

DATSUN 280Z
MODEL S30 SERIES

SECTION EF

ENGINE FUEL

EF

AIR CLEANER ..... EF- 2

ELECTRONIC FUEL INJECTION SYSTEM CONSTRUCTION AND FUNCTION ..... EF- 3

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

AIR CLEANER

The air cleaner, located between the front grille and the radiator, is secured to the radiator core support with four screws.

To prevent the water from the road into the air cleaner and to suck air from the engine compartment, an air duct is installed on the air cleaner.

The air cleaner element is a viscous paper type and requires no cleaning.

Note: Never attempt to clean the element with a brush or air blast.

REPLACEMENT

1. Unfasten air duct clamp and disengage air duct at air cleaner horn.
2. Remove three wing nuts on air cleaner.
3. Remove cover from air cleaner.

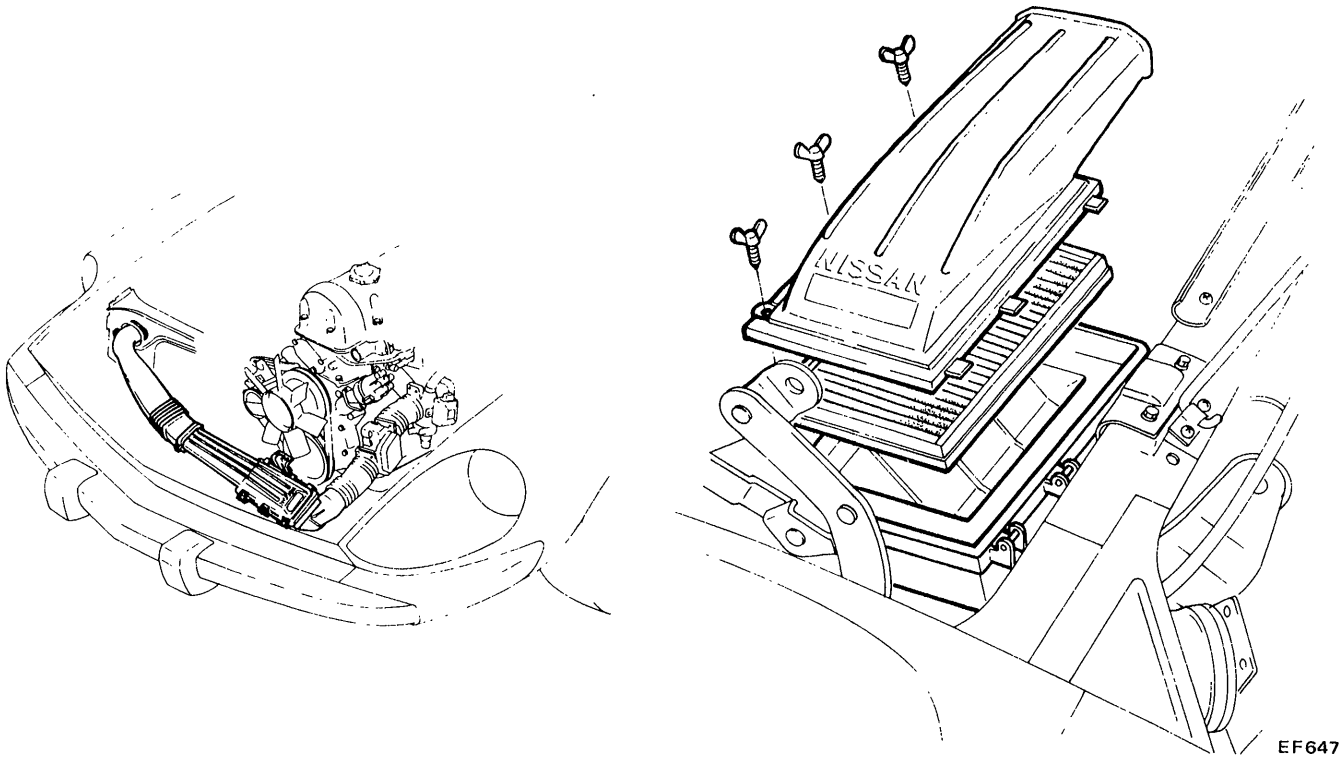
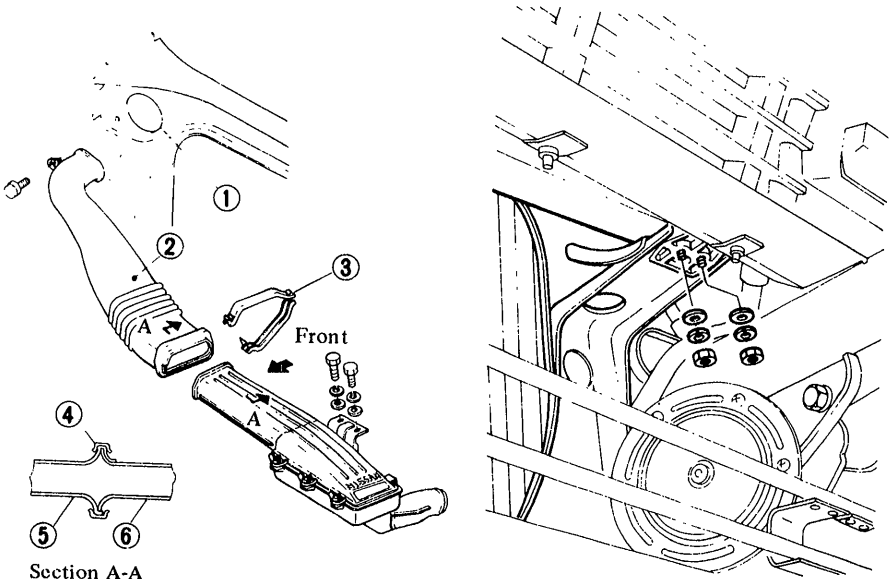


Fig. EF-1 Air cleaner element

4. Replace air cleaner element.
5. To install the air cleaner element, reverse the order of removal.

REMOVAL AND INSTALLATION

1. Remove air duct securing bolt from radiator core support reinforce.
2. Unfasten air duct clamp and disengage air duct at air cleaner horn.
3. Unfasten clamp securing air duct running between air flow meter and air cleaner, and disengage air duct at air cleaner.
4. Remove four screws (two on the upper and two on the lower sides) from radiator core support, and detach air cleaner assembly.
5. To install the air cleaner assembly, reverse the order of removal.



1 Radiator core support reinforce
2 Air duct
3 Air duct clamp
4 Clamp
5 Air duct
6 Air cleaner

Fig. EF-2 Air cleaner and air duct

ELECTRONIC FUEL INJECTION SYSTEM CONSTRUCTION AND FUNCTION

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I. FEATURES

The Electronic Fuel Injection System employs various types of sensors to convert the engine operating conditions into electronic signals. These signals are sent to the control unit where the optimum injector open-valve time period is computed according to the information stored in the memory for control of fuel injection quantity.

The electronic fuel injection system has the following features:

1. Improved exhaust emission

The electronic fuel injection system improves the transient response characteristics of the fuel system, permitting engine operation with lean mixture. This improves the exhaust emission performance of the engine.

2. Improved fuel economy

The electronic fuel injection system permits optimum mixture ratio combustion under all operating conditions; this results in improved fuel economy.

3. Driving performance

The electronic fuel injection system permits accurate mixture ratio control with respect to the cooling water temperature and intake air temperature, thereby improving the startability of the engine. With this electronic fuel injection system, the vehicle can be started immediately without any warming up even in cold weather.

- The electronic fuel injection system permits the supply of the optimum fuel quantity for each cylinder even at lower temperatures, thus greatly improving the startability of the engine.
- The electronic fuel injection system provides superior transient response characteristics for the engine without causing engine breathing or any other engine trouble.
- Since the fuel pressure is always maintained at a level of 2.55 kg/cm^2 (36.3 psi), no vapor lock occurs in this engine. This also gives the engine superior heat resistance. The signal detector section of the electronic fuel injection system employs various types of sensors as indicated below.

(1) Air flow meter
(2) Ignition coil negative terminal revolution trigger signal
(3) Throttle valve switch
(4) Water temperature sensor
(5) Air temperature sensor
(6) Thermotime switch
(7) Starting switch
(8) Altitude switch (California models only)

The essential element of this electronic fuel injection system is the air flow meter which is mounted between the air cleaner and throttle chamber. It measures directly the quantity of intake air, and the injector open-valve time period is determined on the basis of the quantity of intake air required for one rotation of the engine.

Since this electronic fuel injection system directly measures the air flow rate, it is also called the "L-Jetronic system", the "L" being taken from the German "Luft" (air).

II. ELECTRONIC FUEL INJECTION SYSTEM OPERATION

The following Figure EF-3 is an outline of operation of each component of the electronic fuel injection system.

1. Fuel system

(1) Fuel flow

Fuel is sucked 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 manifold cylinder branch from the injector.

Surplus fuel is led through the pressure regulator and is returned to the fuel tank. The pressure regulator controls the fuel pressure in such a manner that the pressure difference between the fuel pressure and the intake manifold vacuum is always 2.55 kg/cm^2 (36.3 psi). During starting operation of the engine when the cooling water temperature is below the specification, the cold start valve is actuated by the thermotime switch to increase the quantity of fuel.

Note: For the specified temperature of cooling water, see the "Thermotime Switch" on page EF-13.

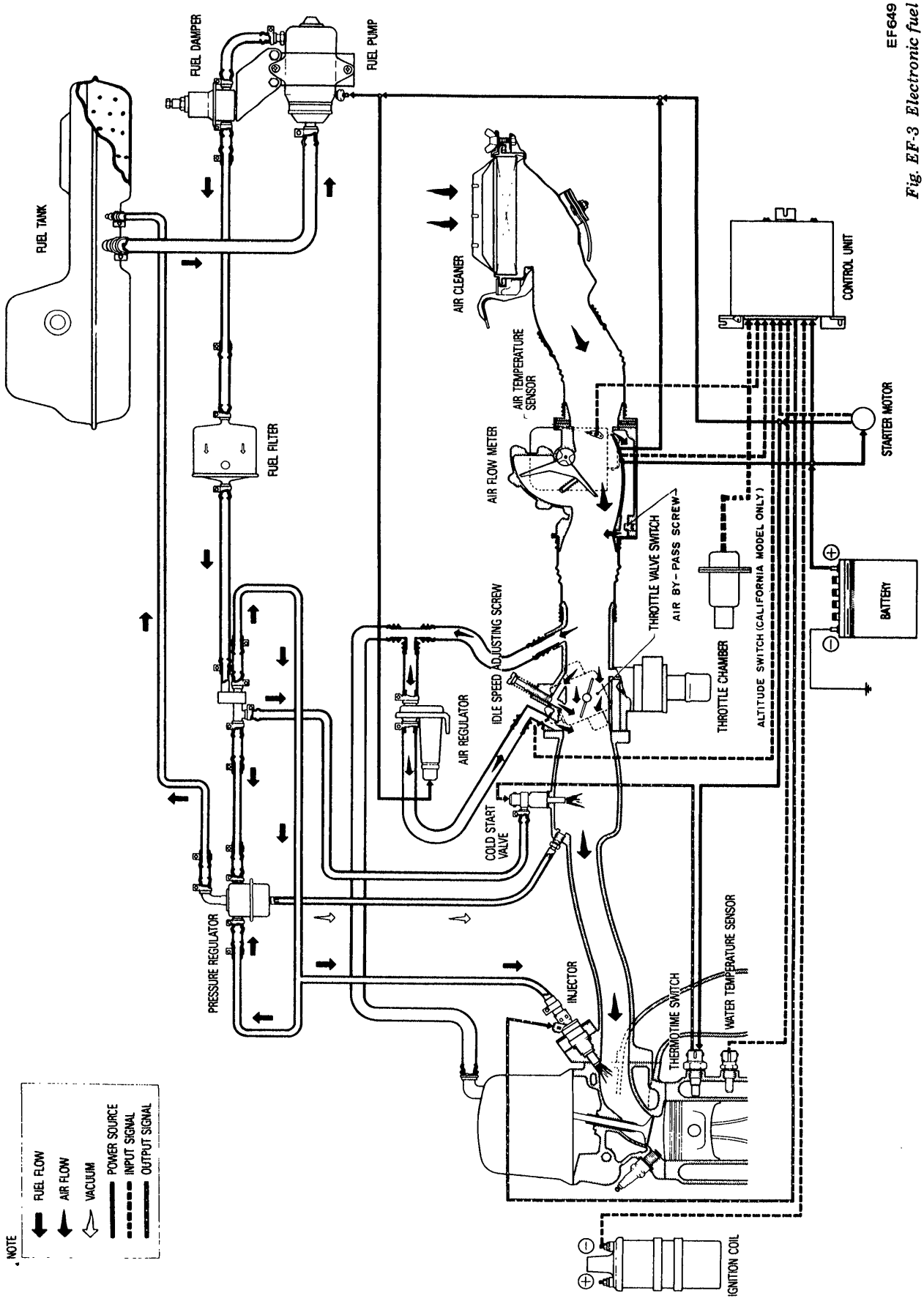
(2) Fuel injection system

The fuel injection system provides simultaneous injection of fuel into the intake manifold for all cylinders. Injection of fuel occurs at each rotation of the engine, and the injected amount of fuel per injection is half the quantity required for one cycle operation of the engine. The ignition signal of the ignition coil is utilized for correct injection of fuel. In this case, the

signal from the ignition coil does not specify the timing for injection. It specifies the frequency of injections only, since the injection timing is always set to be constant.

2. Air flow system

Intake air from the air cleaner is metered at the air flow meter, flows through the throttle chamber and into the intake manifold, and then flows through each intake manifold branch into the cylinder. Air flow during driving is controlled by the throttle valve located in the throttle chamber. During idling operation, the throttle valve is in the almost closed position, and the air is led through the bypass port mounted to the throttle chamber. In this case, the quantity of suction air is adjusted by means of the idle speed adjusting screw. During warming-up operation, the air flow is bypassed through the air regulator to increase engine rpm.



EF649

Fig. EF-3 Electronic fuel injection system

III. ELECTRONIC CONTROL SYSTEM

(1) Input signal of control unit

An electrical signal from each sensor is introduced into the control unit for computation. The open-valve time period of the injector is controlled by the duration of the pulse computed in the control unit.

Input signals to the control unit are as follows:

Input	Sensor	Item to be monitored
A	Air flow meter	Quantity of intake air
B	Ignition coil negative terminal	Engine rpm
C	Throttle valve switch	Opening of throttle valve (Correction of "idle" & "full" enrichment, "after idle" enrichment at low water temperature, and fuel cutting operation during coasting)
D	Water temperature sensor	Temperature of cooling water (Correction of "water temperature", "after start" and "after idle" enrichment)
E	Air temperature sensor	Temperature of intake air (Correction of "intake air temperature" enrichment)
F	Starting switch	Starting operation (Correction of "start" enrichment and "after start" enrichment)
G	Altitude switch (California models only)	Atmospheric pressure (Altitude compensation; Correction of air-fuel mixture ratio at high altitude)

Input signals to the control unit.

(2) Output signal

H: Output of control unit open-valve pulse signal from control unit to injector.

I: Signal from thermotime switch to cold start valve.

When the cooling water temperature is lower than the specification*, the bimetal contact in the thermotime switch remains in the ON position. At this switch position, if the ignition switch is turned to the START position, electric current is supplied from the battery for operation of the cold start valve. When the cooling water temperature is above the specification, the bimetal contact is in the OFF position. In this case, even if the ignition switch is turned to the START position, the cold start valve will not be actuated.

Asterisk(*): For the specified temperature of cooling water, see the "Thermotime Switch" on page EF-13.

(3) Battery voltage

Battery voltage is applied to the solid line in Figure EF-4.

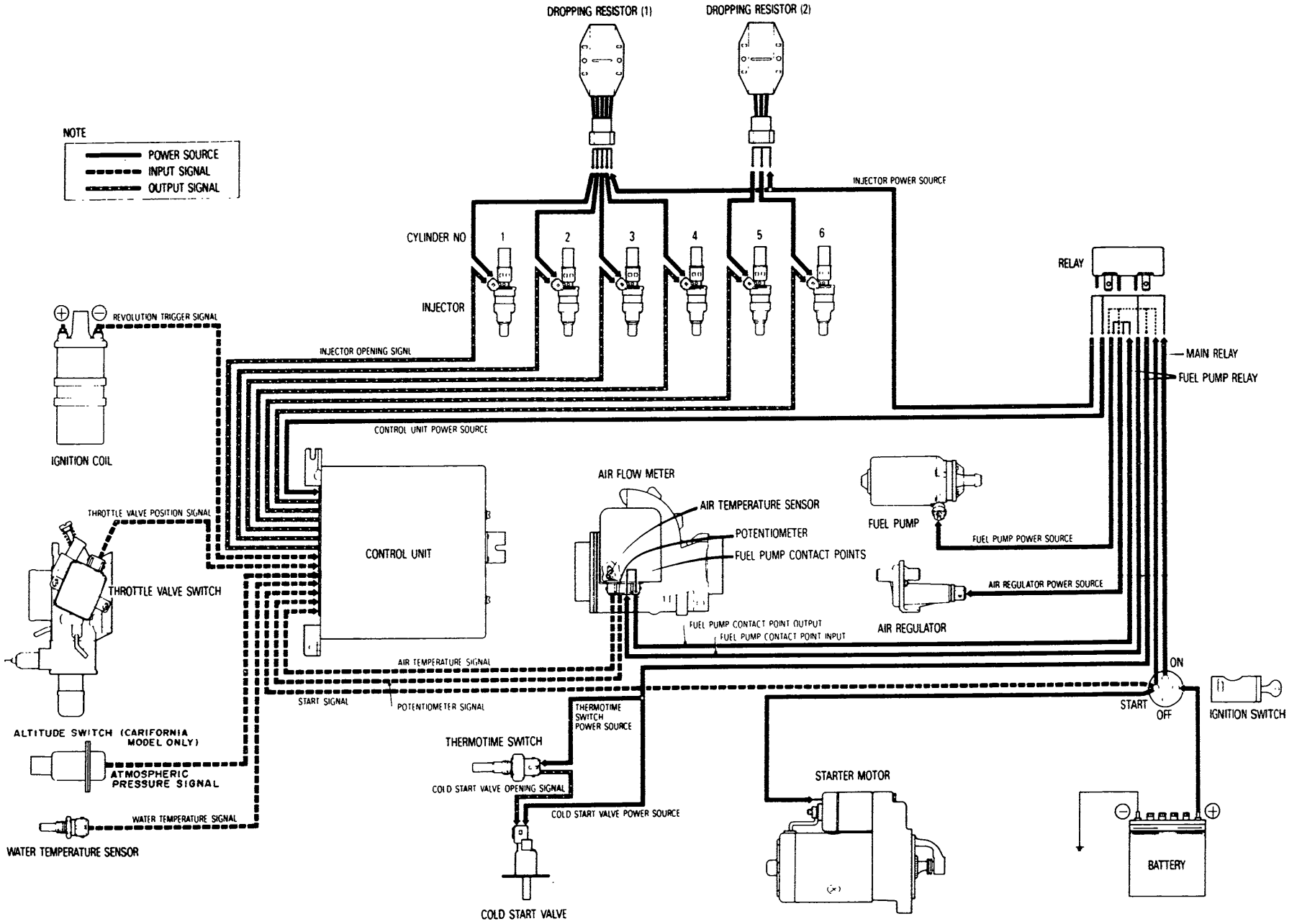


Fig. EF-4 Electronic control signal

Ⅳ. FUEL INJECTION PULSE

1. Generation of injection pulse in control unit

Figure EF-5 shows the control unit block diagram. The function of major elements in the control unit is described as follows:

(1) IC_1

Upon receiving revolution trigger signal ① from the ignition coil negative terminal, the IC_1 carries out wave form shaping ② and frequency conversion ③ operation and issues injection timing signal for each rotation of the engine.

(2) IC_2

Upon receiving the timing signal (engine rpm signal) from the IC_1 and the signal (intake air flow signal) from the air flow meter, the IC_2 computes the base pulse Tp utilizing the charge-discharge characteristics of condenser.

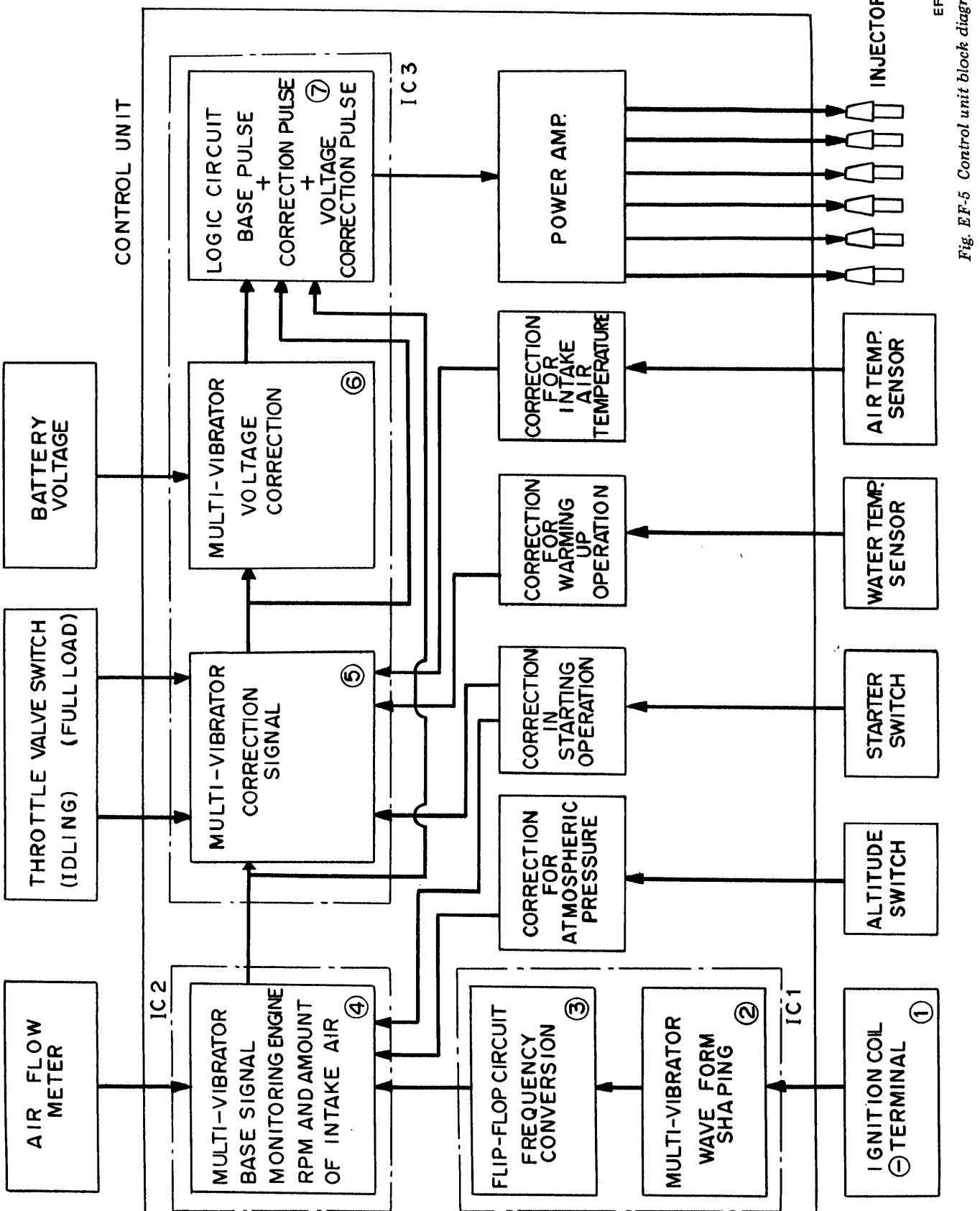
The IC_2 also corrects the "start" enrichment, using signal from the starter, and the air-fuel mixture ratio at "high altitude", using the signal from the altitude switch.

(3) IC_3

In the IC_3 enrichment are added to the base pulse Tp determined in the IC_2 depending on the signals sent from the sensors. The input for the multi-vibrator ⑤ includes the base pulse (Tp), water temperature signal, intake air temperature signal, throttle valve switch signal and starting switch signal, and the output is a corrected pulse (Tq) of the base pulse (Tp). The multi-vibrator ⑥ issues the voltage correction pulse (Ts) which corrects delay in the mechanical response of the injector. The voltage correction pulse (Ts) is determined by the battery voltage signal. In the logic circuit of the IC_3, the base pulse (Tp), correction pulse (Tq) and voltage correction pulse (Ts) are combined to form a summation pulse ($Tg = Tp + Tq + Ts$), which in turn is sent to the power amplifier in the next stage.

(4) Power amplifier

The power amplifier amplifies the summation pulse (Tg) generated in the IC_3, and sends it to the injector. The actual open-valve time period of the injector is "$Tg - Ts = Tp + Tq$", since the delay in mechanical response (Ts) is inherent in the injector operation. This actual open-valve time period is called the "effective injection pulse ($Te = Tp + Tq$)".



EF651

Fig. EF-5 Control unit block diagram

2. Correction of fuel enrichment

Figure EF-8 shows the model diagram of fuel enrichment correction.

(1) Enrichment in starting, idling and driving operations.

1) "Cold start valve" enrichment

The cold start valve operates when the starting switch and thermotime switch have been turned ON, and injects fuel into the intake manifold.

2) "Idle" enrichment

When the engine is idling, that is, when the accelerator pedal is not depressed, the idling switch directly coupled to the throttle valve is ON to provide additional fuel injection.

3) "Start" enrichment

When the starting switch is ON during cranking operation, a constant amount of fuel is increased irrespective of the cooling water temperature.

4) "After start" enrichment

When the starting switch is turned OFF after cranking operation, the "start" enrichment becomes zero. The "after start" enrichment is provided to compensate for this sudden decrease in fuel quantity. The "after start" enrichment decreases gradually as time passes, finally becoming zero.

5) "After idle" enrichment

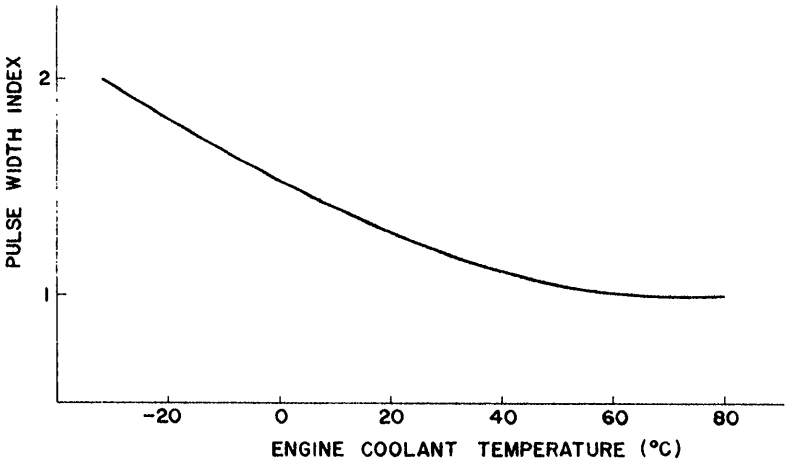
The "after idle" enrichment provides smooth acceleration when the accelerator pedal is depressed to start the vehicle. This enrichment is effective only in cold weather and attenuated in a short period of time.

6) "Full" enrichment

The "full" enrichment provides smooth full throttle driving performance when the throttle valve opening is more than 34°. With this enrichment, about 27% of fuel is increased from the level determined by the base pulse.

(2) Correction by cooling water temperature.

Fuel is increased according to the cooling water temperature monitored by the cooling water temperature sensor. The increased amount of fuel is constant when the cooling water temperature is above 70°C (158°F).

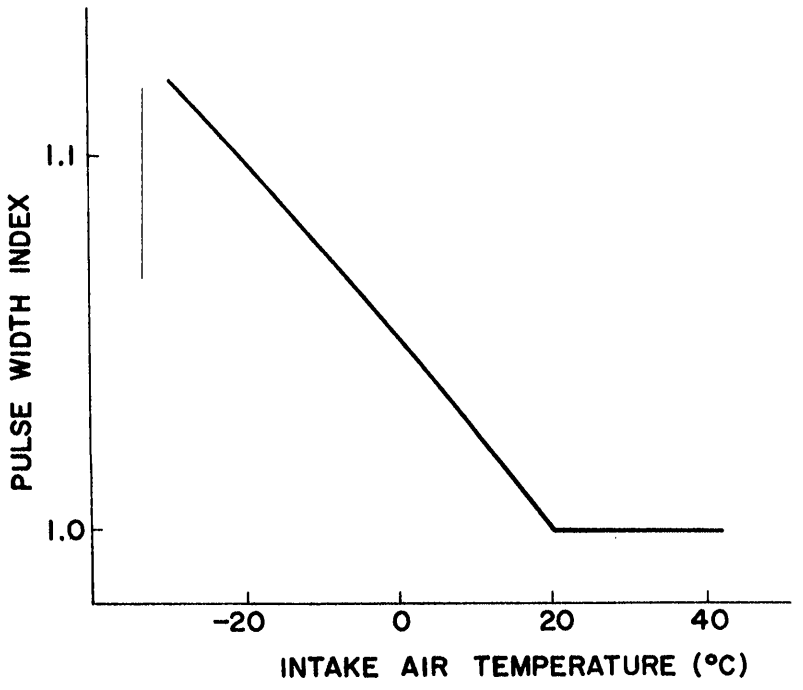


EF345

Fig. EF-6 Correction by cooling water temperature

(3) Correction by intake air temperature.

Fuel injection is increased according to the intake air temperature monitored by the intake air temperature sensor. The increased amount of fuel is constant when the intake air temperature is above 20°C (68°F).



EF346

Fig. EF-7 Correction by intake air temperature

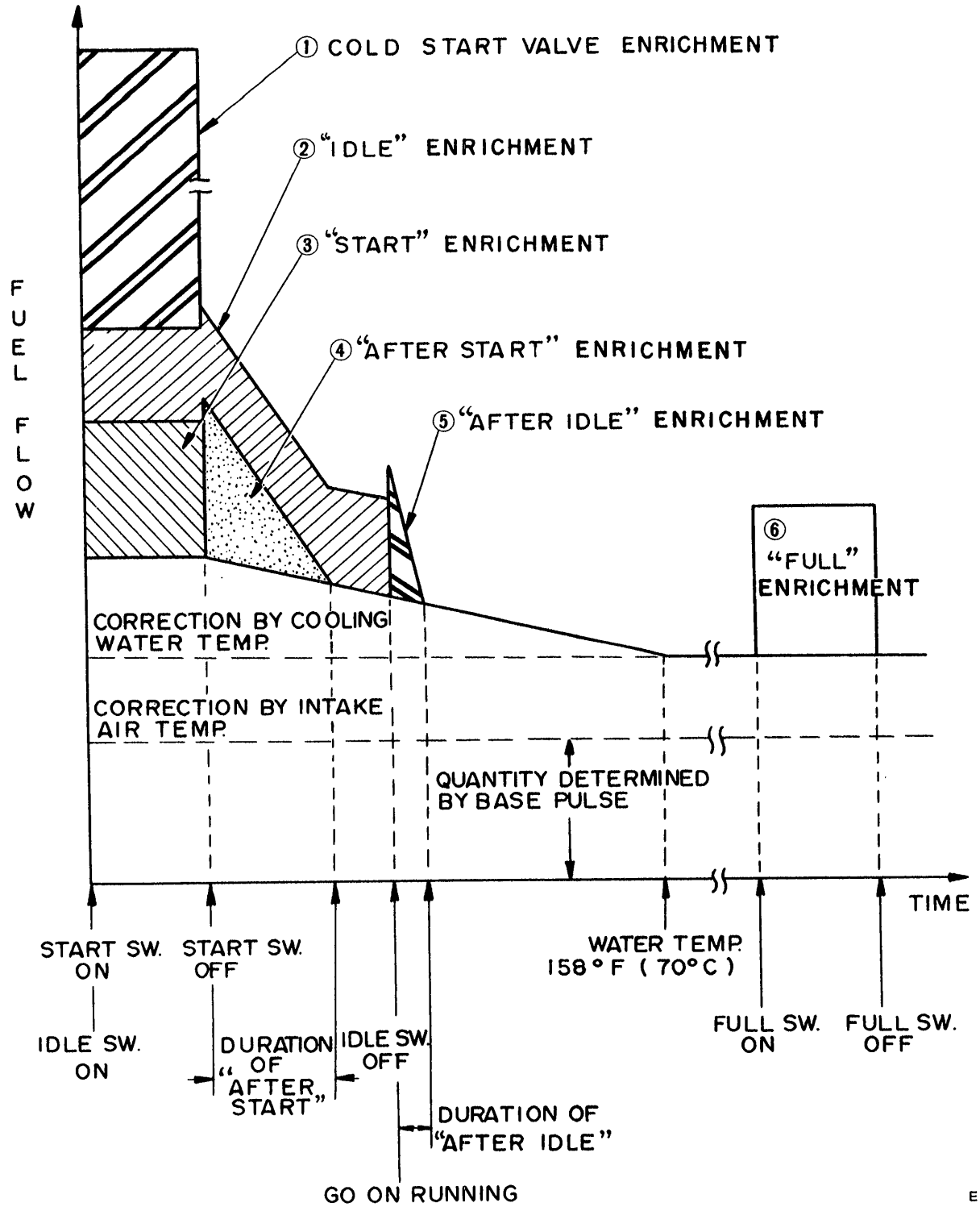


Fig. EF-8 Correction of fuel enrichment

3. Fuel cut

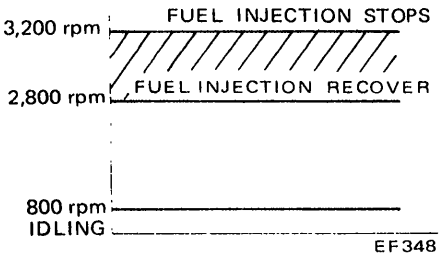


Fig. EF-9 Fuel cut

Fuel cut is accomplished during deceleration when the engine does not require fuel.

The above chart shows the relationship between engine rpm and fuel cut range.

When engine speed is above 3,200 rpm and throttle valve idle switch contacts are closed (that is, accelerator pedal is released), fuel injection does not take place; when engine speed drops below 2,800 rpm, fuel cut is released and fuel injection recommences.

