

CHERY SQR7080R SERVICE MANUAL

II

ENGINE-EFI

CHERY AUTOMOBILE CO., LTD



SERVICE CONTENT

MODEL: SQR7080R

SQR7080R ENGINE EFI DECEMBER 2005

Please write down the changes notice after each assembly numbers, the function is to remind the users there are changes and the technical department will inform the correlated department keep them in archives for checking.

ASSEMBLY	TECHNICAL CHANGES NOTICE				
1 Working Chamber Functional Diagram					
2 EFI Component					
3 EFI Fault					
4 Test Method Of System Component Circuit					
5 Diagnosing Procedure For Engine Symptom					
6 Diagnosing Method & Procedure For Typical Fault					
7 Precaution For EFI System Maintenance					
8 Finished Vehicle Circuit Diagram, System Functional Diagram					

The service man must master the technical improvement conditions of this car to provide better maintenance work.



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1. WORKING PRINCIPLE OF EFI CONTROL SYSTEM

1-1 BASIC PRINCIPLE OF EFI SYSTEM

Basic principle of EFI system is outlined in Diagram 1-1. We introduce Siemens SIMK31 electronic control multipoint gasoline injection system. With an ECU (Electronic Control Unit) as the control center, sensors installed on different parts of engine are used to measure operating parameters of engine. According to programs of computer, and by controlling fuel injectors, fuel injection capacity is precisely controlled. Thus in different operating modes, the engine can obtain mixed air with optimum density.

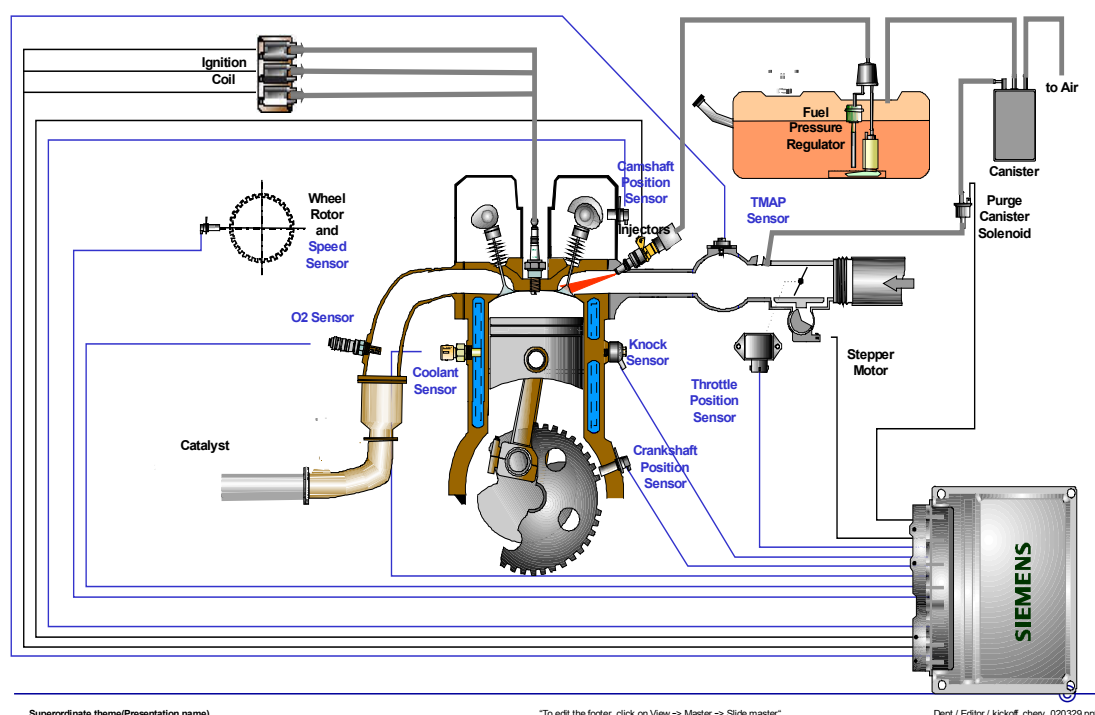


Figure 1-1 372 Basic Principle of Engine EFI System

**ENGINE EFI**

In addition, the electronic- control(EC) gasoline injection system can achieve functions such as start-up enrichment, warm-up enrichment, accelerator enrichment, full-load enrichment, deceleration thinning, cutting off oil compulsively and automatic idle speed control to meet requirement concerning mixed air from engine in different operating modes. Thus 372 engine has favorable fuel economy and low exhaust emission; subsequently, performances of Chery QQ have been greatly improved.

Fuel injection pressure of electronic- control (EC) gasoline injection system is given by electric fuel pump that together with bracket is mounted inside fuel tank. When energized, the pump starts running. It sucks and pressurizes fuel from tank. The pressure is not allowed to exceed 3.8 bar, otherwise fuel-pressure adjuster will open valve to let the excess fuel back to tank. Hence, an electric fuel pump delivers fuel with constant pressure to the delivery pipe which communicates the three fuel injectors fixed on cylinder head. The fuel injector is a kind of solenoid valve, controlled by ECU. When energized, it will open and the pressurized fuel will spray into air intake channel inside cylinder head in atomization, to mix air and be sucked into cylinder during air intake stroke. Air intake consumption is controlled by throttle valve. Temperature and pressure of the air inside channel vary with the throttle opening. Air intake consumption is calculated by its relation with temperature and pressure. Then revolution speed of engine is calculated by means of sensor on crankshaft. According to air intake consumption and revolution speed, ECU calculates basic fuel injection capacities for cylinders respectively. This capacity is controlled by injection time; a longer time means a larger capacity.

1-2 COMPOSING OF FUEL INJECTION SYSTEM

As Diagram 1-2, Fuel injection system can be divided into three parts, namely sensor, ECU and actuator, and according to its functions it also can be divided into oil supply system, air intake system, ignition system and central controller.

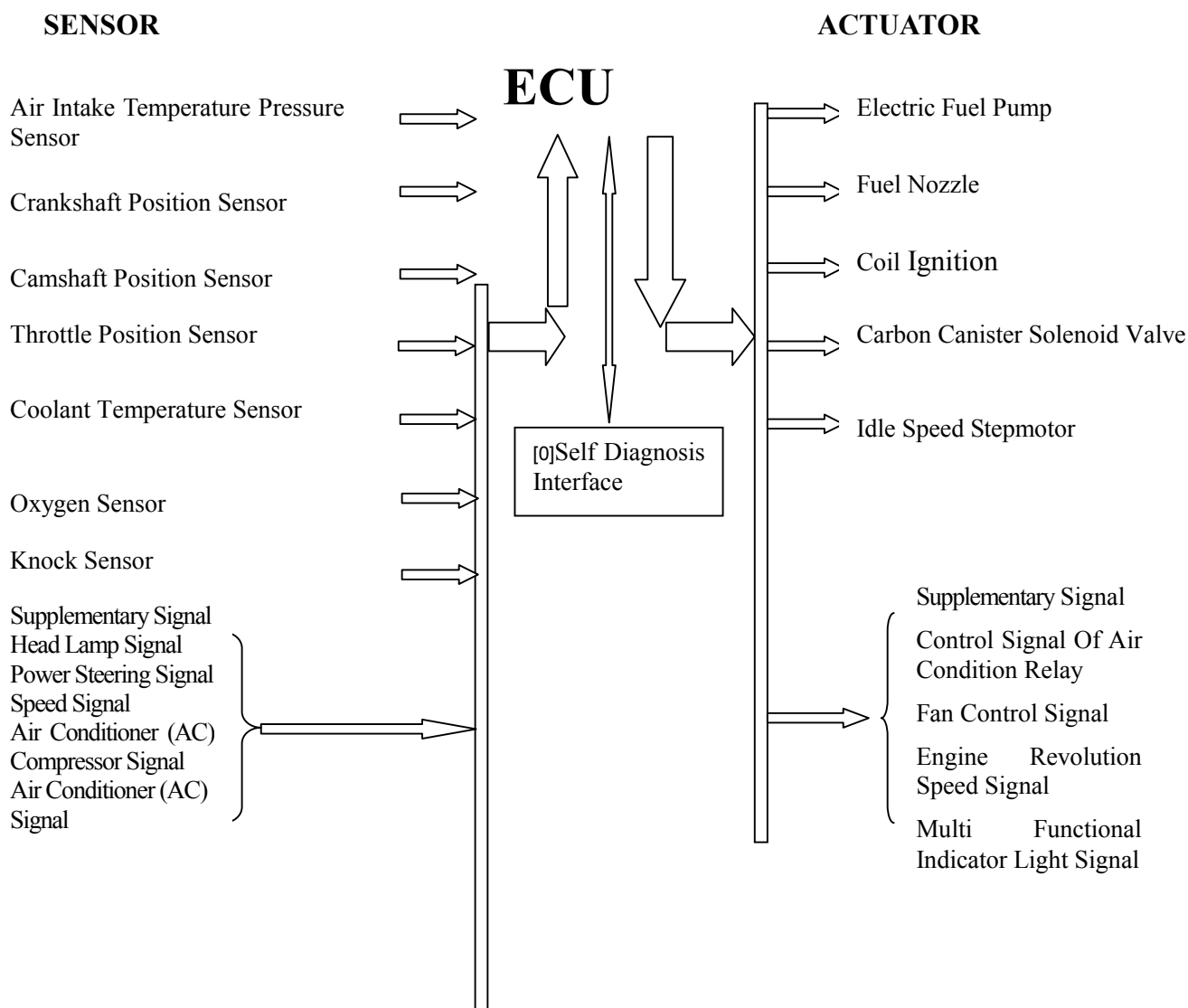
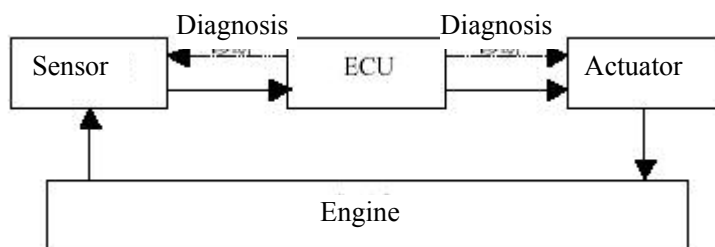


Diagram 1-2 Composing Of Fuel EFI System



EFI SYSTEM COMPOSING VIEW

2 SUMMARIZATION OF EFI COMPONENTS

2-1 AIR-INTAKE TEMPERATURE - PRESSURE SENSOR

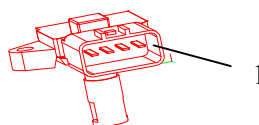
(part number: S11 – 1109411)

Purpose: It can sense 0.1-0.2bar absolute pressure in intake manifold and temperature of air intake. It provides ECU with air intake data under any load.

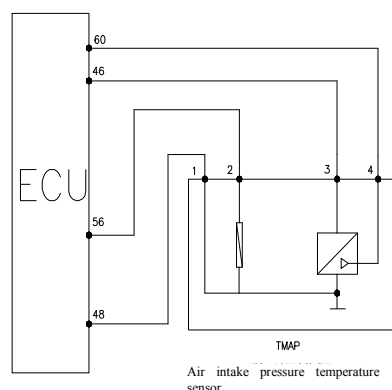
Composition and principle: This sensor is composed of by two sub-sensors, which are intake manifold absolute pressure sensor and air intake temperature sensor. It is installed on top of pressure control box. Air intake consumption is calculated by throttle opening (cross section area) and pressure difference, modification of air intake density is made according to air intake temperature.

Air intake pressure sensor: It is composed of by a silicon chip. A pressure diaphragm, where four piezoelectric resistors as strain elements form Wheatstone bridge, is etched in this chip. Besides the pressure diaphragm, the silicon chip also integrates circuit for signal processing. It forms a close reference with a metal housing where absolute pressure of air approximates zero. Hence a microelectronic mechanical system. The silicon chip is given a force near to zero on its active surface, whose back surface is under an absolute pressure yet to be measured of intake manifold introduced through a connecting pipe. The silicon chip is just several micrometers thick (μm), so its mechanical deformation may be caused by a change of absolute pressure in intake manifold. Four piezoelectric resistors will also be deformed, and the resistance will be changed. After processed by the signal-processing circuit in silicon chip, voltage signal is linear to pressure.

Air intake temperature: A sensor element is a resistor with negative temperature coefficient (NTC), which is similar to water



Intake manifold absolute pressure/air intake temperature sensor



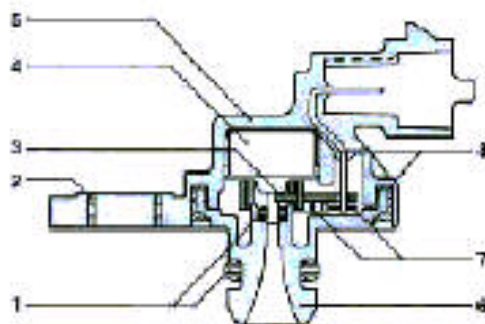
Circuit for sensor of air absolute pressure and temperature in intake manifold

Pins: No.1 grounds;
No.2 outputs temperature signal;
No.3 is applied 5V;
No.4 outputs pressure signal.

temperature sensor whose resistance decreases as air intake temperature increases. Engine ECU through its internal comparison circuit monitor the change of air intake temperature (equivalent to circuit in series) .

