

Chapter 1 Electronic Injection Control and Actuation Element Operation Theory

1. Intake Air Pressure and Intake Air Temperature Sensor

Application: To measure the absolute pressure of intake manifold (Approximate 0.1 bar) and the temperature of intake airflow to provide the load information to the engine, which can automatically check the elevation depending on the **volume effects**.

Structure and Working Principle: This sensor is comprised of two sensors, namely is the combination of the **intake manifold absolute pressure sensor** and the **air intake temperature sensor**, which is assembled on the intake manifold.

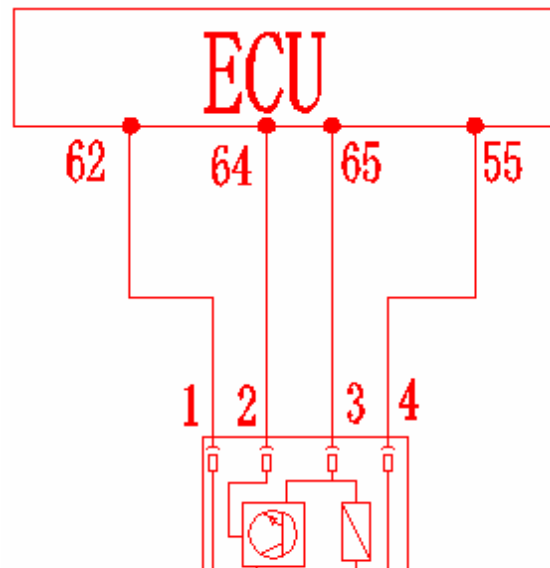
Intake Air Pressure Sensor is secured on the air intake pipe directly by means of one bolt and uses two sealing rings to prevent the leakage. This scheme can omit the connection hose between the intake pressure sensor and the air intake pipe and also bear good response against the fluctuated air pressure. The pressure sensor judges the elevation depending on the air intake efficiency of the engine (Dynamic air pressure correction).

Air Intake Temperature Sensor is one negative temperature coefficient thermistor (NTC), of which the resistance may reduce following the temperature increasing. The system supplies the sensor with one 5V reference voltage and the ECU can calculate the sensor resistance depending on the voltage variation of the sensor so as to achieve the temperature information of the engine.

Fault diagnosis: The subsequent electronic device of intake air pressure sensor can detect faults such as open circuit, short circuit and damage to sensor, etc. When ECU detects output signal from the sensor falls beyond characteristic curves, it shall judge that something is wrong with the sensor. For example: when air intake pressure is higher than upper limit, or lower than lower limit, the ECU will judge as the breakdown of the sensor (The intake



Intake manifold absolute pressure/air intake temperature sensor



Intake air pressure and temperature sensor

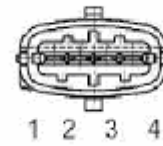
Circuit for sensor of air absolute pressure and temperature in intake manifold

Pins:

- 1 Intake air pressure signal (corresponding ECU62#)
- 2 Standard 5V power supply (corresponding ECU64#)
- 3 Sensor earth wire (corresponding ECU65#)
- 4 Intake air temperature signal (corresponding ECU55#)

pressure is below the lower limit during engine start, however the ECU can judge the engine start working condition) and at the same time turn on engine trouble indicator to run under trouble mode.

Recover Solution: In case of the temperature sensor failure, the system will set at one fixed temperature grade (approximate 50°C) and the engine will enter into trouble mode. In case of pressure sensor failure, the intake pressure will be set as 1024MBAR while the actual air intake volume is calculated based on the throttle position sensor and the engine speed. In case the throttle position sensor is failure at the same time, then the intake pressure will be set at 600Mbar. Under all failure working conditions, the system self-learning function will fail.



Note: In case of intake air pressure sensor failure, the vehicle may not ignite and start normally.

When the pressure sensor signal wire is short-circuit towards the 5V or 12V power supply, the vehicle may not ignite and start normally.

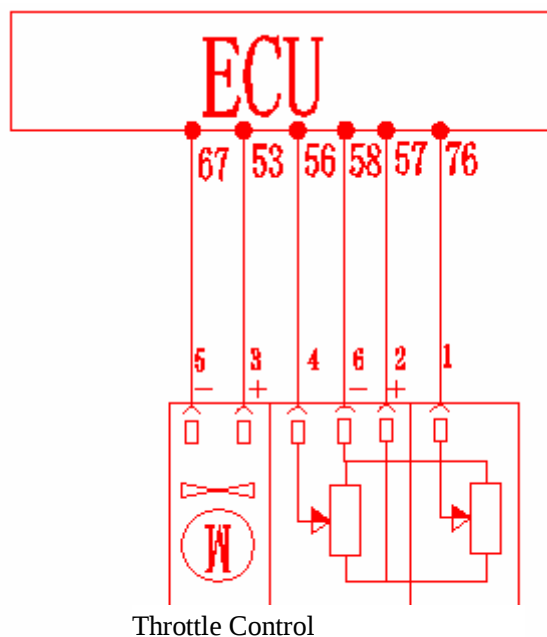
2. Electric Throttle Valve Body Assembly

Application: This system is used to drive the rotation of throttle valve and monitor the open extent of the throttle valve and the rotation position of the stepping motor. The two throttle valve position sensors are used to monitor the throttle valve position and the stepping motor position. The two sensors have inversed signals and the absolute values of both sensors shall be equal, otherwise the ECU will judge as the system trouble and the engine will enter into trouble mode.

Structure and Working Principle: The electric throttle valve adjusts the engine load by means of the signal of the electric pedal, which takes advantage of one DC motor to control the open extent of the throttle valve so as to drive the engine from idle position to full load. The feedback signal of the throttle open extent and the DC motor position are provided by the two potentiometers integrated in the throttle valve body. The open and close of the throttle valve is controlled by these two potentiometers, of which the power supply and the earth wire are public shared. The slide of both potentiometers is directly connected with the throttle valve shaft, of which one potentiometer has plus signal as another one has inversed signal (The equal absolute values denote the same information).

Fault Diagnosis: The ECU monitors the rotation angle of two throttle position sensors and checks if they are beyond the upper limit or the lower limit of the signal output. When the signal output is beyond the upper/lower limit, or when the signal outputs of both throttle position sensors aren't equal, then the ECU judges as the breakdown of the throttle position sensors and the engine runs under the trouble mode with the turn-on of the engine trouble light.

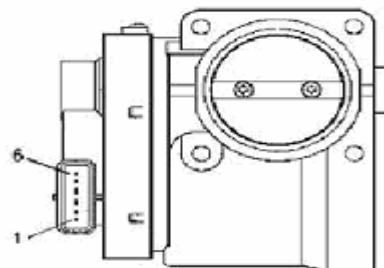
Trouble Light Status: In case of the system trouble, the engine trouble light will turn on and the engine will run under trouble mode.



Circuit Diagram of Throttle Position Sensor

Pins:

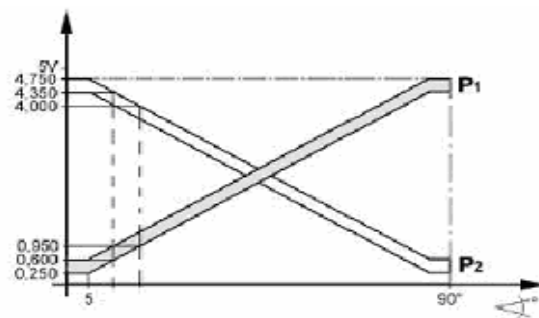
1. Throttle position sensor 1 (Corresponding ECU76#)
2. Throttle position sensor power supply (Corresponding ECU57#)
3. Positive pole of throttle control motor (Corresponding ECU53#)
4. Throttle position sensor 2 (Corresponding ECU56#)
5. Negative pole of throttle control motor (Corresponding ECU67#)
6. Throttle position sensor earth (Corresponding ECU58#)



Installation: Installed at the end of the plastic intake pipe.

Note: When check the throttle body for actuation, turn on the ignition key and step the accelerator pedal during the system self-examination to observe if the throttle valve body is actuated.

Valve body appearance



Sensor Characteristic Curve

3. Coolant Temperature Sensor

Application: When the engine temperature is very low, the fuel has relevant poor evaporability that is difficult to generate turbulent flow and a large amount of fuel is absorbed upon the inner surface of the air intake pipe. And during the start of the engine, the resistant force of the engine mechanical part and the viscosity of the lubrication oil resulted that the engine speed is very low during the engine start. Therefore, the ECU obtains the water temperature information from the water temperature sensor, concentrates the mixed air, and controls the ignition timing and the fuel injection pulse width during the engine start, idle and normal running.

Structure and Working Principle: This sensor is a thermistor of negative temperature coefficient (NTC), and its value will decrease with the coolant temperature increasing but the changes are not linearity. Thermo-sensitive resistor with negative temperature coefficient is installed inside a copper heat conductive sleeve. ECU through a voltage division circuit converts change of thermo-sensitive resistance to that of voltage sent to ECU, thus monitoring change of water temperature (ECU inner structure).

Fault Diagnosis:

Coolant temperature above the upper limit;

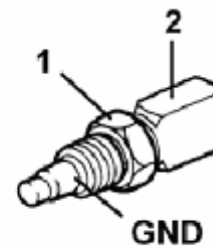
Coolant temperature below the lower limit;

Water temperature not reaches the specified temperature within specified time period;

Sensor line's short-circuit/open-circuit toward earth wire;

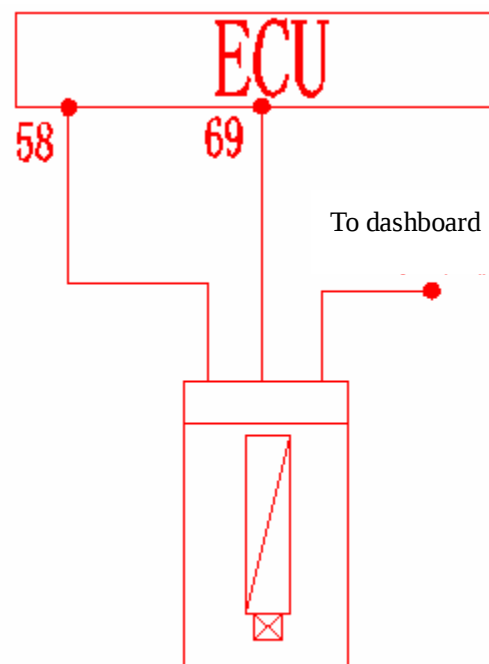
Sensor line's short-circuit/open-circuit toward power supply.

Trouble Light Status: When the ECU detected the water temperature is above or below the limit value, the trouble light will turn on; when the water temperature signal is unstable, the engine will



Coolant Temperature Sensor Diagram

Pin: This sensor has 3 pins in total.



Water temperature sensor

Coolant Temperature Sensor Circuit Diagram

1 Water temperature sensor earth wire (To ECU58#);

2 Water temperature sensor signal (To ECU69#);

3 To instrument.

Hint: This vehicle is equipped with one water temperature sensor. The water temperature signal of the instrument is provided with engine water temperature signal by one sensor pin.

Note: The instrument water temperature signal is powered by the instrument and the earth is through



record the trouble code but the engine trouble light the earth of the sensor housing.
won't turn on.

Reference Data:

Resistance at 20° is approximately 2.45 K Ω (To ECU)

The instrument water temperature pin and the resistance at 80° is approximately 0.05 K Ω

Installation Requirement: Tightening torque is 15 $\pm$ 2Nm

4. Knock Sensor (KS)

Application: Many reasons will result the engine knock including high temperature, ageing, or wear-out of mechanical parts, or the usage of low knock-resistance fuel. The long-term continual knock will damage the engine. In order to prevent the continual engine knock, the ECU will continually monitor and correct the ignition advance angle and the mixed air concentration.

This sensor is installed on the cylinder body of the engine, which will output one electric signal in case of engine knock.

Working Principle: This sensor is made of piezoelectric crystal to convert the engine mechanical shock into mutative electric signal (mv). The sensor and the ECU are connected with the shielded line. The knock sensor is installed under the manifold of the engine cylinder, between the cylinder 2 and cylinder 3. The sensor is installed within one hole with specific dimensions.

Fault Diagnosis: the ECU monitors the various sensors, actuators, power amplifier circuits and detection circuits. The malfunction flag bit of the knock sensor will be set upon detecting either of following conditions:

Fault of knock sensor

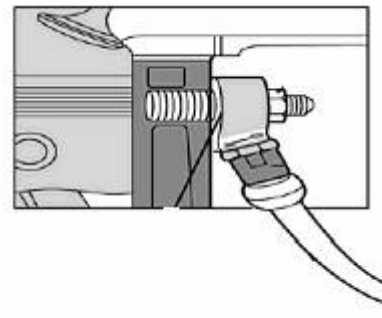
Fault of data processing circuit in knock sensor

Identification signal can not be used.

After the sign digit of fault is set at knock sensor, the knock closed loop control will be closed; the ignition advance angle saved in ECU will be reduced by a safe angle. The sign digit of fault resets.

Trouble Light Status: The engine trouble light will turn on once the knock sensor is with unstable signal or with wrong signal.

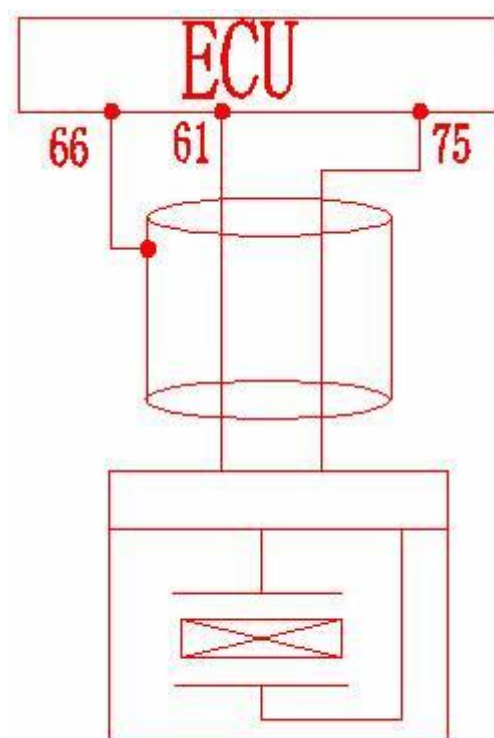
Installation Requirement: The tightening torque shall be $20 \pm 5 \text{ Nm}$ (The tightening torque directly



Knock sensor with cable



Single body knock sensor



Knock sensor

Circuit Diagram of Knock Sensor



affects the system operation).

Recover Solution: In case of sensor failure, the engine management system will rapidly reduce the ignition advance angle so as to protect the engine.

Pins:

- 1 Knock signal - (Corresponding ECU61#)
- 2 Knock signal + (Corresponding ECU75#)
- 3 Knock sensor shield (Corresponding ECU66#)

The shield wire package of sensor wraps around the signal wire.

5. Front Oxygen Sensor

Application: The oxygen sensor is one must part for the engine to ensure the efficient operation of the 3-way catalytic converter. During the closed loop control, the concentration of the mixed air is guaranteed by the oxygen sensor, which measures the oxygen residue concentration information within the air exhaust. The sensor is installed on the exhaust general pipe, closing the manifold nearby. The sensor continually checks the oxygen concentration within the air exhaust and continually corrects the fuel injection pulse width (thinner or thicker) so as to guarantee the air/fuel ratio within one very narrow range of 0.980~1.020. The normal working temperature of the oxygen sensor is approximately 300°C and it's attached with heating coil. When powered, the sensor can be automatically heated. Taking advantage of this device can make the sensor reach the working temperature rapidly so as to make it possible to install the sensor on the relevant cold area of the exhaust pipe. When the ECU detected that the mixed air concentration is too thin, then the system will automatically thicken the mixed air. When fully loaded or under fuel shut mode, then the system won't adopt the signal of the oxygen sensor, which mode is referred as the open loop control mode.

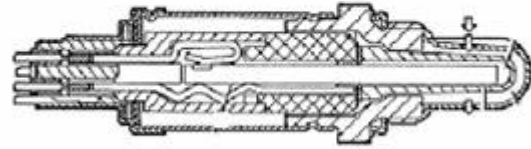
Structure and working principle: The sensor element of oxygen sensor is a ceramic tube with pores, outside of the tube is surrounded by the exhaust of the engine and inside is connected to atmosphere.

The working voltage of the oxygen sensor is fluctuated within 0.1~0.9V and it will fluctuate for more than 5 times within 10s. When below such frequency, it denotes that the sensor is aged and shall be replaced. It will not be resumed.