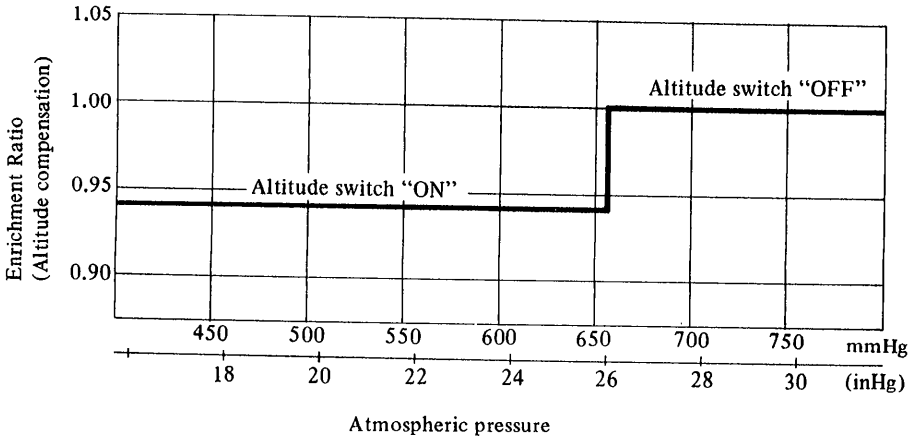
The injection of fuel provides smooth engine idling without stopping the engine.

Fuel cut is not accomplished during deceleration when engine rpm is below 3,200 rpm.

4. Altitude compensation (California models only)

Altitude compensation prevents deterioration of exhaust emissions caused by an enriched air-fuel mixture.

Enrichment Ratio (Altitude Compensation) = Amount of injected fuel with altitude enrichment / Amount of injected fuel without altitude enrichment



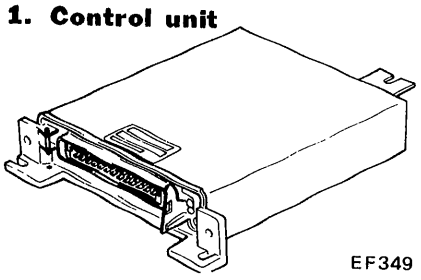
EF652

Fig. EF-10 Altitude compensation

Atmospheric pressure varies according to the altitude. The higher the altitude, the lower the atmospheric pressure. At an atmospheric pressure of 660 mmHg (26 inHg) or below [corresponding to an altitude of 1,120 m (3,675 ft) or higher], the altitude switch transmits an ON signal to the control unit, decreasing fuel by 6% and providing an appropriate air-fuel mixture ratio.

V. ELECTRONIC FUEL INJECTION SYSTEM COMPONENT PARTS

1. Control unit



EF349

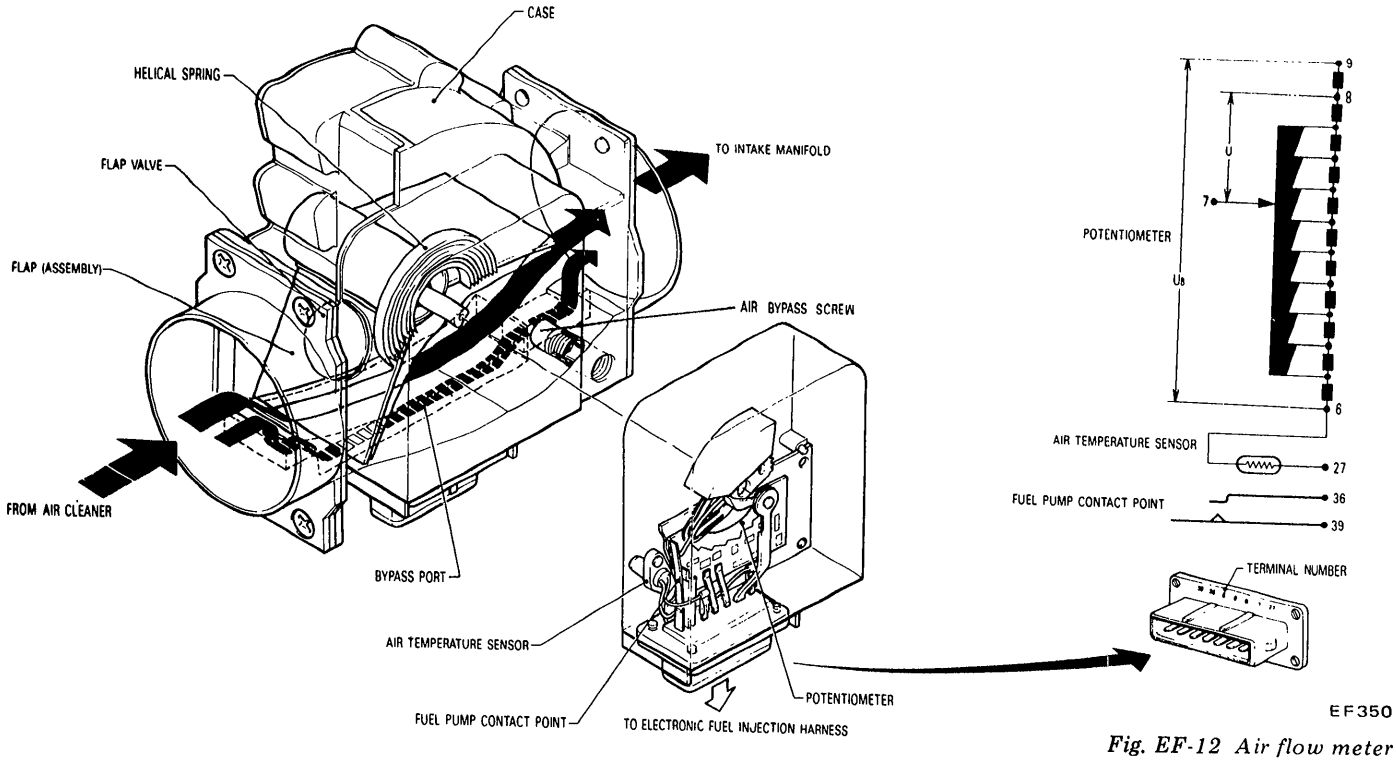
Fig. EF-11 Control unit

The control unit is mounted on a bracket on the driver seat side dash panel. It is connected to the electronic fuel injection harness by means of a multi-connector, and the electronic fuel injection harness is connected to other sensors.

The essential role of the control unit is to generate a pulse. Upon receiving an electrical signal from each sensor, the control unit generates a pulse whose duration (injector open-valve time period) is controlled to provide an optimum quantity of fuel according to the engine characteristics.

The control unit consists mainly of three integrated circuits formed on the printed circuit board. This construction provides superior control unit reliability.

2. Air flow meter



EF350

Fig. EF-12 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 is electronically monitored to count the air flow rate.

More specifically, the angle of rotation of the flap is monitored by a potentiometer provided inside as a potential difference U. A circuit diagram of the potentiometer is shown in Figure EF-13. When the flap deflects along with a change in the intake air flow rate, the terminal ⑦ mounted to the flap shaft slides on the variable resistor R from R1 to R9, causing the voltage across terminals ⑦ and ⑧ to change.

A constant voltage U_B (battery voltage) is applied across terminals ⑥ and ⑨. Then the air flow rate is converted into the voltage ratio signal U/U_B, which in turn is sent to the control unit for computation.

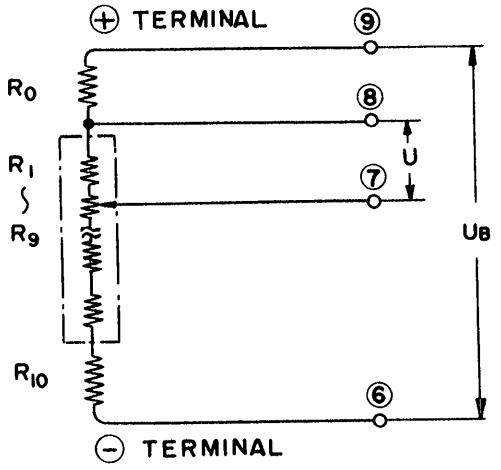


Fig. EF-13 Air flow meter potentiometer

The flap is able to rotate to an angle where an equilibrium can be maintained between the air flow pressure and the return torque of the coil spring. The damper chamber and compensating plate are provided as a damper for the flap so that the flap will not be disturbed by pulsation in manifold vacuum during operation.

The compensating plate is interlinked with the flap, and as the flap rotates, the compensating plate rotates in the damper chamber keeping a very small clearance between the chamber wall.

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

The bypass port has been factory adjusted. It can be adjusted further, if necessary, by turning the air bypass screw.

The fuel pump relay contact is provided in the potentiometer section of the air flow meter. This contact remains in the OFF position when the flap is not actuated. It turns ON when the flap turns 8°, and allows electric current to flow through the fuel pump relay for driving the fuel pump. This construction provides superior safety to the system, as the fuel pump will stop operation if accidental engine stalling should occur during driving.

3. Air temperature sensor

The air temperature sensor, built into the air flow meter, monitors change in the intake air temperature and transmits a signal to control fuel injection in response to the varying pulse duration.

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

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

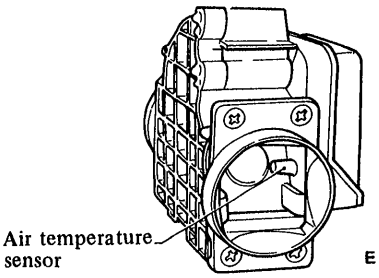


Fig. EF-14 Air temperature sensor

4. Water temperature sensor

The water temperature sensor, built into the thermostat housing, monitors change in cooling water temperature and transmits a signal for the fuel enrichment to change the pulse duration during the warm-up period.

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

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

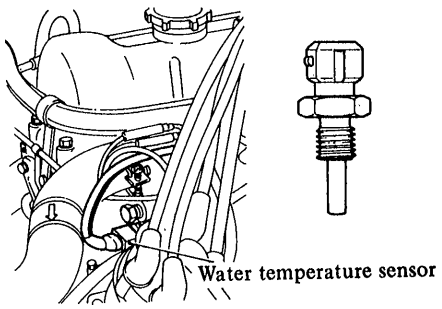


Fig. EF-15 Water temperature sensor

5. Thermotime switch

The thermotime switch is built into the thermostat housing.

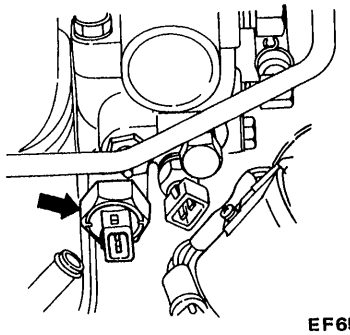
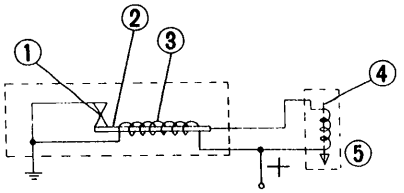


Fig. EF-16 Thermotime switch

The operating principle of the switch is as shown in the chart in Figure EF-17.



1 Contact points
2 Bimetal
3 Heater
4 Plunger
5 Cold start valve

EF312

Fig. EF-17 Operating principle of thermotime switch

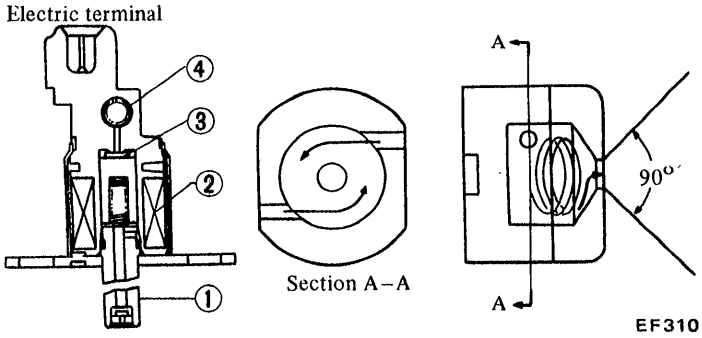
A harness is connected to the cold start valve from the thermotime switch. The bimetal contact in the thermotime switch opens or closes depending on the cooling water temperature, and sends a signal to the cold start valve so that an additional amount of fuel can be injected for cranking operation of the engine when the cooling water temperature is below specification 14 to 22°C (57 to 71°F).

The thermotime switch is ON when the cooling water temperature is below specification. This implies, however, that repeated operation of the ignition switch may result in excessively thick mixture and consequent troubles in engine operation. To prevent this, the bimetal is equipped with a heater. Electric current flows through the heater while the ignition switch is in the start position, and warms up the bimetal. Through repeated operation of the ignition switch, then, the bimetal is sufficiently warmed up to open the thermotime switch, thus stopping excessive injection of fuel from the cold start valve.

The temperature at which the bimetal contact turns ON or OFF can be changed within the range of 14 to 22°C (57 to 72°F).

6. Cold start valve

The cold start valve operates on the electromagnetic principle. It causes fuel to be injected into the intake manifold independently of the injector operation so that the engine can be cranked smoothly during cold weather.

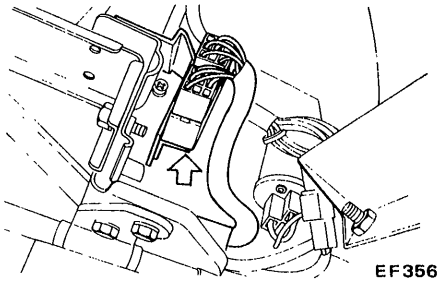


1 Swirl type nozzle
2 Magnet coil
3 Sheet valve
4 Fuel inlet

EF310

Fig. EF-18 Sectional view of cold start valve

To improve fuel-air mixing at lower temperatures, the cold start valve employs a swirl type nozzle which has a turn chamber at the end. With this construction, fuel is injected at an angle of 90° and better atomization of fuel can be obtained.



EF356

Fig. EF-19 Electronic fuel injection relay

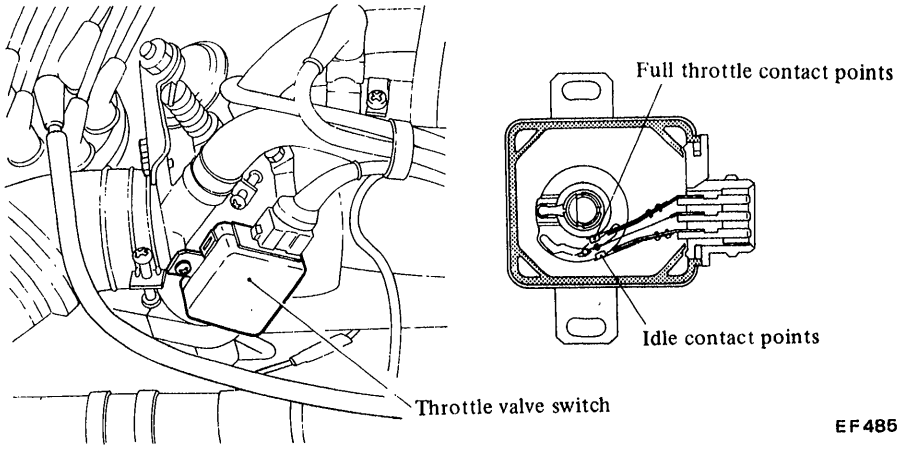
7. Electronic fuel injection relay

The relay is located at the side dash on the driver's side. It is made up of two sections—the main relay section and the fuel pump relay section. The main relay section serves to actuate the electronic fuel injection system through the ignition switch, and the fuel pump relay section to actuate the fuel pump and air regulator. These two relays are incorporated into a compact case. (See Figure EF-19).

8. Throttle valve switch

The throttle valve switch is attached to the throttle chamber and actuates in response to accelerator pedal movement. This switch has two sets of contact points. One set monitors the idle position and the other set monitors full throttle position.

The idle contacts close when the throttle valve is positioned at idle and open when it is at any other position.



EF485

Fig. EF-20 Throttle valve switch

The full throttle contacts close only when the throttle valve is positioned at full throttle (or more than 34 degree opening of the throttle valve). The contacts are open while the throttle valve is at any other position.

The idle switch compensates for enrichment during idle and after idle, sends fuel cut signal. The full throttle switch compensates for enrichment in full throttle.

9. Dropping resistor

The dropping resistor is mounted near the washer tank. It can be seen by opening the L.H. inspection lid.

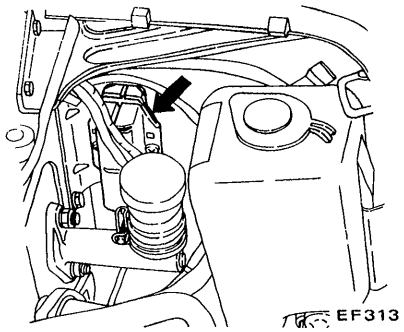


Fig. EF-21 Dropping resistor

The dropping resistor is provided to reduce electric current flowing through the injector and control unit.

10. Altitude switch (California models only)

This switch is attached to the stay on the left side of the instrument panel in the driver's compartment. Consisting of a bellows and a microswitch, the switch transmits an ON or OFF signal to the control unit according to change in atmospheric pressure. When the atmospheric pressure drops below 660 mmHg (26 inHg), an ON signal is transmitted to decrease fuel by 6%.

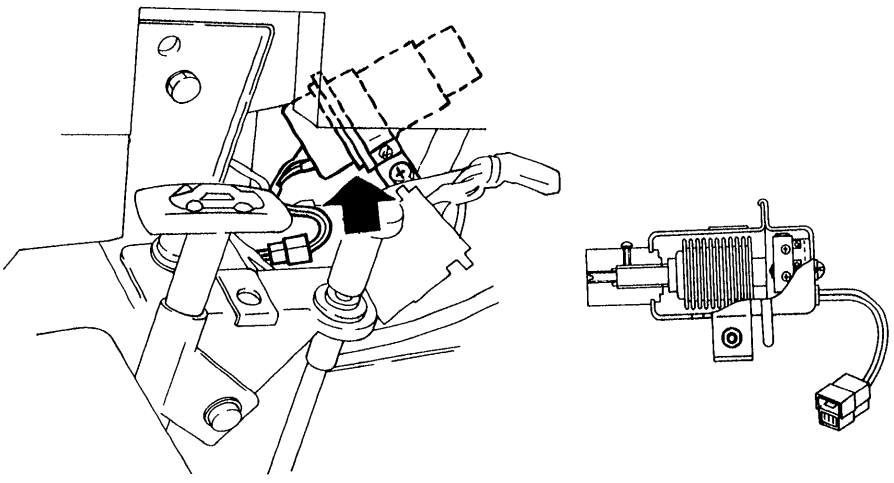


Fig. EF-22 Altitude switch

Classification	Atmospheric pressure	Altitude switch	Air-fuel mixture ratio
"Low" altitude [Approx. 1,120 m (3,675 ft) or lower]	Approx. 660 mmHg (26 inHg) or above	OFF	Standard
"High" altitude [Approx. 1,120 m (3,675 ft) or higher]	Approx. 660 mmHg (26 inHg) or below	ON	Compensated by 6% on lean side

11. Fuel pump

The fuel pump is mounted near the fuel tank and right rear wheel. The pump employs a wet type construction where a vane pump with roller is directly coupled to a motor filled with fuel. This construction provides superior coupling characteristics between the pump and motor, and greater safety in case of fire.

The relief valve in the pump is designed to open when the pressure in the fuel line rises over 3 to 4.5 kg/cm^2 (43 to 64 psi) due to trouble in the pressure system.

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

When the ignition switch is turned to the START position for cranking operation, the fuel pump is actuated irrespective of the position of the air flow meter contact point. After starting the engine (the ignition switch is ON), the air flow meter contact turns ON through rotation of the engine, thereby actuating the fuel pump. If engine stalls for some reason, the air flow meter contact is turned OFF, and the fuel pump is stopped, though the ignition switch remains in the ON position. In this manner, fuel supply is cut off for safety purposes when the engine accidentally stops during driving.

Fuel pump operation chart

IGN. SW. Position			A.F.M. Contact Points	Fuel Pump
OFF	ON	Start		
–	–	X	OFF	Actuated
–	X	–	ON	Actuated
–	X	–	OFF	Unactuated
X	–	–	ON	Unactuated
X	–	–	OFF	Unactuated

X: IGN. SW. positions

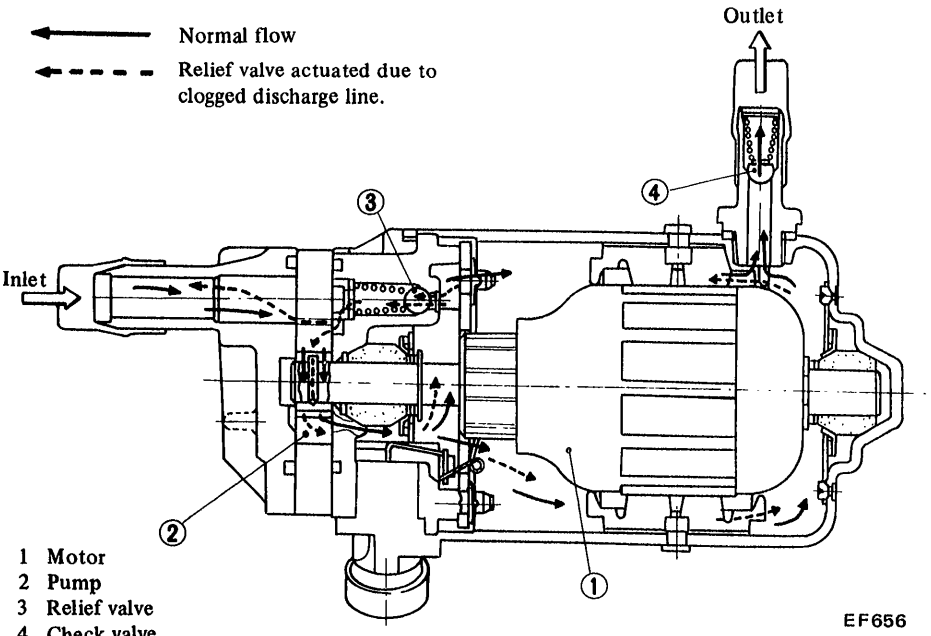


Fig. EF-23 Sectional view of fuel pump

12. Fuel damper

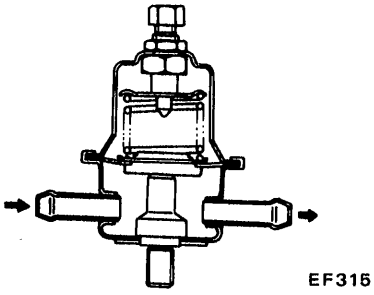


Fig. EF-24 Sectional view of fuel damper

The construction of the fuel damper is shown in Figure EF-24. The fuel damper is provided to suppress pulsation in fuel flow discharged from the fuel pump. No adjustment is allowed on this damper.

13. Pressure regulator

The pressure regulator controls the pressure of fuel so that a pressure difference of 2.55 kg/cm^2 (36.3 psi) can be maintained between the fuel pressure and intake vacuum. This constant differential pressure provides optimum fuel injection in every mode of engine operation.

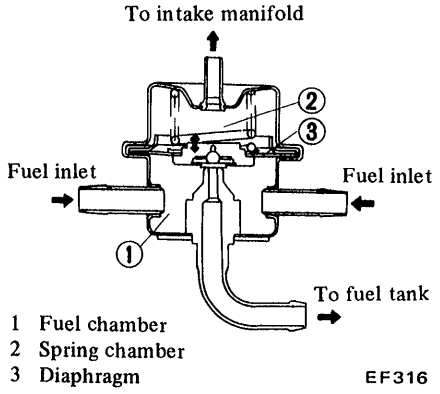


Fig. EF-25 Sectional view of pressure regulator

When the intake manifold vacuum becomes large enough to overcome the diaphragm spring force as combined with the fuel pressure at the pressure line, the diaphragm becomes empty on the intake-side. This opens the return-side port to allow fuel to flow to the tank for reducing fuel pressure.

If fuel pressure is higher than the intake manifold vacuum by 2.55 kg/cm^2 (36.3 psi), the diaphragm returns to its original position by means of spring force, and closes the return port.

In this manner, the pressure regulator maintains the fuel pressure in the fuel line 2.55 kg/cm^2 (36.3 psi) higher than the pressure in the intake manifold.

14. Fuel filter

The fuel filter is mounted on the right hand side of the engine compartment, near the canister.

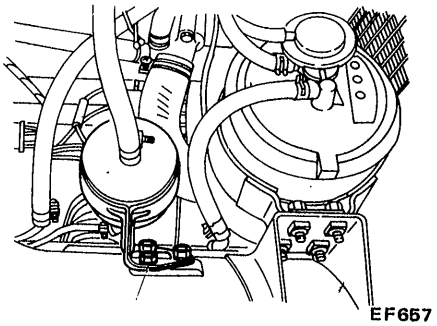


Fig. EF-26 Fuel filter

The filter paper type element must be replaced according to the periodic maintenance schedule, together with the filter body as an assembly.

15. Injector

The injector is mounted on the branch portion of the intake manifold. It receives the pulse signal from the control unit, and injects the fuel toward the intake valve in the cylinder head.

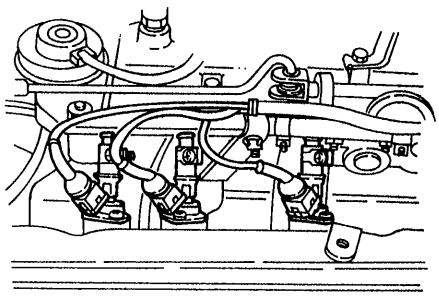


Fig. EF-27 Injector

The injector operates on the solenoid valve principle. When a driving pulse 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.

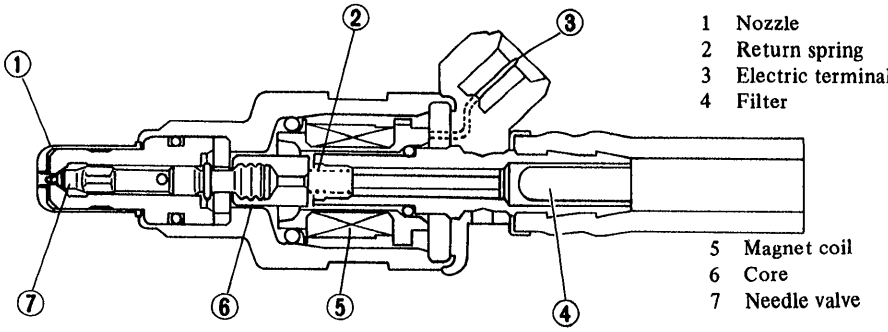


Fig. EF-28 Sectional view of injector

16. Air regulator

The air regulator bypasses the throttle valve to control the quantity of air for increasing the engine idling speed when starting the engine at an underhood temperature of below 80°C (176°F).

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 underhood air temperature drops to below 80°C (176°F).

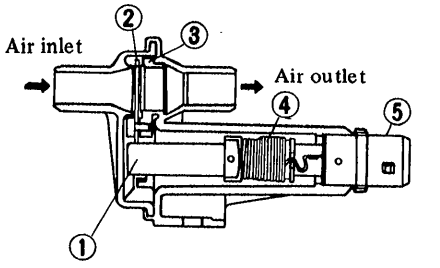


Fig. EF-29 Sectional view of air regulator

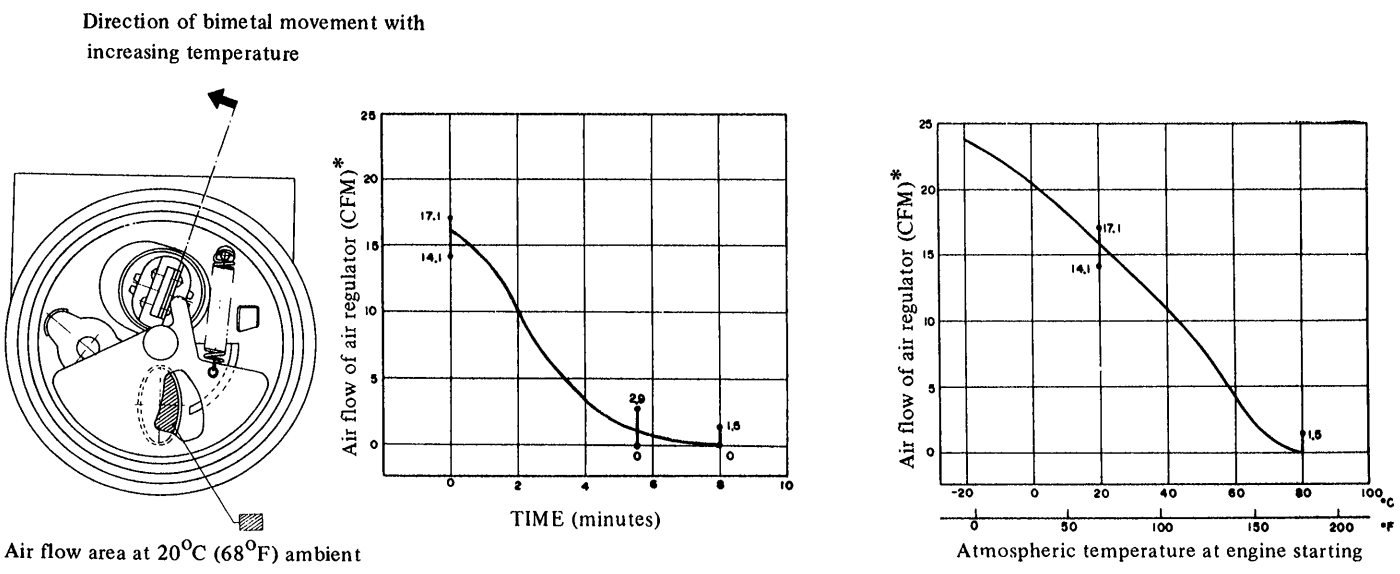


Fig. EF-30 Air regulator characteristic curve

17. Throttle chamber

The throttle chamber, located between the intake manifold and air flow meter, 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.

This valve remains closed during engine idling, and the air required for idling passes through the bypass port into the intake manifold. Idle adjustment is made by the idle speed adjusting screw located in the bypass port. There is another bypass line in this throttle chamber to pass sufficient air through the air regulator into the intake manifold when a cold engine is started.

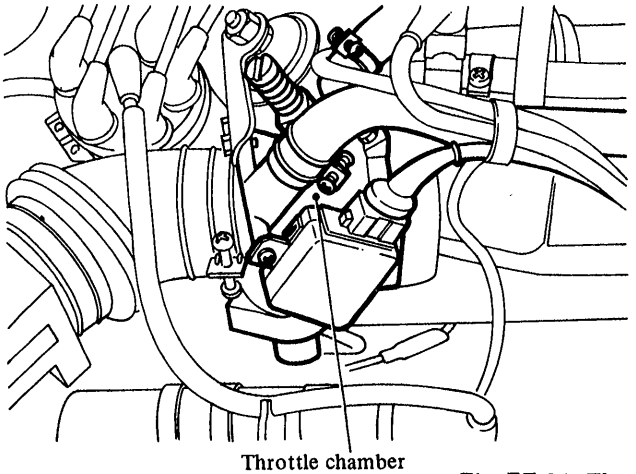


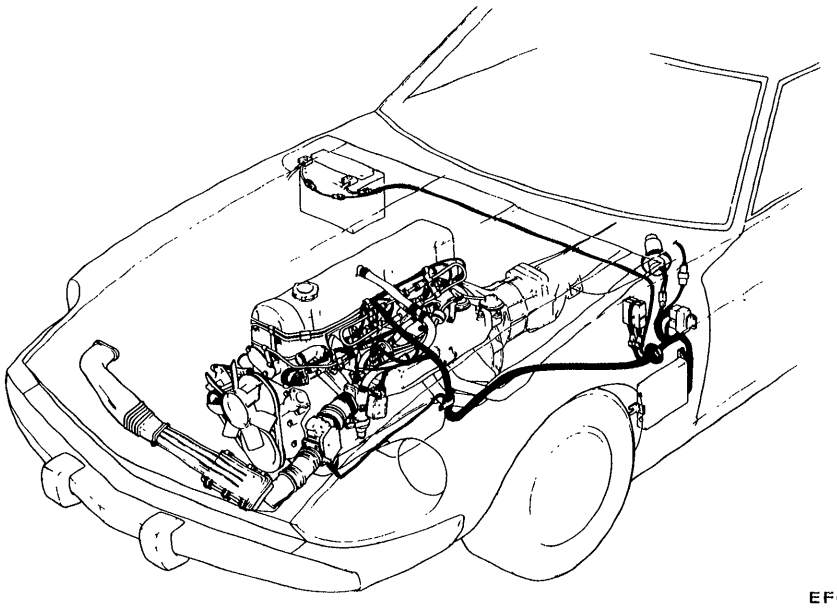
Fig. EF-31 Throttle chamber

18. Harness

One wiring harness is used to connect lines between the control unit and the related major units.

The harness from the 35-pin connector connected to the control unit is combined with the E.F.I. relay at the side dash on the driver's side and the altitude switch at the instrument stay on the driver's seat, and runs to the engine compartment where it is combined with the dropping resistor harness. From the engine compartment, the harness runs to various units; the air flow meter, air temperature sensor, throttle valve switch, air regulator, injector, cold start valve, etc.

Connectors are used only in the line between the 35-pin connector and water temperature sensor, and between the cold start valve and thermo-time switch.



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Fig. EF-32 Electronic fuel injection harness

TROUBLE DIAGNOSES

The electronic fuel injection system must be checked in accordance with the troubleshooting chart. **When using this chart, make sure that the ignition system, battery and transistor ignition system are all in good condition.**

In the troubleshooting chart, trouble phenomena are listed vertically while the inspection items are arranged horizontally. The items which must be checked are marked with an "o" for each trouble phenomenon. Proceed from left to right in the inspection item section.

Check the harness connector for correct insertion.

Then, check the harness together with the unit for continuity. A continuity test on the harness may be carried out on the 35-pole pin of the control unit and other necessary portions with a circuit tester.

Inspection procedure (Proceed from left to right)

Trouble phenomenon \ Inspection item	Harness continuity test (together with unit)	Fuel pump sound	Control unit operation at cranking	Injector sound	Cold start valve system condition	Air regulator system condition	Relay
Engine can not be started	O	O	O	O	O *1		O
Engine stalls	O	O	O	O		O *2	O
Lack of power	O			O			
Engine breather	O						
Unstable idling — During warming-up	O			O		O	
Unstable idling — After warming-up	O			O			
Higher idling speed	O					O	
Running-on or dieseling							
Back fire	O						
After fire	O						
Abnormal fuel consumption	O				O		

*1 Check this item when trouble occurs in cold weather only.