Under normal temperature, the resistance of temperature sensor is 2KΩ.

Fault diagnosis: The subsequent electronic device of pressure sensor can detect faults such as open circuit, short circuit and damage to sensor, etc. When ECU detects output signal from the sensor falls beyond characteristic curves, it shall judge that something is wrong with the sensor. For example: when air intake pressure is higher than upper limit, or lower than lower limit, ECU will judge that there is a sensor fault (except in time of startup, air intake pressure is below than the lower limit, but ECU can judge the startup operating mode) , simultaneously the indicator light for engine fault is on. **The vehicle will run with the limp home function.** (not all faults are indicted by light on)



Cross-Section View For Sensor Of Air Intake Pressure And Temperature

1 Gasket, 2 Stainless Steel Sleeve, 3 PCB Board, 4 Sensing Element, 5 Housing, 6 Pressure Bracket, 7 Soldering , 8 Bonded With Bonding Agent

2-2 THROTTLE POSITION SENSOR

(part number of throttle valve body:372-1107010)

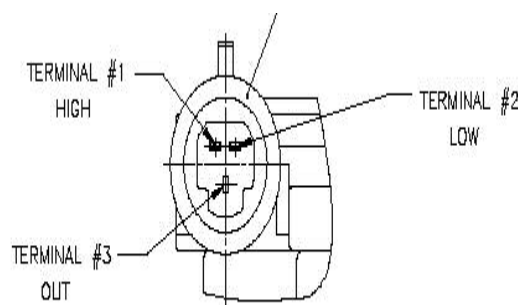
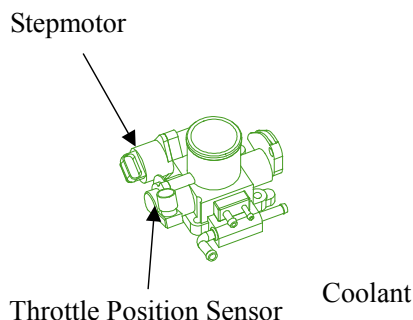
Purpose: This sensor provides information on throttle angle for ECU. According to this information, ECU can obtain information on engine load, operating modes (such as startup, idle speed, no full reduction, part load and full load), acceleration and reduction. This sensor is of 3-line model. ECU tests the opening and speed of throttle by monitoring the voltage change.

Composition and principle: This sensor is an angle sensor with linear output, composed of by two arc-shaped slide resistors and two slide arms. The axle of slide arm is connected to that of throttle, and they are in the same line. A 5v power supply, US, is applied between two ends of slide resistor. As throttle rotates, slide arm also rotates. Meanwhile, the arm slides along the resistor, taking potential at contact point, Up, as output voltage. Therefore the sensor is virtually an angle potential meter. The value employed by ECU is ratio of Up and Us, Up/Us, which can avoid value fluctuation of sensor resulting from that of engine voltage.

Fault diagnosis: ECU monitors whether throttle angle signal exceeds its upper limit or lower limit. When output signal exceeds the upper or lower limit, ECU will judge there is a fault with throttle sensor, and engine will operate in fault mode, its fault light on(The collision or inside dirt of sensor easily results in engine fault.

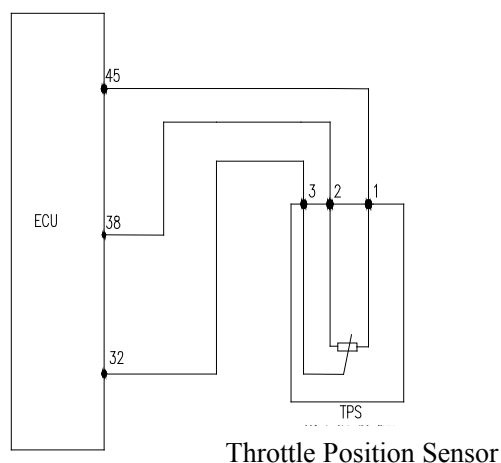
Rotate the throttle, measure the resistance change to judge whether there is fault with circuit.

Assembly: The allowable tightening torque of the fastening screw is 1.5Nm-2.5Nm.



Appearance View For Throttle Position Sensor
Pins:

1. voltage input 2. signal ground 3. signal output



Circuit For Throttle Position Sensor

2-3 COOLANT TEMPERATURE SENSOR TF-W

(Part Number:S11-3808013)

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

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

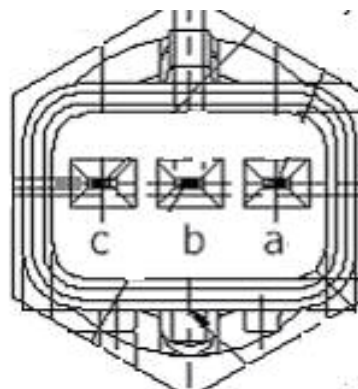
Fault diagnosis: When temperature of coolant is higher than its trusted upper limit, or water temperature is lower than its trusted lower limit, sign digit of fault will be set, fault indicator light for engine will be on, and engine operates in fault mode. ECU will control ignition and injection according to water temperature which is set according to engine operating mode in fault of water temperature, and at the meantime, fan will rotate at a high speed, engine performs its limp home function.

Water temperature signal is used to modify ignition advance angle, oil injection capacity, oil ventilation valve, etc. An interruption of water temperature signal will cause an increase of oil consumption, poor idle-speed self- adaptability and an increase of exhaust emission.

Limit data: $2.5 \pm 5\% K\Omega$

Install notice : The tightening torque is $15 \pm 2 Nm$

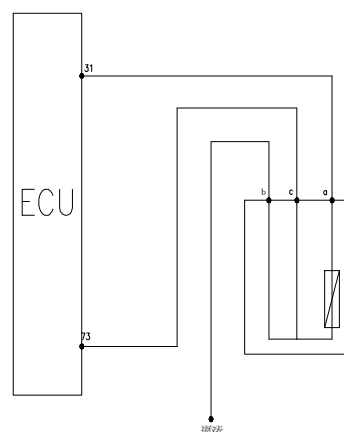
Notice: This vehicle is equipped with a water temperature sensor that has three wires, one of which is live wire, two of which are signal wires. One signal wire is linked to engine



View For Coolant Temperature Sensor

Pins: This sensor has three pins, which can interchange for use.

- a Pin for water temperature signal of EFI system, its resistance at $20^{\circ}C$ is about $2.45 K\Omega$
- b Pin for water temperature of instrument, its resistance at $80^{\circ}C$ is about $0.05 K\Omega$
- c Signal source



Circuit Diagram For Coolant Temperature Sensor



ECU; the other is linked to instruments.

2-4 KNOCK SENSOR KS

(Part Number:372-1002060)

Purpose: This sensor provides engine knock information to ECU, and carries out ignition advance angle control.

Composition and 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. When load and revolution speed of engine, coolant temperature exceed their threshold values, while no record is for fault of knock sensor, signal from knock sensor will be used in knock closed loop control. When knock closed loop is activated, the signal from knock sensor is inputted to ECU, amplified, filtered and integrated. When the integral within a certain rotating angle of crankshaft exceeds its threshold value, ECU will think a fault occurs, then reduce the ignition advance angle at this moment. If there is another knock in next cycle, the ignition advance angle will be reduced again. If there is no knock in several cycles to follow, the ignition advance angle will be restored to its normal value.

Fault diagnosis: ECU monitors sensors, actuators and power amplification circuit. Once one of the following is monitored, the sign digit of fault will be set:

Fault of knock sensor

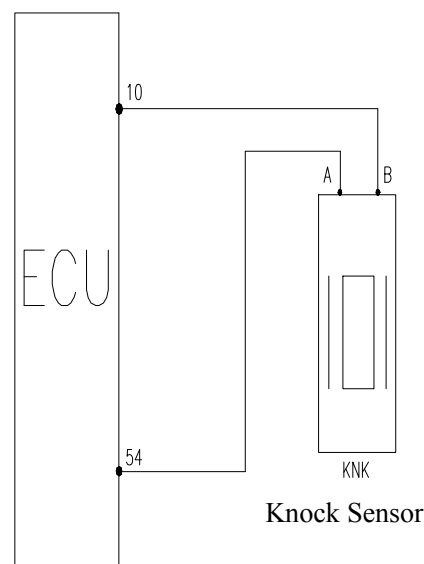
Fault of data processing circuit in knock sensor

Identification signal can not be used.

After the sign digit of fault is set at knock sensor, the knock closed loop control will be closed; the ignition advance angle saved in



Knock Sensor



Circuit Diagram For Knock Sensor

Pins: Pins A and B are not distinguished for connecting to ECU.

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



ECU will be reduced by a safe angle. The sign digit of fault resets.

Assembly notice: The tightening torque is $20 \pm 5 \text{Nm}$.

Notice

It is installed on cylinder body at intake manifold side, bolt washer is not allowed for use. An error of tightening torque will cause inexact output signal

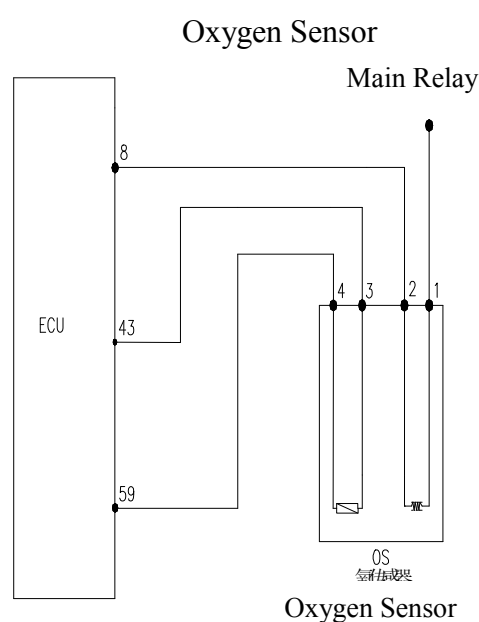
2-5 OXYGEN SENSOR(MODEL: 5WY2406A)

(Part Number: S11-1205110)

Purpose: This sensor provides information whether there is excess oxygen after the fuel taken into cylinder burns in the air taken in. ECU by virtue of the information performs the closed loop control of fuel quantity, to make three main harmful ingredients of engine emission, namely, transfer and purify CO, HC, NO_x compound in 3-way catalytic converter of the tail gas maximally.

Composition and 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. When heated up to 300°C, the ceramic body begins to work, that is, it has properties of solid electrolyte. Thanks to the special material, oxygen ions can penetrate the ceramic pipe randomly. It is by making use of this property that the density difference is converted to potential difference and the voltage output signal is formed. Suppose the mixed air is a little denser, the oxygen density difference between inside and outside ceramic pipe will be a little higher, large quantity of oxygen ions will move from inside to outside, and the output voltage will be higher. Suppose mixed air is a little thin, oxygen density difference between inside and outside ceramic pipe will be smaller, only a little quantity of oxygen ions will move from inside to outside, and the output voltage will be smaller. On basis of this voltage signal, ECU makes closed loop control of oil injection capacity, to ensure the mixed air into cylinder comes close to theoretical air-fuel ratio; A/F=14.7/1

Operating voltage of the oxygen sensor fluctuates within 0.1-0.9V, 5-8 changes within 10 seconds. A frequency lower than this reveals sensor ageing and calls for a replacement. This sensor cannot be repaired. After ECU has been made to enter open loop control, it will operate in closed loop control



Circuit Diagram For Oxygen Sensor

An oxygen sensor is equipped with a cable. The other end of cable is the joint. The cable is wrapped with asbestos fireproof covering.

Every joint has four pins:

- No.1 connects to the positive pole of heater power supply (white);
- No.2 connects to the negative pole of heater power supply (white);
- No.3 connects to signal negative pole (gray);
- No.4 connects to signal positive (black).

**ENGINE EFI**

that is set in advance.

Fault diagnosis: ECU monitors sensors, actuators, power amplification circuit and inspection circuit. Once one of the following is monitored, the sign digit of fault will be set:

Battery voltage can not be used.

Signal for absolute pressure in intake manifold can not be used.

Signal for coolant temperature in engine can not be used.

Fault with drive stage of injector

After the sign digit of fault is set in oxygen sensor, the closed loop control of fuel quantity will be invalidated. The fuel quantity will be controlled by the basic injection time stored in ECU.

Assembly notice : The tightening torque of oxygen sensor is 50-60Nm.

