Chapter Ⅰ

Electric Fuel Injection System

Section Ⅰ Operating Principle of Key Components

1. Pressure and Intake Temperature Sensor (TEMP)

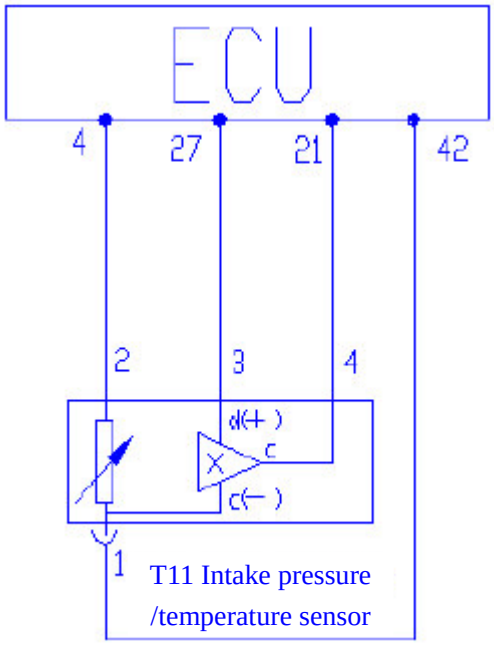
MT 20 electronic fuel injection system employs the velocity-density-air metrological method to detect the air capacity that flow into the engine, and further accurately control the power output of the engine. At the same time, this system applies the **Intake Pressure Cylinder Detection** technology. The intake pressure sensor is mounted near the air intake of No. 1 cylinder's intake manifold. There is an instantaneous pressure drop in the position of sensor on the moment when the air intake opens. The value of pressure drop is approximate 1Kpa. The ECU can detect this instantaneous pressure drop, receive this signal from the sensor, and then determine the signal of compression upper dead center after the signal is analyzed and processed by software.

The **Intake Pressure Sensor**'s internal pressure membrane connects with the magnetic core placed in a coil. The membrane will move together with the iron core when the intake air pressure in the intake pipe changes. In this case, the output voltage of the sensor will also change. The ECU can convert the output voltage of sensor to the intake capacity of the engine. Based on this signal, another signals will be referred to control the fuel injection volume of the engine.

The **intake temperature** sensor element is a resistor with negative temperature coefficient (NTC), the resistance value of which will decrease as the increase of the intake temperature. The ECU of engine can monitor the change of intake temperature through its internal comparison circuit.

Installation: Installed on the No 1 cylinder's intake manifold, and the cylinders are detected based on the instantaneous pressure drop when the air intake opens.

Absolute pressure/intake temperature sensor for intake manifold



Circuit Diagram of the absolute pressure/intake temperature sensor for intake manifold

Troubleshooting:

1) Mainly examine the short or open circuit between the four wires on sensor and the ECU.
2) Examine the clog of the sensor's detection hole.
3) Examine the short or open circuit and the grounding among the harnesses of sensor.
4) Examine the sensor's impact received to cause the sensor failure.
5) **Detection pressure range: 10kPa to 110 kPa**

Trouble Diagnosis:

1) Short circuit of the sensor's wire (shorted to earth, or shorted to supply);
2) Open circuit of the sensor's wire;
3) The intake pressure detected by sensor is greater than its upper limit;
4) The intake pressure detected by sensor is less than its upper limit;

Pin:

1) No.1 (A) for the signal from intake pressure sensor (to ECU 42#);
2) No.2 (B) for the standard 5V power supply (to ECU 4#);
3) No.3 (C) for the signal from the intake temperature sensor (to ECU 27#);
4) No.4 (D) for the ground wire of sensor (to ECU 21#).

Operating temperature range: -40℃ to 125℃

Operating Voltage: 5.0V ±0.1V

2. Throttle Position Sensor (TPS)

Application: MT20U TPS (Throttle Position) sensor is available to provide the ECU with the information about the throttle's **opening angle** and **angular velocity** and the **idle position** of the engine. Based on the information, ECU can obtain the engine's information on load and operating condition (such as startup, idle, reverse towing, part load and full load) as well as acceleration and deceleration. This sensor is a three-wire sensor. And the ECU detects the opening of throttle through the monitoring on the voltage change.

Profile of a throttle position sensor

Structure and Principle: This sensor is with the slip resistance structure (i.e. the linear variable resistance structure). The ECU monitors the voltage among the signal output terminals and gets the opening signal of the throttle through the circuits comparison conducted inside the computer. In the ECU, the voltage signal is not received directly but rather the input-to-output signal ratio is detected, which can avoid the signal fluctuation generated due to the voltage fluctuation.

Trouble Diagnosis:

The signal from throttle position sensor is greater than the measuring range;

The signal from throttle position sensor is less than the measuring range;

Short circuit of the throttle position sensor signal connection;

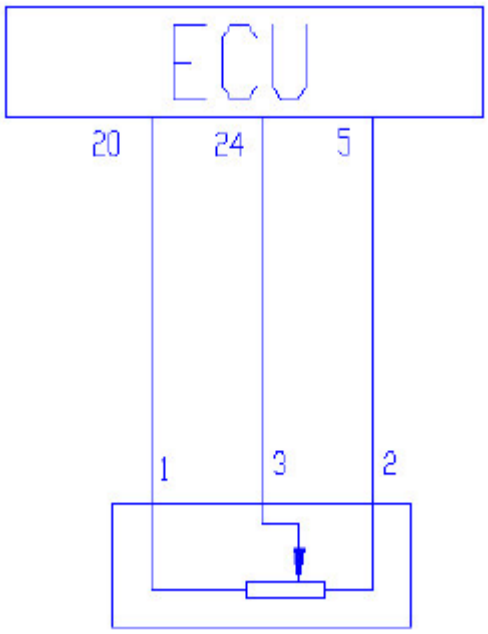
Open circuit of the throttle position sensor signal connection;

WARNING: It is generally prohibited to disassemble the throttle position sensor which has adjusted to its optimal position before it leaves factory.

Installation: The allowable tightening torque of the tightening screw is 1.5 Nm to 2.5 Nm.

Troubleshooting:

1) Mainly examine the short or open circuit between the three wires on sensor and the ECU.
2) Examine the short or open circuit and the grounding among the harnesses of sensor.
3) Examine the jump between the sensor signal terminal and the ground wire, which is detected with the universal meter.
4) Examine the sensor's resistance which is evidently greater than the standard value, the season of which may be that the interior of sensor is dirty.



T11 Throttle Position Sensor

Circuit diagram of the throttle position sensor

Pin:

1) No.1 (A) for the standard 5V power supply (to ECU 20#);
2) No.2 (B) for the ground wire of sensor (to ECU 5#).
3) No.3 (C) for the signal from the sensor (to ECU 24#);

Operating Voltage: 5±0.1 V

Opening Range: 7% to 93%

Resistance of Sensor: 3 kΩ to 12 kΩ

Output signal during the close of throttle: 0.612 to 0.588 V

Output signal during the full open of throttle: 4.15 to 4.65 V

3. Coolant Temperature Sensor (THW, CTS)

Application: This sensor is used to provide the information about the coolant's temperature. It can offer an engine's ECU the water temperature signal which is available to control the startup, idle, ignition timing during the normal operation, and fuel injection pulse width. At the same time, it also offers instruments the water temperature signal which is applied for the water temperature display of the instruments. The water temperature signal is the most signal for the cold start of the engine. During the period of **cold start**, the fuel injection quantity depends on the signal proved by the water temperature sensor.

Structure and Principle: This sensor is a thermistor with negative temperature coefficient (NTC), whose resistance reduces as the coolant temperature rises, and increases as the coolant temperature drops, but it isn't linear. Based on the output signal from the sensor, the ECU monitors the change of water temperature through its internal comparison circuit.

Trouble Diagnosis:

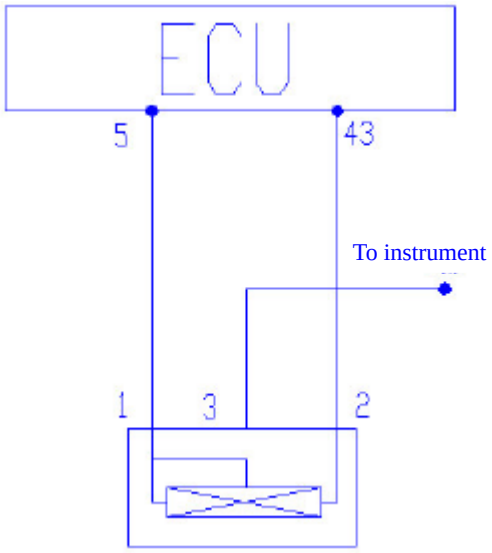
1) The water temperature signal is higher than the limit value;
2) The water temperature signal is lower than the limit value;
3) The open or short circuits of the water temperature sensor.

Resistance value data at normal temperature: 2.5±5%KΩ

Installation Hint: The max. tightening torque is 20 Nm.

Hint: This vehicle is equipped with the three-wire water temperature sensor. This kind of sensor features with the cost-effective and the system consistency.

Profile of a coolant temperature sensor



T11 Water Temperature Sensor

Circuit diagram of coolant temperature sensor

Pin:

This sensor has three pins in total, which can be exchanged each other.

1) No1 (A) for the sensor grounding wire (to Ecu 5#);
2) No 2 (B) for the water temperature sensor signal wire (to ECU 43#);
3) No 2 (C) for the water temperature gauge of the instruments;

The **three wires** of the sensor are respectively:

a. The 5V standard power supply wire;
b. The sensor signal wire (for ECU);
c. The sensor signal wire (for instruments).

Troubleshooting:

1) Mainly examine the short or open circuit between the three wires on sensor and the ECU or instruments.
2) Examine the short or open circuit and the grounding among the harnesses of sensor.
3) Examine the bad wire earth or earth, which easily cause the over-high temperature indicated on the water temperature gauge of the engine.

Characteristic Parameters (Standard Value):

-10℃	**16120Ω**
0℃	**9399Ω**
20℃	**3511Ω**
60℃	**671Ω**
90℃	**241Ω**

Operating Voltage: 5V DC

Opening Temperature Range: -40℃ to 135℃

4. Knock Sensor (KS, KNK)

Application: This sensor is used to provide the ECU with the knock information of the engine to conduct the knock control.

Structure and Principle: The knock sensor is a kind of vibration acceleration sensor mounted on the cylinder body of an engine. It is generally installed between the No 2 cylinder and the No 3 cylinder, which is in favor of the knock balance of the engine. The ECU utilizes the vibration frequency signal output from the knock sensor to determine the knock of the engine through the wave filtering inside the ECU. When the knock signal is detected, the ECU will gradually reduce the knock till there is no knock, and then gradually resume the knock till up to the upper limit of knock. Repeat this procedure above.

Profile of a knock sensor with cable

Trouble Diagnosis: The ECU monitors the knock sensor, power amplification circuit and testing circuit. The fault flag of the knock sensor will be set if one of the following conditions occurs:

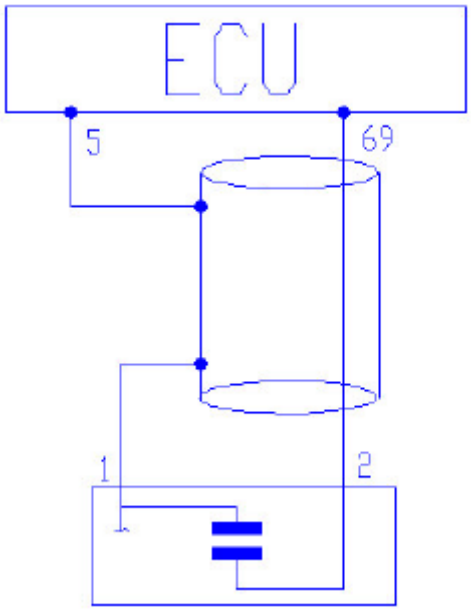
1) The knock sensor fails;
2) The knock control data processing circuit fails;
3) There are some insincere cylinder detection signals;
4) The sensor wire fails.

After the fault flag of the knock sensor is set, the closed-loop control for knocking closes and then the ignition advance angle stored in the ECU is identified as a safety angle by the software program. The fault flag resets when the error frequency drops down to the setting value below.

Installation Hint: The tightening torque is **20 ±5Nm**.

Troubleshooting:

1) Mainly examine the short or open circuit between these two wires on sensor and the corresponding ECU pins.
2) Examine the installation torque of sensor and whether the gaskets are added when the sensor is installed.
3) Examine the bad press fit between the sensor and the cylinder body, or the foreign material between the sensor and the cylinder body.



T11 Knock Sensor

Circuit diagram of the knock sensor

Pin:

1) No 1 (A) for the knock sensor signal 1 (to ECU 5#)
2) No 2 (B) for the knock sensor signal 2 (to ECU 69#)

Operating temperature range: -40℃ to 150℃

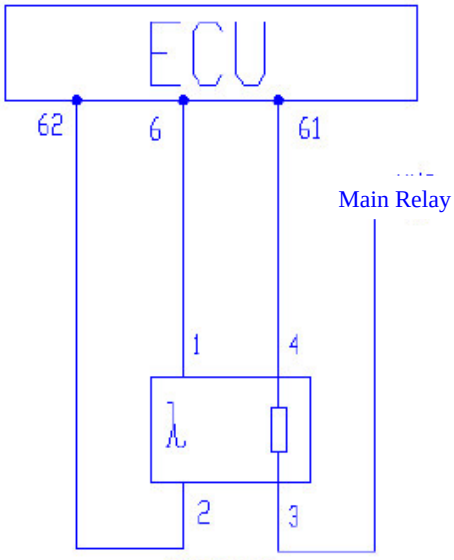
Resistance value: > 1MΩ

5. Oxygen Sensor (O_2S)

Application: This sensor is used to provide the information about weather the oxygen is superfluous after the fuel injected into the engine cylinder fully combust together with air intake. Based on these information, the ECU can conduct the fuel quantitative closed-loop control to convert and purify three main toxic components, i.e. HC, CO and Nox which exist in the engine exhaust, with the help of three-way catalytic converter.

Profile of a oxygen sensor

Structure and Principle: The sensing element of the oxygen sensor is a kind of ceramic tube with small holes, which the outside of tube wall is surrounded by the engine exhaust while the inside is full of air. Based on the oxygen concentration difference between the inside and the outside, the sensor indirectly figure out the pulse width of the fuel injection, transmit the width to the ECU, and then the ECU controls the fuel injection again. At the same time, The output data from the rear oxygen sensor are detected, and, in the ECU, the data from the front and rear oxygen sensors are compared to monitor the operation of three-way catalytic converter.



T11 Oxygen Sensor

Circuit diagram of front oxygen sensor

The operating voltage of the oxygen sensor fluctuates at the range of 0.1 to 0.9 V, and changes 5 to 8 times every 10 seconds. If the change frequency is less than this specified frequency, it indicates that the sensor is aged which needs to replace. This sensor is difficult to repair.

All front oxygen sensors have the cables. The other end of a cable is the electrical connection. There is a layer of asbestos fireproof covering around the outside of the sensor

Trouble Diagnosis:

The ECU detects the oxygen sensor, wires and the power amplification circuit and testing circuit inside ECU. The fault flag of oxygen sensor will be set if one of the following conditions occurs:

1) There is the insincere battery voltage;
2) There are some insincere intake manifold absolute pressure signals;
3) There are some insincere engine coolant temperature signals;
4) The fuel injector driving level fails.

After the fault flag of the oxygen sensor is set, the fuel quantitative closed-loop control closes, and then the basic injection time stored in the ECU is applied to determine the fuel injection quantity.

Installation Hint: The tightening torque of the oxygen sensor is 50 to 60 Nm. After the oxygen sensor is replaced, apply a layer of antirust oil on the new oxygen sensor to avoid that the sensor is difficult to be disassembled after rustiness.

Troubleshooting: Mainly examine the good connection of several wires on the sensor, and the short or open circuit among them.

The damage of sensor is generally caused due to the lead or phosphorus poisoning. So, you shall pay more attention to the fuel quality. At the same time, the excessive consumption of the engine oil also easily creates the sensor failure.

During the specified time interval, the number of the oxygen sensor change shall not be less than the specified number.

Any connection has four pins:

1) No 1 (A) for the oxygen sensor signal low level (to ECU 6#);
2) No 2 (B) for the oxygen sensor signal high level (to ECU 62#);
3) No 3 (C) for the power supply of the main relay;
4) No 4 (D) for the sensor heater wire control (to ECU 61#).

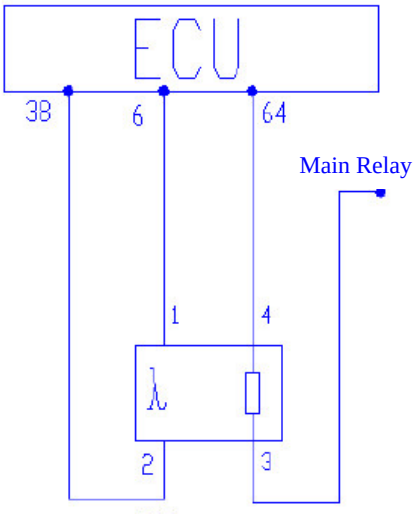
Rear Oxygen Sensor (RO_2S)

The structure and detection of the rear oxygen sensor are similar to the front oxygen sensor, but the purpose that a vehicle equips with the front/rear oxygen sensor is considerably different

Internal structural diagram of a oxygen sensor

Purpose:

Front Oxygen Sensor is mainly used to detect the oxygen content of the exhaust and further determine the fuel injection quantity. The sensor converts the oxygen content of exhaust after combustion into the electric signal, and then transmits the signal to the ECU. The ECU utilizes these signals to control the pulse width of fuel injection, regulate the air-fuel ratio, and indirectly control the exhaust emission of the engine.



T11 Oxygen Sensor

Circuit diagram of rear oxygen sensor

Rear Oxygen Sensor is mainly used to detect the oxygen content of exhaust after the completion of three-way catalytic conversion. The sensor converts this signal into the point signal, and transmits it to the ECU. The ECU compares the signals from the front and rear oxygen sensors and then determines the operation of the three-way catalytic converter.

The **trouble diagnosis, troubleshooting, signal detection** and other characteristics of the rear oxygen sensor are the same as the front oxygen sensor.

Any connection has four pins:

1) No 1 (A) for the oxygen sensor signal low level (to ECU 6#);
2) No 2 (B) for the oxygen sensor signal high level (to ECU 38#);
3) No 3 (C) for the power supply of the main relay;
4) No 4 (D) for the sensor heater wire control (to ECU 64#).

6. Electronic Control Unit (ECU)

Application:

An ECU is an electric engine control center based on the microprocessor, with the sensor signal input interface and actuator drive circuit. It receives and processes the engine status signals from any sensor, and transmits the control signal to the actuators to enable the engine to operate in accordance with the preset procedure. It makes the engine in the optimal condition and ensures the better dynamics, fuel-effective and emission.

Profile of a ECU

Functions:

Multipoint sequential fuel injection system;
Grouping ignition system;
Idle control;
Automatic knock closed-loop control;
Provide sensor with the power supply: 5V/100mA;
λ closed-loop control, with the self-adapting;
Dual oxygen sensors;
Emission canister control;
A/C ECU control;
Engine failure lamp;
Engine speed signal output;
Trouble self-diagnosis, with the flash code function;
Receive the engine load signal.

Normal operating voltage: 9 to 16V

Overvoltage protection: +24V/-12V < 60 s

Structure: with the shielded casing and PCB (Printed Circuit Block). There are a majority of electronic control units in a circuit board, which is applicable for the control of electronic fuel injection system.

Installation: Mounted under the water chute of the front windscreen with the help of a support and vehicle computer (ECU). Pay more attention to waterproof.

Operating temperature: -40℃ to 105℃

Troubleshooting: ECU is an electronic control unit. Due to its lower fault rate, in general, it is not recommended to adapt the ECU replacement to solve all problems. Carefully examine the faults of the periphery circuits, sensors and other components, confirm that there is no fault in the periphery components, and then it is considered to replace the ECU.

7. Electric Fuel Pump (PUMP)

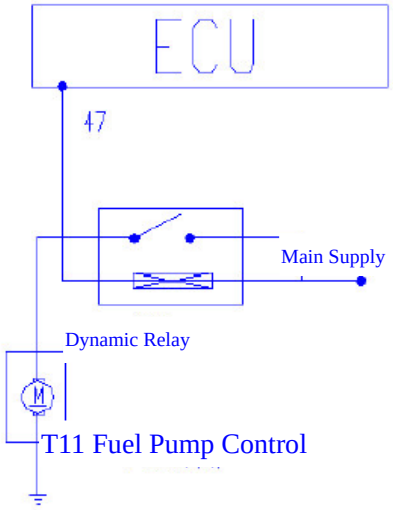
Application: With the specified fuel pressure and flow rate, this pump transmits the fuel from the fuel tank to the engine's main fuel supply pipe, and keeps the stable fuel pressure (by the fuel pressure regulator).

Structure and Principle: The electric fuel pump consists of the DC motor, vane pump, end cover which integrates with the check valve, decompression valve and EMI components) and other elements. The pump is installed coaxially together with the motor, and sealed in the same casing. The maximum pressure of the electric fuel pump outlet depends on the decompression valve, the range of which is **450 kPa** to **650 kPa**. However, the pressure of the whole fuel system depends on the fuel pressure regulator, and, **for the MT 20U electronic fuel injection system, the pressure is generally 350 kPa.**

CAUTION: In case that the fuel tank of a vehicle is short or lack of fuel for a long time, the fuel pump will be difficult to obtain the full lubrication, which makes the fuel pump sintered. Especially, for the engine taking CNG and LPG as its fuel, the fuel tank of this kind of engine is generally in the state of **no fuel** or **lack fuel** for a long time, and its fuel pump fails to be fully lubricated for a long time, which result in the damage of fuel pump.

The temperature of fuel makes more influence on the performance of fuel pump. When the fuel pump operates at the high temperature for a long time and the temperature of fuel is greater than the specified temperature, the fuel pumping pressure of the fuel pump will drop steeply. Thus, if the engine fails to start during the period of vehicle warm up, please carefully examine and confirm whether the high temperature operating performance of the fuel pump is bad.

Profile of a electric fuel pump



Circuit diagram of electric fuel pump

Pin: The electric fuel pump has two pins which connect to the fuel pump relay. There are symbols "+" and "-" stamped on the fuel pump casing near these two pins, which means the connection to the positive and negative electrode respectively.

ECU 46# pin is applied to control the fuel pump relay.

The fuel pump lubricating and cooling are implemented with the help of the gasoline in the fuel tank.

The fuel tank of this vehicle is a saddle-shaped tank, with two fuel pump openings.

Decompression pressure: < 900 kPa

Operating voltage: 8 to 16 V

Fuel pump resistance: < 130 Ω

The injection pump in the reserve tank is used to pump the fuel return to the main fuel tank.

Troubleshooting: The fuel pump failures are generally the fuel pressure shortage, non-pumping and etc. During the period of troubleshooting, examine the fuel pressure of the system is within the specified range, and also examine the leakage of pipeline.

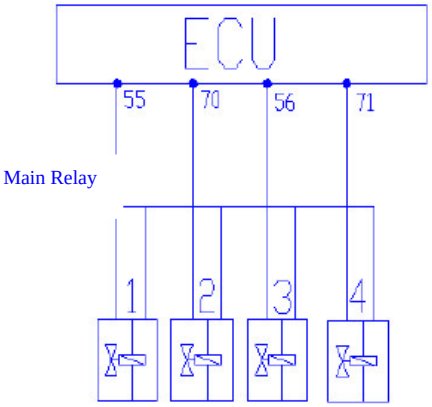
In addition, both the positive and the negative pressure will make influence on the fuel system.

8. Electromagnetic Injector (INJ)

Application: MT 20U employs the sequential fuel injection technology. The sequential injection signals are provided by the intake pressure sensor (TEMP). If the TEMP is damaged, the mode of grouping injection is applied to control the fuel injection in accordance with the ignition sequence. Based on the instructions from ECU, the fuel injector injects the fuel within the specified time, offers engine the fuel and atomizes them.

Structure and Principle: The ECU emits the electrical pulse to the injector coil, which forms the magnetic field force. When the magnetic field force rises up enough to conquer the resultant force of the return spring pressure, gravity force of needle valve and frictional force, the needle valve starts to rise, and the fuel injection process begins. When the fuel injection pulse ends, the pressure of return spring enable the needle valve to be closed again.

Profile of a electromagnetic injector



T11 Fuel Injector Group

Circuit diagram of electromagnetic fuel injector

Installation Hint: For the specified fuel injector, the specified plugs must be applied, without mixing.

To install the injector conveniently, it is recommended to apply the un-silicon c**lean engine oil** on the surface of upper O-ring which connects to the fuel distribution pipe. Pay attention not to let the oil contaminate the interior of fuel injector and its injection hole. During installation, the lower opening of injector must be sealed at all times, otherwise, it is possible to cause the intake system air leak.

Install the fuel injector on the fuel injector mount in the direction vertical to the injector mount, and then use the clips to fix the injector on the fuel injector mount.

CAUTION: For the vehicle out of service for a long term, due to the adhesive of gasoline in the injector, the vehicle will be difficult to start up after a long time of outofcommission. In this case, please examine carefully whether the fuel injector is adhesive.

Trouble Diagnosis: MT 20U electronic fuel injection system doesn't conduct the trouble diagnosis on the fuel injector, but conducts the trouble diagnosis on the fuel injector driver. When there is short circuit between the fuel injector driver and the battery, or short or open circuit between the fuel injector driver and the earth, or the fuel injector driver is overloaded, its fault flag is set. In this case, the oxygen sensor closed-loop control and its self-learning precontrol shall be switched off, and the last self-learning data is effective. The fault flag resets after the completion of troubleshooting.

Pin:

1) No 1 for No 1 cylinder fuel injector control electrode (to ECU 55#);
2) No 2 for No 2 cylinder fuel injector control electrode (to ECU 70#);
3) No 3 for No 3 cylinder fuel injector control electrode (to ECU 56#);
4) No 4 for No 4 cylinder fuel injector control electrode (to ECU 71#).

The other wires of four injectors **connect** together each other, power supply of which is provided through the main relay of engine. The ECU controls the injector earth.

Troubleshooting: Due to the long period of engine operation, it generally results the bad fuel injection and atomization of fuel nozzle. Regularly rinse the fuel nozzle.

The short or open circuit of the internal circuit of fuel nozzle will also cause the fuel injection system failure.

The short or open circuit of the system wires will cause the injection system failure.

Due to the long period of use of unqualified fuel, the fuel will adhesive to the injection hole of nozzle, which easily cause the fault of unstable idle.

Operating pressure: 350 kPa

Resistance of fuel injector: 11 to 16 Ω

Operating temperature: -40 to 130℃

9. Idle Actuator Stepper Motor (IDLE)

Function: Control the air flow area of bypass channel in the throttle valve, and further control the air intake quantity of the engine. Based on the signals from all sensors, the ECU can control the engine speed within the target speed range which can be calibrated in accordance with the **coolant temperature**.

Structure and Principle: In fact, a stepper motor is a micro-motor. Since the coil of motor passes through different directional currents, the motor will rotate in different direction. The rotary shaft of the motor will drive the threaded spindle movement and indirectly control the opening of the valve. MT 20U emits the digital square wave signal to control the ahead-reverse rotation and further control the stroke of the stepper motor.

Trouble Diagnosis: The ECU can monitor the short or open circuit of two coils of the idle stepper motor, and light the engine failure lamp when these troubles occur, which means that the engine switches to the failure mode.

It also monitors the short or open circuit between the four wires of sensor and the ECU.

ECU can't monitor the troubles generated by the mechanical part of the motor.

Troubleshooting: Examine the short or open circuit of four wires connection between the stepper motor and the ECU.

Examine the jamming of the stepper motor.

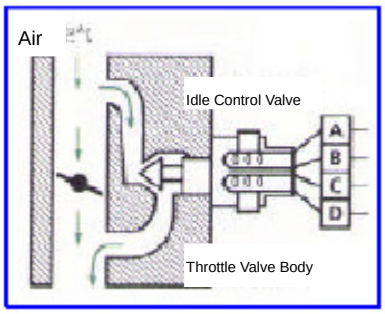
Examine the short or open circuit inside the stepper motor.

Disassemble the stepper motor, power on, and then examine the flexibility of the stepper motor.

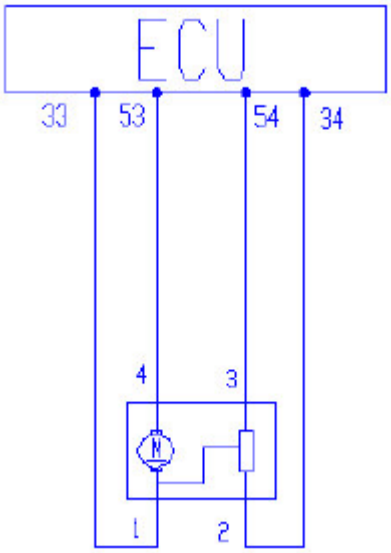
The carbon deposit and dirty material in the intake system will make an influence on the operating performance of stepper motor.

Resistance of motor coil: 58.3 to 47.7 Ω

Operating voltage: 7.5 to 16V



Profile of idle actuator stepper motor



T11 Idle Stepper Motor

Circuit diagram of idle actuator stepper motor

Pin:

1) No 1 (B) for idle actuator stepper motor control (to ECU 33#);
2) No 2 (A) for idle actuator stepper motor control (to ECU 34#);
3) No 3 (D) for idle actuator stepper motor control (to ECU 54#);
4) No 4 (D) for idle actuator stepper motor control (to ECU 53#);

10. Ignition Coil (COIL)

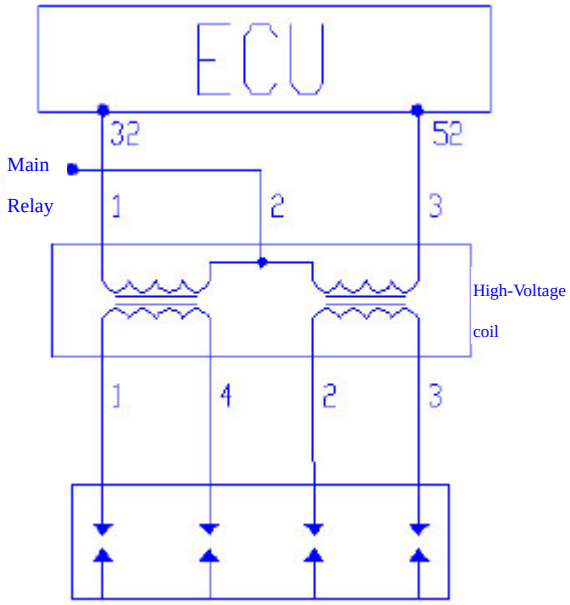
Function: The ignition coil changes the low voltage passing through primary winding to the high voltage through the secondary winding, creates the sparkle with the help of the ignition plug discharge to ignite the fuel-air mixture in the engine.

Structure and Principle: MT 20U adapts the grouping ignition technology, which, based on this principle that the mutual inductance of electromagnetic coils can create higher energy, controls the power on hours and power off time of the primary coil. It applies the high voltage generated in the secondary coil to break down the ignition plug clearance, create strong sparkle and ignite the mixture. Due to there are many ionized airs, lower electrical resistance during the stroke of engine exhaust, only lowest voltage is required to break down the ignition plug clearance. Thus, this system employs the grouping ignition technology, which can't waste the energy and may save cost.

Trouble Diagnosis: The ECU doesn't have the function to conduct the trouble diagnosis on the ignition coil. Thus, if the ignition coil fails to operate, it doesn't create any fault code. Only examination of ignition coil resistance is available to determine the normal operation of ignition coil. In the normal condition, the heating value of ignition coil is great during the operation of the coil, but the over-high temperature of the ignition coil will result in the increase of its resistance value, and further cause the unstable engine operation, automatic stop operation and other failures. However, the ECU can monitor the **control wires** of the ignition coil:

1) Control wires short circuit to earth;
2) Control wires short circuit to power supply;
3) Control wires open circuit.

Profile of ignition coil



T11 Ignition Coil Group

Circuit diagram of ignition coil

Pin:

1) No 1 (C) for the coil primary winding (to ECU 32#);
2) No 2 (A) for the coil primary winding (to ECU 52#);
3) No 3 (B) for the coil power supply (to the main relay of the system)

Measures on troubles: Once one ignition coil failure is detected, close the fuel injector of the corresponding cylinder.

CAUTION: The over-high temperature of ignition coil may cause the bad operation of engine ignition system.

Resistance of ignition coil primary winding: 0.55 to 0.45 KΩ

Resistance of ignition coil secondary winding: 5.6 to 4.8 KΩ

High-voltage side:
These pins No 1, 2, 3 and 4 connect to the ignition plugs of No 1, 2, 3 and 4 engine cylinders respectively via the distribution wire.

Troubleshooting:

1) Short or open circuit inside coil;
2) Electricity leakage of coil, and crack of casing;
3) The coil aging causes the shortage of ignition electricity quantity.

11. Steel Fuel Distributing Pipe Assy.

Application: It is used to store and distribute the fuel supplied from the fuel pump, provide a more stable pressure environment for the fuel injection system to balance the fuel supply pressure and quantity of all cylinders and enable the engine to operate smoothly.

Structure: The fuel distributing pipe assy. consists of a fuel distributing pipe and a fuel injector.

Installation Requirement: The quick connection of fuel outlet/inlet hose and fuel supply pipe must connect reliably. The vehicle shall take a trail run in situ after the repair of fuel system so as to ensure there is no fuel leakage in the fuel system. And, only this, the vehicle can be delivered.

Fuel distributing pipe assy.

Trouble Diagnosis: In normal condition, the probability of the fuel supply main pipe failure is very small. The failures are caused mostly due to the impropriate assembly that enables the fuel system to leak. Thus, you shall pay more attention to the following highlights during assembly: the used O oil-seal shall not be applied again; and some lubricating oils may be applied properly during assembly.

CAUTION:

The pressure must be released firstly before the fuel system is repaired, and it must be ensured that there is no pressure oil in the fuel pipeline. Pull out the connection of fuel pump, and then put on the brake till the vehicle stops. In this case, there is already no pressure oil in this system. After repair, the fuel shall be pumped to the system firstly when the vehicle starts initially, the method of which is: to turn on the ignition switch, and turn off it after the completion of self-checking. Repeat this procedure 3 to 4 times.

12. Crankshaft Position Sensor (Speed Sensor) (CKPS)

Application: The crankshaft position sensor is used to provide the ECU with the engine's **speed, turning angle, top dead center** signals which are applied in the engine ignition, fuel injection and timing system.

Profile of a crankshaft position sensor

Structure and Principle: The MT 20U electronic fuel injection system employs the magnetic induction coil type speed sensor, applies the rotation to cut the magnetic force lines and generate the alternating current and voltage signals. The ECU receives the alternating signals, shapes these signals, and then changes them into the digital signals that can be identified by the ECU and applied in the system control of engine. The flywheel ring gear is installed together with the signal wheel. The latter adapts the 58X gear form, and provides the ECU with **speed, turning angle, top dead center**. There is the No 1 cylinder's top dead center in the continuous gap.

Trouble Diagnosis:

The ECU will real-time monitor the sensors and wires:

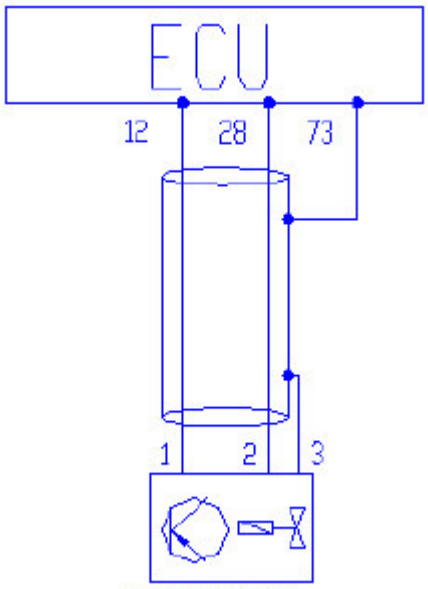
1) The sensors has no signal output;
2) The sensor's output signal is distorted;
3) The sensor signal wire is short circuit;
4) The sensor signal wire is open circuit.

Troubleshooting:

1) Examine the wires of sensor, and the earth or short circuit of wire;
2) Apply the three-way instrument to connect the joints between the sensor and harness and examine the connection of power supply, earth wire and signal wire.

Operating temperature: -40 to 150℃

Clearance between the sensor and ring gear: 0.3 to 1.5 mm
Resistance of sensor: 504to 616Ω



T11 Crankshaft Position Sensor

Circuit diagram of crankshaft position sensor

Pin:

1) No 1 (A) for sensor signal wire high level (to ECU 12#);
2) No 2 (B) for sensor signal wire low level (to ECU 28#);
3) No 3 (C) for sensor earth (to ECU 73#).

13. Canister Control Solenoid Valve (EVAP)

Application: It is used to control the rinse air flow from the canister to the intake main pipe. The adsorptive capacity of the canister is limited. If the evaporated gasoline adhesive to the canister aren't used out, the gasoline will volatilize to the outside and pollute the air as well as increase the insecure factors.

Profile of a canister control solenoid valve

Structure and Principle: There is a solenoid valve organization inside the canister control solenoid valve. The digitalized control pulse square wave from the engine will control the opening of the solenoid valve. Based on the different operation conditions of the engine, the openings of the canister control solenoid valves are different. When the engine is operating with large load and idle, the canister control valve doesn't put into operation in order to ensure the output power of engine.

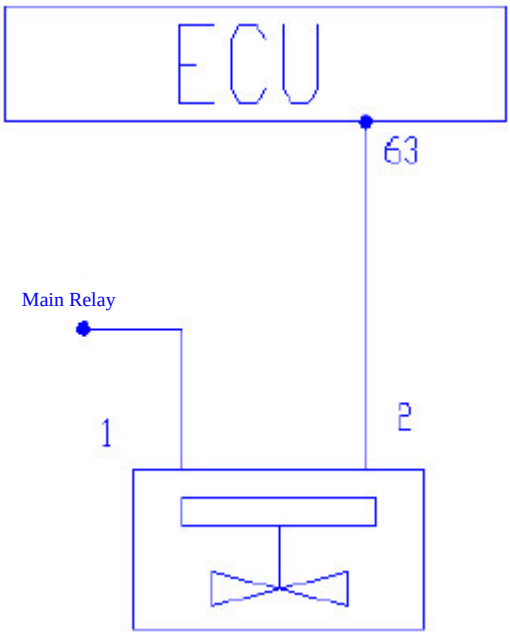
Trouble Diagnosis:

1) The sensor-earth wires are short circuit;
2) The sensor-supply wires are short circuit;
3) The sensor wires are open circuit.

Troubleshooting:

1) Examine the short or open circuit of sensor wires;
2) Examine the wire jumping among harnesses;
3) Examine the short circuit between the sensor and power supply;
4) Examine the jamming inside the canister control solenoid valve and its ventilation.

Operating temperature: -40 to 120℃
Resistance of coil: 19 to 22Ω
Operating voltage: 8 to 16 V
Rated operating voltage: +12V



T11 Canister Control Solenoid Valve

Circuit diagram of canister control solenoid valve

Pin:

1) No 1 (A) for the solenoid valve control (to ECU 63#);
2) No 2 (B) for the power supply of main relay.

14. Air Conditioning Control System (A/C)

Principle: Turn on these A/C switches. If both the A/C pressure and the data detected by the evaporator temperature sensor are normal, the A/C request signal will pass through these switches and get to the ECU. The ECU controls the A/C relay attracting after it detects this signal. At the same time, it gives stepper motor a speed-increasing signal, and switches on the electronic fan. And the A/C system begins to operate.

Conditions to switch off A/C system:

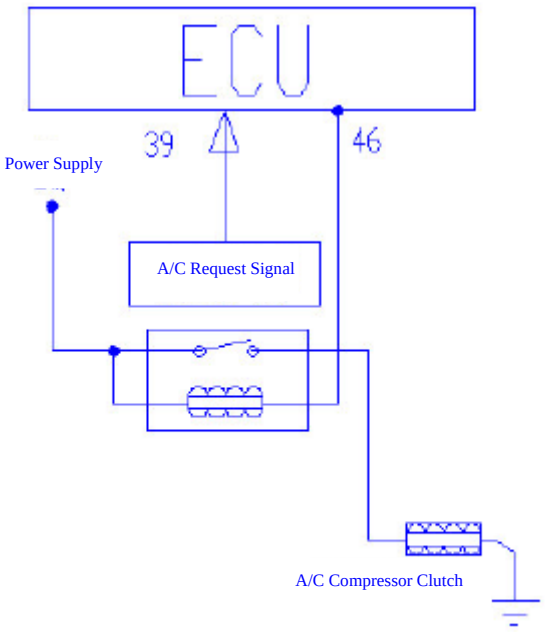
1) Throttle position sensor failure;
2) Vehicle speed sensor failure;
3) When the engine is with large load;
4) Evaporator temperature sensor failure;
5) The evaporator temperature is less than 1.5℃;
6) The engine speed is overspeed;
7) The coolant temperature is greater than 108℃;
8) Refueling is too quick.

Trouble Diagnosis:

1) Short circuit of A/C relay wire to earth;
2) Short circuit of A/C relay wire to power supply;
3) Open circuit of A/C relay wire;
4) Too-low evaporator temperature sensor temperature;
5) Over-high evaporator temperature sensor temperature.

Troubleshooting:

1) Examine the wire of A/C system;
2) Examine the damage of A/C system's evaporator temperature sensor;
3) Examine the wire jumping inside the harness.



Circuit diagram of A/C control system

Pin:

No 1 for the A/C request signal (to ECU 39#);

No 2 for the A/C relay control (to ECU 46#).

15. Fan Control (FAN)

MT 20U controls the fan's low/high speed. Based on the water temperature, air conditioning and other signals, the control system can control the fan's low and high speed operation. If the condition is applicable, the **MT 20U** will control the fan system delay.

Control Mode:

For 1st gear, the fan is switched on at 98℃ and switched off at 94℃;

For 2nd gear, the fan is switched on at 105℃ and switched off at 101℃;

If the water temperature is greater than 101℃ after the fan is switched off, the fan continues to operate for 1 minute;

If the water temperature is greater than 94℃ after the fan is switched off, the fan continues to operate for 0.5 minute;

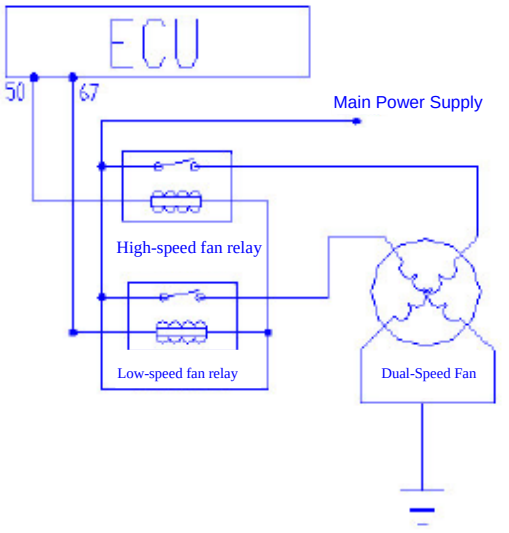
If the water temperature is less than 85℃ after the fan is switched off, the fan stops;

Trouble Diagnosis:

1) Short circuit of high-speed relay wire to power supply;
2) Short circuit of high-speed relay wire to earth;
3) Open circuit of high-speed relay wire;
4) Short circuit of low-speed relay wire to power supply;
5) Short circuit of low-speed relay wire to earth;
6) Open circuit of low-speed relay wire;

Troubleshooting:

In ECU side, examine the short or open circuit of these wires in accordance with the pins shown in the left figure.



Circuit diagram of fan control system

In this figure above, the high/low speed pins are the same as the actual pins. But the actual circuit diagram is different from this circuit diagram above. The latter is for reference only.

16. Definition of ECU Pins

Pin	Connection Point	Type	Pin	Connection Point	Type
1	Ignition switch control fire wire (supply)	Input	2	Unused	
3	Speed signal sensor	Input	4	5V standard power supply	Output
5	5V standard supply earth wire	Earth	6	Front oxygen sensor signal (low level)	Input
7	Unused		8	Unused	
9	Unused		10	Unused	
11	Diagnosis communication	Output	12	Speed sensor signal (high level)	Input
13	Unused		14	Unused	
15	Unused		16	Unused	
17	Battery supply (+12V)	Input	18	Battery supply (+12V)	Input
19	Unused		20	5V standard power supply	Output
21	5V standard power supply earth wire	Earth	22	Unused	
23	Unused		24	Throttle position sensor signal	Input
25	Unused		26	A/C evaporator temperature sensor	Input
27	Intake manifold temperature sensor	Input	28	Speed sensor signal (low level)	Input
29	Unused		30	Diagnosis request	Input
31	Engine failure lamp	Input	32	Ignition switch 1 and 4	Input
33	Idle stepper motor drive coil B	Output	34	Idle stepper motor drive coil A	Output
35	Unused		36	Unused	
37	Unused		38	Rear oxygen sensor signal (low level)	Input
39	A/C request signal	Input	40	Unused	
41	Unused		42	Air intake pressure sensor signal	Input
43	Coolant temperature sensor signal	Input	44	Unused	
45	Engine speed signal	Output	46	A/C relay control	Output
47	Fuel pump relay control	Output	48	Unused	
49	Unused		50	Fan high-speed control	Input
51	Unused		52	Ignition coil 2 and 3	Input
53	Idle stepper motor coil C	Output	54	Idle stepper motor coil D	Output
55	Fuel injector 1#	Input	56	Fuel injector 2#	Input
57	Unused		58	Unused	
59	Unused		60	Unused	
61	Front oxygen sensor heating control	Input	62	Front oxygen sensor signal (high level)	Input
63	Canister control solenoid valve control	Input	64	Rear oxygen sensor heating control	Input
65	Unused		66	Unused	
67	Fan low-speed control	Input	68	Unused	
69	Knock sensor signal	Input	70	Fuel injector 3#	Input
71	Fuel injector 4#	Input	72	Unused	
73	Motive earth	Earth	No		

Section Ⅱ Basic Principles of Trouble Diagnosis

1. Basic Principles

1) Failure Information Record

MT 20U electronic control unit continuously detect sensors, actuators, related circuits, failure lamps, battery voltage and etc, even detect the electronic control unit itself, and conduct the reliability detection on the sensor output signal, actuator drive signal and internal signal (such as oxygen closed-loop control, knock control, idle speed control, battery voltage control and etc.). Once one failure in a certain process occurs, or one signal value is unreliable, the electronic control unit will immediately set a failure information record in the failure register of RAM. The failure information record will be stored with the form of failure code, and displayed in the sequence of failure occurrence.

These failures can be divided into "**Stable Failure**" and "**Chance Failure**" (such as the failures caused by the transient harness short-circuit or the bad contact of connecting parts) in accordance with their frequency of occurrence.

2) Failure State

If the duration of a identified failure occurrence is initially greater than the setting stabilized time, the ECU will confirm it is a stable failure, and store it as the "Stable Failure". If this failure disappears, it will be stored as "Chance Failure" and "Nonexistent". If this failure is identified again, it still be a "Chance Failure", but a "existent" history failure doesn't make an influence on the normal operation of a engine.

3) Failure Type

a. Short circuit to the positive electrode of power supply;

b. Short circuit to earth;

c. Open circuit;

d. Signal unreliable.

4) Four Failure Types

Failures of All Electronic Fuel Injection Vehicle Are Basically Defined As These Types.

a. Max. failure, which means its signal is greater than the upper limit of normal range.

b. Min. failure, which means its signal is less than the lower limit of normal range.

c. Signal failure, without signal.

d. Unreasonable failure, with signal, but the signal is unreasonable.

5) Limp-home

For some identified important failures, when their duration exceeds the setting stabilized time, the ECU will apply appropriate software countermeasure to maintain the operation of the engine and enable the vehicle not to stop in its way.

6) Failure Alarm

MT 20U electronic fuel injection system is equipped with a failure lamp. When some important parts, such as the ECU, intake manifold absolute pressure sensor, throttle position sensor, coolant temperature sensor, knock sensor, oxygen sensor, fuel injector, two drivers of idle actuator stepper motor, A/C relay, fan relay and etc, fail to operate and the corresponding failure flags are set, the ECU will enable the failure lamp to flash and give alarm to warn the owner of the vehicle that your vehicle has already entered into the failure mode, till the failure flag is reset.

7) Definition of Diagnosis Connector Interface

Definition of Diagnosis Connector Interface

8	NULL	16	+12 V
7	Communication	15	NULL
6	NULL	14	NULL
5	Earth Wire	13	NULL
4	Earth Wire	12	NULL
3	NULL	11	NULL
2	NULL	10	NULL
1	Diagnosis	9	NULL

8) Failure Readout by Engine Failure Lamp

When the engine system or its components failure occurs during the operation of engine, the engine failure lamp will light automatically to remind the driver to examine and repair his/her vehicle in time.

During the emergency failure handling, you also may conduct some special operations to enable the engine failure lamp to flash frequently so as to read the engine failure code, which is the most economical means to obtain the failure code. Its operation method is as follows:

Examine and Confirm:

a. The voltage of battery shall ensure the engine gets its startup speed;

b. The engine and the whole vehicle’s accessories shall be in the state of shutdown;

c. The throttle is fully closed;

d. The transmission is placed in the neutral gear;

e. The ignition switch is turned off;

f. Apply wires to enable the **diagnosis request terminal 1** of the **failure diagnosis connectors** to short circuit with the **earth wire terminal 4** or **5**;

g. Turn the ignition switch to ON, but don't start up the engine;

In this case, if the system currently has a **failure** or a **history failure code** uncleared after the failure removal, the engine failure lamp will flash in accordance with a certain rule, and the output system detects the code of failure; (the failure code is read out and, at the same time, the **idle control valve** will conduct the reset action);

After the completion of failure code readout, the ignition switch is turned off and the diagnosis request short-circuit wire is removed;

The rules that the failure lamp flashes to report the failure are:

- Report the failure in accordance with the sequence of failure code memorized;
- 3.2 s pause between two failure codes. The digits flash at the frequency of light for 0.4 s and extinguish for 0.4s, with 1.2 s pause between two digits;
- The number 0 flashes10 times, and other numbers corresponds to the flash numbers;
- Taking the failure code 0110 and 0443 as an example:

Diagnosis request short circuit to earth → Turn on the ignition switch →

Failure lamp flashes for one time → Pause for 3.2s → 10 times → Pause for 1.2s →

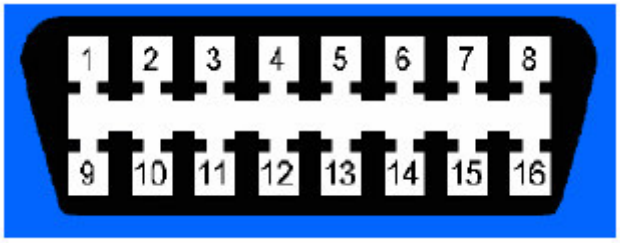
1 time → Pause for 1.2s → 10 times → Pause for 3.2s → 10 times → Pause for 1.2s →

4 times → Pause for 1.2s → 4 times → Pause for 1.2s → 3 times →

Pause for 3.2s

→ If the diagnosis request doesn't interrupt, restart to report 0110 failure code ……

CAUTION: After the removal of failure, it is recommended to apply the failure diagnosis instrument to clear these failure codes so as not to make an influence on the failure detection during the next repair.



ISO 9141-2 Standard Diagnosis Connector

9) Removal of Failure Information Record

After a failure is removed, the failure information record stored in a memory shall be cleared.

Although failure information has occurred when the ignition switch is turned on, it isn't recorded if it isn't kept up to the end of stabilized time.

After the engine starts up successfully the specified times, the failure code will be cleared automatically.

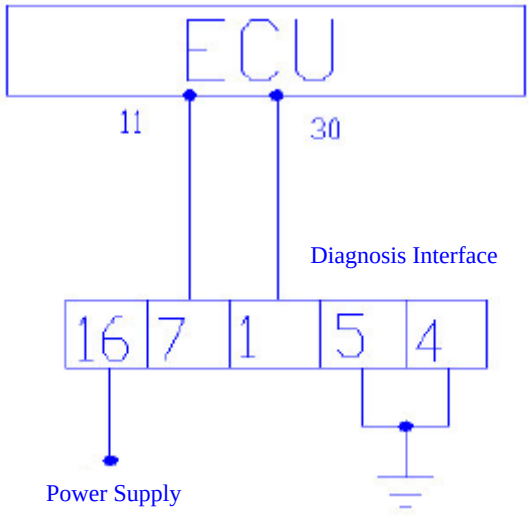
Apply a failure diagnosis instrument and the "Failure Memory Reset" instruction to clear the failure information record.

Pull out the connector from ECU or remove the wires of battery to clear the failure information record stored in the external RAM.

10) Failure Search

After a failure information record is obtained with the help of the means above, only the approximate location where the failure occurs is known, but it doesn't mean that the failure is found because the reason to create a failure information may be the damage of a electrical component (such as sensor or actuator or ECU, etc.), open circuit of a wire, short circuit of a wire to earth or the positive electrode of battery, even may be a mechanical fault.

The failure is inherent, and its external expressive results are various kinds of symptoms. After a symptom is found, it is required firstly to use a failure diagnosis instrument or some flash codes to check whether there are some failure information records. And, based on these information records, the related failure shall be removed. Then, you can search the failure in accordance with the symptom of the engine.



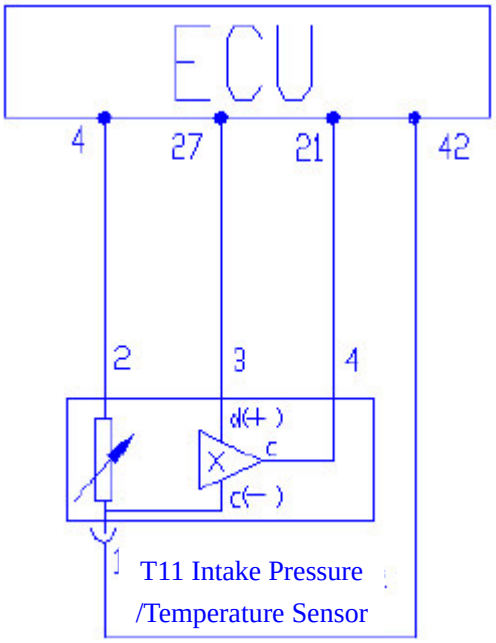
2. Engine Failure Code Table

Delphi MT 20U Engine Management System Failure Code Table

Code	Description	Code	Description
P0105-1	Over-high intake manifold absolute pressure sensor signal	P0443-1	Short-circuit between the wire of canister control solenoid valve and the positive of electrode power supply
P0105-2	Too-low intake manifold absolute pressure sensor signal	P0443-2	Open circuit of the wire of canister control solenoid valve or short circuit to earth
P0110-1	Too-low intake temperature sensor signal	P0480-1	Short circuit of radiator low-speed fan relay drive circuit to the positive electrode of power supply
P0110-2	Over-high intake temperature sensor signal	P0480-2	Open circuit of radiator low-speed fan relay drive circuit or short circuit to earth
P0115-1	Too-low coolant temperature sensor signal	P0481-1	Short circuit of radiator high-speed fan relay drive circuit to the positive electrode of power supply
P0115-2	Over-high coolant temperature sensor signal	P0481-2	Open circuit of radiator high-speed fan relay drive circuit or short circuit to earth
P0120-1	Over-high throttle position sensor signal	P0482-1	Short circuit of A/C cooling fan relay drive circuit to the positive electrode of power supply
P0120-2	Too-low throttle position sensor signal	P0482-2	Open circuit of A/C cooling fan relay drive circuit or short circuit to earth
P0130-4	No oxygen sensor signal	P0500-0	No vehicle speed sensor signal
P0135-1	Short circuit of oxygen sensor heating circuit to the positive electrode of power supply	P0505-0	Idle control error
P0135-2	Open circuit of oxygen sensor heating circuit or short circuit to earth	P0560-1	Over-high system voltage
P0170-1	Over-long oxygen sensor indication of time of rich air-fuel-ratio	P0607-0	Knock control system failure
P0170-2	Over-long oxygen sensor indication of time of lean air-fuel-ratio	P0650-1	Short circuit between the failure lamp wire and the positive electrode of power supply
P0201-0	Fuel injector A (No 1 cylinder) circuit failure	P0650-2	Open circuit of the failure lamp wire or short circuit to earth
P0202-0	Fuel injector B (No 3 cylinder) circuit failure	P1230-1	Short circuit of main relay circuit to the positive electrode of power supply
P0203-0	Fuel injector C (No 4 cylinder) circuit failure	P1230-2	Open circuit of main relay circuit or short circuit to earth

P0204-0	Fuel injector D (No 2 cylinder) circuit failure	P1530-1	Short circuit of A/C compressor relay circuit to the positive electrode of power supply
P0230-1	Short circuit of fuel pump relay to the positive electrode of power supply	P1530-2	Open circuit of A/C relay circuit or short circuit to earth
P0230-2	Open circuit of fuel pump relay or short circuit to earth	P1604-0	EEPROM error
P0325-0	Bad connection to the knock sensor	P1610-0	Anti-theft controller error
P0335-0	No 58X crankshaft position sensor signal	P1610-8	ECM and anti-theft controller communication error
P0335-8	58X crankshaft position sensor signal error	P2000-1	Over-high temperature of front A/C evaporator
P0342-0	Low camshaft position signal	P2000-2	Too-low temperature of front A/C evaporator
P0342-2	High camshaft position signal	P2001-1	Over-high temperature of rear A/C evaporator
P0351-1	Short circuit between the ignition coil 1-4 cylinder drive circuit and the positive electrode of power supply	P2001-2	Too-low temperature of rear A/C evaporator
P0351-2	Open circuit of the ignition coil 1-4 cylinder drive circuit or short circuit to earth	P2100-2	Short circuit of rear A/C trip relay to battery
P0352-1	Short circuit between the ignition coil 2-3 cylinder drive circuit and the positive electrode of power supply	P2100-8	Open circuit of rear A/C trip relay or short circuit to earth
P0352-2	Open circuit of the ignition coil 2-3 cylinder drive circuit or short circuit to earth		

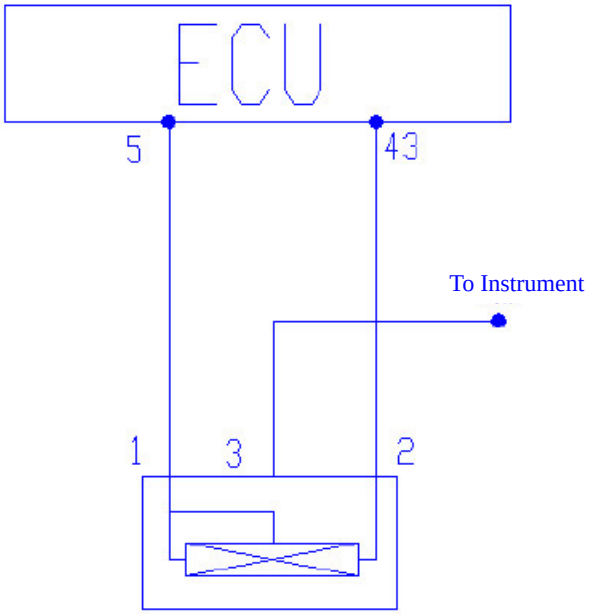
3. Method of Trouble Shooting



Failure Code:	**P0105-1**	**Over-high intake manifold absolute pressure sensor signal**			
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● When the engine stops: 90 kPa ● When the engine idles: = 45 kPa ● When the engine operates: the pressure of manifold changes as the opening of throttle ● If the cylinder pressure detection technology is applied, there is 50% of probability that the fuel injection sequence has 360 degree of ram off.			
Connection terminal:		MT 20U		Pressure/Temperature Sensor	Normal Measurement Signal
5V reference voltage:		04		B	5V
Manifold pressure signal:		42		A	0.5 to 4.5V
Sensor signal earth:		21		D	0V
Condition for Determination		Possible Reason			Actions
Engine operation No TPS failure MAP > 98.117 kPa TPS < 19.141% Failure duration > 2.5 s		1) Short circuit of harness pressure signal circuit to 5V reference voltage circuit or the positive electrode of power supply 2) Sensor damaged 3) ECM's pressure signal input interface failure			1) Repair harness 2) Replace sensor 3) Replace ECM

<table>
<tr><td colspan="2">Failure Code: P0105-2</td><td colspan="4">Too-low intake manifold absolute pressure sensor signal</td></tr>
<tr><td colspan="2">Set emergency control scheme:</td><td colspan="4">● Switch on the failure lamp till the failure disappears
● When the engine stops: 90 kPa
● When the engine idles: = 45 kPa
● When the engine operates: the pressure of manifold changes as the opening of throttle
● If the cylinder pressure detection technology is applied, there is 50% of probability that the fuel injection sequence has 360 degree of ram off.</td></tr>
<tr><td colspan="2">Connection terminal:</td><td>MT 20U</td><td></td><td>Pressure/Temperature Sensor</td><td>Normal Measurement Signal</td></tr>
<tr><td colspan="2">5V reference voltage:</td><td>04</td><td></td><td>B</td><td>5V</td></tr>
<tr><td colspan="2">Manifold pressure signal:</td><td>42</td><td></td><td>A</td><td>0.5 to 4.5V</td></tr>
<tr><td colspan="2">Sensor signal earth:</td><td>21</td><td></td><td>D</td><td>0V</td></tr>
<tr><td colspan="2">Condition for Determination</td><td colspan="3">Possible Reason</td><td>Actions</td></tr>
<tr><td colspan="2">No TPS failure
MAP < 14.047 kPa
RPM < 1050 rpm
TPS > 18.75%
Failure duration > 2.5 s</td><td colspan="3">1) Unreliable connection of the connecting parts
2) Open circuit of harness pressure signal circuit
3) Short circuit of harness pressure signal circuit to earth
4) Open circuit of 5V reference voltage circuit
5) Open circuit of sensor signal earth wire
6) Harness 5V reference voltage direction is reverse with the reference earth wire (this failure may cause the damage of sensor)
7) Sensor damaged
8) ECM’s pressure signal input interface failure</td><td>1) Connect again
2) Repair harness
3) Repair harness
4) Repair harness
5) Repair harness
6) Repair harness
7) Replace sensor
8) Replace ECM</td></tr>
</table>

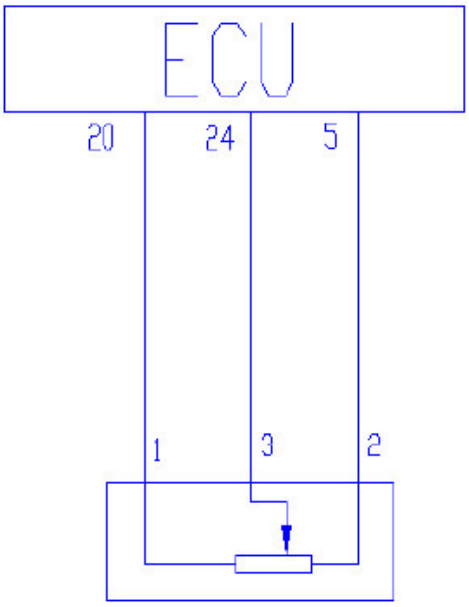
<table>
<tr><td colspan="2">Failure Code: P0110-1</td><td colspan="5">Too-low intake temperature sensor signal</td></tr>
<tr><td colspan="2">Set emergency control scheme:</td><td colspan="5">● Switch on the failure lamp till the failure disappears
● The air intake temperature shall be equal to the coolant temperature, but not more than 44.25℃</td></tr>
<tr><td colspan="2">Connection terminal:</td><td>MT 20U</td><td></td><td colspan="2">Pressure/Temperature Sensor</td><td>Normal Measurement Signal</td></tr>
<tr><td colspan="2">Intake temperature signal:</td><td>27</td><td></td><td colspan="2">C</td><td>0.5 to 4.5V</td></tr>
<tr><td colspan="2">Sensor signal earth:</td><td>21</td><td></td><td colspan="2">D</td><td>0V</td></tr>
<tr><td colspan="2">Condition for Determination</td><td colspan="4">Possible Reason</td><td>Actions</td></tr>
<tr><td colspan="2">Engine operation time > 120 s
MAT < -38.25℃
Failure duration > 2 s</td><td colspan="4">1) Unreliable connection of the connecting parts
2) Open circuit of temperature signal circuit
3) Open circuit of sensor signal earth
4) Short circuit of temperature signal wire to the positive electrode of power supply
5) Sensor damaged
6) ECM’s this signal input interface failure</td><td>1) Connect again
2) Repair harness
3) Repair harness
4) Repair harness
5) Replace sensor
6) Replace ECM</td></tr>
<tr><td colspan="2">Failure Code: P0110-2</td><td colspan="5">Over-high intake temperature sensor signal</td></tr>
<tr><td colspan="2">Set emergency control scheme:</td><td colspan="5">● Switch on the failure lamp till the failure disappears
● The air intake temperature shall be equal to the coolant temperature, but not more than 44.25℃</td></tr>
<tr><td colspan="2">Connection terminal:</td><td>MT 20</td><td>MT 20U</td><td>Intake Temp. Sensor</td><td>Pressure/Temperature Sensor</td><td>Normal Measurement Signal</td></tr>
<tr><td colspan="2">Intake temperature signal:</td><td>35</td><td>27</td><td></td><td>C</td><td>0.5 to 4.5V</td></tr>
<tr><td colspan="2">Sensor signal earth:</td><td>28</td><td>21</td><td></td><td>D</td><td>0V</td></tr>
<tr><td colspan="2">Condition for Determination</td><td colspan="3">Possible Reason</td><td>Actions</td></tr>
<tr><td colspan="2">Engine operation time > 60 s
MAT > 148.5℃
Failure duration > 2 s</td><td colspan="3">1) Short circuit of temperature signal circuit to earth
2) Sensor damaged
3) ECM’s this signal input interface failure</td><td>1) Repair harness
2) Replace sensor
3) Replace ECM</td></tr>
</table>