*2 Check this item when trouble occurs during warming-up.

If a continuity test on an affected harness does not slove the problem, proceed to check by following the inspection items listed in the chart from left to right.

If any abnormality is found in any inspection item, refer to the "INSPECTION" section and carry out further inspection following the procedures described therein. In some cases, the description of an inspection item overlaps that of the preceding item. In such case, the overlapping description of the present inspection item may be omitted.

Note that any component part of the electronic fuel injection system must be replaced as an assembly if it is found to be faulty, since no repairing is allowed.

Control unit replacement	Air flow meter		Water temp. sensor resistance measurement	Air temp. sensor resistance measurement	Throttle valve switch continuity test	Altitude switch (California models only)	Fuel system		
							Leakage		Fuel pressure test
	Flap operation	Resistance measurement					External appearance	Injector Cold start valve	
O	O	O	O					O	O
O	O	O	O					O	O
	O	O			O	O		O	O
O	O	O				O			O
			O	O	O			O	O
			O		O	O		O	O
								O	
O	O	O	O	O		O			O
O	O	O	O					O	O
O		O		O	O		O	O	O

Fig. EF-33 Trouble diagnoses chart

INSPECTION

DESCRIPTION

(1) Checks before inspection

Before attempting any test, check the following items to ensure that nothing has been overlooked.

- All harness connectors (especially the 35-pin coupler and air flow meter connector) are securely in place.
  Connector terminals are free from corrosion and deformation.
- Since the electronic fuel injection system accurately meters the intake air flow through an air flow meter, even a slight air leak will cause an improper air-fuel ratio, resulting in faulty engine operation due to excessive air.
  For this reason, a thorough inspection for leaks should be made at the oil filler cap, dipstick, blow-by hoses, air flow meter to throttle chamber air duct, etc.

(2) Inspection instructions

Before checking the electronic fuel injection system, be sure to observe the instructions below. Failure to do so could result in damage to the control unit or cause fuel line leakage.

(a) Before starting the engine, make sure that all electronic fuel injection harness connectors are firmly in place.

When connecting or disconnecting electronic fuel injection harness connector to or from any electronic fuel injection unit, ensure that the ignition switch is in the OFF position or that the negative battery terminal is disconnected. Removing and installing these connectors with the ignition switch left in the ON position will damage control unit.

(b) Replace hoses if they are deformed, scratched or chafed.

(c) Do not reuse hose clamps after removal.

(d) Do not allow unburned fuel to discharge from injectors and cold start valve while the engine is at rest. Doing so will cause a rich air-fuel mixture ratio, which in turn will deteriorate the catalytic converter when the engine is started.

(3) Idle adjustment

On engines equipped with the electronic fuel injection system, air-fuel mixture ratio adjustments can be made by turning air bypass screw and engine speed can be adjusted by turning idle speed adjusting screw.

When measuring CO percentage to check idling operation, make sure that CO percentage is below 1.0 percent for non-California models and 0.5 percent for California models. If CO percentage is over the specifications, adjust air-fuel mixture ratio. Refer to "Checking engine idle rpm and mixture ratio" on page ET-7.

When inspecting the catalytic converter for deterioration, HC and CO percentage must also be measured.

CONTINUITY CHECK

Circuit tester (Test equipment required)

Description

It is not necessary to conduct a harness continuity check on the entire electronic fuel injection system. Simply locate the pertinent trouble source on the left in the following table and conduct an inspection as denoted by the check item number shown on the opposite side.

To find what is denoted by the check item number, refer to the attached table and to the same check item number given in the service manual. Do not touch the circuit tester probe to any unnecessary pin on the 35-pin connector. Doing so could cause damage to the connector terminal.

Connector and harness continuity check

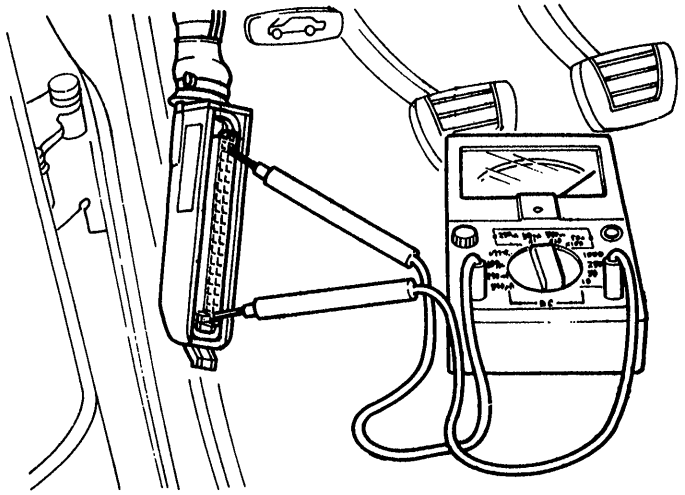
Condition		Check item number
Engine will not start		1 – (3), (5), (6), (7), (8), (9) 2 – (1), (2), (3) 3 – (1), (3)
Engine stalls		1 – (3), (5), (6), (7), (8), (9) 2 – (1), (2), (3)
Lack of power		1 – (1), (2), (3), (4), (6), (8), (10) 2 – (1), (2), (3)
Engine breathes		1 – (1), (2), (3), (4), (5), (6), (8), (9), (10) 2 – (1), (2), (3)
Idling unstable	During warm-up	1 – (1), (3), (4), (5), (6), (8), (9) 2 – (1), (2), (3) 3 – (2)
	After warm-up	1 – (1), (3), (4), (5), (6), (8), (9), (10) 2 – (1), (2), (3)
Higher idling speed		1 – (1), (2), (4), (6), (8) 3 – (2)
Running on or dieseling		———
Backfire		1 – (1), (2), (3), (4), (6), (10) 2 – (1), (2), (3)
Afterfire		1 – (1), (2), (3), (4), (6) 2 – (3) 3 – (1)
Abnormal fuel consumption		1 – (1), (2), (3), (4), (6), (8) 2 – (3) 3 – (2)

1. Continuity check using an ohmmeter

Notes:

a. Before disconnecting 35-pin connector of the control unit, disconnect ground cable from battery.

b. Set circuit tester in the OHM "R" range.



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Fig. EF-34 Check at 35-pin connector ("R" range)

(1) Throttle valve switch: Idle switch

- Make sure that throttle valve switch connector is securely connected in place.
- Check continuity between terminals ② and ⑱.
  *Test results
- Continuity exists ..... OK
- Continuity does not exist ... N.G.
  *If test results are "N.G.", proceed as follows:
- Check the circuit indicated by large solid lines in Figure EF-37.

(2) Throttle valve switch: Full switch

- Make sure that throttle valve switch connector is securely connected in place.
- With accelerator pedal fully depressed, check continuity between terminals ③ and ⑱.
  *Test results
- Continuity exists ..... OK
- Continuity does not exist ... N.G.
  *If test results are "N.G.", proceed as follows:
- Check the circuit indicated by large solid lines in Figure EF-38.

(3) Air flow meter

- Make sure that air flow meter connector is securely connected in place.

3A) Continuity check between terminals ⑥ and ⑧

- Check continuity between terminals ⑥ and ⑧.
  *Test results
- Continuity exists ..... OK
- Continuity does not exist ... N.G.
  *If test results are "N.G.", proceed as follows:
- Check the circuit indicated by large solid lines in Figure EF-39.

3B) Continuity check between terminals ⑦ and ⑧.

Use the same procedure as in step 3A, and check continuity between terminals ⑦ and ⑧. Refer to Figure EF-40 for circuit details.

3C) Continuity check between terminals ⑧ and ⑨.

Use the same procedure as in step 3A, and check continuity between terminals ⑧ and ⑨. Refer to Figure EF-41 for circuit details.

(4) Air temperature sensor

- Make sure that air flow meter connector is securely connected in place
- Check continuity between terminals ⑥ and ㉗.
  *Test results
- Continuity exists ..... OK
- Continuity does not exist ... N.G.
  *If test results are "N.G.", proceed as follows:
- Check the circuit indicated by large solid lines in Figure EF-42.

(5) Fuel pump contact points

- Disconnect rubber hose in the line between air cleaner and air flow meter.
- Make sure that air flow meter connector is securely connected in place.
- Depress air flow meter flap, and check continuity between terminals ⑩ and ⑳.
  *Test results
- Continuity exists ..... OK
- Continuity does not exist ... N.G.
  *If test results are "N.G." proceed as follows:
- Check the circuit indicated by large solid lines in Figure EF-43.

(6) Water temperature sensor

- Make sure that water temperature sensor connector is securely connected in place.
- Make sure that ground lead wire is properly grounded.
- Check continuity between terminal ⑬ and body metal.
  *Test results
- Continuity exists ..... OK
- Continuity does not exist ... N.G.
  *If test results are "N.G.", proceed as follows:
- Check the circuit indicated by large solid lines in Figure EF-44.

(7) Electronic fuel injection relay: Fuel pump relay

- Make sure that relay connector is securely connected in place.
- Check continuity between terminal ⑳ and body metal.
  *Test results
- Continuity exists ..... OK
  Continuity does not exist ... N.G.
  *If test results are "N.G.", proceed as follows:
- Check the circuit indicated by large solid lines in Figure EF-45.

(8) Air regulator and fuel pump

- Make sure that air regulator and relay connectors are securely connected in place.
- Make sure that fuel pump harness is securely connected to fuel pump terminal.
- Check continuity between terminal ㉞ and body metal.
  *Test results
- Continuity exists ..... OK
- Continuity does not exist ... N.G.
  *If test results are "N.G.", proceed as follows:
- Check the circuit indicated by large solid lines in Figure EF-46.

(9) Ground circuit

- Make sure that ground connector is securely connected in place.
- Check all ground lines to ensure that they are properly grounded.

9A) Continuity check between terminal ⑤ and body metal

- Check continuity between terminal ⑤ and body metal.
  *Test results
- Continuity exists ..... OK
- Continuity does not exist ... N.G.
  *If test results are "N.G.", proceed as follows:
- Check the circuit indicated by large solid lines in Figure EF-47.

9B) Continuity check between terminal ⑯ and body metal

Use the same procedure as in step 9A, and check continuity between terminal ⑯ and body metal.

Refer to Figure EF-48 for circuit details.

9C) Continuity check between terminal ⑰ and body metal

Use the same procedure as in step 9A, and check continuity between terminal ⑰ and body metal.

Refer to Figure EF-49 for circuit details.

9D) Continuity check between terminal ㉟ and body metal

Use the same procedure as in step 9A, and check continuity between terminal ㉟ and body metal.

Refer to Figure EF-50 for circuit details.

(10) Altitude switch (California models only)

- Make sure that the altitude switch is securely connected.
- Check continuity between terminals ⑨ and ⑫.

*Test results

10A) If a check is made in the "low" altitude zone [approx. 1,120 m (3,675 ft) or lower, or approx. 660 mmHg (26 inHg) or higher] :

- Continuity does not exist .... OK
- Continuity exists ..... N.G.

10B) If a check is made in the "high" altitude zone [approx. 1,120 m (3,675 ft) or higher or approx. 660 mmHg (26 inHg) or lower] :

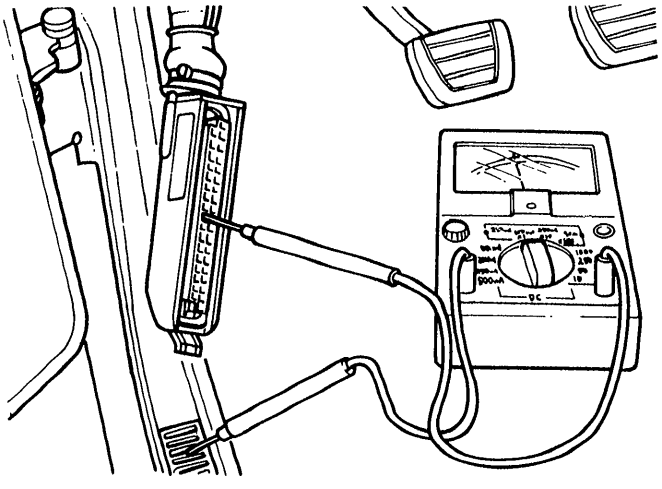
- Continuity exists ..... OK
- Continuity does not exist ... N.G.

If a test result is "N.G.", check the circuit indicated by the large solid lines in Figure EF-51.

2. Continuity check using a voltmeter (1)

Notes:

a. **Set circuit tester in the DC VOLT (DC "V") range.**
b. **Connect negative terminal of voltmeter to body metal with a lead wire.**
c. **If tests check out "N.G.", be sure to turn off the ignition switch and to disconnect battery ground cable before tracing the circuit.**



EF361

Fig. EF-35 Check at 35-pin connector ("V" range)

(1) Revolution trigger signal

- Make sure that ignition coil connector is securely connected in place.
- Turn ignition switch to the "ON" position.
- Contact terminal ① with positive lead wire of voltmeter.

*Test results

- Voltmeter reading indicates power line voltage ..... OK
- Voltmeter reading does not indicate power line voltage .. N.G.

*If test results are "N.G.", proceed as follows:

- Turn ignition switch to the "OFF" position.
- Check the circuit indicated by large solid lines in Figure EF-52.

(2) Power line circuit

- Make sure that relay connector and 6-pin connector are securely connected in place.
- Turn ignition switch to the "ON" position.
- Contact terminal ⑩ with positive lead of voltmeter.

*Test results

- Voltmeter reading indicates power line voltage ..... OK
- Voltmeter reading does not indicate power line voltage .. N.G.

*If test results are "N.G.", proceed as follows:

- Turn ignition switch to the "OFF" position.
- Check the circuit indicated by large solid and dotted lines in Figure EF-53.

(3) Injector and dropping resistor

- Make sure that injector, dropping resistor and relay, and 6-pin connector are securely connected in place.

3A) Terminal ⑭ (Cylinder "4")

- Turn ignition switch to the "ON" position.
- Contact terminal ⑭ with positive lead wire of voltmeter.

*Test results

- Voltmeter reading indicates power line voltage ..... OK
- Voltmeter reading does not indicate power line voltage .. N.G.

*If test results are "N.G.", proceed as follows:

- Turn ignition switch to the "OFF" position.
- Check the circuit indicated by large solid and dotted lines in Figure EF-54.

3B) Terminal ⑮ (Cylinder "1")

Use the same procedure as in step 3A, and take voltmeter reading between terminal ⑮ and ground.

Refer to Figure EF-55 for circuit details.

3C) Terminal ㉚ (Cylinder "5")

Use the same procedure as in step 3A, and take voltmeter reading between terminal ㉚ and ground.

Refer to Figure EF-56 for circuit details.

3D) Terminal ㉛ (Cylinder "6")

Use the same procedure as in step 3A, and take voltmeter reading between terminal ㉛ and ground.

Refer to Figure EF-57 for circuit details.

3E) Terminal ㉜ (Cylinder "3")
Use the same procedure as in step 3A, and take voltmeter reading between terminal ㉜ and ground.
Refer to Figure EF-58 for circuit details.

3F) Terminal ㉝ (Cylinder "2")
Use the same procedure as in step 3A, and take voltmeter reading between terminal ㉝ and ground.
Refer to Figure EF-59 for circuit details.

3. Continuity check using a voltmeter (2)

Notes:

a. Set circuit tester in the DC VOLT (DC "V") range.
b. Connect negative terminal of circuit tester to body metal with a lead wire.
c. If test results check out "N.G.", be sure to turn off the ignition switch and to disconnect battery ground cable before tracing the circuit.
d. Disconnect lead wire from terminal "S" of starter motor.
e. Disconnect cold start valve harness connector.

(1) Starter signal

- Make sure that relay connector and 6-pin connector are securely connected in place.
- Turn ignition switch to the "START" position.
- Contact terminal ④ with positive lead wire of voltmeter.
  *Test results
- Voltmeter reading indicates power line voltage ..... OK
- Voltmeter reading does not indicate power line voltage .. N.G.
  *If test results are "N.G.", proceed as follows:
- Turn ignition switch to the "OFF" position.
- Check the circuit indicated by large solid lines in Figure EF-60.

(2) Air regulator

- Make sure that air regulator, relay and 6-pin connector are securely connected in place.
- Turn ignition switch to the "START" position.
- Contact terminal ㉞ with positive lead wire of voltmeter.
  *Test results
- Voltmeter reading indicates power line voltage ..... OK
- Voltmeter reading does not indicate power line voltage .. N.G.
  *If test results are "N.G.", proceed as follows:
- Turn ignition switch to the "OFF" position.
- Check the circuit indicated by large solid and dotted lines in Figure EF-61.

(3) Cold start valve and thermotime switch

- Disconnect thermotime switch connector.
- Short circuit two pins of thermotime switch harness connector.

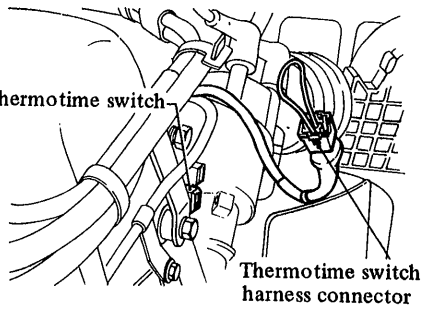
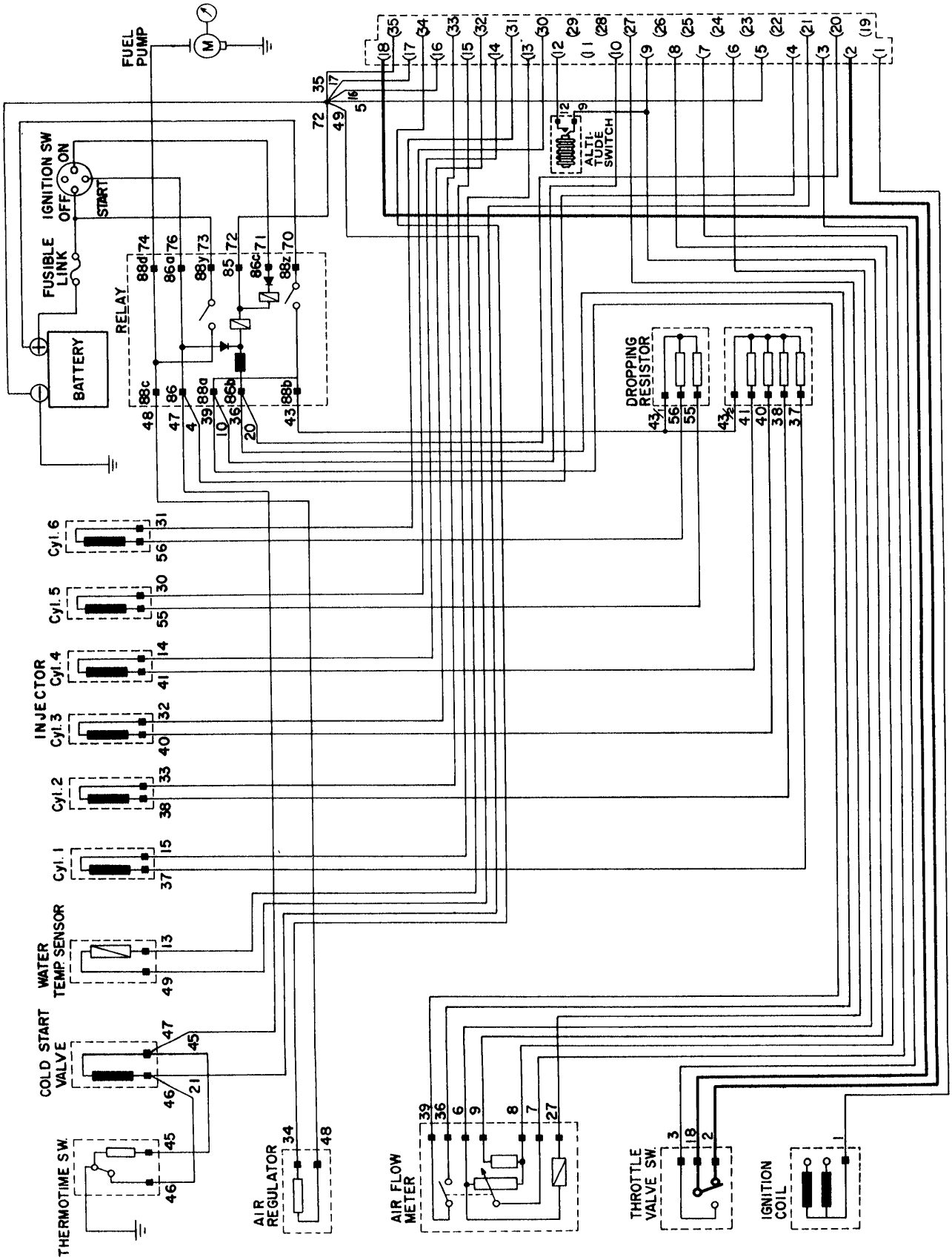


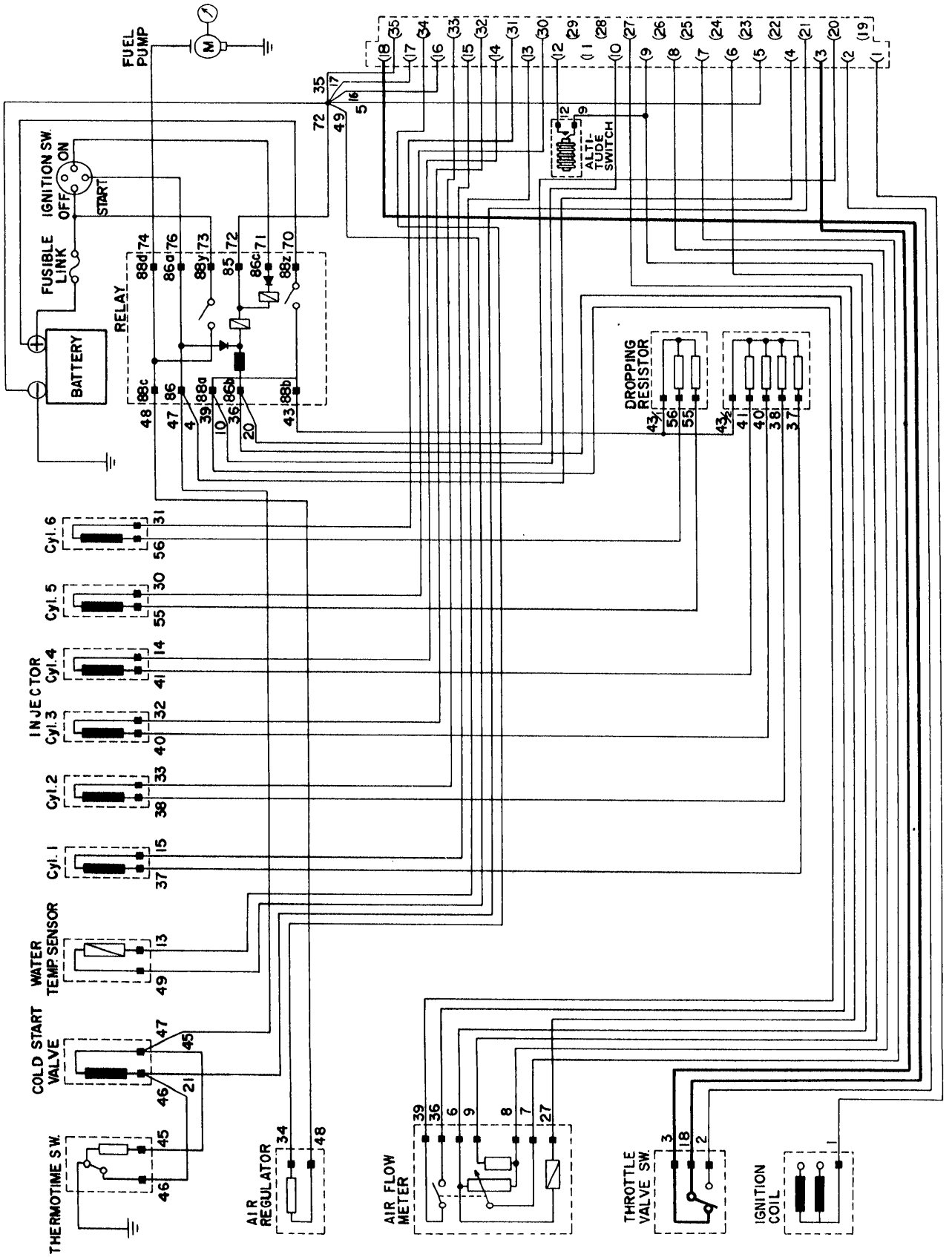
Fig. EF-36 Thermotime switch harness connector short circuit

- Make sure that relay connector is securely connected in place.
- Turn ignition switch to the "START" position.
- Contact terminal ㉑ with positive lead wire of voltmeter.
  *Test results
- Voltmeter reading indicates power line voltage ..... OK
- Voltmeter reading does not indicate power line voltage .. N.G.
  *If test results are "N.G.", proceed as follows:
- Turn ignition switch to the "OFF" position.
- Check the circuit indicated by large solid lines in Figure EF-62.



EF661

Fig. EF-37 Idle switch circuit



EF662

Fig. EF-38 Full switch circuit

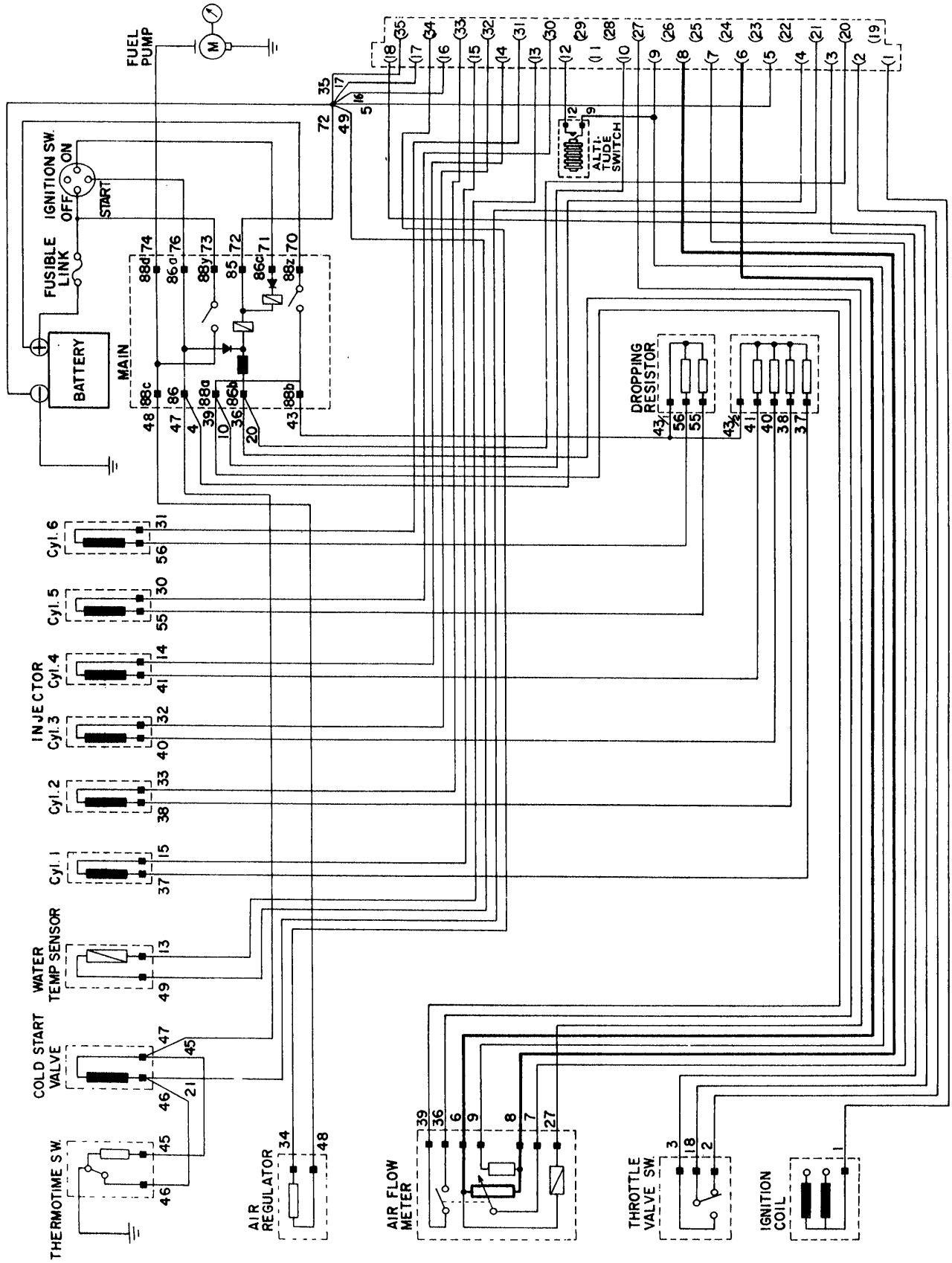
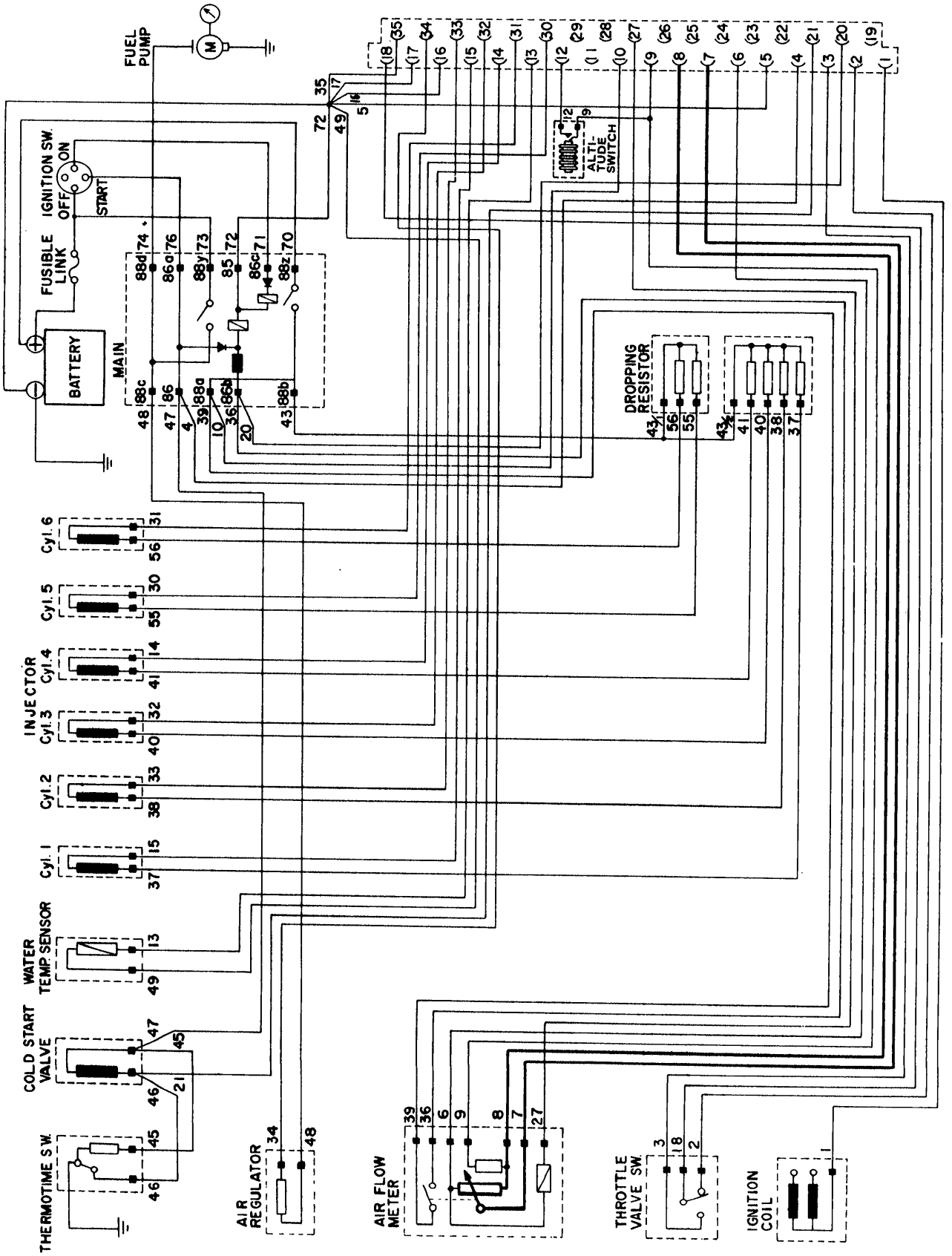


