
Chapter I Overview

Section I General Instructions

I. Summary

This Manual provides the procedures required by service operations, including:

1. Structure and composition
2. Principles
3. Dismantlement and installation steps
4. Inspection methods
5. Adjustment & commissioning methods
6. Common trouble diagnosis procedures
7. Technical parameters

The simple operations that can be conducted through the observation of vehicle are left out in this Manual. No description is given for the necessary basic skills of maintenance technicians in this Manual.

II. How to use

This Manual comprises four parts, i.e. engine volume, chassis volume, electrical appliance & structure volume of vehicle body and electric circuit inspection volume. In front of each part is given a detailed content index, in which you can find the section you want quickly.

This Manual provides following information:

1. Working principles;
2. Component position
3. Inspection and service specifications
4. Component dismantlement & installation steps
5. Common troubles and repair procedures

Such information are in compliance with current model at time published.

Section III Lifting, Protection and Towing of Vehicle

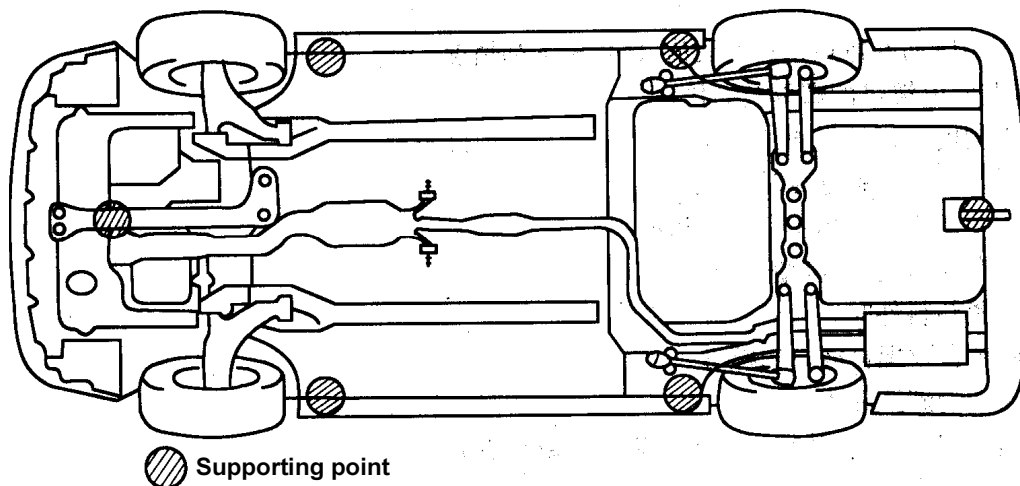
I. Lifting of Vehicle

1. Vehicle's Supporting Points

The positions of vehicle's supporting points are shown in figure below.

Attention:

- Don't lift the vehicle by using the point other than those specified; otherwise vehicle body may be damaged.



Positions of Vehicle's Supporting Points

2. Operation of Lifter

The lifter should be operated strictly in accordance with the specifications of manufacturer.

Caution:

- The operation against the specifications may cause damage of vehicle or personnel injury or even death.

II. Protection of Vehicle

1. Appearance Protection

Be sure to use the four protection appliances including seat cover, steering wheel cover, gearshift lever cover, and foot mat before any operation. A protective pad must be applied on the fenders when engine hood is opened for inspection.

2. Preventive Measures before Welding

Since electrical components are installed on the vehicle, the following procedures must be carried out in order to avoid too large current through such components in welding:

- 1) Turn ignition switch to "OFF" position;
- 2) Disconnect negative pole of battery;
- 3) Ground the welding equipment carefully at a point nearby the welding area;
- 4) Cover other exposed equipment around the welding area to prevent solders from splashing on.

- ④ Blow the back of radiation core with compressed air vertically from top to bottom. The pressure of compressed air should be less than 490 KPa, and a distance of more than 30 cm should be kept.
- ⑤ Blow radiator core surface with compressed air every other minute until no water can be blown away.
- 4) Check for leakage of cooling system
 - ① Check for leakage through applying pressure to the cooling system with a leakage detector of radiator cap.

