

FUEL AND EMISSION CONTROL SYSTEMS

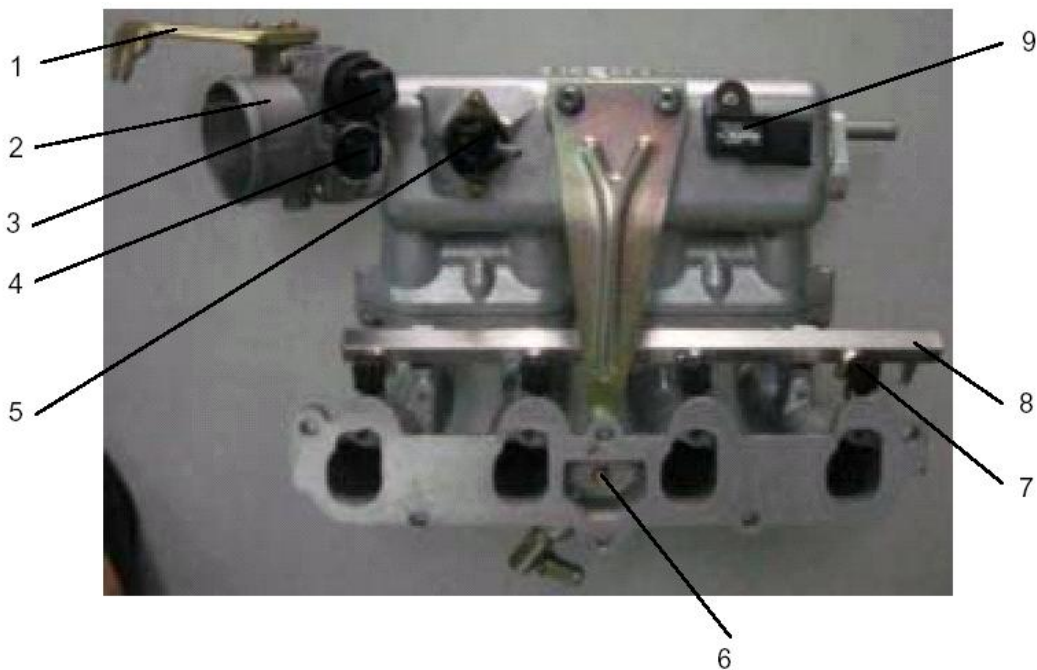
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INTAKE-AIR SYSTEM

INTEGRAL INTAKE MANIFOLDS

Warning:

- When the engine and intake-air system are hot, they can badly burn. Turn off the engine and wait until they are cool before removing the intake-air system.
- Fuel vapor is hazardous. It can easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.
- Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the “Fuel line safety Procedure”

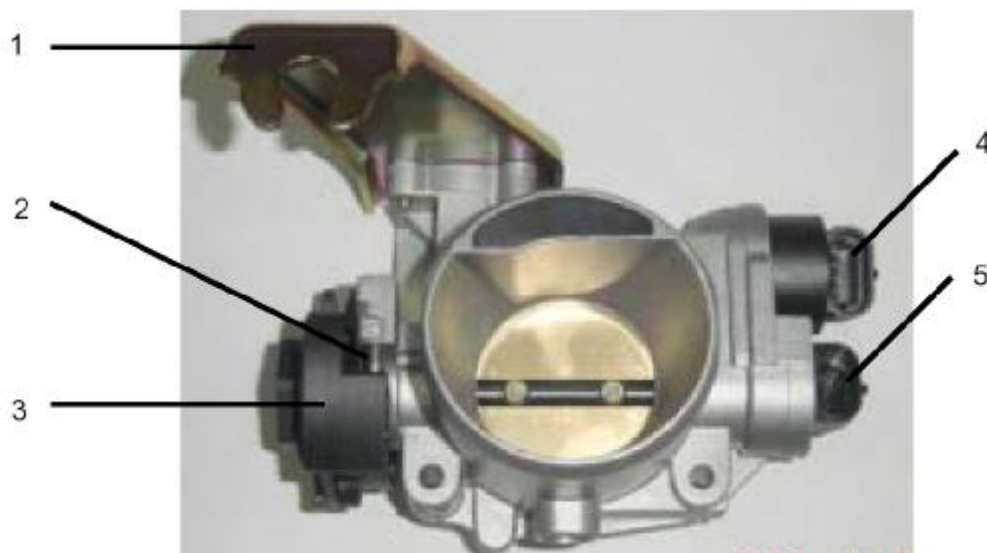


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|-----------------------------|----------------------------|------------------------------------|
| 1. Throttle Cable Supporter | 2. Throttle Body | 3. Idling Speed Step Motor |
| 4. Throttle Position Sensor | 5. Canister Solenoid Valve | 6. Coolant Temperature Sensor |
| 7. Fuel Injector | 8. Oil Rail | 9. Air Pressure/Temperature Sensor |

THROTTLE BODY

According to driver's stepping force on accelerating pedal, throttle body fixed on intake manifolds with three bolts, measures air intake volume flowed into the engine. Step motor adjusts the auxiliary air intake volume when pedal completely released (engine at idle). In this case, throttle valve opening control handle (3) relies on the anti-deadlock screw (2) to keep throttle valve from closing.

To avoid the mixture condensing and freezing in certain condition, throttle valve adjuster is supported by anti-deadlock screw to prevent it from completely closing, and heated by circulating coolant. Idling speed step motor (4) and throttle position sensor (5) are installed on throttle body.