Fig. EF-39 Air flow meter between ⑥ and ⑧ circuit



EF664

Fig. EF-40 Air flow meter between (7) and (8) circuit

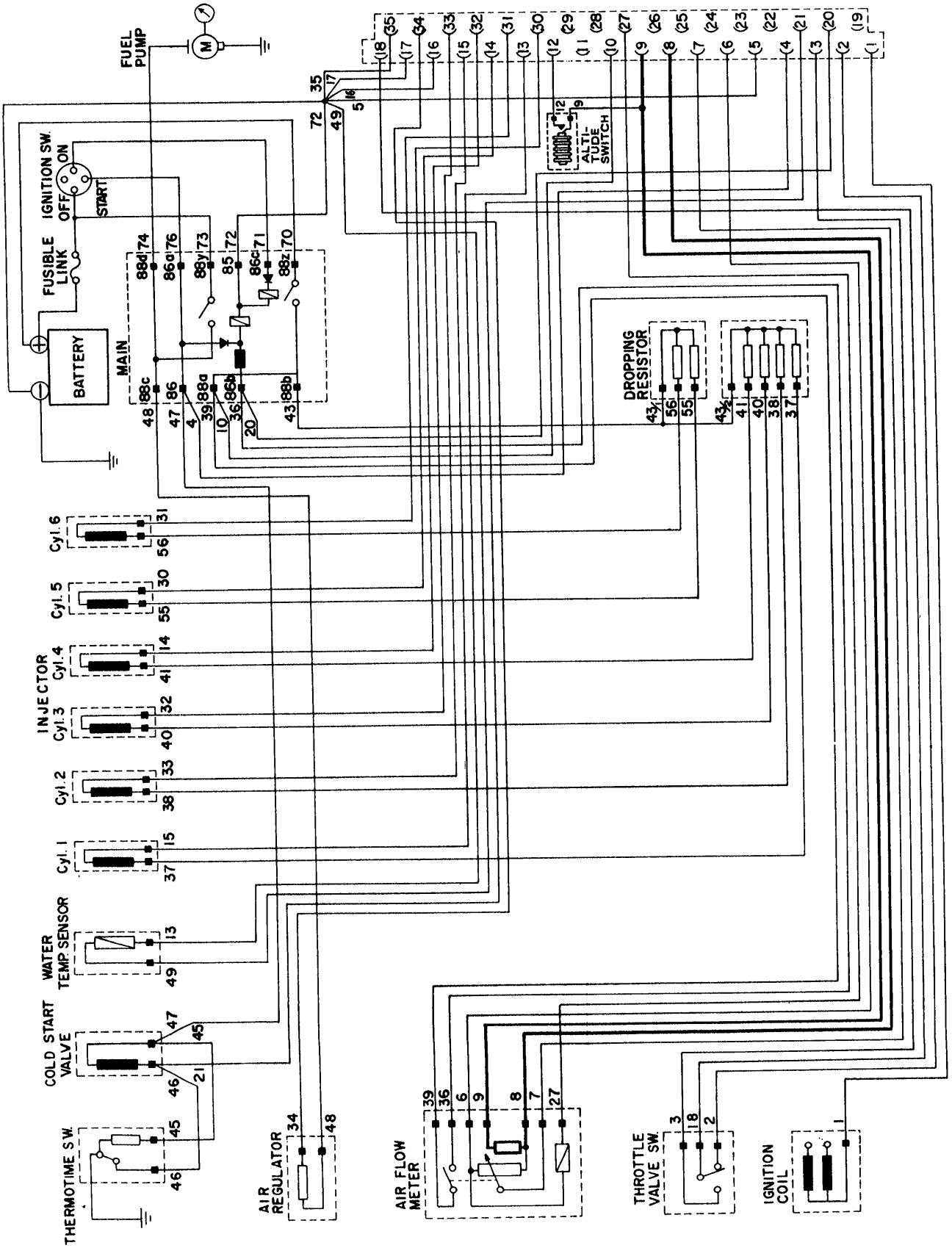


Fig. EF-41 Air flow meter between ⑧ and ⑨ circuit

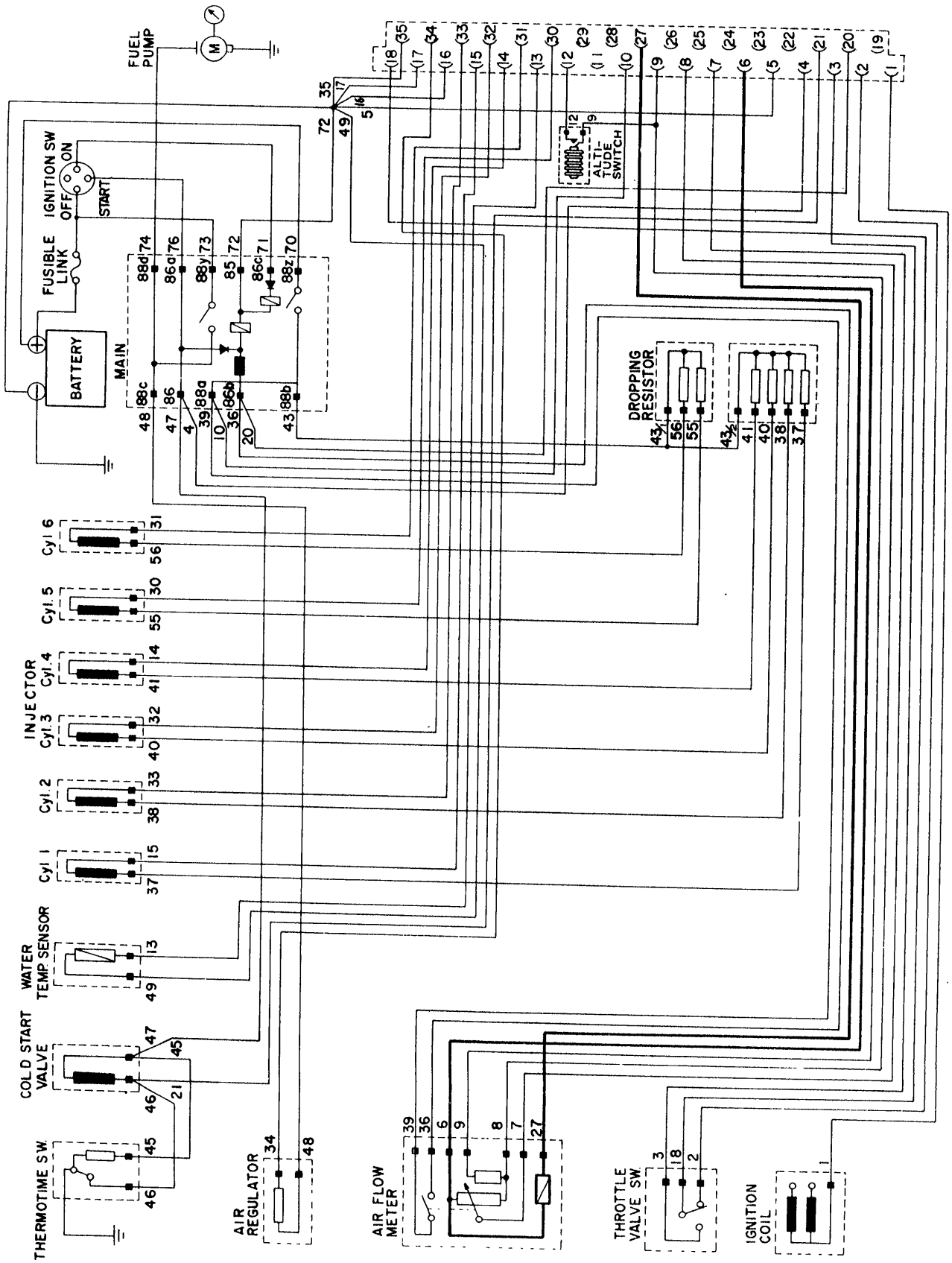
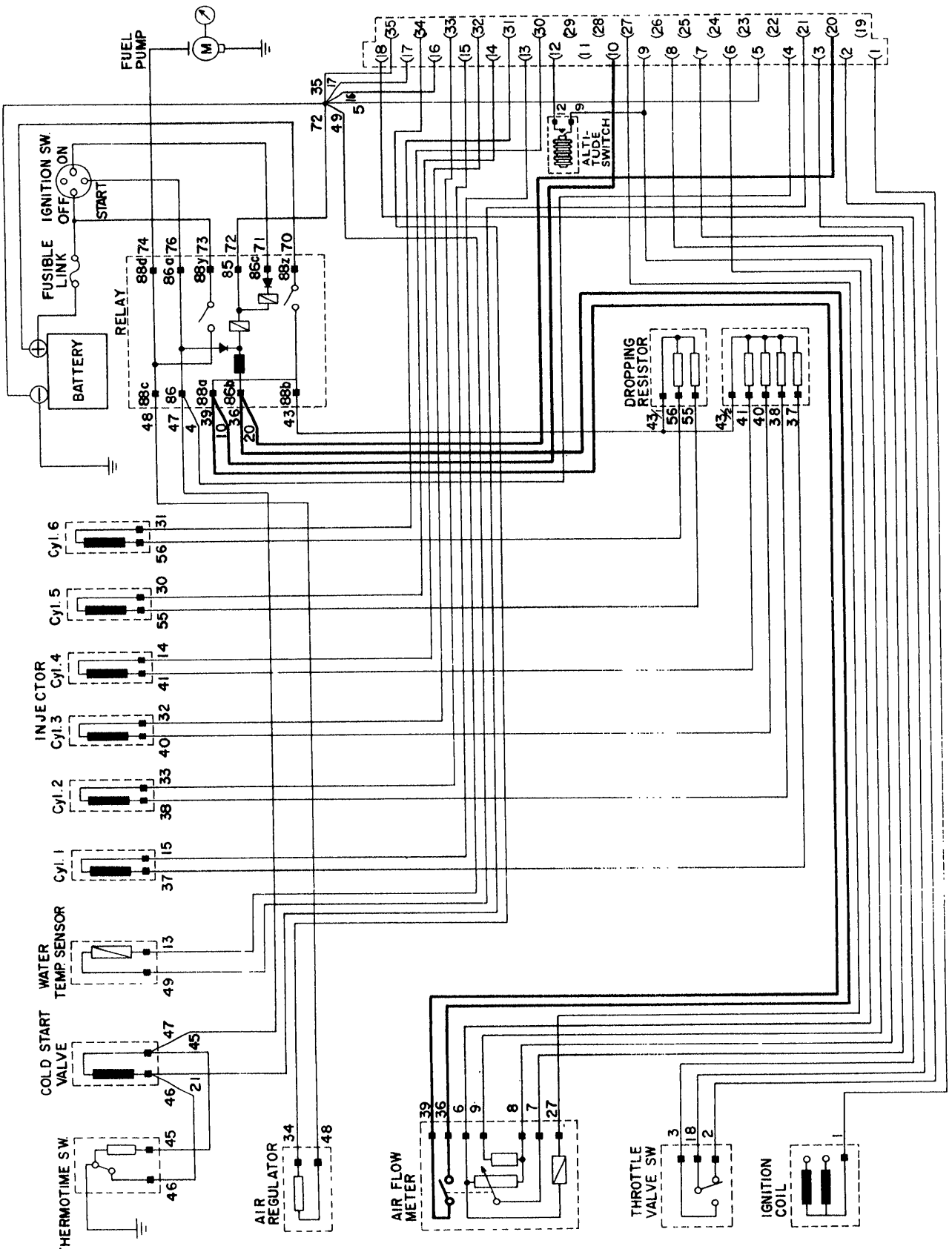


Fig. EF-42 Air temperature sensor circuit



I F667

Fig. F-43 Fuel pump contact points circuit

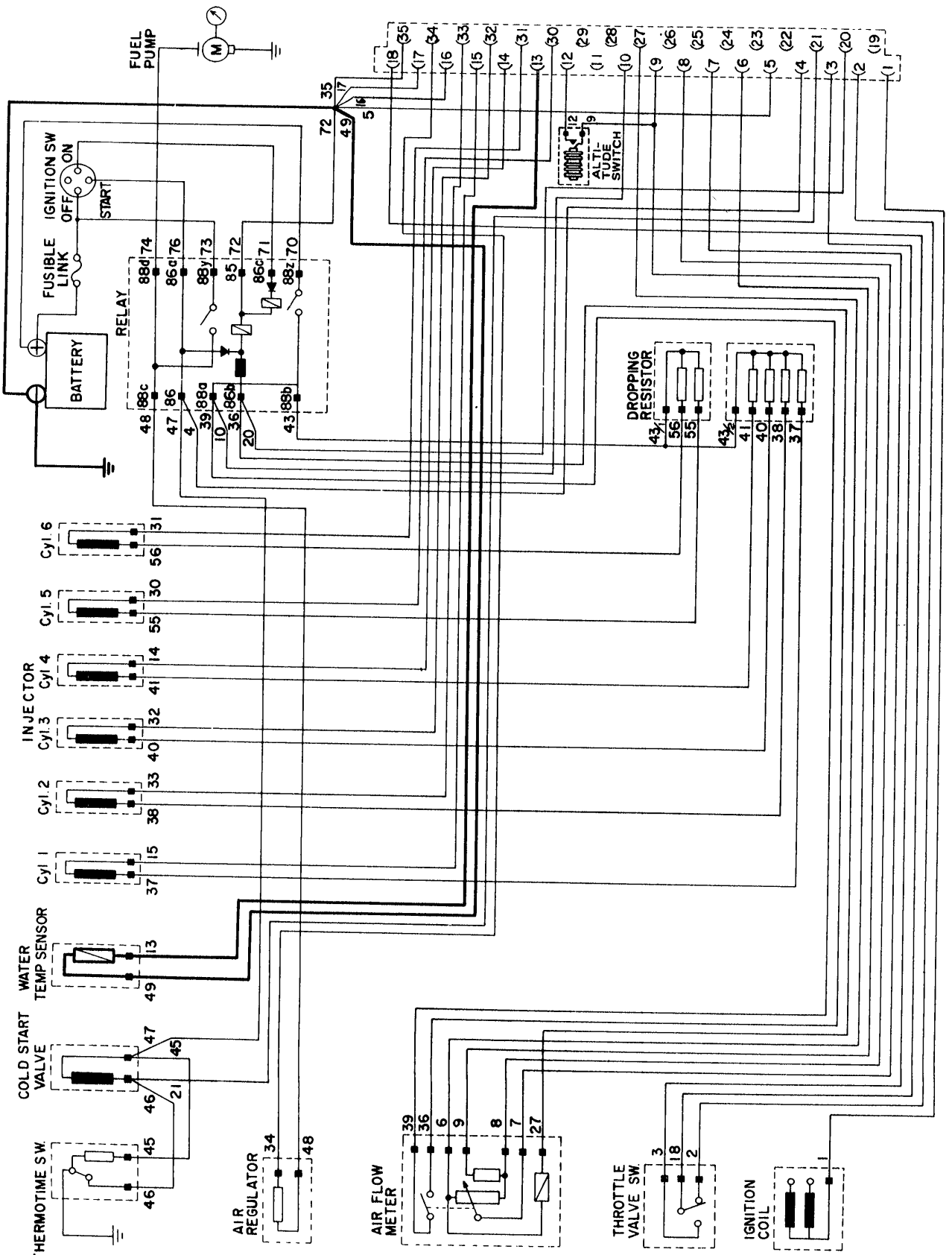


Fig. EF-44 Water temperature sensor circuit

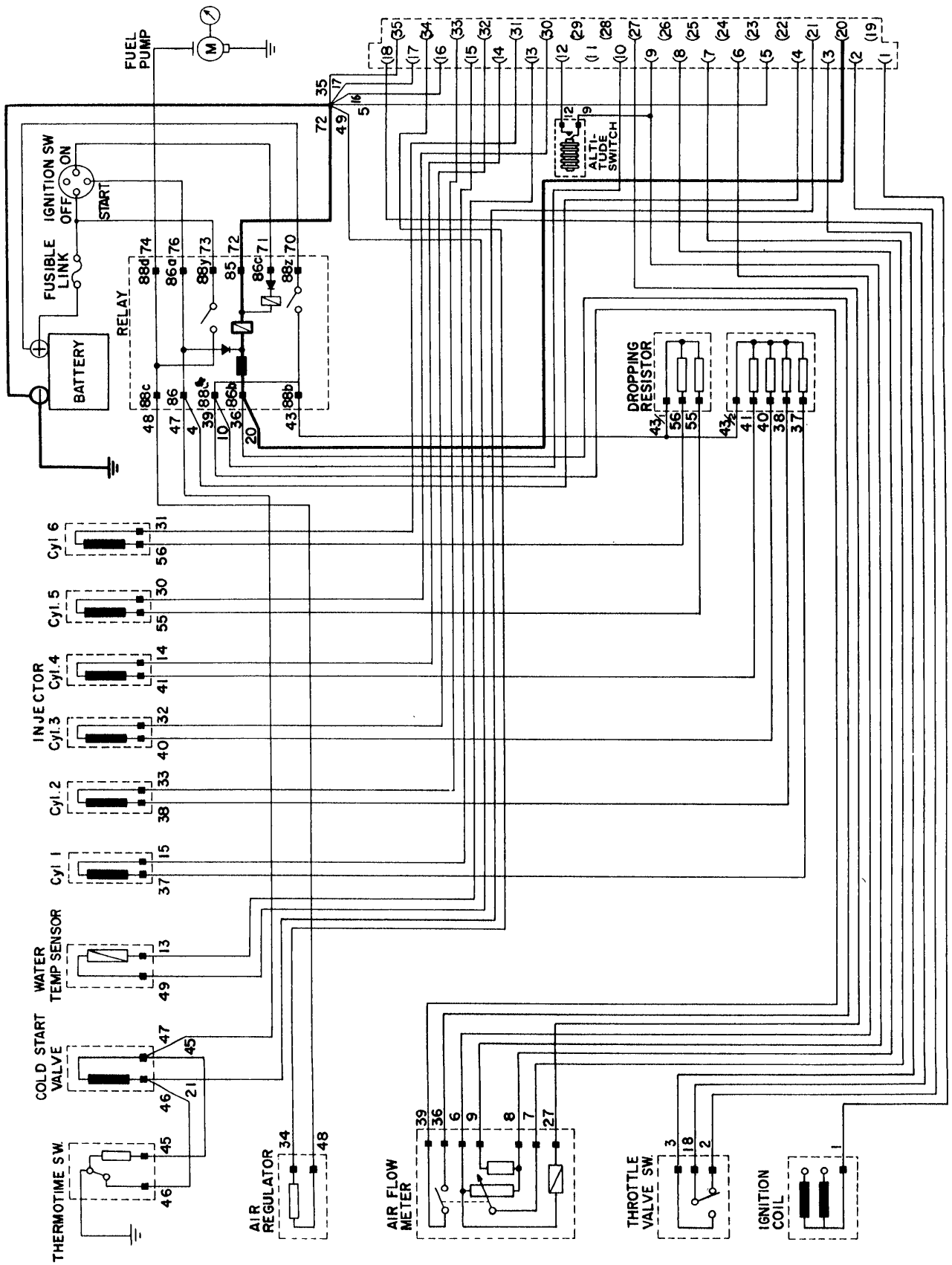
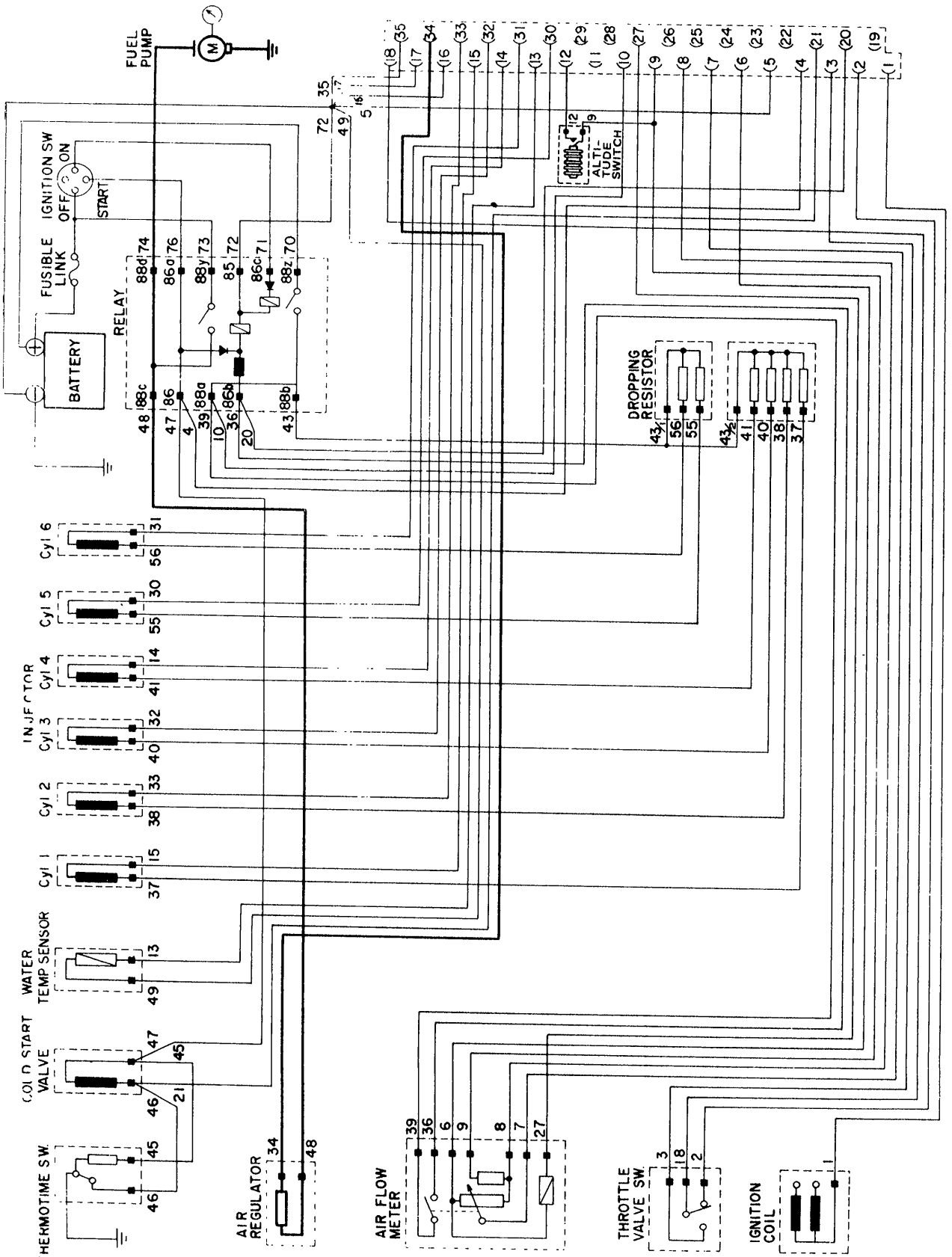
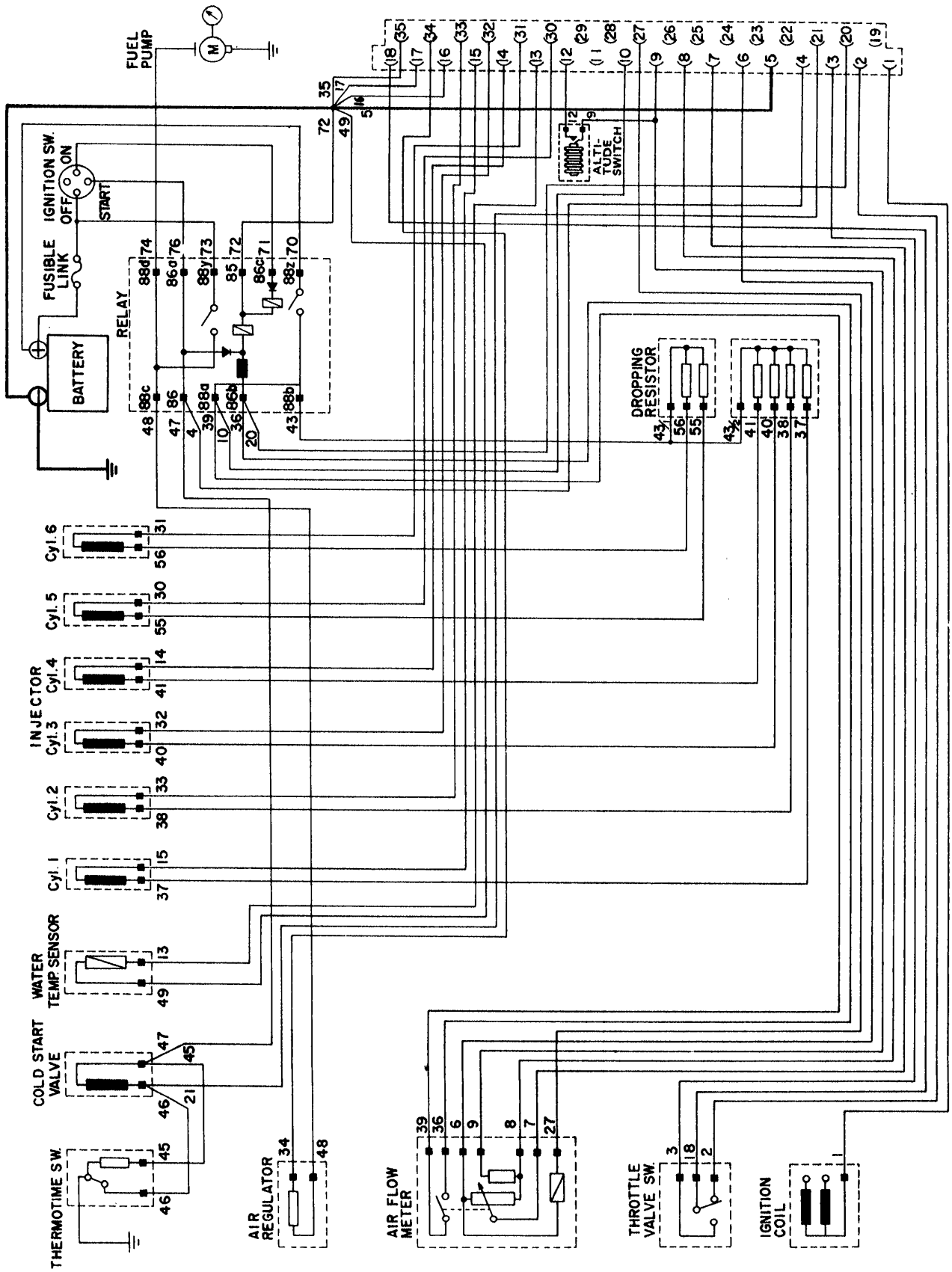


Fig. EF-45 Fuel pump relay circuit



EF670

Fig. EF-46 Air regulator and fuel pump circuit



EF671

Fig. EF-47 Ground (between ⑤ and body metal) circuit

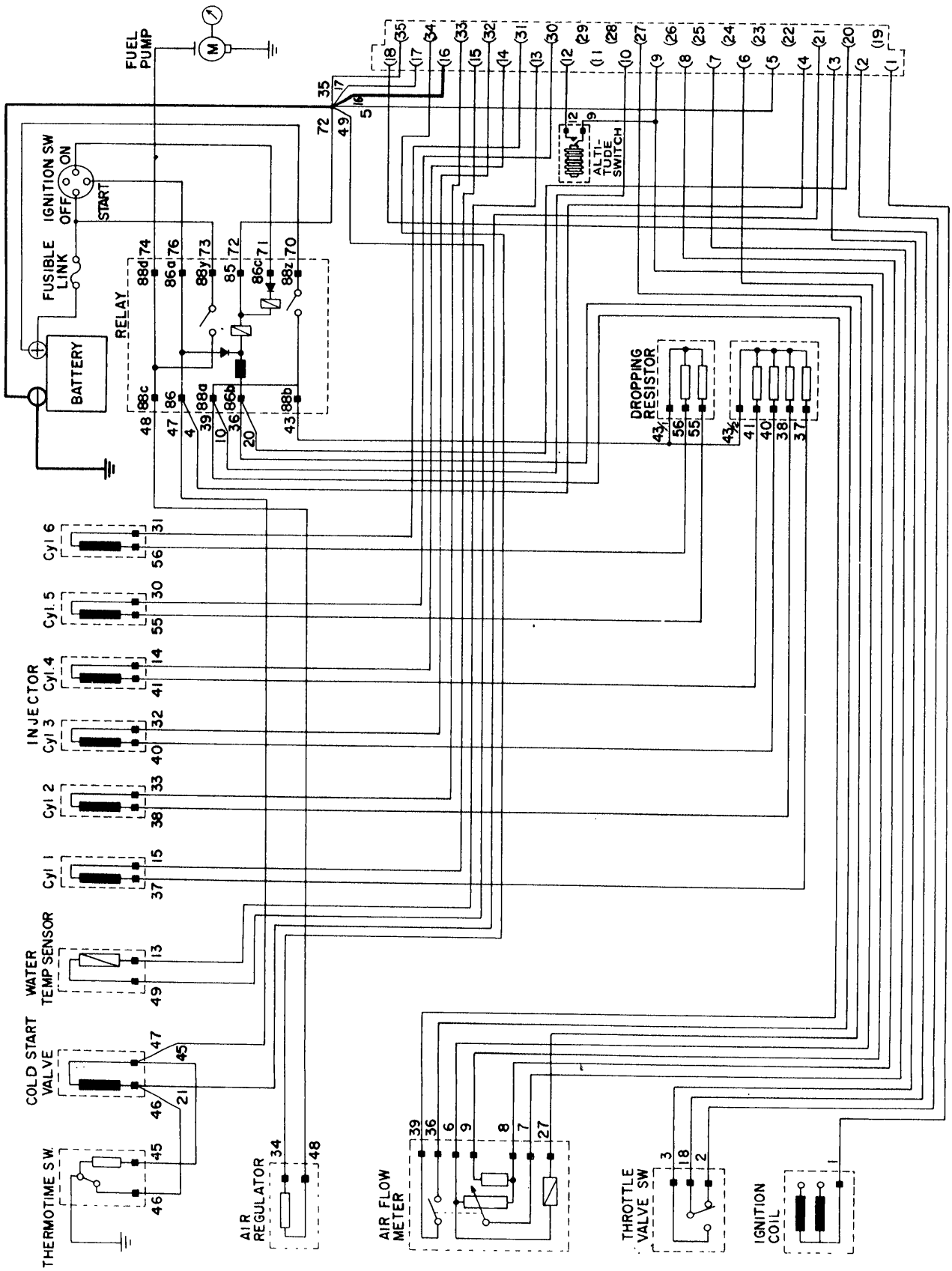
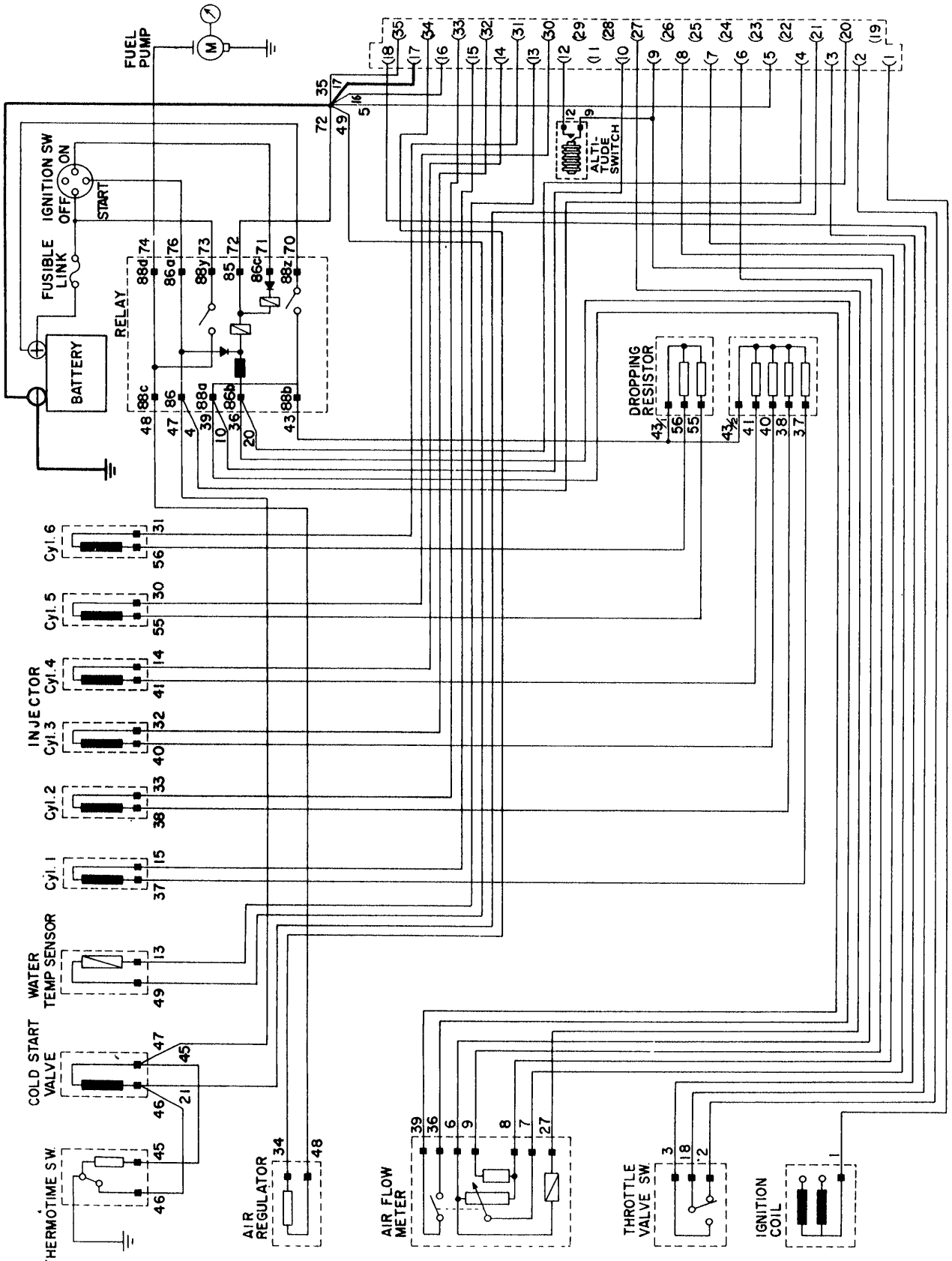