T11 Water Temperature Sensor

Failure Code:	**P0115-1**	**Too-low coolant temperature sensor signal**			
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● Apply the intake temperature during startup, gradually increase up to 79.5℃ and then keep this temperature.			
Connection terminal:		MT 20U		Coolant Temperature Sensor	Normal Measurement Signal
Coolant temperature signal:		43		B	0.5 to 4.5V
Sensor signal earth:		05		A	0V
Condition for Determination		Possible Reason			Actions
Engine operation time > 10 s CTS < -38.25℃ Failure duration > 2 s		1) Unreliable connection of the connecting parts 2) Open circuit of temperature signal circuit 3) Open circuit of sensor signal to earth 4) Short circuit of temperature signal circuit to the positive electrode of power supply 5) Sensor damaged 6) ECM's this signal input interface failure			1) Connect again 2) Repair harness 3) Repair harness 4) Repair harness 5) Replace sensor 6) Replace ECM

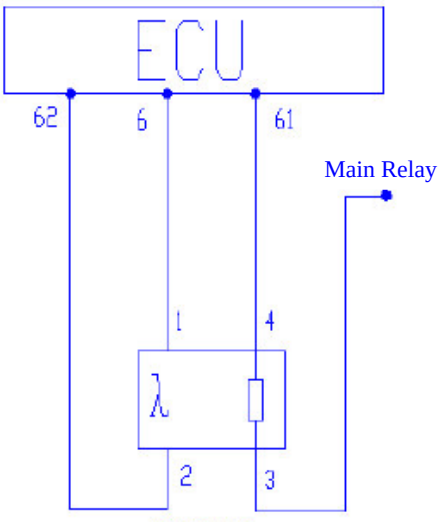
<table>
<tr><td colspan="2">Failure Code: P0115-2</td><td colspan="4">Over-high coolant temperature sensor signal</td></tr>
<tr><td colspan="2">Set emergency control scheme:</td><td colspan="4">● Switch on the failure lamp till the failure disappears
● Apply the intake temperature during startup, gradually increase up to 79.5℃ and then keep this temperature.</td></tr>
<tr><td>Connection terminal:</td><td>MT 20</td><td>MT 20U</td><td></td><td>Coolant Temperature Sensor</td><td>Normal Measurement Signal</td></tr>
<tr><td>Coolant temperature signal:</td><td>34</td><td>43</td><td></td><td>B</td><td>0.5 to 4.5V</td></tr>
<tr><td>Sensor signal earth:</td><td>37</td><td>05</td><td></td><td>A</td><td>0V</td></tr>
<tr><td colspan="2">Condition for Determination</td><td colspan="3">Possible Reason</td><td>Actions</td></tr>
<tr><td colspan="2">Engine operation time > 2 s
CTS > 135℃
Failure duration > 2 s</td><td colspan="3">1) Short circuit of temperature signal circuit to earth
2) Sensor damaged
3) ECM’s this signal input interface failure</td><td>1) Repair harness
2) Replace sensor
3) Replace ECM</td></tr>
</table>



T11 Throttle Position Sensor

Failure Code:	**P0120-1**	**Over-high throttle sensor signal**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● During idle, set the opening of throttle position sensor as 0%; for other speeds, the opening of throttle position sensor changes as speed. ● The throttle position sensor automatic reset function pauses ● The function to clear the remained fuel and air in a cylinder pauses.		
Connection terminal:		MT 20U	Throttle Position Sensor	Normal Measurement Signal
5V reference voltage:		20	A	5V
Throttle position signal:		24	C	0.5 to 4.5V
Sensor signal earth:		05	B	0V
Condition for Determination		Possible Reason		Actions
Engine operation, but speed < 3000 rpm No MAP failure, and MAP < 70 kPa Failure duration > 2 s		1) Short circuit of sensor signal circuit to the positive electrode of power supply or the 5V reference voltage circuit 2) Sensor damaged 3) ECM's this signal input interface failure		1) Repair harness 2) Replace sensor 3) Replace ECM

<table>
<tr><td colspan="2">Failure Code: P0120-2</td><td colspan="3">Too-low throttle sensor signal</td></tr>
<tr><td colspan="2">Set emergency control scheme:</td><td colspan="3">● Switch on the failure lamp till the failure disappears
● During idle, set the opening of throttle position sensor as 0%; for other speeds, the opening of throttle position sensor changes as speed.
● The throttle position sensor automatic reset function pauses
● Clear function pauses.</td></tr>
<tr><td>Connection terminal:</td><td>MT 20</td><td>MT 20U</td><td>Throttle Position Sensor</td><td>Normal Measurement Signal</td></tr>
<tr><td>5V reference voltage:</td><td>36</td><td>20</td><td>A</td><td>5V</td></tr>
<tr><td>Throttle position signal:</td><td>26</td><td>24</td><td>C</td><td>0.5 to 4.5V</td></tr>
<tr><td>Sensor signal earth:</td><td>37</td><td>05</td><td>B</td><td>0V</td></tr>
<tr><td colspan="2">Condition for Determination</td><td colspan="2">Possible Reason</td><td>Actions</td></tr>
<tr><td colspan="2">Failure duration > 2 s</td><td colspan="2">1) Unreliable connection of the connecting parts
2) Open circuit of sensor signal circuit
3) Short circuit of sensor signal circuit to earth
4) Sensor damaged
5) ECM’s this signal input interface failure</td><td>1) Connect again
2) Repair harness
3) Repair harness
4) Replace sensor
5) Replace ECM</td></tr>
</table>



T11 Oxygen Sensor

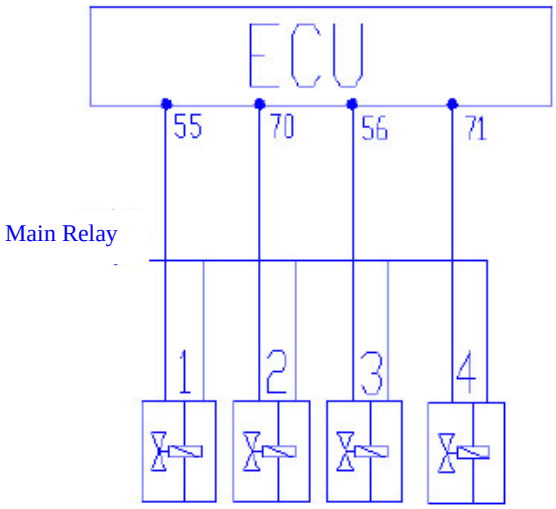
Failure Code:	**P0130-4**	**No oxygen sensor signal**			
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● The air-fuel-ratio can't be closed-loop controlled			
Connection terminal:		MT 20U	Heating-type Oxygen Sensor		Normal Measurement Signal
System main power supply:		\	C		12V
Heating drive:		61	D		0V
Oxygen sensor's high signal:		62	B		0 to 1000mV fluctuation
Oxygen sensor's low signal:		06	A		0V
Condition for Determination		Possible Reason			Actions
360.24mV < oxygen sensor signal < 538.19mV Engine operation time > 40 s No TPS and MAP failure Coolant temperature > 72℃ Enter the closed-loop fuel control state TPS > 10.156% Failure duration > 15 s		1) Unreliable connection of the connecting parts 2) Open circuit of sensor signal circuit 3) Sensor poisoning or failure due to over-heating 4) ECM's this signal input interface failure			1) Connect again 2) Repair harness 3) Replace sensor 4) Replace ECM

Failure Code:	**P0135-1**	**Short circuit of oxygen sensor heating circuit to the positive electrode of power supply**			
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears, and turn off the ignition switch ● System closed-loop operating time postponed			
Connection terminal:		MT 20U	Heating-type Oxygen Sensor		Normal Measurement Signal
System main power supply:		\	C		12V
Heating drive:		61	D		0V
Oxygen sensor's high signal:		62	B		0 to 1000mV fluctuation
Oxygen sensor's low signal:		06	A		0V
Condition for Determination		Possible Reason			Actions
Failure duration > 1 s		1) Short circuit of heating drive circuit to the positive electrode of power supply 2) Sensor damaged 3) ECM's this signal input interface failure			1) Repair harness 2) Replace sensor 3) Replace ECM

Failure Code:	**P0135-2**	**Open circuit of oxygen sensor heating circuit or short circuit to earth**			
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears, and turn off the ignition switch ● System closed-loop operating time postponed			
Connection terminal:		MT 20U	Heating-type Oxygen Sensor		Normal Measurement Signal
System main power supply:		\	C		12V
Heating drive:		61	D		0V
Oxygen sensor's high signal:		62	B		0 to 1000mV fluctuation
Oxygen sensor's low signal:		06	A		0V
Condition for Determination		Possible Reason			Actions
No main relay failure Failure duration > 1 s		1) Unreliable connection of the connecting parts 2) Open circuit of harness's this heating drive circuit 3) Short circuit of harness's this heating drive circuit to earth 4) Sensor damaged 5) ECM's this signal input interface failure			1) Connect again 2) Repair harness 3) Repair harness 4) Replace sensor 5) Replace ECM

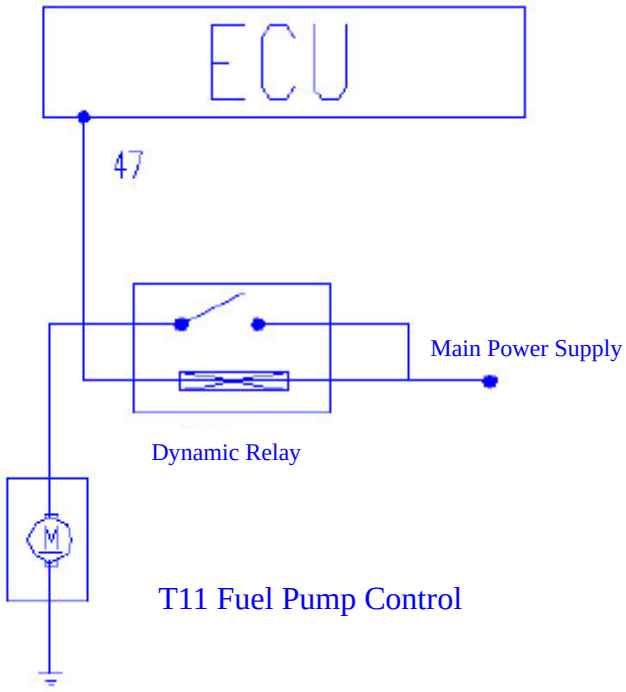
Failure Code:	**P0170-1**	**Over-long oxygen sensor indication of time of rich air-fuel-ratio**			
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● The air-fuel-ratio can't be closed-loop controlled			
Connection terminal:		MT 20U	Heating-type Oxygen Sensor		Normal Measurement Signal
System main power supply:		\	C		12V
Heating drive:		61	D		0V
Oxygen sensor's high signal:		62	B		0 to 1000mV fluctuation
Oxygen sensor's low signal:		06	A		0V
Condition for Determination		Possible Reason			Actions
Oxygen sensor signal > 998.26mV Engine operation time > 40 s No TPS and MAP failure Coolant temperature > 72℃ Enter the closed-loop fuel control state TPS > 10.156% Failure duration > 15 s		1) Short circuit of sensor signal circuit to 5V or 12V circuit 2) Sensor damaged 3) ECM's this signal input interface failure			1) Repair harness 2) Replace sensor 3) Replace ECM

Failure Code:	**P0170-2**	**Over-long oxygen sensor indication of time of lean air-fuel-ratio**			
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● The air-fuel-ratio can't be closed-loop controlled			
Connection terminal:		MT 20U	Heating-type Oxygen Sensor		Normal Measurement Signal
System main power supply:		\	C		12V
Heating drive:		61	D		0V
Oxygen sensor's high signal:		62	B		0 to 1000mV fluctuation
Oxygen sensor's low signal:		06	A		0V
Condition for Determination		Possible Reason			Actions
Oxygen sensor signal < 52.083mV Engine operation time > 40 s No TPS and MAP failure Coolant temperature > 72℃ Enter the closed-loop fuel control state TPS > 10.156% Failure duration > 15 s		1) Short circuit of sensor signal circuit to earth 2) Sensor high/low signal circuit reverse 3) Sensor damaged 3) ECM's this signal input interface failure			1) Repair harness 2) Repair harness 3) Replace sensor 4) Replace ECM



T11 Fuel Injector Group

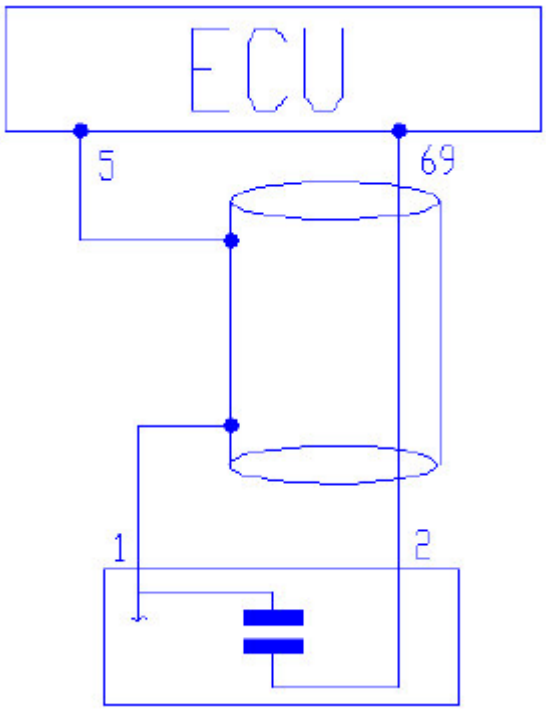
Failure Code:	**P0201-0**	**Fuel injector A (No 1 cylinder) circuit failure**		
	P0202-0	**Fuel injector B (No 3 cylinder) circuit failure**		
	P0203-0	**Fuel injector C (No 4 cylinder) circuit failure**		
	P0204-0	**Fuel injector D (No 2 cylinder) circuit failure**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL		
Connection terminal:		MT 20U	Fuel Nozzle	Normal Measurement Signal
System main power supply:		\	A	12V
Fuel injector A (No 1 cylinder):		55	B	0 to 12V approx. square
Fuel injector B (No 3 cylinder):		56	B	0 to 12V approx. square
Fuel injector C (No 4 cylinder):		71	B	0 to 12V approx. square
Fuel injector D (No 2 cylinder):		70	B	0 to 12V approx. square
Condition for Determination		Possible Reason		Actions
Ignition switch is turn on Fuel pump operation normal Ignition voltage > 10V		1) Short circuit of corresponding nozzle circuit to the positive electrode of power supply or to earth 2) Open circuit of corresponding nozzle circuit 3) Unreliable Sensor high/low signal circuit reverse 4) Nozzle circuit damaged 5) ECM's this signal output interface failure		1) Repair harness 2) Repair harness 3) Connect again 4) Replace 5) Replace ECM



T11 Fuel Pump Control

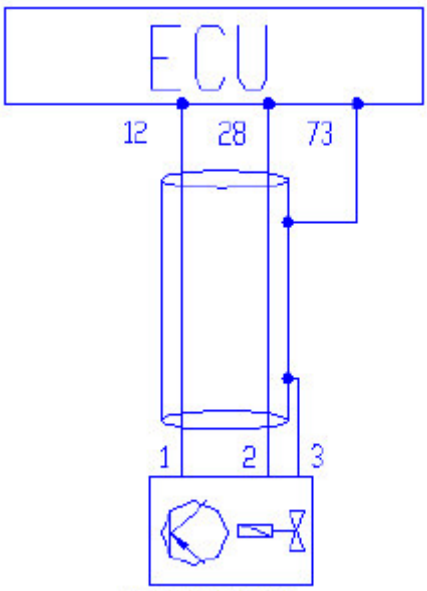
Failure Code:	P0230-1	**Short circuit of fuel pump relay to the positive electrode of power supply**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL		
Connection terminal:		MT 20U	Fuel Pump Relay	Normal Measurement Signal
System main power supply:		\	Refer to Electrical System Description	12V
Relay drive:		47	Refer to Electrical System Description	0V (Operating) and 12V (Stop)
Condition for Determination		Possible Reason		Actions
Failure duration > 1.5625 s		1) Short circuit of relay drive circuit to the positive electrode of power supply 2) Relay damaged 3) ECM's this signal output control interface failure		1) Repair harness 2) Replace relay 3) Replace ECM

<table>
<tr><td colspan="2">Failure Code: P0230-2</td><td colspan="3">Open circuit of fuel pump relay or short circuit to earth</td></tr>
<tr><td colspan="2">Set emergency control scheme:</td><td colspan="3">● Switch on the failure lamp till the failure disappears
● NULL</td></tr>
<tr><td colspan="2">Connection terminal:</td><td>MT
20U</td><td>Fuel Pump Relay</td><td>Normal Measurement Signal</td></tr>
<tr><td colspan="2">System main power supply:</td><td>\</td><td>Refer to Electrical System Description</td><td>12V</td></tr>
<tr><td colspan="2">Relay drive:</td><td>47</td><td>Refer to Electrical System Description</td><td>0V (Operating) and 12V (Stop)</td></tr>
<tr><td colspan="2">Condition for Determination</td><td colspan="2">Possible Reason</td><td>Actions</td></tr>
<tr><td colspan="2">Failure duration > 1.5625 s</td><td colspan="2">1) Unreliable connection of the connecting parts
2) Open circuit of the connection system main power supply circuit
3) Short circuit of relay drive circuit to the negative electrode of power supply
4) Open circuit of relay drive circuit
5) Relay damaged
6) ECM’s this signal output control interface failure</td><td>1) Connect again
2) Repair harness
3) Repair harness
4) Repair harness
5) Replace relay
6) Replace ECM</td></tr>
</table>



T11 Knock Sensor

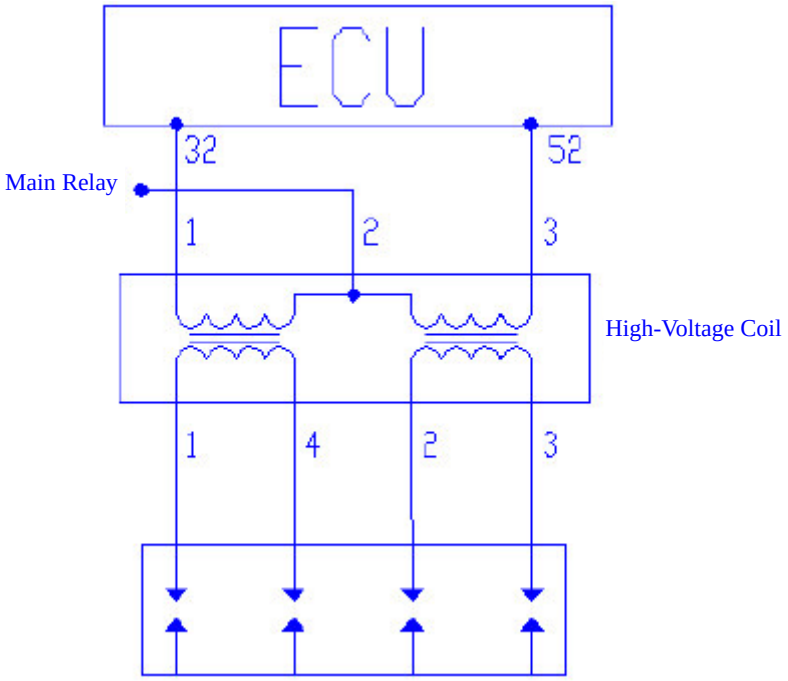
Failure Code:	**P0325-0**	**Bad connection to knock sensor**		
Set emergency control scheme:		● Switch on the failure lamp till the ignition switch is turned off ● Apply the safety ignition advance angle table		
Connection terminal:		MT 20U	Knock Sensor	Normal Measurement Signal
Knock signal:		69		0 to 1 V
Sensor signal earth:		05		0V
Condition for Determination		Possible Reason		Actions
Failure duration > 1.5625 s		1) Unreliable connection of the connecting parts 2) Open circuit of knock signal circuit 3) Short circuit of sensor signal circuit to earth 4) Short circuit of knock signal circuit to other circuits 5) Sensor damaged 6) ECM's this signal output control interface failure		1) Connect again 2) Repair harness 3) Repair harness 4) Repair harness 5) Replace relay 6) Replace ECM



T11 Crankshaft Position Sensor

Failure Code:	**P0335-0**	**No 58X crankshaft position sensor signal**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL ● Engine is difficult to start up		
Connection terminal:		MT 20U	Crankshaft Position Sensor	Normal Measurement Signal
High signal from crankshaft:		12	A	> 400mV sinusoidal wave (with senor B)
Low signal from crankshaft:		28	B	> 400mV sinusoidal wave (with senor A)
System earth wire:		73	C	0V
Condition for Determination		Possible Reason		Actions
Start up the engine No engine speed signal MAP decreases by 2.9509 kPa System voltage decreases by 0.8V Vehicle speed < 4 km/h Failure duration > 2 s		1) Unreliable connection of the connecting parts 2) Reserve connection of high/low signal 3) Open circuit of signal circuit 4) Short circuit of signal circuit to other circuits 5) Sensor damaged 6) ECM's this signal input interface failure		1) Connect again 2) Repair harness 3) Repair harness 4) Repair harness 5) Replace relay 6) Replace ECM

Failure Code:	**P0335-0**	**No 58X crankshaft position sensor signal**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL		
Connection terminal:		MT 20U	Crankshaft Position Sensor	Normal Measurement Signal
High signal from crankshaft:		12	A	> 400mV sinusoidal wave (with senor B)
Low signal from crankshaft:		28	B	> 400mV sinusoidal wave (with senor A)
System earth wire:		73	C	0V
Condition for Determination		Possible Reason		Actions
Engine operation The number of teeth entering into ECM isn't equal to 58 during 5 continuous cycles		1) Bad shielding of signal circuit 2) Foreign metal materials in the 58X gear ring		1) Apply the shielded wire 2) Clean the 58X gear ring



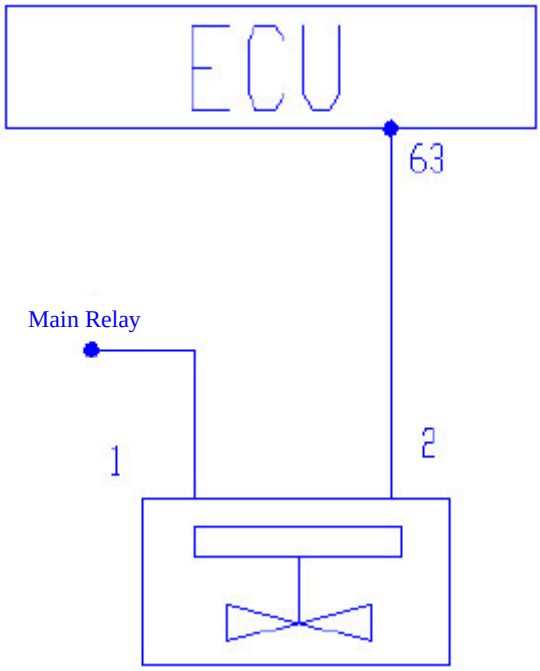
T11 Ignition Coil Group

Failure Code:	**P0351-1**	**Short circuit between the ignition coil 1-4 cylinder drive circuit and the positive electrode of power supply**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● Stop the fuel injection for 1-4 cylinder ● The target idle steps up to 1,200 rpm		
Connection terminal:		MT 20U	Ignition Coil	Normal Measurement Signal
System main power supply:		\	B	12V
1-4 cylinder drive:		32	C	0 to 12 V approx. square wave signal Induction peak value > 300 V
2-3 cylinder drive:		52	A	0 to 12 V approx. square wave signal Induction peak value > 300 V
Condition for Determination		Possible Reason		Actions
Failure duration > 1.25 s		1) Short circuit of 1-4 cylinder drive circuit to the positive electrode of power supply 2) Ignition coil damaged 3) ECM failure		1) Repair harness 2) Replace ignition coil 3) Replace ECM

<table>
<tr><td colspan="2">Failure Code: P0351-2</td><td colspan="3">Open circuit of the ignition coil 1-4 cylinder drive circuit or short circuit to earth</td></tr>
<tr><td colspan="2">Set emergency control scheme:</td><td colspan="3">● Switch on the failure lamp till the failure disappears
● Stop the fuel injection for 1-4 cylinder</td></tr>
<tr><td colspan="2">Connection terminal:</td><td>MT 20U</td><td>Ignition Coil</td><td>Normal Measurement Signal</td></tr>
<tr><td colspan="2">System main power supply:</td><td>\</td><td>B</td><td>12V</td></tr>
<tr><td colspan="2">1-4 cylinder drive:</td><td>32</td><td>C</td><td>0 to 12 V approx. square wave signal
Induction peak value > 300 V</td></tr>
<tr><td colspan="2">2-3 cylinder drive:</td><td>52</td><td>A</td><td>0 to 12 V approx. square wave signal
Induction peak value > 300 V</td></tr>
<tr><td colspan="2">Condition for Determination</td><td colspan="2">Possible Reason</td><td>Actions</td></tr>
<tr><td colspan="2">Failure duration > 1.25 s</td><td colspan="2">1) Unreliable connection of the connecting parts
2) Short circuit of 1-4 cylinder drive circuit to the negative electrode of system power supply
3) Open circuit of 1-4 cylinder drive circuit
4) Ignition coil damaged
5) ECM failure</td><td>1) Connect again
2) Repair harness
3) Repair harness
4) Replace ignition coil
5) Replace ECM</td></tr>
</table>

<table>
<tr><td colspan="2">Failure Code: P0352-1</td><td colspan="3">Short circuit between the ignition coil 2-3 cylinder drive circuit and the positive electrode of power supply</td></tr>
<tr><td colspan="2">Set emergency control scheme:</td><td colspan="3">● Switch on the failure lamp till the failure disappears
● Stop the fuel injection for 2-3 cylinder
● The target idle steps up to 1,200 rpm</td></tr>
<tr><td colspan="2">Connection terminal:</td><td>MT 20U</td><td>Ignition Coil</td><td>Normal Measurement Signal</td></tr>
<tr><td colspan="2">System main power supply:</td><td>\</td><td>B</td><td>12V</td></tr>
<tr><td colspan="2">1-4 cylinder drive:</td><td>32</td><td>C</td><td>0 to 12 V approx. square wave signal
Induction peak value > 300 V</td></tr>
<tr><td colspan="2">2-3 cylinder drive:</td><td>52</td><td>A</td><td>0 to 12 V approx. square wave signal
Induction peak value > 300 V</td></tr>
<tr><td colspan="2">Condition for Determination</td><td colspan="2">Possible Reason</td><td>Actions</td></tr>
<tr><td colspan="2">Failure duration > 1.25 s</td><td colspan="2">1) Short circuit of 2-3 cylinder drive circuit to the positive electrode of power supply
2) Ignition coil damaged
3) ECM failure</td><td>1) Repair harness
2) Replace ignition coil
3) Replace ECM</td></tr>
</table>

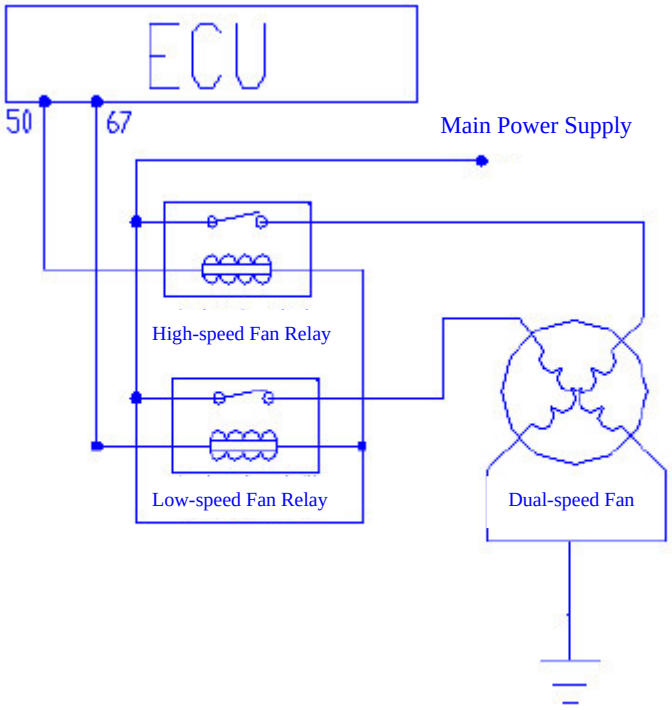
<table>
<tr><td colspan="2">Failure Code:</td><td>P0352-2</td><td colspan="3">Open circuit of the ignition coil 2-3 cylinder drive circuit or short circuit to earth</td></tr>
<tr><td colspan="3">Set emergency control scheme:</td><td colspan="3">● Switch on the failure lamp till the failure disappears
● Stop the fuel injection for 1-4 cylinder</td></tr>
<tr><td colspan="2">Connection terminal:</td><td></td><td>MT 20U</td><td>Ignition Coil</td><td>Normal Measurement Signal</td></tr>
<tr><td colspan="2">System main power supply:</td><td></td><td>\</td><td>B</td><td>12V</td></tr>
<tr><td colspan="2">1-4 cylinder drive:</td><td></td><td>32</td><td>C</td><td>0 to 12 V approx. square wave signal
Induction peak value > 300 V</td></tr>
<tr><td colspan="2">2-3 cylinder drive:</td><td></td><td>52</td><td>A</td><td>0 to 12 V approx. square wave signal
Induction peak value > 300 V</td></tr>
<tr><td colspan="3">Condition for Determination</td><td colspan="2">Possible Reason</td><td>Actions</td></tr>
<tr><td colspan="3">Failure duration > 1.25 s</td><td colspan="2">1) Unreliable connection of the connecting parts
2) Short circuit of 2-3 cylinder drive circuit to the negative electrode of system power supply
3) Open circuit of 2-3 cylinder drive circuit
4) Ignition coil damaged
5) ECM failure</td><td>1) Connect again
2) Repair harness
3) Repair harness
4) Replace ignition coil
5) Replace ECM</td></tr>
</table>



T11 Canister Control Solenoid Valve

Failure Code:	**P0443-1**	**Short-circuit between the wire of canister control solenoid valve and the positive of electrode power supply**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● Shut off the canister control solenoid valve		
Connection terminal:		MT 20U	Canister Control Solenoid Valve	Normal Measurement Signal
System main power supply:		\	B	12V
Solenoid valve drive:		63	A	0 to 12 V square wave signal
Condition for Determination		Possible Reason		Actions
Failure duration > 2 s		1) Short circuit of solenoid valve drive circuit to the positive electrode of power supply 2) Solenoid valve damaged 3) ECM failure		1) Repair harness 2) Replace solenoid valvel 3) Replace ECM

<table>
<tr><td colspan="2">Failure Code: P0443-2</td><td colspan="3">Open circuit of the wire of canister control solenoid valve or short circuit to earth</td></tr>
<tr><td colspan="2">Set emergency control scheme:</td><td colspan="3">● Switch on the failure lamp till the failure disappears
● Shut off the canister control solenoid valve</td></tr>
<tr><td colspan="2">Connection terminal:</td><td>MT 20U</td><td>Canister Control Solenoid Valve</td><td>Normal Measurement Signal</td></tr>
<tr><td colspan="2">System main power supply:</td><td>\</td><td>B</td><td>12V</td></tr>
<tr><td colspan="2">Solenoid valve drive:</td><td>63</td><td>A</td><td>0 to 12 V square wave signal</td></tr>
<tr><td colspan="2">Condition for Determination</td><td colspan="2">Possible Reason</td><td>Actions</td></tr>
<tr><td colspan="2">Failure duration > 5 s</td><td colspan="2">1) Unreliable connection of the connecting parts
2) Short circuit of solenoid valve drive circuit to the negative electrode of system power supply
3) Open circuit of solenoid valve drive circuit
4) Open circuit with system main power supply connection circuit
5) Solenoid valve damaged
6) ECM failure</td><td>1) Connect again
2) Repair harness
3) Repair harness
4) Repair harness
5) Replace solenoid valve
6) Replace ECM</td></tr>
</table>

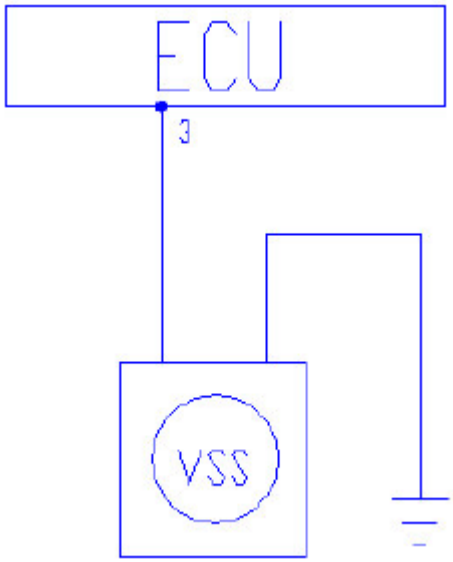


Failure Code:	**P0480-1**	**Short circuit of radiator low-speed fan relay drive circuit to the positive electrode of power supply**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL ● Fan doesn't operate, till the water temperature increases to 98℃ and then the high-speed fan activates		
Connection terminal:		MT 20U	Low-speed Fan Relay	Normal Measurement Signal
Battery:		\	Refer to Electrical System Description	12V
Relay drive:		67	Refer to Electrical System Description	0V (Operating) and 12V (Stop)
Condition for Determination		Possible Reason		Actions
Failure duration > 3 s		1) Short circuit of relay drive circuit to the positive electrode of power supply 2) Relay damaged 3) ECM failure		1) Repair harness 2) Replace relay 3) Replace ECM

Failure Code:	P0480-2	Open circuit of radiator low-speed fan relay drive circuit or short circuit to earth		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL ● Fan doesn't operate (open circuit), till the water temperature increases to 98℃ and then the high-speed fan activates ● Fan operates normally (short circuit to earth)		
Connection terminal:		MT 20U	Low-speed Fan Relay	Normal Measurement Signal
Battery:		\	Refer to Electrical System Description	12V
Relay drive:		67	Refer to Electrical System Description	0V (Operating) and 12V (Stop)
Condition for Determination		Possible Reason		Actions
Failure duration > 3 s		1) Unreliable connection of the connecting parts 2) Short circuit of relay drive circuit to the negative electrode of power supply 3) Open circuit of relay drive circuit 4) Open circuit with the battery connection circuit 5) Relay damaged 6) ECM failure		1) Connect again 2) Repair harness 3) Repair harness 4) Repair harness 5) Replace relay 6) Replace ECM

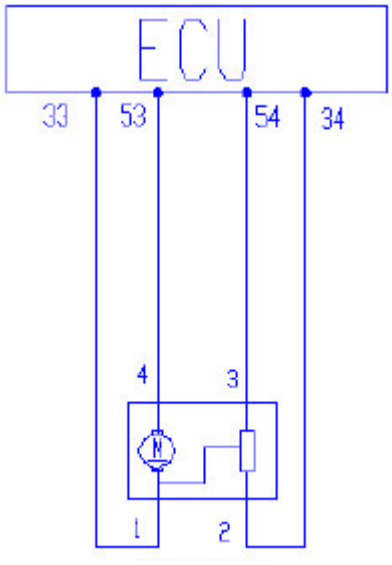
Failure Code:	P0481-1	Short circuit of radiator high-speed fan relay drive circuit to the positive electrode of power supply		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL		
Connection terminal:		MT 20U	High-speed Fan Relay	Normal Measurement Signal
Battery:		\	Refer to Electrical System Description	12V
Relay drive:		50	Refer to Electrical System Description	0V (Operating) and 12V (Stop)
Condition for Determination		Possible Reason		Actions
Failure duration > 3 s		1) Short circuit of relay drive circuit to the positive electrode of power supply 2) Relay damaged 3) ECM failure		1) Repair harness 2) Replace relay 3) Replace ECM

Failure Code:	**P0481-2**	**Open circuit of radiator high-speed fan relay drive circuit or short circuit to earth**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL ● Fan operates normally (short circuit to earth)		
Connection terminal:		MT 20U	High-speed Fan Relay	Normal Measurement Signal
Battery:		\	Refer to Electrical System Description	12V
Relay drive:		50	Refer to Electrical System Description	0V (Operating) and 12V (Stop)
Condition for Determination		Possible Reason		Actions
Failure duration > 3 s		1) Unreliable connection of the connecting parts 2) Short circuit of relay drive circuit to the negative electrode of power supply 3) Open circuit of relay drive circuit 4) Open circuit with the battery connection circuit 5) Relay damaged 6) ECM failure		1) Connect again 2) Repair harness 3) Repair harness 4) Repair harness 5) Replace relay 6) Replace ECM



T11 Vehicle Speed Sensor

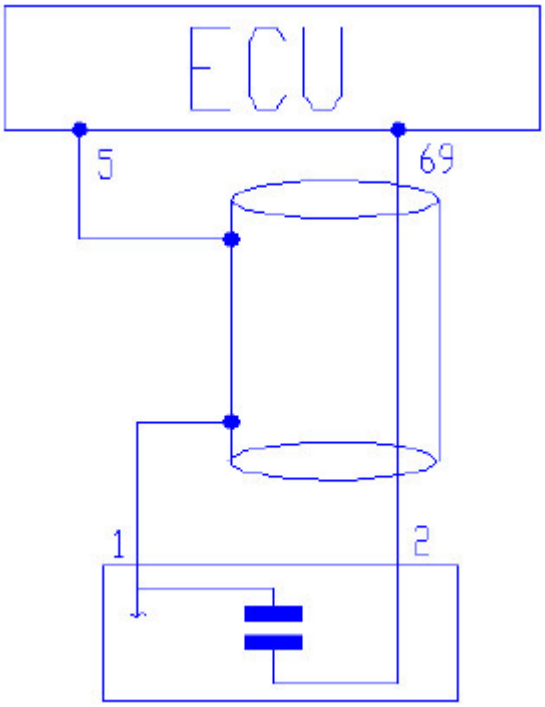
Failure Code:	**P0500-0**	**No vehicle speed sensor signal**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL ● It is possible to take some driving limit measures		
Connection terminal:		MT 20U	Vehicle Speed Sensor	Normal Measurement Signal
Sensor signal earth:		03	/	0 to 12V square wave
Condition for Determination		Possible Reason		Actions
Engine operation Vehicle speed < 2 km/h MAP < 25.82 kPa 1,200 rpm < engine speed < 5000 rpm Throttle closed Failure duration > 5 s		1) Unreliable connection of the connecting parts 2) Interrupt of signal circuit from the automatic transmission to instruments 3) Interrupt of harnesses from instruments to ECM 4) Vehicle speed sensor damaged 5) Instrument failure 6) ECM failure		1) Connect again 2) Replace flexible shaft or signal wire 3) Repair harness 4) Replace vehicle speed sensor 5) Repair or replace instrument 6) Replace ECM



T11 Idle Stepper Motor

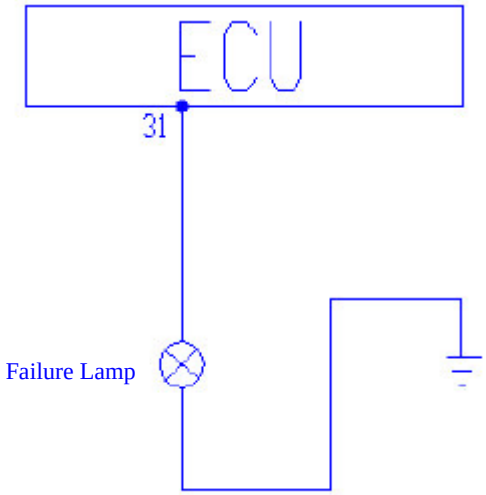
Failure Code:	**P0505-0**	**Idle Control Error**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● Pause the idle control		
Connection terminal:		MT 20U	Idle Control Valve	Normal Measurement Signal
Idle control valve A-high:		54	D	0 to 12V square wave (with idle valve C)
Idle control valve A-low:		53	C	0 to 12V square wave (with idle valve D)
Idle control valve B-high:		33	B	0 to 12V square wave (with idle valve A)
Idle control valve A-low:		34	A	0 to 12V square wave (with idle valve B)
Condition for Determination		Possible Reason		Actions
Engine idle operation Water temperature reaches the normal value No TPS and VSS failure Deviation from the target speed > 180 rpm Failure duration > 15 s		1) Unreliable connection of the connecting parts 2) Open circuit of any circuit of idle valve 3) Error of corresponding relation between the idle valve connecting parts and ECM connecting parts 4) Intake manifold leakage 5) Idle control valve damaged 6) ECM failure		1) Connect again 2) Repair harness 3) Repair harness 4) Remove the leakage failure 5) Replace idle control valve 6) Replace ECM

Failure Code:	P0560-1	Over-high system voltage		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● The system stops fuel injection		
Connection terminal:		MT 20U	Ignition Switch	Normal Measurement Signal
Ignition switch:		01	Refer to Electrical System Description	12V
Condition for Determination		Possible Reason		Actions
Turn on the ignition switch System voltage > 17.2 V Failure duration > 5 s		1) Generator regulator damaged 2) Mistakenly apply the high-voltage battery		1) Replace the damaged voltage regulator 2) Apply proper battery



T11 Knock Sensor

Failure Code:	P0607-0	Knock control system failure		
Set emergency control scheme:		● Switch on the failure lamp till the ignition switch is turned off ● The ignition advance angle will postpone (apply safety ignition advance control)		
Connection terminal:	69#	MT 20U	ECM	Normal Measurement Signal
ECM:	ECM internal failure			\
Condition for Determination		Possible Reason		Actions
		1) ECM failure		1) Replace ECM

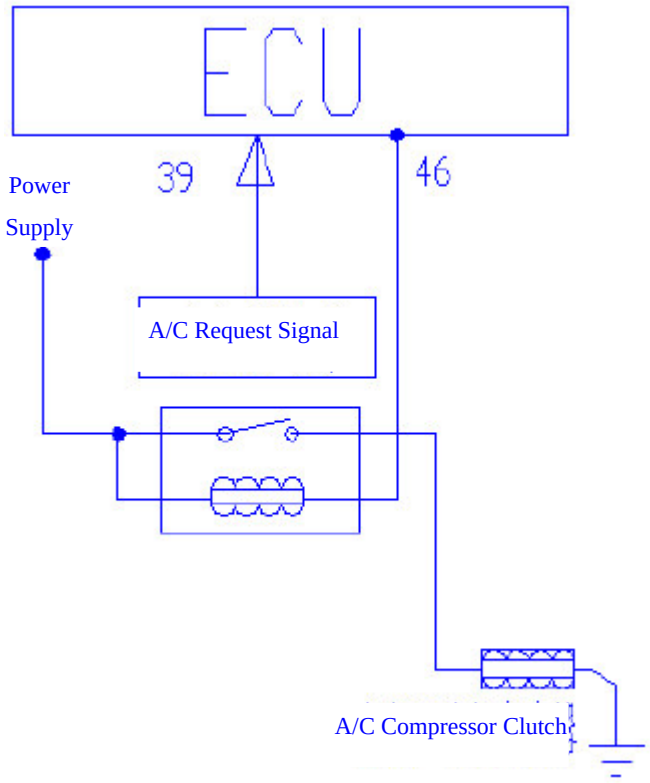


Failure Code:	**P0650-1**	**Short circuit between the failure lamp wire and the positive electrode of power supply**		
Set emergency control scheme:		● No light		
Connection terminal:		MT 20U	System Failure Lamp	Normal Measurement Signal
Ignition switch:		\	Refer to Electrical System Description	12 V
Lamp drive:		31	Refer to Electrical System Description	12 V (ON) and 0 V (OFF)
Condition for Determination		Possible Reason		Actions
Failure Duration > 2 s		1) Short circuit of harness J1-31 wire to the positive electrode of system power supply		1) Repair harness

Failure Code:	**P0650-2**	**Open circuit of the failure lamp wire or short circuit to earth**		
Set emergency control scheme:		● No light (open circuit) ● Normal light (short circuit to earth)		
Connection terminal:		MT 20U	System Failure Lamp	Normal Measurement Signal
Ignition switch:		\	Refer to Electrical System Description	12 V
Lamp drive:		31	Refer to Electrical System Description	12 V (ON) and 0 V (OFF)
Condition for Determination		Possible Reason		Actions
Failure Duration > 2 s		1) Bad installation of failure bulb 2) Failure of circuit to ignition switch 3) Short circuit of drive circuit wire to the negative electrode of power supply 4) Failure bulb damaged		1) Reinstall the bulb 2) Repair harness 3) Repair harness 4) Replace bulb

Failure Code:	**P1230-1**	**Short circuit of main relay circuit to the positive electrode of power supply**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● It is difficult to start up		
Connection terminal:		MT 20U	System Failure Lamp	Normal Measurement Signal
Ignition switch:		\	Refer to Electrical System Description	12 V
Relay drive:		58	Refer to Electrical System Description	12 V (operating) and 0 V (stop)
Condition for Determination		Possible Reason		Actions
Failure Duration > 1 s		1) Short circuit of relay drive circuit to the positive electrode of power supply		1) Repair harness

Failure Code:	**P1230-2**	**Open circuit of main relay circuit or short circuit to earth**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● It is difficult to start up (open circuit) ● Normal startup is available (short circuit to earth)		
Connection terminal:		MT 20U	Main Power Supply Relay	Normal Measurement Signal
Ignition switch:		\	Refer to Electrical System Description	12 V
Relay drive:		58	Refer to Electrical System Description	12 V (operating) and 0 V (stop)
Condition for Determination		Possible Reason		Actions
Failure Duration > 1 s		1) Bad installation of relay 2) Failure of circuit to ignition switch 3) Open circuit of relay drive circuit 4) Short circuit of relay drive circuit to the negative electrode of power supply 5) Relay damaged		1) Reinstall the relay 2) Repair harness 3) Repair harness 4) Repair harness 5) Replace relay



Failure Code:	**P1530-1**	**Short circuit of A/C compressor relay circuit to the positive electrode of power supply**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● The air conditioner is out of service		
Connection terminal:		MT 20U	Main Power Supply Relay	Normal Measurement Signal
Battery:		\	Refer to Electrical System Description	12 V
Relay drive:		58	Refer to Electrical System Description	12 V (operating) and 0 V (stop)
Condition for Determination		Possible Reason		Actions
Detect and find the A/C system Failure Duration > 3 s		1) Short circuit of repair harness circuit to the positive electrode of power supply 2) Relay damaged 3) ECM failure		1) Repair harness 2) Replace relay 3) Replace ECM

Failure Code:	**P1530-2**	**Short circuit of A/C compressor relay circuit to the positive electrode of power supply**		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● The air conditioner is out of service (open circuit) ● Air conditioner operates normally (short circuit to earth)		
Connection terminal:		MT 20U	Main Power Supply Relay	Normal Measurement Signal
Battery:		\	Refer to Electrical System Description	12 V
Relay drive:		46	Refer to Electrical System Description	12 V (operating) and 0 V (stop)
Condition for Determination		Possible Reason		Actions
Detect and find the A/C system Failure Duration > 3 s		1) Unreliable connection of the connecting parts 2) Open circuit to the battery connecting wire 3) Short circuit of the repair harness circuit to the negative electrode of power supply 4) Open circuit of the repair harness circuit 5) Relay damaged 6) ECM damaged		1) Connect again 2) Repair harness 3) Repair harness 4) Repair harness 5) Replace relay 6) Replace ECM

Failure Code:	**P1604-0**	**Knock control system failure**		
Set emergency control scheme:		● Switch on the failure lamp ● The vehicle model is with the anti-theft measures, and the engine is difficult to start up ● The mileage accumulation function loses		
Connection terminal:	69#	MT 20U	ECM	Normal Measurement Signal
ECM:	ECM internal failure			\
Condition for Determination		Possible Reason		Actions
A failure exists		1) ECM failure		1) Replace ECM

Failure Code:	P2000-1	Over-high temperature of front A/C evaporator		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL		
Connection terminal:		MT 20U	Front Evaporator Temperature Sensor	Normal Measurement Signal
Temperature signal:		26	Refer to Electrical System Description	0.5 to 4.5 V
Sensor signal earth:		05	Refer to Electrical System Description	0 V
Condition for Determination		Possible Reason		Actions
Temperature indicated > 144℃ Failure Duration > 3 s		1) Short circuit of temperature signal wire to the negative electrode of power supply 2) Sensor damaged 3) ECM failure		1) Repair harness 2) Replace sensor 3) Replace ECM

Failure Code:	P2000-2	Too-low temperature of front A/C evaporator		
Set emergency control scheme:		● Switch on the failure lamp till the failure disappears ● NULL		
Connection terminal:		MT 20U	Front Evaporator Temperature Sensor	Normal Measurement Signal
Temperature signal:		26	Refer to Electrical System Description	0.5 to 4.5 V
Sensor signal earth:		05	Refer to Electrical System Description	0 V
Condition for Determination		Possible Reason		Actions
Temperature indicated < -36℃ Failure Duration > 3 s		1) Unreliable connection of the connecting parts 2) Short circuit of temperature signal wire to the positive electrode of power supply 3) Open circuit of temperature signal wire 4) Relay damaged 5) ECM damaged		1) Connect again 2) Repair harness 3) Repair harness 4) Replace relay 5) Replace ECM

4. Typical Malfunction

1) Engine doesn't operate or operates slowly when startup

Starter's own problems (such as seized, internal short circuit), over-great engine resistance force, and circuit system (voltage, earth).

No.	Operation Step	Detection Result	Subsequent Step
1	Apply a multimeter to detect whether there is approximate **10 to 12.5 V** between both connecting terminals of battery.	Yes	Next step
		No	Repair or replace battery
2	Place the ignition switch on the "ON" position, and apply a multimeter to detect whether there is approximate 10 to 12.5 V voltage between the connecting terminals which connect to the positive electrode of battery.	Yes	Next step
		No	Repair connecting terminal or replace conducting wire
3	Keep the ignition switch on the start gear, and apply a multimeter to detect whether there is above 8V voltage between the connecting terminals on the ignition switch which connect to the pull-in winding of starter motor.	Yes	Next step
		No	Repair or replace the ignition switch
4	Apply a multimeter to detect whether the circuit of starter motor is short or open circuit.	Yes	Repair or replace the starter motor
		No	Next step
5	Examine and confirm whether the engine is seized firmly due to the bad lubrication.	Yes	Remove the failure
		No	Next step
6	If in winter, examine and confirm whether the resistance force of starter motor is over great due to improper selection of engine lubricating oil and gearbox oil (if with high viscosity, the engine resistance force is great).	Yes	Change with appropriate oil
		No	Examine the other parts

2) The engine can operate manually but it is difficult to start up successfully during the engine starts

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the “ON” position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failures
		No	Next step
2	Pull out the subcylinder line, and connect up the sparkle plug to make the sparkle plug’s electrode be 5 to 10 mm away from the engine body, then apply the starter motor to enable the engine to operate and examine and confirm whether there is blue-white high-voltage fire.	Yes	8
		No	Next step
3	Examine the resistance valve of high-voltage wire (no less than 4K ohm)	Yes	Next step
		No	Repair or replace high voltage wire
4	Examine the damage of the subcylinder high-voltage wire and sparkle plug	Yes	Replace
		No	Next step
5	Examine the damage of crankshaft position sensor	Yes	Replace
		No	Next step
6	Examine the normal operation of the ignition coil	Yes	Next step
		No	Replace
7	Examine the connection condition of intake pressure sensor connecting parts (MT 20U is with the intake pressure cylinder detection technology)	Yes	Next step
		No	Connect the male contact
8	Place the ignition switch on the “ON’ position, and examine and confirm whether the fuel pump relay and fuel pump can operate.	Yes	Next step
		No	Repair the fuel pump circuit
9	Connect the fuel pressure gage valve, short circuit the No 30 pin and No 70 pin of the fuel pump relay to enable the fuel pump to operate, and examine and confirm whether the fuel pressure is approximate **350 kPa**.	Yes	Next step
		No	13
10	Pull out the fuel distributing pipe together with the fuel injector, and pull out the fuel injector connector on the harness one by one, directly supply 12V voltage to fuel injector from the battery, and examine and confirm whether the fuel injector is available to inject fuel.	Yes	12
		No	Next step
11	Rinse the fuel injector, and, after that, reexamine and confirm whether the fuel injector is available to inject fuel.	Yes	Next step
		No	Replace fuel injector

12	Examine and confirm whether the fuel deteriorates or contains water	Yes	Replace fuel
		No	18
13	Examine and confirm whether the fuel pressure is below **350 kPa**.	Yes	Next step
		No	17
14	Shut off the fuel gage valve, turn on the ignition switch again to enable the fuel pump to operate again, and examine and confirm whether the fuel pressure can be established.	Yes	Next step
		No	16
15	Turn on the fuel gage valve, apply the fuel return immobiliser to clip the fuel return pipe tightly so as to make it hasn't fuel return, and examine and confirm whether it is able to establish the fuel pressure quickly (fuel pump aging, operating capacity decrease not exclusive)	Yes	Replace fuel pressure regulator
		No	Repair or replace fuel injector or fuel pipe
16	Examine the leakage or jamming of the fuel intake pipe.	Yes	Repair or replace the fuel intake pipe
		No	Replace fuel pump
17	Examine the jamming or bending of the fuel return pipe	Yes	Repair or replace the fuel return pipe
		No	Replace the fuel pressure regulator
18	Connect up an adaptor between ECU and harness, examine the voltage of No **1, 17 and 18 pins** of ECU, and examine and confirm whether the positive power wire connecting with ECU pins above and the earth wire connecting with No 37 pin of ECU are normal.	Yes	Next step
		No	Repair or replace harness
19	Examine the air leakage of the intake system components.	Yes	Repair
		No	Next step
20	Examine and confirm whether the intake manifold absolute pressure and temperature sensor is jammed.	Yes	Repair or replace
		No	Next step
21	Examine and confirm whether the coolant temperature sensor is normal.	Yes	Next step
		No	Repair or replace

22	Examine and confirm whether the unsuccessful startup is caused due to the mechanical reasons such as too big clearance between the piston and cylinder, cylinder leakage and etc.	Yes	Remove the mechanical fault
		No	Replace ECU

The fuel injector control coil must be disconnected during this experiment is conducted so as to avoid that the excessive fuel enter into the three-way catalytic converter, which may burn down the three-way catalytic converter after the engine starts smoothly.

3) Warm start difficult

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the "ON" position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Connect the fuel pressure gage valve, short circuit the No 30 pin and No 87 pin of the fuel pump relay to enable the fuel pump to operate, and examine and confirm whether the fuel pressure is approximate **350 kPa**.	Yes	Next step
		No	9
3	Disconnect the connecting fuel pipe, turn off the ignition switch, and, after 1 hour, view whether the pressure of fuel system is still **between 250 kPa and 300 kPa** (otherwise, there is leakage inside the system).	Yes	Next step
		No	Repair the fuel system leakage
4	Connect the connecting pipe, and apply the fuel return immobiliser to block the fuel return pipe, at the same time, turn off the fuel pressure gage valve and ignition switch, and, after 1 hour, view whether the pressure of fuel system is still **between 250 kPa and 300 kPa.**	Yes	Replace fuel pressure regulator
		No	Next step
5	Examine the fuel leakage of the fuel injector and fuel pipe.	Yes	Replace fuel injector and fuel pipe
		No	Next step
6	Pull out the connector of water temperature sensor to enable the engine to start, and view whether it can be able to start successfully.	Yes	Examine the coolant temperature and circuit
		No	Next step

7	Connect up an adaptor between ECU and harness, examine the voltage of No **1, 17 and 18 pins** of ECU, and examine and confirm whether the positive power wire connecting with ECU pins above and the earth wire connecting with No 37 pin of ECU are normal.	Yes	Next step
		No	Repair or replace harness
8	Replace fuel, conduct the warm start again, and view whether it can be able to start successfully.	Yes	End
		No	Replace ECU
9	Examine the jamming or bending of the fuel return pipe, and the normal operation of fuel pump regulator.	Yes	Next step
		No	Repair or replace
10	Apply a multimeter to detect the battery voltage of both ends of fuel pump connecting parts.	Yes	Next step
		No	Repair or replace the fuel pump relay and conducting wire
11	Apply a multimeter to detect the proper resistance value of fuel pump..	Yes	Next step
		No	Replace fuel pump
12	Examine and confirm whether the fuel pump is clipped tightly.	Yes	Replace fuel pump
		No	Replace ECU

4) Normal engine speed, while it always starts difficultly

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the “ON” position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Examine and confirm whether the air cleaner is unobstructed.	Yes	Next step
		No	Replace
3	After the success startup, detect and confirm whether the pressure of intake manifold during idle is between **35 kPa and 55 kPa**.	Yes	Next step
		No	Remove the intake system leakage failure

4	Step on the throttle slightly, and view whether it is easy to start.	Yes	Replace and examine the throttle and idle channel
5	Connect the fuel pressure gage valve, short circuit the No 30 pin and No 87 pin of the fuel pump relay to enable the fuel pump to operate, and examine and confirm whether the fuel pressure is approximate **350 kPa**.	Yes	Next step
		No	9
6	Apply the special connecting terminal to directly supply the fuel injector 12 V voltage from the battery, and examine the normal operation of fuel injector.	Yes	8
		No	Next step
7	Rinse the fuel injector, and then reexamine the normal operation of fuel injector.	Yes	Next step
		No	Replace the fuel injector
8	Replace fuel, and examine and confirm whether the fuel deteriorates or contains water.	Yes	Replace fuel
		No	14
9	Examine and confirm whether the fuel pressure is less than **350 kPa**.	Yes	Next step
		No	13
10	Turn off the fuel gage valve, turn on the ignition switch again to enable the fuel pump to operate again, and examine and confirm whether the fuel pressure can be established.	Yes	Replace the fuel pressure regulator
		No	Repair/replace fuel injector or fuel pipe
11	Turn on the fuel gage valve, apply the fuel return immobiliser to clip the fuel return pipe tightly so as to make it hasn't fuel return, and examine and confirm whether it is able to establish the fuel pressure quickly.	Yes	Replace the fuel pressure regulator
		No	Repair or replace the fuel injector or fuel pipe
12	Examine the leakage or jamming of the fuel intake pipe.	Yes	Repair or replace the fuel intake pipe
		No	Replace the fuel pump
13	Examine the jamming or bending of the fuel return pipe	Yes	Repair or replace fuel return pipe
		No	Replace the fuel pressure regulator
14	Pull out the idle actuator connector on the harness before the	Yes	Next step

	engine coolant temperature reaches 35℃, and view whether the engine speed decreases (the engine enters the **Fault Mode**).	No	Repair or replace the idle actuator
15	Place the ignition switch on the "ON" position. Examine and confirm whether the voltages of the following ECU pins are normal: for **No 1, 17 and 18 pins,** its voltage is approx. 12V battery voltage; and for **No 73 pin**, 0V.	Yes	Next step
		No	Examine harness and connecting parts
16	Enable the engine to conduct idle operation, and examine and confirm whether the ignition advance angle is normal after the coolant temperature reaches the normal value..	Yes	Next step
		No	Search the others
17	Examine and confirm whether the cylinder compression pressure of engine is normal.	Yes	Next step
		No	Remove the failure
18	Examine and confirm whether the intake manifold absolute pressure and temperature sensor is jammed.	Yes	Repair or replace
		No	Next step
19	Examine and confirm whether the coolant temperature sensor is normal.	Yes	Replace ECU
		No	Repair or replace

5) Cold start difficult

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the “ON” position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Apply a multimeter to detect whether the coolant temperature sensor is normal. (It is also available to serially connect a 1.5K ohm resistance between the No 43 and 05 pins of ECU, which is used to substitute the coolant temperature sensor to start a engine. If start is available, it indicates that the coolant temperature is off normal.)	Yes	Next step
		No	Replace sensor
3	Turn on the ignition switch. Connect an adaptor between the ECU and harness, and examine and confirm whether the voltages of the following pins are normal: for **No 17 and 18 pins,** its voltage is approx. 12V battery voltage; and for **No 73 pin**, 0V.	Yes	Next step
		No	Examine harness and connecting parts
4	Examine and confirm whether the air cleaner is unobstructed.	Yes	Next step
		No	Replace
5	After the success startup, detect and confirm whether the pressure of intake manifold during idle is between **35 kPa and 55 kPa**.	Yes	Next step
		No	Remove the intake system leakage failure
6	Step on the throttle slightly, and view whether it is easy to start. .	Yes	Examine the throttle and idle channel
		No	Next step
7	Pull out the idle actuator connector on the harness before the engine coolant temperature reaches 35℃, and view whether the engine speed decreases (**the engine enters the Fault Mode**).	Yes	Next step
		No	Repair or replace the idle actuator
8	Connect the fuel pressure gage valve (the connecting point changes as the vehicle model). Directly earth the No 86 pin of fuel pump relay. Turn on the ignition switch to enable the fuel pump relay and fuel pump to operate. Examine and confirm whether the fuel pressure is less than **350 kPa**.	Yes	Next step
		No	12
9	Apply the special connecting terminal to directly supply the fuel injector 12 V voltage from the battery, and examine the normal operation of fuel injector.	Yes	11
		No	Next step
10	Rinse the fuel injector, and then reexamine the normal	Yes	Next step

	operation of fuel injector.	No	Repair/replace fuel injector
11	Examine and confirm whether the fuel deteriorates or contains water.	Yes	Replace fuel
		No	17
12	Examine and confirm whether the fuel pressure is less than **350 kPa**.	Yes	Next step
		No	16
13	Turn off the fuel gage valve, turn on the ignition switch again to enable the fuel pump to operate again, and examine and confirm whether the fuel pressure can be established.	Yes	Next step
		No	15
14	Turn on the fuel gage valve, apply the fuel return immobiliser to clip the fuel return pipe tightly so as to make it hasn't fuel return, and examine and confirm whether it is able to establish the fuel pressure quickly.	Yes	Replace the fuel pressure regulator
		No	Repair or replace the fuel injector or fuel pipe
15	Examine the leakage or jamming of the fuel intake pipe.	Yes	Repair or replace the fuel intake pipe
		No	Replace the fuel pump
16	Examine the jamming or bending of the fuel return pipe	Yes	Repair or replace the fuel return pipe
		No	Replace the fuel pressure regulator
17	Examine and confirm whether the cylinder pressure of engine is normal.	Yes	Next step
		No	Remove the failure
18	Examine the leakage of engine intake system.	Yes	Repair
		No	Next step
19	Examine and confirm whether the intake manifold absolute pressure and temperature sensor is jammed.	Yes	Repair or replace
		No	Replace ECU

6) Unstable idle at any time

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the “ON” position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Examine and confirm whether the stepper motor idle actuator is seized.	Yes	Repair or replace the idle actuator
		No	Next step
3	Turn on the ignition switch, and examine and confirm whether the connecting wires among the water temperature sensor, idle stepper motor and ECU are normal.	Yes	Examine harness and connecting parts
		No	Next step
4	Enable the engine to operate at idle speed, shut down these cylinders one by one, and view whether the engine speed decreases and fluctuates.	Yes	8
		No	Next step
5	Examine and confirm whether the operating condition of fuel injector of any cylinder is normal.	Yes	Next step
		No	Examine the fuel injector and harness
6	Examine and confirm whether the resistance value of high-voltage wire of any cylinder is normal.	Yes	Next step
		No	Replace
7	Examine and confirm whether the ignition switch is damaged.	Yes	Replace
		No	Next step
8	Examine and confirm whether the sparkle plug is normal.	Yes	Next step
		No	Replace sparkle plug
9	Connect the fuel pressure gage valve. Short circuit the No 30 and 87 pins of fuel pump relay to enable the fuel pump relay and fuel pump to operate. Examine and confirm whether the fuel pressure is approx. **350 kPa**.	Yes	Next step
		No	13
10	Apply the special connecting terminal to directly supply the fuel injector 12 V voltage from the battery, and examine the normal operation of fuel injector.	Yes	12
		No	Next step
11	Rinse the fuel injector, and then reexamine the normal operation of fuel injector.	Yes	Next step
		No	Replace the fuel injector
12	Examine and confirm whether the fuel deteriorates or contains water.	Yes	Replace fuel
		No	18
13	Examine and confirm whether the fuel pressure is less than **350**	Yes	Next step

	kPa.	No	17
14	Turn off the fuel gage valve, turn on the ignition switch again to enable the fuel pump to operate again, and examine and confirm whether the fuel pressure can be established.	Yes	Next step
		No	16
15	Turn on the fuel gage valve, apply the fuel return immobiliser to clip the fuel return pipe tightly so as to make it hasn't fuel return, and examine and confirm whether it is able to establish the fuel pressure quickly.	Yes	Replace the fuel pressure regulator
		No	Repair or replace the fuel injector or fuel pipe
16	Examine the leakage or jamming of the fuel intake pipe.	Yes	Repair or replace the fuel intake pipe
		No	Replace the fuel pump
17	Examine the jamming or bending of the fuel return pipe	Yes	Repair or replace the fuel return pipe
		No	Replace the fuel pressure regulator
18	Examine and confirm whether the sensing holes of intake manifold pressure and intake temperature sensor are jammed.	Yes	Clean
		No	Next step
19	Enable the engine to operate at idle speed, and, after the coolant temperature reaches the closed-loop control activated temperature, view whether the operation of oxygen sensor is normal. (Fluctuate between 0V and 1V.)	Yes	Next step
		No	Examine oxygen sensor and harness
20	Examine the leakage of engine intake system.	Yes	Remove the leakage
		No	Next step
21	Examine and confirm whether the cylinder pressure of engine is normal.	Yes	Next step
		No	Remove the failure
22	Enable the engine to operate at idle speed, and, after the coolant temperature reaches the normal value, examine and confirm whether the ignition advance angle is normal.	Yes	Replace ECU
		No	Examine the others