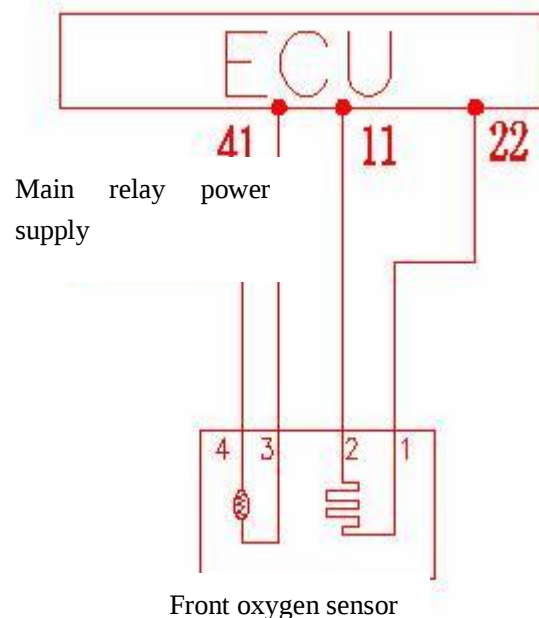
Fault diagnosis:

Oxygen sensor signal fault;

Oxygen sensor signal higher than upper limit;



Oxygen sensor structural diagram



Oxygen Sensor Circuit Diagram

Every joint has four pins:

- 1 Front oxygen sensor signal + (corresponding ECU22#);
- 2 Front oxygen sensor earth - (corresponding ECU11#);
- 3 Front oxygen sensor heating control (corresponding ECU41#);
- 4 Connect to main relay power supply.

Oxygen sensor lower than lower limit;

Mixed air self-adjustment concentration failure.

Trouble Light Status: trouble light will be turn on when the sensor is short circuit to power supply, open circuit to earth, or the signal exceed the tolerance scope.

Installation requirement: The tightening torque of the oxygen sensor shall be 50~60Nm. After the replacement of the oxygen sensor, the oxygen sensor shall be applied with one layer of anti-rust oil to prevent the inability of disassembly after getting rust. Normally, the oxygen sensor shall be disassembled under heated status. All the oxygen sensors are equipped with cables which covered by the fireproof asbestos sleeve. The other end of the cable is electric connector.

6. Rear Oxygen Sensor

Application: This sensor is used to monitor the oxygen concentration within the emission after passing the 3-way catalytic converter. The engine ECU compares the monitored signals of the front oxygen sensor and rear oxygen sensor so as to monitor the working efficiency of the 3-way catalytic converter.

Structure and working principle: The sensor element of oxygen sensor is a ceramic tube with pores, outside of the tube is surrounded by the exhaust of the engine and inside is connected to atmosphere.

The working condition of the rear oxygen sensor is quite difference compared with the one of the front oxygen sensor. Under the conditions of normal operation of the 3-way catalytic converter and the engine, when reading the data stream by means of the diagnostic tester, its data will always be within one very narrow range with slight variation (below 100mv).

Fault diagnosis

Oxygen sensor signal fault;

Oxygen sensor signal higher than upper limit;

Oxygen sensor lower than lower limit;

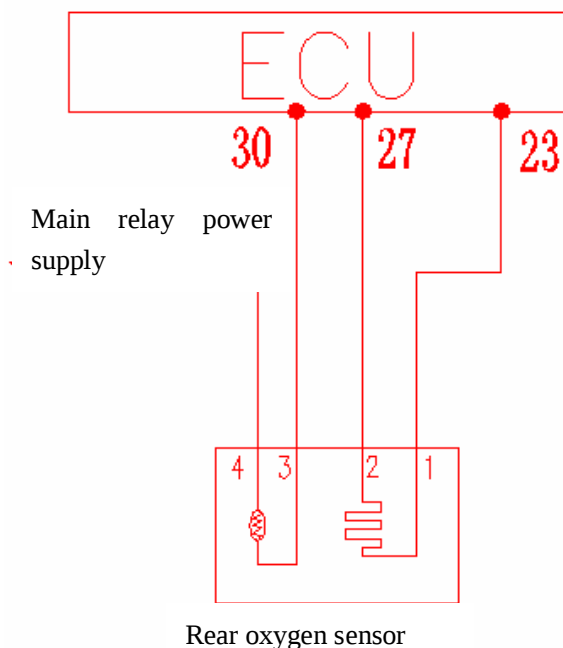
Mixed air self-adjustment concentration failure.

3-way catalytic converter damaged.

In case of rear oxygen sensor trouble signal, the ECU will control to turn on the trouble light to remind the timely replacement of the 3-way catalytic converter.

Trouble Light Status: trouble light will be turn on when the sensor is short circuit to power supply, open circuit to earth, or the signal exceed the tolerance scope.

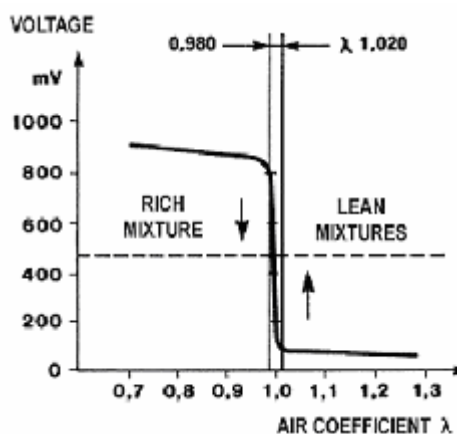
Installation Requirement: The tightening torque



Oxygen Sensor Circuit Diagram

Every joint has four pins:

- 1 Rear oxygen sensor signal (corresponding ECU109#)
- 2 Rear oxygen sensor earth (corresponding ECU112#)
- 3 Rear oxygen sensor heating control (ECU43#)
- 4 Connect to main relay power supply



Sensor Characteristic Curve

of the oxygen sensor shall be 50~60Nm. After the replacement of the oxygen sensor, the oxygen sensor shall be applied with one layer of anti-rust oil to prevent the inability of disassembly after getting rust. Normally, the oxygen sensor shall be disassembled under heated status. All the oxygen sensors are equipped with cables which covered by the fireproof asbestos sleeve. The other end of the cable is electric connector.

6. Electric Control Unit (ECU)

Application: ECU is the core of the engine electric control system. This ECU communicates the sensors with the Transmission Control Unit (TCU) and depending on the shift request controls the fuel injection and ignition so as to control the engine torque output indirectly. The sensors provide the ECU with all signals for electric controls and then the ECU controls the sequent actuator operations after the internal calculations so as to control the engine operation.

Composition: The housing with shield and the print circuit board, on which integrated many electric control units to control the electric fuel injection system (mainly micro electric integrated circuits).

Installation: Installed under the dashboard. The installation site is same with one of other vehicle models of series S and shares one same bracket with the TCU with 80-pin connector.



ECU external and internal configuration figure

Pin Definition:

PIN	I/O	Function	Instruction	PIN	I/O	Function	Instruction
1	Input	Power earth 1	Engine earth	2	Input	Power earth 2	Engine earth
3	Idle			4	Input	Sensor earth	Body earth 1
5	Output	Control fuel pump	Control fuel pump relay	6	Idle		
7	Input	Power steering	Power steering signal	8	Idle		
9	Idle			10	Output	Power supply	Accelerator position sensor positive wire 1
11	Input	Oxygen sensor signal	Front oxygen sensor signal	12	Idle		
13	Idle			14	CAN	CAN signal	CAN signal -
15	Input	Earth wire	Accelerator pedal position sensor earth wire	16	Idle		
17	Input	Positive wire	Air conditioner relay control	18	Input	Brake signal	Brake signal input
19	Input	Positive wire	Air conditioner request	20	Idle		
21	Idle			22	Input	Front oxygen sensor signal	Front oxygen sensor signal +
23	Input	Input	Rear oxygen sensor signal -	24	Idle		
25	Input	CAN	CAN signal +	26	Idle		
27	Output	Earth wire	ECU earth	28	Input	Long flame	Not through key main power
29	Idle			30	Input	Control line	Rear oxygen heating control
31	Output	Frequency signal	Revolution signal	32	Input	Control line	High speed fan control line
33	Idle			34	Idle		
35	Input	Positive wire	Brake signal	36	Output	Power supply wire	Accelerator position sensor positive wire 2
37	Input	Signal wire	Rear oxygen signal +	38	Input	Power supply wire	Through ignition switch power
39	Input	Signal wire	Evaporation chamber temperature sensor	40	Idle		
41	Input	Earth control	Front oxygen heating control	42	Input	Earth control	Low speed fan control
43	Input	Frequency control	Carbon canister electromagnetic valve control	44	Input	Frequency	Vehicle speed sensor input
45	Idle			46	Input	Continuous signal	Diagnosis line K
47	Idle			48	Input	Linear signal	Accelerator pedal position sensor 2
49	Input	Linear signal	Accelerator pedal position sensor 1	50	Idle		
51	Idle			52	Output	Earth signal	Trouble indicator
53	Output	Power supply	Throttle valve motor +	54	Input	Frequency signal	Resolution signal-
55	Input	Analogue signal	Intake temperature signal	56	Input	Analogue signal	Throttle position sensor signal 2
57	Input	Power signal	Throttle position sensor power supply	58	Input	Earth wire signal	Throttle position sensor earth wire
59	Idle			60	Idle		
61	Input	Continuous signal	Knock signal -	62	Input	Analogue signal	Intake pressure signal
63	Idle			64	Output	Power supply wire	Intake pressure temperature sensor
65	Input	Analogue signal	Intake pressure -	66	Input	Ground wire signal	Speed/knock shield
67	Output	Pulse signal	Throttle motor -	68	Input	Frequency signal	Special speed signal +
69	Input	Analogue signal	Water temperature sensor signal	70	Input	Frequency signal	Cylinder 2 ignition coil
71	Input	Frequency signal	Cylinder 3 ignition coil	72	Input	Frequency signal	Cylinder 4 ignition coil (not connected)
73	Input	Frequency signal	Cylinder 1 ignition coil	74	Input	Frequency signal	Camshaft position sensor signal
75	Input	Frequency signal	Knock signal +	76	Input	Linear signal	Throttle position sensor signal 1
77	Input	Frequency signal	Cylinder 2 fuel injector	78	Input	Frequency signal	Cylinder 4 fuel injector (not connected)
79	Input	Frequency signal	Cylinder 1 fuel injector	80	Input	Frequency signal	Cylinder 3 fuel injector

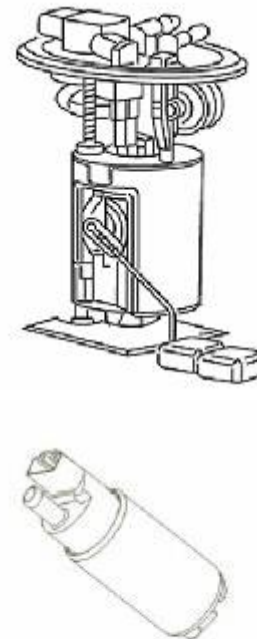
7. Electric Fuel Pump

Application: The fuel system only has one fuel supply general guide from the fuel tank to the fuel injector. Since it has no fuel return pipe from the fuel supply general guide to the fuel tank, this system is referred as limited fuel return control system. The fuel pressure regulator is installed on the fuel supply assembly, within the fuel tank.

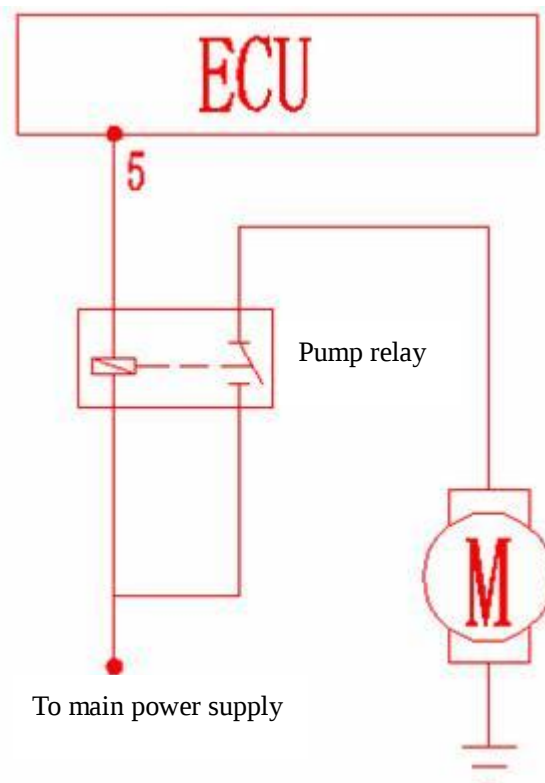
Structure and Working Principle: The electric fuel pump is made up of DC electromotor, vane pump and end cover (it's an integration of check valve, relief valve and an anti electromagnetic interference element). Pump and electromotor are coaxial assembly and within the same casing. The pump and electromotor are full of gasoline for coolant and greasing inside of the casing. The fuel pump is equipped with relief valve. When the fuel pump pressure is above **7 Bar**, in order to prevent the overheating of the fuel pump, this valve will open automatically to connect the fuel inlet and fuel outlet so as to relieve the fuel pump. The maximum pressure at the outlet of the electric fuel pump depends on the relief valve, between **450~650 kPa**. However, the pressure of the entire fuel system will fluctuate following the fluctuation of the intake manifold pressure. The difference between the system pressure and the intake manifold pressure depends on the fuel pressure regulator, normally **3,500 kPa**.

Fuel pump working temperature range:
-30~+70°C;

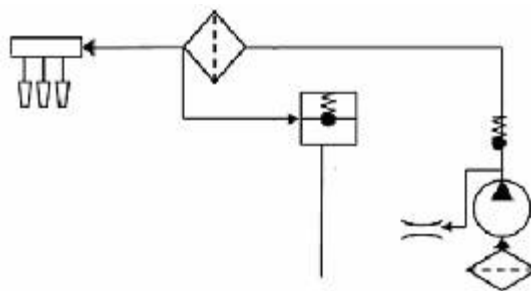
Notice: Fuel temperature has a lot influence on performance of oil pump. For long time operating at high temperature, when fuel temperature exceeds some value, pressure of oil pump sharply decreases. Therefore if engine can't start after a stop during operating, please inspect carefully for the poor performance at high temperature of oil pump.



Electric Fuel Pump Sketch



Electric Fuel Pump Circuit Diagram



System Fuel Supply Illustration

Pins: An electric fuel pump has two pins connected to pump relay. Mark “+” and “-” are carved beside the two pins on pump housing respectively, indicating positive pole and negative pole.

8. Electromagnetic Fuel Injector

Application: Depending on the ECU code, the fuel injector will inject the fuel within the specified time period (**fuel injection pulse width**) to provide the atomized fuel into the engine.

Structure and Working Principle: The ECU signals electric pulse to the fuel injector coil to form the magnetic field force. When magnetic field force increase to conquer return spring pressure, needle valve gravity and friction force, the needle valve begin to rise up and start the injection process. The max extent of rise up is not exceeding 0.1mm. When the fuel injection pulse stops, the pressure of return spring will shut the needle valve again.

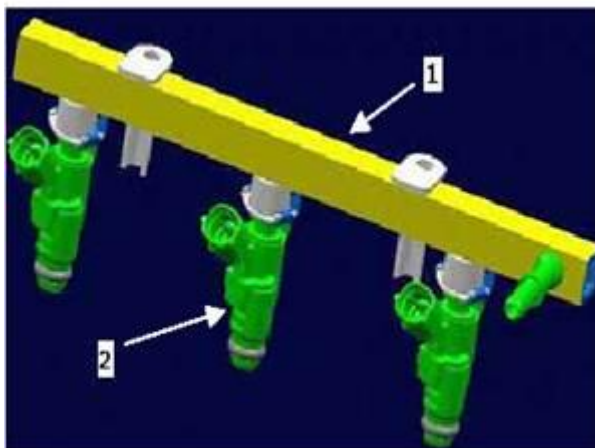
Assembly notices: A certain injector has its own plug; plugs for different injectors can't interchange for use.

For ease installation, it is recommended that the surface of O-type ring connecting to fuel distribution pipe should be spread with non-silicon clean engine oil. Be careful not to pollute the inside of injector or injector nozzle with engine oil.

Install the fuel injector into the fuel injector seat in the direction that perpendicular to the fuel injector seat and then use the clamp to secure the fuel injector into the fuel injector seat. During the installation, the installation direction must be cautioned so as to prevent the kink of the fuel injector harness.

Notice: For the vehicles left unused for a long time, the fuel adhesion in the fuel injection will cause that the vehicles that left unused for a long time can't start normally. Please check the adhesion of fuel injector carefully. It's preferable to use **disassembling-free** cleaner during the cleaning of the fuel injector.