Fig. EF-48 Ground (between (6) and body metal) circuit



EF673

Fig. EF-49 Ground (between ⑰ and body metal) circuit

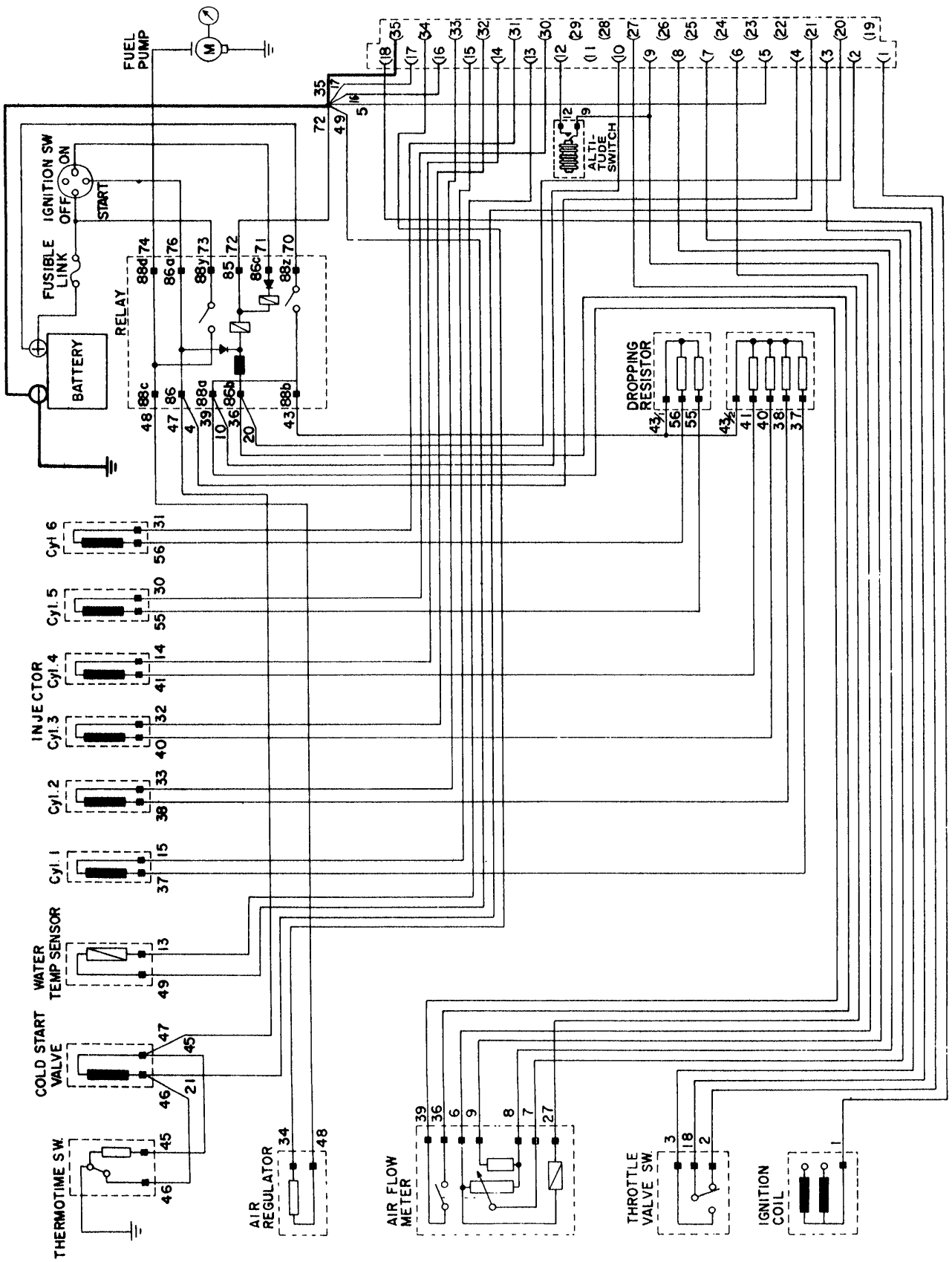
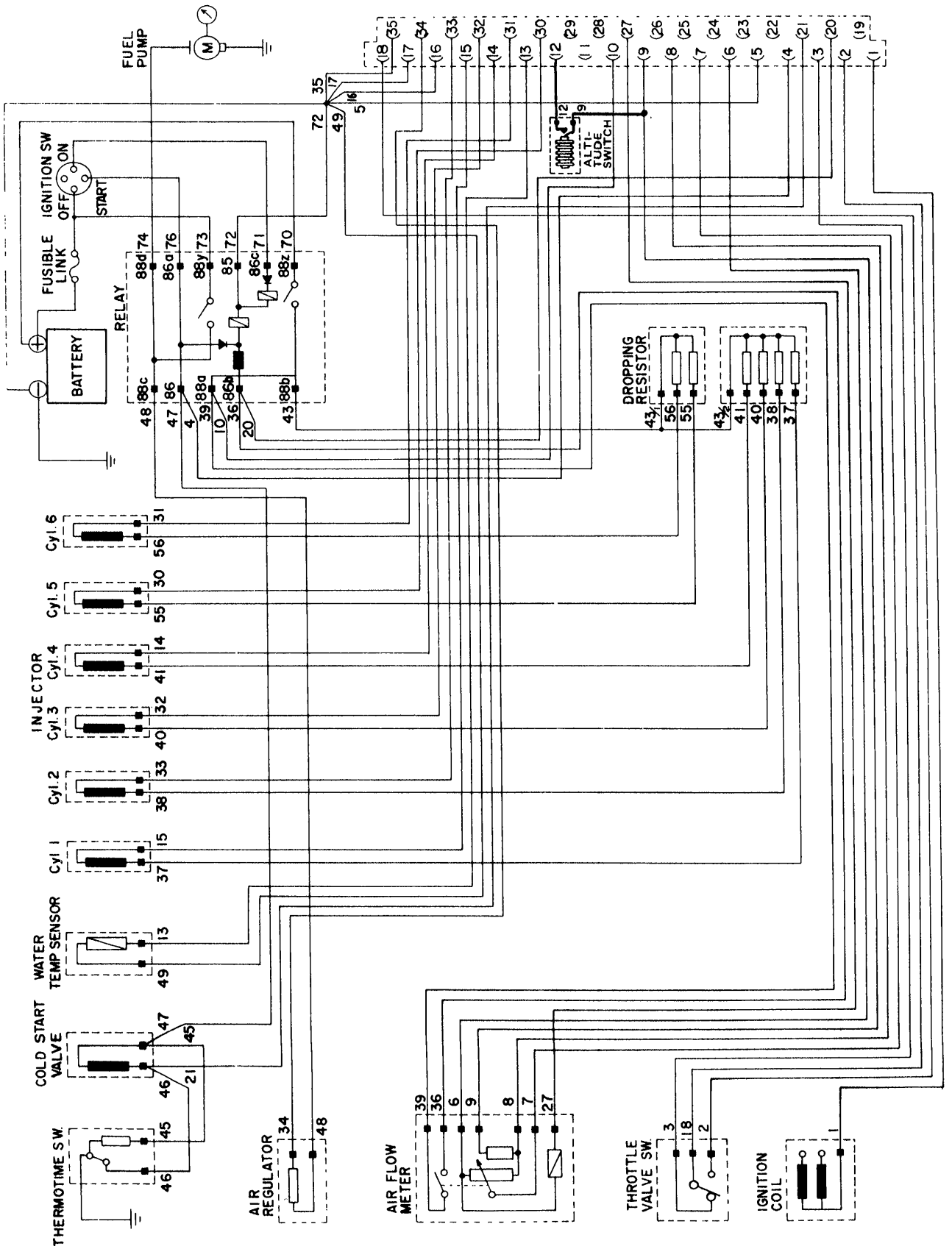
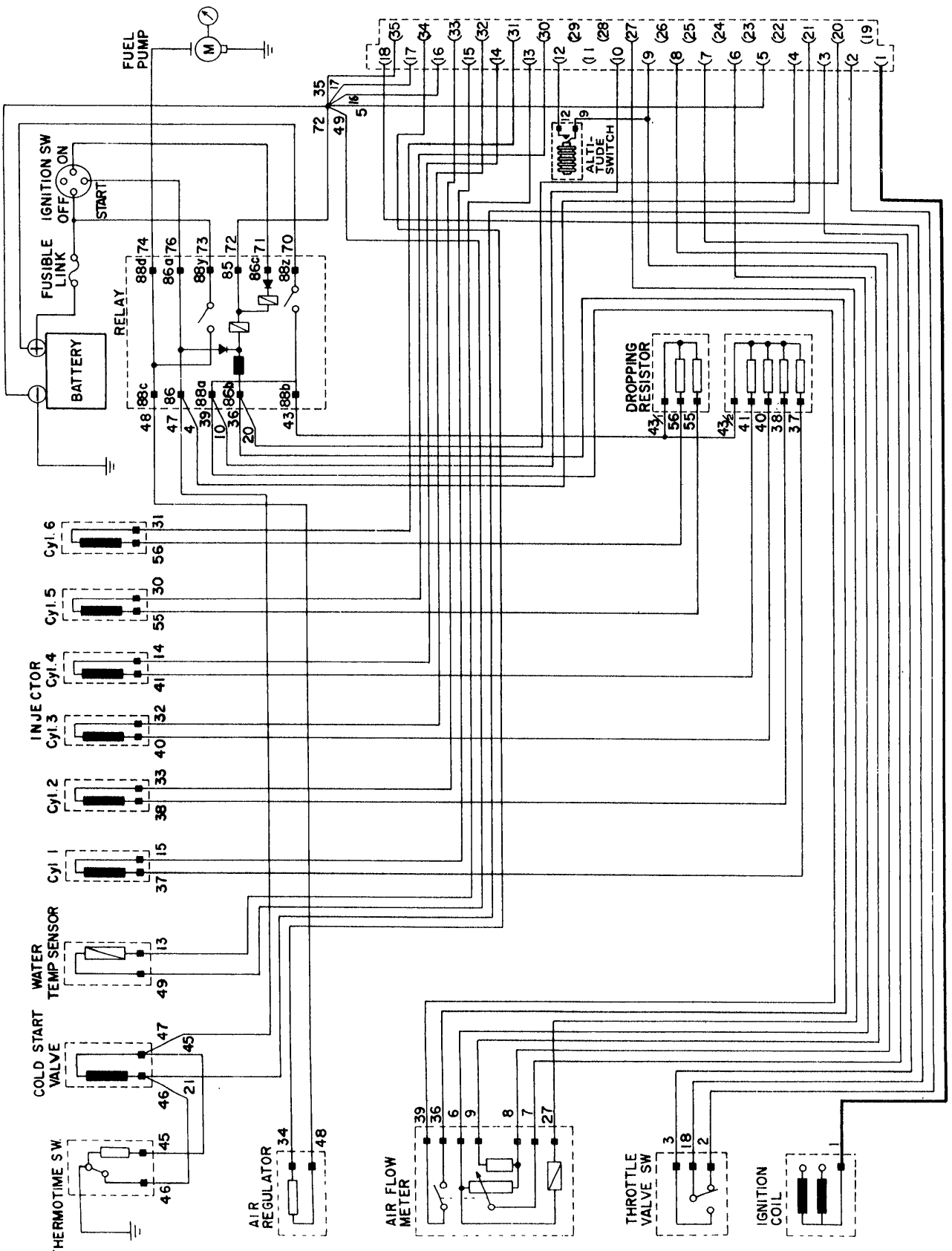


Fig. EF-50 Ground (between ㉟ and body metal) circuit



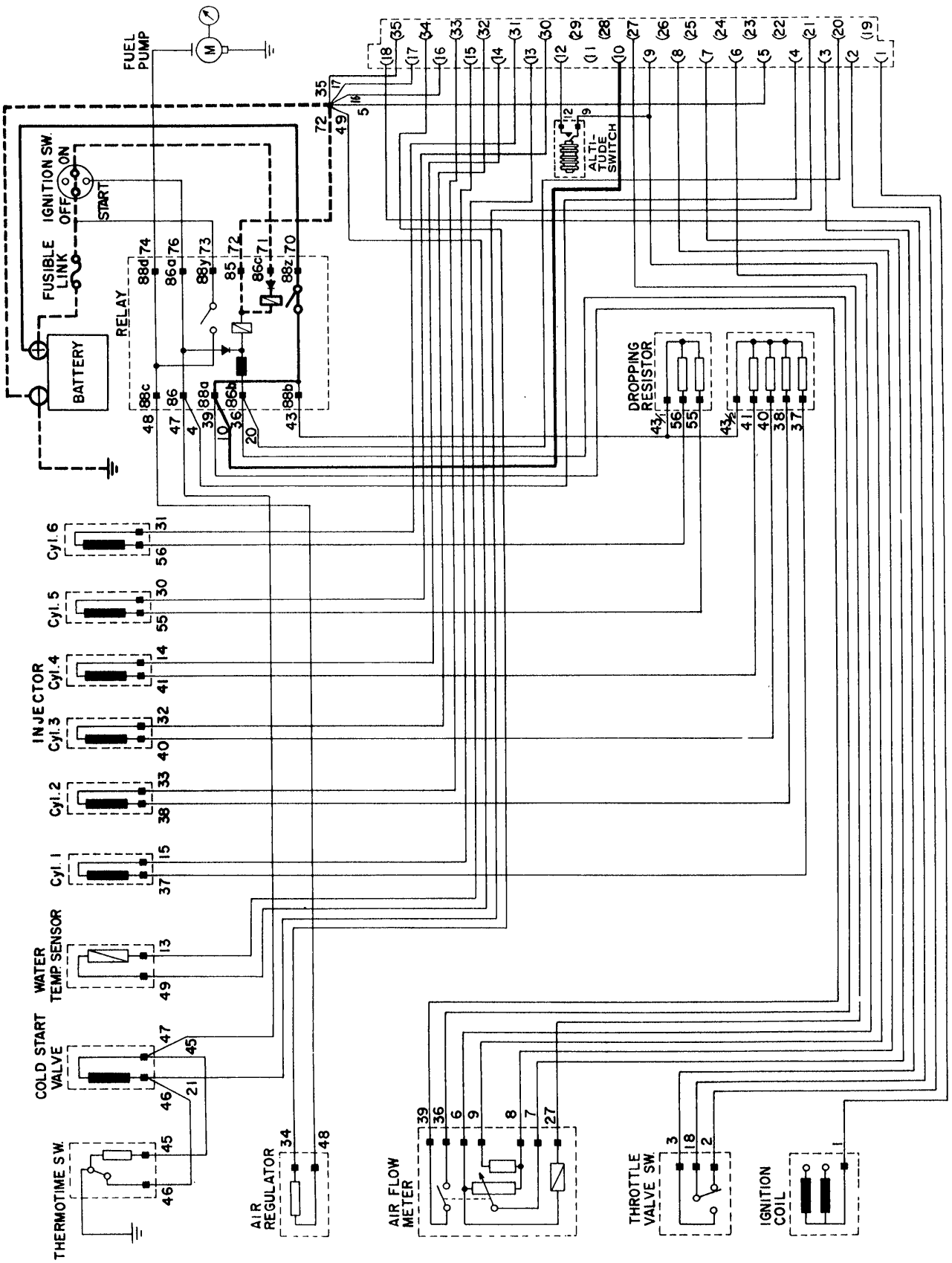
EF675

Fig. EF-51 Altitude switch circuit (California models)



EF676

Fig. EF-52 Revolution trigger signal circuit



EF677

Fig. EF-53 Power line circuit

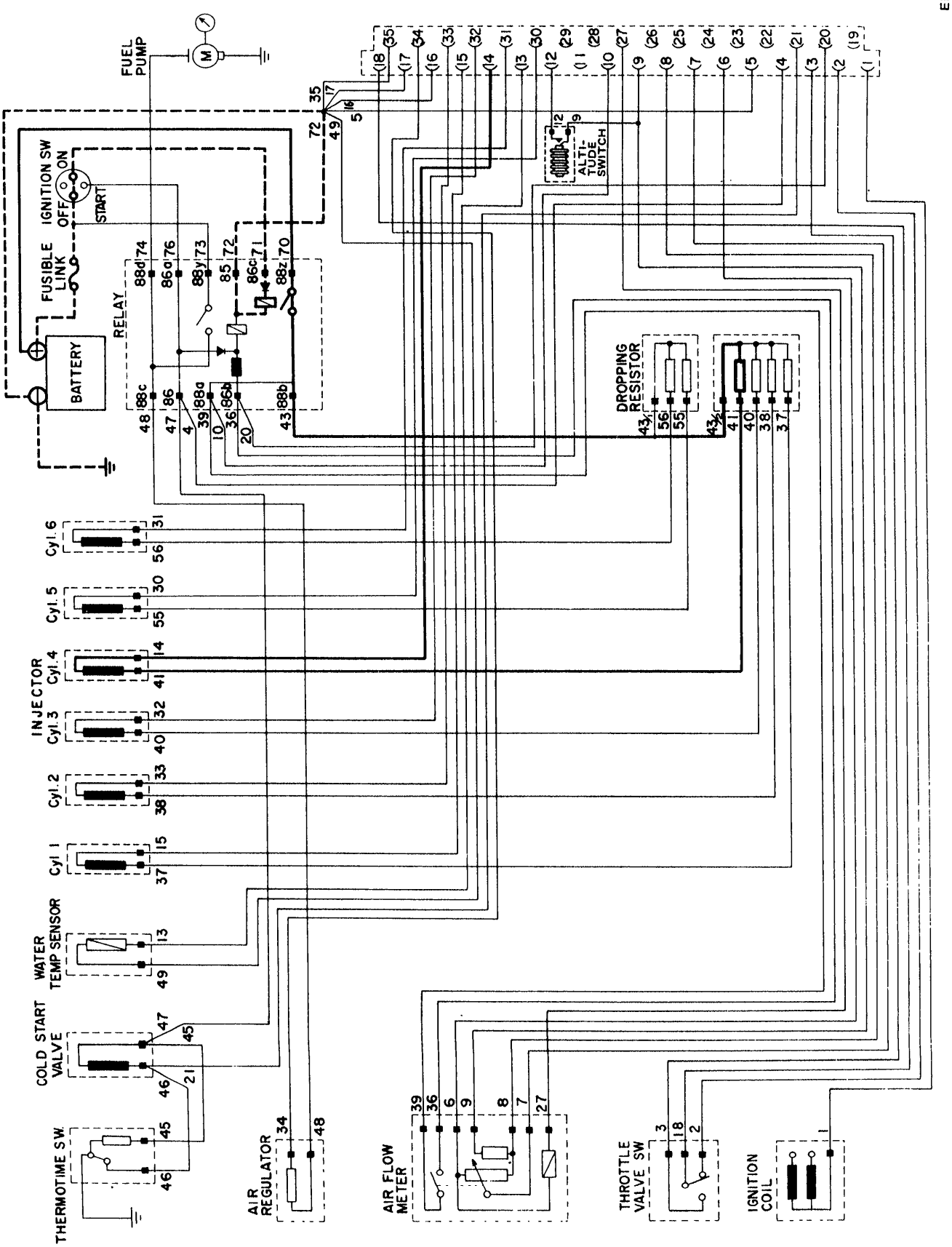
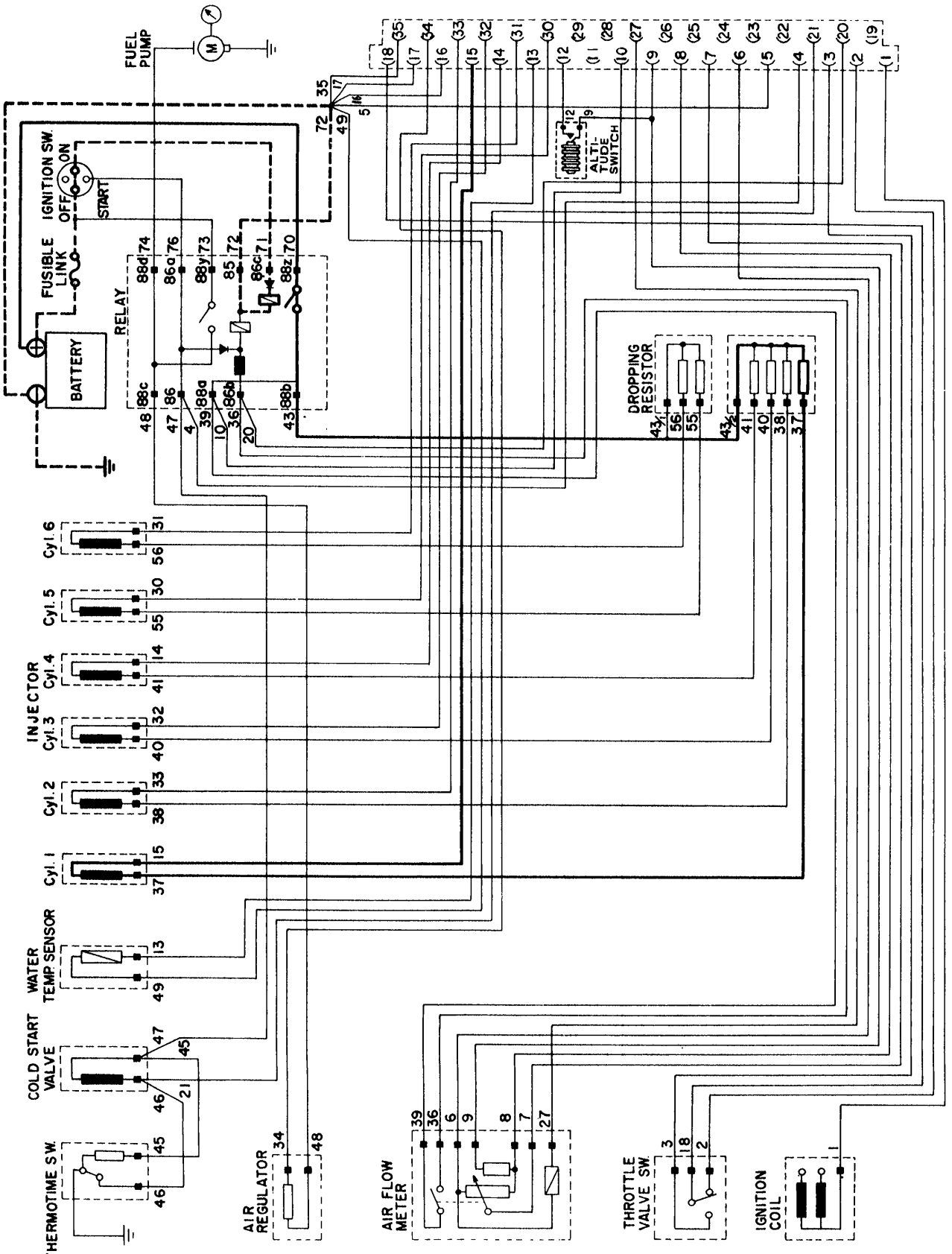
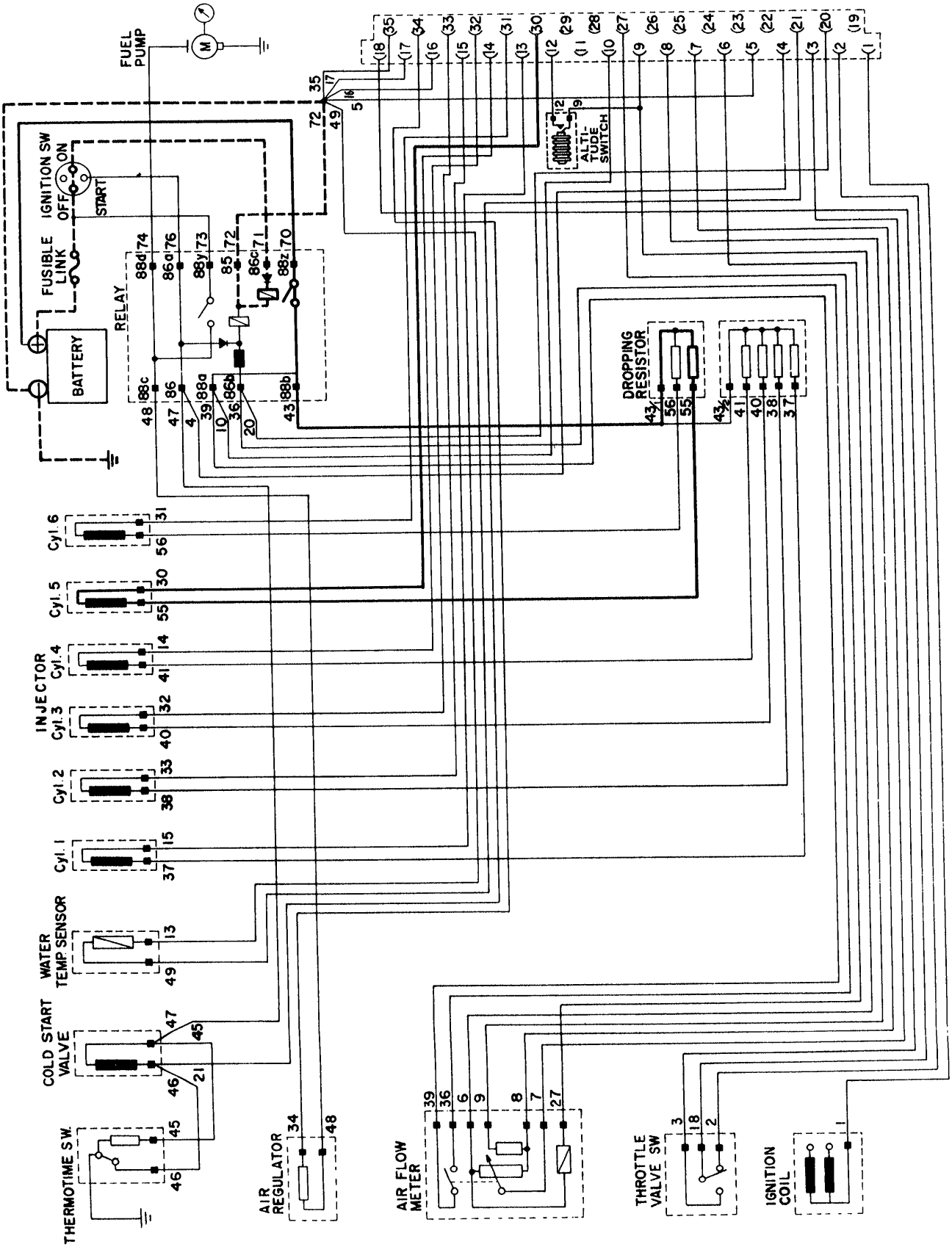