When an oxygen sensor is replaced, it should be spread with a film of anticorrosive oil for fear that it can't be removed because of rust.

The heater coil of this oxygen sensor is controlled by computer. When oxygen sensor is heated up to a certain temperature, engine ECU will cut off the current to the heater coil, the heating will be stopped. (in case of a short circuit or open circuit of the heater coil, engine ECU can detect the fault, and turn on the fault indicator light. In some special operating modes, for example, startup, engine operates in mode of fault.

2-6 CRANKSHAFT POSITION SENSOR

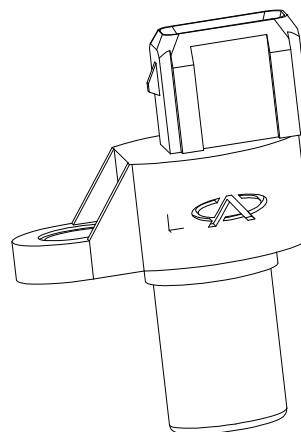
Crankshaft position sensor is shown in the diagram. The crankshaft position sensor of 372 engine employs double Hall elements, so it is called as double Hall sensor. It can sense tiny change of magnetic force. This sensor is based on principle of Hall Effect. The so-called Hall Effect refers to: when a Hall semiconductor chip where a current flows is placed in a magnetic field whose direction is vertical to the current direction, a micro voltage will be generated at the transverse side vertical to the current direction of Hall semiconductor chip, which is called as Hall voltage. A change of magnetic field intensity will cause a change of voltage; Hall voltage is zero when the magnetic field disappears.

Crankshaft position sensor is fixed on the housing of the transmission, a clearance of 0.3-1.9 to the flywheel gear ring. A too large or too small clearance can cause a difficult startup or a startup failure.

The main purpose of this sensor is to detect the speed and angle position of engine and to sense the change of instantaneous speed of flywheel.

CAMSHAFT POSITION SENSOR

Camshaft position sensor is fixed on cylinder head, to sense the crescent gear at the back side of intake camshaft. The signal generated is sent to ECU to determine which cylinder of engine should oil spraying and ignition take place in.



Sketch For Crankshaft Position Sensor

2-6 ELECTRONIC CONTROL UNIT ECU (MODEL: 5WY5100A)

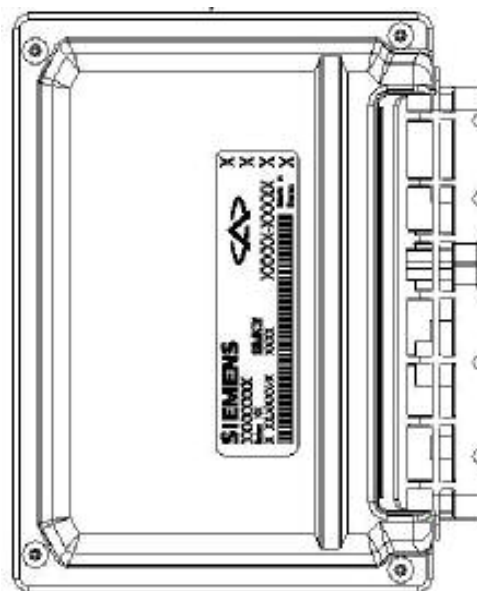
(Part Number:S11-3605010)

Purpose : ECU is the core of engine electronic control system. Sensors provide signals to ECU for electronic control. After internal calculation, ECU will control a series of actuators, such as fuel injectors and ignition coil, to put the engine in normal condition.

ECU is ready to make and store records of system faults. The records in the form of code are stored in RAM; the codes will disappear when power is off. If the circuit from ECU to battery is open, or, the circuit from battery to vehicle is open, memory of fault will disappear. Therefore, before ECU is turned off, it is required to use X431 diagnostic tester in advance to detect fault. For ECU in vehicle, its operating voltage is 6-16V, its operating temperature is -40°C-70°C; its wire of power supply employs 2 A fuse connecting to relays.

Composition: A housing with shield , a printed circuit board on which many ECUs are integrated for controlling EFI system.

Assembly: It is located inside the driver's compartment, above the pedal of clutch, fixed under the instrument panel. Engine ECU is a double-interface one, Series 372 employs an interface only, which is 81 PIN.



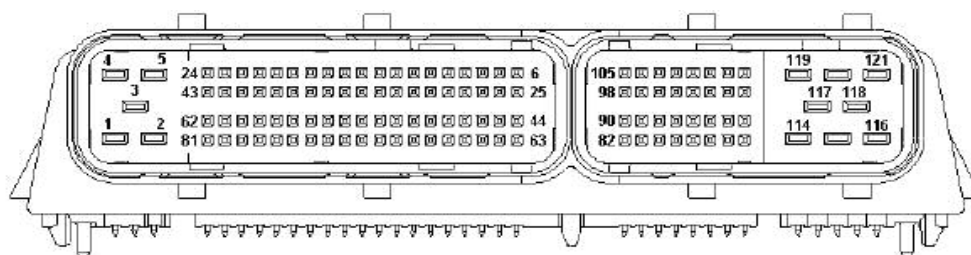
Outside View Of ECU



Definition of Engine Controller Pin:

1	Power Supply Earth	28	Unused	55	Ignition Coil Earth
2	Power Supply Earth	29	Crankshaft Position Sensor Input	56	Signal Of Air Intake Temperature Pressure Sensor
3	Ignition Coil 3	30	Camshaft Position Sensor Earth	57	Unused
4	Ignition Coil	31	Coolant Temperature Sensor Signal	58	Ac Application
5	Ignition Coil 2	32	Input Of Throttle Valve Position Sensor	59	Oxygen Sensor Earth
6	Can Wire Low	33	Unused	60	Pressure Sensor Earth Of Air Intake Temperature
7	Can Wire High	34	Unused	61	2 Cylinder Nozzle
8	Oxygen Sensor	35	Stepmotor B+	62	Unused
9	Unused	36	Stepmotor B -	63	ECU power Supply (+12v Bat)
10	Knock Signal	37	Unused	64	Control Output Of High-Speed Fan Relay
11	Unused	38	Throttle Valve Position Sensor	65	Control Output Of High-Speed Fan Relay
12	Evaporator	39	Speed Signal	66	Output Of Engine revolution speed Signal
13	Evaporator Temperature Sensor Earth	40	Unused	67	Main Relay Control Output
14	Unused	41	Unused	68	A/C Relay Control Output
15	Unused	42	Unused	69	Oil Pump Relay Output
16	Unused	43	Oxygen Sensor Signal	70	Failure Indicator Light
17	Unused	44	Vacancy	71	Unused
18	Unused	45	Power Supply Of Throttle Valve Position Sensor (+5v)	72	Crankshaft Position Sensor Output
19	Stepmotor A +	46	Power Supply Of Air Intake Temperature Pressure Sensor (+5v)	73	Coolant Temperature Sensor Earth
20	Stepmotor A -	47	Unused	74	Signal Of Power Steering
21	Main Relay Power Supply	48	Air Intake Temperature Pressure Sensor Earth	75	Pressure Switch
22	Power Supply Of Ignition Switch	49	Unused	76	Unused
23	3 Cylinder Nozzle	50	ECU Power Supply (+12v Bat)	77	Diagnosis (K Wire
24	1 Cylinder Nozzle	51	Unused	78	Unused
25	Unused	52	Unused	79	Unused
26	Carbon Canister Solenoid Valve	53	Unused	80	Unused
27	Crankshaft Position Sensor Earth	54	Knock Sensor Earth	81	Unused

Pin Definition And Joint Exterior



2-7 ELECTRIC FUEL PUMP

(Part Number:S11-1106610)

Purpose: It pumps fuel at a certain pressure and flow volume from oil tank to injector. It is greatly affected by temperature and voltage.

Composition and 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 the fuel pump relay controlled by ECU, and the relay switches on electric fuel pump only when engine starting and running at more than 30rpm. When the engine stops for some reason (n=) the pump will stop to run by itself. The maximum pressure at the outlet of electric pump is determined by relief valve. As 372 adopts non-oil-return system, a fuel pressure regulator is fixed on the pump assembly which will regulate oil pressure to 380kPa and stabilize it to suit the system requirement, for the exactness of fuel flow when a current with a certain pulse-width flows through.

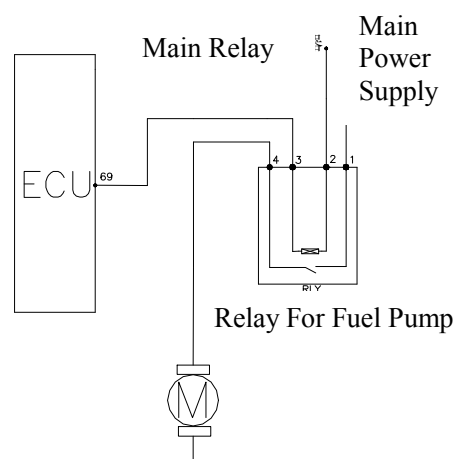
Notices: Fuel temperature has a lot influence on performance of oil pump. For long time operating at high temperature, when fuel temperature exceeds some value, pressure of oil pump sharply decreases. Therefore if engine can't start after a stop during operating, please inspect carefully for the poor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

Fuel pump is not allowed to operate without load if it is short of fuel. Otherwise loss of cooling may cause pump motor overheating, and the motor will be damaged quickly.

If ECU can not receive the signal for engine revolution speed, oil pump won't operate.



View Of Electric Oil Pump



Circuit Diagram For Electric Oil Pump

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



2-8 INJECTOR

(Part Number:S11-1112020)

Purpose : An injector according to instruction from ECU injects fuel within specified time. It provides fuel for engine and atomizes the fuel.

Composition and principle : An ECU transmits electric pulses to the electromagnetic coil of injector $R=14.5$, to generate magnetic force. When the magnetic force increases enough to overcome the resultant force of the return spring pressure, the gravity of needle valve and the frictional force, the needle valve begins to rise, and the fuel injecting begins. The maximum lift of needle valve isn't beyond 0.1mm. When pulses for fuel injecting are stopped, pressure from return spring closes the needle valve again.

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

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

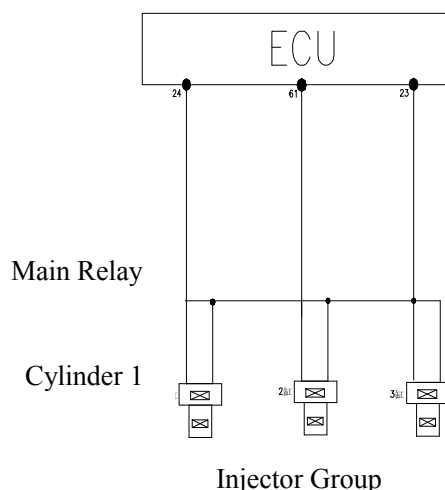
Place an injector in its base vertically. Then fix it to the base with retaining clips.

Notice: For vehicles not in use over a long time, as the wax in gasoline of injectors may deposit and become sticky, thus vehicles can't be started normally. Please inspect carefully for injector sticking.

Fault diagnosis: S11 diagnoses the driving solenoids of injectors instead of injector themselves. When the drive stage of injector is short circuit or overload to battery voltage, or short circuit to earth, or open circuit, the sign digit for fault will be set. In the meanwhile, the closed loop control of oxygen sensor and its self-tuning pre-control are invalidated, data of the last self-tuning is effective. After the fault is removed, sign digit for fault will be reset.



Electromagnetic Injector



Circuit Diagram For Electromagnetic Injector

Pins: Each injector has two pins, one is No.87 pin at housing side with positive sign connecting to the relay of fuel pump; the other is No.23, 24 or 61 pin connecting to ECU.

Notice: Don't mistake pin numbers, otherwise the order for fuel injecting is disturbed.

2-9 IDLE SPEED ACTUATOR-STEP MOTOR DLA

(Part Number Of Throttle Body:372-1107010)

Function: An idle speed actuator with step motor is located in throttle body and an air intake channel for bypassing is provided. When throttle is closed, air flows into engine through this bypassing channel. By virtue of a step motor, ECU can adjust the cross section area of this bypassing channel, consequently adjusting air intake to engine, and adjusting fuel injection by air intake. In engine idle speed actuator, ECU controls motor operating according to different operating modes of engine, and then stabilizes the operating status of engine.

When because of low water temperature, or, driving other accessories (booster pump. Compressor), an engine need idle speed control, this will be done by a step motor.