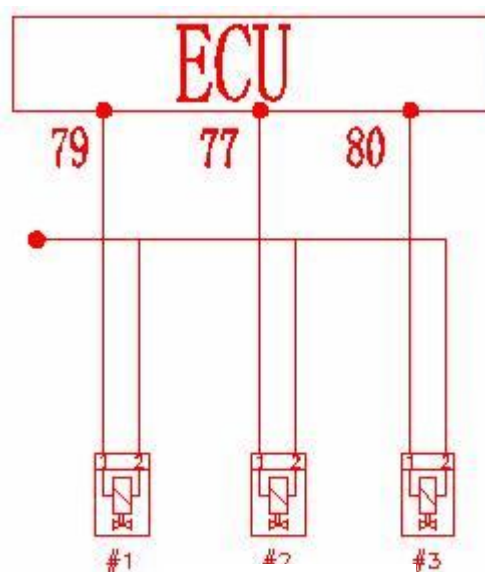
Fault Diagnosis: The electric injection system



Electromagnetic fuel injector illustration

(1) Fuel supply general guide

(2) Fuel injector



Fuel injector set

Circuit Diagram of Electromagnetic Injector

Every joint has four pins:

- 1 Fuel Injector 1# (Corresponding ECU 79#)
- 2 Fuel Injector 2# (Corresponding ECU 177#)
- 3 Fuel Injector 3# (Corresponding ECU 80#)

Note: During the disassembling and the replacement



doesn't perform trouble diagnosis to the fuel injector itself but perform trouble diagnosis to the drive level of the fuel injector.

Power supply short-circuit towards earth

Signal line short-circuit/open-circuit towards power supply

Trouble Light Status: The engine trouble light turns on in case of short-circuit/open-circuit of all fuel injector circuit part (drive level). The closed loop control of the oxygen sensor and its memory pre-control are disabled, but the last data stored in its memory is valid.

of the fuel injector, the two O-rings on the fuel injector shall be replaced at the same time. During installation, the O-rings shall be applied with small amount of silicone-free clean engine oil.

9. Idle Actuator Stepping Motor

Function: The traditional idle stepping motors are no longer used on the AMT vehicles and the job used to be fulfilled by the stepping motor is fulfilled by the throttle drive motor (Electric throttle).

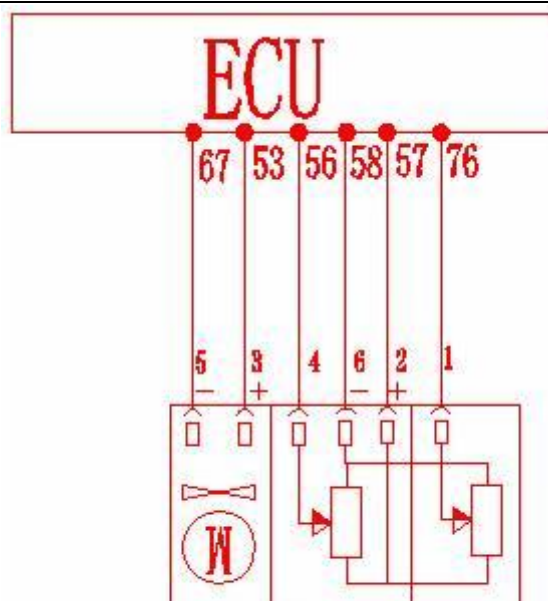
Structure and Working Principle: Within the electric throttle valve body, there has one set of deceleration mechanism that connected with the throttle drive motor. The throttle drive motor is one micro motor that comprised of many steel stator that surrounded as one circle and one rotor, of which each steel stator is winded with one coil. The rotor is one permanent magnet, of which there has one solenoid in the center. All the coils of stators are always on. The stator will rotate for certain angle once the current direction of certain coil is altered. If all coils of stators change their currents directions in a proper order, a rotating magnetic field will be generated and result in the permanent magnet rotor rotating in designed direction. Its theory is one micro DC motor.

Fault Diagnosis: The ECU can monitor the coil short-circuit/open-circuit of the throttle drive motor and turn on the engine trouble light in case of such troubles and then the engine will enter into trouble mode.

Trouble Control Solution:

The dual return spring can ensure that the open extent of the throttle shall be 7~12° under limp driving mode. It will also enter into limp driving mode in case of discordance of both signals or without signal.

The ECU controls and corrects the open extent of the throttle. In order to prevent the jamming between the throttle and throttle valve body while the throttle is fully closed, the throttle shall have one open extent that between the open and close of normal throttle valve body.



Throttle control

Throttle Position Sensor Circuit Diagram

Pins:

- 1 Throttle position sensor 1 (Corresponding ECU76#);
- 2 Throttle position sensor power supply (Corresponding ECU57#);
- 3 Positive pole of throttle control motor (Corresponding ECU53#)
- 4 Throttle position sensor 2 (Corresponding ECU56#)
- 5 Negative pole of throttle control motor (Corresponding ECU67#)
- 6 Throttle position sensor earth (Corresponding ECU58#);

Note: When replaced with new throttle valve body assembly or when the ECU is replaced, it's compulsory to perform electric throttle self-learning.

The check of throttle actuator shall be during the time period when the key is turned on and the system is under self-examination. Step the accelerator pedal and observe at the same time the actuation of the throttle valve leaf. The jamming of



	the throttle valve leaf shall be cautioned.
--	---

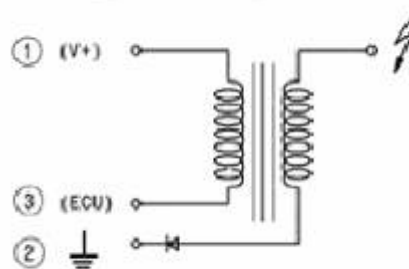
10. Ignition Coil

Function: The ignition coil converts the low voltage power of the primary winding into the high voltage power of secondary winding and generates the spark by means of the discharge of spark plug to burn the fuel-air mixed air in the cylinder.

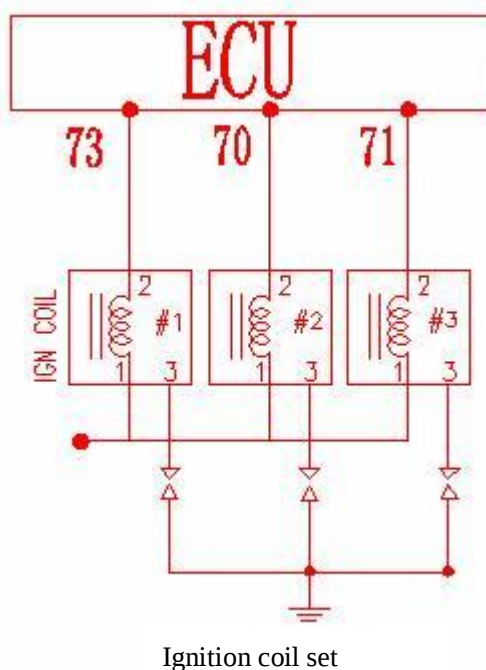
Structure and Working Principle: The ignition coil is comprised of the primary winding, the secondary winding, the iron core, the shell and so on. If the battery voltage applies on the primary winding, the primary winding is charged. After the ECU cut off the circuit of the primary winding the charging will be stopped and the high voltage will be inducted in the secondary winding.

The inside of the ignition coil uses one audion to control the current switch-on/ switch-off in the primary coil, therefore it can't measure its resistance value by means of the multimeter.

Fault Diagnosis: The ECU has no function to perform trouble diagnosis to the ignition coil; therefore it has no trouble code when something's wrong with the ignition coil. Only the check of ignition coil resistance can judge if the ignition coil functions well. Under normal conditions, the running of ignition coil will generate great amount of heat, however the overheat of the ignition coil will increase the resistance value of the ignition coil, which may result the troubles such as unstable engine running or auto flame-out of the engine.



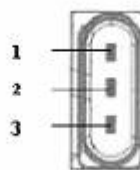
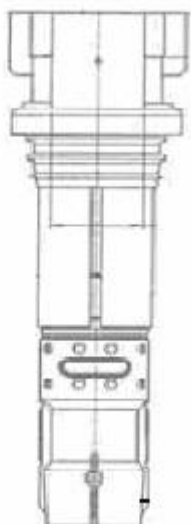
Internal Structural Diagram of Ignition Coil



Circuit Diagram For Ignition Coil

Pins:

- 1 Cylinder 1 ignition coil control (corresponding ECU73#)
- 2 Cylinder 2 ignition coil control (corresponding ECU70#)
- 3 Cylinder 3 ignition coil control (corresponding ECU4#)
- 4 Connect with main relay power supply.



Pins:

- 1 Power supply
- 2 Ground wire
- 3 Control line (controlled by ECU)

11. Carbon Canister Control Valve

Purpose: It is used to control purging air flow for canister. Canister purge valve is controlled by ECU according to engine load, through the duration and frequency of electric pulse (i.e. duty cycle). Excessive accumulation of gasoline steam inside the active canister may cause gasoline overflow, resulting in environment pollution. Therefore, the purpose of canister purge valve is to open solenoid valve to let excessive gasoline into air intake pipe, participating in combustion.

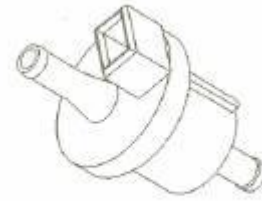
Structure and Working Principle: Canister is made up of electromagnetic coil, armature and valve etc. There is strainer on the intake. The flow quantity passes canister valve is correlate not only to electrical impulse duty ratio of canister control valve output by ECU, but also to the pressure difference between canister valve intake and outlet. When there is no electronic impulse, the canister control valve will shut down. According to signals from sensors, ECU controls energizing time of solenoid valve, to indirectly control the purging flow.

Fault Diagnosis: ECU has no diagnostic function with canister itself, but has diagnostic function with the drive stage of canister control valve. When drive stage of canister control valve is short circuit or overload to battery voltage, short circuit to earth or open circuit, the self-tuning for fuel closed loop control is invalidated, so is self-tuning for idle speed air needed. Data of self-tuning at that moment is still available. In case of canister fault, engine frequently operates in a manner of unsteady idle speed or too high an idle speed.

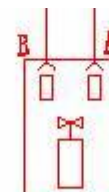
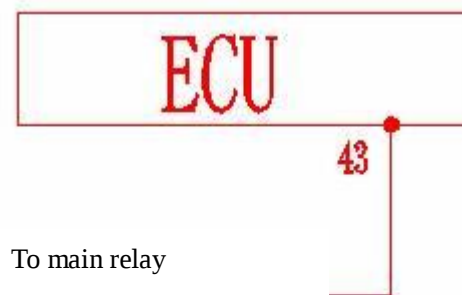
Resistance: 19~22 Ω

Working Voltage: 8~16V

Rated Working Voltage: 12V



Carbon Canister Control Valve



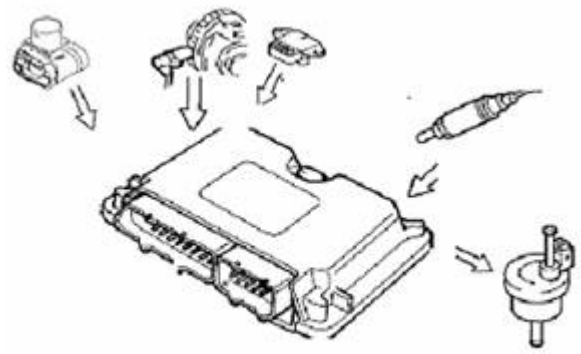
Canister control valve

Circuit Diagram For Canister Control Valve TEV-2

Pins:

A Carbon canister cleaning control (corresponding ECU43#) ;

B Coil power supply (to main relay) ;



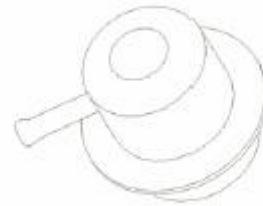
Control Principle Illustration

12. Fuel Pressure Regulator

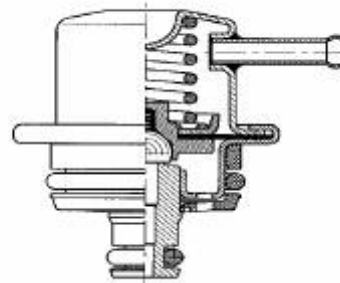
Application: The fuel pressure regulator itself isn't of electric element, however it's used in the electric control system of the gasoline engine to regulate the fuel pressure in the fuel distribution pipes to make its difference to the **atmosphere pressure** at one constant value on the whole so as to control the inconvenient fuel speed and make it possible for the ECU to control the fuel injection pulse width simply.

Structure and Working Principle: As shown in the figure, one soft film made of rubber-fiber separates the fuel pressure regulator as upper chamber and lower chamber. The upper chamber uses the hose to connect the intake manifold by means of the lateral joints and is equipped with the spring internally. The lower chamber is full of the fuel that flowed through the fuel inlet from the fuel distribution pipe after passing through the circle surrounding the bottom plane of the pressure regulator. The lower side of the film is subject to the fuel pressure of the fuel distribution pipe while the upper side is subject to the force sum of the atmosphere pressure and the spring pressure. The file may deform to drive the valve seat to open or close the valve and the action force of the spring can be considered as constant due to the neglectable deformation of the film. Therefore, the open/close of the valve depends on the difference between the fuel pressure of the lower chamber and the atmosphere pressure of the upper chamber. When the pressure output of the fuel pump exceeds the sum of spring force and the atmosphere pressure, the valve will open and the extra fuel will be exhausted through the relieve hole so as to maintain the system pressure within one specified range basically.

Fuel Requirement: The fuel pressure regulator can be used in the fuel (It's allowable to use the alcohol-gasoline with the alcohol concentration



Fuel Pressure Regulator



Fuel Pressure Regulator Section View

Installation Position: The AMT uses the semi return-free fuel control method. The fuel pressure regulator is integrated on the fuel pump assembly to control the working pressure of the fuel system by controlling the fuel return pressure.



below 15%) specified in the national standard GB 17930-1999 “Automotive Unleaded Gasoline” and the national environmental protection standard GWKB1-1999 “Automotive Gasoline Hazardous Substance Control Standard of the People’s Republic of China.

Fault Diagnosis: The fuel pressure regulator normally can’t be damaged easily. However, the direct evidence of damage is that the system pressure can’t be established.

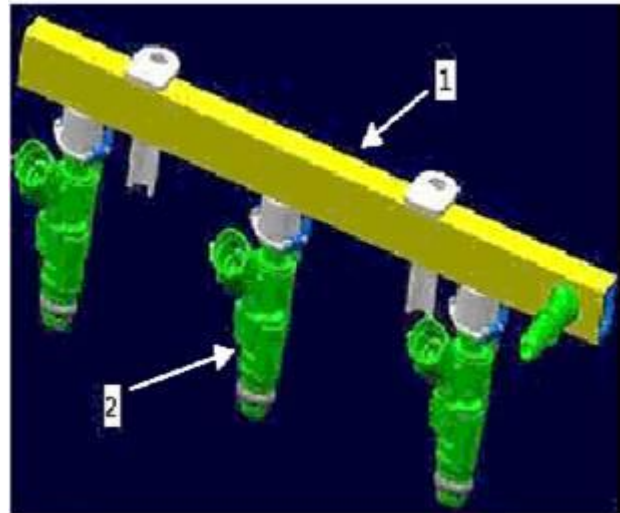
13. Steel Fuel Distribution Pipe Assembly

Application: To store and distribute the fuel and return the extra fuel to the fuel tank. On which the fuel injector is installed to provide relevant stable pressure environment to the fuel injection system (similar with common rail diesel engine) so as to ensure the balance of fuel supply pressure and volume to each cylinder and the stable running of the engine.

Structure: The fuel distribution pipe assembly is comprised of fuel distribution pipe and the fuel injector.

Installation Requirement: The connection of fuel pipe and rubber hose shall be fastened by clamp. The model of the selected clamp shall match to the rubber hose to ensure the seal connection between the fuel pipe and the rubber hose. During the repair, the good connection between the fuel supply general pipe and the rubber hose must be ensured without any leakage.

Fault Diagnosis: Normally, the trouble ratio of the fuel supply general pipe is really small, of which the most cases are due to the improper assembling that resulted the leakage of the fuel system. Therefore, it shall be ensured during the assembling process that the used fuel injector sealer can't be used again.



Fuel Distribution Pipe Assembly

14. Accelerator Pedal Position Sensor

Application: This sensor is integrated from two sensors of potentiometer type and is enclosed within one engineering plastic cabinet that fixed on the accelerator pedal. The accelerator pedal rotates around one axis and is fixed to the body through the rack. This mechanism contains one pre-stressing spring and mechanical positioning mechanism so as to ensure the full-open and full-close of the pedal. The accelerator pedal applied to the sensor shaft through the connecting rod mechanism. When the accelerator pedal is stepped, the pointer that connected to the revolution shaft will slide on two potentiometers to indicate the position of the accelerator pedal.

It's in consideration of the **safety** to **adopt dual sensors** to resolve such problem. The two pedal position sensors send the signal to ECU at the same time and the ECU will **verify** the **consistency** of **both position signals**.