1.Throttle Cable Supporter

2.Anti-deadlock Screw

3.Throttle Valve Opening Angle Control

4.Idling Speed Step Motor

5.Throttle Position Sensor

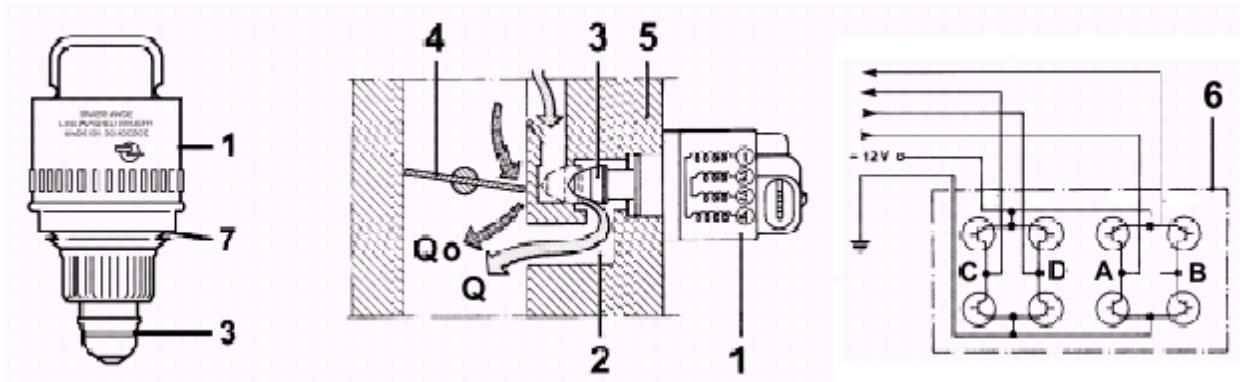
Remark: Do not loosen the screw because the anti-deadlock screw is locked by manufacturer during calibration of throttle valve.

IDLE SPEED STEP MOTOR

This kind of idling speed step motor ($\pm 25r/m$) with high accuracy and good locating ability is used to control idle speed. Directly fixed on throttle body and composed of a step motor and a screw/worm retarder, it enables the lock pin (3) to convert the rotation motion into linear motion. When receiving control instruction from ECU, the step motor drive valve core moving (about 0.04mm/step) on axis direction through screw/worm device to change the bypass air intake volume of engine at idle, therefore the idle speed can be insured steady. The change is regulated based on the engine coolant temperature.

Air intake efficiency of the engine at idle speed is demarcated based on opening of the throttle valve when by-pass air intake is closed through adjusting in manufacturing.

Step motor is connected directly on throttle body by a fast clamp without fixing screw.



1. Idling Speed Step Motor 2. By-pass Hose 3. Lock Pin 4. Throttle Valve
 5. Throttle Body 6. ECU Electrical Control Unit 7. Steel Lock Ring

Qo. Air Leakage Volume Of Throttle

Q. By-pass Air Volume Of Step Motor

Specification:

The coil resistance is $R=53 \pm 10\Omega$ at 20°C . A max air intake volume will be got when the lock pin turns back 200 steps (approx 8mm stroke, correspond to about 60kg/h air intake volume).

Working steps are determined according to the engine running condition, including heater opening and electrical load air condition opening etc.

Batter terminal shall be disconnected for at least 5 minutes before inserting idling speed step motor into the throttle body. Accordingly, when the key opened, ECU will reset a new step motor and define steps according to the coolant temperature to adjust the valve core's axial moving (forward or backward) with a correct idle speed.

Electronic components can be diagnosed by engine ECU. Through regulating the throttle valve position, with engine speed and intake pressure signals, the engine ECU can detect whether the step motor (tested by a diagnosis tester) loses step or not.

Recovery:

If a failure happens, step motor will become invalid, correspondingly the adaptive function of air fuel ratio at idle is ceased.

THROTTLE POSITION SENSOR

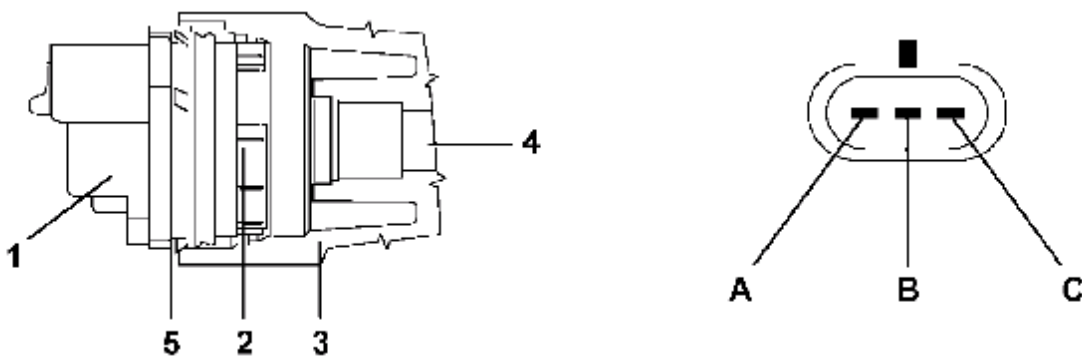
The sensor, including a potentiometer, the movable part of which is controlled by the throttle axis. ECU supplies a voltage approx. 5V to the potentiometer when working.

From idling to throttle full open, oil injection process is administrated by parameters gained from throttle valve opening angle.

ECU identifies whether the throttle is in the open or close position according to the output voltage and modifies the mixture ratio. When throttle closed, the voltage signal is transferred to ECU to confirm whether the engine is in idle or fuel cut-off state (differ from engine speed).

Signals for throttle potentiometer need not adjusting because ECU software can automatically obtain the idle position (0-950mV) of throttle valve.

Potentiometer is installed directly on throttle body and fixed with a fast snap ring.



1.Connector 2.Resistance Circuit 3.Throttle Body 4.Throttle Valve Axis 5.Seat Snap Ring

A – Ground Signal B – 5V Voltage C – Output Signal

Recovery:

If failure happens, the setting value is calculated through the readings of TDC (top dead center)/ ESS (engine speed sensor) and absolute pressure sensor.

If there is a failure in the absolute pressure sensor signal, set throttle valve opening angle a fixed value 50 degree. For the moment, adopting the methods like buffering, idling adaptability and air fuel ratio adjustment all doesn't work.. Throttle signal cycle is also malfunctioned when running automatic transmission.

INTEGRAL AIR PRESSURE/TEMPERATURE SENSOR

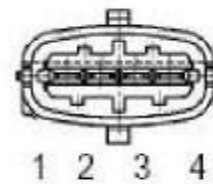
Pressure signals are obtained from the voltage of one among four resistors in Wheatstone bridge marked on a special diaphragm. This diaphragm is compressed and stretched under the absolute pressure from inside of the manifolds (thus the above resistor is under pressure too).

Air temperature sensor is a negative factor temperature sensor. So the higher the temperature is, the lower the resistance and the weaker the pressure signals will be.