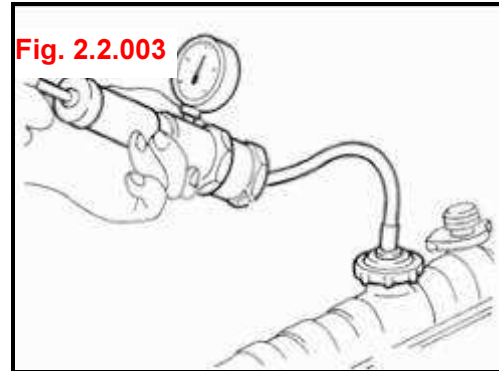
■ Test pressure: 157 KPa

Caution:

- **Never remove the radiator cap with engine hot; otherwise the high temperature and high pressure liquid overflowing from the radiator may cause severe scald.**

Attention:

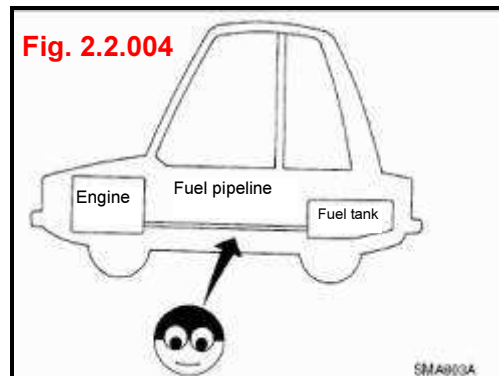
- **A pressure exceeds the specified test pressure may cause damage to the radiator.**
- **In case the engine coolant is found decreased, please refill engine coolant into the radiator.**
- ② If any component is found damaged, repair or replace.



5. Inspection of Fuel Pipeline

Check the fuel pipeline, fuel filler cap and fuel tank for incorrect installation, leakage, crack, damage, loose connection, worn or aged.

- Repair or replace damaged component as required.



6. Replacement of Air Filter

1) Dismantlement

- ① Unscrew lock bolt of air filter upper cover lift up the cover.



Chapter I Mechanical Part of Engine

Section I Engine Body

I. General Precautions

1. Precautions on Discharging Engine Coolant

Discharge coolant after engine has cooled down.

2. Precautions on Disconnecting Fuel Pipeline

- 1) Before the operation, ensure that the operating area is free of objects which may cause combustion or sparks.
- 2) Disconnect the piping, plug openings to prevent leakage of fuel.

3. Precautions on Dismantlement and Disassembly

- 1) Use special tools as required in Instruction. Always operate safely; any forcible operations and operations other than that specified in Instructions are forbidden.
- 2) Take particular care not to damage the matching face or the sliding face.
- 3) Use the adhesive tape or equivalent to cover the opening of engine system so as to prevent the entry of foreign bodies, if necessary.
- 4) For the purpose of troubleshooting and reassembly, methodically mark and neaten the disassembled parts.
- 5) When loosening the bolts and nuts, follow this basic principle: “outmost ones first, diagonal ones second, and so on”. Conduct the operation in compliance with the loosening sequence, if specified.

4. Precautions on Check, Repair and Replacement

Thoroughly check the parts before repair or replacement. Check the substitutive parts by the same means, and then replace as required.

5. Precautions on Assembly and Installation

- 1) Use the torque spanner to tighten the nuts and bolts.
- 2) When tightening the nuts and bolts, follow this basic principle: screw up the central nuts and bolts with the same torque in steps, and then carry out the same operation with the internal and external diagonal ones. Perform the operation in accordance with the tightening sequence, if it is specified.
- 3) Replace gaskets, oil seal or O-ring with new ones.
- 4) Thoroughly rinse, clean and dry every part. Carefully check the engine oil pipeline or engine coolant pipeline for obstruction.
- 5) Never damage the sliding face and the matching face. Completely eliminate the foreign bodies such as cloth scraps or the dust. Before assembly, paste the sliding face with engine oil.
- 6) When refilling engine coolant after draining completely, release air from the pipes at first.
- 7) After repair, start the engine and run with high speed to check for any leakage of the engine coolant, fuel, engine oil and exhaust gas.

i) Dismantle tensioner and set/dynamic tracks of the automatic timing chain. Check for any abnormalities.

