

Chapter 2 Air Intake System

I. Airflow Sensor

1.Sensor position is as below:



It is integrated with intake air temperature sensor and inlet pressure sensor.

1.The air flow meter is Karman vortices air flow meter.

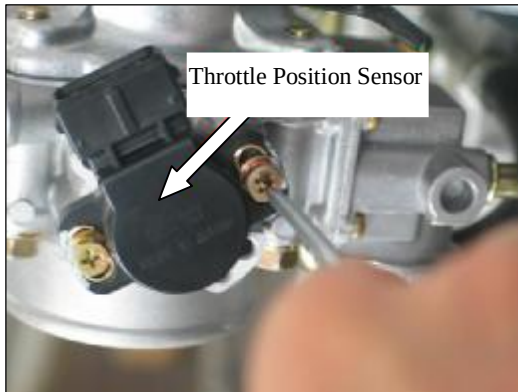
2.Features:

- A. Small air intake resistance
- B. Quick response, high precision
- C. High cost

2.Sensor Structure Principle

The air goes through rippling device and swirl pole and then generates swirl variation, which makes variation bank librated. The distortion of strain thread will generate variation signal, which is tuned into rectangular wave and detect the airflow through rippling device. It will provide engine ECU with inlet air signal. ECU will calculate and decide the drive time of basic fuel injection with this signal and engine rotating speed signal.

II. Throttle Position Sensor



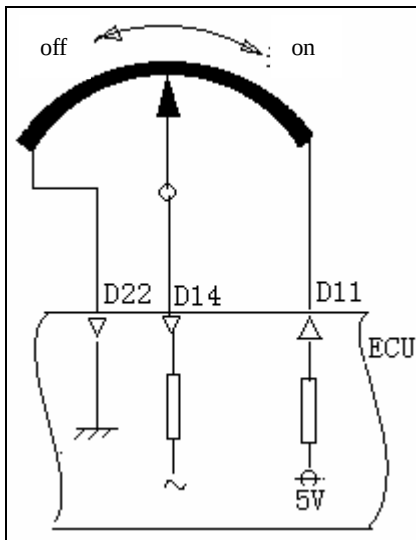
1.Type:

Potentiometer

2.Structure Feature:

Position sensor is combined with idle speed switch.

It includes resistance loop, conducting device and mobile contact point. The mobile contact point is linked to throttle axle and sliding on resistance loop, which change resistance impedance to affect output voltage. If ECU detects different throttle position, it will calculate the drive time of fuel injection according to the voltage signal.



D11--Sensor power supply (12V)

D14--Throttle position sensor

When ignition switch in ON, the voltage of idle speed position is 0.3-1.0V and the voltage of wide open throttle is 4.5-5.5V.

Check

Remove harness joint from TPS joint.

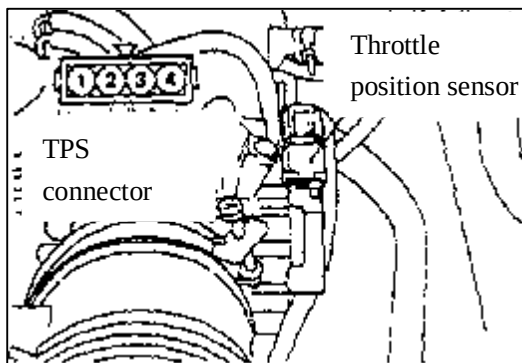
Measure the resistance value between 1# and 3# terminal from TPS joint side.