When a failure in sensor circuit happens, the air temperature is fixed at 45°C.

Recovery:

When a failure in sensor circuit happens, manifolds pressure value will be estimated according to the method of data-inserting arithmetic based on the rotate speed and related throttle valve opening angle in a pressure-recovery recorder Then the value shall be modified by coolant temperature and the air pressure.



Pins:

1. Grounded
2. Outputs Temperature Signal
3. 5V Power Source
4. Outputs Pressure Signal

TPRT

ASSEMBLY AND DISASSEMBLY OF INTAKE SYSTEM

Remove accessories around the engine:

1. Loosen fastening clamp, demount air cleaner and air intake hose.



2. Remove throttle cable and clutch cable.

3. Remove all intake pipes and vacuum hoses around engine.

4. Put down water hose to discharge anti-freeze liquid.

5. Disassemble the throttle position sensor/ canister solenoid/crankshaft position sensor/Injection nozzle / knock sensor and wire plugs on electric components like fuel pressure switch.



CANISTER SOLENOID AND INTAKE/EXHAUST PIPE

Assembly:

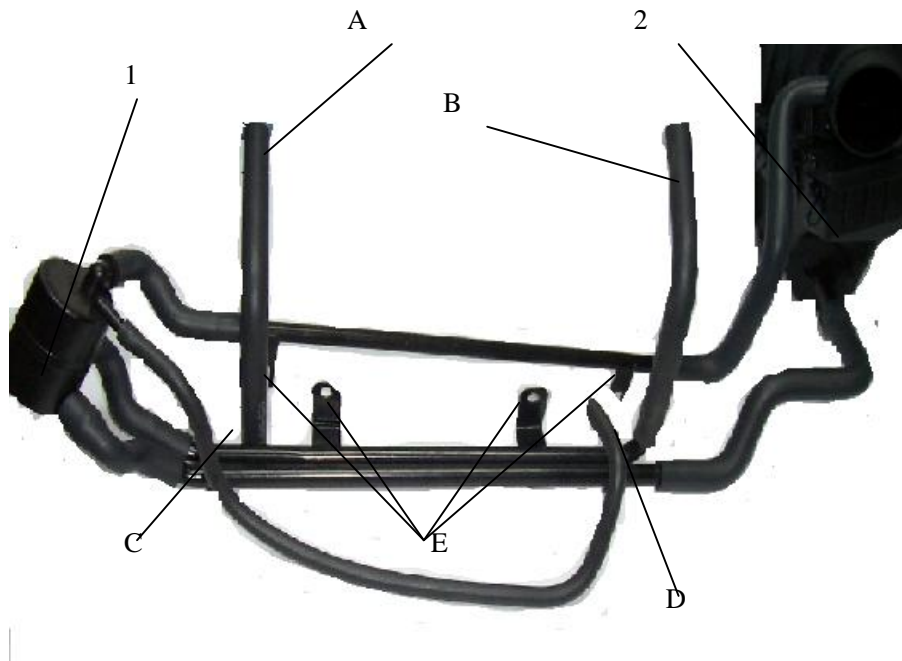
— Fix the solenoid on the intake manifolds with a semicircular clamp and tighten two inner bolts.

— Install the solenoid intake pipe between the activated canister and the solenoid, then tighten the clamp around the intake pipe with special tool.

— Install solenoid exhaust pipe between the throttle body and the solenoid. then tighten the clamp around the exhaust pipe with special tool.



OIL-VAPOR SEPARATOR



1.Oil-vapor separator

2. Air cleaner

3.Others---ventilating pipe in crankcase

Working principle:

Main function of the oil-vapor separator is leading gas in crankcase to intake manifolds through oil-vapor separator, which keeps pressure in crankcase within a certain range and prevent gas in crankcase from mixing and flowing out. Oil-vapor separator shall separate the oil vapor mixture passed the crankcase to avoid the oil entering into engine where it will generate carbon grains that causes engine wear.

Oil-vapor separator assembly, air cleaner and ventilating pipe assembly is showed in fig. A connect to one interface on the engine valve cover; B connect to another interface on the engine valve cover; C connect to the crankcase interface; D connect to the intake manifold interface. Connect the ventilating pipe to the interfaces of oil-vapor separator, air cleaner by-pass hose and engine valve with spring clamp.

Assembly and disassembly:

Fix three iron-ventilating pipes to the bolts in engine intake manifolds using 4 M8 nuts with a tightening torque of $10 \pm 1 \text{ Nm}$.

Maintenance of fuel-vapor separator:

Disassemble it per 5000km and wash it with lead-free gasoline, then blow it to dry.

EXHAUST SYSTEM

OUTLINE

Exhaust system inspection :

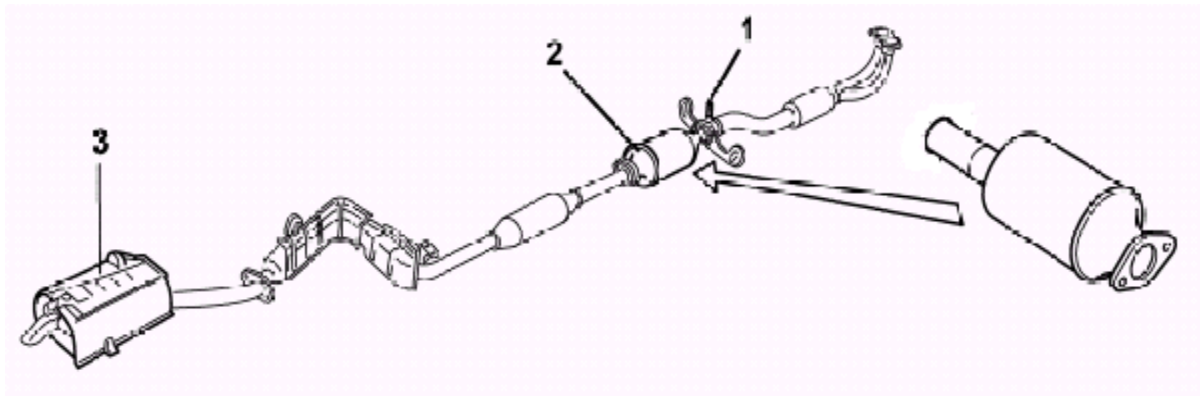
- Start the engine and inspect each exhaust system component for exhaust gas leakage.
- If leakage is found, repair or replace as necessary.