- Tightening torque: Automatic tensioner: 9 - 11 N·m

Set track: 10-12 N·m

Dynamic track: 19-28 N·m

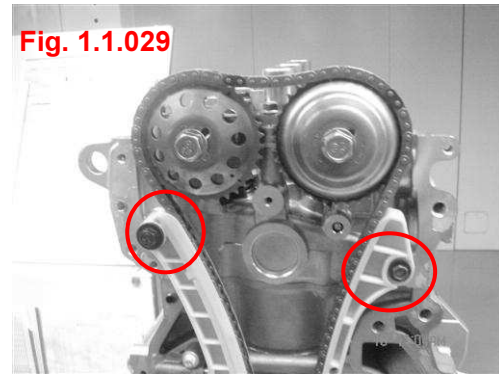


Fig. 1.1.029

j) Dismantle exhaust camshaft sprocket bolt

- Tightening torque: 88±10 N·m

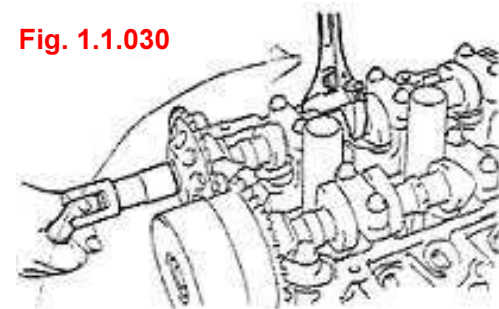


Fig. 1.1.030

k) Remove the bolts of intake cam chain wheel

- Tightening torque: 88±10 N·m

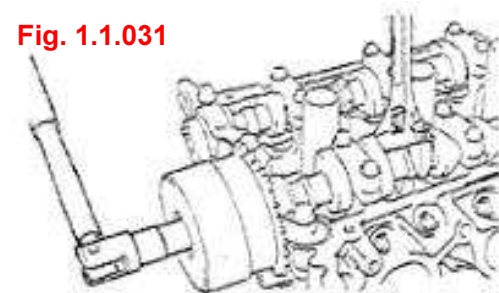
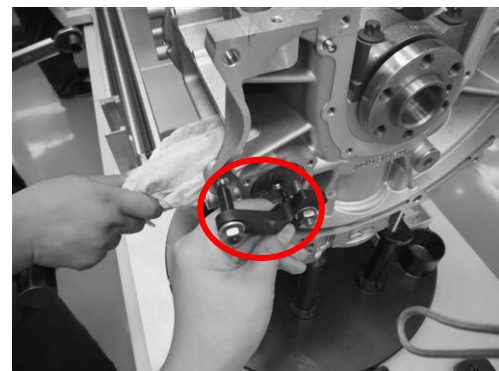


Fig. 1.1.031

l) Remove the rear end cap of balance shaft and secure the anti-rotation device of balance shaft on the tail of the balance shaft.

- Tightening torque for rear end cap of balance shaft: 7.6±0.6 N·m



Standard values:

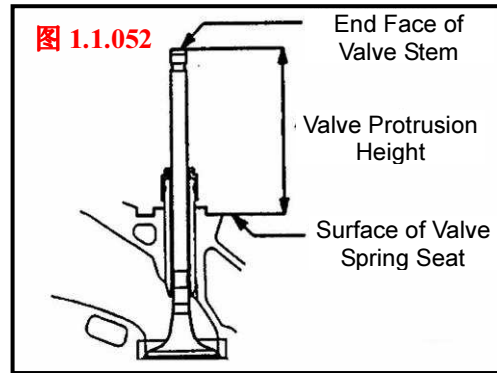
For intake valve: 53.21mm

For exhaust valve: 54.10mm

Limits:

For intake valve: 53.71mm

For exhaust valve: 54.60mm

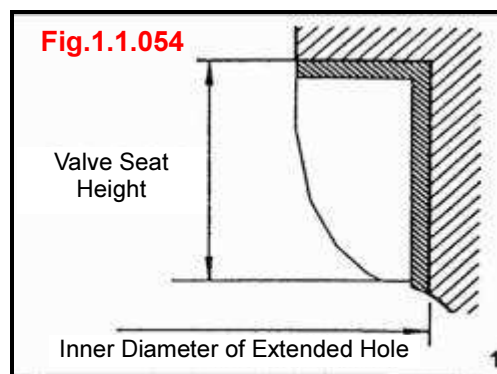
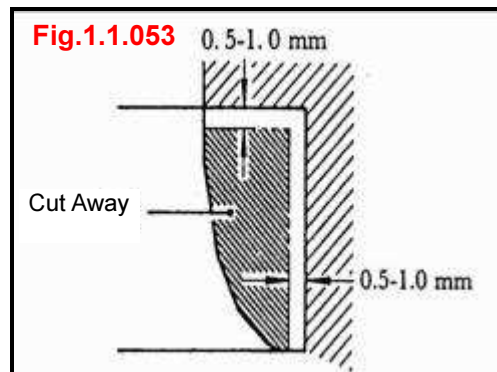


■ Renew valve seat.

