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EFI SERVICE MANUAL

A21 car is equipped with ME7.9.7 EFI system which developed by UAES. This manual will introduce the general service and the operational principle and character of sensor elements of EFI system in detail. At last there will be some diagnostic method and flow for the typical problems.

1. NOTICE TO THE EFI SYSTEM SERVICE

1.1. GENERAL SERVICE

- Digital multimeter is the only permitted instrument to inspect the EFI system.
- Please use the quality spare parts for service, otherwise can not make sure the EFI work properly.
- Please use lead free gasoline during service.
- Please be obedient to the service and diagnose flow.
- It is forbidden to disassembly the EFI part during service.
- It should be careful to take the electronic component (ECU, sensor, etc.) for preventing from dropping to the ground.
- Please protect the environment, deal with the rejectamenta carefully and effectively.

1.2. NOTICE DURING THE SERVICE

- Do not disassemble any part or inserts of the EFI system from its original position at random to prevent from damaging parts or that moisture and dirt oil come into the inserts. And that will keep the system from working properly.
- Please leave the ignition switch at shut off position when you disconnect and connect the inserts otherwise it will damage the electric element.
- It is must keep the ECU under 80℃, when you do the work of hot status simulation and other works which may cause the temperature increase.
- The supplying oil pressure is high(around 300kPa), all the fuel pipe is made up of anti high pressure pipe. There is high pressure in fuel pipe even the engine does not run. So do

not disassemble the fuel pump at random when carrying out service for fuel system. Before disassemble the fuel pipe please carry out discharge pressure procedure. The method is as below: Disassemble the fuel pump relay (or disconnect the connector plug), start engine at its idle running and it dies out by itself. After the service supply fuel to engine fuel pipe at first, the method is: turn ignition key to ON position and wait a while, repeat this four or five times. Disassembly of fuel pipe and fuel filter should be carried out at a place with good ventilation and done by professional maintainer.

- Do not give electricity to fuel pump when the electrical pump is taken out of fuel tank in order to prevent from electrical spark and cause fire.
- Fuel pump is not allowed to carry out running test at dry or water situation, which will decrease its life. And do not exchange anode and cathode of the pump.
- Carry out jump spark inspection at necessary time when inspect the ignition system, and the time to inspect must be short. Do not open the throttle valve to prevent a lot of unburned gasoline entering exhaust pipe and damage the 3-way catalytic converter (It is better to take off the corresponding injector insert during the jump spark testing)
- The adjustment of idle speed is done completely by EFI without manual work. The accelerator stop screw of throttle valve has been fixed well in advance by manufacturer so that it is not allowed to change it original position by the customer.
- Do not exchange the anode and cathode of the accumulator to prevent damaging the electronic component. This system uses cathode ground.
- Do not disassemble accumulator cable when the engine is running.
- Disassemble the cable of accumulator anode and cathode, and ECU when there is welding work on the car.
- Do not inspect the input and output signal of component by impaling the lead surface.

1.3. SERVICE TOOLS

Tool name:

EFI system diagnostic tester

Function:

Read/clear the breakdown code in EFI and inspect data, test part motion.

**Tool name:**

Ignition timing lamp

Function:

Inspect engine ignition timing.

**Tool name:**

Digital multimeter

Function:

Inspect the character parameter of voltage, current, resistance.

**Tool name:**

Fuel pressure gauge

Function:

Inspect the pressure in fuel system, judge the status of fuel pump and fuel pressure regulator.



Tool name:

Pressure gauge for cylinder

Function:

Inspect the pressure in every cylinder.



Tool name:

Fuel injector cleaner and analyzer

function:

Analyze and clean the injector.



Tool name:

Vacuum meter

function:

Inspect the pressure of intake manifold



1.4. EXPLANATIONS OF THE ABBREVIATION IN THE MANUAL

DG Speed Sensor	DVE Electronic Throttle Valve
DR Fuel Pressure Regulator	FPM Accelerator Pedal
ECU Electronic Control Unit (Computer)	EKP Fuel Pump
EMS Engine Management System	EV Fuel Injector
LSH Heating Oxygen Sensor	KS Knock Sensor
KSZ Fuel Distributing Pipe Assembly	KVS Fuel Distributing Pipe
ROV Ignition System with Distributor	PG Phase Sensor
RUV Ignition System without Distributor	TEE Oil Pump Bracket Assembly
TF-W Coolant Temperature Sensor	TEV Purge Canister Control Valve
HFM Air Flow Sensor	ZSK Ignition Coil

2. ME7.9.7 SYSTEM INTRODUCTION

2.1. SYSTEM BASIC PRINCIPLE

2.1.1 SYSTEM GENERAL INTRODUCTION: ME7.9.7-MOTRONIC EMS

Engine management system (EMS) is composed mainly by three components: sensor, ECU, and actuator. And these three parts control the intake air quantity, fuel injection quantity and ignition advance angle. The basic frame is shown in chart 2.1.

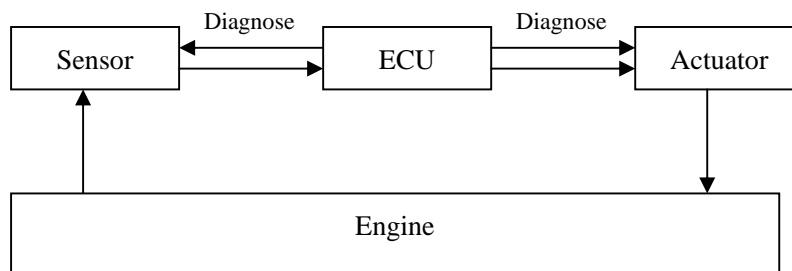


Chart 2.1 compose of engine electronic control system

In engine electronic control system, the sensor is the input part used for measuring all kinds of physics signal (temperature and pressure etc.) and change them to corresponding electronic signal; the function of ECU is accepting the signal and calculate it according to the programmed program and generate corresponding output signal to power drive circuit; and the power drive circuit makes the engine running according to established strategy by driving every actuator to do different action; at the same time the malfunction diagnosis system of ECU monitors all parts or control function, and if a malfunction is detected and confirmed it will memorize malfunction code, transferring “limping home” function, and when the malfunction is deleted, the normal value will be deesterilized.

Engine electronic control system schematic of ME7.9.7 chart 2.2

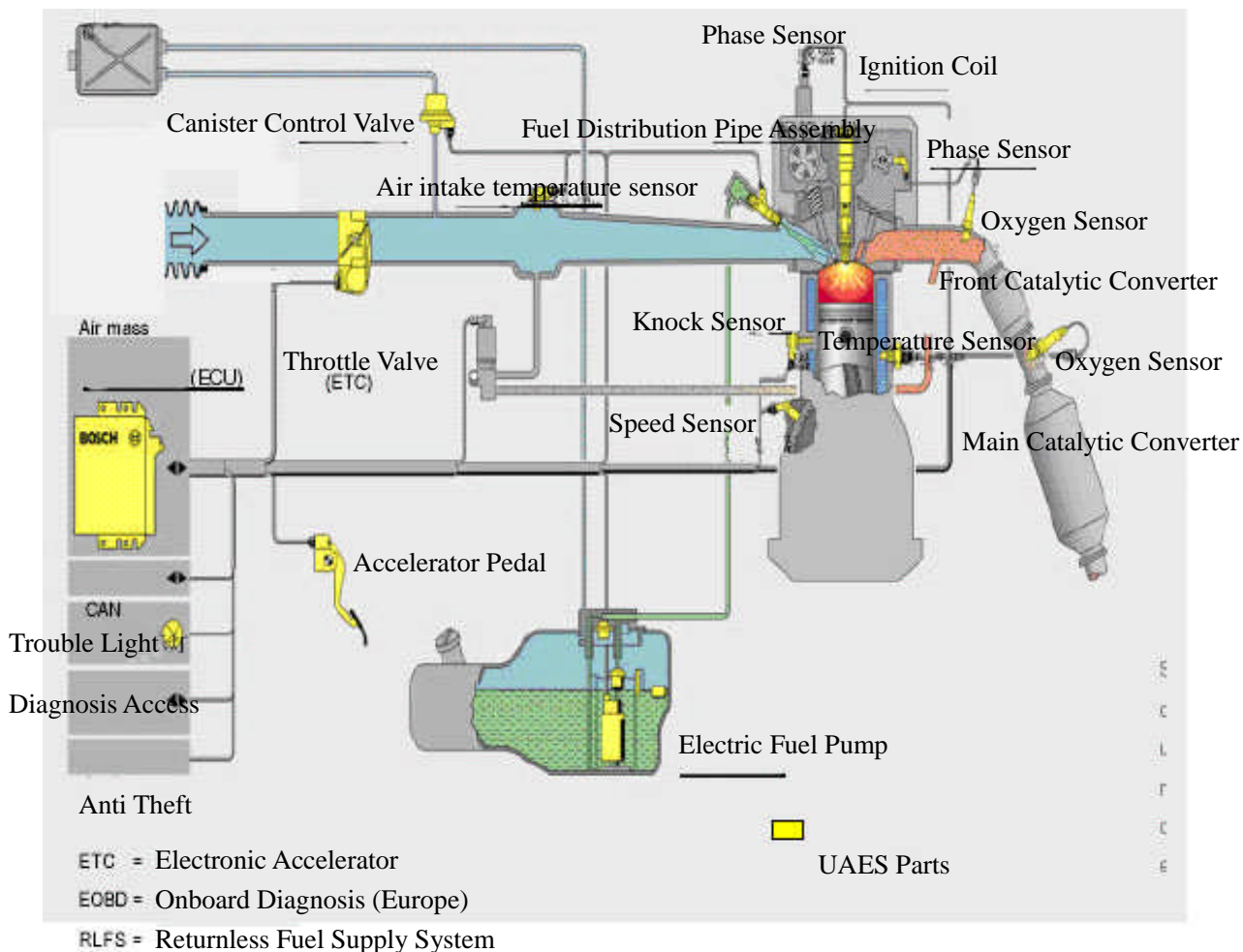


Chart 2.2

The basic component of ME7.9.7 engine electronic control system:

Electronic Control Unit(ECU)	Accelerator	Electronic Throttle Valve
Air Quality Flow Meter	Injector	Electronic Fuel Pump
Coolant temperature sensor	Fuel Pressure Regulator	Throttle position sensor
Fuel Pump Bracket	Camshaft Position Sensor	Fuel Distributing Pipe
Speed Sensor	Oxygen Sensor	Canister Control Valve
Knock Sensor	Ignition Coil	

ME7.9.7 engine management system is an electronic gasoline control system, and it can provide lots of control characters about operator and vehicle or equipment. The system adopts a combination method of open loop and closed loop (feed back) control to provide all kinds of control signal to engine. The main function of the system:

- 1) The basic functions of applying physics mode engine
 - ◆ For the system structure based on torque, the airflow sensor will confirm the loading of cylinder and improve the mixture air control function closed loop control.
 - ◆ Fuel injects ignition timing on the order of cylinder order, including knock control and emission control functions.
 - ◆ 3 way catalytic convert heating
 - ◆ Canister control
 - ◆ Idle speed control
 - ◆ Limping home

2.2. CONTROL SIGNAL: ME7.9.7 SYSTEM INPUT/OUTPUT SIGNAL

The main sensor input signal of ECU of ME7 system:

- Air flow signal
- Throttle valve corner signal
- Coolant temperature signal
- Engine speed signal
- Phase signal
- Knock sensor signal
- Oxygen sensor signal
- Speed signal
- Air conditioner pressure signal

The above information after the transaction of ECU, there will generate required actuator control signal, and this signal will be magnified in output driving circuit and was transferred to its corresponding actuator. The signals include below information:

- Injection timing and injection continuous time
- Fuel pump relay
- Opening degree of canister control valve
- Ignition coil closing angle and ignition angle of advance
- Air conditioner compressor relay

- Cooling fan relay

2.3. INTRODUCTION OF SYSTEM MALFUNCTION DIAGNOSIS FUNCTION

2.3.1. MALFUNCTION INFORMATION RECORD

The ECU monitors sensor, actuator, related circuit, malfunction indicator and accumulator voltage etc., and ECU itself continuously. At the same time the ECU inspect the reliability test on sensor signal output, actuator driving signal and internal signal (e.g.: closed loop control, coolant temperature, knock control, idle engine speed and accumulator voltage etc.). ECU will set the malfunction record on RAM malfunction memory immediately once the malfunction or the unlikelihood signal is detected. The malfunction information is recorded by malfunction code and displayed according to its appeared order, dividing malfunction into “steady malfunction” and “contingency malfunction” (for example the malfunction is caused by short time cable braking or bad contact of the inserts) according to its appeared frequency.

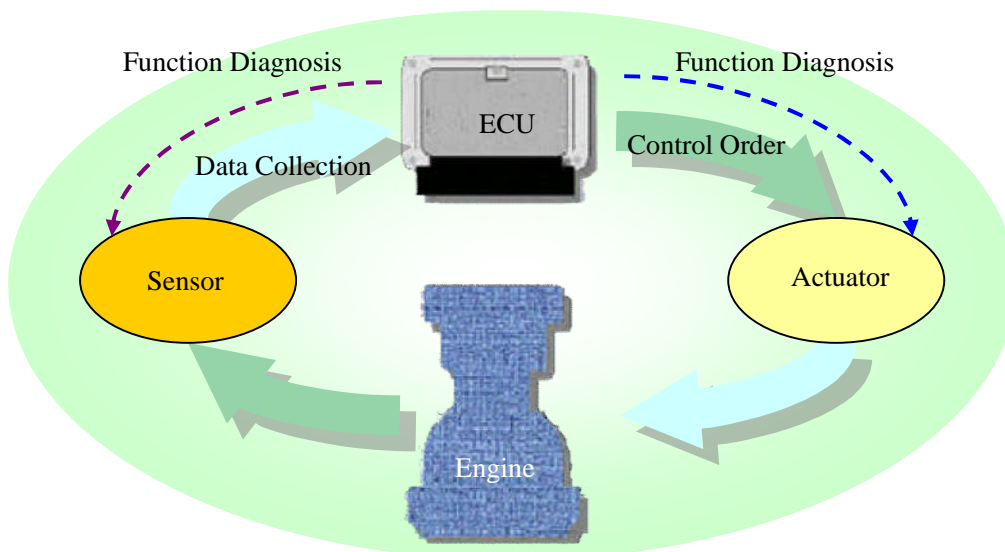


Chart 2.4 EFI System Malfunction Diagnosis Principle Chart

2.3.2. CONTROL STRATEGY OF FAILURE LAMP

When there is no trouble:

- The failure lamp is lighting and die out within 4 seconds after the ignition switch is ON
- Starting within 4 seconds, the failure lamp dies when the engine speed signal is found;
- The failure lamp winking at 2HZ frequency when the K cable contact to ground more than 2.5 seconds.

When there is a trouble:

- The failure lamp always on light when the ignition switch is ON;
- Start and die out when the engine speed signal is detected; if the failure lamp was defined as lighting mode, it will always on light after reach its confirmed conditions;

- Output winking code that is P-CODE value after the K cable contact with the ground more than 2.5 seconds. For example: the winking mode of P0203 is: wink 10 times continuously – intermission – wink 2 times continuously – intermission - wink 10 times continuously – intermission – wink 3 times continuously.

