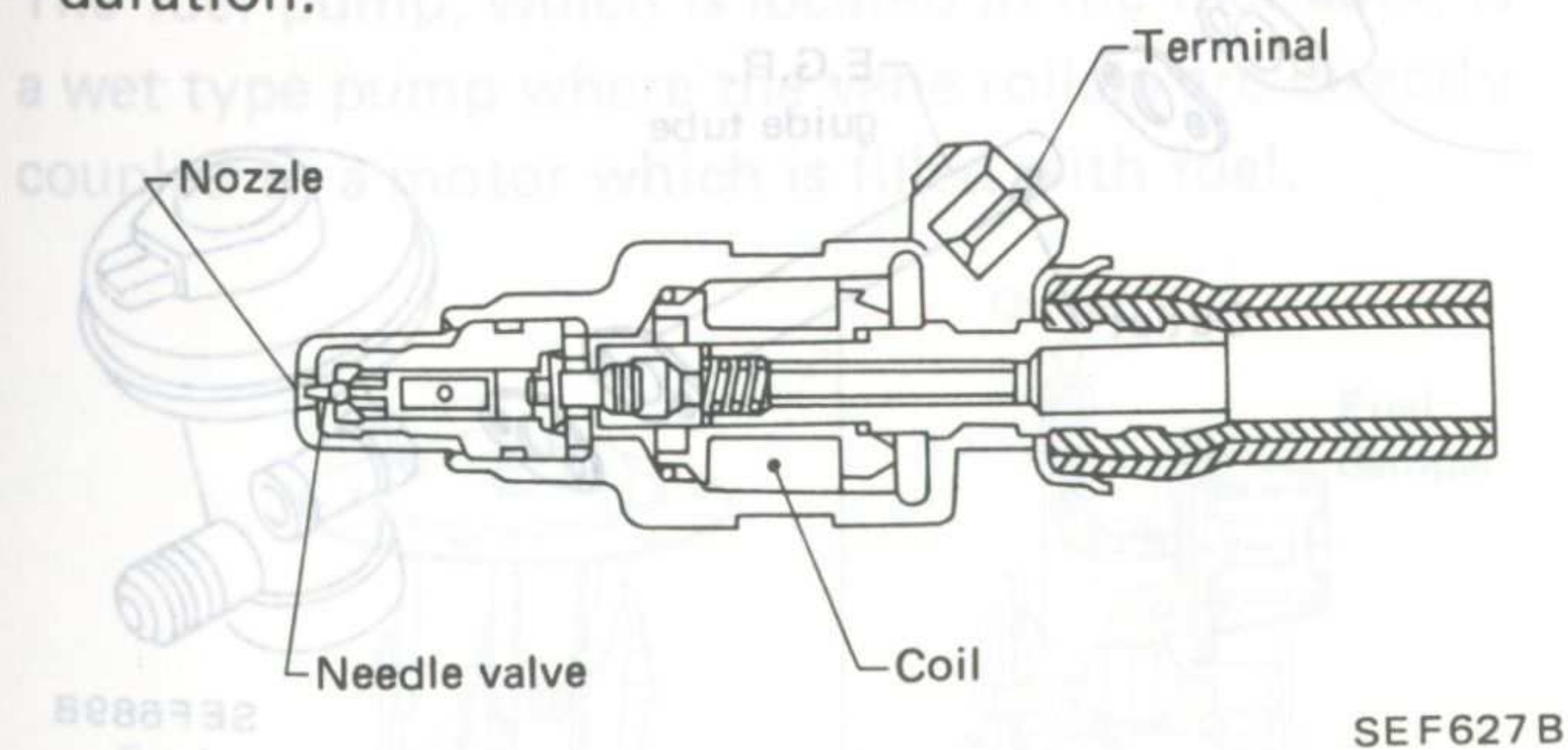
### DETONATION SENSOR (VG30ET engine only)

The detonation sensor is attached to the cylinder block and senses engine knocking conditions. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. This vibrational pressure is then converted into a voltage signal which is delivered as output.



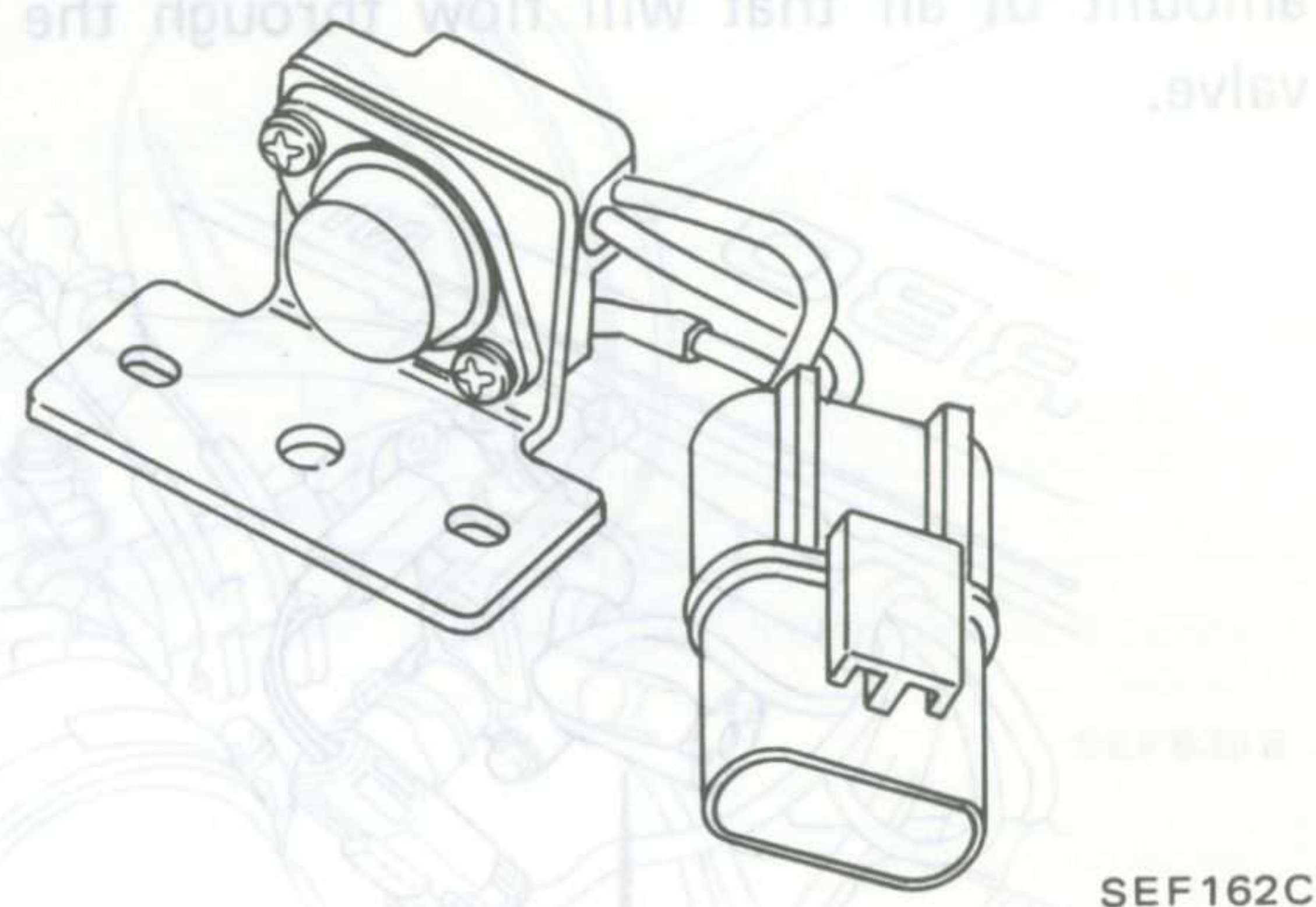
### FUEL INJECTOR

The fuel injector is a small, precision solenoid valve. As the E.C.C.S. control unit outputs an injection signal to each fuel injector, the coil built into the injector pulls the needle valve back, and fuel is injected through the nozzle to intake manifold. The amount of fuel injected is controlled by the E.C.C.S. control unit as an injection pulse duration.



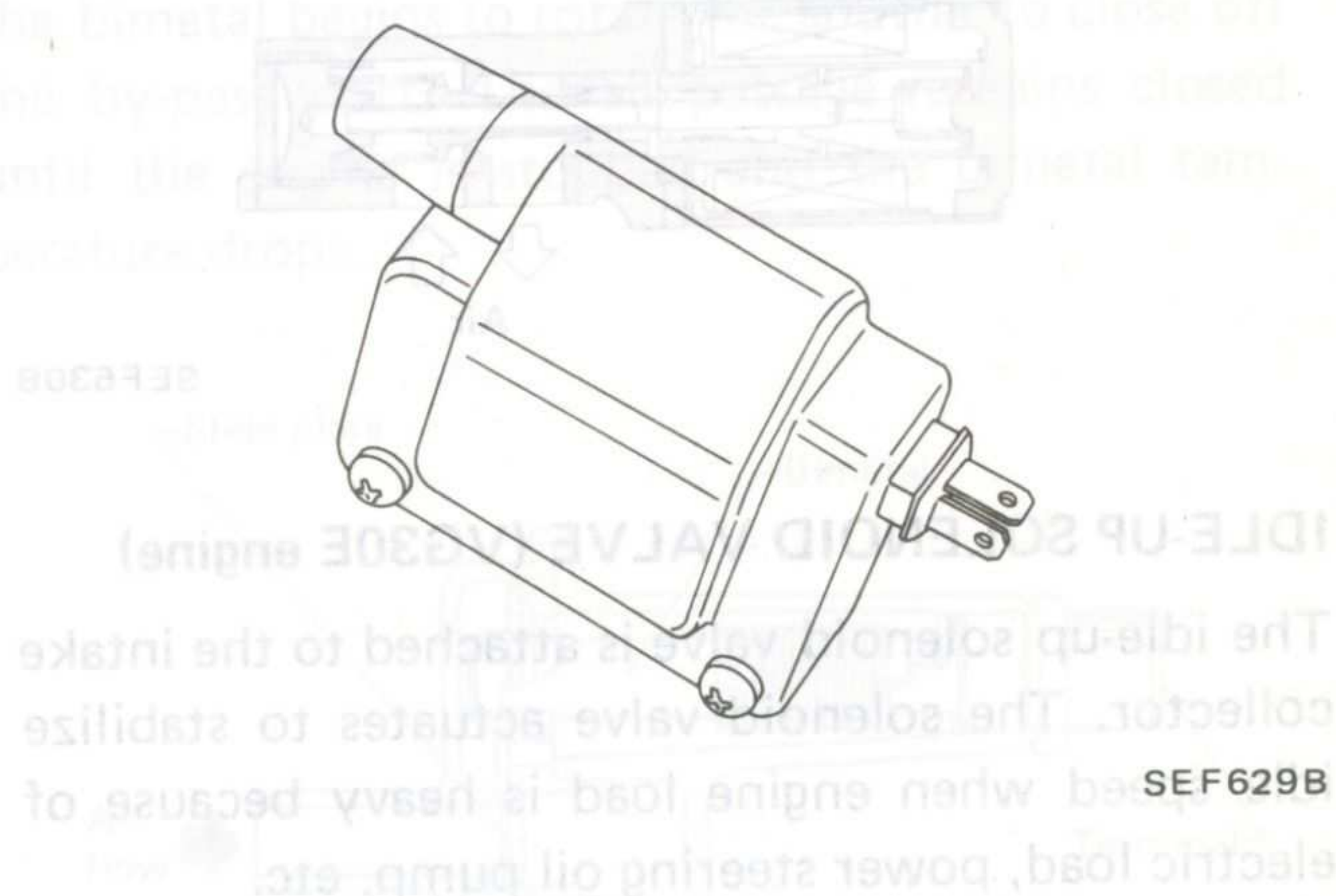
### POWER TRANSISTOR

The ignition signal from the E.C.C.S. control unit is amplified by the power transistor, which connects and disconnects the coil primary circuit to induce the proper high voltage in the secondary circuit.



### IGNITION COIL

The ignition coil is a mold type.



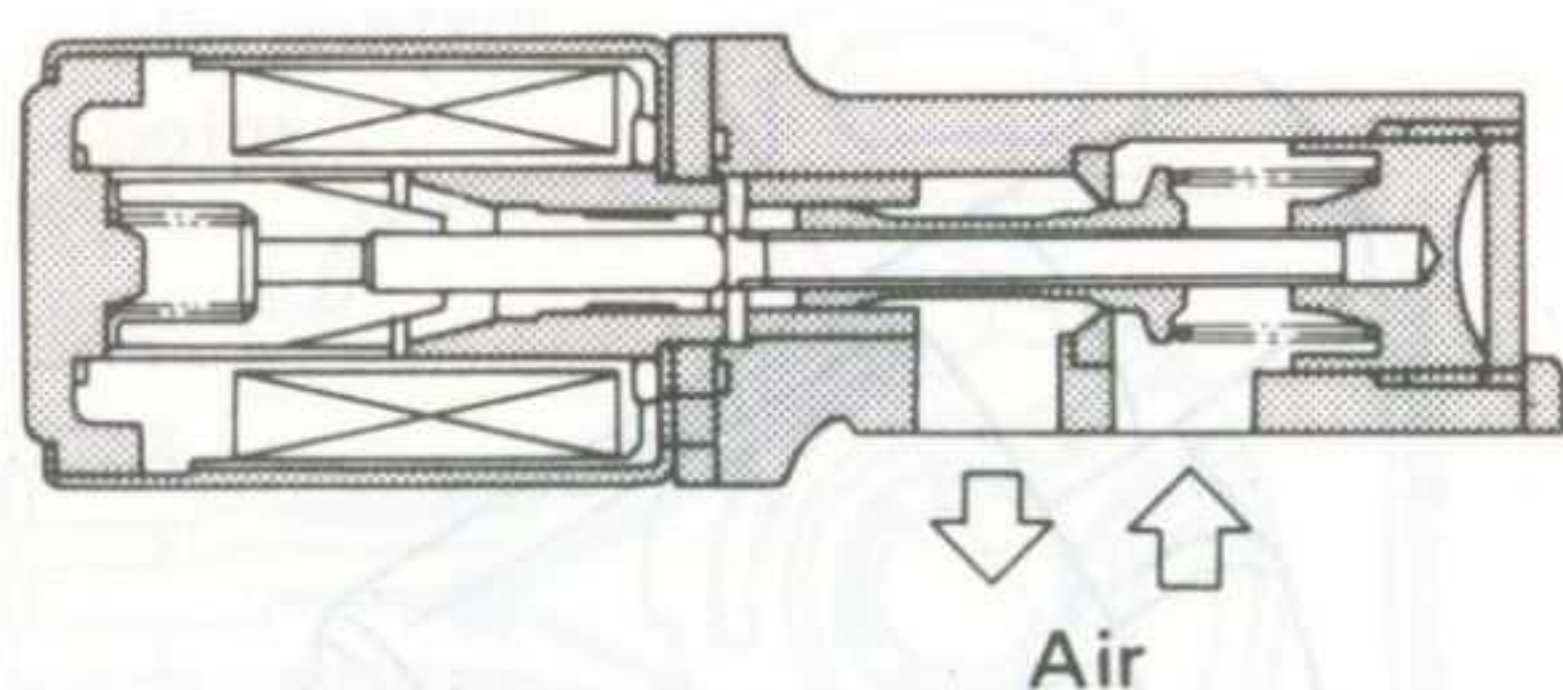
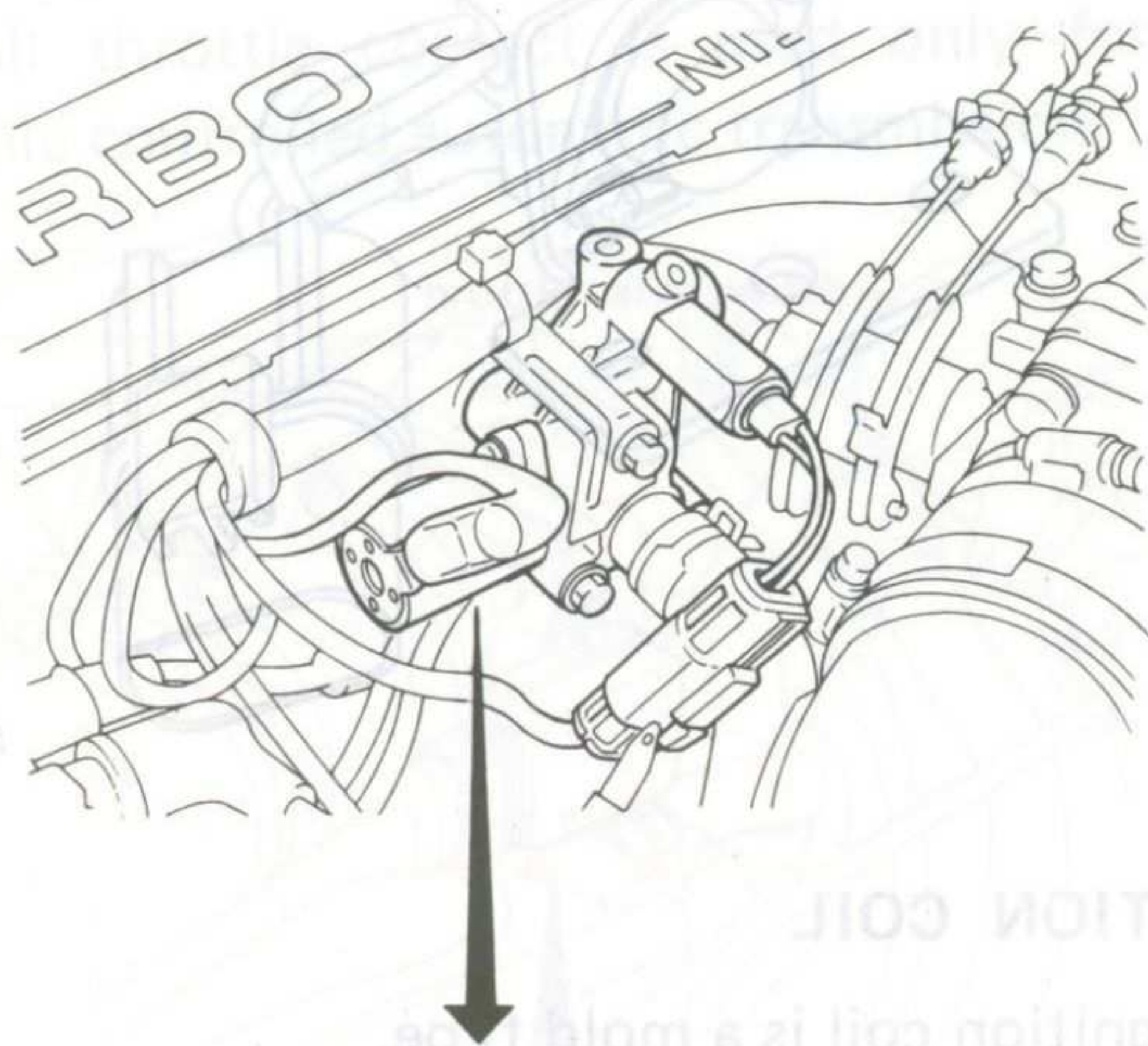


# E.C.C.S. DESCRIPTION

## E.C.C.S. Components (Cont'd)

### AUXILIARY AIR CONTROL (A.A.C.) VALVE (VG30ET engine)

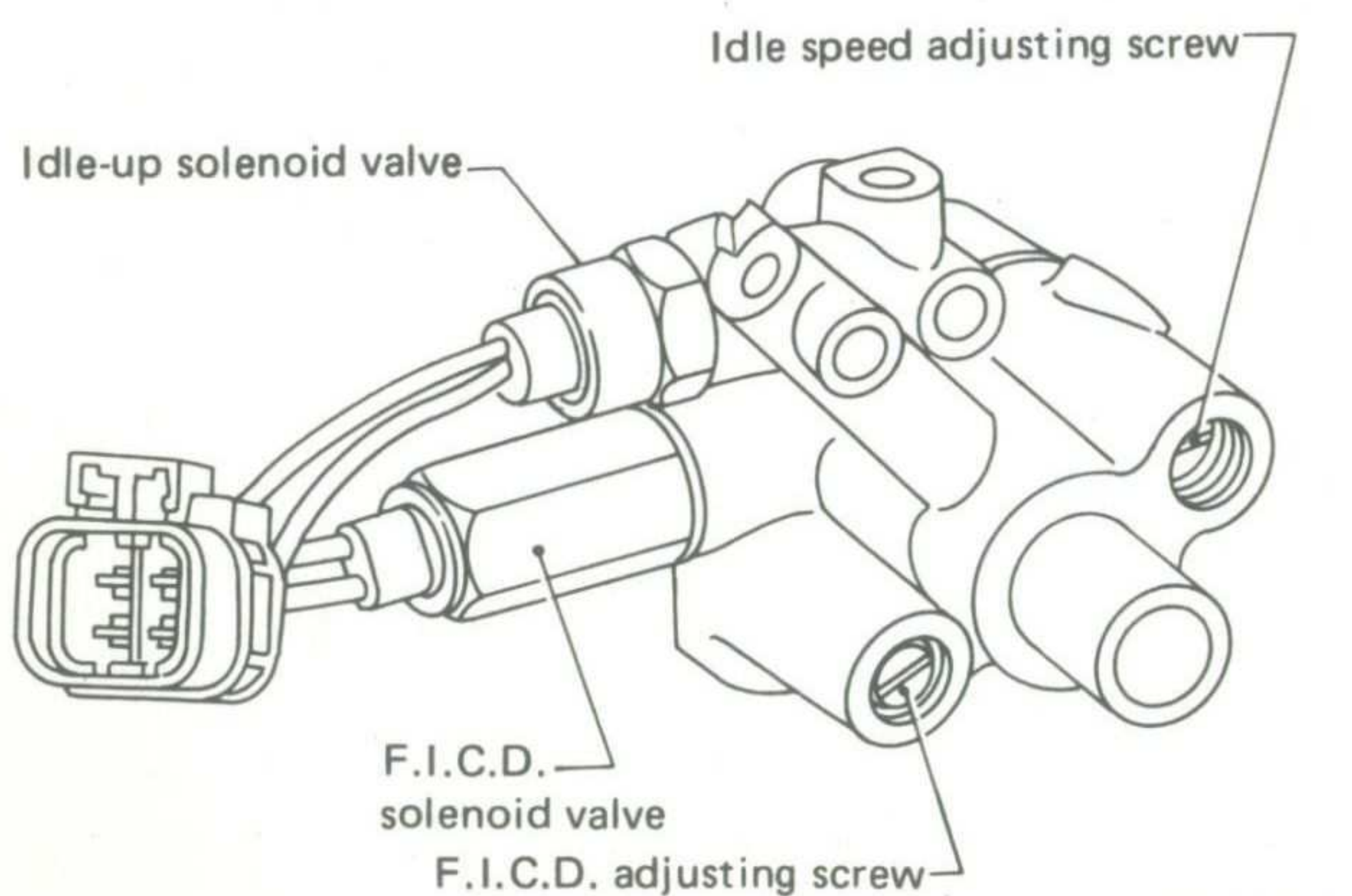
The A.A.C. valve is attached to the intake collector. The E.C.C.S. control unit actuates A.A.C. valve by ON/OFF pulse of approximately 160 Hz. The longer that ON duty is left on, the larger the amount of air that will flow through the A.A.C. valve.



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### IDLE-UP SOLENOID VALVE (VG30E engine)

The idle-up solenoid valve is attached to the intake collector. The solenoid valve actuates to stabilize idle speed when engine load is heavy because of electric load, power steering oil pump, etc.

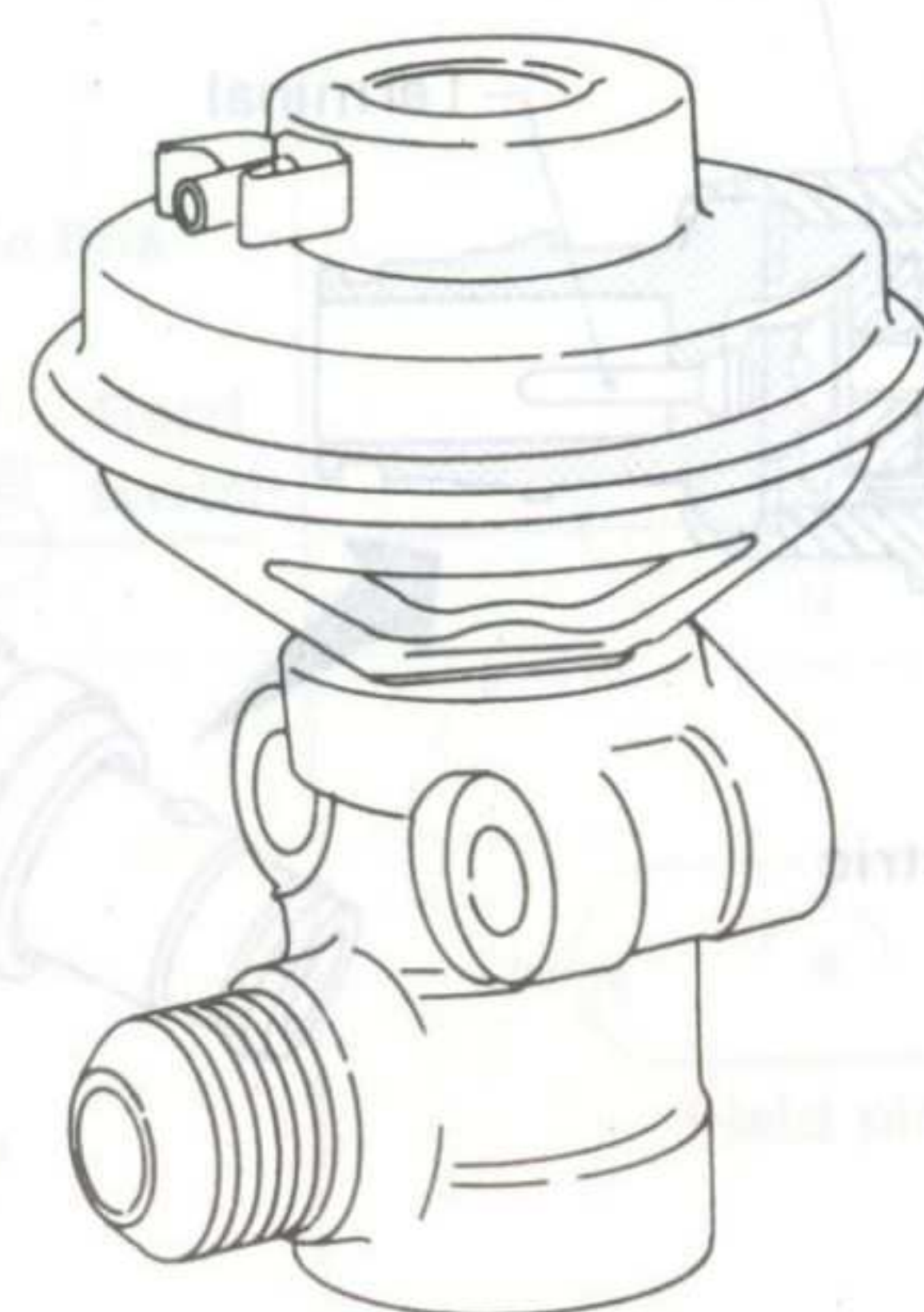


SEF130C

### E.G.R. CONTROL VALVE

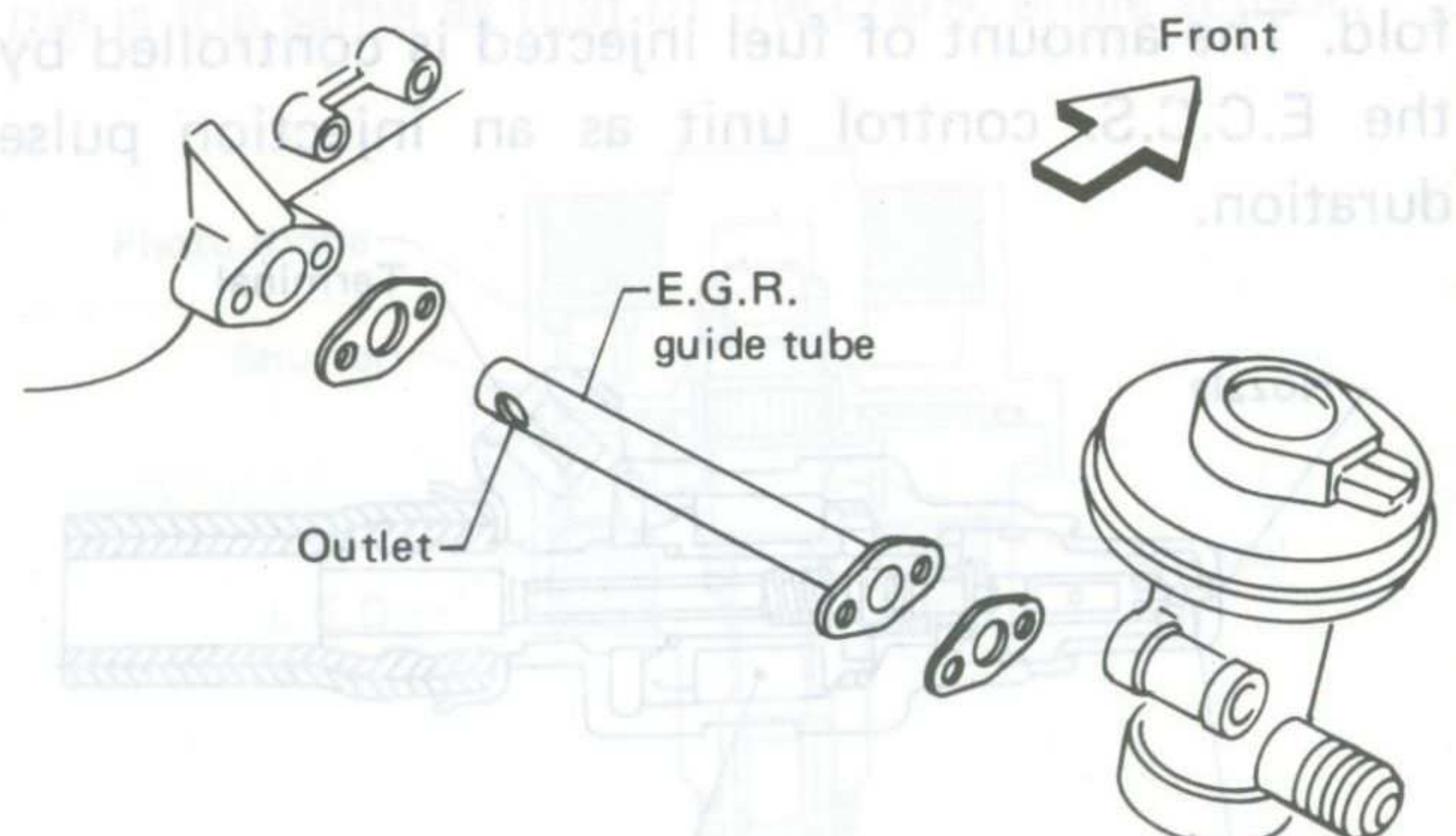
(Sweden, Switzerland and Australia models)

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.



SEF632B

When installing the E.G.R. guide tube, be careful of its direction. Otherwise the distribution efficiency of the exhaust gas will be reduced.



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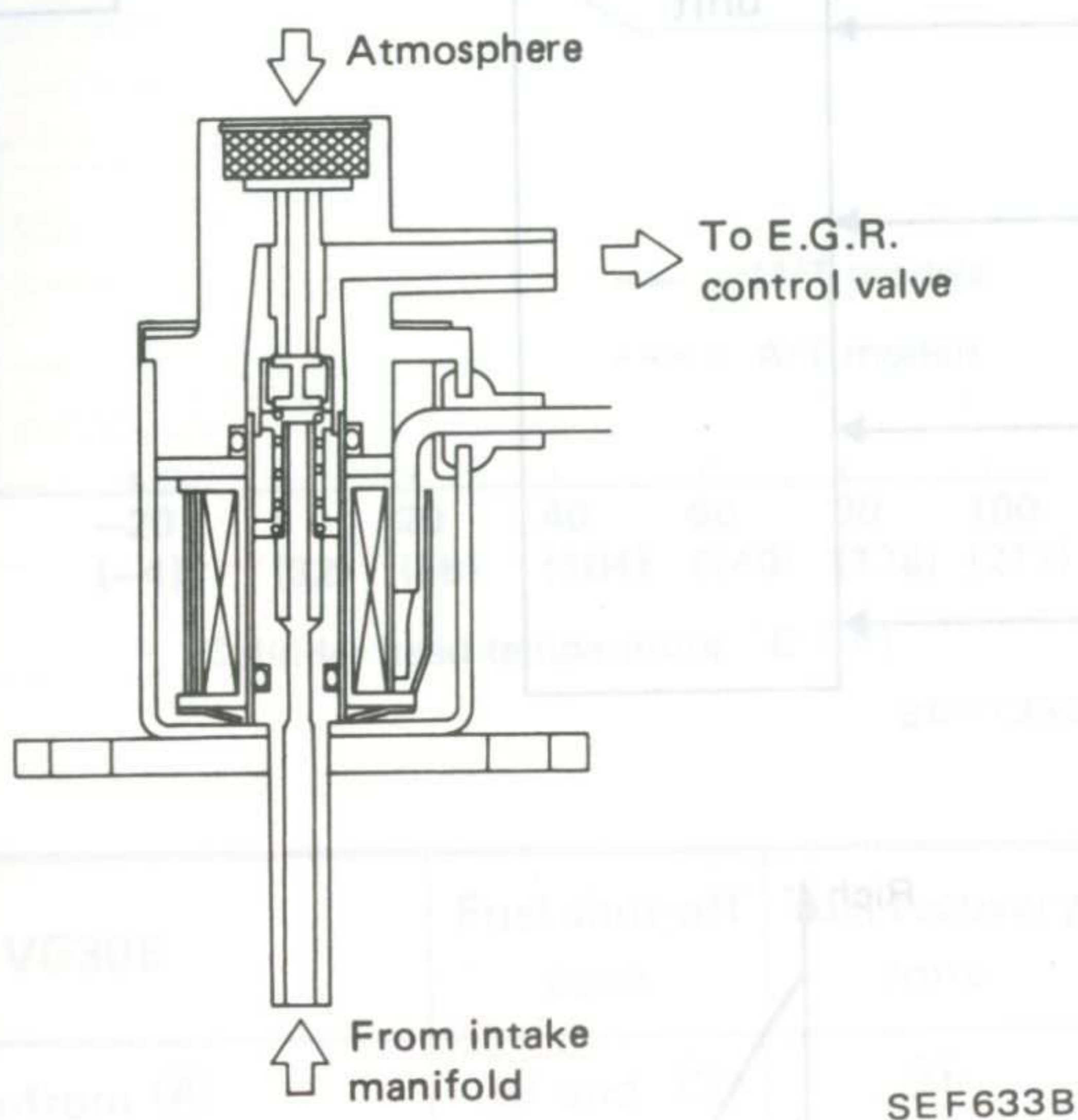


# E.C.C.S. DESCRIPTION

## E.C.C.S. Components (Cont'd)

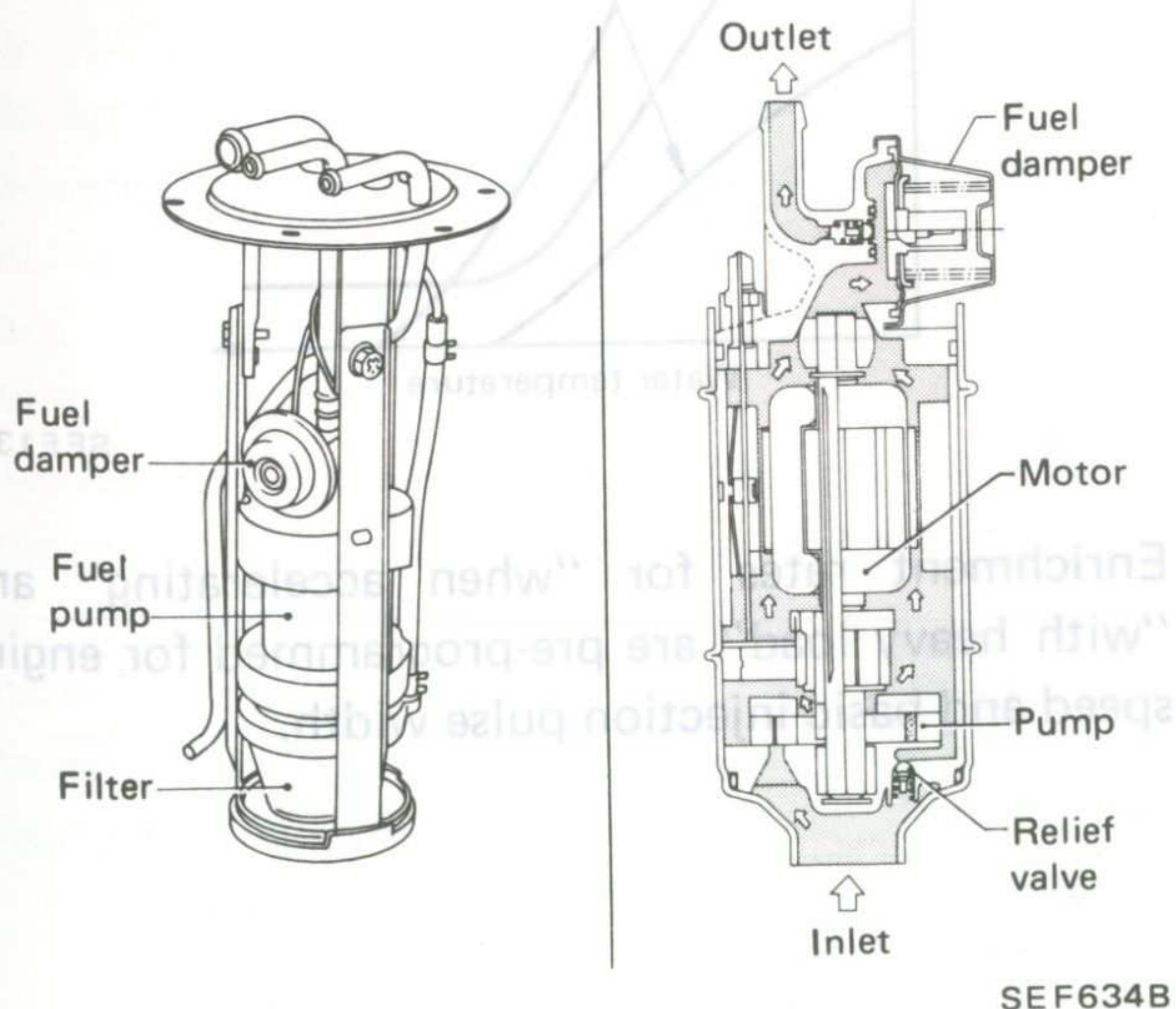
### E.G.R. CONTROL SOLENOID VALVE (Sweden, Switzerland and Australia models)

E.G.R. control solenoid valve cuts intake manifold vacuum signal for E.G.R. control. The solenoid valve actuates in response to the ON/OFF signal from the E.C.C.S. control unit. When the solenoid is off, vacuum signal from intake manifold is fed into the E.G.R. control valve. As the control unit outputs an ON signal, the coil pulls the plunger downward, and cuts the vacuum signal.



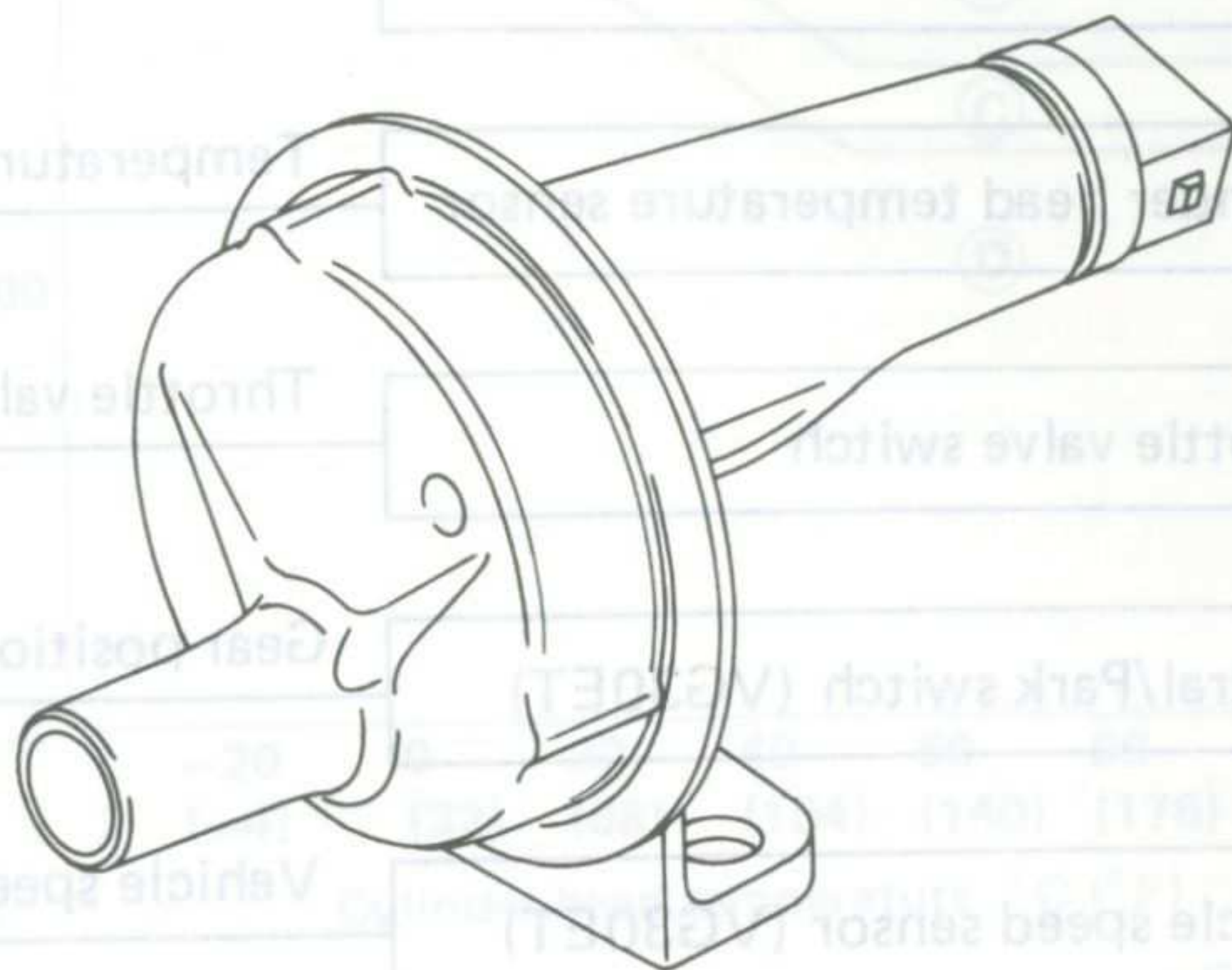
### FUEL PUMP

The fuel pump, which is located in the fuel tank, is a wet type pump where the vane rollers are directly coupled to a motor which is filled with fuel.

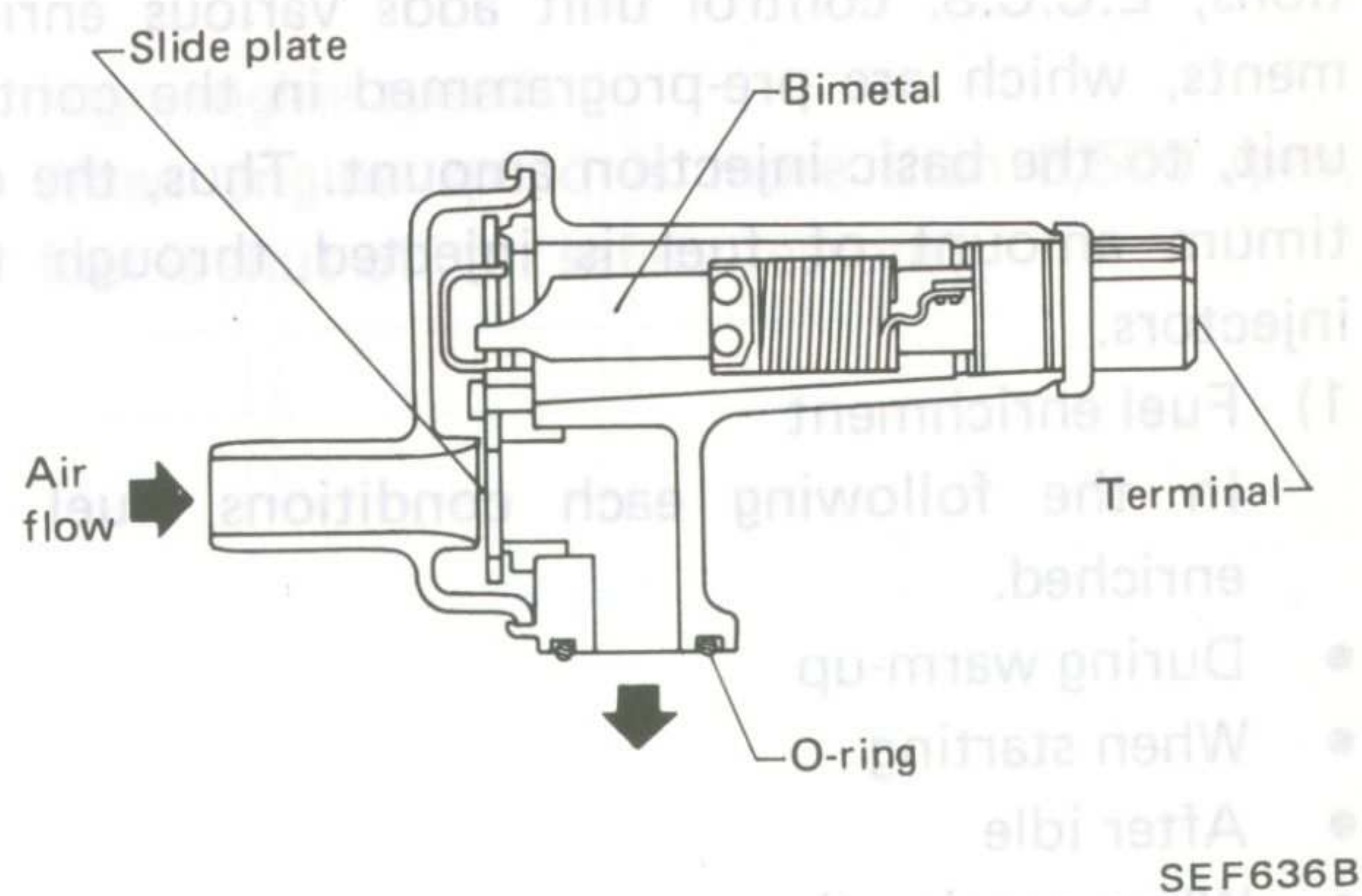


### AIR REGULATOR

Air regulator gives an air by-pass when the engine is cold for the purpose of a fast idle during warm-up.



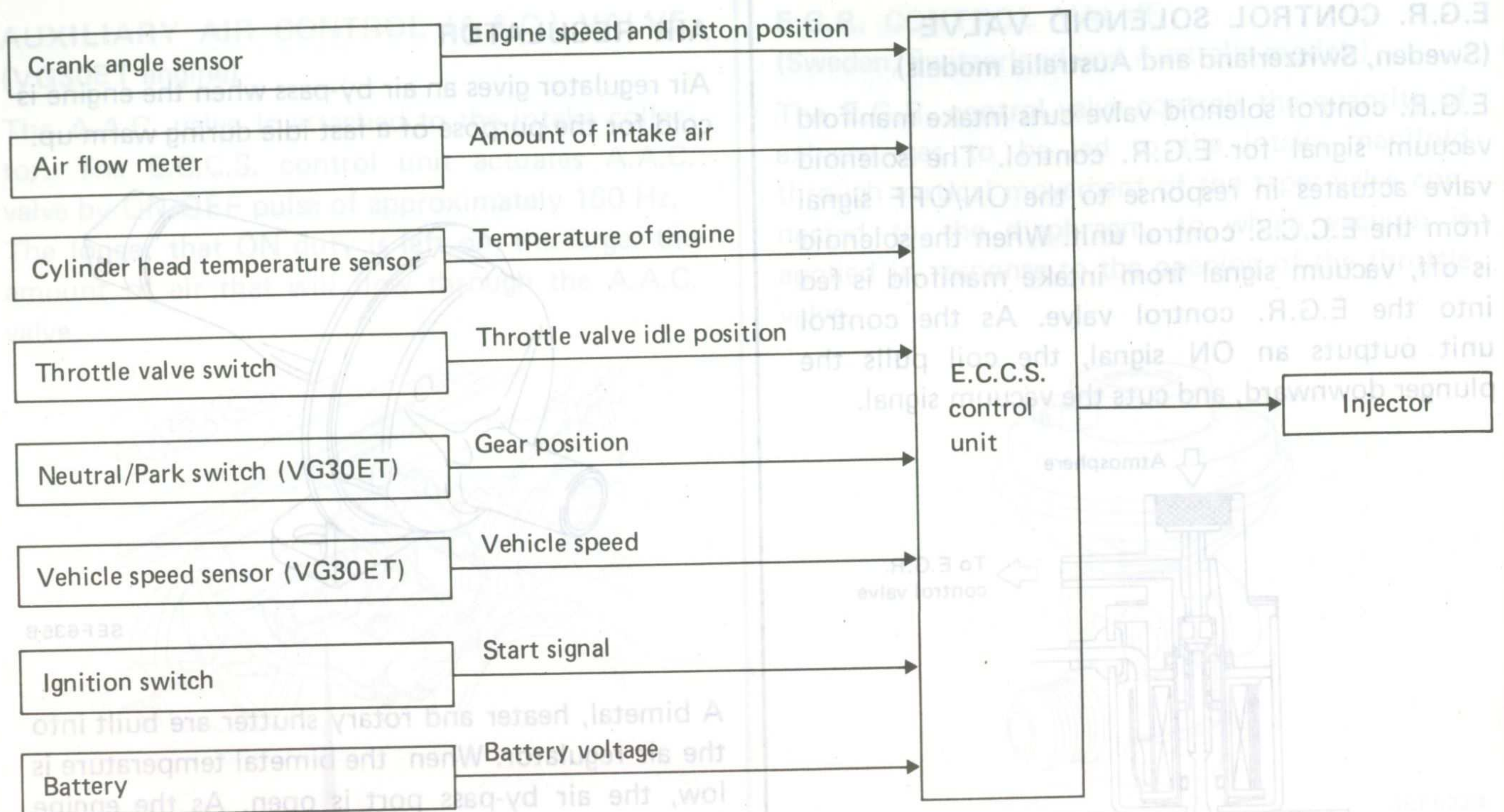
A bimetal, heater and rotary shutter are built into the air regulator. When the bimetal temperature is low, the air by-pass port is open. As the engine starts and electric current flows through a heater, the bimetal begins to rotate the shutter to close off the by-pass port. The air passage remains closed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





# E.C.C.S. DESCRIPTION

## Fuel Injection Control

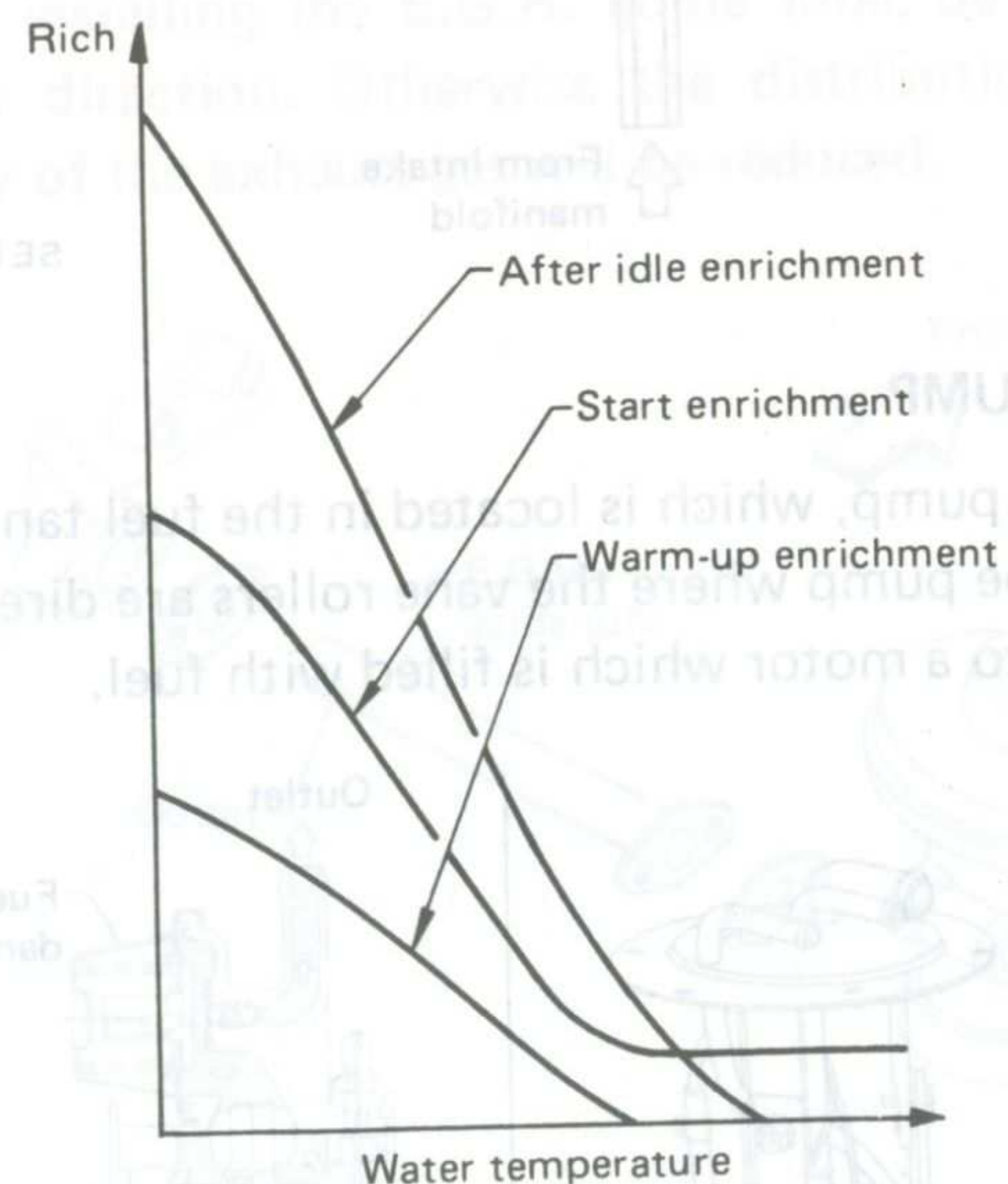


The E.C.C.S. control unit calculates basic injection pulse width by processing signals from crank angle sensor and air flow meter. Receiving signals from each sensor which detects various engine conditions, E.C.C.S. control unit adds various enrichments, which are pre-programmed in the control unit, to the basic injection amount. Thus, the optimum amount of fuel is injected through the injectors.