- Before renewing the valve seat, check the clearance between valve guide and valve. Replace the valve guide if necessary.
- Resurfacing the valve seat by the proper special tool or the valve seat grinder till specified seat surface width and angle are met.
- After renewing the valve seat, grind the valve and the valve seat by the grinding cream. Then, check the protrusion height of valve stem (refer to the above mentioned check steps of valve seat)

■ Replacement of Valve Seat

- Cut away the replaced valve seat from its inner side in order to decrease the wall thickness. Then remove the valve seat.
- Rebore the valve seat hole on cylinder head till the hole matches the selected valve seat with a extended diameter. See "Parameters for Maintenance" for the detailed size.
- Do not have the cylinder head hole scratched by the valve seat cooled by the liquid nitrogen before it is pressed.
- Renew the valve seat till its width and angle meet the specifications (see the operation instruction of valve seat correction).
- leak testing must be conducted for disassembly of valve related components.



XIII. Cylinder Body Assembly

- ③ Loosen engine oil filler cap and remove the oil drain bolt.
- ④ Discharge the engine oil.
- ⑤ Install the oil drain bolt with new washer.

Attention:

- **Be sure to clean oil drain bolt and install with new gasket.**
- **Tightening torque of oil drain bolt: 34-44N·m**

- ⑥ Fill new oil.

Please refer to “Maintenance” for specification and viscosity of oil.

- Oil volume: 3.8L

Attention:

- **Do not pull out oil gauge when filling oil.**
- **The oil filling volume varies with oil temperature and oil drainage time, thus the above data are only for reference.**
- **Always use oil gauge to check oil filling volume.**

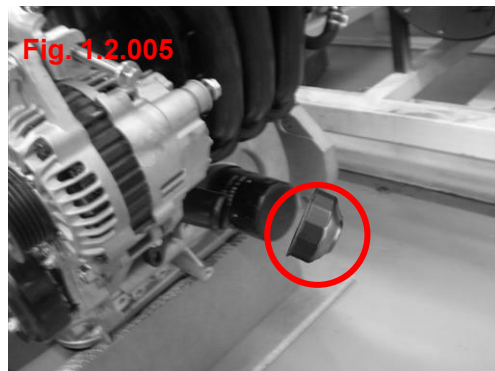
- ⑦ Warm up engine and check the oil drain bolt and oil filter for oil leakage.
- ⑧ Stop engine and wait for 10min.
- ⑨ Check the oil level. Please refer to “Engine Oil Level”.

IV. Oil Filter

1. Dismantlement and Installation

1) Dismantlement

Dismount the oil filter with an oil filter spanner.

**Attention:**

- *Use original oil filter provided by JAC or equivalent.*
- *As the temperatures of engine and engine oil are high, please protect yourself from being hurt.*
- *During dismantlement, prepare a cleaning cloth to absorb leaked or splashed oil.*
- *Do not make the engine oil stick on drive belt.*
- *Thoroughly wipe and dry the engine oil splashed on the engine and vehicle.*

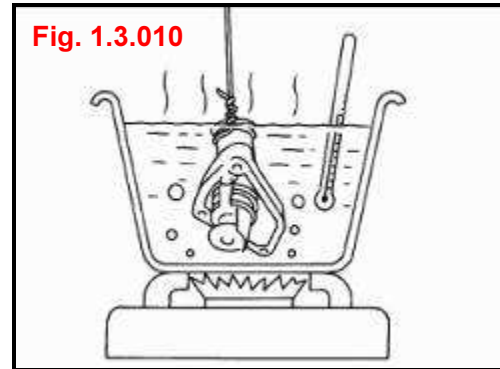
2) Check after Dismantlement

① Thermostat

- Inspect opening of thermostat valve at normal room temperature.

Temperature of thermostat (ON): 82°C (initially open)

95°C (fully open)



Maximum lift of valve stem: $\geq 8\text{mm}$

Please replace the thermostat when the measurement exceeds the specified range.