Exhaust system removal/installation

Warning:

- When the engine and exhaust system are hot, they can badly burn. Turn off the engine and wait until they are cool before removing the exhaust system.

Exhaust assembly and oxygen sensor position



1. Oxygen Sensor

2. Catalytic Converter

3. Silencer

OXYGEN SENSOR

To gain max. conversion efficiency from catalytic converter, the engine oxygen sensor always keeps the concentration of fuel-gas mixture as chemical reaction equivalence ratio.

The sensor shall realize closed loop controlling to the mixture concentration through measuring the proportion of oxygen in exhaust.

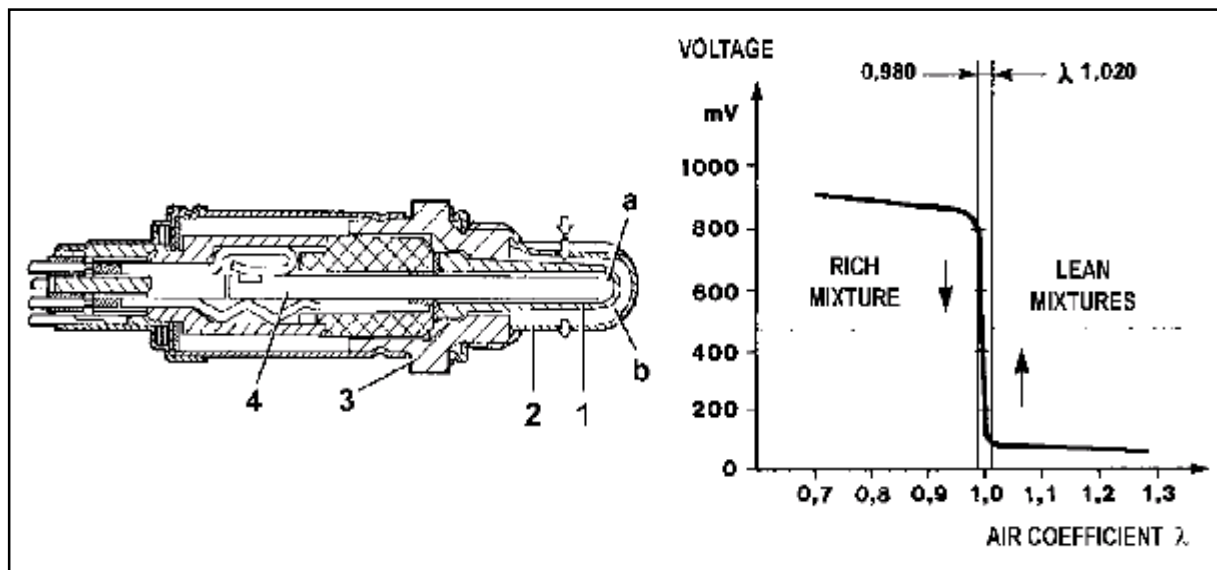
Oxygen sensor is installed in the first section of exhaust pipe near manifolds.

Oxygen sensor is a ZrO_2 porcelain (1) with a thin platinum layer on its surface and one end is sealed with a protection pipe inserted in. (2), the outside bushed with a metal housing (3) to protect the sensor and to enable it to install on the exhaust manifolds. The outside of porcelain (b) is exposed in exhaust gas, the inside (a) communicate with outer surroundings. Working principle: voltages generated by electrode will change with the variation of oxygen concentration; oxygen sensor measure the components of the exhaust, thus ECU will obtain

the mixture concentration value in time and change mixture thicker or thinner to make it always be close to chemical reaction equivalence ratio. The voltage range of which is 0.980~1.020V.

To reach working temperature rapidly (~300°C), a resistor (4) installed in the sensor can shorten the starting electric time of the porcelain. It means sensor can be installed in cold area of exhaust hose. If mixed gas concentration is thinner than chemical reaction equivalence ratio when working in full speed, ECU will give signal to the oxygen sensor to add mixture thicker (half-closed loop).

Oxygen sensor doesn't work under cut-off and full load condition, which is called open loop.



Recovery:

If fault occurs in sensor or resistor, all information will be ignored and the whole system will work as an opened loop system.

Oxygen sensor test procedure:

If diagnosis tester displays signal as “lambda sensor error “, please check:

- If there is air leakage in every manifold, pipes, brake booster, exhaust gas and fuel-vapor re-cycle system.
- Spark wear and efficiency of high voltage wire insulator.
- If timing and positioning of TDC (top dead center)/rotate speed sensor is right or not.
- Tappet clearance and engine compression ratio.
- If supplied oil pressure is right or not.

Exhaust gas emission	CO%	HC (p.p.m.)	CO ₂ (%)
Before catalytic converter	0.4 - 1	< 600	> 12
After catalytic converter	< 0.35	< 90	> 13

See the above table, using three-way catalyst converter can reduce three types of harmful gases in exhaust gas at the same time: HC, CO, NO_x, while harmless CO₂ increases.

The following factors will rapidly damage the catalytic converter:

- Fuel contained lead, which will decrease converter efficiency even invalidate catalytic converter.
- Incomplete burned fuel in converter, for example, the catalytic converter will be melt and damaged only in 30 seconds by the fuel under 800°C (temperature in converter).

Do not cut off the high voltage cable no matter the engine is running for any reason to insure ignition parts (static ignition coil, high voltage cable, spark) are effective.

Oxygen sensor signal is displayed on diagnosis tester.

This value shall continuously wave in a defined range (thin mixture<0.45V, thick mixture>0.45V).

Oxygen sensor heater resistance is about 4~5Ω at environment temperature 20°C, and its battery voltage is 12V.

ASSEMBLY AND DISASSEMBLY OF EXHAUST SYSTEM

1. Installation of exhaust system with three-way catalyst converter:

① Installation of back hose hook:

- Install back hose hook on the dash panel of the body.
- Screw down M8 lock nut, screw down torque is 12±1Nm.



② Installation of front hoses assembly:

—Install Oxygen sensor assembly on front hose assembly with a tightening torque of $45\pm 4.5\text{Nm}$.