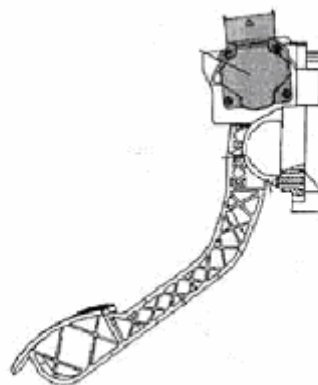
Structure: The accelerator pedal position sensor is of damp mechanism internally that integrated two same potentiometer type slide resistances, however, the resistances of start point and end point aren't same.

Installation Requirement: The assembly is installed on the accelerator pedal.

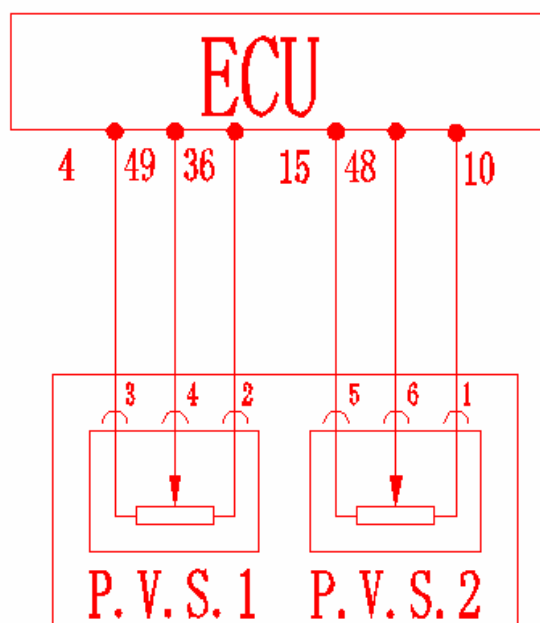
Fault diagnosis:

Short and open circuit of sensor wiring 1;
Short and open circuit of sensor wiring 2;
Sensor signal unsteady;
Sensor signal overrun.

Troubleshooting: Use diagnosis instrument to check the trouble code to determine the trouble point, mainly check the sensor wiring, the short-circuit/open-circuit between the wiring and the earth wire, the short-circuit to the power supply, the consistency of the wiring to the pin definition given in the right.



Sensor Appearance Figure

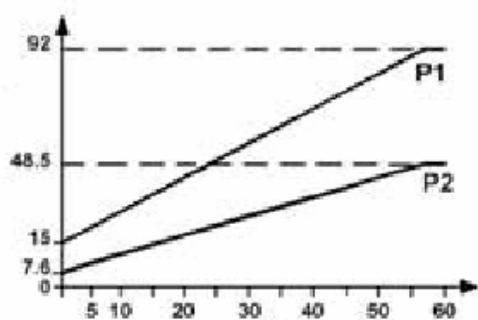


Accelerate pedal position sensor

Circuit Diagram for Sensor

Pins:

- 1 Accelerator pedal position sensor power supply 2 (Corresponding ECU 10#)
- 2 Accelerator pedal position sensor power supply 1 (Corresponding ECU 36#)
- 3 Accelerator pedal position sensor earth line 1 (Corresponding ECU 4#)
- 4 Accelerator pedal position sensor signal 1 (Corresponding ECU 49#);



Sensor Hyperbola Figure

5 Accelerator pedal position sensor earth line 2
(Corresponding ECU 82#)

6 Accelerator pedal position sensor signal 2
(Corresponding ECU 107#);

15. Dual Brake Accelerator Pedal Position Sensor

Application: The brake switch internally has one dual contact switch, comprised of one normal open switch and one normal close switch, that is used to control the AMT system performance including start, gear shift, and comfort.

Working Principle: This switch is one dual contact switch. When the brake pedal is stepped down, the normal open contact closes and the normal close contact opens to provide brake signal to the ECU and TCU, and the normal contact also provides the brake signal to the ABS and brake light.

Structure: The dual brake switch is installed on the brake pedal with dual contact inside. On one same ejector rod headed with two spring patch switches that act following the brake pedal. It will act at the same time when the brake is stepped.

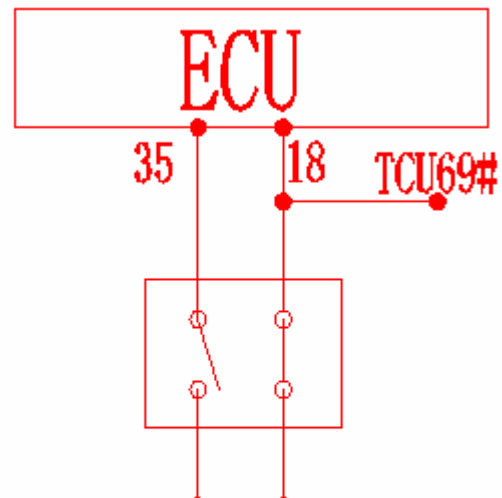
Installation Requirement: The assembly, being one white square switch, is installed on the brake pedal assembly.

Fault Diagnosis:

Short and open circuit of sensor wiring 1;
Short and open circuit of sensor wiring 2;
Sensor signal unsteady;
Sensor signal overrun.

Short-circuit/open-circuit of sensor power supply to earth

Troubleshooting: Use diagnosis instrument to check the trouble code to determine the trouble point, mainly check the sensor wiring, the short-circuit/open-circuit between the wiring and the earth wire, the short-circuit to the power supply, the consistency of the wiring to the pin definition given in the right.



To absolute main power
supply dual brake switch

Circuit Diagram for Sensor

Pins:

- 1 Dual brake switch power supply 1 (to power supply)
- 2 Dual brake switch power supply 2 (to power supply)
- 3 Dual brake switch verification signal (corresponding ECU 35#)
- 4 Dual brake switch brake signal (corresponding ECU 18#)

Note: The engine enters into trouble mode when this switch is damaged. In consideration of the safety, make sure to step down the brake.

16. Camshaft Position Sensor

Application: This camshaft position sensor provides the ECU with cam phase information and through the combination of the crankshaft, the ECU can judge which stroke of working cycle the engine is currently in. For each revolution of the camshaft, the Hall Effects will generate one pulse and at the same time control the fuel injector to inject to the correct cylinder.

Structure: It's internally Hall sensor type and 3-way type that powered by the reference voltage of the ECU.

Installation Requirement: Installed on the rear of the cylinder cover with the signal wheel installed on the camshaft that rotates in-phase with the camshaft to provide camshaft position information.

Torque require: $8 \pm 2 \text{ Nm}$

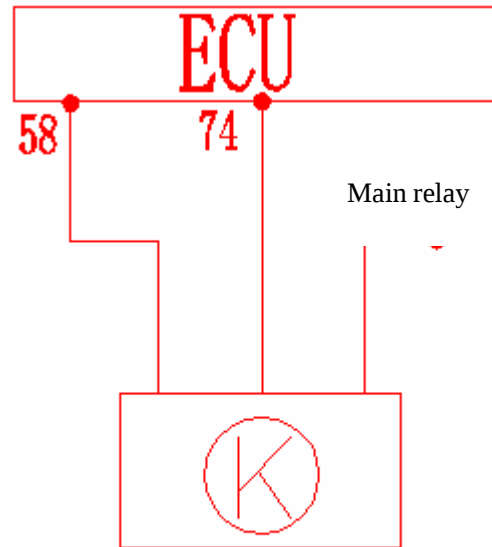
Installation clearance: 0.5 to 1.5mm

Fault Diagnosis:

Short-circuit/open-circuit of sensor wiring
Signal distortion, fault and suspect;
Sensor signal unsteady;
Sensor signal overrun.

Troubleshooting: Use diagnosis instrument to check the trouble code to determine the trouble point, mainly check the sensor wiring, the short-circuit/open-circuit between the wiring and the earth wire, the short-circuit to the power supply, the consistency of the wiring to the pin definition given in the right.

Trouble Affection: Increased engine fuel consumption and poor exhaust.

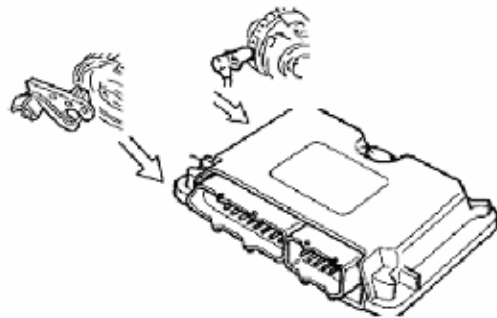


Camshaft position sensor

Circuit Diagram for Sensor

Pins:

- 1 Sensor power supply (to main relay)
- 2 Sensor signal (corresponding ECU 75#)
- 3 Sensor earth wire (corresponding ECU 58#)



Sketch

Trouble Evidence: Strictly, the 3-cylinder engine can run only with the equipment of the crankshaft position sensor or the camshaft position sensor, however in order to enhance the system safety and the system fuel injection precision (exhaust control), Marelli electric injection system is all equipped with crankshaft and camshaft position sensor. The ECU will enter into trouble emergency



	mode in case of the trouble of the camshaft position sensor. The fuel injection moment will change to 360° from 720° and the driver won't feel any change of the engine performance. However, the exhaust will exceed the standard and the trouble indicator will be turned on.
--	--

17. Crankshaft Position Sensor

Application: The output of the crankshaft position sensor can be used to determine the rotation position and revolution of the engine and is the most important signal output of the system to the ECU. This sensor is one Hall type sensor that is installed near the crankshaft and cooperates with the 58x gear ring of the crankshaft. During the revolution of the crankshaft, the addendum and the tooth space of the 58x gear ring passes the sensor in different distance and the sensor will induce the change of the reluctance, which will generate the alternating signal output. And the nick position of the 58x gear ring corresponds to the stop point position on the engine. At the stop point of the cylinder 1, the sensor aims at the lagging edge of the 20th tooth of the 58x gear ring. Taking advantage of this signal, the ECU determines the rotation position and the revolution of the crankshaft.

Structure: It's magnetic pulse type sensor internally, 3-way type comprised of two signal wires and one shield wire.

Installation Requirement: Installed on the rear of the cylinder body with the signal wheel installed on the flywheel that rotates in-phase with the crankshaft to provide the information including crankshaft revolution, rotation angle and datum point.

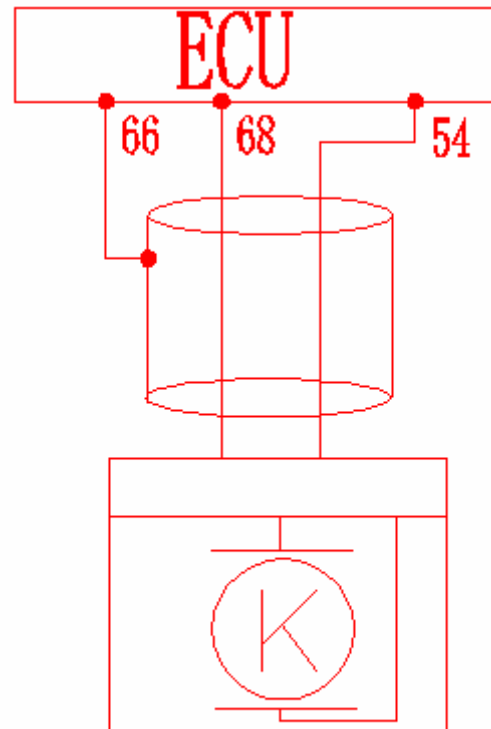
Torque requirement: 8±2Nm

Installation clearance: 0.5 to 1.5mm

Fault Diagnosis:

Short-circuit/open-circuit of sensor wiring
Signal distortion, fault and suspect;
Sensor signal unsteady;
Sensor signal overrun.

Troubleshooting: Use diagnosis instrument to



Camshaft position sensor

Circuit Diagram for Sensor

Pin:

- 1 Sensor signal – (corresponding ECU 54#);
- 2 Sensor signal + (corresponding ECU 68#);
- 3 Sensor shield wire (corresponding ECU 66#);

Trouble Evidence: The damage of crankshaft position sensor or the signal distortion may result the troubles such as the engine ignition intermittence, start failure, increased fuel consumption. Also it may result the problems such as acceleration pinch, black engine exhaust and increased fuel consumption.

Note: When the crankshaft position sensor enters into the trouble mode, then the system will also enter into trouble mode with extreme slow acceleration.



check the trouble code to determine the trouble point, mainly check the sensor wiring, the short-circuit/open-circuit between the wiring and the earth wire, the short-circuit to the power supply, the consistency of the wiring to the pin definition given in the right.

Note: Cautions shall be taken during the installation of the sensor to avoid any padding, otherwise it may result the distortion of the sensor signal.

18. Fan Control

Application: For the purpose of engine system radiation and the condenser radiation after the switch-on of the AC, the fan control is affected by the signal the water temperature sensor transmitted to the ECU. The fan runs in high speed when and the fan runs in low speed when the water temperature is low. The fan starts in low speed when the AC is running. Since the AMT isn't equipped with **moderate pressure switch**, the fan can't be started in high speed when the AC system pressure is increased.

Composition: DC motor dual fan.

Installation Requirement: Installed on the front and rear of the radiator. Cautions shall be taken to prevent the drop-off of the balance patch of the fan leaf and deformation of the fan leaf since these original designs are intended to lower the fan running noise and for the fan dynamic balance.

Fault Diagnosis:

Short-circuit/open-circuit of fan control wiring to earth.

Problem of fan itself

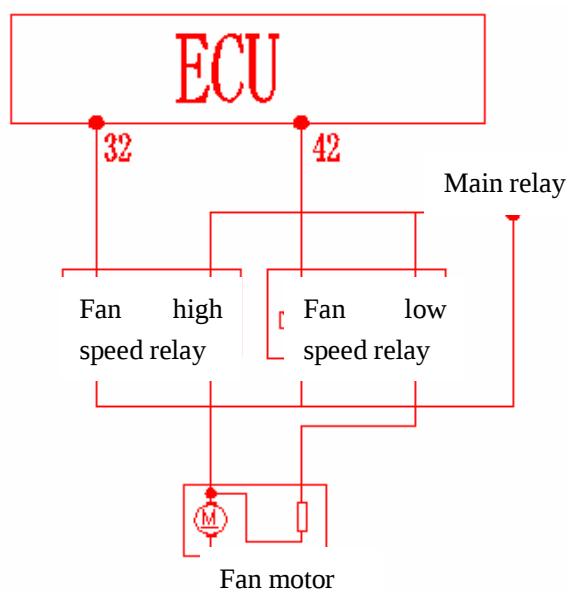
Excessive fan noise

Fan power circuit trouble

Troubleshooting: Firstly determine that the trouble is resulted from the high-speed fan system or the low-speed fan system. In case of fan control system trouble, it may use diagnosis instrument to determine the trouble point so as to determine the short-circuit or open-circuit of the control wiring.

Trouble Evidence: The fan trouble may result the increased engine water temperature, poor AC refrigeration and then the engine will boil rapidly.

When the water temperature sensor is damaged, the engine will enter into trouble mode, the water temperature runs in accordance with the preset 80°C and the fan is in normal running.



Sketch for fan control system

Circuit Diagram for Sensor

Pins:

- 1 Fan high speed control (corresponding ECU32#);
- 2 Fan low speed control (corresponding ECU 42#)

Note: This circuit diagram is the sketch of the fan control system that may differ from the actual circuit, however the control terminal is same with the actual practice.



--	--

CHAPTER 2 TROUBLE DIAGNOSIS BASIC PRINCIPLE OF ELECTRIC INJECTION SYSTEM

(1) RECORDS OF FAULT

ECU continuously monitor sensors, actuators, related circuits, failure indicator lights and battery voltages etc, and even ECU themselves. ECU inspect signals from sensors, signals for actuator- driving and internal signals(such as oxygen closed loop control, knock control, idle speed speed-controlling and voltage-controlling of battery etc) for their reliabilities. Once a fault is detected in some aspect, or some signal can not be used, ECU will immediately put down records of fault in fault memory of RAM. Records of fault is stored in the form of codes, and displayed according to fault-occurring orders.

Faults can be divided into “stable faults” and “random faults” (for example, caused by transient open circuit of wires or poor contact of inserted parts) by fault frequency.

(2) FAULT STATE

If duration of a recognized fault exceeds the prescribed time for stabilization, ECU will consider it to be a steady fault, and store it as “steady-state fault”. If this fault disappears, it will be stored as “non-existed”. If this fault is again detected, it is still a “random fault”, but the early fault of “existed” doesn’t affect engine in normal use.

(3) TYPES OF FAULT

- . Short circuit to positive pole of power supply
- . Short circuit to earth
- . Open circuit (for the case where there are pull-up resistors or pull-down resistors during input stage, ECU will recognize fault of open circuit at input port as that of short circuit to positive pole of power supply or that of short circuit to earth)
- . Signals can not be used.