② Water pump inlet and thermostat housing

Check them for cracks and other damages.

3) Installation

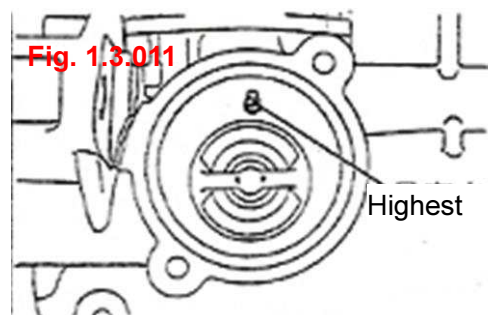
Be aware of following precautions to install with steps contrary to dismantlement.

- ① Be careful not to splash engine coolant onto the engine and wipe and dry the engine coolant with cleaning cloth.
- ② Replace the thermostat seal ring.

Attention:

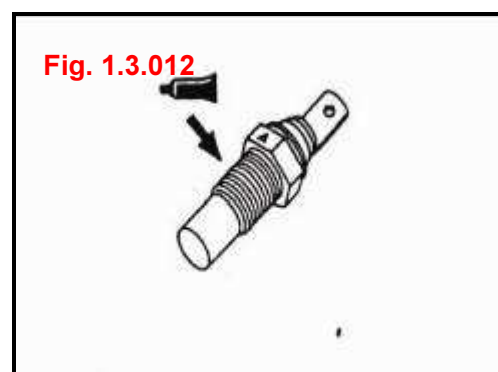
- Do not apply engine oil or other oil substances to the seal ring.
- Water pipes on thermostat housing must be installed solidly.

- ③ When mounting thermostat, its poppet valve must be set at the highest position.



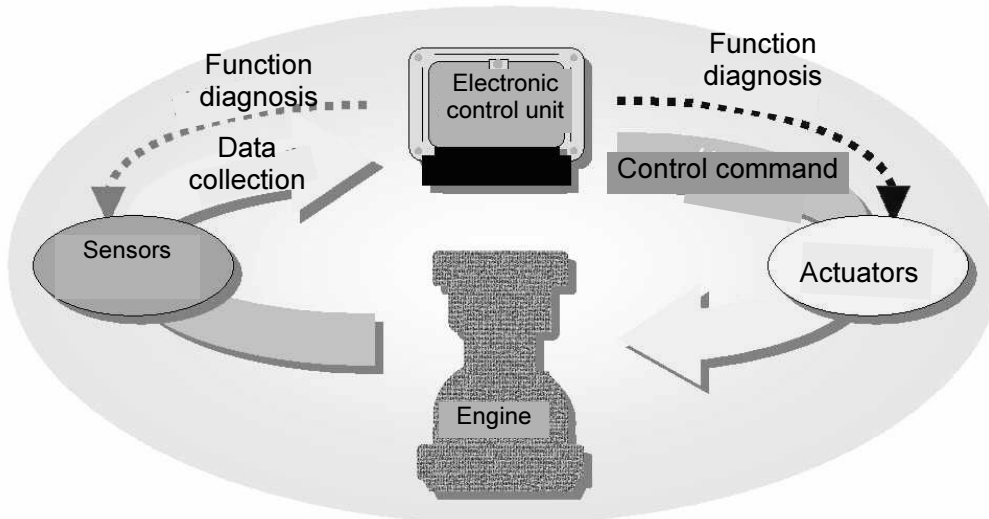
- ④ If the water temperature alarm switch needs to be reused, apply specified sealant to its thread.

- Specified sealant: LT648 or equivalent.



Even with engine stopped, there is high pressure in fuel pipelines. Therefore, the fuel pipe should not be dismantled casually during the course of maintenance. In case that it is necessary to repair fuel system, pressure in fuel system should be released before dismantlement of fuel pipe.