2.3.3, DIAGNOSIS METER CONNECTION

This system adopts “K” cable communication protocol and use ISO 9141-2 standard diagnosis joint, please see chart 2.5. This standard diagnosis joint is connected to engine harness fixed. The pins of No.4, 7 and 16 on the standard diagnosis joint are used for EMS. The pin of No. 4 on standard diagnosis joint is ground wire; Pin of No.7 is connecting to No.71 pin of ECU, which is engine data “K” cable; No.16 pin is connecting to accumulator anode.

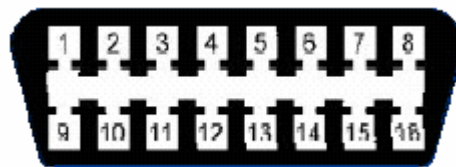


Chart 2.5 ISO9141-2 Standard Diagnosis Joint

2.3.4, READ MALFUNCTION INFORMATION BY WINK CODE

Switch on ignition switch and use engine data K cable(that is standard diagnosis joint 7#)to ground(use one lead connect pin of diagnosis joint 4# and pin of 7#) more than 2.5 seconds, if there are malfunction code in ECU malfunction memorizer, the malfunction light wink code of engine now is P-CODE value. Such as: P0203 winking type is: wink 10 times continuously – intermission – wink 2 times continuously – intermission - wink 10 times continuously – intermission – wink 3 times continuously.

3. WORKING PRINCIPLE AND CHARACTER OF EFI SYSTEM ELEMENT

3.1 ELECTRONIC CONTROL UNIT - ECU

1)Exterior drawing

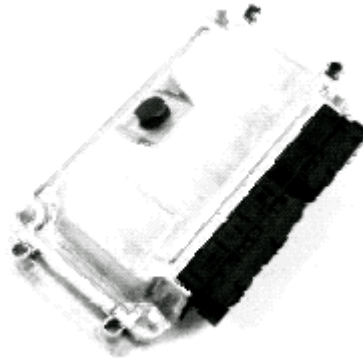
2)**Purpose:** ECU accepts and deals with engine status signals inputted from sensors and drives the actuators to work. Making engine working as the established program, insure power good, fuel consuming effectively and low emission.

3)**Mounting position:** Passenger compartment

4)Functions

- Multipoint injection in order
- Control ignition

- Idle speed control
- Knock control
- Provide sensor power: 5V/100mA
- Closed loop control
- Control carbon canister solenoid valve
- Air conditioner switch
- engine malfunction indicator
- Fuel fix quantity modification
- Engine speed signal output(TN signal)
- Input of speed signal
- Malfunction self diagnosis
- Accept engine loading signal etc.



5)Definition of pin

Pin	point	Pin	Connection point
1	Oxygen sensor heating	42	Air intake temperature
2	Ignition coil 2	43	
3	Ignition	44	Non persistent power
4	Oxygen sensor heating	45	Non persistent power
5	Ignition coil 1	46	Canister valve
6	Injection nozzle 4(cylinder No. 2)	47	Injection nozzle 3(cylinder No.4)
7	Injection nozzle 2(cylinder No.3)	48	
8	Engine speed	49	
9	Coolant temperature	50	Fan control 1
10	Fuel consuming	51	electronically 2
11	Trouble light	52	
12	Persistent power	53	electronically 1
13	Ignition coil	54	Electronic throttle valve
14	Main relay	55	Downstream oxygen sensor
15	Engine speed sensor A	56	

16	Accelerator position sensor	57	
17	Sensor 1	58	Brake switch
18	Upstream oxygen sensor	59	Speed signal
19	Knock sensor A	60	Medium switch
20	Knock sensor B	61	Power 1
21	Brake light	62	CAN communication
22		63	Non persistent power
23	Accelerating sensor	64	Electronic throttle valve
24		65	Electronic throttle valve
25		66	Electronic throttle valve
26		67	Electronic throttle valve
27	Injection nozzle 1(cylinder No.1)	68	Cooling fan
28		69	Air conditioner relay
29		70	Fuel pump relay
30		71	Diagnosis K cable
31	EOBD inspection light	72	
32	5V power supply 2	73	Anti theft device
33	5V power supply 1	74	Clutch switch
34	Engine speed sensor B	75	Air conditioner switch
35	Sensor 3	76	Power steering switch
36	Sensor 2	77	Headlamp switch
37	Air flow sensor	78	Sensor
38	Electronic throttle valve control	79	Phase sensor
39	Engine coolant temperature sensor	80	Power 2
40	Accelerator position sensor	81	CAN communication
41	Air conditioner pressure		

6)Normal working voltage: 9--16V

Normal working temperature: -40--70□

7)Malfunction phenomena and diagnosis method

- **Malfunction phenomena:** idle speed not stable, accelerating not good, can not start, idle speed is too high, exhaust gas exceed standard, difficult to start, air conditioner failure, injector control failure, engine dies out etc..
- **Reasons for general malfunction:** 1, ECU component was burnt down caused by overloading of the exterior connected electrical device; 2, circuit board was rust and erode caused by water in ECU.
- **Service notice:** 1, do not disassemble ECU at random during the service; 2, disassemble accumulator 5 minutes prior to disassemble ECU; 3, keep the disassembled ECU carefully; 4, prohibit to connect any circuit to ECU connecting line.
- Simple measurement method:
 - 1、(connect ECU joint)Read engine malfunction record by K line.
 - 2、(disassemble ECU joint)Check the connecting line of ECU, and pay more attention to check the power supply and ground line of ECU;
 - 3、 Check the working conditions of exterior sensor and its output signal and its circuit;
 - 4、 Check actuator and its circuit;
 - 5、 At last change ECU and have a test.

3.2 COOLANT TEMPERATURE SENSOR

1) exterior drawing and pin

This sensor has two exchangeable pins.

2)Purpose: The sensor provide the coolant temperature signal to ECU for ignition timing and modifying fuel injection of starting, idle speed and normal working.

3)Installation position

Coolant temperature sensor was installed on the water outlet of cylinder block and the copper heat conducted socket was inserted into water. There are thread on the socket, and screw in coolant temperature sensor onto the threaded hole on cylinder block by the hexagon head of the socket. The maximum moment is 20Nm.

4)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. There are several different resistance values at different temperature:

T(□)	Resistance value(kΩ)
-10	8.62----10.28
20	2.37----2.63
80	0.299----0.345

5)Normal working temperature: -30----130 □

Normal working voltage: 5V DC

6)Malfunction phenomenon and diagnosis method

- **Malfunction phenomenon:** Difficult to start.
- Reasons of malfunction: man made
- Simple measurement method:

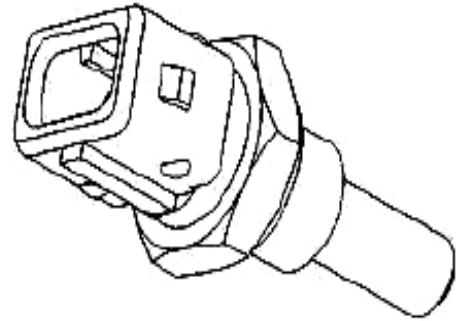


Chart 3-2 Outlook drawing of the coolant temperature sensor

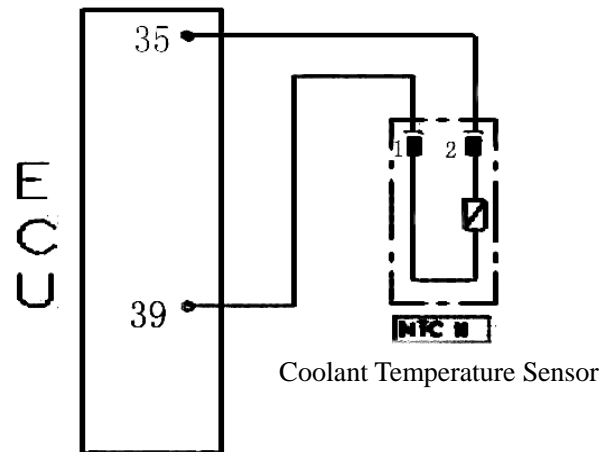


Chart 3-3 Circuit diagram of coolant temperature sensor

(Disassemble the joint)leave the digital multimeter at ohm shift and contact the No.1 and No. 2 pin of the sensor by its two meter pens. When it is 20℃ Rated the resistance is $2.5k\Omega \pm 5\%$. The other temperature can get reference from above chart.

3.3 KNOCK SENSOR

1)Exterior drawing and pin

This sensor has three pins; No.1 and No.2 pin connect with ECU, and No. 3 pin connects with shield.

2)Purpose: This sensor provides engine knock information to ECU, and carries out knock control.

3)Installation position

There is a hole in the middle of knock sensor, and the sensor is assembled on the block between No.2 and No.3 cylinder head. For the aluminum alloy block, using long bolt with 30mm long; for the casting iron, using 25mm long bolt. And the moment is $20 \pm 5Nm$.

4)Working principle

Knock sensor is a kind of vibrating acceleration sensor and is assembled on cylinder block. The sense organ of the sensor is a piezoelectric element. The vibration of cylinder block is transferred to piezoelectric crystal by mass block inside of sensor. The piezoelectricity crystalloid gets pressure from mass block vibration, producing voltage on two polar and transferring vibration signals to voltage signal and output it. Because the frequency of knock vibration signal is much higher than the normal engine vibration signal, the ECU can separate the signal into knock signal and non knock signal.

5)Normal working temperature: -40--130℃

6)Malfunction phenomenon and diagnosis method

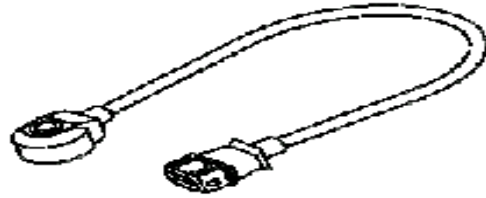


Chart 3-4 Exterior drawing of knock sensor

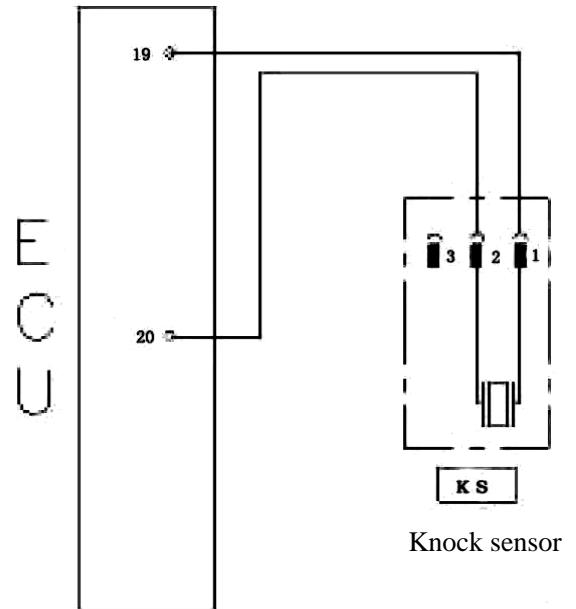


Chart 3-5 circuit diagram of knock sensor

- Malfunction phenomenon: badness accelerating.
- Normal malfunction reason: all kinds of liquid such as oil, coolant, braking liquid and water contact with sensor for a long time and erode the sensor.
- Simple measuring method: (disassemble the joint) put digital multimeter at ohm shift, and contact the No.1, No. 2 and No.3 pin with its two meter pens. The resistance value should be more than $1M\Omega$ at normal conditions. Leave the digital multimeter at millivolt shift, and tap around the sensor using little hammer, there should be voltage signal output.

3.4 OXYGEN SENSOR

1) Exterior drawing and pin

There are 4 pins on this oxygen sensor

No. 1 connect to heating power anode (white)

No. 2 connects to heating power cathode (white)

No. 3 connects to signal cathode (gray)

No. 4 connects to signal anode (black)

2) Installation position: Assemble it on the top of exhaust pipe.

3) Purpose: The oxygen sensor checks the oxygen percent in exhaust gases and transfer the signal to ECU, and ECU will control the fuel closed loop according to this information. This will make engine working at its optimum conditions. And transfer and purify CO, HC, NO_x compound in 3-way catalytic converter of the tail gas maximally.

4) Working principle

Sensing element of oxygen sensor is a kind of ceramic tube with holes, and outside of tube walls are surrounded by engine exhaust gas and inside is air. Ceramic sensor element is a kind of solid state electrolyte with electrical heating

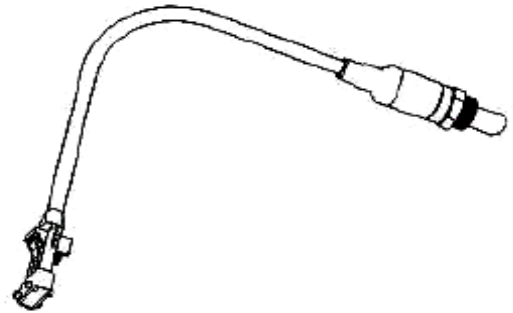


Chart 3-6 Exterior drawing of oxygen sensor

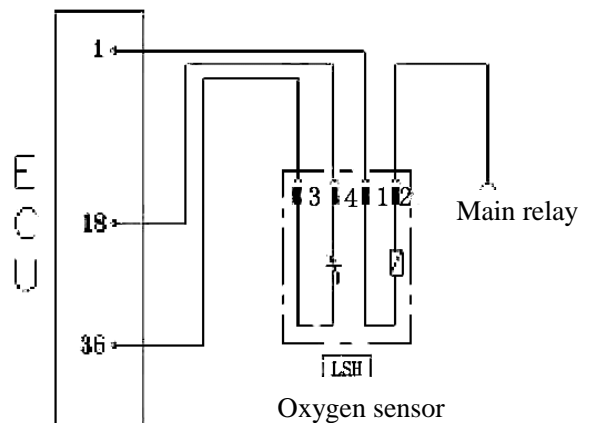


Chart 3-7 circuit diagram of oxygen sensor

tube inside. The working of oxygen sensor is carried out by transferring the concentration difference of the oxygen ion outside of ceramic tube to voltage (100mv—900mv) signal and output.

5) Working voltage: 12—14V

6) Malfunction and diagnosis method

- **Malfunction:** badness idle speed, badness acceleration, badness tail gas, over fuel consume etc.
- **Reason:** 1, moisture entering inside of sensor, and when the temperature is changed pin is broken; 2, sensor poisoning(Pb,S,Br,Si)
- **Notice:** it is forbidden to use cleaning liquid, oiliness liquid or volatility solid during service.
- **Measuring method:** a) disassemble joint, put digital multimeter to ohm shift, connect meter pen to No.1(white) and No.2(white) pins of the sensor. Normally the resistance value is 1~6Ω. b) Connect the joint and keep it at idle speed status. When the oxygen sensor reaches to its working temperature 350℃, keep digital multimeter to DC volt shift and connect meter pen to No.3 (gray) and No.4 (black) pins of sensor. Now the voltage should be fluctuate between 0.1- 0.9V quickly (the data also can be gotten from data flow inspected by diagnosis meter).