(4) Trouble Frequency Counter

- . One independent frequency counter value (Hz) is set against each identified trouble.
- . The value (Hz) of the frequency counter decides the time period the trouble information will store in the memory after the identified trouble disappeared (Troubleshooting).
- . The Hz value will be set as original 40 when one trouble is identified for the first time and such value will remain if the trouble status remains unchanged.
- . Once the disappearance of the trouble is identified and such status is maintained for certain time, then the Hz value will subtract by 1 after every successful start of engine (The revolution exceeds the one at the end of the start). In such case, the ECU considers that the trouble has disappeared, however the trouble information record still exists.
- . In case of the frequent appearance and disappearance of the trouble (such as the ones resulted from the poor contact), the Hz value will add by 1, however the Hz value won’t exceed the upper limit 100.

If the Hz value is subtracted to zero, then such trouble information record stored in the memory will be fully erased.

(5) COMING BACK LAMELY

If durations of some important faults recognized exceed the prescribed time for stabilization, ECU will implement appropriate software strategy. For example, to invalidate some functions of control, and to set subsistent values for data are considered to be unusable. At this time, although engine is in poor operating mode, the vehicle can operate. The purpose of doing in this manner is to let vehicle try to go home reluctantly or run to repair station for repairing, saving the embarrassment of breakdown on expressway or in the field. Once it is recognized that the fault has gone, the normal data will be used again.

(6) FAULT ALARM

A fault indicator light is employed in 372 model that is equipped with MS2000. When faults occur at some important parts such as ECU, sensor of absolute pressure of intake manifold, throttle position sensor, coolant temperature sensor, knock sensor, oxygen sensor, phase sensor, injectors, two drive stages of step motor for idle speed actuator, canister control valve and fan relay, the corresponding digits for fault will be set, and ECU will alarm by means of fault indicator light until fault digits are reset.

(7) FAULT CALL

The trouble information record can be taken from the electric control unit by means of the trouble diagnosis instrument. In case the trouble related the function of fuel-air mixed air ratio regulator, then the engine must run for at least 4 minutes to read the trouble information record. Especially for the trouble of the oxygen sensor, the data shall be checked until the warm running of the engine.

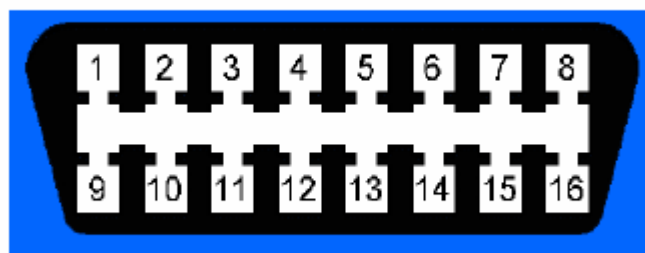


Figure 3-1 ISO 9141-2 Standard diagnostic connector

(8) CLEARING RECORDS OF FAULT

After the malfunction is fixed, the malfunction information record in the memory shall be cleared. The trouble code can be cleared by following means:

The trouble information record in the trouble memory will be cleared automatically once the Hz value of the ECU internal frequency counter reaches zero.

. Employing fault diagnostic tester to clear records of fault with the instruction of “reset memory for records of fault”.

. Pulling out connectors of ECU or disconnecting wires of battery to clear records of fault in external ram.

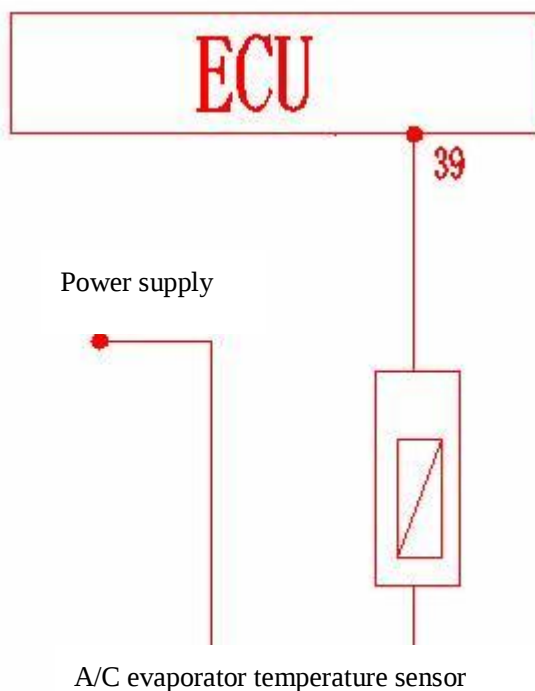
.(9) FAULT-SEARCHING:

Records of fault are obtained by means above, only approximate locations of faults are known which does not mean faults have already been detected. Because a fault may arise from damage of electric parts (for example, sensors, actuators or ECU , etc.), or may arise from open circuit, wires short circuit to earth or to battery positive pole, even from mechanical failure.

Faults take place internally, whose external representation are various symptoms. Once symptoms are found, employ a fault diagnostic tester or flashing codes to check that there are records of fault and to remove such faults according to these records. Then search for fault according to engine symptom.

STEPS TO PERFORM TROUBLE DIAGNOSIS BASED ON TROUBLE INFORMATION RECORD

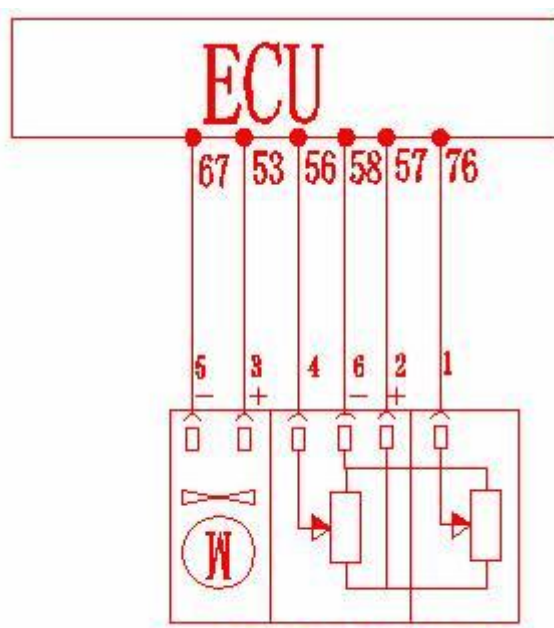
A/C Evaporator Vent Temperature Sensor



Temperature Sensor of AC Evaporator Circuit Diagram

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to ON.		Next step
2	Take off the connector of wires for AC evaporator output temperature sensor, check the voltage between two pins with multimeter and look if it is around 12V.	Yes	Next step
		No	4
3	Check if the sensor is short circuit or break circuit between two pins with multimeter.	Yes	Replace sensor
		No	Replace ECU
4	Connect the adapter between the ECU and the harness and use the multimeter to inspect the wires between the #39 pin of ECU and the sensor connector respectively for short-circuit and open-circuit.	Yes	Repair or replace wires
		No	Replace ECU

Electric Throttle Trouble



Throttle control

Circuit Diagram of Throttle Position Sensor

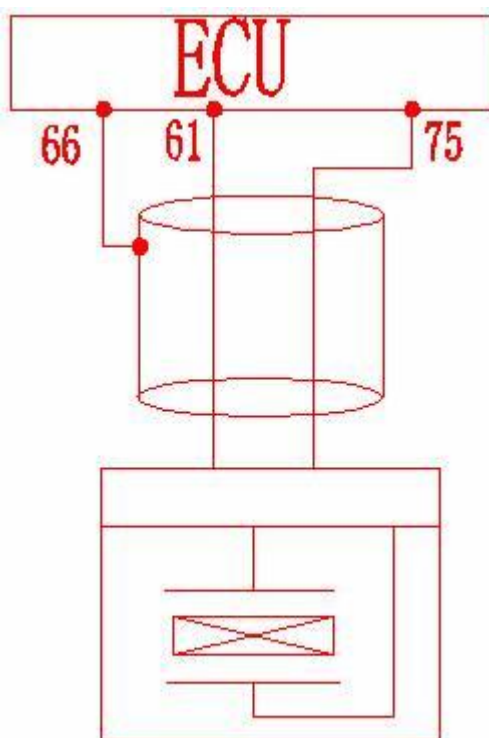
No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to ON.		Next step
2	Pull out the throttle position sensor connector on the harness and use multimeter to check if the voltage value between the #3 pin and #5 pin is about 12V and the one between the #6 pin and #2 pin is about 5V.	Yes	Next step
		No	5
3	Use multimeter to check if the resistance value between the #1 & #4 pin and the #6 pin of the sensor is between 0.5 and 1.6k Ω .	Yes	Next step
		No	Replace sensor
4	Rotate the throttle position sensor slowly from one end to another end and use the multimeter at the same time to check if there is open-circuit or short-circuit between #1/#4/#6 pin and the ECU 76#/#56#/#58#, or rotate the throttle leaf to check if there has jumping resistance value.	Yes	Replace sensor
		No	Replace ECU
5	Connect the adapter between the ECU and the harness and use multimeter to check if there's open-circuit or short-circuit between the #1/#2/#6/#4 pin of the sensor and the ECU 76#/#57#/#56#/#58# pin.	Yes	Repair or replace wires
		No	Replace ECU

Note: This vehicle adopts electric throttle body to substitute the previous stepping motor, therefore the functions normally fulfilled by the stepping motor in the normal throttle valve body will be fully fulfilled by the throttle drive motor and the electric throttle is incapable of repair. The trouble rate of the throttle valve body is really low, the damaged ones can be dealt with by replacing the assembly.



When **check** the electric throttle valve body for actions, turn on the key and step the accelerator pedal during the system self-examination for another person to observe the throttle valve plate for actions.

Knock Sensor



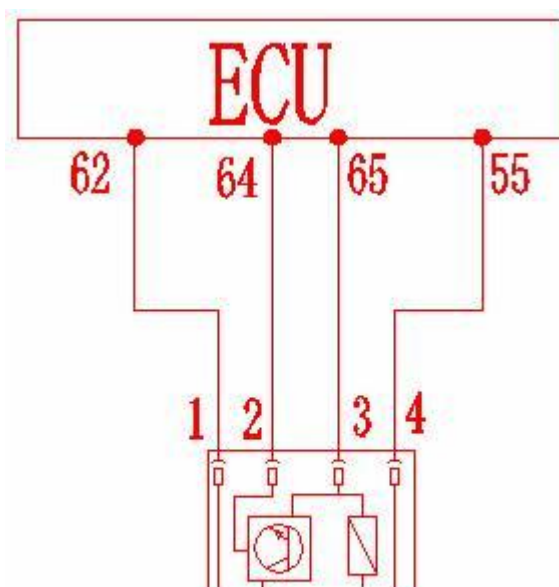
Knock sensor

Circuit Diagram of Knock Sensor

No.	Operating steps	Result	Follow up steps
1	Close the ignition switch, and the engine stops.		Next step
2	Pull out the knock sensor connector on the harness and use the multimeter to check if the resistance valve between the #1/#2 pin of the sensor and the shield wire (Sensor shield) pin is above 1M.	Yes	Next step
		No	Replace with a new sensor
3	Use small hammer to knock the surrounding of the knock sensor and use multimeter to check for the AC signal output between the #1 and #2 pin of the sensor (mV level).	Yes	Next step
		No	Replace sensor
4	Turn on the ignition switch but do not start the engine.		Next step
5	Connect the adapter between the ECU and the harness and use multimeter to check if there's open-circuit or short-circuit between the #1/#2/ pin of the sensor and the ECU 61#/75# pin.	Yes	Repair or replace wires
		No	Replace ECU

Note: Normally it's difficult for the knock sensor to get damaged. During the disassembling of the knock sensor, cautions must be taken to clear any dirt on the contact plane between the sensor and engine body and to get away any gaskets. The sensor damage bears relevant great effects to the economic values and exhaust of the engine (The effects scope of the knock sensor normally resulted under the high revolution and great load.

PRESSURE SENSOR PART OF INTAKE AIR PRESSURE AND TEMPERATURE SENSOR



Intake air pressure/temperature sensor

Circuit Diagram of Intake Air Pipe Absolute Pressure and Intake Air Temperature Sensor

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to ON.		Next step
2	Pull out the coolant temperature sensor connector on the harness and use multimeter to check if the voltage value between the #1 (+) pin and #2 (-) pin is about 5V.	Yes	4
		No	Next step
3	Between the ECU and harness, use multimeter to check if there's short-circuit or open-circuit between the #62/#64/#65/#55 pin of the ECU and #1/#2/#3/#4 pin of the sensor connector respectively.	Yes	Repair or replace wires
		No	Next step
4	Turn on the ignition switch but do not start the engine.		Next step
5	Start up the engine, run at idle speed. Step down the accelerator pedal to closing full-open, within which period use multimeter through adapter to check if the voltage between the #4 pin and #1 pin of the sensor increases gradually to about 4V.	Yes	Replace ECU
		No	Replace ECU Replace sensor

Note: It may result the start failure or stop of the engine in case of the sensor's short-circuit to the 5V or 12V power supply or to the ground. In such case, firstly pull out the intake pressure sensor to check if it can normally start. If yes, then it may be the short-circuit of the sensor internal circuit.

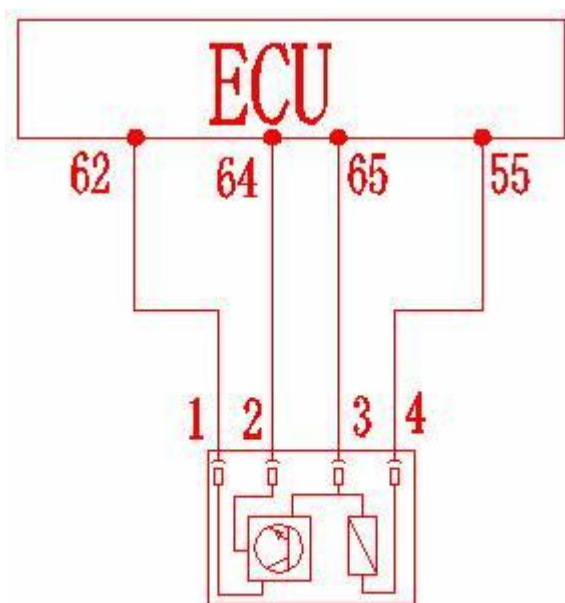
FRONT OXYGEN SENSOR TROUBLE

Circuit Diagram of Oxygen Sensor

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to “ON”.		Next step
2	Pull out the oxygen sensor connector on the harness and use multimeter to check if the voltage value between the #4 (+) pin and #3 (-) pin is about 12V storage cell voltage.	Yes	Next step
		No	4
3	Use multimeter to check if the resistance value at 23°C between the #4 pin and #3 pin of the oxygen sensor is between 5.4 and 6.6 Ω .	Yes	Replace ECU
		No	Replace sensor
4	Check the fuse inside of oxygen sensor heating circuit and observe if it is blow.	Yes	Replace fuse
		No	Next step
5	Use multimeter to check if there's open-circuit or short-circuit between the #4 pin of oxygen sensor connector and the main relay (87) pin and between the #36 pin of the sensor connector and the #41 pin of ECU.	Yes	Repair or replace the harness
		No	Next step
6	Connect the connector of wires for oxygen sensor and use neutral. Start the engine and leave it at idle speed until its coolant temperature reaches to the normal value.		Next step
7	Pull out the oxygen sensor connector on the harness and use multimeter to check if there is 0.1~0.9V voltage output (after warm running of the engine) between the (1) pin (+) and (2) pin (-) of the sensor.	Yes	Next step
		Yes	Replace sensor
8	Connect the adapter between the ECU and the harness and use multimeter to check if there's open-circuit or short-circuit between the #1/#2 pin of the sensor and the ECU #22/#11 pin.	Yes	Repair or replace wires
		No	Replace ECU

Note: The trouble diagnosis of the rear oxygen sensor is similar with the one of the front oxygen sensor. Perform the diagnosis in accordance with the diagnosis method of the front oxygen sensor with reference to the foregoing circuit diagram.