### 1) Fuel enrichment

In the following each conditions, fuel is enriched.

- During warm-up
- When starting
- After idle
- When accelerating
- With heavy load
- When cylinder head temperature is high.



SEF132C

Enrichment rates for "when accelerating" and "with heavy load" are pre-programmed for engine speed and basic injection pulse width.



# E.C.C.S. DESCRIPTION

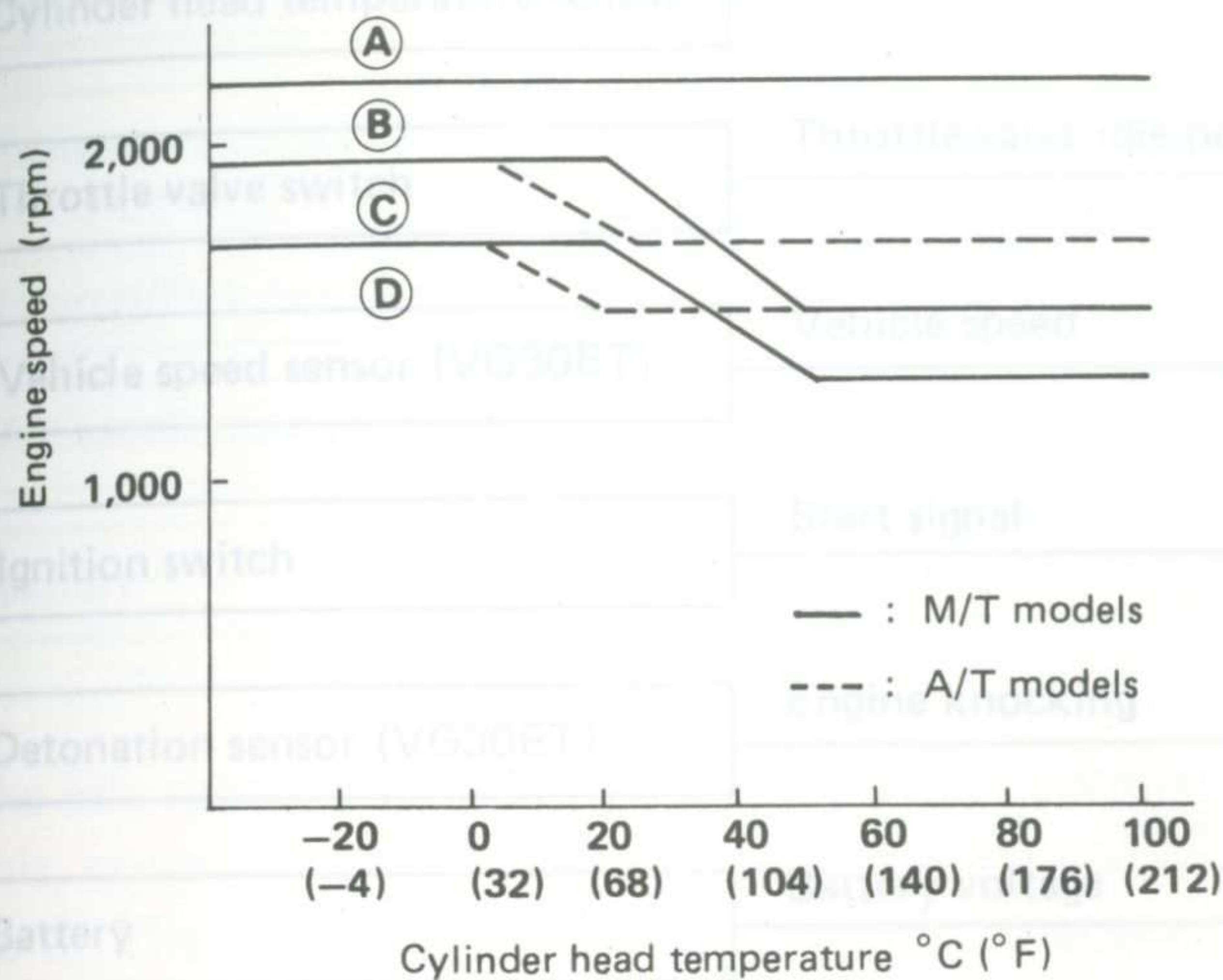
## Fuel Injection Control (Cont'd)

### 2) Fuel shut-off

Fuel shut-off is accomplished under the following conditions:

#### a. During deceleration

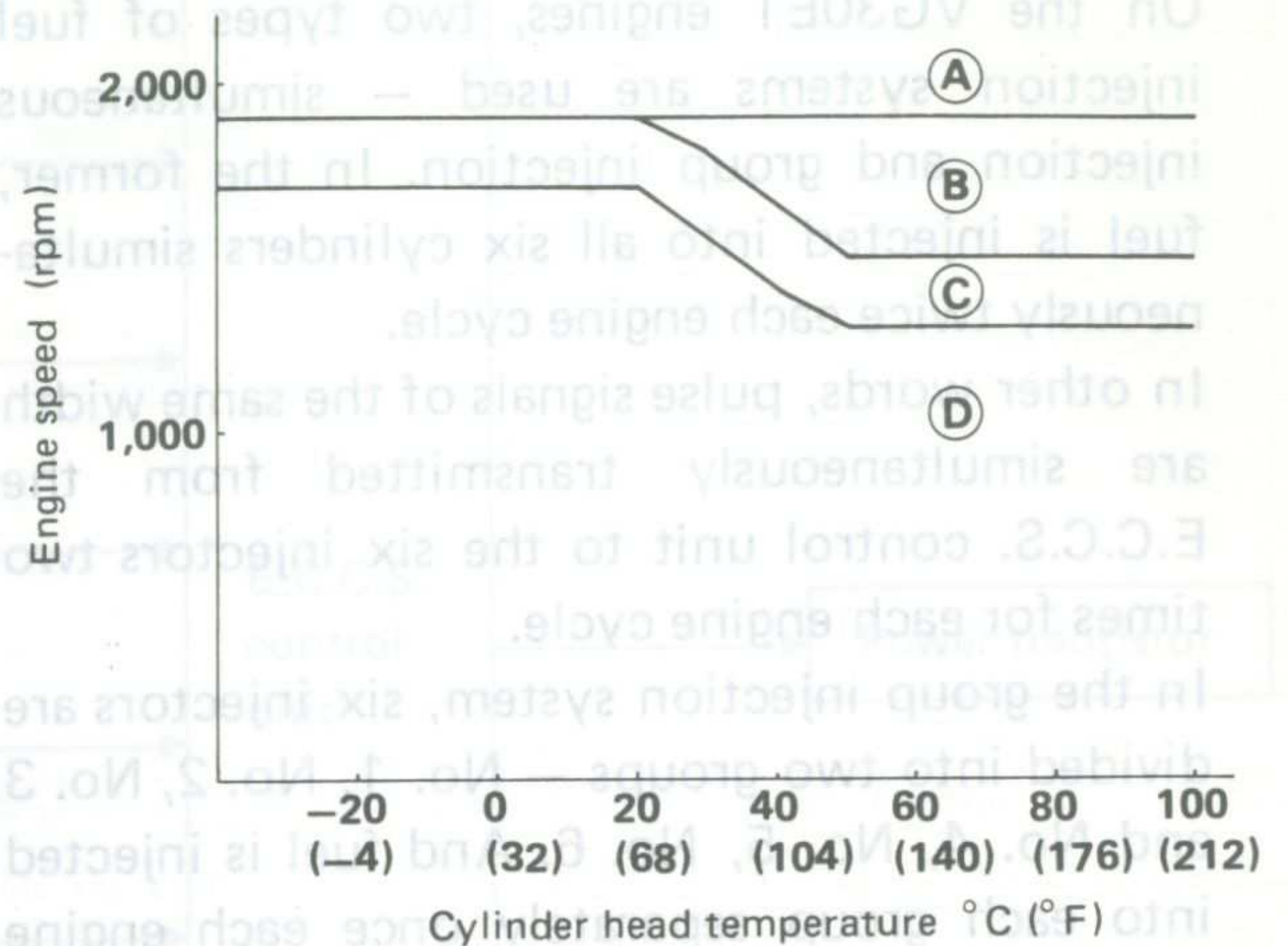
##### VG30E engine



SEF133C

VG30E	Fuel shut-off zone	Fuel recovery zone
Deceleration from (A)	(B) and (C)	(D)
Deceleration from (B)	(C)	(D)
Deceleration from (C) or (D)	—	—

##### VG30ET engine

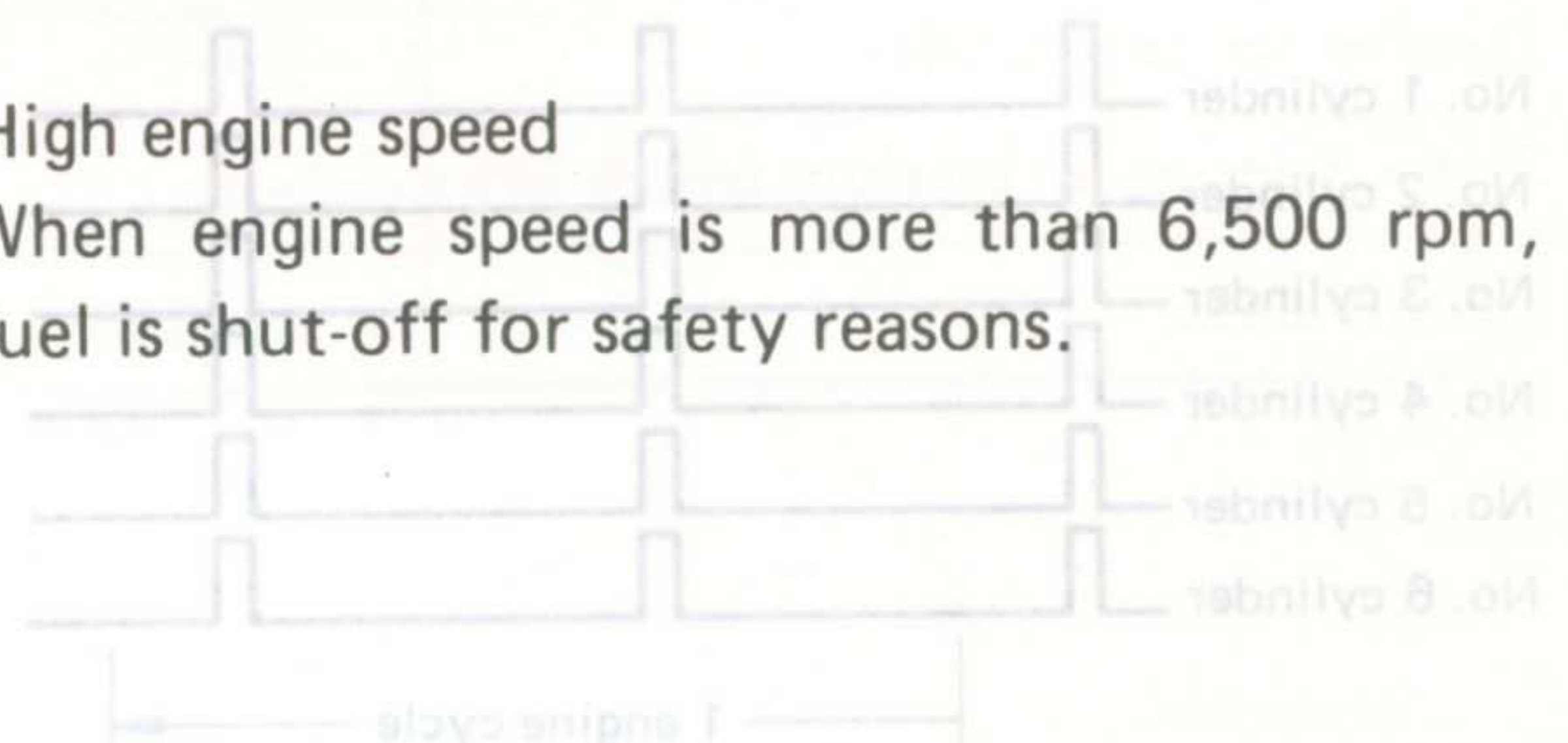


SEF236C

VG30ET	Gear position	Fuel shut-off zone	Fuel recovery zone
Deceleration from (A)	Any position	(B) and (C)	(D)
Deceleration from (B)	1st, 2nd or 3rd	—	—
	4th or 5th	(C)	(D)
Deceleration from (C) or (D)	Any position	—	—

#### b. High engine speed

When engine speed is more than 6,500 rpm, fuel is shut-off for safety reasons.



SEF236C

When any of the following conditions are met, fuel injection shifts to simultaneous injection from group injection.

- Engine speed is more than 3,000 rpm
- Injection pulse duration is more than 5.37ms.
- Cylinder head temperature is below 80°C (176°F).



## E.C.C.S. DESCRIPTION

### Fuel Injection Control (Cont'd)

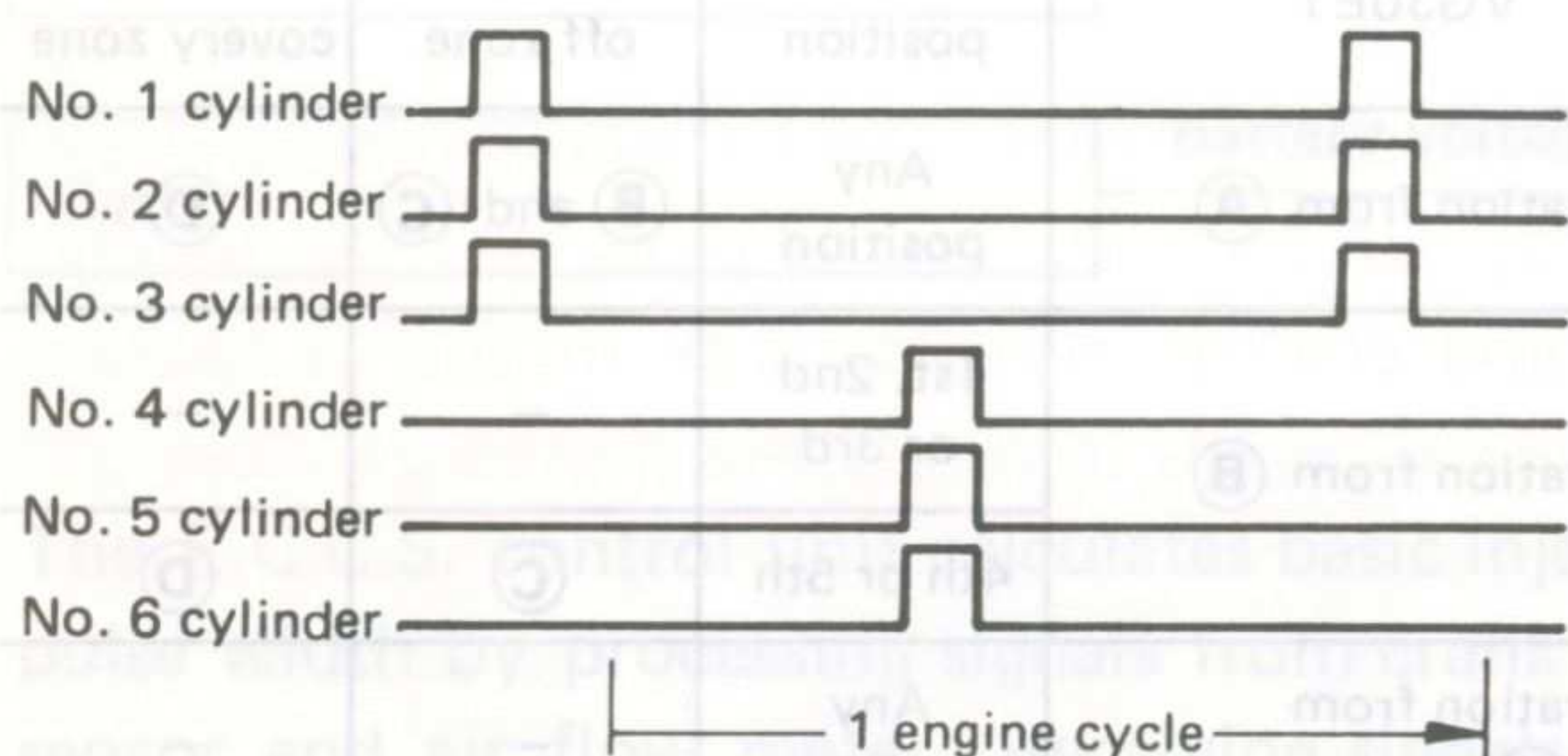
#### 3) Simultaneous injection and group injection

On the VG30ET engines, two types of fuel injection systems are used — simultaneous injection and group injection. In the former, fuel is injected into all six cylinders simultaneously twice each engine cycle.

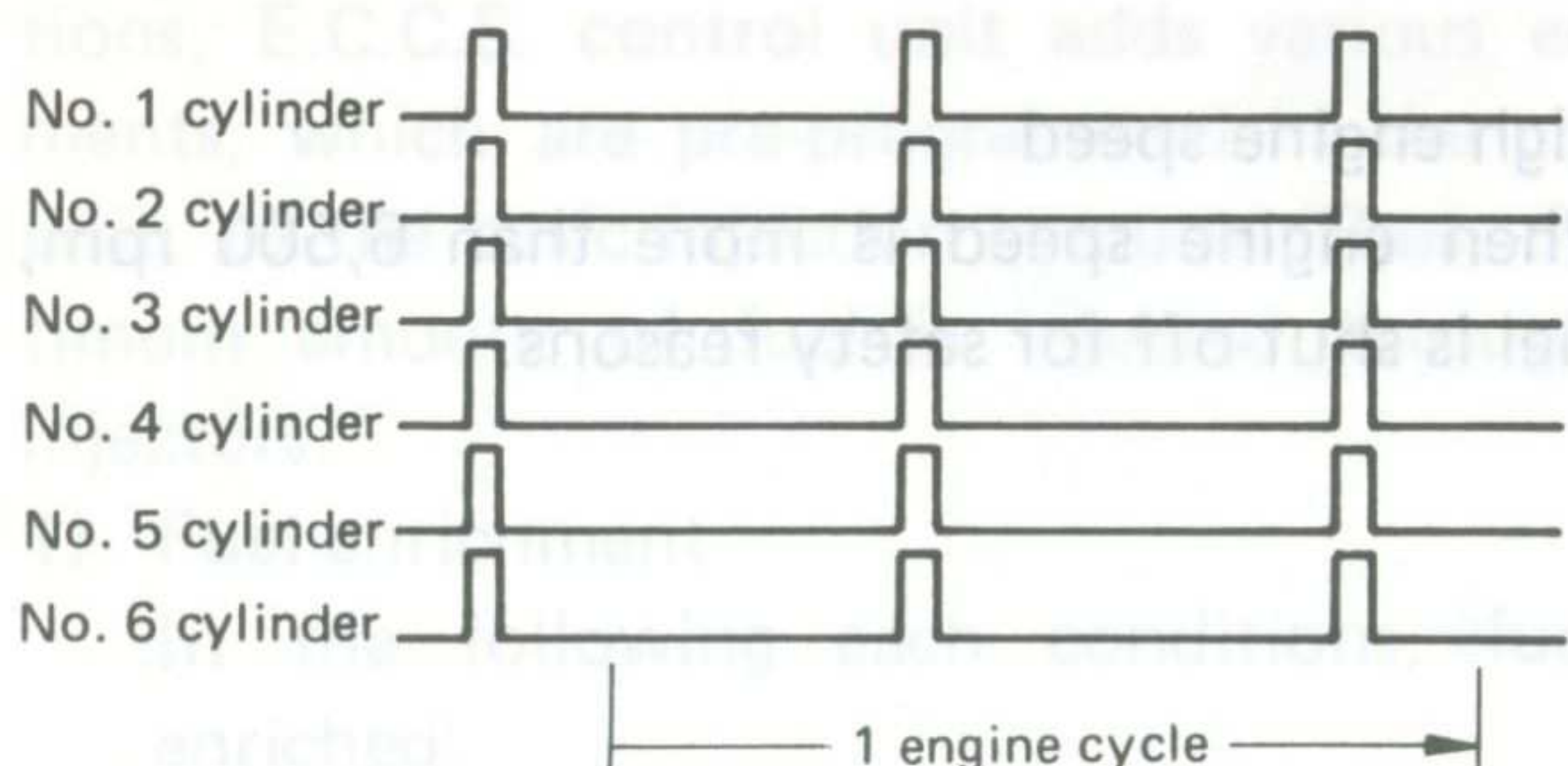
In other words, pulse signals of the same width are simultaneously transmitted from the E.C.C.S. control unit to the six injectors two times for each engine cycle.

In the group injection system, six injectors are divided into two groups — No. 1, No. 2, No. 3 and No. 4, No. 5, No. 6. And fuel is injected into each group separately once each engine cycle.

##### • Group injection



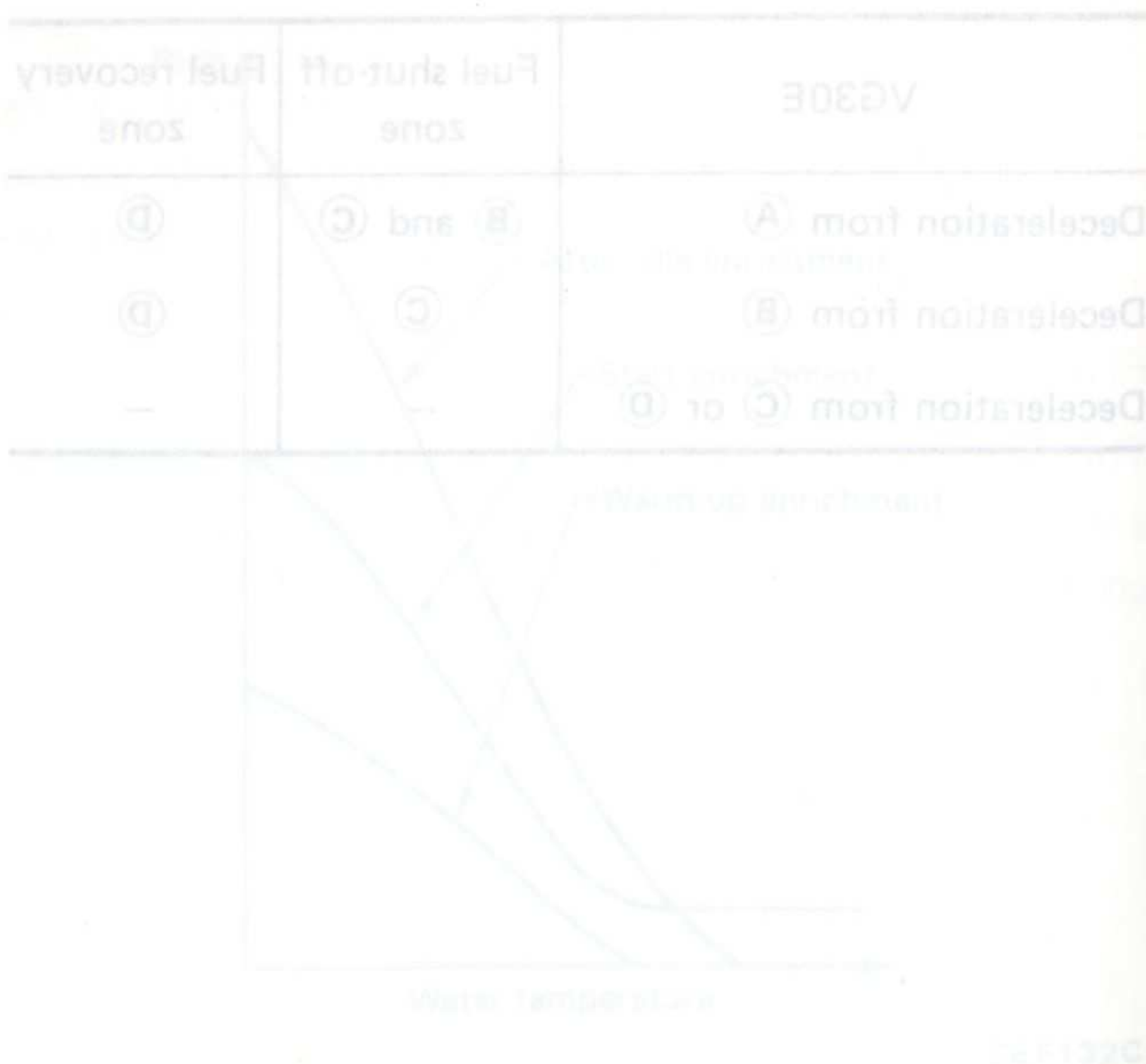
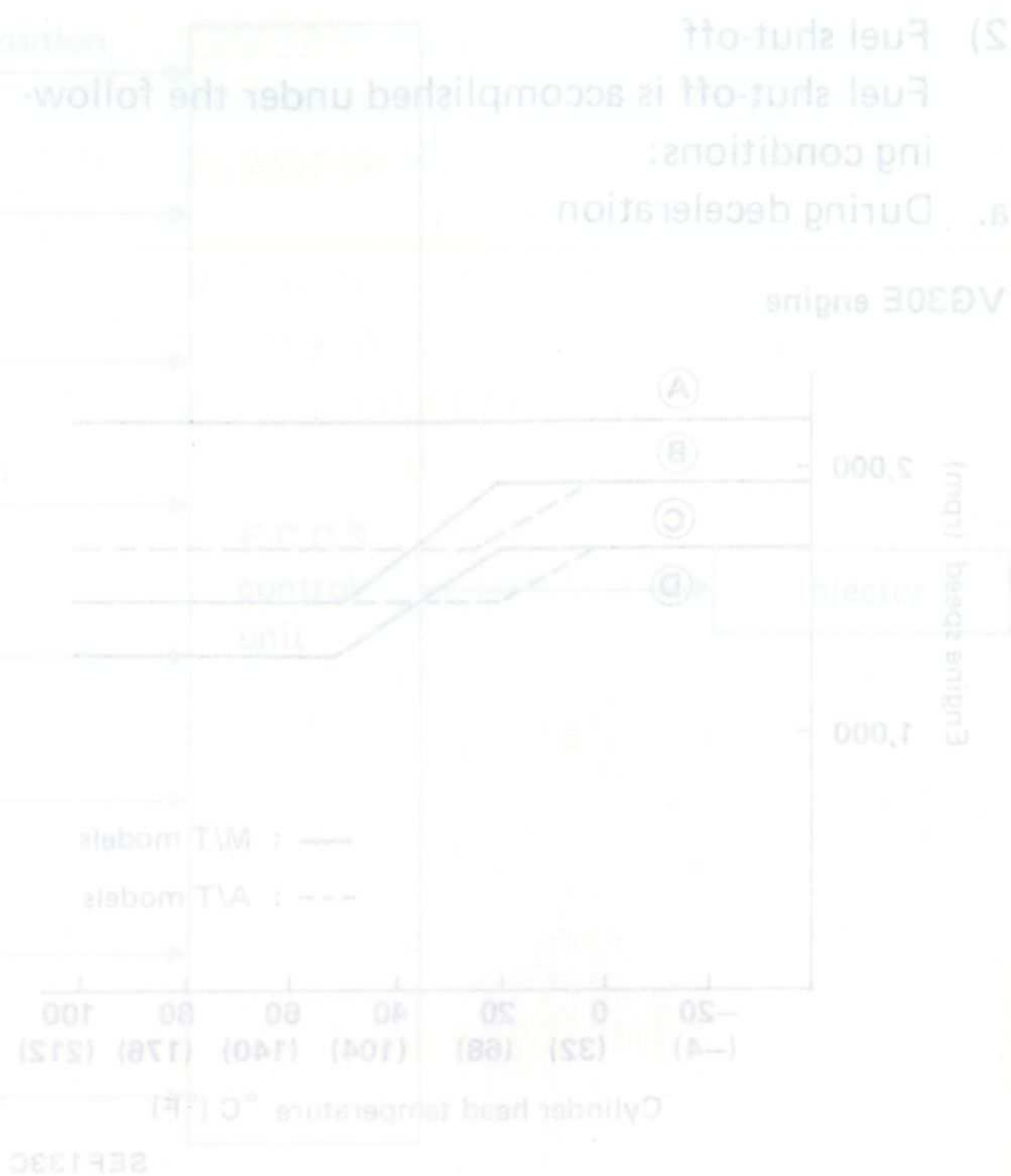
##### • Simultaneous injection



SEF640B

When any of the following conditions are met, fuel injection shifts to simultaneous injection from group injection.

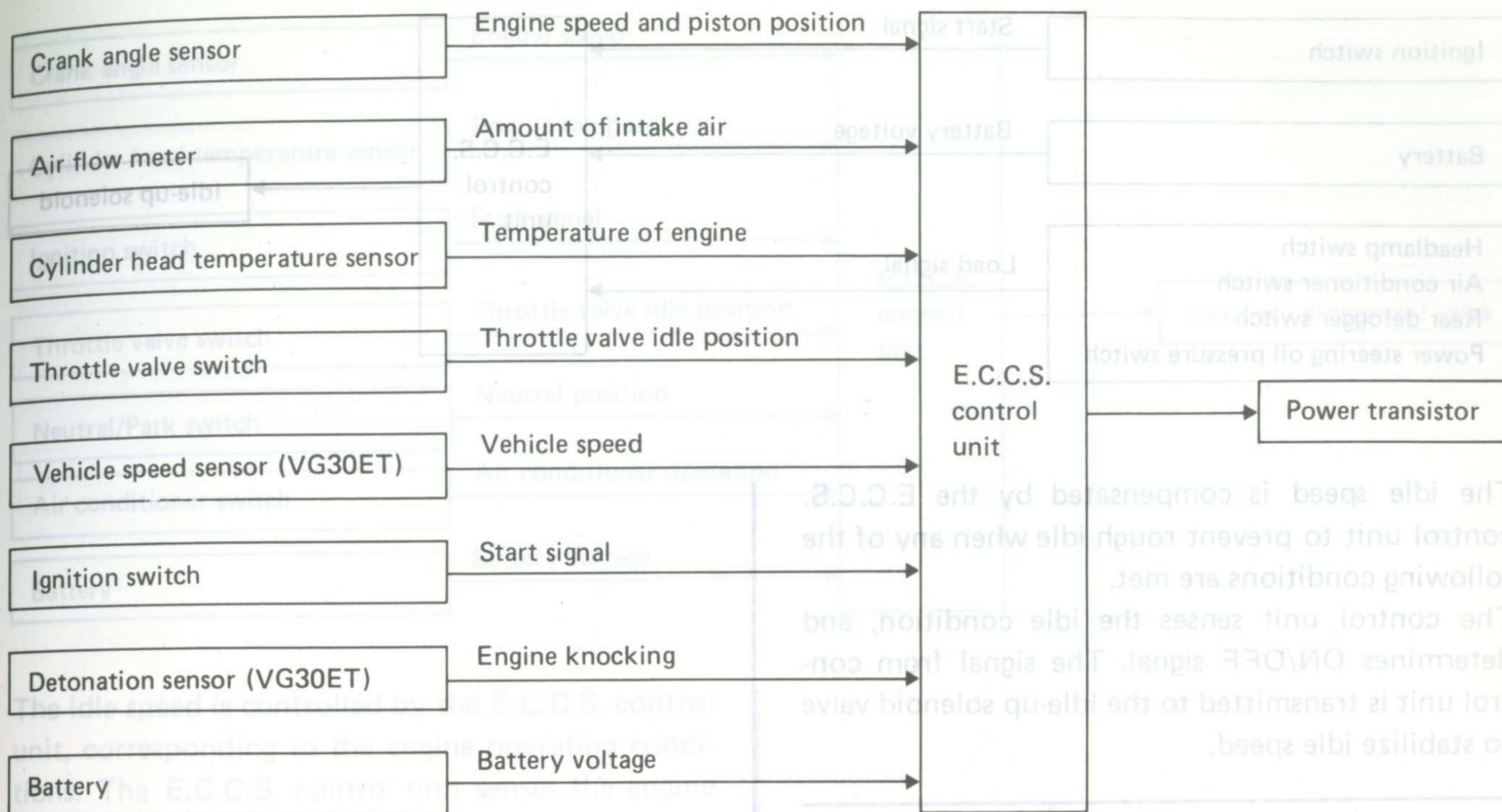
- Engine speed is more than 3,000 rpm.
- Injection pulse duration is more than 5.37ms.
- Cylinder head temperature is below 60°C (140°F).





# E.C.C.S. DESCRIPTION

## Ignition Timing Control



Ignition timing is controlled, corresponding to the engine operating conditions, by the E.C.C.S. control unit: that is, as the optimum ignition timing in each driving condition has been pre-programmed in the control unit, the ignition timing is determined by electrical signals processed in the unit.

The signal from E.C.C.S. control unit is transmitted to power transistor, and controls ignition timing.

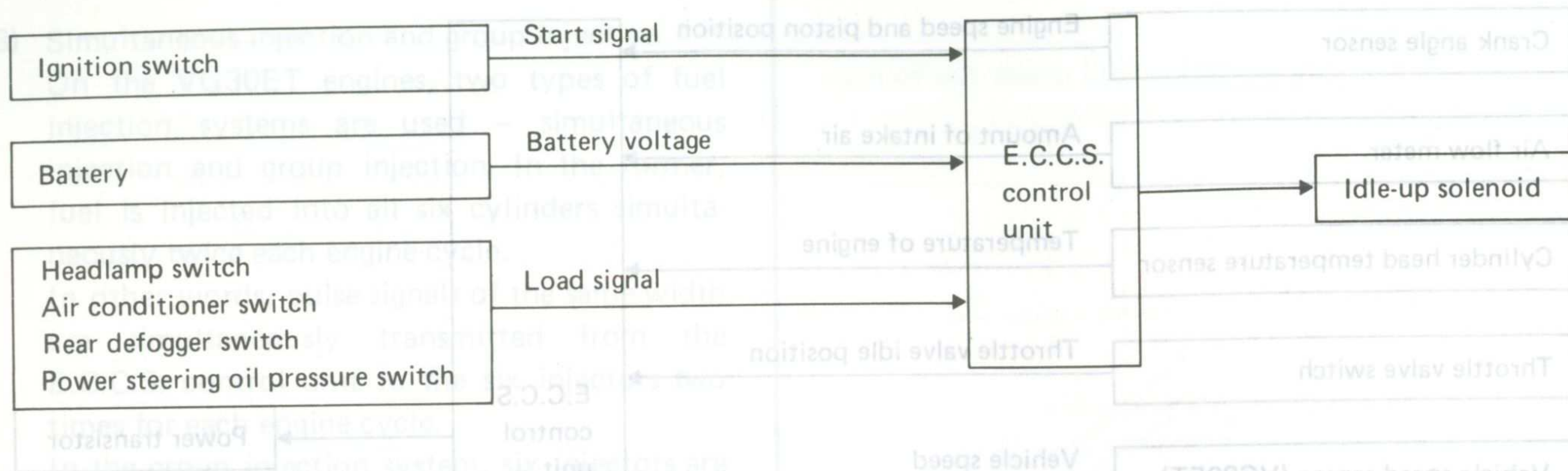
The retard system by detonation sensor is designed only for emergencies on VG30ET engines. The basic ignition timing is pre-programmed within the anti-knocking zone, even if recommended fuel is used under dry conditions. Consequently, the retard system does not operate under normal driving conditions.

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



# E.C.C.S. DESCRIPTION

## Idle-up Control (VG30E engine)



The idle speed is compensated by the E.C.C.S. control unit to prevent rough idle when any of the following conditions are met.

The control unit senses the idle condition, and determines ON/OFF signal. The signal from control unit is transmitted to the idle-up solenoid valve to stabilize idle speed.

Condition	Idle-up solenoid operation
During engine start	ON
20 seconds after engine start	
Battery voltage is below 12V	
Headlamp switch ON	
Cooling fan switch ON	
Power steering oil pressure switch ON	OFF
Except above	

Ignition timing is controlled, corresponding to the engine operating conditions, by the E.C.C.S. control unit: that is, as the optimum ignition timing in each driving condition has been pre-programmed in the control unit, the ignition timing is determined by electrical signals processed in the unit. The signal from E.C.C.S. control unit is transmitted to power transistor, and controls ignition timing.

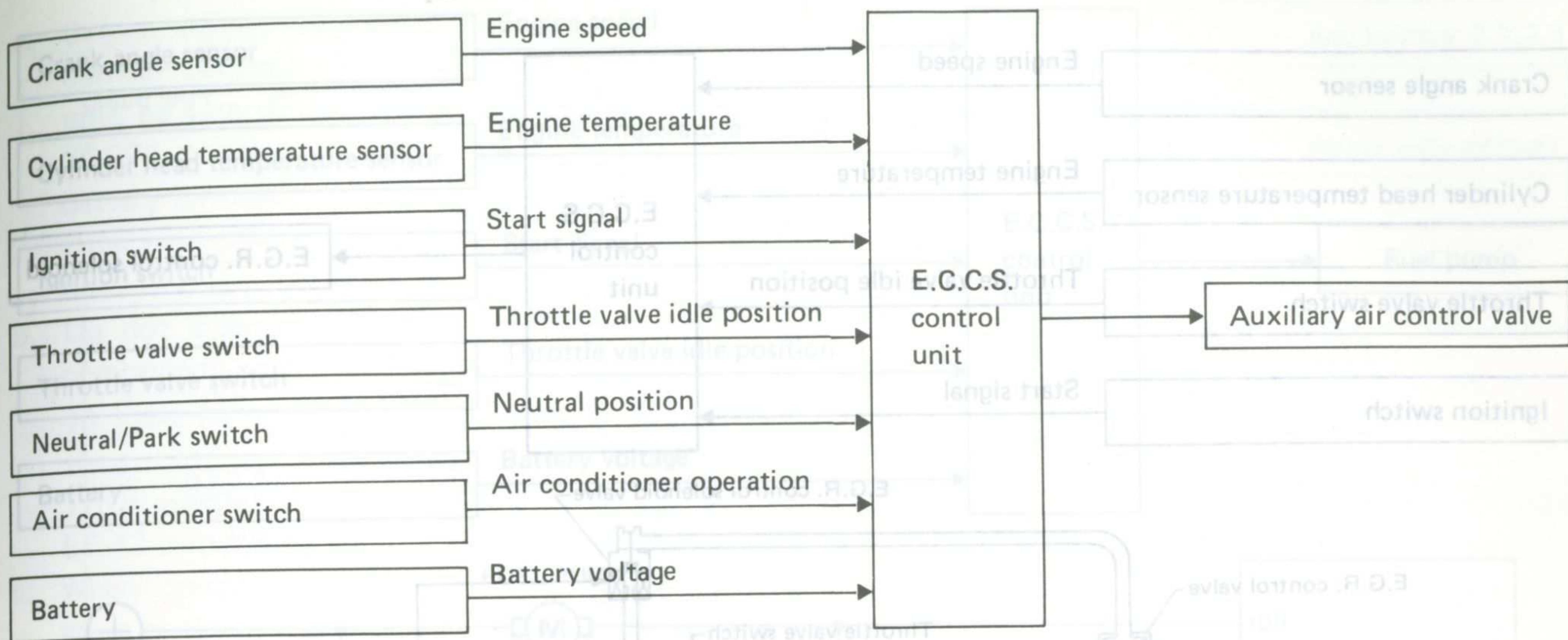
The retard system by detonation sensor is designed only for emergencies on VG30ET engines. The basic ignition timing is pre-programmed within the anti-knocking zone, even if recommended fuel is used under dry conditions. Consequently, the retard system does not operate under normal driving conditions.

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

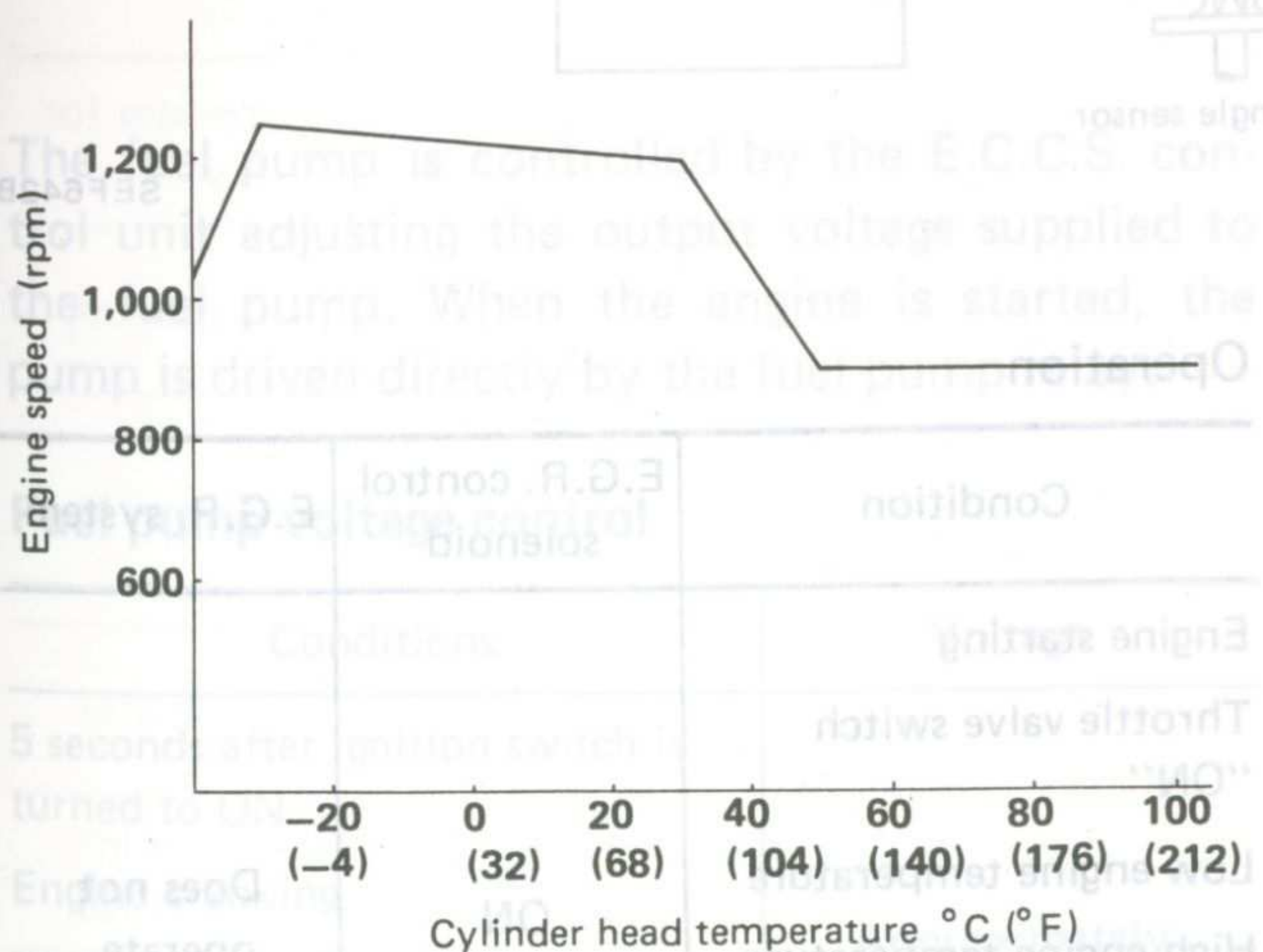


# E.C.C.S. DESCRIPTION

## Idle Speed Control (VG30ET engine)



The idle speed is controlled by the E.C.C.S. control unit, corresponding to the engine operating conditions. The E.C.C.S. control unit senses the engine condition and determines the best idle speed at each cylinder head temperature and gear position. The control unit then sends an electronic signal corresponding to the difference between the best idle speed and the actual idle speed to the A.A.C. valve.

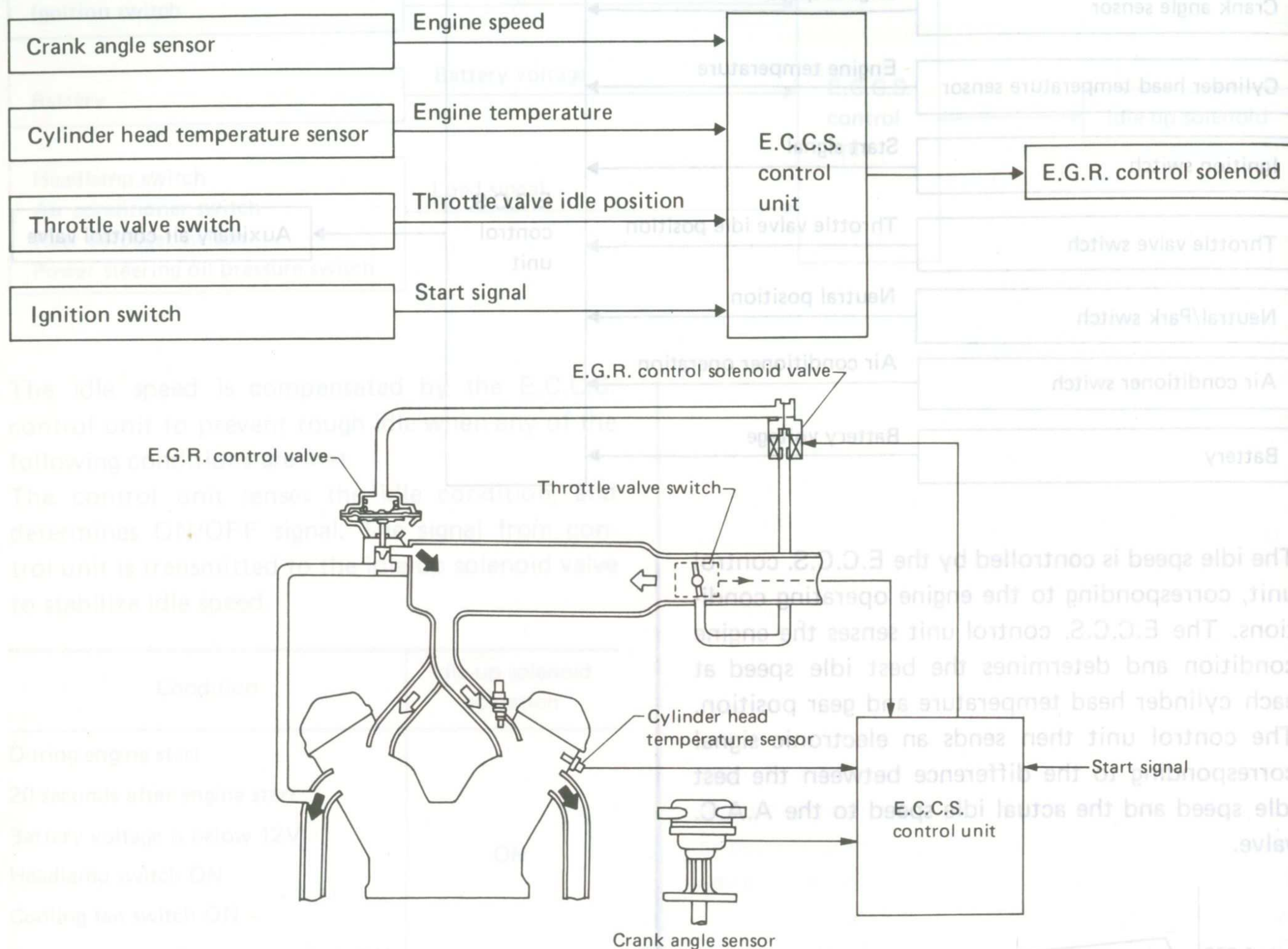


SEF237C



## E.C.C.S. DESCRIPTION

### Exhaust Gas Recirculation (E.G.R.) Control (Sweden, Switzerland and Australia)



SEF642B

#### OPERATION

In the exhaust gas recirculation system, some of the exhaust gas is returned to the combustion chamber to lower the flame temperature during combustion. This results in a reduction of the nitrogen oxide density in the exhaust gas.

When the E.G.R. control valve is open, some of the exhaust gas is led from the exhaust manifold to the E.G.R. tube. The exhaust gas is then regulated by E.G.R. valve, and is introduced into the intake manifold.

The signal from the E.C.C.S. control unit is sent to the E.G.R. control solenoid valve, which cuts the vacuum line for the E.G.R. control valve when any of the following conditions are met.