—Install 3 M10 double head studs on exhaust manifolds.

—Lay exhaust hose pad, install front hose assembly on exhaust manifolds.

—Mount 3 M10 copper nuts with a tightening torque of $60\pm 3\text{Nm}$.

③ Installation of back hose assembly and three-way catalyst converter:

—Connect three-way catalyst converter assembly and back hose assembly flange with 2 M8 bolts and 2 M8 flange plane nuts and lay sealing pad with a tightening torque of $30\pm 3\text{Nm}$. The nuts shall near the three-way catalyst converter.

—Install back hose assembly on front hose assembly with a hose clamp.

—Connect back hose assembly to the back hose hook with a hang block.

④ Installation of three-way catalyst converter:

—Connect three-way catalyst converter assembly and front hose assembly flange with 2 M8 bolts and 2 M8 flange plane nuts and lay sealing pad with a tightening torque of $30\pm 3\text{Nm}$.

—Use one hang block connecting front hose of three-element catalytic converter to the hook of back hose.

⑤ Installation of back silencer:

—Install a buffer stopper on back silencer with a hose clamp around the opening position of back silencer.

—Set 2 hooks to welding bolts and tighten them using 2 M8 lock nuts with a torque of $30\pm 3\text{Nm}$.

—Connect back silencer to the body with 4 flying rings (hang block).

⑥ Installation of front silencer:

—Install front silencer between three-way catalyst converter and back silencer.

—Install hose clamp assembly.

—Tighten all bolts in hose clamps and hose clamp assembly with a torque of $30\pm 3\text{Nm}$.

Note:

- **Eccentricity between front silencer and the intake/exhaust hose is 18mm. Adjust front silencer position in assembly to guarantee a gap between the front silencer and the channel heat insulator more than 10mm.**
- **In assembly, hose clamp should not be aslant installed around the exhaust hose.**
- **Distance between the expanding section on exhaust hose and the section of hose clamp should be 1~4mm in assembly.**

⑦ Installation of exhaust hose bracket:

—Install exhaust hose bracket.

—Mount 4 M8 lock nuts and tighten them with a torque of $12\pm 1\text{Nm}$.

2. Examine gas leakage in exhaust system connection and its adjustment method:

Examine leakage in exhaust system interface after engine warm-up. Certain amount of gas leakage is permitted (but not permitted in interface between exhaust manifolds and front hose assembly). It can be taken as a principle of no leakage if no engine wobble and no sound like 'pu', 'pu' in interface heard. If the above phenomenon is found, loosen the hose clamp in interface and rotate it a few circles, then tighten it again after adjusting installation direction of hose clamp.

Installation of heat insulator

—Install each heat insulators to its proper position, and then tighten the clip.

FUEL SYSTEM

ASSEMBLY AND DISASSEMBLY OF FUEL SYSTEM

Before repair procedure

Warning:

- **Fuel vapor is hazardous. It can easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.**
- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the following “Fuel Line Safety Procedure” .**

Fuel Line Safety Procedure

Note

- **Fuel in the fuel system is under high pressure also when the engine is not running.**
1. Remove the fuel-filler cap and release the pressure in the fuel tank.
 2. Remove the fuel pump relay.
 3. Start the engine.
 4. After the engine stalls, crank the engine several times.
 5. Turn the ignition switch to LOCK position.
 6. Install the fuel pump relay.

After repair procedure

Warning:

- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. When installing the fuel hose, observe “Fuel Leakage Inspection” described below.**

Fuel Leakage Inspection

Warning:

- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Always carry out the following procedure with the engine stopped.**

Caution:

- **Connecting the wrong check connector terminal may possibly cause malfunction. Carefully connect the specified terminal only.**

1. Short the check connector terminal F/P body GND using a jumper wire.
2. Turn the ignition switch to ON position to operate the fuel pump.
3. Pressurize the system in this way for **at least 5 minutes** to be sure of no leakage.
 - If there is fuel leakage, inspect the fuel hose, hose clamps, and fuel pipe sealing surface, and replace as necessary.
4. After repair, assemble the system and repeat Steps 1 to 3.

Fuel tank removal/installation

Warning:

- **Repair a fuel tank that has not been properly cleaned can be dangerous. Explosion or fire may cause death or serious injury. Always properly steam clean a fuel tank before repairing it.**
- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, do not damage the sealing surface of the fuel pump until when removing or installing.**

Caution

- **Disconnecting/connecting the quick release connector without cleaning it may possibly cause damage to the fuel pipe and quick release connector. Always clean the quick release connector joint area before disconnecting/connecting using a cloth or soft brush, and make sure that it is free of foreign material.**
1. Level the vehicle.
 2. Complete the “**Before repair procedure**”
 3. Disconnect the negative battery cable.
 4. Remove the fuel pump unit.
 5. Siphon the fuel from the fuel tank.
 6. Remove the middle pipe.
 7. Remove in the order indicated in the table.
 8. Install in the reverse order of removal.
 9. Complete the “**After repair procedure**” .

Installation of fuel case assembly:

- Install fuel tank assembly.
- Install 2 tapping screws (M6) on fuel tank mouth.
- Set up 3 fuel tank fixed belts and 5 M8 bolts.
- Tighten 5 M8 bolts (tightening torque is $30 \pm 3\text{Nm}$) and 2 tapping screws (tightening torque is $4 \pm 0.5\text{Nm}$).
- Install fuel mouth cap and steel wire stopper.
- Connect import and export tube on fuel tank, clamp tube lock hoop by special tool.

Note: In assembly, clearance between fuel tank assembly and back wheel cover inner board should be more than 12mm.



Assembly and disassembly of fuel rail and fuel injector:

- Disassemble import tube lock hoop of fuel rail. Remove injector plug.
- Unscrew two root bolts under fuel rail. Take out fuel rail and injector by carefully shaking upwards.
- Pull out fuel injector by rotating it. Replace pad when re-install.

Pay attention to right position in assembly, and take care of the pad.