3. The dismantlement of fuel pipe and the replacement of fuel filter should be carried out by the special personnel in well-ventilated area.
4. Power supply of electric fuel pump should be turn off before pump is removed from fuel tank in order to avoid sparks that may cause fire. The fuel injection pump should not be test with dry state or in water, otherwise its service life may be shortened. In addition, the positive and negative poles of the fuel injection pump must not be reversed.
5. During inspection of ignition system, the sparking should be detected only when it is necessary and the time should be as short as possible. The air throttle must not be opened during inspection; otherwise copious unburned full may flow into the exhaust pipe, accordingly leading to the damage of three-way catalyst.
6. The manual adjustment is unnecessary because the idling regulation is completed solely by the electronic controlled injection system. The throttle limiting screw of throttle body has been adjusted by the manufacturer in factory; the initial position must not be changed by users arbitrarily.
7. Terminals of battery must not be reversed, otherwise electronic components may be damaged. Negative grounding is used in this system.
8. Battery cable should not be disconnected with engine running. Before welding on vehicle, cable on negative and positive poles of battery, and all electronic components should be removed.
9. Do not test input and output signal of components by puncturing the insulator of wire.



Schematic Diagram for Malfunction Diagnosis of Electronic Injection System

3. Control strategy of malfunction indicator lamp

1) When no malfunction is present:

- ★ The malfunction indicator lamp lights up after the ignition switch is turned on (ON) and then goes out after 4s.
- ★ If the engine is started within 4s, the malfunction indicator lamp goes out upon detection of speed signal.
- ★ After the K-line is grounded for more than 2.5s, the malfunction indicator lamp will flash at a frequency of 2Hz.

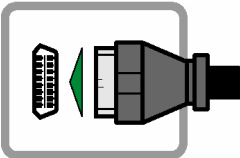
2) When a malfunction is present:

- ★ The malfunction indicator lamp will be always on after the ignition switch is turned on (ON).
- ★ After the engine is started, the malfunction indicator lamp will go out upon detection of speed signal. If the malfunction indicator lamp in question is defined as ON mode in the malfunction category, the malfunction indicator lamp will be always on after the corresponding conditions are met.

4. Inspection steps

- 1) For the vehicles with OBD function, inspection should be carried out always with steps below:

OBD Inspection Steps

	<p>1. Connect the diagnosis equipment to the diagnosis connector to put through it.</p>
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- *During inspection of fuel pressure, always to make sure whether there is fuel leakage in fuel pipeline.*

- 7) If the measured fuel pressure is more than the standard value, analyze the possible reasons referring the following table and repair as required.

Fuel System Trouble Diagnosis Table 1

Phenomenon	Possible Cause	Troubleshooting
Too low fuel pressure	Blockage of fuel filter	Replace the fuel filter
	Damaged fuel pump or poor sealing of fuel pressure regulator resulting in fuel leakage at returning side	Replace fuel pump
Too high fuel pressure	Cementation of fuel pressure	Replace fuel pump
	Blockage or bend of fuel return pipe	Repair or replace fuel pipe

- 8) Turn off engine and check the changes of fuel pressure gauge reading for 5min. If the reading drops, observe the reduction rate. Referring to following table to analyze and eliminate the trouble.

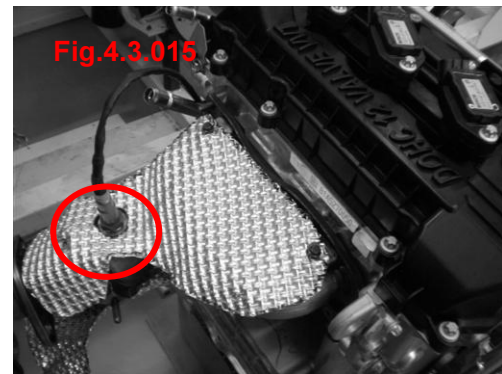
Fuel System Trouble Diagnosis Table 2

Phenomenon	Possible Cause	Troubleshooting
Fuel pressure drops slowly after engine stopped	Leakage of fuel injector	Replace injector
Fuel pressure drops completely after engine stopped.	Trouble of fuel pump	Replace pump

- 9) Reduce the pressure in fuel pipeline.
- 10) Disconnect the fuel pressure gauge and install the inspection port nut.
- 11) Check for fuel leakage with following steps.
- ① Turn the ignition switch to the "ON" position (with engine stopped), and then check for leakage at the joint of the fuel pipeline.
 - ② Start the engine and increase speed, inspect whether there is leakage at joint of fuel system.

2. Installation position

Front (upstream) oxygen sensor is installed on the exhaust manifold before the three-way catalyst converter and the rear (downstream) oxygen sensor is installed behind the three-way catalytic converter.