3.5 SPEED SENSOR (CRANKCASE POSITIONING SENSOR)

1) Exterior drawing and pin

No.1 pin connects to shield

No.2 and No.3 pin provide signal to ECU.

2) Installation position: on the flywheel plane at rear of engine.

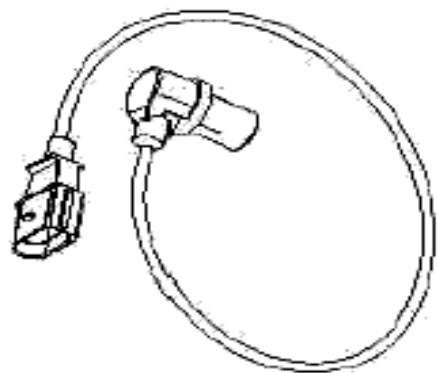


Chart 3-8 Exterior Drawing Of Speed Sensor

Service notice:

- For the inductive engine speed sensor, it is permitted to take out from its pack before it is assembled to the auto or testing device right away.
- Inductive engine speed sensor is assembled by press in method but not hammer tapping.
- Tightening torque is 8.2Nm. Gas clearance between inductive engine speed sensor and pulse disc is 0.8 - 1.2mm.

3)Purpose: Speed sensor provides engine speed, crankshaft angle and top dead center signal to ECU. That will control engine ignition and injection timing.

4)Working principle: The inductive engine speed sensor work together with pulse disc, it is used in ignition system without distributor providing engine speed and crank shaft top dead center information. Speed sensor is made up of a permanent magnet and coil outside of magnet. Pulse disc is a tooth disc with 60 teeth originally but there are two teeth opening. Pulse disc is assembled on crank shaft and rotate with crankshaft. When the tip of the tooth passed the end of inductive engine speed sensor, the magnet pulse disc incises the magnetic line of force, generating rotating speed signal and output.

5)Working temperature:-40--120□

Resistance of coil in room T:731--989Ω

6)Malfunction and diagnosis method:

- Malfunction: can not start etc.
- Reason: man failure
- Service notice: use pressing method but not a hammer to install it.
- **Simple measure method: disconnect the joint, put digital multimeter to ohm shift, connecting two meter pen to No. 2 and No.**

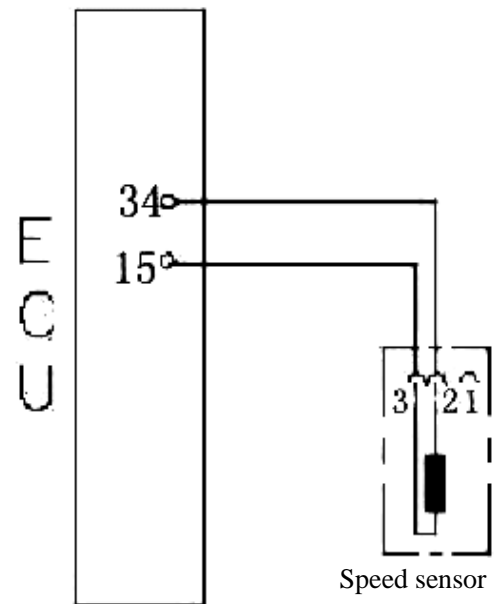


Chart 3-9 Circuit diagram of speed sensor

3 sensor connectors. The rated resistance is $860\Omega \pm 10\%$ When it is 20□

3.6 PHASE SENSOR (CAM SHAFT POSITIONING SENSOR)

1) Exterior drawing and pin

This sensor has three pins: No. 1 grounding, No. 2 for signal output and No. 3 connecting to power anode.

2) Installation position: on the valve cover. There is only one hole on this sensor casing for tightening M6, and the torque is: $8 \pm 0.5 \text{Nm}$.

3) Purpose: This sensor provides crankshaft phase information to ECU, that is to say, to separate crankshaft compression top dead center and exhaust top dead center.

4) Working principle

It is a Hall sensor.

5) Working temperature: -30--130□

Working voltage: 4.5—16V

Trigger gap: 0.1—1.8mm

6) Malfunction and diagnosis method

- Malfunction: can not start, emission exceed standard, fuel consume increased.
- Reason: Man made.
- Simple measuring method: (connect the joint) switch on ignition switch but do not start the engine; put digital multimeter on DC volt, connect two meter pen to No. 3 and No. 1 sensor connectors and make sure there is 12V reference voltage. Start the engine, checking if it is in good conditions of No. 2 pin by oscillograph on vehicle.

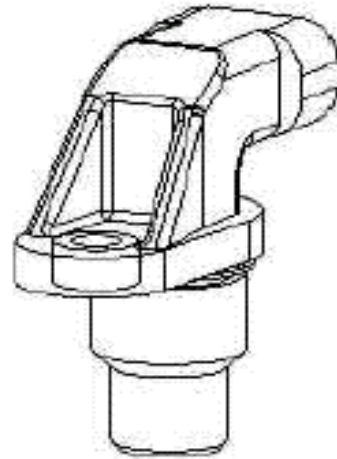


Chart 3-10 Exterior drawing of phase sensor

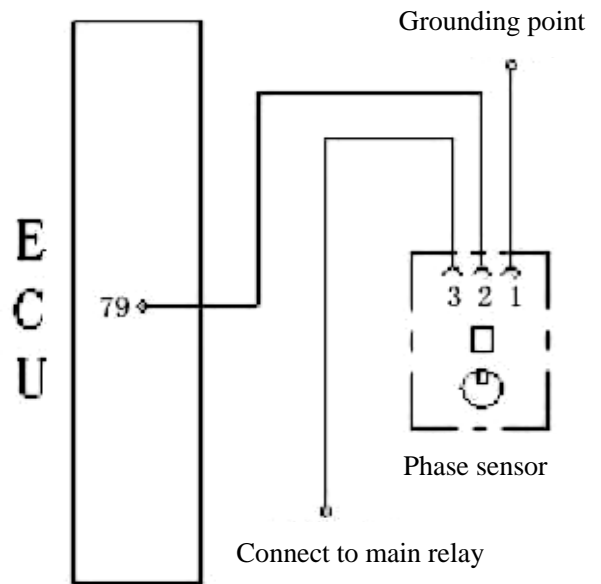


Chart 3-10 Exterior drawing of phase sensor

3.7 ELECTRIC FUEL PUMP

1) Exterior drawing and pin

The electric fuel pump has two pins connecting to pump relay. There are “+” and “-” showing anode and cathode on the pump housing near to pins.

2) Installation position: inside fuel tank

3) Purpose: Deliver the fuel to engine fuel supplying pipe at certain flow and fuel pressure and keep the stable fuel pressure (realized by fuel pressure regulator)

4) 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 accumulator provide power to electric fuel pump via fuel pump relay, and the relay switches on electric fuel pump only when engine starting and running. When the engine stops for some reason, the pump will stop to run by itself.

5) Working voltage: 8—14V

Working temperature: -30--70℃

System pressure: 300KPa

6) Malfunction and diagnosis method

- Malfunction: big running noise, badness acceleration, can not start (difficult to start) etc..
- Reason: use of low quality fuel and cause 1, colloid became insulation layer; 2, fuel pump bushing and armature come to together; 3, components of fuel level sensor eroded.
- Service notice: 1, the electric fuel pump can

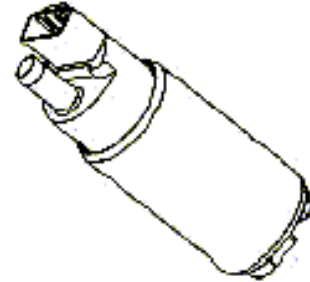


Chart 3-12 Exterior Drawing of Electric Fuel Pump

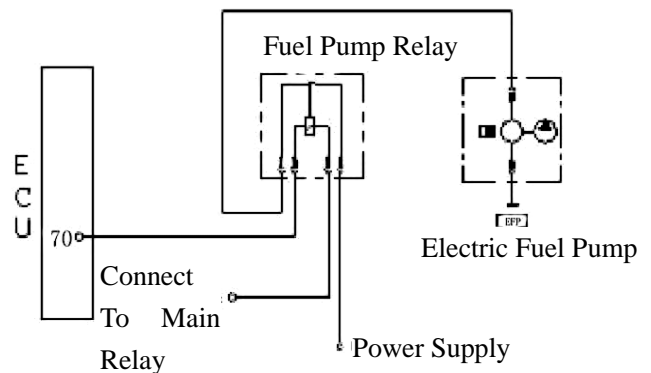


Chart 3-10 Exterior Drawing Of Phase Sensor

has different flow according to the requirement of engine, but with the same exterior looking.

The pump which can be assembled to perhaps is not the fittest. For service the replaced electric fuel pump must has the same part number as the original pump; 2, do not change the pump at dry status to prevent the pump from accident; 3, when it needs changing fuel pump, please clean fuel tank and fuel filter.

- Simple measuring method: (disconnect joint) leave digital multimeter at ohm shift, connect two meter pen to two pins of pump, measure the resistance, it is not zero or infinite(that is non short circuit, open circuit).(connect the joint)connect the fuel pressure meter to fuel intake pipe and start the engine, observing if the fuel pump works; If it is not running, check if there is power or not on the pin of”+”; if it is running, at the condition of idle speed, check the fuel pressure if it is around 260kPa; plug off the fuel pressure regulator vacuum pipe if it is around 300kPa.

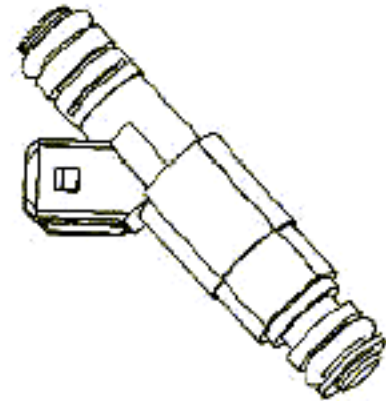


Chart 3-14 Exterior Drawing of Injector

3.8 ELECTROMAGNETIC INJECTOR

1)Exterior drawing and pin

There are two pins on each injector. One of them is No. 87 pin aside of casing marked with plus and connected to main relay output; and another one connect with ECU No. 27,6,7,47 pins.

2)Installation position: On the air intake manifold near the end of air intake port. When you disassemble and reassemble the fuel injector the O ring must be changed. And pay attention not to damage the sealing surface of the injector.

3)Purpose: Inject some fuel to its correspondent cylinder at proper time to meet the engine requirement of different power and different torque.

4)Working principle: ECU sends electrical impulse to injector coil and form magnetic field force. When magnetic field force increase to

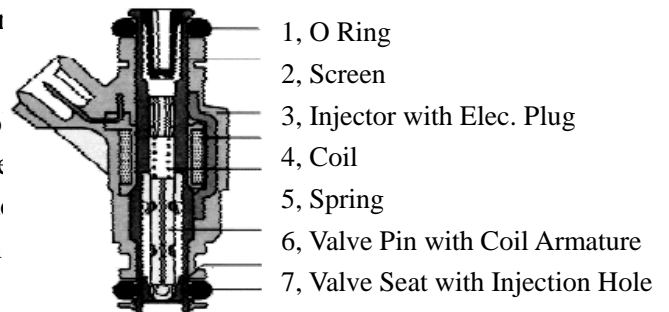


Chart 3-15 Cutaway View Of Injector

conquer Return spring pressure, needle valve gravity and friction force, the needle valve begin to rise up and start the injection process. The pressure of return spring makes needle valve close again when the injection impulse is stopped.

5) Working voltage: 6—16V

Working injection pressure: 350KPa

6) Malfunction and diagnosis method

- Malfunction: badness idle speed, badness acceleration, can not start (difficult to start) etc..
- Reason: lack of maintenance causes invalid by the colloid inside of injector became insulation layer.
- Simple measure method: (disconnect the joint) leave digital multimeter at ohm shift, connect the meter pen to the two pins of injector. The rated resistance should be 11 - 13Ω when it is 20□.

3.9 AIR FLOW SENSOR

1) Exterior drawing and pin definition

This sensor is 5 pins: No. 1 is intake temperature pressure signal; No. 2 is accumulator pressure; No. 3 is grounding; No. 4 is reference voltage 5V; No. 5 is intake airflow signal output.

2) Installation position

It is behind the air cleaner of the air intake tube.

3) Purpose:

This sensor is hot cable airflow sensor, which check the temperature and air intake flow entering to cylinder and provide evidence to ECU to calculate fuel injection quantity.

4) Working principle

If there are no airflow passing when the air quality and flow meter works, temperature grads of both sides of the heating area spread symmetry, and temperature of these two points are same. When the air passes here just one way, the air will be heated when it passes the central heating area and this will

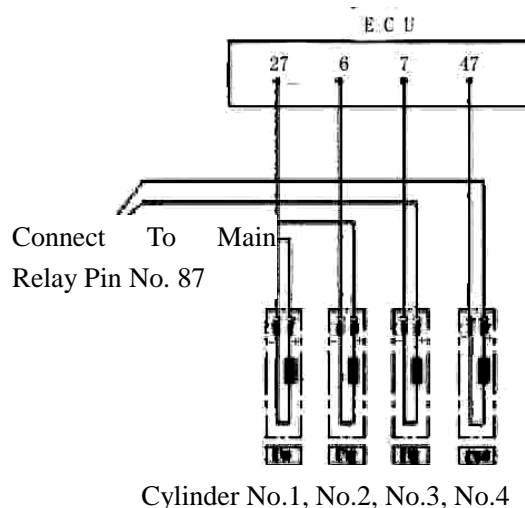


Chart 3-16 Circuit Diagram of Injector

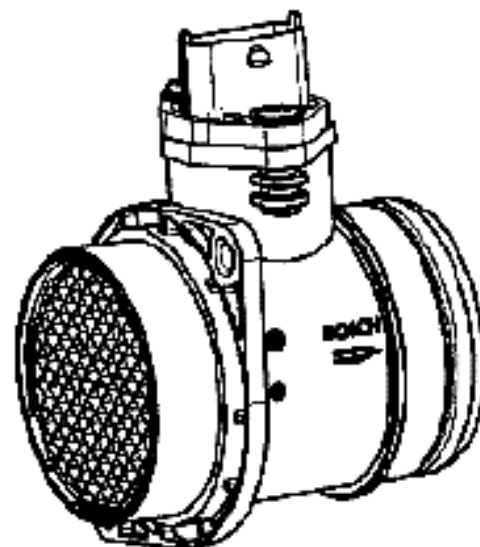


Chart 3-17 Exterior Drawing of Airflow Sensor

make the heat exchange different of the heat diaphragm of both sides.

This will make the temperature of two sensing element measuring point inside of the flowmeter Changes differently and appears difference in temperature. And the difference of the temperature will increase with the increase of the airflow. Big/small and positive/negative of the temperature difference improved the quality and direction of the airflow. And the inside evaluate circuit will transfer the temperature difference to voltage signal and output.