7) Unstable idle during warm up

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the "ON" position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Examine and confirm whether the air cleaner is unobstructed.	Yes	Next step
		No	Replace
3	Enable the engine to operate at idle speed, and detect and confirm whether the pressure of intake manifold during warm up is between **35 kPa and 55 kPa**.	Yes	Next step
		No	Remove the intake system leakage failure
4	Switch off the engine, turn off the ignition switch, connect an adaptor between the ECU and harness, and examine and confirm whether the voltages of intake temperature sensor, water temperature sensor and ECU's No 4 and 20 pins (applied for 4.5 to 5V sensor power supply) are normal.	Yes	Next step
		No	Examine and repair
5	Pull out the idle actuator connector on the harness before the completion of warm up, and view whether the engine speed changes (**the engine enters the Fault Mode**).	Yes	Next step
		No	Replace the idle actuator
6	Examine and confirm whether the coolant temperature sensor operates normally.	Yes	Next step
		No	Replace
7	Enable the engine to operate at idle speed, and, after the coolant temperature reaches the normal value, examine and confirm whether the ignition advance angle is normal.	Yes	Replace ECU
		No	Examine the others

8) Unstable idle after the completion of warm up

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the "ON" position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Place the ignition switch on the "ON" position. Connect up an adaptor between ECU and harness, and examine and confirm whether the voltages of ECU's intake manifold absolute pressure sensor output, intake temperature sensor output, coolant temperature sensor output, oxygen sensor output pins, and the voltage of ECU's (outputs to idle actuator) pins are normal.	Yes	Next step
		No	Repair or replace harness and its corresponding parts
3	Stop the engine, and examine and confirm whether the air cleaner is unobstructed.	Yes	Next step
		No	Replace
4	Detect and confirm whether the pressure of intake manifold during idle operation is between **35 kPa and 55 kPa**.	Yes	Next step
		No	Remove the intake system leakage failure
5	Connect the fuel pressure gage valve (the connecting point changes as the vehicle model). Short circuit the No 30 and 87 pins of fuel pump relay to enable the fuel pump relay and fuel pump to operate. Examine and confirm whether the fuel pressure is approx. **350 kPa**.	Yes	Next step
		No	9
6	Apply the special connecting terminal to directly supply the fuel injector 12 V voltage from the battery, and examine the normal operation of fuel injector.	Yes	8
		No	Next step
7	Rinse the fuel injector, and then reexamine the normal operation of fuel injector.	Yes	Next step
		No	Replace the fuel injector
8	Examine and confirm whether the fuel deteriorates or contains water.	Yes	Replace fuel
		No	14
9	Examine and confirm whether the fuel pressure is less than **350 kPa**.	Yes	Next step
		No	13
10	Turn off the fuel gage valve, turn on the ignition switch again to enable the fuel pump to operate again, and examine and confirm whether the fuel pressure can be established.	Yes	Next step
		No	12
11	Turn on the fuel gage valve, apply the fuel return immobiliser to clip the fuel return pipe tightly so as to make it hasn't fuel return, and examine and confirm whether it is able to establish the fuel	Yes	Replace the fuel pressure regulator

	pressure quickly.	No	Repair or replace the fuel injector or fuel pipe
12	Examine the leakage or jamming of the fuel intake pipe.	Yes	Repair or replace the fuel intake pipe
		No	Replace the fuel pump
13	Examine the jamming or bending of the fuel return pipe	Yes	Repair or replace the fuel return pipe
		No	Replace the fuel pressure regulator
14	Enable the engine to operate at idle speed, and, after the coolant temperature reaches the normal value, examine and confirm whether the ignition advance angle is normal.	Yes	Nest step
		No	Adjust the ignition advance angle
15	Pull out the coolant temperature sensor, and view whether the engine operates normally.	Yes	Replace the coolant temperature sensor
		No	Next step
16	Examine and confirm whether the cylinder compression pressure of engine is normal.	Yes	Next step
		No	Remove the failure
17	Examine and confirm whether the resistance value of high-voltage wire of any cylinder is normal.	Yes	Next step
		No	Replace
18	Examine and confirm whether the ignition coil and high-voltage wire are damaged or have cracks and etc.	Yes	Replace
		No	Next step
19	Examine and confirm whether the sparkle plug operates normally.	Yes	Replace ECU
		No	Replace sparkle plug

9) Unstable idle or shut-down when the load (such as air conditioner and etc.) is applied

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the “ON” position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Turn on the A/C switch, connect an adaptor between the ECU and harness, and measure the signal input of the ECU’s A/C switch and pressure.	Yes	Next step
		No	Examine and repair A/C circuit
3	Examine and confirm whether the A/C system pressure, compressor’s electromagnetic clutch and A/C pump are normal..	Yes	Next step
		No	Repair or replace
4	Place the ignition switch on the “ON” position, and examine and confirm whether the voltages of ECU’s No 33, 34, 53 and 54 (output to the idle actuator) pins are normal.	Yes	Next step
		No	Examine the control circuit
5	Disassemble the stepper motor, and examine and confirm whether the stepper motor is seized or operates inflexibly.	Yes	Repair or replace the stepper motor
		No	Next step
6	Start the engine, switch on the air conditioner, and apply the failure diagnosis instrument to examine with the help of steps of stepper motor and confirm whether the idle actuator operates normally.	Yes	Replace ECU
		No	Replace the idle actuator

10) Periodical instability (ECU must self-learn again after power off)

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the “ON” position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Examine and confirm whether the air cleaner is unobstructed.	Yes	Next step
		No	Replace
3	Enable the engine to operate at idle speed, and examine and confirm whether the intake pressure is between **35 kPa and 55 kPa**.	Yes	Next step
		No	Remove the air intake and leakage
4	Enable the engine to operate at idle speed, shut down these cylinders one by one, and view whether the engine speed decreases and fluctuates.	Yes	7
		No	Next step
5	Place the ignition switch on the “ON” position. Connect up an adaptor between ECU and harness, and examine and confirm whether the voltages of ECU’s intake manifold absolute pressure sensor output, intake temperature sensor output, coolant temperature sensor output, oxygen sensor output, electronic earth and ignition switch pins, and the voltages of ECU’s No 33, 34, 53 and 54 (outputs to idle actuator) pins are normal.	Yes	Next step
		No	Repair or replace harness
6	Enable the engine to operate at idle speed, and, after the coolant temperature reaches the normal value, examine and confirm whether the ignition advance angle is normal.	Yes	Replace ECU
		No	Examine the others
7	Examine and confirm whether the sensing holes of intake manifold pressure and intake temperature sensor are jammed.	Yes	Clean
		No	Next step
8	Examine and confirm whether the fuel deteriorates or contains water.	Yes	Replace fuel
		No	Next step
9	Apply the special connecting terminal to directly supply the fuel injector 12 V voltage from the battery, and examine the normal operation of fuel injector.	Yes	Next step
		No	Examine and repair the fuel injector and related harness
10	Examine and confirm whether the resistance value of high-voltage wire of any cylinder is normal.	Yes	Next step
		No	Replace
11	Examine and confirm whether the ignition coil and high-voltage wire are damaged or have cracks and etc.	Yes	Replace
		No	Next step
12	Examine and confirm whether the sparkle plug operates normally.	Yes	Replace ECU
		No	Replace sparkle plug

11) Over-high idle (ECU must self-learn again after power off)

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the “ON” position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Examine and confirm whether the backstay cable connecting to the accelerator pedal is seized tightly or too tight.	Yes	Adjust or replace
		No	Next step
3	Examine and confirm whether the canister control valve, furl pressure regulator, crankcase force ventilation vacuum pipe and brake system vacuum boost hose are installed reliably or damaged. .	Yes	Repair or replace
		No	Next step
4	Enable the engine to operate, apply the neutral gear, step on the brake pedal, and view whether the idle speed is overhigh.	Yes	Next step
		No	6
5	Clip the vacuum boost hose, and view whether the idle turns into the normal.	Yes	Repair or replace the vacuum booster
		No	Next step
6	Clip the crankcase force ventilation vacuum pipe, and view whether the idle turns into the normal.	Yes	Replace PVC valve
		No	Next step
7	Clip the canister control valve hose, and view whether the idle turns into the normal.	Yes	Replace canister control valve
		No	Next step
8	Examine and confirm whether the idle actuator is inflexible or seized tightly.	Yes	Repair or replace
		No	Next step
9	Examine and confirm whether there is leakage in the other positions of intake pipe..	Yes	Repair or replace
		No	Next step
10	Examine and confirm whether the seal ring of fuel injector is in good condition.	Yes	Next step
		No	Replace the seal ring
11	Examine and confirm whether	Yes	Replace ECU
		No	Replace sensor

12) The engine speed increases difficultly or the engine shuts down when acceleration

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the “ON” position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Examine and confirm whether the air cleaner is unobstructed.	Yes	Next step
		No	Replace
3	Enable the engine to operate at idle speed, and examine and confirm whether the speed is normal during idle operation.	Yes	Next step
		No	Refer to the idle failure items to examine and repair
4	Enable the engine to operate at idle speed, and examine and confirm whether the intake pressure is **35 to 55 kPa.**	Yes	Next step
		No	Examine and repair
5	Enable the engine to operate at idle speed, and, after the coolant temperature reaches the normal value, examine and confirm whether the ignition advance angle is normal.	Yes	Next step
		No	Adjust the ignition advance angle
6	Connect the fuel pressure gage valve, short circuit the No 30 pin and No 87 pin of the fuel pump relay to enable the fuel pump to operate, and examine and confirm whether the fuel pressure is approximate **350 kPa**.	Yes	Next step
		No	10
7	Apply the special connecting terminal to directly supply the fuel injector 12 V voltage from the battery, and examine the normal operation of fuel injector.	Yes	9
		No	Next step
8	Rinse the fuel injector, and then reexamine the normal operation of fuel injector.	Yes	Next step
		No	Replace the fuel injector
9	Examine and confirm whether the fuel deteriorates or contains water	Yes	Replace fuel
		No	15
10	Examine and confirm whether the fuel pressure is below **350 kPa**.	Yes	Next step
		No	14
11	Shut off the fuel gage valve, turn on the ignition switch again to enable the fuel pump to operate again, and examine and confirm whether the fuel pressure can be established.	Yes	Next step
		No	13
12	Turn on the fuel gage valve, apply the fuel return immobiliser to clip the fuel return pipe tightly so as to make it hasn’t fuel return, and examine and confirm whether it is able to establish	Yes	Replace fuel pressure regulator

	the fuel pressure quickly.	No	Repair or replace fuel injector or fuel pipe
13	Examine the leakage or jamming of the fuel intake pipe.	Yes	Repair or replace the fuel intake pipe
		No	Replace fuel pump
14	Examine the jamming or bending of the fuel return pipe	Yes	Repair or replace the fuel return pipe
		No	Replace the fuel pressure regulator
15	Place the ignition switch on the “ON” position. Connect up an adaptor between ECU and harness, and examine and confirm whether the voltages of the output terminal of ECU’s throttle position sensor, earth terminal, and No 4 and 20 pins (applied for 4.5 to 5.0V sensor power supply) are normal.	Yes	Next step
		No	Repair or replace harness
16	Examine and confirm whether the ignition coil, high-voltage wire and sparkle plug operate normally.	Yes	Replace ECU
		No	Replace related parts

13) Slow response when acceleration

Whether the fuel meets the standard requirement and whether there are the intake pressure sensor and throttle position sensor failures.

No.	Operation Step	Detection Result	Subsequent Step
1	Place the ignition switch on the "ON" position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
2	Shut down the engine, and examine and confirm whether the air cleaner is unobstructed.	Yes	Next step
		No	Replace
3	Enable the engine to operate at idle speed, and examine and confirm whether the speed is normal during idle operation	Yes	Next step
		No	Refer to the idle failure items to examine and repair
4	Enable the engine to operate at idle speed, and examine and confirm whether the intake pressure is **35 to 55 kPa.**	Yes	Next step
		No	Examine and repair
5	Place the ignition switch on the "ON" position. Connect up an adaptor between ECU and harness, and examine and confirm whether the voltages of the output terminal of ECU's throttle position sensor, earth terminal, and No 4 and 20 pins (applied for 4.5 to 5.0V sensor power supply) are normal.	Yes	Next step
		No	Repair or replace harness
6	Enable the engine to operate at idle speed, and, after the coolant temperature reaches the normal value, examine and confirm whether the ignition advance angle is normal.	Yes	Next step
		No	Examine the others
7	Connect the fuel pressure gage valve, short circuit the No 30 pin and No 87 pin of the fuel pump relay to enable the fuel pump to operate, and examine and confirm whether the fuel pressure is approximate **350 kPa**.	Yes	Next step
		No	11
8	Apply the special connecting terminal to directly supply the fuel injector 12 V voltage from the battery, and examine the normal operation of fuel injector.	Yes	10
		No	Next step
9	Rinse the fuel injector, and then reexamine the normal operation of fuel injector.	Yes	Next step
		No	Replace the fuel injector
10	Examine and confirm whether the fuel deteriorates or contains water	Yes	Replace fuel
		No	16
11	Examine and confirm whether the fuel pressure is below **350 kPa**.	Yes	Next step
		No	15

12	Shut off the fuel gage valve, turn on the ignition switch again to enable the fuel pump to operate again, and examine and confirm whether the fuel pressure can be established.	Yes	Next step
		No	14
13	Turn on the fuel gage valve, apply the fuel return immobiliser to clip the fuel return pipe tightly so as to make it hasn't fuel return, and examine and confirm whether it is able to establish the fuel pressure quickly.	Yes	Replace fuel pressure regulator
		No	Repair or replace fuel injector or fuel pipe
14	Examine the leakage or jamming of the fuel intake pipe.	Yes	Repair or replace the fuel intake pipe
		No	Replace fuel pump
15	Examine the jamming or bending of the fuel return pipe	Yes	Repair or replace the fuel return pipe
		No	Replace the fuel pressure regulator
16	Examine and confirm whether the exhaust system and three-way catalytic converter are jammed.	Yes	Replace or clean
		No	Replace ECU

14) Bad acceleration performance and force shortage when acceleration

Confirm whether the fuel meets the standard requirements and whether the manual brake and brake drag.

No.	Operation Step	Detection Result	Subsequent Step
1	Examine and confirm whether there are clutch slip, tire pressure low, brake dragging, tire size improper, four wheels positioning incorrect and other failures.	Yes	Repair
		No	Next step
2	Examine and confirm whether the throttle fully opens.	Yes	Next step
		No	Replace or repair the throttle
3	Place the ignition switch on the “ON” position, and apply the failure diagnosis instrument to examine and confirm whether there are some failure information records.	Yes	Remove the displayed failure
		No	Next step
4	Enable the engine to operate at idle speed, and, after the coolant temperature reaches the normal value, examine and confirm whether the ignition advance angle is normal.	Yes	Next step
		No	Examine the others
5	Place the ignition switch on the “ON” position. Connect up an adaptor between ECU and harness, and examine and confirm whether the voltages of ECU’s intake manifold absolute pressure sensor, throttle position sensor, intake temperature sensor, coolant temperature sensor pins, ECU’s oxygen earth terminal and signal output terminal pins, ECU sensor’s signal earth terminal and ECU’s No 4 and 20 pins (applied for 4.5 to 5.0V sensor power supply) are normal.	Yes	Next step
		No	Repair or replace harness
6	Enable the engine to operate at idle speed, and examine and confirm whether the intake pressure is **35 to 55 kPa.**	Yes	Next step
		No	Examine and repair
7	Connect the fuel pressure gage valve, short circuit the No 30 pin and No 87 pin of the fuel pump relay to enable the fuel pump to operate, and examine and confirm whether the fuel pressure is approximate **350 kPa**.	Yes	Next step
		No	11
8	Apply the special connecting terminal to directly supply the fuel injector 12 V voltage from the battery, and examine the normal operation of fuel injector.	Yes	10
		No	Next step
9	Rinse the fuel injector, and then reexamine the normal operation of fuel injector.	Yes	Next step
		No	Replace the fuel injector
10	Examine and confirm whether the fuel deteriorates or contains water	Yes	Replace fuel
		No	16
11	Examine and confirm whether the fuel pressure is below	Yes	Next step

	350 kPa.	No	15
12	Shut off the fuel gage valve, turn on the ignition switch again to enable the fuel pump to operate again, and examine and confirm whether the fuel pressure can be established.	Yes	Next step
		No	14
13	Turn on the fuel gage valve, apply the fuel return immobiliser to clip the fuel return pipe tightly so as to make it hasn't fuel return, and examine and confirm whether it is able to establish the fuel pressure quickly.	Yes	Replace fuel pressure regulator
		No	Repair or replace fuel injector or fuel pipe
14	Examine the leakage or jamming of the fuel intake pipe.	Yes	Repair or replace the fuel intake pipe
		No	Replace fuel pump
15	Examine the jamming or bending of the fuel return pipe	Yes	Repair or replace the fuel return pipe
		No	Replace the fuel pressure regulator
16	Examine and confirm whether the data from intake manifold absolute pressure and intake temperature sensors are normal.	Yes	Next step
		No	Replace sensors
17	Examine and confirm whether the ignition coil, high-voltage wire and sparkle plug operate normally.	Yes	Next step
		No	Replace or repair
18	Examine and confirm whether the failure is caused due to the A/C system.	Yes	Examine the A/C system
		No	Replace ECU

15) A/C system failure

No.	Operation Step	Detection Result	Subsequent Step
1	Examine and confirm whether the system has sufficient coolants, the A/C system's belts are normal, and the A/C clutch, pressure switches operate normally.	Yes	Next step
		No	Remove the failure
2	Enable the engine to operate at idle speed, turn on the A/C switch, and apply the failure diagnosis instrument to examine and confirm whether there is a A/C thermistor failure.	Yes	Remove the displayed failure
		No	Next step
3	Turn on the A/C switch, connect up the adaptor between the ECU and harness, and measure whether the ECU's A/C switch and A/C pressure have the signal input.	Yes	Next step
		No	Examine harness
4	If the vehicle is equipped with the low level control, examine and confirm whether the A/C system still operates when the A/C system shuts down.	Yes	Repair harness
		No	Next step
5	Examine and confirm whether the earth terminal of A/C system relay pull-in coil has the low level output.	Yes	Repair the A/C relay and harness
		No	Replace ECU

5. Electronic fuel injection system failure diagnosis:

In general, the engine electronic fuel injection system failure is generated due to the following reasons:

(1) The engine electronic fuel injection system match problem. This problem generally occurs in the early stages of vehicle coming into market, such as: unstable idle, shutdown and etc, at the same time, these problems are by batch. This kind of problem is basically difficult to be solved via the mode of maintenance. Thus, if you find this kind of problem, please actively contact the Chery After-sales Service Department.

(2) In the electronic fuel injection system, the problem that occurs frequently is the failure caused due to the bad contact of connecting parts. A majority of these problems can be removed after the completion of some parts replacement. However, if these used parts are installed on the other vehicles, these vehicles still can operate normally. Thus, it is recommended that it is best to firstly examine the connection of related components of the electronic fuel injection system when the similar problems occur.

(3) The electronic fuel injection system parameter and data flow are very important during the course of maintenance. Thus, it is recommended that it is best not to determine problem relying on the failure codes only during the course of maintenance, we shall integrate the data flow to determine and solve these problems.

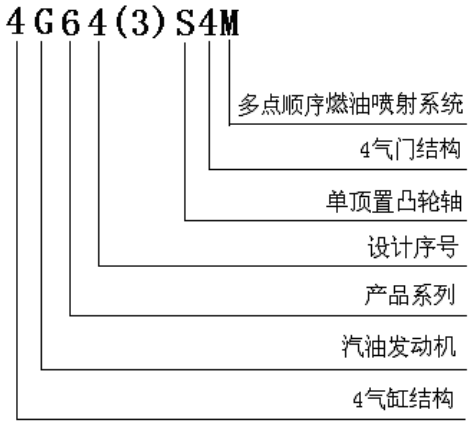
Contents

Chapter 1 Overview

Engine used in Chery Tiggo car is MITSUBISHI 4G64 (2.4L) and 4G63 (2.0L) model engine, which adapt single-overhead-camshaft, 4-cylinder 16-valve and multi-point sequential injection.

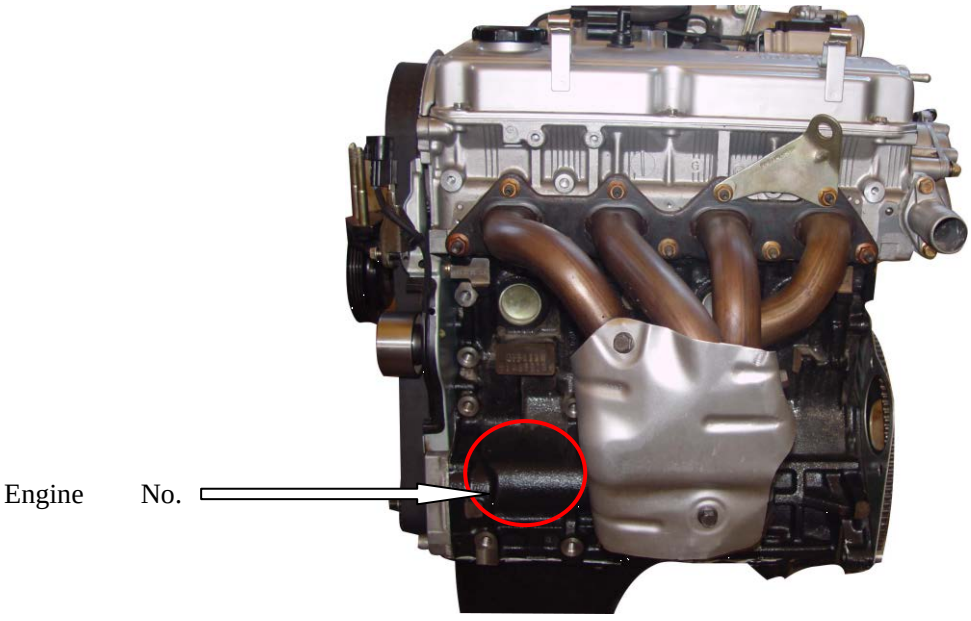
I. Technical Data

1. Engine Mode Number Indication



多点顺序喷射系统：Multi-point sequential injection
4 气门结构：4 valve structure
单顶置凸轮轴：Single-overhead-camshaft
设计序号：Design serial number
产品系列：Product serial
汽油发动机：Gasoline engine
4 气缸结构：4 cylinder structure

2.Engine Number Position



3. Related Engine Data

Item	Specification	
	4G63 S4 MPI	4G64 S4 MPI
Engine type	Four cylinder in-line, 4 stroke, water-cooled, single-overhead-camshaft,16 valve multi-point sequential injection	
Cylinder number	4	4
Combustion chamber	Ridge chamber	Ridge chamber
Total displacement ml	1,997	2,351
Cylinder diameter mm	85.0	86.5
Stroke mm	88.0	100.0
Output power kw	92（6000r/min）	95（5500r/min）
Max torque N.m	167.7	198.1
Compression ratio	10	9
Lubrication system	Pressure supply, full filter	Pressure supply, full filter
Fuel pump type	Gear type	Gear type
Water pump type	Centrifugal impeller	Centrifugal impeller

4. Maintenance Standard

UOM：mm

Item				Standard Value	Usage Limit Value
Engine gear belt	Tensioner arm protrusion			12	——
	Tensioner arm depression (98～196N)			≤1	——
Camshaft	Cam height	Air-in	4G63	37.50	37.00
		Air-out	4G63	36.99	36.49
	Shaft diameter			45.0	
Cylinder cover	Lower surface flatness			0.03	0.2
	Surface grinding limit* total grinding of cylinder body and cylinder cover			——	* 0.2
	Full height			119.9－120.1	
				97.4	≤99.4
Valve	Edge thickness	Air-in		1.0	0.5
		Air-out		1.2	0.7
	Valve rod diameter			6.0	——
	Crest clearance between valve rod and duct	Air-in		0.02－0.05	0.10
		Air-out		0.03－0.07	0.15
	Inclination angle			45°－45.5°	——

Item			Standard Value	Usage Limit Value
	Height	Air-in	112.30	111.80
		Air-out	114.11	113.61
Valve spring	Free height		51.0	50.0
	Pre-loading force/Operation height Km/mm		27.2/44.2	——
	Verticality		≤2°	≤4°
Valve duct	Contact bandwidth		0.9－1.3	——
	Internal diameter		6.0	——
	External diameter		11.0	——
	Depression depth		14.0	——
	Valve rod protrusion height		49.3	49.8
Engine oil pump	Side clearance	Driving gear	0.08－0.14	——
		Driven gear	0.06－0.12	——
Piston	Piston clearance		0.02－0.04	——
Piston ring	Lateral clearance	No.1 ring	0.02－0.06	0.1
		No.2 ring	0.02－0.06	0.1
	End clearance	No.1 ring	0.25－0.35	0.8
		No.2 ring	0.40－0.55	0.8
		Oil ring	0.10－0.40	1.0
Piston pin	External diameter		22.0	——
	Depressing force (Kg)		755－1750	——
	Depressing temperature		Room temperature	——
Crank	Crank pin clearance		0.02－0.05	0.1
Connecting rod	Bigger end clearance		0.10－0.25	0.4
Crank	Axial clearance		0.05－0.18	0.25
	Main axle diameter		57	——
	Connecting axle diameter		45	——
	Main axle diametral clearance		0.02－0.04	0.1
Cylinder body	Upper surface flatness		0.05	0.1
	Upper surface grinding limit*Total grinding of cylinder body and cylinder cover		——	* 0.2
	Full height 4G63		284±0.1	——
	Internal diameter of cylinder hole 4G63		85.00－85.03	——
Cylinder body	Cylinder hole cylindricity		0.01	——
Motor	Rotor coil resistance		3－5	——
Cylinder Cover	Secondary processing size of valve conduit installation hole (air-in and air-out valve) enlargement	0.05 O.S.	11.05－11.07	
		0.25 O.S.	11.25－11.27	
		0.50 O.S.	11.50－11.52	

Item			Standard Value	Usage Limit Value
	Secondary processing size of air-in valve seating hole enlargement	0.30 O.S.	34.435－34.455	
		0.60 O.S.	34.735－34.755	
	Secondary processing size of air-out valve seating hole enlargement	0.30 O.S.	31.935－31.955	
		0.60 O.S.	32.235－32.255	

Remarks:
O.S.: Enlarged diameter

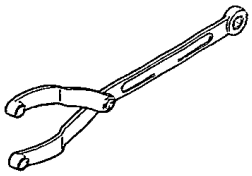
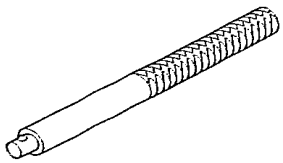
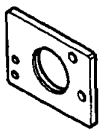
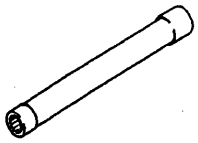
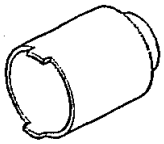
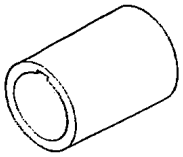
5. Tightening torque

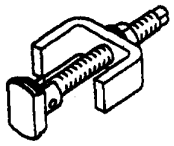
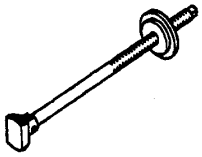
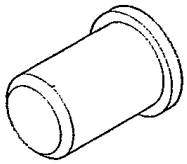
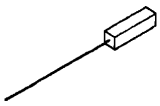
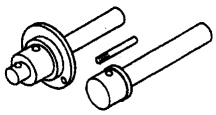
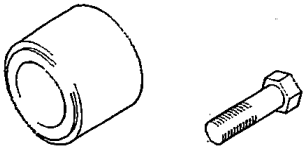
Tightened Part	**Torque (kgf .M)**
Alternator, Ignition system	
Water pump belt gear	0.9
Adjusting bolt	1.0
Locking bolt	2.2
Alternator bracket screw bolt	2.4
Alternator center axle nut	4.5
Crank belt gear	2.5
Ignition coil	1.0
Spark piston	2.5
Camshaft position sensor cylinder	2.2
Camshaft position sensor bracket	1.4
Camshaft position sensor	1.0
Timing Belt	
Protruded screw bolt on timing belt cover	1.1
Tensioner wheel screw bolt	4.9
Tensioner arm screw bolt	2.2
Automatic tensioner screw bolt	2.4
Central belt wheel screw bolt	3.6
Tensioner bracket	4.9
Timing belt rear cover	1.1
Timing belt indicator	0.9
Engine oil pump belt gear	5.5
Screw bolt of crank belt gear	12.0
Tensioner “B”	1.9
Belt gear of balance axle	4.6
Screw bolt of camshaft belt gear	9.0
Belt gear of balance axle	4.6
Fuel System	
Throttle	1.9

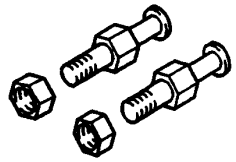
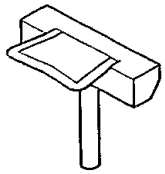
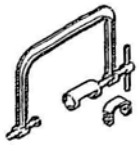
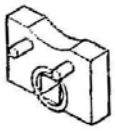
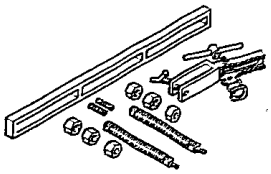
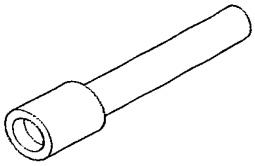
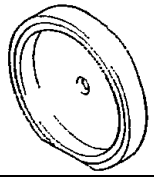
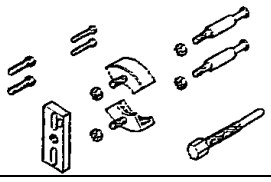
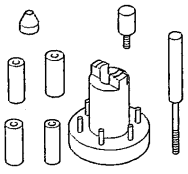
EGR valve	2.2
Injector and distribution pipe	1.2
Fuel oil return pipe	0.9
Fuel pressure regulator	0.9
Intake Manifold	
Screw bolt of engine flying rings	1.9
Engine coolant temperature sensor	3.0
Connecting bolt of outflow pipe	2.0
Manifold bolt	2.0
Coolant temperature sensor	1.1
Manifold bracket	1.4
Exhaust Manifold	
Screw bolt of emission manifold cover	1.4
Screw bolt of inflow duct joint	2.4
Exhaust manifold nut (M8)	3.0
Exhaust manifold nut (M10)	5.0
Screw bolt of coolant bypass duct joint	2.4
Screw bolt of coolant duct component	1.3
Thermostat housing bolt	2.4
Water pump screw bolt	1.4
Rocker and Camshaft	
Rocker cover screw bolt	0.4
Screw bolt of rocker and camshaft assembly	3.2
Trust bearing cover bolt	1.9
Cylinder Cover and Valve	
Cylinder cover bolt	2.0＋90°＋90°
Front cover & Engine oil pump	
Drain plug	4.5
Oil pan	0.7
Screw bolt and nut of oil strainer	1.9
Oil pressure switch	1.0
Pressure relief plug	4.5
Screw bolt of oil cleaner bracket	1.9
Front cover bolt	2.4
Plug	2.4
Flange bolt	3.7
Engine oil pump cover bolt	1.6
Engine oil pump cover screw	1.0
Piston and Connecting Rod Assembly	
Connecting rod nut	2.0＋90°～100°
Crank, Cylinder Body, Flywheel	
Flywheel screw bolt	13.5

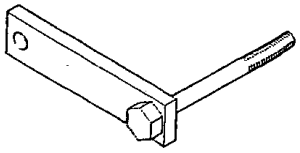
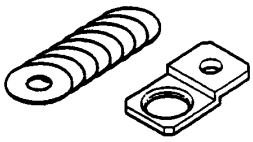
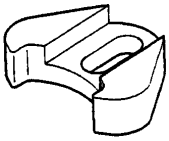
Installation screw bolt of rear cover Installation screw bolt of bell jar Installation screw bolt of oil seal cover Screw bolt of main bearing cover	1.1 0.9 1.1 2.5＋90°～100°
Throttle Body	
Bracket screw bolt	0.5
Throttle Position Sensor	0.35
Screw bolt of idle speed air valve	0.35
Idle speed adjustment bolt and installation nut	0.3

II. Special Tools

Tool	Number	Name	Purpose
	MB990767	Spanner for crankshaft belt gear	Use MD998719 when fixing camshaft belt gear
	MB990938	Handle	Use it together with MD998776 to install crankshaft rear oil seal.
	MB991603	Balance axle bearing puller limiter	Use it with MD998372 together to disassemble reverse balance axle rear bearing and install guiding limiter.
	MB991654	Cylinder cover bolt spanner (12)	Disassemble and assemble cylinder cover bolt.
	MD998162	Plug spanner	Disassemble and assemble front cover plug cock.
	MD998285	Crankshaft front oil seal duct	MD998375 Use MD998375 to install crankshaft front oil seal

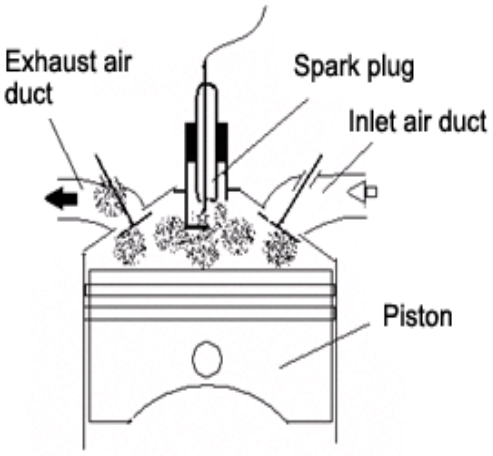
Tool	Number	Name	Purpose
	MD998371	Balance axle bearing puller	Disassemble reverse balance axle front bearing
	MD998372	Balance axle bearing puller	Disassemble reverse balance axle rear bearing
	MD998375	Crank shaft front oil seal installer	Install crankshaft front oil seal
	MD998440	Leakage check tester	Leakage test for hydraulic post.
	MD998441	Hydraulic post keeper	Exhaust air from hydraulic post
	MD998442	hydraulic post wiring	Exhaust air from hydraulic post
	MD998443	hydraulic post keeper	Use it when disassembling or assembling rocker shaft component
	MD998705	Balance axle bearing installer	Install balance axle front and rear bearing.
	MD998713	Camshaft oil seal installer	Install camshaft oil seal

Tool	Number	Name	Purpose
	MD998719	Fixing pin for belt gear	Use MB990767 to fix camshaft belt gear.
	MD998727	Oil pan remover	Disassemble oil pan
	MD998735	Valve spring compressor	Disassemble and assemble valve and related parts
	MD998767	Tensioner puller sleeve	Timing belt tension adjustment
	MD998772	Valve spring compressor	Disassemble and assemble valve and related parts
	MD998774	Valve oil seal installer	Install valve oil seal
	MD998776	Crankshaft rear oil seal installer	MB990938 Use MB990938 to install crankshaft rear oil seal.
	MD998778	Crankshaft belt gear puller	Disassemble crankshaft belt gear
	MD998780	Piston disassembling and assembling tool	Disassemble and assemble piston pin.

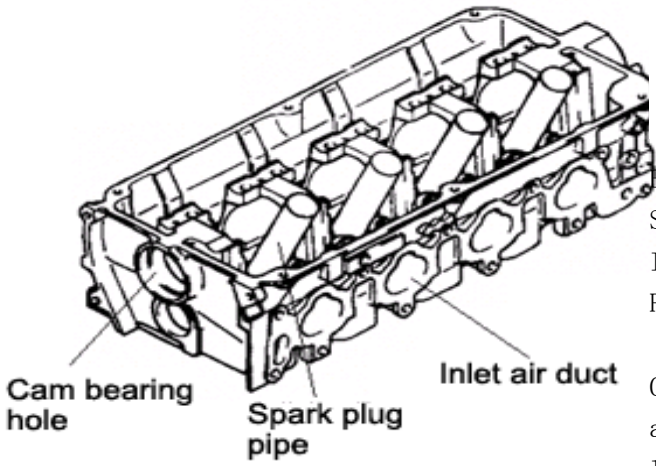
Tool	Number	Name	Purpose
	MD998781	Flywheel stopper	Fix flywheel and driving disk
	MD998783	Plug spanner fixer	Disassemble and assemble front cover plug
	MD998785	Timing belt gear stopper	Keep balance axle belt gear.

Chapter 2 Engine Structure Features

1.Cylinder Cover Structure Features



Exhaust air duct
Spark plug
Inlet air duct
Piston

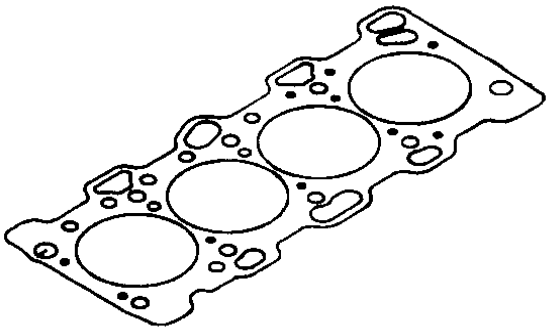


Cam bearing hole
Spark plug pipe
Inlet air duct

Cylinder cover is made of horniness aluminium alloy, which is firstly low-pressure-molten and then machining.

Four-valve structure is applied and its advantage is increasing emission channel area and decreasing valve movement inertia.

2.Cylinder Cushion Structure

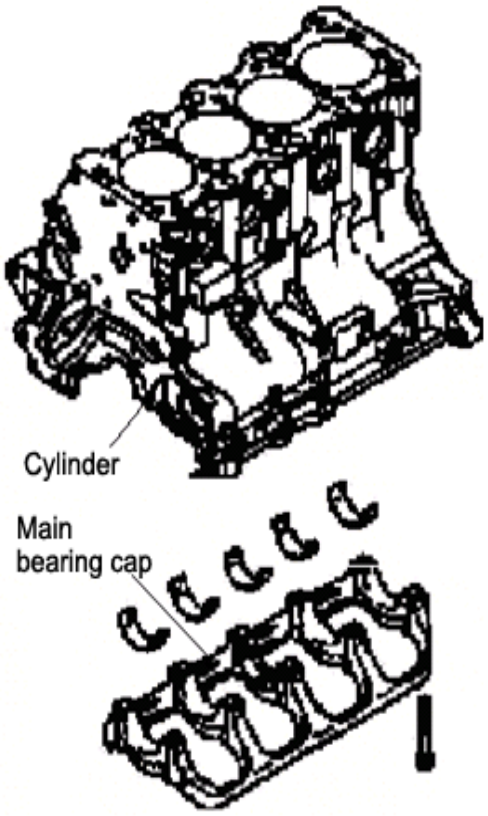


Agile fiberboard structure is applied. Many 1.5mm-diameter through holes are pressed in the steel board and fiber liquid mixture is filtered through steel board. And then sealant is sprayed on both sides of agile broad and the important part is additionally sprayed with seal thread.

3.Spark Plug Position

Spark plug is located in the center of chamber, which may let flame reach each chamber corner at almost the same time.

4.Cylinder Main Bearing Cap



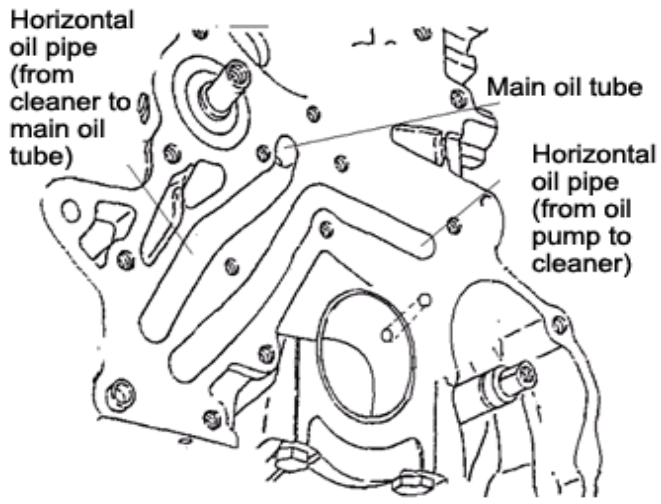
. ..

Cylinder

Main bearing cap

Integrated main bearing cap is applied, which may increase engine operation rigidity, observe and distribute efficiently periodic viable force generated by crank running, and ensure engine stable and smooth running at high speed, large load or large torque.

5.Oil Tube Features

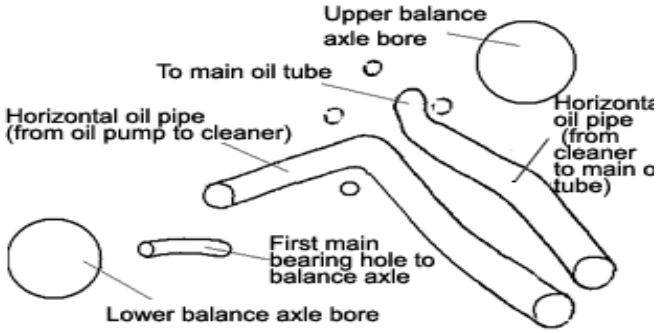


Main oil tube

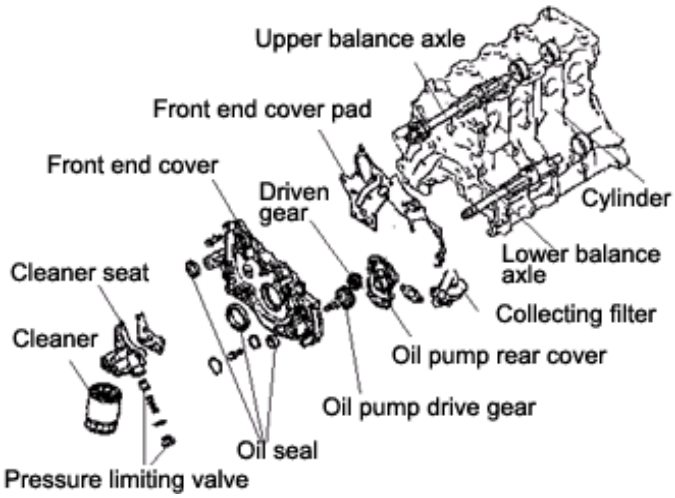
Horizontal oil pipe (from cleaner to main oil tube)

Horizontal oil pipe (from oil pump to cleaner)

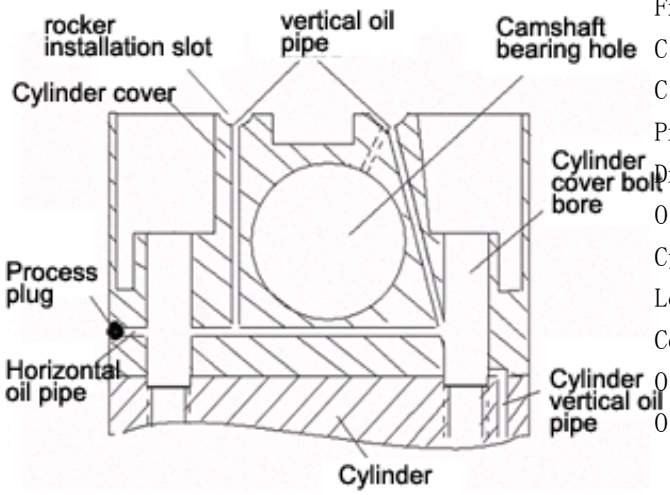
1、Modular oil pipe is applied. (The whole oil pipe consists of the half oil pipe cast on cylinder body and the other half on front end cover)



Upper balance axle bore
To main oil tube
Horizontal oil pipe (from oil pump to cleaner)
Horizontal oil pipe (from cleaner to main oil tube)
First main bearing hole to balance axle
Lower balance axle bore



Upper balance axle
Front end cover pad
Front end cover
Cleaner seat
Cleaner
Pressure limiting valve
Driven gear
Oil seal
Cylinder
Lower balance axle
Collecting filter
Oil pump rear cover
Oil pump drive gear

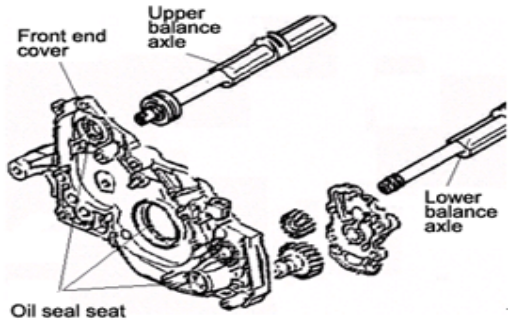


rocker installation slot
vertical oil pipe
Cylinder cover
Camshaft bearing hole
Cylinder cover bolt bore
Process plug
Horizontal oil pipe
Cylinder vertical oil pipe
Cylinder

2、There is a vertical oil pipe in the rear end of cylinder cover, which provides lubricant to air distribution mechanism.

The front end cover is made of molten horniness aluminum metal. Oil pump and cleaner system are located on the front end cover's board. The cover board itself is front housing of oil pump.

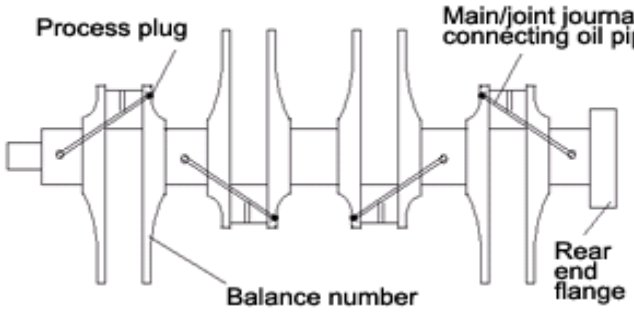
6. Front End Cover Features



Front end cover
Upper balance axle
Oil seal seat
Lower balance axle

balance axle oil seal are pressed and fixed on front cover board.
The cylinder front end is combined as horizontal oil pipe and there is an oil pipe to lubricate the rear bearing of lower balance axle.
Both upper and lower balance axles are supported by front end cover board. Lower balance axle is also driven axle of oil pump.

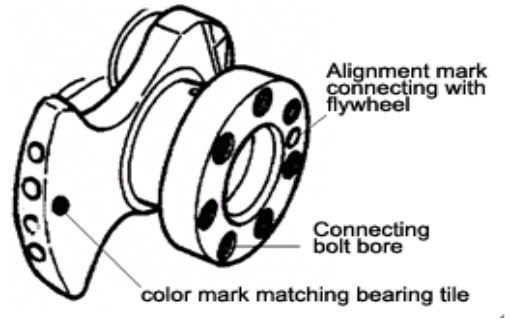
7. Crank Connecting Rod Mechanism



Process plug
Main/joint journal connecting oil pipe
Balance number
Rear end flange

Crankshaft is made of forged carbon steel, which surface is machining processed
The location of crankshaft oil pipe is as shown.
Crankshaft is full-balance type, that is Balance Number = Number of Cylinders × 2.

The rotary radius of crankshaft main axle center and crankshaft pin center is separately 88/2 (4G63), 100/2 (4G64).
Main axle diameter/57mm、Connecting rod diameter/45mm (The diameter of 4G63 and 64 is same);

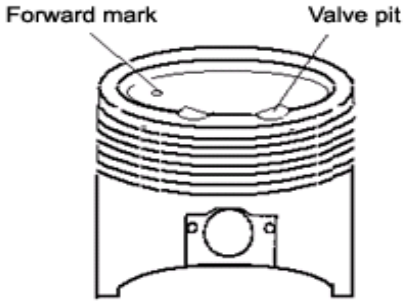


Alignment mark connecting with flywheel
Connecting bolt bore
color mark matching bearing tile

The rear end flange is thickened as oil seal top and don't impact it.
Seven flywheel bolts are part distributed and there is a flywheel locking pin.

Front crank oil seal, oil pump seal and upper

8. Piston Structure Features

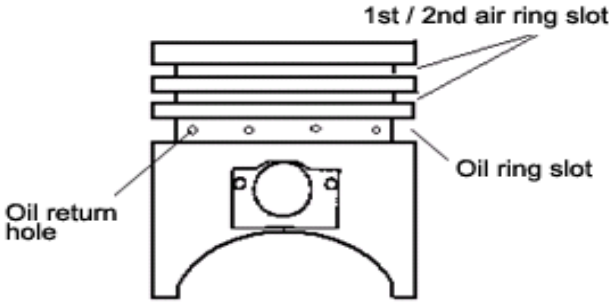


Forward mark
Valve pit

It is made of molten horniness aluminum, which has been surface processed.

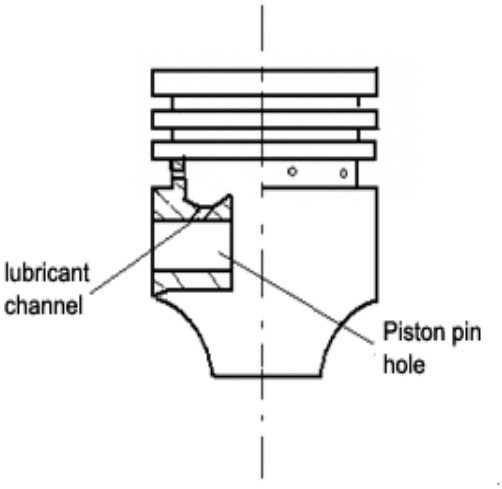
There is a roundness concave on the top, which makes chamber compacted, decreases F/V value, reduces nocuousness emission, increases power and decreases oil consumption.

There is valve pit on the right side of piston, which makes chamber structure more impacted.



1st / 2nd air ring slot
Oil return hole
Oil ring slot

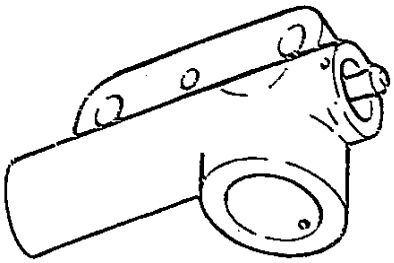
There are two air ring slots and one oil ring slot. A oil return hole is drilled in the oil ring slot, which lubricate piston pin mating and reduce dynamic pressure of oil ring.

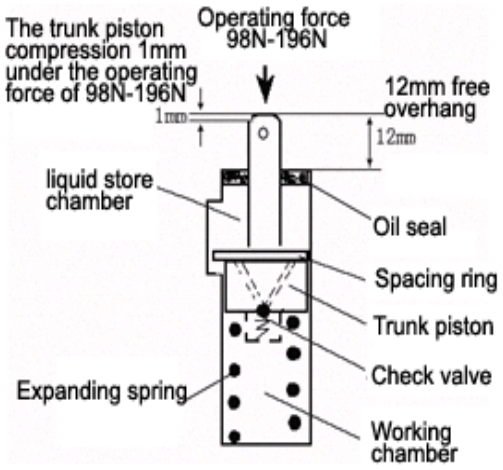


lubricant channel
Piston pin hole

There is oil slot in the inside upper of piston pin seating, which collect splash oil to lubricate piston pin mating

9. Automatic Tensioner





Operating force 98N-196N

The trunk piston compression 1mm under the operating force of 98N-196N

12mm free overhang

liquid store chamber

Oil seal

Spacing ring

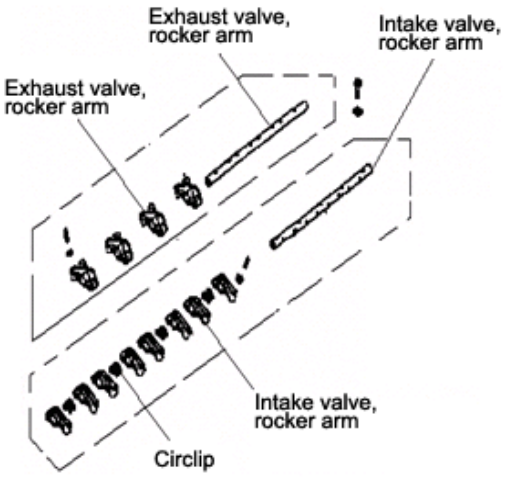
Trunk piston

Check valve

Expanding spring

Working chamber

10. Air Distribution Mechanism



Exhaust valve, rocker arm

Exhaust valve, rocker arm

Intake valve, rocker arm

Circlip

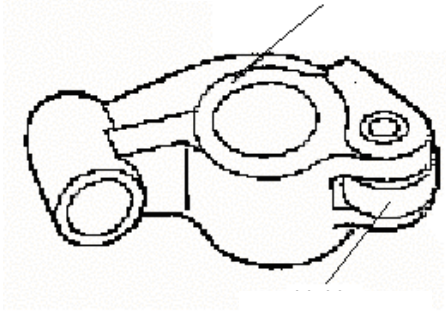
Intakevalve, rocker arm

Automatic tensioner is to make timing belt tensioned. In an operation cycle, the belt tension is not

constant and changing periodically. With usage time increasing and belt aging, tensioner may be tensioned automatically to prevent belt sliding and affect engine air distribution phase.

latter will inject incoming oil from rocker to lubricate air distribution mechanism.

Intake valve, rocker arm



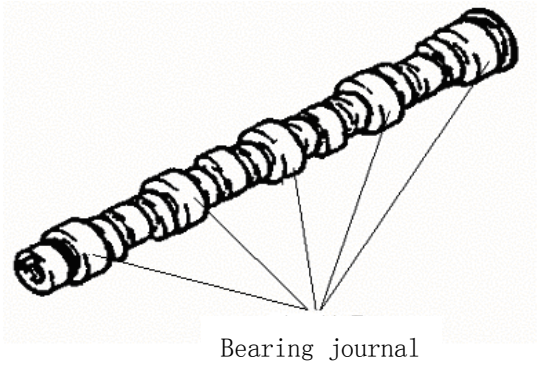
Idler wheel

Intake valve, rocker arm

Idler wheel

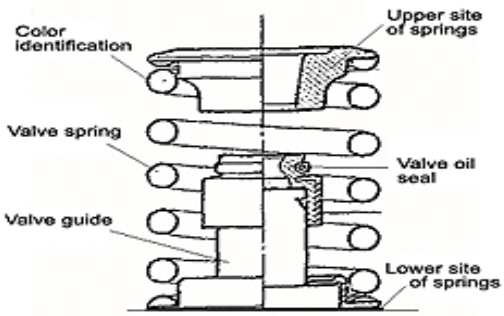
The two hollow rocker of oil hole can neither be exchanged nor be reversely installed.

Eight intake valve, rocker arms are divided into group A and B without exchange. Four exhaust valve, rocker arms are exchangeable. The intake/exhaust valve, rocker arms are made of aluminum metal, which may decrease weight, reduce crankshaft cam load, extend its life time and improve engine performance and fuel economics. There are oil pipe and oil injection hole, which are supported by hydraulic pole in intake/exhaust valve, rocker arms. The



Bearing journal

Bearing journal



Upper site of springs

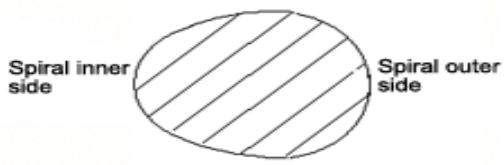
Color identification

Valve spring

Valve guide

Valve oil seal

Lower site of springs



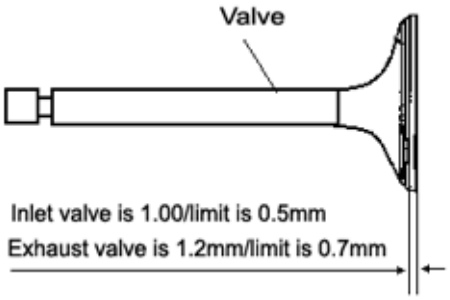
Spiral inner side

Spiral outer side

The valve spring is non-isometry structure, which may prevent sympathetic vibration and rupture. Please notice that the color-marked should be upwards and the larger-distant is upwards. Spring section is elliptoid, which surface is shot blasting processed to improve fatigue resistance.

Idler wheel rocker arm is adopted in the rocker arm so as to reduce the abrasion between camshaft cam and rocker arm

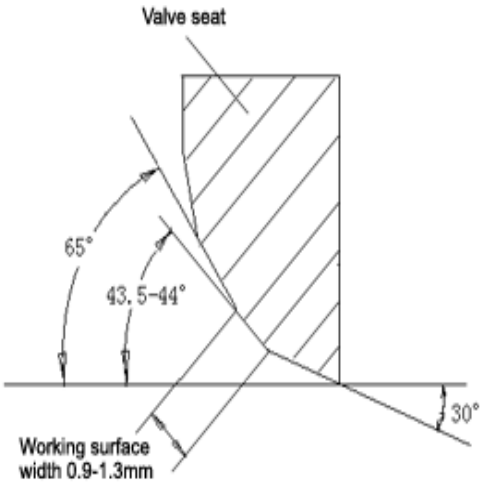
Camshaft is made of spheroidal graphite iron, of 5-point bearing and no special bearing.



Valve

Inlet valve is 1.00/limit is 0.5mm

Exhaust valve is 1.2mm/limit is 0.7mm



Valve seat

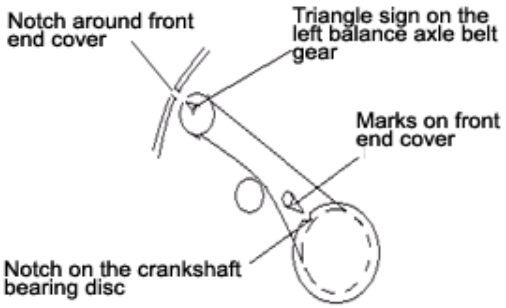
Working surface width 0.9-1.3mm

The valve is of umbrella structure. The intake valve is similar to the exhaust valve, but the size of the former is a little bigger than the later. Each cylinder is of four-valve structure, which may improve emission efficiency, decrease weight and inertia resistance and extend the life time of valve and valve seat. Besides it, it is of benefit for spark plug allocation, which improve burning efficiency and reduce injurant emission and fuel consumption.

Valve oil seal is of steel-shelf and rubber-ring-spring tension structure. The

11. Timing Gears Train

Upper Balance Axle Belt Fitting Mark



Notch around front end cover

Triangle sign on the left balance axle belt gear

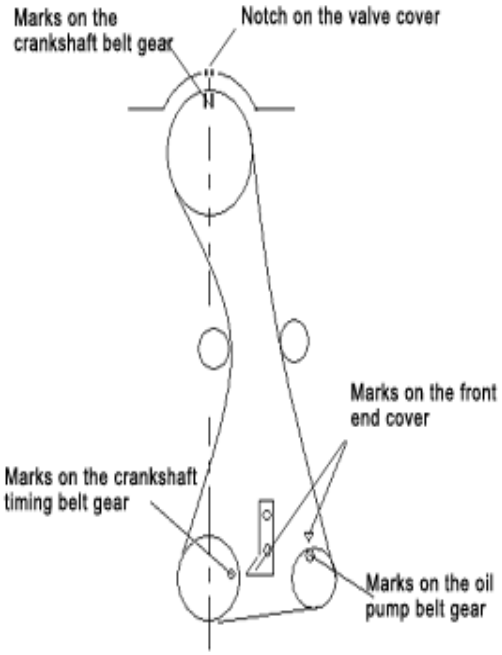
Marks on front end cover

Notch on the crankshaft bearing disc

There is an independent transmission belt on the upper-left balance axle. Tension wheel B is located on the loosened side, which is to adjust belt tension manually. The teeth number of drive gear is 38 teeth and the teeth number of driven gear is 19.

Please note that align the marks of crankshaft B belt gear and front end cover and the marks of upper-left balance axle belt gear and front end cover when installing left balance axle belt gear, which is as shown.

Timing Belt Fitting Mark



Marks on the crankshaft belt gear

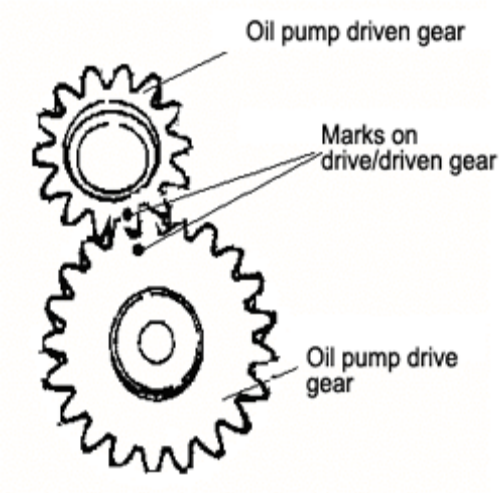
Notch on the valve cover

Marks on the front end cover

Marks on the crankshaft timing belt gear

Marks on the oil pump belt gear

Oil Pump Gears Mark



Please align the marks of drive/driven gears when installing oil pump gears as shown.

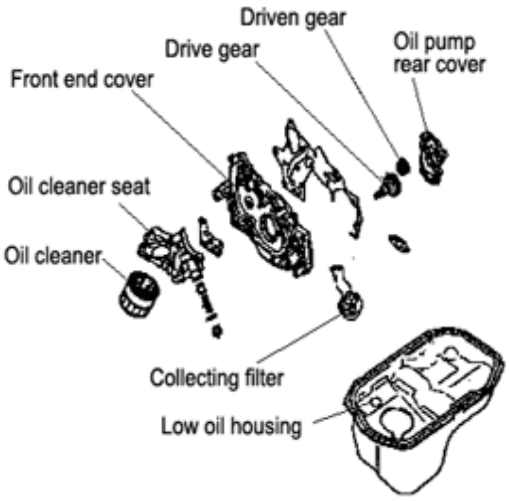
Oil pump driven gear

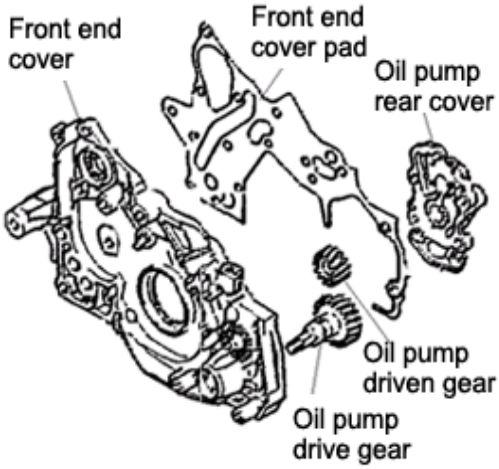
Marks on drive/driven gear

Oil pump drive gear

Please note that align the marks of camshaft belt gear and valve cover, the marks of crankshaft timing belt gear and front end cover and the marks of oil pump belt gear and front end cover when installing timing belt. (The 60mm-length screw drive must be inserted into the lower balance test hole, otherwise turn around oil pump belt gear and then align timing mark.)