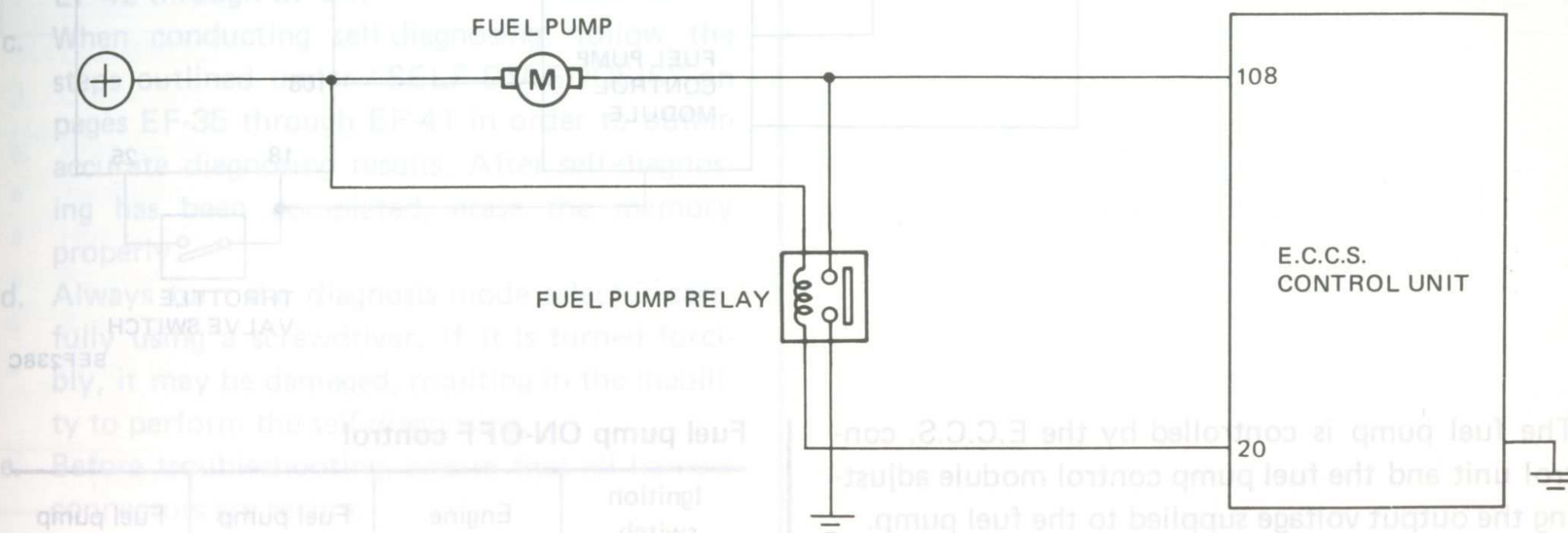
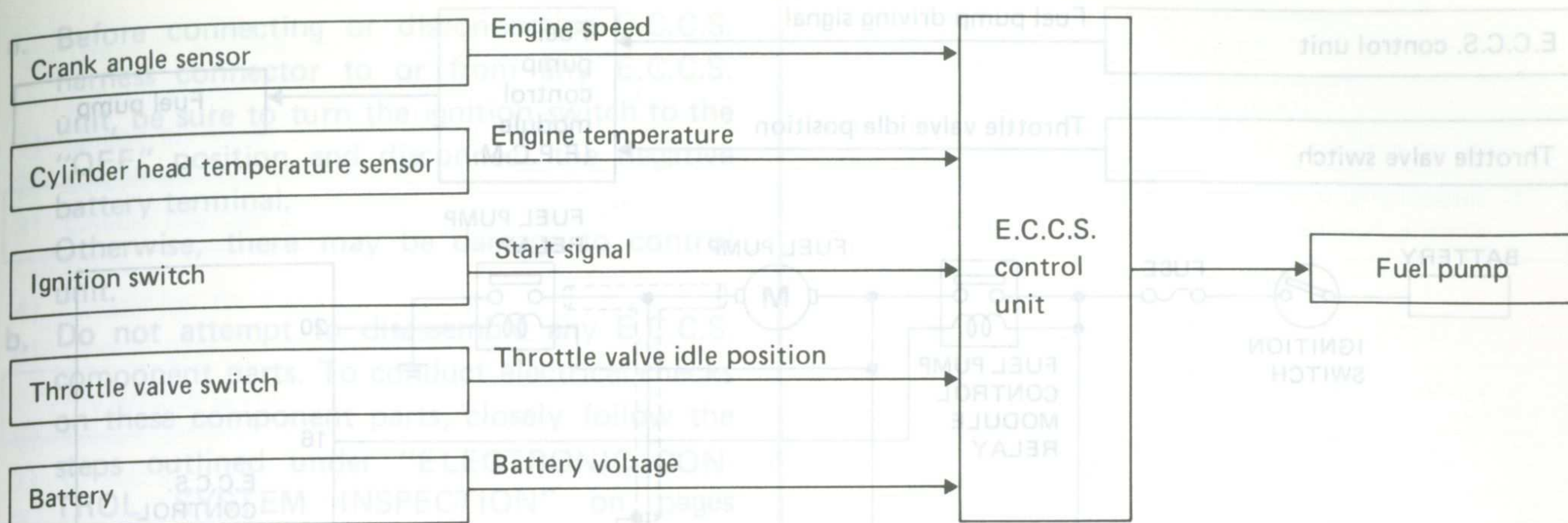
#### Operation

Condition	E.G.R. control solenoid	E.G.R. system
Engine starting	ON	Does not operate
Throttle valve switch "ON"		
Low engine temperature		
High engine temperature		
Engine speed below 900 rpm above 3,200 rpm	OFF	Operates
Except above		



# E.C.C.S. DESCRIPTION

## Fuel Pump Control (VG30E engine)



SEF643B

The fuel pump is controlled by the E.C.C.S. control unit adjusting the output voltage supplied to the fuel pump. When the engine is started, the pump is driven directly by the fuel pump relay.

### Fuel pump voltage control

Conditions	Voltage
5 seconds after ignition switch is turned to ON	Approximately 13.4 [V]
Engine cranking	
25.5 seconds after engine start [above 50°C (122°F)]	
Engine temp. above 90°C (194°F)	
Engine temp. below 10°C (50°F)	9.4 ~ 13.4 [V]
Except above	

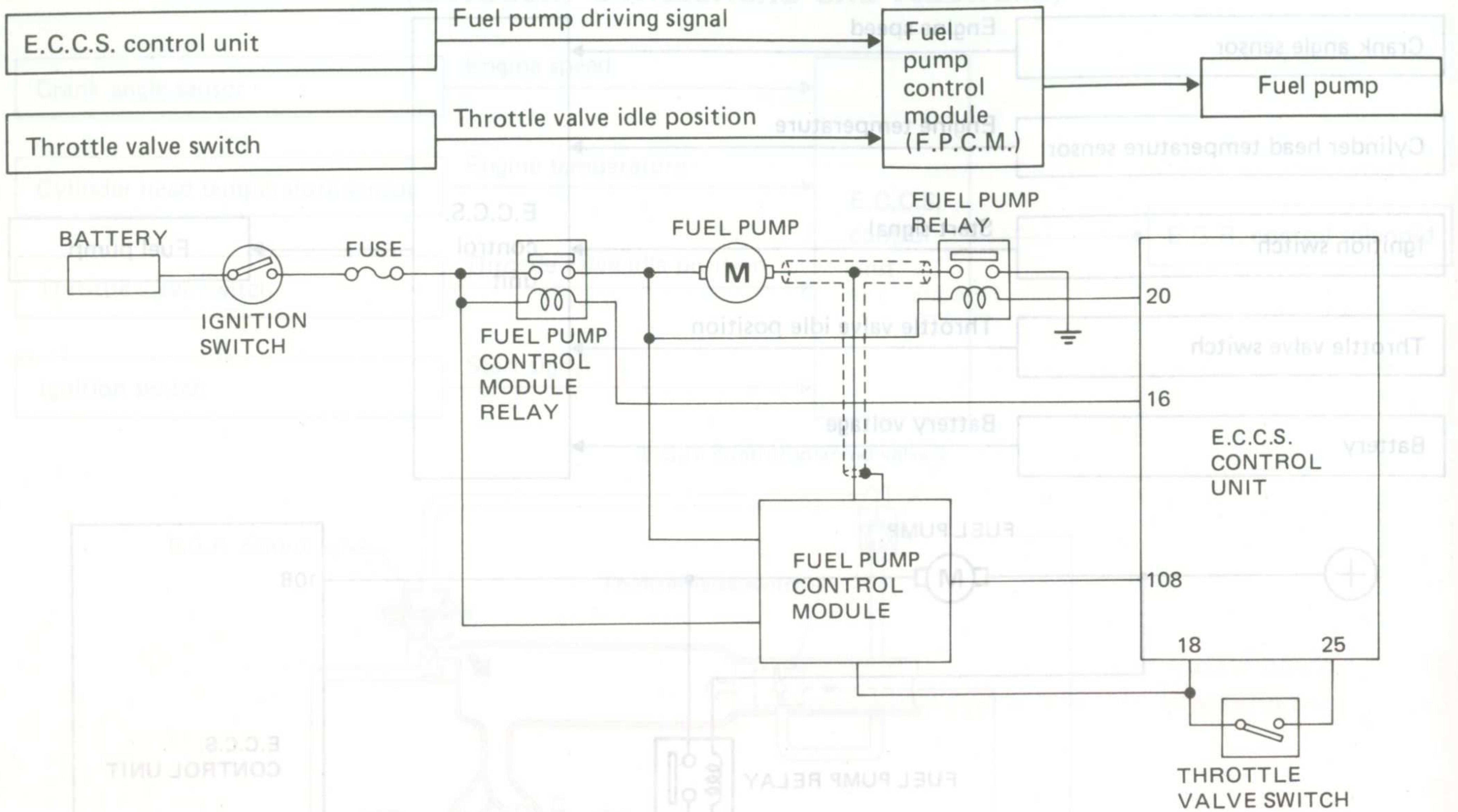
### Fuel pump ON-OFF control

Ignition switch position	Engine condition	Fuel pump relay	Fuel pump operation
ON	Stopped	OFF	Operates for 5 seconds
	Starting	ON for 30 seconds	Operates
	Running	OFF	Operates
	After stall	OFF	Stops in 1 second



## E.C.C.S. DESCRIPTION

## Fuel Pump Control (VG30ET engine)



SE F238C

The fuel pump is controlled by the E.C.C.S. control unit and the fuel pump control module adjusting the output voltage supplied to the fuel pump. When the engine is started, the pump is driven directly by the fuel pump relay.

At idle, fuel pump voltage is kept low to reduce the operating noise.

## Fuel pump ON-OFF control

Ignition switch position	Engine condition	Fuel pump relay	Fuel pump operation
ON	Stopped	ON for 5 seconds	Operates for 5 seconds
	Starting	ON for 30 seconds	Operates
	Running (normal driving)	OFF	Operates
	Running (heavy load)	ON	Operates
	After stall	OFF	Stop in 1 second

## Fuel pump voltage control

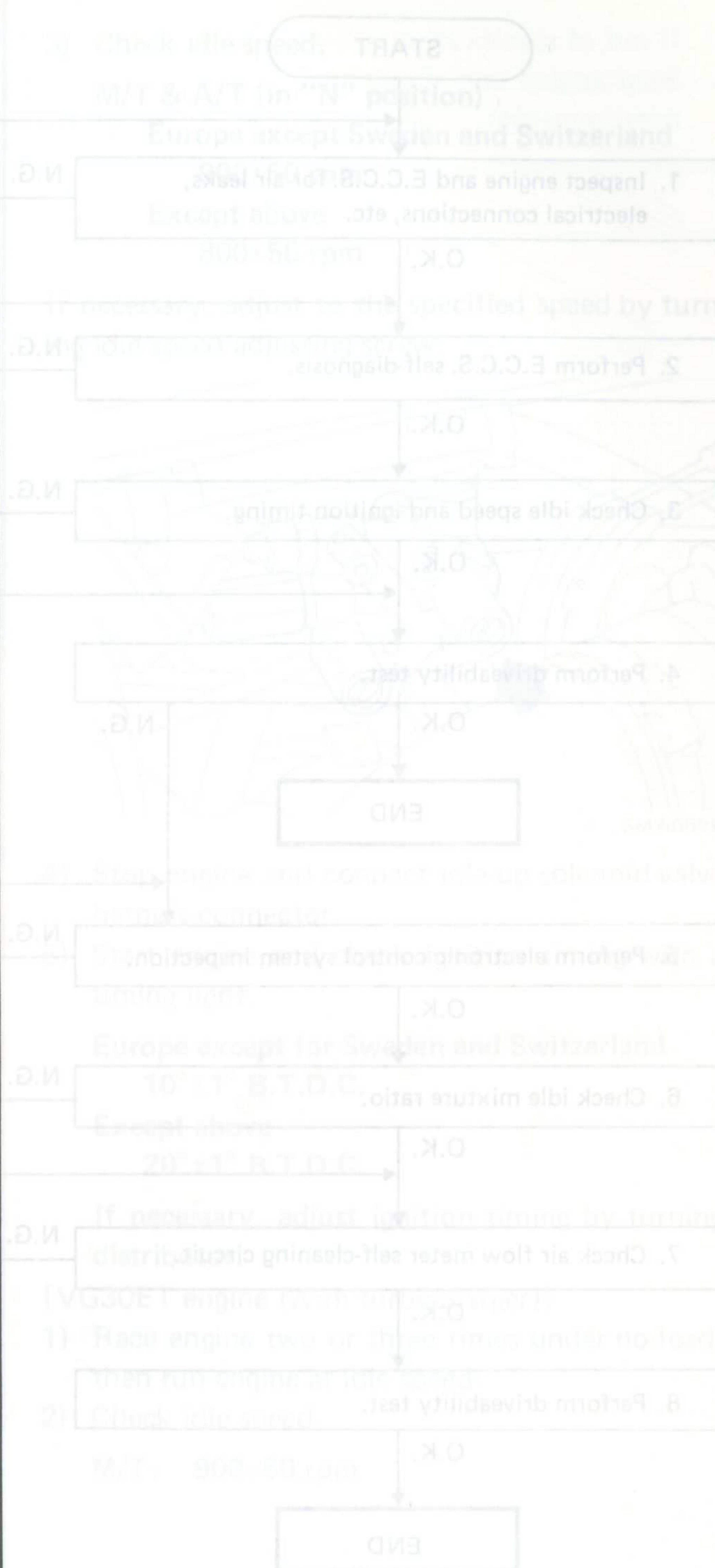
Idle switch	Voltage
ON	Approximately 8.9[V]
OFF	Above (Battery voltage-0.8) [V]



# DIAGNOSTIC PROCEDURE

## Caution

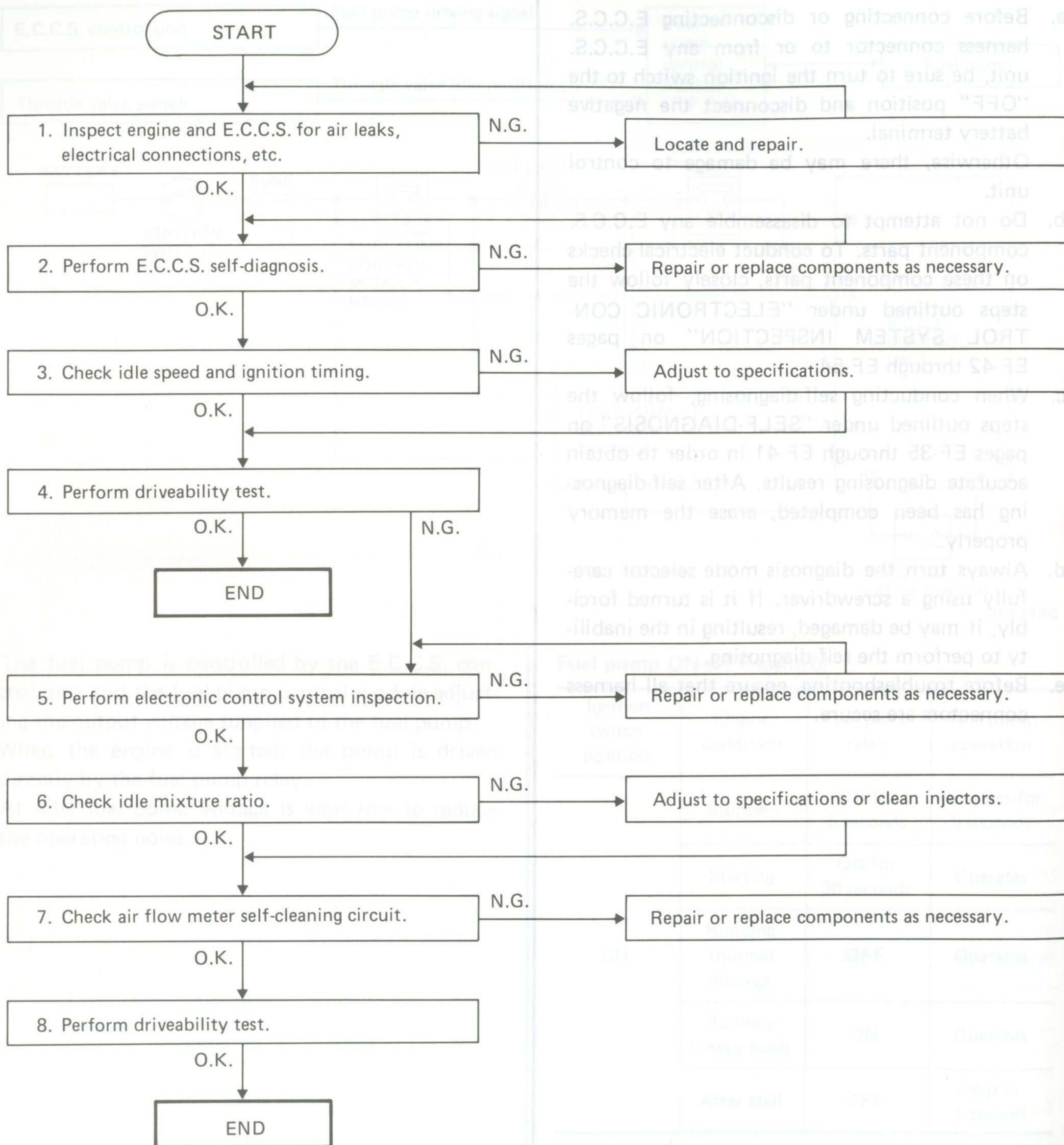
- Before connecting or disconnecting E.C.C.S. harness connector to or from any E.C.C.S. unit, be sure to turn the ignition switch to the "OFF" position and disconnect the negative battery terminal. Otherwise, there may be damage to control unit.
- Do not attempt to disassemble any E.C.C.S. component parts. To conduct electrical checks on these component parts, closely follow the steps outlined under "ELECTRONIC CONTROL SYSTEM INSPECTION" on pages EF-42 through EF-54.
- When conducting self-diagnosing, follow the steps outlined under "SELF-DIAGNOSIS" on pages EF-35 through EF-41 in order to obtain accurate diagnosing results. After self-diagnosing has been completed, erase the memory properly.
- Always turn the diagnosis mode selector carefully using a screwdriver. If it is turned forcibly, it may be damaged, resulting in the inability to perform the self-diagnosing.
- Before troubleshooting, ensure that all harness connectors are secure.





# DIAGNOSTIC PROCEDURE

## Driveability





# DIAGNOSTIC PROCEDURE

## Driveability (Cont'd)

1. Inspect engine and E.C.C.S. for air leaks, proper electrical connections, etc.

- 1) Check all hoses and ducts for air leaks.
- 2) Check air cleaner for clogging.
- 3) Check harness connectors for proper connections.
- 4) Check ignition wiring.
- 5) Check gaskets for leaks at all air intake components.

6) Check E.G.R. valve operation.  
7) Check air regulator operation.  
2. Perform E.C.C.S. self-diagnosis.  
Follow the procedure in E.C.C.S. SELF-DIAGNOSIS (Page EF-35).

3. Check idle speed and ignition timing.

a. Prepare the following conditions:

- Headlamp switch: OFF
- Heater blower: OFF
- Rear window defogger: OFF
- Air conditioner switch: OFF
- Front wheel (Power steering model):

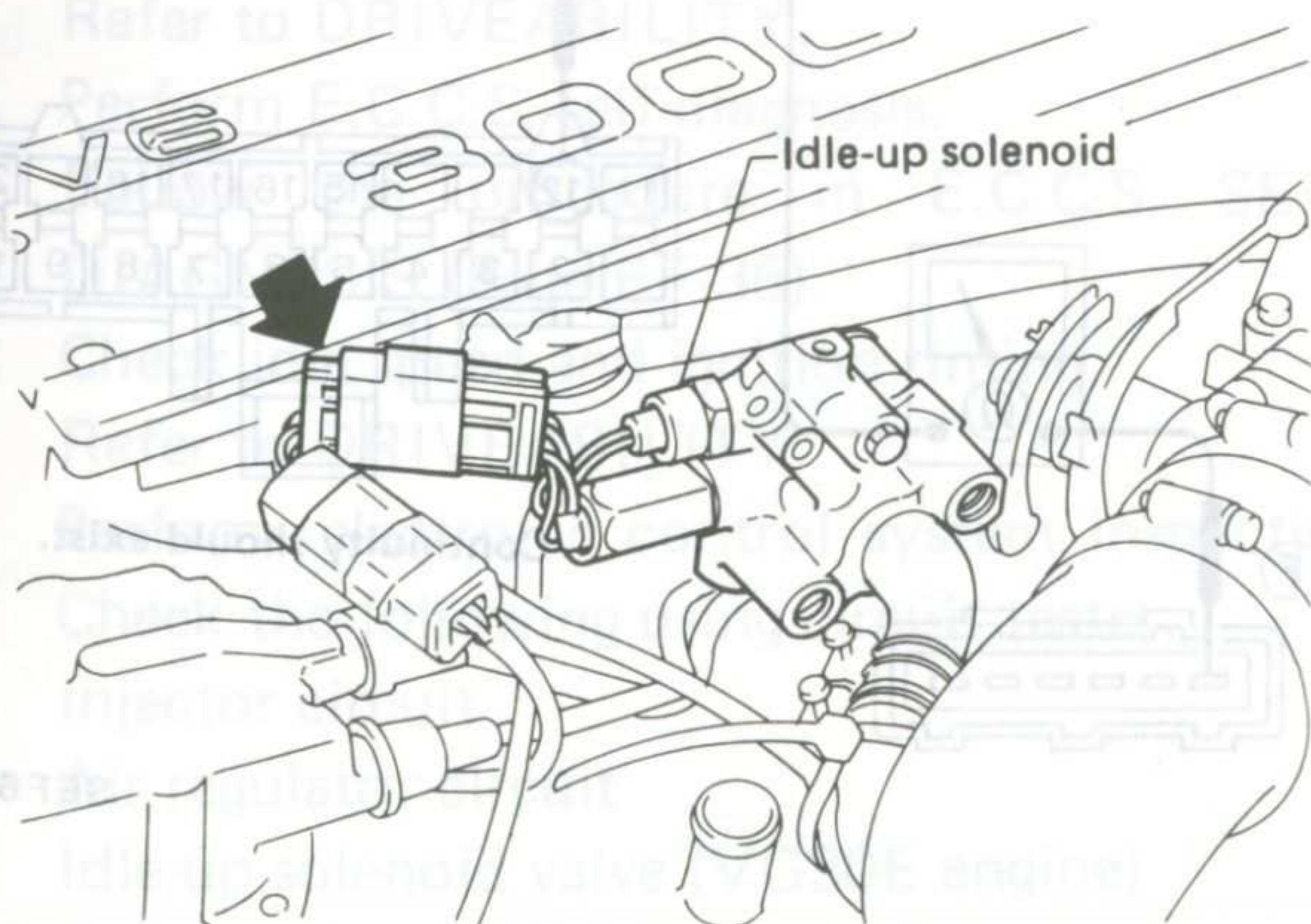
**KEEP STRAIGHT AHEAD**

b. Warm engine to operating temperature.

Check and adjust as follows:

[VG30E engine (Without turbocharger)]

1) Stop engine and disconnect idle-up solenoid valve harness connector.



SEF644B

2) Start engine and race engine two or three times under no-load, then run engine at idle speed.

3) Check idle speed.

M/T & A/T (in "N" position)

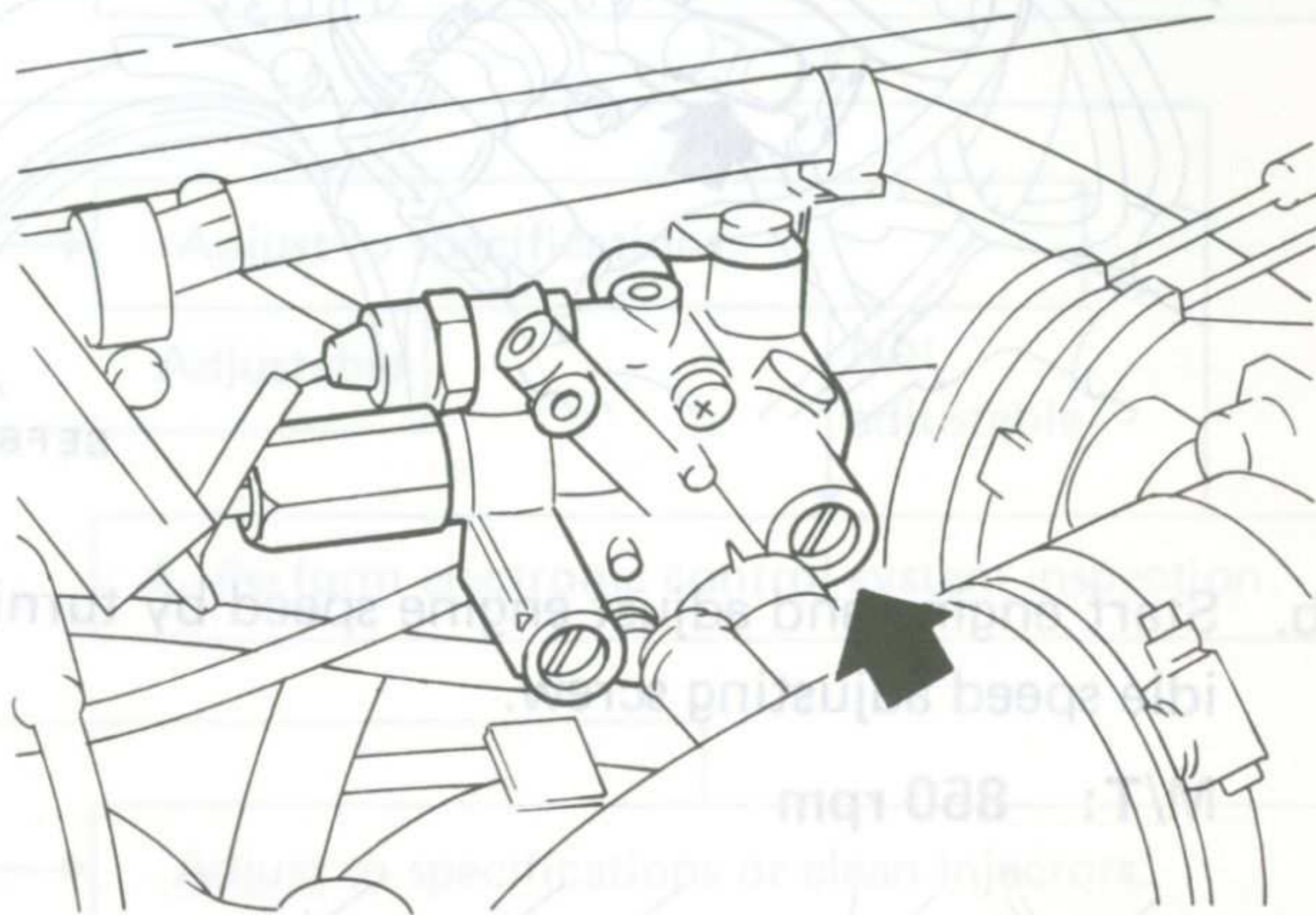
Europe except Sweden and Switzerland

$900 \pm 50$  rpm

Except above

$800 \pm 50$  rpm

If necessary, adjust to the specified speed by turning idle speed adjusting screw.



SMA069B

4) Stop engine and connect idle-up solenoid valve harness connector.

5) Start engine and check ignition timing with a timing light.

Europe except for Sweden and Switzerland

$10^\circ \pm 1^\circ$  B.T.D.C.

Except above

$20^\circ \pm 1^\circ$  B.T.D.C.

If necessary, adjust ignition timing by turning distributor.

[VG30ET engine (With turbocharger)]

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

2) Check idle speed.

M/T:  $900 \pm 50$  rpm

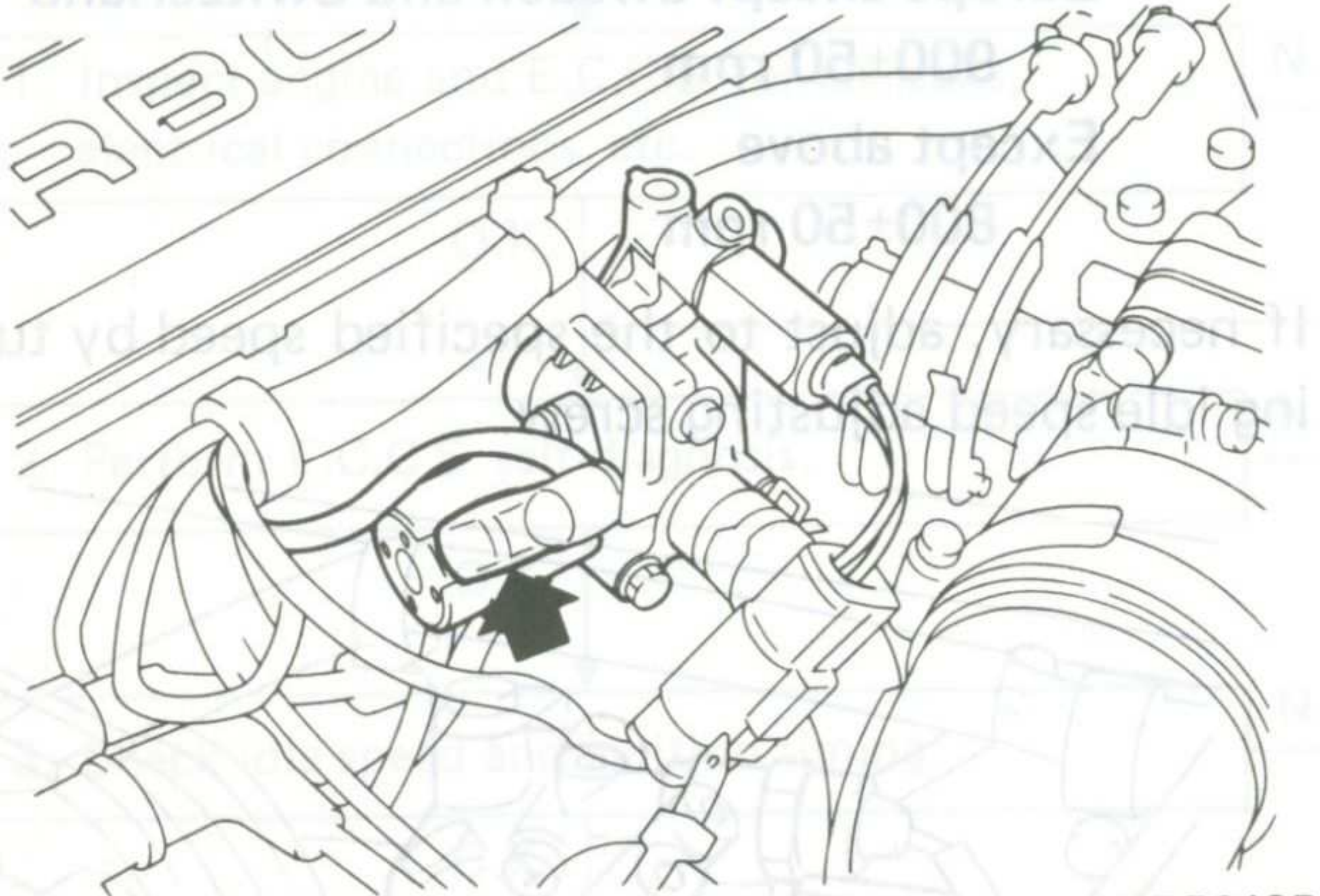


# DIAGNOSTIC PROCEDURE

## Driveability (Cont'd)

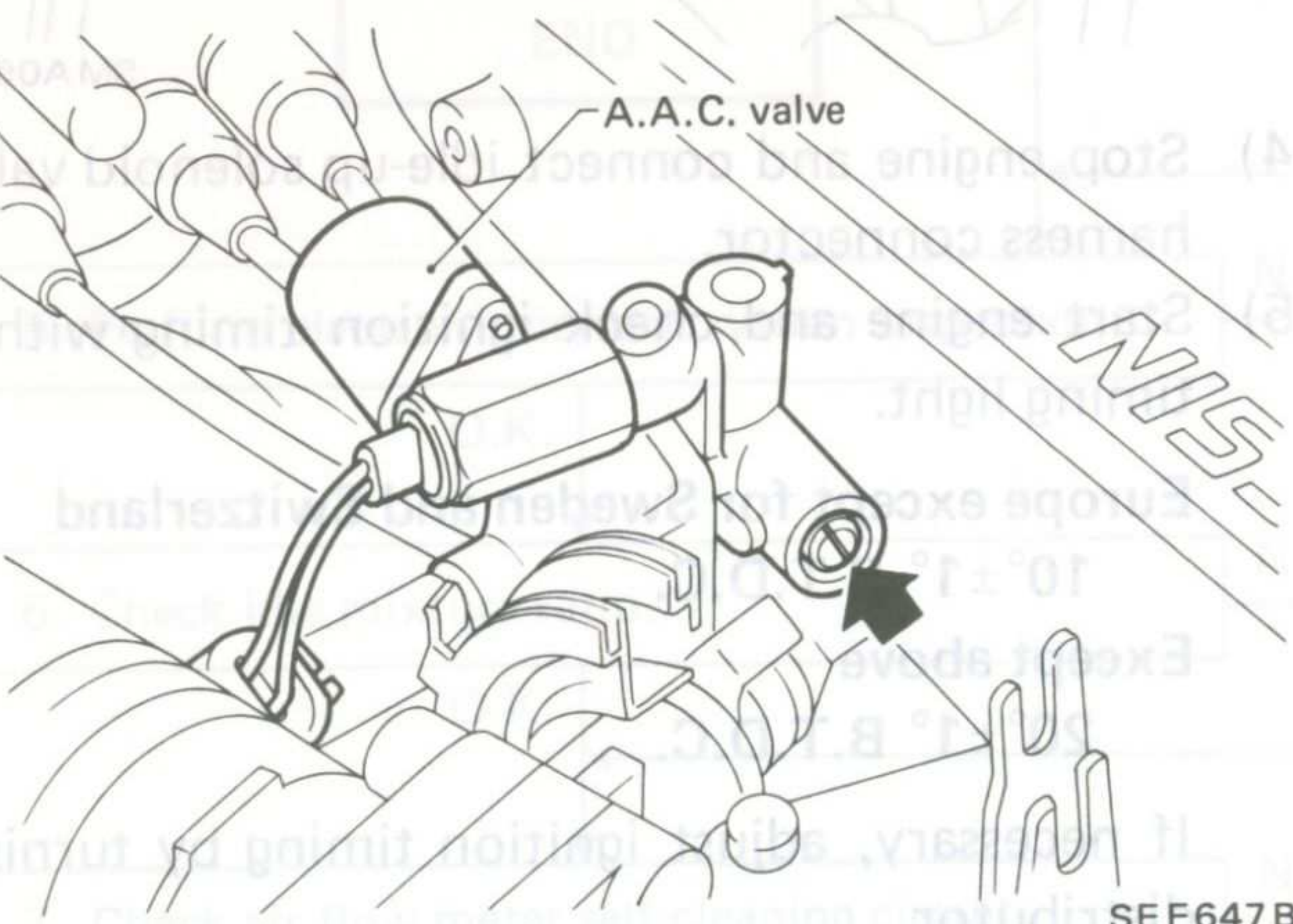
If out of specification, adjust as follows:

- a. Stop engine and disconnect A.A.C. valve harness connector.



- b. Start engine and adjust engine speed by turning idle speed adjusting screw.

**M/T: 850 rpm**



- c. Stop engine and connect A.A.C. valve harness connector. Then start engine.
- d. Make sure that idle speed is in the specified range.

**M/T: 900±50 rpm**

- 3) Check ignition timing with a timing light.  
**10°±1° B.T.D.C.**

If necessary, adjust ignition timing by turning distributor.

4. Perform driveability test.  
Evaluate effectiveness of adjustments by driving vehicle. If unsatisfactory, proceed to step 5.

5. Perform electronic control system inspection.  
Check the following using circuit tester.

- Injector circuits
  - Air regulator circuit
  - E.G.R. control solenoid circuit
- Follow the procedure in ELECTRONIC CONTROL SYSTEM INSPECTION (Page EF-42).

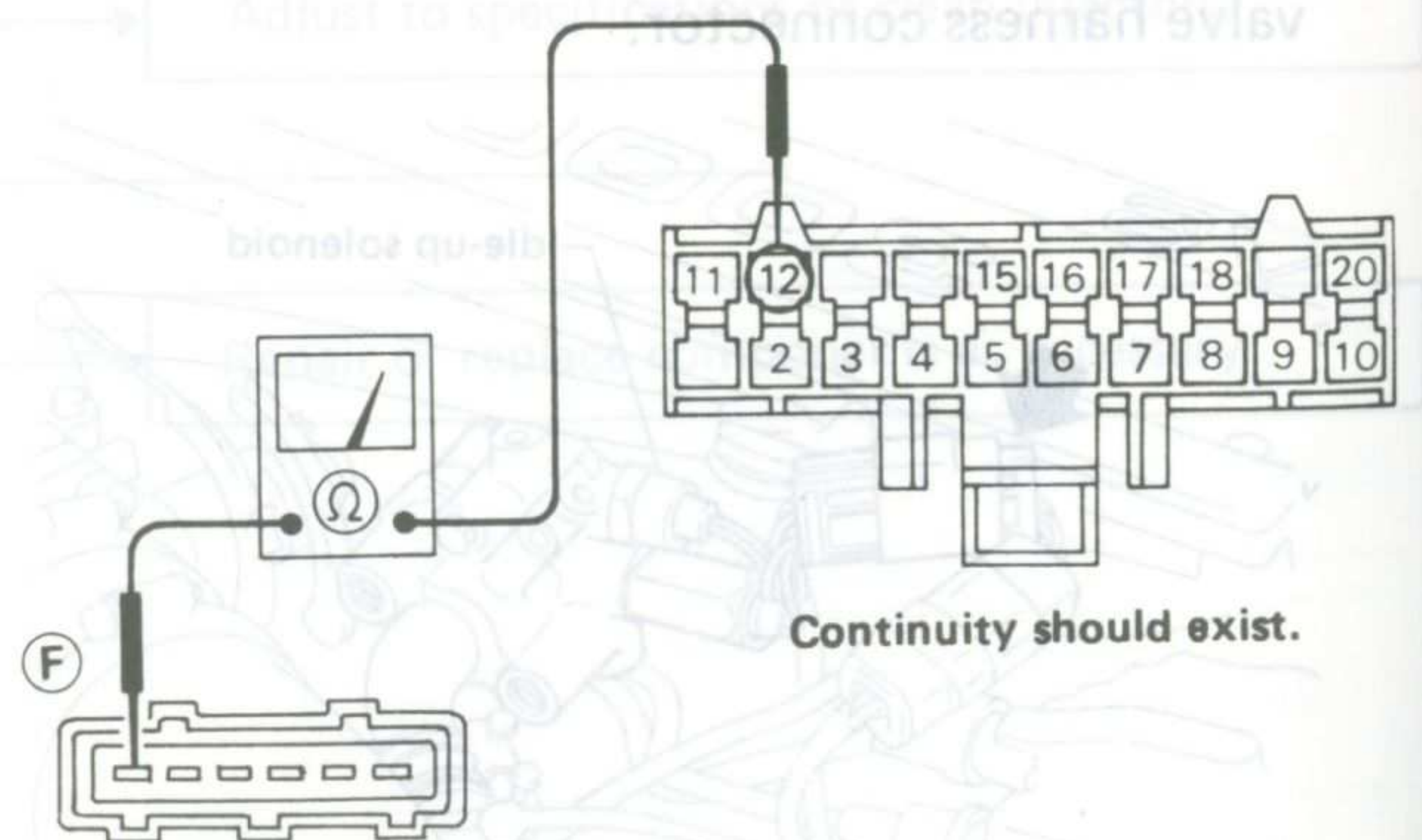
6. Check idle mixture ratio.  
Follow the procedure in CHECKING AND ADJUSTING MIXTURE RATIO (Section MA).

Clean injectors as necessary.

7. Check air flow meter self-cleaning circuit.

- 1) Start engine and race engine to above 2,500 rpm.
- 2) Drive vehicle at above 30 km/h (19 MPH) (VG30ET only) then run engine at idle.
- 3) Remove air duct from air flow meter (air cleaner side) while engine is idling.
- 4) Using a mirror, ensure that hot wire heats up to a red glow for one second after the ignition switch has been turned off for five seconds.
- 5) If N.G., check harness for continuity.

Check for continuity between terminal ⑫ of 20-pin connector and terminal (F) of air flow meter harness connector.



Continuity should exist.

- 6) If continuity does not exist, repair or replace harness.

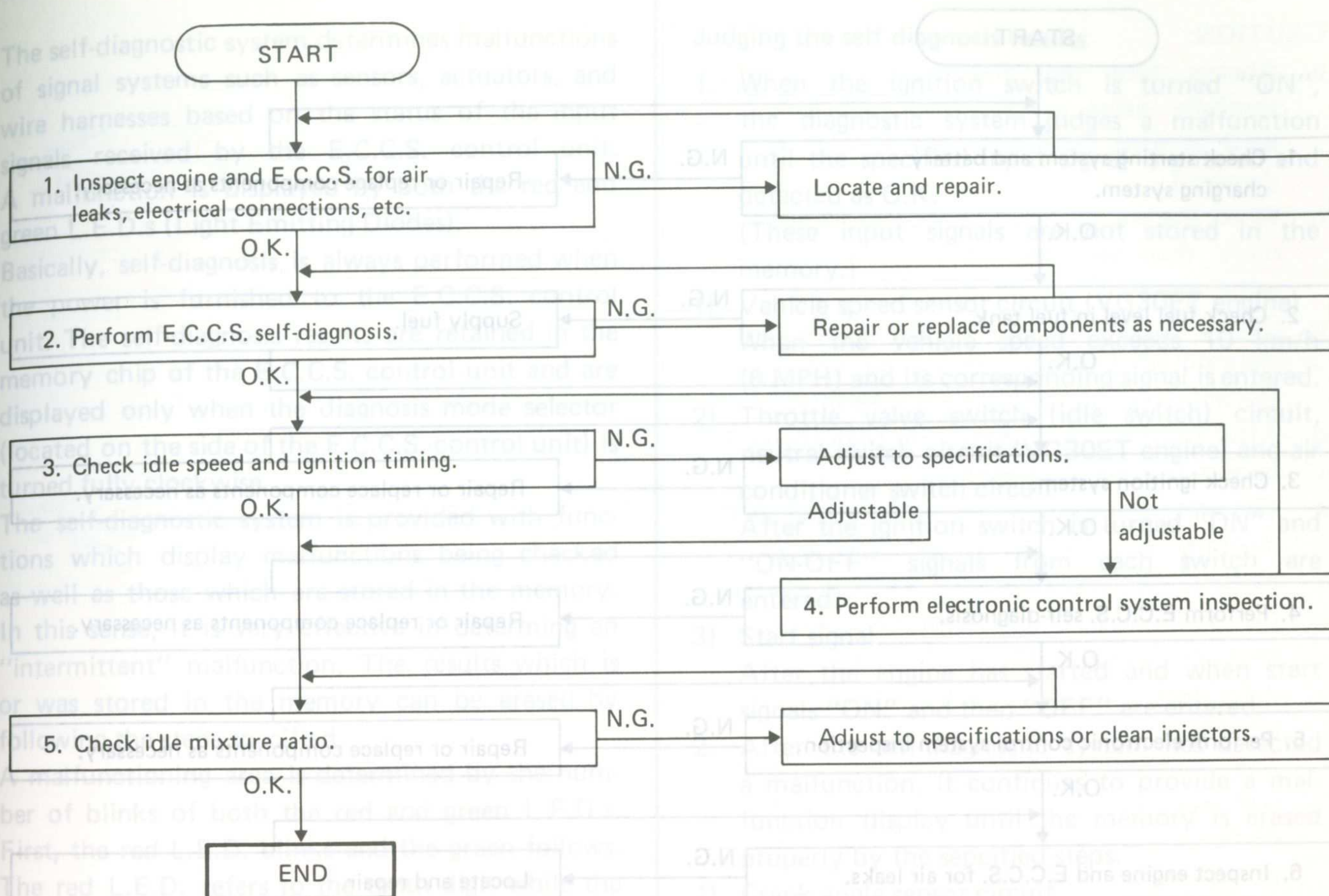
If harness is O.K. replace air flow meter.

8. Perform driveability test.  
Re-evaluate vehicle performance.



# DIAGNOSTIC PROCEDURE

## Improper Idling and Stall



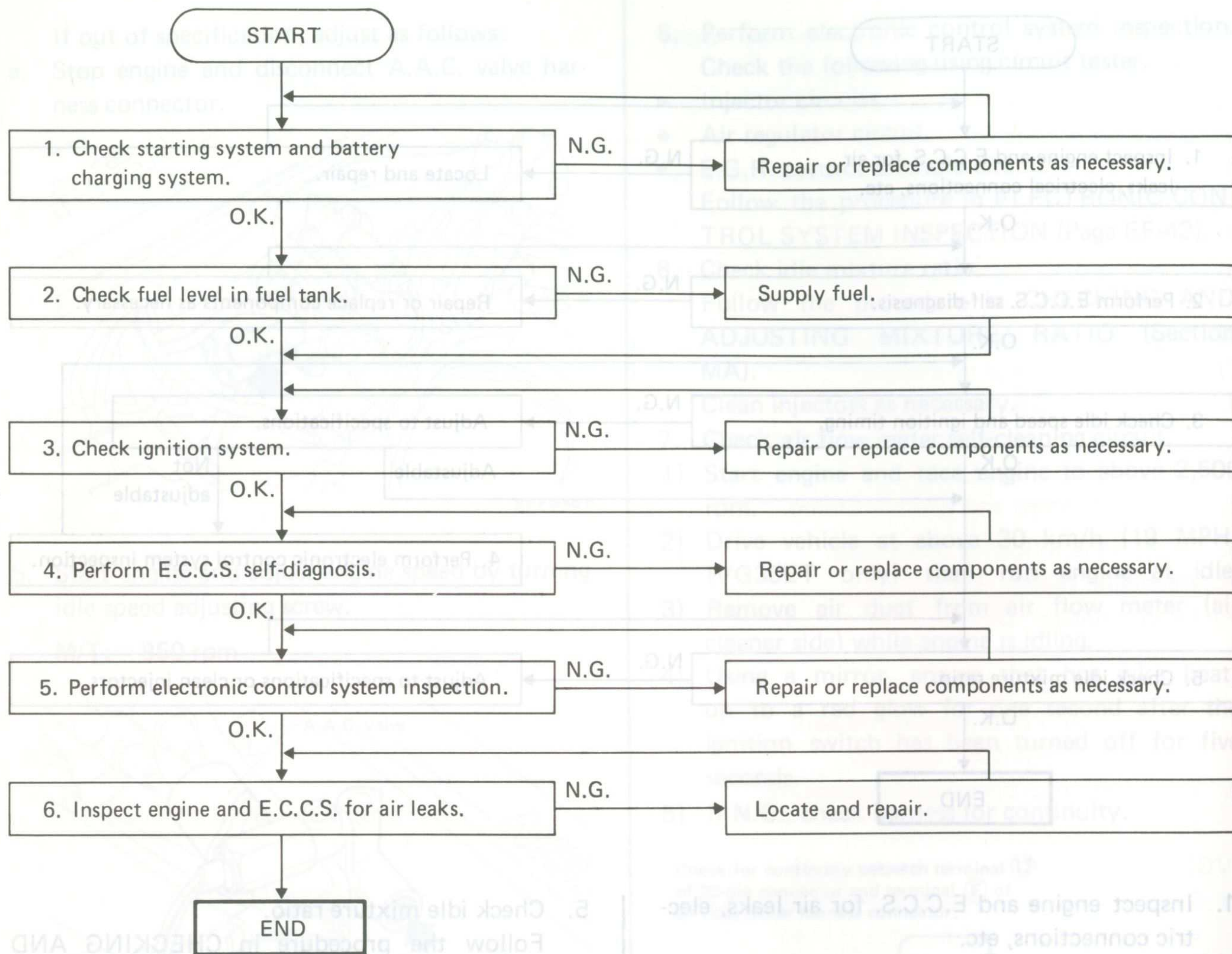
1. Inspect engine and E.C.C.S. for air leaks, electric connections, etc.  
Refer to DRIVEABILITY.
2. Perform E.C.C.S. self-diagnosis.  
Follow the procedure in E.C.C.S. SELF-DIAGNOSIS (Page EF-35).
3. Check idle speed and ignition timing.  
Refer to DRIVEABILITY.
4. Perform electronic control system inspection.  
Check the following using circuit tester.
  - Injector circuit
  - Air regulator circuit
  - Idle-up solenoid valve (VG30E engine)
  - A.A.C. valve (VG30ET engine)
  - E.G.R. control solenoid circuit
 Follow the procedure in ELECTRONIC CONTROL SYSTEM INJECTION (Page EF-42).

5. Check idle mixture ratio.  
Follow the procedure in CHECKING AND ADJUSTING MIXTURE RATIO (Section MA).  
Clean injectors as necessary.



# DIAGNOSTIC PROCEDURE

## Engine Startability



1. Check starting system and battery charging system.
  - 1) Check starter operation.
  - 2) Check battery voltage.  
Repair or replace as necessary.
2. Check fuel level.  
If fuel level is low or empty, add fuel.
3. Check ignition system.
  - 1) Check ignition wiring.
  - 2) Check distributor rotor head.
  - 3) Check spark plug.
4. Perform E.C.C.S. self-diagnosis. Follow the procedure in E.C.C.S. SELF-DIAGNOSIS (page EF-35).

5. Perform electronic control system inspection. Check the following using circuit tester.
  - Injector circuit
  - Air regulator circuit
  - E.G.R. control solenoid valve
 Follow the procedure in ELECTRONIC CONTROL SYSTEM INSPECTION (page EF-42).
6. Inspect engine and E.C.C.S. for air leaks.  
Refer to DRIVEABILITY.