PRESSURE SENSOR PART OF INTAKE AIR PRESSURE AND TEMPERATURE SENSOR



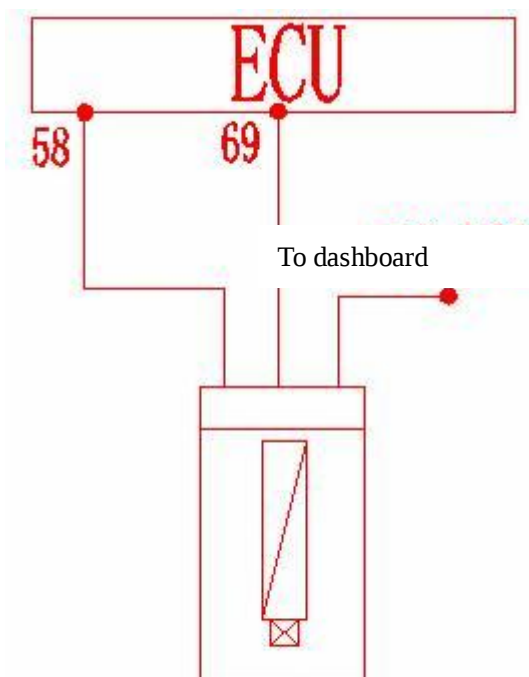
Intake air pressure/temperature sensor

Circuit Diagram of Intake Air Pipe Absolute Pressure and Intake Air Temperature Sensor

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to "ON".		Next step
2	Pull out the coolant temperature sensor connector on the harness and use multimeter to check if the voltage value between the #1 (+) pin and #2 (-) pin is about 5V.	Yes	Next step
		No	4
3	Use multimeter to check if the resistance value between #1 and #3 pin of the sensor is same with the one under normal conditions.	Yes	Replace ECU
		No	Replace sensor
4	Connect the adapter between the ECU and the harness and use multimeter to check if there's open-circuit or short-circuit between the #1/#2/#3 pin of the sensor and the ECU #62/#65/#64 pin.	Yes	>Repair or replace wires
		No	Replace ECU

Note: The intake temperature sensor has no great affection upon the system, however, when the water temperature sensor is damaged at the same time, the trouble status of such sensor is very obvious.

COOLANT TEMPERATURE SENSOR TROUBLE



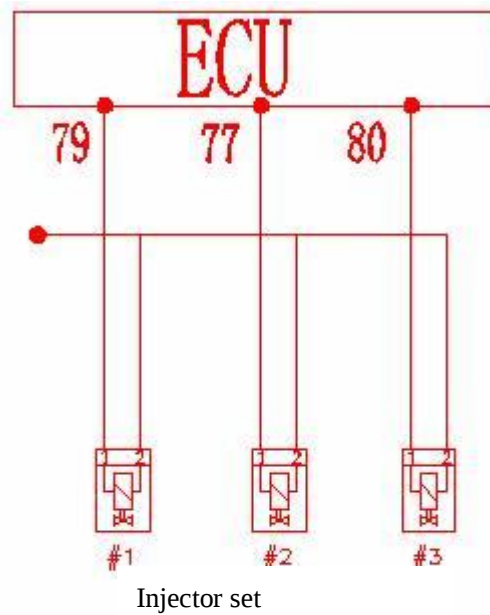
Water temperature sensor

Circuit Diagram of Coolant Temperature Sensor

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to "ON".		Next step
2	Pull out the coolant temperature sensor connector on the harness and use multimeter to check if the voltage value between the #1 (+) pin and #2 (-) pin is about 5V.	Yes	Next step
		No	4
3	Use multimeter to check if the resistance value between the #1 pin and #2 pin of the sensor corresponds to its temperature (See related part in this repair manual).	Yes	Replace ECU
		No	Replace sensor
4	Connect the adapter between the ECU and the harness and use multimeter to check if there's open-circuit or short-circuit between the (2)/(1) pin of the sensor and the ECU #58/#69 pin.	Yes	Repair or replace wires
		No	Replace ECU

Note: The engine enters into trouble mode immediately after the damage of the water temperature sensor. The water temperature of trouble mode is set at 80°C and the fan runs in high speed. The system will automatically perform fan relay control after the ignition switch is turned off at the same time.

FUEL INJECTOR DRIVE LEVEL



Circuit Diagram of Electromagnetic Injector

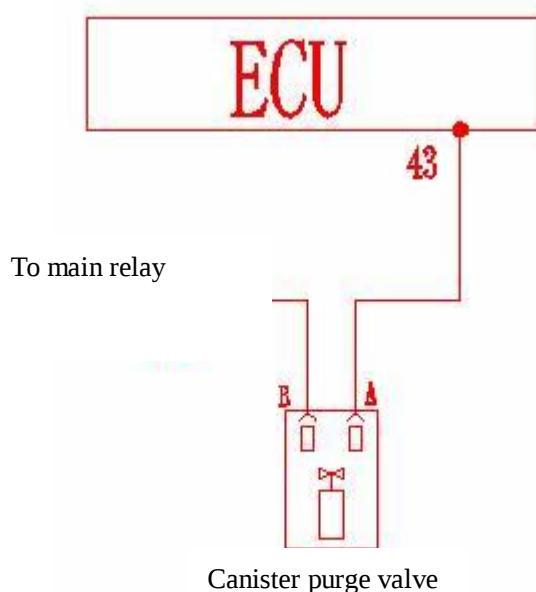
No.	Operating steps	Result	Follow up steps
1	Close the ignition switch, and the engine stops.		Next step
2	Pull out all electromagnetic fuel injector connectors in turn and use two pins of the multimeter to touch the #1 pin of such connector and the earth wire of the engine.		Next step
3	Put the ignition switch to ON. Observe if the multimeter can display the reading of about 12V storage cell voltage for about 1s at the moment the ignition switch is turned on (mainly check if there's power on the fuel injector) and the working voltage is 12V.	Yes	Repeat step 2
		All	6
		No	Next step
4	Use multimeter to check in turn if there's open-circuit or short-circuit between #87 oil pump relay output terminal and the (1) pin of each electromagnetic fuel injector connector.	Yes	Repair or replace wires
		No	Next step
5	Repair or replace the oil pump relay and main relay with its circuit.	Yes	Repair or replace wires
6	Connect the adaptor between ECU and the wiring harness , use multimeter to verify that if there is short-circuit or open circuit between pin (2) of electromagnetic injector and pin 79#, 77#, and 80# of ECU.	No	Next step
7	Use multimeter in turn to check if the resistance value at 20°C between the #1 and #2 pin of the electromagnet fuel injector (and fuel injector resistance value) is between 12~16 Ω .	Yes	Repeat step 7
		All	Next step
		No	Replace electromagnetic

			injector
8	Connect all the joints of electromagnetic injector again. And use neutral, start the engine and leave it running at idle speed. Take off the joints of wires for electromagnetic injector in sequence. And observe if the engine becomes more vibrant every time when a joint is taken off. (similar with flame cut test).	Yes	Repeat step 8
		No	Replace ECU

Note: The damage rate of the fuel injector is really low, mainly it's the fuel injector nozzle carbon that resulted the atomization of fuel injection, poor fuel injection, unstable engine idling. Therefore above items shall be checked carefully during the checking.

During the testing of the cylinder failure, it shall be advised that it's not allowable to pull out the high voltage line to perform cylinder failure test. Instead, it shall pull out the fuel injector nozzle; otherwise, the large amount of the unburned gasoline will enter into the 3-way catalytic converter. The rapid increasing temperature of the 3-way catalytic converter may damage the 3-way catalytic converter.

CARBON CANISTER CONTROL VALVE DRIVE LEVEL



Circuit Diagram of Canister Purge Valve

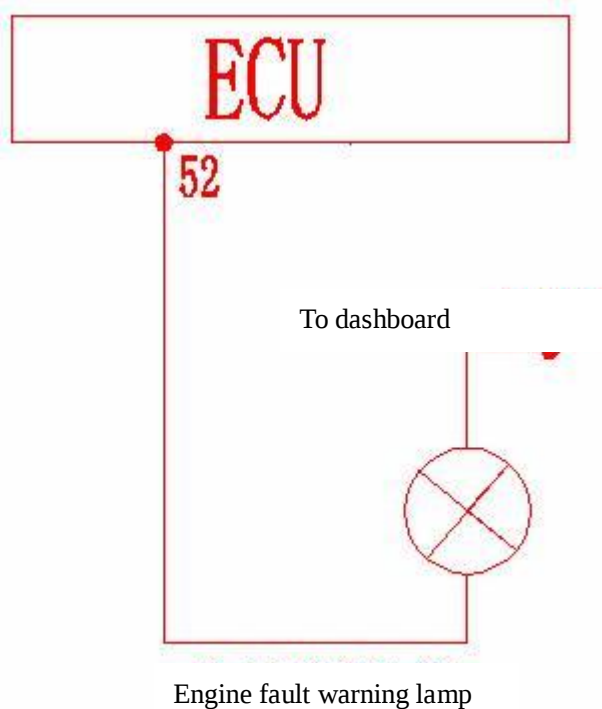
No.	Operating steps	Result	Follow up steps
1	Start the engine and leave it at idle speed until its coolant temperature reaches to the normal value. Next step		Next step
2	Take off the joint of wires for canister purge valve. Check the battery voltage between the two pins of joint with multimeter and look if it is around 12V.	Yes	Next step
		No	5 (Check the positive wire)
3	Re-insert the carbon canister control valve connector on the harness and increase the engine revolution to 1,500 rpm. Touch the valve body with hand to check the carbon canister for slight vibration and shock (frequency control).	Yes	Next step
		No	7 (Check the earth wire)
4	Use multimeter to check whether the resistance between (A) and (B) pin of the carbon canister control valve is about 25 Ω (at 20°C).	Yes	Replace ECU
		No	Replace the canister purge valve
5	Use multimeter to check whether there's open-circuit or short-circuit between #87 pin of main relay and the (B) pin of carbon canister control valve.	Yes	Repair or replace the harness
		No	Next step
6	Repair or replace the main relay and the circuit.		
7	Turn off the engine, connect the adapter between the ECU and the harness, use multimeter to check	Yes	Repair or replace wires



	whether there's open-circuit or short-circuit between #43 pin of the ECU and the (A) pin of carbon canister control valve connector.	No	Replace ECU
--	--	----	-------------

Note: Carbon canister electromagnetic valve is to control the exhaust of the gasoline steam within the fuel tank. This valve should not work when the engine runs in idle or under great load. It may result idle instability in case this valve opens under idle speed.

MALFUNCTION INDICATING LAMP (MIL) DRIVE LEVEL

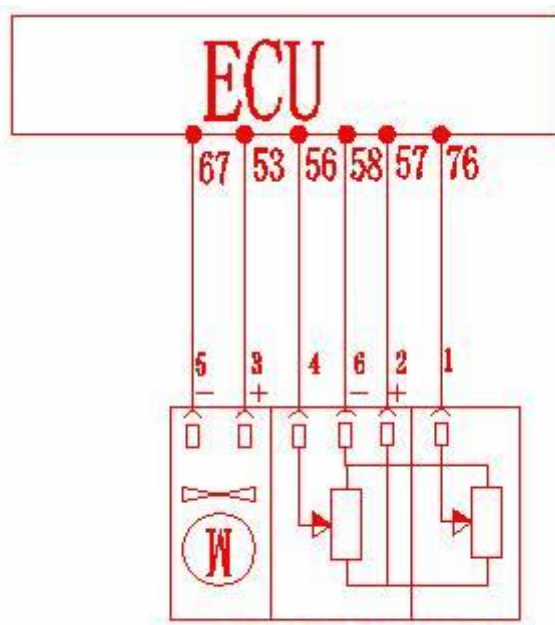


Circuit Diagram of MIL

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to ON.		Next step
2	Disassemble the dashboard and use multimeter to check whether there's about 12V storage cell voltage between the malfunction indication lamp pin and the ground wire.	Yes	Next step
		No	5 (Check the positive wire)
3	Replace the instrument and check that if it is normal.	Yes	Next step
		No	Replace instrument
4	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No. 52 of ECU and the input joint of MIL with multimeter.	Yes	Repair or replace wires
		No	Replace ECU
5	Check if there's earth or short-circuit between the wiring.	Yes	Replace wire
		No	Next step
6	Replace the instrument and check that if it is normal.	Yes	Repair or replace instrument
		No	Next step
7	Repair or replace the main relay and the circuit.		

Note: The malfunction indicating lamp is that through the control of earth, the ECU checks by the means of the malfunction indicator follow-up circuit if there's short-circuit or open-circuit in the malfunction lamp wiring.

THROTTLE DIRECT-DRIVE MOTOR



Throttle control

Circuit Diagram of Idle Speed Actuator Stepmotor

No.	Operating steps	Result	Follow up steps
1	Turn on the ignition switch but do not start the engine.		Next step
2	Pull out the dock connector of the electric throttle and check if the resistance value between the #5 and #3 of the connector is about 6.1 Ω .	Yes	Next step
		No	Replace the electronic throttle body
3	Pull out the connector and use multimeter to check if there's 12V alternating voltage between #5 and #3 of the electric throttle connector.	Yes	Next step
		No	Check the harness
4	Use multimeter to check if there's 12V voltage to ground on the harness connector when the key is switched to ON.	Yes	Replace idle speed actuator
		No	Next step
5	Between the ECU and the harness, use multimeter to check if there's open-circuit or short-circuit between the ECU #67 and the #5 on the connector and between the ECU #53 and #3 of the connector respectively.	Yes	Repair or replace the harness
		No	Replace ECU

Note: Since the trouble rate of the throttle valve body is really low, normally it's unnecessary to doubt the electric throttle valve body. It's preferable to perform one self-learning so as to ensure its trouble before the replacement.

6. STEPS TO PERFORM TROUBLE DIAGNOSIS BASED ON ENGINE SYMPTOM

The initial checking shall be conducted before the steps that to perform trouble diagnosis based on engine diagnosis:

- (1) Verify that there is no abnormal behavior with the ECU and malfunction indicator light (not applicable for car models without setting of malfunction indicator light).
- (2) Inspect with the diagnostic tester or flashing light to verify that there is no malfunction information record.
- (3) Inspect the idle speed data of warmed up engine in the electronic control system with the diagnostic tester and verify that they are normal.

Name	Parameter
Intake Temperature tans	20-70 °C
Storage Cell Voltage ub	12-14V
Engine Coolant Temperature tmot	80-90 C
Engine Load tl	1.8-3.0ms
Air-Fuel Ratio Control Integrator xfr	5%-5%
Ignition Advance Angle	5-10 CA
Throttle Rotation Angle wdkbl	0
Fuel Injection Period ti	4-7ms
Engine Revolution n	Expected idle±50rpm
Carbon Canister Control Valve Volume Ratio	0
Air-Fuel Ratio Control Self Adaptation xfra	0.95-1.05
Air-Fuel Ratio Control Self Adaptation xtra	120-140
Intake Manifold Absolute Pressure	350-650hPa
Front Oxygen Sensor Voltage	0.1-0.9V Rapid Fluctuation
Rear Oxygen Sensor Voltage	0.1-0.9V Rapid Fluctuation (Relevant low under normal running)
Air Intake Volume	6 -12kg/h
Idle Adjustment Condition	60-100

- (4) Verify that the malfunction symptom complained by the car owner exists and locate the exact position of the symptom.

Then check the appearancef°

- . Check that grounding of wire harness is clean and firm.
- . Check that vacuum is unbroken, twisted and in right connection.
- . Check that there is no obstruction in pipe.
- . Check that air intake pipe is not squashed or damaged.
- . Check that the seal between throttle body and intake manifold is perfect.
- . Check that ignition cable of ignition system is unbroken , no ageing and in right wiring.
- . Check that wires are in right connection, no loosening or poor connection for connectors.

(1) Engine Not Running or Runs Slowly During Start

No.	Operating steps	Result	Follow up steps
1	Check the voltage value between the two wiring terminals of battery by multimeter; check if it is around 8-12V.	Yes	Next step
		No	Repair or replace battery
2	Put the ignition switch to “ON”. Check the voltage value of anode wiring terminals of battery on the ignition switch by multimeter; check if it is around 10-12.5V.	Yes	Next step
		No	Repair wiring terminal or replace cable
3	Put the ignition switch at start position, checking the anode terminal of starting motor by multimeter and observe the voltage if it is above 8V.	Yes	Next step
		No	Replace ignition switch
4	Put the ignition switch at start position, checking the anode terminal of starting motor by multimeter and observe the voltage if it is above 8V.	Yes	Next step
		No	Repair wiring terminal or replace cable
5	Check if it is short circuit or break circuit in the starting motor.	Yes	Repair or replace the start motor
		No	Next step
6	Check if there is jammed by poor lubricating.	Yes	Troubleshooting
		No	Next step
7	If the failure is happened in winter time, check if it is because of the wrong engine lubricant and gearbox oil causes the big resistance of the starting motor.	Yes	Replace proper oil
		No	Check if other systems are normal.

Note: For the occurrence of such problems, mainly the voltage, starter and earth system shall be checked. In modern sedans, the affection of the lubrication oil to the vehicle start is really minor, therefore the problem of lubrication oil can be basically excluded and the self resistance of the engine shall be considered.

In north-east areas, it's easy to have the problem of starter idling during engine start for 0.8 vehicles that are resulted from the excess internal resistance of the starter and the force of the suction coil isn't great enough to throw out the gear.