12. Lubrication System Structure Features





Front end cover

Front end cover pad

Oil pump rear cover

Oil pump driven gear

Oil pump drive gear

Driven gear

Drive gear

Oil pump rear cover

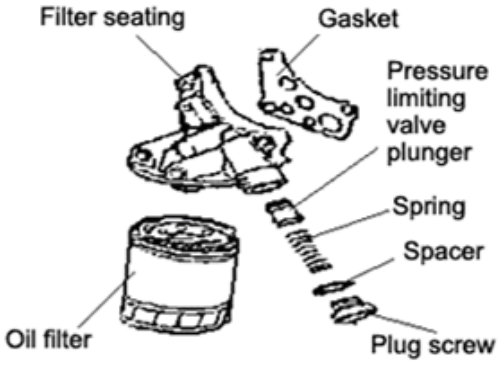
Front end cover

Oil cleaner seat

Oil cleaner

Collecting filter

Low oil housing



Filter seating

Gasket

Pressure limiting valve plunger

Spring

Spacer

Oil filter

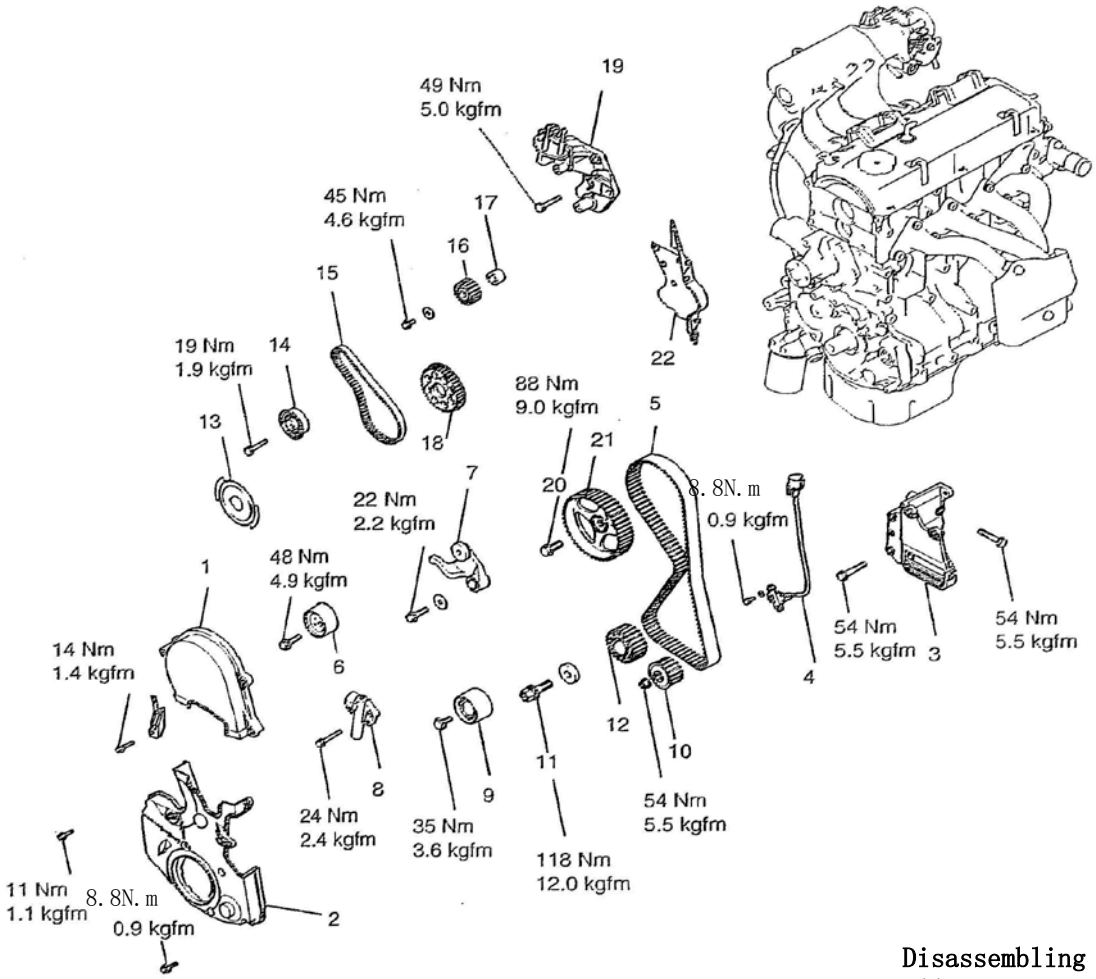
Plug screw

External gear oil pump is applied and its oil supply performance is better than current rotor pump. The efficiency of external gear pump is high, that is, the efficiency of oil supply is proportional to the speed, which may satisfy large-load oil supply requirement. However, if rotor pump speed increase, the oil pump efficiency will increase at low speed, but it will drop gradually when the speed reach mid-speed as shown, which will cause lack of large-load oil supply. Therefore, large load should be considered when designing rotor pump, but it will consume power during low loading.

Oil filter seating and pressure limiting valve – Pressure limiting valve is of plunger spring structur

Chapter 3 Valve gear

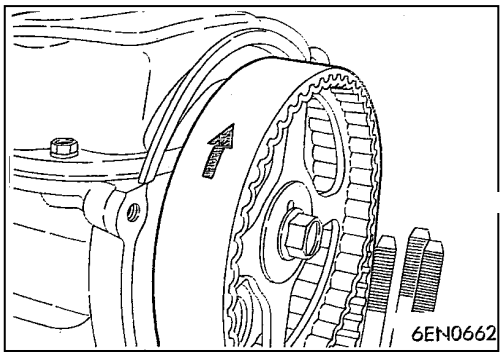
I. Timing belt

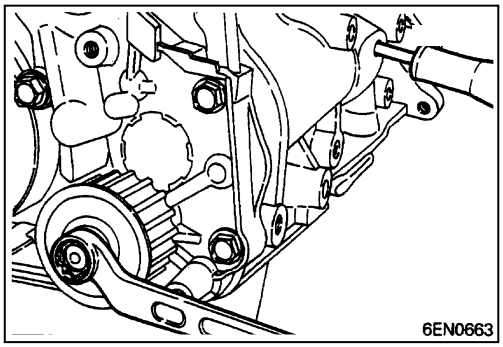


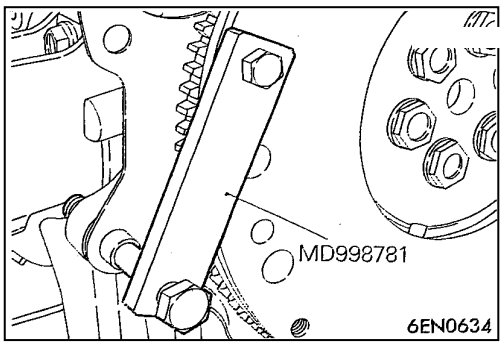
Disassembling illustration

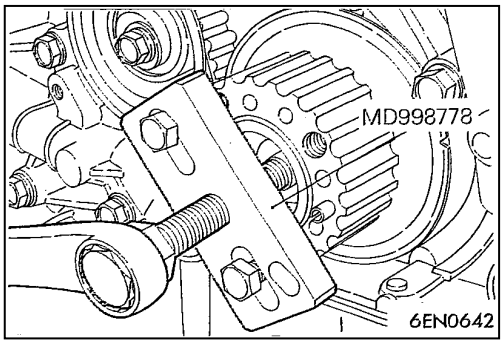
Disassembling steps

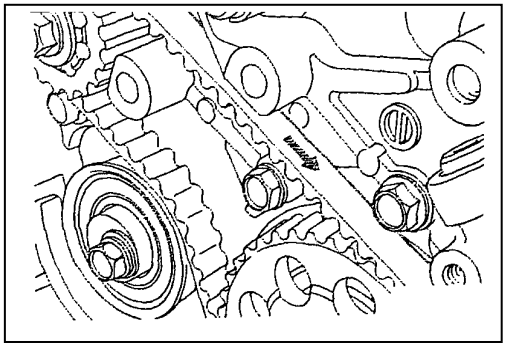
1. front upper cap of timing belt
2. front lower cap of timing belt
3. power steering bracket
4. crankshaft position sensor
5. timing belt
6. tensioning gear
7. tensioner arm
8. automatic tensioner
9. idler
10. oil pump pulley
11. crankshaft screw bolt
12. crankshaft timing pulley
13. flange
14. tensioner B
15. timing belt B
16. pulley of upper balance shaft
17. bushing
18. crankshaft timing pulley B
19. right bracket component of engine
20. screw bolt of camshaft pulley
21. camshaft timing pulley











1 Disassembling Notice

- **Disassembling of timing belt**

Remember the rotation direction of belt in order to avoid any error when reassembling.

Caution:

1) If there is water or grease on the belt, the lifecycle of belt will be decreased rapidly. So, after disassembling, take care not to have water or grease adhere to and pollute the belt, the pulley, and the tensioner. Do not clean these parts. When they are seriously polluted, please replace them with new ones.

2) If water or grease is found in these parts, please check whether there is any leakage in the oil seal of front cover, the oil seal of camshaft and water pump.

- **Disassembling of oil pump pulley**

(1) Disassemble the plug cock on the cylinder side.

(2) Insert an 8mm-diameter cross-ended screwdriver to fasten the left side balance shaft.

(3) Disassemble the screw nut of oil pump pulley.

(4) Disassemble the oil pump pulley.

- **Disassembling of crankshaft screw bolt (Disassembling of flywheel)**

(1) Fix the driving board or flywheel with special tool.

(2) Disassemble the crankshaft screw bolt. Support the driving board or flywheel with special tool.

- **Disassembling of crankshaft pulley**

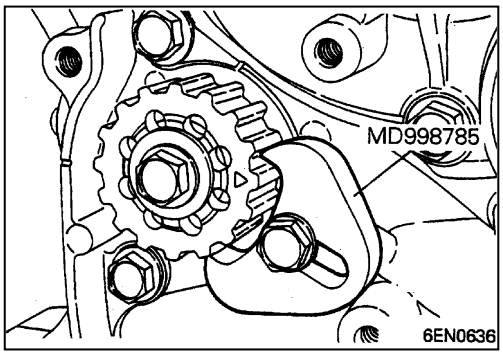
If it is difficult to disassemble due to the reason of adhering, please apply special tool.

- **Disassembling of timing belt B**

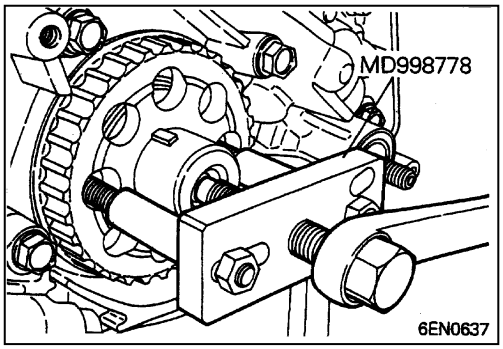
(1) Remember the rotation direction of belt to avoid any error when reassembling.

Notice:

If there is water or grease on the belt, the lifecycle of belt will be decreased rapidly. So, after disassembling, take care not to have water or grease adhere to and pollute the belt, the pulley, and the tensioner. Do not clean these parts. When they are seriously polluted, please replace them with new ones.



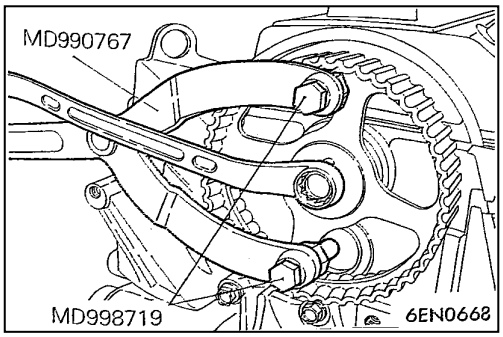
(2) If water or grease is found in these parts, please check whether there is any leakage in the oil seal of front cover, the oil seal of camshaft and water pump.



- **Disassembling of pulley of upper balance shaft**

(1) Apply tool as shown in the illustration to fix the pulley of balance gear.

(2) Disassemble the pulley of upper balance shaft.



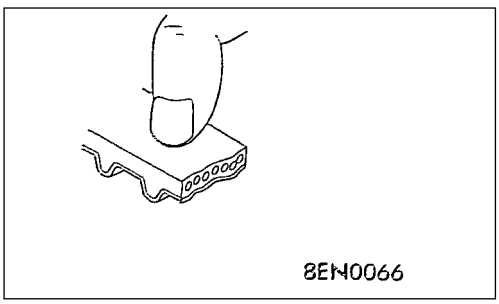
- **Disassembling of crankshaft pulley B**

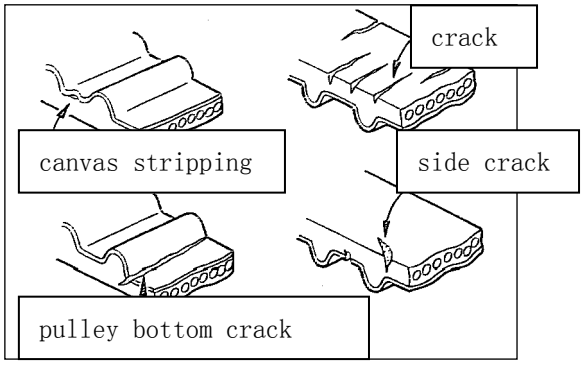
(1) If it is difficult to disassemble due to the reason of adhering, please apply special tool.

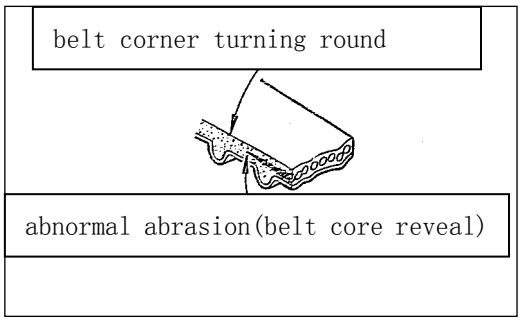
- **Disassembling of camshaft pulley screw bolts**

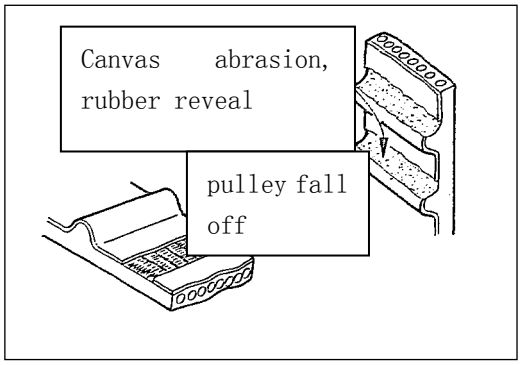
(1) Fix the camshaft timing pulley with special tool.

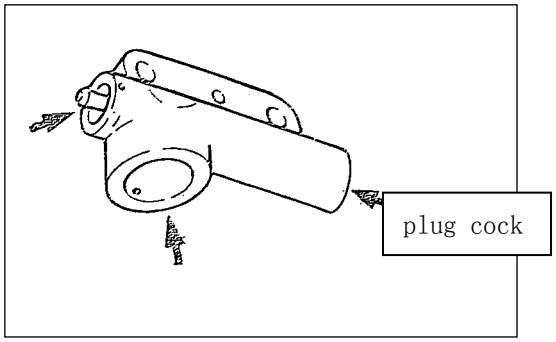
(2) Disassemble the screw bolts of camshaft pulley.











2 Check

- **Timing belt**

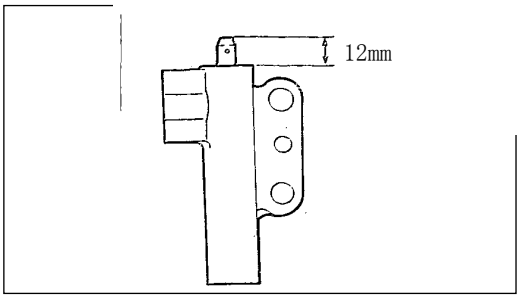
Check every part of the belt carefully, if there is any damage as the following, please replace with new one.

(1) The back rubber is aging and glistening. There is no crack when fingernail scratches it and there is no flexibility.

(2) There is crack in the back rubber.
(3) There is crack and stripping in the canvas.
(4) There is crack at the bottom of pulley.
(5) There is crack in the side of pulley.
(6) Abnormal abrasion in the side of pulley. When the side of belt is as smooth as surface of one cut by sharp knife, it is normal.
(7) Abnormal abrasion in the part of pulley.
(8) Teeth off.

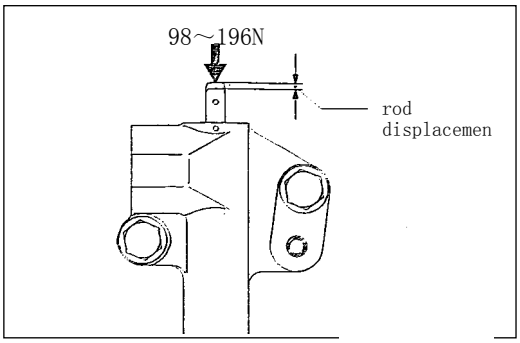
- **Automatic tensioner**

(1) Check the leakage of automatic tensioner. Replace with a new one when necessary.
(2) Check if there is any abrasion or damage at the end of the rod. Replace with a new one when necessary.



(3) Measure the stretch of the rod. If it is not conformed to the standard, replace the automatic tensioner with a new one.

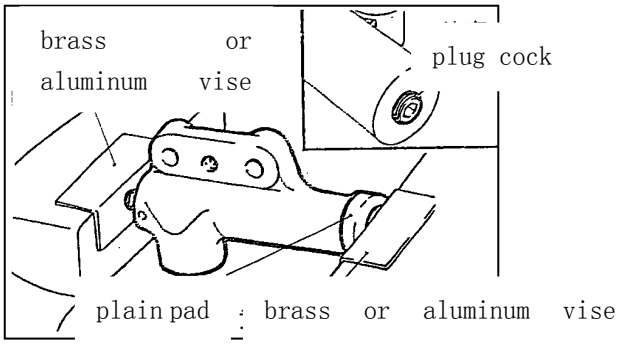
Standard value: 12mm



(4) Press down the rod with a power of 98～196N and measure the rod displacement.

(5) If the rod displacement is 1mm larger than the value measured in the (3)item, the automatic tensioner should be replaced.

Standard value: ≤1mm

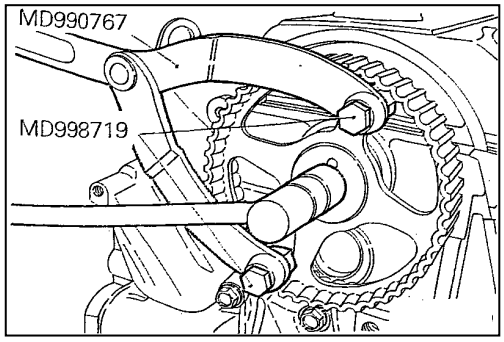


(6) Fasten the automatic tensioner with vises which has soft opening.

Caution:

- **As there is screw bolt stretching out at the bottom of automatic tensioner, a plain pad should be inserted between the vises and screw bolt to avoid their direct contact.**

(7) Rotate the handle of vises to push the rod of automatic tensioner in. If it is easy to push in, please replace the automatic tensioner with a new one. It should be felt as if there is some resistance when you push in the rod.

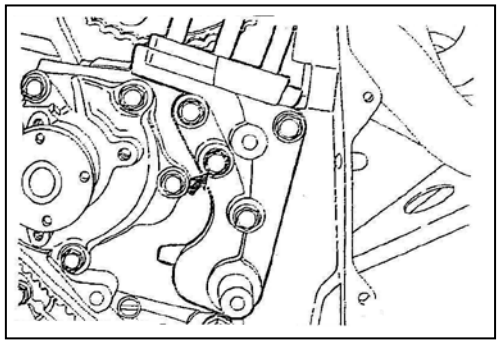


3 Installation Notice

- **Fasten bolt of camshaft pulley**

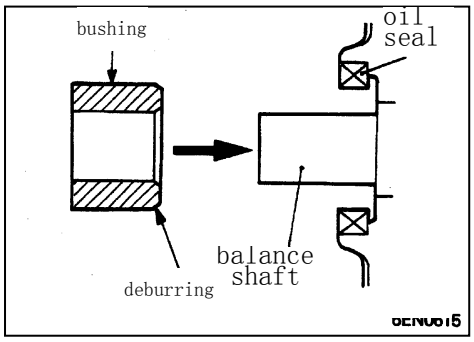
(1) Fix the camshaft pulley with special tool.

(2) Fasten the bolt of camshaft pulley to the assigned torque.



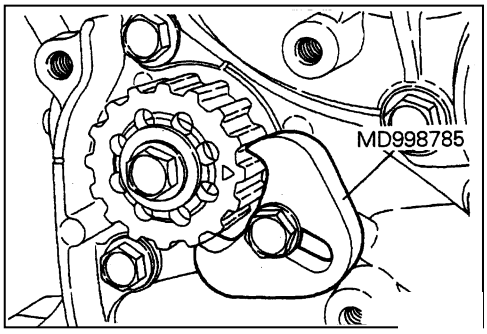
- **Installation of engine bracket base**

(1) Before starting fastening, apply sealant to the bolt part as shown in the illustration.



- **Installation of bushing in upper balance shaft**

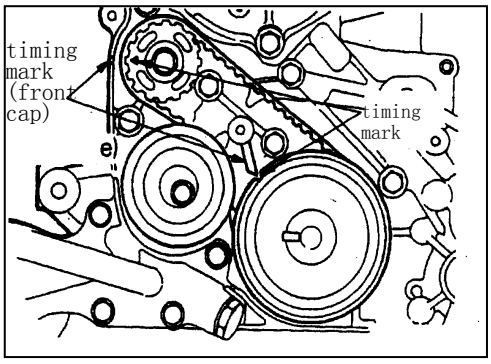
(1)When installing the bushing, place the side with deburring to the direction of oil seal.



- **Installation of pulley in upper balance shaft**

(1) Fix pulley in the balance shaft with a tool as shown in the illustration.

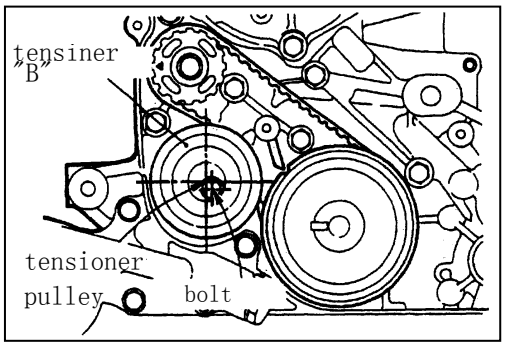
(2) Fasten the bolt to assigned torque.



- **Installation of timing belt B**

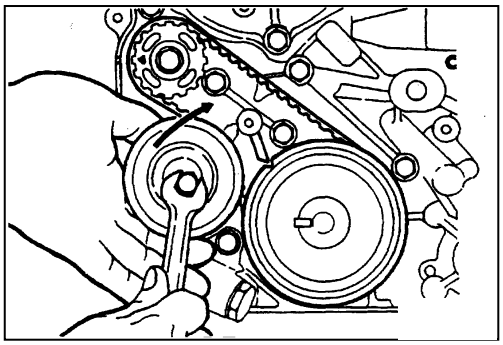
(1) Align the marks on the crankshaft pulley and balance shaft pulley with the marks on the front cover respectively.

(2) Install timing belt B in the crankshaft pulley and balance shaft pulley. There should not be loose in the tensioner side.

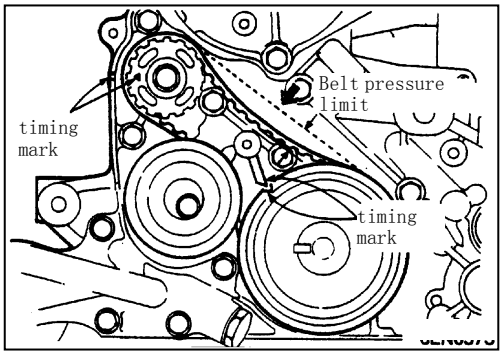


(3) Make sure that the position of tensioner center and bolt center as shown in the illustration.

(4) While putting power on the side of timing belt tensioner with finger, move tensioner B according to the arrow. Now fasten the screw bolt to fix tensioner B.

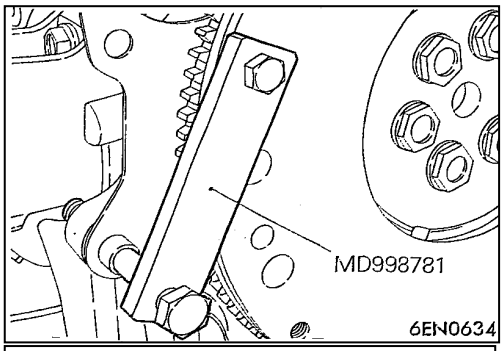


Caution: When fastening the bolt, do not keep the axle revolve with the pulley in case that the belt gets too tight.



(5) Ensure to keep the marks in the pulley and the front cover aligned.

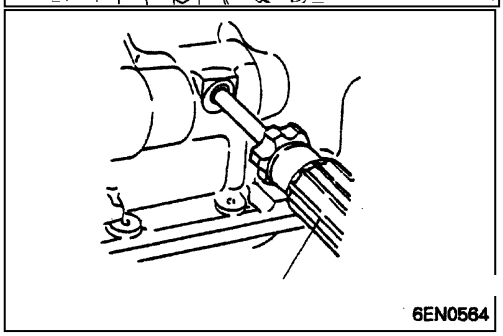
(6) Press the central part in the side of tensioner of the timing belt B with the index finger, with the pressure limit of 5～7mm.



- **Fasten the crankshaft bolt**

(1) Fix the flywheel with special tool.

(2) Install crankshaft bolt.



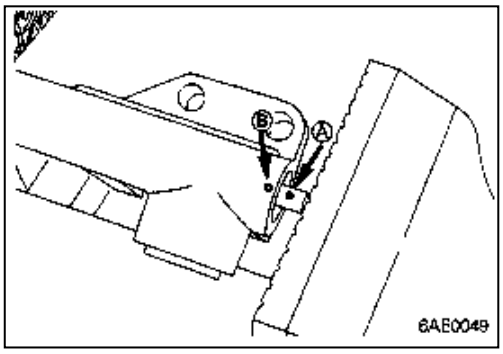
- **Installation of pulley in oil pump**

(1) Insert cross-ended screwdriver to the left side of hole in the cylinder to prevent turning of balance shaft.

(2) Install pulley of oil pump.

(3) Apply oil to the combining side of screw nut and bearing.

(4) Fasten the screw nut with a torque of 54Nm.



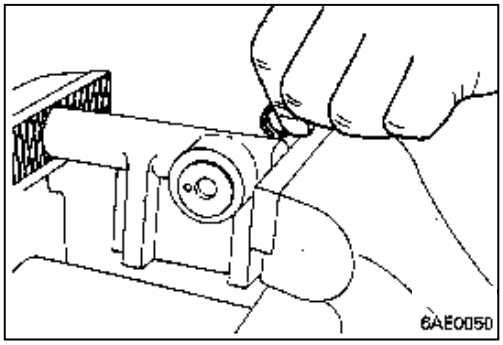
- **Installation of automatic tensioner**

(1) If the automatic tensioner is in the stretching position, it should be drawn back according to the following steps.

(2) Fasten the automatic tensioner with vises that have soft opening.

Caution:

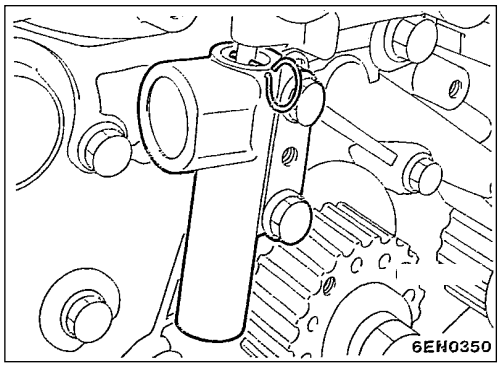
- **As there is a stretching screw plug at the bottom of automatic tensioner, a plain pad should be inserted between the vises and the screw plug to prevent their direct contact.**



(3) Slowly push the vises in until the rod Ⓐ hole and oil tank Ⓑ gets aligned.

(4) Insert the steel wire(diameter 1.4mm) to the aligned hole.

(5) Disassemble the automatic tensioner from the vises.



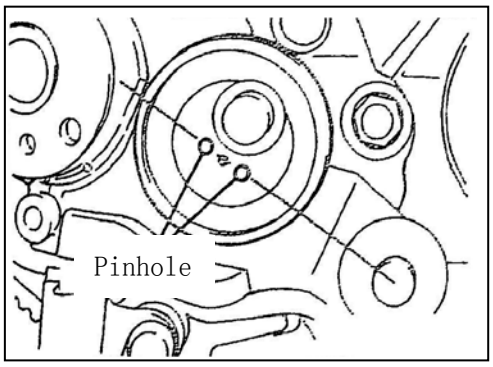
(6) Install the automatic tensioner in the front cover, fastening the bolt with a torque of 24Nm.

Caution:

• Leave the steel wire in the automatic tensioner.

- **Installation of tensioning pulley**

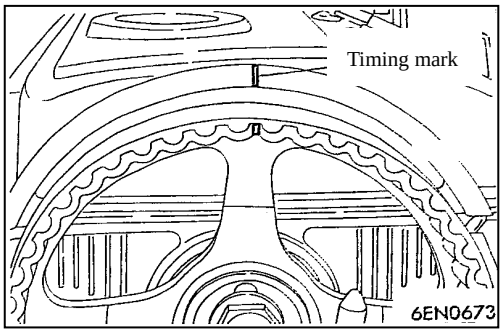
(1) Install the tensioning pulley and keep the two pin holes in a vertical line.



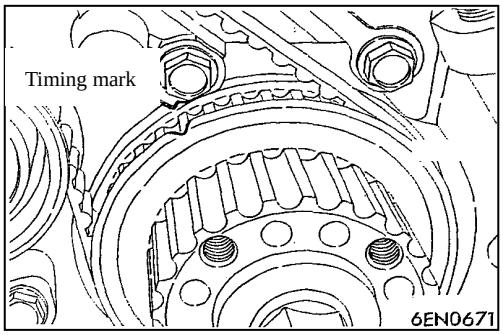
- **Installation of timing belt**

(1) Make sure that the belt tensioner is installed properly.

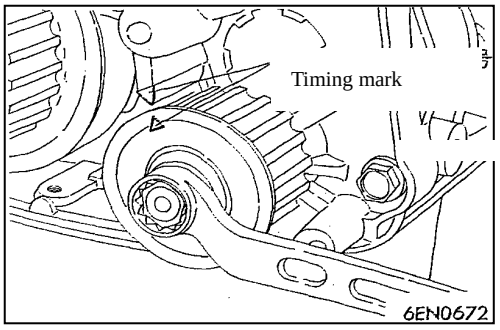
(2) Make the timing mark in the camshaft pulley and that in the cylinder cover aligned.

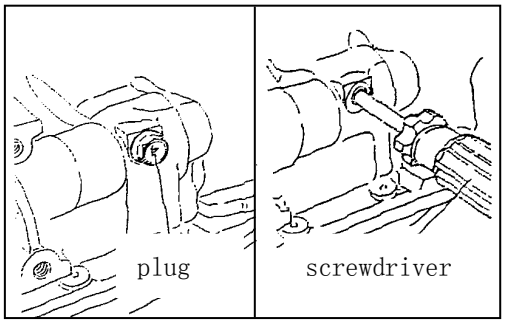


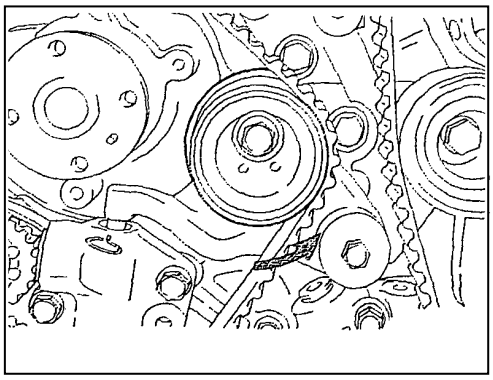
(3) Make the timing mark in the crankshaft pulley and that in the front cover aligned.

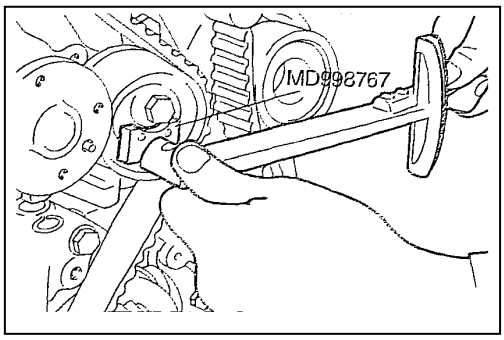


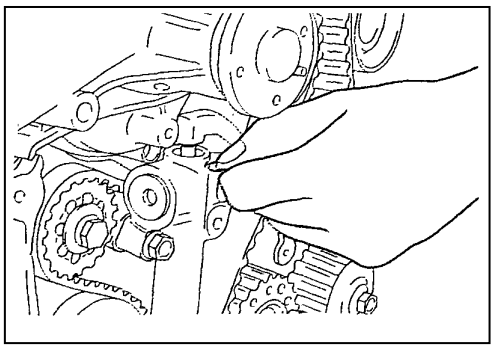
(4) Keep the timing mark in the oil pump pulley and its conforming mark aligned.

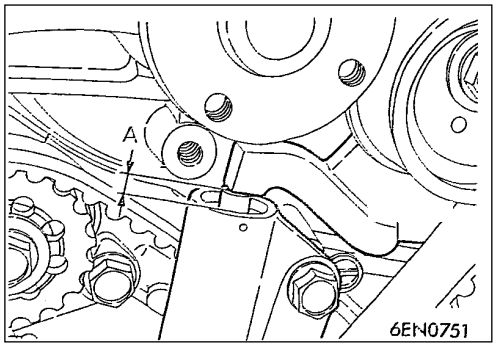












(5) Disassemble the plug from the cylinder block and then insert the cross-ended screwdriver (diameter of8mm) to the hole. If it could be inserted more than 60mm in, it means that the timing marks are aligned. If the range that could not be inserted above 20～25mm, the oil pump pulley should be turned for one revolution and the timing marks should be then aligned. Again check if the screwdriver could be inserted over 60mm. Keep the screwdriver in the inserting position until the installation of belt finishes.

(6)Connect the timing belt to the crankshaft pulley, middle pulley, camshaft pulley and tensioner pulley in turn.

(7) Raise the pulley of the tensioner to the direction of arrow and then fasten the central bolt.

(8) Make sure that all the timing marks are aligned.

(9) Disassemble the screwdriver inserted in step (5) and fix the plug.

(10)Rotate counterclockwise the crankshaft for a quarter of revolution until all the timing marks again get aligned.

(11)Install the special tools socket wrench and torque wrench to the tensioner pulley and then loosen the central bolt in the pulley of tensioner.

Remarks:

If special tools could not be applied, a general torque wrench that could measure a torque of 0 to 0.5 KgM may be used.

(12)Fasten to the torque of 3.5N.m(0.35 KgM) with a torque wrench.

(13)While keeping the tensioner pulley with special tool and torque, fasten the central bolt to standard value.

(14)Rotate clockwise the crankshaft two revolutions and lay it for about 15minutes. Then check whether the fixing steel wire of automatic tensioner could slide freely.

Remarks:

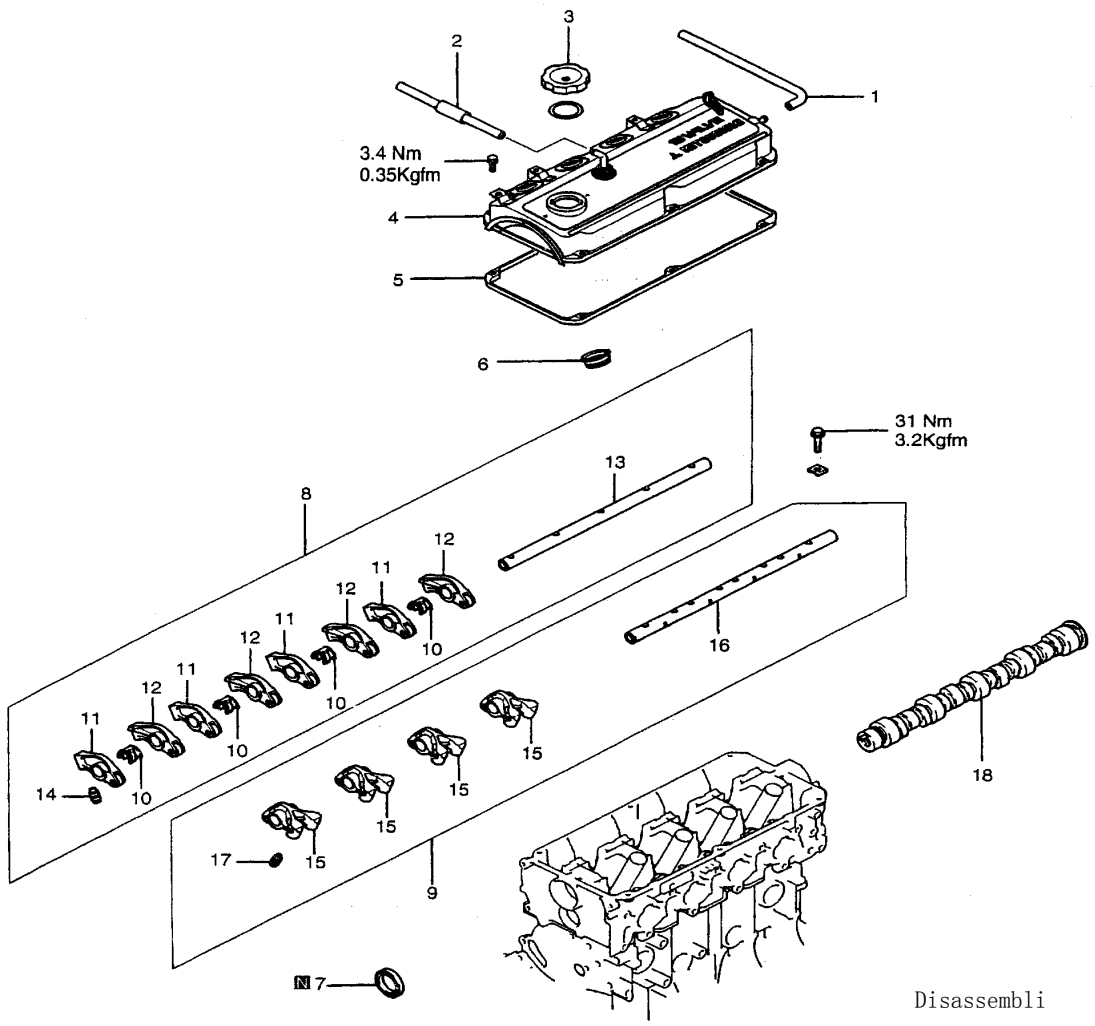
If the steel wire could not slide freely, repeatedly do the steps after (10) until the steel wire slides.

(15)Take off the fixing steel wire of automatic tensioner.

(16)Measure the distance “A” (between the tensioner arm and the automatic tensioner itself).

Standard value: 3.8—4.5mm

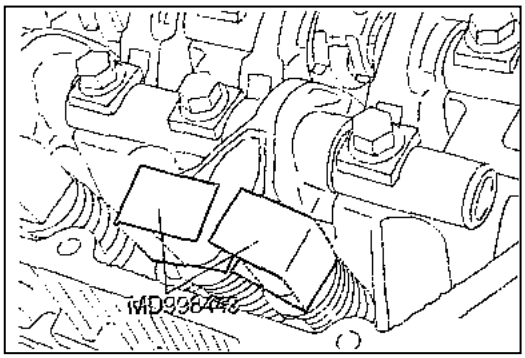
II. Rocker arm and camshaft

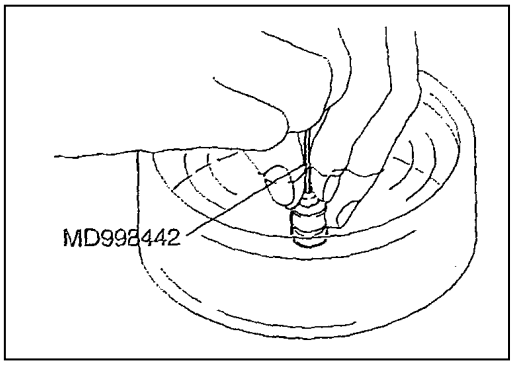


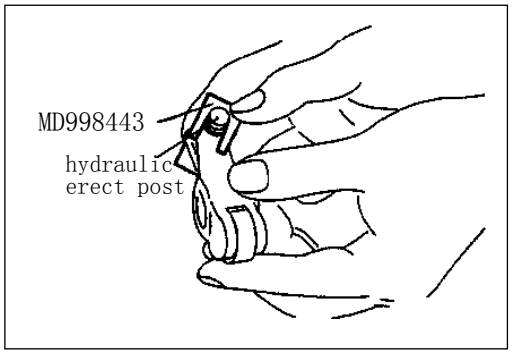
Disassembling

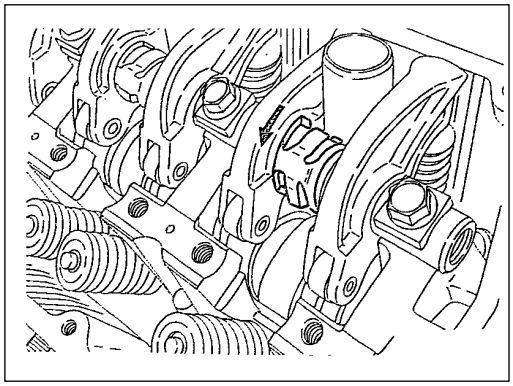
Disassembling steps

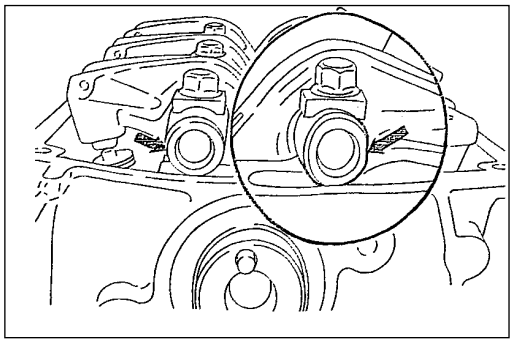
1. air flow tube
2. P.C.V. tube
3. fuel filler cap
4. rocker arm cap
5. pad of rocker arm cap
6. oil seal
7. oil seal
8. rocker arm and rocker shaft
9. rocker arm and rocker shaft
10. rocker shaft spring
11. rocker arm A
12. rocker arm B
13. rocker shaft(intake side)
14. hydraulic erect post
15. rocker arm C
16. rocker shaft(exhaust side)
17. hydraulic erect post
18. camshaft











1. Disassembling Notice

● **Disassembling of rocker arm and rocker shaft**

(1) Before disassembling the rocker arm and rocker arm shaft assembly, install the special tools as shown in the illustration to prevent dropping of hydraulic erect post.

2. Installation Notice

● **installation of hydraulic erect post**

(1) Soak the hydraulic erect post in clean diesel oil.

(2) With the special tool "exhaust steel wire", while slightly pressing the steel ball of check valve, move the plunger up and down for four to five times to exhaust the air.

Caution: As the rigid ball spring is especially soft, do not push the steel ball too violently with exhaust steel wire in case any damage to the hydraulic erect post.

It is easy to exhaust air from the hydraulic erect post installed by rocker arm with a keeper(special tool).

(3) Insert the hydraulic erect post into the rocker arm, being careful to avoid diesel oil overflow. Then apply special tool to prevent the dropping of hydraulic erect post during the installation.

● **Installation of rocker shaft spring, rocker arm and rocker shaft**

(1) Fasten the intake rocker shaft with a bolt temporarily until no rocker arm push and press the valve.

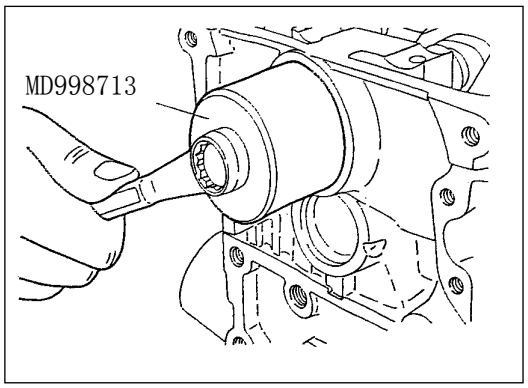
(2) Assemble the rocker shaft spring from the upper until it is vertical with the duct of spark plug.

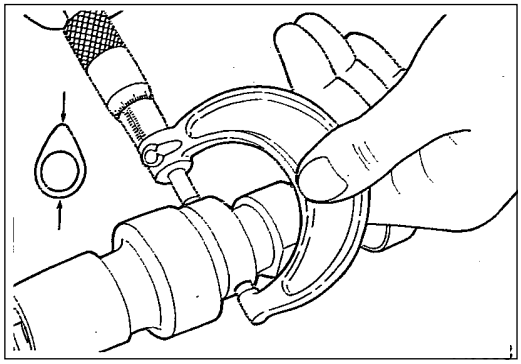
Caution: The rocker shaft spring should be installed first and then tighten the bolt of exhaust rocker arm.

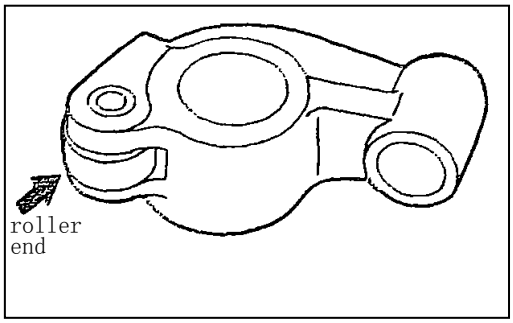
(3) Disassemble the special tool for keep the hydraulic erect post.

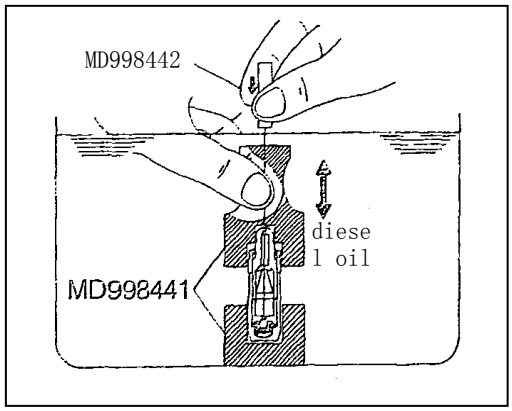
(4) Make sure that the position of cutting opening in the rocker shaft is in that shown in the illustration.

Caution: The oil hole in the rocker shaft should be aligned with the cylinder block to ensure a correct installation position.









● **Installation of camshaft oil seal**

Install the oil seal of camshaft with special tool

3. Check

● **camshaft**

(1) Measure the height of cam

The standard value and usage limit value are as follows.

4G64:

	standard value	usage limit value
intake	37.39	36.89
exhaust	37.14	36.64

4G63:

	standard value	usage limit value
intake	37.50	37
exhaust	37.14	36.49

● **Rocker arm**

(1) Check the surface of the roller. If there is any trace, there must be some damage or check and the rocker arm should be replaced.

(2) Check whether the roller could revolve smoothly and evasively. If it could not revolve smoothly and evasively or is a bit loose, the rocker arm should be replaced.

(3) Check the internal diameter. If there is some damage or lock is checked, the rocker arm should be replaced.

● **Test on the return leakage of hydraulic erect post**

Caution:

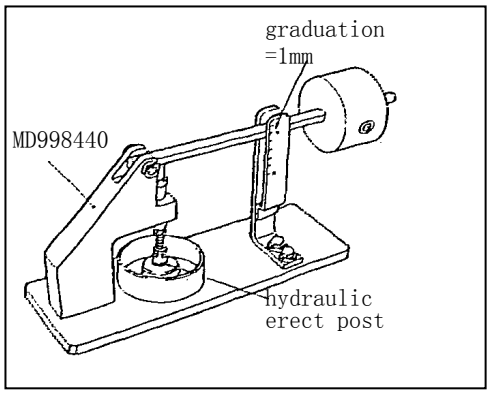
• The hydraulic erect post is a precision spare part. There should not be any dust or foreign matter on its surface

• It is not allowed to disassemble the hydraulic erect post.

• It is required to use clean diesel oil to clean the hydraulic erect post.

(1) Soak the hydraulic erect post in clean diesel oil.

With the special tool (MD998442), while pressing the steel ball in the inner side, exhaust the air by moving the plunger up and down for four to five times. It is easy to exhaust air from the hydraulic erect post installed by rocker arm.



(3) Disassemble the special tool (MD998442) and check whether the plunger could be pressed. If it is not easy to press the plunger, the hydraulic erect post is normal. If it is easy to press the plunger to the end, the hydraulic erect post should be exhausted again and then be checked again. If the plunger is still loose, the hydraulic erect post should be replaced.

Caution:

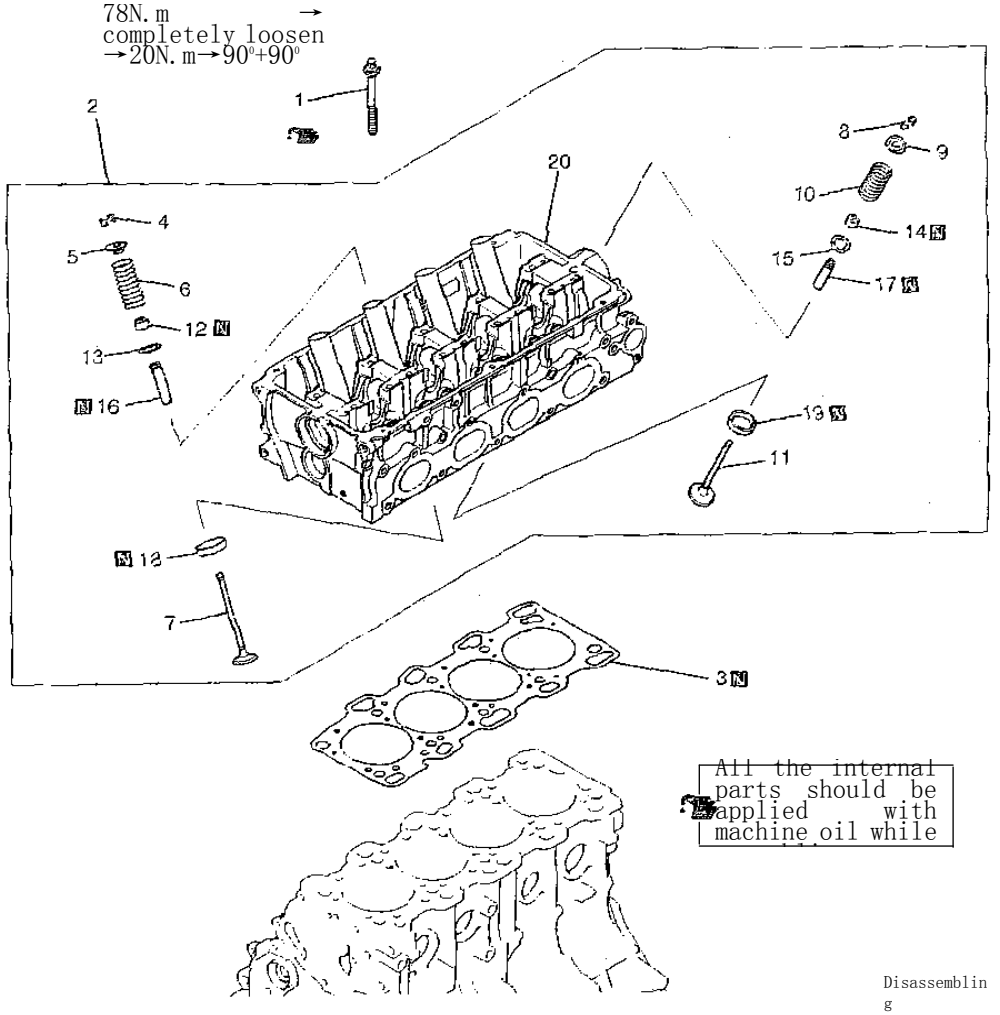
- **After the exhaust of air, the hydraulic erect post should be kept erect to avoid outflow of the internal diesel oil.**

(4) After the exhaust, the hydraulic erect post should be installed in special tool (return leakage tester).

(5) When the plunger sinks a little(0.2～0.5mm), measure the time it needs to sink a second 1mm. If the measurement value is not conformed to the standard value, replace the hydraulic erect post.

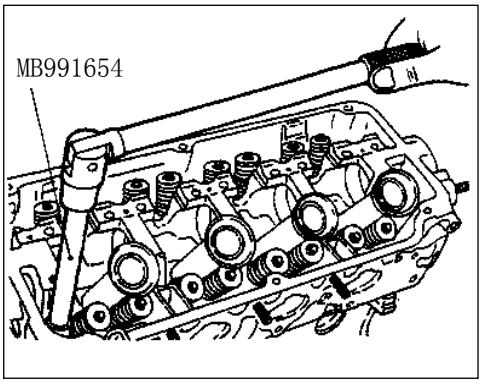
Standard value: 4～20seconds/1mm (applying diesel oil of 15～20℃)

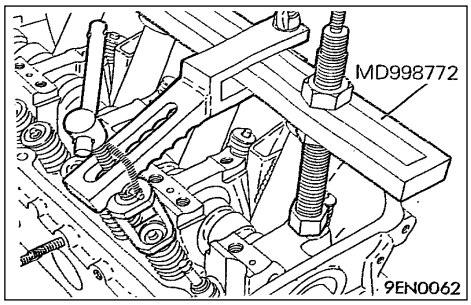
III. Disassembling and assembling of cylinder cover, valve

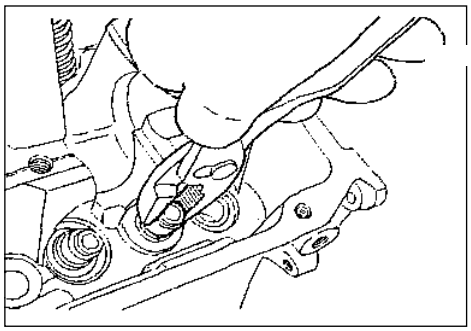


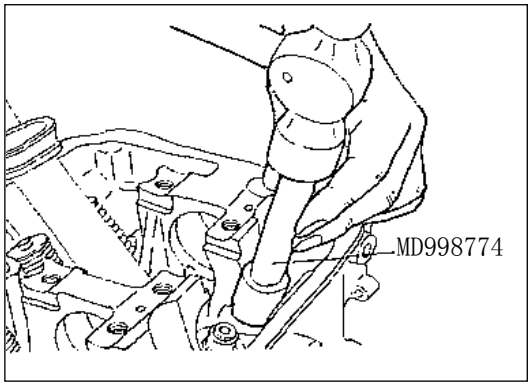
Disassembling steps

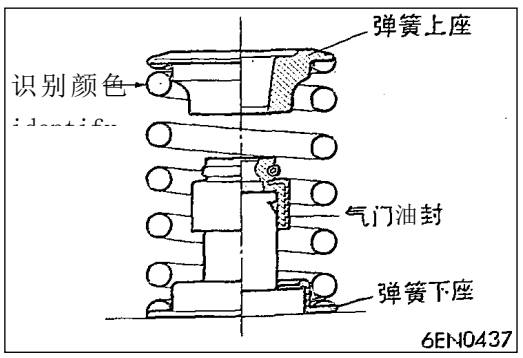
1. bolt for cylinder cover
2. components for cylinder cover
3. cylinder gasket
4. lock for valve spring retainer
5. upper valve spring retainer
6. compression spring for valve
7. intake valve
8. lock for valve spring retainer
9. upper valve spring retainer
10 compression spring for valve
11. exhaust valve
12 valve oil seal
13 valve spring retainer
14 valve oil seal
15 valve spring retainer
16 duct for intake valve
17 duct for exhaust valve
18 seat for intake valve
19 seat for exhaust valve
20 cylinder cover











Disassembling Notice

1、Cautions after disassembling

The parts disassembled must be placed according to the cylinder numbers and intake/exhaust area respectively.

- **Disassembling of the bolt of cylinder cover**

(1) Loosen the bolts on every cylinder cover with special tool. It should be loosened evenly and gradually.

- **Disassembling of lock for valve spring retainer**

(1) The disassembled parts such as valve and spring should be marked with cylinder No. and installation position, and should be kept well for use in the assembling.

- **Disassembling of valve oil seal**

(1)Valve oil seal should not be used repeatedly.

[illegible]、Installation Notice

- **Installation of valve oil seal**

(1) Install the lower retainer of valve spring.

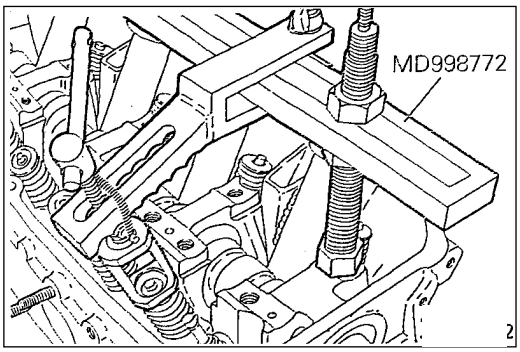
(2) Install the valve oil seal in the valve duct with special tool. Improper installation may cause leakage.

Caution:

- **Valve oil seal should not be used repeatedly.**

- **Installation of valve spring**

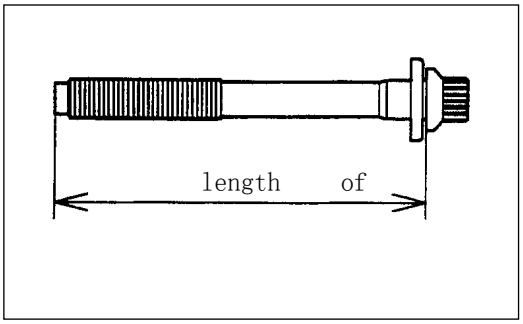
(1)When installing the valve spring, the end with identifying color should be faced to the upper retainer for valve spring.



● **Installation of lock for valve spring retainer**

(1)If the valve spring is excessively compressed, the bottom of upper valve spring retainer will contact with it and will damage the valve oil seal.

（2）Install the spring lock with special tool.

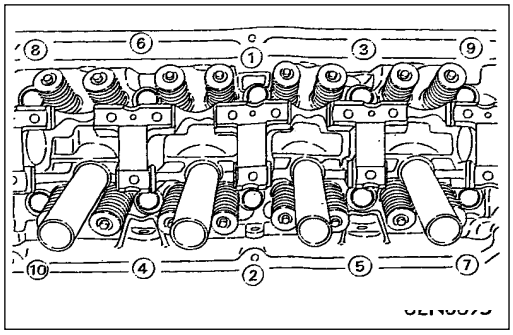


● **Installation of bolt for cylinder cover**

(1) When assembling the bolt for the cylinder cover, make sure that the length of bolt is suitable to the limited value. If it is larger that the limited value, the bolt should be replaced.

Limit value (A): maximum99.4mm

(2) Apply some machine oil to the rippling part of bolt and washer.

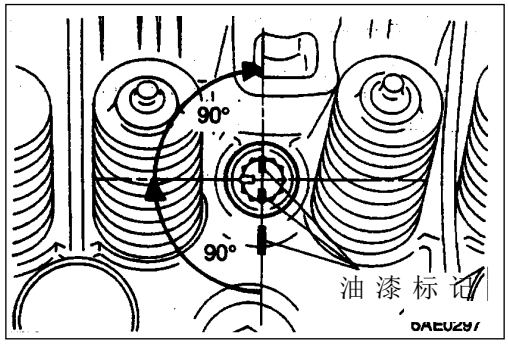


(3) According to the fastening sequence, tighten the bolts to the assigned torque with special tool （MB991654）.

Fasten torque: 78N.m

(4) Completely loosen all the bolts.

(5) According to the fastening sequence again, tighten the bolt with a torque of 20N.m



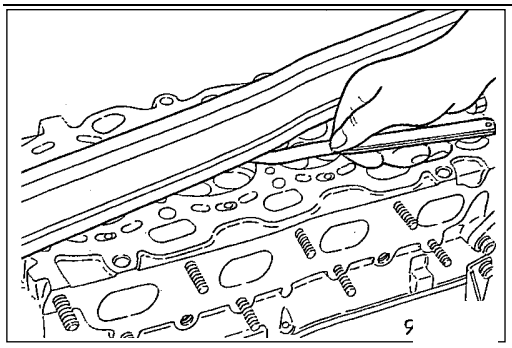
(6) Make a lined painting mark in the bolt end of cylinder cover and the cylinder cover.

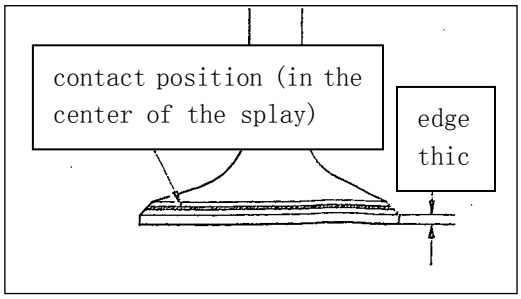
(7) Tighten the bolt of cylinder cover for 90° according to the fastening sequence.

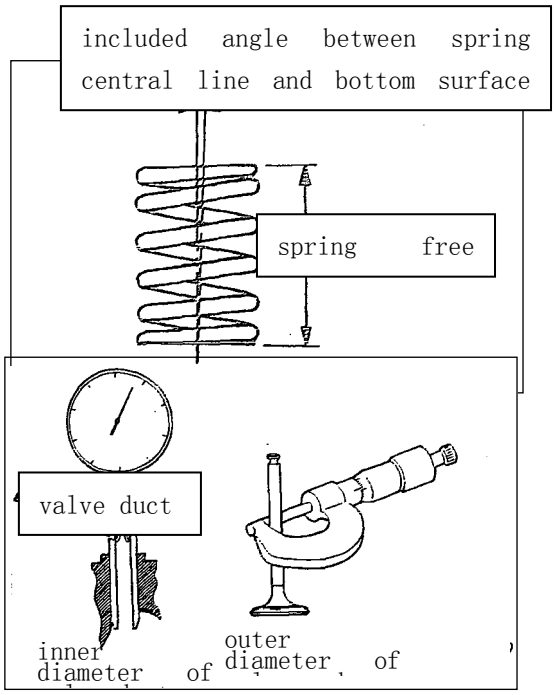
(8) Further tighten the bolt for 90° and make sure that the painting mark in the bolt end of cylinder cover and that in the cylinder cover aligned.

Caution:

- **If the tightening angle of bolt is smaller than 90°, the correct tightening torque is not expected. So while tightening, the correct tightening angle must be paid much attention to.**
- **When the bolt is excessively tightened, it should be fully loosened and then begin to be tightened again from step (1).**







3、Check

- Cylinder cover

(1) Check the flatness of the bottom of cylinder cover with straightedge and plug gauge.

Standard value: 0.03mm

Limit value: 0.2mm

(2) When the distortion exceeds the limit value, modification by abrasion is needed.

Abrasion limit value: * 0.2mm

***Together with the abrasion of cylinder block.**

Height of cylinder cover(standard value of new part): 119.9～120.1mm

- valve

(1) Check whether the working surfaces of valve are contacted properly. If the contact is improper, abrade again with valve polishing machine. The contacting side of valve seat should be conformed to the center of valve working surface.

(2) If the edge thickness exceeds the usage limit value, the valve should be replaced.

Edge thickness standard value:

intake……1.0mm

exhaust……1.2mm

Usage limit value: intake……0.5mm

exhaust……0.7mm

(3) Measure the total height of valves. If it is smaller than the limit value, the valve should be replaced.

Standard value:

intake: ……112.30mm

exhaust……114.11mm

Limit value:intake……111.80mm

exhaust……113.61mm

- Valve spring

(1) Check the free height of the valve spring. If it is smaller than the limit value, it should be replaced.

Standard value: 51.0mm

Limit value: 50.0mm

(2) Check the verticality of spring central line and the bottom surface. If the gradient exceeds the limit value, it should be replaced.

Standard value: ≤2°

Limit value: 4°

- Valve duct

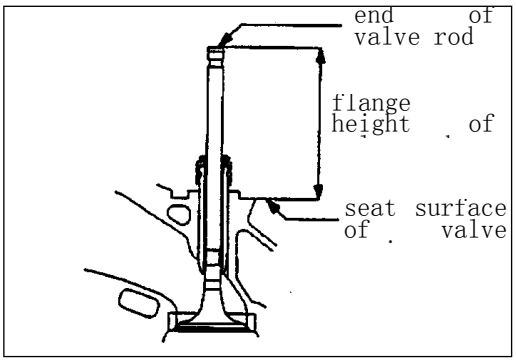
(1) Check the clearance between the valve duct and the valve rod. When the clearance exceeds the limit value, the valve duct or the valve or both of them should be replaced.

Standard value: intake …… 0.02 — 0.05mm

exhaust……0.03—0.07mm

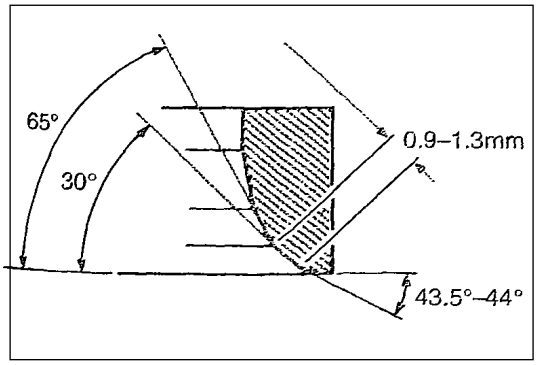
Limit value: intake……0.10mm

exhaust……0.15mm



(1)Assemble the valve and measure the flange height of valve rod between the end of valve rod and seat surface of valve spring. If the measurement value exceeds the assigned limit value, the valve seat should be replaced.