Fig. EF-54 Injector (cylinder "4") and dropping resistor circuit



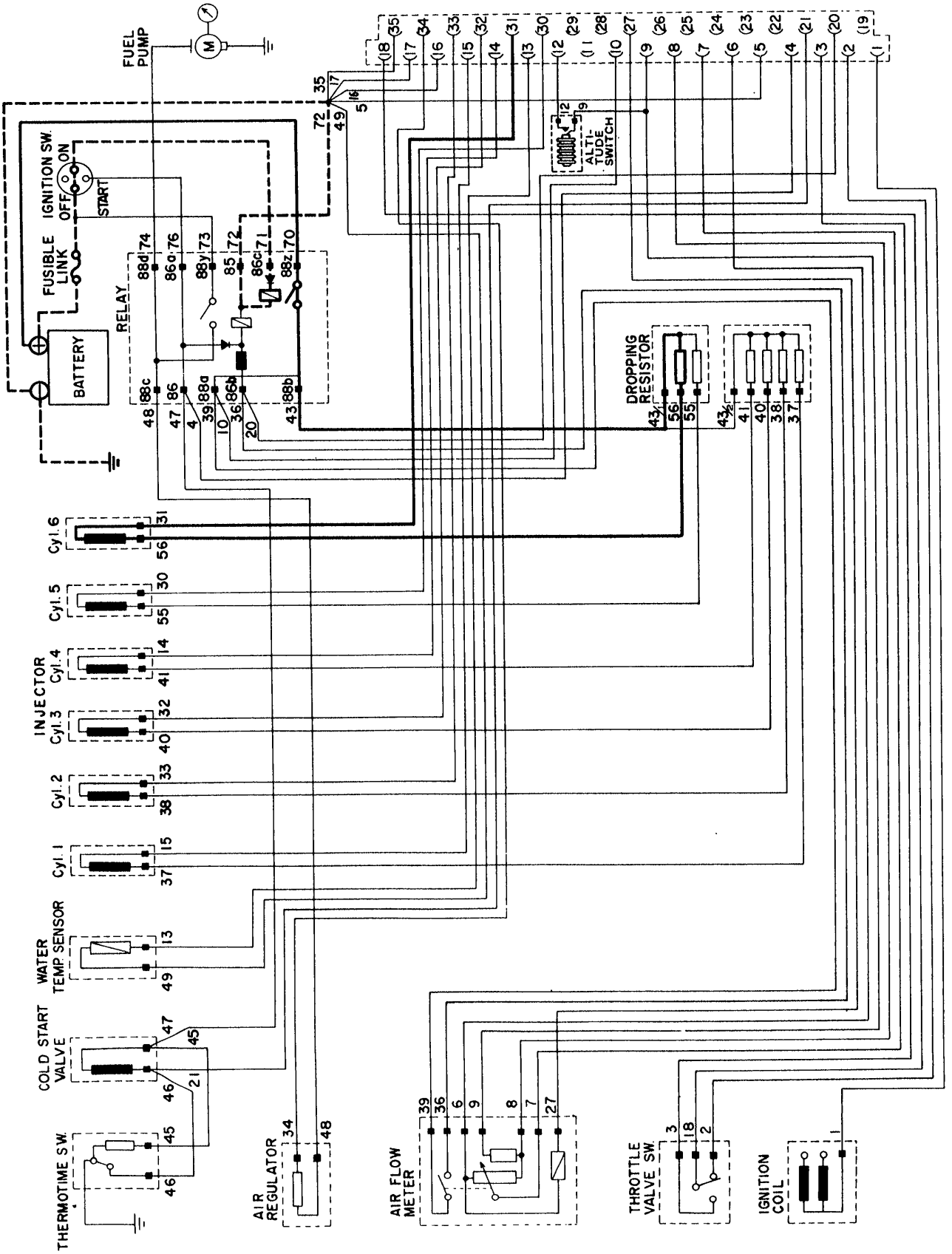
EF679

Fig. EF-55 Injector (cylinder "1") and dropping resistor circuit



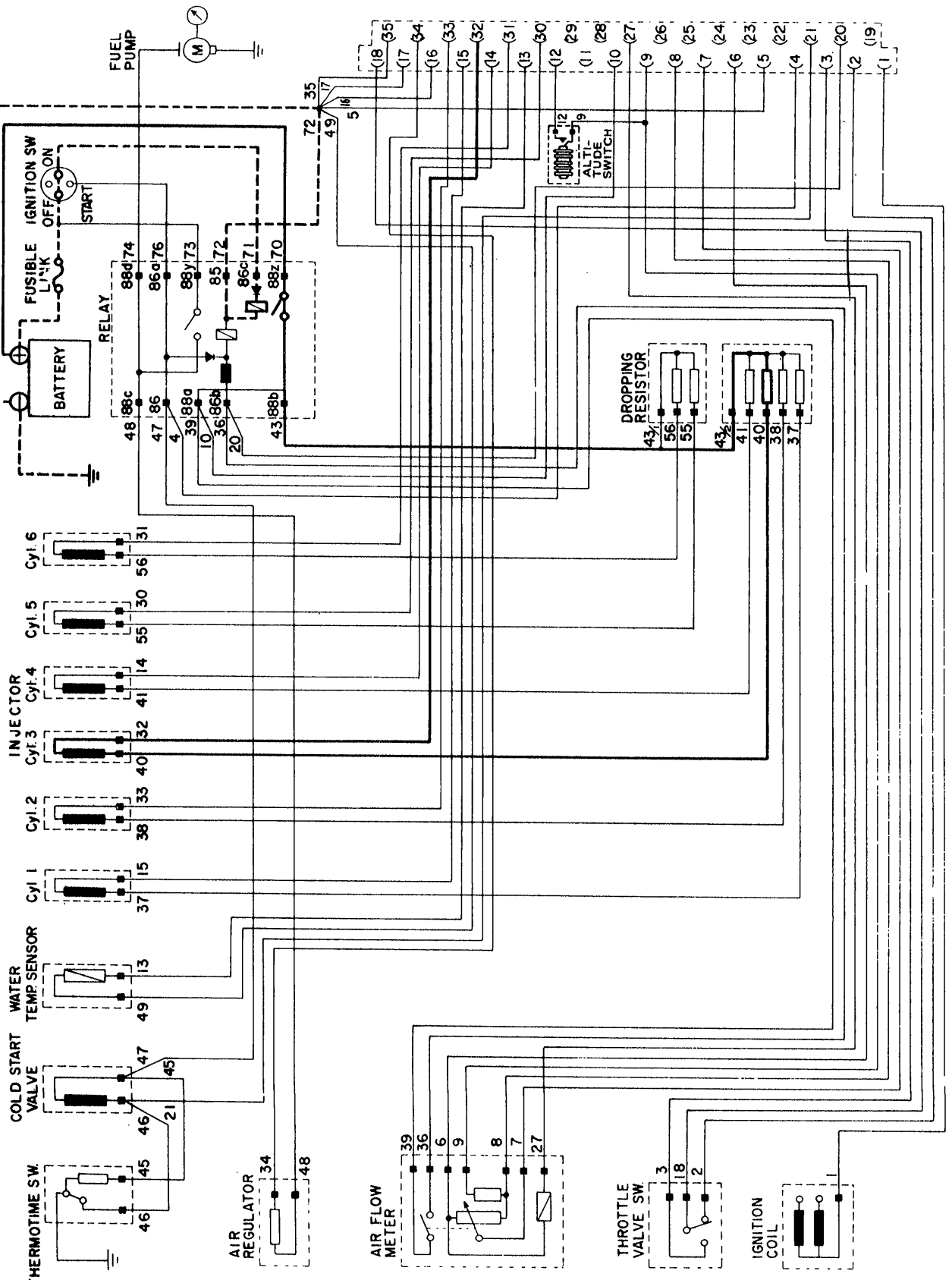
EF680

Fig. EF-56 Injector (cylinder "5") and dropping resistor circuit



EF681

Fig. EF-57 Injector (cylinder "6") and dropping resistor circuit



EF682

Fig. EF-58 Injector (cylinder "3") and dropping resistor circuit

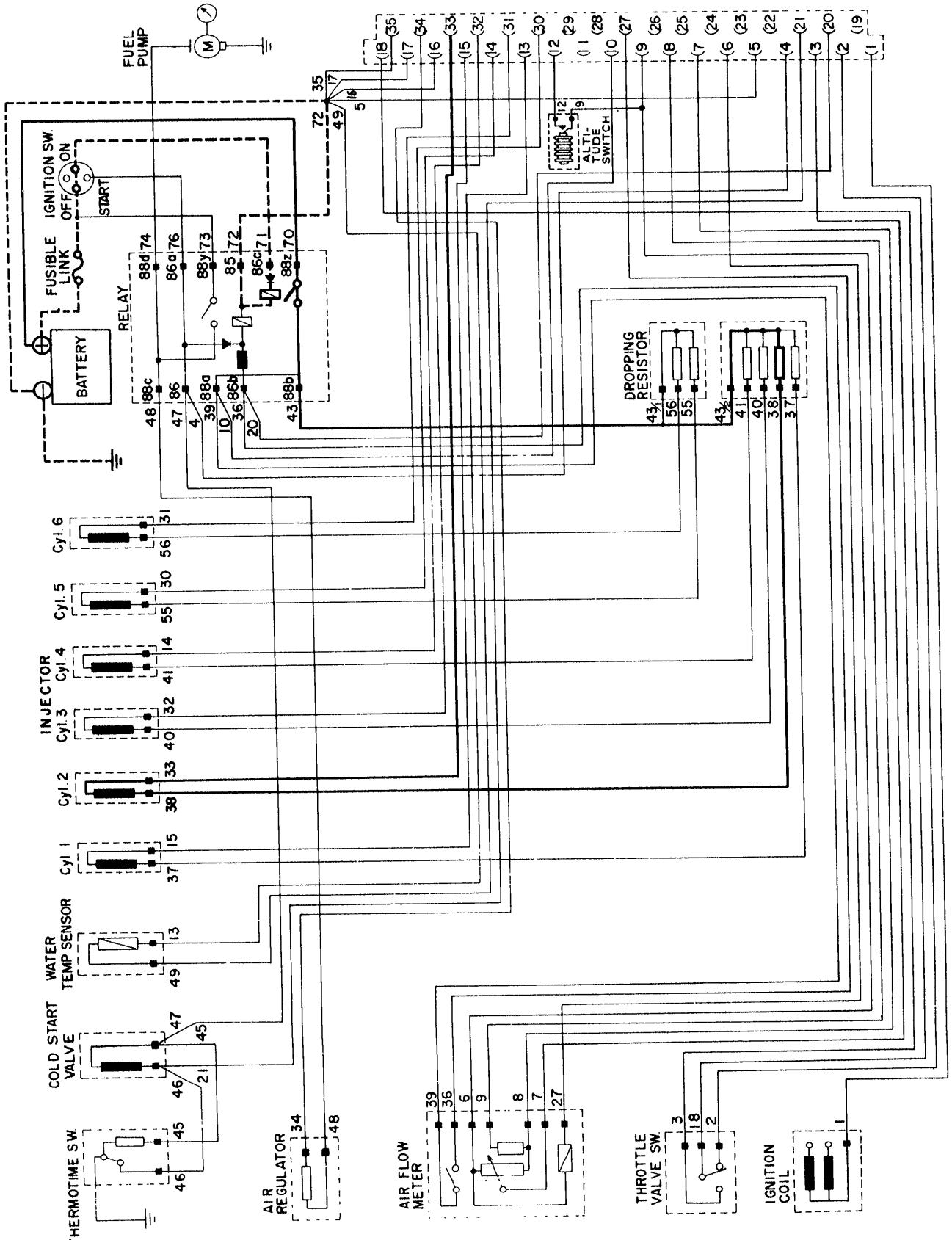
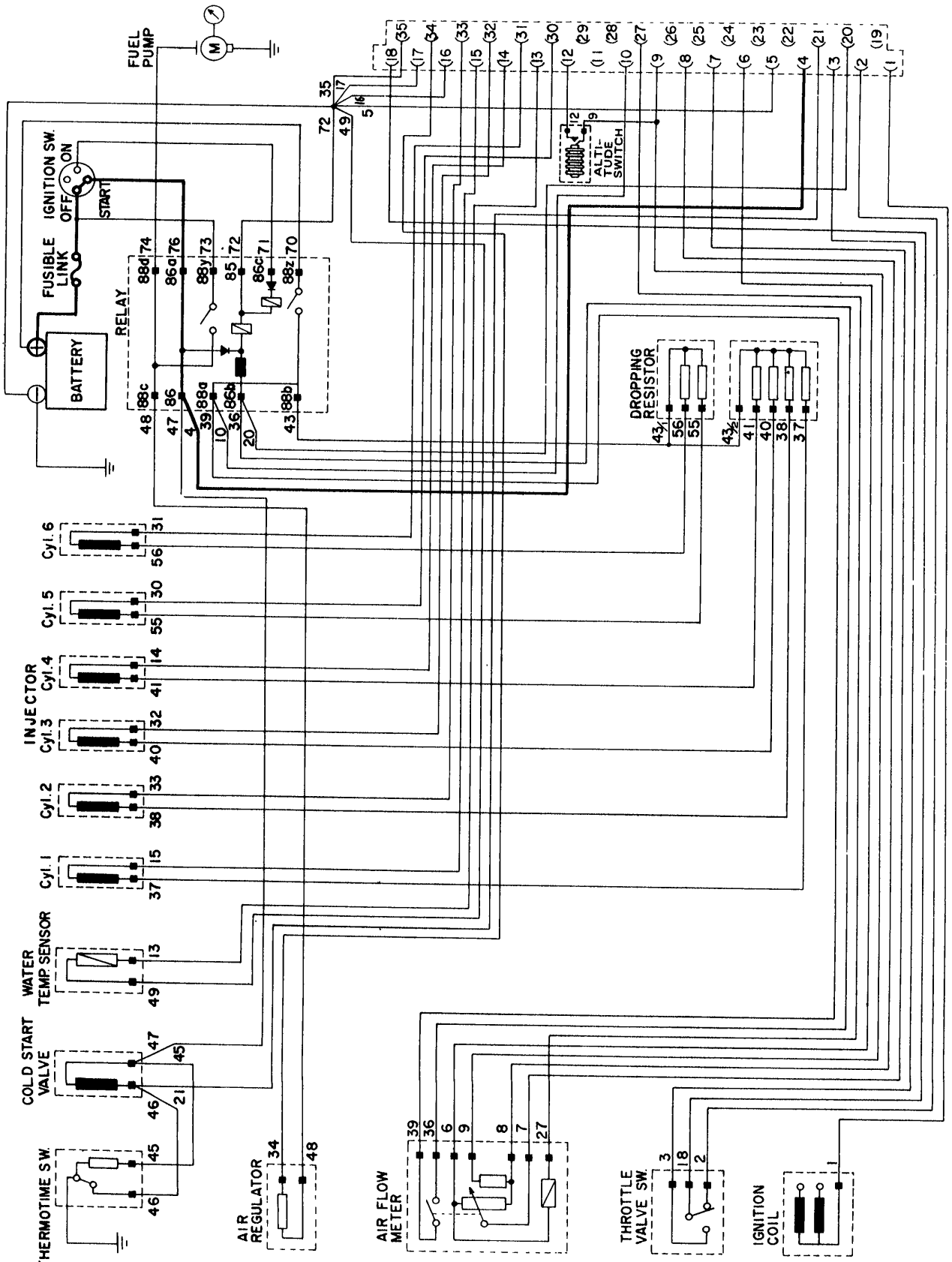


Fig. EF-59 Injector (cylinder "2") and dropping resistor circuit



EF684

Fig. EF-60 Starter signal circuit

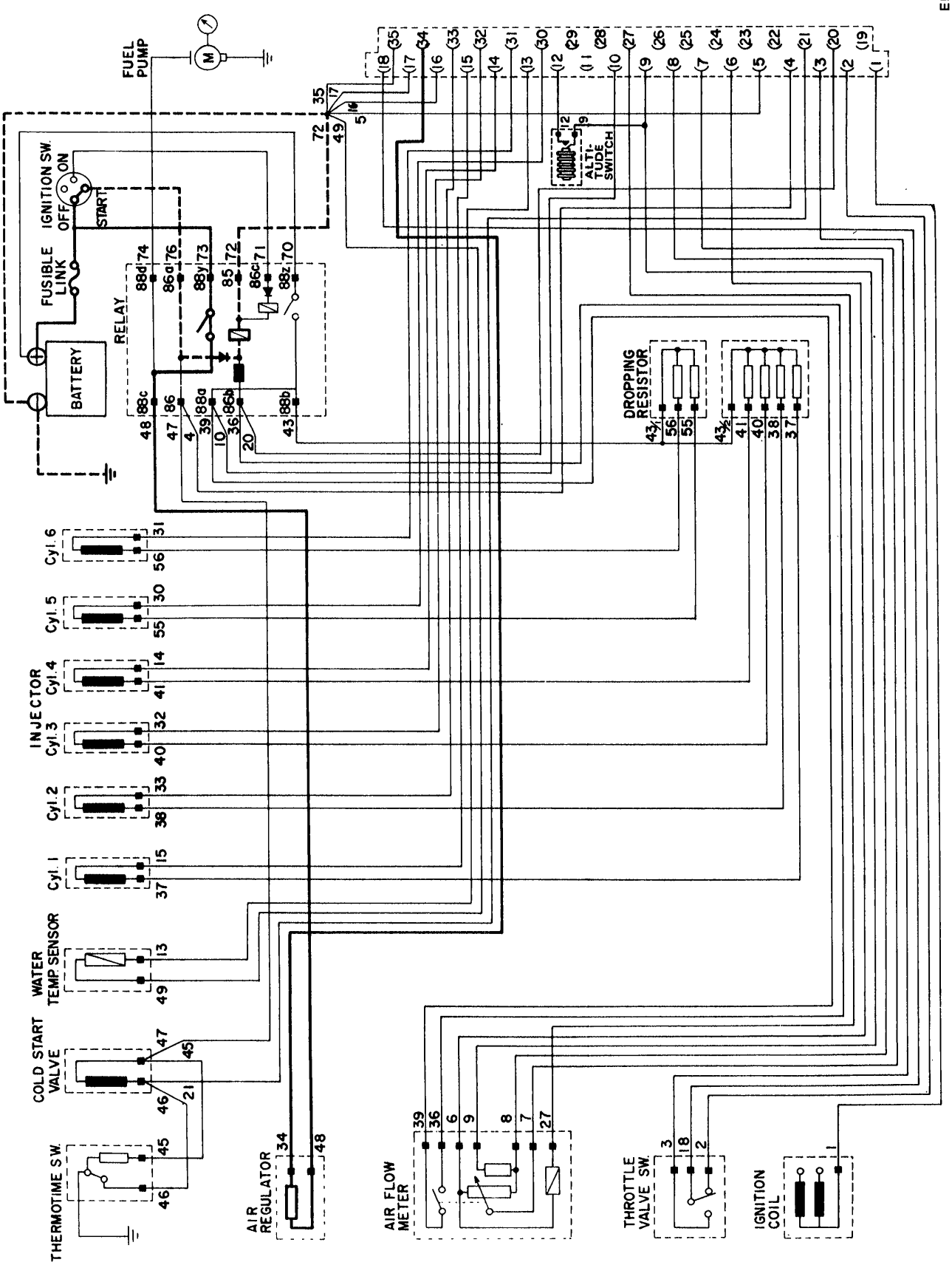
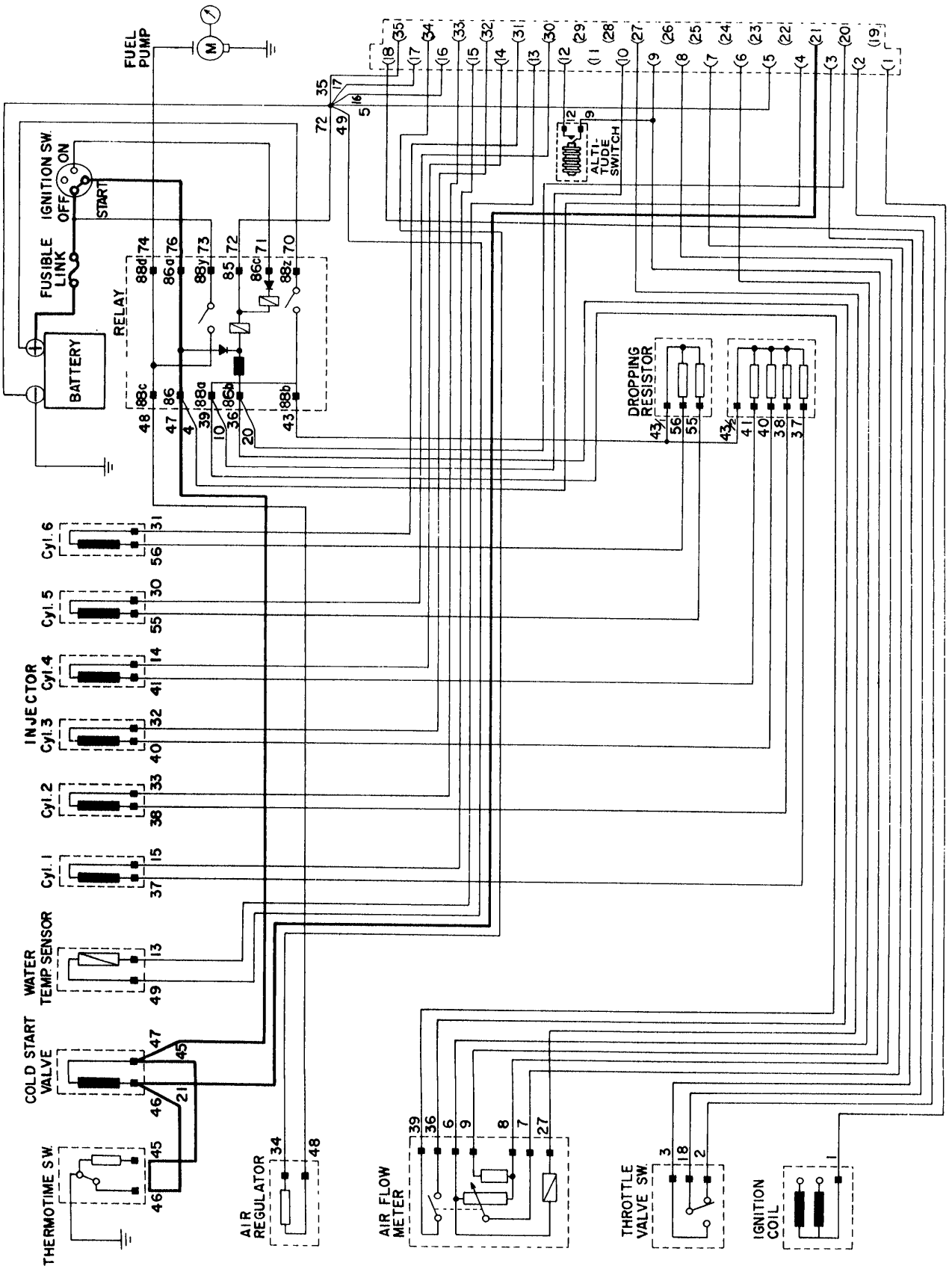
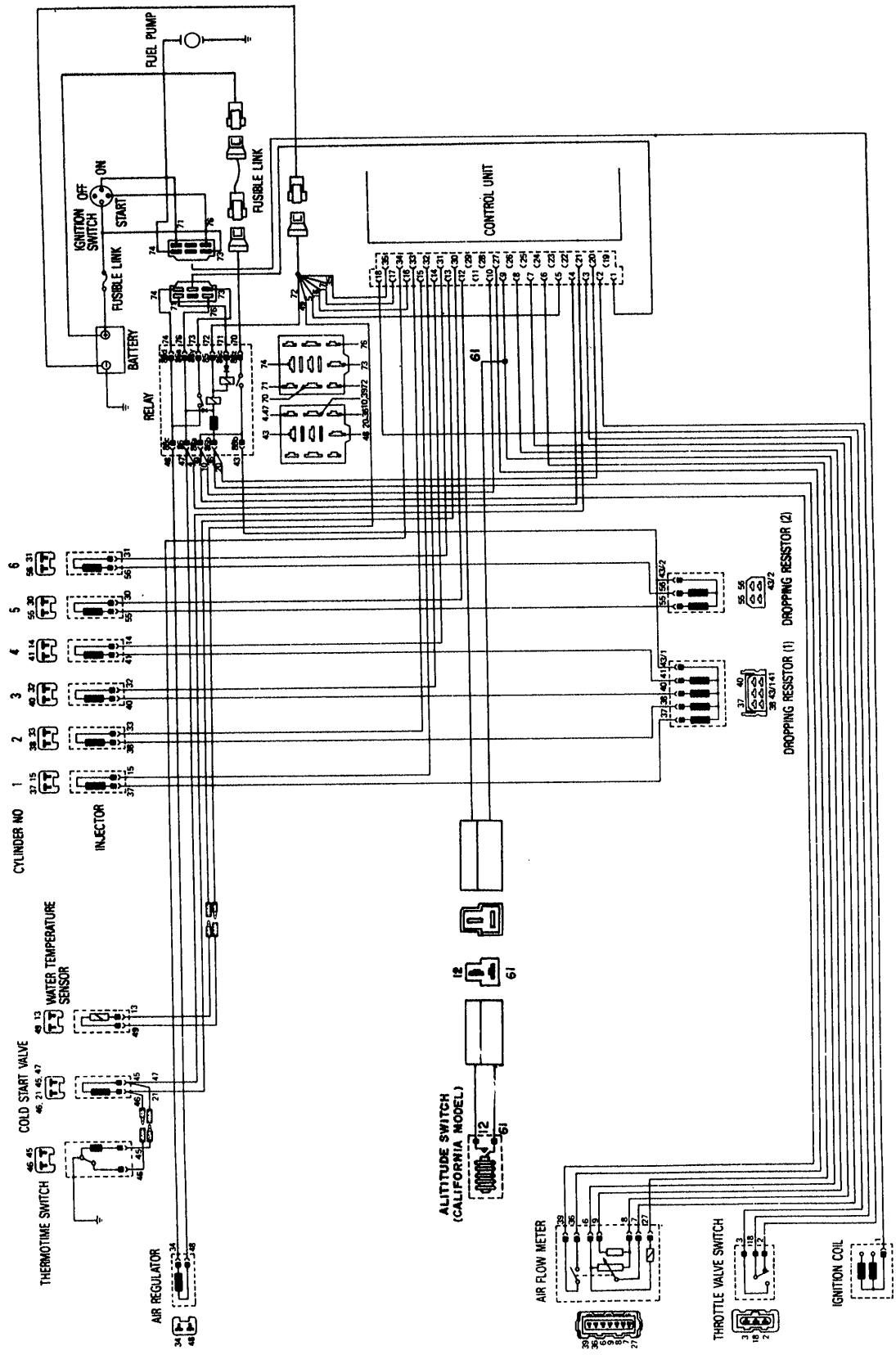


Fig. EF-61 Air regulator circuit



EF686

Fig. EF-62 Cold start valve and thermotime switch circuit



EF687

Fig. EF-63 Electronic fuel injection system wiring diagram

CHECKING FUNCTIONAL PARTS

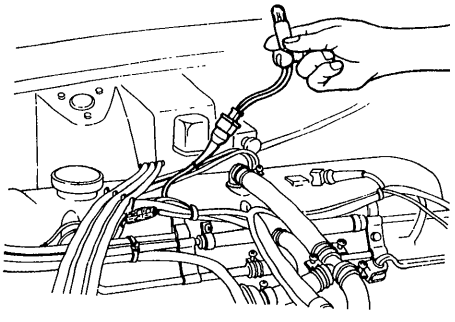
1. Control unit

This inspection employs a miniature lamp to check whether or not the open-valve pulse for cranking the engine is applied to the injector when the engine fails to start. To check, connect a miniature lamp to the harness-side connector of the injector, and crank the engine. If the lamp flashes due to pulse voltage applied to the injector, the control unit is normal. Since two different power transistors are used (one is for No. 1, 2, and 3 cylinders, and the other is for No. 4, 5, and 6 cylinders), this inspection must be carried out on both the No. 1 and No. 4 cylinders.

For confirmation purposes, remove the harness connector of the cooling water temperature sensor. If the lamp flashes more brightly, then it is positive indication that the control unit is functioning normally. This inspection may be limited to the No. 1 or No. 4 cylinder only.

Requirements for inspection

1. The engine must be cranked at a speed of more than 80 rpm.
2. 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.



EF352

Fig. EF-64 Checking control unit

Inspection procedure

Checking No. 1 cylinder

Turn ignition switch to the "OFF" position.

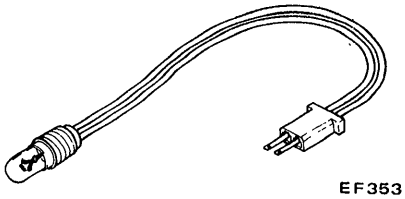
1. Disconnect harness connector of injector.
2. Disconnect cold start valve harness connector.
3. Connect a miniature lamp to the injector harness connector of the No. 1 cylinder.

4. Turn ignition starter switch on to crank engine, and see whether the lamp flashes or not.
5. Disconnect cooling water temperature sensor harness connector, and see whether the lamp becomes brighter or not.

Checking No. 4 cylinder

1. Connect a miniature lamp to the injector harness connector of the No. 4 cylinder.
2. Turn ignition switch on to crank engine, and see whether the lamp flashes or not.

Note: Use a 3-volt miniature lamp with a special terminal connected to its end as shown.



EF353

Fig. EF-65 Miniature lamp for inspection

Judging criteria

The miniature lamp should flash when the engine is cranked. In the No. 1 cylinder, if the lamp becomes brighter when the cooling water temperature sensor connector has been disconnected, it indicates that the control unit is normal. If the lamp does not flash, or if the lamp does not become brighter when the cooling water temperature sensor harness connector is removed, it indicates that the control unit is faulty. Replace the control unit, and carry out the inspection again as described above.

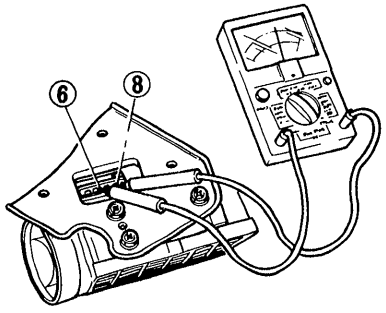
If the lamp flashes when the engine is cranked, but does not become brighter when the water temperature sensor connector is disconnected, it is an indication that the water temperature sensor is faulty. Check the water temperature sensor.

2. Air flow meter

Caution: Before checking air flow meter, remove battery ground cable.

2-1. Checking potentiometer

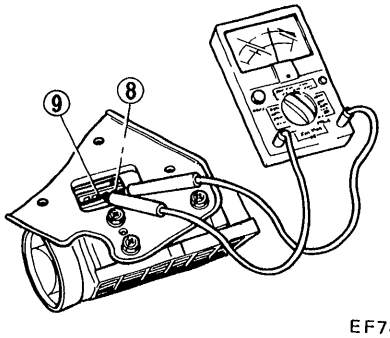
1. Remove air flow meter.
2. Measure the resistance between terminals ⑧ and ⑥. The standard resistance is approximately 180 ohms.



EF742

Fig. EF-66 Measuring the resistance between terminals ⑧ and ⑥

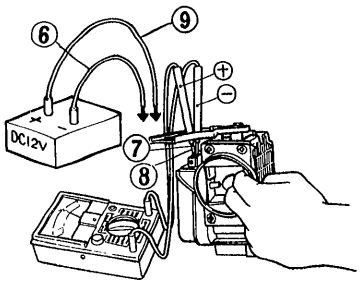
3. Measure the resistance between terminals ⑨ and ⑧. The standard resistance is approximately 100 ohms.



EF743

Fig. EF-67 Measuring the resistance between terminals ⑨ and ⑧

4. Connect a 12-volt dc across terminal ⑨ (positive) and terminal ⑥ (negative).
5. Connect the positive lead of a voltmeter to terminal ⑧ and negative lead to terminal ⑦.
6. Gradually open the flap by hand to ensure that the voltmeter indication decreases proportionately. If the indication varies abruptly, the problem may be in the potentiometer.

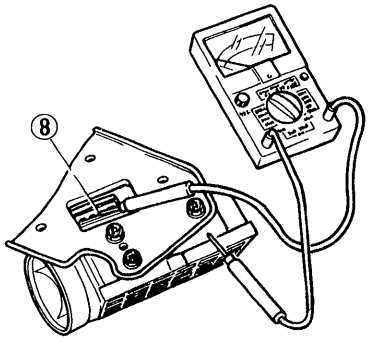


EF398

Fig. EF-68 Checking voltage variation between terminals ⑧ and ⑦

2-2. Checking insulation resistance of air flow meter

Check insulation resistance between the air flow meter body and any one of terminals ⑥, ⑦, ⑧ and ⑨. If continuity exists, the air flow meter is out of order.

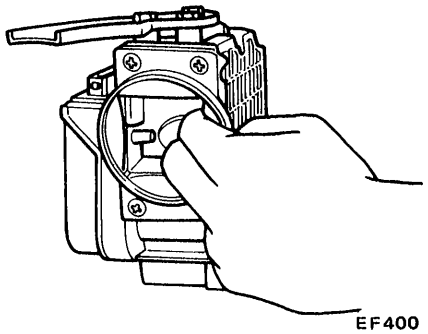


EF744

Fig. EF-69 Checking insulation resistance

2-3. Checking flap

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

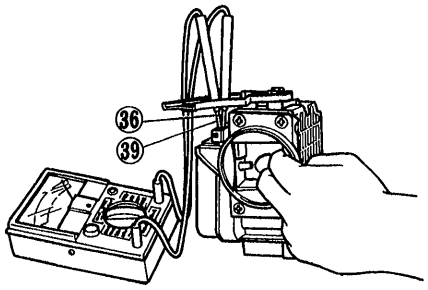


EF400

Fig. EF-70 Checking flap

2-4. Checking fuel pump contact points

Continuity should exist between terminals ㊱ and ㊴ of the air flow meter when the flap is opened approx. 8 degrees. Continuity should not exist when the flap is fully closed. If continuity does not exist when the flap is opened, or continuity occurs at a different position, replace air flow meter as an assembly.



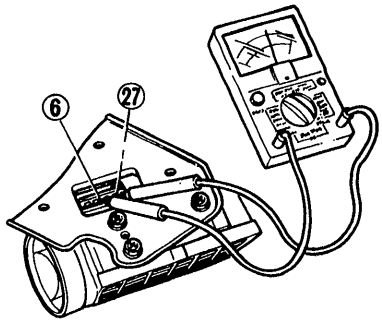
EF401

Fig. EF-71 Checking fuel pump contact points

3. Air temperature

3-1. Checking continuity

1. Disconnect battery ground cable.
2. Remove air flow meter.
3. Measure the outside air temperature.
4. Measure resistance between terminals ㉗ and ⑥ of the air flow meter connector.



EF745

Fig. EF-72 Measuring the resistance of air temperature sensor

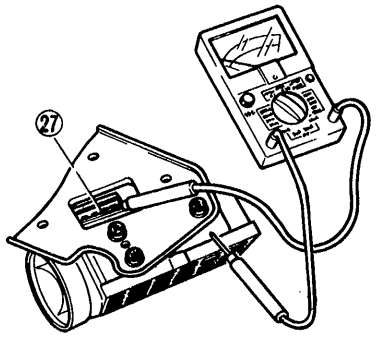
The relationship between the outside air temperature and resistance is shown in the following chart.

Air temperature °C (°F)	Resistance (kΩ)
−30 (−22)	20.3 to 33.0
−10 (−14)	7.6 to 10.8
10 (50)	3.25 to 4.15
20 (68)	2.25 to 2.75
50 (122)	0.74 to 0.94
80 (176)	0.29 to 0.36

If test results are far from the range indicated in the chart, the air temperature sensor is out of order. The air temperature sensor and air flow meter should be replaced as an assembly.

3-2 Checking insulation resistance

Check insulation resistance between terminal ㉗ and air flow meter body. If continuity exists, the air temperature sensor is out of order. The air temperature and air flow meter should be replaced as an assembly.



EF746

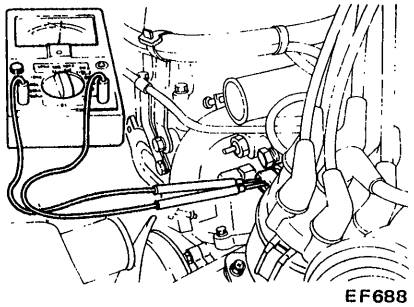
Fig. EF-73 Checking insulation resistance

4. Water temperature sensor

This check can be done with the sensor either on or off the vehicle.

4-1. Checking on engine

Check the resistance of the water temperature sensor before and after engine warm-up.



EF688

Fig. EF-74 Measuring the resistance of water temperature sensor (on the engine)

1. Disconnect battery ground cable.
2. Disconnect the water temperature sensor harness connector.
3. Place a thermometer in the radiator coolant when the engine is cold, and read the coolant temperature (which is used as a reference sensor temperature) and sensor resistance.

Note: When measuring cooling temperature, insert a rod type thermometer into the radiator.

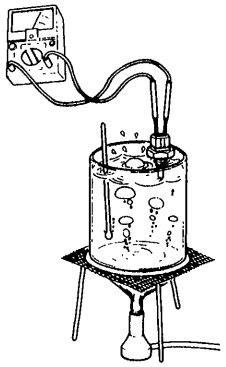
4. Connect the water temperature sensor harness connector.
5. Connect battery ground cable.
6. Warm up the engine sufficiently.
7. Disconnect battery ground cable.
8. Disconnect the water temperature sensor harness connector.
9. Read the sensor resistance in the same manner as described in step (3) above.

Cooling water temperature °C (°F)	Resistance (kΩ)
−30 (−22)	20.3 to 33.0
−10 (−14)	7.6 to 10.8
10 (50)	3.25 to 4.15
20 (68)	2.25 to 2.75
50 (122)	0.74 to 0.94
80 (176)	0.29 to 0.36

If the resistance of the sensor with respect to the coolant temperature is not specified in the range shown in the chart, the water temperature sensor may be out of order.

4-2. Checking water temperature sensor off the engine

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



EF405

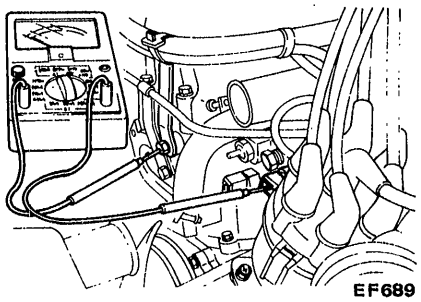
Fig. EF-75 Measuring the resistance of water temperature sensor (off the engine)

If the sensor resistance with respect to the coolant temperature is not held within the range specified in the chart, the water temperature sensor may be out of order.

4-3. Checking insulation resistance

This test is done on the engine.

1. Disconnect battery ground cable.
2. Disconnect the sensor harness connector.
3. Check continuity between the engine block and one of the terminals at sensor.



EF689

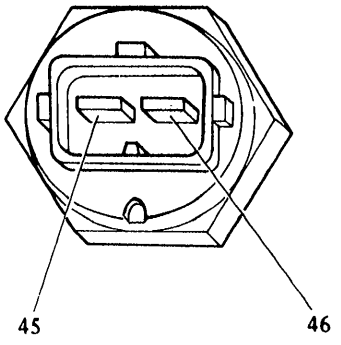
Fig. EF-76 Checking insulation resistance

If continuity exists, the sensor is out of order.

5. Thermotime switch

Static check

1. Disconnect ground cable from battery.
2. Disconnect electric connector of thermotime switch.
3. Measure the resistance between terminal No. 46 and switch body.



EF335

Fig. EF-77 Thermotime switch terminal number

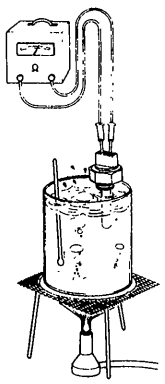
- The resistance is zero when the cooling water temperature is less than 14°C (57°F).
- The resistance is zero or infinite when the cooling water temperature is between 14 to 22°C (57 to 72°F).

- The resistance is infinite when the cooling water temperature is more than 22°C (72°F).

4. Measure the resistance between terminal No. 45 and switch body.
   The ohmmeter reading is
   70 to 86 ohms ..... OK
   The ohmmeter reading is not
   70 to 86 ohms ..... Not OK

Dynamic check

1. Disconnect ground cable from battery.
2. Disconnect electric connector of thermotime switch.
3. Remove thermotime switch from thermostat housing.
4. Dip heat-sensing portion of thermotime switch into cooling water maintained at 10°C (50°F).
5. When the thermotime switch temperature is just about the same as the cooling water temperature, measure the resistance between terminal Nos. 45 and 46.
   - The resistance should be about 78Ω.
6. Increase cooling water temperature at a rate of 1°C (1.8°F) per second until it is more than 25°C (77°F), then check continuity between terminal Nos. 45 and 46.
   - If the ohmmeter reading increases from about 78Ω to infinite, circuit is OK.

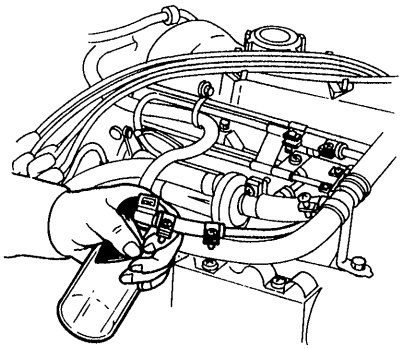


EF336

Fig. EF-78 Checking thermotime switch

6. Cold start valve

1. Disconnect lead wire from the S terminal of starter motor.
2. Turn ignition switch to the START position, and make sure that fuel pump is operating properly. Operating sound should be heard.
3. Disconnect ground cable from battery.
4. Remove two screws securing cold start valve to intake manifold, and remove cold start valve.
5. Disconnect electric connector of cold start valve.
6. Put cold start valve into a transparent glass container of min. 20 cc (1.22 cu in) capacity, plug the transparent glass container opening with a clean rag.



EF757

Fig. EF-79 Fuel injection from cold start valve

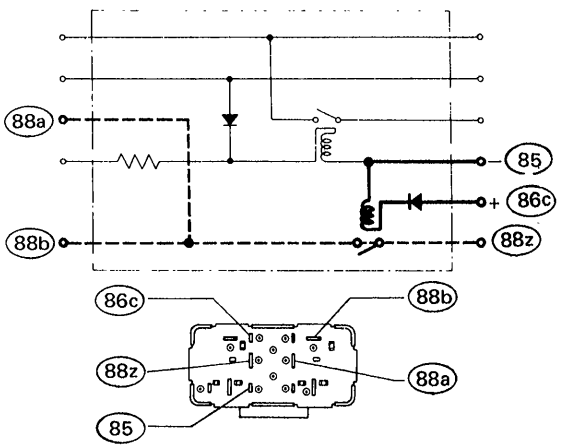
7. Connect ground cable to battery.
8. Turn ignition switch to the START position. Cold start valve should not inject fuel.
9. Turn ignition switch to the OFF position, and connect a jumper wire between cold start valve and battery terminals. Leave cold start valve as it is in step 6 above.
   - Cold start valve should inject fuel. If not, proceed to step 10 below.
10. With ignition switch in the START position and cold start valve set as outlined in step 9 above, check fuel injection.
    - The fuel injected ..... OK
    - The fuel is not injected .... N.G.

7. Electronic fuel injection relay

1. Disconnect ground cable from battery.
2. Remove relay from vehicle.

7-1. Main relay check

1. Connect 12-volt dc between positive terminal (86C) and negative terminal (85).
   "Clicks" should be heard and continuity should exist between terminals (88Z) and (88a), and between (88Z) and (88b).