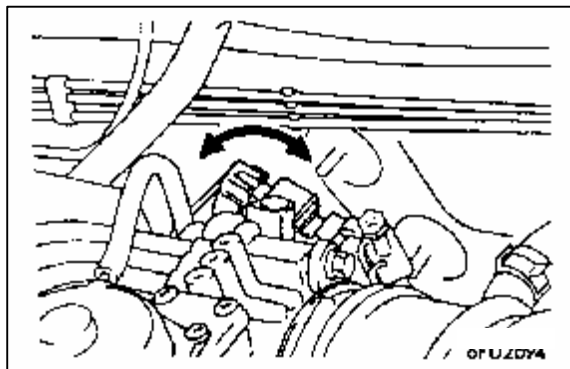
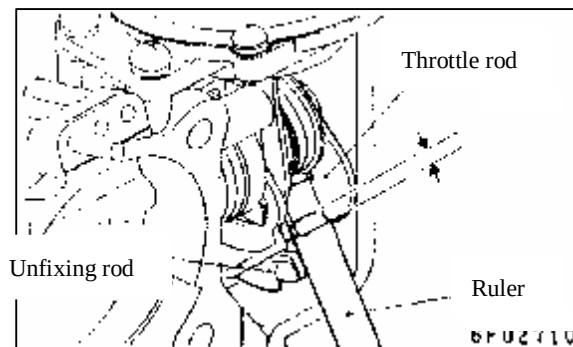
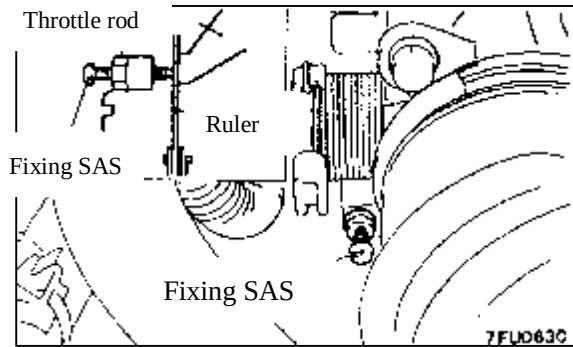
Standard Value: 3.5~6.5K Ω

Measure the resistance value between 1# and 2# terminal from TPS joint side.

Normal Status:

Throttle open gradually from idle position until it is wide open. The resistance value is proportionable to the open angle of throttle, otherwise please replace throttle position sensor.





Adjustment

(1) Connect MUT-II to diagnostic troubleshooting connector.

(2) Insert intermission gauge into the place between fixed SAS and throttle pole as follow (vehicle without positioning control system) . The thickness of intermission gauge is 0.45mm.

〈Vehicle with positioning control system〉

Insert a 1.4mm-thick intermission gauge into the place between fixed SAS and throttle pole. The insertion depth is 3mm.

Note: The insertion depth can't be more than 3mm. Otherwise the open angle of throttle pole will be more than pre-defined angle, which will cause incorrect adjustment.

(3) Turn ignition switch to ON (don't start on engine)

(4) Loosen installation bolt of throttle position sensor and then turn around throttle position sensor counter-clockwise to its limitation position.

(5) Under the status, check if idle speed position switch is ON with MUT-II "DATA LIST" or ohmmeter.

(6) Turn around slowly throttle position sensor clockwise until idle speed position signal is turned from ON to OFF. And then fasten the fasten bolt of throttle position sensor.

(7) Check the output voltage of throttle position sensor.

Standard Value: 400~1000mV。

(8) If different from standard value, please check throttle position sensor and related harness.

(9) Remove thickness gauge.

(10) Turn ignition switch to OFF and remove MUT-II.

**Idle Speed Position Switch Check**

- (1) Remove harness joint from TPS joint.
- (2) Check the conductivity between 1# and 2# terminal on throttle position sensor joint.

Normal Status:

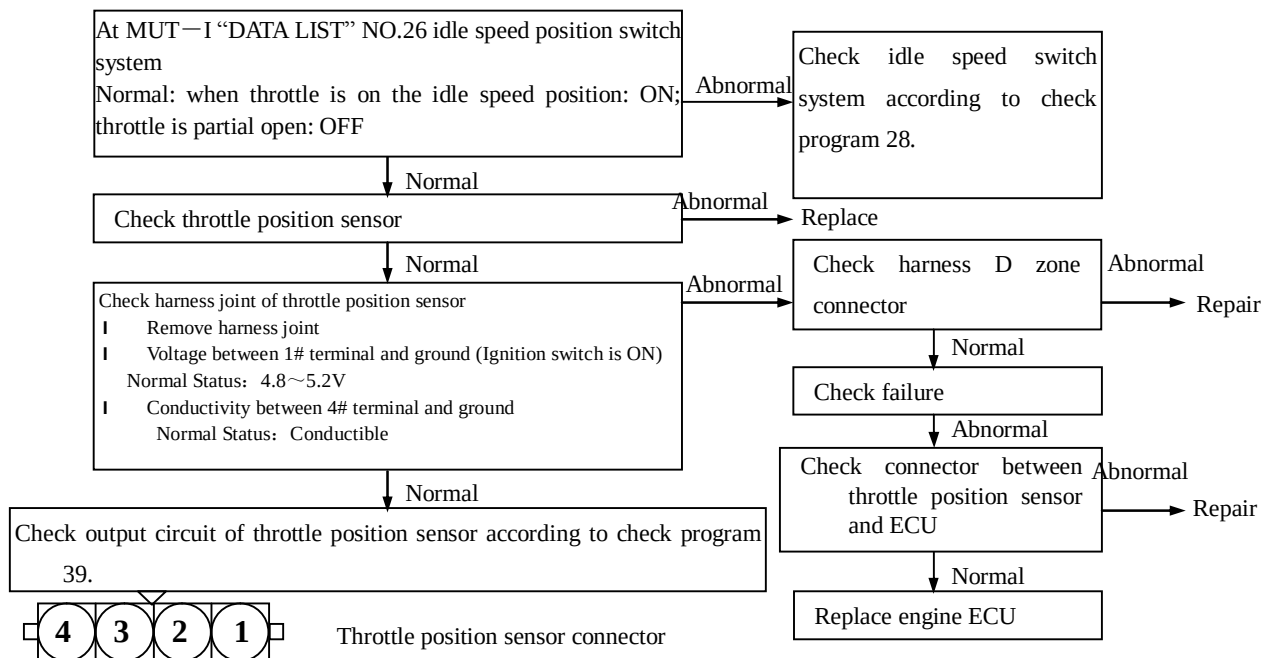
Accelerator Pedal	Conductivity
Step on	Non-conductible
Loosen	conductible (0Ω)

- (3) If it disobey specification requirement, please replace throttle position sensor.

Note: After replacement please adjust idle speed position switch and throttle position sensor.

2. Diagnostic Troubleshooting

Error Code NO.14 Throttle Position (TPS) Sensor System	Possible Reasons
Check Area I Ignition switch: ON I Ignition switch ON last 60 seconds or engine start on Setup Condition I Engine idle speed position is ON and sensor output voltage is above 2V for more than 4 seconds. I Output voltage of the sensor lasts 4 seconds below 0.2V.	I Throttle position sensor is in failure or malfunction I Contactor contact defect of throttle position sensor circuit, broken circuit or short circuit of sensor I Abnormal “ON” status at idle speed position switch I The signal cable of idle speed position is short. I Engine ECU failure



III. Intake Air Temperature

Sensor

calculated to adjust injection drive time.

Intake air temperature sensor Check

- (1) Remove harness joint on airflow sensor.
- (2) Measure resistance value between 5# and 6# terminal on airflow sensor.

Standard value:

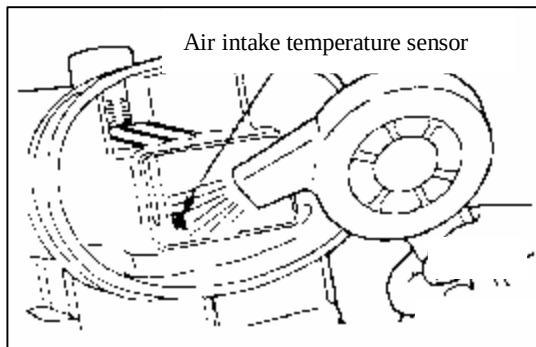
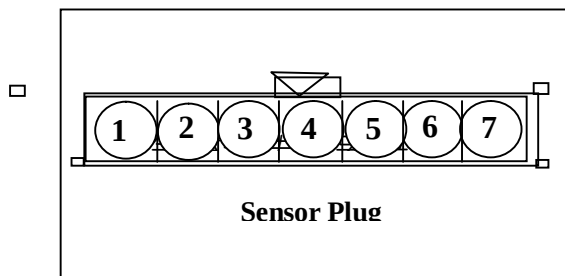
2.3-3.0K Ω (at 20℃)

0.30-0.42K Ω (at 80℃)

- (3) Use motor blower to heat intake air temperature sensor and measure the resistance value again.