3. Wiring diagram

Pin 39: Downstream oxygen sensor grounding

Pin 29: Downstream oxygen sensor signal

Pin 4: Downstream oxygen sensor heating control

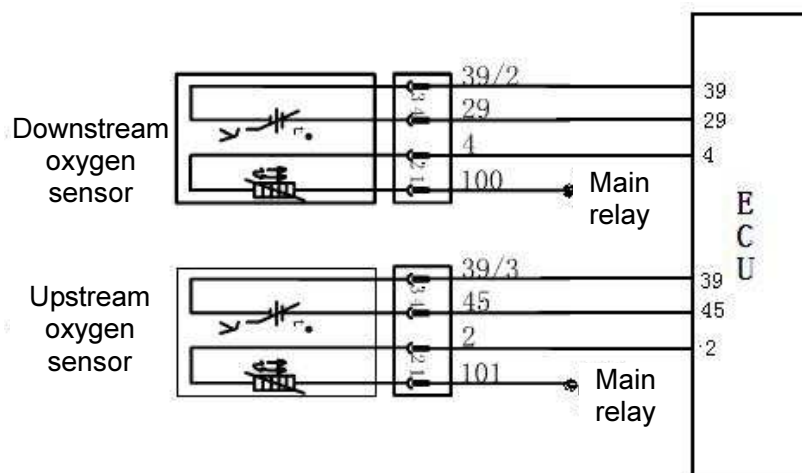
1#: To main relay power

Pin 39: Upstream oxygen sensor grounding

Pin 45: Upstream oxygen sensor signal

Pin 2: Upstream oxygen sensor heating control

1#: To main relay power



4. Diagnosis

ECU detects the oxygen sensor circuit and ECU internal power amplifier circuit and testing circuit. If one of the following conditions occurs, the oxygen sensor fault indicator will be set:

- Battery voltage not reliable
- Intake manifold absolute pressure signal not reliable
- Engine coolant temperature signal not reliable

XIII. Electronic Control Module (ECM) of Engine

1. System description

The greatest characteristic in the electronic control system of the M7 engine is the adoption of torque-based control strategy. The torque-based control strategy is mainly intended to link a great amount of different control objectives. This is the sole method to integrate flexibly all kinds of functions into different variants of ECU depending on the engine and vehicle models.

In the engine electronic control system, the sensors are functioned as input parts to measure all kinds of physical signals (temperature, pressure, etc.) and convert to corresponding electric signals, the ECU is functioned to receive the input signals from sensors, calculate and process as per preset programs, generate corresponding control signals, and output to power drive circuits, and the power drive circuits execute different actions by driving corresponding actuators and control the engine to run as per preset control strategy. At the same time, the malfunction diagnosis system of ECU monitors various components and control functions in the system. Once a malfunction is detected and confirmed, the system will save the malfunction code and activate the “Limp home” function. Upon the detection that the malfunction is resolved, the system will resume to normal values.

1) Functions

- Torque-based system structure
 - Determine cylinder load quantity based on intake pressure sensor
 - Improve control function of gas mixture under static and dynamic conditions
 - λ closed-loop control
 - Fuel cylinder-by-cylinder sequential injection
 - Ignition timing (including cylinder-by-cylinder knock control)
 - Exhaust control function
 - Catalytic converter heating control
 - Carbon canister control
 - Idling control
 - Limp home
 - Anti-theft device function
 - Connection between torque and external system
 - Control over central electronic control parts
 - Complete a series of OBDII control functions
 - Used for management system of diagnosis function
- etc.

Fault code: P0130 “the signal of upstream oxygen sensor is unreasonable”

S/N	Step	Check result	Subsequent step
1	Connect the diagnosis device and adapter, and turn the ignition switch to ON position.		Next step
2	Start the engine and run the engine idly till the coolant temperature reaches to the normal value. Observe the change of the value of “Oxygen sensor voltage” on the diagnosis meter, and at this moment, the displayed value shall change fast between 100mV and 900mV.	Yes	Diagnosis help
		No	Next step
3	Check if the circuits connecting Pins 39# and 45# of ECU respectively to Pin 3# (relative to gray connecting wire of oxygen sensor) and Pin 4# (relative to black connecting wire of oxygen sensor) of sensor connector are short to ground.	Yes	Repair or replace the harness
		No	Next step
4	A. Check if the intake system has serious leakage. B. Check if the fuel injector is blocked. C. Check if the spark plug clearance is too big. D. Check if the resistance of live wire branch is too high. E. Check if the intake valve guide is worn. Etc.	Yes	Make check and repair according to diagnosis results.
		No	Diagnosis help