(2) Engine can lug but can't start successfully during start

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to "ON". Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
2	Pull off one of the cylinder separating line and connect spark plug to it; keep the spark electrode around 8-10 mm away from engine body; start the engine by starter and check if there is blue and white high pressure fire.	Yes	8
		No	Next step
3	Check it the resistance of high voltage wire is normal (Not exceed 16kΩ)	Yes	Next step
		No	Repair or replace high voltage wire.
4	Check ignition coil and high voltage wire for burns, corrosion or cracks.	Yes	Replacement
		No	Next step
5	Check if the high voltage wire is normal.	Yes	Replacement
		No	Next step
6	Check if the ignition coil is working correctly.	Yes	Next step
		No	Replacement
7	Check if the connectors of ignition coil and high voltage coil are secured.	Yes	Next step
		No	Connect the plug
8	Check if the oil pump relay and the fuel pump can maintain for certain period.	Yes	Next step
		No	Service the fuel pump circuit
9	Connect it to the fuel manometer valve. Make the 30# and 87# pins of fuel pump relay short so as to operate the fuel pump, and then verify that the fuel pressure is maintained at about 350kPa.	Yes	Next step
		No	13
10	Pull off the fuel distributing pipe and the fuel injector; pull off the joints of fuel injector one by one. And supply the voltage of 12 V from battery to fuel injector directly and look if the fuel injector can inject normally.	Yes	12
		No	Next step
11	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
12	Check if fuel is bad or moisture.	Yes	Replace the fuel
		No	18
13	Check if the fuel pressure value is below 350 kPa.	Yes	Next step
		No	17
14	Close the fuel manometer valve. Connect the ignition switch again to re-operate the fuel pump in order to verify that the fuel pressure can be established.	Yes	Next step
		No	16
15	Open the valve of fuel gauge and clamp the oil return pipe	Yes	Other check

	by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.	No	Repair or replace the fuel pump
16	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
17	Check if the oil return pipe is bended or jammed.	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator
18	Connect an adapter between ECU and the wiring harness. Then verify that there is any voltage at the ECU's pin No.38, 28 and 5, and to see whether the positive power supply wires connected to the above ECU's pins and the ground wires connected to the pin No. 1, 2 and 27 are normal.	Yes	Next step
		No	Repair or replace wires
19	Check if the part of air intake system is leaking.	Yes	Repair
		No	Next step
20	Check the absolute pressure of air intake pipe and look if the temperature sensor is jammed.	Yes	Repair or replace
		No	Next step
21	Check if the coolant temperature sensor is working correctly.	Yes	Next step
		No	Repair or replace
22	Check if the reason for the failure on starting is about mechanism, such as much cylinder clearance, cylinder leaking, and so on.	Yes	Fix the mechanical malfunction
		No	Replace ECU

Note: When all parts of electric injection system are excluded as normal, the checking of such problem shall consider if the engine mechanical mechanism runs normally, the cylinder pressure is normal without leakage and so on.

The 0.8AMT has no fuel pump relay and the system working voltage and fuel pump are controlled by the main relay.

(3) Difficult Start of Warmed Vehicle

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
2	Connect the fuel manometer valve. Short the 30# and 87# pins of the fuel pump relay to operate the fuel pump in order to verify that the fuel pressure is maintained at about 350kPa.	Yes	Next step
		No	9
3	Disconnect the connection oil pipe and turn off the ignition switch. Observe after 1 hour if the pressure of the fuel system can still maintain at 250 kPa .	Yes	Next step
		No	Repair the fuel system to stop leaking
4	Disconnect the connecting fuel pipe and turn off the ignition switch. After 1 hour, verify that the pressure of fuel system is maintained between 250-300 kPa.	Yes	Replace fuel pressure regulator
		No	Next step
5	Check if there is fuel leaking of fuel injector and oil pipe.	Yes	Replace the fuel injector and fuel pipe
		No	Next step
6	Take off the coolant temperature sensor joint and start the engine, observe if the engine can be started successfully.	Yes	Check coolant temperature and lines.
		No	Next step
7	Put adaptor between ECU and wiring harness. Then verify that there is any voltage at the ECU's 28#, 38# and 5# pins and to see whether the positive power wires connected to the above ECU's pins and the ground wire connected to the pins of 1#, 2# and 27# are normal.	Yes	Next step
		No	Repair or replace wires
8	Replace fuel and warm up the engine; observe if the engine can be started successfully.	Yes	End
		No	Replace ECU
9	Check if there is jam or bending of fuel pipe and if the pressure regulator valve of oil pump is working correctly.	Yes	Next step
		No	Repair or replace
10	Use multimeter to check if the both ends of the oil pump fitting have storage cell voltage (Since the fuel pump system is controlled by the main relay, the checking can only be performed at the moment when the ignition switch is turned on.	Yes	Next step
		No	Repair or replace fuel pump relay and wires
11	Try to replace the fuel pump and observe if the system can resume normal.	Yes	Next step
		No	Replace fuel pump
12	Check if the fuel pump is stopped up.	Yes	Replace fuel pump



		No	Replace ECU
--	--	----	-------------

Note: The difficult start of warmed vehicle is related to many systems including storage cell, throttle valve body and water temperature sensor and also is related to the engine mechanical mechanism such as the throttle shut, the swelling of the engine that may result the increasing of engine resistance under warmed vehicle condition, the normal running of fuel system.

(4) Normal Revolution but with consistent difficult start

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
2	Check the air cleaner and look if it is open.	Yes	Next step
		No	Replacement
3	After start successfully, check under idling if the pressure of intake manifold is between 35 and 65 kPa (Carefully check if the cylinder pressure is normal).	Yes	Next step
		No	Eliminate the failure of air intake system leaking
4	Step on the throttle slightly and observe if it is easy to be started easily.	Yes	Replace the throttle valve body
5	Connect the fuel manometer valve. Short the 30# and 87# pins of the fuel pump relay to operate the fuel pump in order to verify that the fuel pressure is maintained at about 350kPa.	Yes	Next step
		No	9
6	Use special connector to provide directly 12V voltage and intermitted ground wire from the storage cell to the fuel injector and check if the fuel injector runs normally (intermitted running).	Yes	8
		No	Next step
7	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
8	Check if fuel is bad or moisture.	Yes	Replace the fuel
		No	14
9	Check if the fuel pressure value is below 350 kPa.	Yes	Next step
		No	13
10	Close the valve of fuel gauge. Connect the ignition switch again to run the oil pump 3 minutes more and check if there is the oil pressure.	Yes	Next step
		No	12
11	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.	Yes	Replace fuel pressure regulator
		No	Repair and replace fuel injector and oil pipe
12	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
13	Check if the oil return pipe is bended or jammed.	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator



14	Pull out the electric throttle body while the engine coolant temperature is low and observe if the engine revolution is increased.	Yes	Next step
		No	Check the electric throttle body for damage.
15	Turn the ignition switch to “ON” position. Verify that the voltages at following ECU pins are normal: 38# is at about 12V of battery voltage; 27#, 2# and 1# are at zero.	Yes	Next step
		No	Check wires and plugs
16	Check if the ignition advance angle is normal.	Yes	Next step
		No	Inspection of other system
17	Check if the compression pressure of cylinder is normal.	Yes	Next step
		No	Troubleshooting
18	Check the absolute pressure of air intake pipe and look if the temperature sensor is jammed.	Yes	Repair or replacement
		No	Next step
19	Check if the coolant temperature sensor is working correctly.	Yes	Replace ECU
		No	Repair or replacement

Note: This problem shall notice if the AMT guard system is activated. During the engine start while the guard system is activated, the starter can run normally but the engine can't start. Therefore, it shall notice if this system runs normally.

(5) Difficult Cold Start

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
2	Inspect with multimeter to see whether the coolant temperature sensor is normal. (Or connect a 2.5KΩ resistance in series with ECU’s pin to replace the function of the coolant temperature sensor to start up the engine. If the engine can be started, it indicates that the coolant temperature sensor is abnormal.)	Yes	Next step
		No	Replace sensor
3	Turn the ignition switch to “ON” position and connect the adaptor between ECU and the wiring harness. Verify that the voltages at following ECU pins are normal: 38# is at about 12V of battery voltage; 27#, 2# and 1# are at zero.	Yes	Next step
		No	Check wires and plugs
4	Check the air cleaner and look if it is open.	Yes	Next step
		No	Replacement
5	After starting the engine, check the air intake pressure at idle speed and look if it is between 35 and 65 kpa.	Yes	Next step
		No	Eliminate the failure of air intake system leaking
6	Step down the throttle slightly and observe if the engine starts normally (This operation shall be fulfilled rapidly during the system self-examination).	Yes	Check electric throttle
		No	Next step
7	When the engine coolant temperature is low, pull out the idling actuator connector on the harness and observe if the engine revolution is increased (It shall perform code clear at the finish of this operation).	Yes	100{>Next step
		No	Inspection of throttle valve body
8	Directly ground the #86 pin of the main relay. Turn on ignition switch to run the main relay and fuel pump and observe if the fuel pressure is about 350 kPa .	Yes	Next step
		No	12
9	Use special connector to provide 12V power and earth wire directly from the storage cell to the fuel injector and observe if the fuel injector runs normally.	Yes	11
		No	Next step
10	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
11	Check if fuel is bad or moisture.	Yes	Replace the fuel
		No	17
12	Check if the fuel pressure value is below 350 kPa.	Yes	Next step
		No	16

13	Close the fuel manometer valve. Connect the ignition switch again to re-operate the fuel pump in order to verify that the fuel pressure can be established.	Yes	Next step
		No	15
14	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.	Yes	Check oil pressure regulator and oil pump.
		No	Repair and replace fuel injector and oil pipe
15	Check if the oil intake pipe is leaky or jammed.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
16	Check if the oil return pipe is bended or jammed.	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator and oil pump.
17	Check if the pressure of cylinder is normal.}	Yes	Next step
		No	Troubleshooting
18	Check if the engine air intake system is leaky.	Yes	Replacement
		No	Next step
19	Check the absolute pressure of air intake pipe and look if the temperature sensor is jammed.	Yes	Repair or replacement
		No	Replace ECU

Note: The cold start problem is related to many trouble points, of which the relevant importance is the water temperature sensor since the main parameter that determined the fuel injection pulse width during engine start is the water temperature sensor. In case of the failure of water temperature sensor or generation of wrong signal, then the system can't judge the temperature, which may result the problem of difficult start.

In case of the batch of difficult cold start within certain time period, then it may relate to the match of entire system.

(6) Unstable Idling at any time

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
2	Check if the engine electric throttle system runs normally.	Yes	Repair or replace electric throttle.
		No	Next step
3	Turn the ignition switch to “ON” position and connect the adaptor between ECU and the wiring harness. Verify that the voltages at following ECU pins are normal: 55# and 65#, 58# and 69#, 67# and 53# (Output end signal of intake air temperature sensor and coolant temperature sensor).	Yes	Check wires and plugs
		No	Next step
4	Run the engine at idle speed, make the cylinder cut off oil and observe if the engine revolution speed is decreased and fluctuated.	Yes	8
		No	Next step
5	Check the fuel injectors of each cylinder and look if they are in right conditions.	Yes	Next step
		No	Check fuel injector and wires
6	Verify that the resistance of each cylinder high voltage cable is normal. (Lower than 16k Ω).	Yes	Next step
		No	Replacement
7	Check if the ignition system is normal.	Yes	Repair
		No	Next step
8	Check if the spark plug is in right conditions.	Yes	Next step
		No	Replace spark plug
9	Connect the fuel manometer valve. Short the 30# and 87# pins of the fuel pump relay to operate the fuel pump in order to verify that the fuel pressure is being maintained at about 350kPa.	Yes	Next step
		No	13
10	Use special connector to directly provide 12V power and intermitted ground line signal from the storage cell to fuel injector and check if the fuel injector can intermitted run.	Yes	12
		No	Next step
11	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
12	Check if fuel is bad or moisture.	Yes	Replace the fuel
		No	18
13	Check if the fuel pressure value is below 380kPa.	Yes	Next step
		No	17
14	Close the fuel manometer valve. Connect the ignition switch again to re-operate the fuel pump in order to verify that the fuel pressure can be established.	Yes	Next step
		No	16
15	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil	Yes	Replace fuel pressure regulator
		No	Repair and replace fuel injector

	pressure occurs immediately.		and oil pipe
16	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil return pipe
		No	Replace oil pump
17	Check if the oil return pipe is bended or jammed.	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator
18	Check the pressure of air intake pipe and if the sense port of air intake temperature sensor is jammed.	Yes	Clean with cleaning agent
		No	Next step
19	Run the engine at idle speed. After the coolant reaches the temperature of actuating closed loop control, you may observe if the oxygen sensor can work correctly.	Yes	Next step
		No	Inspection of oxygen sensor and harness
20	Check if the engine air intake system is leaky.	Yes	Fix the leakage
		No	Next step
21	Check if the pressure of cylinder is normal.	Yes	Next step
		No	Troubleshooting
22	Run the engine in idle and use special diagnosis instrument to check if the ignition advance angle is within standard range after the coolant temperature reached normal value.	Yes	Replace ECU
		No	Other inspection

Note: The unstable idling is related to many systems such as leakage, carbon, throttle valve body and so on, therefore make sure that the air cleaner, spark plug and ignition system run normally before the replacement of the parts.

The AMT electric injection system adopts electric throttle, therefore, in case of the conditions such as unstable idling, it shall consider if it's related to the failure of engine electric injection system self-learning. It shall re-perform the self-learning at the confirmation of the problem.

(7) Unstable Idling during Engine Warming

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
2	Check the air cleaner and look if it is open.	Yes	Next step
		No	Replacement
3	Run the engine at idle speed and check if the air intake pressure during engine heating is between 35 and 65 kPa.	Yes	Next step
		No	Eliminate the failure of air intake system leaking
4	Shut down the engine. Turn on the ignition switch and connect the adaptor between ECU and the wiring harness. Verify that the voltages at air intake temperature sensor, water temperature sensor, and ECU’s pins of 64# and 69# (used as sensor power supply of 4.5-5V) are normal.	Yes	Next step
		No	Overhauling
5	Before the finish of the engine warming, pull out the connector on the electric throttle body and observe if the engine revolution is changed.	Yes	Next step
		No	Inspection of throttle valve body
6	Check if the coolant temperature sensor is working correctly.	Yes	Next step
		No	Replacement
7	Run the engine in idle and use short special diagnosis instrument to check if the ignition advance angle is normal after the coolant temperature reached the normal value.	Yes	Replace ECU
		No	Adjust the ignition advance angle.

Note: The occurrence of unstable idling during engine warming is really rare and the exclusion method is similar with the above condition, however, the normal function of the water temperature sensor must be confirmed in advance.

During the start of cold vehicle in the morning or the cold start, normally don’t step the accelerator pedal but to start the engine at the finish of the system self-examination, otherwise it may have the problem of unstable idling of engine warming.

(8) Unstable Idling at finish of engine warming

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
2	Connect the adapter between the ECU and the harness and check if the voltage of #62 (intake manifold absolute pressure sensor output), #55 (intake temperature sensor output), #69 (coolant temperature sensor output) pin of the ECU and the #67/#53 (Output to electric throttle valve body) of ECU are normal.	Yes	Next step
		No	Repair or replace harness
3	Turn off the engine. Check the air cleaner and look if it is open.	Yes	Next step
		No	Replacement
4	Check the air intake pressure at idle speed and look if it is between 35 and 65 kPa.	Yes	Next step
		No	Eliminate the failure of air intake system leaking
5	Short-circuit the #30 and #87 pin of the oil pump relay to run the fuel pump and check if the fuel pressure is about 350 kPa.	Yes	Next step
		No	9
6	Use special adapter to provide 12V power and intermitted earth line from the storage cell to fuel injector and check if the fuel injector can intermitted run.	Yes	8
		No	Next step
7	Clean out the fuel injector and look if it can work correctly.	Yes	Replacement
		No	Replace fuel injector
8	Check if fuel is bad or moisture.	Yes	Replace the fuel
		No	14
9	Check if the fuel pressure value is below 380kPa.	Yes	Next step
		No	13
10	Turn off the fuel manometer valve. Connect the ignition switch again to re-operate the fuel pump in order to verify that the fuel pressure can be established.	Yes	Next step
		No	12
11	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.	Yes	Replace fuel pressure regulator
		No	Repair and replace fuel injector and oil pipe
12	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
13	Check if the oil return pipe is bended or jammed.	Yes	Repair or replace oil return pipe
		No	Replace fuel

			pressure regulator
14	Run the engine in idle and use diagnosis instrument to check if the ignition advance angle is normal after the coolant temperature reached normal value.	Yes	Next step
		No	Inspect other system
15	Pull off the coolant temperature sensor and observe if the engine is in right conditions.	Yes	Replace the coolant temperatuer sensor
		No	Next step
16	Check if the compression pressure of cylinder is normal.	Yes	Next step
		No	Troubleshooting
17	Verify that the resistance of each cylinder high voltage cable is normal. (Lower than 16k Ω).	Yes	Next step
		No	Replacement
18	Check if the ignition coil and high voltage line system runs normally and check the ignition coil for cracks.	Yes	Replacement
		No	Next step
19	Check if the spark plug is in right conditions.	Yes	Replace ECU
		No	Replace spark plug

Note: The engine will enter into normal idling status at the finish of the engine warming. The unstable revolution under normal idling is related to many factors such as spark plug, high voltage line, ignition coil, system leakage, system carbon, normal cylinder pressure and so on.