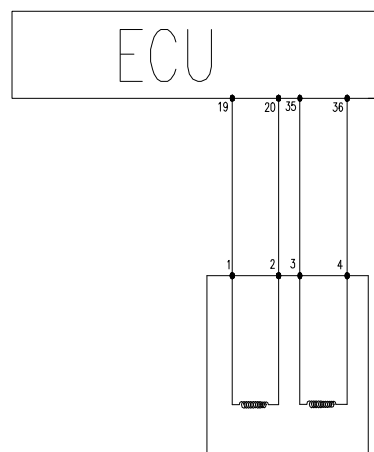
Composition and principle: A step motor is a mini-size one. It consists of several steel stators in a circle and a rotor. Every steel stator is wound with a winding ; the rotor is a permanent magnet, whose center is a nut. All stator windings are always energized. If direction of current in one of its windings is changed, the rotor will rotate by a certain angle, which is called as a step, the angle is generally 180°. When windings change current direction in an appropriate order, a rotating magnetic field is generated; this will rotate the rotor made of permanent magnet in a certain direction. Since a rotor is a nut whose pitch is 0.08 mm, each step means half pitch that is 0.04mm, and then the screw will move for 0.04 mm called as a step length. Steps of a step motor is generally around 200, so the whole open travel of idle- speed air valve driven by step motor is 0.04mm*200=8mm. Size of idle speed air channel is calculated by step number, for example, Step 38 means open,

0.04*38=1.52mm. The number of step for step motor start is indicated in the data flow from X431 diagnostic tester for reference.

Fault diagnosis : ECU can inspect two

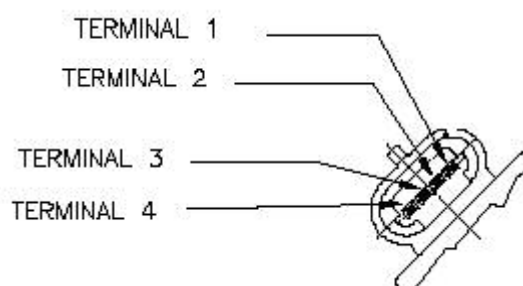


View For Step Motor Of Idle Speed Actuator



:Idle Speed Step Motor

Circuit Diagram For Step Motor Of Idle Speed Actuator



Pins:

Pin1 connects to Pin 19 of ECU
Pin2 connects to Pin 20 of ECU
Pin3 connects to Pin 35 of ECU
Pin4 connects to Pin 36 of ECU
Pins 1 and 2 are coils, Pins3 and 4 are coils.
Resistance of the two coils shall be same.
Therefore in inspection, please make sure resistance of coils fall within standard scope.

**ENGINE EFI**

windings of idle speed step motor for short circuit or open circuit, and turn on the light for fault in such cases, engine will operate in fault mode. Sometimes diagnostic tester can detect changes of step number, but engine still can't operate normally. Then inspect air intake pressure to judge whether the piston of step motor can move.

Notice: It is not allowed to remove step motor from throttle body, or to interchange with throttle body.

2-10 IGNITION COIL ZSK-ROV

(Part Number:S11-3705100)

Function: An ignition coil transforms low voltage of primary winding to high voltage of secondary winding. It sparks through spark plug charging , igniting the compressed appropriate mixed air inside cylinder.

Independent ignition: A vehicle has three such ignition coils, whose primary windings from grounding to power-off, secondary windings from inducing high voltage to igniting mixed air one cylinder after another for engine operating, are controlled by engine ECU according to signals from crankshaft position sensor and camshaft position sensor

Composition and principle: An ignition coil consists of a primary winding, a secondary winding, an iron core and housing. When voltage of battery is applied to primary winding, the primary winding is charged. Once ECU cuts off winding circuit loop, the charging will be interrupted, at the same time, a voltage will be induced at secondary winding which will be transmitted through ignition cable to spark plug and break down electrodes of spark plug, generating violent spark to ignite the compressed mixed air inside cylinder.

Fault diagnosis: ECU has no function of fault diagnosis to ignition coil, so there are no codes for fault in ECU if something is wrong with ignition coil. Only through examining primary and secondary windings or ignition coil, can the coil be determined whether it operates normally. In normal condition, an ignition coil emits heat fairly much when working. But an increase of resistance may arise from a too high temperature, subsequently, faults that engine do not work steadily or there is a self-extinguish in engine may occur.

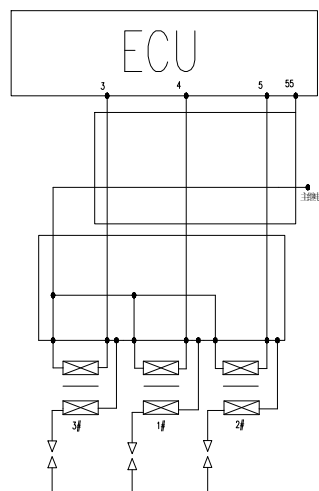
Primary winding: $0.47\Omega\text{m}$

Secondary winding: $8\Omega\text{m}$



Appearance Shape Of Ignition Coil

(372 Has 3 Such Ignition Coils In Total)



Circuit Diagram For Ignition Coil

Pins: There are two pins at lower-voltage side of ignition coil: the pin near which a “+” is marked on the housing connects to battery; the pin near which a “-” is marked on the housing connects to ECU,

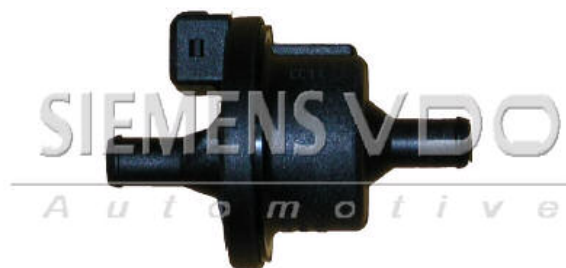
2-11 CANISTER PURGE VALVE

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

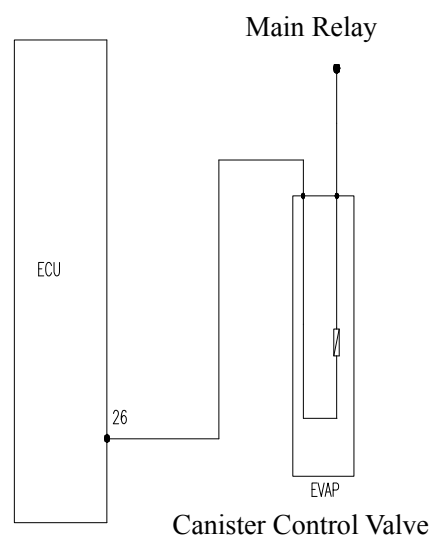
Composition and principle: Canister is made up of electromagnetic coil, armature and valve etc.. There is strainer on the intake. The flow quantity passes canister valve is correlate not only to electrical impulse duty ratio of canister control valve output by ECU, but also to the pressure difference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

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

If a solenoid valve opens at time of engine idle speed, which equals to air leak out of the resonance cave of throttle, the idle speed will be directly affected. Therefore whenever vehicles are in maintenance, check that this valve is in normal condition, resistance between whose two pins is 26Ω (20°C).



Outside View Of Canister Control Valve



Circuit Diagram For Canister Control Valve
TEV-2

Pins: A canister control valve has two pins connecting to Pin87 of the output port of the main relay and to Pin 26 of ECU.

2-12 STEEL FUEL DISTRIBUTION PIPE ASSEMBLY

Purpose: Its purpose is to store and distribute fuel and to let excessive fuel flow back to fuel tank. Injectors and fuel pressure regulators are installed on its top to make a relatively stable environment for fuel injection system, to achieve the balance of fuel-supplying, in pressure and capacity, in cylinders to drive engine operating steadily.

Composition: It consists of the 372 system fuel distribution main pipe and the fuel-supplying main pipe. Because the system employs no oil-return control, there is no fuel pressure adjuster for oil-supplying main pipe.

Assembly requirement: Oil inlet pipe and oil outlet pipe connect to rubber hose, clip tightly with hoop. The type of hoop shall match the rubber hose to ensure the seal between oil pipes and rubber hose.



Fuel Distribution Pipe Assembly

Fault diagnosis: In general, fault probability of fuel-supplying main pipe is fairly small. Most of faults result from improper installation that may result in fuel leak. Hence for installation do:

Notice: The used injection nozzles or O-type rings can't be used again.



3 SUMMARIZATION FOR FAULT OF EFI SYSTEM FAULT

(1) RECORDS OF FAULT

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

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

(2) FAULT STATE

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

(3) TYPES OF FAULT

Short circuit to positive pole of power supply

Short circuit to earth

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

(4) COMING BACK LAMELY

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

(6) FAULT ALARM

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

(7) FAULT CALL

Records of fault can be called from ECU with Chery special diagnostic tester. If faults are related to the function of regulator for fuel-air mixing ratio, the records shan’t be called until engine operates for a while.

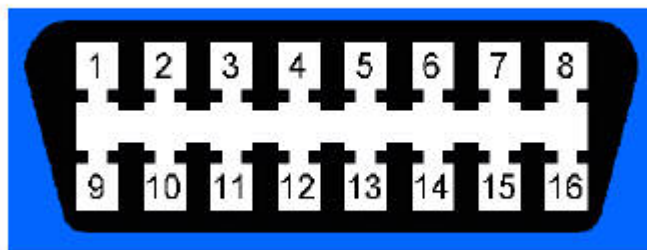


Diagram For ISO 9141-2 Standard Diagnostic Interface

This connector is fixed on co-driver side, under the glove box.

(8) CLEARING RECORDS OF FAULT

Faults removed, records of fault in memory shall be cleared in the following ways:

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

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

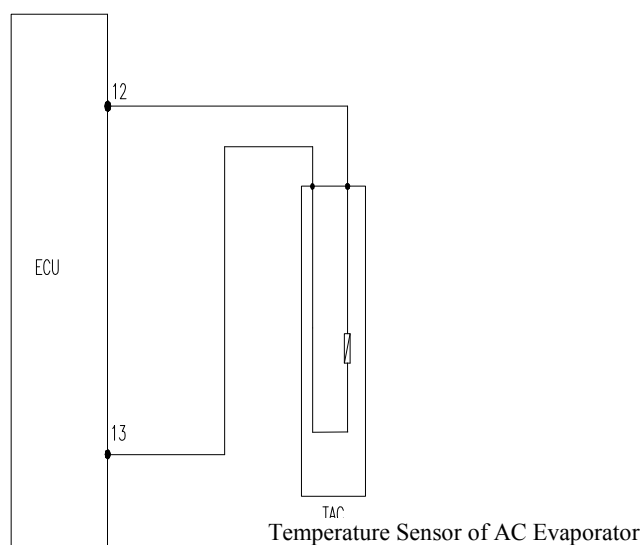
(9) FAULT-SEARCHING:

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

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

4 INSPECTION METHOD OF EFI ELEMENT CIRCUIT

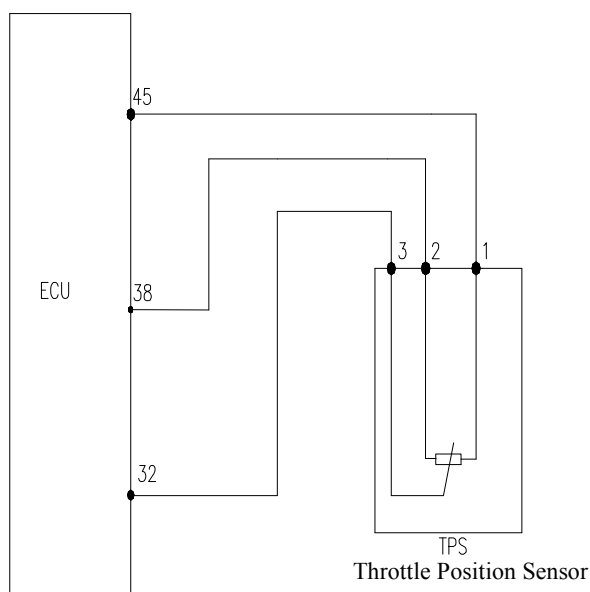
4-1 TEMPERATURE SENSOR OF AC EVAPORATOR EXIT



Temperature Sensor of AC Evaporator Circuit Diagram

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to "ON".		Next step
2	Take off the connector of wires for AC evaporator output temperature sensor, check the voltage between two pins with multimeter and look if it is around 5V.	Yes	Next step
		No	4
3	Check if the sensor is short circuit or break circuit between two pins with multimeter.	Yes	Replace sensor
		No	Replace ECU
4	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No. 12 and No.13 and the sensor connector No. (1) and No. (2) respectively with multimeter.	Yes	Repair or replace wires
		No	Replace ECU