# SELF-DIAGNOSIS

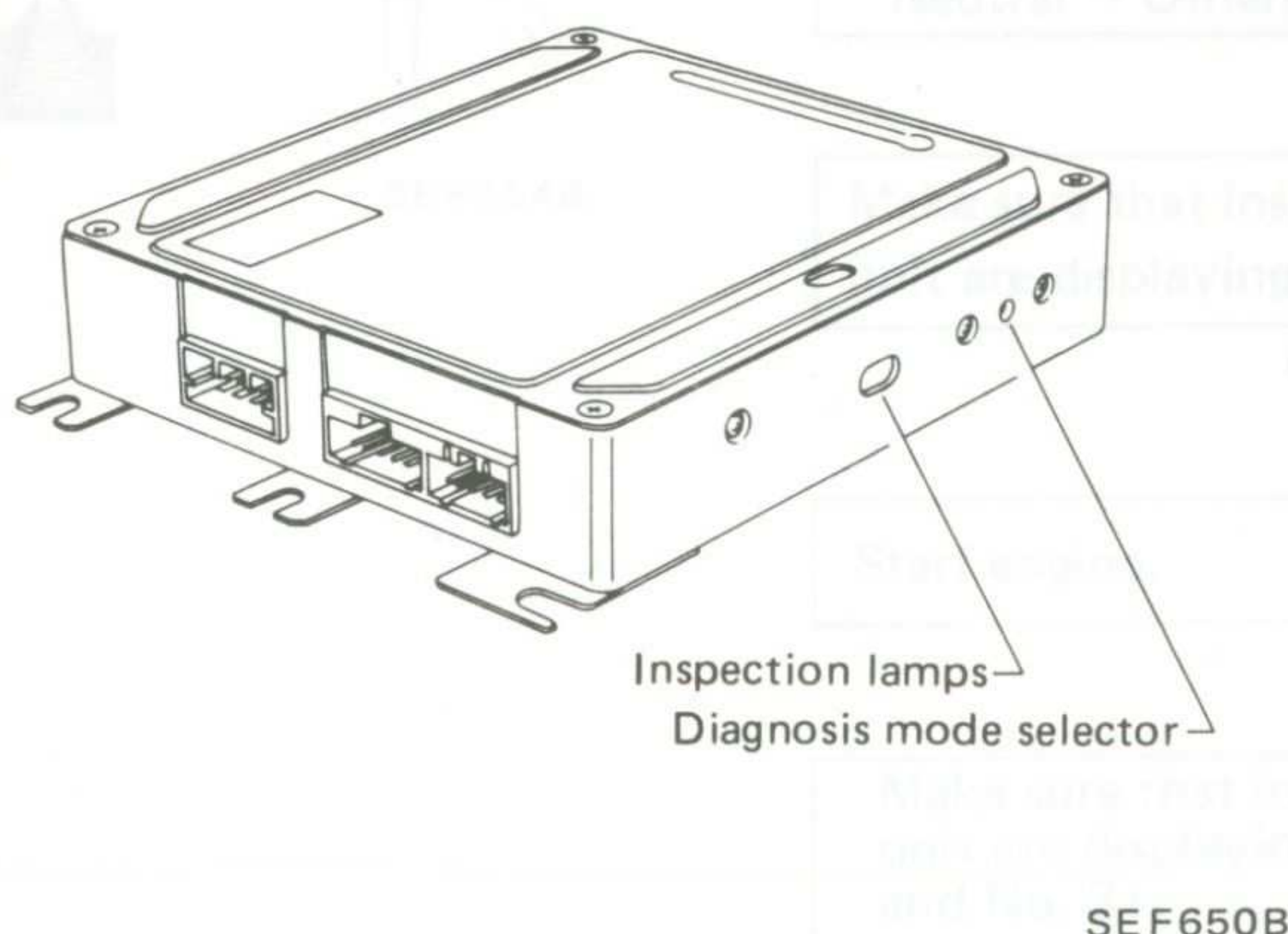
## Self-diagnostic System

The self-diagnostic system determines malfunctions of signal systems such as sensors, actuators, and wire harnesses based on the status of the input signals received by the E.C.C.S. control unit. A malfunction is displayed by both the red and green L.E.D.s (Light Emitting Diodes).

Basically, self-diagnosis is always performed when the power is furnished to the E.C.C.S. control unit. The self-diagnosis results are retained in the memory chip of the E.C.C.S. control unit and are displayed only when the diagnosis mode selector (located on the side of the E.C.C.S. control unit) is turned fully clockwise.

The self-diagnostic system is provided with functions which display malfunctions being checked as well as those which are stored in the memory. In this sense, it is very effective in determining an "intermittent" malfunction. The results which is or was stored in the memory can be erased by following the steps specified.

A malfunctioning area is determined by the number of blinks of both the red and green L.E.D.s. First, the red L.E.D. blinks and the green follows. The red L.E.D. refers to the tenth digit while the green one refers to the unit digit. For example, when the red L.E.D. blinks three times and the green L.E.D. blinks twice, this implies number "32". In this way, all problems are classified by code numbers.



### Judging the self-diagnosis results

1. When the ignition switch is turned "ON", the diagnostic system judges a malfunction until the specified input signal is entered and detected as O.K.

(These input signals are not stored in the memory.)

- 1) Vehicle speed sensor circuit (VG30ET engine)  
When the vehicle speed exceeds 10 km/h (6 MPH) and its corresponding signal is entered.
- 2) Throttle valve switch (idle switch) circuit, neutral switch circuit (VG30ET engine) and air conditioner switch circuit

After the ignition switch is turned "ON" and "ON-OFF" signals from each switch are entered.

- 3) Start signal  
After the engine has started and when start signals "ON" and then "OFF" are entered.

2. After the self-diagnostic system has detected a malfunction, it continues to provide a malfunction display until the memory is erased properly by the specified steps.

- 1) Crank angle sensor circuit
  - When 1° or 120° signal is not entered after the engine has started.
  - When either 1° or 120° signal is not entered often enough.

- 2) Air flow meter circuit
  - When the air flow meter produces an abnormally high output voltage with the engine off.
  - When the air flow meter produces an abnormally low output voltage with the engine running.

- 3) Cylinder head temperature sensor circuit  
When the circuit is shorted or open.

- 4) Ignition signal  
When an ignition signal is not produced on the primary winding of the ignition coil after the engine has started.

- 5) Detonation sensor circuit (VG30ET engine)  
When the circuit is shorted with the engine operating at a speed of above 2,000 rpms.



# SELF-DIAGNOSIS

## Self-diagnostic System (Cont'd)

### CAUTION:

- Always turn the diagnosis mode selector carefully using a screwdriver. Do not press hard to turn. Otherwise, the selector may be damaged.
- When the engine fails to start, crank the engine more than two seconds before starting the self-diagnosing.
- Before starting the self-diagnosing, do not erase the stored memory. Doing so will reduce the self-diagnosis function considerably.
- After a malfunctioning area has been corrected, be sure to erase the memory.
- The self-diagnosed results are retained in the memory by a small current flow from the battery. Disconnecting the battery cable or the E.C.C.S.'s 15-pin connector erases the memory stored. Always perform the self-diagnosing regarding "intermittent" checks before disconnecting.
- The crank angle sensor signal plays an important role in the E.C.C.S. A malfunctioning sensor is sometimes accompanied by a display which shows malfunctions in other signal systems. In such a case, always start with checking the crank angle sensor.

The self-diagnostic system determines malfunctions of signal systems such as sensors, actuators, and wire harnesses based on the status of the input signals received by the E.C.C.S. control unit. A malfunction is displayed by both the red and green L.E.D.s (Light Emitting Diodes). Basically, self-diagnosis is always performed when the power is furnished to the E.C.C.S. control unit. The self-diagnosis results are retained in the memory chip of the E.C.C.S. control unit and are displayed only when the diagnosis mode selector (located on the side of the E.C.C.S. control unit) is turned fully clockwise. The self-diagnostic system is provided with functions which display malfunctions being checked as well as those which are stored in the memory. In this sense, it is very effective in determining an "intermittent" malfunction. The results which or was stored in the memory can be erased by following the steps specified. A malfunctioning area is determined by the number of blinks of both the red and green L.E.D.s. First, the red L.E.D. blinks and the green follows. The red L.E.D. refers to the tenth digit while the green one refers to the unit digit. For example, when the red L.E.D. blinks three times and the green L.E.D. blinks twice, this implies number "32". In this way, all problems are classified by code numbers.

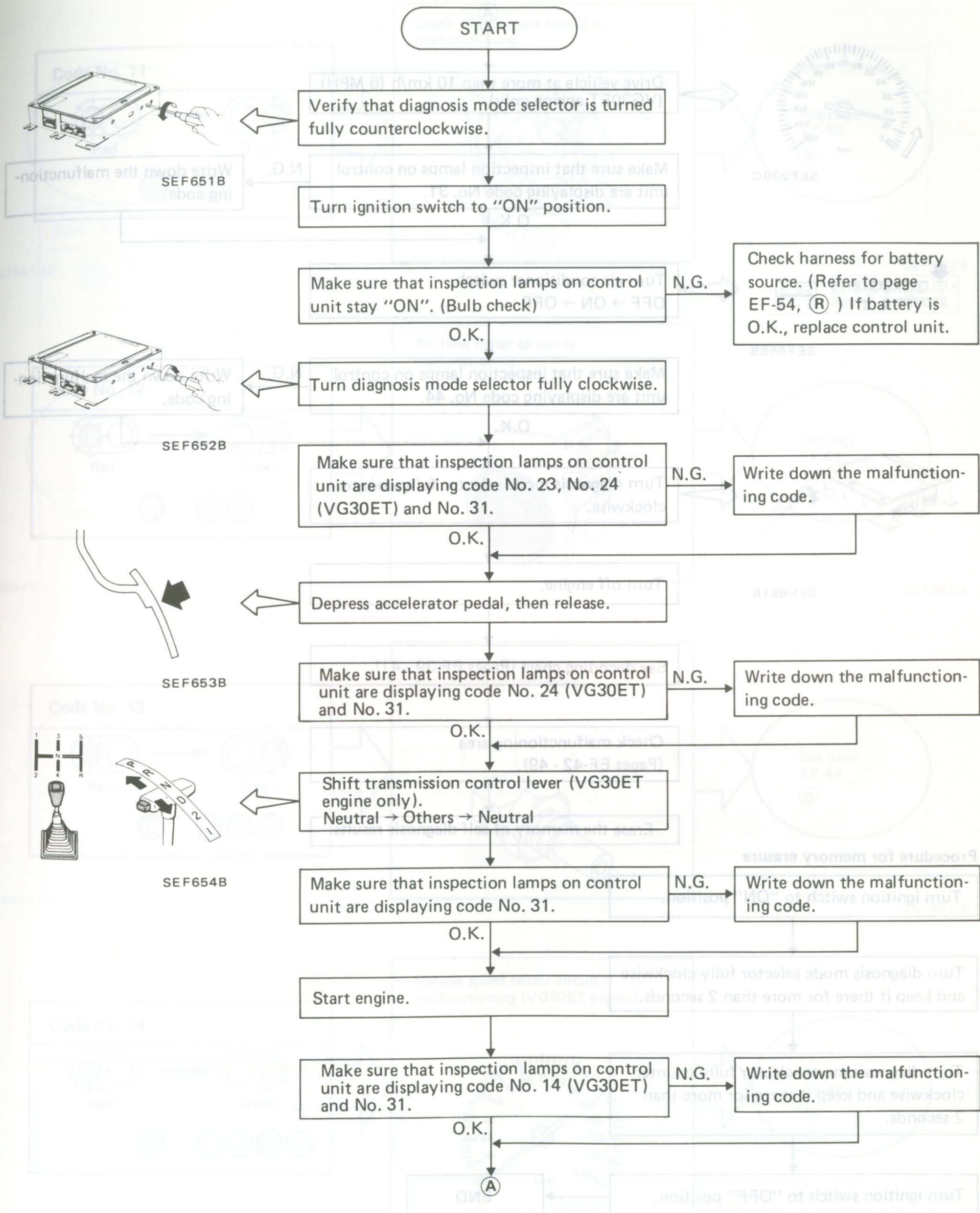
- Perform engine control system inspection. Check the following items.
  - Injection pump
  - Air filter
  - E.G.R. valve
- Follow the steps in the E.C.C.S. CONTROL SYSTEM INSPECTION.
- Inspect engine and engine system.

EF-36



# SELF-DIAGNOSIS

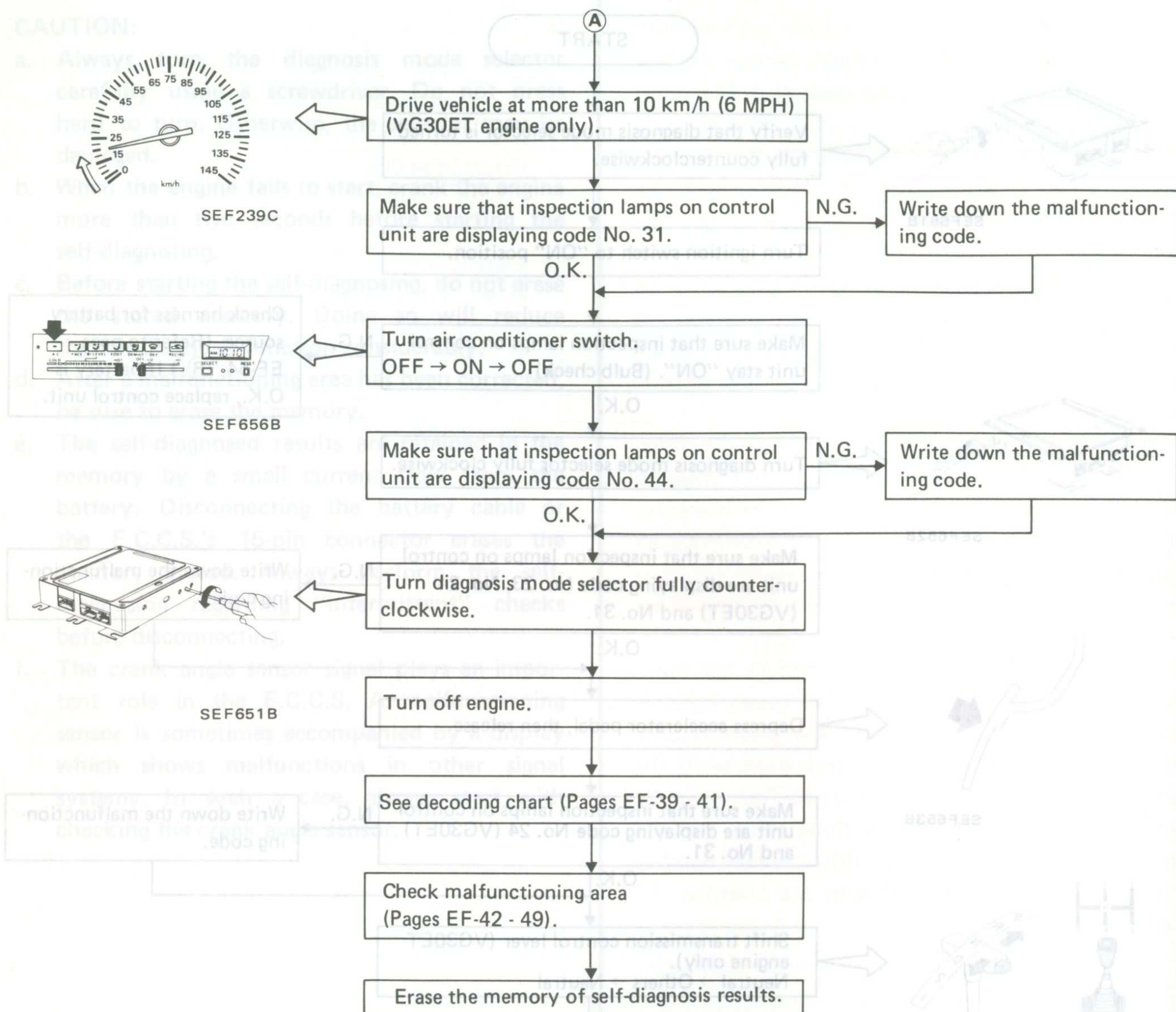
## Self-diagnostic Procedure



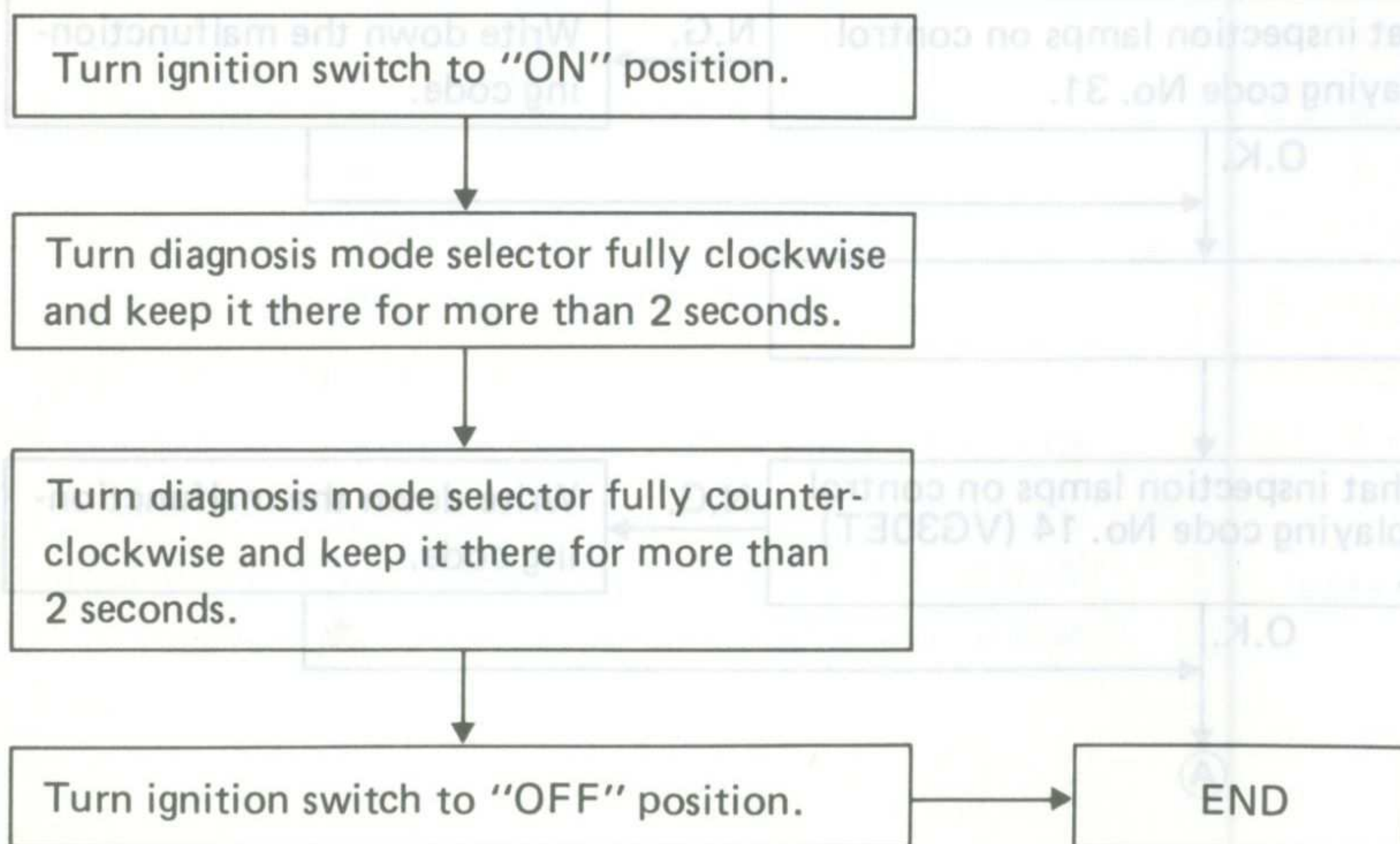


# SELF-DIAGNOSIS

## Self-diagnostic Procedure (Cont'd)



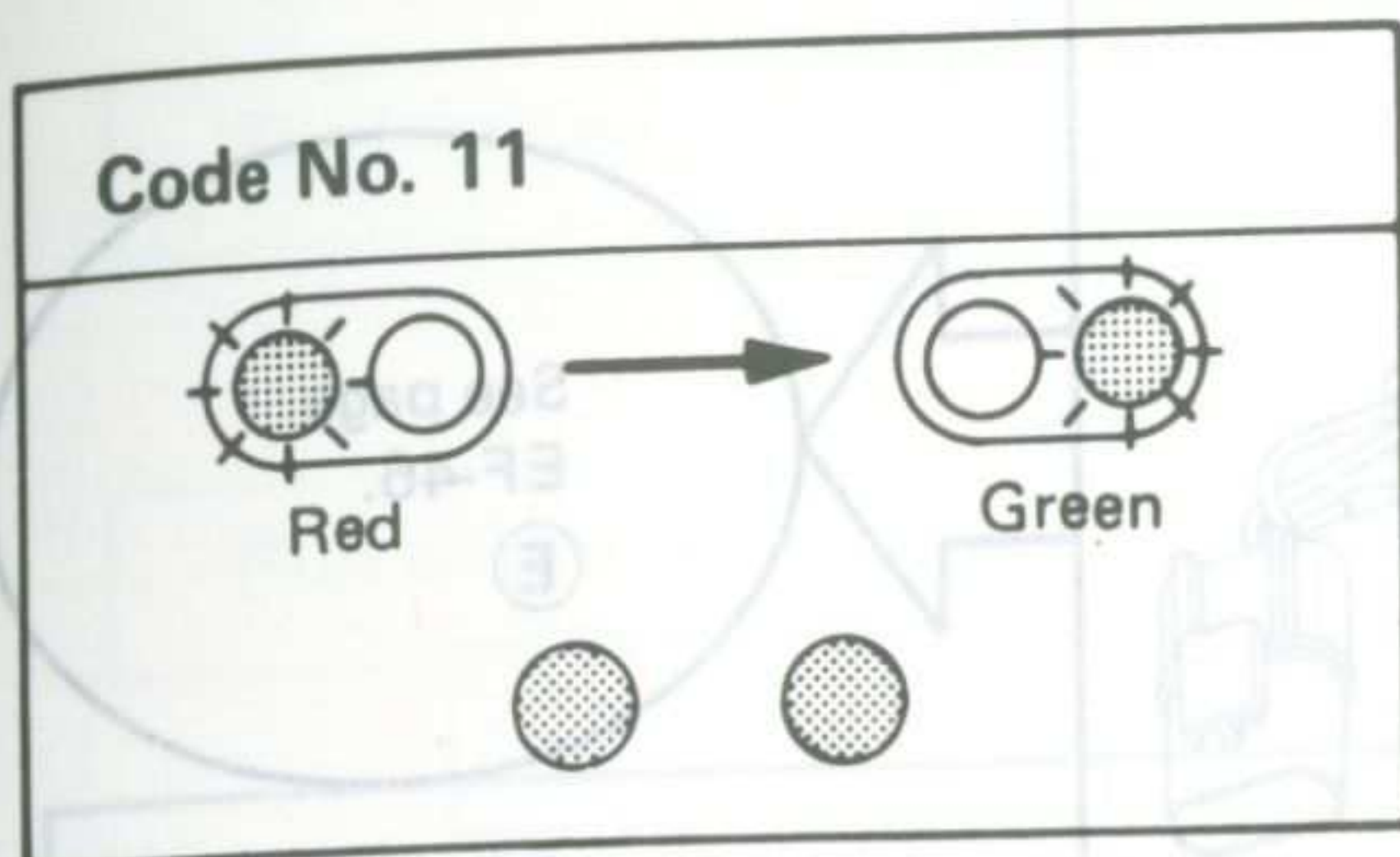
### Procedure for memory erasure



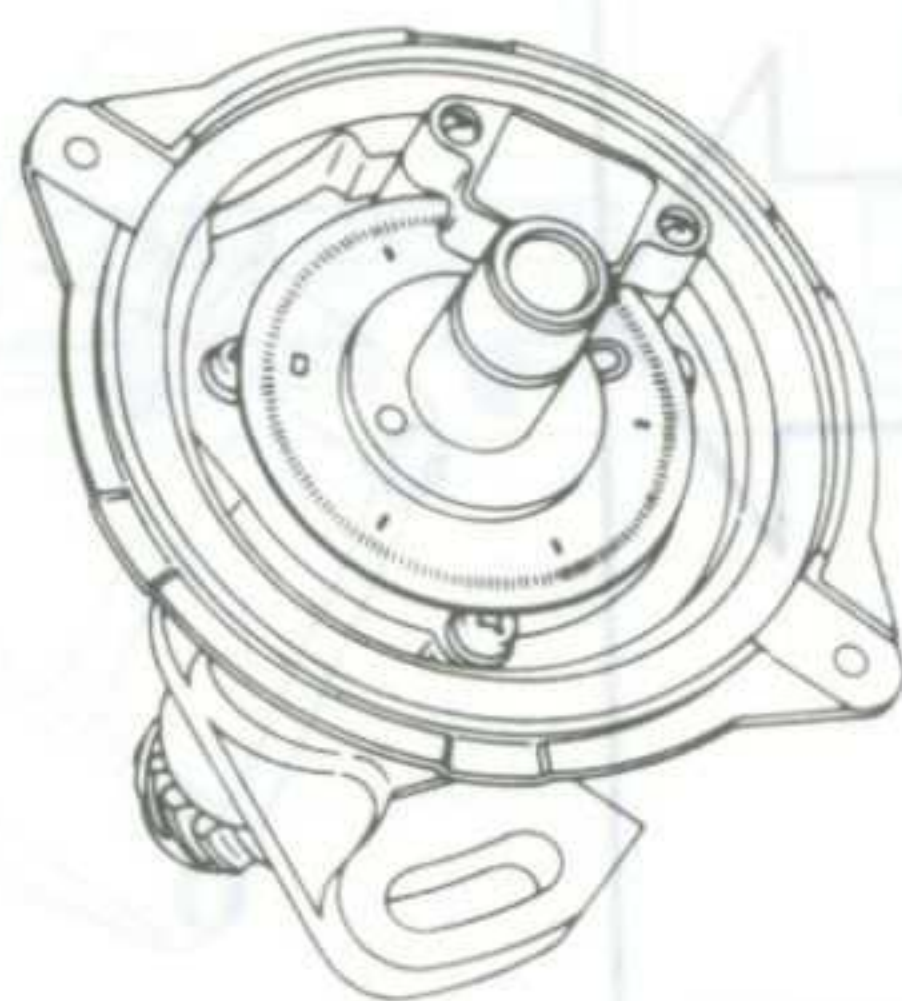


# SELF-DIAGNOSIS

## Decoding Chart



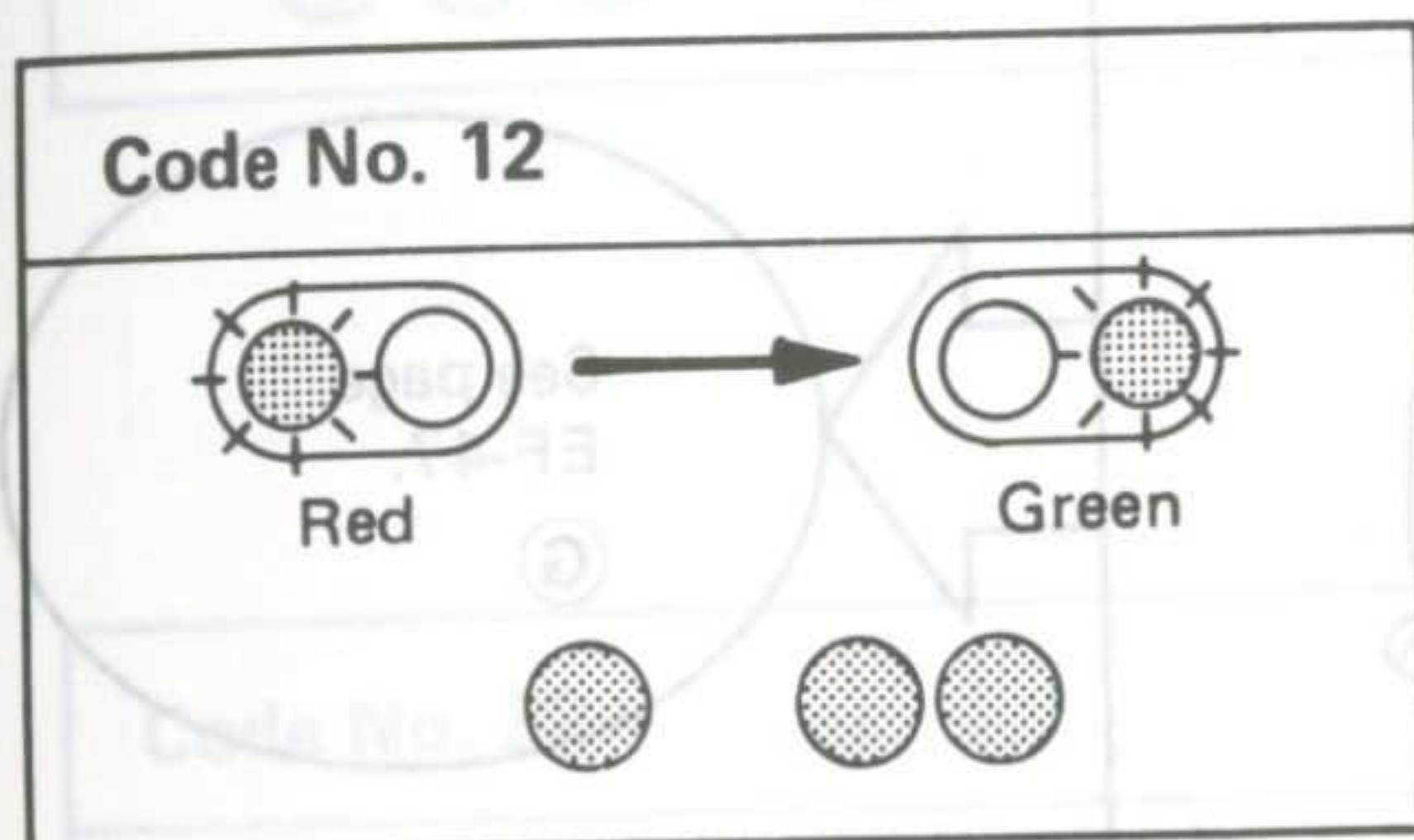
Crank angle sensor circuit is malfunctioning.



See page EF-42.

(A)

SEF657B



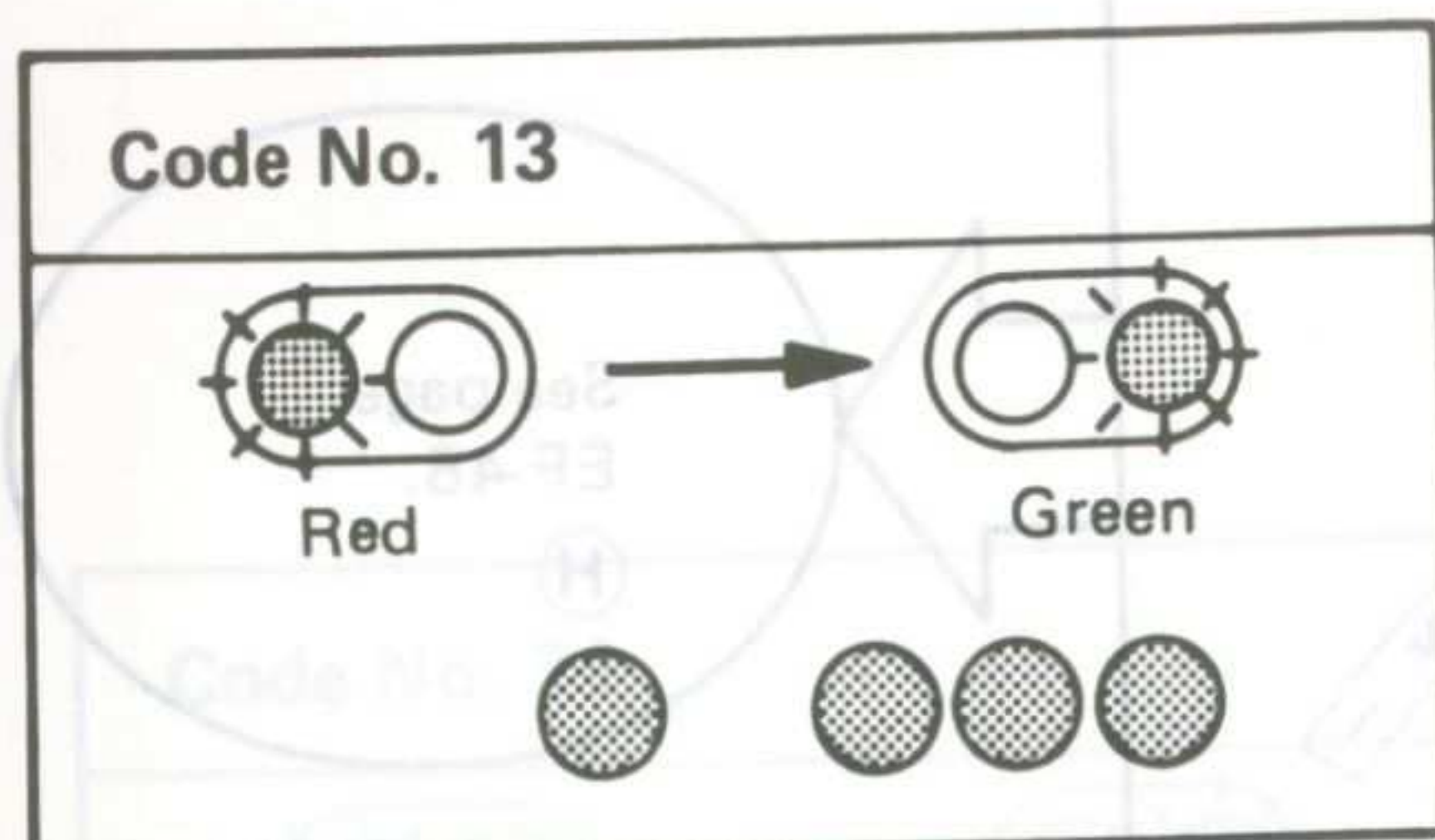
Air flow meter circuit is malfunctioning.



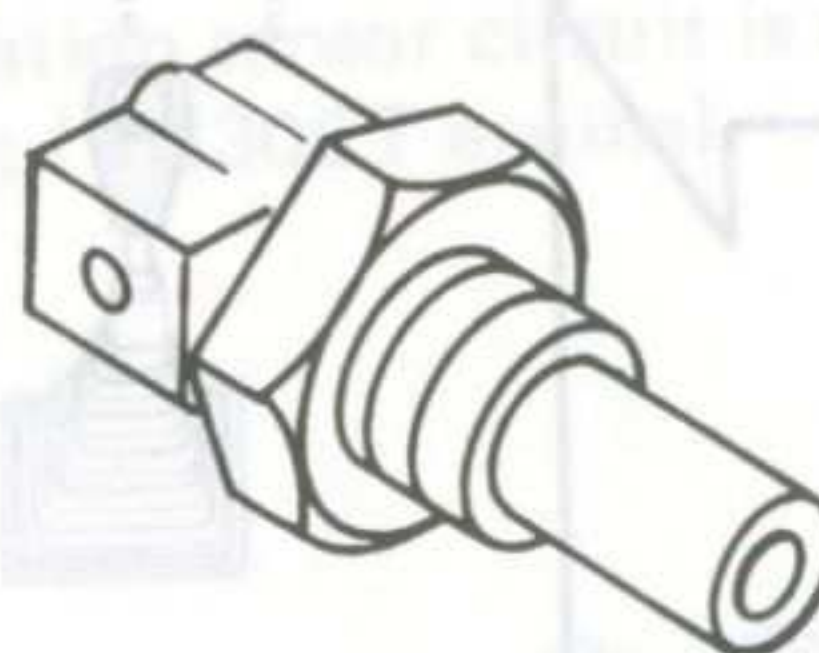
See page EF-43.

(B)

SEF658B



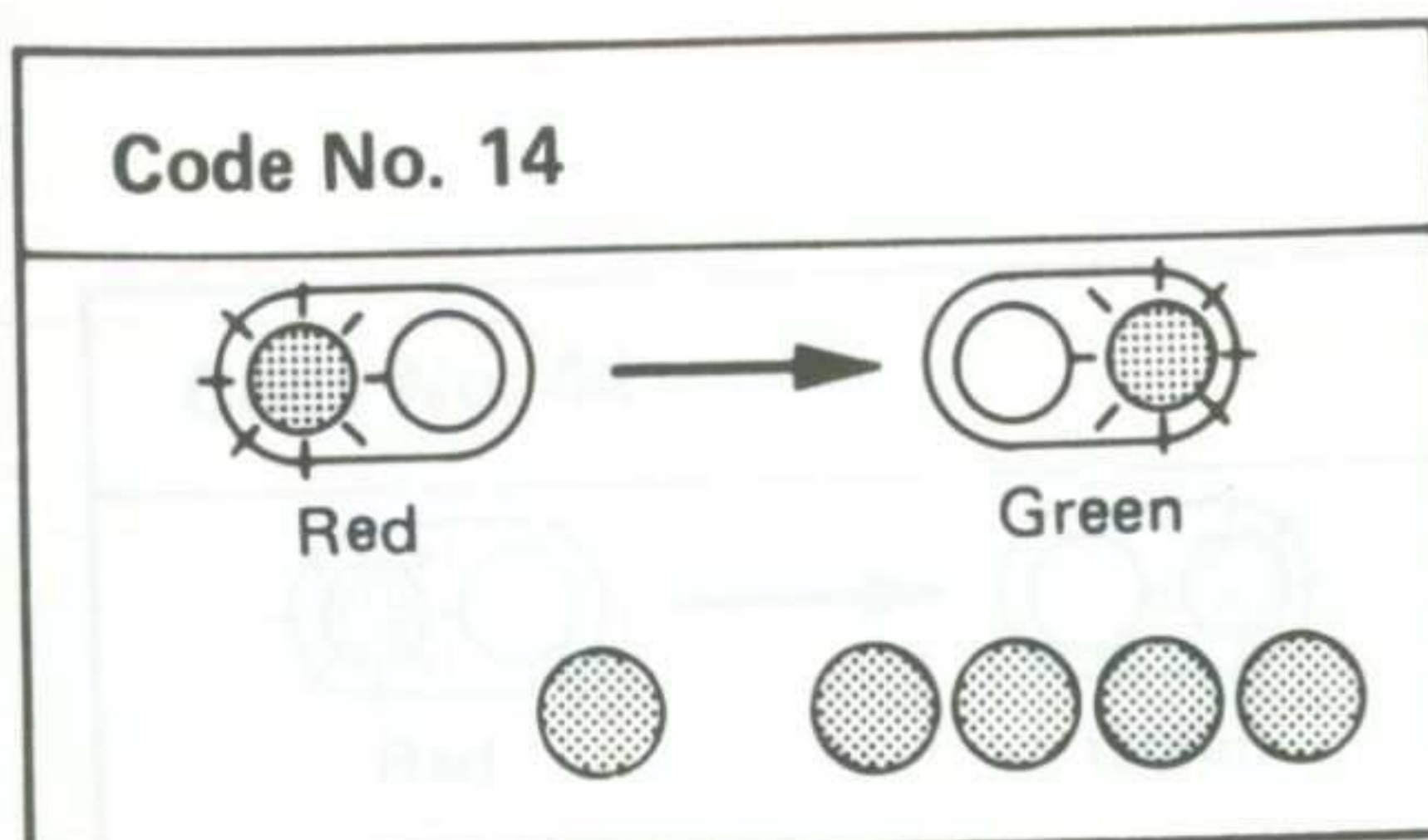
Cylinder head temperature sensor circuit is malfunctioning.



See page EF-44.

(C)

SEF659B



Vehicle speed sensor circuit is malfunctioning (VG30ET engine).



See page EF-45.

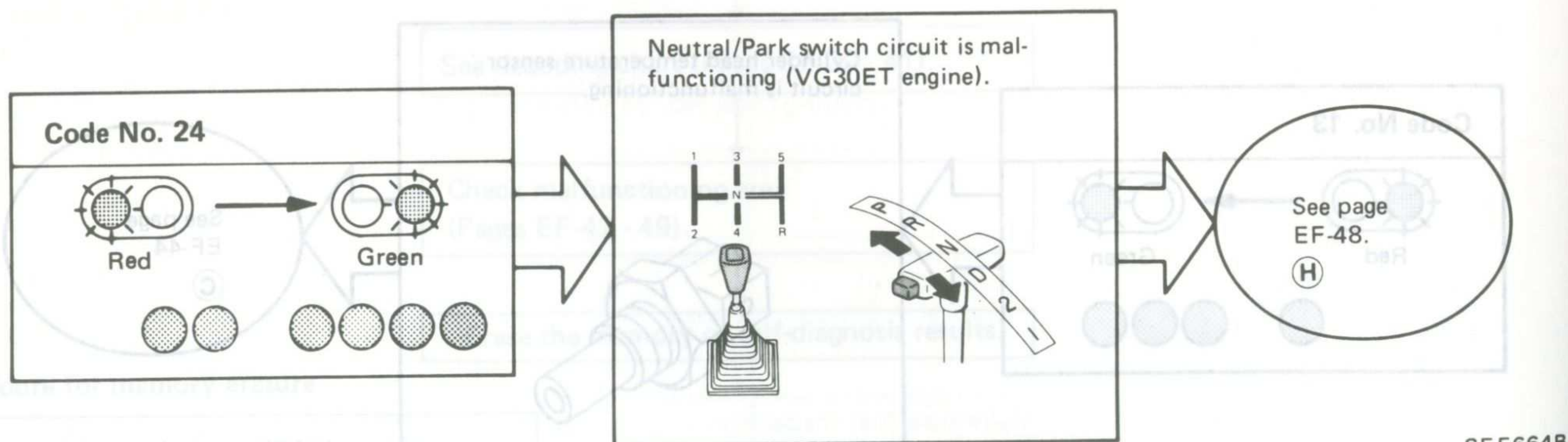
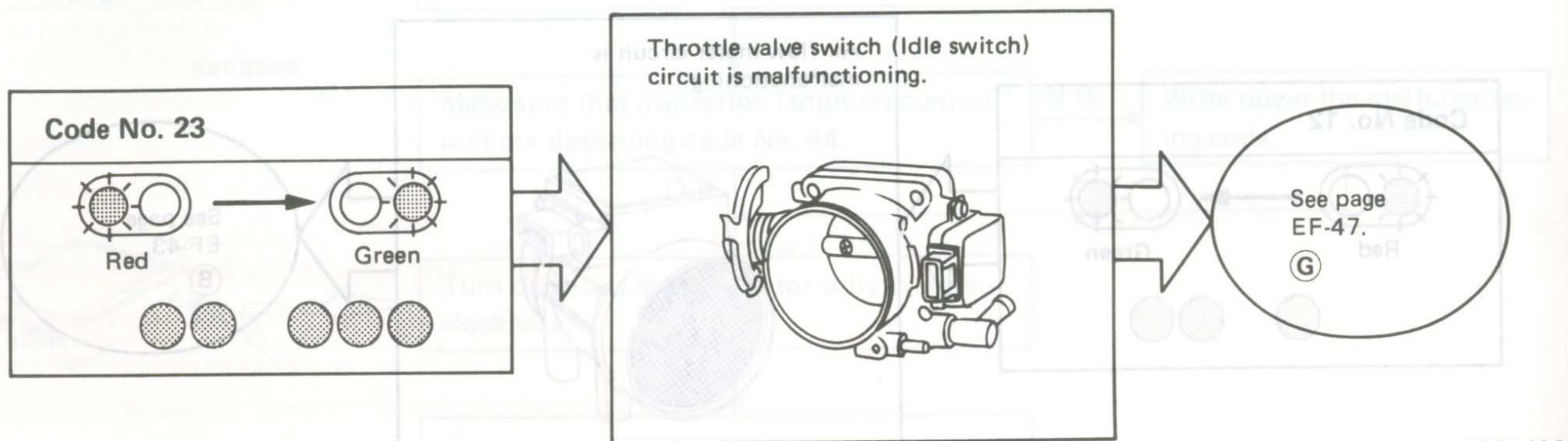
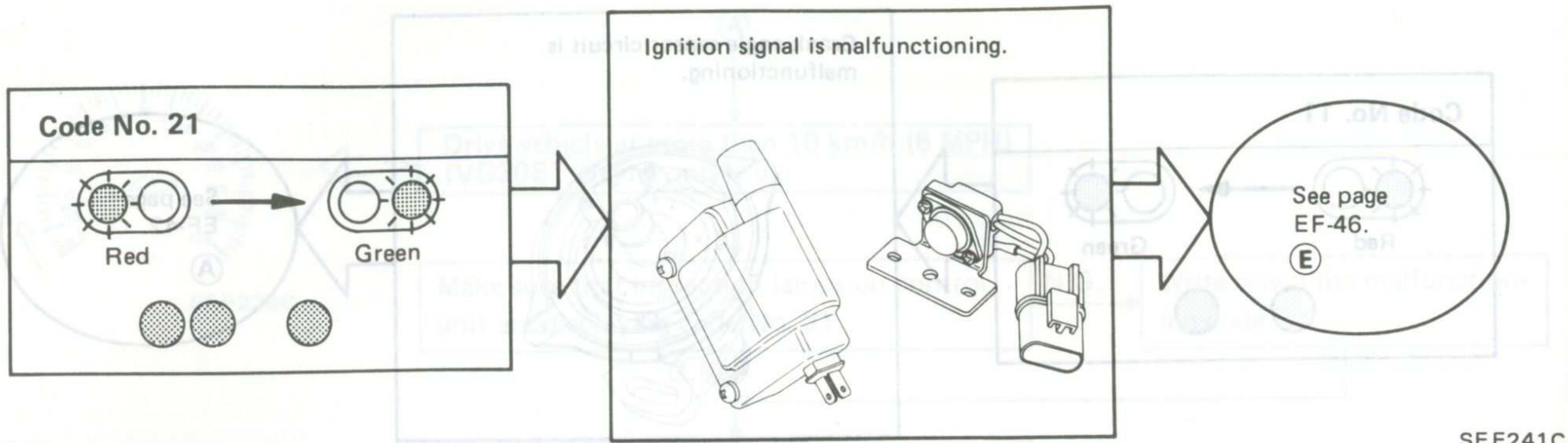
(D)

SEF240C



# SELF-DIAGNOSIS

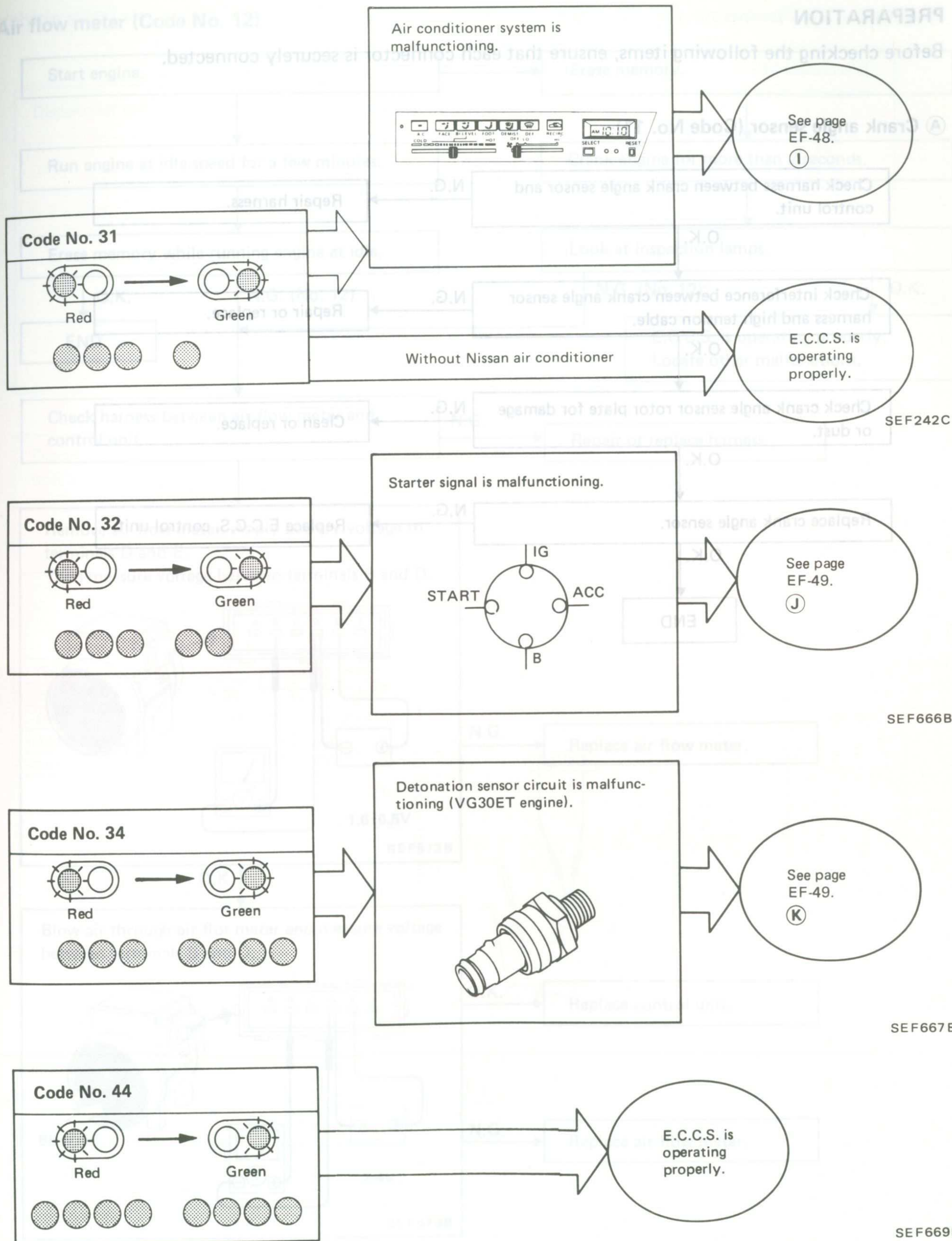
## Decoding Chart (Cont'd)





# ELECTRONIC SELF-DIAGNOSIS

## Decoding Chart (Cont'd)



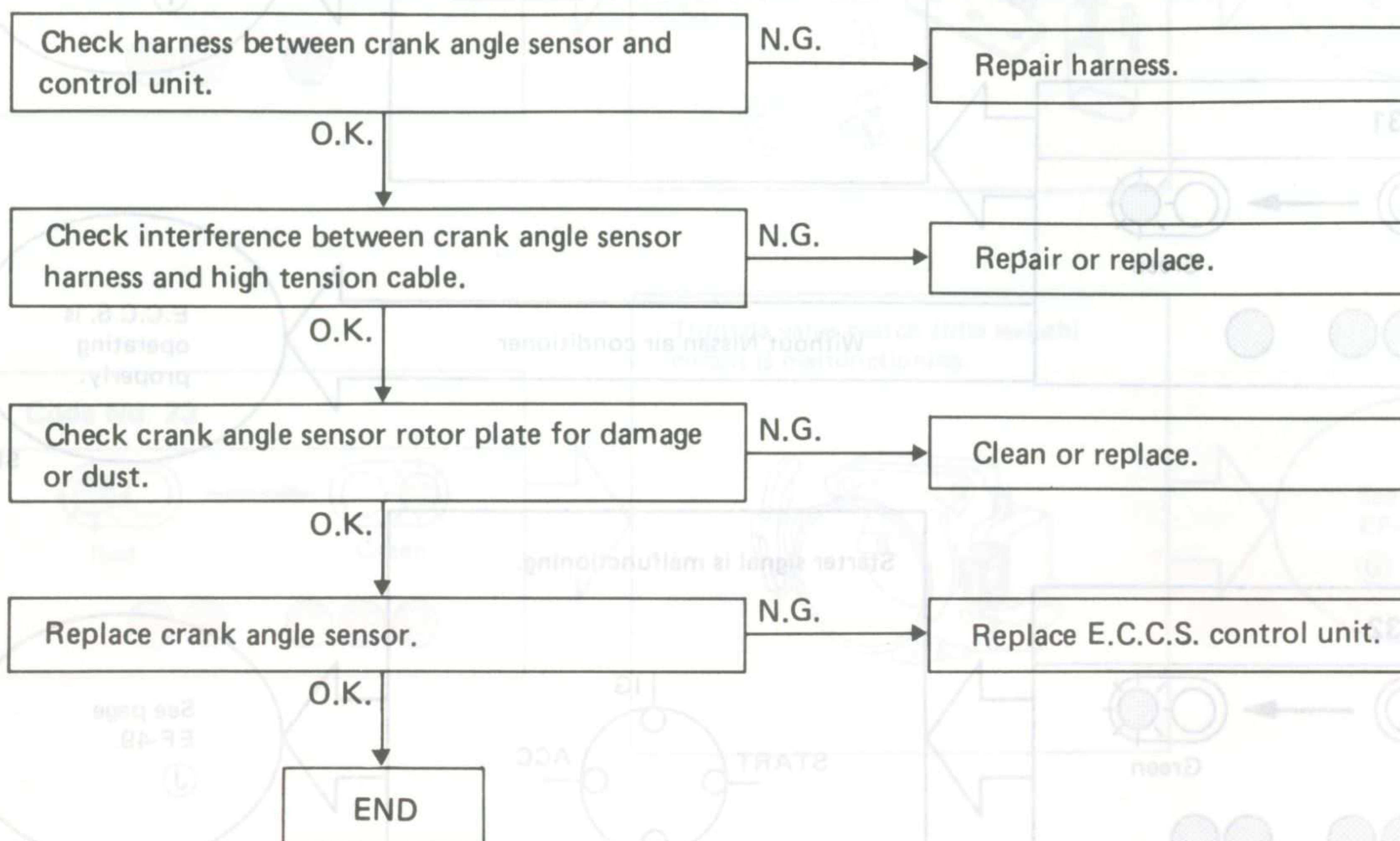


# ELECTRONIC CONTROL SYSTEM INSPECTION

## PREPARATION

Before checking the following items, ensure that each connector is securely connected.