Standard value: intake……49.30mm
exhaust……49.30mm
Limit value: intake……49.80mm
exhaust ……49.80mm

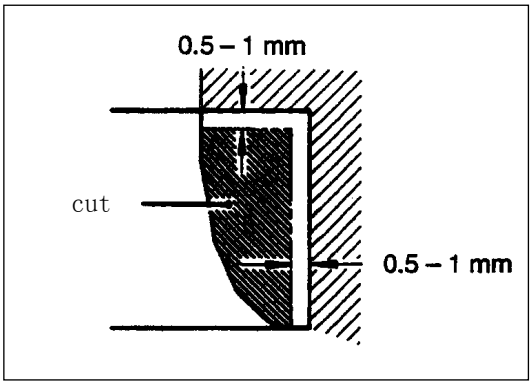


● **Points for maintaining the valve seat**

(1) Before maintaining the valve seat, check the clearance between the valve duct and the valve rod. Maintain after replacement of valve duct if necessary.

(2) Repair the width and angle of the valve seat until their adjustment to the assigned value with abrasion machine.

(3) After repairing the valve seat, rub the valve and the valve seat in pairs with rubbing cream. Then check the flange height of valve rod. (Refer to the checking item of **valve seat**).



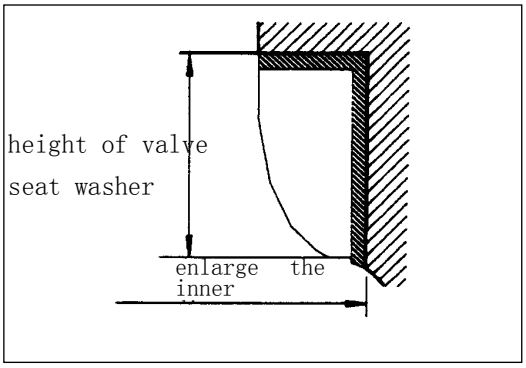
● **Points for changing valve seat**

(1)Cut a part of the to-be-replaced valve seat from the inner side to make it thinner and then remove it.

(2)Repair and adjust the seat hole in cylinder cover according to the outer diameter of the enlarged valve seat.

Diameter of valve seat washer

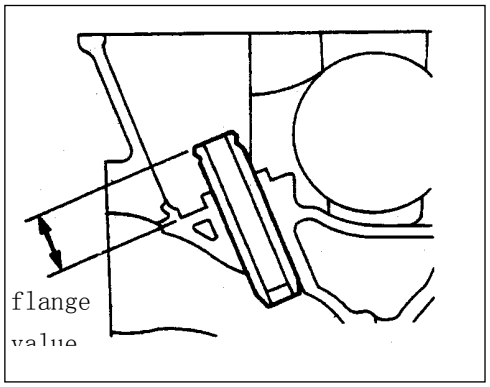
intake valve seat	enlargement size 0.30	34.435-34.455
	enlargement size 0.60	34.735-34.755
exhaust valve seat	enlargement size 0.30	31.935-31.955
	enlargement size 0.60	32.235-32.255



(3)Before assemble the valve seat washer, heat the cylinder cover to the temperature of about 250℃, or cool the valve seat washer in the liquid nitrogen in order to engage inside the cylinder cover.

(4)Repair and adjust the valve seat to the assigned width and angle with a valve seat milling cutter. (Refer to **Points for maintaining the valve seat**).

● **valve seat**



Points for changing of valve duct

(1) Press out the valve duct to the direction of cylinder with press machine.

(2) Modify the valve duct hole of cylinder cover until the hole diameter gets to the size of enlarged valve duct to be installed.

。Caution:

Do not use a new valve duct with the same size as the disassembled valve duct.

Duct hole diameter of valve in the cylinder cover.

enlarge size 0.05:	11.05-11.068
enlarge size 0.25:	11.25-11.268
enlarge size 0.50:	11.50-11.518

(3) As shown in the illustration, press the valve duct to the assigned flange value.

Standard value: 14mm

Caution:

。Press the valve duct from the top surface of cylinder head.

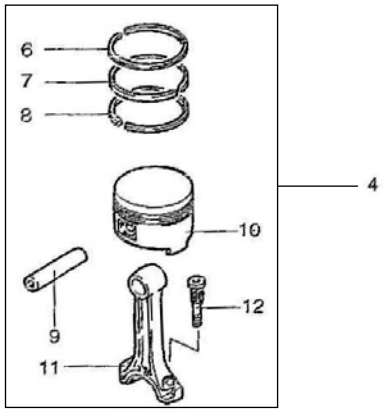
。the length of intake valve duct and exhaust valve duct are different. (Intake valve: 45.5, exhaust valve: 50.5)

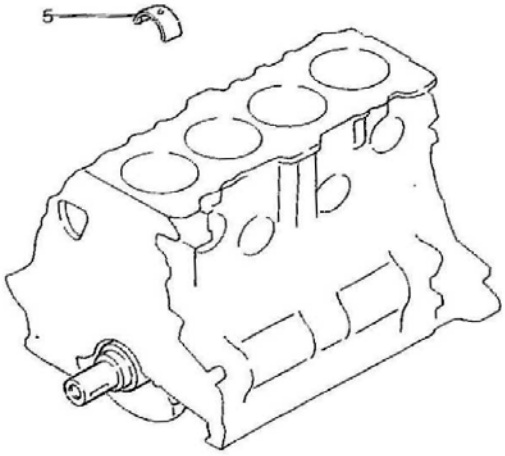
(4) After installation of valve duct, insert the new valve and check if it could move smoothly.

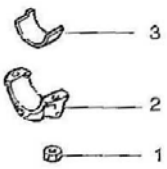
Chapter 4 Crank Connecting Rod Mechanism

1、 Piston and connecting rod component

Daub oil on all the inner parts when installing.

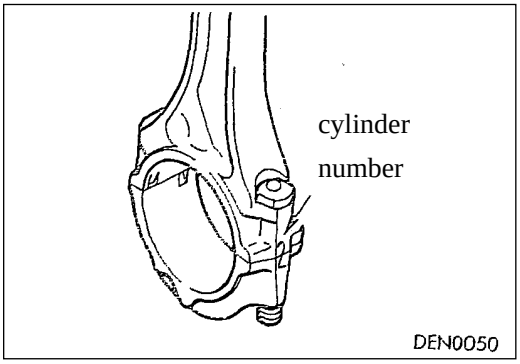






Disassembling steps

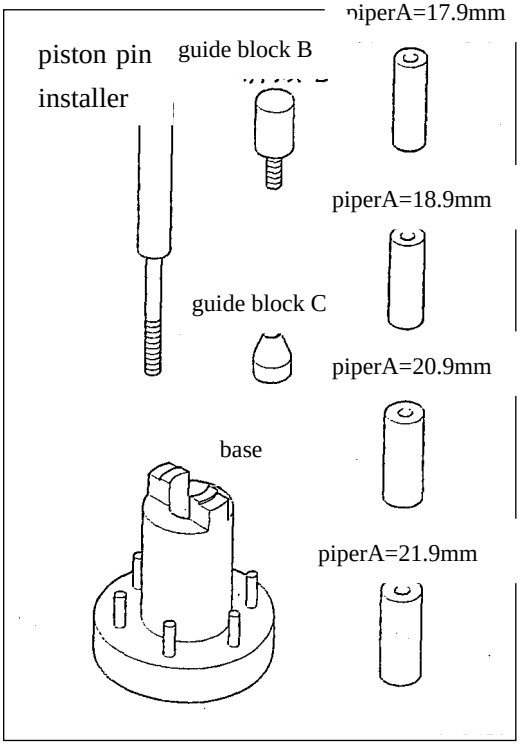
1. Connecting rod nut 2、Connecting rod cap 3、Connecting rod bearing 4、Piston and connecting rod component
5、 Connecting rod bearing 6、No.1 compression ring 7、No.2 compression ring 8、Oil control ring
9、 Piston pin 10、Piston 11、Connecting rod 12、Connecting rod bolt



Disassemble

(1) Mark cylinder number on the side of connecting rod big end to prepare for correct installation.

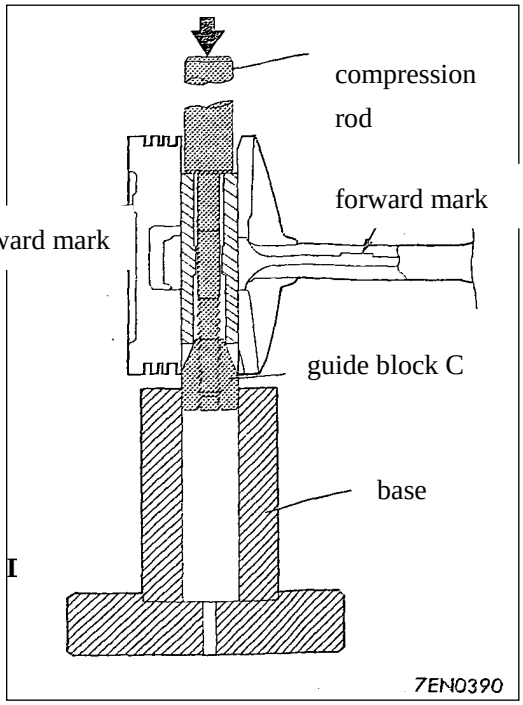
(2) Take turns putting connecting rod, connecting rod cap and connecting rod bearing away, according to cylinder number.



Piston Pin Disassemble

(1) After inserting compression rod of the special tool from the top of piston marked with the arrowhead, install guide block C in the top of compression rod.

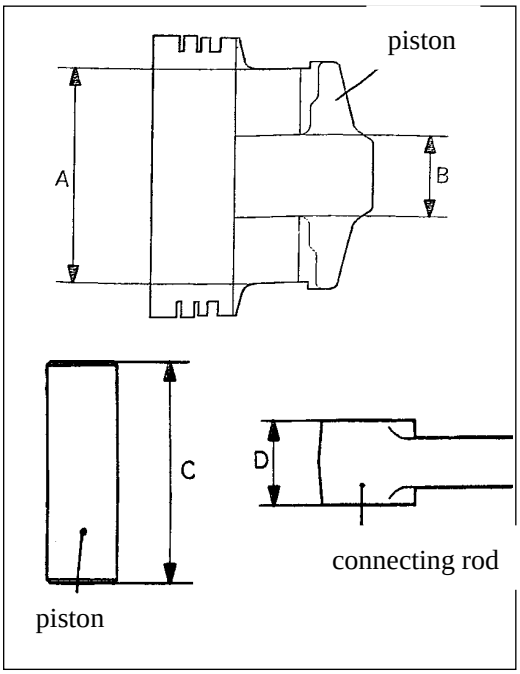
(2) Keep forward mark of piston upward. Install piston and connecting rod component in base of piston pin installer (special tool).

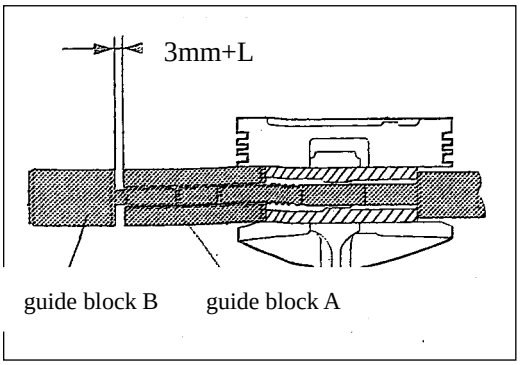


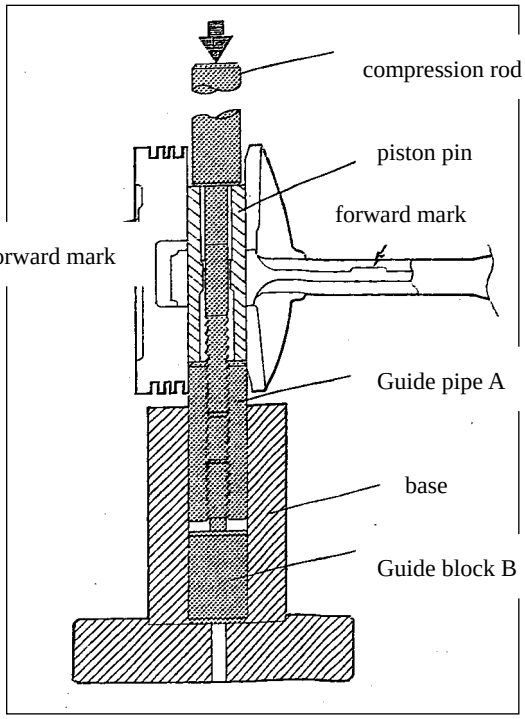
(3) Force piston pin out with pressure.

Caution:

Take turns putting piston, piston pin and connecting rod disassembled away according to cylinder number.







Installation Notice

Piston Pin Installation

(1) Measure the following sizes of piston, piston pin and connecting rod.

A：Length of inserting piston pin in the hole.

B：Width of pin sockets

C：Length of piston pin

D：Width of small end of connecting rod.

(2) Put measured sizes above into following formula to calculate L.

L＝[(A－C)－(B－D)] / 2

(3) After inserting compression rod of the special tool into piston pin, install pipe A in the top of compression rod.

(4) Install forward marks of piston and connecting rod towards the same direction.

(5) Daub engine oil on the external diameter of piston pin

(6) Through Pipe A, insert compression rod, piston pin and pipe component installed according to (3) into piston pin hole from the side of forward mark.

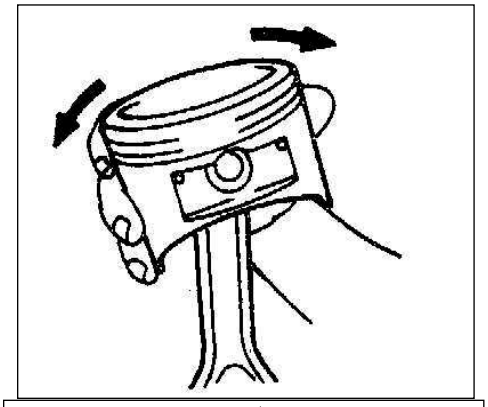
(7) Screw on guide block B into guide pipe A to make clearance value between guide block A and guide block B equal to the value of Value L got from (3) plus 3mm.

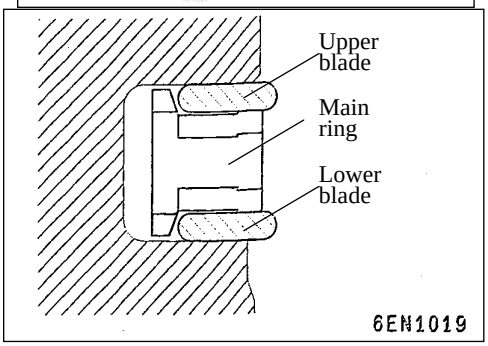
(8) Keep forward mark of piston upward. Install piston and connecting rod component in base of piston pin installer.

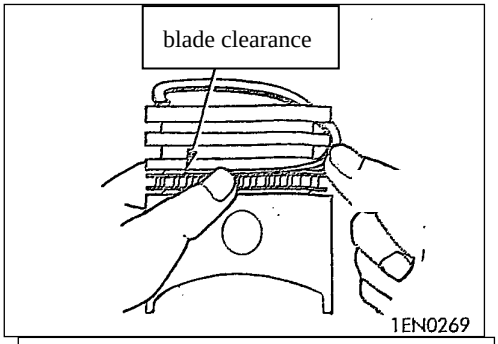
(9) Force piston Pin in under pressure. When the pressure is less than standard value, replace piston pin and piston component and/or replace connecting rod.

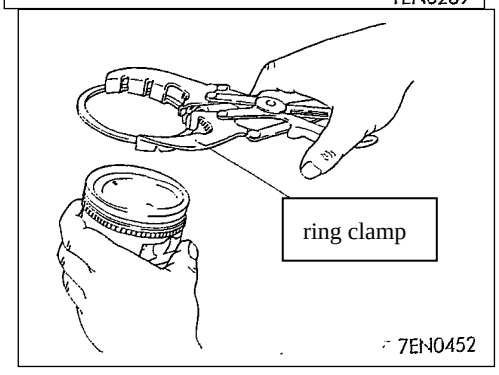
standard value： 7350～17200N

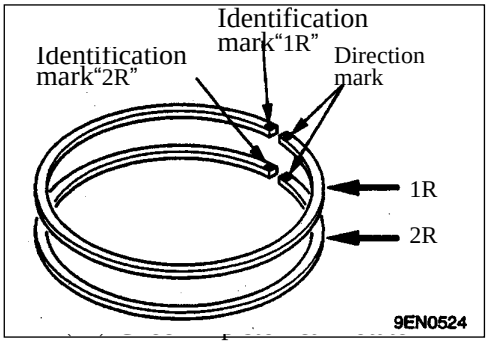
freely.











Oil Control Ring Installation

(1) Put the main ring of oil control ring into oil ring groove.

Remarks:

1. There's no difference of upper and lower surface between blade and main ring.
2. New blade and new main ring shall be colorized to distinguish their sizes.

Size	Identification color
Standard	Nil
Increase 0.50mm	*Red*
Increase1.00mm	Yellow

(2) Put upper blade. When installing blade, force one side of blade into piston oil ring groove. Then force the rest parts of blade into oil ring groove with the thumb as shown.

Expanding blade with ring clamp will break it off and make it differed from other piston rings.

Caution:

Don't use ring clamp to install blade

(3) Install lower blade in accordance with Step (2).

(4) Ensure if blade can turn from the left to the right freely after installing blade.

Installation of No.1 compression ring and No.2compression ring

(1) After installing No.2 compression ring, install No.1compression ring with ring clamp.

Remarks:

1. There's the identification mark on the top of the ring.

Identification mark

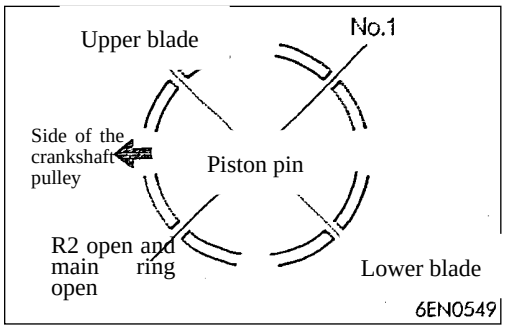
No.1 ring……1R

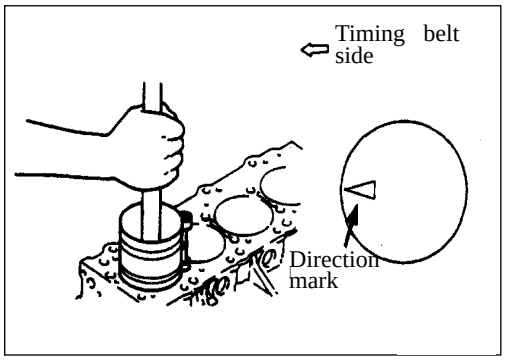
No.2 ring……2R

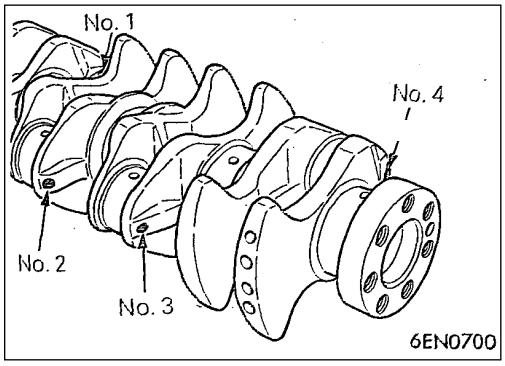
2. When installing piston ring, keep the mark upwards and towards the top of piston.

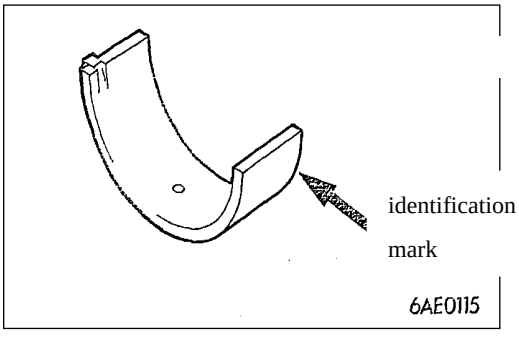
3.Size marks of piston shown as the following.

Size	Size mark
Standard	Nil
Increase 0.50mm	50
Increase 1.00mm	100









Piston and Connecting Rod Component Installation

(1) Daub enough engine oil on piston, compression ring and oil control ring.

(2) Adjust open position of compression ring and oil control ring (blade and main ring) to the position as shown.

(3) Rotate crankshaft to make crank pin located in the middle of cylinder

(4) Before inserting piston and connecting rod component into cylinder, proper screw-mounted protector is applied in connecting rod bolt. Be careful and don't damage crank pin.

(5) Use suitable piston ring compressor to insert piston and connecting rod component into cylinder.

Caution:

•There's a forward mark on the top of piston, make it point to straight position of the engine (the side of timing belt).

Connecting Rod Bearing Installation

If it is necessary to replace bearing, choose and install bearing according to the following steps.

(1) Measure external diameter of crank pin and confirm the groups according to the following table. As crankshaft for maintenance, distinguish sizes by painting color in the position as shown.

(2) Identification mark of connecting rod bearing is imprinted in the position as shown.

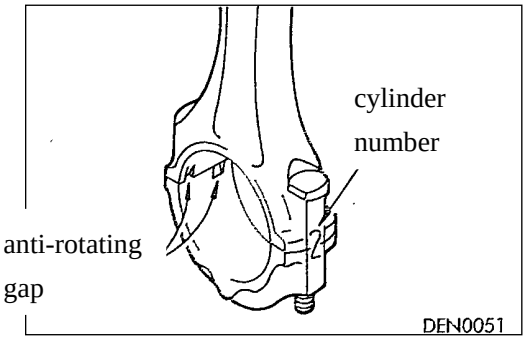
Crank pin			Connecting rod bearing		
Groups	Identification color	External diameter (mm)	Identification mark	Identification color	Thickness (mm)
I	Yellow	44.995～45.000	1	Yellow	1.487～1.491
II	Nil	44.985～44.995	2	Nil	1.491～1.495
III	White	44.980～44.985	3	Blue	1.495～1.499

Internal diameter of connecting rod：48.000～48.015mm

(3) Choose bearing in the table above, according to groups assured in (1) and (2).

Examples for choosing bearing:

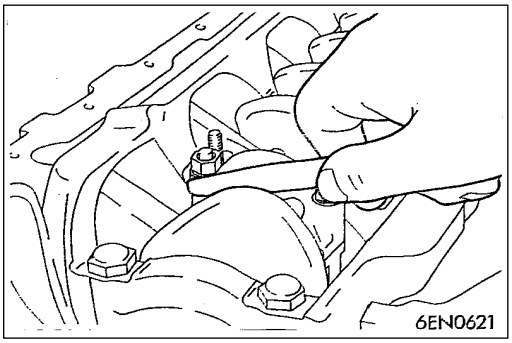
If measurement value of external diameter of crankshaft pin is 44.996mm , it shall be Group 1 in the table above. If replacing crankshaft of maintenance, check identification color applied on new crankshaft pin. If it's yellow, crankshaft pin shall be Group 1 and choose connecting rod bearing of which identification mark is 1.



Installation of Connecting Rod Cap

(1) When installing connecting rod cap, check marks of disassembling. If installing new parts which have no marks, install anti-rotating gap as shown on one side.

(2) Ensure if axial clearance of big end of connecting rod is suitable.
Standard value：0.10～0.25mm
Limit value：0.4mm



Connecting Rod Nut **Installation**

Caution:

- **Before installing connecting rod cap, disassemble spark plug and install connecting rod nut, if having installed cylinder cap.**

(1) As for connecting rod nut and bearing, plastic-zone screw-on method shall be adopted. Before reusing the bearing, check if the bearing is expanded. Checking method: screw nuts into screw thread of bearing with fingers till the whole length of screw thread. If nuts can't be screwed on smoothly, screw thread may be expanded and bearing should be replaced.

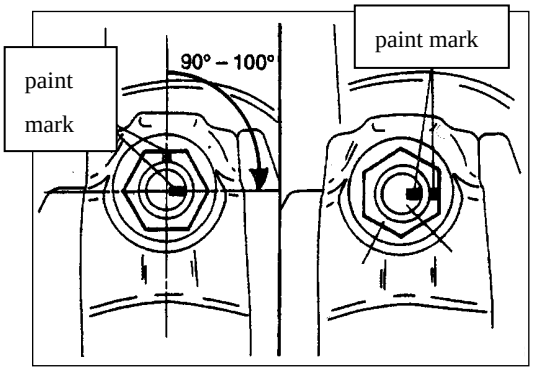
(2) Before screwing nuts on, daub oil on screw thread of nuts and seat surface.

(3) Screw nuts into bearing with fingers and screw nuts on alternatively to install connecting rod cap correctly.

(4) Screw nuts on by torque of 20N.M.

(5) Daub paint mark on every nut head.

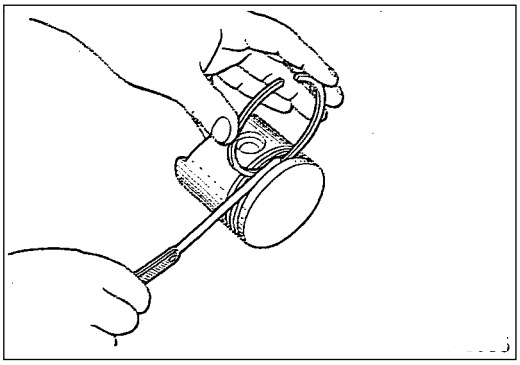
(6) Daub paint mark on bolts of which the position is from paint mark on every nut head to screwing direction of90～100° and note down the paint mark.

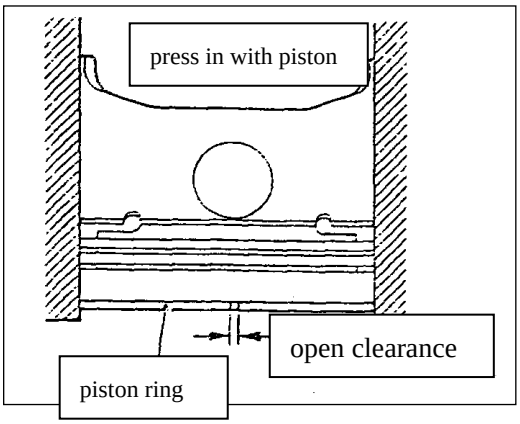


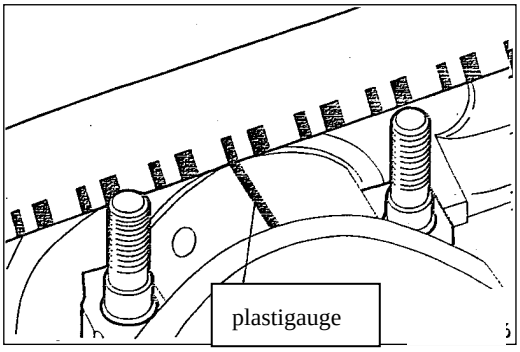
(7) Screw nuts on from 90～100° until marks on nuts and bearing are aligned.

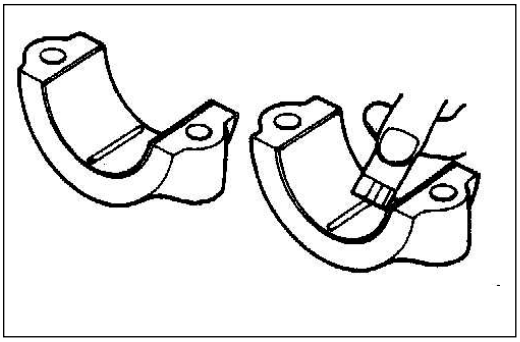
Caution:

- **If screwing angle is less than 90°, screwing specified capability can't be assured. When screwing it on, notice screwing angle.**
- **If screwing nuts are excessively tightened (exceed angle of 100°), screw nuts off totally. And restart to screw nuts from step 1**









Check

Piston ring

(1) Check if there's damage, excessive wear and breach on piston ring. If any, replace it. If replacing piston, it is necessary to replace piston ring.

(2) Check clearance between piston ring and piston ring groove. If it's too wide, replace piston ring or both of them.

Standard value: 0.02～0.06mm

Limit value: 0.1mm

(3) Put piston ring into cylinder. After using top surface of piston to put it away, measure open clearance with clearance gauge. When open clearance is too wide, replace piston ring.

Standard value:

No.1 ring…0.25～0.35mm

No.2 ring…0.40～0.55mm

Oil control ring…0.10～0.40mm

Limit value:

No.1 ring and No.1 ring…0.8mm

Oil control ring…1.0mm

Oil clearance of crank pin (Plastigauge)

(1) Clean the oil on connecting rod neck and bearing out.

(2) Divide plastigauge into the same length of rearing width and put it on crank pin and make it parallel to axle center line.

(3) Install connecting rod cap carefully, and screw nuts on according to the regulated torque.

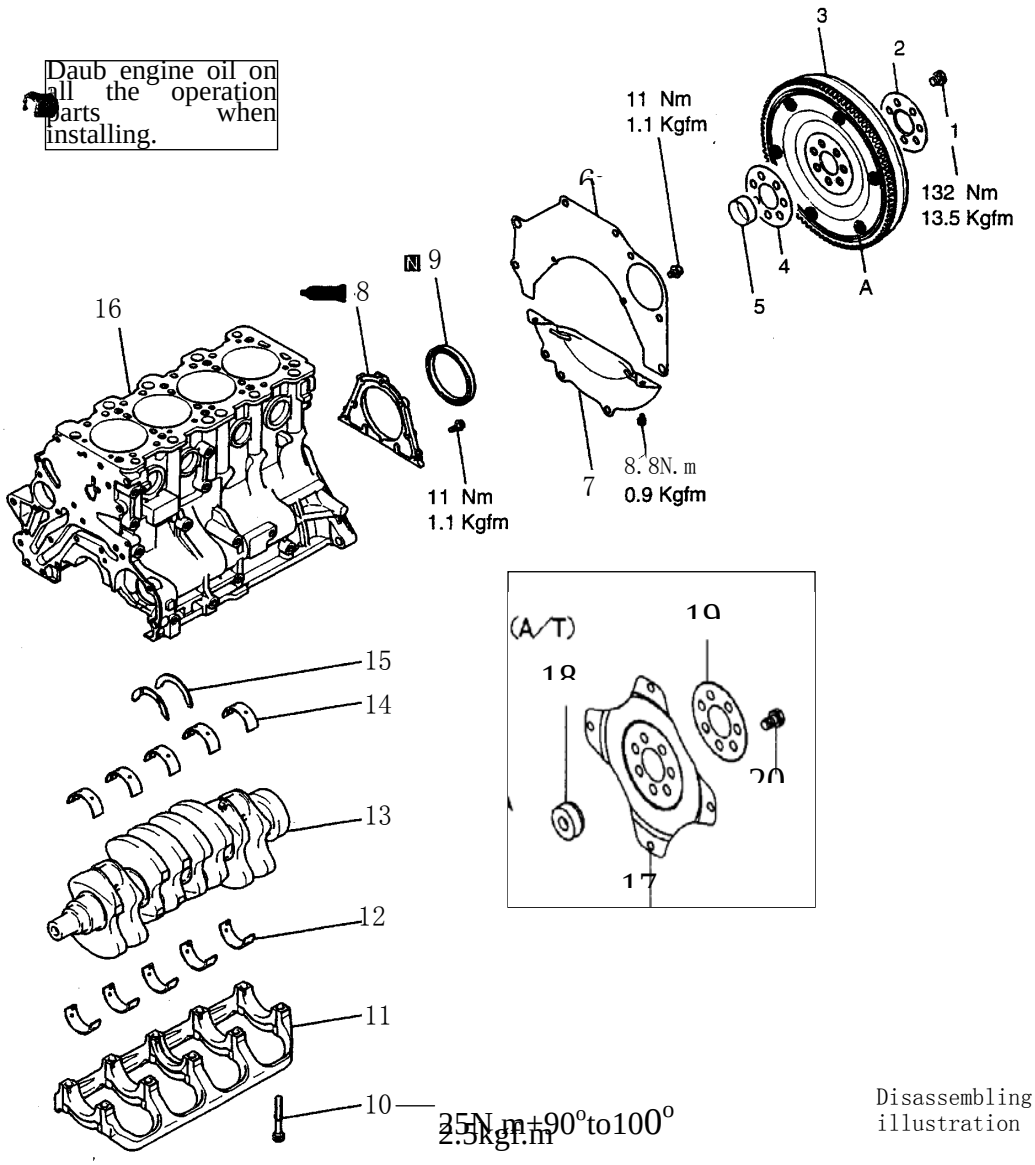
(4) Disassemble connecting rod cap carefully.

(5) Use measuring rule imprinted on the package of plastigauge to measure the width of the widest part of staved plastic line and get clearance value.

Standard value: 0.02～0.05mm

Limit value: 0.1mm

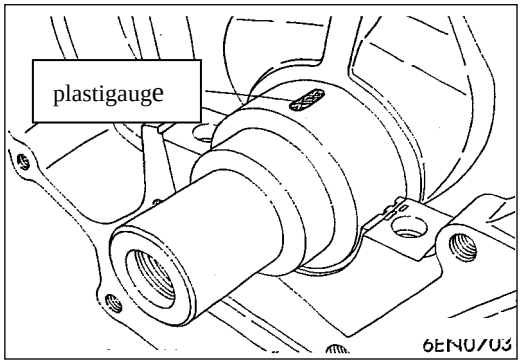
2、 Crankshaft, cylinder block and flywheel

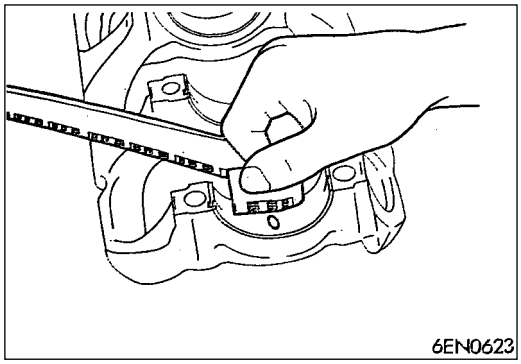


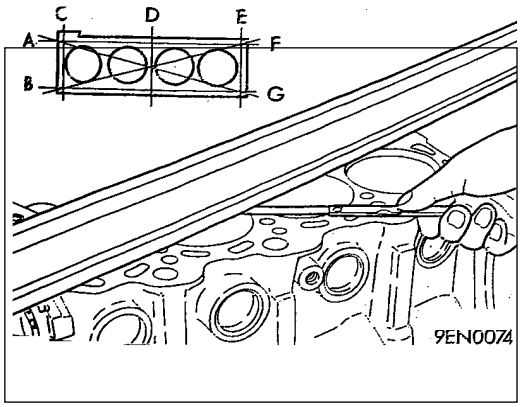
Disassembling illustration

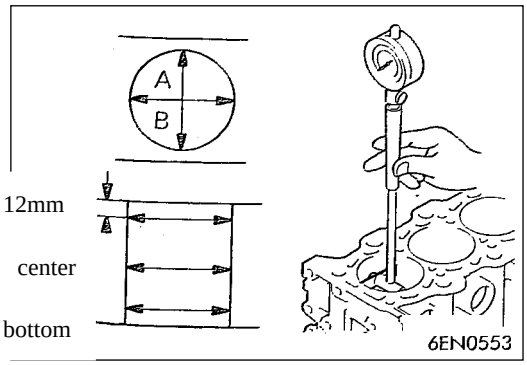
Disassembling steps

1. Screw rearing of flywheel<M/T>
2. Jointing board<M/T>
3. Flexible flywheel<M/T>
4. Jointing board<M/T>
5. Crankshaft bushing<M/T>
6. Rear cover board
7. Bell housing
8. Rear oil seal cap
9. Rear oil seal
10. Main bearing cap bolt
11. Main bearing cap
12. Lower bearing of crankshaft
13. Crankshaft
14. Upper bearing of crankshaft
15. Crankshaft thrust rearing
16. Cylinder block
17. Drive board〈A/T〉
18. Crankshaft sleeve〈A/T〉









Oil clearance of crankshaft (Plastigauge)

(1) Clean the oil on main journal and internal diameter of bearing out.
(2) Install crankshaft.
(3) Divide plastigauge into the same length of bearing width and put it on crankshaft journal and make it parallel to axle center line.
(4) Install main bearing cap carefully, and screw nuts on according to the regulated torque.
(5) Disassemble main bearing cap carefully.
(6) Use measuring rule imprinted on the package of plastigauge to measure the width of the widest part of staved plastic line and get clearance value.

Standard value：0.02～0.04mm
Limit value：0.1mm

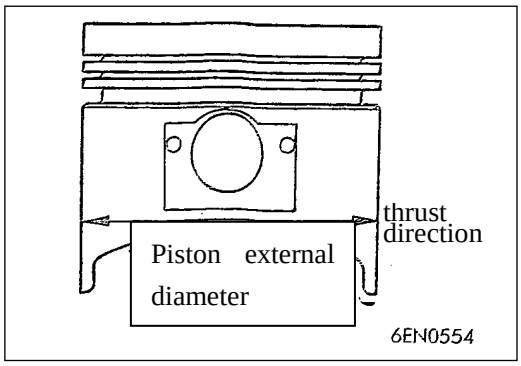
Cylinder block

(1) Observe if there are defects like scratch, rust and corrosion with eyes. Use defect detector to check breach. If any, fix or replace it.
(2) Check if the surface of cylinder block warps and assure there's no pad scraps or other foreign matters.
Standard value：0.05mm
Limit value：0.1mm
(3) If warping excessively, revise or replace it within the permitting range.
Abrasive limit：**0.2mm**
Maximum sum of abrasive thickness of cylinder block and cylinder cap permitted is o.2mm.
Height of cylinder block(new): 4G63 284mm, 4G64 290mm
(4) Check if there's scratch and cylinder sticking. If it's disqualified, revise (increase the size) or replace it.
(5) Check internal diameter of cylinder and cylindricality with cylinder bore gauge.

Revise cylinder according to increased diameter, replace piston and piston ring if wearing badly. Checking position as shown.

Standard value：
internal diameter of cylinder
4G63 85.00～85.03mm
4G64 86.50～86.53MM

Cylindricality：≤0.01㎜



Cylinder reboring

(1).Choose diameter of piston increased according to the maximum cylinder bore.

Identification of piston sizes

Size	Identification mark
Increase 0.50	0.50
Increase 1.00	1.00

Note: Imprint size marks on the top of piston

(1).External diameter of piston used in the measurement should be measured in the thrust direction as shown.

(2).According to measuring value of external diameter of piston, calculate the size of cylinder reboring.

size of cylinder reboring＝external diameter of piston＋(clearance between piston and cylinder)－0.02mm(Abrasive capacity)

(1) Rebore every cylinder bore to size of cylinder reboring

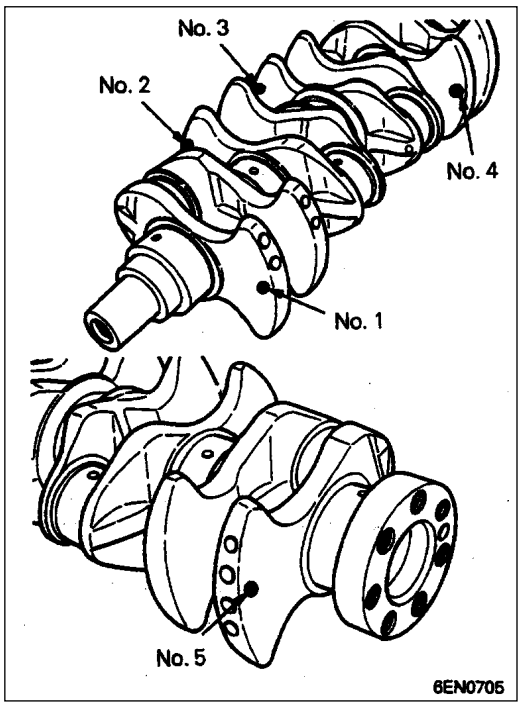
Notice: **When boring out cylinder, process according to the following procedures to avoid errors because of temperature raising :**No. 2→No. 4→No. 1→No. 3

(2) Cylinder bore which is abrasive to the ultimate. (diameter of piston＋clearance between piston and cylinder)

(3) Check clearance between piston and cylinder

Standard value：0.02～0.04mm

Remarks: When boring out cylinder, four cylinders should be bored in the same size which is increased, instead of only bore one cylinder.

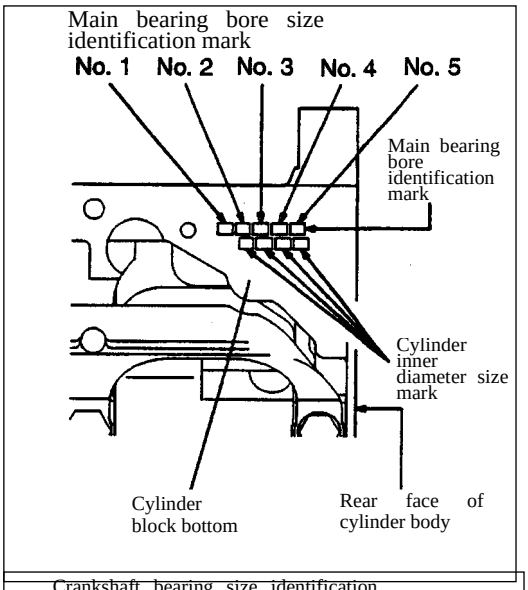


Installation notice

Installation of crankshaft bearing

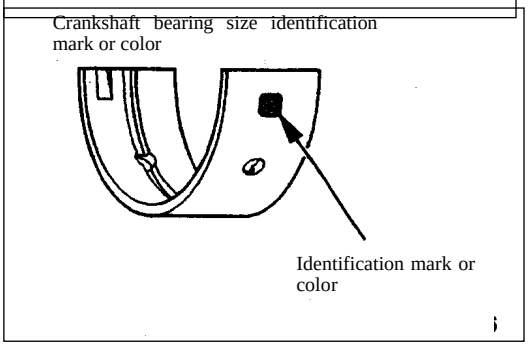
(1) Choose bearings that conform to crankshaft main journal according to the following table.

Combination of crankshaft main journal and spindle bore				Identification mark and color of No. 1, 2, 4, 5 journal bearing	Identification mark and color of No. 3 journal bearing
Crankshaft main journal			Identification mark of spindle bore		
Groups	Identification color	External diameter (mm)			
Ⅰ	Yellow	56.994－57.000	0	1、green	0、black
			1	2、yellow	1、green
			2	3、nil	2、yellow
Ⅱ	Nil	56.988－56.994	0	2、yellow	1、green
			1	3、nil	2、yellow
			2	4、blue	3、nil
Ⅲ	White	56.982－56.988	0	3、nil	2、yellow
			1	4、blue	3、nil
			2	5、red	4、blue

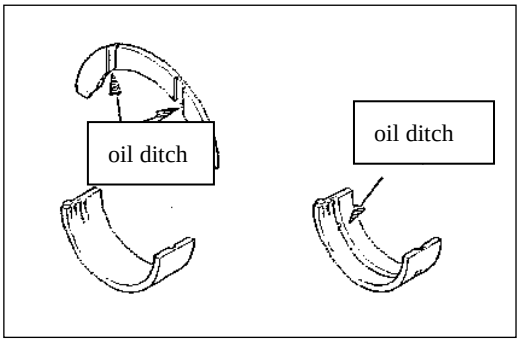


Examples for bearings choosing

- If identification color of crankshaft main journal is yellow and identification mark of spindle bore is “1”, choose the No. 1,2,4,5 bearing of which identification mark is “2” and identification color is “yellow” and No.3 bearing of which identification mark is “1” and identification color is “green”.
- If there’s no identification paint color on crankshaft, measure main journal and choose corresponding groups of bearing according to measurement value.

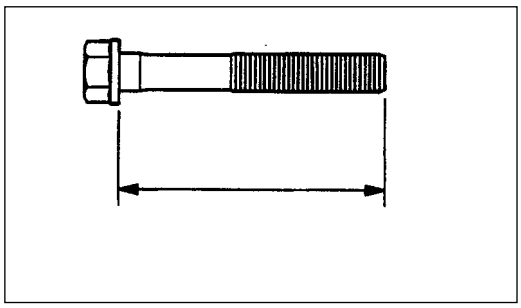


(2) Install bearing with grooves on one side of cylinder block.
(3) Install bearing without grooves on one side of main bearing cap.
(4) Install two of thrust bearing of crankshaft in No. 3 main bearing hole of cylinder block. For convenient installation, apply a little oil on the surface of thrust bearing.
(5) One side of thrust bearing with groove should face towards crankshaft crank arm.

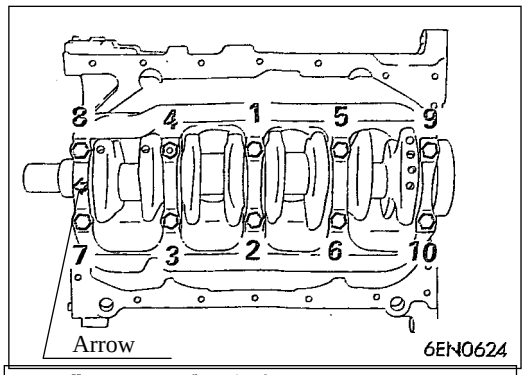


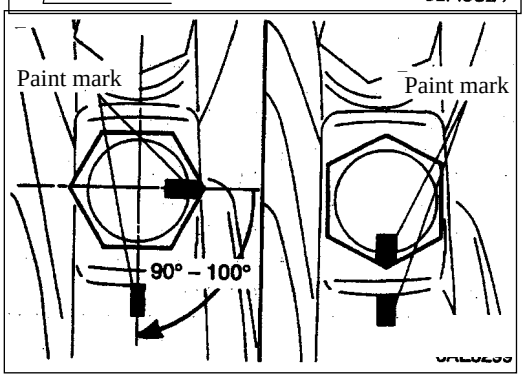
Main bearing cap and main bearing cap bolt installation

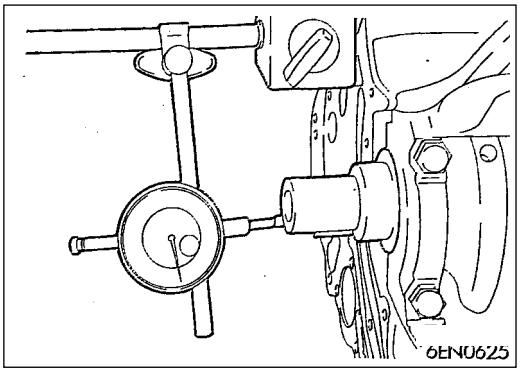
(1) Install arrowhead of main bearing cap towards the side of timing belt.

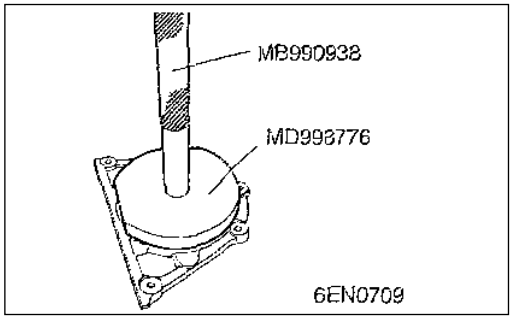


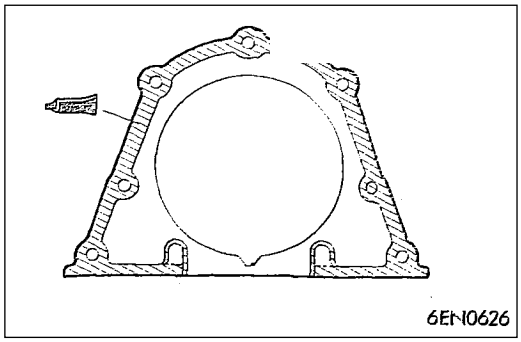
(2) Before screwing main bearing cap bolt on, assure that length of bolts is less than value limit. If not, replace the bolt.
Limit value (A)：71.1mm
(3) Daub oil on screw thread of nuts and seat surface.
(4) Screw main bearing cap bolt on by torque of 25N.M, according to regulated order.











(5) Daub paint mark on every nut head.

(6) Daub paint mark on the main bearing cap of which the position is from paint mark on bolts to screwing direction of 90～100°

(7) Screw nuts on from 90～100° regulated in the picture above, according to screwing order till paint mark on bolts aligns paint mark on main bearing cap.

Notice:

- **If screwing angle is less than 90°, screwing specified capability can't be assured. When screwing it on, pay much attention to screwing angle.**
- **If screwing nuts are excessively tightened (exceed angle of 100°), screw nuts off totally. And restart to screw nuts from Step 1.**

(8) After installing main bearing cap, assure if crankshaft can turn smoothly and check axial clearance.
If axial clearance exceeds usage limit value, replace NO.3 crankshaft thrust bearing of crankshaft.
Standard value：0.05～0.18mm
Limit value：0.25mm

Oil seal installation

Rear oil seal cap installation
Specified sealant：
Brand：**Mitsubishi pure components MD970389 or corresponding equivalents.**

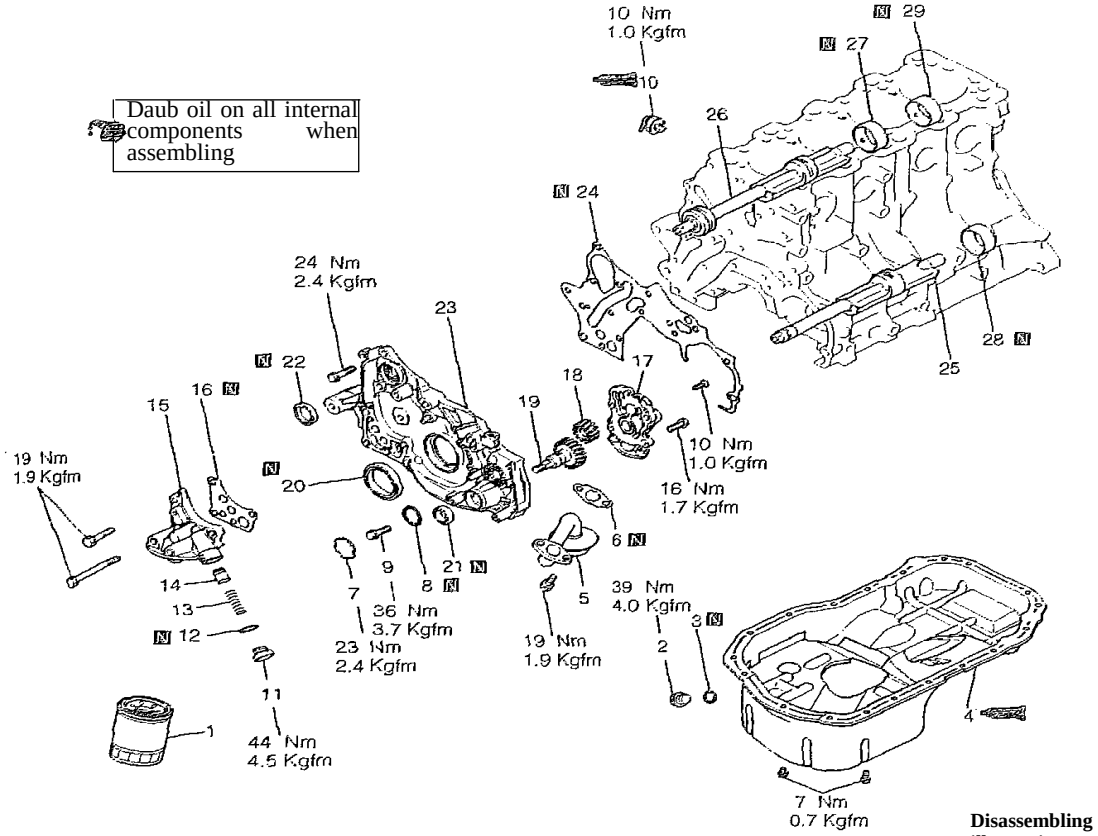
Notices:

(1) Ensure **rear oil seal cap is installed quickly when sealant is still wet. (≤15 min)**

(2) After installing, keep sealed area away from lubricate grease and coolant for one hour.

Chapter 5 Lubrication System

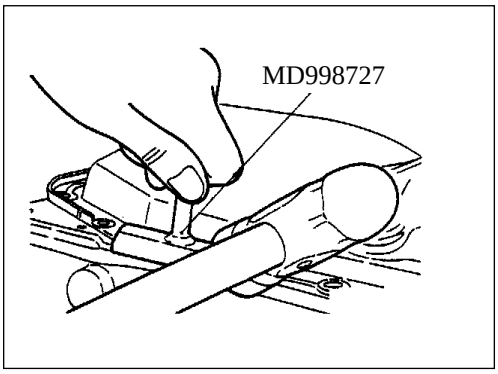
Front cover, oil pump, balance axle and oil pan

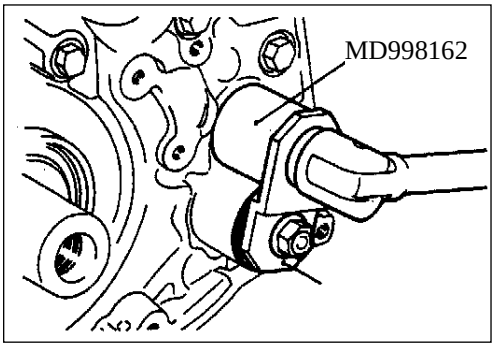


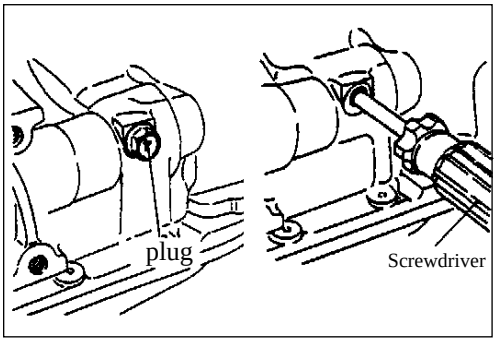
Disassembling illustration

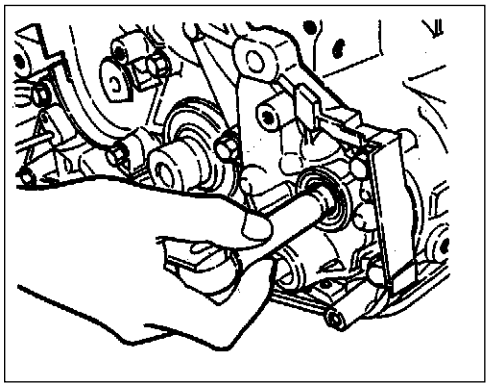
Disassembling Steps

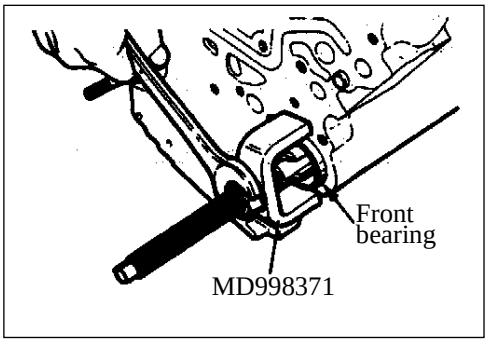
1.Oil cleaner
2.Oil drain plug
3.Oil drain plug cushion
4.Oil pan
5. Oil collect filter
6. Oil collect filter cushion
7. Plug
8. O-shape ring
9. Flange bolt
10. Oil pressure switch
11. Pressure relief plug
12. Seal cushion
13. Pressure relief spring
14. Pressure-relief plunger
15. Oil cleaner bracket
16. Oil cleaner bracket cushion
17. Oil pump cover
18. Oil pump driven gear
19. Oil pump drive gear
20. Crankshaft front oil seal
21. Oil pump oil seal
22. Balance axle oil seal
23. Front cover
24. Front cover cushion
25. Left balance axle
26. Right balance axle
27. Right balance axle front bearing
28. Left balance axle bearing
29. Right balance axle rear bearing











Disassemble Notice

Oil pan disassemble

(1) Disassemble all oil pan bolts

(2) Insert special tool between cylinder body and oil pan.

Remarks：

Do not use screwdriver or chisel instead of special tool, otherwise the edge of oil pan may be distorted and oil leakage will occur.

Plug disassemble

Disassemble plug cock with special tool. If plug is tightened, tap the plug top with hammer several times and the plug will loose.

Flange bolt disassemble

(1) Disassemble plug from cylinder body.

(2) Insert cross screwdriver (pole diameter is 8mm) into the plug hole and lock balance axle.

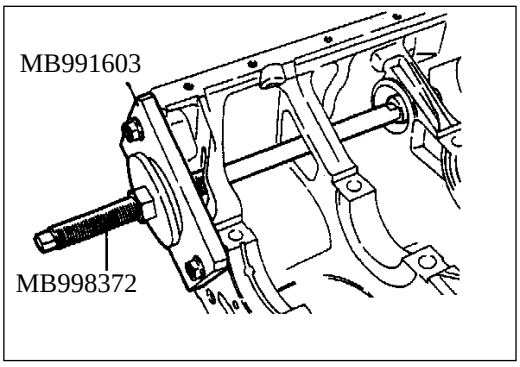
(3) Loosen flange bolt

Right balance axle front bearing disassemble

(1)Disassemble balance axle right-front bearing with special tool from cylinder body.

Remarks：

Front bearing must be disassembled firstly. If it is not disassembled, rear bearing puller can not be used.

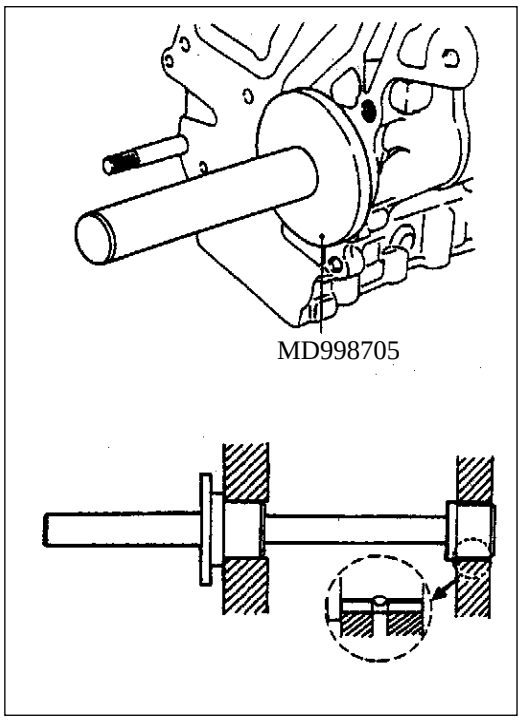


Balance axle rear bearing disassemble

Disassemble left balance axle rear bearing with special tool from cylinder body.

Remarks:

Special tool (MB991603) should be installed in front of cylinder body when disassembling left balance axle rear bearing.

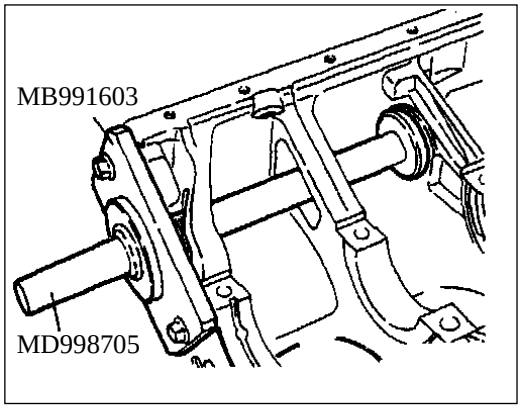


Installation Notice

Right balance axle rear bearing installation

(1) Daub oil on bearing surface.

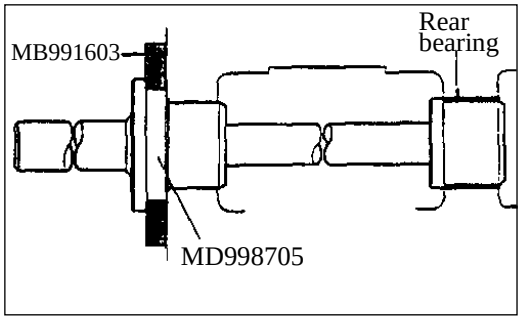
(2) Install right rear bearing with special tool. Make sure that oil holes on bearing and cylinder body are aligned.



Left balance axle rear bearing installation

(1) Install special tool (conducting board) on cylinder body.

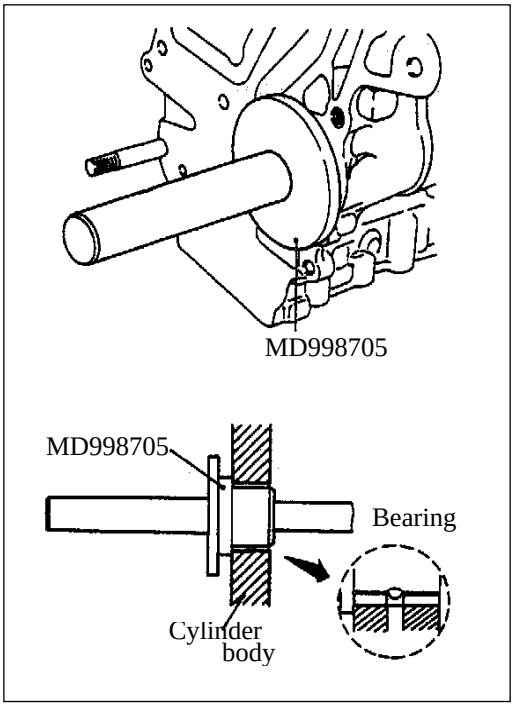
(2) Daub oil on rear bearing edges and inside cylinder body bearing holes.



(3) Install rear bearing with special tool

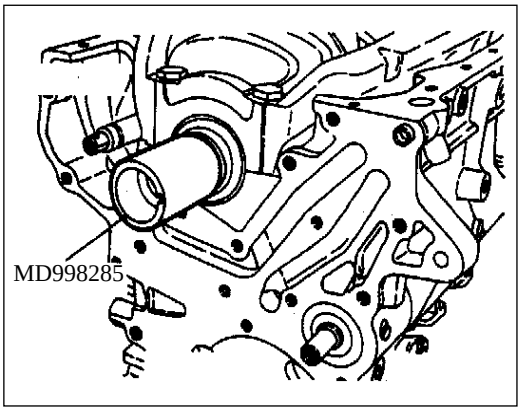
Remarks:

There is no oil hole in left rear bearing.



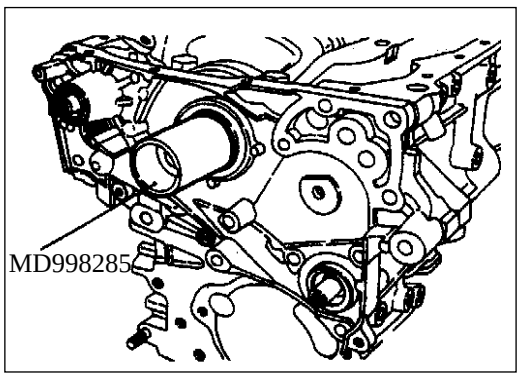
Balance axle front bearing installation

Install front bearing with special tool

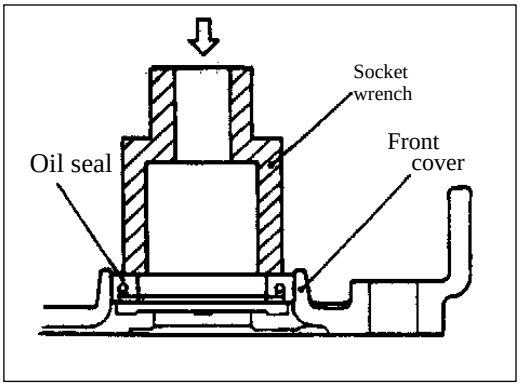


Front cover installation

(1)Install special tool on crankshaft front end . daub oil slightly on the exterior circle surface of special tool and then install front cover

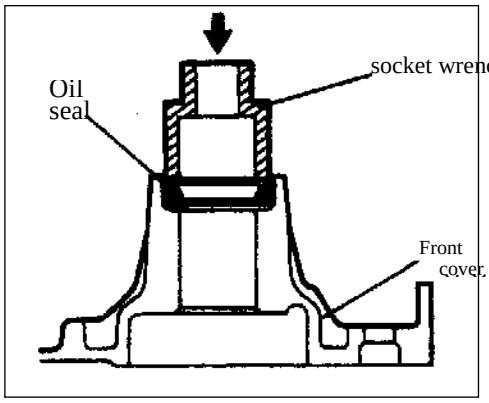


(2)Use new front cover oil seal cushion and install front cover component. Tighten flange bolt temporarily (Except for oil cleaner bracket locking bolt)



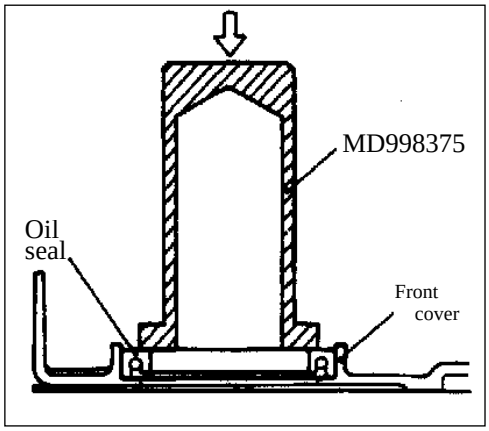
Balance axle oil seal installation

Press oil seal into front cover with socket wrench.