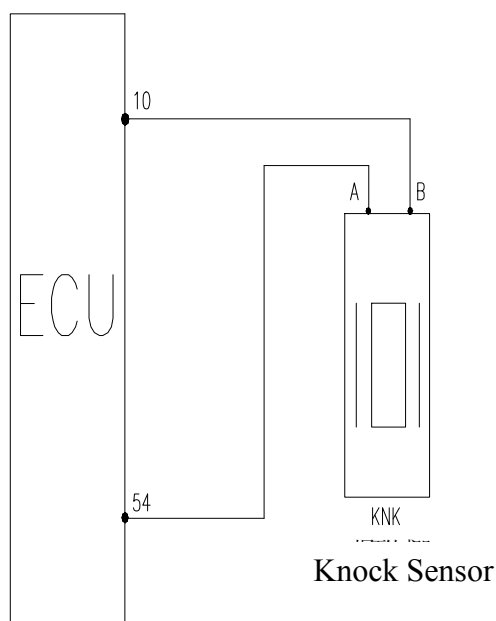
4-2 THROTTLE POSITION SENSOR



Circuit Diagram of Throttle Position Sensor

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to "ON".		Next step
2	Take off the connector of wires for throttle position sensor, check the voltage between pin No. (1) and No. (2) with multimeter and look if it is around 5V.	Yes	Next step
		No	5
3	Check the resistance value between sensor pin No. (1) and No. (2) with multimeter, and observe if it is between 1.6 and 2.4kΩ.	yes	Next step
		No	Replace sensor
4	Rotate the throttle position sensor from one side to another side slowly. At the same time, check if it is short circuit or break circuit between the pin of throttle position sensor No. (1) (-) and No. (3) (+) with multimeter. Or check if the resistance value is leaping.	yes	Replace sensor
		No	Replace ECU
5	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No. 48, No. 38 and No. 32 and the sensor connector No. (1), No. (2) and No. (3) respectively with multimeter.	yes	Repair or replace wires
		No	Replace ECU

4-3 KNOCK SENSOR

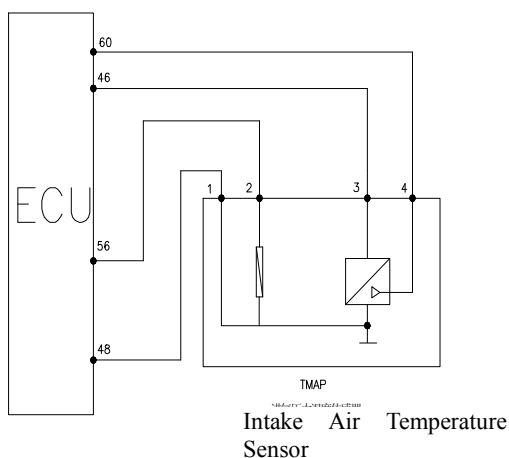


Circuit Diagram of Knock Sensor

No.	Operating steps	Result	Follow up steps
1	Close the ignition switch, and the engine stops.		Next step
2	Take off the connector of wires for knock sensor. Check the resistance value between knock sensor pin No. A and No. B with multimeter, and observe if it is above 1MΩ.	yes	Next step
		No	Replace with a new sensor
3	Knock on the edge of knock sensor with a small hammer and check with multimeter if there is communicating signal output between sensor pin No.A and No.B.	yes	Next step
		No	Replace sensor
4	Turn on the ignition switch but do not start the engine.		Next step
5	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No. 10 and No.54 and the sensor connector No. A and No. B respectively with multimeter.	yes	Repair or replace wires
		No	Replace ECU



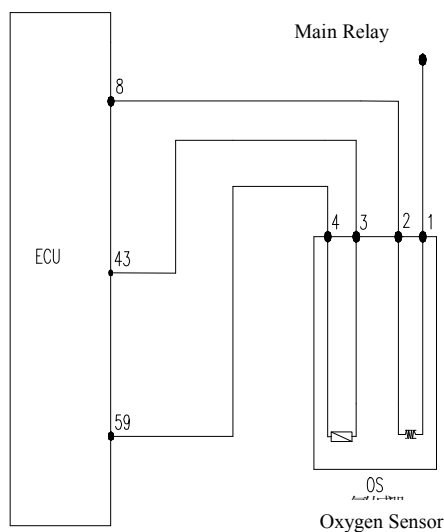
4-4 THE PRESSURE SENSOR OF AIR INTAKE PIPE ABSOLUTE PRESSURE AND INTAKE AIR TEMPERATURE SENSOR



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

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to "ON".		Next step
2	Take off the connector of wires for air intake pipe absolute pressure and intake air temperature sensor. Check the voltage between pin No. (1) and No. (3) with multimeter and look if it is around 5V.	yes	4
		No	Next step
3	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No. 48, No.46 and No. 60 and the sensor connector No. (1), No. (2) and No. (3) respectively with multimeter.	yes	Repair or replace wires
		No	Next step
4	Turn on the ignition switch but do not start the engine.		Next step
5	Use neutral and start engine at its idle running. Step on the accelerator slowly approach to open completely At the same time, check the voltage between pin No. (4) and No. (1) (between pin No. 60 and No. 48) with multimeter, by adaptor, and look if it is increased to about 4V.	yes	Replace ECU
		No	Replace ECU and sensor

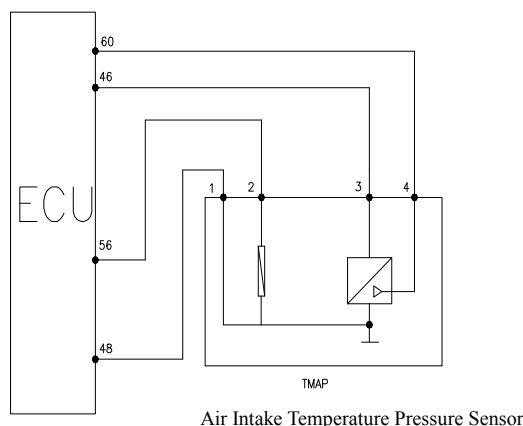
4-5 OXYGEN SENSOR



Circuit Diagram of Oxygen Sensor

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to "ON".		Next step
2	Take off the connector of wires for oxygen sensor. Check the voltage between pin No. (1) (+) and No. (2) (-) with multimeter and look if it is around 12V.	yes	Next step
		No	4
3	Check the resistance value between oxygen sensor pin No. (1) and No. (2) with multimeter, and observe if it is between 6Ω and 25Ω.	yes	Replace ECU
		No	Next step Replace sensor
4	Check the fuse inside of oxygen sensor heating circuit and observe if it is blow.	yes	Replace fuse
		No	Next step
5	Check if it is short circuit or break circuit between the pin No. (1) and main relay No. (87) and between the sensor connector No. (2) and ECU No. (8) with multimeter.	yes	Repair or replace wires
		No	Next step
6	Connect the connector of wires for oxygen sensor and use neutral. Start the engine and leave it at idle speed until its coolant temperature reaches to the normal value.		Next step
7	Take off the connector of wires for oxygen sensor. Check the battery output voltage between pin No. (4) (+) and No. (3) (-) with multimeter and look if it is from 0.1 to 0.9V.	yes	Next step
		yes	Replace sensor
8	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No. (43) and No. (59) of ECU and the sensor connector No. (3) and No. (4) respectively with multimeter.	yes	Repair or replace wires
		No	Replace ECU

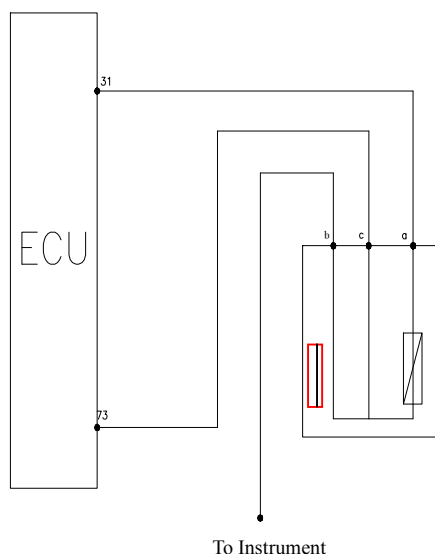
4-6 THE INTAKE AIR TEMPERATURE PRESSURE SENSOR OF AIR INTAKE PIPE ABSOLUTE PRESSURE AND INTAKE AIR TEMPERATURE SENSOR



Circuit Diagram about Air Intake Temperature Part of Air Intake Temperature Pressure Sensor

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to "ON".		Next step
2	Take off the connector of wires for air intake pipe absolute pressure and intake air temperature sensor. Check the voltage between pin No. (1) and No. (2) with multimeter and look if it is around 5V.	yes	Next step
		No	4
3	Check the resistance value between sensor pin No. (1) and No. (2) with multimeter, and observe if it is consistent with that temperature (refer to the relative part in this manual).	yes	Replace ECU
		No	Replace sensor
4	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No. 48, No.46 and No. 56 and the sensor connector No. (1), No. (3) and No. (2) respectively with multimeter.	yes	Repair or replace wires
		No	Replace ECU

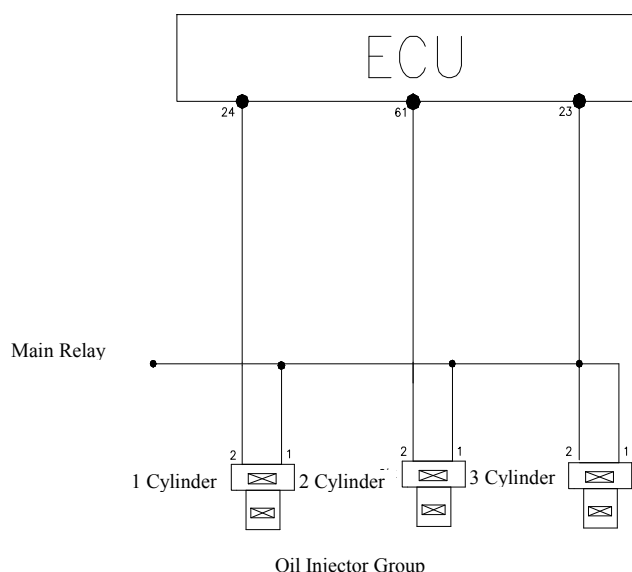
4-7 COOLANT TEMPERATURE SENSOR



Circuit Diagram of Coolant Temperature Sensor

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to "ON".		Next step
2	Take off the connector of wires for coolant temperature sensor, check the voltage between pin No. (a) (+) and No. (c) (-) with multimeter and look if it is around 5V.	yes	Next step
		No	4
3	Check the resistance value between sensor pin No. (a) and No. (c) with multimeter, and observe if it is consistent with that temperature (refer to the relative part in this manual).	yes	Replace ECU
		No	Replace sensor
4	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No. 73 and No.31 and the sensor connector No. (a) and No. (c) respectively with multimeter.	yes	Repair or replace wires
		No	Replace ECU

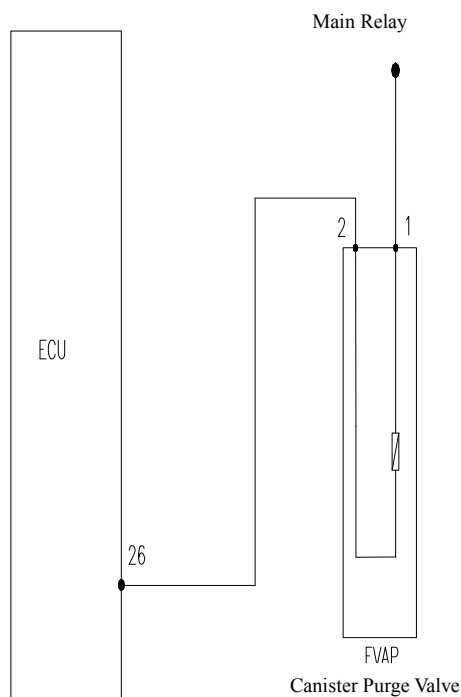
4-8 INJECTOR



Circuit Diagram of Electromagnetic Injector

No.	Operating steps	Result	Follow up steps
1	Close the ignition switch, and the engine stops.		Next step
2	Take off the connector of wires for electromagnetic injector. Connect the two pins of multimeter with the place between the pin No. (1) (+) and engine earth.		Next step
3	Put the ignition switch to "ON". Observe the voltage as soon as putting on the ignition switch look if it is about 12 V and the battery reading is 1 second.	yes	Repeat the step No. 2
		Yes for all	6
		No	Next step
4	Take off all the joint of wires for electromagnetic injector in sequence. Connect the two pins of multimeter with the place between the pin No. (1) (+) and engine earth.	yes	Repair or replace wires
		No	Next step
5	Repair or replace the oil pump relay, the main relay and their circuits.	yes	Repair or replace wires
6	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No. 24, No.61 and No.23 of ECU and the pin No. (2) of electromagnetic injector joint respectively with multimeter.	No	Next step
7	Check the resistance value between the pin No. (1) and No. (2) of electromagnetic injector using multimeter, and observe if it is 12-16Ω when it is 20°C. The resistance value should be consistent with that of its injector (14、 5Ω) .	yes	Repeat the step No. 7
		Yes for all	Next step
		No	Replace electromagnetic injector
8	Connect all the joints of electromagnetic injector again. And use neutral, start the engine and leave it running at idle speed. Take off the joints of wires for electromagnetic injector in sequence. And observe if the engine becomes more vibrant every time when a joint is taken off.	yes	Repeat the step No. 8
		No	Replace ECU