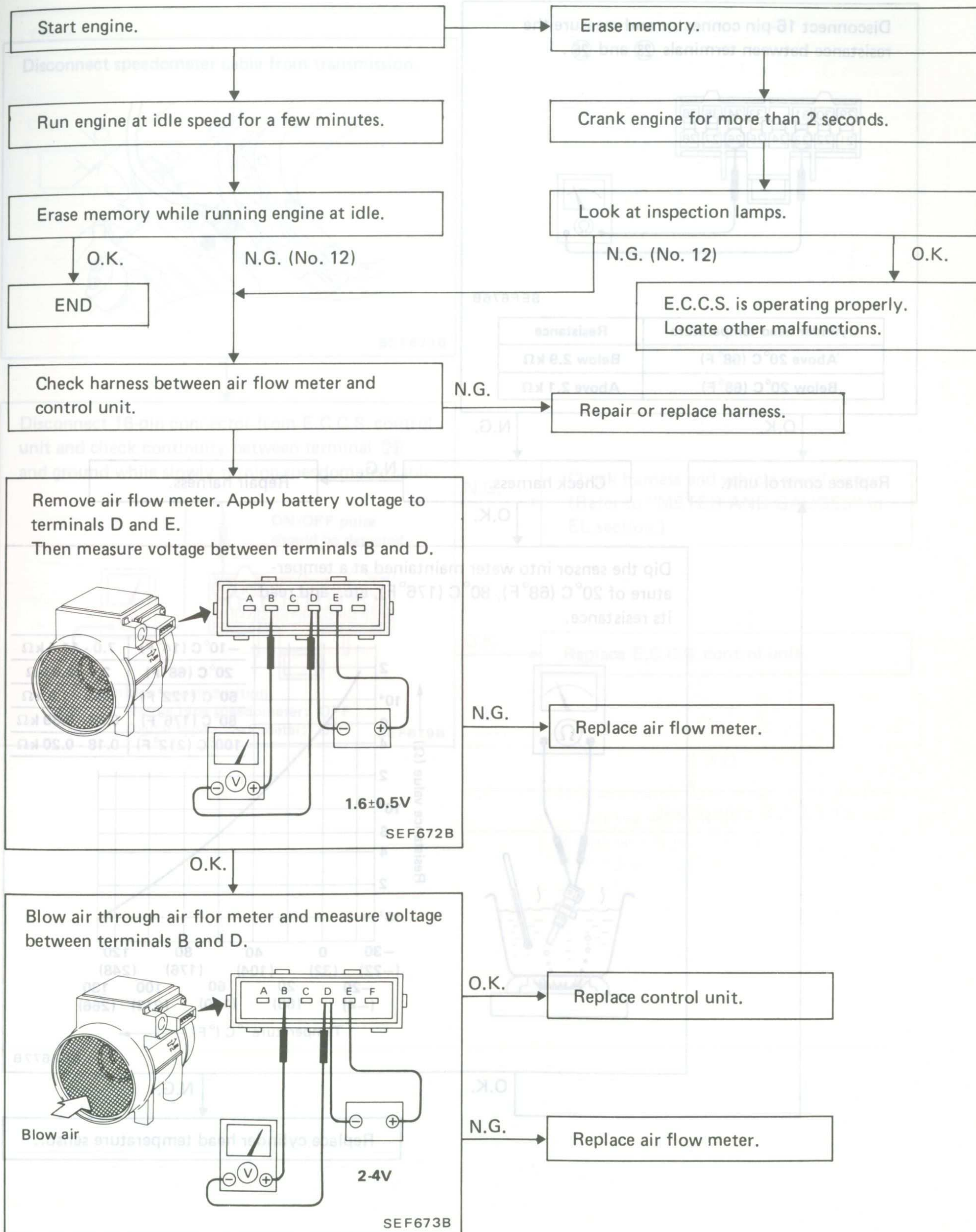
### ① Crank angle sensor (Code No. 11)





# ELECTRONIC CONTROL SYSTEM INSPECTION

## ⑧ Air flow meter (Code No. 12)

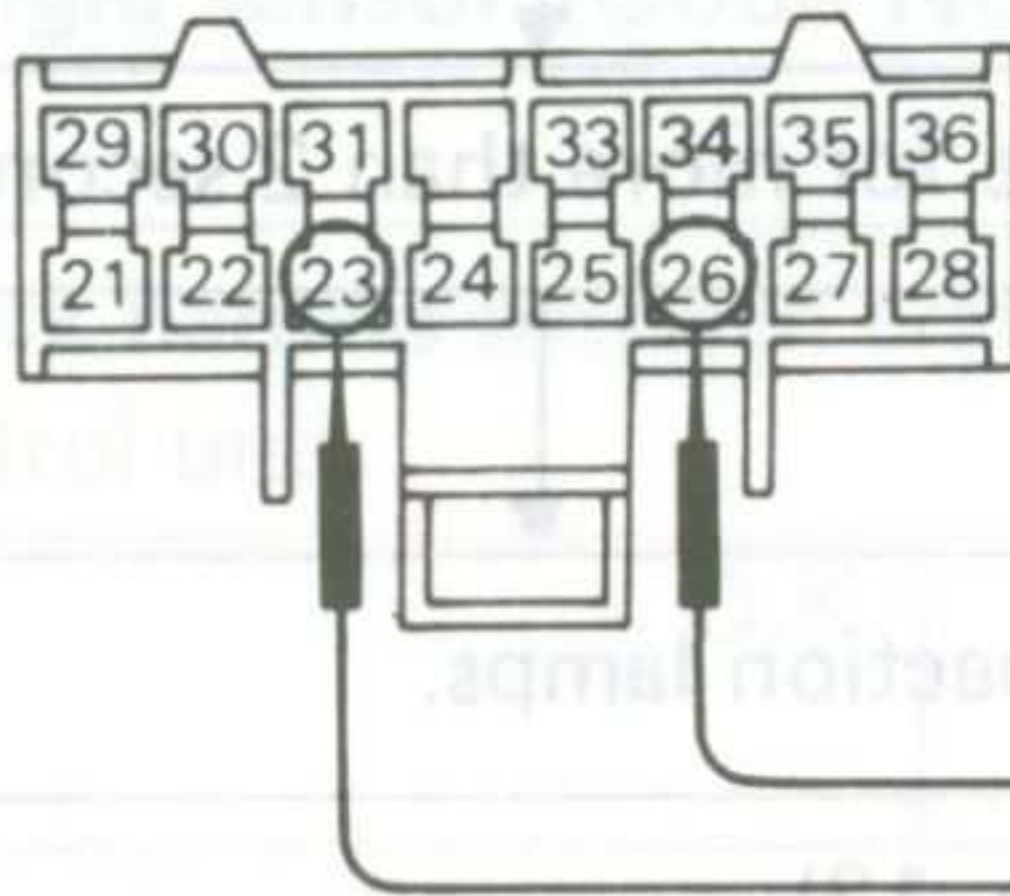




# ELECTRONIC CONTROL SYSTEM INSPECTION

## © Cylinder head temperature sensor (Code No. 13)

Disconnect 16-pin connector and measure the resistance between terminals ②③ and ②⑥.



SEF676B

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

O.K.

N.G.

Replace control unit.

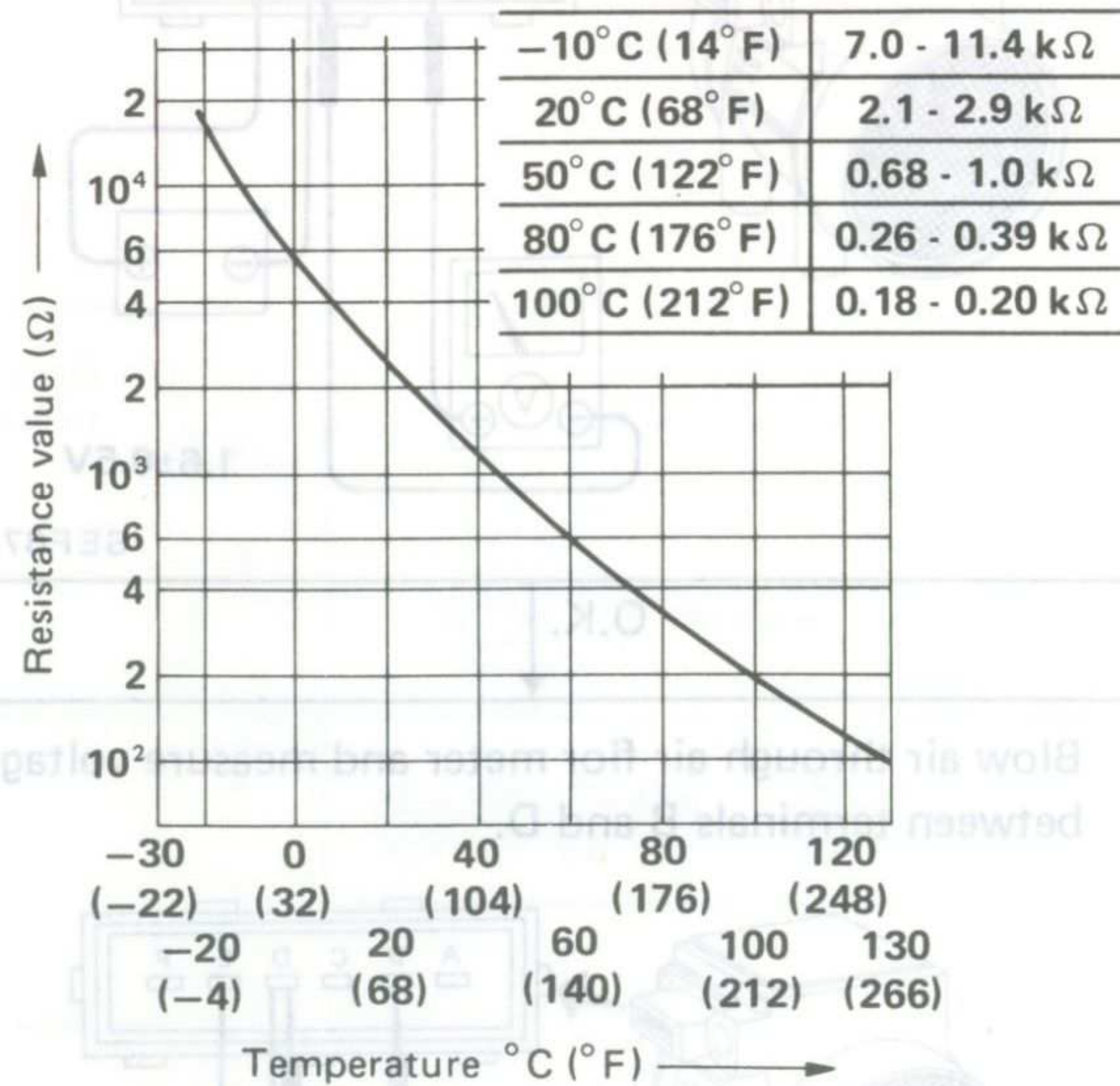
Check harness.

N.G.

Repair harness.

O.K.

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



SEF677B

O.K.

N.G.

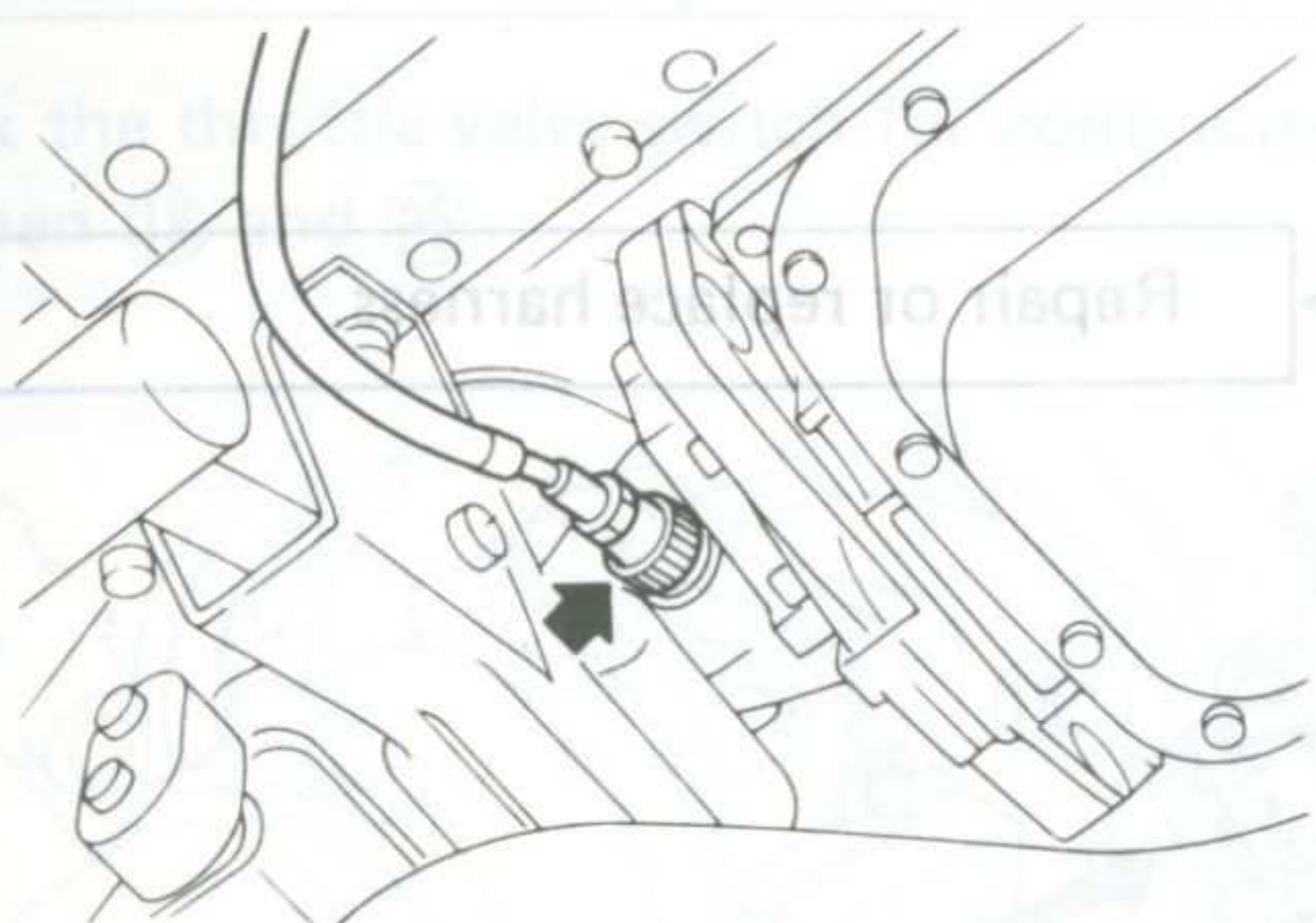
Replace cylinder head temperature sensor.



# ELECTRONIC CONTROL SYSTEM INSPECTION

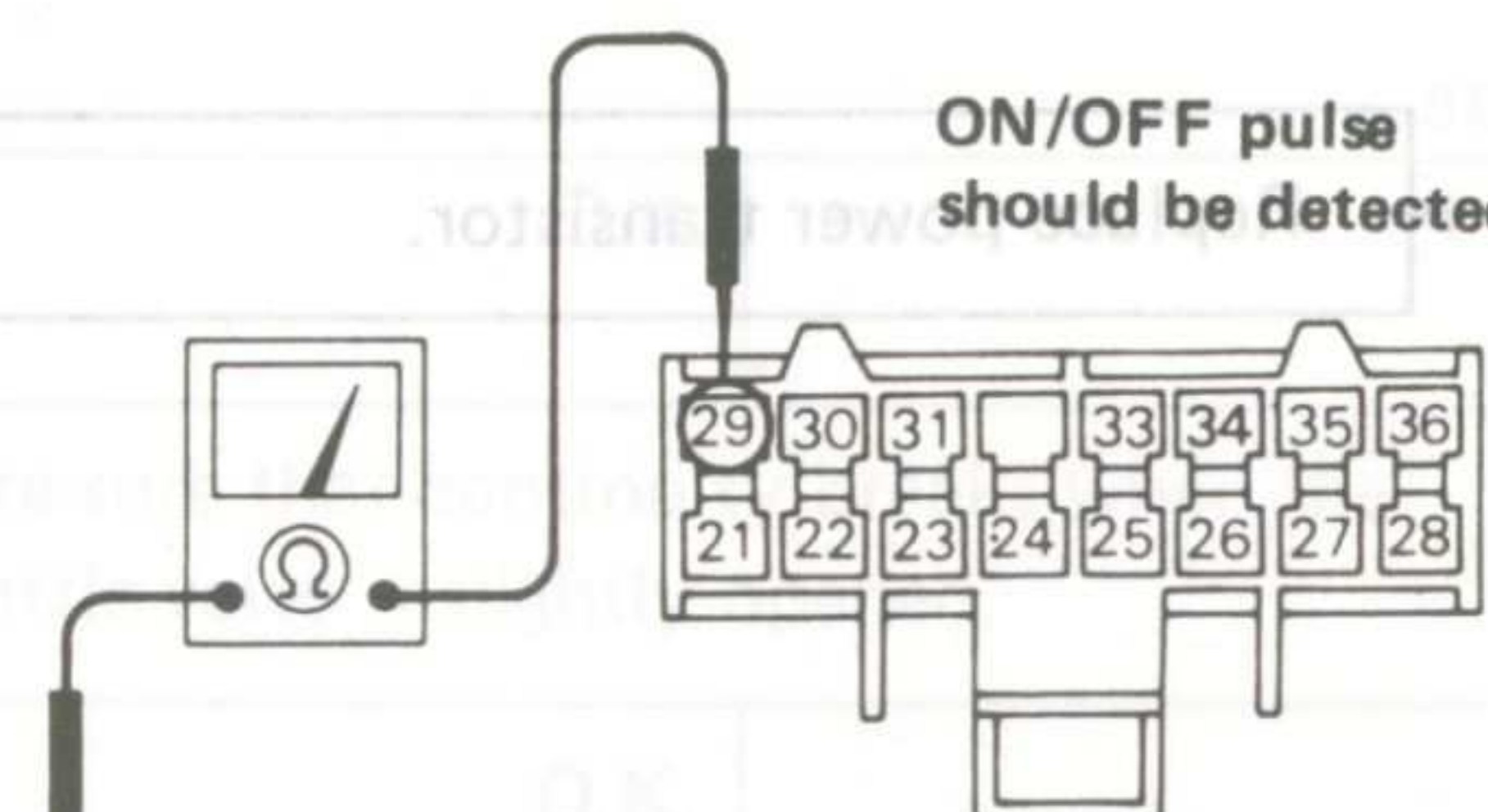
## ④ Vehicle speed sensor (Code No. 14)

Disconnect speedometer cable from transmission.



SEF678B

Disconnect 16-pin connector from E.C.C.S. control unit and check continuity between terminal ②⑨ and ground while slowly turning speedometer cable.



Ignition switch position

Needle type speedometer: OFF

Digital type speedometer: ON

SEF679B

N.G.

Check harness and vehicle speed sensor.  
(Refer to "METER AND GAUGES" in  
EL section.)

O.K.

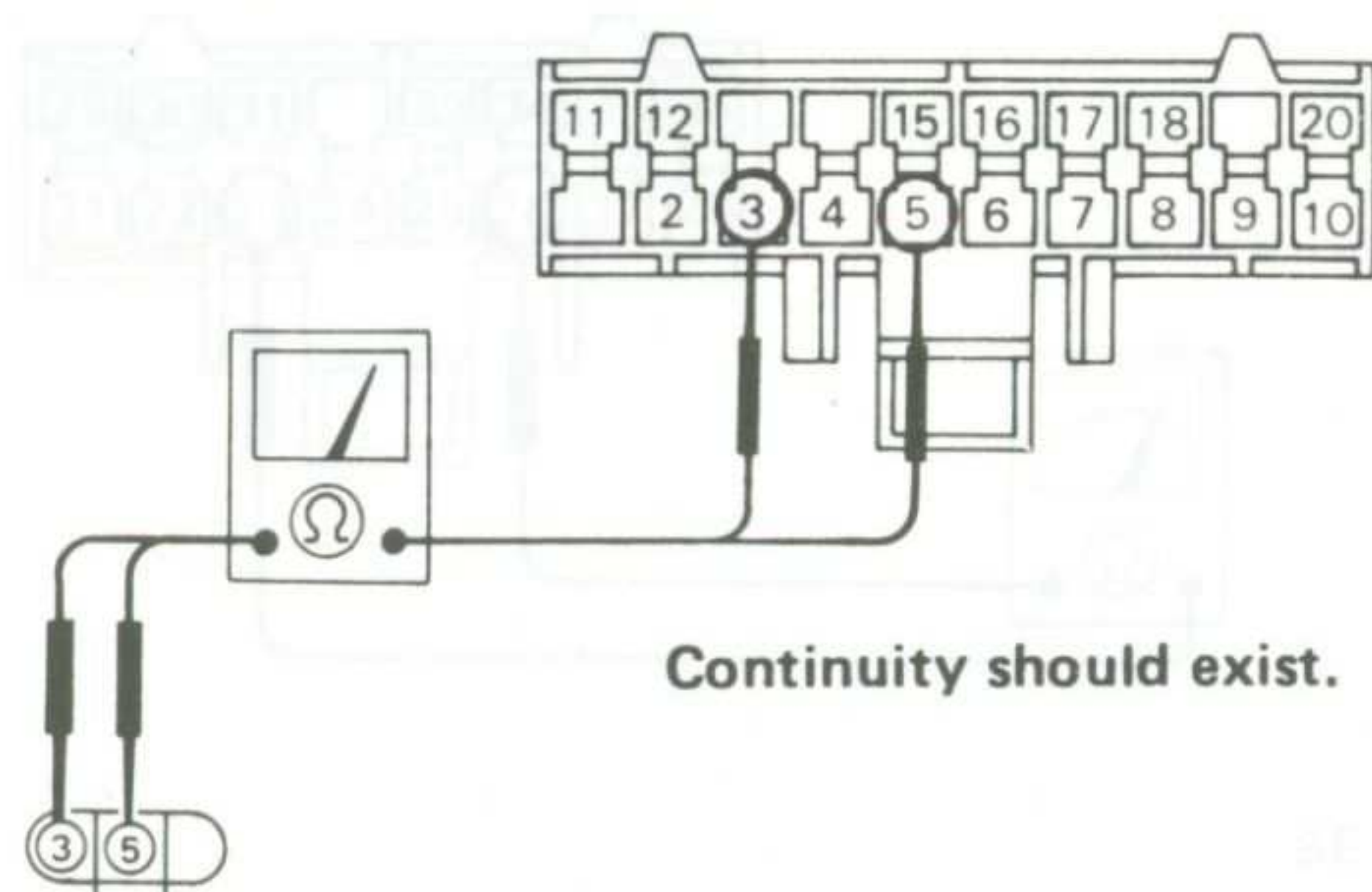
Replace E.C.C.S. control unit.



# ELECTRONIC CONTROL SYSTEM INSPECTION

## ⑤ Ignition signal (Code No. 21)

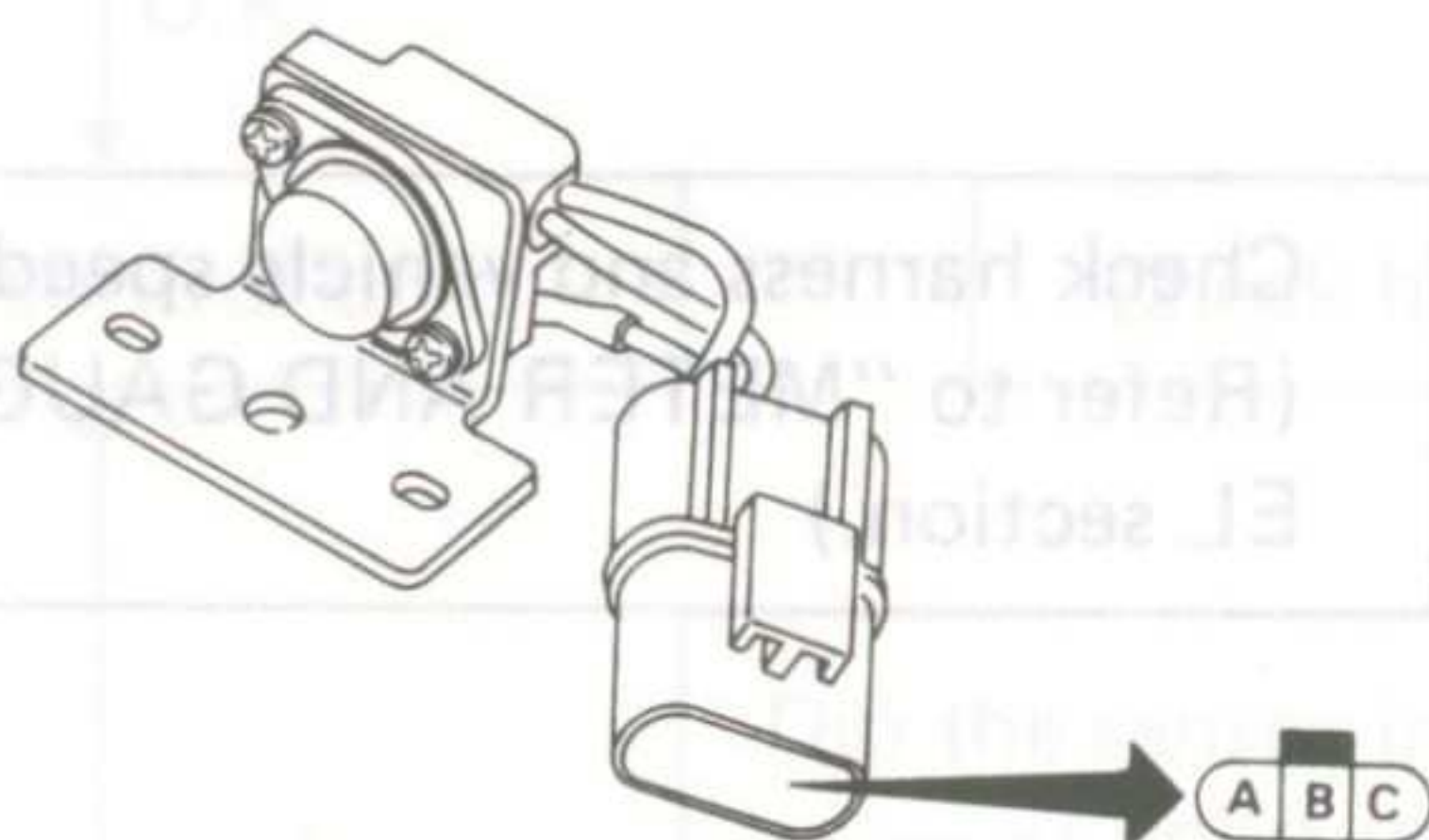
Disconnect 20-pin connector and power transistor harness connector. Then check harness for continuity between ③ - ③ and ⑤ - ⑤.



SEF243C

O.K.

Check power transistor.



Tester	Leads to pins		Should read
	(+)	(-)	
Ohmmeter	A	C	Continuity exists.
	B	C	
	A	B	

SEF244C

O.K.

Replace E.C.C.S. control unit.

N.G.

Repair or replace harness.

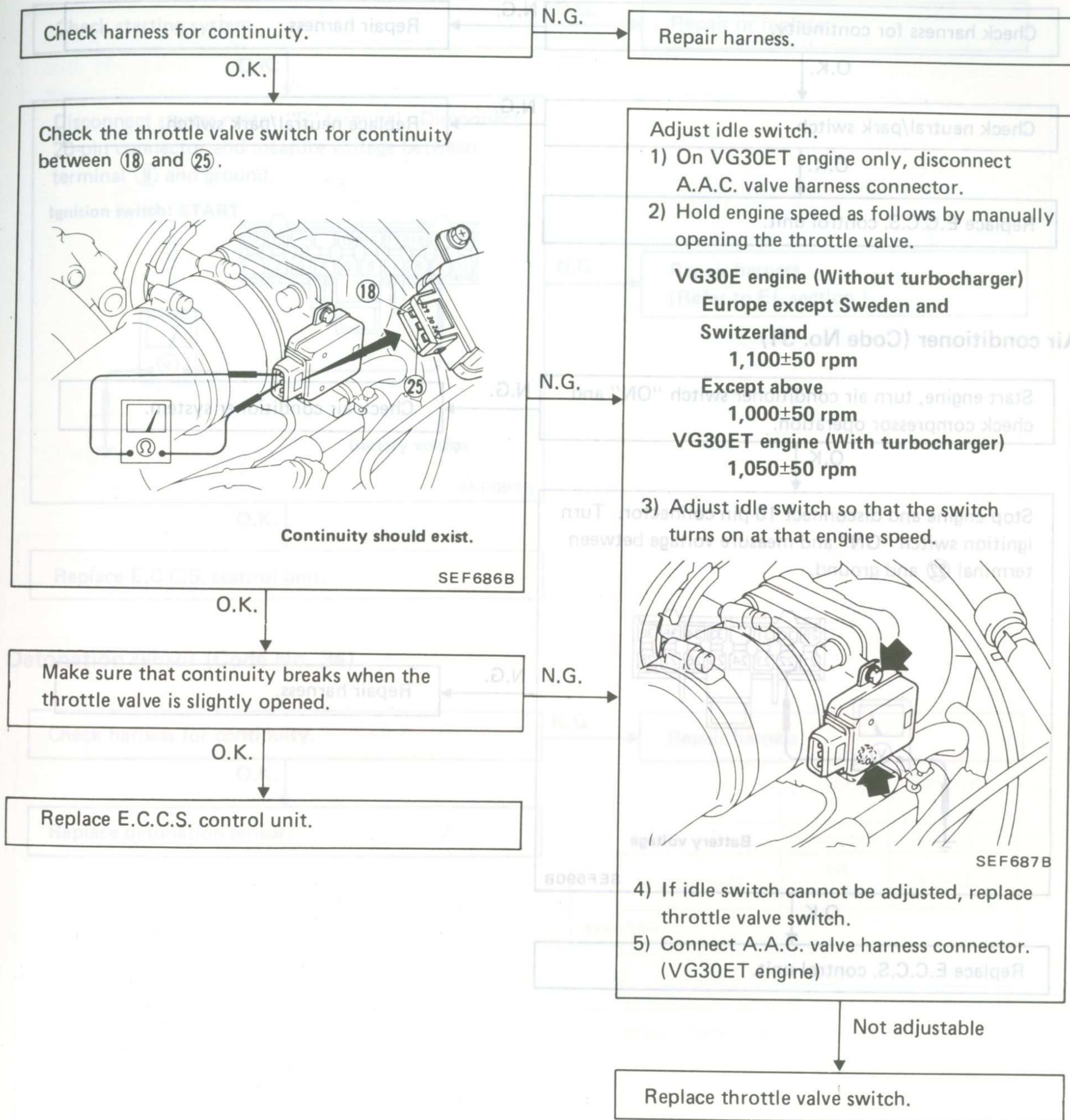
N.G.

Replace power transistor.



# ELECTRONIC CONTROL SYSTEM INSPECTION

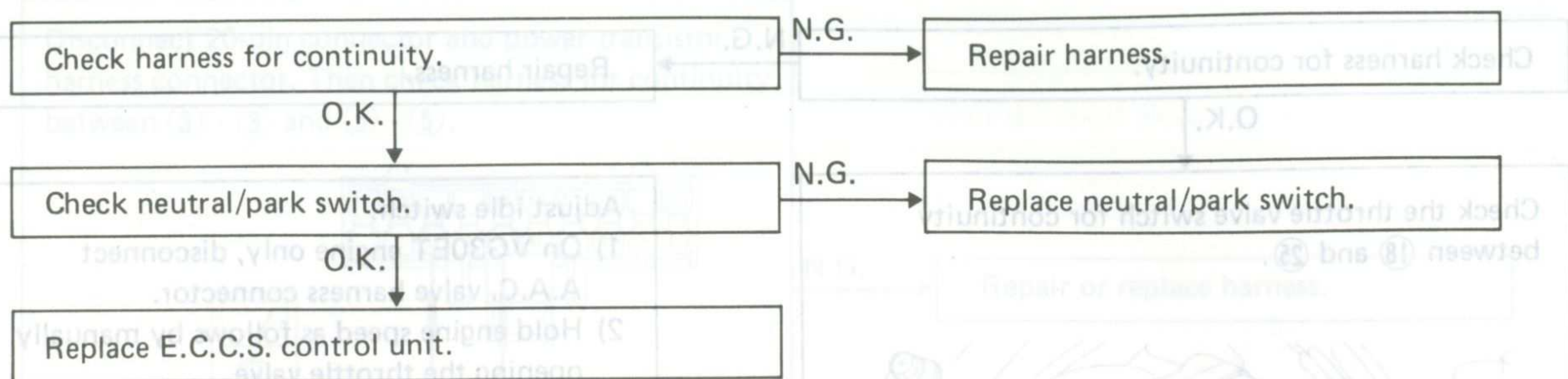
## ⑥ Throttle valve switch (Code No. 23)



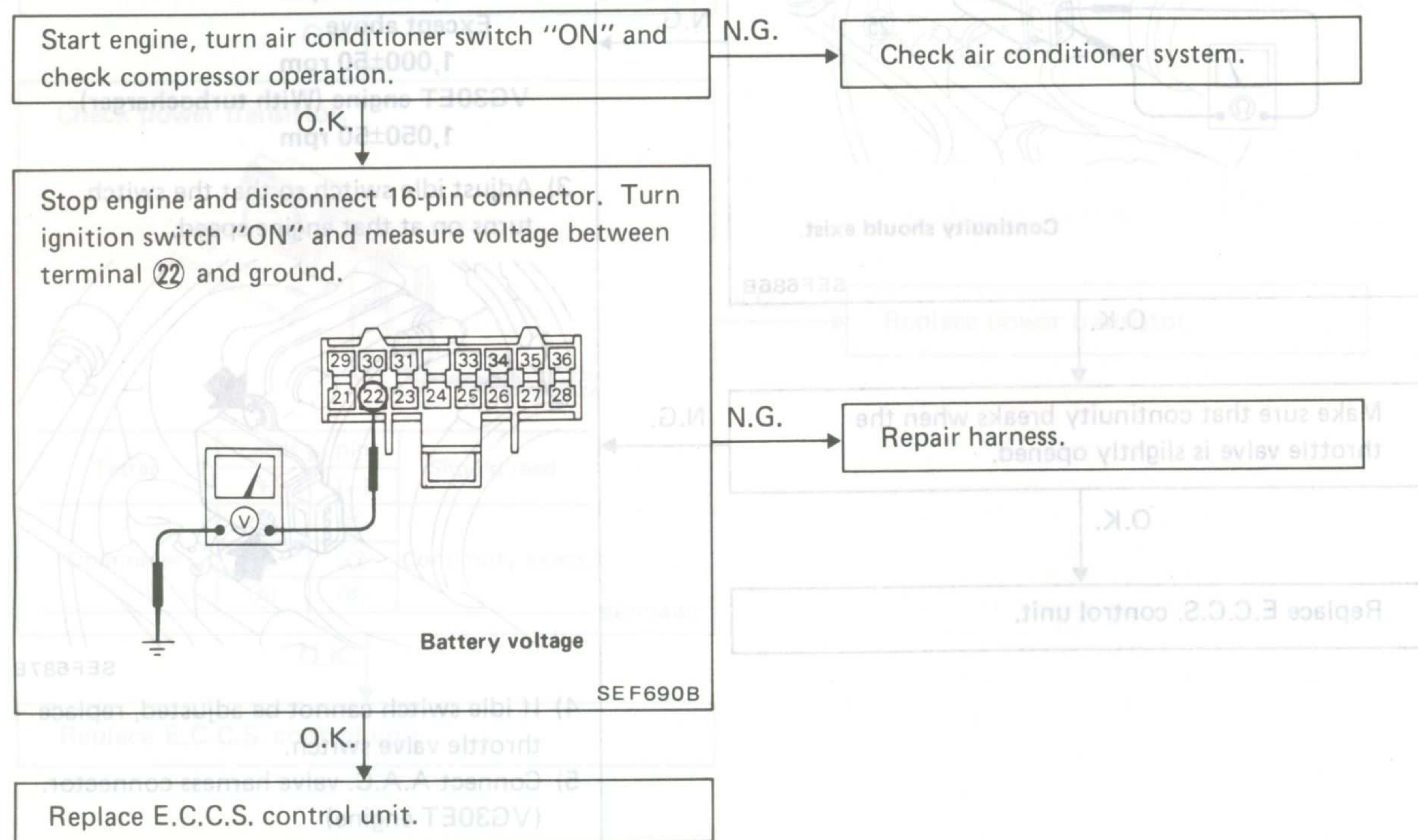


# ELECTRONIC CONTROL SYSTEM INSPECTION

## H Neutral/Park switch (Code No. 24)



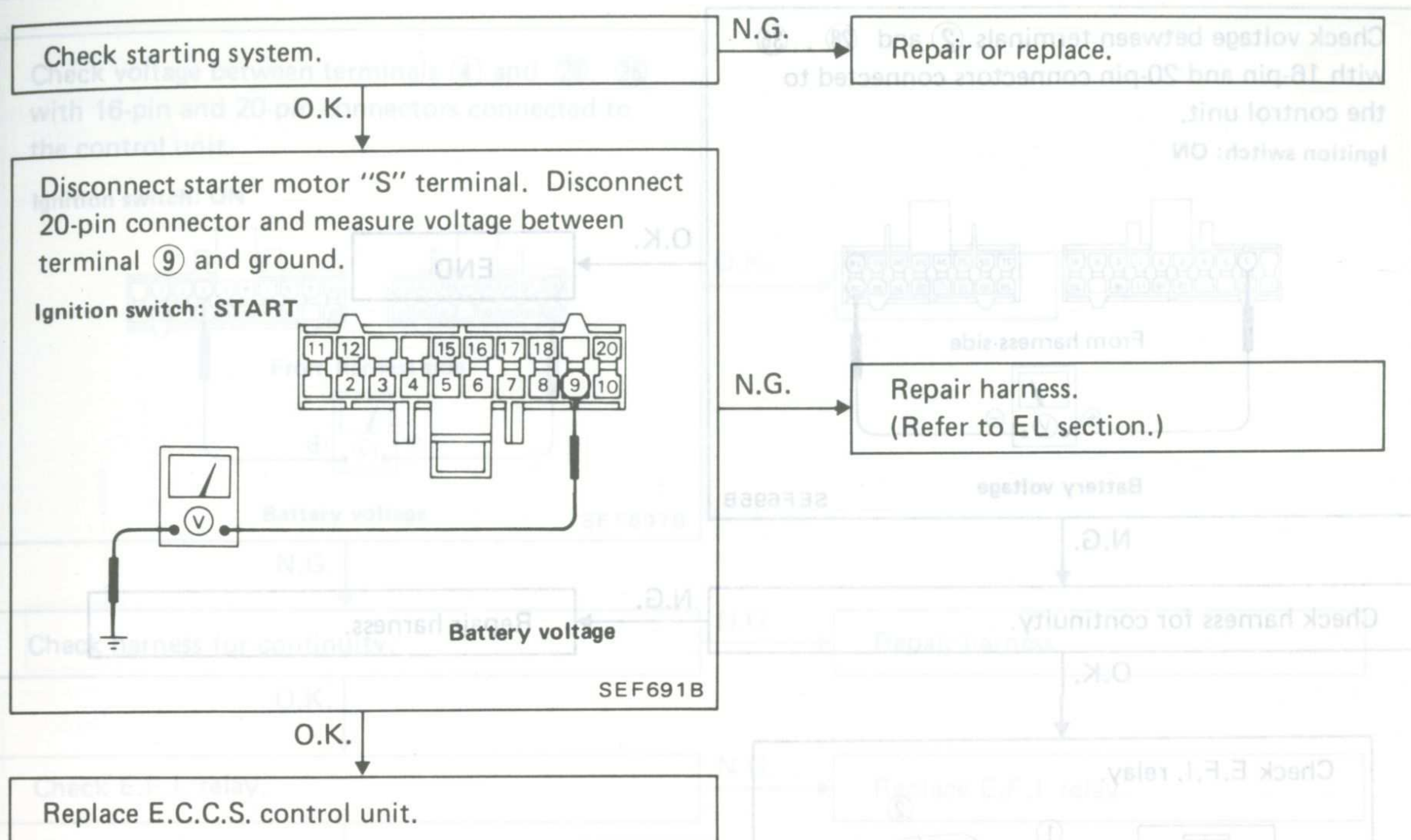
## I Air conditioner (Code No. 31)



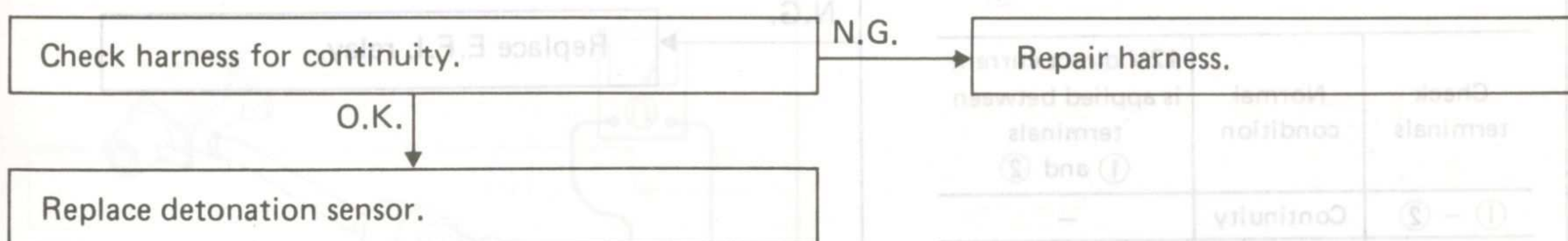


# ELECTRONIC CONTROL SYSTEM INSPECTION

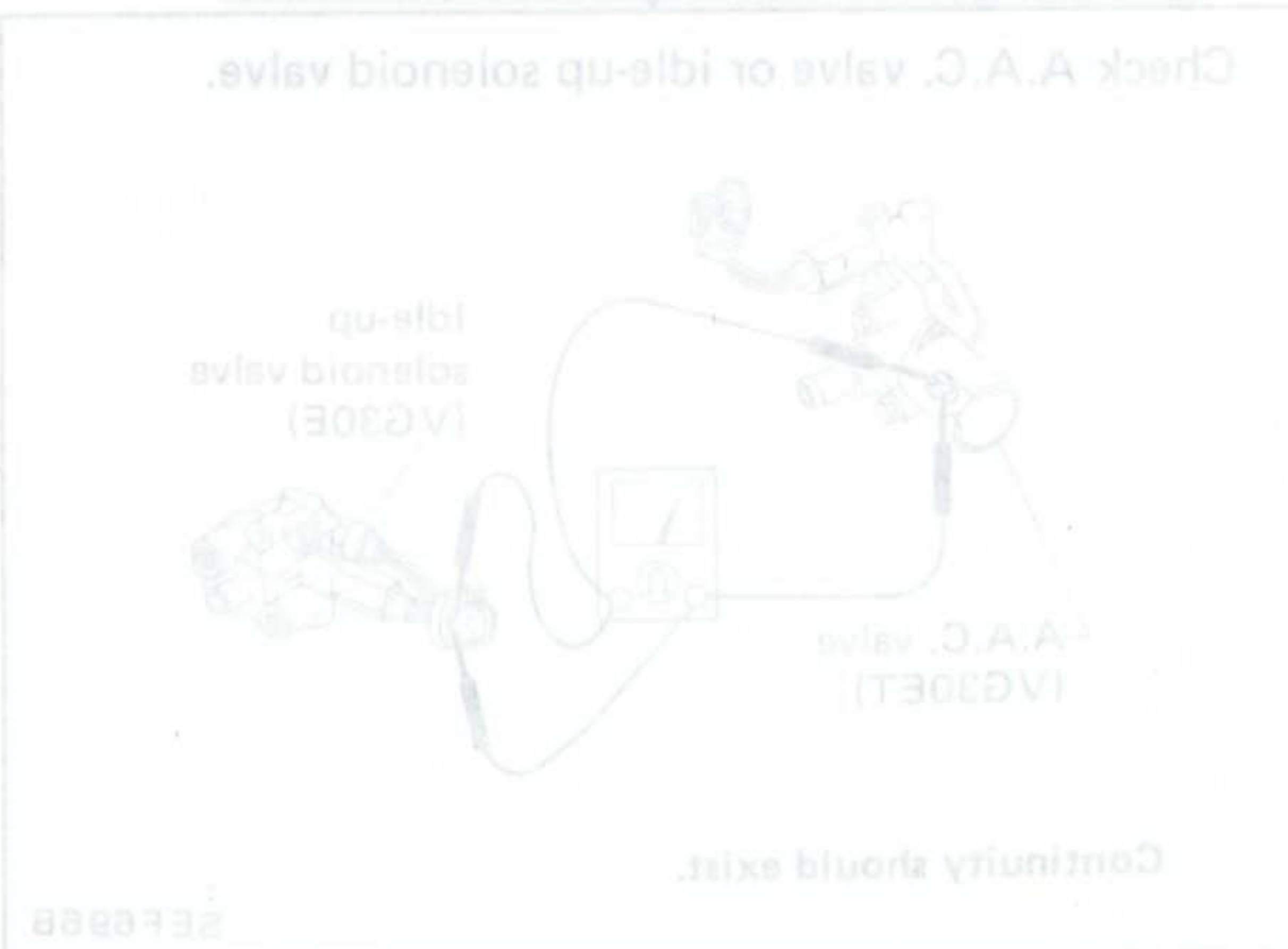
## J Start signal (Code No. 32)



## K Detonation sensor (Code No. 34)



Replace A.A.C. valve or idle-up solenoid valve.



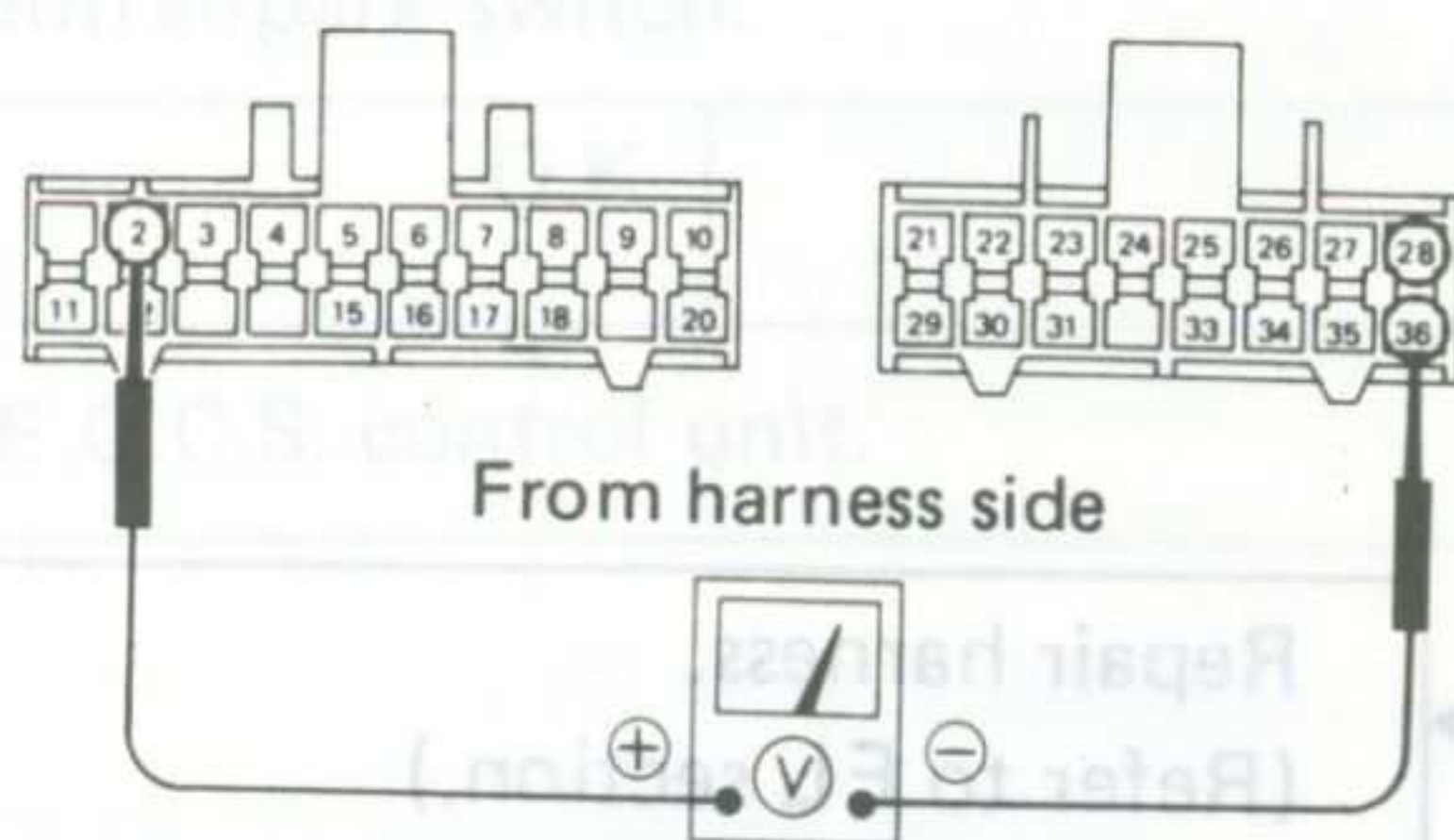


# ELECTRONIC CONTROL SYSTEM INSPECTION

## ④ Auxiliary air control (A.A.C.) valve or idle-up solenoid valve

Check voltage between terminals ② and ②⑧, ③⑥ with 16-pin and 20-pin connectors connected to the control unit.

Ignition switch: ON



SEF695B

O.K.

END

N.G.

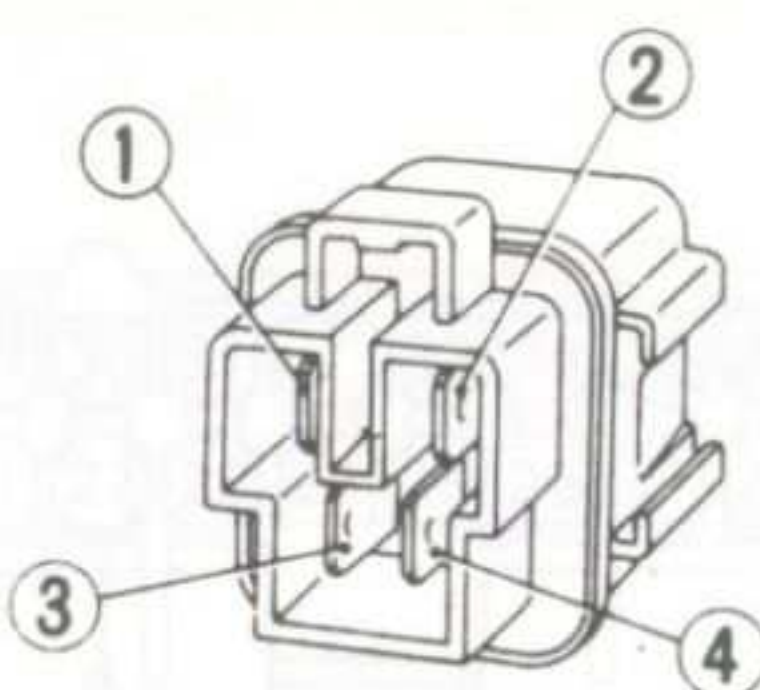
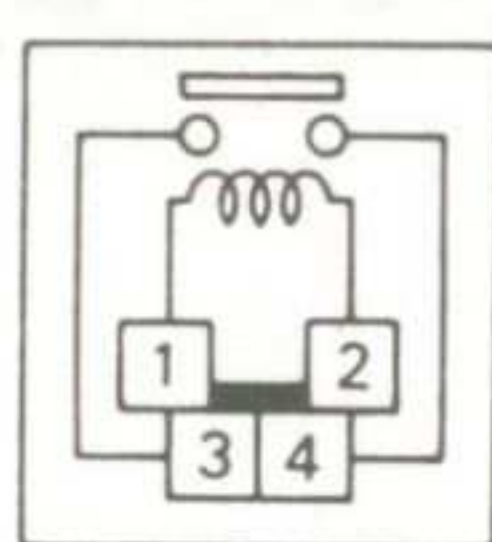
Check harness for continuity.