(9) Unstable idling or flame-out under operation load (Such as AC)

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction.
		No	Next step
2	Turn on the A/C switch and connect the adaptor between ECU and the wiring harness. Measure and see whether the ECU’s pin 19# A/C switch have any signal input.	Yes	Next step
		No	Check and repair air conditioning circuits
3	Check if the pressure of air conditioning system, the electromagnetic clutch of compressor and the air conditioning pump are in right conditions.	Yes	Next step
		No	Repair or replacement
4	Check if the voltage of ECU #56, #57, #58 and #76 (output to electric throttle) pin is normal.	Yes	Next step
		No	Check controlling circuit
5	Disassemble the electric throttle valve body and check the throttle for jamming or dumb operation.	Yes	Inspect the throttle valve body
		No	Next step
6	Start the engine and the AC. The checking of throttle open extent by means of trouble diagnosis instrument can judge if there’s AC acceleration function while the AC system is turned on.	Yes	Replace ECU
		No	Replace idle speed actuator

Note: The 19# is high storage cell request signal. When the AC switch is turned on, there will be high storage cell signal transmitted to the ECU from this pin and the ECU will re-check the other AC systems. If the system is normal, the ECU will control the AC relay earth and the AC system will start running (this signal will pass through the AC pressure switch).

(10) Unstable Periodicity (Self-learning must be re-performed after the ECU power cut)

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction.
		No	Next step
2	Check the air cleaner and look if it is open.	Yes	Next step
		No	Replacement
3	Run the engine at idle speed and check if the air intake pressure is from 35 to -65kPa.	Yes	Next step
		No	Check and repair air intake and leak
4	Run the engine at idle speed, make the cylinder cut off oil and observe if the engine revolution speed is decreased and fluctuated.	Yes	7
		No	Next step
5	Turn the ignition switch to “ON” position and connect the adaptor between ECU and the wiring harness. Verify that the voltages at following ECU’s pins including absolute pressure sensor output of air intake manifold, air intake temperature sensor output, coolant temperature sensor output, oxygen sensor output, electronic grounding, ignition switch pin, and ECU’s pins of 67# and 53# (output connected to idle actuator) are normal.	Yes	Next step
		No	Repair or replace the harness
6	Run the engine in idle and use diagnosis instrument to check if the system ignition advance angle is normal after the coolant temperature reached normal value.	Yes	Next step
		No	Inspect other
7	Check the pressure of air intake pipe and if the sense port of air intake temperature sensor is jammed.	Yes	Clean
		No	Next step
8	Check if fuel is bad or moisture.	Yes	Replace the fuel
		No	Next step
9	Use special adapter to provide 12V power and intermitted earth line from the storage cell to fuel injector and check if the fuel injector can intermitted run.	Yes	Next step
		No	Check and repair oil injector and related wires
10	Check if the resistance values of cylinders _i - ignition cable are normal.	Yes	Next step
		No	Replacement
11	Check if the ignition coil is damaged or cracked.	Yes	Replacement
		No	Next step
12	Check if the spark plug is in right conditions.	Yes	Replace ECU
		No	Replace spark plug

Note: For unstable periodicity, it mainly shall check the intake system for leakage or check the failure of the electric throttle valve body. The method of electric throttle checking is as follows: The throttle will act slightly at the same time when the ignition key is turned on. During the self-examination process, the



throttle shall act following the action of accelerator pedal.

11) Excess idling (Self-learning must be re-performed after ECU power cut)

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction.
		No	Next step
2	Check the throttle valve leaf for jamming and the electric throttle body for troubles.	Yes	Adjust or replace
		No	Next step
3	Check if the canister purge valve, the fuel pressure regulator, the positive crankcase ventilation vacuum pipe and the vacuum pipe of brake system are mounted steadily or they are damaged.	Yes	Repair or replacement
		No	Next step
4	Run the engine at idle speed and use neutral. Step on the accelerator and observe if the idle speed is too high.	Yes	Next step
		No	6
5	Clamp the vacuum pipe and observe if the idle speed becomes normal.	Yes	Repair or replace the vacuum booster
		No	Next step
6	Replace PVC valve and clamp the positive crankcase ventilation vacuum pipe. Observe if the idle speed becomes normal.	Yes	Replace PVC valve
		No	Next step
7	Clamp the canister purge valve pipe and observe if the idle speed becomes normal.	Yes	Replace the carbon canister control valve
		No	Next step
8	Check the electric throttle body for dumbness or jamming.	Yes	Repair or replacement
		No	Next step
9	Check the other areas of intake pipe for leakage.	Yes	Repair or replacement
		No	Next step
10	Check if the gasket of fuel injector is in good condition.	Yes	Next step
		No	Replace gasket
11	Check the absolute pressure of air intake pipe and look if the air intake temperature sensor is in good condition.	Yes	Replace ECU
		No	Replace sensor

Note: Check if the system has passed the self-learning. If the system hasn't passed the self-learning, the system will always be under trouble mode or unstable condition, which may result the excess engine idling as well as the system leakage. When the system leakage is beyond the regulation range of the ECU, there will be the evidence of unstable idling.

After the full cut of system power, it shall resume the power again and turn on the ignition key to wait the finish of the self-examination. Then turn off the ignition key and wait for 30 seconds to basically finish the self-learning steps. Repeat above steps in case the idle still can't resume normal.

(12) Revolution increasing failure or flame-out during acceleration

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
2	Check the air cleaner and look if it is open.	Yes	Next step
		No	Replacement
3	Run the engine at idle speed and check if the engine revolution speed is normal at idle speed.	Yes	Next step
		No	Overhaul according to the idle speed malfunction instruction
4	Run the engine at idle speed and check if the air intake pressure is from 35 to -65kPa.	Yes	Next step
		No	Overhauling
5	Run the engine in idle and use diagnosis instrument to check if the system ignition advance angle is normal when the coolant temperature reached normal value.	Yes	Next step
		No	Inspect other system
6	Connect the fuel manometer valve. Short the 30# and 87# pins of the fuel pump relay to operate the fuel pump in order to verify that the fuel pressure is being maintained at about 350kPa.	Yes	Next step
		No	10
7	Apply a voltage supply of 12V directly between the battery and the fuel injector with special connector, and verify that the fuel injector functions normally.	Yes	9
		No	Next step
8	After washing and cleaning the fuel injector, verify again that it can function normally.	Yes	Next step
		No	Replace fuel injector
9	Verify that the fuel is deteriorated or contaminated with water.	Yes	Replace the fuel
		No	15
10	Verify that the fuel pressure is lower than 350kPa.	Yes	Next step
		No	14
11	Turn off the fuel manometer valve. Connect the ignition switch again to re-operate the fuel pump in order to verify that the fuel pressure can be established.	Yes	Next step}
		No	13
12	Turn on the fuel manometer valve and clamp the fuel return pipe with the fuel tube clamp to stop the fuel return in order to verify that the fuel pressure can be established quickly.	Yes	Replace fuel pressure regulator
		No	Repair and replace fuel injector and oil pipe
13	Verify that the fuel inlet pipe has any leakage or blockage.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
14	Verify that the fuel return pipe has any leakage or bending.	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator
15	Turn the ignition switch to “ON” position and connect the adaptor between ECU and the wiring harness. Verify that the	Yes	Next step
		No	Repair or replace the harness



	voltages at following pins of ECU including signal output terminal and grounding terminal of the throttle position sensor, and pins of 76# and 56# (signal output end of throttle valve position sensor), 1#, 2#, 27# (earth end) are normal.		
16	Check if the ignition coil, high-voltage wire and spark plug are normal.	Yes	Replace ECU
		No	Repair the relevant parts

Note: This trouble belongs to the relevant obvious troubles and the relevant slight details shall be checked such as the jamming of system cleaner, the jamming of air vent and so on. Other details include the spark plug and the high voltage line and so on. The normal operation of system sensor and actuator also shall be checked, such as camshaft position sensor, fuel injector nozzle and so on.

(13) Slow response during acceleration

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
2	Turn off the engine. Check the air cleaner and look if it is open.	Yes	Next step
		No	Replacement
3	Run the engine at idle speed and check if the engine revolution speed is normal at idle speed.	Yes	Next step
		No	Repair in accordance with idle speed failure item
4	Run the engine at idle speed and check if the air intake pressure is from 35 to 65 kPa.	Yes	Next step
		No	Overhauling
5	Turn the ignition switch to “ON” position and connect the adaptor between ECU and the wiring harness. Verify that the voltages at following pins of ECU including signal output terminal and grounding terminal of the throttle position sensor, and pins of 76# and 56# (signal output end 1 and 4 of throttle valve position sensor), 1#, 2#, 27# (earth end) are normal.	Yes	Next step
		No	Repair or replace wires
6	Run the engine in idle and use diagnosis instrument to check if the system ignition advance angle is normal when the coolant temperature reached normal value.	Yes	Next step
		No	Inspect other
7	Connect the fuel manometer valve. Short the 30# and 87# pins of the fuel pump relay to operate the fuel pump in order to verify that the fuel pressure is maintained at about 350kPa.	Yes	Next step
		No	11
8	Use special connector to directly provide 12V and intermitted earth line from the storage cell to the fuel injector and check if the fuel injector can intermitted run.	Yes	10
		No	Next step
9	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
10	Check if fuel is bad or moisture.	Yes	Replace the fuel
		No	16
11	Check if the fuel pressure value is below 350 kPa.	Yes	Next step
		No	15
12	Turn off the fuel manometer valve. Connect the ignition switch again to re-operate the fuel pump in order to verify that the fuel pressure can be established.	Yes	Next step
		No	14
13	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.	Yes	Replace the pressure regulator.
		No	Repair and replace fuel injector and oil pipe



14	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
15	Check if the oil return pipe is bended or jammed.	Yes	Repair or replace oil return pipe
		No	Replace the pressure regulator.
16	Check if the exhaust system and three-way catalytic converter are jammed.	Yes	Replace or clean
		No	Replace ECU

Note: For the problem of slow response during acceleration, it mainly shall check the intake pressure, fuel injection pulse width and so on. The jamming of air vent and the dirt of air cleaner also may result this problem. And it also includes the problems of spark plug and the high voltage line. It shall check if the crankshaft position sensor is under normal function. The system has restricted drive measures after the crankshaft position sensor is damaged.

(14) Poor performance/

1	Check if failure occurs, such as clutch slipping, low tire pressure, brake delay, wrong tire size and incorrect four-wheel alignment.	Yes	Overhauling
		No	Next step
2	Check if the electric throttle can be fully opened.	Yes	Next step
		No	Repair or replace throttle
3	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
4	Run the engine in idle and use diagnosis instrument to check if the system ignition advance angle is normal when the coolant temperature reached normal value.	Yes	Next step
		No	Adjust ignition advance angle
5	Turn the ignition switch to “ON” position and connect the adaptor between ECU and the wiring harness. Verify that the voltages at following pins of ECU including signal output terminal and grounding terminal of the throttle position sensor, and pins of 55# and 65#, and 58# and 69# (signal output end of intake air temperature sensor and coolant temperature sensor), pin 63# and 53# (for DC motor control) are normal. At the same time check if there’s alternating current that between 100 and 900 mv between #11 and #22 of the oxygen sensor (The checking of system shall notice that it shall be performed after full system pre-warming).	Yes	Next step
		No	Repair or replace wires
6	Run the engine at idle speed and check if the air intake pressure is from 35 to 65kPa.	Yes	Next step
		No	Overhauling
7	Connect the fuel manometer valve. Short the 30# and 87# pins of the fuel pump relay to operate the fuel pump in order to verify that the fuel pressure is being maintained at about 350kPa.	Yes	Next step
		No	11
8	Use special connector to directly provide 12V and intermitted earth line from the storage cell to the fuel injector and check if the fuel injector can intermitted run.	Yes	10
		No	Next step
9	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
10	Check if fuel is bad or moisture.	Yes	Replace the fuel
		No	16
11	Check if the fuel pressure value is below 350 kPa.	Yes	Next step
		No	15
12	Turn off the fuel manometer valve. Connect the ignition switch again to re-operate the fuel pump in order to verify that the fuel pressure can be established.	Yes	Next step
		No	14
13	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure	Yes	Replace the pressure regulator

	occurs immediately.	No	Repair and replace fuel injector and oil pipe
14	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
15	Check if the oil return pipe is bended or jammed.	Yes	Repair or replace oil return pipe
		No	Replace the pressure regulator
16	Check the absolute pressure of air intake pipe and look if the date of air intake temperature sensor is normal.	Yes	Next step
		No	Replace sensor
17	Check if the spark plug, high voltage wire and ignition coil are normal.	Yes	Next step
		No	Replace or adjust
18	Check if it results from air conditioning system.	Yes	Inspect the A/C system
		No	Replace ECU

Note: The poor system acceleration is related to many factors, it mainly shall check if all parts of electric injection system function well; also it shall check if the engine mechanical mechanism part functions well, such as cylinder pressure, throttle carbon and so on. It's also related to other engine systems, such as power steering system, AC system, and if the engine intake/exhaust system functions well.

(15) AC system trouble

1	Check if there is enough coolant, if the air condition belt, the air condition clutch and the pressure switch are in good condition.	Yes	Next step
		No	Troubleshooting
2	Run the engine at idle speed and connect the air condition switch. Check if there is the failure of air condition thermo-sensitive Resistance with failure diagnostic tester.	Yes	Fix the indicated malfunction
		No	Next step
3	Turn on the A/C switch and connect the adaptor between ECU and the wiring harness. Measure and see whether the ECU's A/C switch and A/C pressure have any signal input.	Yes	Next step
		No	Inspect the harness
4	If this vehicle adopts low level control, check if the air condition is working still even though it is turned off. Replace lamp or repair wires	Yes	Repair or replace the harness
		No	Next step
5	Check if there is low level output at ECU pin No.68 (connect to the ground of air condition drive coil).	Yes	Repair the A/C relay and the wiring harness.
		No	Replace ECU

Note: The control method of the AMT AC control system is basically same with the one of other vehicle models, of which the ECU will determine if it's necessary to start the AC system depending on the AC system pressure change.

8. SYSTEM REPAIR SAFETY NOTICE

(1) Diagnosis & repair safety notice for gasoline injection electric control system

(1) Removal/installation requirements of controller

Controller shall be removed before performing electric welding or paint baking.

The ignition switch must be switched to OFF position during the removal of the controller so as to avoid the damage.

The power supply wire can't be disassembled from the storage cell when the engine is running or the electric system is in use.

Do not use charger great current to start the engine.

Pay attention to keep the environment temperature surrounding the controller below 80°C.

(3) Cleanliness requirements: following rules shall be complied strictly before operating the fuel supply system and fuel injector system:

The disassembled parts shall be placed and covered in the clean areas. Do not use the cloth of which the fiber is easy to drop out.

(2) All the wiring harness and the same for diagnostic tester can only be disconnected or connected after the ignition switch has been turned off;

Make sure the correct wiring during the voltage or grounding measurement to the electric control system.

The disassembling of power supply wire from the storage cell or the pull-out of the harness controller connector may cause the memory loss of diagnosis and self-learning information.

(2) Notes for maintaining the fuel supply system:

When disassembling or installing the fuel pump on the fully filled or partial filled fuel tank, the following items must be cautioned:

Before the operation, the device that capable to absorb the leaked gasoline shall be installed closing to the opening of the fuel tank.

Prevent the direct contact of gasoline to the skin;

Before loosening the joint portion, such portion and surrounding area shall be fully cleaned.

In order to prevent the fuel spray of the loosening portion, such joint portion shall be placed with duster cloth;

The opened parts that can't be repaired immediately shall be covered or enclosed carefully.

The spare parts shall be taken from the package right before the installation. Do not use the spare parts that without the package.

During the installation of fuel injector, pay attention not to damage the O-ring. In order to facilitate the assembling, apply some lubrication oil on the O-ring.

When the system is opened, try not to use compressed air and not to move the vehicle.

(2) Safety Measures

Attention should be paid to the followings so as to avoid the injury of personnel and damage of the fuel injectors and the ignition device:

(1) If the engine is running or at the start up speed, then it is not allowed to contact or disconnect the ignition wiring harness;

In case the engine is to be driven by the starter motor while not to start itself, such as at the checking of compression pressure, the harness connector shall be pulled out from the Hall sensor and the system



trouble code shall be cleared after the checking.