Normal status: temperature increase and resistance value decrease.

- (4) If resistance value is different from standard value or resistance value keep unchanged, please replace airflow sensor assembly.



Intake air temperature sensor is integrated with vortices airflow meter.

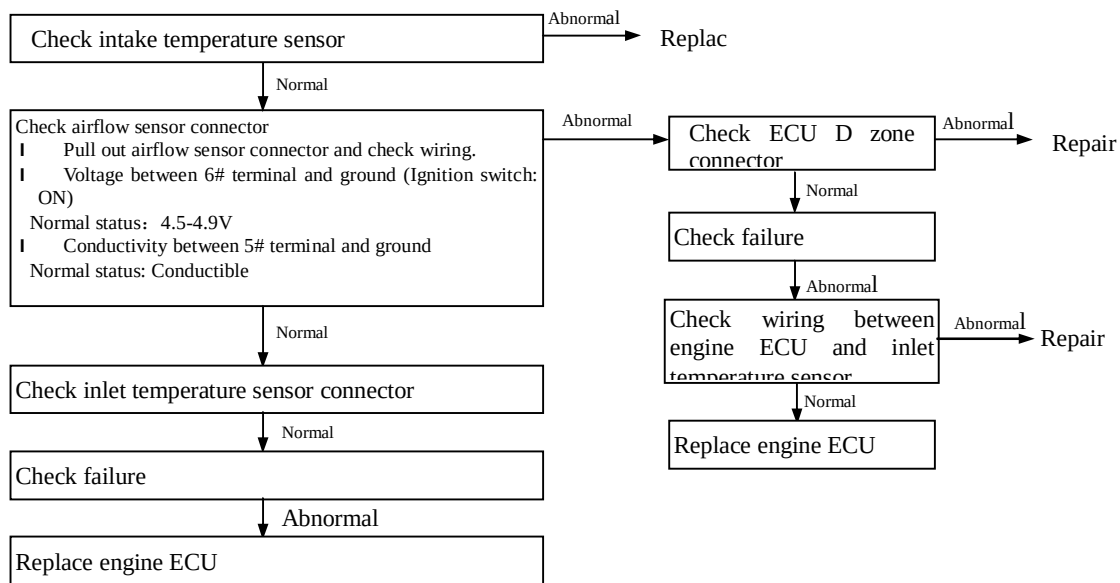
1.Type—Negative temperature coefficient thermo resistance

2.Structure Feature--A thermo resistance which is installed on the upper of AFS swirl pole back, will turn the detected inlet temperature into voltage and then transfer electric signal to ECU. The input signal will be



Diagnostic Troubleshooting

Error Code No.13 Intake Air Temperature Sensor System	Possible Reasons
Check - Ignition switch: ON - Ignition switch ON last 60 seconds or engine start on Setup Condition - Output voltage of the sensor lasts 4 seconds above 4.6V (equals to inlet air temperature is below -45°C). - Output voltage of the sensor lasts 4 seconds below 0.2V (equals to inlet air temperature is below 125°C).	- Throttle position sensor failure - Joint contact defect of intake air temperature sensor harness, broken circuit or short circuit of sensor - Engine ECU failure