N.G.

Repair harness.

O.K.

Check E.F.I. relay.



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

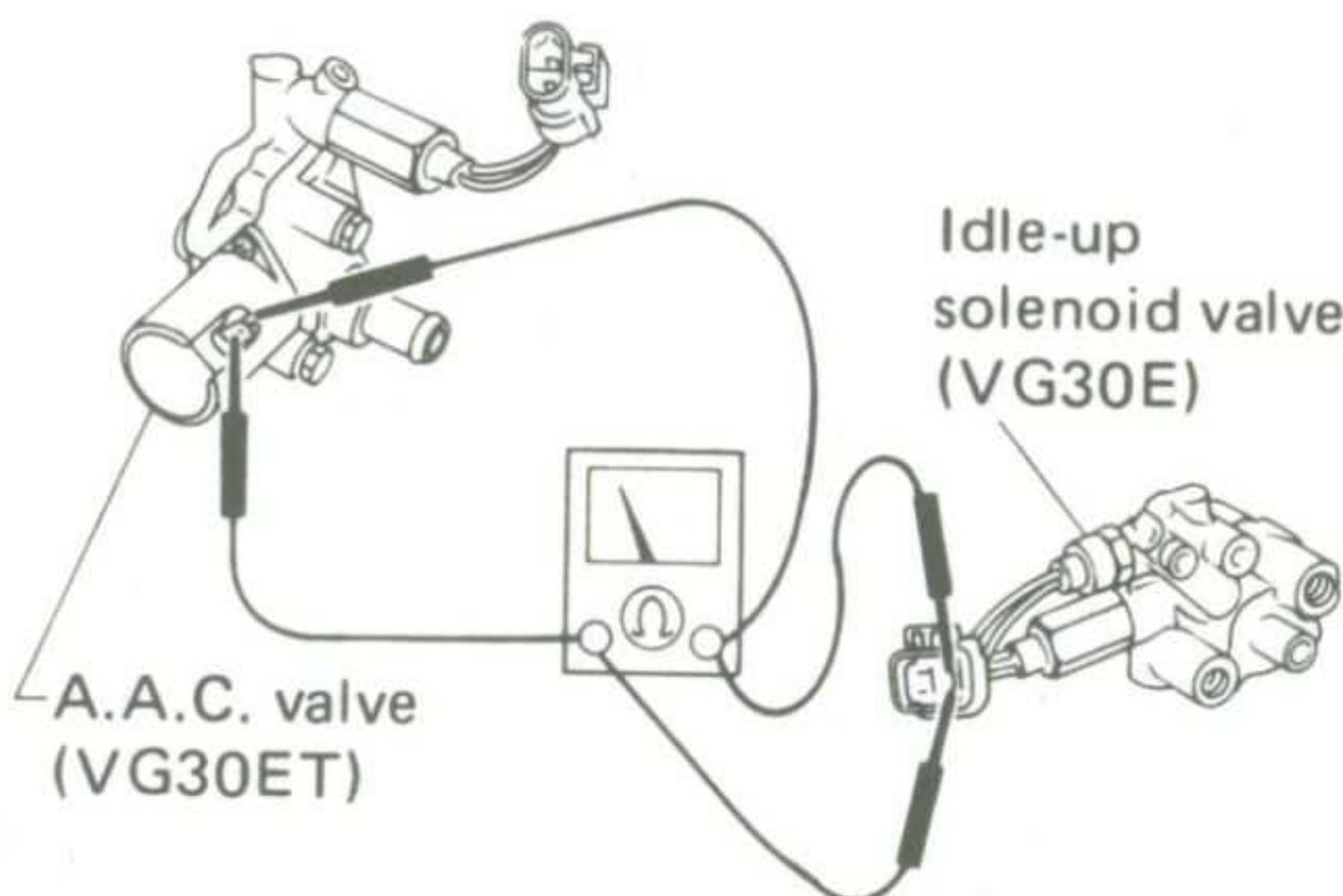
SEF685B

N.G.

Replace E.F.I. relay.

O.K.

Check A.A.C. valve or idle-up solenoid valve.



Continuity should exist.

SEF696B

N.G.

Replace A.A.C. valve or idle-up solenoid valve.

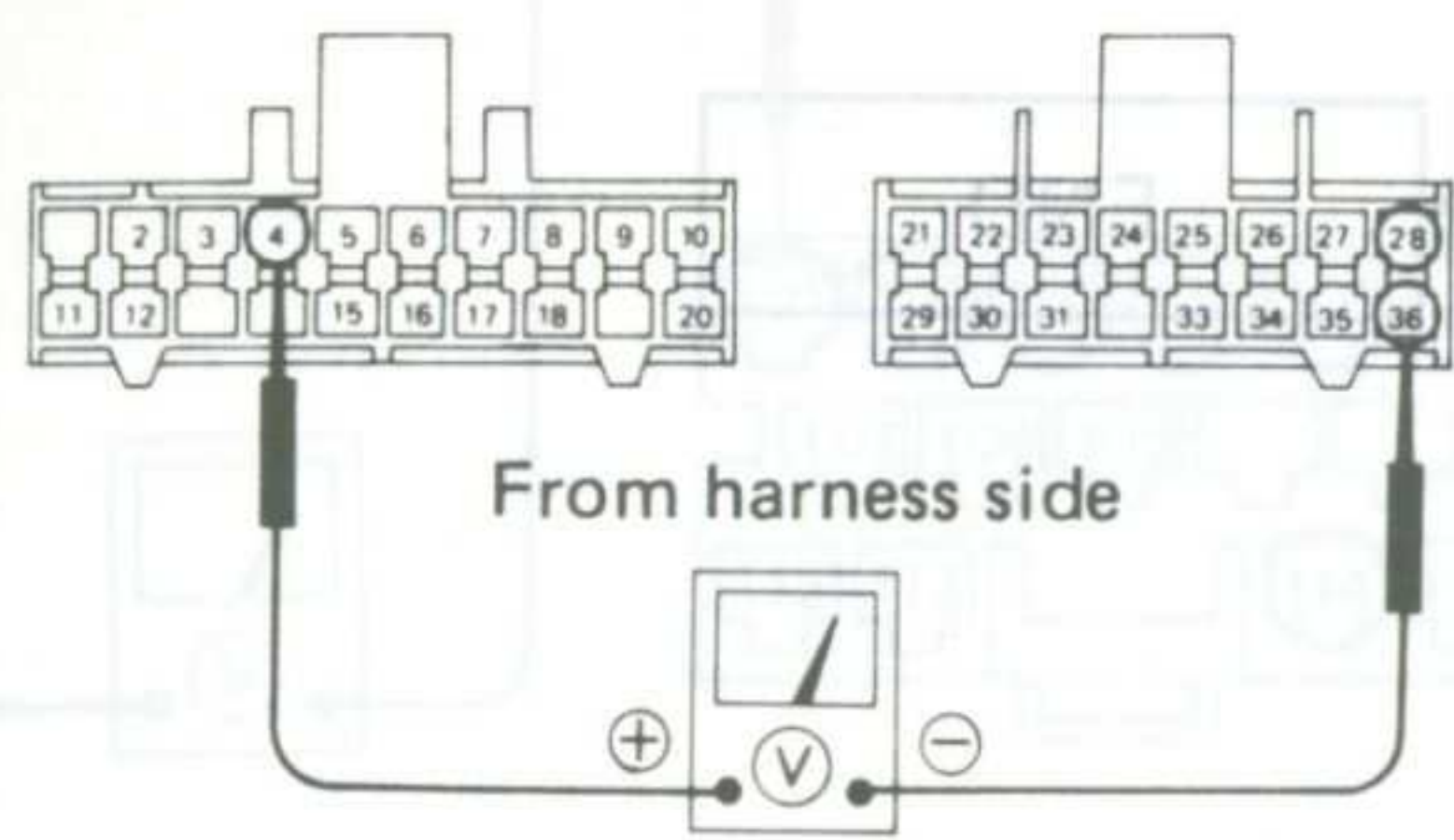


# ELECTRONIC CONTROL SYSTEM INSPECTION

## ④ E.G.R. control valve

Check voltage between terminals ④ and ②⑧, ③⑥ with 16-pin and 20-pin connectors connected to the control unit.

Ignition switch: ON



Battery voltage

SEF697B

N.G.

Check harness for continuity.

N.G.

Repair harness.

O.K.

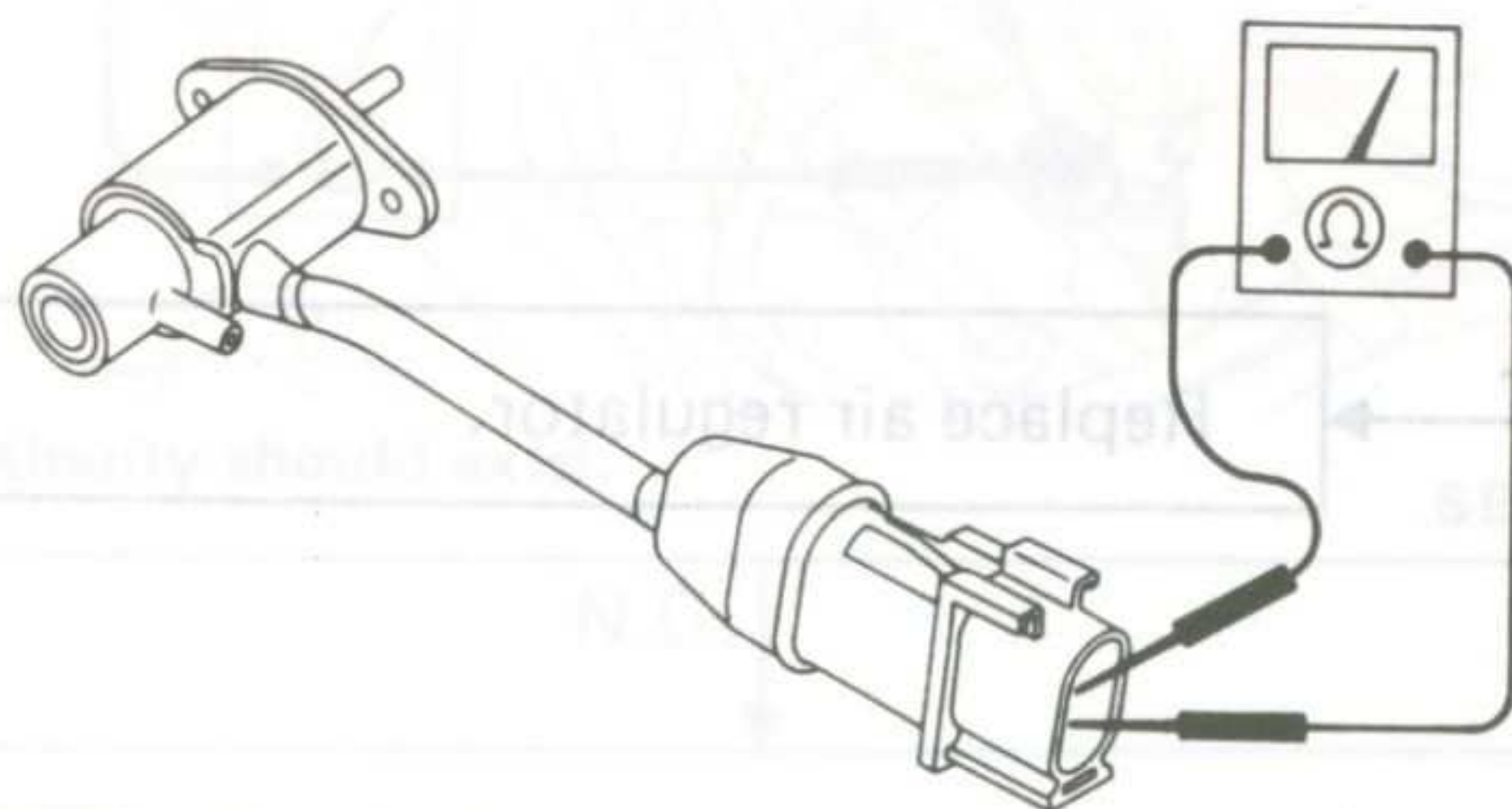
Check E.F.I. relay.

N.G.

Replace E.F.I. relay.

O.K.

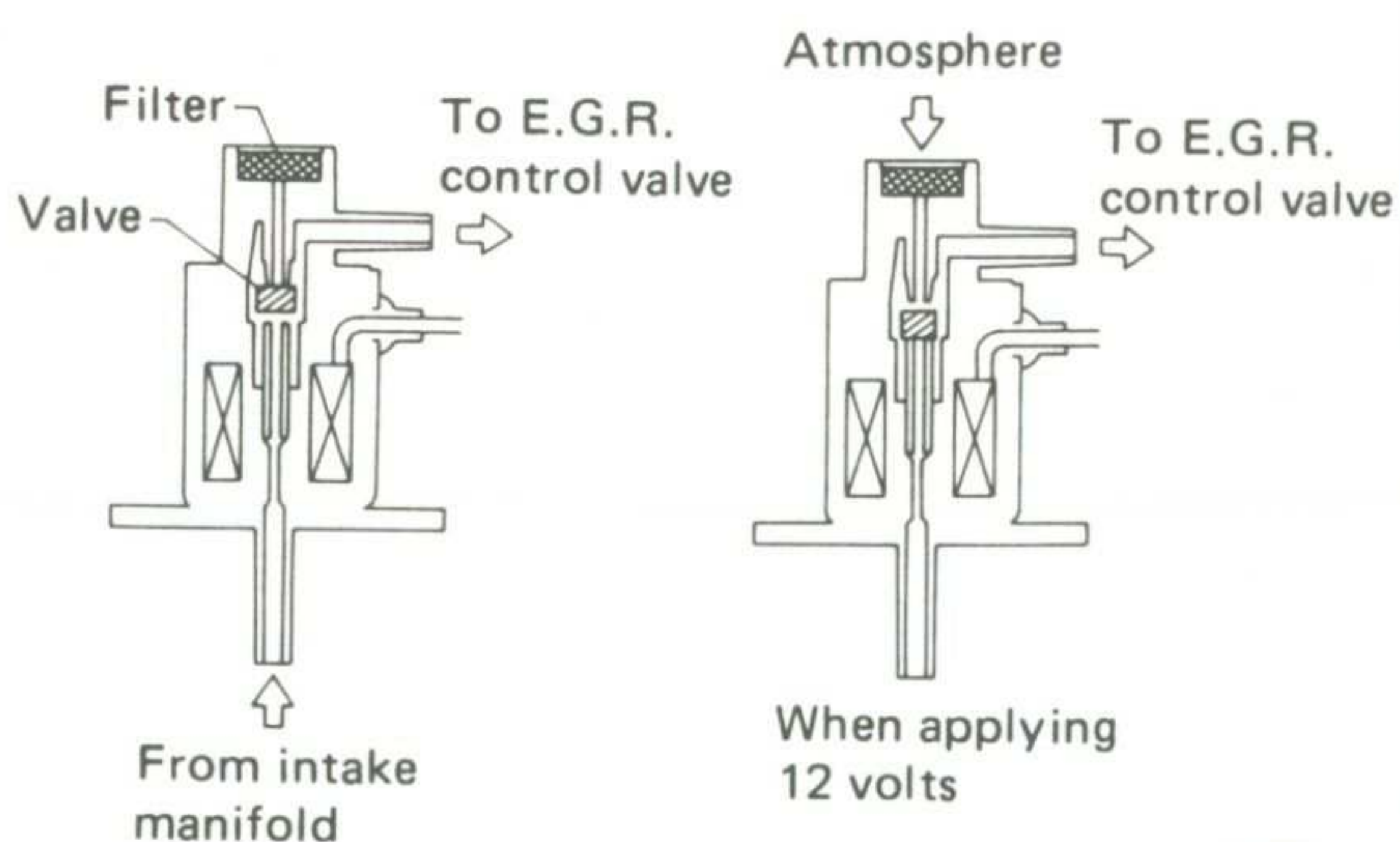
Check E.G.R. control solenoid valve for continuity.



Continuity should exist.

SEF148C

Check E.G.R. control valve for operation.



SEF792B

N.G.

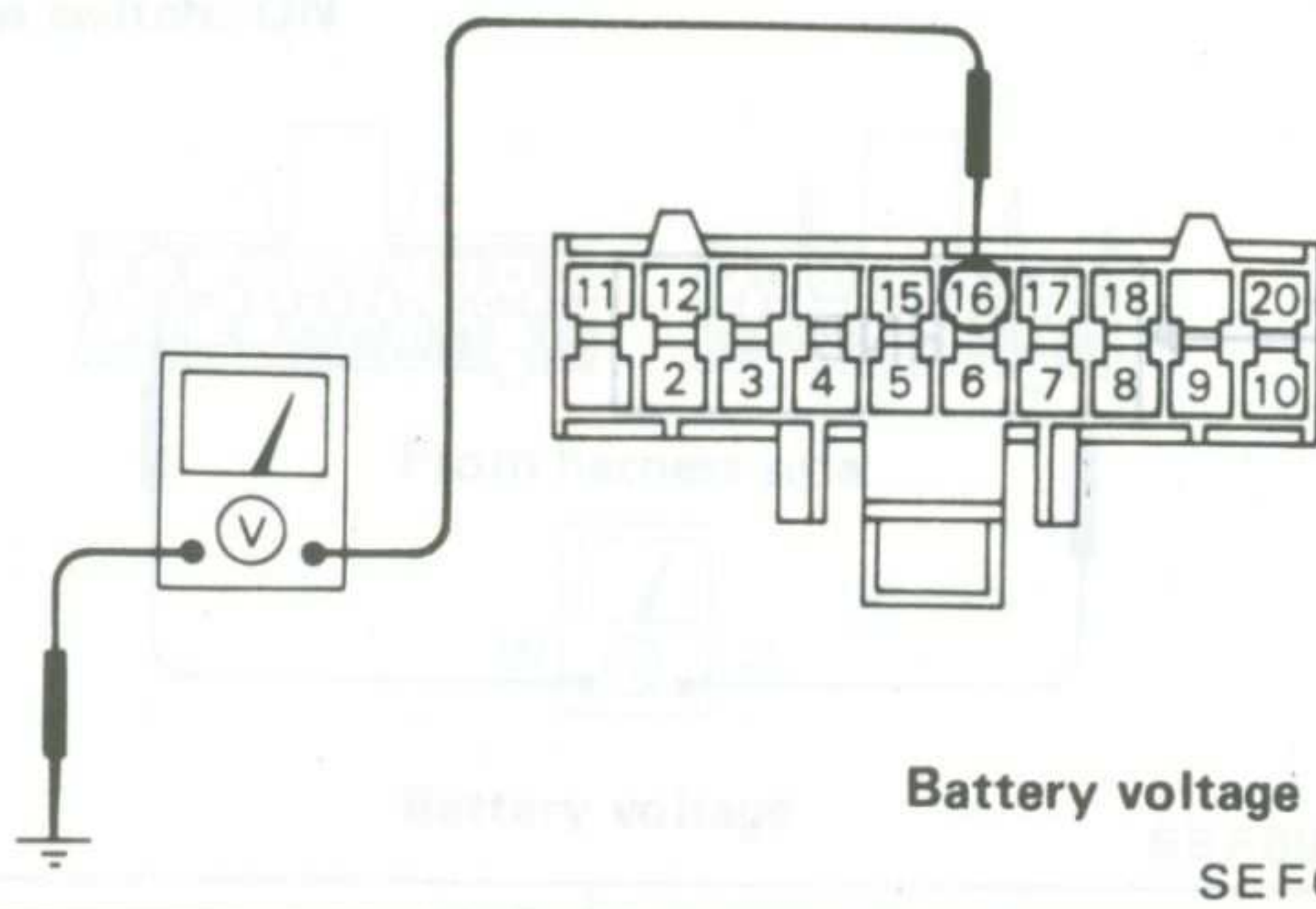
Replace E.G.R. control valve.



# ELECTRONIC CONTROL SYSTEM INSPECTION

## ① Air regulator

Disconnect E.C.C.S. 20-pin connector, and check voltage between terminal ①⑥ and ground when ignition switch is turned to ON.



O.K.

END

N.G.

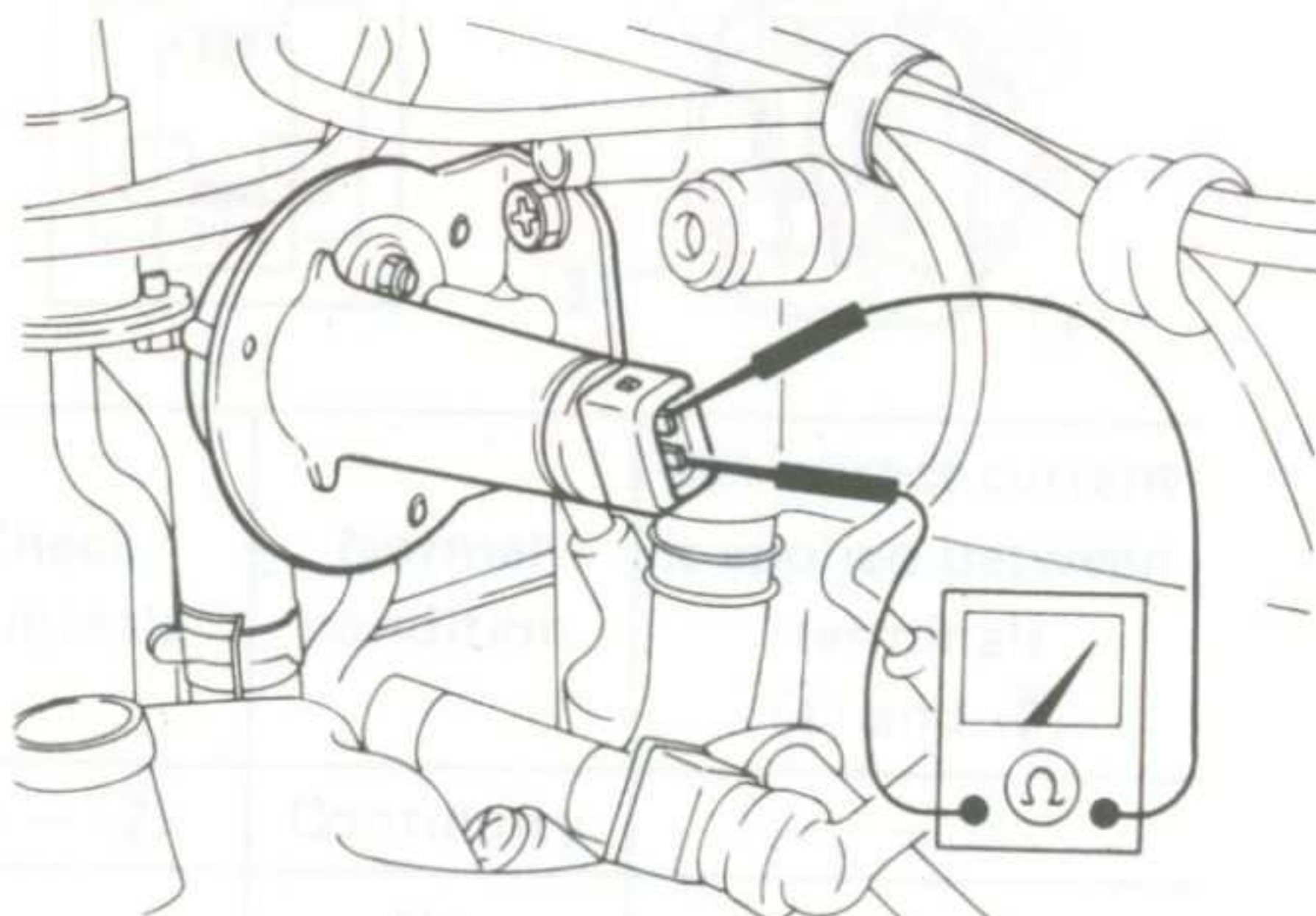
Check harness.

N.G.

Repair harness.

O.K.

Check air regulator.  
a. Check continuity.



N.G.

Replace air regulator.

b. Remove air regulator and visually check shutter opening.

- When engine is cold ..... Open
- After warm-up ..... Closed

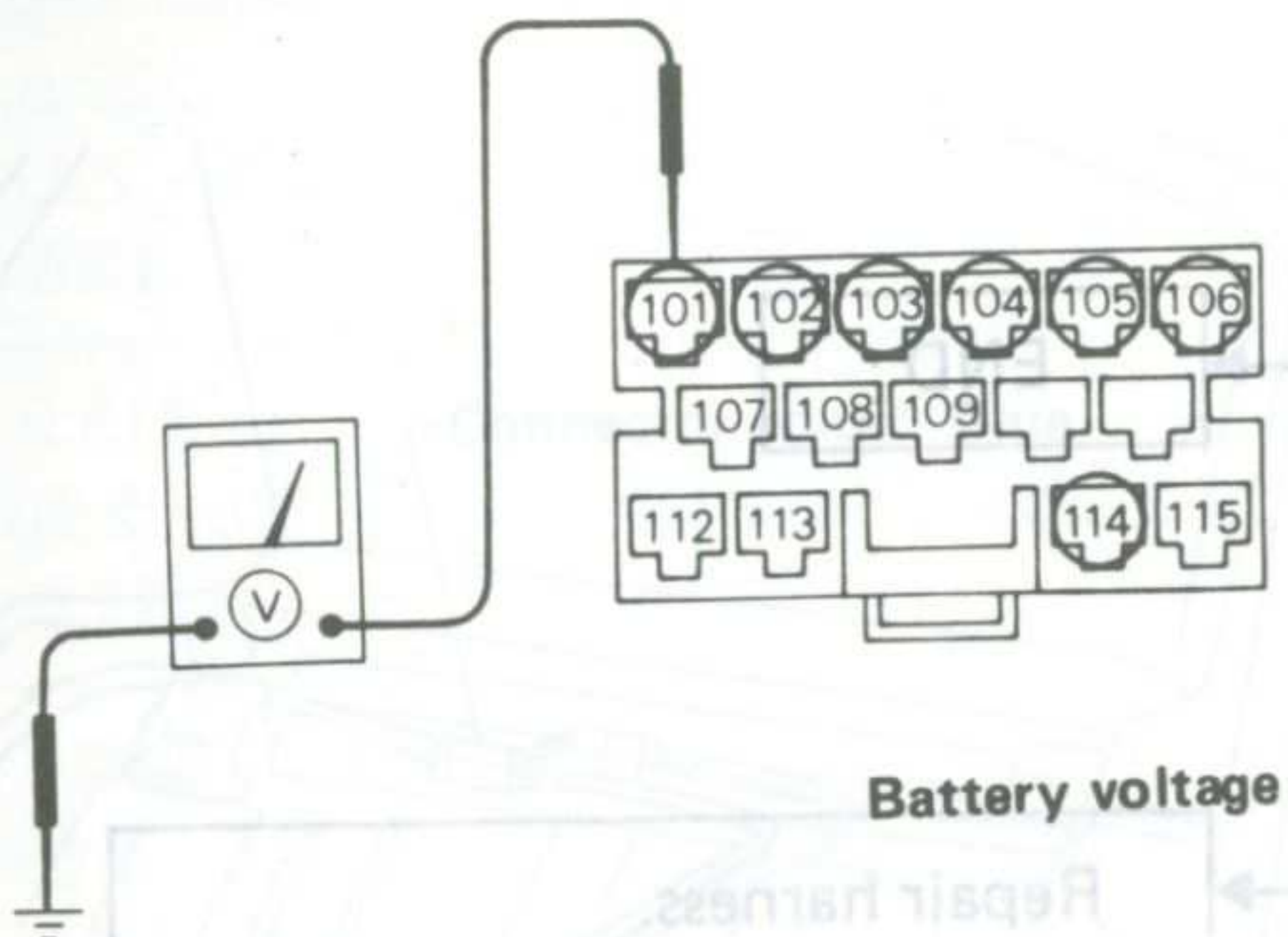
c. Pry air regulator shutter to open with a screwdriver, and check if shutter opens and closes smoothly.



# ELECTRONIC CONTROL SYSTEM INSPECTION

## @ Injector

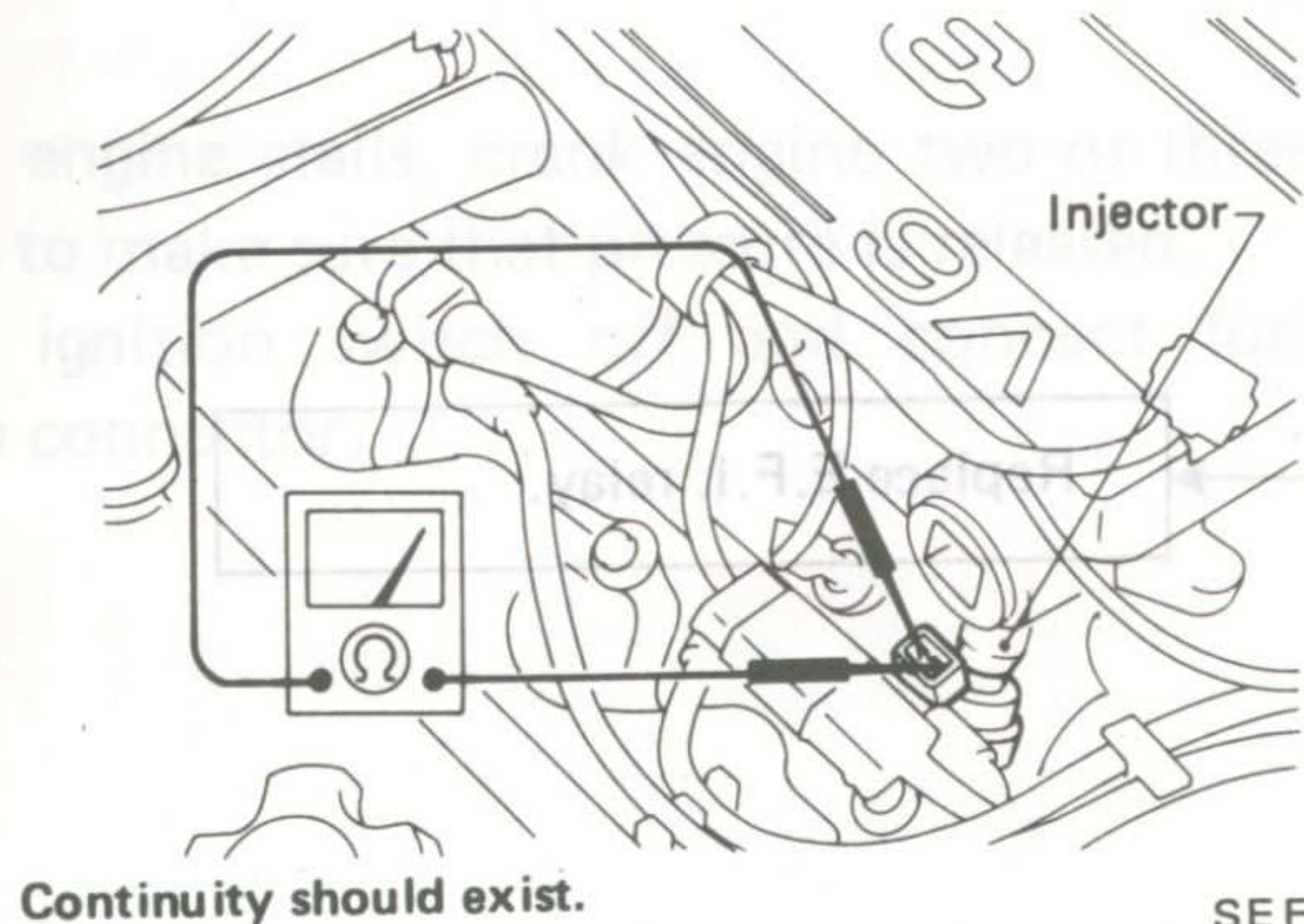
Disconnect E.C.C.S. 15-pin connector, and check voltage between terminal (101), (102), (103), (104), (105), (106), (114) and ground.



SEF703B

N.G.

Check each injector for continuity.



SEF704B

N.G.

Replace injector.

O.K.

END

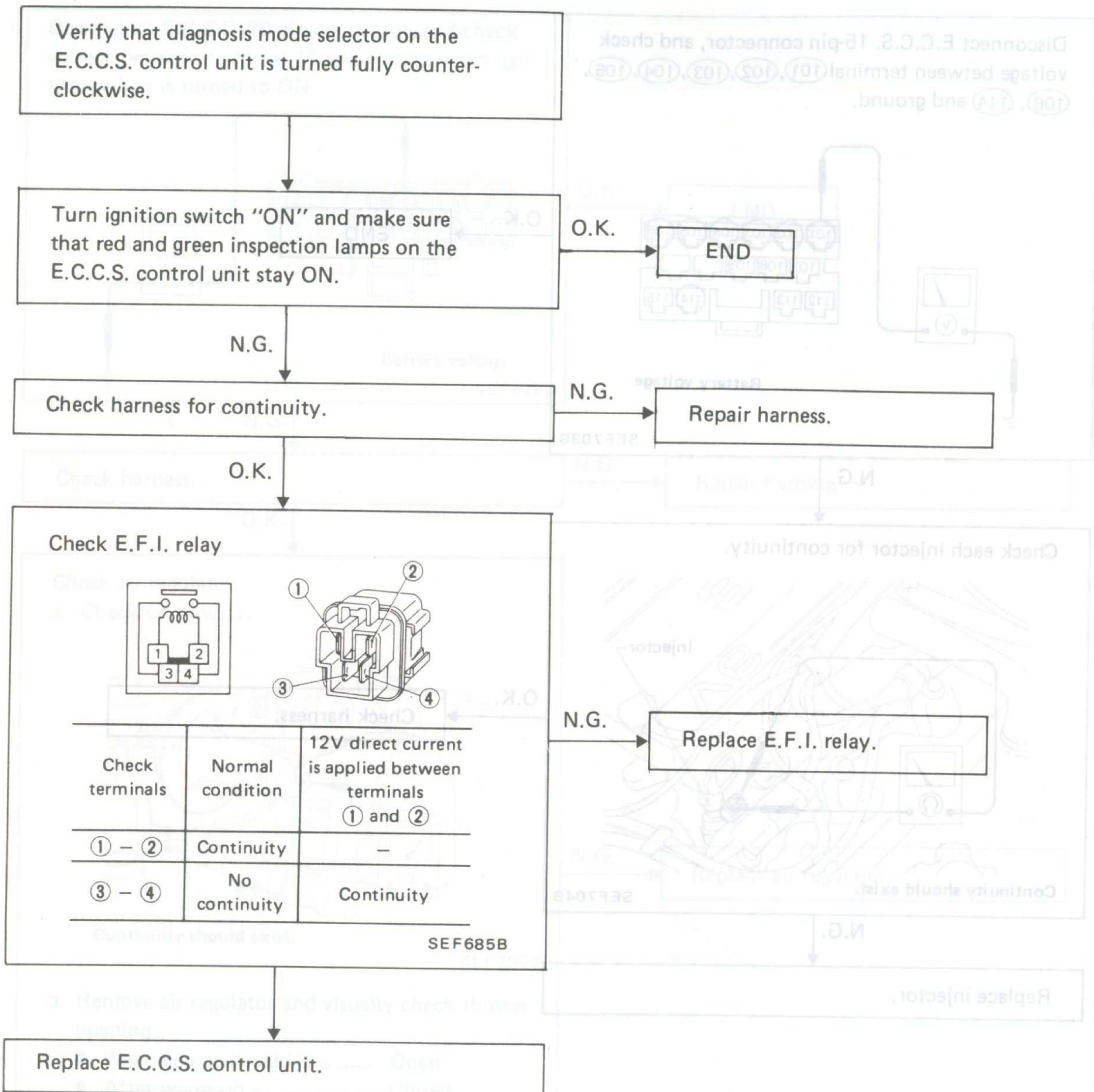
O.K.

Check harness.



# ELECTRONIC CONTROL SYSTEM INSPECTION

## Ⓡ Battery source and ground



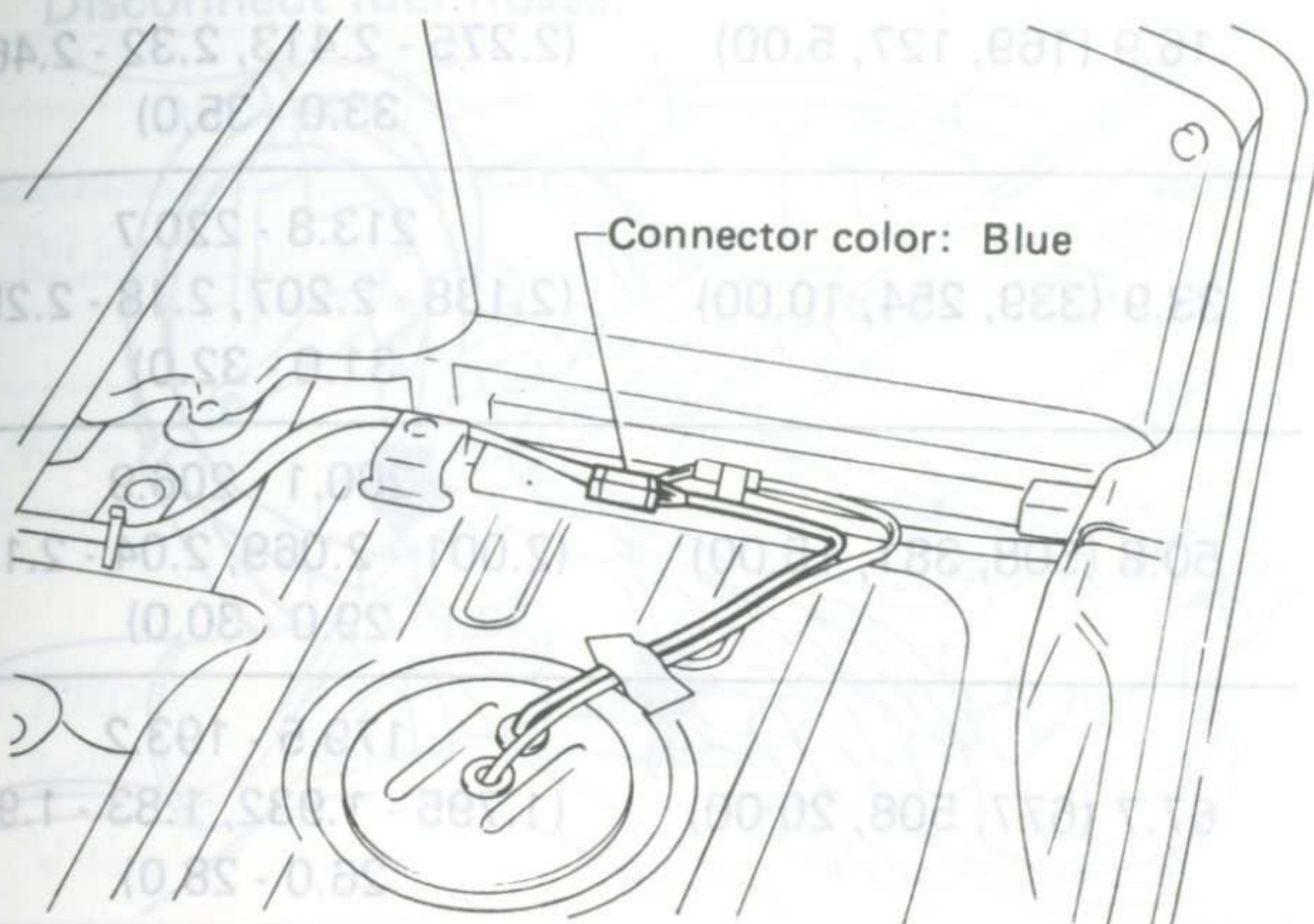


# FUEL SYSTEM INSPECTION

## Releasing Fuel Pressure

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

1. Start engine.
2. Remove luggage floor mat.
3. Disconnect fuel pump connector with engine running.

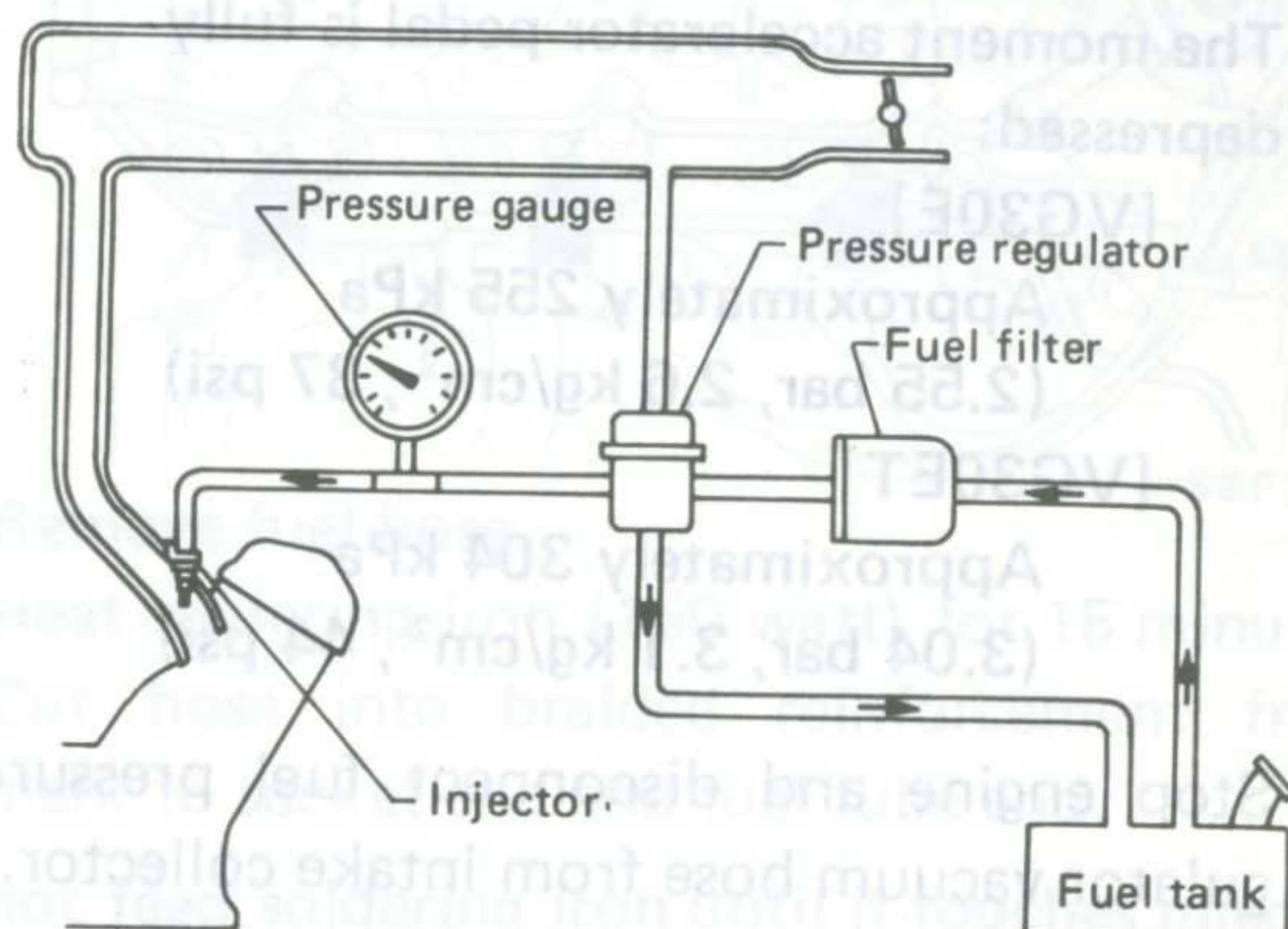


SEF245C

4. After engine stalls, crank engine two or three times to make sure that pressure is released.
5. Turn ignition switch off and connect fuel pump connector.

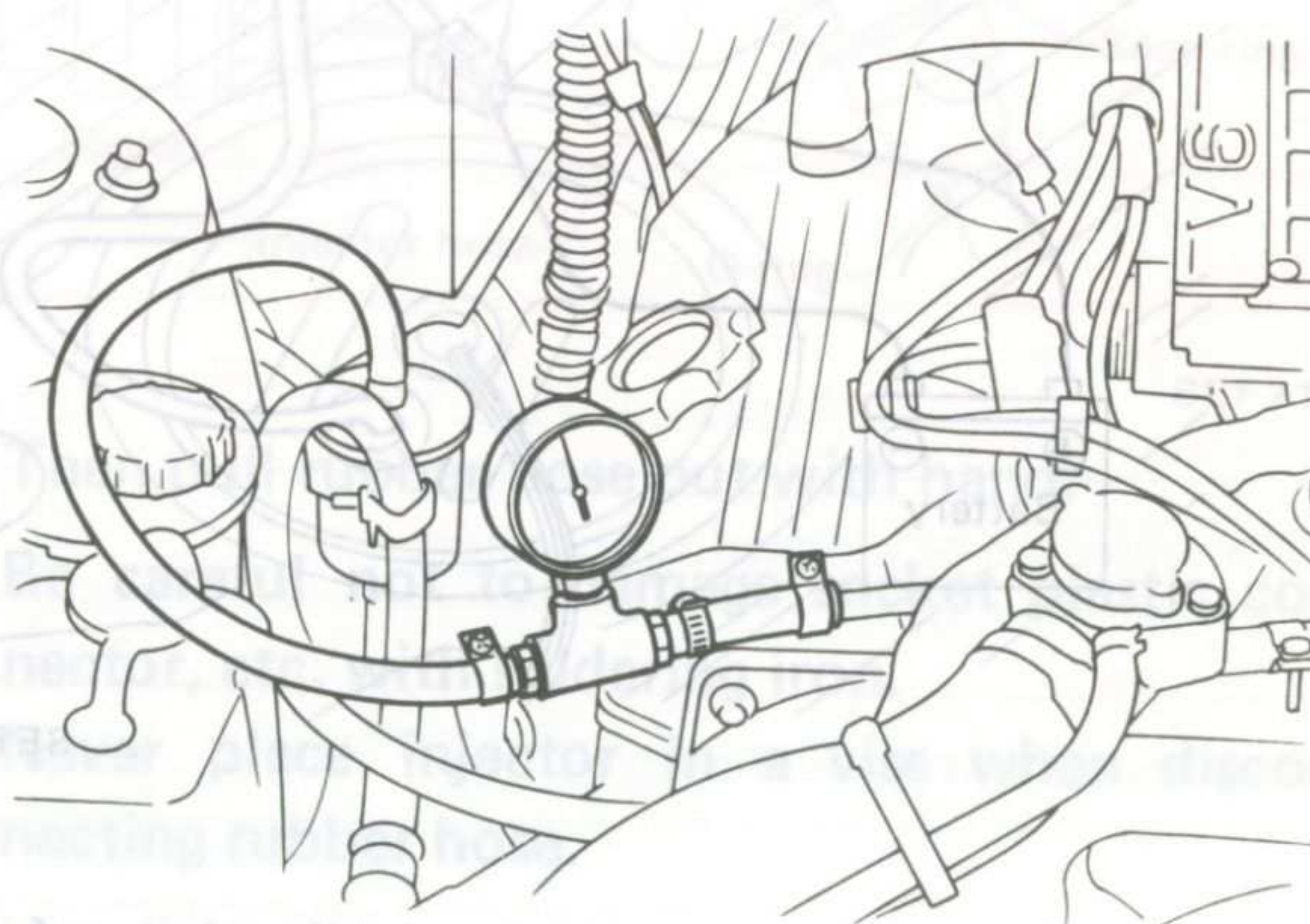
## Fuel Pressure Check

- a. Use a torque driver to tighten clamps.
- b. Use Pressure Gauge to check fuel pressure.



SEF715B

1. Release fuel pressure to zero.
2. Disconnect fuel hose between fuel filter and fuel tube (engine side).
3. Install pressure gauge between fuel filter and fuel tube.