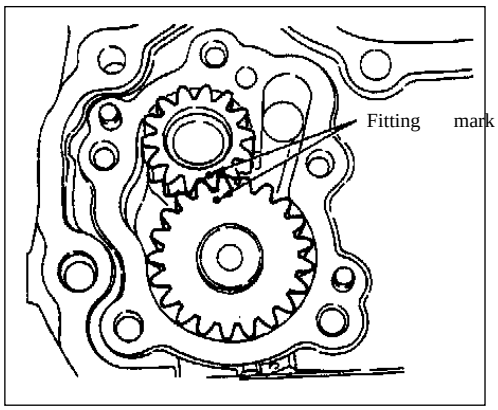
Oil pump oil seal installation

Press oil seal into front cover with socket wrench.



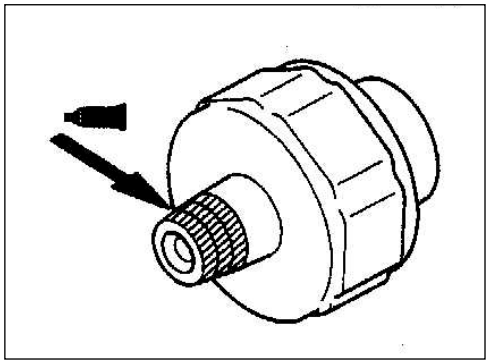
Crankshaft front oil seal installation

Install crankshaft oil seal on front cover with special tool.



Oil pump driven/drive gear installation

Daub oil on gear surface and align the fitting marks.



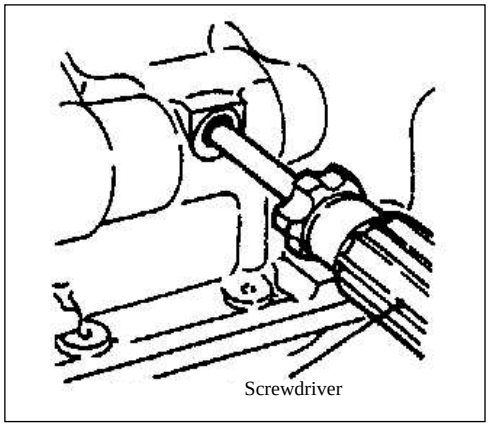
Daub sealant on oil pressure switch

Daub sealant on oil pressure switch screw thread parts and then install the said switch with special tool.

Special sealant: 3M ATV or relevant equivalents.

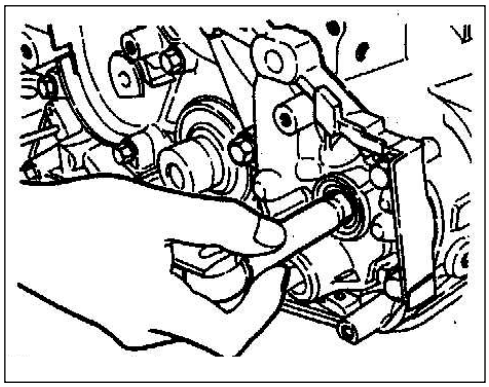
Caution:

- **Keep the top of screw thread clean and do not daub sealant.**
- **Excessive tightening should be avoided.**

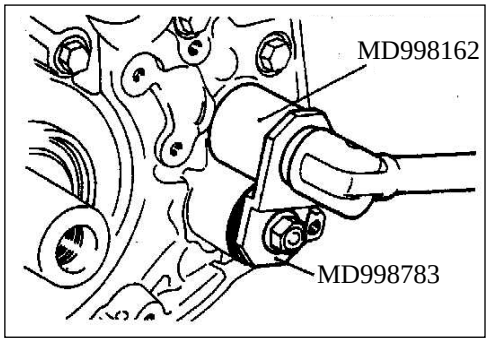


Flange bolt installation

(1)Insert cross screwdriver into the hole in the left side of cylinder body and lock balance axle.



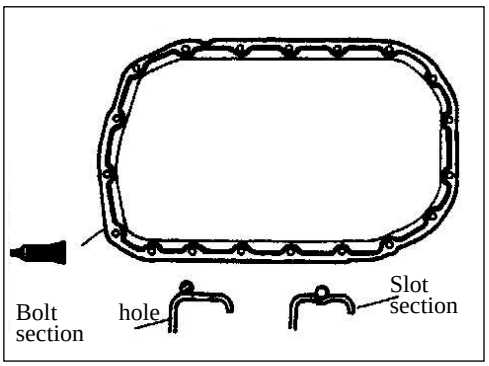
(2)Tighten flange bolt with specified torque to ensure driven gear of oil pump is fixed on left balance axle.



Plug installation

(1) Install O-shape ring in front cover slot.

(2) Install plug with special tool and tight it to specified torque.



Oil pan installation

(1) Keep the fitting surface of oil pan and cylinder body clean.

(2) Daub 4mm-diameter sealant on the edge of oil pan flange surface.

Specified sealant：

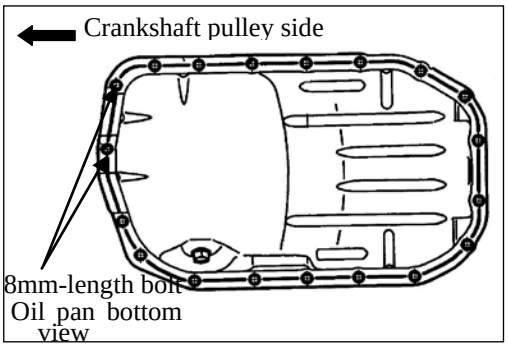
Mitsubishi pure product MD970389 or relevant equivalents.

Remarks：

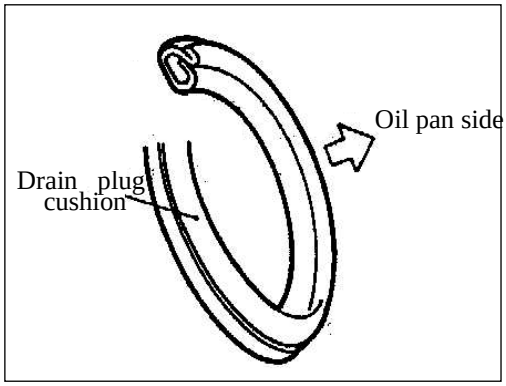
(1) Install oil pan quickly when sealant is still wet (about 15 minutes)

(2) Do not make the sealed part bedewed

with oil in an hour or so after installation.



(3) Confirm the bolt length and their installation locations are a little different.

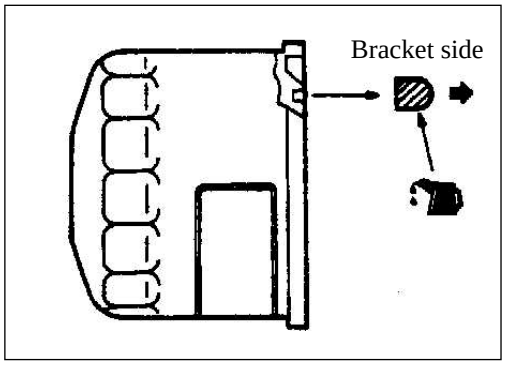


Drain plug cushion installation

Install drain plug cushion according to the direction as shown.

Caution：

The incorrect installation direction may result in oil leakage.



Oil cleaner installation

(1) Make installation surface of oil cleaner bracket clean.

(2) Daub engine oil on O-shape ring of oil cleaner.

(3) Screw on oil cleaner. When the O-shape ring reaches installation surface, screw 3/4 cycle further. (Tighten torque: 1.4kg.m)

Check

Front cover

(1) Check if oil hole is jammed. If necessary, clear it up.

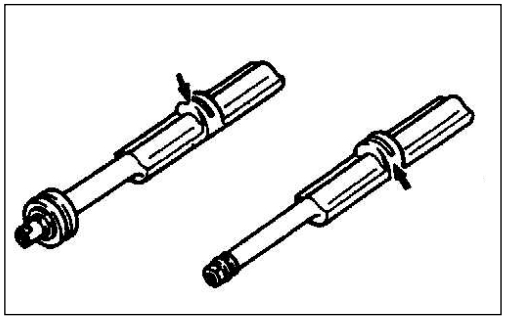
(2) Check if there is abrasion, damnification or sinter on left balance axle front bearing. If necessary, replace front cover.

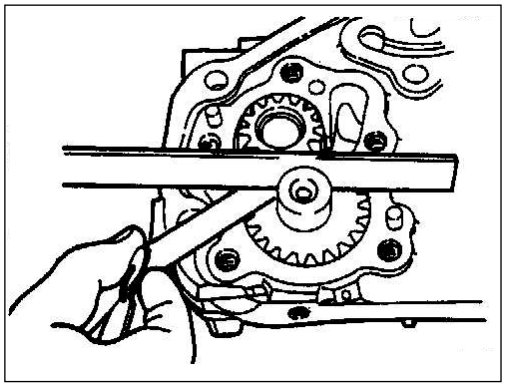
(3) Check if there is crack or other damnification. If any, replace front cover component.

Oil seal

(1) Check if there is abrasion or damnification on oil seal lip. If necessary, replace oil seal.

(2) Check if there is deterioration on oil seal lip. If necessary, replace oil seal.





Balance axle

(1) Check if oil hole is jammed.

(2) Check if there is sinter, damnification or interposition of bearing. If any badness, replace balance axle, bearing or front cover component.

Oil pump

(1) Install oil pump gear on front cover and then screw on the gear. Check if it can rotate smoothly and is tightened.

(2) Ensure there is no ridge shape abrasion on the contact surface of front cover and oil pump cover gear surface.

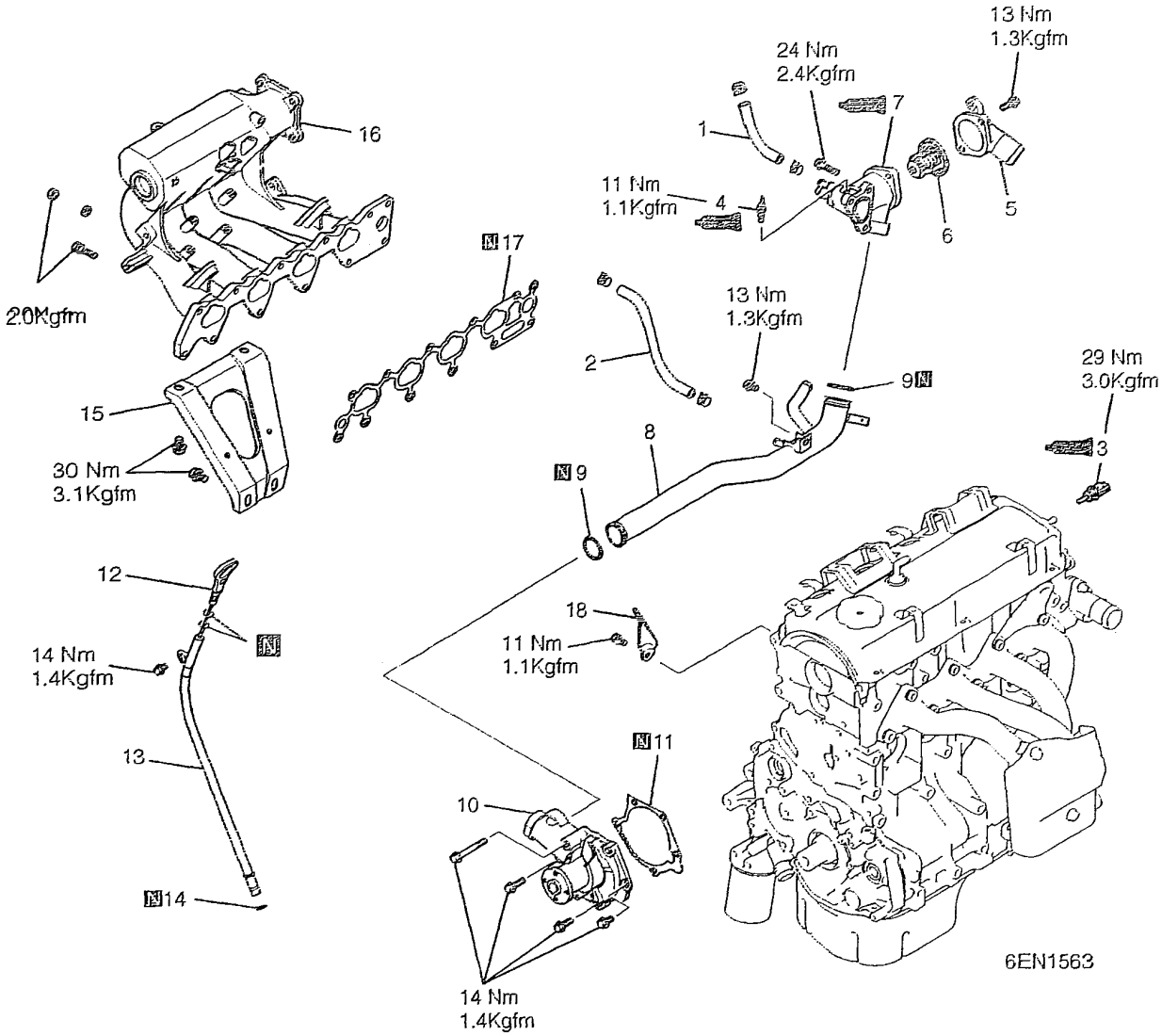
(3) Check side clearance.

Standard value：

Drive gear	**0.08-0.14mm**
Driven gear	**0.06-0.12mm**

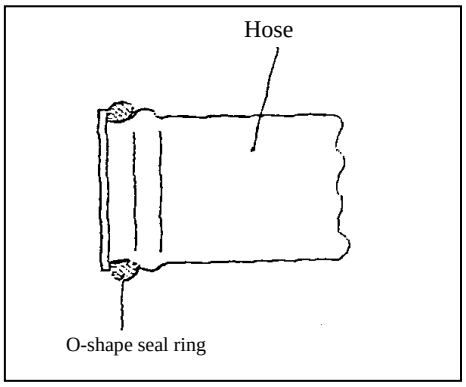
Chapter 6 Cooling System

Intake Manifold, Water Pump



Remove Steps:

1. Water soft tube
2. Water soft tube
3. Engine coolant temperature sensor
4. Engine coolant induction plug
5. Inflow tube joint
6. Thermostat
7. Thermostat shell
8. Inflow Tube
9. O-shape seal ring
10. Water pump
11. Water pump seal ring
12. Oil gauge
13. Oil gauge duct
14. O-shape seal ring
15. Manifold bracket
16. Intake manifold
17. Manifold gasket
18. Engine flying ring



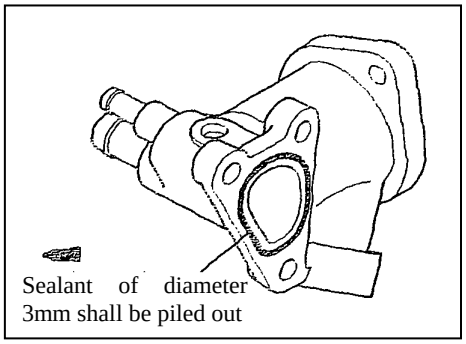
Installation Notice

O-shape seal installation

(1)Make seal ring wet to install it easily.

Caution：

There must be no engine oil or lubricate grease on seal ring.



Daub thermostat shell with sealant

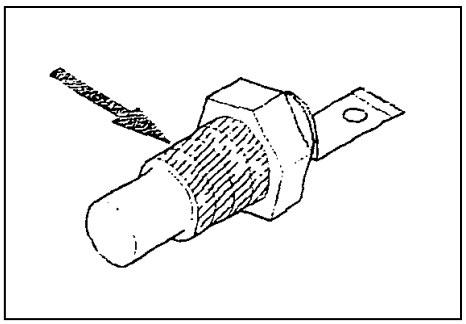
Specific sealant：

Component of Mitsubishi brand 3M ATD or equivalent.

Note：

(1) Thermostat shell should be installed immediately when the sealant is still wet (in 15 minutes).

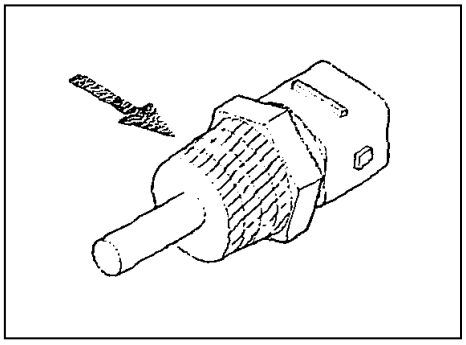
(2) Don't daub oil on the sealed part in about 1 hour after installation.



Daub engine coolant induction plug with sealant

Specific sealant：

3M ATD or equivalent



Daub engine coolant temperature sensor with sealant

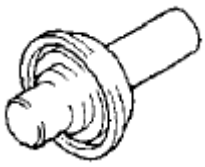
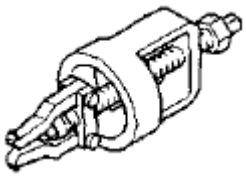
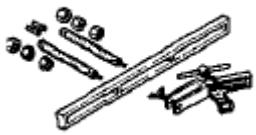
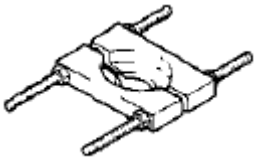
Specific sealant：

3M ATD nut fastening or equivalent

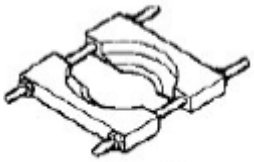
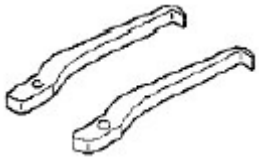
Chapter Ⅱ

QR523 Transmission Service Manual

Section Ⅰ Special Service Tools

Tool	Symbol	Name	Application
	MB990926	Installer Connector	To install the oil seal of input shaft
	MB990934	Installer Connector	To install the outer race of bearing
	MB990935	Installer Connector	To install the outer race of front/rear bearing of the differential
	MB990938	Handle	Apply this handle together with the installer connector
	MB998325	Oil seal/differential installer	To install the oil seal of differential
	MB998346	Bearing outer race detacher	To uninstall the outer race of bearing
	MB998772	Valve spring compressor	To uninstall the outer race of bearing
	MB998801	Bearing detacher	To install/uninstall the gears, bearings and sleeves

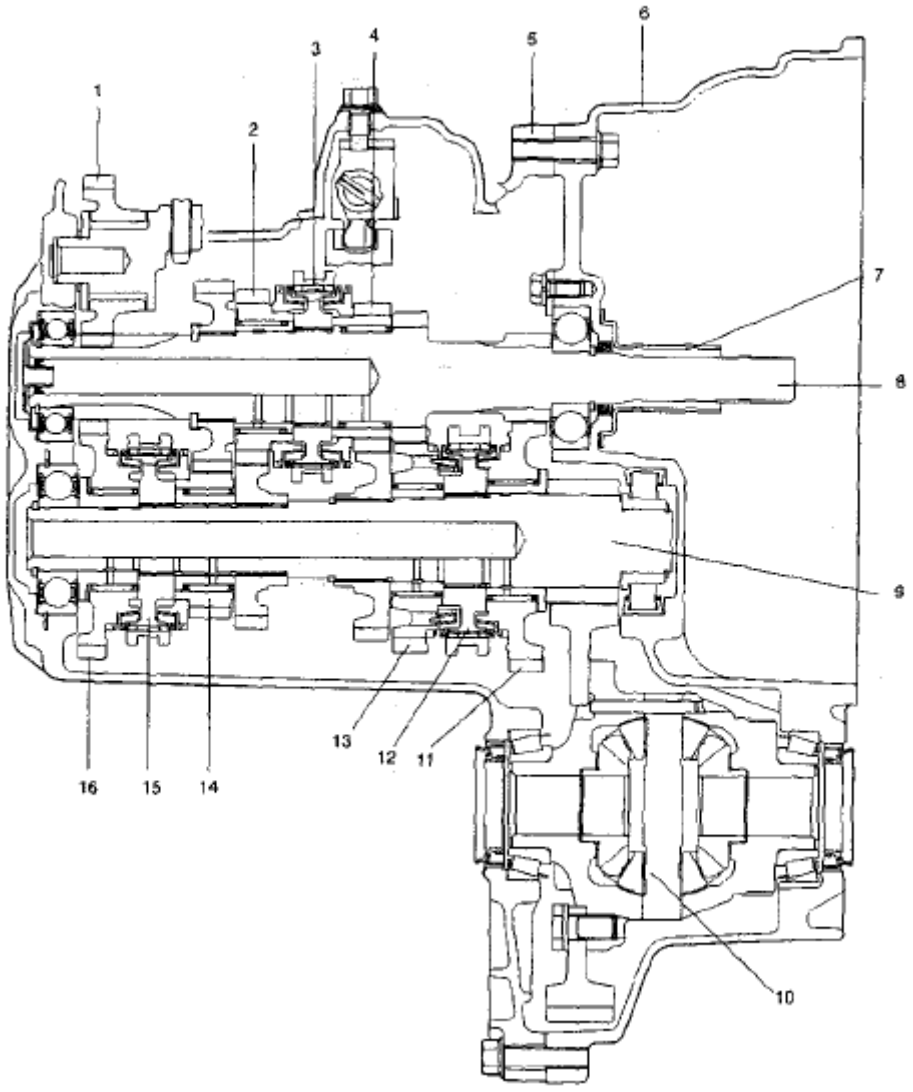
Tool	Symbol	Name	Application
	MB998812	Installer Cap	Apply this cap together with the installer and the installer connector
	MB998813	Installer (100)	Apply this installer together with the installer cap and the installer connector
	MB998814	Installer connector (200)	Apply this installer together with the installer cap and the installer connector
	MB998816	Installer connector (30)	To install the front bearing of input shaft
	MB998817	Installer connector (34)	To install the rear bearing of output shaft
	MB998818	Installer connector (38)	To uninstall the bearing of input shaft, inner race of bearing, reverse gear, needle bearing and bush – the bearing of reverse gear
	MB998819	Installer connector (40)	To install the bush- 5th-reverse gear synchronizer, front/rear bearing of differential, and bush – 4th gears and bush – 5th gears
	MB998822	Installer connector (46)	To install the bush – the 1st gears and bush – the 2nd gears and 3rd gears
	MB998823	Installer connector (48)	To install the inner race of differential’s bearings and the bearing of differential

Tool	Symbol	Name	Application
	MB998824	Installer connector (50)	To install the bush – the 4th gears and 5th gears
	MB998825	Installer connector (52)	To install the bush – 1st-2nd gear synchronizer, bush, 3rd-4th gear synchronizer and bush – the 1st gears
	MB998917	Bearing detacher	To install/uninstall gears, bearings and sleeves
	MB999566	Hook	To uninstall the outer race of front/rear bearing of differential

Section Ⅱ Technical Data and Precautions

1. Schematic Diagram

Schematic Diagram



1. Idler Assembly
2. Pinion Gear, 4th Gear
3. 3rd-4th Gear Synchronizer
4. Pinion Gear, 3rd Gear
5. Transmission Housing
6. Clutch Box
7. Release Bearing Saddle
8. Input Shaft
9. Output Shaft
10. Differential Assembly
11. Driven Gear of 1st Gear
12. 1st-2nd Gear Synchronizer
13. Driven Gear, 2nd Gear
14. Driven Gear, 5th Gear
15. Synchronizer of 5th-Gear and Reserve Gear
16. Gear, Reverse Gear

2. Maintenance Specifications

Item	Allowable Range	Limit Value
Axial clearance of input shaft front bearing (mm)	-0.01 ~ 0.21	–
Axial clearance of input shaft rear bearing (mm)	-0.01 ~ 0.12	–
Axial clearance of input shaft fifth gear (mm)	-0.01 ~ 0.09	–
Axial clearance of output shaft front bearing (mm)	-0.01 ~ 0.12	–
Axial clearance of output shaft rear bearing (mm)	-0.01 ~ 0.09	–
Axial clearance of output shaft third gear (mm)	-0.01 ~ 0.09	–
Back clearance of differential case planetary gear (mm)	0.025 ~ 0.150	–
Pretension of differential case (mm)	0.05 ~ 0.11	–
Clearance between the gear and the back of Synchro Ring (mm)	–	0.05

3. Sealants and Adhesives

Item	Specified Sealants and Adhesives
The fitting surface of clutch box–transmission housing	Three Arrow 1216E
The fitting surface of control case–transmission housing	
The fitting surface of lower head–transmission housing	

4. Disassembly

These parts assembled with sealants are easy to be disassembled without special methods. But, on some occasions, it is necessary to tap these parts slightly with wooden mallet or similar tools in order to break the sealants on the junction surface, or to use a flat, smooth and thin sealant scraper to insert into the junction surface slightly while you shall pay more attention to the junction surface and not damage it.

5. Cleanness of Sealing Surface

Apply the sealant scraper or steel brush to clean the foreign materials on the sealing surface, and confirm that the sealing surface is flat and smooth, without oil stains and foreign materials. Do not forget to remove the old sealants which enter into the transmission through the fitting holes or screwed holes.

6. Highlights for Applying Sealants

Precautions that shall be paid more attention when assembling parts.

Uniformly apply the sealant in the specified diameter, and fully enclose the surroundings of the fitting hole. Remove the sealants that are not hardened yet, and install the part on the specified position. After the completion of the part installation, you shall wait for till the sealants harden completely (approx. 1 hour required). Do not add the oil to the smeared part or make the engine wet or start up the engine.

7. Lubricating Grease

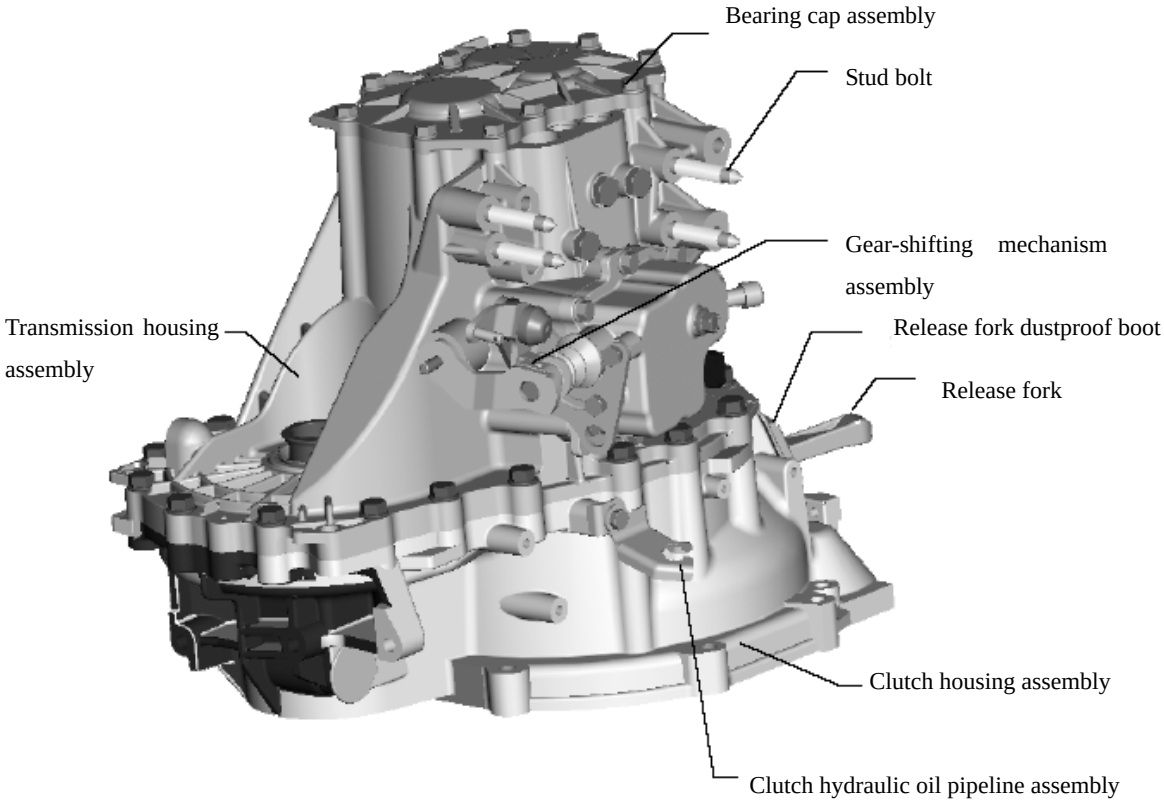
Item	Specified Lubricating Grease
Drive shaft seal lip	**Mobilux Ep2**
Input shaft seal lip	
Selector lever support cushion	

8. Torque Specification

Item	Torque N.m (kgf)
Bottom cap-Transmission installation bolts	6.2~7.6
Clutch box-Transmission housing installation bolts	39.5~48.5
Clutch release bearing saddle retainer installation bolts	8.8~10.8
Gear-shifting mechanism assembly installation bolts	16.1~19.9
Gear-shifting staying wire bracket installation bolts	16.1~19.9
Speedometer gear installation bolts	3.5~4.3
Main gearbox driven gear installation bolts	118.5~145.5
Backup lamp switch	28.7~35.3
Idling gear assembly installation bolts	43.1~52.9

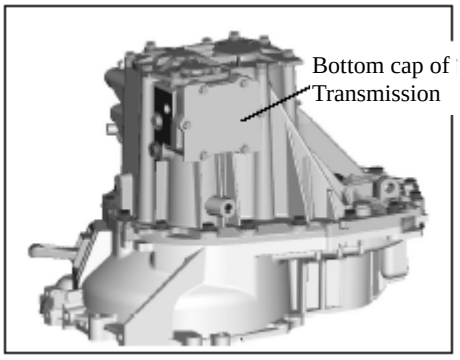
Section Ⅲ Removal and Installation

1. External Structural Diagram of QR523 Transmission



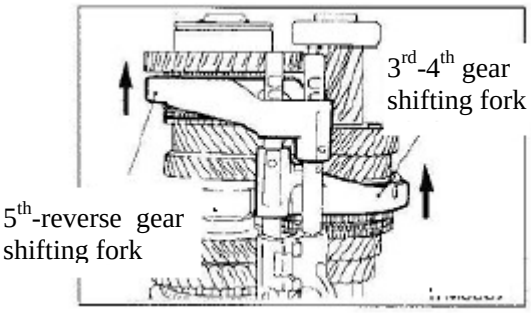
2. Removal and Installation of Main Parts

(1) Removal



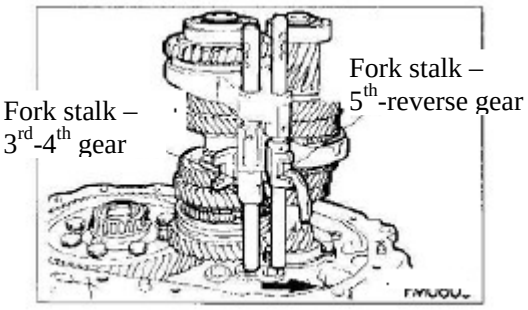
1) Removal of transmission housing

Remove the gear-shifting mechanism assy., bearing cap assy., snap ring-output shaft front bearing, bottom cap-transmission and reverse gear idling gear assembly, and then remove the transmission housing.

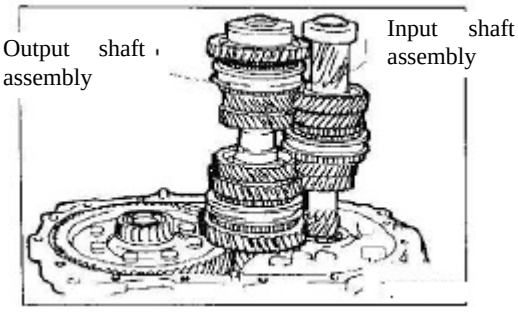


2) Removal of 3rd-4th gear shifting fork rail/3rd-4th gear shifting fork/5th-reverse gear shifting fork rail/5th-reverse gear shifting fork

a. Move the 3rd-4th gear-shifting fork and 5th-reverse gear-shifting fork in the directions shown in the left figure.



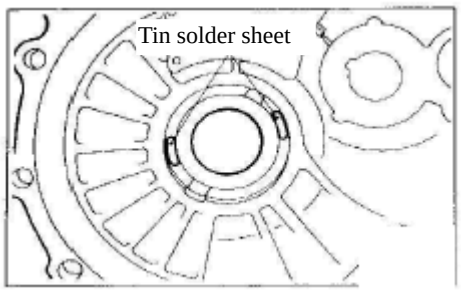
b. Slide the fork stalk–3rd-4th gear and fork stalk–5th-reverse gear in the directions shown in the left figure, and disassemble them together with the shift fork.

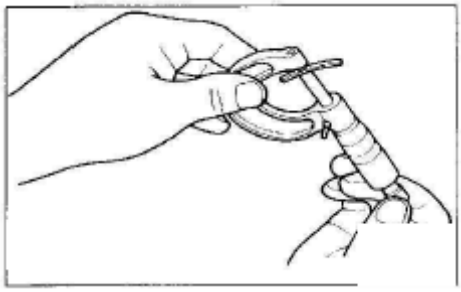


2) Removal of input/output shaft

Remove the input shaft together with the output shaft.

(2) Adjustment before Installation





Select the thickness of washer to adjust the differential pretension

1) Place the tin solder sheet (approx. 10 mm long and 1.6 mm diameter) on the specified part of transmission housing, and then install the outer race of bearing and the differential.

2) Install the clutch box, and tighten the bolt to the specified torque.

3) Replace these tin solder sheets with thicker tin solder sheets if these sheets aren't flattened. And then repeat these steps (1) and (2).

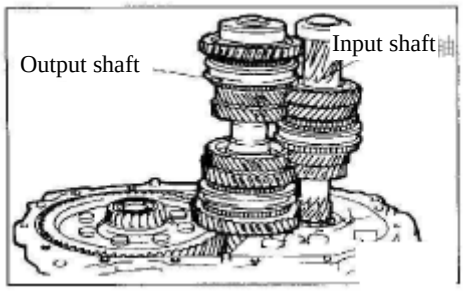
4) Apply a micrometer calipers to measure the thickness (T) of the flattened tin solder sheet.

5) Select the thickness of washer that shall be installed according to the following equation.

Thickness of washer:

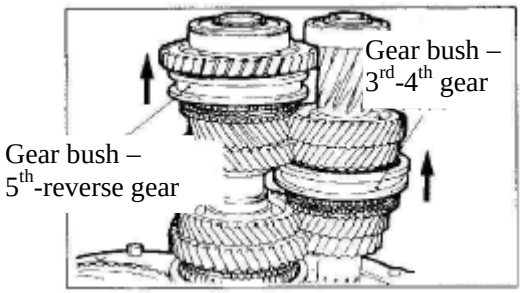
(T+0.005 mm)~ (T+0.11 mm)

(3) Installation



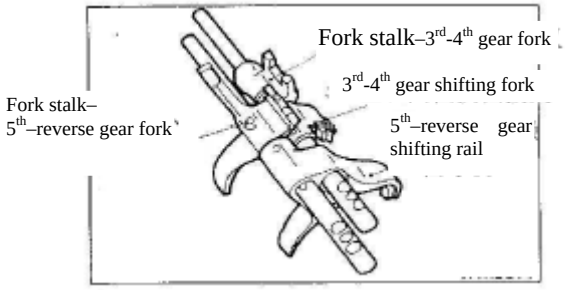
1) Installation of input/output shaft

Install the input shaft together with the output shaft.

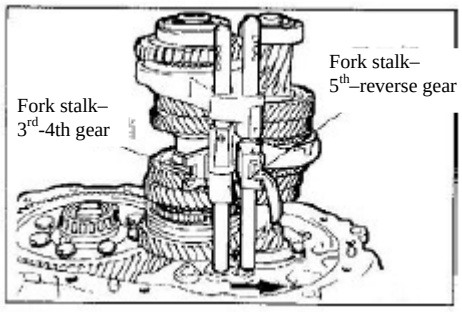


2) Installation of the 5th-reverse gear shifting fork/fork stalk–5th-reverse gear fork/3rd-4th gear shifting fork/fork stalk–3rd-4th fork

   a. Move the gear bush–3rd-4th gear and the gear bush–5th-reverse gear in this direction shown in the left figure.

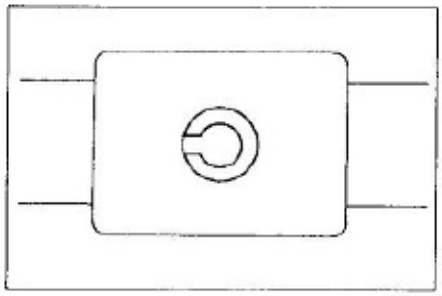


b. Install the 3rd-4th gear shifting fork and its fork stalk and the 5th-reverse gear shifting fork and its stalk.

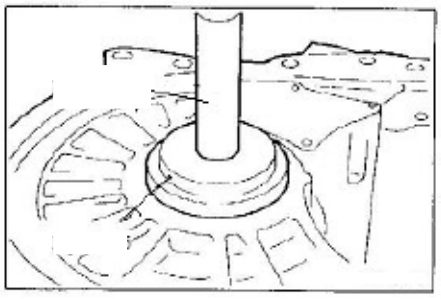


c. Install all gear shifting fork into the gear hub, and, at the same time, move the fork stalks in the direction shown in the left figure.

3) Installation of the locking pin

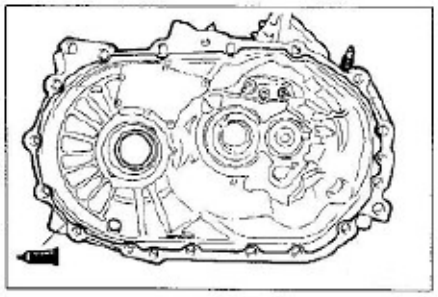


4) Installation of the outer race of bearing



5) Installation of the transmission housing

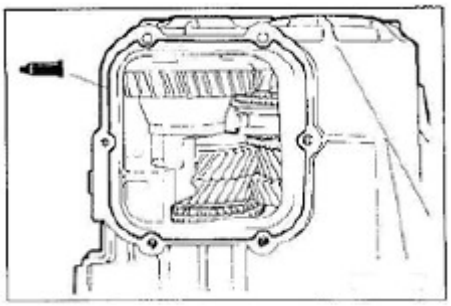
a. Apply the 1mm to 1.2 mm diameter sealants on the specified position of transmission housing, shown in left figure



CAUTION:

The sealant line applied shall be uniform and continuous, without break or over-paint.

After the completion of the housing installation, screw up the bolts to the specified torque.



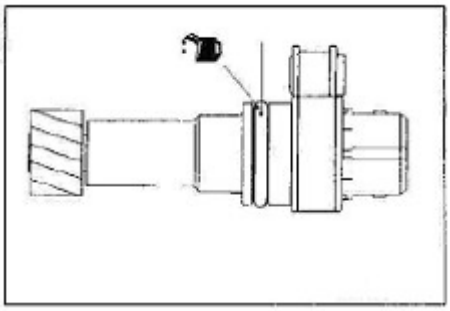
6) Installation of bottom cap–transmission

Apply the 1mm to 1.2 mm diameter sealants on the specified position of transmission housing, shown in left figure.

The specified sealants:

CAUTION:

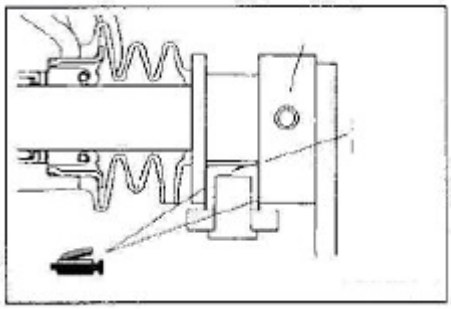
The sealant line applied shall be uniform and continuous, without break or over-paint.



7) Installation of speedometer

Apply the transmission oil on the O-ring of speedometer gear.

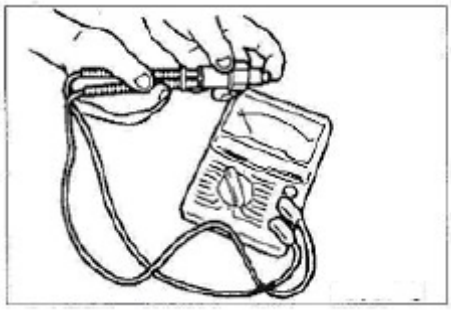
Transmission oil: **75W-90**



8) Installation of the gear shifting arm assembly

Apply the lubricating oil on the contact surface of the gear shifting drive slider and the gear shifting arm assembly.

The specified lubricating oil: **Mobilux Ep2**



9) Examination of reverse lamp switch

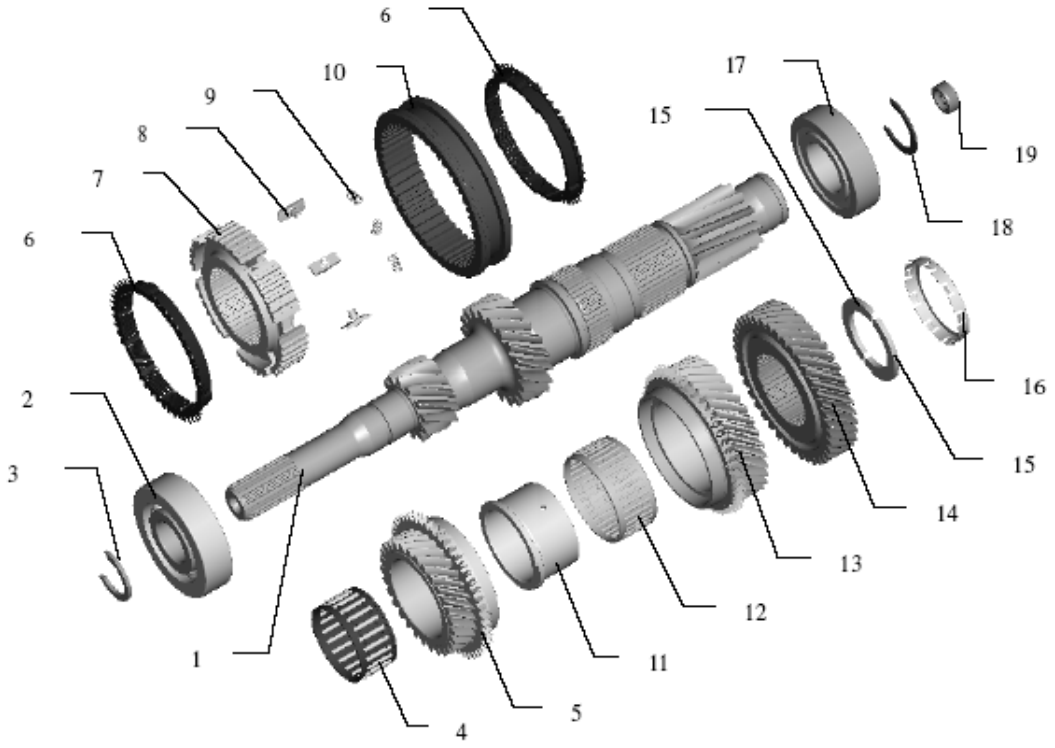
Examine there is no broken circuit between the terminals.

Status of Switch	Circuit
Pressed	OFF
Released	ON

Section Ⅳ Input Shaft

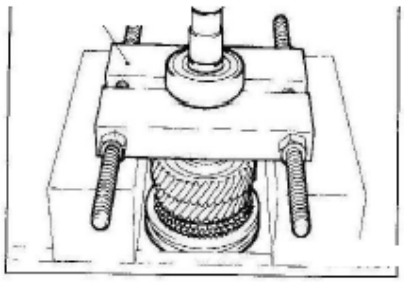
1. Disassembly

1) Apply the gear oil when assembling.
2) Lubricate all interior components.

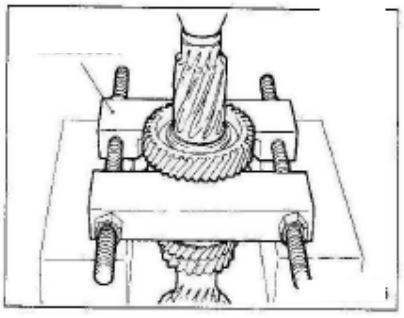


1. Input shaft
2. Input shaft front bearing
3. Snap ring
4. Needle bearing-3rd gear
5. 3rd driving gear assembly
6. Synchronizer ring-3rd-4th gear
7. Gear hub-3rd-4th gear
8. Guide block
9. Spring-3rd-4th gear synchronizer
10. Gear bush-3rd-4th gear
11. Gear bush-4th gear
12. Needle bearing-2nd-4th gear
13. 4th driving gear assembly
14. 5th driving gear
15. Thrust ring-5th driving gear
16. Clip-5th driving gear thrust plate
17. Input shaft rear bearing
18. Snap ring-input shaft rear bearing
19. Seal-input shaft oil-collecting hole

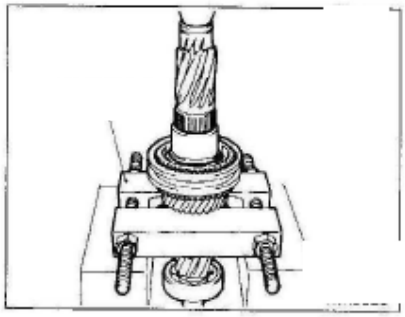
2. Disassembly



1) Disassembly of input shaft rear bearing.

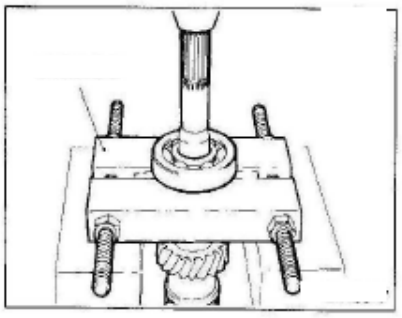


2) Disassembly of 5th driving gear.



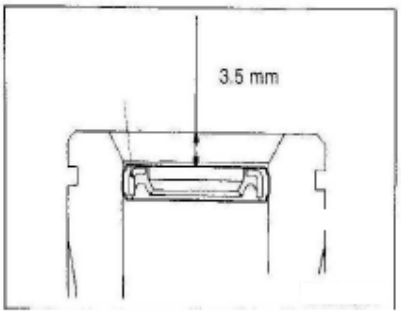
3) Disassembly of sleeve-4th gear

Mount the special tool on the 3rd driving gear to disassemble the sleeve-4th gear.



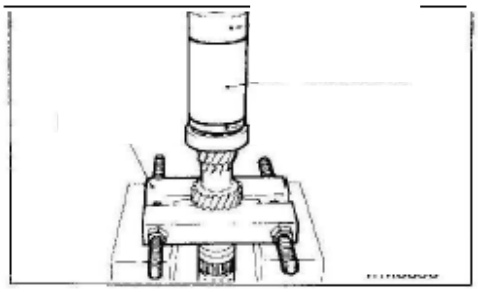
4) Disassembly of input shaft front bearing.

3. Assembly

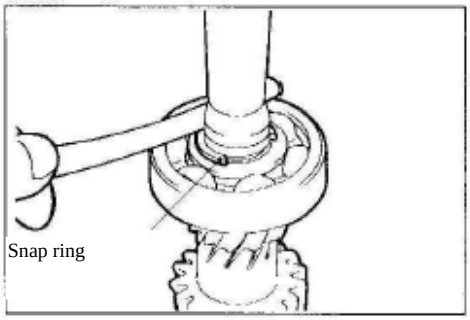


1) Installation of seal-input shaft oil-collecting hole

Press in the seal till the dimension shown in the left figure is obtained.



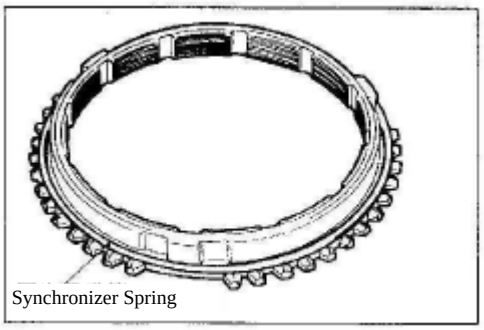
2) Installation of input shaft front bearing



3) Installation of snap ring-input shaft front shaft

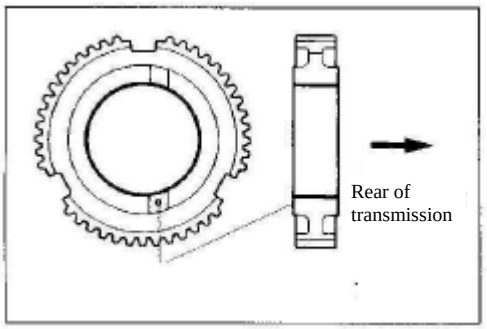
Select the thickness of snap ring to make the axial clearance of input shaft front bearing conform to the standard.

The standard value: 0.01 mm to 0.12 mm



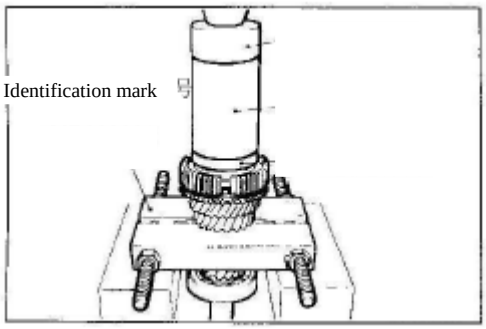
4) Installation of synchronizer spring

Install the synchronizer spring on the specified position of the synchronizer ring, shown in the left figure.



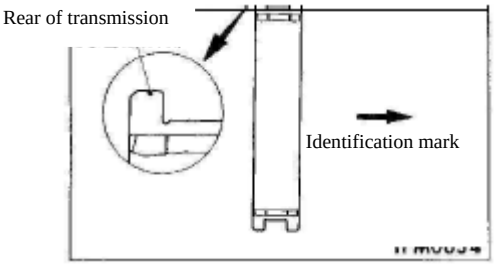
5) Installation of gear hub-3rd-4th gear

Install the gear hub-3rd-4th gear in the direction shown in the left figure.



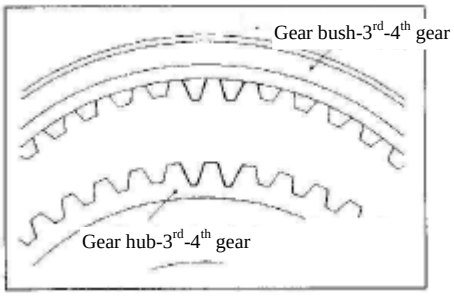
CAUTION:

Confirm that the synchronizer ring is not locked when the installation of gear hub.

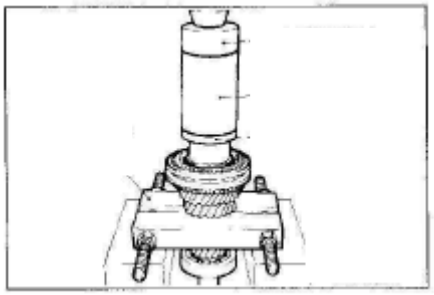


6) Installation of gear bush-3rd-4th gear

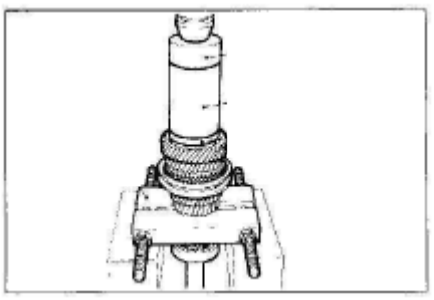
a. Install the gear bush in the direction shown in the left figure.



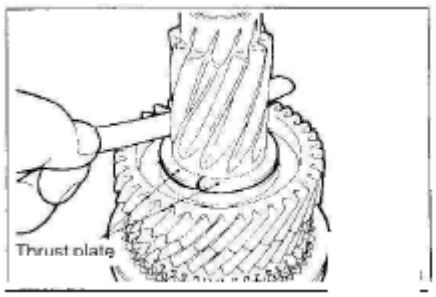
b. Confirm that these two deep tooth spaces of gear hub are correctly aligned with these two high racks of the gear hub during the installation of gear bush.



7) Installation of sleeve-4th gear.



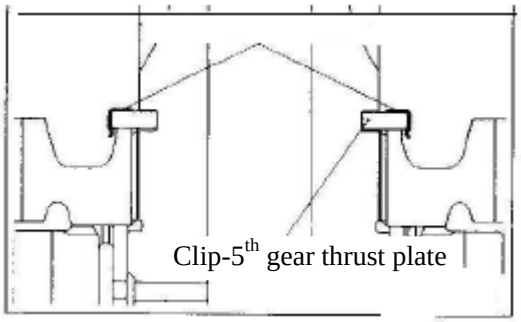
8) Installation of 5th driving gear.



9) Installation of transmission housing assembly

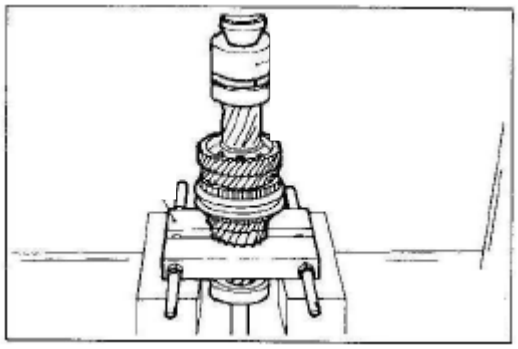
Select the thickness of the thrust plate-5th driving gear to make the axial clearance of input shaft 5th driving gear shaft.

The Standard Value:
-0.01 mm to 0.09 mm

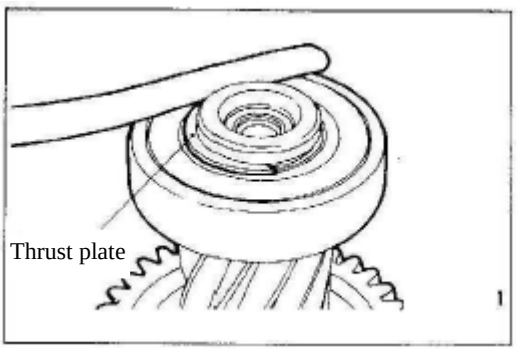


10) Installation of clip-5th driving gear thrust plate

Confirm that the thrust plate doesn't tilt when the installation of clip.



11) Installation of input shaft rear bearing



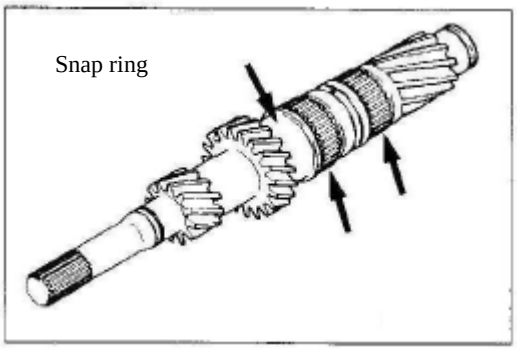
12) Installation of snap ring

Select the thickness of snap ring to make the axial clearance of input shaft rear bearing conforms to the standard.

Installation of snap ring

The Standard Value: 0.01 mm to 0.12 mm

4. Inspection



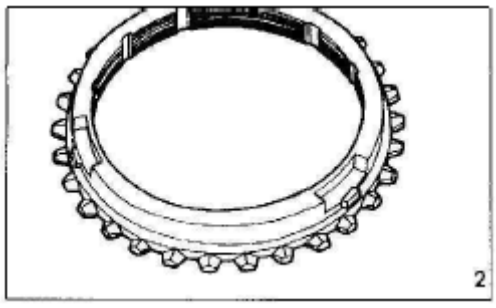
1) Input Shaft

a. Examine that the external surface of installation part of needle bearing isn't damaged, abnormally worn or locked, and hasn't other faults.

b. Examine that the spline isn't damaged or worn.

2) Needle Bearing

a. Examine that the assembly of input shaft and gear is correct and this shaft turns smoothly, without loose or noise and etc.

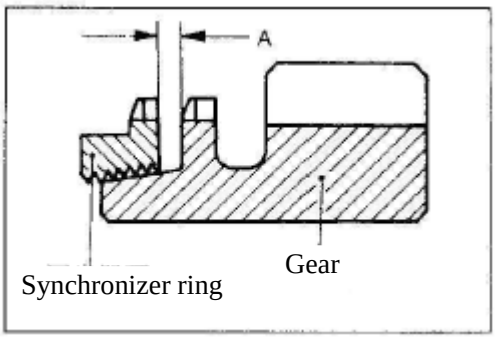


3) Synchronizer Ring

a. Examine there is no damage or breakage in the surface of synchronizer ring.

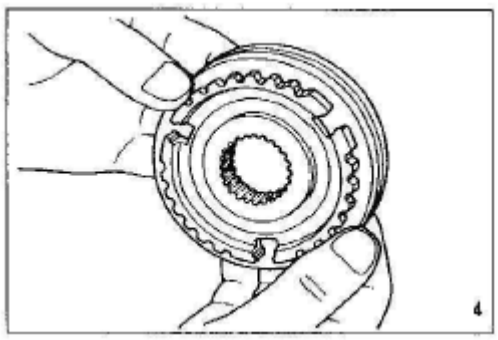
b. Examine there is no damage or wearing in the minor diameter part of conical components, without the crushing damage of screw threads.

c. Press down the synchronizer ring-3rd-4th gear, and then examine the clearance "A".



If the "A" is less than the limit value, the synchronizer ring-3rd-4th gear shall be replaced.

The Limit Value: 0.5 mm



4) Gear bush and hub of synchronizer

a. Assemble the gear bush together with the gear hub of synchronizer, and then examine they can slide smoothly without lock.

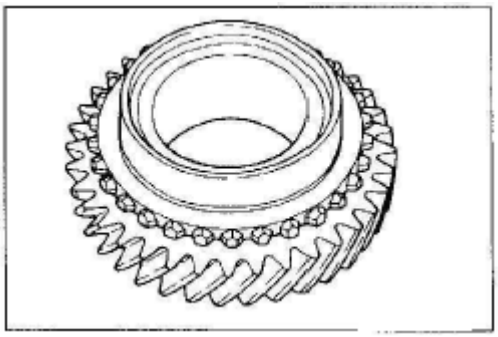
b. Examine there is no damage in the front/rear end of the interior surface of gear bush.

CAUTION:

If it is necessary to replace the gear bush and gear hub of the synchronizer, they shall be replaced with a new complete set.

The spring of synchronizer

Examine there is no sagging, deformation or breakage on the spring.



5) 3^{rd}-4^{th} driven gear

a. Examine there is no damage or wearing on the gear surface of the skew gear and clutch gear.

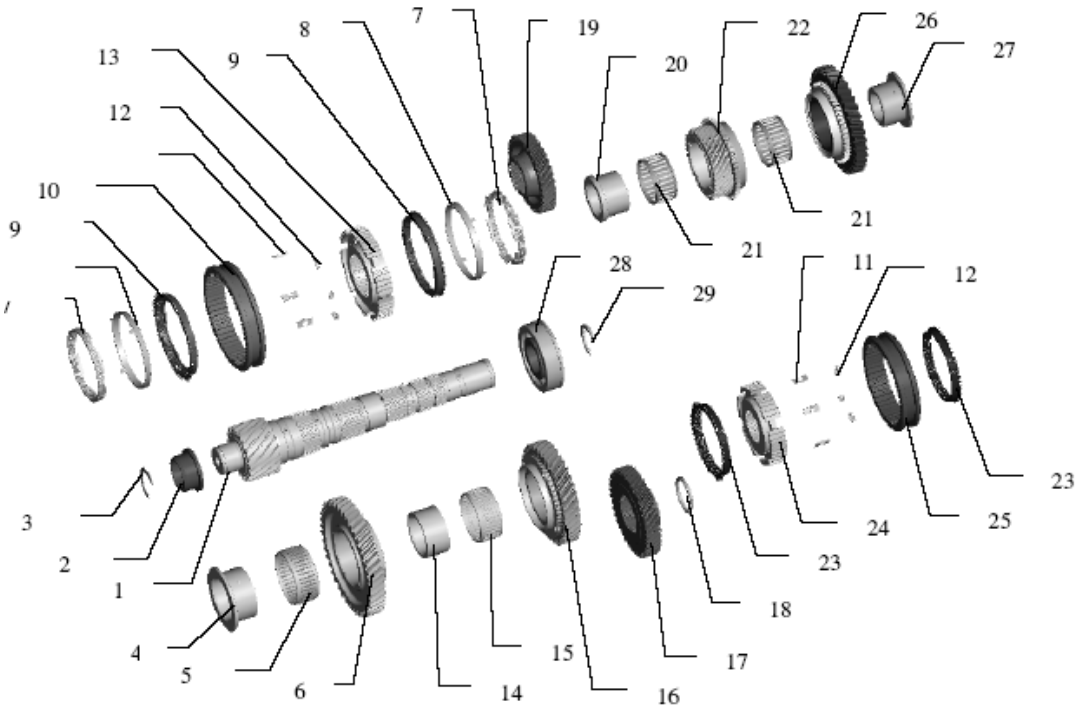
b. Examine there is no thickening, damage or wearing on the conical surface of synchronizer.

c. Examine there is no damage or wearing inside the internal diameter of gear and on the front/rear end surface of gear.

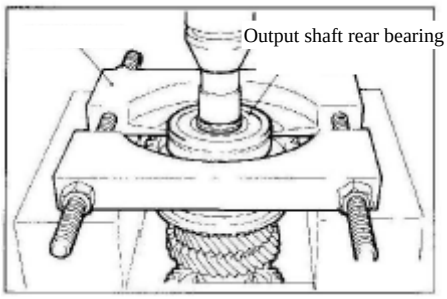
Section Ⅴ Output Shaft

1. Disassembly

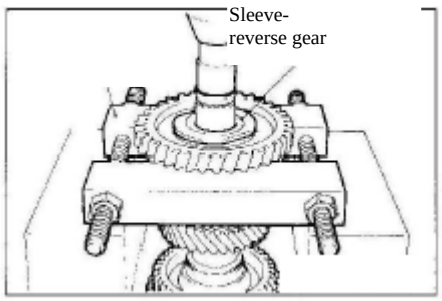
a. Apply the gear oil when assembling.
b. Lubricate all interior components.



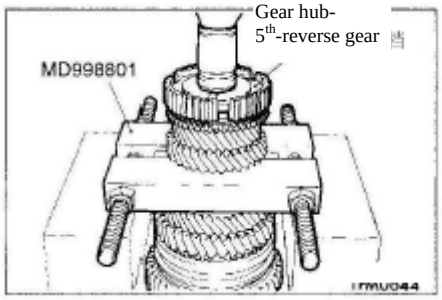
1. Output shaft
2. Output shaft front bearing
3. Snap ring-output shaft front bearing
4. Sleeve-1st gear
5. Needle bearing-1st gear
6. 1st driven gear assembly
7. Inner ring-1st-2nd synchronization ring
8. Steel ring-1st-2nd synchronization ring
9. Outer ring-1st-2nd synchronization ring
10. Gear bush-1st-2nd synchronizer
11. Guide block
12. Spring-1st-2nd gear and 5th-reverse gear synchronizer
13. Gear bush-1st-2nd gear
14. Sleeve-2nd gear
15. Needle bearing-2nd gear
16. 2nd driven gear assembly
17. 3rd driven gear
18. Snap ring-3rd driven gear
19. 4th driven gear
20. Gear bush-5th gear
21. Needle bearing-reverse gear
22. 5th driven gear assembly
23. Synchronization ring-3rd-4th gear and 5th-reverse gear
24. Gear hub-5th -reverse gear
25. Gear bush-5th-reverse gear
26. Reverse driven gear assembly
27. Sleeve-reverse gear
28. Output shaft rear bearing
29. Snap ring-output shaft rear bearing



1) Disassembly of output shaft rear bearing

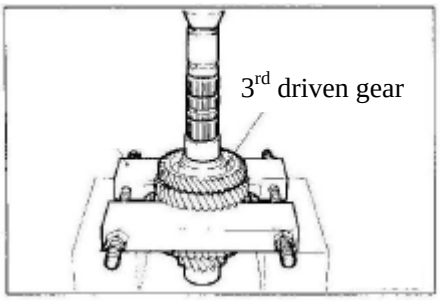


2) Disassembly of sleeve-reverse gear
Install the special tool on the reverse driven gear, and then disassemble the sleeve.



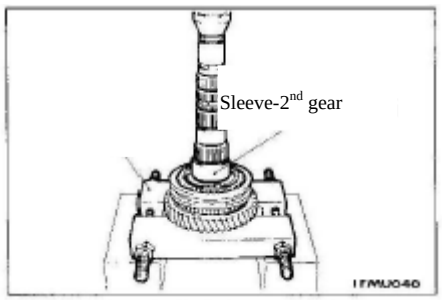
3) Disassembly of 5th-reverse gear synchronizer hub

Install the special tool on the 4th driven gear, and then disassemble the gear hub-5th-reverse gear.