Fault code: P0131 “the circuit voltage of upstream oxygen sensor signal is too low”

S/N	Step	Check result	Subsequent step
1	Connect the diagnosis device and adapter, and turn the ignition switch to ON position.		Next step
2	Start the engine and run the engine idly till the coolant temperature reaches to the normal value. Observe the change of the value of “Oxygen sensor voltage” on the diagnosis meter, and at this moment, the displayed value shall change fast between 100mV and 900mV.	Yes	Diagnosis help
		No	Next step
3	Check if the circuits connecting Pins 39# and 45# of ECU respectively to Pin 3# (relative to gray connecting wire of oxygen sensor) and Pin 4# (relative to black connecting wire of oxygen sensor) of sensor connector are short to power source.	Yes	Repair or replace the harness
		No	Diagnosis help

Fault code: P0132 “the circuit voltage of upstream oxygen sensor signal is too high”

S/N	Step	Check result	Subsequent step
1	Connect the diagnosis device and adapter, and turn the ignition switch to ON position.		Next step
2	Start the engine and run the engine idly till the coolant temperature reaches to the normal value. Observe the change of the value of “Oxygen sensor voltage” on the diagnosis meter, and at this moment, the displayed value shall change fast between 100mV and 900mV.	Yes	Diagnosis help
		No	Next step
3	Check if the circuits connecting Pins 39# and 45# of ECU respectively to Pin 3# (relative to gray connecting wire of oxygen sensor) and Pin 4# (relative to black connecting wire of oxygen sensor) of sensor connector are short to power source.	Yes	Repair or replace the harness
		No	Diagnosis help

DTC	Information Introduction of Malfunction Codes (UAES)
P0300	Detection of misfire in various cylinders
P0301	Detection of misfire in 1# cylinder
P0302	Detection of misfire in 2# cylinder
P0303	Detection of misfire in 3# cylinder
P0321	No detection of missing tooth BM signal after certain angle rotation of crankshaft
P0322	No pulse signal of speed sensor (open-circuit or short-circuit)
P0327	Low voltage of knock sensor signal circuit
P0328	High voltage of knock sensor signal circuit
P0340	Inappropriate installation location of phase sensor
P0341	Poor contact of phase sensor
P0342	Short-circuit of phase sensor to ground
P0343	Short-circuit of phase sensor to power supply
P0420	Aged oxygen storage capacity of three-way catalytic converter (out-of-limit of emission)
P0444	Open-circuit of carbon canister control valve control circuit
P0458	Low voltage of carbon canister control valve control circuit
P0459	High voltage of carbon canister control valve control circuit
P0480	Open-circuit of cooling fan relay control circuit (low speed)
P0481	Open-circuit of cooling fan relay control circuit (high speed)
P0501	Inappropriate vehicle speed sensor signal
P0506	Lower idling control speed against target speed
P0507	Higher idling control speed against target speed
P0508	Short-circuit of stepping motor drive pin to ground
P0509	Short-circuit of stepping motor drive pin to power supply
P0511	Open-circuit of stepping motor drive pins
P0560	Inappropriate system battery voltage signal
P0562	Low system battery voltage
P0563	High system battery voltage
P0602	Programming error of electronic control unit
P0627	Open-circuit of fuel pump relay control circuit
P0628	Short-circuit of fuel pump relay control circuit to ground
P0629	Short-circuit of fuel pump relay control circuit to power supply
P0645	Open-circuit of A/C compressor relay control circuit
P0646	Short-circuit of A/C compressor relay control circuit to ground
P0647	Short-circuit of A/C compressor relay control circuit to power supply
P0650	Malfunction of malfunction indicator lamp circuit
P0691	Short-circuit of cooling fan relay control circuit to ground (low speed)
P0692	Short-circuit of cooling fan relay control circuit to power supply (low speed)
P0693	Short-circuit of cooling fan relay control circuit to ground (high speed)
P0694	Short-circuit of cooling fan relay control circuit to power supply (high speed)
P1651	Malfunction of SVS lamp drive circuit
P2177	Out-of-upper-limit of air-fuel ratio closed-loop control self-learning (Medium load zone)