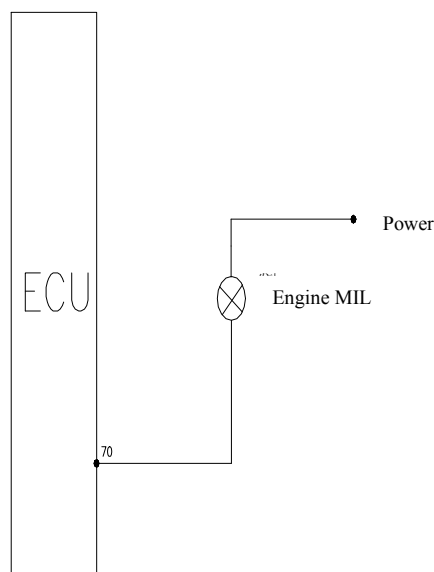
4-9 CANISTER PURGE VALVE DRIVES ELECTROMAGNETIC COIL



Circuit Diagram of Canister Purge Valve

No.	Operating steps	Result	Follow up steps
1	Start the engine and leave it at idle speed until its coolant temperature reaches to the normal value.		Next step
2	Take off the joint of wires for canister purge valve. Check the battery voltage between the two pins of joint with multimeter and look if it is around 12V.	Yes	Next step
		No	5 (Check the positive wire)
3	Connect the joint of wires for canister purge valve, make the engine revolution speed exceed 1500 rpm and touch the valve by hands in order to observe if the canister purge valve is lightly vibrant and impulsive at critical behaviors.	Yes	Next step
		No	7 (Check ground)
4	Check the resistance value between the canister purge valve pins, No. (1) and No. (2), with multimeter, and observe if it is between 22 and 30Ω.	Yes	Replace ECU
		No	Replace canister purge valve
5	Check if it is short circuit or break circuit between the pin of main relay, No. 87, and the pin of canister purge valve, No. (1) with multimeter.	Yes	Repair or replace wires
		No	Next step
6	Repair or replace the main relay and the circuit.		
7	Stop the engine and connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin of ECU, No. 26 and the pin of canister purge valve, No. (2) with multimeter.	Yes	Repair or replace wires
		No	Replace ECU

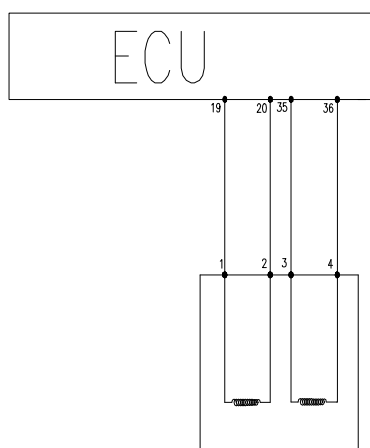
4-10 LIGHTING CIRCUIT OF MALFUNCTION INDICATOR LIGHT



Circuit Diagram of MIL

No.	Operating steps	Result	Follow up steps
1	Put the ignition switch to “ON”		Next step
2	Disassemble the instrument panel and take off the bulb of MIL. Check the battery voltage on the MIL socket with multimeter and look if it is around 12V.	Yes	Next step
		No	5 (Check the positive wire)
3	Check the bulb of instrument panel MIL with multimeter and look if it is whole.	Yes	Next step
		No	Replace bulb
4	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No. 70 of ECU and the input joint of MIL with multimeter.	Yes	Repair or replace wires
		No	Replace ECU
5	Check the fuse inside of oxygen sensor heating circuit and observe if it is blow.	Yes	Replace fuse
		No	Next step
6	Check if it is short circuit or break circuit between the pin of main relay, No. 87, and the pin of MIL socket, No. (1) with multimeter.	Yes	Repair or replace wires
		No	Next step
7	Repair or replace the main relay and the circuit.		

4-11 NO. 1 AND NO.2 COIL CIRCUIT OF STEPMOTOR



Idle Speed Actuator Stepmotor

Circuit Diagram of Idle Speed Actuator Stepmotor

No.	Operating steps	Result	Follow up steps
1	Turn on the ignition switch but do not start the engine.		Next step
2	Take off the joint of wires for idle speed actuator stepmotor. Check the resistance value between the pins of idle speed actuator stepmotor, between No.1 and No.2, and between No.3 and No.4. And then look if it is from 40 to 80.	Yes	Next step
		No	Replace idle actuator
3	Check the resistance value between the pins of idle speed actuator stepmotor with multimeter, between No.1 and No.2 and between No.3 and No. 4. And then look if it is infinite.	Yes	Next step
		No	Replace idle actuator
4	Check the battery voltage between the pins of idle speed actuator stepmotor with multimeter, between No.1 and No.2 and between No.3 and No.4, then look if it is about 12 V.	Yes	Replace idle speed actuator
		No	Next step
5	Connect the adaptor between ECU and wires. Check if it is short circuit or break circuit between the pin No.19, No.20, No.35 and No.36 and the joint of idle speed actuator stepmotor No. 1, No. 2, No. 3 and No.4 respectively with multimeter.	Yes	Repair or replace wires



5 FAULT-DIAGNOSING PROCEDURES BY ENGINE SYMPTOM

5-1 FUNDAMENTAL CHECKUPS OF ENGINE SHALL BE DONE BEFORE THE ENGINE FAULT-DIAGNOSING

- (1) Inspect engine oil for volume and dirt.
- (2) Inspect coolant for volume and dirt
- (3) Inspect battery for volume of electrolyte and specific gravity.
- (4) Inspect connecting post of battery and connection wire for connection state and corrosion state.
- (5) Inspect multi-wedges belt and timing belt for deflection, abrasion and ageing states.
- (6) Inspect spark plug for erosion, canister-depositing and electrode clearance.
- (7) Inspect ignition timing.
- (8) Inspect air-cooling-cleaning device for dirt.
- (9) If necessary, inspect cylinder pressure, etc.

5-2 FUNDAMENTAL CHECKUPS SHALL BE IMPLEMENTED BEFORE FAULT-DIAGNOSING OF THE ENGINE IS DONE

- (1) Make sure ECU and fault indicator lights (except for vehicles without fault indicator lights) are in normal condition.
- (2) Employ fault diagnostic tester or flashing light to check that there are no records of fault.
- (3) Employ fault diagnostic tester to check that hot idle data from electronic control system fall within normal scope.
- (4) Make sure the fault owner of vehicle complains about does exist and detect the exact location of symptom.

Then check the appearance:

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

5-3 BASIC RULES FOR DIAGNOSIS OF ENGINE:

From simple to complicate, from outside to inside, from plain to profound, reason gradually, analyze carefully.

5-4 BASIC PRINCIPLES FOR DIAGNOSIS OF ENGINE:

According to three basic elements of engine:

1. Appropriate mixed air
2. Adequate compressing pressure
3. Violent electric spark



6 TYPICAL MOTHEDED AND PROCESS OF FAILURE DIAGNOSIS (ONLY FOR REFERENCE)

6-1 THE ENGINE DOES NOT ROTATE OR ROTATE SLOWLY WHEN IT IS STARTED

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



6-2 THE ENGINE CAN DRAW ROTATING BUT CAN NOT START SUCCESSFULLY WHEN IT IS STARTED. (WITH DISTRIBUTOR)

No.	Operating Steps	Result	Follow up steps
1	Put the ignition switch to "ON". Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Pull off one of the cylinder separating line and connect spark plug to it; keep the spark electrode around 5-10 mm away from engine body; start the engine by starter and check if there is blue and white high pressure fire.	Yes	To step 8
		No	Next step
3	Check the resistance value of ignition cable and look if it is normal (it can not be too high, about 16 k/ m, or it means there are some problems on circuits.	Yes	Next step
		No	Repair or replace ignition cable
4	Check if the ignition coil broke or cracked.	Yes	Replace
		No	Next step
5	Check if the ignition coil is flexible or broke down.	Yes	Replace
		No	Next step
6	Check if the ignition coil is working correctly.	Yes	Next step
		No	Replace
7	Check if the ignition cable is connected correctly.	Yes	Next step
		No	Connect the connector
8	Put the ignition switch to "ON". Check if the fuel pump relay and fuel pump can work 3 minutes continuously.	Yes	Next step
		No	Check the circuit of fuel pump
9	Connect the valve of fuel pressure gauge. Connect the fuel pump relay pin No. 30 and No. 87 to run the fuel pump and check if the pressure value of fuel pump is around 380 kPa.	Yes	Next step
		No	To step 13
10	Pull off the fuel distributing pipe and the fuel injector; pull off the joints of fuel injector one by one. And supply the voltage of 12 V from battery to fuel injector directly and look if the fuel injector can inject normally.	Yes	To step 12
		No	Next step
11	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
12	Check if fuel is bad or moisture.	Yes	Replace fuel
		No	To step 17
13	Check if the fuel pressure value is below 380kPa.	Yes	Next step
		No	To step 16
14	Close the valve of fuel gauge. Connect the ignition switch again to run the oil pump 3 minutes more and check if there is the oil pressure.	Yes	Next step
		No	15
15	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe



		No	Replace oil pump
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16	Check if there is jam or bending of oil return pipe (this applies to that with oil return system).	Yes	Repair or replace oil return pipe
		No	Replace fuel Pressure regulator
17	Connect the adaptor between ECU and wires. Check if there is the voltage between the pins of ECU, No.1 and No.2, and then check if it is working correctly on the positive power cord connecting the ECU pins mentioned above and the ground wire connecting ECU pins, No.22, No.44 and No.63.	Yes	Next step
		No	Repair or replace wires
18	Check if the part of air intake system is leaking.	Yes	Repair
		No	Next step
19	Check the absolute pressure of air intake pipe and look if the temperature sensor is jammed.	Yes	Repair or replace
		No	Next step
20	Check if the coolant temperature sensor is working correctly.	Yes	Next step
		No	Repair or replace
21	Check if the reason for the failure on starting is about mechanism, such as much cylinder clearance, cylinder leaking, and so on.	Yes	Eliminate mechanical failure
		No	Replace ECU



6-3 IT IS HARD TO START THE HEATING CAR.

No.	Operating Steps	Result	Follow up steps
1	Put the ignition switch to "ON". Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Connect the valve of fuel pressure gauge. (connecting point is the oil intake pipe) Connect the fuel pump relay pin No. 30 and No. 87 to run the fuel pump and check if the pressure value of fuel pump is around 380 kPa.	Yes	Next step
		No	9
3	Disconnect the connecting oil pipe and turn off the ignition switch. Observe the voltage of fuel system and look if it is between 200 and 260 kPa after an hour.	Yes	Next step
		No	Repair the fuel system to stop leaking
4	Connect the connecting oil pipe, baffle the flow in oil return pipe with oil return baffle and close the valve of fuel pressure gauge at the same time. turn off the ignition switch. Observe the voltage of fuel system and look if it is around 380 kPa after an hour. (this applies to that with oil return system)	Yes	Replace fuel Pressure regulator (inside)
		No	Next step
5	Check if there is fuel leaking of fuel injector and oil pipe.	Yes	Replace fuel injector and oil pipe
		No	Next step
6	Take off the coolant temperature sensor joint and start the engine, observe if the engine can be started successfully.	Yes	Check coolant temperature sensor and wires
		No	Next step
7	Connect the adaptor between ECU and wires. Check if there is the voltage between the pins of ECU, No.1 and No.2, and then check if it is working correctly on the positive power cord connecting the ECU pins mentioned above and the ground wire connecting ECU pins, No.22, No.44 and No.63.	Yes	Next step
		No	Repair or replace wires
8	Replace fuel and warm up the engine; observe if the engine can be started successfully.	Yes	End
		No	Replace ECU
9	Check if there is jam or bending of fuel pipe and if the pressure regulator valve of oil pump is working correctly.	Yes	Next step
		No	Repair or replace
10	Check if there is battery voltage between the plugs of oil pump with multimeter.	Yes	Next step
		No	Repair or replace fuel pump relay and wires
11	Check if the fuel pump resistance value is correct.	Yes	Next step
		No	Replace fuel pump
12	Check if the fuel pump is stopped up.	Yes	Replace fuel pump
		No	Replace ECU





6-4 NORMAL ENGINE REVOLUTION SPEED BUT HARD TO START AT ANY TIME.