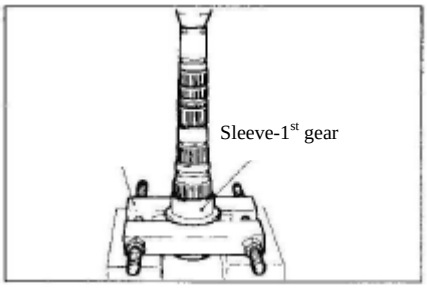
4) Disassembly of 3rd driven gear

Install the special tool on the 2nd driven gear, and then disassemble the 3rd driven gear.

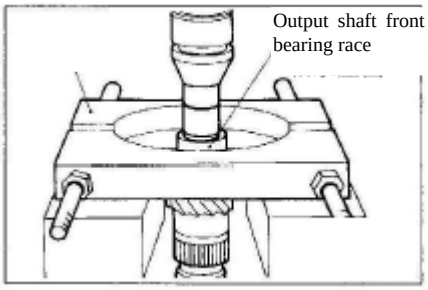


5) Disassembly of sleeve-2nd gear

Install the special tool on the 1st driven gear, and then disassemble the sleeve-2nd gear.

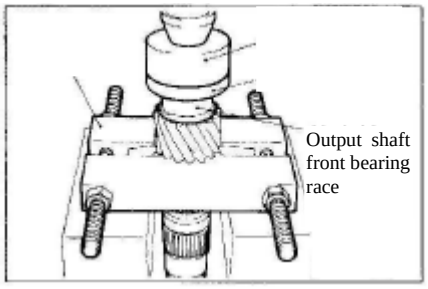


6) Disassembly of sleeve-1st gear

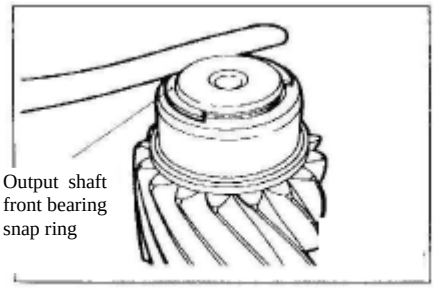


7) Disassembly of output shaft front bearing race

2. Assembly



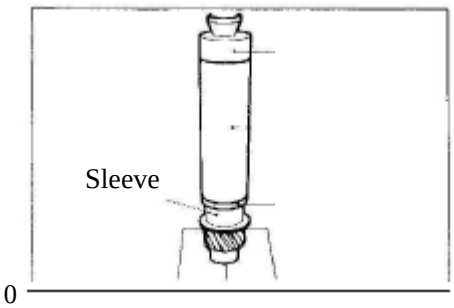
1) Installation of output shaft front bearing race



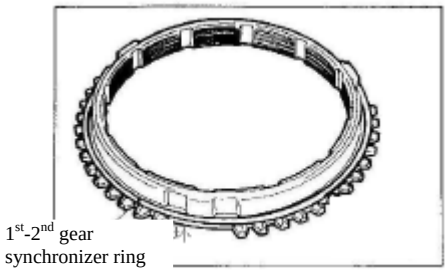
2) Installation of snap ring-output shaft front bearing

Select the snap ring and install it to make the axial clearance of output shaft front bearing conform to the standard value.

The Standard Value: 0.01 mm to 0.12 mm

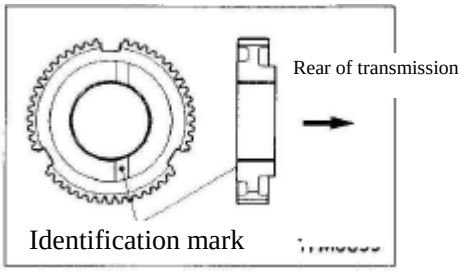


3) Installation of sleeve-1st gear



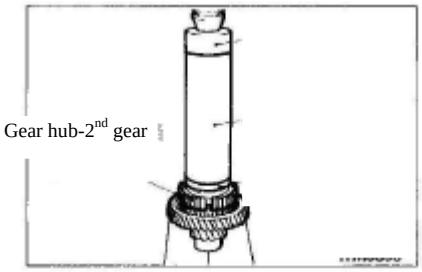
4) Installation of the 1st-2nd gear synchronization ring

Install the 1st-2nd gear synchronizer ring correctly on the specified position of synchronizer ring shown in the left figure.



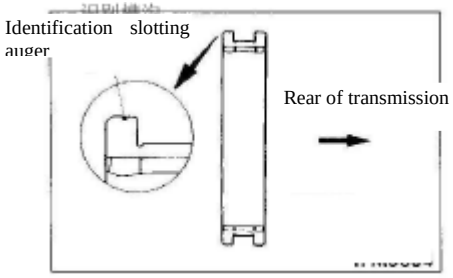
5) Installation of the gear hub-1st-2nd gear

Install the gear hub-1st-2nd gear on the position shown in the left figure.



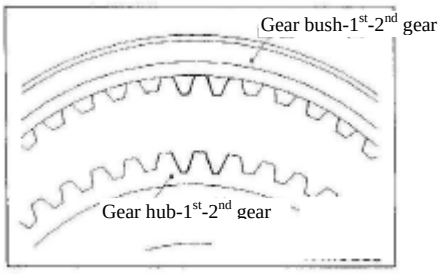
CAUTION:

Confirm that the synchronization ring isn't locked when the installation of gear hub.

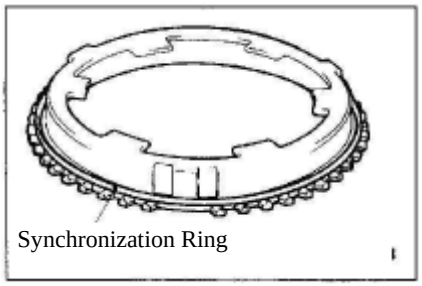


6) Installation of the gear bush-1st-2nd gear synchronizer

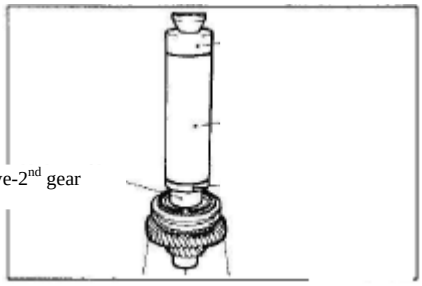
a. Install the gear bush on the position shown in the left figure.



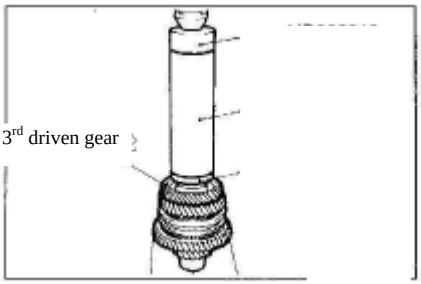
b. Confirm that these two deep tooth spaces of gear hub are correctly aligned with these two high racks of the gear hub during the installation of gear bush.



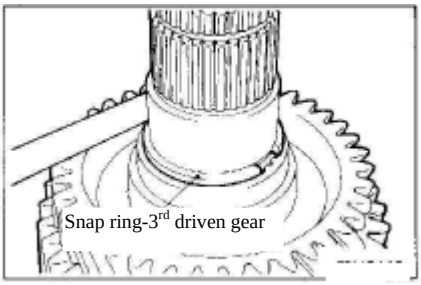
7) Installation of Synchronization Ring



8) Installation of sleeve-2nd gear



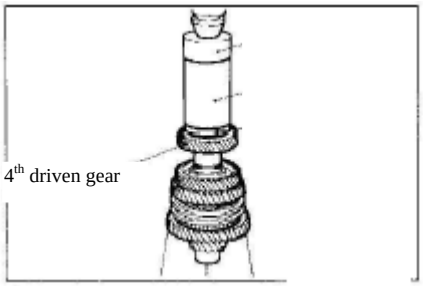
9) Installation of the 3rd driven gear



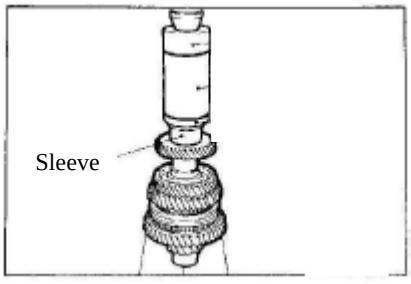
10) Installation of the snap ring- 3rd driven gear

Install the snap ring to make the axial clearance of the output shaft 3rd driven gear conform to the standard value.

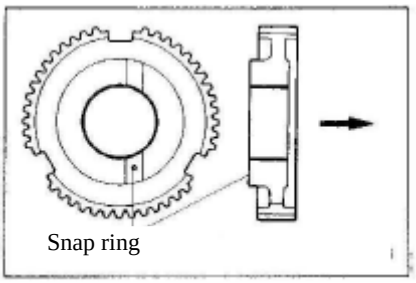
The Standard Value: -0.01 mm to 0.09 mm



11) Installation of 4th driven gear

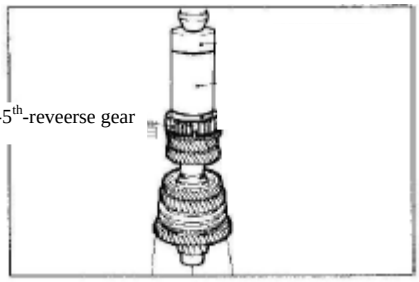


12) Installation of sleeve-5th gear



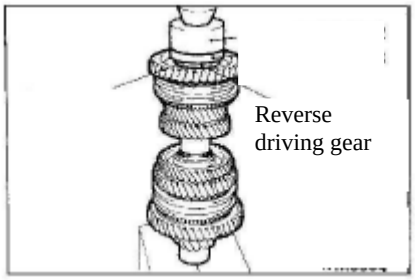
13) Installation of gear hub-5th-reverse gear

Install the gear hub-5th-reverse gear on the position shown in the left figure.

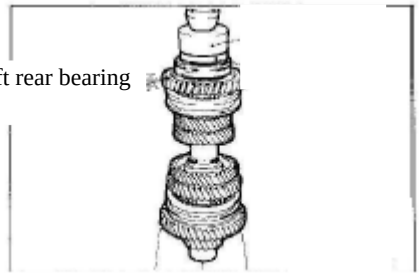


CAUTION:

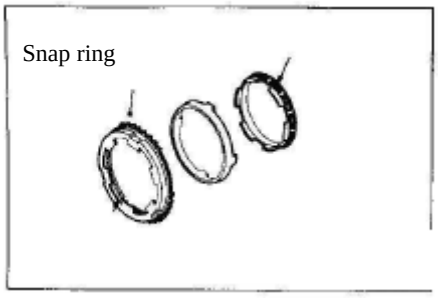
Confirm that the synchronizer ring is not locked during the installation of gear hub-5th-reverse gear.



14) Installation of reverse driven gear/needle bearing-reverse gear/sleeve-reverse gear

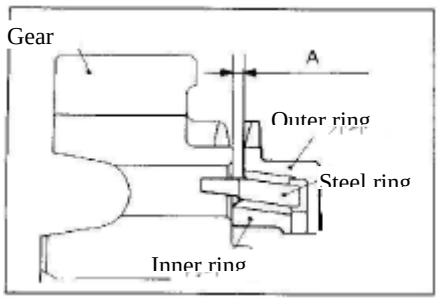


15) Installation of input shaft rear bearing



16) Outer ring-1st-2nd gear synchronization ring/steel ring-1st-2nd gear synchronization ring/inner ring-1st-2nd gear synchronization ring

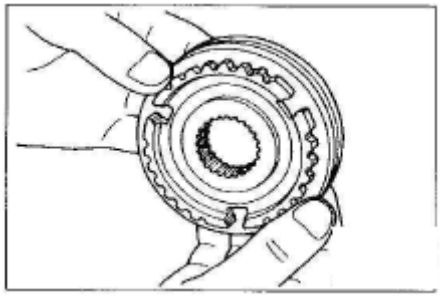
(1) Examine there is no damage or breakage on the gear surface and conical surface of the clutch gear.



(2) Install the outer ring and inner ring, and then press them down to the gear to measure the clearance “A”. If the “A” is less than the limit value, theses rings shall be replaced.

The limit value: 0.5 mm

CAUTION: If it is necessary to replace the outer ring, inner ring or steel, they shall be replaced with a new complete set.



17) Gear bush and hub of synchronizer

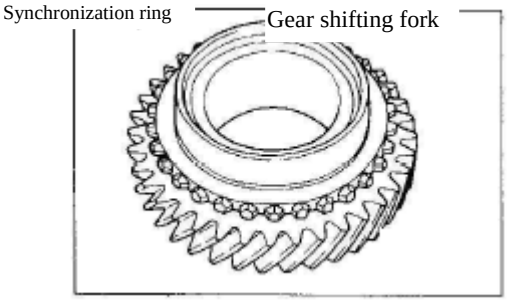
(1) Assemble the gear bush together with the gear hub of synchronizer, and then examine they can slide smoothly.

(2) Examine there is no damage in the front/rear end of the interior surface of gear bush.

CAUTION: If it is necessary to replace the gear bush or gear hub of the synchronizer, they shall be replaced with a new complete set.

The spring of synchronizer

Examine there is no sagging, deformation or breakage on the spring.



18) Transmission gear

(1) Examine there is no damage or wearing on the gear surface of the skew gear and clutch gear.

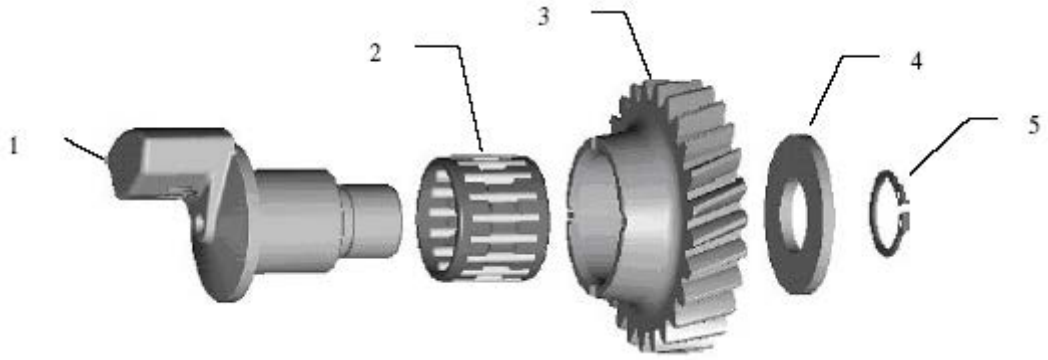
(2) Examine there is no thickening, damage or wearing on the steel ring-synchronization ring.

(3) Examine there is no damage or wearing inside the internal surface of gear and on the front/rear end surface of gear.

Section Ⅵ Intermediate Gear for Reverse Gear

1. Disassembly and Assembly

a. Apply the gear oil (**75W-90**) when assembling
b. Lubricate all interior components



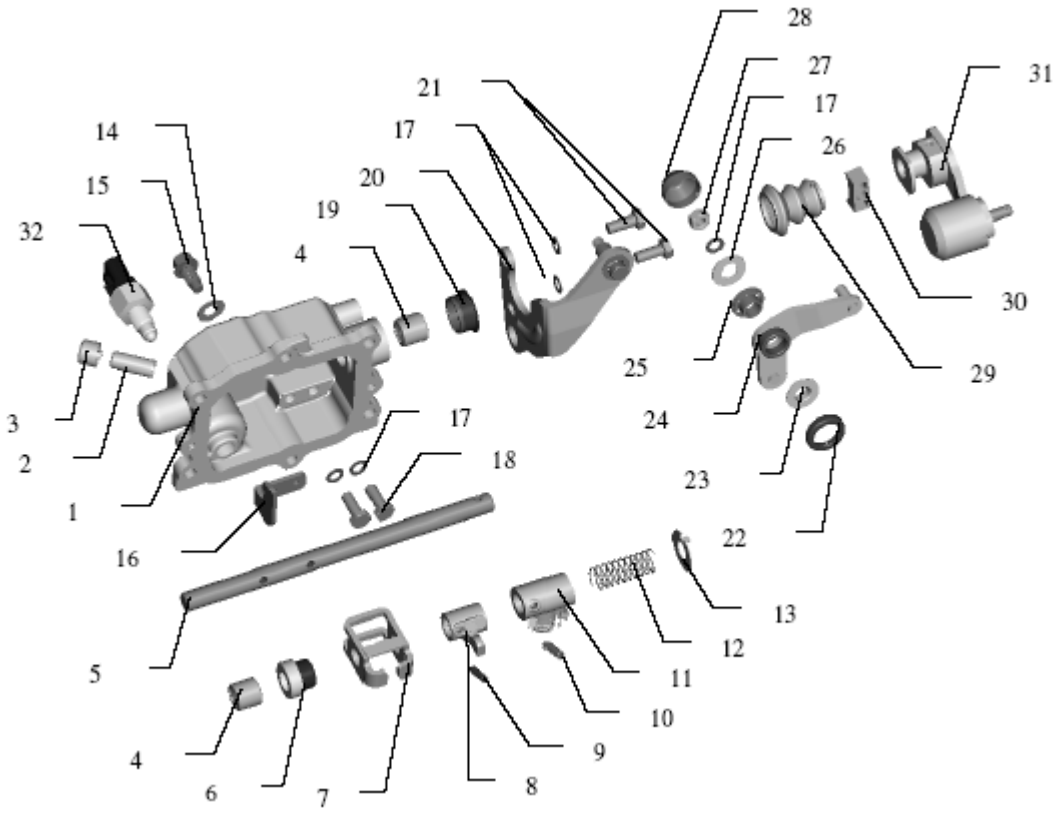
1. Idler shaft
2. Needle bearing-idler
3. Reverse gear idler
4. Thrust plate-idler
5. Snap ring-idler thrust plate

2. Inspection

1) Needle Bearing

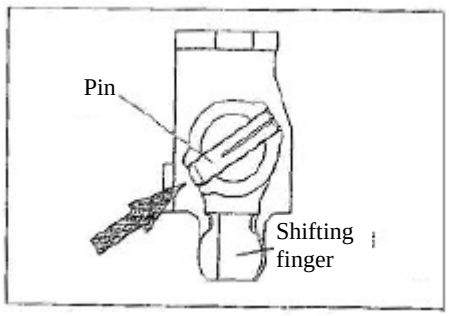
(1) Assemble the shaft together with the gear, and then examine they can slide smoothly without sagging or noise.
(2) Examine there is no deformation in the bearing cage.

Section Ⅶ Gear Shifting Mechanism



1. Gear shifting mechanism housing
2. Air guide pipe
3. Air guide pipe cap
4. Bearing-gear shifting mechanism
5. Gear shifting shaft
6. Front neutral position return spring assembly
7. Interlocking plate assembly
8. Gear shifting finger
9. Pin **GB879 5X22**
10. Pin **GB879 6X26**
11. Reverse gear locking mechanism assembly
12. Rear neutral position return spring
13. Baffle-rear neutral position return spring
14. Plain washer-interlocking plate limit stop screw
15. Limit stop screw-interlocking plate
16. Retainer plate-reverse gear locking mechanism
17. Washer **GB938**
18. Bolt **GB5783 M8X22**
19. Oil seal-gear shifting shaft
20. Gear selecting arm support assembly
21. Bolt **GB5783 M8X20**
22. Lower dust cap-gear selecting arm
23. Lower bush-gear selecting arm
24. Gear selecting arm assembly
25. Upper bush-gear selecting arm
26. Plain washer-gear selecting arm nut
27. Nut **GB6170 M8**
28. Upper dust cap-gear selecting arm
29. Dust cap-gear shifting shaft oil seal
30. Gear shifting drive slider
31. Gear shifting arm assembly
32. Reverse lamp switch assembly

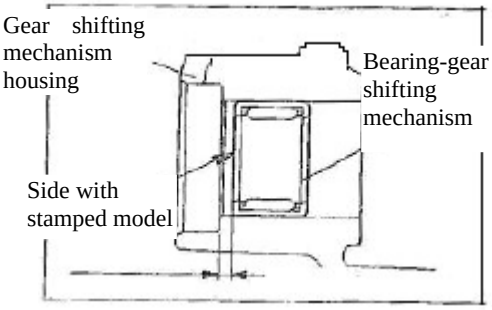
1. Disassembly



Disassembly of lock pin:

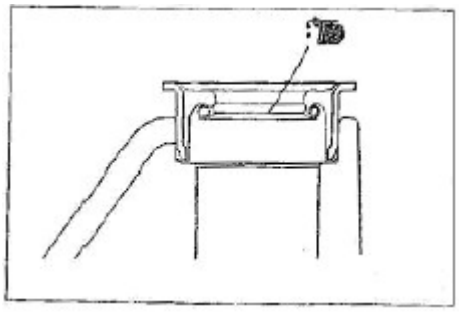
Punch out the lock pin in this direction shown in the left figure.

2. Assembly



1) Installation of the needle bearing

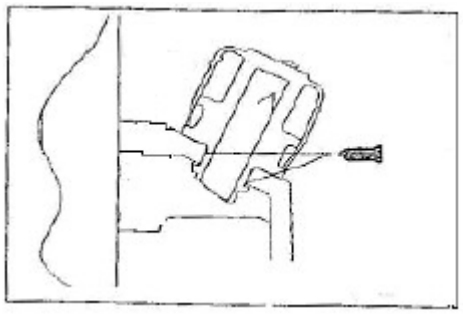
Press in the needle bearing to the dimension shown in the left figure. In this case, the side surface with the stamped model shall be in the side of controller housing.



2) Installation of oil seal

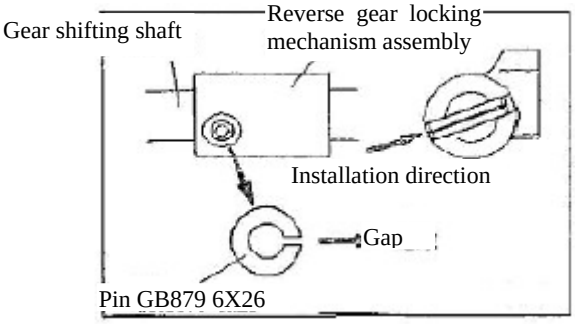
Apply the transmission oil on the oil seal lip.

The transmission oil: 75W-90

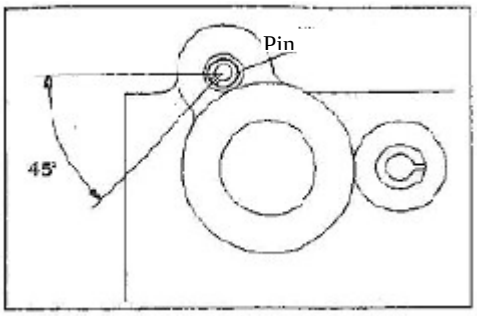


3) Installation of vent

(1) Apply the sealants on the surface of the inserted part.

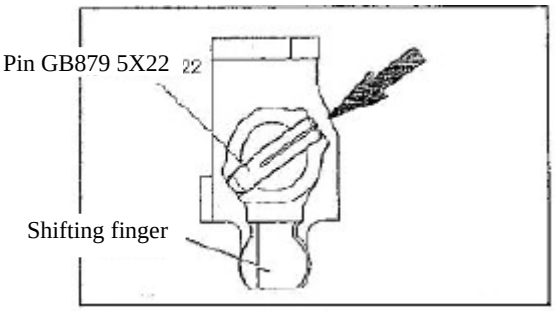


4) Installation of spring pin



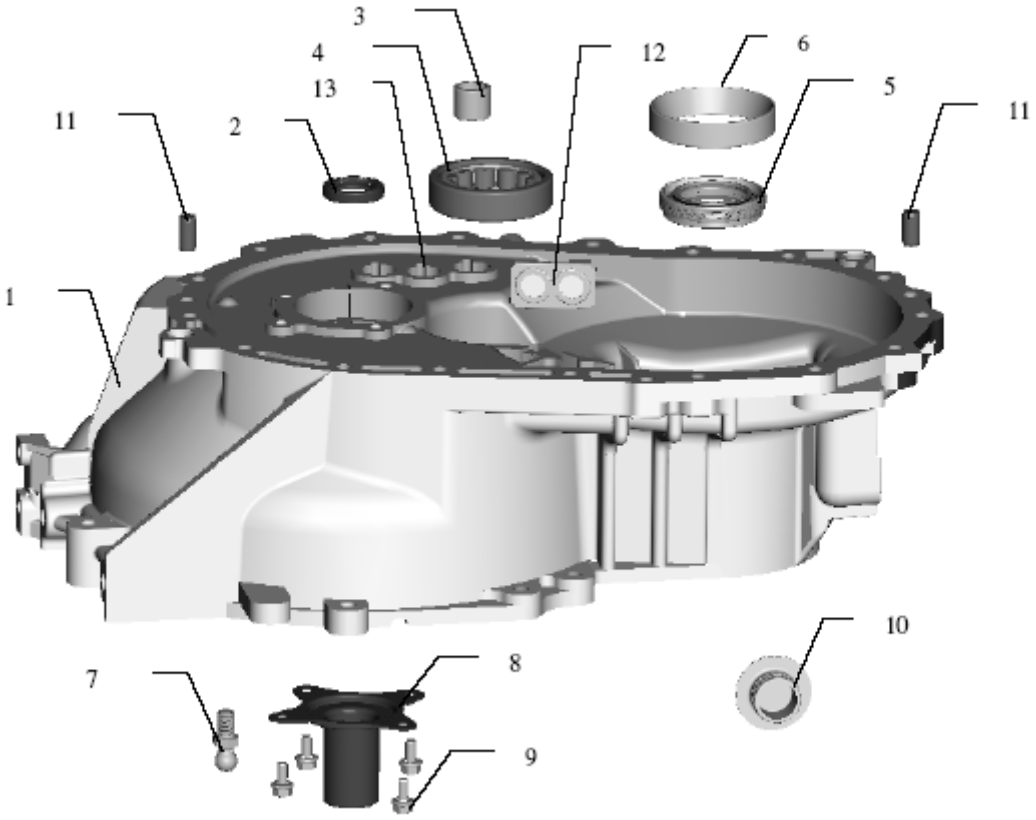
5) Installation of spring pin

Punch out the lock pin in this direction shown in the left figure.



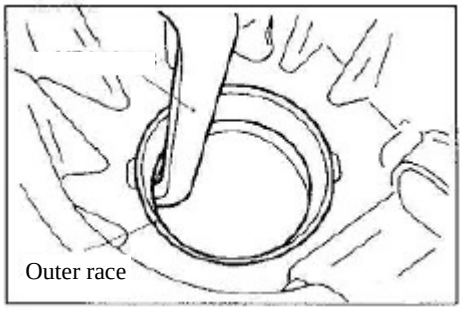
6) Installation of lock pin

Section Ⅷ Clutch Box

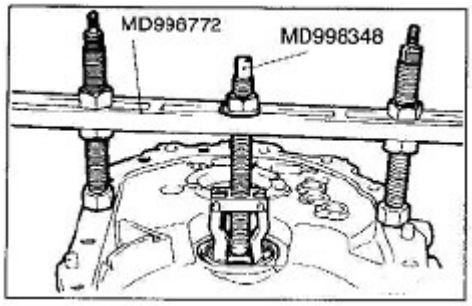


1. Clutch box
2. Oil seal-input shaft
3. Bearing-gear shifting mechanism
4. Output shaft front bearing
5. Oil seal-differential
6. Front/rear bearing of differential
7. Buttonhead-seat release fork
8. Release bearing race
9. Bolt **GB5787 M6×12**
10. Speedometer banking cover
11. Pin **GB119 A10×20**
12. Magnetic assembly
13. Bush-gear shifting mechanism

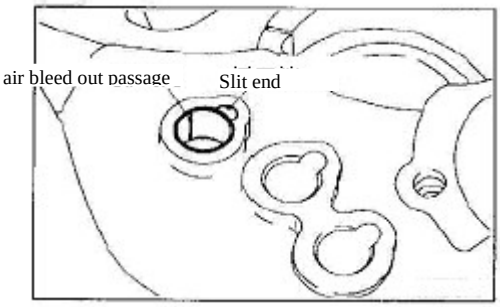
1. Assembly



1) Disassembly of the outer race of front/rear bearing of differential

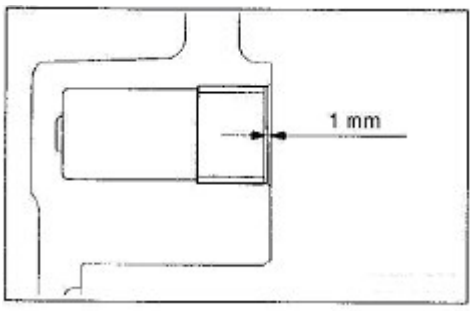


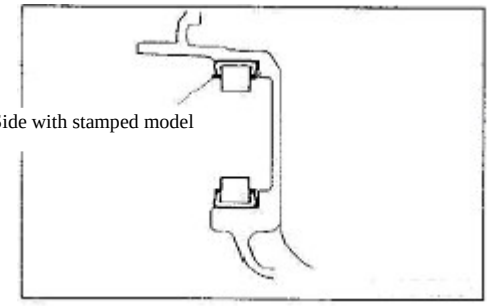
2. Assembly



1) Installation of bush

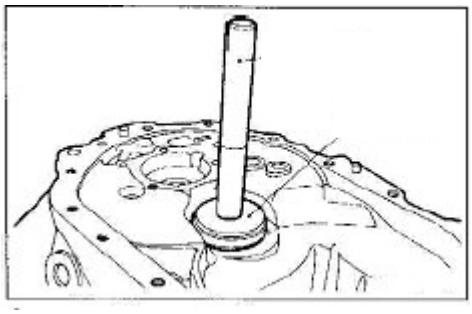
Press the bush into its own position, shown in the left figure, to ensure the air bleed out passage doesn't conform to the slit end.

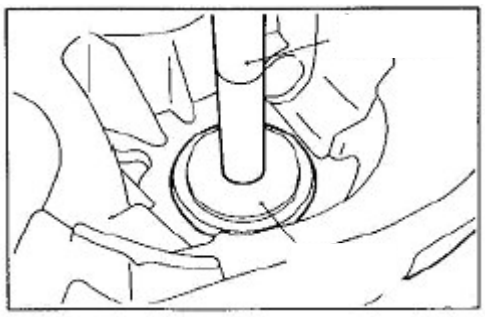




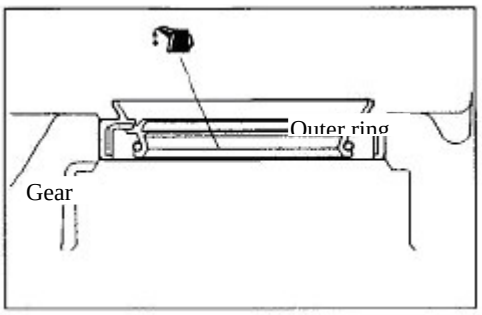
2) Installation of the outer race-output shaft bearing

Install the outer race to place the side surface with stamped model on the position shown in the left figure.





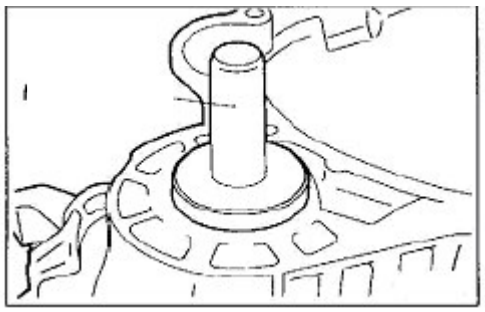
1) Installation of the race-differential bearing

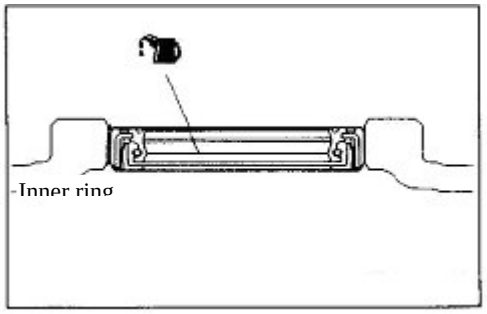


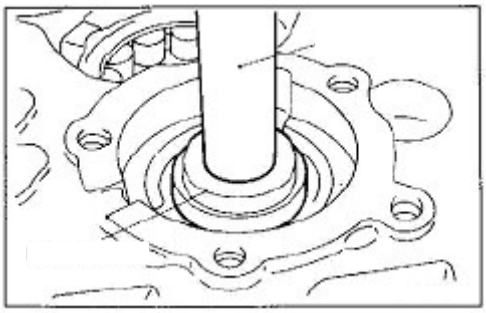
2) Installation of the oil seal-differential

Apply the transmission oil on the oil seal lip.

The specified oil: 75W-90





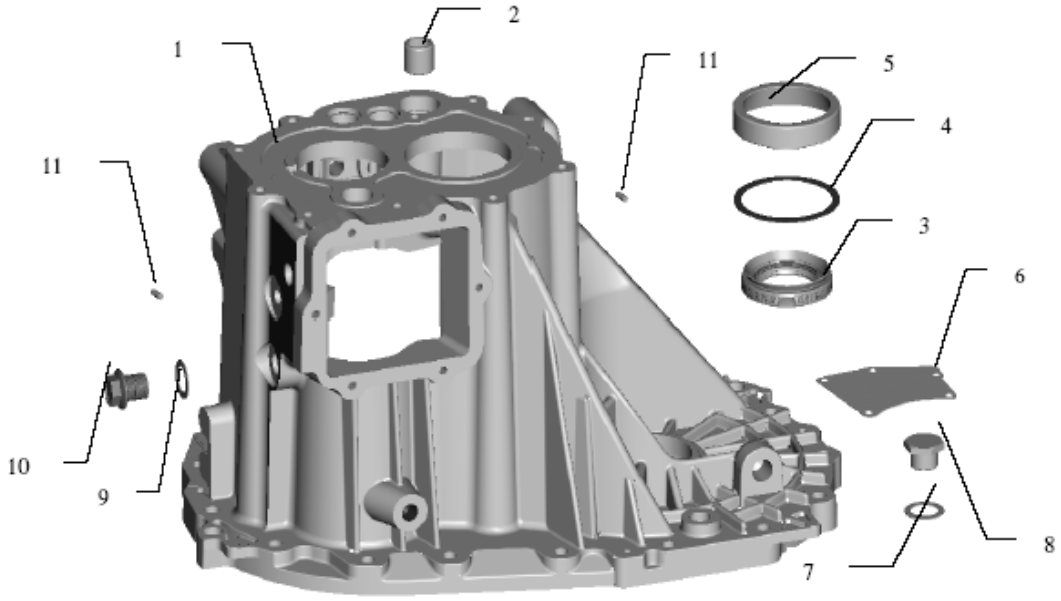


3) Installation of the oil seal-input shaft

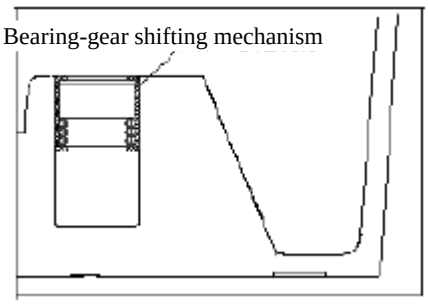
Apply the lubricating grease on the oil seal lip.

The specified lubricating grease
Mobilux Ep2 or equivalents

Section Ⅸ Transmission Housing Assembly

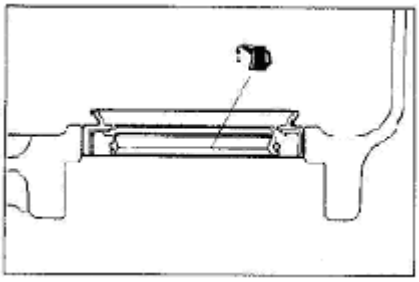


1. Transmission housing
2. Bearing-gear shifting mechanism
3. Oil seal-differential
4. Adjustment gasket-differential rear bearing
5. Outer race of front/rear bearing of differential
6. Oil baffle
7. Plain washer-oil draining screw plug
8. Oil draining screw plug
9. Plain washer-oil limiting screw plug
10. Oil limiting screw plug
11. Pin **GB119**



1) Installation of bearing-gear shifting mechanism

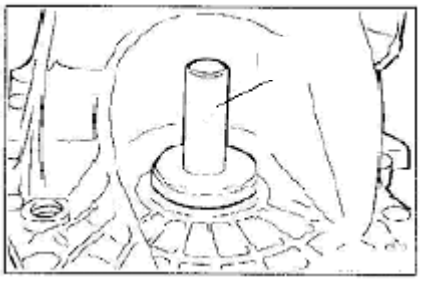
Press in the bearing till to flush with the surface of housing.



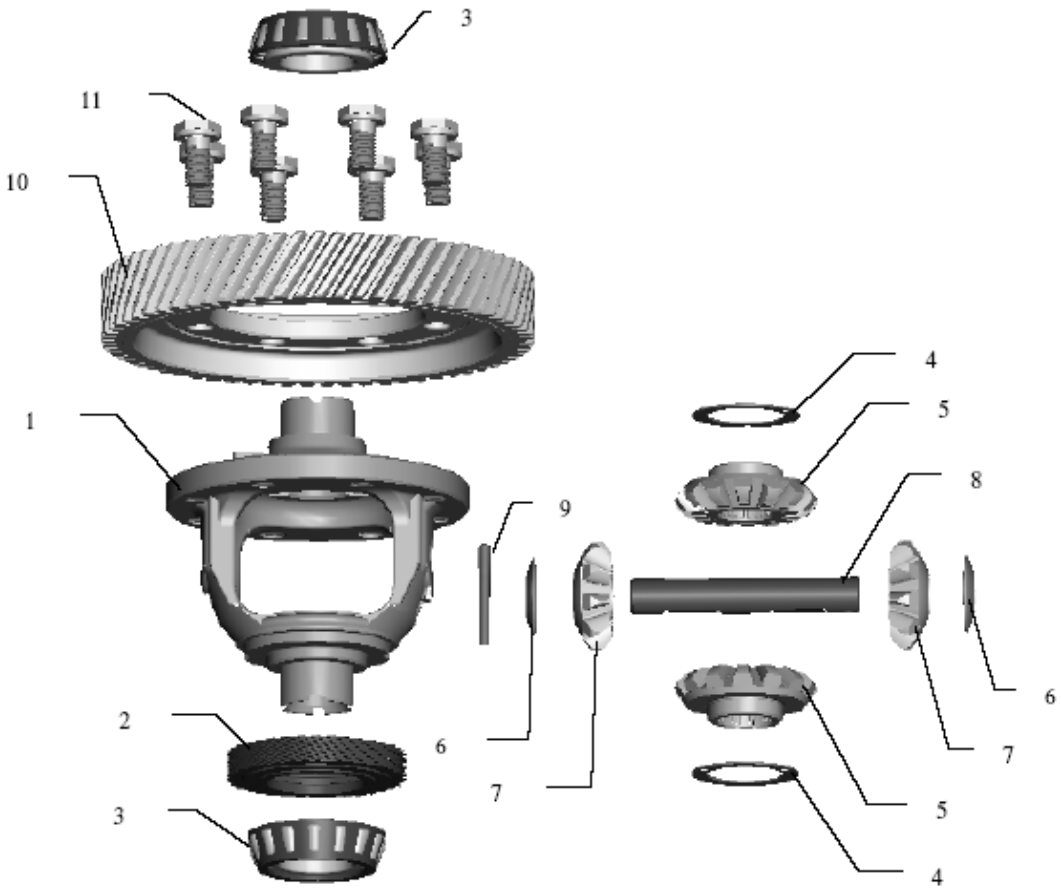
2) Installation of the oil seal-differential

Examine that the oil seal has no damage, apply the lubricating grease on the external diameter and inner lip mouth of the oil seal, and then use the special tool to install the seal into the specified position.

The lubricating grease: Mobilux Ep2

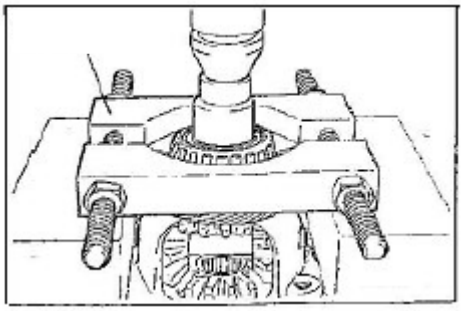


Section Ⅹ Differential Assembly



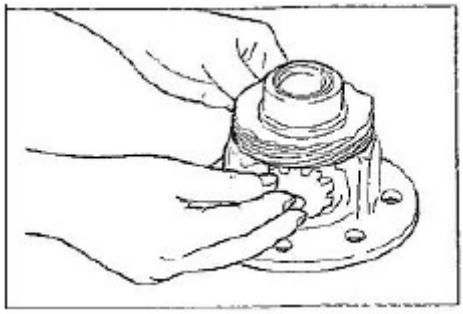
1. Differential housing
2. The driving gear-speedometer
3. Front/rear bearing of differential
4. Adjustment gasket-axle shaft gear
5. Axle shaft gear
6. Spherical washer-planetary gear
7. Planetary gear
8. Planetary gear shaft
9. Anchor pin-planetary gear shaft
10. The driven gear of main reducing gear
11. Bolt-the driven gear of main reducing gear and the differential housing

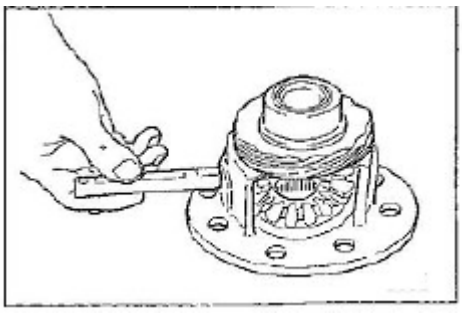
1. Disassembly

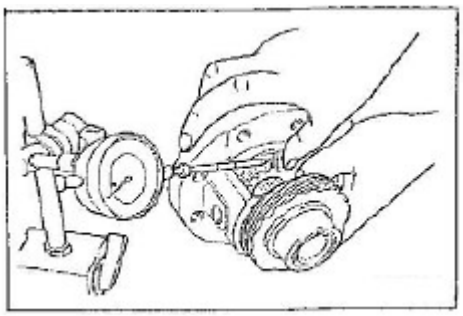


Disassembly of the differential-front/rear shaft bearing

2. Assembly







1) Installation of adjustment gasket-axle shaft gear/axle shaft gear/spherical washer-planetary gear/planetary gear/planetary gear shaft

   (1) Assemble the spherical washer on the back of axle shaft gear, and then install the axle shaft gear on the differential.

   Remarks: The adjustment gasket with intermediate thickness (0.93 to 1.00 mm) shall be assembled when a new axle shaft gear is installed.

   (2) Place the spherical washer on the back of any planetary gear to make two planetary gears engage simultaneously with the axle shaft gear. Turn these gears, and, at the same time, install them on their proper positions.

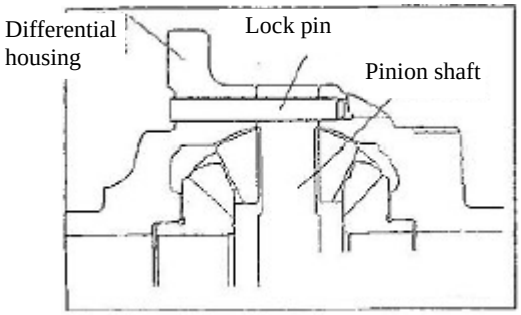
   (3) Insert and install the planetary gear shaft.

   (4) Measure the gear clearance between the axle shaft gear and the planetary gear.

   The standard value: 0.08 to 0.15 mm

   (5) If the measured gear clearance doesn't conform to the standard value, select and install the adjustment gasket, and then measure the gear clearance again.

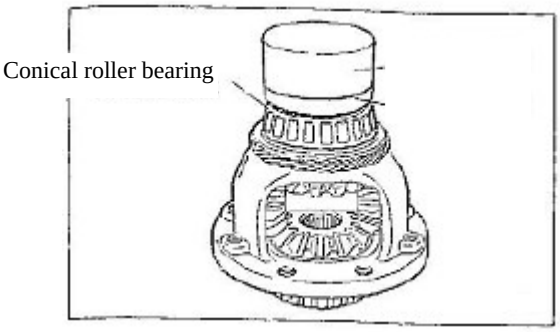
   Remarks: Adjust the gear clearance till that the gear clearances of both sides is the same as each other.



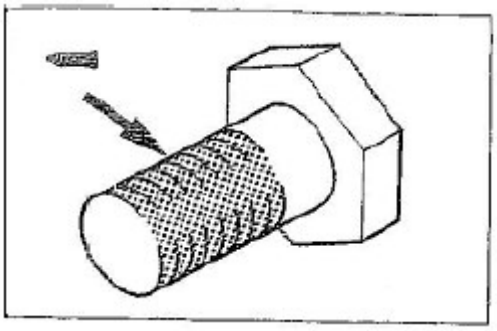
1) Installation of the lock pin

Install the lock pin on the position shown in the left figure.

CAUTION: After the lock pin is taped in, the axle shaft gear and the planetary gear shall operate normally.

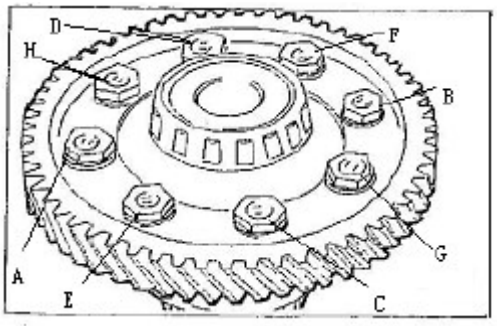


2) Installation of the front/rear bearing of differential



3) Installation of the driven gear of main reducing gear

(1) Apply the sealant on the full screw threads of a bolt.



(2) Screw up the bolt in the sequence, shown in the left figure, to the specified torque (132N.M).

Chapter Ⅲ

Chassis System

Section Ⅰ Brake System

Ⅰ Technical Parameters of Brake System

1. Front Brake

1) Specification

Application	Specification
Piston diameter of brake caliper	57mm
Brake disc diameter	265mm
Min. thickness of brake disc	23mm
Brake disc thickness (new)	25mm
Maximum jump	0.1mm
Thickness of front brake lining	17.8mm
Thickness of rear brake pad	14mm

2) Fastener Tightening Specification

Brake caliper guide bolt	31～38Nm
Brake caliper locating bolt	120～128Nm
Bleeding screw	9～11Nm
Dust board bolt	6.5～8.5Nm
Locating bolt (brake disc)	6～12Nm

2. Rear Brake

1) **Fastener Tightening Specification**

Locating stay bolt of brake caliper	60～66N.m
Locating stove bolt of brake caliper	60～66N.m
Brake caliper guide bolt	80～110N.m
Bleeding screw	9～11N.m
Retaining nut of bearing	73～83N.m
Fastening bolt of hand brake fasteners	6～12N.m

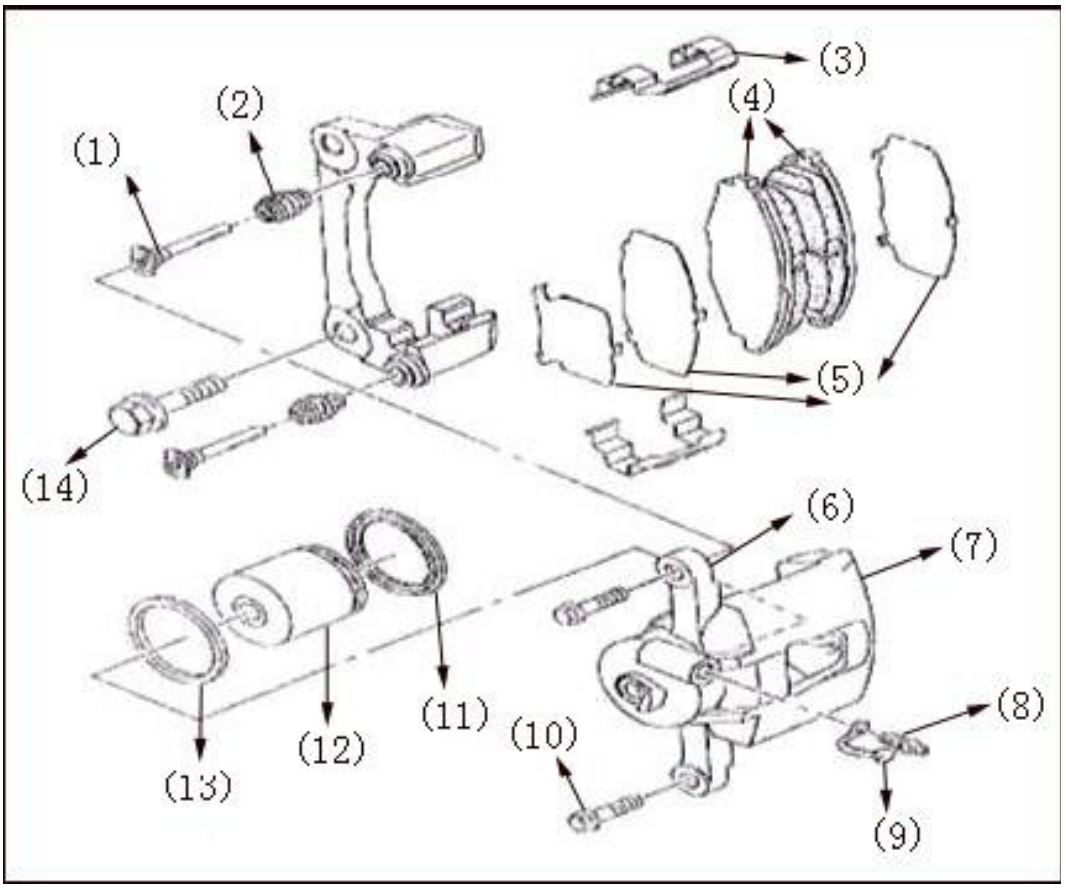
2) Specification

Nominal brake disc diameter	303mm
Brake disc thickness	9mm
Min. thickness of brake disc	7mm
Thickness of brake pad	15mm
Min. thickness of brake pad	7mm
Thickness of brake lining	2.5mm
Min. thickness of brake lining	1.5mm

Ⅱ Front Brake

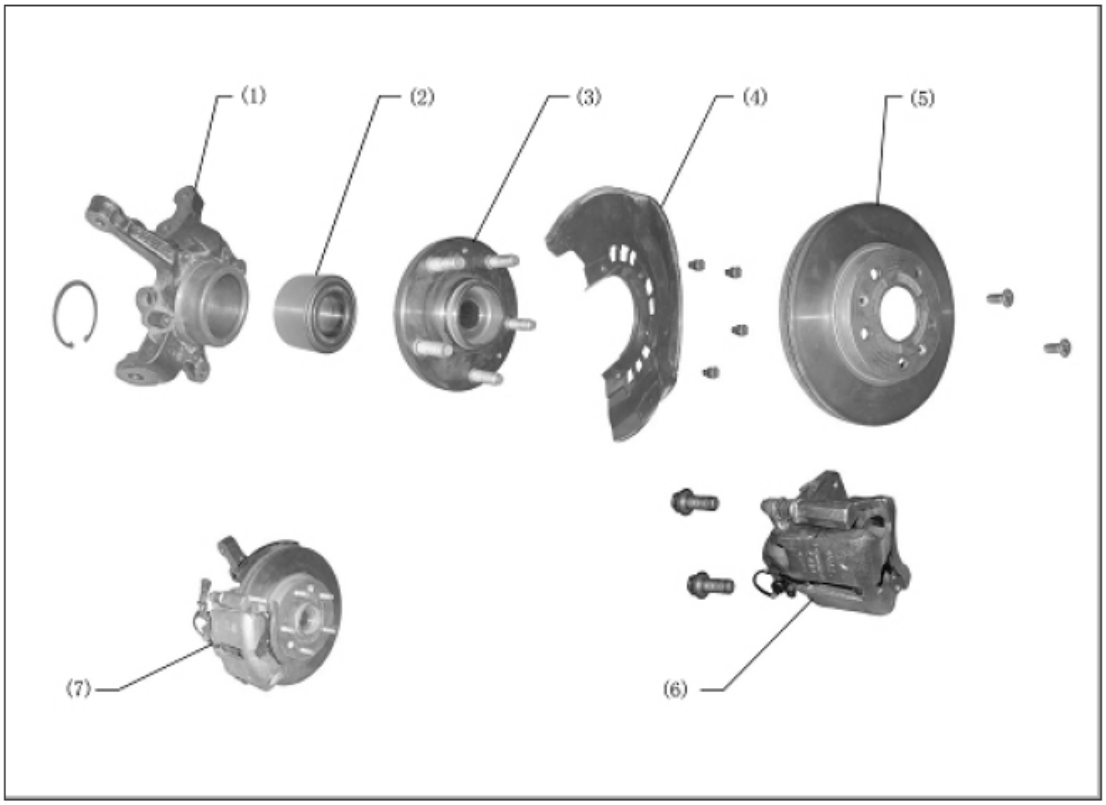
1. Structural Drawing of Adjusting Caliper

The brake caliper assembly consists of brake caliper body, brake caliper bracket, bleeding screw, dust cover, piston, piston dust cap, piston seal ring, rack shim, locating guide rod, brake lining assembly, lining damper, dust cap and bracket, etc.



(1) Locating guide rod
(2) Dust cap
(3) Rack gasket
(4) Brake lining assembly
(5) Lining damper
(6) Brake caliper bracket
(7) Brake caliper body
(8) Bleeding screw
(9) Dust cover
(10) Connecting bolt of brake caliper body
(11) Piston dust cap
(12) Piston
(13) Piston seal
(14) Fixing bolt of brake caliper bracket

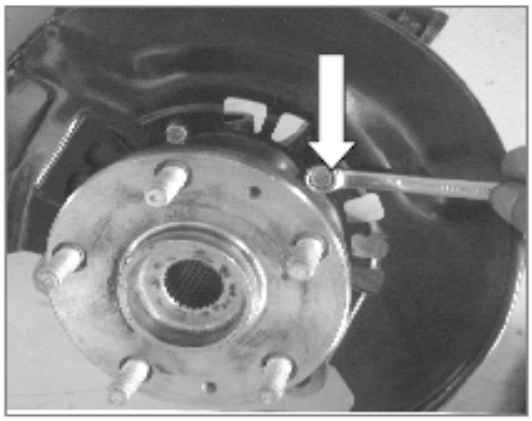
2. **Assembly Drawing of Front Brake**



(1) Front wheel knuckle
(2) Knuckle hub Bearing
(3) Front wheel hub assembly
(4) Dust board
(5) Front brake disc
(6) Brake caliper assembly
(7) Disc brake assembly of front knuckle

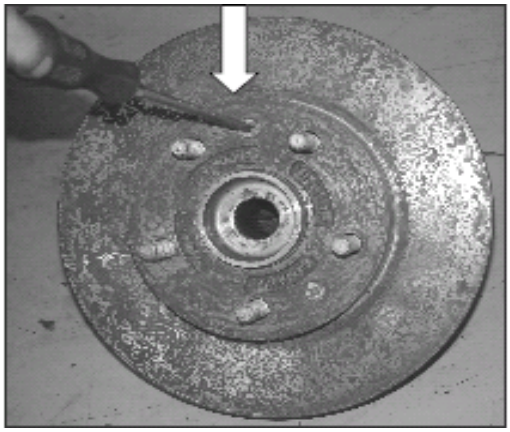
3. Installation of Disc Brake Assembly of Front Knuckle

1) Put knuckle into clamp, and fix dust board onto knuckle, then use bolt to tighten it. The tightening torque shall be 9~11N.m.



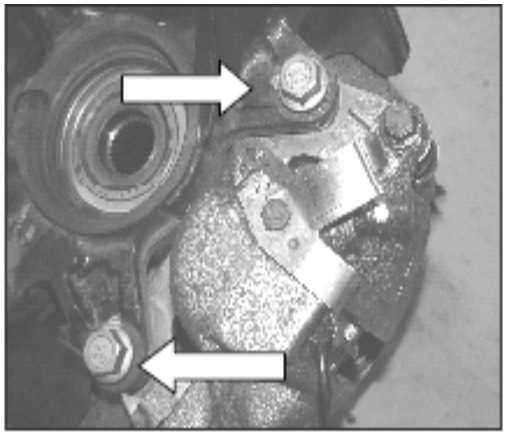
2) Press the front wheel hub-bearing unit into the knuckle.

3) Bolt brake disc onto front wheel hub bearing unit. And the tightening torque shall be 7~9N.m.



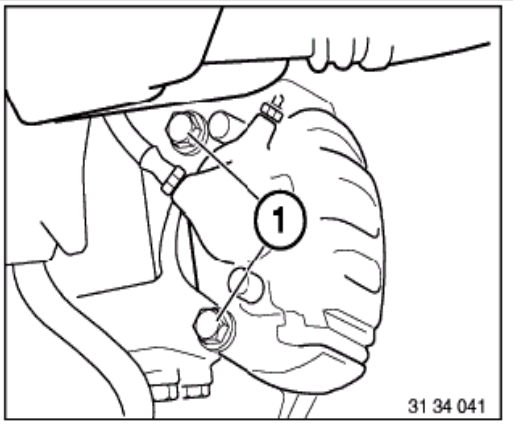
4) Joint brake caliper assembly and knuckle via two bolts. The brake disc shall be located between brake linings. And the tightening torque shall be 85±5N.m.

Note: grease shall not exist on the brake disc and brake lining.



4. Installation or Replacement of Front Brake Discs

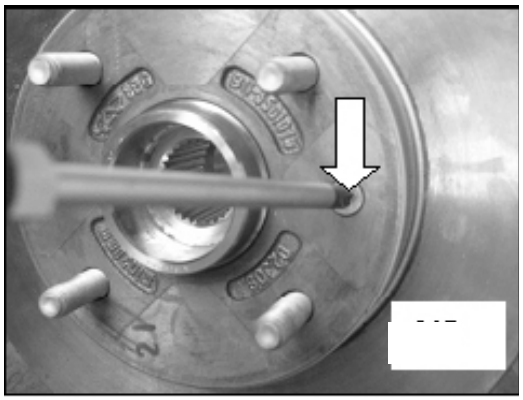
1) Remove wheels



Remove and clean the brake linings if necessary.

Note: if less than the minimum thickness of brake disc, it is necessary to replace the brake disc. Always replace the brake discs (of the same axle) in pairs! If brake disc is replaced, brake linings must be re-fixed as well.

2) Loosen the fixing bolt of brake caliper assembly, then remove the brake caliper and tie it on one side.



Hint: Keep connection between brake lines.

3) Loosen the locating screw and remove brake disc.

Caution: under no circumstances could it use hammer or equivalent to knock the worn ring to loosen the brake disc! Use rubber hammer to carefully knock the body of brake disc if necessary.

Installation instructions:

Replace the fixing bolt of brake disc, and thoroughly clean the contact surface of hub, then remove corrosions if necessary. Uneven contact surface may result in deformation of brake disc, and refer to specific technical data for tightening torque. Installation sequence is opposite to that of removal.

5. Diagnostic Information of Brake Discs

1) Inspection of brake disc thickness deviation

Use micrometer to measure the thickness of random four or more points on the brake disc. Measure all of the thickness at the points that have the same distance from brake disc edge. If the thickness deviation of brake disc exceeds 0.013 mm, when braking, it may result in brake pedal pulsation or front end vibration. Replace the brake disc that cannot meet the above requirements.

2) Inspection of transverse jump of brake disc

Remark: Once disconnecting the brake disc from the flange of wheel bearing, rust or impurities on fitting surface between brake disc and flange must be cleaned, otherwise it may increase brake disc transverse jump or brake vibration. Keep the wheel on the vehicle, and inspect its transverse jump so as to obtain more accurate overall jump indications at actual braking conditions. If there is no certain device along with the vehicle to inspect the wheel, remove the wheel while keeping the position of caliper for the purpose of getting more accurate readings.

3) Removal procedures

a. Refer to the general information of vehicle elevating and lifting to properly lift and sustain the vehicle.
b. Mark relative positions of wheel and wheel hub.
c. Remove wheel and tire.
d. Clean the brake disc surface.
e. Re-screw wheel nuts to tighten brake disc.
f. Fix the micrometer assembly onto knuckle to ensure that the distance between exterior margin and the contact point of indication lamp button and brake disc surface is about 13 mm.
g. Adjust micrometer to zero.
h. Turn wheel for one circle and check the readings of micrometer, if the overall indication variation of TIR exceeds 0.080mm, then perform surface finishing or replace brake disc.

Under certain circumstances, excessive transverse jump of brake disc can be solved via calibrating the brake disc position of wheel hub by means of staggering one or two bolts distance. After calibrating the brake disc, if transverse jump still occurs, the wheel hub shall be inspected to confirm whether the transverse jump of the hub is excessive or over loose. If transverse jump of the hub exceeds 0.040mm, it must be replaced. If transverse jump meets the requirement, surface finishing or brake disc replacement can be performed if necessary.

4) Tolerance of brake disc.

Under the following circumstances, it shall strictly maintain the surface tolerance of brake during the process of brake disc manufacturing.

- ☐ Flatness
- ☐ Parallelism
- ☐ Transverse jump

Maintain the form tolerance of brake surface and thus prevent brake from abrasion or pulsation. Surface accuracy must be maintained below the specified 60° of radius roughness. New brake disc shall conform to above specifications. And the brake disc that is subject to proper surface finishing shall also conform to the above specifications. Refer to the specification of brake surface finishing to control its surface precision and thus to eliminate the following malfunctions.

- ☐ Pedal excessive rigidity
- ☐ Severe degeneration of braking performance

- ☐ Deflection driving
- ☐ Abnormal performance

Maintain brake surface precision can prolong the service life of lining. Brake disc slight scratch whose depth is less than 1.5mm will not influence braking performance, as normal use can also result in slight scratch.

6. Replacement of Brake Caliper

1) Removal procedures

Caution: prior to achieving stable brake pedal stroke, never move the vehicle to prevent from personal injury!

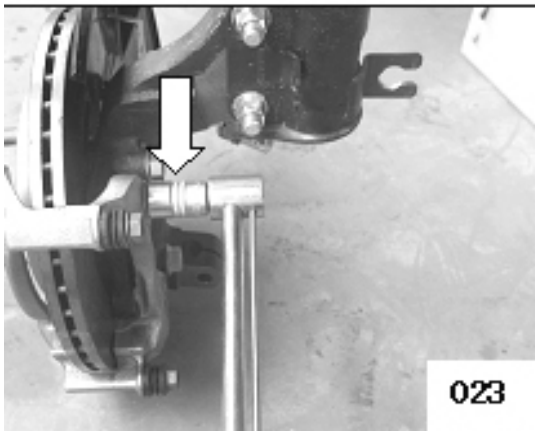
a. Discharge a small amount of brake fluid from master cylinder.

b. Lift and properly sustain the vehicle.

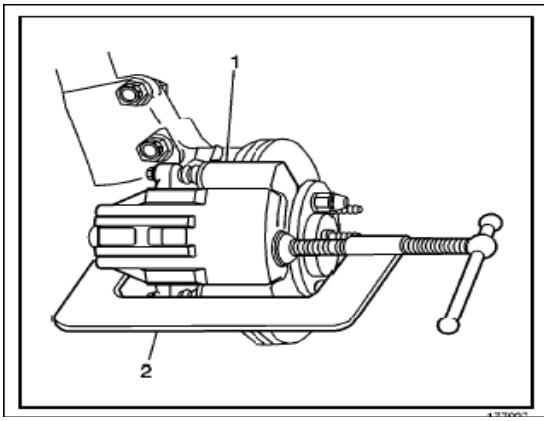
c. Mark the relative locations of wheel and hub.

d. Refer to tire and wheel removal and installation to remove the front tire and wheel assembly.

e. Unscrew the fixing bolt of brake caliper



f. Fix a large C-shape clamp 2 onto the top of brake caliper, and press it to the back of external brake lining.



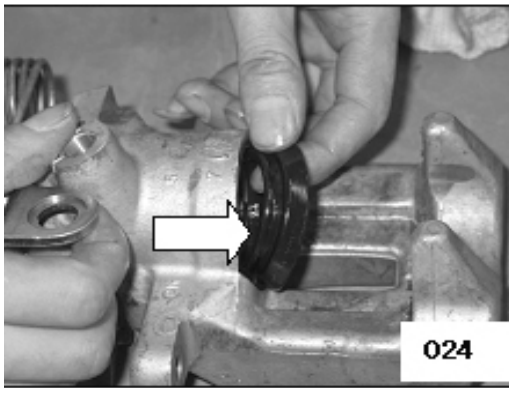
g. Tighten the C-shape clamp till the caliper piston is pushed to an adequate depth in the caliper cylinder sleeve so as to make the brake caliper slide out of the brake disc.

h. Remove the fixed bracket of the lining thickness sensor harness.

i. Refer to the replacement of brake lining.

j. Remove the dust cover of oil cylinder.

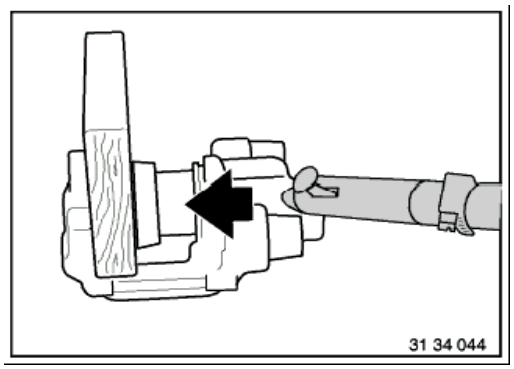
Remove dust cover from oil cylinder by screwdriver.



k. Remove the piston

(a) Use a piece of wood board to stop the piston, put the board between pistons, and then insert the lining from one side.