5)Working temperature:-40--125□

6)Malfunction and diagnosis method

- Reason: sensing element is polluted by the dust particle, oil and water and causes the part invalid.
- Service notice: 1, it is prohibited to use erosion liquid to clean sensing element during service; 2, not to use high pressure air to impact sensing element; 3, make sure there are no dust into air pipe when you change air cleaner and no unqualified air into air cleaner.
- Simple measuring method: **static measurement:** (zero flow measurement) No. 3 grounding; No. 4 input 5V reference voltage; No.2 input 14V rated voltage; check No. 5 output voltage, if the output is bigger than 1.025V, we can confirm the function of this sensor is not qualified. **Dynamic measurement:** if it is confirmed the sensor is broken, connect a tail gas analysis meter to exhaust pipe and check it by using “two working conditions method”: 1, idle speed working conditions; 2, 2000rpm stable working conditions.

Check the reading of HC 、 CO、 CO₂, normally

HC<100ppm CO<0.5%,CO₂ >13.5%

3.10 DOUBLE SPARK IGNITION COIL

1)Exterior and pin definition

No. 1 coil primary winding connect with No.5 pin of ECU; No. 2 coil primary winding connect with No. 2

pin of ECU; No. 3 and No.4 pins connect with power anode.

2)Installation position: on the engine

3)Purpose: Ignition coil transfers the low voltage of primary winding to high voltage of secondary winding, and produce spark by spark plug discharging then burning the combustible gas inside of the cylinder.

4)Working principle

Ignition coil ZS - K22 is made up of two primary windings, two secondary windings, mandrel, and casing. When one of the primary windings grounding chunnel is connected, the primary winding is in charging. Once the circuit is cut off by ECU, the charging is stopped. At the same time the high voltage is sensed in the secondary winding and making the spark plug discharging. There is a different with the distributor ignition coil: for the ignition coil ZS - K22, there is one spark plug on both side of the secondary winding, and the both spark plugs can ignite at the same time. These two primaries connect and disconnect to power alternatively. And correspondently these two secondary windings discharge alternatively.

5)Working voltage:14V

Working temperature:-40—120□

6)Malfunction and diagnosis method

- Malfunction: can not start.
- Reason: current is too big and got burnt, damage by outside force etc..
- Service notice: forbid to use "short circuit test igniting method" to test ignition function, prevents the electronic controller from damaging.
- Simple measuring method: (disassemble the joint) leave digital multimeter at ohm shift, connect two meter pen to two pins of primary winding, the resistance value is 0.42- 0.58Ωwhen it is 20□; secondary winding resistance value is 11.2- 14.8kΩ.

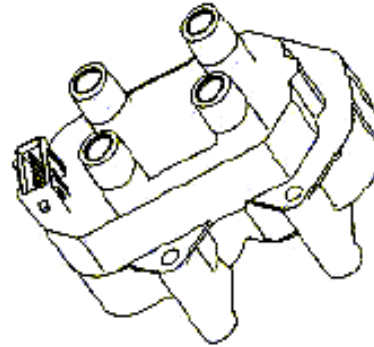


Chart 3-18 Exterior Drawing of Ignition Coil

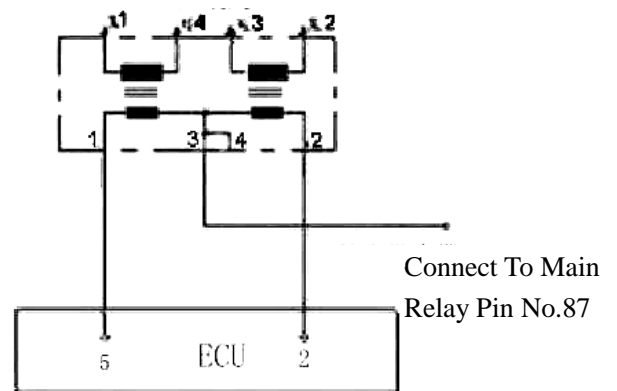


Chart 3-19 circuit Diagram of Ignition Coil

3.11 CARBON CANISTER SOLENOID VALVE

1) Exterior drawing and pin definition

Canister control valve only has two pins; one is connect to No.87 pin of main relay output end; and another pin connected to No. 5 pin of ECU.

2)Installation position: Canister vacuum pipe of intake manifold

3)Purpose: Control the quantity of the cleaning flow from canister to air intake chief pipe. The absorption of the canister is limited so if the gasoline vapor adhesive to canister can not be consumed the gasoline vapor will volatility to outside and pollute the air.

4)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.

5)Working voltage:9—16V

Working temperature:-30--120□

6)Malfunction and diagnosis method

- Malfunction: Function invalidation.
- Reason: some particle coming to inside of valve causes erosion or poor sealing.
- Service notice: 1, let the airflow direction be accord with the regulation; 2, when there are black particle inside of valve and causes the control valve invalidation, the valve need to be changed, please check the canister working conditions; 3, avoid the water, fuel and other liquid into valve during the service; 4, hang the valve on the tube to avoid the transferring of solid sound.
- Simple measurement method: (disassemble the

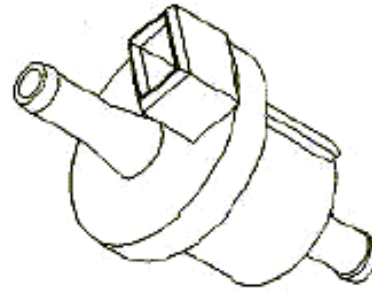


Chart 3-20 Exterior Drawing of Canister Solenoid

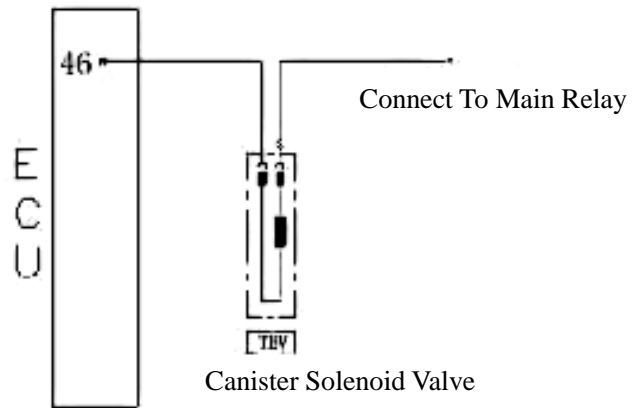


Chart 3-21 Circuit Diagram of Canister Solenoid

joint) leave digital multimeter to ohm shift, two meter pen connect to the pins of canister valve, it is $26 \pm 4 \Omega$ when it is 20□.

3.12 FUEL PRESSURE REGULATOR

1) Exterior drawing

2) Installation position: Fuel bracket assembly

3) Purpose: Adjust the pressure inside of fuel pipe, keep the System pressure around 350Kpa.

4) Working principle: See chart 3- 23, one piece of flexible film made up of rubber and fiber separate the fuel pressure regulator into two compartments. The upper compartment communicates to the air, and there is spring inside. The lower compartment is full of fuel entering from the fuel intake under the fuel pressure regulator. The lower part of the film gets the pressure from fuel and the upper part gets the pressure from air and spring. The film can distort and drive valve seat making the valve open and close, but the distortion is smaller the acting force of the spring may be seemed as not changed. So the opening and closing of the valve is decided by the pressure difference of the fuel pressure from lower compartment and the air pressure from the upper compartment. If the valve is closed at first, then the fuel pressure increased causing the pressure difference between upper and lower compartments increased. At last the film was raised up by the fuel pressure and valve is opened. The fuel return to fuel tank from oil return port of pressure regulator, the fuel pressure decreased until the valve is closed. If the engine changes its working conditions now, the pressure difference of fuel system and the air pressure is about the same.

5) Malfunction and diagnosis method

- Malfunction: fuel pressure is too high or too low, difficult to start.
- Reason: long time using without maintenance causing: 1, strainer jammed; 2, particle causes big leaking; 3, man made mechanical damages.
- Service notice: 1, prohibit to use high pressure air blowing film element; 2, Forbid using strong



Chart 3-22 Fuel Pressure Regulator

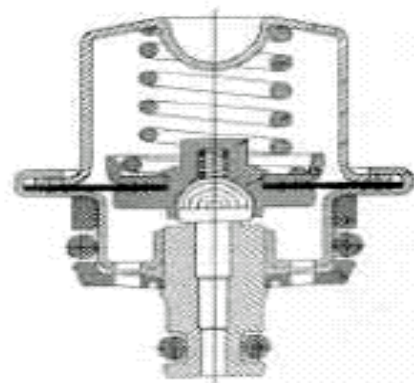


Chart 3-23 cutaway View of Fuel Pressure Regulator

causticity liquid to wash it; 3, avoid it from distorting by outside force.

Simple measurement method: connect fuel pressure gauge at fuel intake pipe, start the engine and make the engine running at idle speed; check the fuel pressure around 350kPa or not; step on the gas until the engine speed to 2500rpm, and observe if the fuel pressure at around 350kPa.

3.13 ELECTRONIC THROTTLE VALVE AND ACCELERATOR

1) Exterior drawing and pin

- Accelerator pin definition

Pin No.1 and No.2 is the anode of the 5V reference voltage

Pin No.3 and No.5 is the cathode of 5V reference voltage

Pin No. 4 and No. 6 is output voltage signal

- Electronic throttle valve pin definition

Pin No. 1 is motor anode.

Pin No. 2 is potentiometer anode.

Pin No. 3 is potentiometer cathode.

Pin No. 4 is motor cathode.

Pin No. 5 is signal output 1.

Pin No. 5 is signal output 2.

2)Installation position: Electronic throttle valve: front end of intake manifold; accelerator: driver cockpit.

3)Working principle: The engine on time torque requirement was transferred from accelerator to ECU, and ECU sends impulse electronic signal to electronic throttle valve according to torque requirement information; the motor is running and drive throttle valve to its opening required degrees; this throttle valve can stay at one fixed position or change to another position upon required to meet the

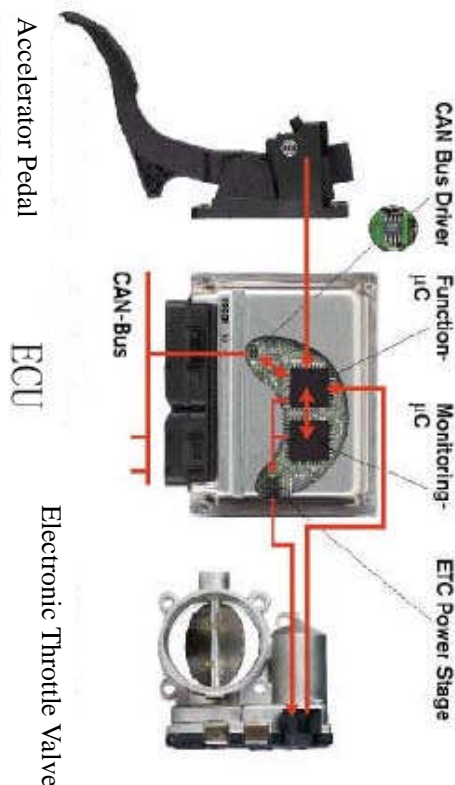


Chart 3-24 Electronic Throttle Valve and Accelerator

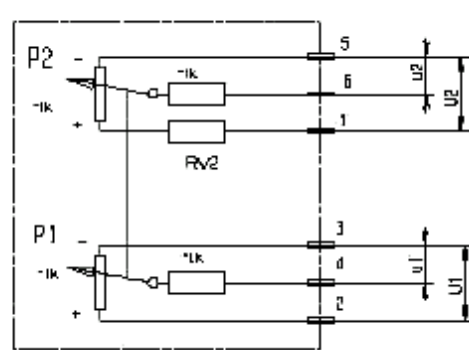


Chart 3-25 Circuit Diagram of Accelerator

requirement of the engine working conditions according to the impulse signal frequency and width of impulse.

3.14 FAN CONTROL

ECU control the fan according to water temperature of the engine and the requirement signal and control the fan system delay at the fit conditions.

- 1) Conditions for fan running at low speed:
 - a) Engine coolant temperature between 96□ to 102□.
 - b) There is air conditioner requirement and the air conditioning compressor begins to work.
- 2) Conditions for fan running at high speed:
 - a) Engine coolant temperature sensor broken
 - b) Engine coolant temperature higher than 102□.
- 3) Conditions of fan continue to work after the engine stops working
 - A) Engine air intake temperature sensor is broken and delay 60 seconds.
 - B) Engine coolant temperature sensor is broken and delay 60 seconds.
 - C) Engine coolant temperature higher than 100.5□, high speed delay 60 seconds.
 - D) Temperature of intake air more than 70.5□, delay 60 seconds.
- 4) Malfunction diagnose
 - Short circuits from high relay line to power supply
 - Short circuits from high-speed relay line to ground
 - Open circuits of high-speed relay line
 - Short circuits from low-speed relay to power supply

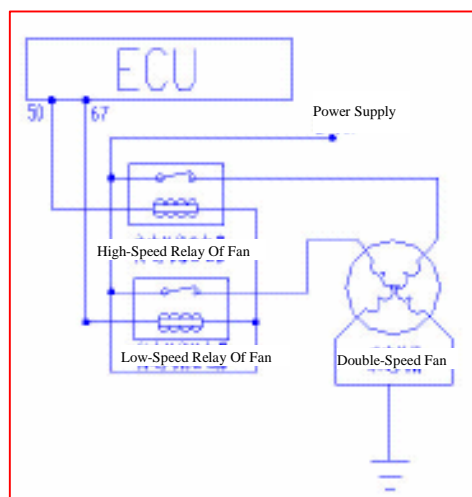


Chart 3-26 Fan control schematic

Short circuits from low-speed relay line to ground

Open circuits of low-speed relay line

Engine coolant temperature sensor failure

Engine intake air temperature sensor failure

3.15 AIR CONDITIONER CONTROL

1) Working principle

Switch on the air conditioner and blower; air conditioner pressure is regular; evaporator temperature sensor inspect the right data; requirement signal of air conditioner is sending by these switches to ECU, and ECU controls air conditioning relay attracting and provide rotating speed signal to step motor and open the electronic fan and air conditioning chart to work.

2) Air conditioner control strategy

- a) The air condition can be switched on after 5 seconds of the engine starts.
- b) Cut off the air conditioner when temperature of intake air higher than 140.3□.
- c) Cut off air conditioner when the coolant temperature higher than 114.8□; resume the air conditioning control after its lower than 11.8□.
- d) Cut off air conditioner when the engine speed is higher than 6520rpm or lower than 520rpm.
- e) Cut off air conditioner when the pressure inside of air conditioner high pressure pipe is higher than 20bar and resume the control when the pressure is lower than 9.5bar.
- f) Cut off air conditioner when the evaporator temperature is lower than 1.5□; and resume the control when it is higher than 4.5□.
- g) Cut off air conditioner when the system pressure is lower than 8.04V; consume the control when it is higher than 10.01V.