Fuel tank inspection

Caution

- **Disconnecting/connecting the quick release connector without cleaning it may possibly cause damage to the fuel pipe and quick release connector. Always clean the quick release connector joint area before disconnecting / connecting using a cloth or a soft brush, and make sure that it is free of foreign material.**



Installation of fuel filter:

- Set up fuel filter assembly in fuel filter protection box assembly.
- Connect import and export tube in both end of fuel filter, clamp tube lock hoop by special tool.
- Using two M8 lock nuts to install protection box assembly under vehicle ground board. Tighten bolts, and the tightening torque is $30 \pm 3\text{Nm}$.



Installation of fuel tube:

- Set up lock clamp on relevant screw under vehicle body.
- Cover protective sleeves, set up fuel tube on relevant lock clamp.
- Cover hose protection bushing, connect relevant tube and hose.
- Clamp tube lock hoop by special tool



Caution

- **Fuel pipe can not be bent excessively.**
- **After insert the quick release connector, please pull and push the quick release connector several times to confirm it insert in position.**

Assembly and disassembly of fuel pump and fuel level sensor:

- Lay down back seat backrest forwards, lift carpet on back cabinet, remove 3 tapping screws on fuel pump cover, and then take down the cover.
- Loosen fast joint on import and export tube, disassemble import and export tube.
- Remove fuel pump plug, rotate fixed outer collar of fuel pump assembly in



counter-clockwise, slowly bring forward fuel pump assembly.

- Pull out fuel level sensor with little upwards strength.



Installation of accelerator cable:

- Install rubber jacket on vehicle front boarding.
- Thread accelerator cable through rubber jacket, then push it to right position.
- Install hook of accelerator cable in gluey block of accelerator pedal.
- Install the other end of accelerator cable on throttle valve rocker of throttle valve body.
- Adjust degree of tightness of accelerator cable, located by locating clamp.

Caution

- **When adjusting degree of tightness of accelerator cable you should ensure that: Accelerator pedal doesn't need any part of empty stroke at idle; when throttle is full open, accelerator pedal limiting screw assembly is effective (accelerator pedal can step on accelerator pedal limiting screw assembly).**

Adjusting of accelerator cable:

Range of free travel : 1.0~3.0mm

OPERATION CONTROL OF ENGINE FUEL SUPPLY SYSTEM

1. Start engine:

In start process, ECU firstly inject to all cylinder at the same time to shorten start time. After that, ECU will inject according to phase order.

2. Acceleration:

In acceleration process, ECU will add injection fuel by engine requirement and deal with sensor signal below: throttle position, absolute pressure, upper dead center/ speed sensor, multiply "basic" fuel injection time by a modification factor, which is calculated from engine cooling temperature, throttle opening speed, and intake manifold pressure increment. When injector is closed and if calculated injection time has a sudden change, ECU will add injection Fuel by the modification factor mentioned above, that is to re-open injector (extra pulse) for compensating fuel as soon as possible. In order to make vehicle more comfortable, torque control strategy doesn't affect performance and fuel consumption in accelerating by adjusting spark advance angle. Because exhaust regulatory become much more Stricter, a kind of much more complicated active manage strategy is developed, which utilize some physics and hydrokinetics phenomenon (such as fuel film mode) to gain not only a sudden change in throttle air input but also steady air fuel ratio.

3. Deceleration:

In deceleration process, fuel engine needed is decrease to reduce pollution, ECU identifies the phase by that throttle potentiometer signal change from high level to low level but do not back to idle. Furthermore, it can adopt dashpot strategy to decrease output torque (reduce engine brake), when throttle potentiometer signal shows that throttle is closed and engine is in very high speed, ECU considers it's satisfied condition that ECU will minish by-pass air input by controlling step motor step by step.

4. Cut off:

ECU will adopt cut off strategy when ECU identifies that throttle is in idle position (throttle potentiometer signal) and hot engine speed exceeds 1500r/m. The warm up strategy is determined by the speed when engine coolant temperature increase strategy is running. Fuel will be supplied again to system if throttle is not closed and hot engine speed is lower than 1400r/m. In high speed, ECU will adopt cut off strategy (part cut off) if throttle is not closed completely but manifolds pressure is very low.

5. Full load:

In full load status (distinguished from throttle potentiometer and absolute pressure sensor), ECU obtains maximal output power by increase basic fuel injection time, while temperature of catalysis converter is kept in prescriptive range.

6. Air pressure modification:

Air pressure will change with different altitude, which will cause change to volumetric efficiency. That is why basic specified parameter (fuel injection time and by pass air input) need to be modified. Fuel injection time modification and by pass air input compensation is decided by altitude change, and ECU will refresh those parameters automatically when start, or does dynamic modification (air pressure dynamic modification) on a certain throttle position and engine speed.

7. Engine speed limitation:

When engine speed has exceeded “critical” value for 10 seconds or instantly exceeds a certain value prescribed by manufacturer, ECU will cut off fuel injector control function. ECU will rebuild fuel injector control function when speed comes back to normal value.

8. Fuel pump:

- When engine speed is lower than a certain value close fuel pump (approx, 50r/m);
- Open ignition switch for 2 seconds, but engine does not start fuel pump;
- Fuel pump keeps working when engine is running or vehicle is in its way.

9. Self adapting:

ECU has self adapting function for air fuel ratio. ECU can store difference between basic pulse diagram and oxygen sensor modification factor continuously generated in running. The difference will be permanently stored because of ageing of engine and system components. It permits system to amend engine and components as new.

This function includes automatically consistency test and automatically diagnosis for stored parameters, special diagnosis instrument can delete those parameters, and modification parameters will not be lost if batter or ECU is cut off. This strategy is ineffective if canister solenoid valve is open. After changing ECU, it should run at idle (warm up) for some time to make ECU restore modification parameter. When engine is in high speed, modification parameter in memory is the parameter of normal running condition. ECU another self adapting function can modify step motor opening degree change caused by throttle leakage and engine natural ageing. The self adaptive parameter will be lost when power off or ECU is cut off.

10. Electric power balance:

Normal working of electric components (front light, heat back window, etc.) will make battery voltage lower than 12.2V, electric components power demanded in that time is larger than electric power from generator. That is to say, negative “electric power balance” may cause damage to battery. In that condition, ECU accelerates idle speed step by step (from 800 r/m to 1200 r/m) to make adequate electric power from generator. Accelerating idle will disappear when “electric power balance” is positive.