SEF716B

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



# FUEL SYSTEM INSPECTION

## Fuel Pressure Check (Cont'd)

4. Start engine and check for fuel leakage.
5. Read the indication of fuel pressure gauge.

At idling:

Approximately 206 kPa  
(2.06 bar, 2.1 kg/cm<sup>2</sup>, 30 psi)

The moment accelerator pedal is fully depressed:

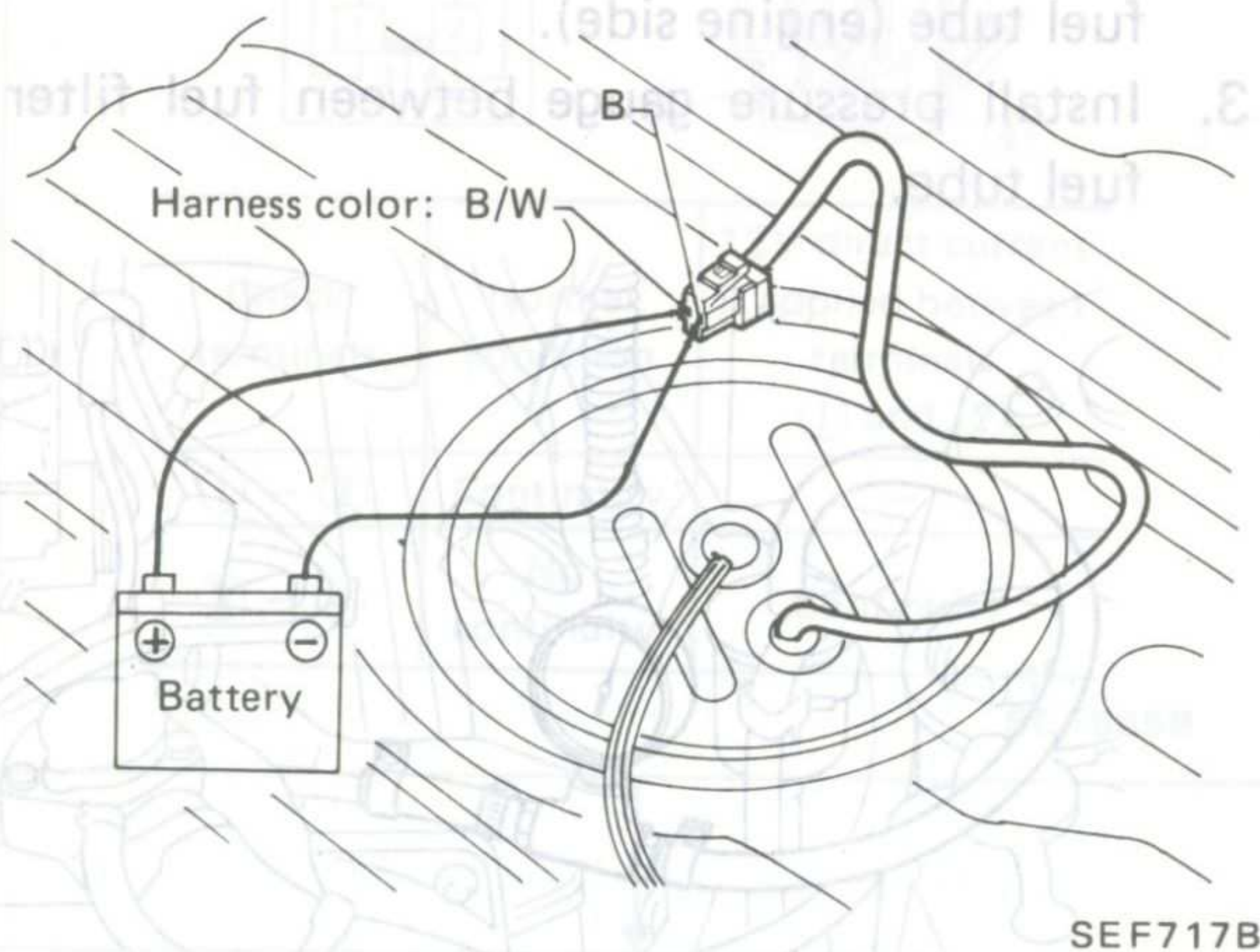
[VG30E]

Approximately 255 kPa  
(2.55 bar, 2.6 kg/cm<sup>2</sup>, 37 psi)

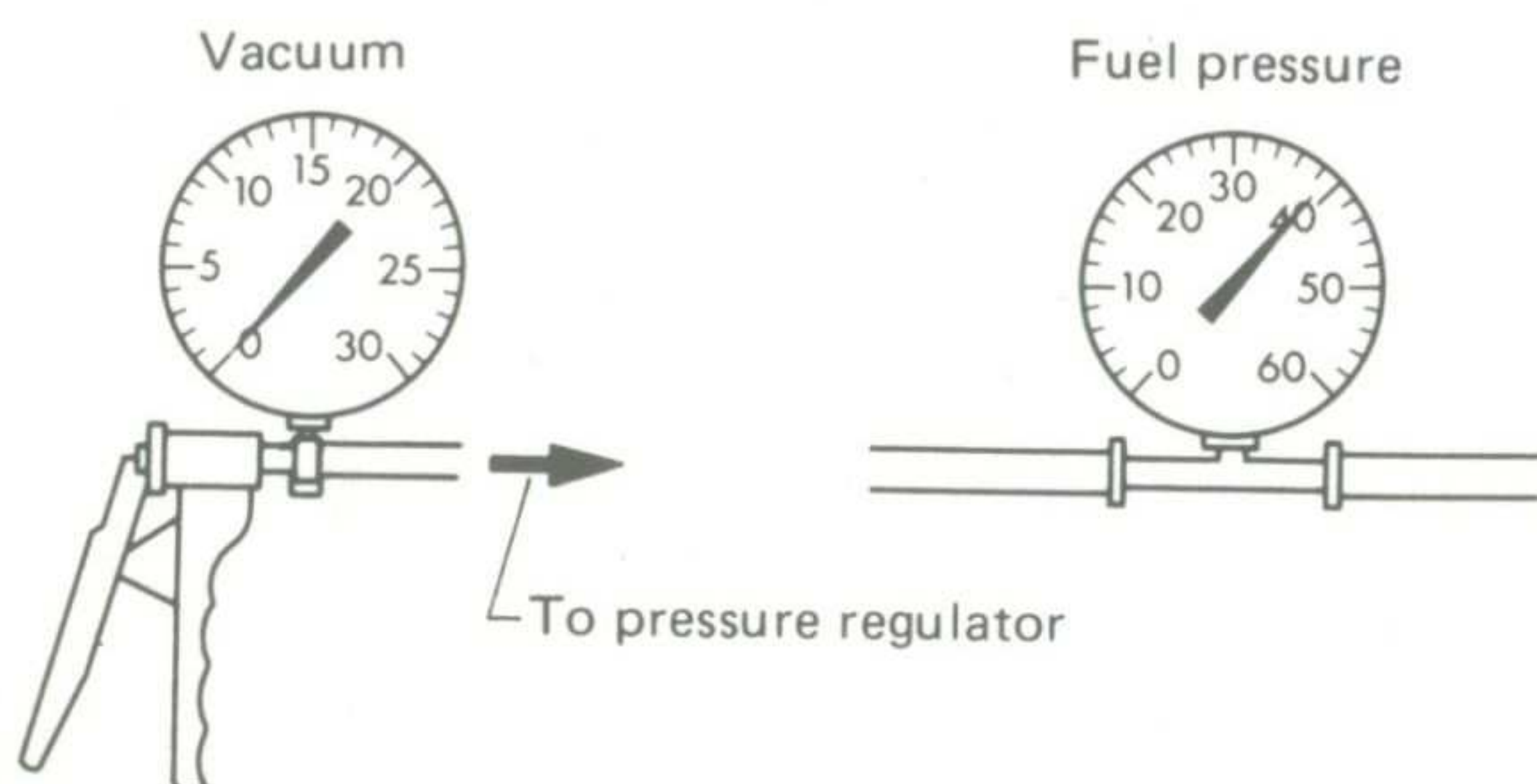
[VG30ET]

Approximately 304 kPa  
(3.04 bar, 3.1 kg/cm<sup>2</sup>, 44 psi)

6. Stop engine and disconnect fuel pressure regulator vacuum hose from intake collector.
7. Plug intake collector with a rubber cap.
8. Connect variable vacuum source to fuel pressure regulator.
9. Disconnect fuel pump connector and apply battery voltage as follows:



10. Start engine and read the indication of fuel pressure gauge as vacuum is changed.



Vacuum kPa (mbar, mmHg, inHg)	Fuel pressure kPa (bar, kg/cm <sup>2</sup> , psi)
0 (0, 0, 0)	248.1 - 255.0 (2.481 - 2.550, 2.53 - 2.60, 36.0 - 37.0)
16.9 (169, 127, 5.00)	227.5 - 241.3 (2.275 - 2.413, 2.32 - 2.46, 33.0 - 35.0)
33.9 (339, 254, 10.00)	213.8 - 220.7 (2.138 - 2.207, 2.18 - 2.25, 31.0 - 32.0)
50.8 (508, 381, 15.00)	200.1 - 206.9 (2.001 - 2.069, 2.04 - 2.11, 29.0 - 30.0)
67.7 (677, 508, 20.00)	179.5 - 193.2 (1.795 - 1.932, 1.83 - 1.97, 26.0 - 28.0)

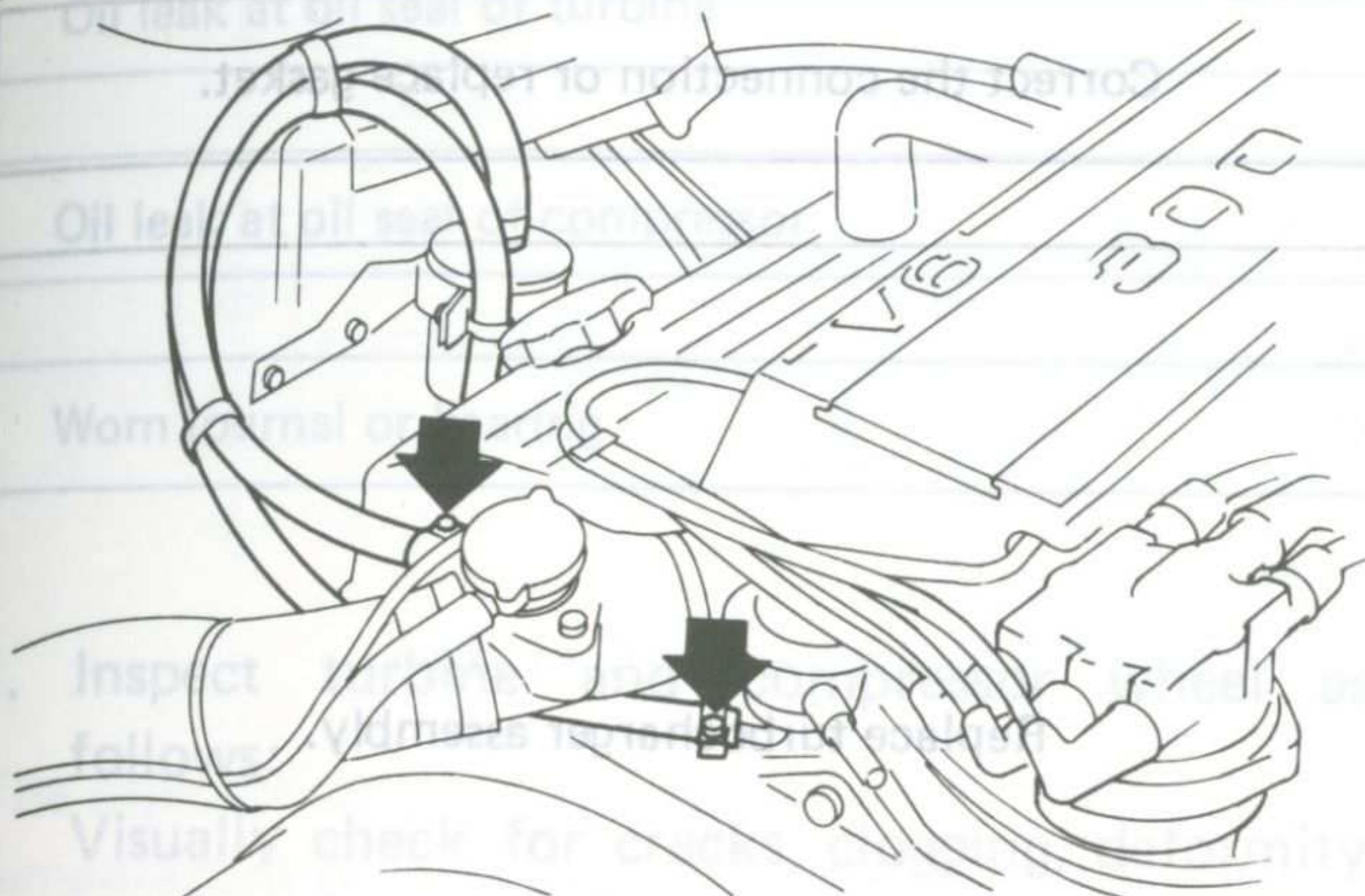
Fuel pressure should decrease as vacuum increases. If results are unsatisfactory, replace fuel pressure regulator.



# FUEL SYSTEM INSPECTION

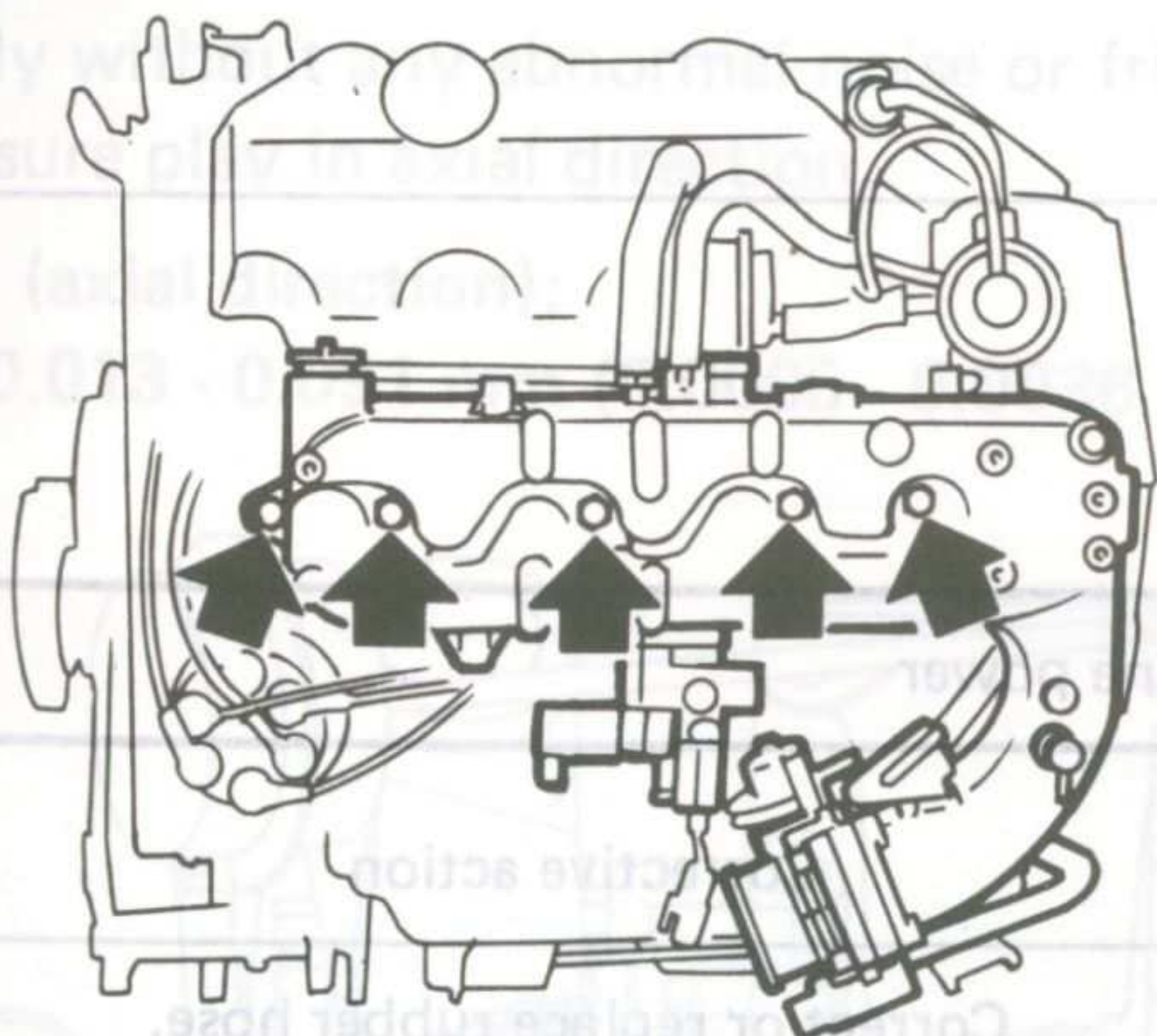
## Injector Removal and Installation

1. Release fuel pressure to zero.
2. Disconnect the following from intake collector.
  - Air duct
  - Accelerator wire
  - Blow-by hoses
  - Air regulator hose
  - E.G.R. tube
  - Harness clamps
  - Harness connectors
  - Intake collector cover
3. Disconnect fuel hoses.



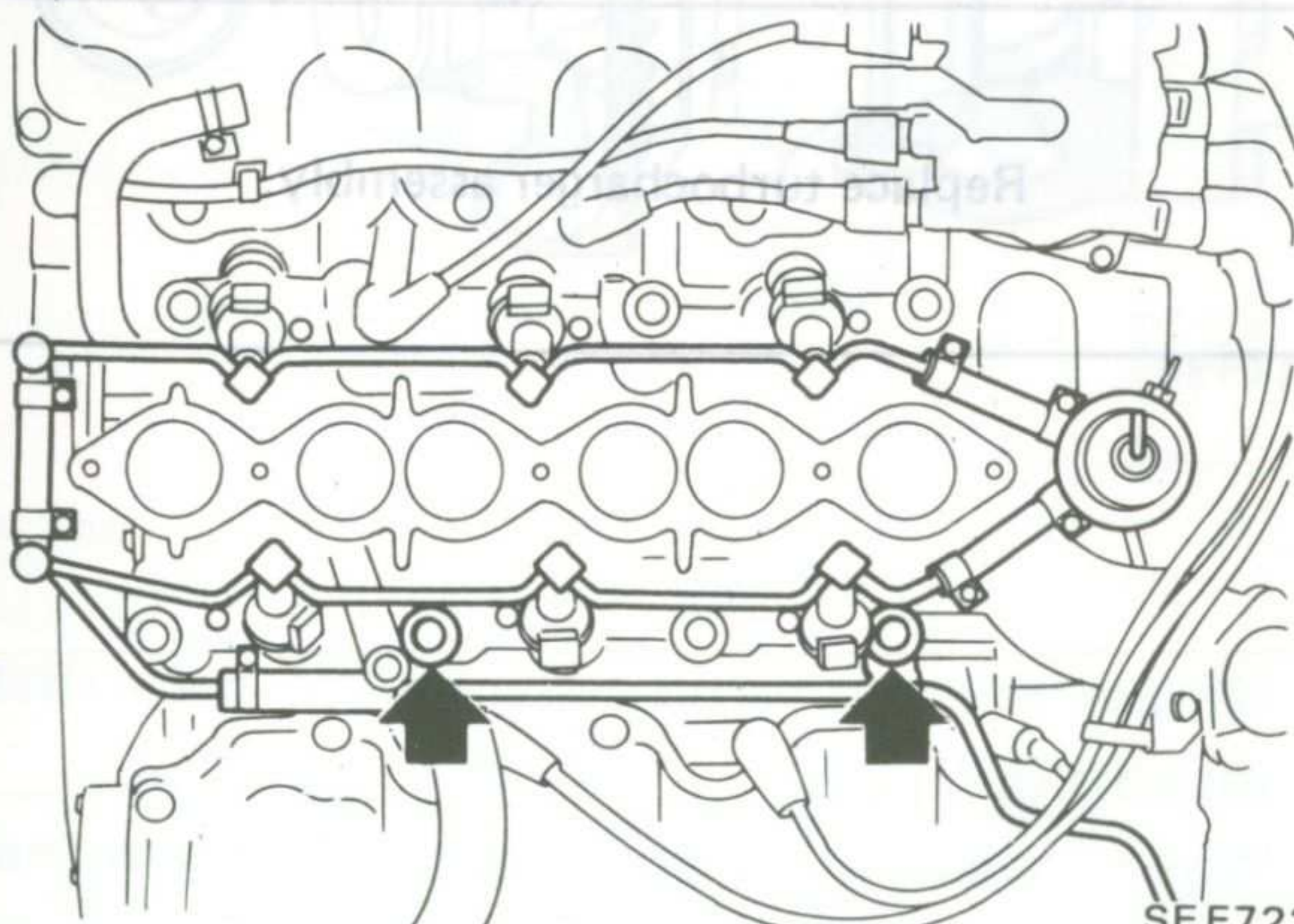
SEF721B

4. Remove intake collector.



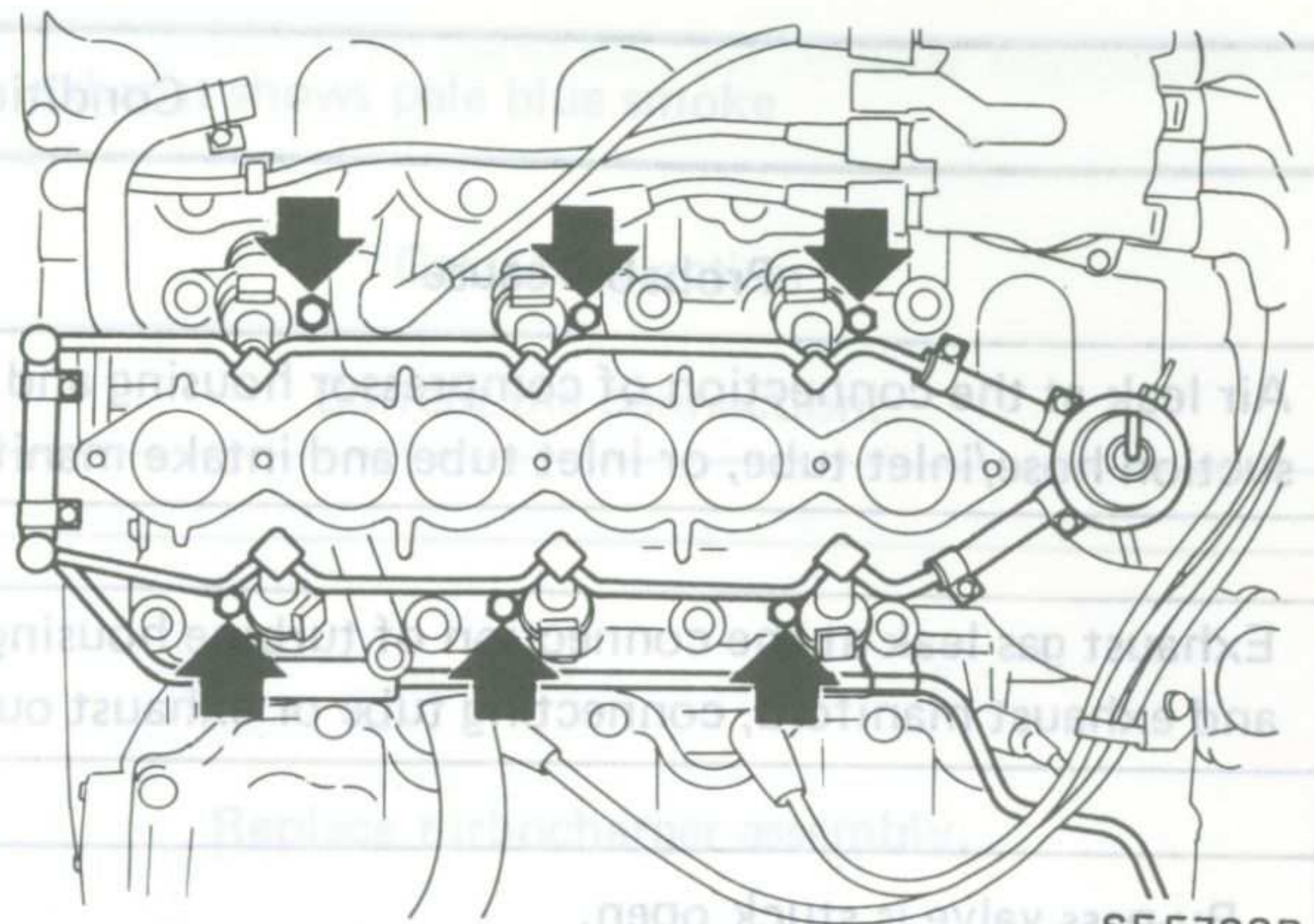
SEF720B

5. Remove bolts securing fuel tube.



SEF722B

6. Remove bolts securing injectors and remove injectors, fuel tubes and pressure regulator as an assembly.

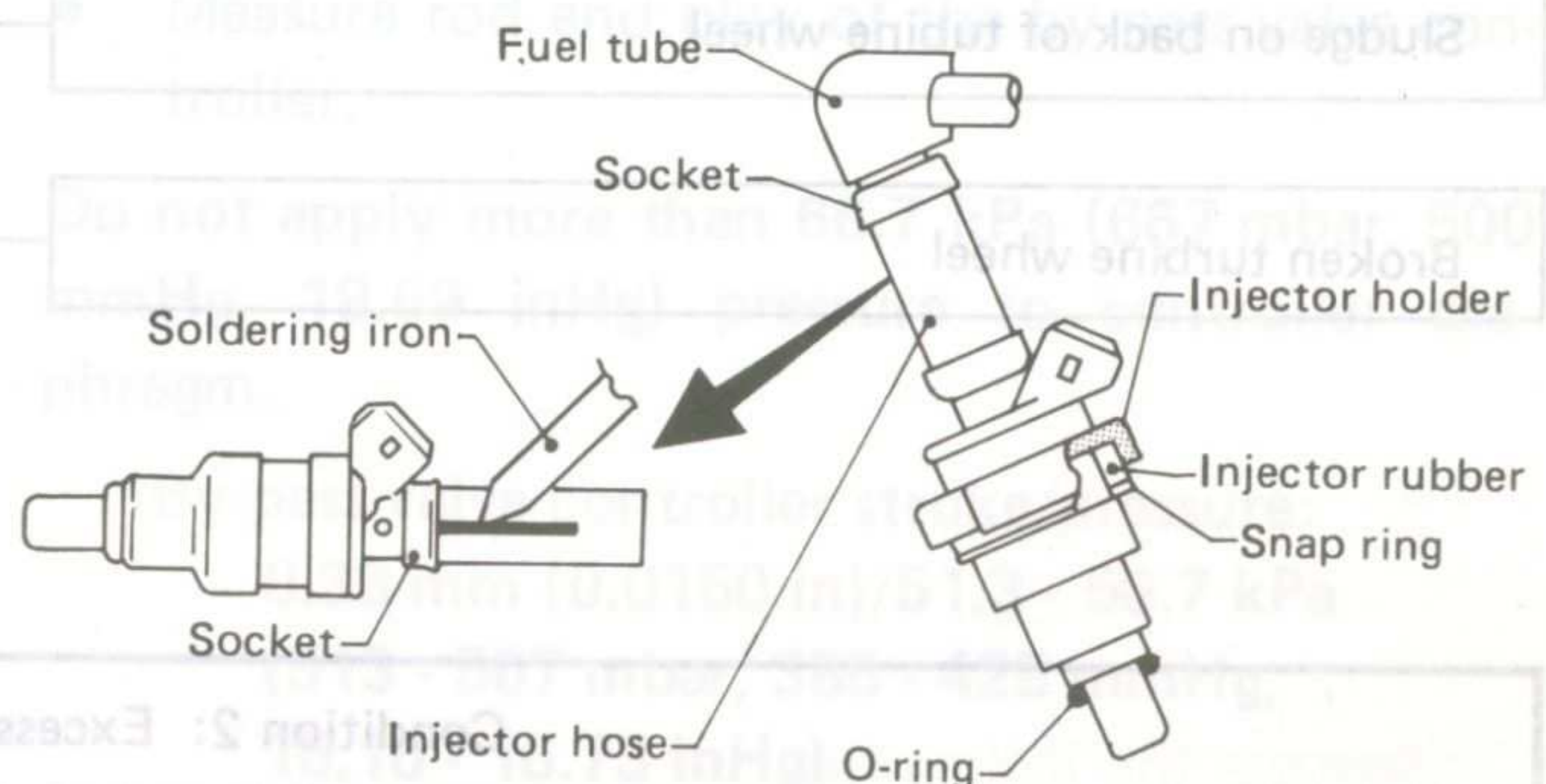


SEF723B

7. Remove fuel hose.

- 1) Heat soldering iron (150 watt) for 15 minutes. Cut hose into braided reinforcement from mark to socket end and fuel tube end.

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



SEF719B

- 2) Then pull rubber hose out with hand.
  - a. Be careful not to damage socket plastic connector, etc. with soldering iron.
  - b. Never place injector in a vise when disconnecting rubber hose.
8. Install fuel hose as follows:
  - 1) Clean exterior of injector tail piece and fuel tube end.
  - 2) Wet inside of new rubber hose with fuel.
  - 3) Push end of rubber hose with hose sockets onto injector tail piece and fuel tube end by hand as far as they will go.

Clamp is not necessary at the connections.

### CAUTION:

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



# TURBOCHARGER

## Inspection

### Condition 1: Low engine power

#### Probable cause

Air leak at the connection of compressor housing and suction hose/inlet tube, or inlet tube and intake manifold.

Exhaust gas leak at the connection of turbine housing and exhaust manifold, connecting tube or exhaust outlet

By-pass valve is stuck open.

Stuck or worn journal or bearing

Broken shaft

Sludge on back of turbine wheel

Broken turbine wheel

#### Corrective action

Correct the connection.

Correct the connection or replace gasket.

Replace turbocharger assembly.

### Condition 2: Excessively high engine power

#### Probable cause

Disconnected or cracked rubber hose

By-pass valve is stuck closed.

Controller diaphragm is broken.

#### Corrective action

Correct or replace rubber hose.

Replace turbocharger assembly.



# TURBOCHARGER

## Inspection (Cont'd)

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

Oil leak at oil seal of compressor

Worn journal or bearing

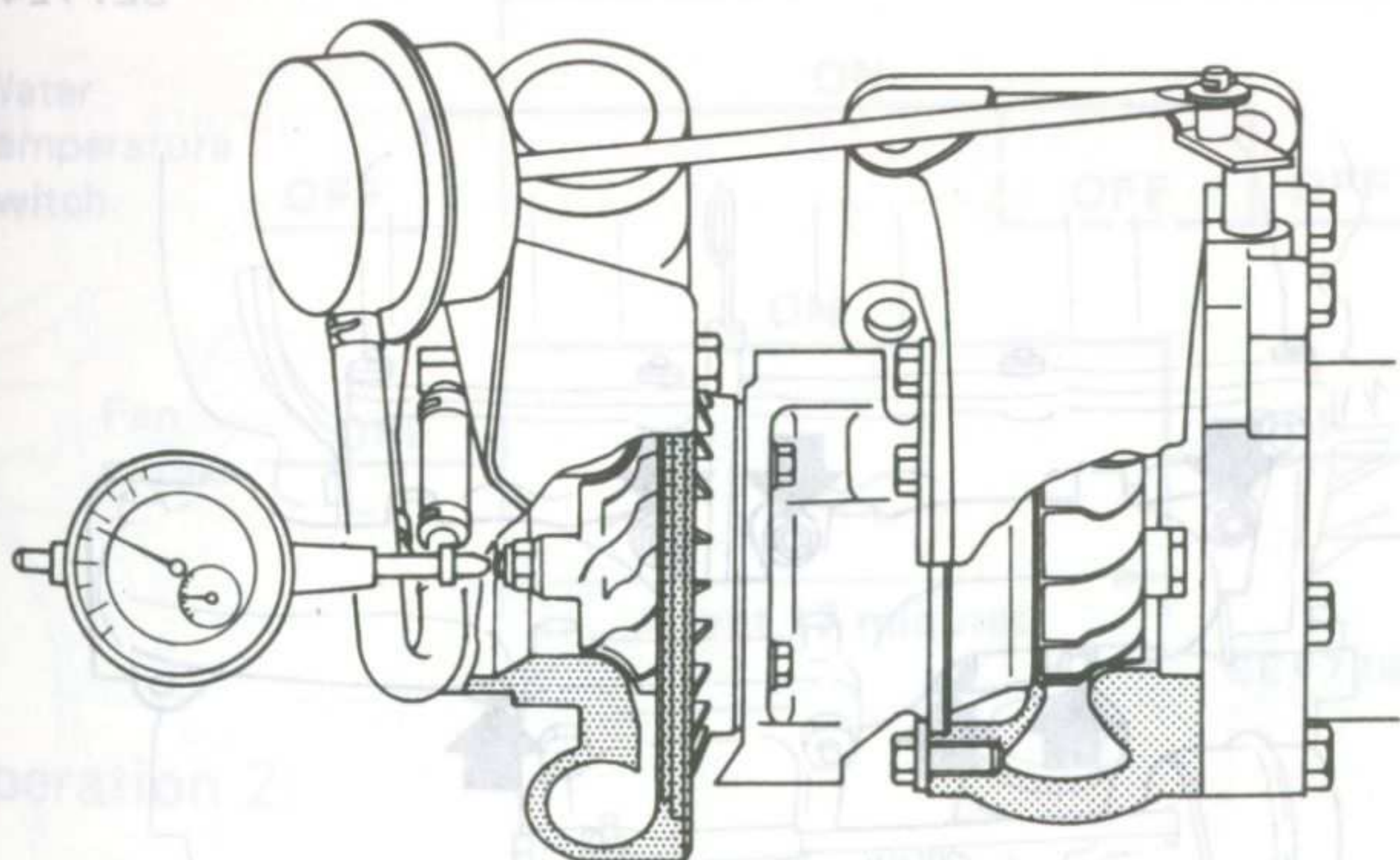
Replace turbocharger assembly.

1. Inspect turbine and compressor wheel as follows:

- Visually check for cracks, clogging, deformity or other damage.
- Revolve wheels to make sure that they turn freely without any abnormal noise or friction.
- Measure play in axial direction.

Play (axial direction):

0.013 - 0.091 mm (0.0005 - 0.0036 in)



SEF726B

2. Check operation of by-pass valve controller.

- Move by-pass valve to make sure that it is not sticking or scratched.
- Measure rod end play of the by-pass valve controller.

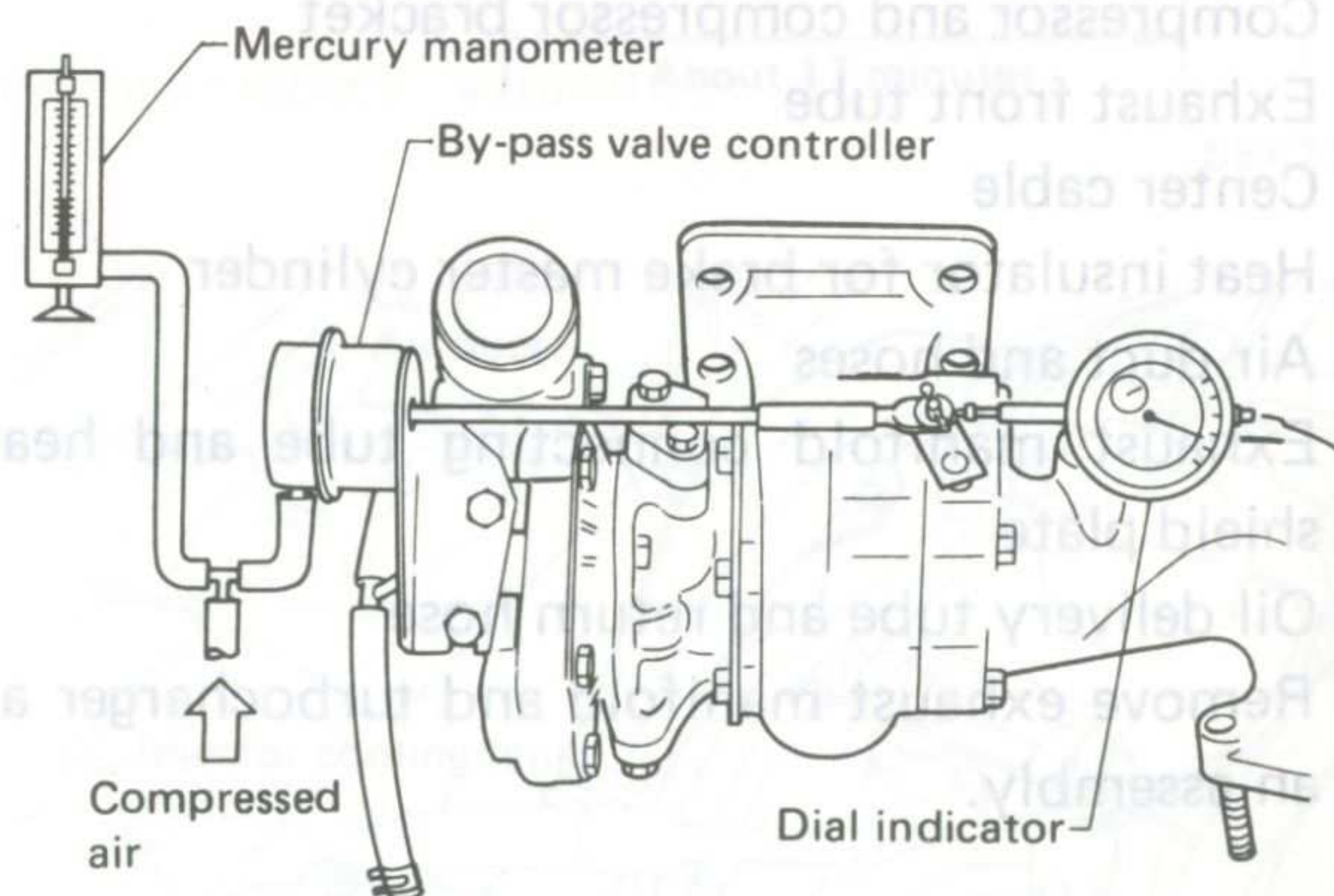
Do not apply more than 66.7 kPa (667 mbar, 500 mmHg, 19.69 inHg) pressure to controller diaphragm.

By-pass valve controller stroke/pressure:

0.38 mm (0.0150 in)/51.3 - 56.7 kPa

(513 - 567 mbar, 385 - 425 mmHg,

15.16 - 16.73 inHg)



SEC727B

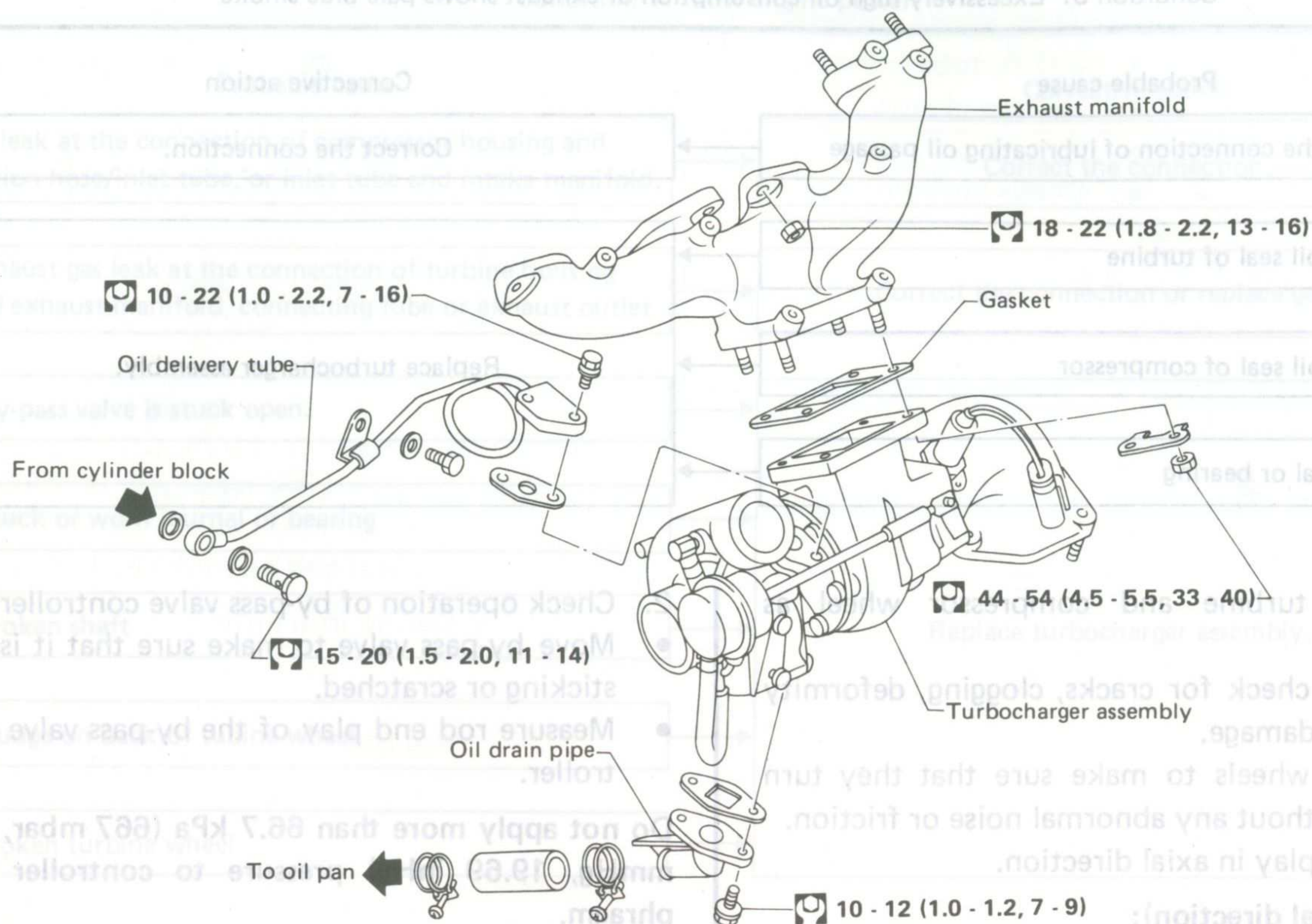
Always replace the turbocharger as an assembly if faulty.



# TURBOCHARGER

## Removal and Installation

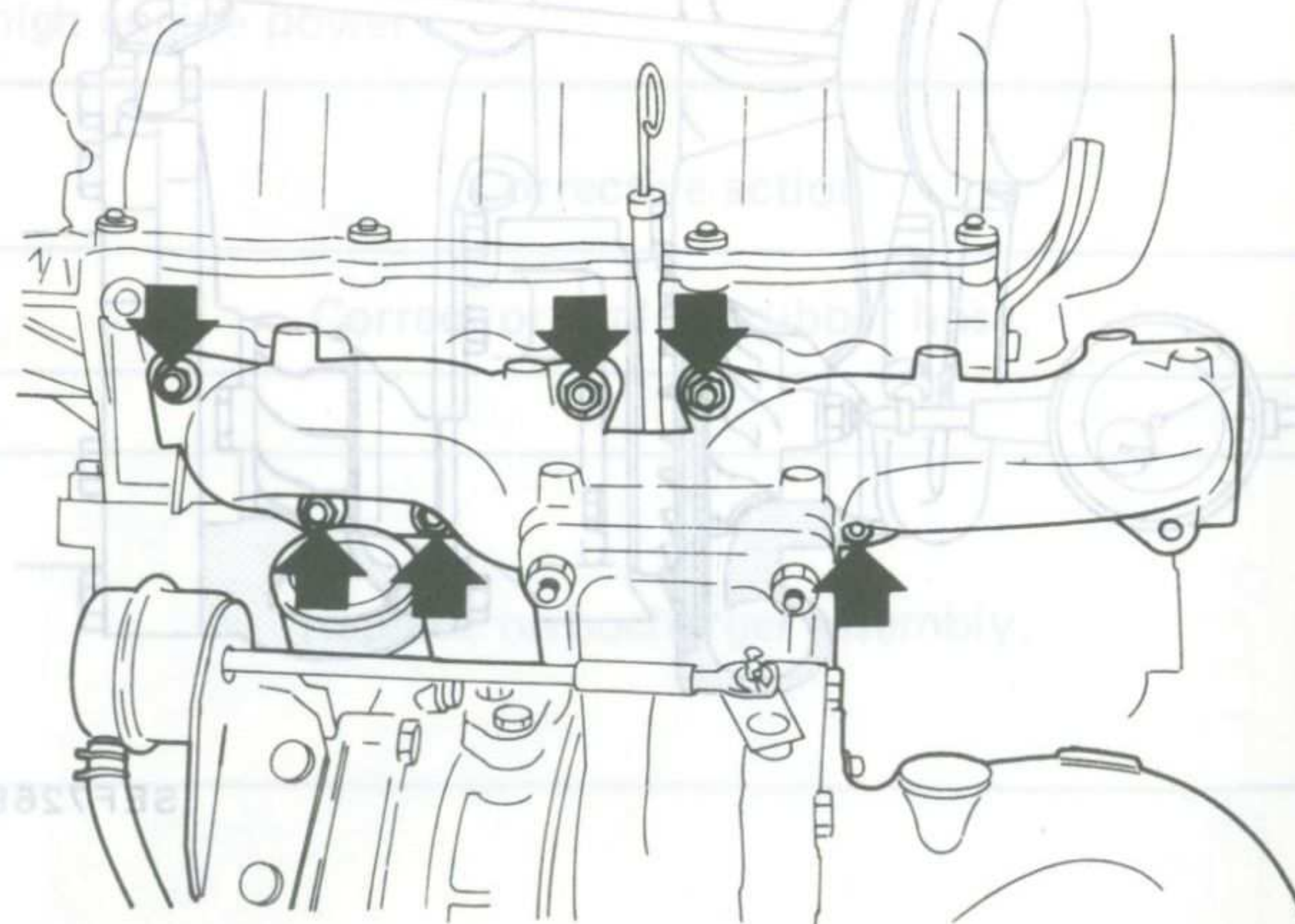
Turbocharger should not be disassembled.



: N·m (kg-m, ft-lb)

SEF724B

1. Remove the following:
  - Compressor and compressor bracket
  - Exhaust front tube
  - Center cable
  - Heat insulator for brake master cylinder
  - Air duct and hoses
  - Exhaust manifold connecting tube and heat shield plate
  - Oil delivery tube and return hose
2. Remove exhaust manifold and turbocharger as an assembly.



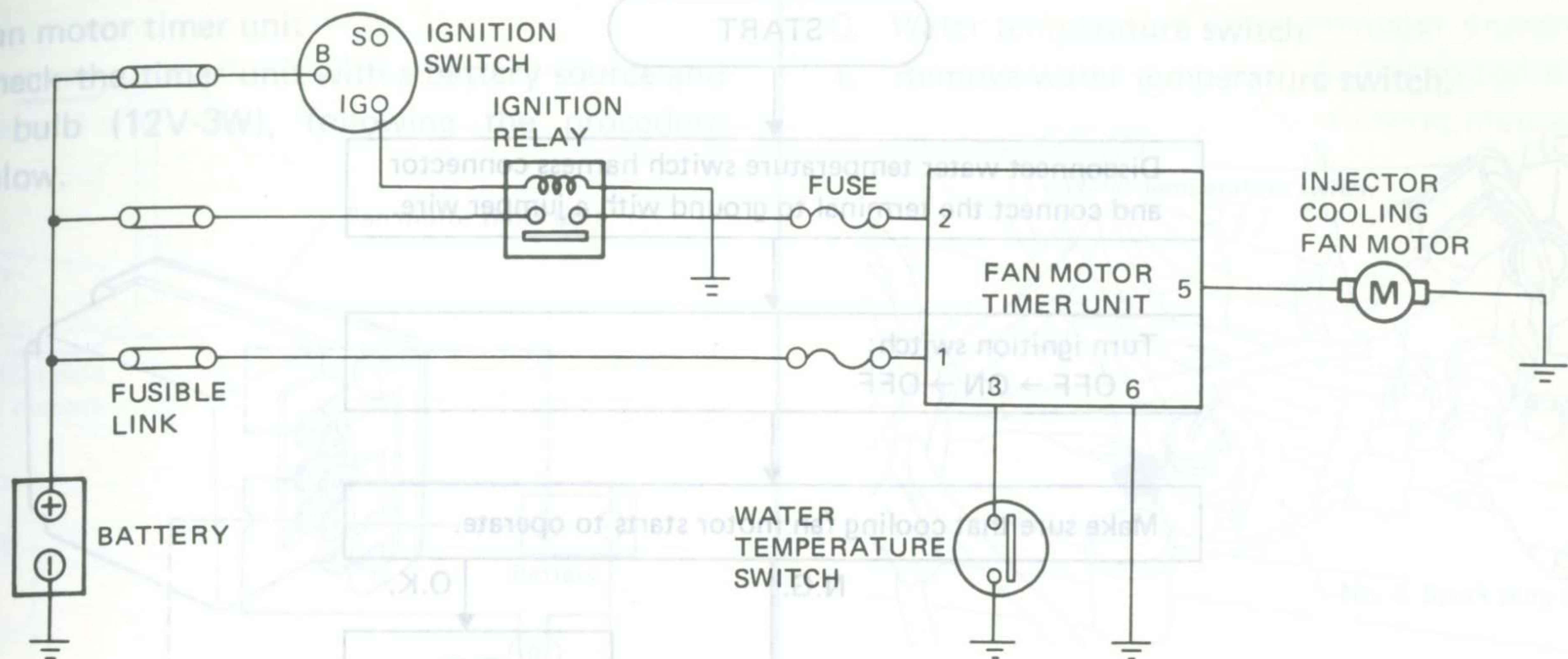
SEF247C

3. Disconnect the turbocharger from the exhaust manifold.
4. When installing turbocharger to exhaust manifold, securely tighten nuts and bend up new lock washers.



# INJECTOR COOLING FAN

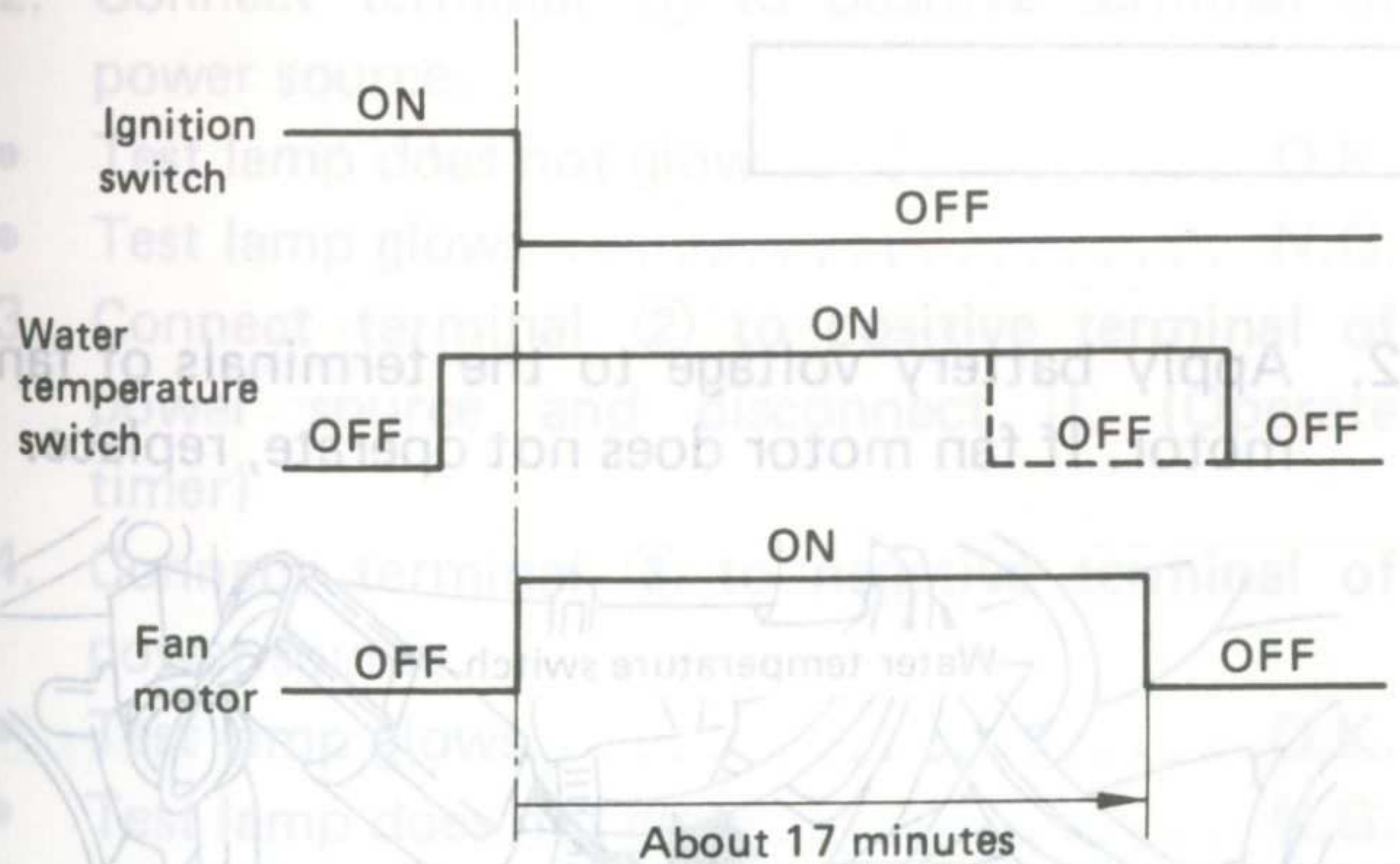
## Operation



SEF728B

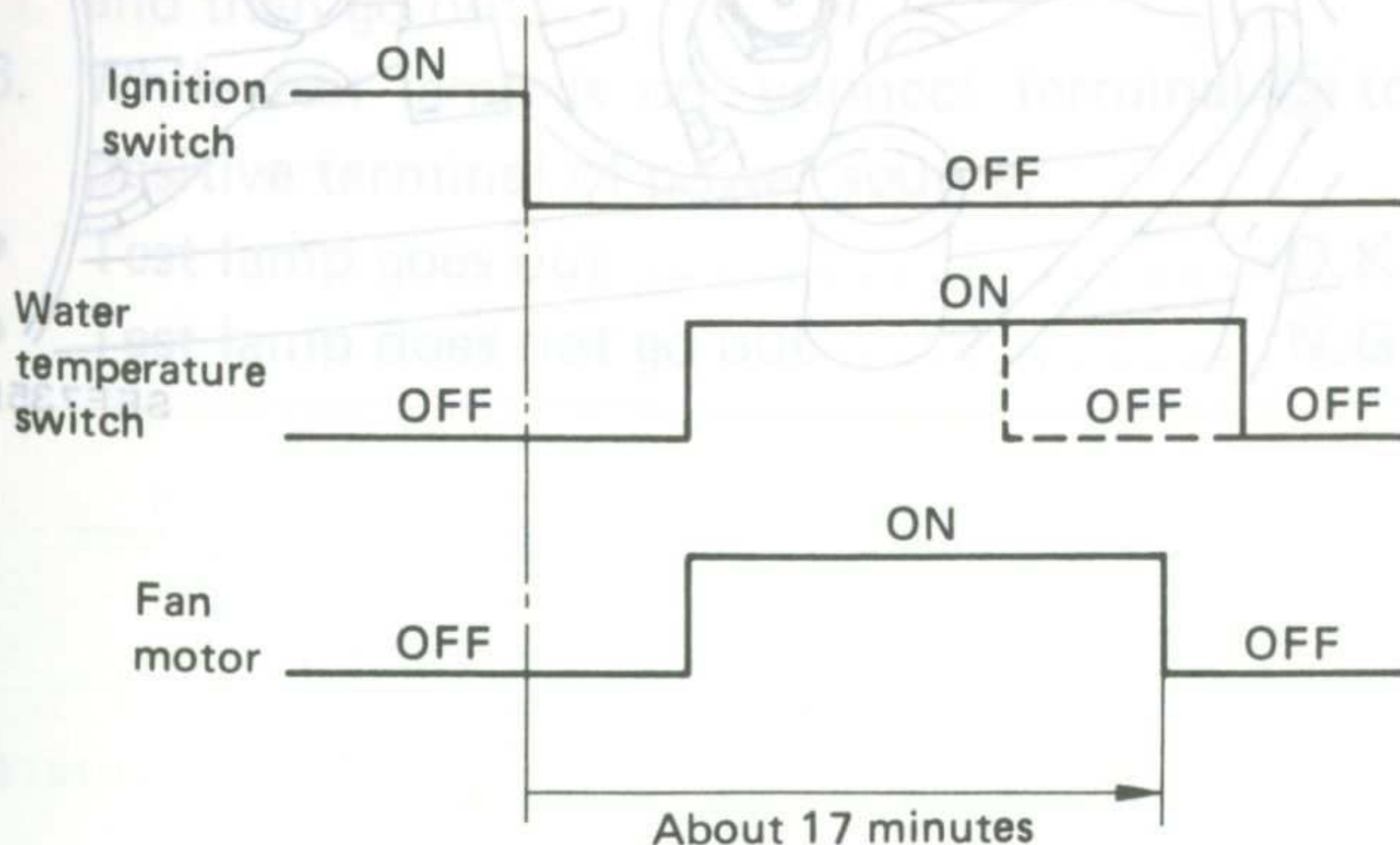
The injector cooling fan operates to cool down the temperature of fuel inside the injector and the fuel gallery when engine is stopped under high engine temperature condition.