EF407

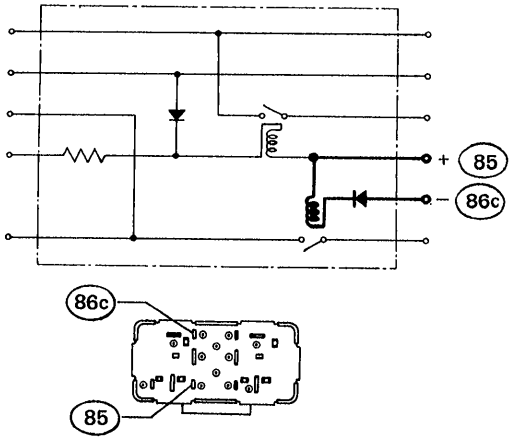
Fig. EF-80 Checking main relay (1)

Notes:

a. Before applying test voltage to relay, connect a fuse in series with lead wire to prevent damage to the circuit.

b. If available, use a 7-volt dc in place of 12-volt to test relay operation.

2. Connect 12-volt dc between positive terminal (85) and negative terminal (86C). No clicks should be heard.



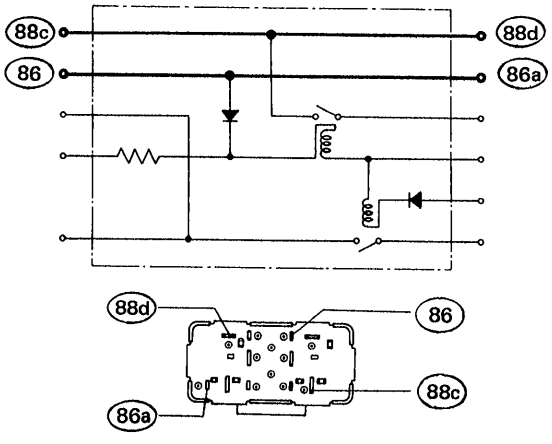
EF408

Fig. EF-81 Checking main relay (2)

3. If test results (steps 1 and 2 above) are not satisfactory, relay is faulty.

7-2. Fuel pump relay check

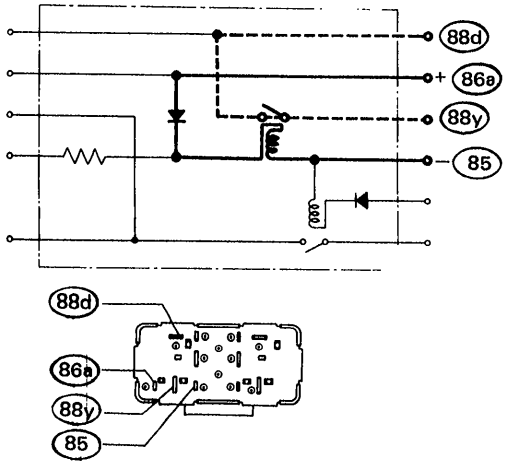
1. Make sure continuity exists between terminals (88d) and (88c), and between (86a) and (86).



EF409

Fig. EF-82 Checking fuel pump relay (1)

2. Connect 12-volt dc to positive terminal (86a) and negative terminal (85). "Clicks" should be heard and continuity should exist betwen terminals (88Y) and (88d).



EF410

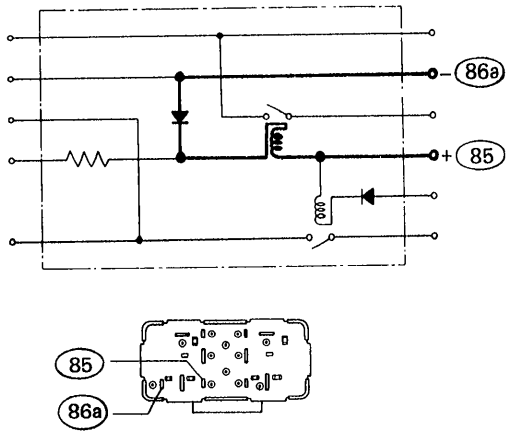
Fig. EF-83 Checking fuel pump relay (2)

Notes:

a. Before applying test voltage to relay, connect a fuse in series with lead wire to prevent damage to the circuit.

b. If available, use a 7-volt dc in place of 12-volt to test relay operation.

3. Connect 12-volt dc to positive terminal (85) and negative terminal (86a). No "clicks" should be heard.



EF411

Fig. EF-84 Checking fuel pump relay (3)

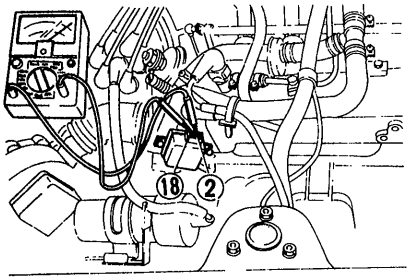
4. If test results (steps 1 through 3) are not satisfactory, relay is faulty.

8. Throttle valve switch

1. Disconnect ground cable from battery.
2. Remove throttle valve switch connector.

8-1. Idle switch check

1. Connect ohmmeter between terminals ② and ⑱.



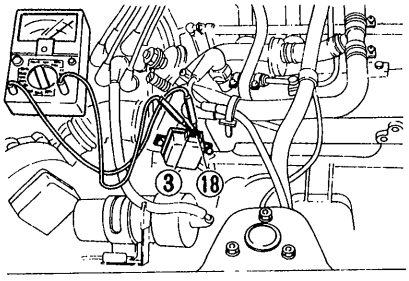
EF492

Fig. EF-85 Checking idle switch

2. If continuity exists when throttle valve is in the IDLE position, and does not exist when valve opens approximately 4°, idle switch is functioning properly.

8-2. Full switch check

1. Connect ohmmeter between terminals ③ and ⑱.

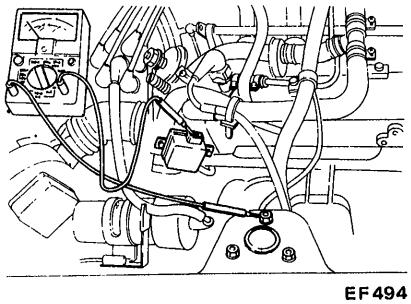


EF493

Fig. EF-86 Checking full switch

2. Gradually open throttle valve from fully-closed position. Observe ohmmeter reading when valve is opened approximately 34°. If ohmmeter reading at all other valve position is greater than that at 34°, full switch is functioning properly.

8-3. Throttle valve switch insulation check



EF494

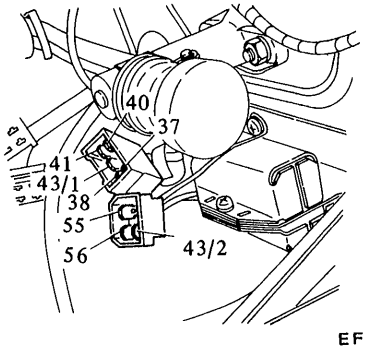
Fig. EF-87 Checking throttle valve switch insulation

Connect ohmmeter between body metal and terminals ②, ③ and ⑱. Ohmmeter reading should be infinite.

9. Dropping resistor

1. Disconnect ground cable from battery.
2. Disconnect 4-pin and 6-pin connectors of dropping resistors from electronic fuel injection harness connectors.
3. Conduct resistance checks on dropping resistor (6-pin connector side) between the following points.
- 43/1 and terminal No. 41 (Number four cylinder resistor)
- 43/1 and terminal No. 40 (Number three cylinder resistor)
- 43/1 and terminal No. 38 (Number two cylinder resistor)
- 43/1 and terminal No. 37 (Number one cylinder resistor)

The resistance should be approximately 6 ohms.



EF772

Fig. EF-88 Dropping resistor terminal number

4. Conduct resistance checks on dropping resistor (4-pin connector side) between the following points.
- 43/2 and terminal No. 56 (Number six cylinder resistor)
- 43/2 and terminal No. 55 (Number five cylinder resistor)

The resistance should be approximately 6 ohms. See Figure EF-88.

10. Altitude switch (California models only)

This switch contains a microswitch which performs the ON-OFF operation according to change in atmospheric pressure.

1. Disconnect ground cable from battery.
2. Remove altitude switch from car. Refer to "Removal and Installation" section on page EF-64.

3. With an ohmmeter connected as shown in Figure EF-89, orally blow through discharge port or suck back. Altitude switch is in good order if a "click" is heard and continuity exists on ohmmeter scale.

Note: This check can also be made by connecting rubber hose to vacuum pump.

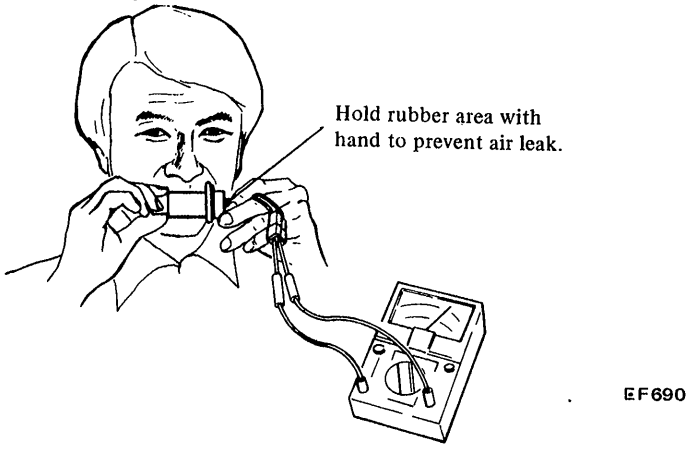


Fig. EF-89 Checking altitude switch

4. Altitude switch is pressure-set at factory and no further adjustment is necessary.
5. If switch is found inoperative, replace.

11. Fuel pump

Functional test

1. Disconnect lead wire from the S terminal of starter motor.
2. With ignition switch to the START position, ensure that fuel pump sounds while operating. If not, check all fuel pump circuits. If all circuits are checked out OK, replace fuel pump.

Discharge pressure check

1. Disconnect ground cable from battery.
2. Disconnect cold start valve harness connector.
3. Using two jumper wires shown in illustration, connect each terminal to battery positive and negative terminals.
4. Release pressure in fuel system by connecting other terminals of jumper wires to cold start valve connector for two or three seconds.

Note: Be careful to keep both terminals separate in order to avoid short circuit.

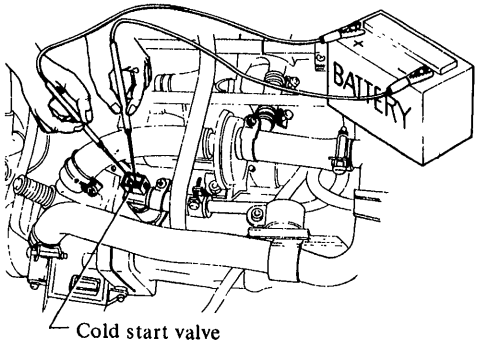


Fig. EF-90 Releasing pressure in fuel system

5. Connect a fuel pressure gauge between fuel tube and fuel hose of fuel filter.

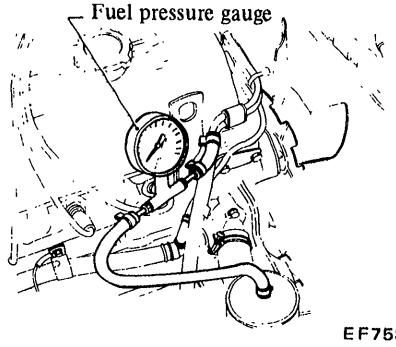


Fig. EF-91 Connect fuel pressure gauge

6. Disconnect lead wire from S terminal of starter motor.
7. Disconnect electric connector from cold start valve.
8. Connect ground cable to battery.
9. Turn ignition switch to the START position to operate fuel pump.

A fuel pressure of approximately 2.55 kg/cm^2 (36.3 psi) indicates a good fuel discharge pressure.

10. If fuel pressure is not as specified, replace fuel pressure regulator, and repeat pressure discharge tests.

If fuel pressure is 2.55 kg/cm^2 (36.3 psi), fuel pump is OK. If below the specified value, check for clogged or deformed fuel lines, and if necessary, replace fuel pump.

Fuel discharge check

1. Connect a fuel pressure gauge as outlined under Fuel Discharge Pressure Check.
2. Check fuel pressure, observing the full-load requirements described below.

Full-load requirements

1. Drive the car and conduct fuel discharge check in accordance with state laws or local regulations.
2. For the sake of safety, two hands are necessary to conduct tests. One is a driver and the other an observer.
3. Check fuel pressure with the engine at full throttle, starting with 20 km/h (13 mph) up to 60 km/h (38 mph). The shift gear should be in 2nd position.

If fuel pressure is approximately 2.55 kg/cm^2 (36.3 psi) over the specified car speed range, fuel discharge is normal. If below the specified value, replace fuel pump.

3. If fuel pressure does not increase when a new fuel pump is installed, check for clogged or deformed fuel lines, fuel filter and fuel damper. If necessary, replace.

12. Fuel damper

1. Connect a fuel pressure gauge as outlined under Fuel Discharge Pressure Check, and check fuel discharge pressure.

If fuel discharge pressure reading fluctuates excessively, replace fuel damper.

13. Pressure regulator

1. Connect a fuel pressure gauge as outlined under Fuel Discharge Pressure Check, and check fuel discharge pressure. If a fuel discharge of 2.55 kg/cm^2 (36.3 psi) is not obtained, replace pressure regulator.

14. Fuel filter

Replace fuel filter periodically in accordance with recommended Maintance Schedule.

15. Injector

Continuity check

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.

Check injectors for sound as follows:

1. Engine can run

1-1. Start the engine and run it at idle. Attach the tip of a screwdriver to each injector to ensure that it sounds while operating.

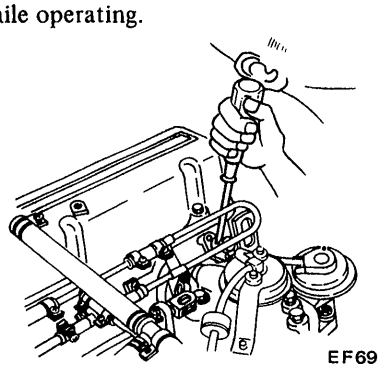


Fig. EF-92 Injection operating sound

1-2. If a low sound is produced from any particular injector, that injector is faulty.

2. Engine cannot run

2-1. If the engine fails to run, disconnect electric connector of cold start valve to protect catalytic converter.

2-2. Crank the engine and check that injectors produce sounds to indicate operation.

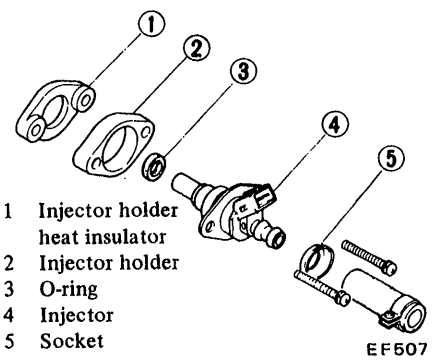
2-3. If a low sound is produced from any particular injector, that injector is faulty.

2-4. If no sound is heard from all injectors, check harnesses for discontinuity as outlined in Continuity Check.

2-5. If harnesses are normal, check operation of control unit.

2-6. If sounds are heard from either Nos. 1, 2 and 3 injectors or Nos. 4, 5 and 6, replace control unit.

2-7. When replacing injector, refer to page EF-65, "Injector".



1 Injector holder heat insulator
2 Injector holder
3 O-ring
4 Injector
5 Socket

Fig. EF-93 Injector

16. Air regulator

1. Hold rubber hose in the line between throttle chamber and air regulator with fingers.

- Engine speed should be reduced.

If not, proceed as follows:

2. Disconnect air hoses from both end of air regulator, and visually check to see if air regulator valve opens.

The valve opening at a temperature of 20°C (68°F) is as shown in Figure EF-94.

3. Disconnect electric connector of air regulator, and check continuity. Continuity should exist. If not, air regulator is faulty.
4. Pry air regulator valve to open with a flat-bladed screwdriver, then close.

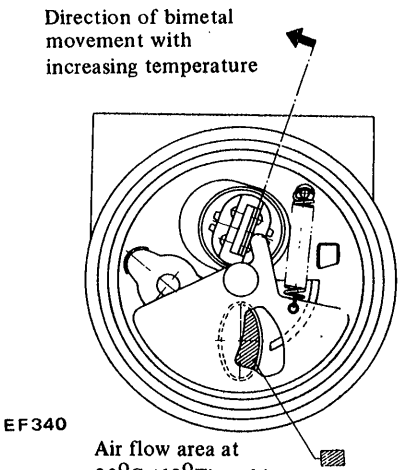


Fig. EF-94 Valve opening at a temperature of 20°C (68°F)

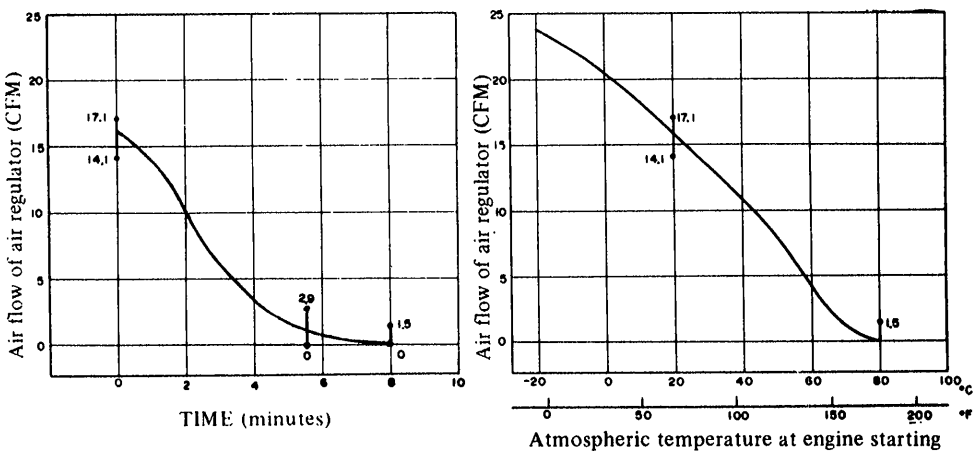


Fig. EF-95 Air flow characteristic curve

Test results

If valve opens and closes smoothly, it is operating properly. If not, replace.

17. Throttle chamber

1. Remove throttle chamber.

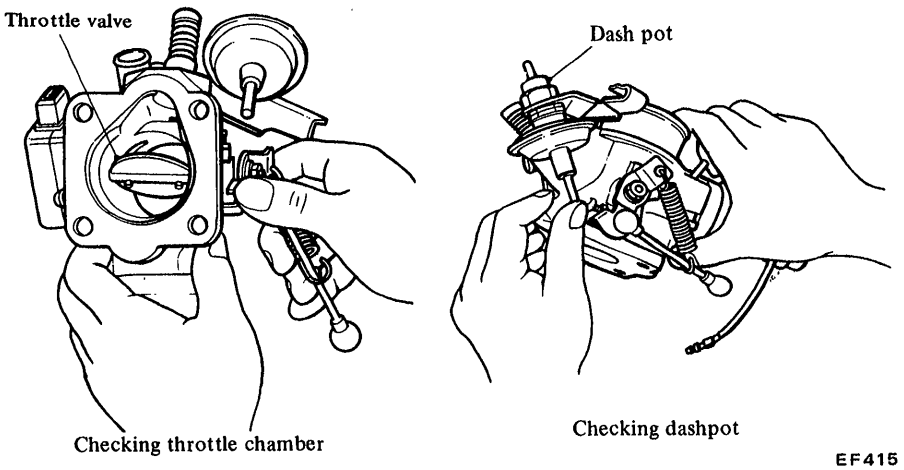


Fig. EF-96 Throttle chamber

2. Make sure that throttle valve moves smoothly when throttle lever is manipulated.
3. Make sure that bypass port is free from obstacles and is clean.
4. Make sure that idle adjust screw moves smoothly.
5. Adjust throttle valve for fully-close position.
6. Push dash pot rod with finger to ensure that it moves smoothly.
7. Check B.C.D.D. For details, refer to section EC.

E.G.R. Vacuum Port Screw

The E.G.R. vacuum port screw attached to the throttle chamber is designed to change the amount of exhaust gas recirculated.

This screw is properly preset at the factory and further adjustment should not be made.

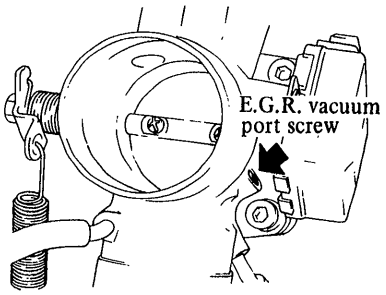
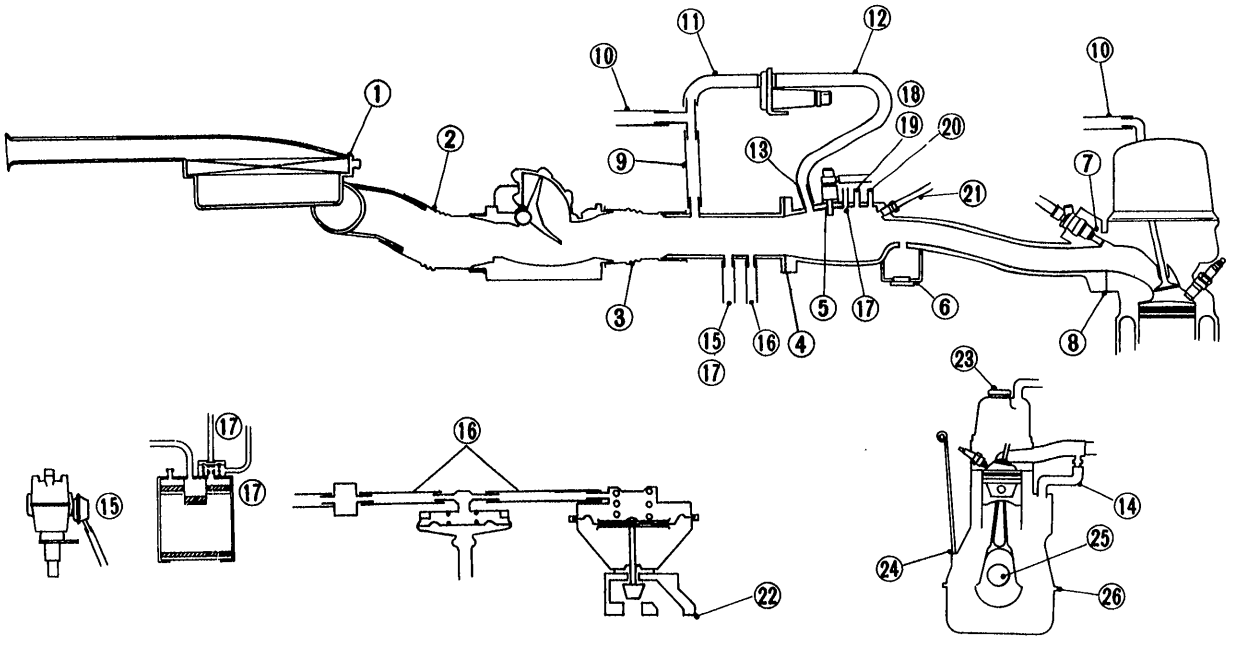


Fig. EF-97 E.G.R. vacuum port screw

18. Checking air leakage in air intake system

Since the air flow meter used in the electronic fuel injection system directly measures the quantity of intake air to permit the supply of the optimum fuel quantity for each cylinder, there should not occur even a slight air leak.

When inspecting the electronic fuel injection system, pay particular attention to hose connections, dipstick, oil filler cap, etc. for any indication of air leaks.



EF693

1 Air cleaner element
2 Air duct (air cleaner to AFM)
3 Air duct (AFM to throttle chamber)
4 Flange (throttle chamber to intake manifold)
5 Cold start valve mounting surface
6 Blind plug (E.G.R.),
7 Injector mounting surface in intake manifold
8 Cylinder head mounting surface in intake manifold
9 Hose (throttle chamber to 3-way connector), both sides
10 Hose (3-way connector to rocker cover), both sides
11 Hose (3-way connector to air regulator), both sides
12 Hose (air regulator to throttle chamber connector), both sides
13 Throttle chamber connector mounting surface
14 Hose (pipe connector to P.C.V. valve), both sides
15 Distributor vacuum line
16 E.G.R. vacuum line
17 Canister vacuum and purge line
18 Automatic transmission vacuum line } Same vacuum hole
19 Cooler vacuum line }
20 Master-Vac line
21 Pressure regulator vacuum line
22 E.G.R. valve mounting surface
23 Oil filler cap
24 Oil level gauge
25 Oil seal (on front and rear of crankshaft)
26 Oil pan gasket mounting surface.

Fig. EF-98 Checking air leakage in air intake system

19. Checking fuel hoses

Check fuel hoses for leakage, loose connections, cracks or deterioration.

Retighten loose connections and replace any damaged or deformed parts. Replace any rubber fuel hose whose inner surface is deformed, scratched or chafed.

For replacement of high pressure fuel rubber hose, refer to item 18 "Fuel Rubber Hose" under heading "Removal and Installation".

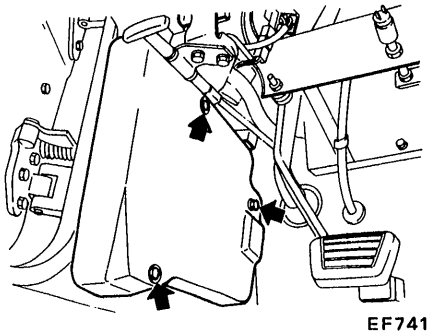
REMOVAL AND INSTALLATION

1. Control unit

1. Turn ignition switch to the OFF position.

Caution: Before disconnecting electronic fuel injection harness at 35-pin coupler, ensure that ignition switch is in the OFF position.

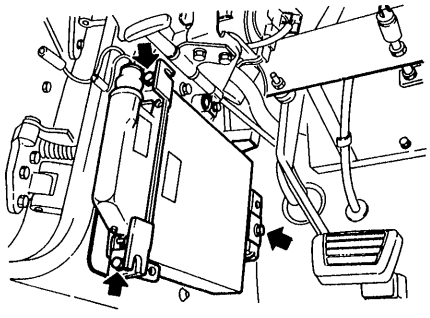
2. Remove three bolts securing resin control unit cover to the left dash side panel, and remove cover.



EF741

Fig. EF-99 Removing control unit cover

3. Remove three bolts securing control unit to dash side panel bracket, and remove control unit.



EF423

Fig. EF-100 Removing control unit

4. Disconnect 35-pin coupler from control unit.

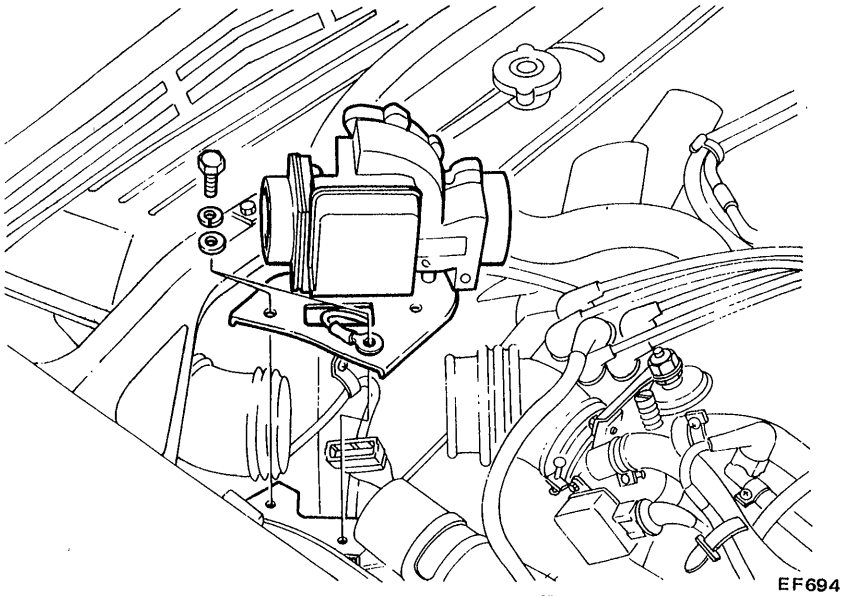
Note: 35-pin coupler can be disconnected without removing control unit from dash side panel.

2. Air flow meter

1. Disconect battery ground cable.

Caution: Be sure to disconnect battery ground cable to prevent control unit from damaging.

2. Disconnect rubber hose from each side of air flow meter.
3. Remove three bolts securing air flow meter bracket.



EF694

Fig. EF-101 Air flow meter

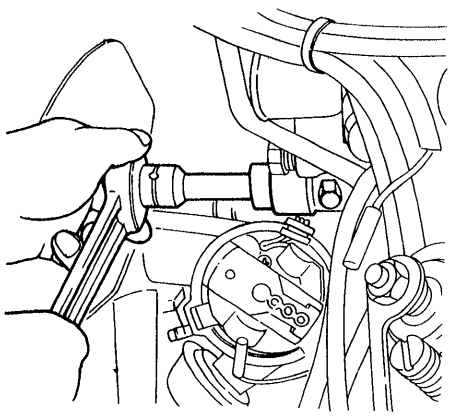
4. Move air flow meter upward, disconnect harness connector, and remove air flow meter.
5. To install air flow meter, reverse the order of removal.

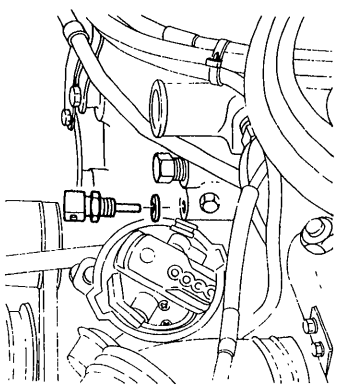
3. Air temperature sensor

The air temperature sensor is built into the air flow meter and cannot be removed as a single unit. When replacement of air temperature sensor is necessary, the entire air flow meter assembly should be replaced.

4. Water temperature sensor

1. Disconnect battery ground cable.
2. Remove radiator cap.
3. Remove drain plug from radiator to drain coolant of approximately 1.5 liters (1⅝ US qt, 1⅜ Imp qt).
4. Disconnect radiator upper hose.
5. Disconnect water tempeature sensor harness connector.
6. Remove water temperature sensor.
7. To install water temperature sensor, reverse the order of removal.





EF695

Fig. EF-102 Water temperature sensor

Caution: When connecting water temperature sensor harness, always keep it away from high tension wire.

Notes:

a. Be sure to install copper washer when installing water temperature sensor.

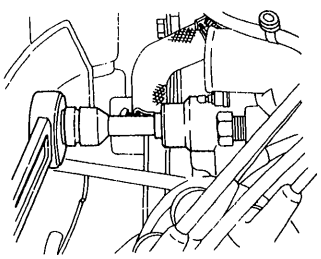
b. After installing water temperature sensor, add cooling water with a proper amount of anti-freeze.

5. Thermotime switch

1. Remove radiator filler cap. Drain cooling water by opening drain valve located on the lower side of radiator.

Note: If cooling water is hot, give it a chance to cool down.

2. Disconnect water hose at thermostat housing.
3. Disconnect ground cable from battery.
4. Disconnect lead wires from thermal transmitter, and remove thermal transmitter.
5. Disconnect electric connector from thermotime switch.
6. Remove thermotime switch by turning it counterclockwise.



EF696

Fig. EF-103 Thermotime switch

7. To install thermotime switch, reverse the order of removal.

6. Cold start valve

1. Disconnect ground cable from battery.
2. Disconnect cold start valve harness connector.
3. Using two jumper wires shown in illustration, connect each terminal to battery positive and negative terminals.

4. Release pressure in fuel system by connecting other terminals of jumper wires to cold start valve connector for two or three seconds.

Note: Be careful to keep both terminals separate in order to avoid short circuit.

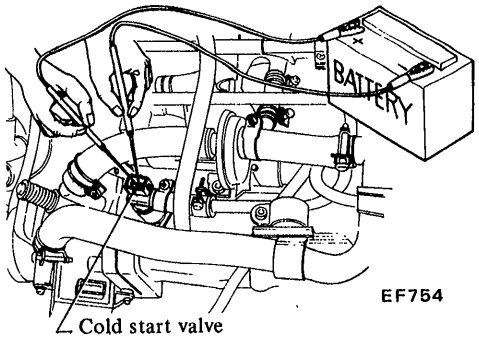


Fig. EF-104 Fuel injection from cold start valve

5. Remove two screws seuring cold start valve to intake manifold.
6. Unfasten clip and disengage cold start valve from fuel hose.

Note: Place a container to receive fuel left in fuel hose.

7. To install cold start valve, reverse the order of removal.
8. For installation of fuel rubber hose, refer to item 18 "Fuel Rubber Hose".

7. Relay

1. Disconnect battery ground cable.
2. Remove two screws securing relay to side dash.
3. Disconnect harness connector.
4. To install relay, reverse the order of removal.

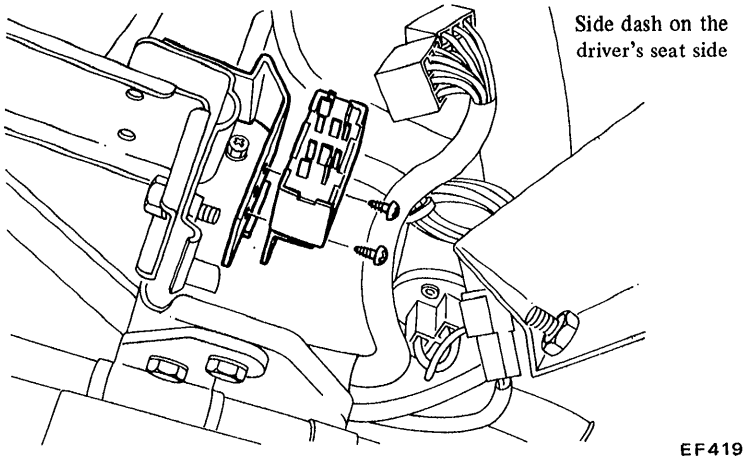


Fig. EF-105 Electronic fuel injection relay

8. Throttle valve switch

1. Disconnect battery ground cable.
2. Disconnect throttle valve switch harness connector.
3. Remove two screws securing throttle valve switch to throttle chamber.
4. Slowly pull throttle valve switch forward.
5. To install throttle valve switch, reverse the order of removal.
6. After installation, adjust the position of throttle valve switch so that idle switch may be changed from ON to OFF when throttle valve stopper screw-to-throttle valve shaft lever clearance is 1.3 mm (0.051 in).