Fuel supply system of this vehicle is belonging to “half no scavenge fuel”, there is only one tube connecting fuel tank and fuel rail.

This system has advantages below:

- When accident occurs, no scavenge fuel tube can lower fire possibility to minimum.
- There is comparative less fuel vapor in fuel tank.
- Fuel temperature in fuel tank is lower.

FUEL SYSTEM WORKING COMPONENTS

Fuel Injection Volume Inspection

Warning:

- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Always carry out the following procedure with the engine stopped.**

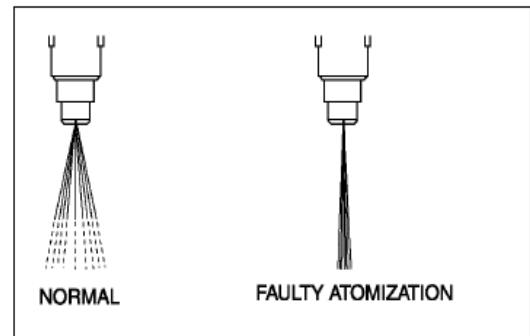
Note

- **If there is an after market fuel injector tester, perform the following test.**
 - **If there is no an after market fuel injector tester, perform “Operation Test” , “Resistance Inspection” , and “FUEL Leakage Test” to verify the fuel injector is ok or not.**
1. Complete the “**Before repair procedure**”
 2. Disconnect the negative battery cable.
 3. Remove the fuel injectors.
 4. Connect the fuel injector to the fuel injector tester.
 5. Measure the injection volume of each fuel injector using a graduated container.

Working pressure: 350kpa

Working temperature: $-30^{\circ}\text{C} \sim +110^{\circ}\text{C}$

6. Turn the ignition switch to LOCK position and disconnect the jumper wire.
7. Complete the “**After repair procedure**” .



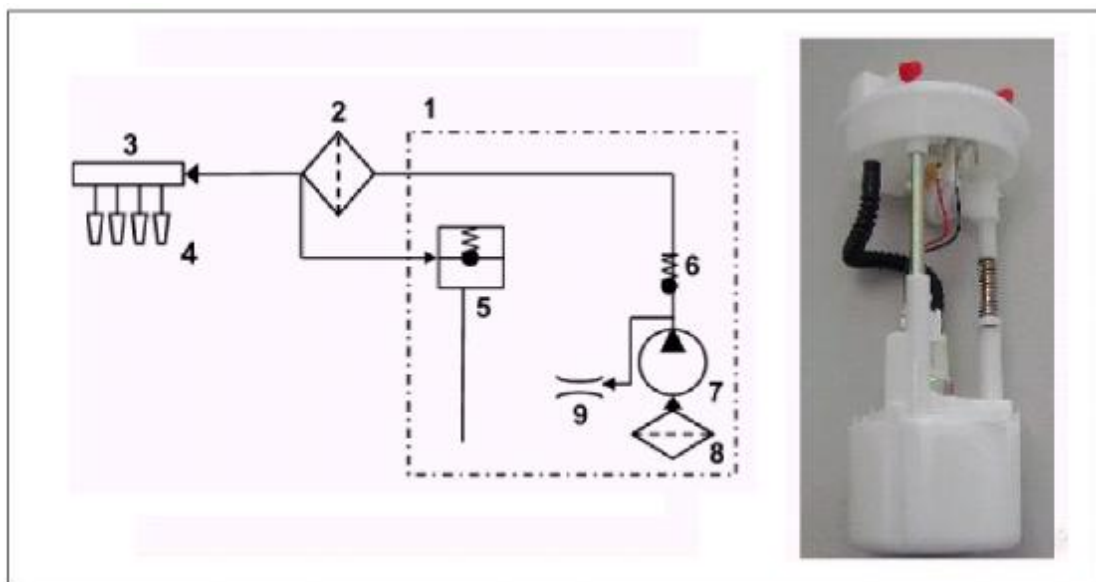
Atomization

1. Inspect atomization pattern.
 - If the atomization is faulty, replace the fuel injector.

Half no scavenge fuel supply integrated module

Fuel supply module is in fuel tank, which includes:

- Fuel pump;
- Diaphragm type fuel pressure adjuster;
- Fuel filter (out of the fuel tank)



- | | | | | |
|----------------------|---------------|------------------|------------------|----------------------|
| 1.Fuel Supply Module | 2.Fuel Filter | 3.Fuel Rail | 4.Fuel Injector | 5.Pressure Regulator |
| 6.Cone Way Valve | 7.Fuel Pump | 8.Primary Filter | 9.Injection Pump | |

Fuel pump

Fuel pump inspection

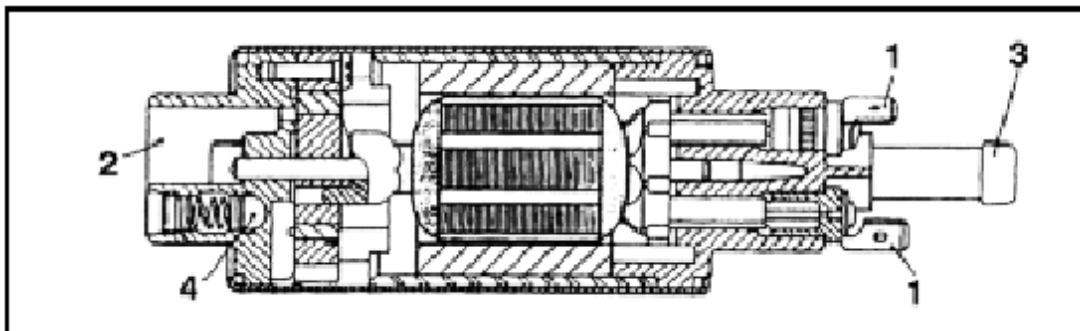
Note

- When ignition switch is at ON position, it is normal to hear the sound of fuel pump running.

Fuel pump is located in fuel tank, and there is netlike filter in the fuel pump entrance. Internal gear positive displacement fuel pump should use unleaded gasoline. Rotor is driven by motor, while motor power comes from battery through relay.

There is safety valve installed in fuel pump. Safety valve will open to prevent engine from over hot when pressure in fuel line is over 7bar.