No.	Operating Steps	Result	Follow up steps
1	Put the ignition switch to "ON". Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Check the air cleaner and look if it is open.	Yes	Next step
		No	Replace
3	After starting the engine, check the air intake pressure at idle speed and look if it is between 35 and 65 kpa.	Yes	Next step
		No	Eliminate the failure of air intake system leaking
4	Step on the throttle slightly and observe if it is easy to be started easily.	Yes	Replace and check throttle and idle speed air port
5	Connect the valve of fuel pressure gauge. Connect the fuel pump relay pin No. 30 and No. 87 to run the fuel pump and check if the pressure value of fuel pump is around 380 kPa.	Yes	Next step
		No	9
6	Supply with the voltage of 12 V from battery to fuel injector directly through the special joint and check if the fuel injector is working correctly.	Yes	8
		No	Next step
7	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
8	Replace fuel, and check if the fuel is bad or moisture.	Yes	replace fuel
		No	14
9	Check if the fuel pressure value is below 380kPa.	Yes	Next step
		No	13
10	Close the valve of fuel gauge. Connect the ignition switch again to run the oil pump 3 minutes more and check if there is the oil pressure.	Yes	Next step
		No	12



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11	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately (this item applies to that with oil return system).	Yes	Replace fuel pressure regulator
		No	Repair and replace fuel injector and oil pipe
12	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
13	Check if the pressure regulator is damaged or jammed.	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator
14	Pull off the joint of wires for idle speed actuator before the temperature of engine coolant becomes 35 °C; Observe if the engine revolution speed is decreased.	Yes	Next step
		No	Replace or repair idle speed actuator
15	Put the ignition switch to “ON”. Check if the voltages of following pins are normal: the battery voltage of pin No.27 is around 12V, and No.14 and No.19 are 0 V.	Yes	Next step
		No	Check wires and plugs
16	Run the engine at idle speed, short circuit the ECU pin No. 51 to ground after the temperature of coolant becomes normal, and check if the ignition advance angle is 6.75° of crankshaft angle.	Yes	Next step
		No	Adjust ignition advance angle
17	Check if the compression pressure of cylinder is normal.	Yes	Next step
		No	Troubleshooting
18	Check the absolute pressure of air intake pipe and look if the temperature sensor is jammed.	Yes	Repair or replace
		No	Next step
19	Check if the coolant temperature sensor is working correctly.	Yes	Replace ECU
		No	Repair or replace



6-5 IT IS HARD TO START THE COLD CAR.

No.	Operating Steps	Result	Follow up steps
1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Check if the coolant temperature sensor is working correctly with multimeter. (Or serial connect a 1.5kΩ resistance between ECU pin No.45 and No.30 instead of the coolant temperature sensor to start the engine) If the engine can start, it means that the coolant temperature sensor is abnormal.	Yes	Next step
		No	Replace sensor
3	Connect the ignition switch and the adaptor between ECU and wires; Check if the voltages of following pins are normal: the battery voltage of pin No.27 is around 12V, and No.14 and No.19 are 0 V.	Yes	Next step
		No	Check wires and plugs
4	Check the air cleaner and look if it is open.	Yes	Next step
		No	Replace
5	After starting the engine, check the air intake pressure at idle speed and look if it is between -35 and -65 kpa.	Yes	Next step
		No	Eliminate the failure of air intake system leaking
6	Step on the throttle slightly and observe if it is easy to be started easily.	Yes	Check throttle and idle speed air port
		No	Next step
7	Pull off the joint of wires for idle speed actuator before the temperature of engine coolant becomes 35 °C; Observe if the engine revolution speed is decreased.	Yes	Next step
		No	Replace or repair idle speed actuator
8	Connect the valve of fuel pressure gauge. (connecting point is the oil intake pipe)Connect the pin No.86 of fuel pump relay to ground directly. Connect the ignition switch to run the fuel pump and its relay; check if the pressure value of fuel pump is around 380kPa.	Yes	Next step
		No	12
9	Supply with the voltage of 12 V from battery to fuel injector directly through the special joint and check if the fuel injector is working correctly.	Yes	11
		No	Next step
10	Clean out the fuel injector and look if it can	Yes	Next step



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	work correctly.	No	Replace fuel injector
11	Check if fuel is bad or moisture.	Yes	replace fuel
		No	17
12	Check if the fuel pressure value is below 380kPa.	Yes	Next step
		No	16
13	Close the valve of fuel gauge. Connect the ignition switch again to run the oil pump 3 minutes more and check if there is the oil pressure.	Yes	Next step
		No	15
14	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.(this applies to that with oil return system)	Yes	Replace fuel pressure regulator
			Or fuel pump
		No	Repair and replace fuel injector and oil pipe
15	Check if the oil intake pipe is leaky or jammed.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
16	Check if there is jam or bending of oil return pipe (this applies to that with oil return system).	Yes	Repair or replace fuel pump
		No	Replace fuel pump Pressure regulator
17	Check if the pressure of cylinder is normal.	Yes	Next step
		No	Troubleshooting
18	Check if the engine air intake system is leaky.	Yes	Repair
		No	Next step
19	Check the absolute pressure of air intake pipe and look if the temperature sensor is jammed.	Yes	Repair or replace
		No	Replace ECU



6-6 THE IDLE SPEED IS NOT STEADY AT ANY TIME.

1	Put the ignition switch to "ON". Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Check if the idle speed actuator or that of stepmotor is jammed.	Yes	Replace or repair idle speed actuator
		No	Next step
3	Turn on the ignition switch and connect the adaptor between ECU and wires; Check the ECU pins, No.31 and No.56 (the output signal terminals of air intake temperature sensor and coolant temperature sensor), as well as No.19, No.20, No.35 and No.36 (the output signal terminals of stepmotor) and look if the voltage of pin No.19 and No.35 is normal.	Yes	Check wires and plugs
		No	Next step
4	Run the engine at idle speed and cut off oil of cylinder (cut off fire) and observe if the engine revolution speed is decreased and fluctuated.	Yes	8
		No	Next step
5	Check the fuel injectors of each cylinder and look if they are in right conditions.	Yes	Next step
		No	Check fuel injector and wires
6	Check if the resistance values of cylinders' ignition cable are normal.	Yes	Next step
		No	Replace
7	Check if the ignition coil is damaged or cracked.	Yes	Replace
		No	Next step
8	Check if the spark plug is in right conditions.	Yes	Next step
		No	Replace spark plug
9	Connect the valve of fuel pressure gauge. Connect the fuel pump relay pin No. 30 and No. 87 to run the fuel pump and check if the pressure value of fuel pump is around 380 kPa.	Yes	Next step
		No	13
10	Supply with the voltage of 12 V from battery to fuel injector directly through the special joint and check if the fuel injector is working correctly.	Yes	12
		No	Next step
11	Clean out the fuel injector and look if it can work smoothly.	Yes	Next step



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	work correctly.	No	Replace fuel injector
12	Check if fuel is bad or moisture.	Yes	replace fuel
		No	18
13	Check if the fuel pressure value is below 380kPa.	Yes	Next step
		No	17
14	Close the valve of fuel gauge. Connect the ignition switch again to run the oil pump 3 minutes more and check if there is the oil pressure.	Yes	Next step
		No	16
15	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.(this applies to that with oil return system)	Yes	Replace fuel pressure regulator
		No	Repair and replace fuel injector and oil pipe
16	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil return pipe
		No	Replace oil pump
17	Check if there is jam or bending of oil return pipe (this applies to that with oil return system).	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator
18	Check the pressure of air intake pipe and if the sense port of air intake temperature sensor is jammed.	Yes	Clean
		No	Next step
19	Run the engine at idle speed. After the coolant reaches the temperature of actuating closed loop control, you may observe if the oxygen sensor can work correctly.	Yes	Next step
		No	Check oxygen sensor and wires
20	Check if the engine air intake system is leaky.	Yes	Eliminate leaking
		No	Next step
21	Check if the pressure of cylinder is normal.	Yes	Next step
		No	Troubleshooting



6-7 THE IDLE SPEED IS NOT STEADY DURING ENGINE HEATING.

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Check the air cleaner and look if it is open.	Yes	Next step
		No	Replace
3	Run the engine at idle speed and check if the air intake pressure during engine heating is between 35 and 65 kPa.	Yes	Next step
		No	Eliminate the failure of air intake system leaking
4	Turn off the engine and connect the ignition switch. Connect the adaptor between ECU and wires and check the ECU pins, No.31 and No.56 (the output signal terminals of air intake temperature sensor and coolant temperature sensor) .	Yes	Next step
		No	Check and repair
5	Pull off the joint of wires for idle speed actuator before finishing engine heating. Observe if the engine revolution speed is changing.	Yes	Next step
		No	Replace idle speed actuator
6	Check if the coolant temperature sensor is working correctly.	Yes	Next step
		No	Replace



6-8 IDLE SPEED IS NOT STEADY AFTER THE ENGINE HEATING.

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Put the ignition switch to “ON”. Connect the adaptor between ECU and wires and check the ECU pins, No.60 (output of air intake absolute pressure sensor), No.56 (output of air intake temperature sensor), No.31 (output of coolant temperature sensor) and No.43 (output of oxygen sensor), as well as the voltages of ECU pins, No. 19, No.20, No.35 and No.36 (output to idle speed actuator).	Yes	Next step
		No	Repair or replace wires
3	Turn off the engine. Check the air cleaner and look if it is open.	Yes	Next step
		No	Replace
4	Check the air intake pressure at idle speed and look if it is between 35 and 65 kPa.	Yes	Next step
		No	Eliminate the failure of air intake system leaking
5	Connect the valve of fuel pressure gauge. Connect the fuel pump relay pin No. 30 and No. 87 to run the fuel pump and check if the pressure value of fuel pump is around 380 kPa.	Yes	Next step
		No	9
6	Supply with the voltage of 12 V from battery to fuel injector directly through the special joint and check if the fuel injector is working correctly.	Yes	8
		No	Next step
7	Clean out the fuel injector and look if it can work correctly.	Yes	Replace
		No	Replace fuel injector
8	Check if fuel is bad or moisture.	Yes	replace fuel
		No	14
9	Check if the fuel pressure value is below 380kPa.	Yes	Next step
		No	13
10	Close the valve of fuel gauge. Connect the ignition switch again to run the oil pump 3 minutes more and check if there is the oil pressure.	Yes	Next step
		No	12
11	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.(this applies to that with oil	Yes	Replace fuel pressure regulator



	return system)	No	Repair and replace fuel injector and oil pipe
12	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
13	Check if the oil return pipe is bended or jammed. (this applies to that with oil return system)	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator
15	Pull off the coolant temperature sensor and observe if the engine is in right conditions.	Yes	Replace coolant temperature sensor
		No	Next step
16	Check if the compression pressure of cylinder is normal.	Yes	Next step
		No	Troubleshooting
17	Check if the resistance values of cylinders' ignition cable are normal.	Yes	Next step
		No	Replace
18	Check if the ignition coil is damaged or cracked.	Yes	Replace
		No	Next step
19	Check if the spark plug is in right conditions.	Yes	Replace ECU
		No	Replace spark plug



6-9 IDLE SPEED IS NOT STEADY OR DYING OUT WHEN THERE IS PARTIAL LOADING.

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Connect the air condition switch and the adaptor between ECU and wires. Check if there are input signals on the ECU pins, No.50 and No.58 (Air Condition Switch).	Yes	Next step
		No	Check and repair air conditioning circuits
3	Check if the pressure of air conditioning system, the electromagnetic clutch of compressor and the air conditioning pump are in right conditions.	Yes	Next step
		No	Repair or replace
4	Put the ignition switch to “ON”. Check the voltages of ECU pins, No.19, No.20, No.35 and No.36 (output to the idle speed actuator), and look if they are normal.	Yes	Next step
		No	Check controlling circuit
5	Disassemble the stepmotor and check if the stepmotor is jammed or bad working.	Yes	Repair or replace stepmotor
		No	Next step
6	Start the engine and switch on the air condition. Check if the idle speed actuator is working correctly by the steps of stepmotor on failure diagnostic tester. (The normal amount of steps will be supplied later)	Yes	Replace ECU
		No	Replace idle speed actuator



6-10 IT IS PERIODICALLY UNSTEADY (NEED TO RESTUDY BY SELF AFTER ECU TURNING OFF)

1	Put the ignition switch to “ON”. Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Check the air cleaner and look if it is open.	Yes	Next step
		No	Replace
3	Run the engine at idle speed and check if the air intake pressure is from -35 to -65kPa.	Yes	Next step
		No	Check and repair air intake and leak
4	Run the engine at idle speed, make the cylinder cut off oil and observe if the engine revolution speed is decreased and fluctuated.	Yes	7
		No	Next step
5	Put the ignition switch to “ON”. Connect the adaptor between ECU and wires and check the ECU pins, No.48 (output of air intake absolute pressure sensor), No.60 (output of air intake temperature sensor), No.45 (output of coolant temperature sensor), No. 28 (output of oxygen sensor), No.1, No.2 (electron ground) and No.22 (ignition switch), as well as the voltages of ECU pins, No. 19, No.20, No.35 and No.36 (output to idle speed actuator).	Yes	Next step
		No	Repair or replace wires
6	Run the engine at idle speed and check if the ignition advance angle is normal after the coolant temperature reaches to the normal value.	Yes	Next step
		No	Adjust ignition advance angle
7	Check the pressure of air intake pipe and if the sense port of air intake temperature sensor is jammed.	Yes	Clean
		No	Next step
8	Check if fuel is bad or moisture.	Yes	replace fuel
		No	Next step
9	Supply with the voltage of 12 V from battery to fuel injector directly through the special joint and check if the fuel injector is working correctly.	Yes	Next step
		No	Check and repair oil injector and related wires
10	Check if the resistance values of cylinders' ignition cable are normal.	Yes	Next step
		No	Replace
11	Check if the ignition coil is damaged or cracked.	Yes	Replace



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	cracked.	No	Next step
12	Check if the spark plug is in right conditions.	Yes	Replace ECU
		No	Replace spark plug

6-11 DLE SPEED IS TOO HIGH (NEED TO RESTUDY BY SELF AFTER ECU TURNING OFF).