3) Malfunction diagnosis

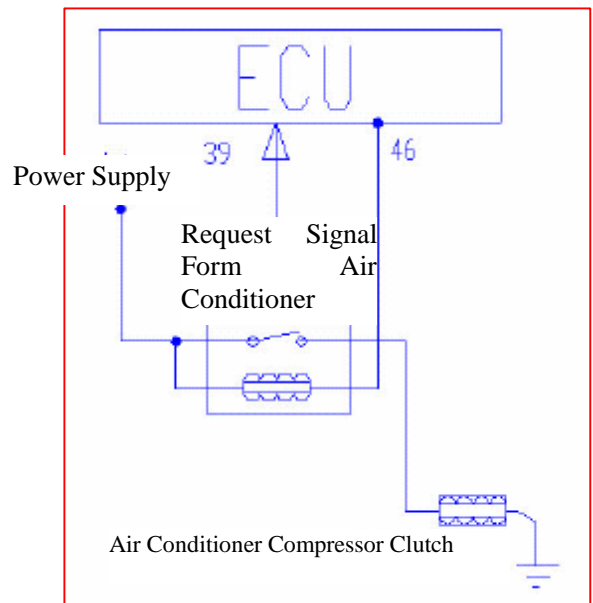


Chart 3-27 Air conditioner control schematic

Blower circuit malfunction (fuse is burnt, relay circuit is open circuit or short circuit)

Irregular pressure of air conditioner (much higher of the high voltage or the much lower of the low voltage)

Malfunction of evaporator temperature sensor

Air conditioner relay circuit is failure (short circuit to ground, short circuit to power supply, open circuit).

4 ME7 SYSTEM TEST AND REPAIR ACCORDING TO TDC

Explanation:

1. When it is confirmed that malfunction is steady we can carry out the test and repair as below, otherwise this will cause wrong diagnosis.
2. There is multimeter mentioned below, it is referred to digital multimeter; prohibit to use finger multimeter check the EFI system.
3. Check and repair the vehicle with anti theft system please re-program the replaced ECU when there is the occasion of changing the ECU at “flow up steps”.
4. In this items when the TDC of P0171、P0172、P0335、P0336、P1651 existing, the engine trouble light will not light on.
5. If it shows much lower of the voltage in some circuit in DTC explanation, it refers to perhaps there is ground short circuit inside of this circuit; If it shows much higher of the voltage in some circuit in DTC explanation, it refers to perhaps there is power supply short circuit inside of this circuit; If it shows circuit failure in DTC explanation, it refers to perhaps there is open circuit or multi circuit malfunction inside of this circuit.

- Diagnosis help:
1. DTC can not be deleted; it is steady failure; if it is occasional failure, check if it is because of the loosening of cable joint.
 2. Check according to the above steps and find noting wrong;
 3. During check and repair pay attention that the influence of vehicle maintenance, cylinder pressure and mechanical ignition timing to the system;
 4. Change ECU and test it. If the DTC can be deleted, the malfunction is inside of ECU; if the DTC can not be deleted, change back to the original ECU and check it again according to above items.

4.1 ENGINE DTC (DIAGNOSTIC TROUBLE CODE) LIST

DTC	Definition	DTC	Definition
P0107	Much lower voltage of the air intake pressure sensor	P0340	Phase sensor signal failure
P0108	Much higher voltage of the air intake pressure sensor	P0342	Much lower voltage of the phase sensor
P0112	Indicated temperature is much lower of the air intake temperature sensor	P0343	Much higher voltage of the phase sensor
P0113	Temperature is much higher indicated by the air intake temperature sensor	P0443	Canister control valve drive grade control circuit failure
P0117	Temperature is much lower indicated by engine coolant temperature sensor	P0444	Much lower voltage of canister control valve drive grade control circuit
P0118	Temperature is much higher indicated by engine coolant temperature sensor	P0445	Much higher voltage of canister control valve drive grade control circuit
P0122	The circuit voltage of throttle position sensor is much lower	P0480	Air conditioner condenser cooling fan relay control circuit failure
P0123	The circuit voltage of throttle position sensor is much higher	P0500	Unreasonable failure of speed signal
P0130	Unreasonable failure of the upstream oxygen sensor signal	P0506	Rotating speed of idle speed is lower than target idle speed
P0132	Much higher voltage of upstream oxygen sensor	P0507	Rotating speed of idle speed is higher than target idle speed
P0134	Signal failure of upstream oxygen sensor	P0508	Idle speed regulator control circuit voltage is too low
P0135	Heating circuit failure of upstream oxygen sensor	P0509	Idle speed regulator control circuit voltage is too high
P0171	Closed loop air fuel ratio control self adapting exceeds it maximum limit	P0511	Idle speed regulator control circuit failure
P0172	Closed loop air fuel ratio control self adapting exceeds it minimum limit	P0560	System voltage signal unreasonable
P0201	The 1st cylinder injector circuit failure	P0562	System voltage is too low
P0202	The 2nd cylinder injector circuit failure	P0563	System voltage is too high
P0203	The 3rd cylinder injector circuit failure	P0601	ECU testing code failure
P0204	The 4th cylinder injector circuit failure	P0602	ECU diagnosis data ID code failure
P0230	Fuel pump control circuit failure	P0645	Air conditioner compressor relay control circuit failure
P0325	Knock sensor circuit failure	P0646	Much lower voltage of air conditioner compressor relay control circuit

P0335	Crank shaft position sensor signal failure	P0647	Much higher voltage of air conditioner compressor relay control circuit
P0336	Crank shaft position sensor signal unreasonable failure	P1651	Trouble light control circuit failure

4.2 DIAGNOSIS FLOW WHEN THERE IS DIFFERENT DTC

P0107 Much lower voltage of the air intake pressure sensor

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Observe “air intake pressure” item in data flow, if it is about 101kpa (specific data is correlated to that time air pressure).	Yes	To step No. 5
		No	Next steps
3	Take off the joint of cable air intake pressure sensor, check the voltage between pin No. 3 and pin No. 1 by multimeter and look if it is around 5V.	Yes	To step No. 5
		No	Next step
4	Check if it is short circuit to ground between ECU pin No. 17, No. 33, No. 37 and sensor connector No.1, No.3 and No. 4.	Yes	Repair or replace cable
		No	Next step
5	Start the engine at idle speed. Step on the accelerator slowly approach to open completely and observe the value changes of diagnostic tester “air intake pressure”, the changes should be not big; step on the accelerator quickly to complete open, the displayed value should be reach up to 90kpa instantaneous.	Yes	Diagnosis help
		No	Replace the sensor

DTC: P0108 Much higher voltage of the air intake pressure sensor

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Observe “air intake pressure” item in data flow, if it is about 101kpa(specific data is correlated to that time air pressure)	Yes	To step No. 5
		No	Next steps
3	Take off the joint of cable air intake pressure sensor, check the voltage between pin No. 3 and pin No. 1 by multimeter and look if it is around 5V.	Yes	To step No. 5
		No	Next step
4	Check if it is open circuit or short circuit to power supply between ECU pin No. 17, No. 33, No. 37 and sensor connector No.1, No.3 and No. 4.	Yes	Repair or replace cable
		No	Next step
5	Start the engine at idle speed. Step on the accelerator slowly approach to open completely and observe the	Yes	Diagnosis help
		No	Replace the

	value changes of diagnostic tester “air intake pressure”, the changes should be not big; step on the accelerator quickly to complete open, the displayed value should be reach up to 90kpa instantaneous.		sensor
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DTC P0112 Circuit voltage is much lower of the throttle position sensor

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Observe “air intake temperature” item in data flow, if it is same temperature with air intake pipe(specific data is correlated to the engine temperature at that time) Notice: if the value is - 40□ there is perhaps open circuit failure in the circuit.	Yes	To step No. 5
		No	Next step
3	Take off the joint of cable air intake temperature sensor, check the resistance values using multimeter between sensor connector No. 1 and No. 2 and check if it is corresponding to its temperature (please reference the related section of this service manual)	Yes	Next step
		No	Replace sensor
4	Take off the joint of cable air intake temperature sensor, check the voltage between pin No.1 and pin No.2 by multimeter and look if it is around 5V.	Yes	To step 5
		No	Next step
5	Check if it is open circuit or short circuit to power supply between ECU pin No. 17, No. 40 and sensor connector No.1, No.2	Yes	Repair or replace cable
		No	Next step
6	Start the engine at idle speed. Observe the value changes of diagnostic tester “air intake temperature”, the value should increase with the increase of the engine intake air.	Yes	Diagnosis help
		No	Replace the sensor

DTC: P0113 Temperature is much higher indicated by the air intake temperature sensor

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Observe “air intake temperature” item in data flow, if it is same temperature with air intake pipe(specific data is correlated to the engine temperature at that time) Notice: if the value always is - 40□ there is perhaps open circuit failure in the circuit.	Yes	To step No. 5
		No	Next step
3	Take off the joint of cable air intake temperature sensor, check the resistance values using multimeter between sensor connector No. 1 and No. 2 and check if it is corresponding to its temperature (please reference the related section of this service manual).	Yes	Next step
		No	Replace sensor
4	Take off the joint of cable air intake temperature sensor, check the voltage between pin No.1 and pin No.2 by multimeter and look if it is around 5V.	Yes	To step 5
		No	Next step

5	Check if it is short circuit to ground between ECU pin No. 17, No. 40 and sensor connector No.1, No.2	Yes	Repair or replace cable
		No	Next step
6	Start the engine at idle speed. Observe the value changes of diagnostic tester “air intake temperature”, the value should increase with the increase of the engine intake air.	Yes	Diagnosis help
		No	Replace the sensor

DTC: P0117 Temperature is much lower indicated by engine coolant temperature sensor.

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Observe “coolant temperature” item in data flow, if it is same temperature with engine temperature (specific data is correlated to the engine temperature at that time). Notice: if the value always is - 40□ there is perhaps open circuit failure in the circuit.	Yes	To step 6
		No	Next
3	Take off the joint of coolant temperature sensor on the cable, check the resistance values using multimeter between sensor connector No. 1 and No. 2 and check if it is corresponding to its temperature (please reference the related section of this service manual).	Yes	Next step
		No	Replace sensor
4	Take off the joint of coolant temperature sensor on the cable, check the voltage between pin No.1 and pin No.2 by multimeter and observe if it is around 5V.	Yes	To step 6
		No	Next step
5	Check if it is open circuit or short circuit to power supply between ECU pin No.39, No. 35 and sensor connector No.1, No.2.	Yes	Repair or replace cable
		No	Next step
6	Start the engine at idle speed. Observe the value changes of diagnostic tester “coolant temperature”, the value should increase with the increase of the engine coolant temperature.	Yes	Diagnosis help
		No	Replace sensor

DTC: P0118 Temperature is much higher indicated by engine coolant temperature sensor

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Observe “coolant temperature” item in data flow, if it is same temperature with engine temperature (specific data is correlated to the engine temperature	Yes	To step 6
		No	Next

	at that time). Notice: if the value always is - 40□ there is perhaps open circuit failure in the circuit.		
3	Take off the joint of coolant temperature sensor on the cable, check the resistance values using multimeter between the sensor connector No. 1 and the No. 2 and check if it is corresponding to its temperature (please reference the related section of this service manual).	Yes	Next step
		No	Replace sensor
4	Take off the joint of coolant temperature sensor on the cable, check the voltage between pin No.1 and pin No.2 by multimeter and observe if it is around 5V.	Yes	To step 6
		No	Next step
5	Check if it is short circuit to ground between ECU pin No.39, No. 35 and sensor connector No.1, No.2.	Yes	Repair or replace cable
		No	Next step
6	Start the engine at idle speed. Observe the value changes of diagnostic tester “coolant temperature”, the value should increase with the increase of the engine coolant temperature.	Yes	Diagnosis help
		No	Replace sensor

DTC: P0122 Indicated temperature is much lower of the air intake temperature sensor.

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Observe “throttle valve absolute opening” item in data flow, check the value if it is between 4% and 10% (specific data is correlated to the vehicle type).	Yes	Next step
		No	To step No. 5
3	Step on the accelerator slowly to complete opening and observe “throttle valve absolute opening” item in data flow, check if the value is increased to around 85-90% with the opening of the throttle valve (specific data is correlated to the vehicle type).	Yes	Next step
		No	To step No. 5
4	Repeat step 3 and observe “throttle valve absolute opening” item in data flow, and check if there is jump during the changes.	Yes	Replace the sensor
		No	Next step
5	Take off the joint of throttle valve positioning sensor on the cable, check if there is short circuit to ground between pin No.17, No.32, No.16 of ECU and pin No.1, No.2, No.3.	Yes	Repair or replace cable
		No	Next step
6	Check the voltage between pin No.1 and pin No.2 by multimeter and observe if it is around 5V.	Yes	Replace sensor
		No	Diagnosis help

DTC: P0123 Circuit voltage is much higher of the throttle position sensor

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Observe “throttle valve absolute opening” item in data flow, check the value if it is between 4% and 10% (specific data is correlated to the vehicle type).	Yes	Next step
		No	To step No. 5
3	Step on the accelerator slowly to complete opening and observe “throttle valve absolute opening” item in data flow, check if the value is increased to around 85-90% with the opening of the throttle valve (specific data is correlated to the vehicle type).	Yes	Next step
		No	To step No. 5
4	Repeat step 3 and observe “throttle valve absolute opening” item in data flow, and check if there is jump during the changes.	Yes	Replace the sensor
		No	Next step
5	Take off the joint of throttle valve positioning sensor on the cable, check if there is open circuit or short circuit to power supply between pin No.17, No.32, No.16 of ECU and pin No.1, No.2, No.3 of sensor	Yes	Repair or replace cable
		No	Next step
6	Check the voltage between pin No.1 and pin No.2 by multimeter and observe if it is around 5V.	Yes	Replace sensor
		No	Diagnosis help

DTC: P0130 Unreasonable failure of the upstream oxygen sensor signal

(Notice: below diagnosis process is fit for those without P0135 at the same time; if there is P0135 failure, please deal with P0135 failure at first and then check as below.)

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Start the engine and leave it at idle speed until its coolant reaches to the normal value. Observe the value changes of “oxygen sensor voltage” item on diagnostic meter, the displayed value should change rapidly from 100mV-900mV.	Yes	Diagnosis help
		No	Next step
3	Check if there is short circuit to ground between pin No.36, No.18, of ECU and pin A (opposite to oxygen sensor gray connecting line), B (opposite to oxygen sensor black connecting line).	Yes	Repair or change cable
		No	Next step

DTC: P0132 Much higher voltage of upstream oxygen sensor

(Notice: below diagnosis process is fit for those without P0135 at the same time; if there is P0135 failure, please deal with P0135 failure at first and then check as below.)

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Start the engine and leave it at idle speed until its coolant reaches to the normal value. Observe the value changes of “oxygen sensor voltage” item on diagnostic meter, the displayed value should change rapidly from 100mV-900mV.	Yes	Diagnosis help
		No	Next step
3	Check if there is short circuit to power supply between pin No.36, No.18, of ECU and pin A (opposite to oxygen sensor gray connecting line), B (opposite to oxygen sensor black connecting line).	Yes	Repair or change cable
		No	Diagnosis help
4	A, check if the exhaust system is jammed B, check if the injector is leaking C, check if the fuel pressure is over higher D, check if the valve clearance is over smaller etc.	Yes	Check and repair according to diagnosis
		No	Diagnosis help

DTC: P0134 Signal failure of upstream oxygen sensor

(Notice: below diagnosis process is fit for those without P0135 at the same time; if there is P0135 failure, please deal with P0135 failure at first and then check as below.)