IV. Barometric Pressure Sensor

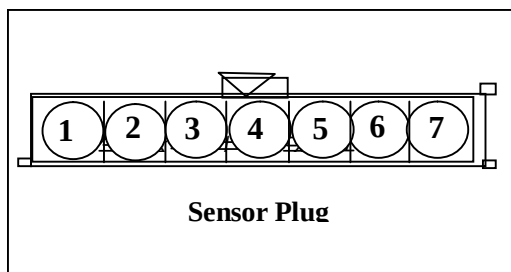
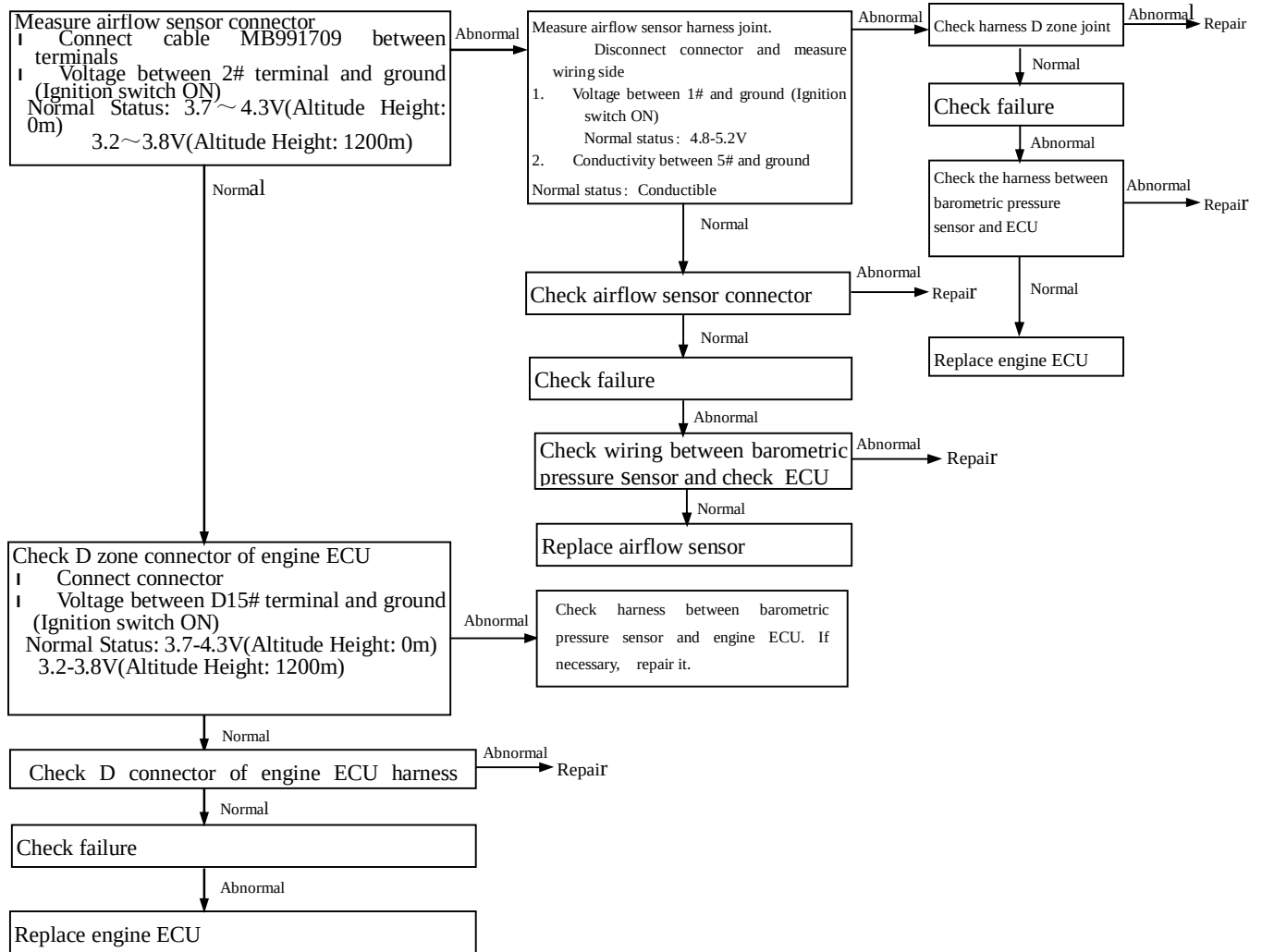
Barometric pressure sensor is integrated with vortices airflow meter.

1.Type--Semiconductor pressure strain

2.Principle--Absolute pressure is measured through the pressure difference between swirl pole and then turned into voltage signal, which is output to ECU for the drive time calculation of fuel injection.