Note: Use suitable shim to measure the specified clearance.

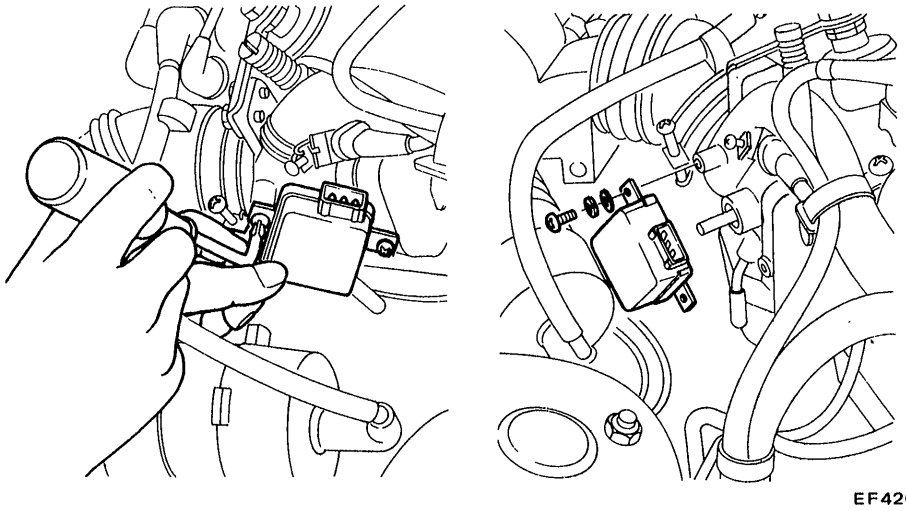


Fig. EF-106 Throttle valve switch

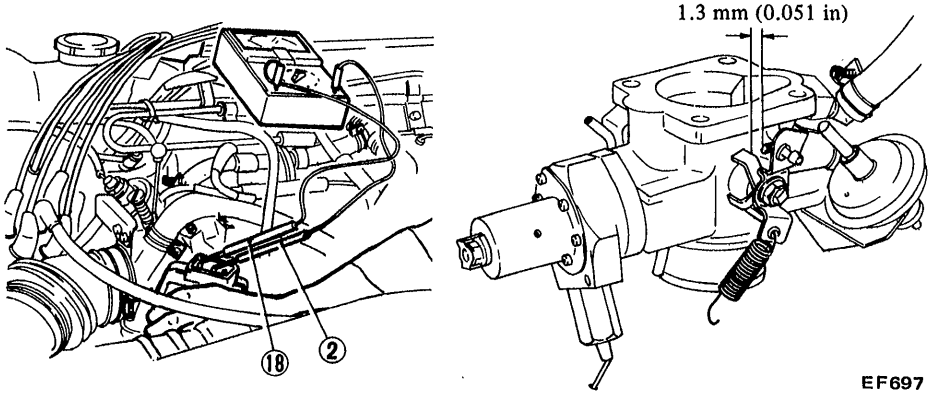


Fig. EF-107 Adjusting throttle valve switch position

9. Dropping resistors

1. Disconnect ground cable from battery.
2. Disconnect two electric connectors from dropping resistor.
3. Remove two screws securing dropping resistor to dashboard.
4. To install dropping resistor, reverse the order of removal.

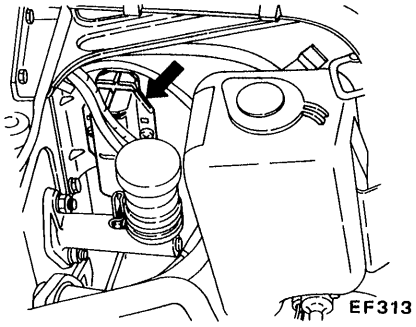


Fig. EF-108 Dropping resistor

10. Altitude switch (California models only)

1. Disconnect ground cable from battery.
2. Remove instrument lower cover on the driver's seat side.
3. Disconnect electric connector from altitude switch.
4. Remove two screws securing altitude switch bracket. The altitude switch can then be removed as bracket assembly.

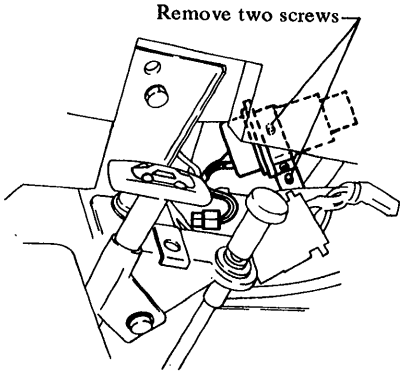


Fig. EF-109 Altitude switch

5. To install altitude switch, reverse the order of removal.

11. Fuel pump

1. Disconnect ground cable from battery.
2. Disconnect cold start valve harness connector.
3. Using two jumper wires shown in illustration, connect each terminal to battery positive and negative terminals.
4. Release pressure in fuel system by connecting other terminals of jumper wires to cold start valve connector for two or three seconds.

Note: Be careful to keep both terminals separate in order to avoid short circuit.

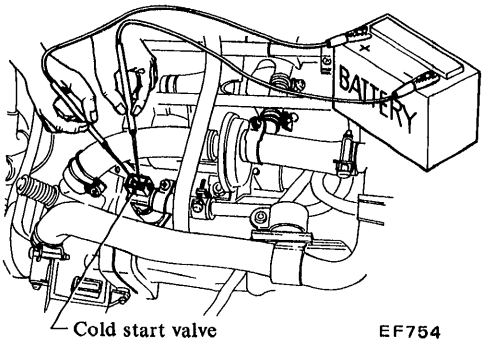


Fig. EF-110 Releasing pressure in fuel system

5. Raise the rear portion of vehicle with a jack, and block wheels. Refer to section "GI".
6. Temporarily clamp hose at a suitable location between fuel tank and fuel pump.

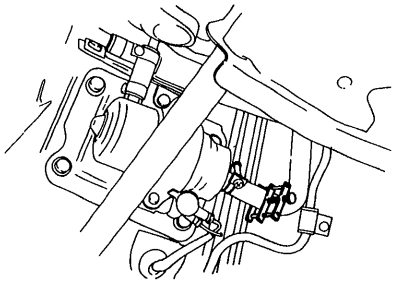


Fig. EF-111 Fuel hose clamp at fuel pump

Note: Be sure to receive fuel into a suitable container.

7. Unfasten clamps at the suction and outlet sides of fuel pump, and disengage fuel hoses.
8. Remove two screws securing fuel pump bracket, and remove bracket.

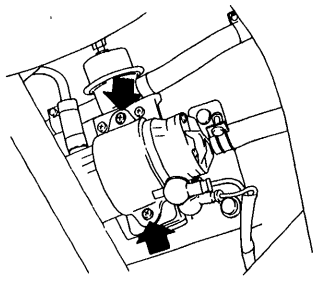


Fig. EF-112 Fuel pump removal

9. Disconnect fuel pump harness connector at passenger compartment side.

To disconnect harness connector, proceed as follows:

- S30 MODEL
  Roll carpet at rear of assistant seat. Take off harness protector, then disconnect harness connector.
- GS30 MODEL
  Remove rear seat and take off harness protector. Then disconnect harness connector.

10. Pull out harness through grommet hole in floor and remove fuel pump.
11. To install fuel pump, reverse the order of removal.
12. For installation of fuel rubber hose, refer to item 18 "Fuel Rubber Hose".

12. Fuel damper

1. Disconnect ground cable from battery.
2. Disconnect cold start valve harness connector.
3. Using two jumper wires shown in illustration, connect each terminal to battery positive and negative terminals.
4. Release pressure in fuel system by connecting other terminals of jumper wires to cold start valve connector for two or three seconds. Refer to Figure EF-110.

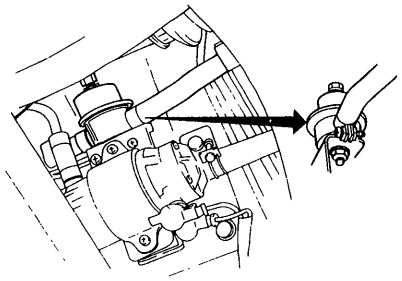
Note: Be careful to keep both terminals separate in order to avoid short circuit.

5. Raise the rear portion of vehicle with a jack, and block wheels. Refer to section "GI".

6. Temporarily clamp fuel hose at a suibtable location between fuel tank and suction side of fuel pump. Refer to Figure EF-111.
7. Unfasten fuel hose clamps, and disengage fuel hoses at the inlet and outlet of fuel damper.

Note: Be sure to receive fuel into a suitable container.

8. Remove nuts securing fuel damper to bracket.



EF701

Fig. EF-113 Fuel damper removal

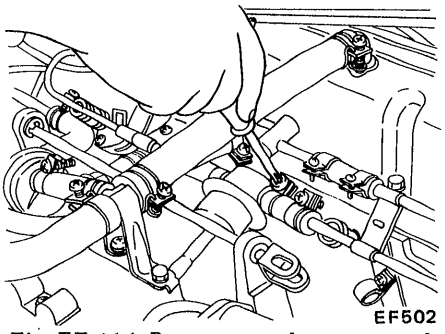
9. To install fuel damper, reverse the order of removal.
10. For installation of fuel rubber hose, refer to item 18 "Fuel Rubber Hose".

13. Pressure regulator

1. Disconnect ground cable from battery.
2. Disconnect cold start valve harness connector.
3. Using two jumper wires shown in illustration, connect each terminal to battery positive and negative terminals.
4. Release pressure in fuel system by connecting other terminals of jumper wires to cold start valve connector for two or three seconds. Refer to Figure EF-110.

Note: Be careful to keep both terminals separate in order to avoid short circuit.

5. Disengage vacuum tube connecting regulator to manifold from pressure regulator.
6. Place a rag under pressure regulator to prevent fuel splash. Unfasten three hose clamps, and disengage fuel hose from pressure regulator.



EF502

Fig. EF-114 Pressure regulator removal

7. To install pressure regulator, reverse the order of removal.
8. For installation of fuel rubber hose, refer to item 18 "Fuel Rubber Hose".

14. Fuel filter

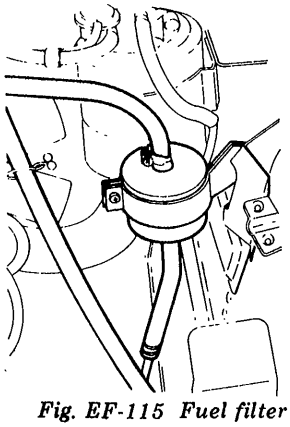
1. Disconnect ground cable from battery.
2. Disconnect cold start valve harness connector.
3. Using two jumper wires shown in illustration, connect each terminal to battery positive and negative terminals.
4. Release pressure in fuel system by connecting other terminals of jumper wires to cold start valve connector for two or three seconds. Refer to Figure EF-110.

Note: Be careful to keep both terminals separate in order to avoid short circuit.

5. Unfasten clamps securing fuel hoses to the outlet and inlet sides of fuel filter, and disengage fuel hoses.

Note: Be careful not to spill fuel over engine compartment. Place a rag to absorb fuel.

6. Remove bolt securing fuel filter to bracket, and remove fuel filter.



EF773

Fig. EF-115 Fuel filter removal

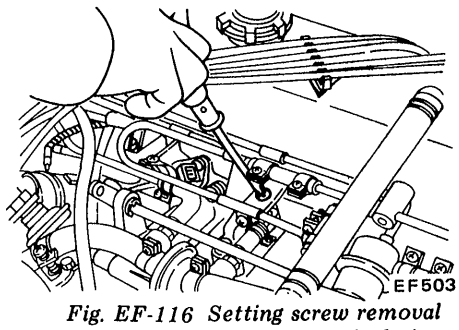
7. To install fuel filter, reverse the order of removal.
8. For installation of fuel rubber hose, refer to item 18 "Fuel Rubber Hose".

15. Injector

1. Disconnect ground cable from battery.
2. Disconnect cold start valve harness connector.
3. Using two jumper wires shown in illustration, connect each terminal to battery positive and negative terminals.
4. Release pressure in fuel system by connecting other terminals of jumper wires to cold start valve connector for two or three seconds. Refer to Figure EF-110.

Note: Be careful to keep both terminals separate in order to avoid short circuit.

5. Disconnect ground cable from battery.
6. Disconnect electric connector from injector.
7. Disengage harness from fuel pipe B wire clamp.
8. To remove the front three injectors, remove screws securing fuel pipe.



EF503

Fig. EF-116 Setting screw removal of front fuel pipe

9. To remove the rear three injectors, remove bolts securing fuel pipe C to intake manifold. These bolts are located on bracket.

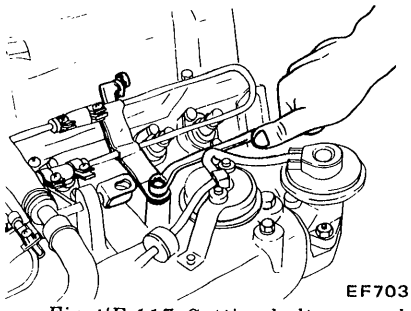

EF703

Fig. EF-117 Setting bolt removal of rear fuel pipe

10. When removing any of the front or rear injector, unfasten hose clamps on that side.
11. Pull fuel pipe forward, and disengage injector and fuel pipe.

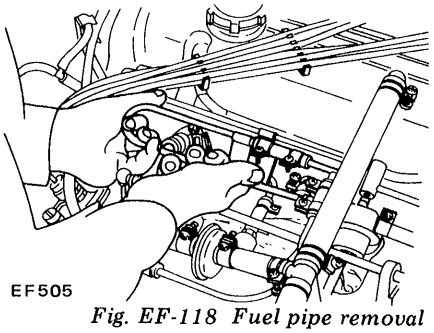

EF505

Fig. EF-118 Fuel pipe removal

Caution: Place a rag under injector when disconnecting fuel pipe to prevent fuel splash.

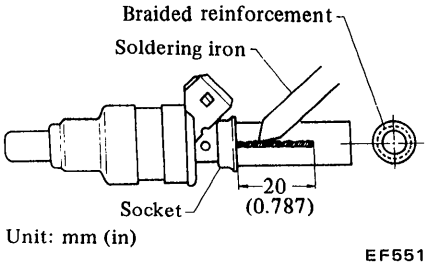
12. On injector rubber hose, measure off a point approx. 20 mm (0.787 in) from socket end. Heat soldering iron (150 watt) for 15 minutes. Cut hose into braided reinforcement from mark to socket end. Do not feed soldering iron until it touches injector tail piece.

Then pull rubber hose out with hand.

Cautions:

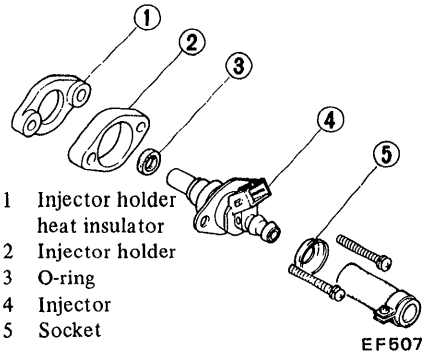
a. Be careful not to damage socket, plastic connector, etc. with soldering iron.

b. Never place injector in a vise when disconnecting rubber hose.



EF551

Fig. EF-119 Melting injector rubber hose



1 Injector holder heat insulator
2 Injector holder
3 O-ring
4 Injector
5 Socket

EF507

Fig. EF-120 Injector

13. Install injector fuel rubber hose as follows:

- Clean exterior of injector tail piece.
- Wet inside of new rubber hose with fuel.
- 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.

16. Air regulator

1. Disconnect ground cable from battery.
2. Disconnect electric connector from regulator.
3. Unfasten clamp on each side of air hose, and disengage hose.
4. Remove two setscrews.

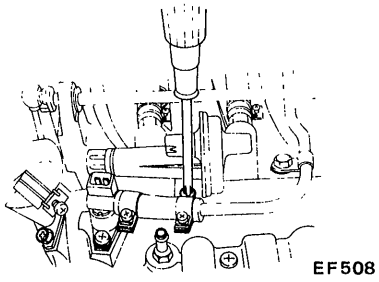
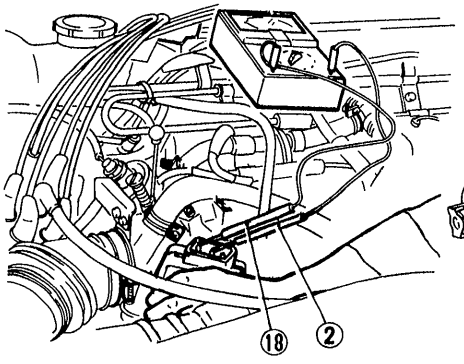

EF508

Fig. EF-121 Air regulator removal

5. To install air regulator, reverse the order of removal.



17. Throttle chamber

1. Disconnect battery ground cable.
2. Remove distributor cap.
3. Remove rubber hoses from throttle chamber.

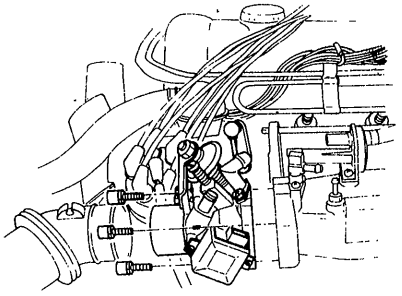
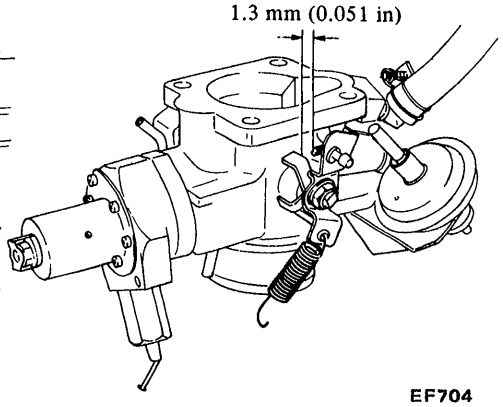

EF421

Fig. EF-122 Throttle chamber

4. Remove throttle valve switch.
5. Disconnect B.C.D.D. harness connector.
6. Disconnect rod connector at auxiliary throttle shaft.
7. Remove four screws securing throttle chamber to intake manifold. The throttle chamber can be removed together with B.C.D.D. and dash pot.
8. To install throttle chamber, reverse the order of removal.

Throttle chamber securing screw tightening torque:
1.5 to 2.0 kg-m
(11 to 14 ft-lb)

9. After installation, adjust the position of throttle valve switch so that idle switch may be changed from ON to OFF when throttle valve stopper screw-to-throttle valve shaft lever clearance is 1.3 mm (0.051 in).



EF704

Fig. EF-123 Adjusting throttle valve switch position

Notes:

a. Use suitable shim to measure the specified clearance.

b. After throttle chamber has been installed, warm up engine sufficiently and adjust engine speed to specified idle rpm with idle speed adjusting screw. Specified idle rpm should be reached if idle speed adjusting screw is turned back about six rotations from the "fully closed" (throttle valve) position. If more than six rotations are required to obtain specified rpm, throttle valve is closed excessively at idle; if less than six rotations are required, throttle valve is opened excessively or working parts are faulty.

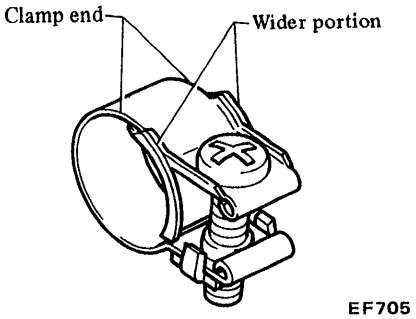


Fig. EF-124 Fuel hose clamp

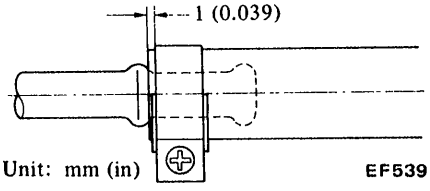


Fig. EF-125 Fuel hose clamp position

18. Fuel rubber hose

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

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

Cautions:

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 1 mm (0.039 in) from hose end or screw position (wider than other portions of clamp) is flush with hose end. Tightening torque specifications are the same for all rubber hose clamps.

Tightening torque of fuel hose clamps:
0.10 to 0.15 kg-m
(0.72 to 1.1 ft-lb)

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

b. Insertion length of high pressure fuel rubber hoses is not the same for conventional pipes and those for EFI unit. For details, refer to items (1) through (25) below. Items with an asterisk mark "*" indicate hoses whose ends should bottom or be pushed until they contact bulges, EFI unit, etc.

Rubber hoses between fuel pump and damper

① *Insert rubber hose until its end contacts pump.

② Push rubber hose onto pump to damper fuel pipe until its end is on black paint on pipe.

③ Push rubber hose onto pump to damper fuel pipe until its end is on black paint on pipe.

④ *Insert rubber hose until its end contacts damper unit.

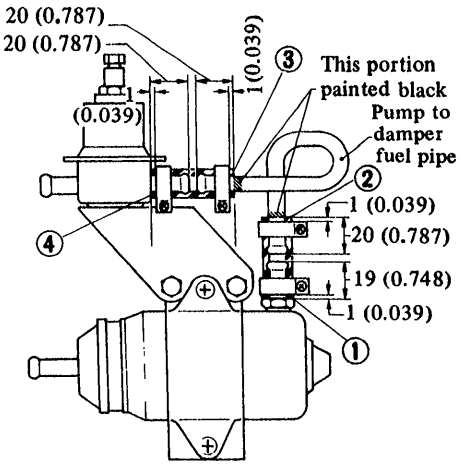


Fig. EF-126 Rubber hoses between pump and damper

Fuel damper to fuel feed pipe rubber hose

⑤* Insert rubber hose until its end contacts fuel damper unit.

⑥ *Push end of rubber hose onto fuel feed pipe until it contacts inner bulge.

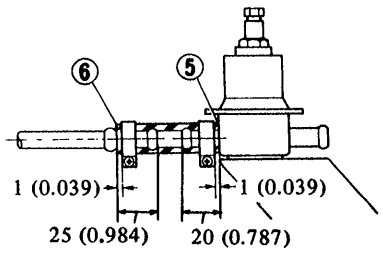
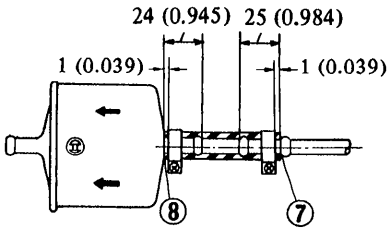


Fig. EF-127 Fuel damper to fuel feed pipe rubber hose

Fuel feed pipe to fuel filter inlet pipe rubber hose

⑦* Push end of rubber hose onto fuel feed pipe until it contacts inner bulge.

⑧* Push end of rubber hose onto fuel filter inlet pipe until it contacts fuel filter unit.



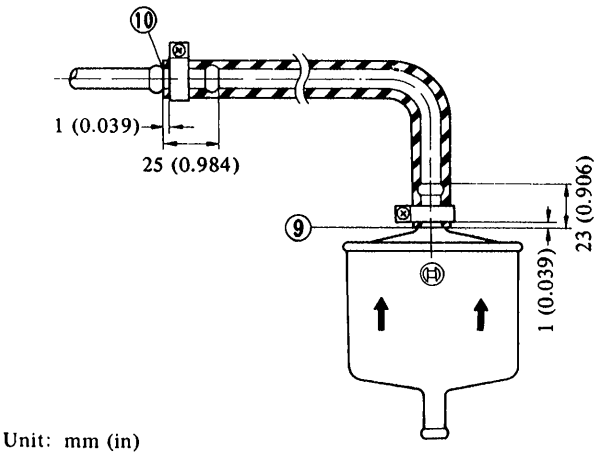
Unit: mm (in) EF542

Fig. EF-128 Fuel feed pipe to fuel filter inlet pipe rubber hose

Fuel filter outlet to fuel pipe A rubber hose

⑨* Push end of rubber hose onto fuel filter outlet pipe until it contacts fuel filter unit.

⑩* Push end of rubber hose onto fuel pipe A until it contacts inner bulge.



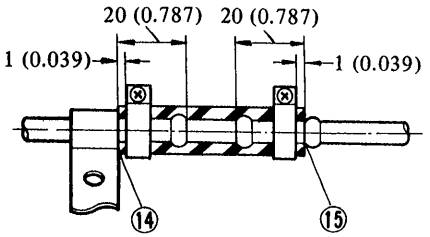
Unit: mm (in) EF543

Fig. EF-129 Fuel filter outlet to fuel pipe A rubber hose

Fuel pipe A to fuel pipe B or C rubber hose

⑭* Push end of rubber hose onto fuel pipe (B) or (C) until it contacts pipe bracket.

⑮* Push end of rubber hose onto fuel pipe A until it touches inner bulge.



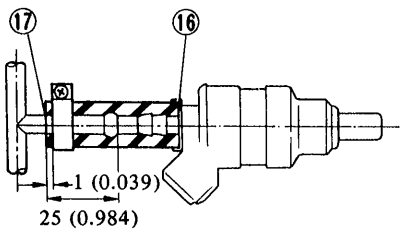
Unit: mm (in) EF531

Fig. EF-131 Fuel pipe A to fuel pipe B or C rubber hose

Injector rubber hose

⑯* Push end of rubber hose with hose socket onto injector tail piece until hose socket contacts injector. Clamp is not necessary at this connection.

⑰ Push end of injector rubber hose onto fuel pipe B or C approx. 25 mm (0.984 in).
Insertion length will be automatically set by relative positions of fuel pipe B or C and injector.



Unit: mm (in) EF534

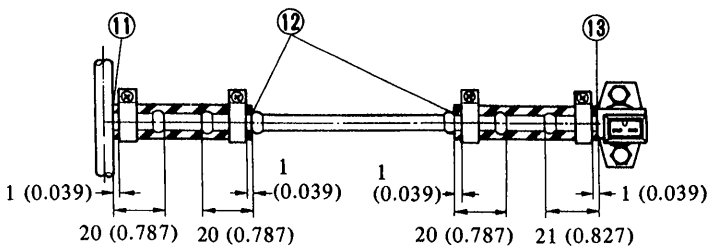
Fig. EF-132 Injector rubber hose

Cold start valve rubber hose

⑪* Push end of rubber hose onto fuel pipe A until it bottoms.

⑫* Push end of rubber hose onto fuel pipe D until it contacts inner bulge.

⑬ Push rubber hose onto cold start valve inlet pipe approx. 21 mm (0.827 in).
Insertion length of rubber hose will be automatically set by relative positions of fuel pipe A and cold start valve fuel pipe.



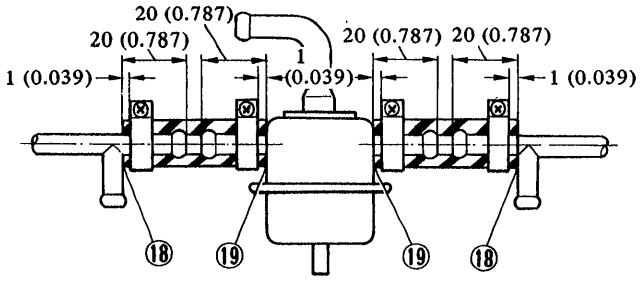
Unit: mm (in) EF532

Fig. EF-130 Cold start valve rubber hose

Pressure regulator to fuel pipe B or C rubber hose

⑱* Push end of rubber hose onto fuel pipe B or C until it contacts pipe branch for injector.

⑲* Push end of rubber hose onto pressure regulator inlet pipe until it contacts pressure regulator



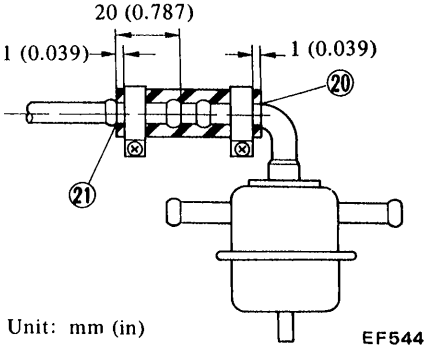
Unit: mm (in)

Fig. EF-133 Pressure regulator to fuel pipe B or C rubber hose

Pressure regulator to fuel return pipe A rubber hose

⑳ Insertion length of rubber hose for pressure regulator outlet pipe will automatically set after the other end of hose (for fuel return pipe A in item 19) has been inserted all the way.

㉑* Push end of rubber hose onto fuel return pipe A until it contacts inner bulge.



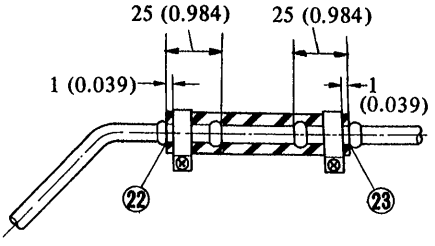
Unit: mm (in)

Fig. EF-134 Pressure regulator to fuel return pipe A rubber hose

Fuel return pipe A to fuel return pipe rubber hose

㉒* Push end of rubber hose onto fuel return pipe A until it contacts inner bulge.

㉓* Push end of rubber hose onto fuel return pipe until it contacts inner bulge.



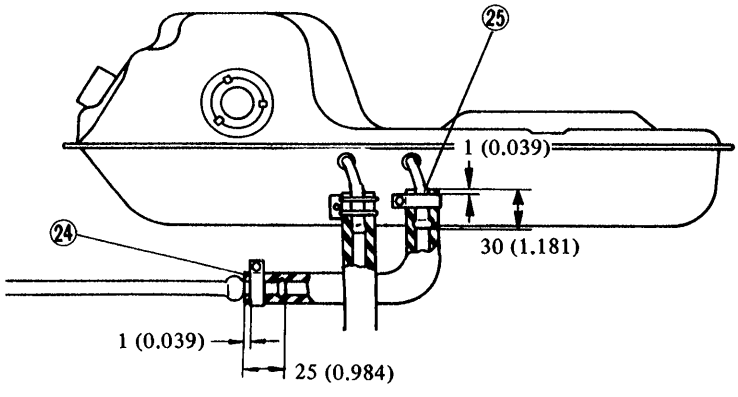
Unit: mm (in)

Fig. EF-135 Fuel return pipe A to fuel return pipe rubber hose

Fuel return pipe to fuel tank rubber hose

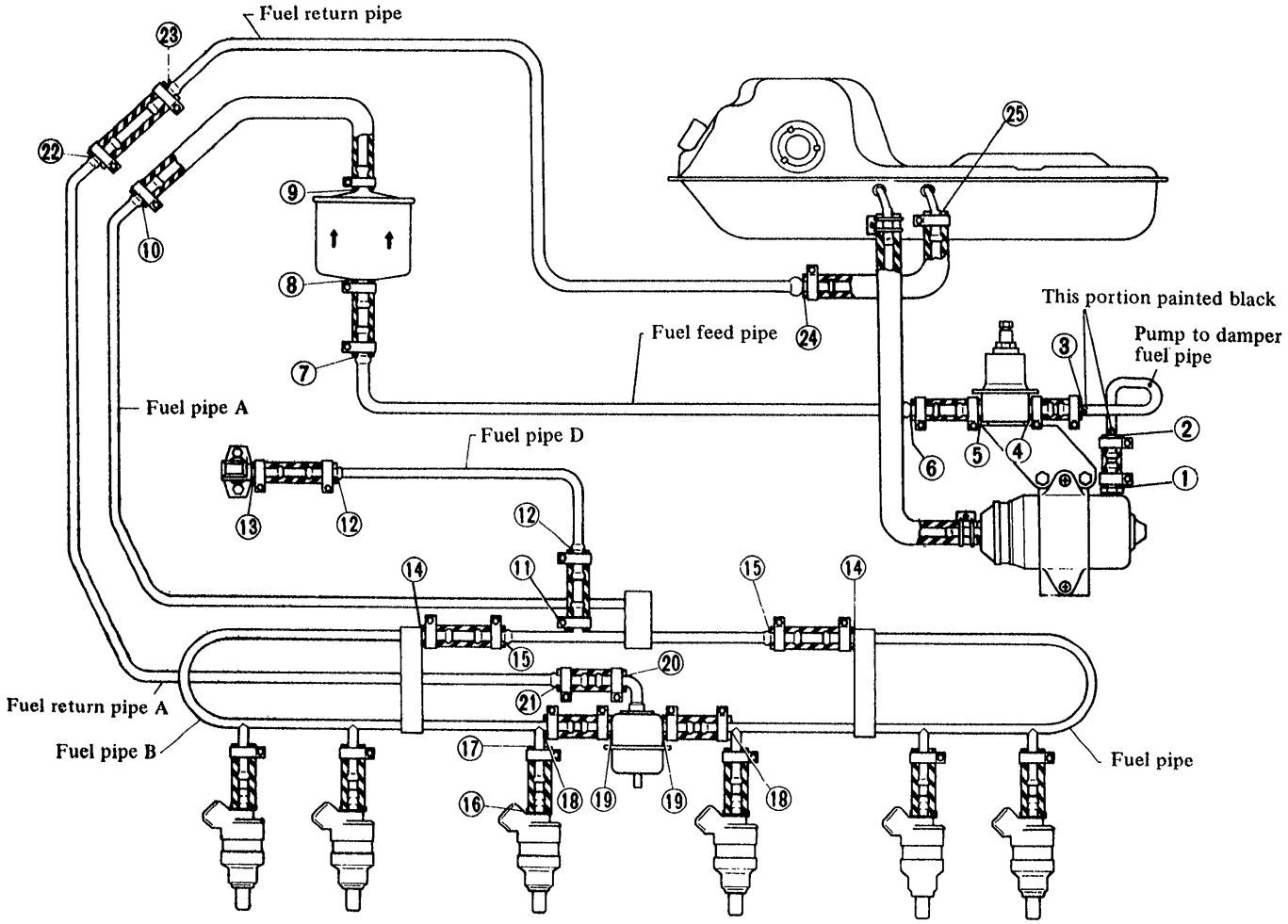
㉔* Push end of rubber hose onto fuel return pipe until it contacts inner bulge.

㉕ Push end of rubber hose onto fuel tank inlet pipe connector until it is 30 mm (1.181 in) from end of pipe. Be careful not to insert rubber hose to bend portion of connector.



Unit: mm (in)

Fig. EF-136 Fuel return pipe to fuel tank rubber hose



EF755

Fig. EF-137 Fuel rubber hoses