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Start the engine and leave it at idle speed until its coolant temperature reaches to the normal value. Observe the value changes of “oxygen sensor voltage” item on diagnostic meter, the displayed value should change rapidly from 100mV-900mV.	Yes	Diagnosis help
		No	Next step
3	Check if there is open circuit between pin No.36, No.18, of ECU and pin A (opposite to oxygen sensor gray connecting line), B (opposite to oxygen sensor black connecting line) of sensor joint.	Yes	Repair or change cable
		No	Diagnosis help

DTC: P0135 Heating circuit failure of upstream oxygen sensor

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Take off the oxygen sensor joint on the cable and check the voltage between the pins of C (opposite to oxygen sensor white connecting line) and D (opposite to oxygen sensor white connecting line) by multimeter, and observe if it is about 12V.	Yes	Next step
		No	To step No.4
3	Check the resistance value between oxygen sensor	Yes	Next step

	connectors C (white) and D (white) using multimeter, and observe if it is 2-5Ω when it is 20□.	No	Change sensor
4	Check the fuse inside of oxygen sensor heating circuit and observe if it is blow.	Yes	Change fuse
			Next step
5	Check if there is open circuit or short circuit to power supply between ECU pin No.1, main relay sensor No.87 and pin C (opposite to oxygen sensor white connecting line), D (opposite to oxygen sensor white connecting line) of sensor joint.	Yes	Repair or change cable
		No	Diagnosis help

DTC: P0171 Closed loop air fuel ratio control self adapting exceeds it maximum limit

(Notice: below diagnosis flow is fit for when air intake pressure sensor failure, canister control valve failure and oxygen sensor failure are not appeared at the same time; if there are failures existing at the same time please deal with other failures at first and then do as below.)

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Start the engine and leave it at idle speed until its coolant temperature reaches to the normal value. Observe the value changes of “oxygen sensor voltage” item on diagnostic meter, and the displayed value keeps around the value of 100mV at some working conditions.	Yes	Next step
		No	Diagnosis help
3	Connect the fuel pressure meter (connection position is the front end of fuel distributing pipe assembly fuel intake pipe); start the engine and check the fuel pressure at idle speed conditions if it is around 260kpa; take off the vacuum pipe on fuel pressure regulator, check the pressure and observe if it is around 300kpa.	Yes	Repair or replace the cable
		No	Next step
4	Check if there is short circuit to ground between ECU pin No.36, No.18 and pin A (opposite to oxygen sensor gray connecting line), pin B (opposite to oxygen sensor black connecting line) of sensor joint.	Yes	Repair or replace cable
		No	Next step
5	A, check if there is a heavy leaking in air intake system B, check if the injector is jammed C, check if the clearance of spark plug is too big D, check if the sub live wire resistance is too big E, check if the valve clearance is too big etc.	Yes	Repair according to diagnosis data
		No	Diagnosis help

DTC: P0172 Closed loop air fuel ratio control self adapting exceeds it minimum limit

(Notice: below diagnosis flow is fit for when air intake pressure sensor failure, canister control valve failure and oxygen sensor failure are not appeared at the same time; if there are failures existing at the same time please deal with other failures at first and then do as below.)

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to "ON"		Next step
2	Start the engine and leave it at idle speed until its coolant temperature reaches to the normal value. Observe the value changes of "oxygen sensor voltage" item on diagnostic meter, and the displayed value keeps around the value of 900mV at some working conditions.	Yes	Next step
		No	Diagnosis help
3	Connect the fuel pressure meter (connection position is the front end of fuel distributing pipe assembly fuel intake pipe); start the engine and check the fuel pressure at idle speed conditions if it is around 260kpa; take off the vacuum pipe on fuel pressure regulator, check the pressure and observe if it is around 300kpa.	Yes	Repair or replace the cable
		No	Check and repair fuel system
4	Check if there is short circuit to power supply between ECU pin No.36, No.18 and pin A (opposite to oxygen sensor gray connecting line), pin B (opposite to oxygen sensor black connecting line) of sensor joint.	Yes	Repair or replace cable
		No	Next step
5	A, check if the injector is leaking B, check if the exhaust pipe is jammed C, check if the valve clearance is too small etc.	Yes	Repair according to diagnosis data
		No	Diagnosis help

DTC: P0201 The 1st cylinder injector circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to "ON"		Next step
2	Take off the 1 st cylinder injector joint from the cable, check the voltage value between this joint pin No.1 and the power cathode by multimeter and observe if it is 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground between the 1 st injector joint pin No.1 and main relay.	Yes	Repair or replace the cable
		No	Next step
4	Check the resistance value by multimeter between 1 st cylinder injector pin No.1 and No.2, and observe if it is 11-13Ω when it is 20°C.	Yes	Next step
		No	Change injector
5	Check the voltage value by multimeter between 1 st	Yes	Repair according to

	cyliner injector pin No.2 and power supply cathode, and observe if it is around 3.7V.	No	diagnosis data Diagnosis help
6	Check if there is open circuit or short circuit to ground between 1 st cylinder injector joint pin No.2 and the ECU pin No.27.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0202 The 2nd cylinder injector circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Take off the 2 nd cylinder injector joint from the cable, check the voltage value between this joint pin No.1 and the power cathode by multimeter and observe if it is 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground between the 2 nd injector joint pin No.1 and main relay.	Yes	Repair or replace the cable
		No	Next step
4	Check the resistance value by multimeter between 2 nd cylinder injector pin No.1 and No.2, and observe if it is 11-13Ω when it is 20°C.	Yes	Next
		No	Change injector
5	Check the voltage value by multimeter between 2 nd cylinder injector pin No.2 and power supply cathode, and observe if it is around 3.7V.	Yes	Diagnosis help
		No	Next step
6	Check if there is open circuit or short circuit to ground between 2 nd cylinder injector joint pin No.2 and the ECU pin No.6.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0203 The 3rd cylinder injector circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Take off the 3 rd cylinder injector joint from the cable, check the voltage value between this joint pin No.1 and the power cathode by multimeter and observe if it is 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground between the 3 rd injector joint pin No.1 and main relay.	Yes	Repair or replace the cable
		No	Next step
4	Check the resistance value by multimeter between 3 rd cylinder injector pin No.1 and No.2, and observe if it is 11-13Ω when it is 20°C.	Yes	Next step
		No	Change injector
5	Check the voltage value by multimeter between 3 rd	Yes	Diagnosis help

	cylinder injector pin No.2 and power supply cathode, and observe if it is around 3.7V.	No	Next step
6	Check if there is open circuit or short circuit to ground between 3 rd cylinder injector joint pin No.2 and the ECU pin No.7.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0204 The 4th cylinder injector circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Take off the 4 th cylinder injector joint from the cable, check the voltage value between this joint pin No.1 and the power cathode by multimeter and observe if it is 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground between the 4 th injector joint pin No.1 and main relay.	Yes	Repair or replace the cable
		No	Next step
4	Check the resistance value by multimeter between 4 th cylinder injector pin No.1 and No.2, and observe if it is 11-13Ω when it is 20°C.	Yes	Next step
		No	Replace injector
5	Check the voltage value by multimeter between 4 th cylinder injector pin No.2 and power supply cathode, and observe if it is around 3.7V.	Yes	Diagnosis help
		No	Next step
6	Check if there is open circuit or short circuit to ground between 4 th cylinder injector joint pin No.2 and the ECU pin No.47.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0230 Fuel pump control circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”		Next step
2	Take off the fuel pump relay and put ignition switch to “ON”; check the voltage separately between fuel pump relay power supply ends - that is relay pin No. 30 and No.86 and power supply cathode, and observe if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground of the relay power supply ends circuit.	Yes	Repair or replace the cable
		No	To step No.2
4	Check the voltage by multimeter between fuel pump relay control ends that is relay pin No. 85 and power supply cathode and observe if it is around 3.7V.	Yes	Replace fuel pump relay
		No	Next step
5	Check if there is open circuit or short circuit to ground	Yes	Repair or replace

	or to power supply between relay control ends that is relay pin No.85 and ECU pin No.69.		cable
		No	Diagnosis help

DTC: P0325 Knock sensor circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”		Next step
2	Take off the knock sensor joint from the cable; check the resistance value by multimeter between knock sensor connector No.1and No.2 and observe if it is 1MΩ.	Yes	Next step
		No	Change sensor
3	Check if there is open circuit or short circuit to ground or to power supply between circuit of knock sensor joint No.1, No.2 and ECU pin No.19, No. 20	Yes	Repair or replace the cable
		No	To step No.2
4	Replace the knock sensor according to the regulation; try running the vehicle and make the engine speed exceed 2200rpm. Check if the DTC P0325 will appear again.	Yes	Diagnosis help
		No	Check if it is a occasional fault

DTC: P0335 Crank shaft position sensor signal failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”		Next step
2	Take off the speed sensor joint from the cable; check the resistance value by multimeter between speed sensor connector No.2and No.3 and observe if it is around 770-950MΩwhen it is 20°C	Yes	Next step
		No	Replace sensor
3	Check if there is open circuit or short circuit to ground or to power supply between circuit of speed sensor joint No.2, No.3 and ECU pin No.34, No. 15	Yes	Repair or replace the cable
		No	Next step
4	Check the flywheel signal disc if it is in good conditions.	Yes	Diagnosis help
		No	Replace signal disc

DTC: P0336 Crank shaft position sensor signal unreasonable failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”		Next step
2	Take off the speed sensor joint from the cable; check the resistance value by multimeter between speed sensor connector No.2and No.3 and observe if it is around 770-950MΩwhen it is 20°C	Yes	Next step
		No	Replace sensor

3	Check if there is open circuit or short circuit to ground or to power supply between circuit of speed sensor joint pin No.2, No.3 and ECU pin No.34, No.15	Yes	Repair or replace the cable
		No	Next step
4	Check the flywheel signal disc if it is in good conditions.	Yes	Diagnosis help
		No	Replace signal disc

DTC: P0340 Phase sensor signal failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Take off the phase sensor joint from the cable; check the voltage value by multimeter between phase sensor joint pin No.3 and No.1; and observe if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground between circuit of phase sensor joint pin No.3 and main relay pin No.87; check if there is bad contact of phase sensor connector No.1.	Yes	Repair or replace the cable
		No	Next step
4	Check the voltage if it is around 9.9V between phase sensor joint pin No.2 and power supply cathode.	Yes	To step 6
		No	Next step
5	Check if there is open circuit or short circuit to power supply or to ground between phase sensor joint pin No.2 and ECU pin No.79.	Yes	Repair or replace cable
		No	Next step
6	Check the camshaft signal disc if it is in good conditions.	Yes	Diagnosis help
		No	Replace signal disc

DTC: P0342 Much lower voltage of the phase sensor

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Take off the phase sensor joint from the cable; check the voltage value by multimeter between phase sensor joint pin No.3 and No.1; and observe if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground between circuit of phase sensor joint pin No.3 and main relay pin No.87; check if there is bad contact of phase sensor connector No.1.	Yes	Repair or replace the cable
		No	Next step
4	Check the voltage if it is around 9.9V between phase sensor joint pin No.2 and power supply cathode.	Yes	To step 6
		No	Next step
5	Check if there is open circuit or short circuit to power supply or to ground between the circuit of phase sensor joint pin No.2 and ECU pin No.79.	Yes	Repair or replace cable
		No	Next step
6	Check the camshaft signal disc if it is in good conditions.	Yes	Diagnosis help
		No	Replace signal disc

DTC: P0343 Much higher voltage of the phase sensor

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Take off the phase sensor joint from the cable; check the voltage value by multimeter between phase sensor joint pin No.3 and No.1; and observe if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground between circuit of phase sensor joint pin No.3 and main relay pin No.87; check if there is bad contact of phase sensor connector No.1.	Yes	Repair or replace the cable
		No	Next step
4	Check the voltage if it is around 9.9V between phase sensor joint pin No.2 and power supply cathode.	Yes	To step 6
		No	Next step
5	Check if there is open circuit or short circuit to power supply or to ground between the circuit of phase sensor joint pin No.2 and ECU pin No.79.	Yes	Repair or replace cable
		No	Next step
6	Check the camshaft signal disc if it is in good conditions.	Yes	Diagnosis help
		No	Replace signal disc

DTC: P0443 Canister control valve drive grade control circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Take off the canister control valve joint from the cable; check the voltage value by multimeter between this joint pin No.1 and power supply cathode; and observe if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground of the canister control valve power supply ends circuit.	Yes	Repair or replace the cable
		No	To step No.2
4	Check the resistance value if it is around 22-30Ω when it is 20°C between canister control valve pin No.1 and pin No.2.	Yes	Next step
		No	Replace the valve
5	Check the voltage if it is around 3.7V between canister control valve joint pin No.1 and power supply cathode.	Yes	Diagnosis help
		No	Next step
6	Check if there is open circuit between the circuit of canister joint pin No.2 and ECU pin No. 46.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0444 Much lower voltage of canister control valve drive grade control circuit

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Take off the canister control valve joint from the cable; check the voltage value by multimeter between this joint pin No.1 and power supply cathode; and observe if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground of the canister control valve power supply ends circuit.	Yes	Repair or replace the cable
		No	To step No.2
4	Check the resistance value if it is around 22-30Ω when it is 20°C between canister control valve pin No.1 and pin No.2.	Yes	Next step
		No	Replace the valve
5	Check the voltage by the multimeter if it is around 3.7V between canister control valve joint pin No.1 and power supply cathode.	Yes	Diagnosis help
		No	Next step
6	Check if there is short circuit to ground between the circuit of canister joint pin No.2 and ECU pin No. 46.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0445 Much higher voltage of canister control valve drives grade control circuit

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”		Next step
2	Take off the canister control valve joint from the cable; check the voltage value by multimeter between this joint pin No.1 and power supply cathode; and observe if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground of the canister control valve power supply ends circuit.	Yes	Repair or replace the cable
		No	To step No.2
4	Check the resistance value if it is around 22-30Ω when it is 20°C between canister control valve pin No.1 and pin No.2.	Yes	Next step
		No	Replace the valve
5	Check the voltage by the multimeter if it is around 3.7V between canister control valve joint pin No.1 and power supply cathode.	Yes	Diagnosis help
		No	Next step
6	Check if there is short circuit to power supply between the circuit of canister joint pin No.2 and ECU pin No. 46.	Yes	Repair or replace cable

		No	Diagnosis help
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DTC: P0480 Air conditioner condenser cooling fan relay control circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”		Next step
2	Take off the air conditioner condenser cooling fan relay; put the ignition switch to “ON” position, and check the voltage value by multimeter between this relay power supply end that is relay pin No.30, No.85 and power supply cathode if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground of the air conditioner cooling fan relay power supply end circuit.	Yes	Repair or replace the cable
		No	To step No.2
4	Check the voltage by the multimeter if it is around 3.7V between air conditioner condenser cooling fan relay control ends that is relay pin No.86 and power supply cathode.	Yes	Replace relay
		No	Next step
5	Check if there is open circuit or short circuit to power supply or to ground between the circuit of relay control end pin No.86 and ECU pin No. 50.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0500 Unreasonable failure of speed signal