### Operation 1:



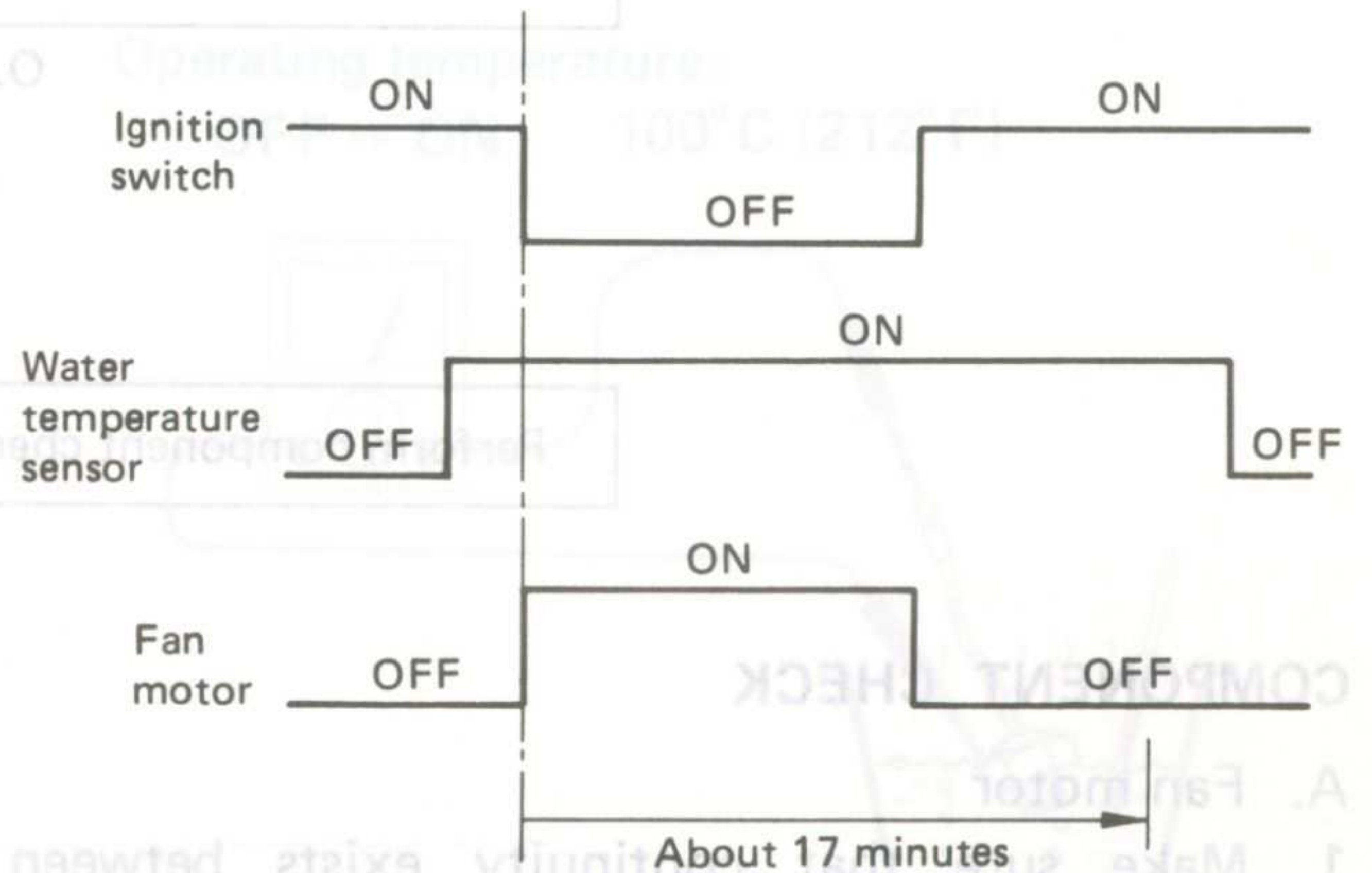
SEF729B

### Operation 2:

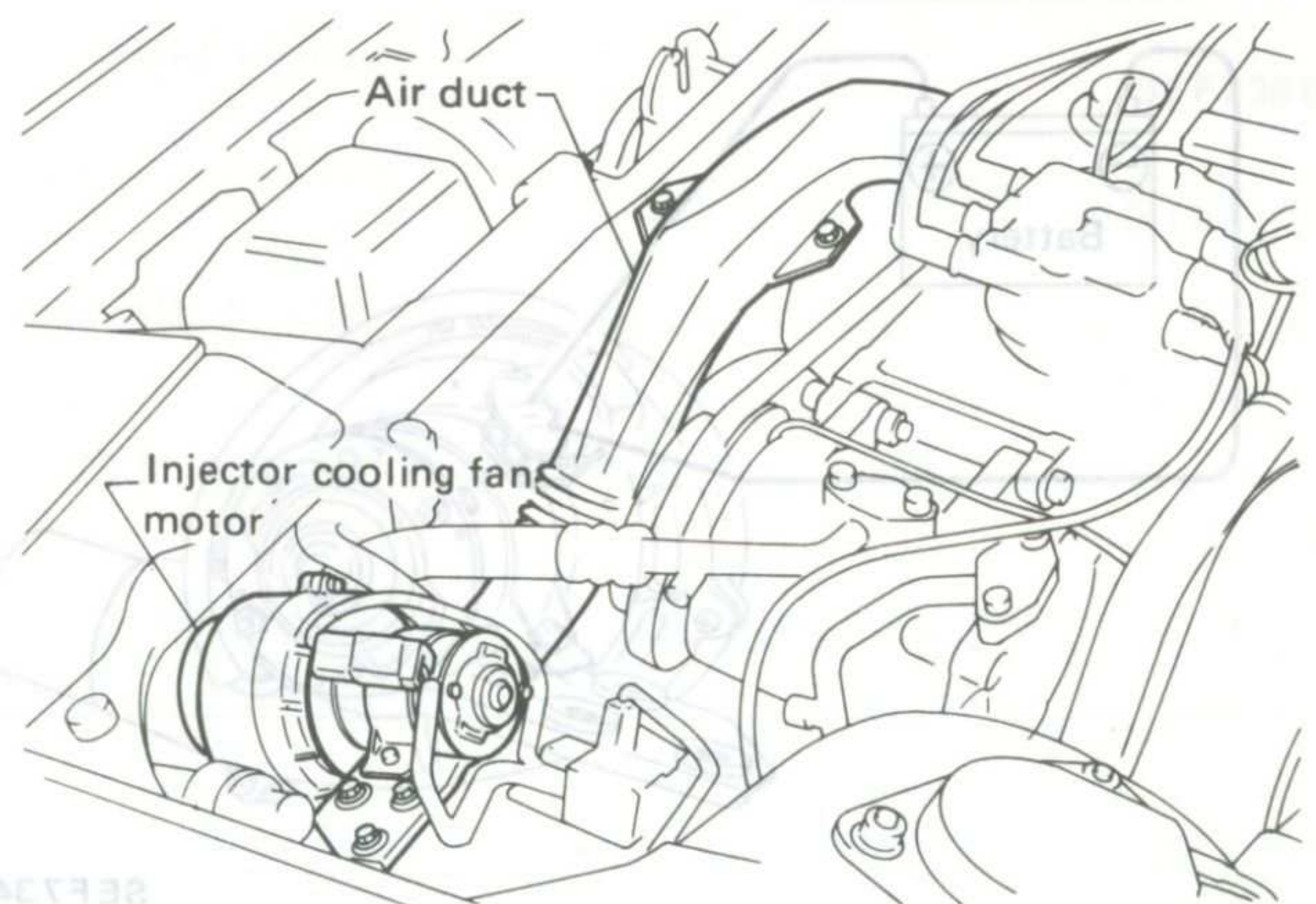


SEF730B

### Operation 3:



SEF731B

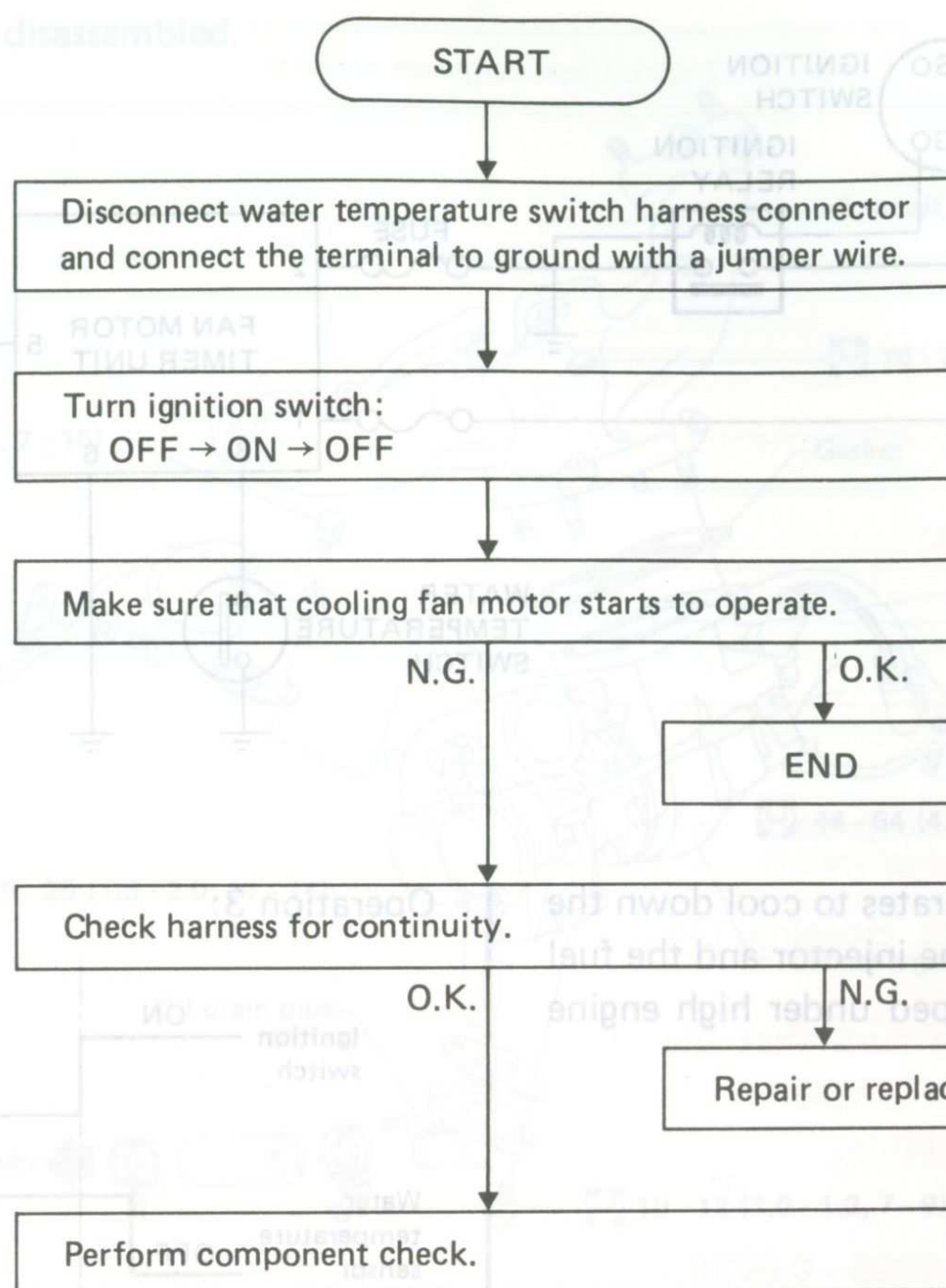


SEF732B



# INJECTOR COOLING FAN

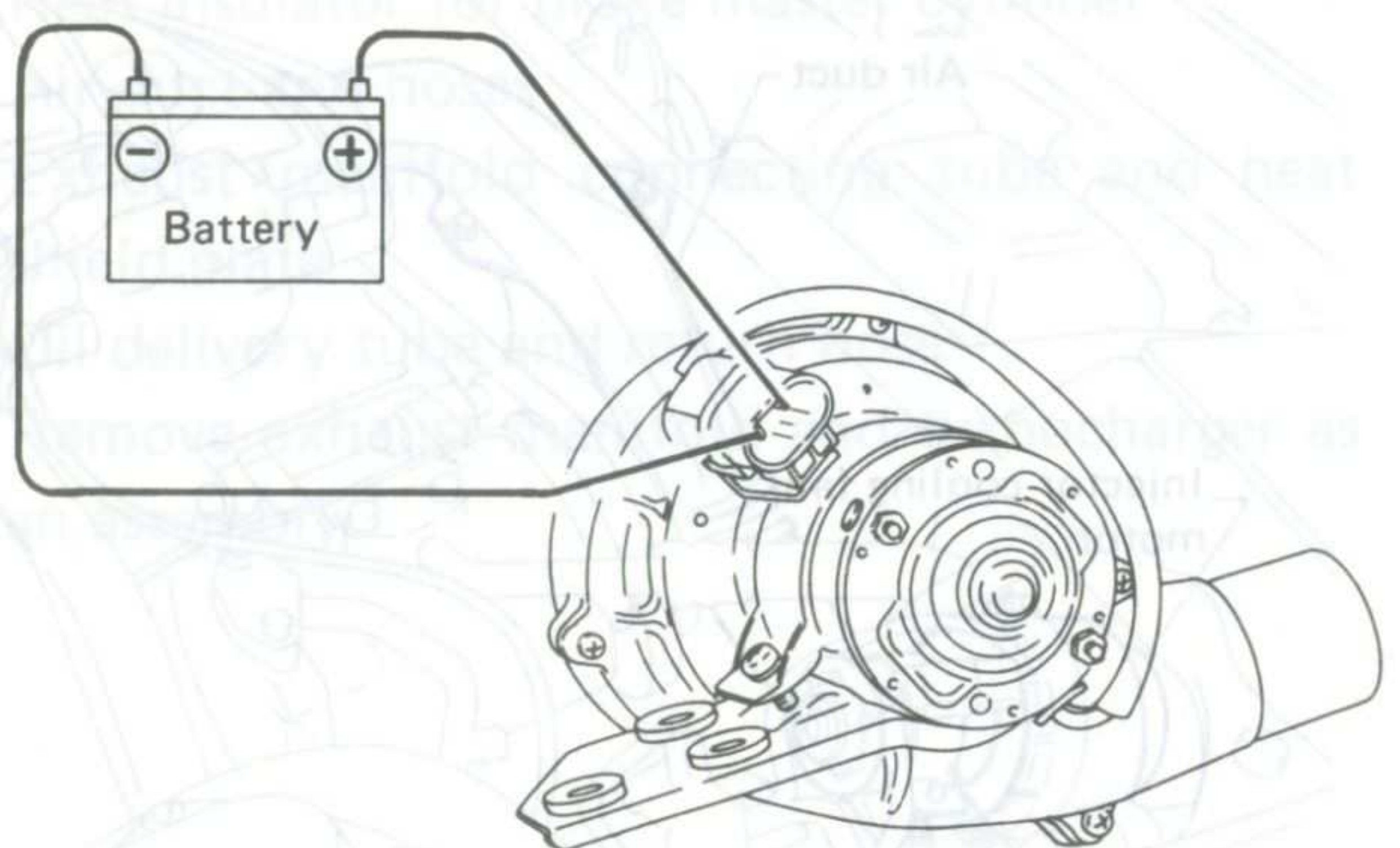
## Inspection



### COMPONENT CHECK

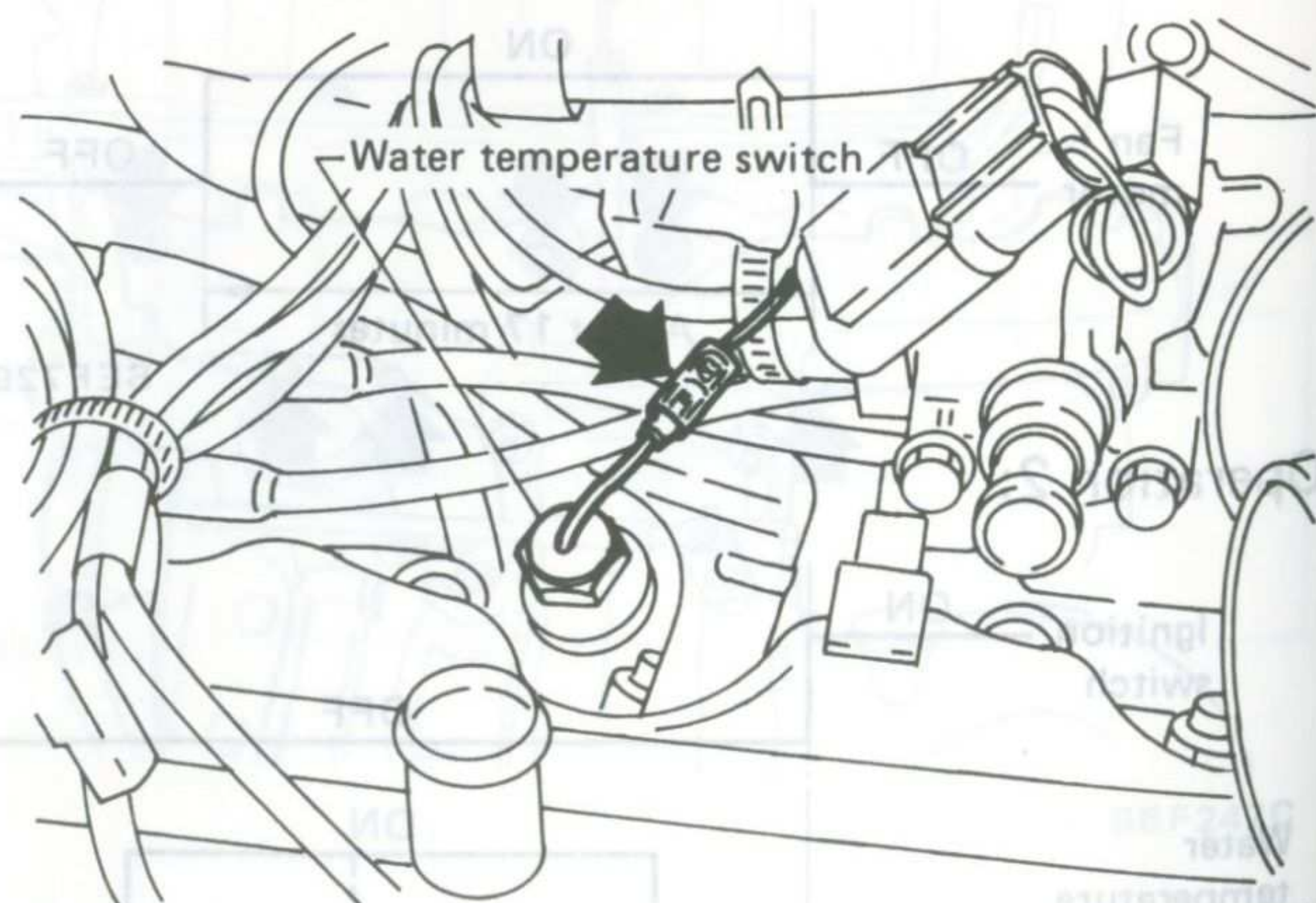
#### A. Fan motor

1. Make sure that continuity exists between terminals of fan motor.



SEF734B

2. Apply battery voltage to the terminals of fan motor. If fan motor does not operate, replace.



SEF735B

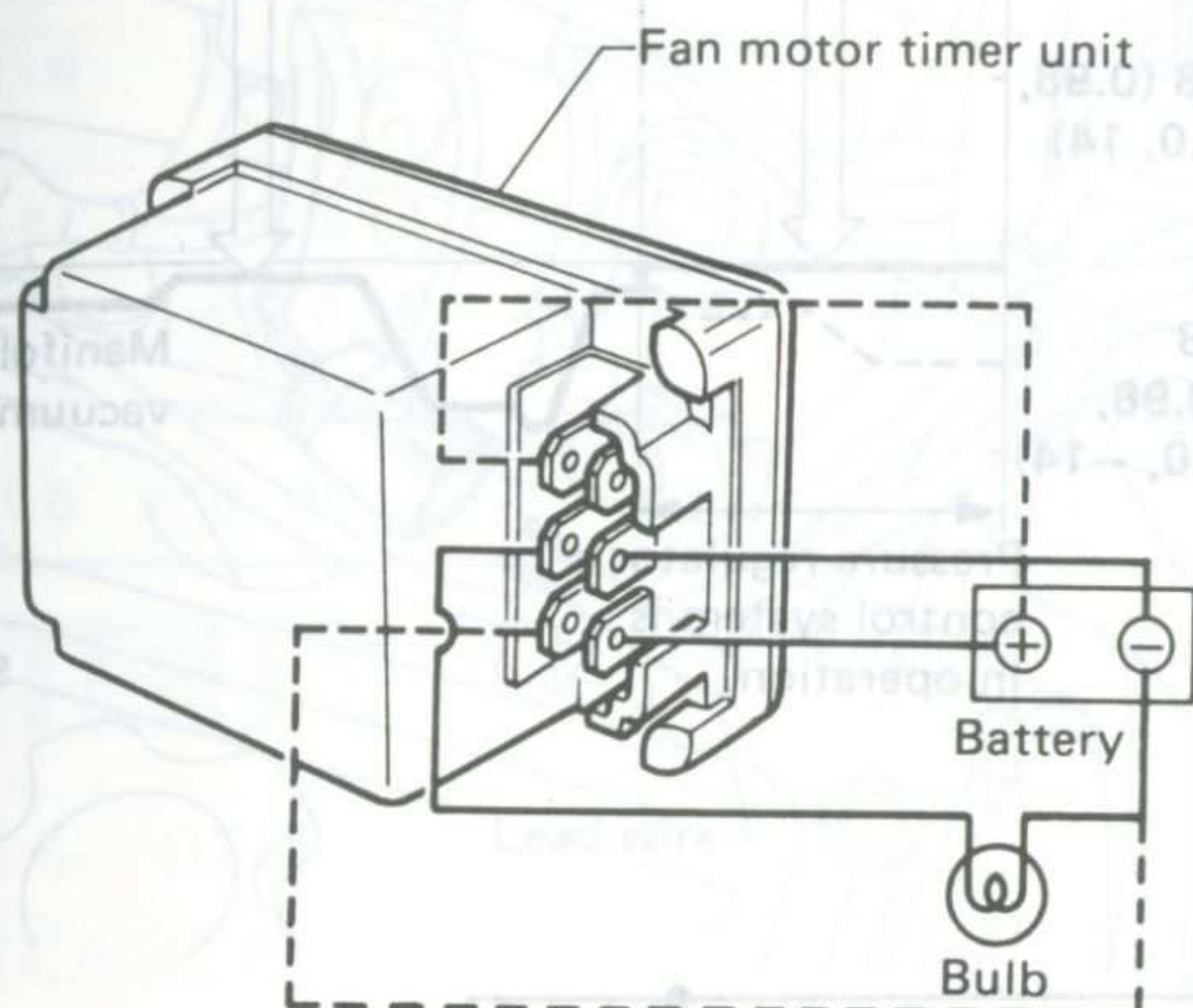


# INJECTOR COOLING FAN

## Inspection (Cont'd)

### B. Fan motor timer unit

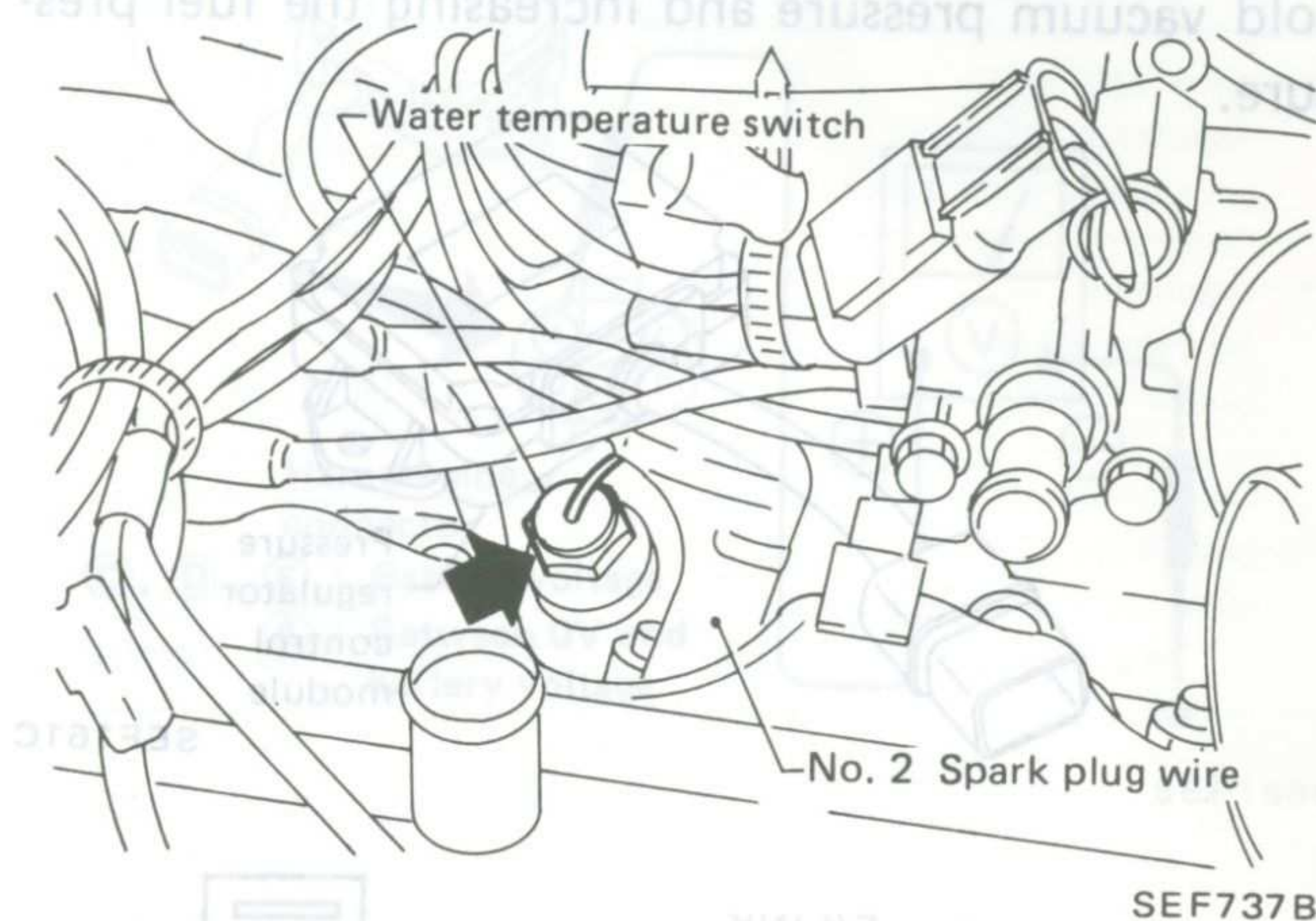
Check the timer unit with a battery source and a bulb (12V-3W), following the procedure below.



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.

### C. Water temperature switch

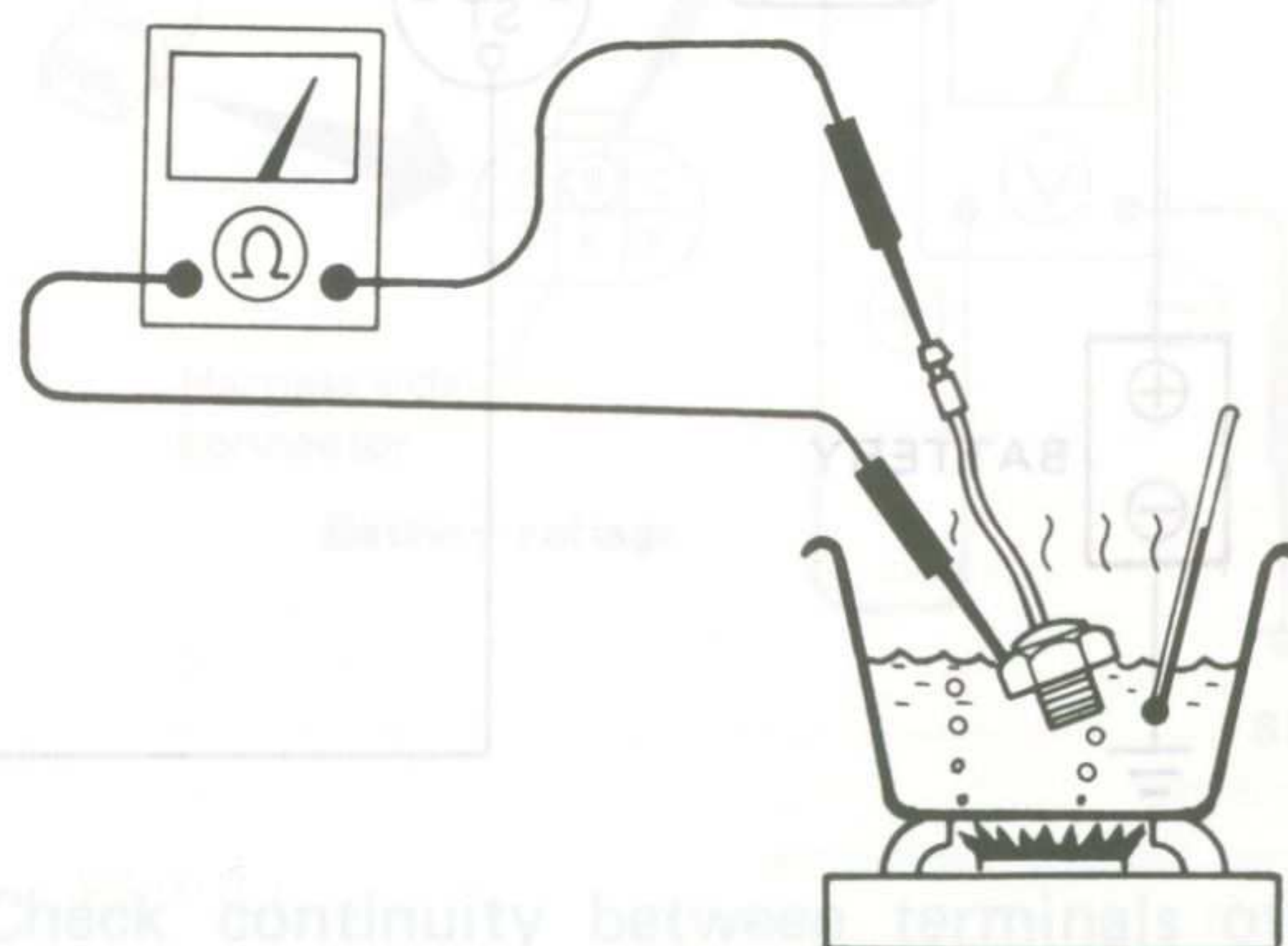
1. Remove water temperature switch.



2. Check water temperature switch for proper operation.

Operating temperature:

OFF → ON 100°C (212°F)

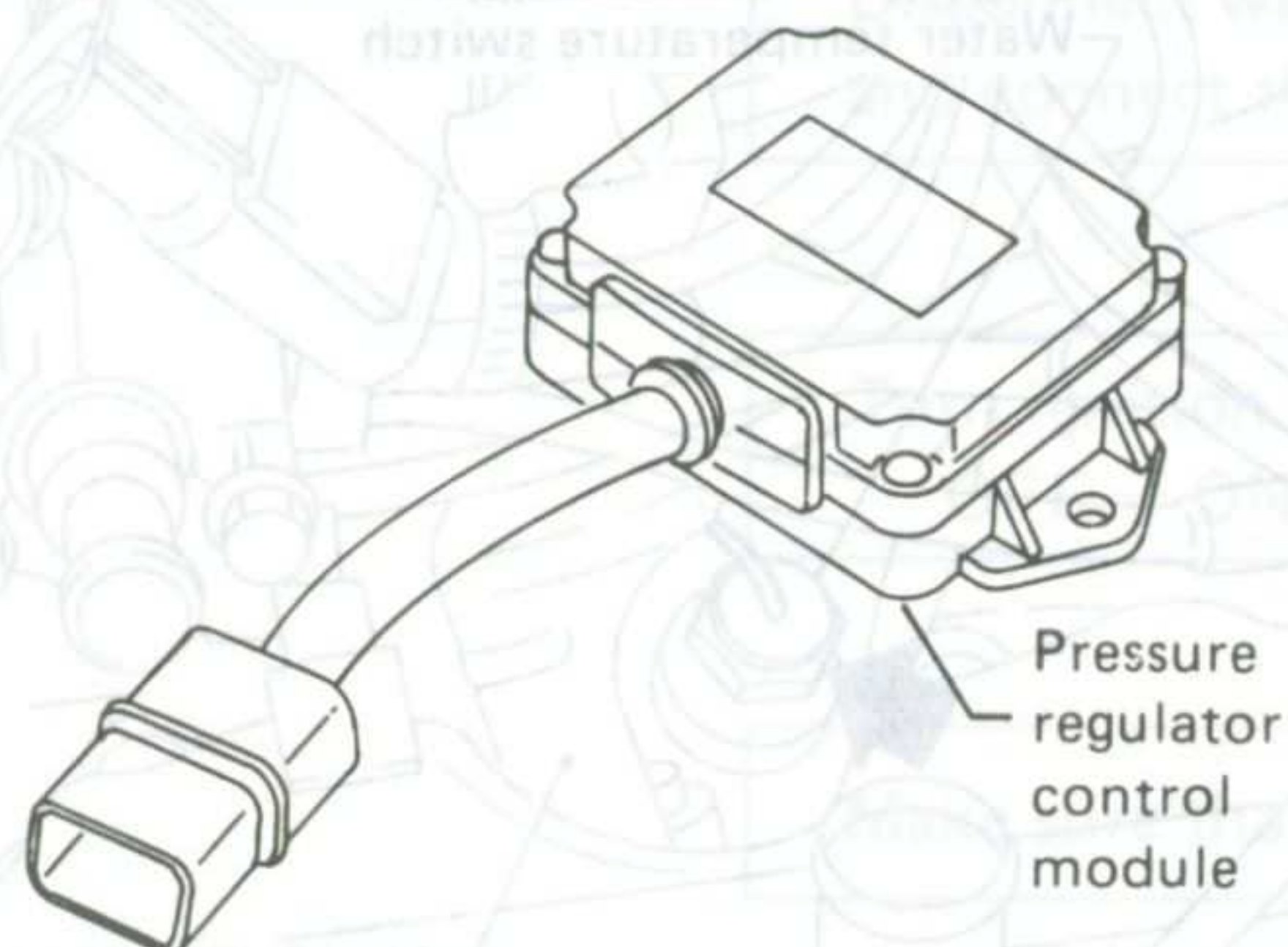




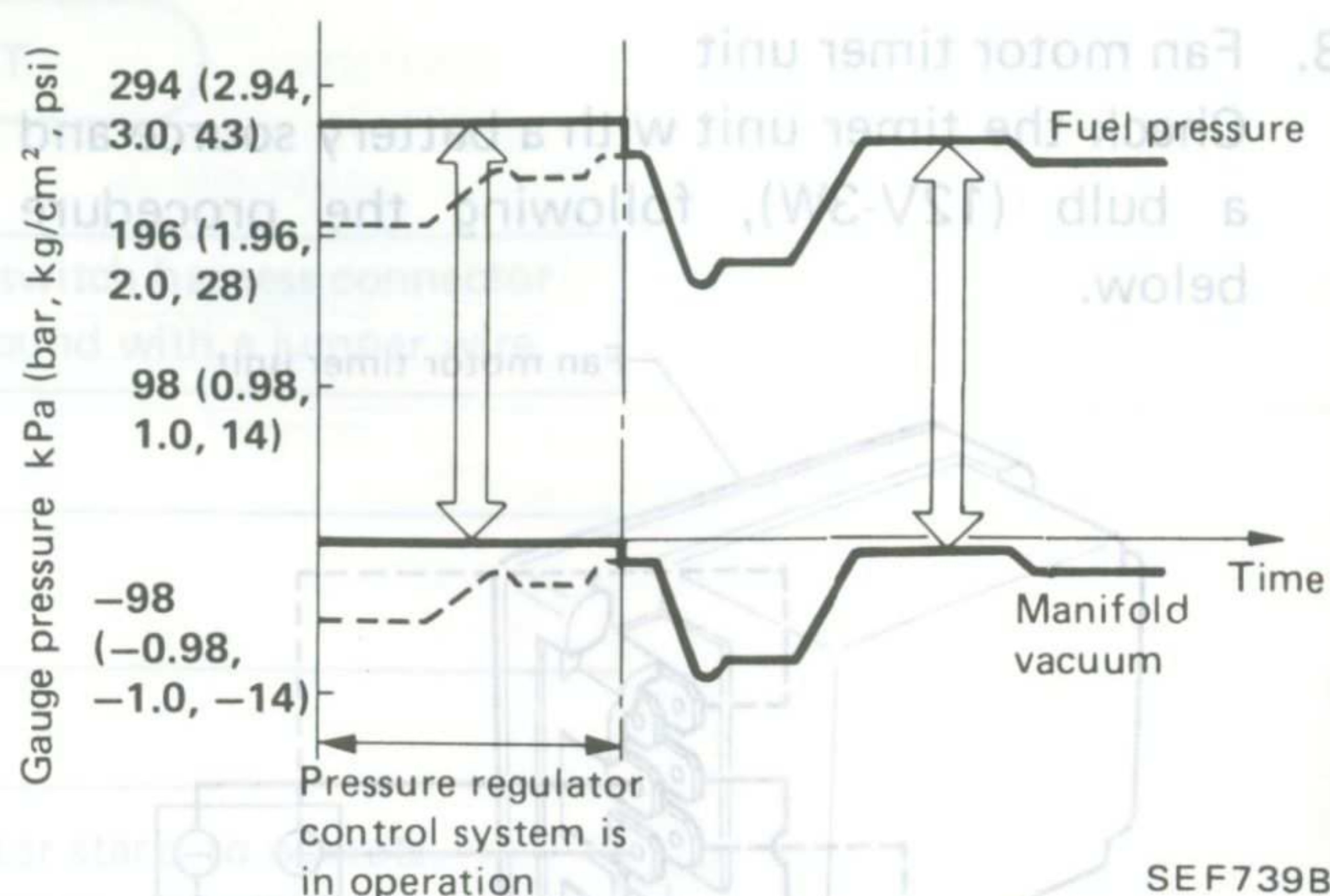
# PRESSURE REGULATOR CONTROL

## Operation

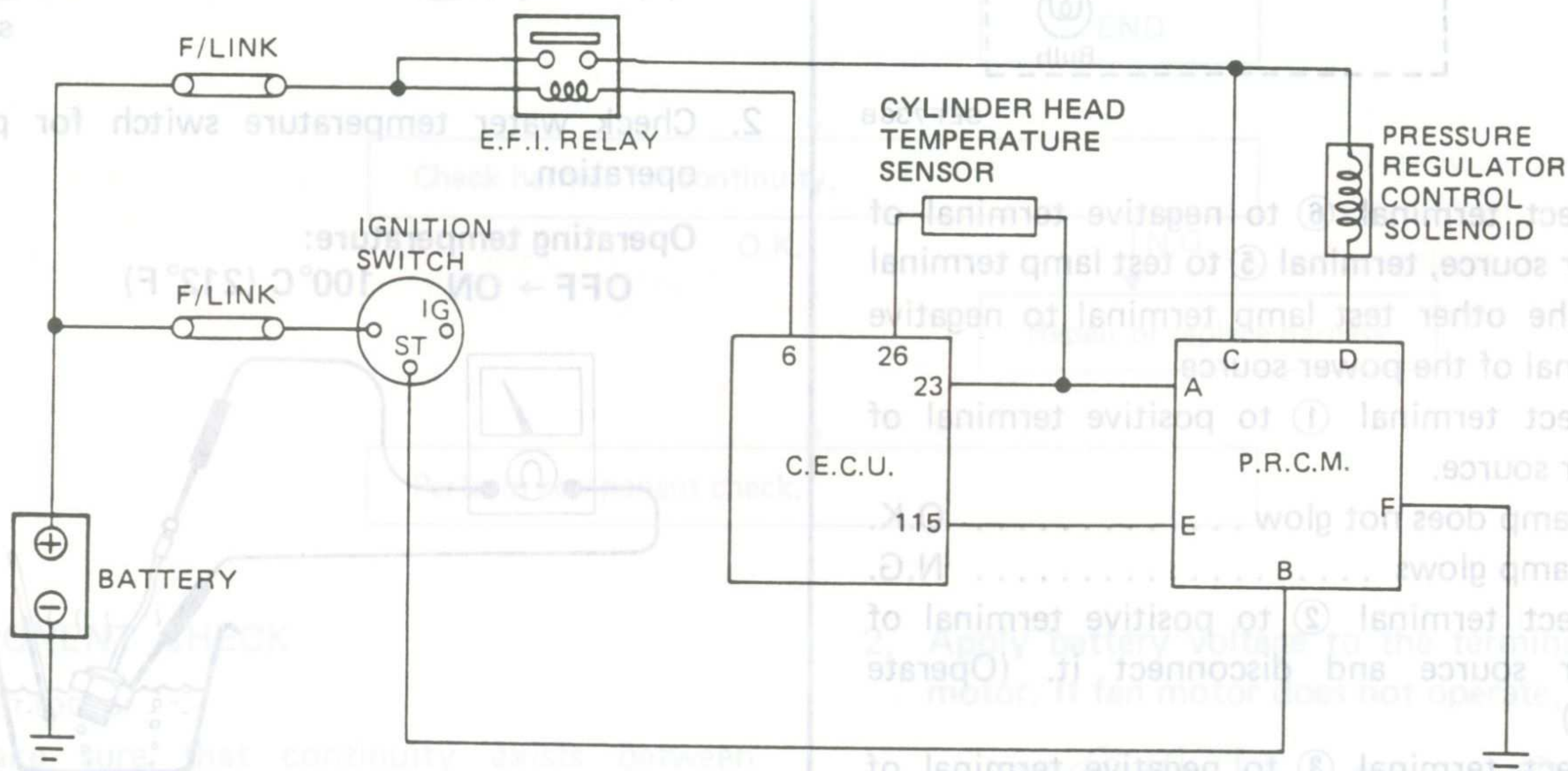
The pressure regulator control improves the starting of a hot engine by cutting off the intake manifold vacuum pressure and increasing the fuel pressure.



SEF161C



SEF739B

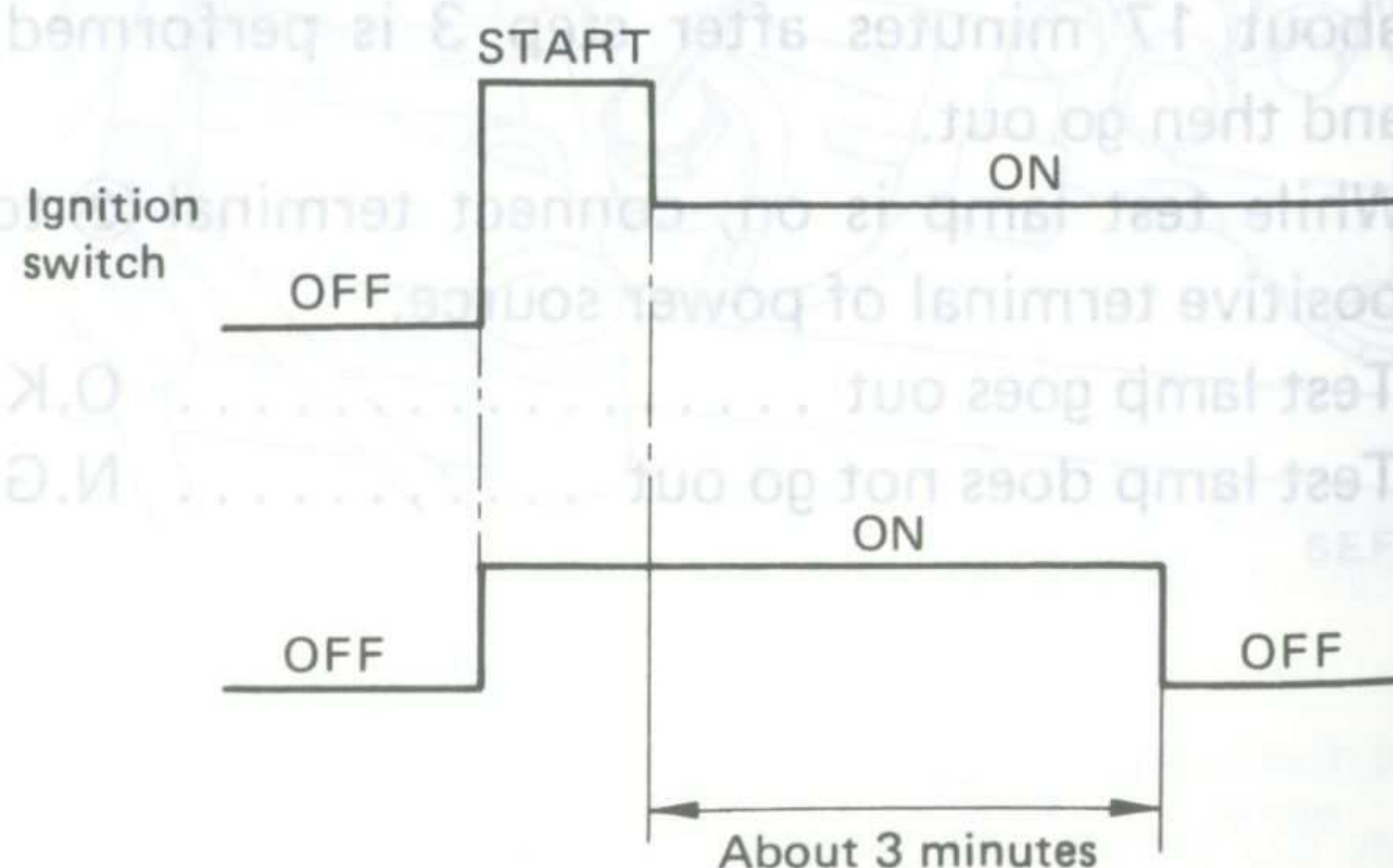


SEF152C

## Operation

This system operates when all of the following conditions are met.

- Cylinder head temperature is above 100°C (212°F).
- During starting and after 3 minutes after starting



SEF741B







# SERVICE DATA AND SPECIFICATIONS

## General Specifications

Fuel pump	
Cut-off discharge pressure	422 - 490
kPa (bar, kg/cm <sup>2</sup> , psi)	(4.22 - 4.90, 4.3 - 5.0, 61 - 71)
Pressure regulator	
Regulated pressure	250.1 (2.501, 2.55, 36.3)
kPa (bar, kg/cm <sup>2</sup> , psi)	
Air regulator	
Air flow amount	
[at 20°C (68°F)]	27.5 (971)
m <sup>3</sup> (cu ft)/hr	
Turbocharger	
Max. supercharging pressure	42.7 - 50.7 (427 - 507,
kPa (mbar, mmHg, inHg)	320 - 380, 12.60 - 14.96)
Emergency relief valve	
Valve opening pressure	55.3 - 63.3 (553 - 633,
kPa (mbar, mmHg, inHg)	415 - 475, 16.34 - 18.70)

## Inspection and Adjustment

Fuel pressure	
At idle	kPa (bar, kg/cm <sup>2</sup> , psi)
	Approximately 206 (2.06, 2.1, 30)
The moment accelerator pedal is fully depressed	
	VG30E Approximately 255 (2.55, 2.6, 37)
	VG30ET Approximately 304 (3.04, 3.1, 44)
Air flow meter	
Voltage between terminals B and D	1.6±0.5V
Cylinder head temperature sensor and fuel temperature sensor	
Thermistor resistance	
at -10°C (14°F)	7.0 - 11.4 kΩ
at 20°C (68°F)	2.1 - 2.9 kΩ
at 50°C (122°F)	0.68 - 1.0 kΩ
Throttle valve switch	
	VG30E
	Europe except Sweden and Switzerland
	Approximately 1,100 rpm
Engine speed when idle switch is turned from "ON" to "OFF"	Except above 1,000 rpm
	VG30ET
	Approximately 1,050 rpm

## Tightening Torque

Unit	N·m	kg-m	ft-lb
Throttle chamber securing bolt	18 - 22	1.8 - 2.2	13 - 16
Intake collector bolt	18 - 22	1.8 - 2.2	13 - 16
Cylinder head temperature sensor	12 - 16	1.2 - 1.6	9 - 12
E.G.R. control valve	18 - 23	1.8 - 2.3	13 - 17
E.G.R. tube	34 - 44	3.5 - 4.5	25 - 33
Detonation sensor	25 - 34	2.5 - 3.5	18 - 25
Fuel hose clamp	1.0 - 1.5	0.10 - 0.15	0.7 - 1.1

1. Disconnect a vacuum hose between pressure regulator and solenoid valve.
2. Start engine and make sure that the vacuum does not exist for three minutes.

3. If vacuum exists, disconnect pressure regulator control modulator harness connector for the module located under the battery and check solenoid valve and circuit.