Fuel pump can work in fuel temperature range of $-30 \sim +70^{\circ}\text{C}$. Minimum rate of flow is 76 l/h on 4bar-12V(maximal current is 8.5A), while minimum rate of flow is 20 l/h on 3bar-8V.



1.Electric Terminal 2 Fuel sucking Slot 3.Fuel transporting Groove 4.Safety Valve

ECU realizes below control to fuel pump through relay:

- Fuel pump works as key switch is on for 2 seconds but engine does not start.
- Fuel pump keeps working when engine is running or vehicle is in its way.

Fuel pump will stop working if engine speed is lower than a certain value (approx.50r/m). Remained fuel can prevent disturbance of static and electric wave. Fuel continuously flowing can cool fuel pump and clean fuel rail.

Fuel Pump Hold Pressure Inspection

Warning

- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Always carry out the following procedure with the engine stopped.**

Caution

- **Disconnecting/connecting the quick release connector without cleaning it may possibly cause damage to the fuel pipe and quick release connector. Always clean the quick release connector joint area before disconnecting/connecting using a cloth or soft brush, and make sure that it is free of foreign material.**

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Fuel pressure regulator

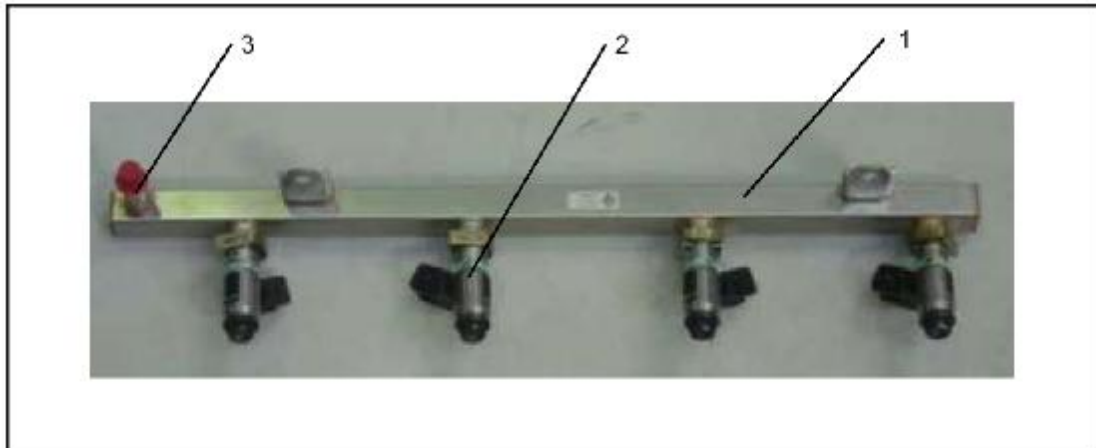
Fuel pressure regulator is located in fuel tank, which is specified on fixed pressure of 3.5bar.

Caution

- **Due to adoption of the mechanical returnless fuel system, the pressure regulator cannot be inspected separately.**

Fuel rail

Fuel rail 1 is made of cast aluminum. Its function is distributing fuel to injector 2.



1.Fuel Rail

2.Fuel Injector

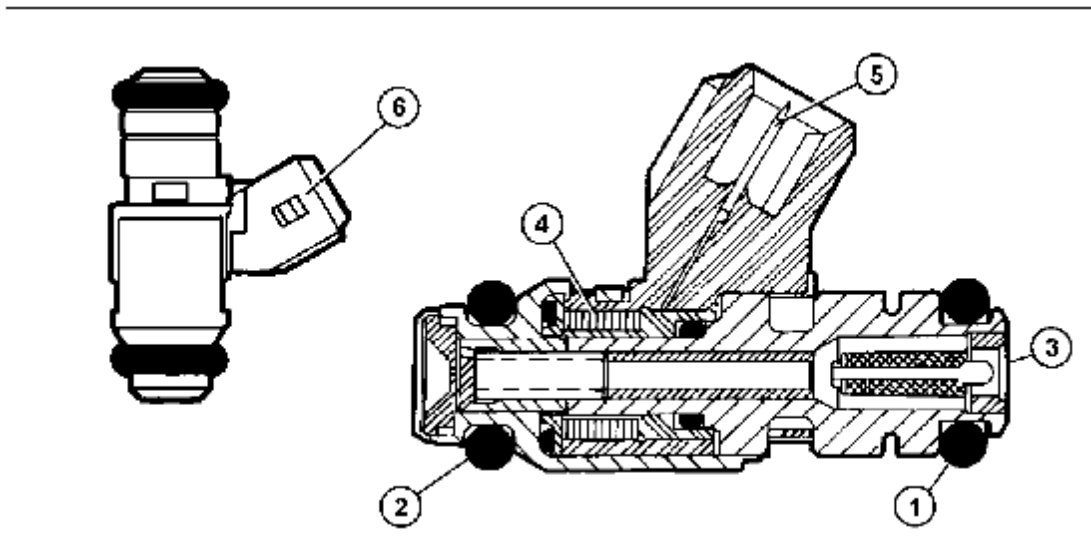
3.Fuel Feeding Port

Fuel injector

This system adopts head supplying single hole Fuel injector, and fuel injection pressure is 3.5bar. Fuel injected from fuel injector keeps in atomization and comes into cone angle (15 degree to injection nozzle axis).

Control logic of Fuel injector is “phase, order” controlling. These four fuel injectors are controlled by air input order of four cylinders. Fuel injector is open on expansion stroke till intake stroke started.

Fuel injector is fixed on fuel rail, and fuel rail can press injector on fixed seat of intake manifold. Two O-type pads (1) (2) are used in sealing. Fuel is entering from upper side of fuel injector. Fuel injector includes coil (4) and electric terminal (5) on electric plug (6).



1. O-ring

4. Coil

2. O-ring

5. Electric Terminal

3. Fuel Feeding Port

6. Electric Plug

Specification:

Voltage: 12V

Resistance: $13.8 \sim 15.2 \Omega \pm 10\%$ (on 23°C)

Remark: Force on fuel injector socket in assembly and disassembly must be less than 120N, or it will influence function.

Caution

- **use of a deformed injector retaining clip will cause the injector to not engage correctly. Always use a new clip when reattaching the injector, otherwise it may cause the injector to rotate.**