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”.		Next step
2	If it is a vehicle with ABS, please check if there is ABS DTC.	Yes	Check and repair ABS system
		No	Next step
3	Check if the speedometer finger works normally.	Yes	Next step
		No	Check the speedometer line
4	Check if the speed sensor works normally.	Yes	Next step
		No	Replace speed sensor
5	Check if there is open circuit or short circuit to power	Yes	Repair or

	supply or to ground between the circuit of speed sensor and ECU pin No. 59.		replace cable
		No	Diagnosis help

DTC: P0506 Rotating speed of idle speed is lower than target idle speed

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”.		Next step
2	Check if the throttle valve adjusting screw, accelerator cable and throttle valve working in good conditions.	Yes	Next step
		No	Carry out the necessary repair and maintenance
3	Check if the idle speed regulator works in good conditions.	Yes	Next step
		No	Carry out the necessary repair and maintenance
4	E, check if the pressure of the fuel supplying system is too low F, check if the injector is jammed G, check if the exhaust system is not straightway	Yes	Next step
		No	Replace speed sensor

DTC: P0507 Rotating speed of idle speed is higher than target idle speed

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”		Next step
2	Check if the throttle valve adjusting screw, accelerator cable and throttle valve working in good conditions.	Yes	Next step
		No	Carry out the necessary repair and maintenance
3	Check if the idle speed regulator works in good conditions.	Yes	Next step
		No	Carry out the necessary repair and maintenance
4	A, check if the system is leaking; B, check if the injector is leaking; C, check if the pressure of fuel supplying system is too high	Yes	Carry out the necessary repair and maintenance
		No	Diagnosis help

DTC: P0508 Idle speed regulator control circuit voltage is too low

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Take off the idle regulator joint and Check the resistance value between idle speed regulator pin A and pin D, pin B and pin C if it is around $53\pm 5.3\Omega$ when it is 20°C.	Yes	Next step
		No	Replace step motor
3	Check if there is short circuit to ground between the circuits of idle speed regulator joint pin A, B, C, D and ECU pin No. 65, No.66, No.67. No.64.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0509 Idle speed regulator control circuit voltage is too high

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Take off the idle regulator joint and check the resistance value by multimeter separately between idle speed regulator pin A and pin D, pin B and pin C if it is around $53\pm 5.3\Omega$ when it is 20°C.	Yes	Next step
		No	Replace step motor
3	Check using multimeter separately if there is short circuit to power supply between the circuits of idle speed regulator joint pin A, B, C, D and ECU pin No. 65, No.66, No.67. No.64.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0511 Idle speed regulator control circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Take off the idle regulator joint and check the resistance value by multimeter separately between idle speed regulator pin A and pin D, pin B and pin C if it is around $53\pm 5.3\Omega$ when it is 20°C.	Yes	Next step
		No	Replace step motor
3	Check using multimeter separately if there is open circuit between the circuits of idle speed regulator joint pin A, B, C, D and ECU pin No. 65, No.66, No.67. No.64.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0560 System voltage signal unreasonable

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”.		Next step

2	Check the accumulator voltage by multimeter if it is around 12V.	Yes	Next step
		No	Replace accumulator
3	Check if there is open circuit or short circuit to ground between the circuits of ECU pin No.44, No.45, No.63 and main relay pin No.87.	Yes	Repair or replace cable
		No	Next step
4	Start the engine and check if the entire generator recharging voltage is around 9-16V at the different engine speed.	Yes	Next step
		No	Replace generator
5	Check the engine cable harness contact position if it is in good conditions.	Yes	Diagnosis help
		No	Repair or replace cable

DTC: P0562 System voltage is too low

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”.		Next step
2	Check the accumulator voltage by the multimeter and observe if it is around 12V.	Yes	Next step
		No	Replace accumulator
3	Check if the resistance is over big between the circuits of ECU pin No.44, No.45, No.63 and main relay pin No.87.	Yes	Repair or replace cable
		No	Next step
4	Start the engine and check if the entire generator recharging voltage is around 9-16V at the different engine speed.	Yes	Next step
		No	Replace generator
5	Check the engine cable harness contact position if it is in good conditions.	Yes	Diagnosis help
		No	Repair or replace cable

DTC: P0563 System voltage is too high

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”.		Next step
2	Check the accumulator voltage by the multimeter and observe if it is around 12V.	Yes	Next step
		No	Replace accumulator
3	Start the engine and check if the entire generator recharging voltage is around 9-16V at the different engine speed.	Yes	Next step
		No	Replace generator
4	Check the engine cable harness contact position if it is in good conditions.	Yes	Diagnosis help
		No	Repair or replace



			cable
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DTC: P0601 ECU testing code failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Clean up the DTC and check the failure once again if it is a steady failure.	Yes	Next step
		No	System if correct
3	Replace ECU		Finish

DTC: P0602 ECU diagnosis data ID code failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Clean up the DTC and check the failure once again if it is a steady failure.	Yes	Next step
		No	System if correct
3	Replace ECU		Finish

DTC: P0645 Air conditioner compressor relay control circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”.		Next step
2	Take off air conditioner compressor relay; put ignition switch to “ON”; check the voltage value between relay power supply ends that relay pin No.30, No.85 and power cathode and observe if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground of the relay power supplying ends circuit.	Yes	Repair or replace cable
		No	To step No.2
4	Check the voltage value by the multimeter between air conditioner compressor relay control ends that is relay pin No.86 and power cathode and observe if it is around 3.7V.	Yes	Replace relay
		No	Next step
5	Check if there is open circuit between the circuit of air conditioner compressor relay control ends that is relay pin No.86 and ECU pin No.70.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0646 Much lower voltage of air conditioner compressor relay control circuit

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”.		Next step
2	Take off air conditioner compressor relay; put ignition switch to “ON”; check the voltage value between relay power supply ends that relay pin No.30, No.85 and power cathode and observe if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground of the relay power supplying ends circuit.	Yes	Repair or replace cable
		No	To step No.2
4	Check the voltage value by the multimeter between air conditioner compressor relay control ends that is relay pin No.86 and power cathode and observe if it is around 3.7V.	Yes	Replace relay
		No	Next step
5	Check if there is short circuit to ground between the circuit of air conditioner compressor relay control ends that is relay pin No.86 and ECU pin No.70.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P0647 Much higher voltage of air conditioner compressor relay control circuit

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “OFF”.		Next step
2	Take off air conditioner compressor relay; put ignition switch to “ON”; check the voltage value between relay power supply ends that relay pin No.30, No.85 and power cathode and observe if it is around 12V.	Yes	To step No.4
		No	Next step
3	Check if there is open circuit or short circuit to ground of the relay power supplying ends circuit.	Yes	Repair or replace cable
		No	To step No.2
4	Check the voltage value by the multimeter between air conditioner compressor relay control ends that is relay pin No.86 and power cathode and observe if it is around 3.7V.	Yes	Replace relay
		No	Next step
5	Check if there is short circuit to power supply between the circuit of air conditioner compressor relay control ends that is relay pin No.86 and ECU pin No.70.	Yes	Repair or replace cable
		No	Diagnosis help

DTC: P1651 Trouble light control circuit failure

No.	Operating steps	Result	Follow up steps
1	Connect the diagnostic tester and commutator, put the ignition switch to “ON”.		Next step
2	Carry out action test to engine trouble light by using diagnostic meter “actuator action test” item; and observe the indicator if it is always at the status of extinguishing or lighting on.	Yes	Next step
		No	System is correct
3	Check if there is open circuit or short circuit to ground of the engine trouble light power supplying circuit.	Yes	Repair or replace cable
		No	Next step
4	Check if there is open circuit or short circuit to power supply or short circuit to ground between the circuit of engine trouble light control ends and ECU pin No. 28.	Yes	Repair or replace cable
		No	Diagnosis help

5. TYPICAL FAILURE AND ITS DIAGNOSIS FLOW

5.1 EXPLANATION

Carry out the primary inspection before start the diagnosing according to the engine failure phenomenon.

- 1) Make sure the engine trouble light is working properly;
- 2) Make sure that there is no failure information record checked by diagnostic meter;
- 3) Make sure that the failure phenomenon exists according to the customers’ complaints, and confirm the conditions causing the failure.

Then carry out the exterior inspection:

- (1) Check if there is any fuel pipe is leaking;
- (2) Check if the vacuum pipe is broken, kinked up or linked correctly;
- (3) Check if the air intake pipe is jammed, leaking, staved or damaged;
- (4) Check the high voltage line of ignition system if it is broken or aging and if the ignition order is correct;
- (5) Check the cable grounding place if it is clean and fastness;

(6) Check the sensor and actuator joint if it is loosening or bad contact.

Important notice: if the above phenomenon is appeared, you should repair the above the failure at first otherwise it will influence the later service.

Diagnosis help:1 Confirm there is no engine failure record;

- 2 Confirm that the failure exists before the customer complaints;
- 3 Inspect the engine according to the above steps and find nothing wrong;
- 4 During the service please do not ignore the influence from vehicle maintenance, cylinder pressure, mechanical ignition timing and fuel conditions;
- 5 Replace ECU and carry out test. If the failure is deleted, the failure is in ECU; if the failure can not be deleted, replace back to the original ECU and repeat the flow and check and repair it again.

5.2 TYPICAL FAILURE DIAGNOSIS FLOW

1. The engine does not rotate or rotate slowly when it is started

The normal failure component: 1) accumulator; 2) starting motor; 3) cable or ignition switch; 4) mechanical part of the engine.

The general diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Check the voltage value between the two wiring terminals of the accumulator by multimeter; check if it is around 8-12V when the engine is starting.	Yes	Next step
		No	Replace accumulator
2	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 or replace cable
3	Disassemble the starting motor and check its working conditions. Check if there is open circuit or jammed by poor lubricating.	Yes	Repair or replace starting motor
		No	Next step
4	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	Change to correct lubricant
		No	Next step
5	Check the mechanical resistance inside of the engine if it is too big causes the starting motor can not rotate or rotate slowly.	Yes	Repair the engine inside resistance
		No	Repeat the above steps

2. The engine can draw rotating but can not start successfully when it is started.

General failure component: 1) no fuel in fuel tank; 2) fuel pump; 3) speed sensor; 4) ignition coil; 5) engine mechanical part.

Diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Connect the fuel pressure meter (connecting point is the front end of fuel distributing pipe assembly fuel intake pipe); starting the engine by starter and check fuel pressure if it is around 260kpa; take off the vacuum pipe from fuel pressure regulator check the fuel pressure if it is around 300kpa.	Yes	Next step
		No	Repair the fuel supplying system
2	Connect EFI diagnostic meter; observe “engine speed” data item and start the engine and check if there is rotation speed signal is output.	Yes	Next step
		No	Repair the sensor cable
3	Pull off one of the cylinder separating line and take off this cylinder injector joint and connect spark plug to it; keep the spark electrode around 5mm away from engine body; start the engine by starter and check if there is blue and white high pressure fire.	Yes	Next step
		No	Repair the ignition system
4	Check the pressure of each engine cylinder; check if there is engine cylinder insufficient pressure.	Yes	Eliminate engine mechanical failure
		No	Next step
5	Check if the power supply to ECU pin No.12, 13, 44, 45, 63 is correct; check if the pin armature of No. 3, 51, 53, 61, 80 are working correctly.	Yes	Diagnosis help
		No	Check the corresponding line

3. It is hard to start the heating car.

General failure component: 1) water inside of fuel; 2) fuel pump; 3) coolant temperature sensor; 4) fuel pressure regulator vacuum pipe; 5) ignition coil.

General diagnostic flow

No.	Operating steps	Result	Follow up steps
1	Connect the fuel pressure meter (connecting point is the front end of fuel distributing pipe assembly fuel intake pipe); starting the engine and check fuel pressure at idle speed if it is around 260kpa; take off the vacuum pipe from fuel pressure regulator check the fuel pressure if it is around 300kpa.	Yes	Next step
		No	Repair the fuel supplying system
2	Pull off one of the cylinder separating line and connect spark plug to it; keep the spark electrode around 5mm away from engine body; start the engine and check if there is blue and white high pressure fire.	Yes	Next step
		No	Repair the ignition system
3	Take off the coolant temperature sensor joint and start the engine; observe if the engine can be started successfully. (or serial connecting a 300Ωresistance at the joint of coolant temperature sensor; observe if we can start the engine)	Yes	Repair circuit or replace sensor
		No	Next step
4	Check if there if loosen or leaking of the fuel pressure regulator vacuum pipe..	Yes	Repair or replace
		No	Next step
5	Check fuel conditions and check if the failure is appeared after the fuel refilling	Yes	Change fuel
		No	Diagnosis help
6	Connect EFI system adaptor, turn on the ignition switch; check the power supply of pin No.12, 13, 44, 45 and No.63 if it is in right conditions; check pin armature of No.3, 51, 53, 61 and No.80 if it is in right conditions.	Yes	Diagnosis help
			Check correspond circuit

4. It's hard to start the cold car.

General failure component: 1), water in the fuel; 2), fuel pump; 3), coolant temperature sensor; 4), injector; 5), ignition coil; 6), throttle valve and idle speed by pass port; 7), engine mechanical part.

General diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Connect the fuel pressure meter (connecting point is the front end of fuel distributing pipe assembly fuel intake pipe); start the engine and check fuel pressure at idle speed if it is around 260kpa; take off the vacuum pipe from fuel pressure regulator check the fuel pressure if it is around 300kpa.	Yes	Next step
		No	Repair the fuel supplying system
2	Pull off one of the cylinder separating line and connect spark plug to it; keep the spark electrode around 5mm away from engine body; start the engine and check if there is blue and white high pressure fire.	Yes	Next step
		No	Check and repair ignition system
3	Take off the coolant temperature sensor joint and start the engine; observe if the engine can be started successfully. (or serial connecting a 2500Ωresistance at the joint of coolant temperature sensor; observe if we can start the engine)	Yes	Repair circuit or replace sensor
		No	Next step
4	Step on the accelerator slightly and observe if it is easy to be started	Yes	Clean throttle valve and idle speed air port
		No	Next step
5	Disassemble the injector, check the injector using the injector special cleaning analysis meter and observe if it is leaking or jammed.	Yes	Replace the part
		No	Next step
6	Check fuel conditions and check if the failure is appeared after the fuel refilling	Yes	Change fuel
		No	Next step
7	Check pressure conditions of every cylinder and observe if there is insufficient pressure	Yes	Trouble shoot
		No	Next step
8	Connect EFI system adaptor, turn on the ignition switch; check the power supply of pin No.12, 13, 44, 45 and No.63 if it is in right conditions; check pin armature of No.3, 51, 53, 61 and No.80 if it is in right conditions.	Yes	Diagnosis help
		No	Check correspond circuit

5. Normal engine speed but hard to start at any time.

General failure component: 1), water in fuel; 2), fuel pump; 3), coolant temperature sensor; 4), injector; 5), ignition coil; 6), throttle valve and idle speed by pass port; 7), air intake port; 8), ignition timing; 9), spark plug; 10), engine mechanical part.

General diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Check the air cleaner if it is jammed; check the air intake port if it is leaking.	Yes	Repair the air intake system
		No	Next step
2	Connect the fuel pressure meter (connecting point is the front end of fuel distributing pipe assembly fuel intake pipe); start the engine and check fuel pressure at idle speed if it is around 260kpa; take off the vacuum pipe from fuel pressure regulator check the fuel pressure if it is around 300kpa.	Yes	Next step
		No	Repair the fuel supplying system
3	Pull off one of the cylinder separating line and connect spark plug to it; keep the spark electrode around 5mm away from engine body; start the engine and check if there is blue and white high pressure fire.	Yes	Next step
		No	Check and repair ignition system
4	Check spark plugs in every cylinder and observe its type and clearance if it is accord with the regulation.	Yes	Next step
		No	Adjust or replace
5	Take off the coolant temperature sensor joint and start the engine; observe if the engine can be started successfully.	Yes	Repair circuit or replace sensor
		No	Next step
6	Step on the accelerator slightly and observe if it is easy to be started easily.	Yes	Clean throttle valve and idle speed air port
		No	Next step
7	Disassemble the injector, check the injector using the injector special cleaning analysis meter and observe if it is leaking or jammed.	Yes	Replace the part
		No	Next step
8	Check fuel conditions and check if the failure is appeared after the fuel refilling	Yes	Change fuel
		No	Next step
9	Check pressure conditions of every cylinder and observe if there is insufficient pressure	Yes	Trouble shoot
		No	Next step
10	Check the engine ignition order and ignition timing if it is accord with the regulation.	Yes	Next step
		No	Repair the ignition timing

6. Regular starts but the idle speed is not steady at any time.

General failure component: 1), water in fuel; 2), injector; 3), spark plug; 4), throttle valve and idle speed by pass port; 5), air intake port; 6), idle speed regulator; 7), ignition timing; 8), spark plug; 9), engine mechanical.

General diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Check the air cleaner if it is jammed; check the air intake port if it is leaking.	Yes	Repair the air intake system
		No	Next step
2	Check idle speed regulator if it is partial blocked	Yes	Clean or replace
		No	Next step
3	Check spark plugs in every cylinder and observe its type and clearance if it is accord with the regulation.	Yes	Next step
		No	Adjust or replace
4	Check the throttle valve and idle speed by pass if there is carbon deposition.	Yes	Cleaning
		No	Next step
5	Disassemble the injector, check the injector using the injector special cleaning analysis meter and observe if it is leaking or jammed.	Yes	Replace part
		No	Next step
6	Check fuel conditions and check if the failure is appeared after the fuel refilling	Yes	Change fuel
		No	Next step
7	Check pressure conditions of every cylinder and observe if there is big pressure difference between the cylinders.	Yes	Trouble shoot
		No	Next step
8	Check the engine ignition order and ignition timing if it is accord with the regulation.	Yes	Next step
		No	Repair the ignition timing
9	Connect EFI system adaptor, turn on the ignition switch; check the power supply of pin No.12, 13, 44, 45 and No.63 if it is in right conditions; check pin armature of No.3, 51, 53, 61 and No.80 if it is in right conditions.	Yes	Diagnosis help
		No	Repair the corresponding line

7. Regular starts but the idle speed is not steady during engine heating.

General failure component: 1), water in fuel; 2), coolant temperature sensor; 3), spark plug; 4), throttle valve and idle speed by pass port; 5), air intake port; 6), idle speed regulator; 7), engine mechanical.

General diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Check the air cleaner if it is jammed; check the air intake port if it is leaking.	Yes	Repair the air intake system
		No	Next step
2	Check spark plugs in every cylinder and observe its type and clearance if it is accord with the regulation.	Yes	Next step
		No	Adjust or replace
3	Disassemble the idle speed regulator and check the throttle valve and idle speed by pass port if there is carbon deposition	Yes	Cleaning the related parts
		No	Next step
4	Pull off coolant temperature sensor joint and start the engine; observe the engine if it is idle speed unsteady during warming up the engine.	Yes	Repair the line or replace sensor
		No	Next step
5	Disassemble the injector, check the injector using the injector special cleaning analysis meter and observe if it is leaking or jammed or overflowing.	Yes	Replace part
		No	Next step
6	Check fuel conditions and check if the failure is appeared after the fuel refilling	Yes	Change fuel
		No	Next step
7	Check pressure conditions of every cylinder and observe if there is big pressure difference between the cylinders.	Yes	Trouble shoot
		No	Next step
8	Connect EFI system adaptor, turn on the ignition switch; check the power supply of pin No.12, 13, 44, 45 and No.63 if it is in right conditions; check pin armature of No.3, 51, 53, 61 and No.80 if it is in right conditions.	Yes	Diagnosis help
		No	Repair the corresponding line

8. Regular starts but idle speed is not steady after the engine heating.

General failure component: 1), water in fuel; 2), coolant temperature sensor; 3), spark plug; 4),throttle valve and idle by pass port; 5), air intake port; 6), idle speed regulator; 7), engine mechanical part.

General diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Check the air cleaner if it is jammed; check the air intake port if it is leaking.	Yes	Repair the air intake system
		No	Next step
2	Check spark plugs in every cylinder and observe its type and clearance if it is accord with the regulation.	Yes	Next step
		No	Adjust or replace
3	Disassemble the idle speed regulator and check the throttle valve and idle speed by pass port if there is carbon deposition	Yes	Cleaning the related parts
		No	Next step
4	Pull off coolant temperature sensor joint and start the engine; observe the engine if it is idle speed unsteady during warming up the engine.	Yes	Repair the line or replace sensor
		No	Next step
5	Disassemble the injector, check the injector using the injector special cleaning analysis meter and observe if it is leaking or jammed or overflowing.	Yes	Replace part
		No	Next step
6	Check fuel conditions and check if the failure is appeared just after the fuel refilling	Yes	Change fuel
		No	Next step
7	Check pressure conditions of every cylinder and observe if there is big pressure difference between the cylinders.	Yes	Trouble shoot
		No	Next step
8	Connect EFI system adaptor, turn on the ignition switch; check the power supply of pin No.12, 13, 44, 45 and No.63 if it is in right conditions; check pin armature of No.3, 51, 53, 61 and No.80 if it is in right conditions.	Yes	Diagnosis help
		No	Repair the corresponding line

9. Regular starts but idle speed is not steady or dying out when there is partial loading.

General failure component: 1) air conditioner system; 2) idle speed regulator; 3) injector.

General diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Disassemble the idle speed regulator and check the throttle valve and idle speed by pass port if there is carbon deposition.	Yes	Cleaning the related parts
		No	Next step
2	Observe if the engine output power increased when the air conditioner is switched on, that is using EFI system diagnosis meter observing ignition angle of advance, fuel injection pulse width and changes of air intake flow.	Yes	To step No.4
		No	Next step
3	Connect EFI system adaptor; break connecting line of ECU pin No.75; check the cable end if it is up level signal when the air conditioner is switched on.	Yes	Next step
		No	Repair air conditioning system
4	Check air conditioning system pressure; check the compressor solenoid clutch and air conditioner compressor pump fuel conditions and check if it is working correctly.	Yes	Next step
		No	Repair the air conditioning sys.
5	Disassemble the injector, check the injector using the injector special cleaning analysis meter and observe if it is leaking or jammed or overflowing.	Yes	Replace fault part
		No	Next step
6	Connect EFI system adaptor, turn on the ignition switch; check the power supply of pin No.12, 13, 44, 45 and No.63 if it is in right conditions; check pin armature of No.3, 51, 53, 61 and No.80 if it is in right conditions.	Yes	Diagnosis help
		No	Repair the corresponding line

10. Regular starts with high idle speed.

General failure component: 1) throttle valve and idle speed by pass port; 2) vacuum pipe; 3) idle speed regulator; 4) coolant temperature sensor; 5) ignition timing.

General diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Check accelerator cable if it is blocked or over tightening	Yes	Adjust
		No	Next step
2	Check the air intake system and its connecting vacuum pipe if it is leaking.	Yes	Repair the air in taking system
		No	Next step
3	Disassemble the idle speed regulator and check the throttle valve and idle speed by pass port if there is carbon deposition	Yes	Clean related part
		No	Next step
4	Take off the coolant temperature sensor joint; start the engine and observe if it has high idle speed.	Yes	Repair line or replace sensor
		No	Next step
5	Check the engine ignition timing if it is accord with the regulations.	Yes	Next step
		No	Repair the ignition timing
6	Connect EFI system adaptor, turn on the ignition switch; check the power supply of pin No.12, 13, 44, 45 and No.63 if it is in right conditions; check pin armature of No.3, 51, 53, 61 and No.80 if it is in right conditions.	Yes	Diagnosis help
		No	Repair the corresponding line

11. Low engine speed or dying out exists when it is accelerated.

General failure component: 1) water in fuel; 2) air intake pressure sensor and throttle position sensor; 3) spark plug; 4) throttle valve and idle speed by pass port; 5) air intake port; 6) idle speed regulator; 7) injector; 8) ignition timing; 9) exhaust pipe.

General diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Check the air cleaner if it is jammed.	Yes	Repair the air intake system
		No	Next step
2	Connect the fuel pressure meter (connecting point is the front end of fuel distributing pipe assembly fuel intake pipe); start the engine and check fuel pressure at idle speed if it is around 260kpa; take off the vacuum pipe from fuel pressure regulator check the fuel pressure if it is around 300kpa.	Yes	Next step
		No	Repair the fuel supplying system
3	Check spark plugs in every cylinder and observe its type and clearance if it is accord with the regulation.	Yes	Next step
		No	Adjust or replace
4	Disassemble idle speed regulator and check throttle valve, idle speed regulator and idle speed by pass port if there is carbon deposition.	Yes	Clean related part
		No	Next step
5	Inspect air intake pressure sensor, throttle position sensor and its line if it is working correctly.	Yes	Next step
		No	Repair line or replace sensor
6	Disassemble the injector, check the injector using the injector special cleaning analysis meter and observe if it is leaking or jammed.	Yes	Replace fault part
		No	Next step
7	Check fuel conditions and check if the failure is appeared after the fuel refilling	Yes	Replace fuel
		No	Next step
8	Check the engine ignition order and ignition timing if it is accord with the regulation.	Yes	Next step
		No	Repair ignition timing
9	Check the exhaust pipe if the air exhausting is smooth	Yes	Next step
		No	Repair or replace exhaust pipe
10	Connect EFI system adaptor, turn on the ignition switch; check the power supply of pin No.12, 13, 44, 45 and No.63 if it is in right conditions; check pin armature of No.3, 51, 53, 61 and No.80 if it is in right conditions.	Yes	Diagnosis help
		No	Repair corresponding line

12. React slowly when it is accelerated.

General failure component: 1) water in fuel; 2) air intake pressure sensor and throttle position sensor; 3) spark plug; 4) throttle valve and idle speed by pass port; 5) air intake port; 6) idle speed regulator; 7) injector; 8) ignition timing; 9) exhaust pipe.

General diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Check the air cleaner if it is jammed.	Yes	Repair the air intake system
		No	Next step
2	Connect the fuel pressure meter (connecting point is the front end of fuel distributing pipe assembly fuel intake pipe); start the engine and check fuel pressure at idle speed if it is around 260kpa; take off the vacuum pipe from fuel pressure regulator check the fuel pressure if it is around 300kpa.	Yes	Next step
		No	Repair the fuel supplying system
3	Check spark plugs in every cylinder and observe its type and clearance if it is accord with the regulation.	Yes	Next step
		No	Adjust or replace
4	Disassemble idle speed regulator and check throttle valve, idle speed regulator and idle speed by pass port if there is carbon deposition.	Yes	Clean related part
		No	Next step
5	Inspect air intake pressure sensor, throttle position sensor and its line if it is working correctly.	Yes	Next step
		No	Repair line or replace sensor
6	Disassemble the injector, check the injector using the injector special cleaning analysis meter and observe if it is leaking or jammed.	Yes	Replace fault part
		No	Next step
7	Check fuel conditions and check if the failure is appeared after the fuel refilling	Yes	Replace fuel
		No	Next step
8	Check the engine ignition order and ignition timing if it is accord with the regulation.	Yes	Next step
		No	Repair ignition timing
9	Check the exhaust pipe if the air exhausting is smooth	Yes	Next step
		No	Repair or replace exhaust pipe
10	Connect EFI system adaptor, turn on the ignition switch; check the power supply of pin No.12, 13, 44, 45 and No.63 if it is in right conditions; check pin armature of No.3, 51, 53, 61 and No.80 if it is in right conditions.	Yes	Diagnosis help
		No	Repair corresponding line

13. The performance is poor when it is accelerated.

General failure component:1) water in fuel; 2) air intake pressure sensor and throttle position sensor; 3) spark plug; 4) ignition coil; 5) throttle valve and idle speed by pass port; 6) air intake port;7) idle speed regulator; 8) injector; 9) ignition timing; 10) exhaust pipe.

General diagnosis flow:

No.	Operating steps	Result	Follow up steps
1	Check if there are failures like clutch skidding, low tyre pressure, brake dragging, wrong tyre size, and wrong four wheel positioning etc..	Yes	Repair
			Next step
2	Check the air cleaner if it is jammed.	Yes	Repair the air intake system
		No	Next step
3	Connect the fuel pressure meter (connecting point is the front end of fuel distributing pipe assembly fuel intake pipe); start the engine and check fuel pressure at idle speed if it is around 260kpa; take off the vacuum pipe from fuel pressure regulator check the fuel pressure if it is around 300kpa.	Yes	Next step
		No	Repair the fuel supplying system
4	Pull off one of the cylinder separating line and connect spark plug to it; keep the spark electrode around 5mm away from engine body; start the engine and check the high pressure fire strength if it is regular.	Yes	Next step
		No	Repair ignition system
5	Check spark plugs in every cylinder and observe its type and clearance if it is accord with the regulation.	Yes	Next step
		No	Adjust or replace
6	Disassemble idle speed regulator and check throttle valve, idle speed regulator and idle speed by pass port if there is carbon deposition.	Yes	Clean related part
		No	Next step
7	Inspect air intake pressure sensor, throttle position sensor and its line if it is working correctly.	Yes	Next step
		No	Repair line or replace sensor
8	Disassemble the injector, check the injector using the injector special cleaning analysis meter and observe if it is leaking or jammed.	Yes	Replace fault part
		No	Next step
9	Check fuel conditions and check if the failure is appeared after the fuel refilling	Yes	Replace fuel
		No	Next step
10	Check the engine ignition order and ignition timing if it is accord with the regulation.	Yes	Next step
		No	Repair ignition timing

11	Check the exhaust pipe if the air exhausting is smooth	Yes	Next step
		No	Repair or replace exhaust pipe
12	Connect EFI system adaptor, turn on the ignition switch; check the power supply of pin No.12, 13, 44, 45 and No.63 if it is in right conditions; check pin armature of No.3, 51, 53, 61 and No.80 if it is in right conditions.	Yes	Diagnosis help
		No	Repair corresponding line