Diagnostic Troubleshooting

Error Code No.25 Barometric Pressure Sensor System	Possible Reasons
Check condition - Ignition switch: ON - Ignition switch ON last 60 seconds or engine start on - Battery voltage is below 8V Setup Condition - Output voltage of the sensor lasts 4 seconds above 4.5V (equals to barometric pressure is below 114 KPa) or - Output voltage of the sensor lasts 4 seconds below 0.2V (equals to barometric pressure is below 5.33 KPa).	- Barometric pressure sensor failure - Harness joint contact defect, broken circuit or short circuit of sensor - Engine ECU failure

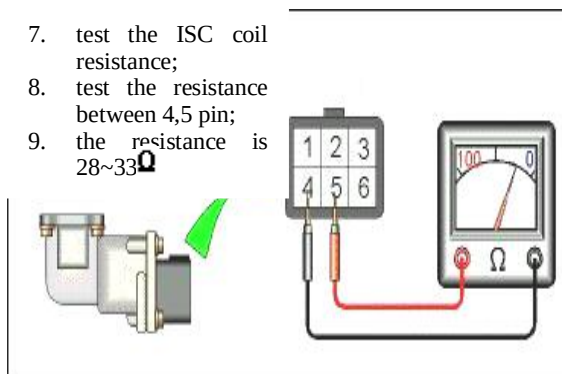
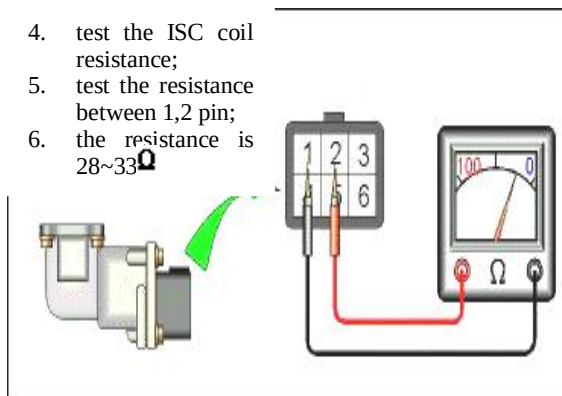
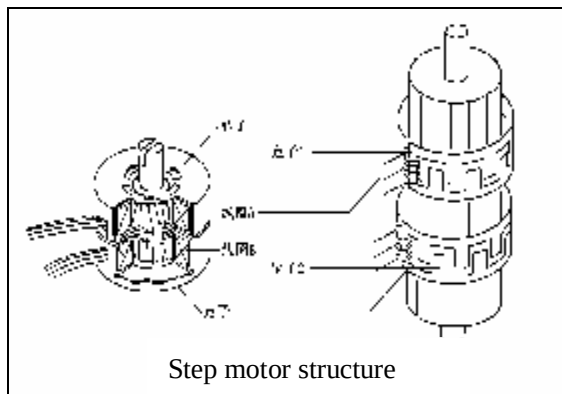
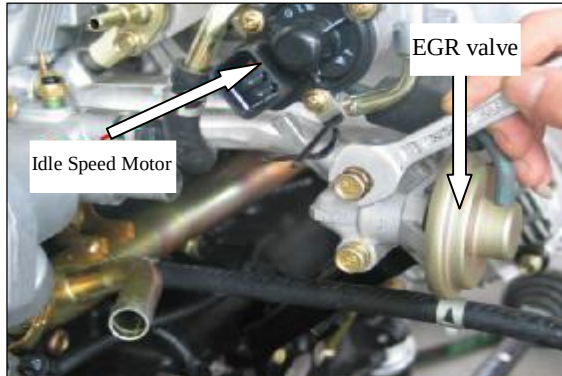


Sensor Plug

Note: Barometric pressure sensor is embedded in airflow sensor, so refer to airflow sensor connector for the joint terminal of barometric pressure sensor.

V. Idle Speed Motor

1. Idle Speed Motor Component Position Figure



1. test the ISC coil resistance;
2. test the resistance between 5,6 pin;
3. the resistance is 28~33Ω



To keep idle speed status and operation load of engine stable, stepper motor is moving forward or backward according to pre-defined control status, which controls the airflow through throttle and keeps idle speed at best status.

ISC system is in control and actual idle speed is calculated by ECU. If actual idle speed is different from target idle speed, you may drive stepper motor speed feedback control in order to adjust actual speed to target speed.