1	Put the ignition switch to "ON". Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Check accelerator cable if it is blocked or over tightening	Yes	Adjust or repair
		No	Next step
3	Check if the canister purge valve, the fuel pressure regulator, the positive crankcase ventilation vacuum pipe and the vacuum pipe of brake system are mounted steadily or they are damaged.	Yes	Repair or replace
		No	Next step
4	Run the engine at idle speed and use neutral. Step on the accelerator and observe if the idle speed is too high.	Yes	Next step
		No	6
5	Clamp the vacuum pipe and observe if the idle speed becomes normal.	Yes	Repair or replace vacuum pipe
		No	Next step
6	Replace PVC valve and clamp the positive crankcase ventilation vacuum pipe. Observe if the idle speed becomes normal.	Yes	Replace PVC valve
		No	Next step
7	Clamp the canister purge valve pipe and observe if the idle speed becomes normal.	Yes	Replace canister purge valve
		No	Next step
8	Check if the idle speed actuator is jammed or on bad working.	Yes	Repair or replace
		No	Next step
9	Repair or replace, check if there is leaking at other place of air intake pipe.	Yes	Repair or replace
		No	Next step
10	Check if the gasket of fuel injector is in good condition.	Yes	Next step
		No	Replace gasket
11	Check the absolute pressure of air intake pipe and look if the air intake temperature sensor is in good condition.	Yes	Replace ECU
		No	Replace sensor



6-12 ENGINE REVOLUTION SPEED IS TOO LOW OR FLAMEOUT

1	Put the ignition switch to "ON". Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Check the air cleaner and look if it is open.	Yes	Next step
		No	Replace
3	Run the engine at idle speed and check if the engine revolution speed is normal at idle speed.	Yes	Next step
		No	Next step refers to t check and repair of idle speed failure item
4	Run the engine at idle speed and check if the air intake pressure is from -35 to -65kPa.	Yes	Next step
		No	Check and repair
5	Run the engine at idle speed and check if the ignition advance angle is normal after the coolant temperature reaches to the normal value.	Yes	Next step
		No	Adjust ignition advance angle
6	Connect the valve of fuel pressure gauge. Connect the fuel pump relay pin No. 30 and No. 87 to run the fuel pump and check if the pressure value of fuel pump is around 380 kPa.	Yes	Next step
		No	10
7	Supply with the voltage of 12 V from battery to fuel injector directly through the special joint and check if the fuel injector is working correctly.	Yes	9
		No	Next step
8	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
9	Check if fuel is bad or moisture.	Yes	Replace fuel
		No	15
10	Check if the fuel pressure value is below 250kPa.	Yes	Next step
		No	14
11	Close the valve of fuel gauge. Connect the ignition switch again to run the oil pump 3 minutes more and check if there is the oil pressure.	Yes	Next step
		No	13
12	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.(this applies to that with oil return system)	Yes	Replace fuel pressure regulator
		No	Repair and replace fuel injector and oil pipe
13	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
14	Check if there is jam or bending of oil return pipe (this applies to that with oil return system).	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator
15	Put the ignition switch to "ON". Connect the adaptor between ECU and wires. Check the voltages of ECU pins, No.32 (output signal terminal of throttle position sensor), No.38 (ground) and No.45 (power supply for 4.5 to 5V sensors), and look if they are normal.	Yes	Next step
		No	Repair or replace wires
16	Check if ignition coil, distributor, ignition cable and spark plug are in good condition.	Yes	Replace ECU
		No	Repair or replace the related parts



6-13 REACT SLOWLY WHEN IT IS ACCELERATED.

1	Put the ignition switch to "ON". Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
2	Turn off the engine. Check the air cleaner and look if it is open.	Yes	Next step
		No	Replace
3	Run the engine at idle speed and check if the engine revolution speed is normal at idle speed.	Yes	Next step
		No	Repair in accordance with idle speed failure item
4	Run the engine at idle speed and check if the air intake pressure is from 35 to 65 kPa.	Yes	Next step
		No	Check and repair
5	Switch on the ignition switch and connect the adaptor between ECU and wires. Check the voltages of ECU pins, No.32 (output signal terminal of throttle position sensor), No.38 (ground) and No.45 (power supply for 4.5 to 5V sensors), and look if they are normal.	Yes	Next step
		No	Repair or replace wires
6	Run the engine at idle speed and check if the ignition advance angle is normal after the coolant temperature reaches to the normal value.	Yes	Next step
		No	Adjust ignition advance angle
7	Connect the valve of fuel pressure gauge. Connect the fuel pump relay pin No. 30 and No. 87 to run the fuel pump and check if the pressure value of fuel pump is from 250 to 300kPa.	Yes	Next step
		No	11
8	Supply with the voltage of 12 V from battery to fuel injector directly through the special joint and check if the fuel injector is working correctly.	Yes	10
		No	Next step
9	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
10	Check if fuel is bad or moisture.	Yes	replace fuel
		No	16
11	Check if the fuel pressure value is below 380kPa.	Yes	Next step
		No	15
12	Close the valve of fuel gauge. Connect the ignition switch again to run the oil pump 3 minutes more and check if there is the oil pressure.	Yes	Next step
		No	14
13	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.(this applies to that with oil return system)	Yes	Replace fuel pressure regulator
		No	Repair and replace fuel injector and oil pipe
14	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
15	Check if the oil return pipe is bended or jammed. (this applies to that with oil return system)	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator
16	Check if the exhaust system and three-way catalytic converter are jammed.	Yes	Replace or clean
		No	Replace ECU



6-14 THE PERFORMANCE IS POOR WHEN IT IS ACCELERATED.

1	Check if failure occurs, such as clutch slipping, low tire pressure, brake delay, wrong tire size and incorrect four-wheel alignment.	Yes	Repair
		No	Next step
2	Check if the throttle can be open fully.	Yes	Next step
		No	Repair or replace throttle
3	Put the ignition switch to "ON". Check if there are some records about failures with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
4	Run the engine at idle speed and check if the ignition advance angle is normal after the coolant temperature reaches to the normal value.	Yes	Next step
		No	Adjust ignition advance angle
5	Put the ignition switch to "ON". Connect the adaptor between ECU and wires and check the ECU pins, No.48 (output of air intake absolute pressure sensor), No.60 (output of air intake temperature sensor), No.45 (output of coolant temperature sensor), No.28 (output of oxygen sensor), No.1, No.2 (electron ground) and No.22 (ignition switch), as well as the voltages of ECU pins, No. 19, No.20, No.35 and No.36 (output to idle speed actuator).	Yes	Next step
		No	Repair or replace wires
6	Run the engine at idle speed and check if the air intake pressure is from 35 to 65kPa.	Yes	Next step
		No	Check and repair
7	Connect the valve of fuel pressure gauge. Connect the fuel pump relay pin No. 30 and No. 87 to run the fuel pump and check if the pressure value of fuel pump is around 300 kPa.	Yes	Next step
		No	11
8	Supply with the voltage of 12 V from battery to fuel injector directly through the special joint and check if the fuel injector is working correctly.	Yes	10
		No	Next step
9	Clean out the fuel injector and look if it can work correctly.	Yes	Next step
		No	Replace fuel injector
10	Check if fuel is bad or moisture.	Yes	replace fuel
		No	16
11	Check if the fuel pressure value is below 380 kPa.	Yes	Next step
		No	15
12	Close the valve of fuel gauge. Connect the ignition switch	Yes	Next step



	again to run the oil pump 3 minutes more and check if there is the oil pressure.	No	14
13	Open the valve of fuel gauge and clamp the oil return pipe by oil return baffle so that the oil can not return. Check if the oil pressure occurs immediately.	Yes	Replace fuel pressure regulator
		No	Repair and replace fuel injector and oil pipe
14	Check if there is leaking or jam in oil intake pipe.	Yes	Repair or replace oil intake pipe
		No	Replace oil pump
15	Check if the oil return pipe is bended or jammed.	Yes	Repair or replace oil return pipe
		No	Replace fuel pressure regulator
16	Check the absolute pressure of air intake pipe and look if the date of air intake temperature sensor is normal.	Yes	Next step
		No	Replace sensor
17	Check if ignition coil, distributor, ignition cable and spark plug are in good condition.	Yes	Next step
		No	Adjust or repair
18	Check if it results from air conditioning system.	Yes	Check air conditioning system
		No	Replace ECU



6-15 AIR CONDITIONER SYSTEM FAILURE

1	Check if there is enough coolant, if the air condition belt, the air condition clutch and the pressure switch are in good condition.- {} -	Yes	Next step
		No	Troubleshooting
2	Run the engine at idle speed and connect the air condition switch. Check if there is the failure of air condition thermo-sensitive Resistance with failure diagnostic tester.	Yes	Eliminate display failure
		No	Next step
3	Connect the air condition switch and the adaptor between ECU and wires. Check if there are input signals on the ECU pins, No.50 and No.58 (Air Condition Switch).	Yes	Next step
		No	Check wires
4	If this vehicle adopts low level control, check if the air condition is working still even though it is turned off.	ËÇ	Replace lamp or repair wires
		No	Next step
5	Check if there is low level output at ECU pin No.68 (connect to the ground of air condition drive coil).	Yes	Repair air condition relay and wires
		No	Replace ECU



7 PRECAUTIONS FOR EFI SYSTEM MAINTENANCE

7-1 PRECAUTIONS FOR EFI SYSTEM DIAGNOSIS AND MAINTENANCE

(1) Requirements for controller-removing

Controllers shall be removed before welding or paint-baking;

Set ignition switch to OFF when controller is being removed for fear of damage;

Power supply wires shall not be removed from battery when engine is in operation or electric system is in use;

It is not allowed to start engine in large current of battery charger;

Notice: Do not let the ambient temperature of controllers beyond 80 °C.

(3) Requirements for cleanness : the following rules should be observed for any operation on oil-supply system and oil-injection system:

Parts removed shall be placed in clean place and well covered. It is not allowed to use cloth liable to fiber-dropping;

(2) All kinds of wiring harnesses and wire harness of fault diagnostic tester are not allowed to be plugged in or pulled out when ignition switch is ON;

When grounding measuring is done to electronic control system, make sure that wires are in right connection;

Disassembly of power-supply wires from battery or pulling out connectors of wires of controllers may cause loss of stored data of diagnosis and self-tuning.

(2) Precautions for maintenance of oil-supply system

Disassembly or installation of oil pump inside the tank full of oil or partly full of oil, notice:

Any device for hold leaking gasoline shall be installed near the opening of oil tank in advance;

Thoroughly clean the connecting part and area around it before loosening the connecting part;

Dishcloth shall be placed around the connecting part for fear of oil-spraying;

Removed parts which are not maintained immediately should be carefully covered or closed;

Fittings are not taken out from package until installation, it is not allowed to use fittings without package;

You should be careful not to damage the O-type ring when installing the injector. A small quantity of lubricant should be spread for easy installation;

After system is opened, try not to use compressed air or move vehicle.

7-2 SAFETY MEASUREMENT

For fear of any injury to personnel or damage to the fuel injection and ignition devices, note:

(1) Ignition wires are not allowed to be pulled out or contacted when engine is in normal operating or startup;

If engine doesn't start but is dragged by starter motor, for example when pressure of compression is inspected, its wire plug should be pulled out from Hall sensor (distributor).

8 CHECK OF SERVICE TOOLS

Tool name:

Ignition Timing Lamp

Function:

Inspect engine ignition timing etc.

**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 operating mode of fuel pump and fuel pressure regulator.



Tool name:

EFI diagnostic tester

Function:

Read/ clean EFI DTC

Observe data flow and test the part operation



Tool name:

Fuel injector cleaner and analyzer

Function:

Clean and analyze fuel injector.



Tool name:

Vacuum gauge

Function:

Check the pressure condition of air intake pipe



Tool name:

Pressure gauge for cylinder

Function:

Check the pressure condition of cylinders





ENGINE EFI

SYSTEM FUNCTIONAL DIAGRAM