In order to process the load of air conditioners etc., stepper motor (STM) position control also may drive stepper motor to target position.

Check

(1)Action sound check

①Confirm engine coolant temperature is below 20℃.

Note: If engine coolant temperature is above 20℃, you may remove the harness joint of engine coolant temperature sensor and connect another coolant temperature sensor which is below 20℃ with it.

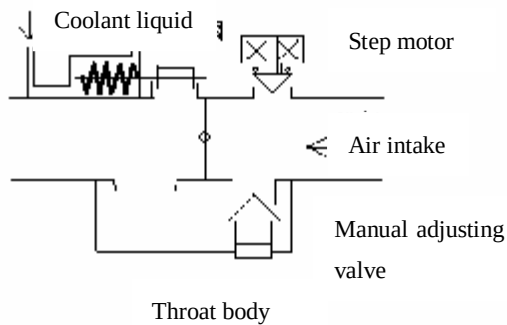
②When ignition switch is turned to ON (don't start on engine), check if there is action sound from stepper motor.

③If there is no action sound from stepper motor, please check the drive circuit of stepper motor. If drive circuit is OK, it maybe caused by the defect of stepper motor or engine ECU.

(2)Coil resistance check

Standard Value:28-33Ω(at 20℃)

VI. Throttle Body Structure



There are 3 inlet tubes of throttle body.

The airflow volume of main inlet tube is controlled by throttle. The throttle axle is connected to throttle sensor (throttle position sensor and idle speed switch). The throttle position change is turned into electric signal by sensor and transferred into ECU.

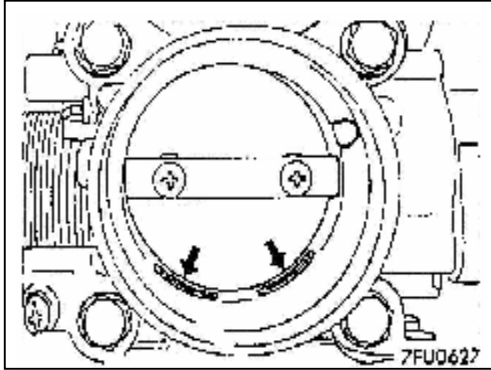
The other two inlet tubes are bypass inlet tubes. The airflow of one bypass inlet tube is adjusted by helical pin valve. The airflow of the other bypass inlet tube is adjusted by pin valve driven by stepper motor and protected by coolant temperature control valve.

Engine idle speed is controlled by ECU. The pin valve is driven by stepper motor, which may adjust airflow. No manual adjustment is required.

The airflow is controlled by the position of helical pin valve in bypass tube.

Because engine idle speed is controlled by total airflow, the airflow of each tube affects each other. Stepper motor is a mechanism that controls airflow during engine idle speed running, so it can't be closed. If new engine is running at idle speed (no load on engine), the frequency of stepper motor is about 20 steps, while after running-in, if it is running at idle speed (no load on engine), the frequency of stepper motor is about 10 steps.

VII. Throttle Body Cleanness



Throttle Body Cleanness

- (1) Start and preheat engine until coolant temperature reaches 80 °C or more, and then stop engine.
- (2) Remove inlet soft tube from throttle body.
- (3) Stem bypass induction port of throttle body.

Note: Don't let cleanser into bypass tube.

- (4) Inject the cleanser into valve through throttle body induction port and keep for 5 minutes.
- (5) After starting engine, racing several times at high speed and then running at idle speed for 1 minute. If instable idle speed or engine flameout due to stemmed bypass tube, you can open throttle partially, which make engine run well.
- (6) If deposit inside throttle fails to be cleaned up, please repeat step (4) and (5).
- (7) Pull out the plug of bypass inlet port.
- (8) Connect inlet soft tube.
- (9) Clear diagnostic code with MUT-II.
- (10) Adjust basic idle speed.

Note: If there is interrupted vibration during engine running at idle speed after basic idle speed adjustment, please keep battery cathode disconnected for more than 10 seconds and then re-connect it, the engine run at idle speed for about 10 minutes.