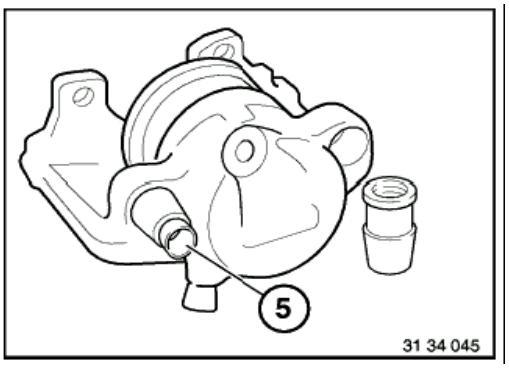
(b) Use compressed air to carefully squeeze out the piston through switch port. Put a shield (for example, hardwood) at the notch of brake caliper to protect the piston. Never hold the piston by finger, as it is too dangerous!



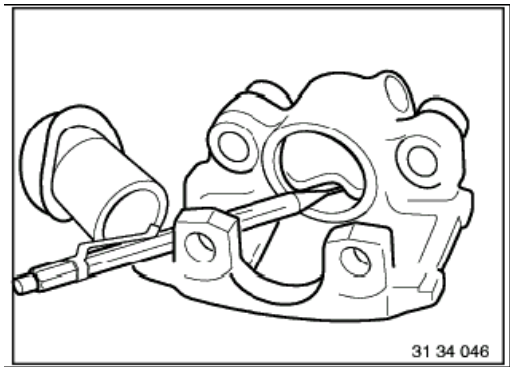
l. Inspect the guide sleeve (5)

When manually push the guide sleeve, it must be smooth. If stagnation or heaviness occurs, please replace the guide sleeve

Note: Grease shall be applied to the guide sleeve when assembling.

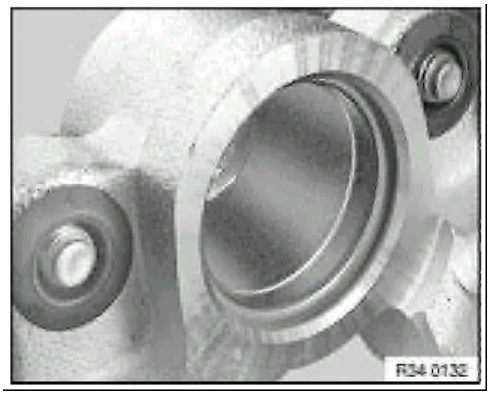


m. Remove the seal ring via plastic pin carefully. Use alcohol to clean the brake cylinder and parts, and apply compressed air to blow it dry. Check through the surface of brake cylinder, piston and flange. Never carry out mechanical machining to brake cylinder and piston.

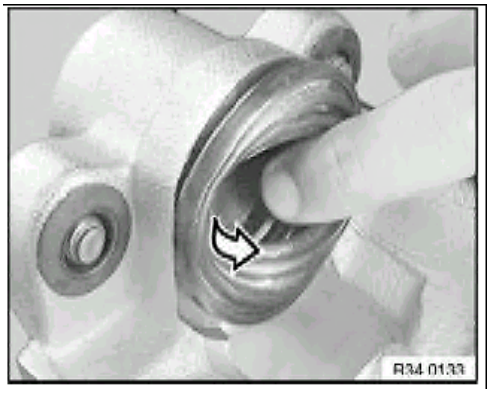


2) Installation

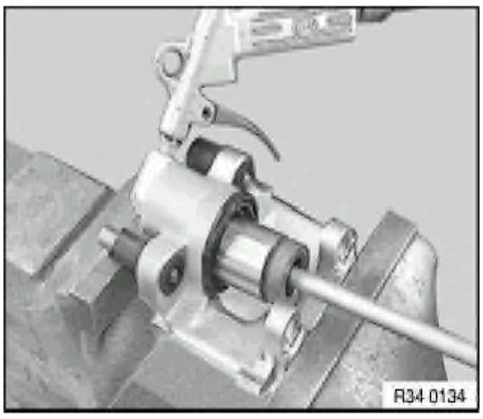
a. Bray brake cylinder grease on the cylinder, stud plug and seal sleeve, and then fix seal ring in the ring slot at the tail of brake cylinder. Finally fix the dust seal ring into the front ring slot and press the overall seal ring into the ring slot.



b. The area between dust seal ring and brake caliper house must be kept dry. Never contact brake cylinder grease or brake fluid to ensure the dust seal ring properly located.



c. Use extended piece sold in the market to fix the brake piston and gently press it onto dust seal ring, and then blow dust ring via compressed air (maximum 3bar). Finally fix the sealing ring over the brake piston.



d. Use brake fluid to soak the dust seal ring and brake piston to enable the seal ring to past through the piston easily.

7. Inspection and Replacement of Brake Lining

For all of the Chery vehicles, genuine brake linings shall be used for replacement to prevent from affecting braking performance.

i Removal

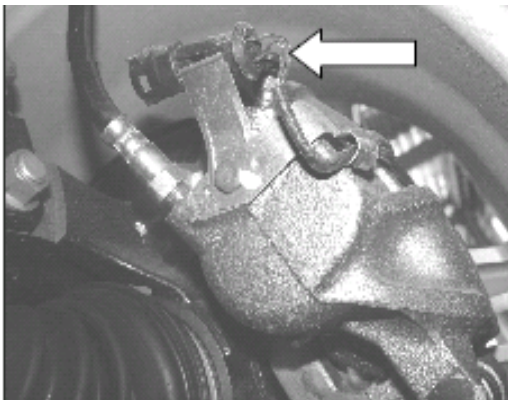
1) Lift and properly sustain the vehicle to remove trim board.

Note: prevent the front surface of the trim board from scraping ground after dismounting the trim board.

2) Unscrew the five fixing bolts of the wheel and then remove the wheel.

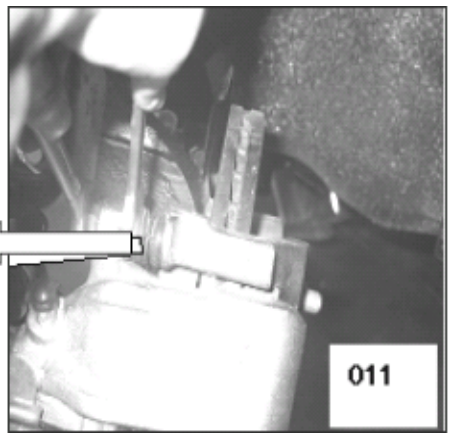
Torque: 120N.m
Note: The tightening torque of tire bolt shall be highlighted.

3) Unscrew the fixing bolt of the harness of the lining wearing indication lamp, and then pull out the plug of lining thickness warning lamp. (Remark: the plug of lining thickness warning lamp is a kind of preset one.)



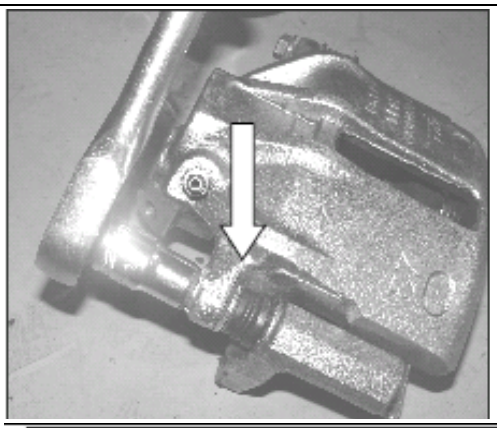
4) Loosen the guide bolt above brake caliper (a), and then loosen the guide bolt below brake caliper. And finally take out the brake caliper. Never connect brake caliper with brake hose to prevent from brake hose damage.

(a)



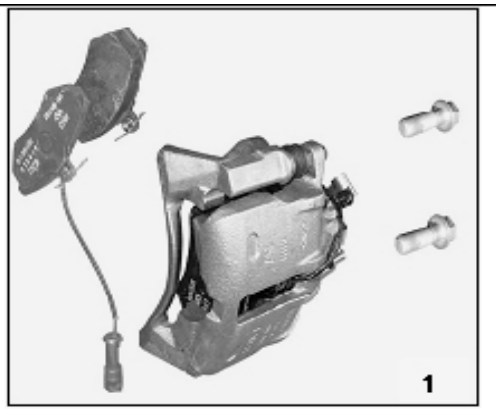
Installation instructions:
Only clean the guide bolt, but never apply grease to the guide bolt.

Inspect screw thread to ensure there is no guide bolt damage. Waggle the brake caliper from below to the up to unscrew it. And then remove the brake lining thickness sensor harness bracket and brake caliper bracket.



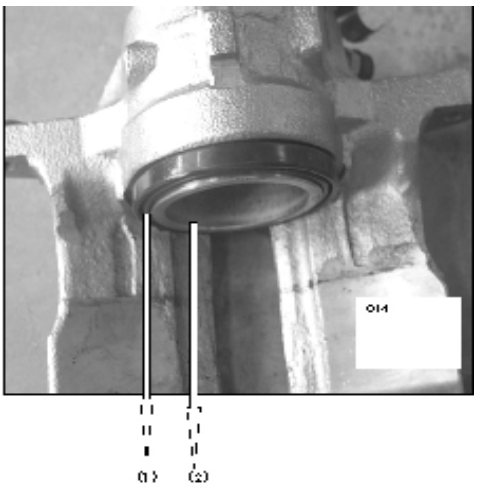
5) Remove the brake lining

Note: mark the linings that have been subject to running in. Never replace brake disc if brake linings have side wear. Employ a new brake lining if the thickness of brake disc is equal or less than minimum thickness. Pay attention to the minimum thickness of brake lining, and then clean the brake lining. Never apply grease to the back plate of brake lining.

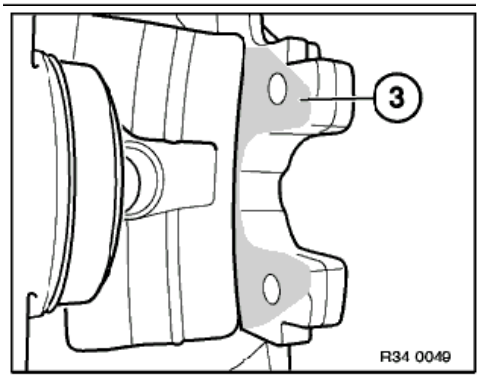


6) Check the damage status of dust seal ring (1) and replace if necessary. Clean the contact surface (2) of the piston, and apply muffle grease.

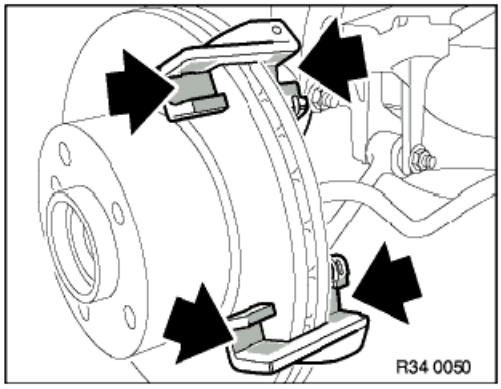
Note: dust seal ring shall not contact muffle grease to prevent from expansion.



7) Clean the contact surface (3) of brake caliper, and coat thin muffle grease on it.



8) Clean the hammerhead-shaped guiding piece of brake caliper bracket, and coat thin grease on it.



ii Installation Procedures

Installation sequence is opposite to that of removal.

Note:

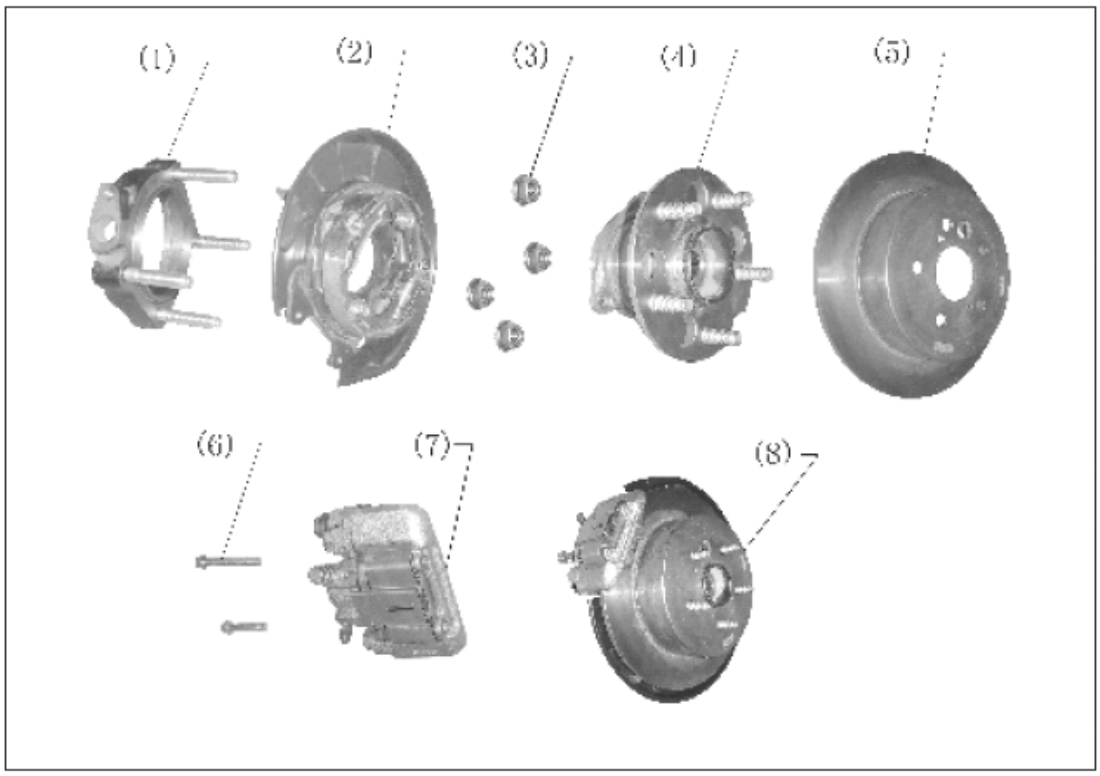
a. New brake surface needs running in after replacing the brake lining.
b. Run in the new brake surface after surface finishing or replacing the brake disc.
c. Apply the brake for 15 times at a speed of 40-60km/ h to run in the new brake lining.
d. Apply the brake pedal by intermediate or above force to prevent from brake overheating.

iii Diagnostic Information of Brake Lining

a. Check brake lining once per 10000 kilometers.
b. Check brake lining once as long as removing wheel or changing the tire.
c. Check the wearing condition of brake lining at both ends of caliper.
d. Inspect the thickness of internal brake lining to ensure no wear occurs to brake lining. And some brake linings have a thermal-protective coating, which is molded along with linings. Avoid wearing between the said thermal-protective coating and the uneven inside/outside linings, and inspect brake linings via caliper sight hole.
e. Brake lining shall be replaced if the thickness of worn brake lining is less than 7mm. And for brake lining that is riveted, it shall be replaced if the worn rivet head is less than 5mm.

Ⅲ Rear Brakes

1. Assembly drawing of rear brakes



(1) Joint plate assembly
(2) Rear brake assembly
(3) Lock nut
(4) Rear wheel hub bearing unit
(5) Rear brake disc
(6) Fixing bolt
(7) Brake caliper assembly
(8) Disc brake with drum brake assembly

2. Removal and Installation of Rear Brake Lining

Hint: after completing the operation, apply the brake for several times to run in brake lining and brake disc to ensure safety! After replacing the brake lining of rear axle, brake fluid level shall be inspected to ensure it is between MIN. and MAX.

1) Dismount trim board

Note: prevent the front surface of the vehicle from friction with ground after removing the trim board in case of scratching it.

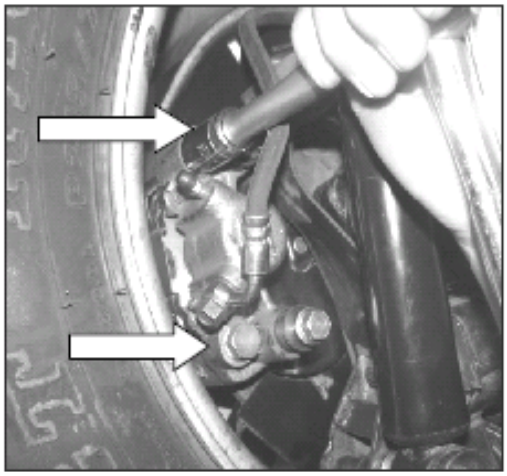
2) Unscrew five fixing bolts of the wheel and remove the wheel.

Torque: 120N.m

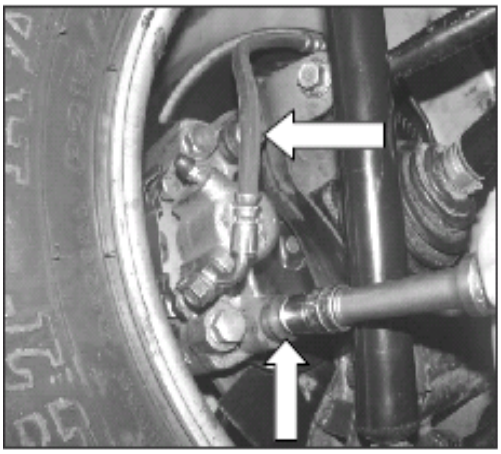
Note: The tightening torque of tire bolt shall be highlighted.

3) Loosen guide bolt and the fixing bolt of brake hose.

Inspect screw thread and replace defective guide bolt. Waggle brake caliper from below to the up and dismount it. And then hang the brake caliper by wire.

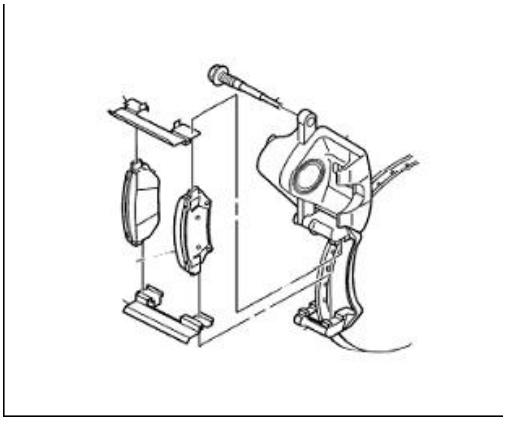


4) Unscrew the fixing bolt of brake caliper and pull out brake caliper outward.



5) Remove the brake lining

Note: mark the linings that have been undergone running in. Never replace brake disc if brake linings have side wear. Never replace brake lining only if the thickness of brake disc is equal or less than minimum thickness. Pay attention to the minimum thickness of brake lining, and then clean the brake lining. Never apply grease to the back plate of brake lining.

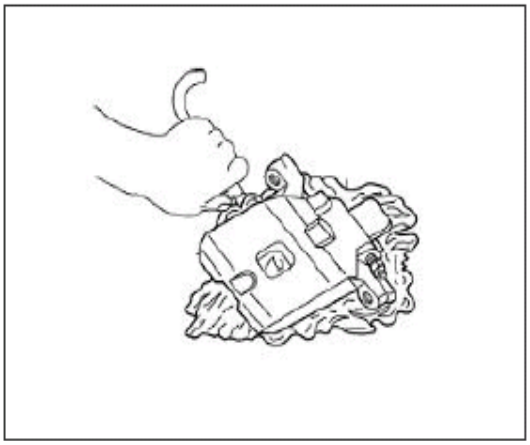


6) Check the damage status of dust seal ring and replace it if necessary. Clean the contact surface of the brake piston, and apply thin muffle grease on it.

Note: dust seal ring shall not contact muffle grease to prevent from expansion. To prevent from severe vehicle body damage due to piston flying off, never put finger before caliper piston to attempt to seize or protect it when using compressed air.

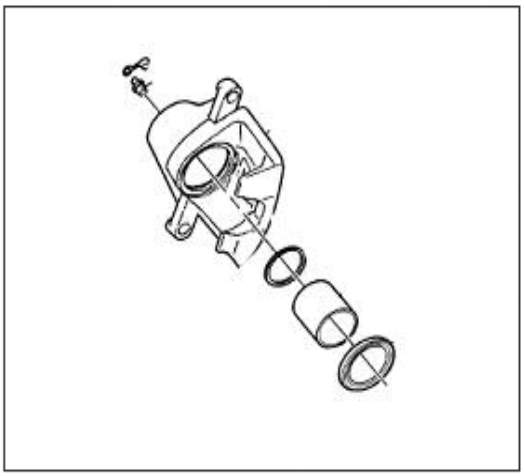
7) Remove piston

Blow compressed air into the caliper inlet, then the piston will be pulled out of piston shield.



8) Inspect the piston to see whether there are scratch, crack, erosion, plating wear or damage, etc. And replace it if necessary.

Hint: The installation procedure of lining is opposite to that of removal!



3. Replacement of Rear Brake Disc

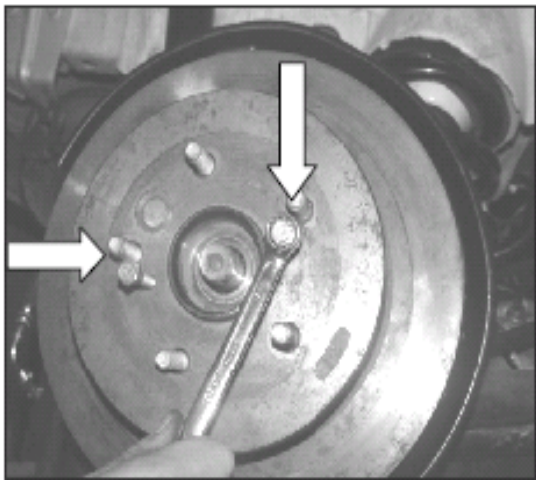
ⅰ Removal

1) Remove the tire.

2) Loosen the fixing bolt of brake caliper assembly, then remove the brake caliper and tie it to one side.

Hint: keep brake lines connectted.

3) Use two bolts to tighten it to the brake disc through two preset holes, and then remove the brake disc.



Caution: never knock the friction ring via a hammer or equivalences when removing the brake disc.

ⅱ Installation

Replace the fixing bolts of brake disc. And thoroughly clean the contact surface of wheel hub, and then eliminate the erosions if necessary. Uneven contact surface will result in brake disc deformation!

Caution: Never perform surface finishing for brake disc for the purpose of solving the following troubles.

- ☐ Brake noises, for example, roar or squeal
- ☐ Undue wear of brake lining
- ☐ Brake disc surface erosion
- ☐ Brake disc fading

Only under the circumstances of one or a combination of the following items can the brake disc is subject to surface finishing:

- ☐ Grave scratches on brake disc surface and the depth exceeding specification.
- ☐ Brake jump due to the following conditions:
  - Transverse jump exceeds limit.
  - The thickness deviation of brake disc exceeds specification.
  - Erosion or pitting penetration exceeds brake disc surface.

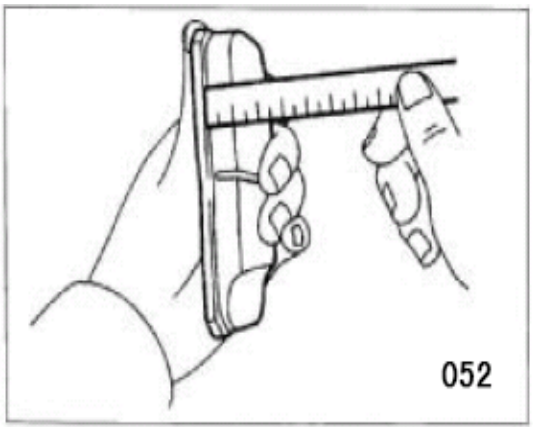
Remark: Please refer to the overhaul of front brake disc to inspect the brake disc.

4. Rear Brake Parts

1) Inspection and maintenance

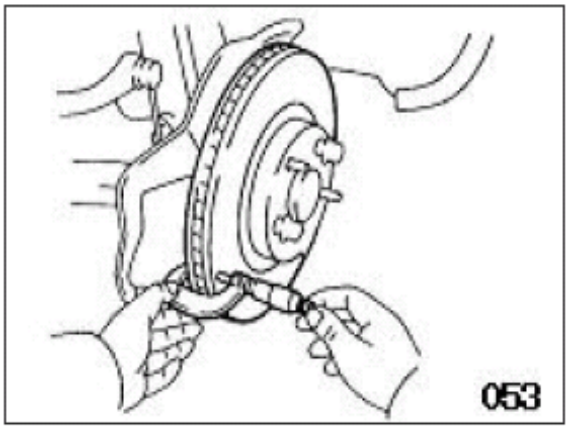
a. Measure the thickness of brake lining pad.

Measure the thickness of brake lining pad via ruler. If the thickness of lining pad is less than or equal to minimum value, or the wear is severely non-uniform, the lining pad shall be replaced.



b. Measure the thickness of brake disc.

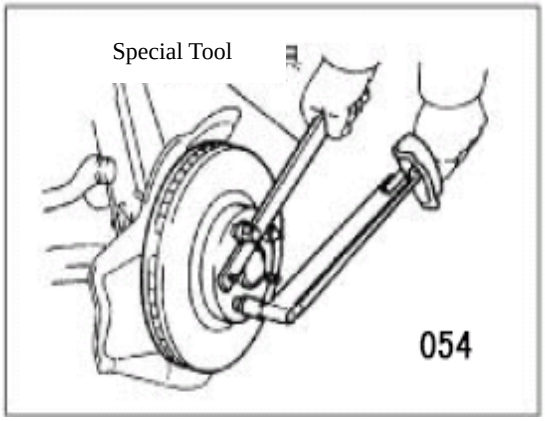
If the brake disc thickness is equal or less than minimum thickness value, please replace the brake disc. If there is scratch or irregular wear on the brake disc, the brake disc shall be grinded and finished via machine tools or even replaced.



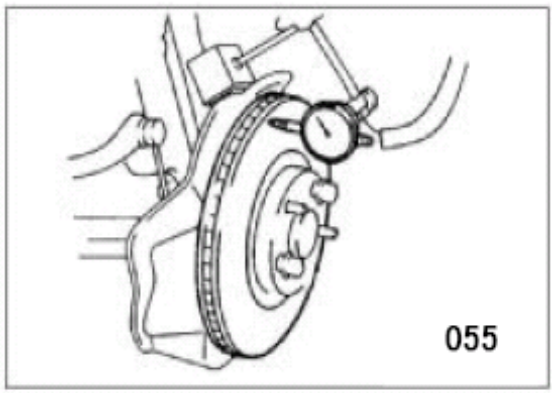
c. Measure the run-out of brake disc.

(a) Tighten the brake disc via two hub nuts.

Hint: special tools shall be used to clamp the brake disc when measuring the run-out value.
Torque: 120N.m



(b) Measure the run-out value of brake disc via micrometer at the location where is 10mm away from disc exterior margin. If the run-out value of brake disc is equal or more than the maximum value, inspect the axial clearance of bearing and the run-out of vehicle axle wheel hub. If bearing free play and the run-out of vehicle axle and hub are in good condition, adjust the run-out value of brake disc.



Ⅳ Installation of Parking Brakes

1. Replacement of Parking Brake Shoes

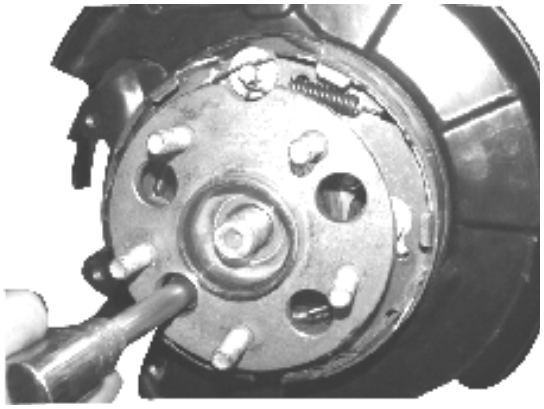
1) Removal

a. Remove the tire.

b. Remove brake caliper, and refer to the section of "Disc brake" to replace the bracket of brake caliper.

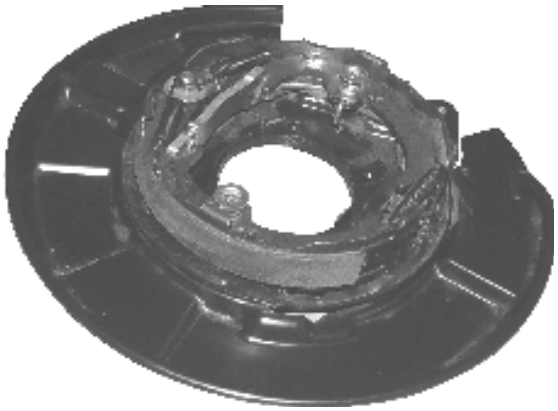
c. Refer to the replacement of brake disc to remove rear brake disc.

d. Remove the rear wheel hub units.

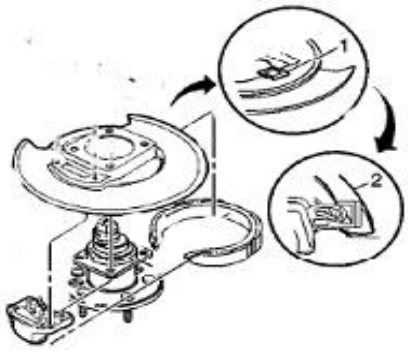


Remark: properly align the four holes in the brake hub units to the corresponding fixing bolts of brake elements.

e. Remove the actuator of parking brake.



f. Remove the brake shoes.



2) Installation

a. Fix the brake shoes and linings.

Note: Ensure brake shoes and parking brake is well engaged.

b. Install the actuator of parking brake

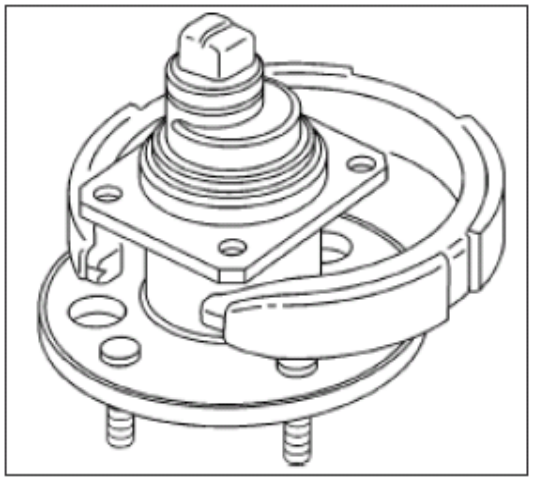
c. Refer to the replacement of wheel bearing/hub of rear suspension to install rear wheel hub.

d. Adjust the rear parking brake shoes.

e. Refer to the replacement of brake disc to install rear brake disc.

f. Refer to the replacement of brake caliper bracket in disc brake to install rear caliper bracket.

g. Adjust the parking brake.



2. Adjustment of Parking Brake Shoes

Necessary adjusting tools

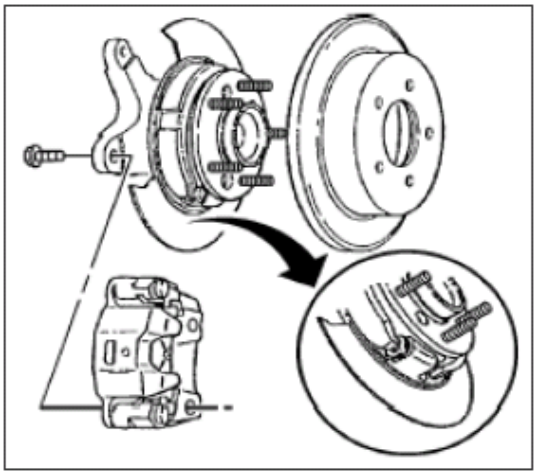
J21177-A gap gauge for brake drum and brake shoes

a. Refer to the replacement of brake caliper bracket in disc brake to remove caliper bracket.

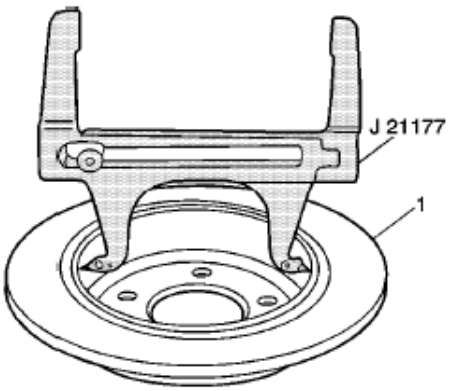
b. Remove the brake disc.

When pulling out the brake disc from wheel hub, please slowly turn the brake disc.

c. Loosen the adjusting nut on the cable of parking brake to keep the bar at a stop position.

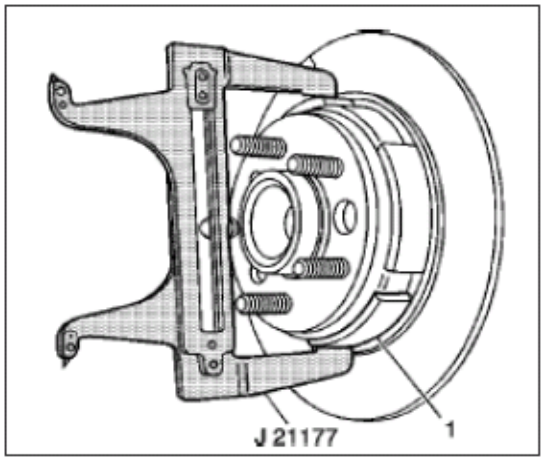


d. Adjust J21177-A to contact the inside diameter of brake disc.



e. Put J21177-A at the widest area of the clearance between brake shoe and lining.

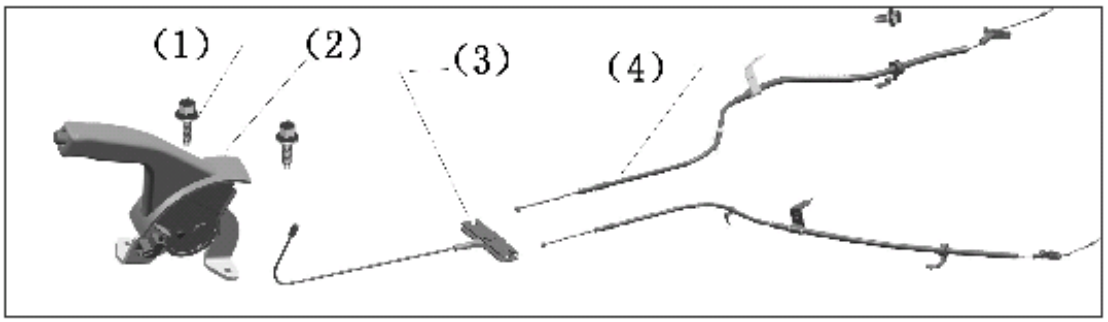
f. Turn the adjusting nut till the brake shoe and lining 1 barely contact J21177- A.



g. With respect to the brake disc of the opposite side, please repeat the above-mentioned procedure 2 to 5.

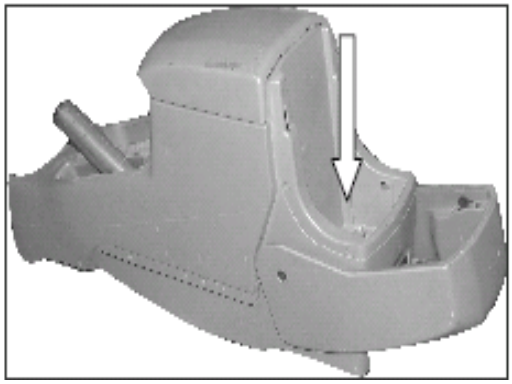
h. Adjust the adjusting nut on the cable of rear parking brake, and then install brake disc and brake caliper.

3. Replacement of Parking Brake Cable

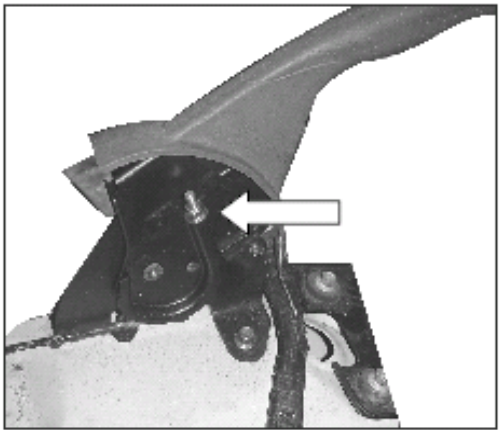


(1) Fixing bolt of hand brake maneuver mechanism
(2) Hand brake maneuver mechanism assembly
(3) Hand brake front cable assembly
(4) Hand brake cable assembly

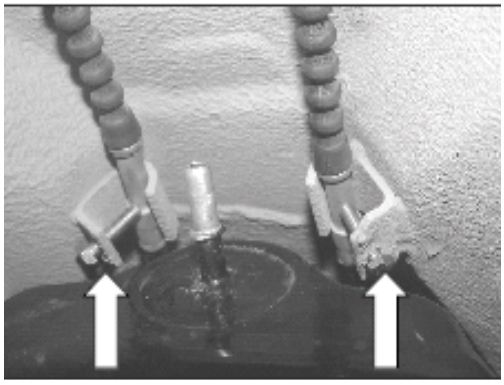
a. Remove the handrail case.



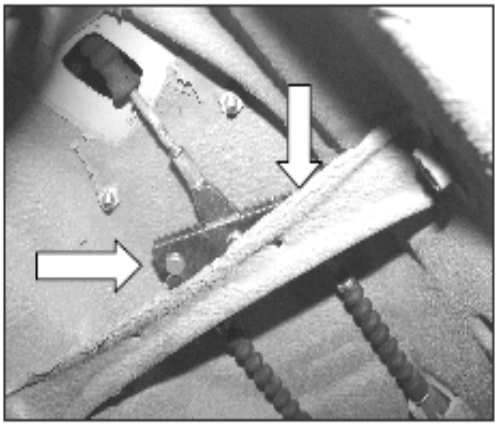
b. Loosen the adjusting bolt of hand brake.



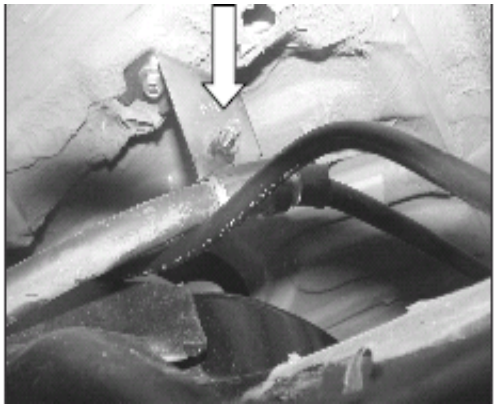
c. Loosen the fixing bolts of right and left cable.

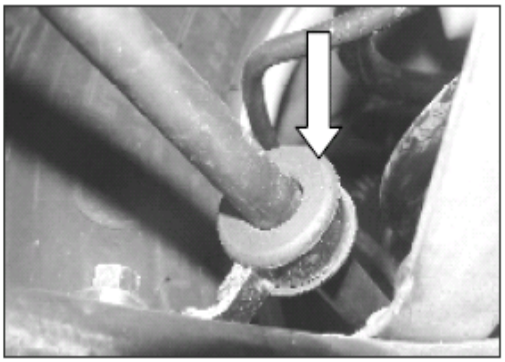


d. Loosen the hand brake cable.

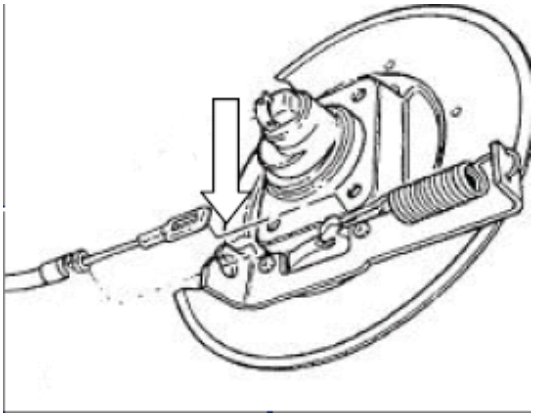


e. Unscrew the fixing bolts of right and left hand brake cable.





f. Remove the hand cable from the actuator of brake.



Hint: the installation procedure is opposite to that of removal!

Remark: the parking brake shall be adjusted after replacing brake shoes or hand brake cable.

- ☐ Loosen the parking brake handle.
- ☐ Forcibly step on brake pedal once.
- ☐ Pull the parking brake handle up by four teeth.
- ☐ Tighten the adjusting nut till the two wheels cannot be turned by hand.
- ☐ After completing the above procedures, loosen the parking brake to inspect the two rear wheels to see whether they can be turned freely. Otherwise the above process of adjustment shall be repeated.

Ⅴ Removal of Brake Master Cylinder

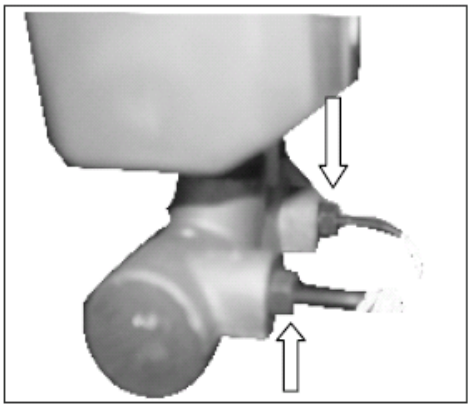
1. Removal of Brake Master Cylinder

a. Disconnect the electric joint of fuel level gauge.

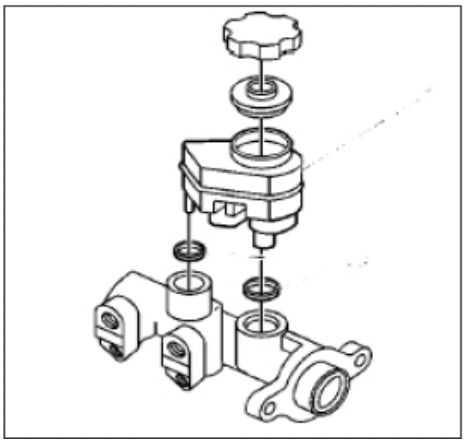
b. Drain the brake oil via suction hose.

Remark: avoid splashing brake oil onto skin or vehicle finish, as it has comparatively strong corrosiveness!

c. Loosen the brake lines of brake master cylinder.

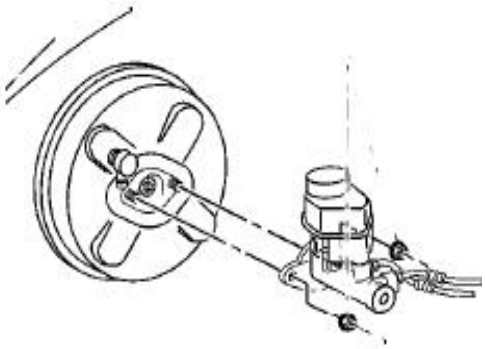


d. Remove the liquid reservoir.



Remark: straightly push the liquid reservoir body upwards so as to dismount is from the master cylinder body. And then remove O-ring from the reservoir flute. Inspect the liquid reservoir to avoid crack or deformation, and replace it if necessary. Then clean the reservoir via denatured alcohol. Finally dry the liquid reservoir by oil free compressed air.

e. Unscrew the retaining nut of brake master cylinder.



2. Disassembly of Brake Master Cylinder

a. Refer to the removal instruction to remove the brake master cylinder.

b. Clean the liquid reservoir cover.

c. Remove the liquid reservoir cover and membrane element.

d. If there exist the following damages, please replace liquid reservoir cover and membrane element 3.
   - ☐ Kerfs
   - ☐ Rupture
   - ☐ Scratch
   - ☐ Deformation

e. Remove the liquid reservoir of master cylinder.

f. When removing the clamp holder, in the mean time, the primary piston shall be pressed downward. Be cautious to avoid damaging the following parts:
   - ☐ Piston
   - ☐ Cylinder sleeve
   - ☐ Groove of clamp holder

g. When other external tapping is jammed, please feed low-pressure and non-lubricated compressed air into the upper outlet of hole closed-end. When removing the following parts, the above described operation procedures must be performed.
   - ☐ Primary piston
   - ☐ Auxiliary piston
   - ☐ Spring
   - ☐ Spring retainer

h. Remove the seal and spring retainer from the secondary piston.

i. Inspect the master cylinder to avoid scratch or erosion, if damage occurs, please replace the master cylinder. And never employ abrasive in the holes.

j. Clean all of parts in uncontaminated denatured alcohol.

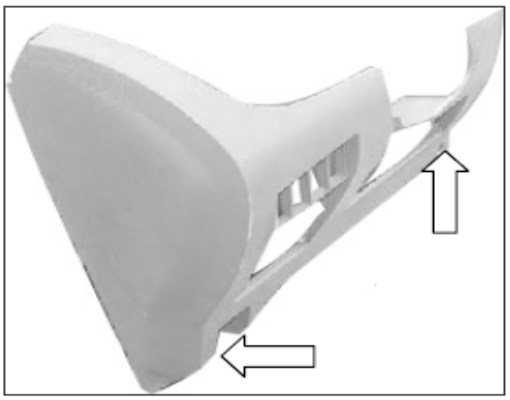
k. Dry the parts by oil free compressed air.

Remark: the installation procedure is opposite to that of removal!

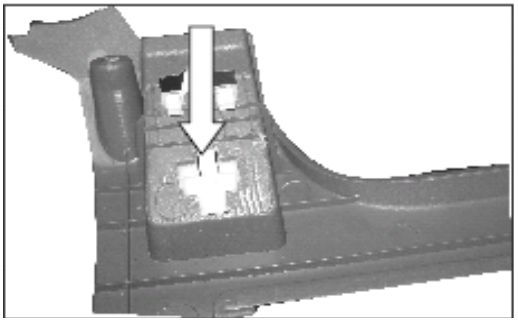
Ⅵ Brake Booster and Brake Pedal

1. Removal of Brake Pedal and Vacuum Booster.

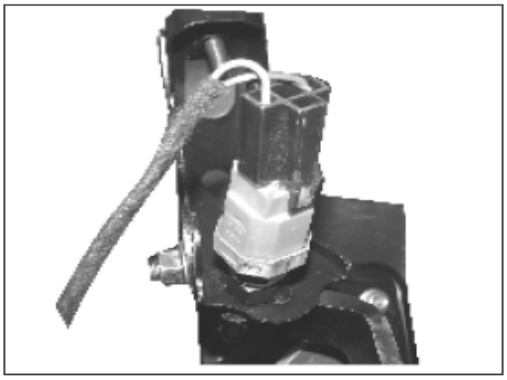
1) Unscrew the two fixing bolts of the plate that is left and downward to the instrument panel.



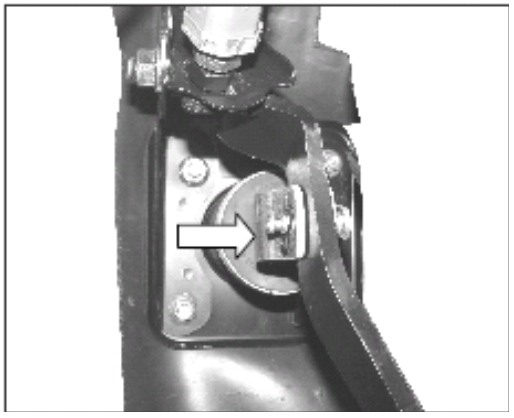
2) Forcibly press and remove the handle assembly of front engine cover then disconnect four switch plugs and finally remove the instrument shield.



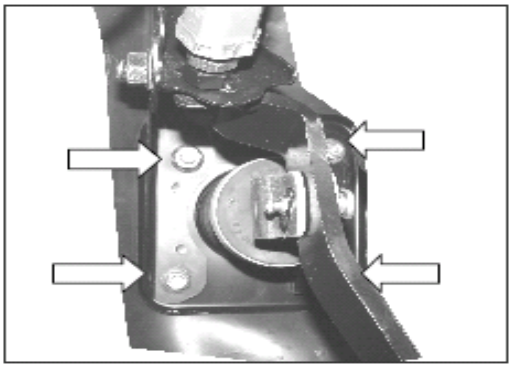
3) Disconnect the plug of brake lamp switch and then remove it.



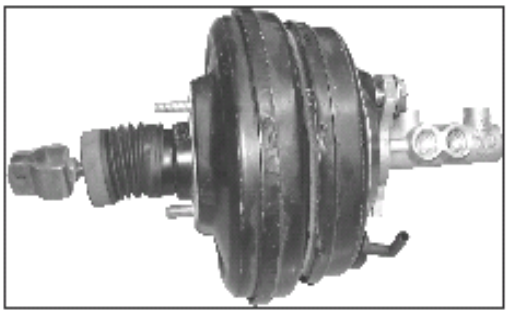
4) Loosen the connecting pin of vacuum booster pump and brake pedal and then remove the pin.



5) Unscrew the four fixing bolts of brake pedal bracket.
6) Remove the bracket of brake pedal.



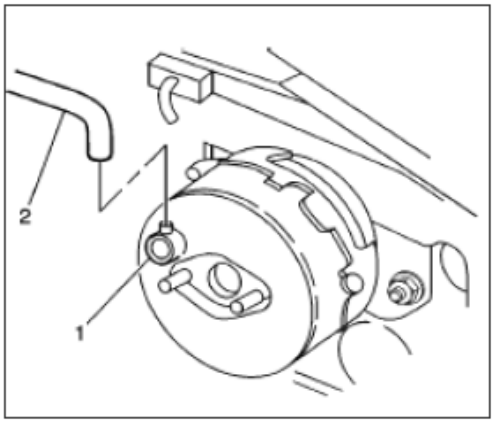
7) Remove the vacuum tube, and refer to the section of removal of booster master cylinder to remove the vacuum booster.



Remark: the interior parts of booster cannot be repaired and the housing shall not be split. Because splitting the housing may result in permanent deformation and improper boosting capacity.

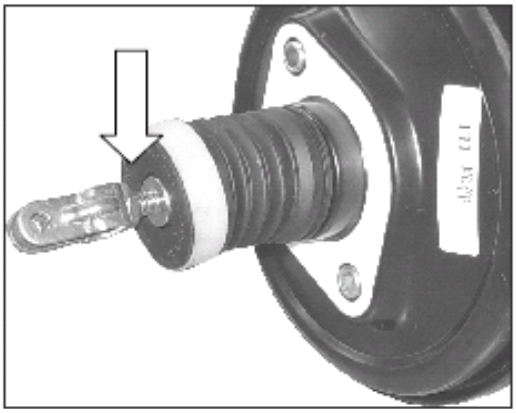
8) Replacement of cone-way valve of vacuum booster.

Note: the vacuum cone-way valve and seal ring can be inspected without demounting the booster from vehicle.



a. Disconnect the vacuum hose of brake booster via vacuum cone-way valve.
b. Disconnect the vacuum cone-way valve of brake booster from the booster.
c. Remove the vacuum cone-way valve seal ring from the brake booster.

9) Loosen the adjusting bolt and adjust the brake pedal to specified height.

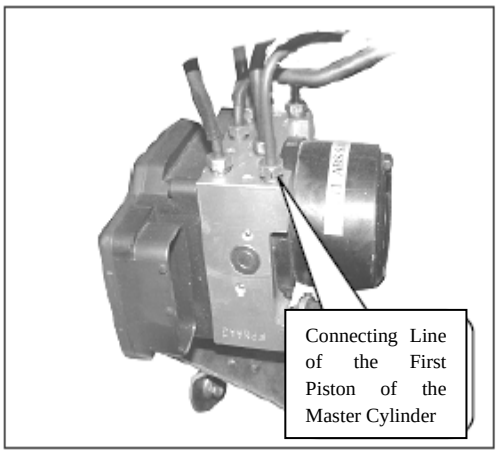


Remark: after finishing the above procedures, the installation procedure of vacuum booster and brake pedal is opposite to their removal and mounting procedures.

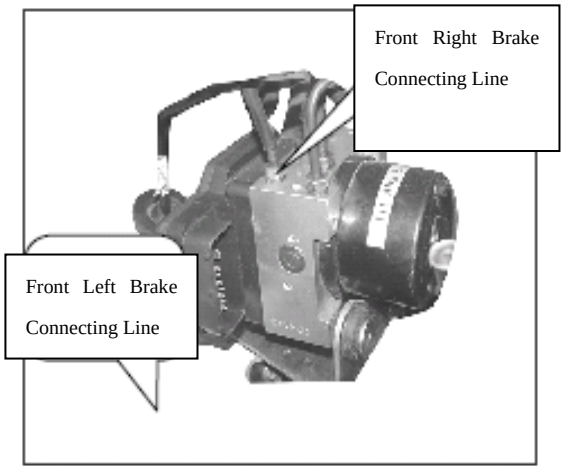
Ⅶ Installation and Removal of Brake Line

Note: double-wall steel brake line shall be employed when replacing the brake line to avoid brake system malfunction. Properly layout and replace the brake line, and then fix the new brake line to the original location. Inadequate layout or fixing may damage the brake line, and it may result in poor braking effect or malfunction.

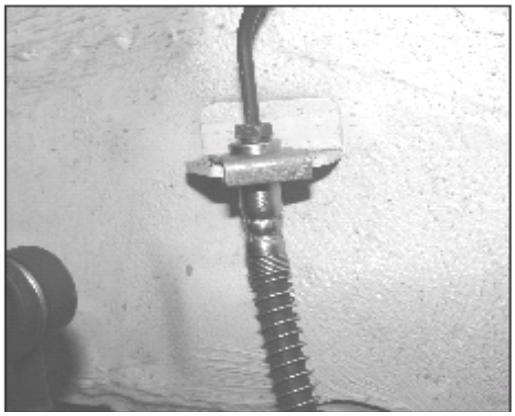
1) Removal of brake's master cylinder and ABS controller assembly lines.



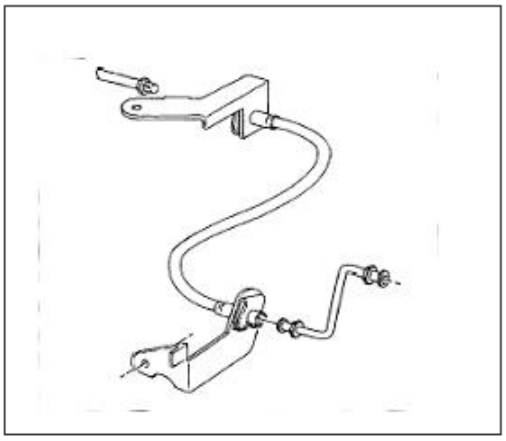
2) Removal of brake line.
   a. Loosen the connecting bolt of ABS hydraulic unit.



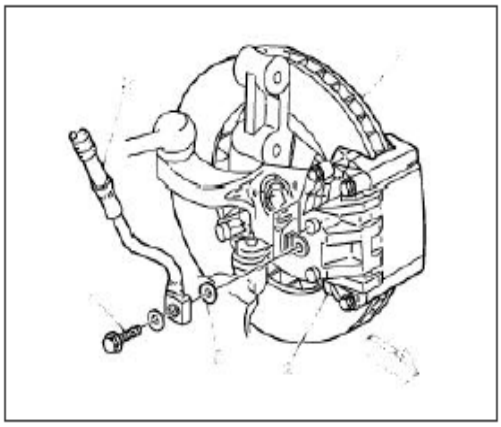
   b. Remove the fixing clip of vehicle body and the fixing bolts of brake line.



3) Removal of brake hose
   a. Lift the vehicle to remove the tires.
   b. Employ sustaining spanner to clamp the hose coupling, and then remove the brake line from the brake hose bracket. Please never bend or break the brake pipeline or bracket.
   c. Remove the clip of clamp holder on the hose assembly bracket.
   d. Remove the hose from the bracket.



4) Remove the following parts from caliper: brake hose bolt, hose, and two washers (Remark: They shall be replaced when installing).



Caution: prior to achieving reliable brake pedal travel, never move the vehicle. And air in the brake line may result in poor braking effect or brake malfunction.

Remark: never suspends parts onto brake flexible hose, because this may damage the hose. Never bend or break any section of the brake hose to avoid brake fluid leakage from any parts.

Remark: brake lines shall not disturb vehicle body.

Tightening torque of brake joint bolts shall be as below:

M12×1: 16~20N.m

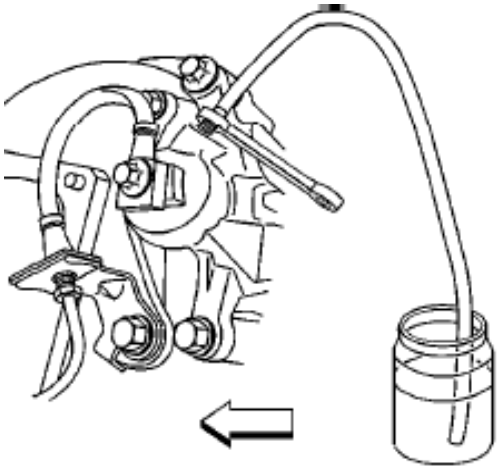
M11×1.5: 13~17N.m

M10×1: 10~14N.m

Ⅷ Filling and Bleeding of Brake Fluid

Hint: if air enters brake system when repairing or replacing brake parts, a complete exhaust procedure shall be performed. Prior to performing brake bleeding, front and rear exhaust cylinder pistons must return to the highest position; and the preferred method is to employ malfunction analyzer to perform the returning procedure. If the malfunction analyzer is not available, adopt the second procedure. However, it must be operated strictly in accordance with the above-described procedures. If air comes into the brake line due to the liquid level is too low, or the master cylinder brake lines are disconnected, all of the four braking hydraulic systems must be bled. If brake hose or brake is disconnected at some wheel, only bleeding the caliper of that wheel. If any joint of brake line or hose between master cylinder and brake is disconnected, only bleeding the disconnected line or the brake system that is related to the hose.

1) Bleeding of brake system
   a. Lift and properly sustain the vehicle.
   b. Fix the transparent plastic bleeding hose onto the bleeding valve of brake caliper.
   c. Immerge the other end of transparent plastic bleeding hose into a clean vessel containing part of clean brake.
   d. Slowly open the bleeding valve to allow the brake fluid flow.
   e. Shut off the bleeding valve when bubble does not appear in brake fluid any more.
   f. Remove the transparent plastic bleeding hose from bleeding valve.



Remark: the above procedures are applicable to the bleeding of brake line.

2. The bleeding sequence of brake system shall be: back, right, left, front, right back and left front. If ABS system is available, link the malfunction analyzer and start fluid filling and air bleeding procedure till completely bleeding the air in the ABS system.

3. Perform air bleeding to the brake loop.

Joint the bleeding hose that has vessels to the bleed and bleeding valve of rear-left brake caliper. Open the bleeding valve, then push the brake pedal to the bottom for quite a few times. The discharged brake fluid must be clean and free of bubbles. Then keep the brake pedal to the bottom and cut off the bleed and bleeding valve. Finally release the brake, and the similar operation can also be performed to the brakes of other wheels.

4. Brake fluid filling

To ensure the reliability of brake during cruise, please do not forget to inspect the level of brake fluid at intervals or after bleeding the brake system. And refill brake fluid in time if necessary.

Note:

1) Brake fluid shall conform to the standard (only apply DOT4) stipulated by Ministry of Transportation (DOT) of PRC, in addition, brake fluid shall not be blended with other types of brake fluid for application.
2) Brake fluid has very strong hydroscopic property, so its recovery shall be operated inside an original packaging sealed container.
3) Brake fluid has comparatively strong corrosiveness, if it splashes onto skin, please use wet cloth to clean it immediately, and then use soap and water to thoroughly clean the skin. Brake fluid also has strong corrosion against vehicle body paint, therefore, never splash brake fluid onto vehicle finish. If it happens, flush it immediately.
4) Observe the brake fluid level inside the reservoir during the bleeding process, if it is very low, add brake fluid in time.
5) If manually bleeding the air, it shall be repeated for several times till all of the air inside the brake system has been bleed.
6) After completing the liquid filling and bleeding operation, inspect the brake system to avoid leakage. If leakage occurs, please handle it in time to ensure cruise safety.

Section Ⅱ Anti-block Brake System

Ⅰ General Description

The ABS of T11 is supplied by Mando Auto Spare Parts Co., Ltd (South Korea). MGH-20 dry-type product employs four-channel control technology, and by means of collecting the wheel speed data, the ABS electronic control unit can perform independent control to each wheel brake pressure. When ABS warning lamp is on, malfunction diagnosis and maintenance can be done via diagnostic device.

Precautions of maintenance:

1) Prior to performing electric welding, disconnect the harness plug from electronic brake control modular.
2) The parts of antilock brake system are exceptionally sensitive to EMI, so please be cautious to all of the location, installation and positioning of the parts of ABS and pay close attention to wiring, joints, clips and brackets, etc.
3) Never employ quick charger to charge the battery that enables engine start-up, or still connects to the engine, to avoid battery malfunction or damage to the parts of ABS.
4) Shut off ignition switch to turn off the battery.
5) Cut off ignition, and then disconnect the harness plug from electronic brake control modular.
6) Never attempt to repair any parts of ABS, as all of the parts can only be replaced.
7) Never hang the suspension parts on the harness of wheel sped sensor to avoid harness damage.
8) Never put electronic brake control modular at a gear ring environment that is higher than 85 ℃ (184 F).
9) Never use petroleum-based liquid in brake master cylinder, nor employ vessels that ever contain petroleum-based liquid. Because petroleum may make the rubber parts of brake fluid system swollen or deformation, bring water into the system, or lower the boiling point of liquid.

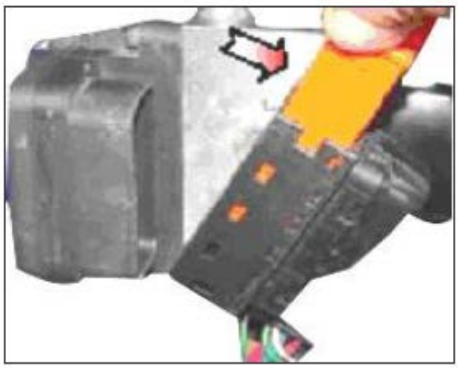
2.1 Precautions of Removal and Installation

1) Find out the malfunction causes using analyzer and then repair it.
2) Only unpack the spare parts prior to installation.
3) Only use genuine parts supplied by the original manufacturer.
4) Be cautious to the cleanliness when performing maintenance, and always employ non-wool cloth to wipe it.
5) Prior to maintenance, employ mineral oil free cleaner to clean the surface.
6) Never employ compressed air or move the vehicle when the system is running.
7) Proper plugs shall be used to clog all of the hydraulic outlets after removing ABS assembly.
8) Remove other parts that may disturb its normal operation.
9) Please employ DOT 4 brake fluid but never use mineral oil.
10) Use brake fluid but not engine oil or brake oil/ grease to soak sealing elements and O-ring.
11) Inspect the conventional brake system and ABS function after finishing maintenance.
12) Inspect all of hydraulic pipe joints to avoid any leakage.

2.2 Removal of MGH-20 Assembly

1) Shut off ignition switch and then disconnect the negative wire of battery.

2) Remove the harness plug from ABS control unit assembly.



3) Push down the pedal by more than 60mm and use pedal bracket to clamp it. In this way to shut the center valve of master cylinder and avoid brake fluid from flowing out of the outlet when starting the system.

4) Remove the brake hard tube on HCU firstly, then mark it and immediately block the outlet by plug.

5) Loosen the bracket bolt of ABS control unit.

2.3 Installation of ABS Assembly

Caution: only when mounting brake hard tube can the hydraulic opening plug of ABS assembly is taken off so as to avoid impurities coming into the brake system.

1. Mount the ABS assembly onto the bracket, and the tightening torque shall be 16~24Nm；
2. Remove the plug in the hydraulic opening and mount the brake hard tube, and then confirm that the hard tube connection is correct.
3. Mount the brake hard tube that leads to master cylinder, and the tightening torque of brake hard tube shall be 8~16Nm and 12~18Nm respectively.
4. Fill new brake fluid into liquid reservoir till the level reaches MAX, and then bleeding in accordance with specified method.
5. When turning the ignition switch to ON, the ABS warning lamp will be on for 3.7 seconds as well, and then it will be off.

2.4 The Bleeding and Oil Filling after Replacing HECU

1. Employ HECU (wet type) that is used for after-sales service as substitution, and then turn the ignition switch to the position ON, finally use analyzer to check if malfunction code exists.
   - If there exist malfunction codes, firstly eliminate the malfunction code via analyzer.
   - If it fails to eliminate the malfunction code, refer to "Malfunction Maintenance" for inspection.
2. Step on the brake pedal, and unscrew the venting bolts of brake caliper or drum brake of all of the wheels for air bleeding.
   - The oil storage tank of master cylinder shall connect to a device, which can continuously supply brake fluid so as to ensure the oil storage tank is always full.
   - The operation shall not be stopped until there is no air in the brake fluid, which comes through the venting bolt. In addition, the brake pedal shall be adequately stiff (the same as the bleeding /oil filling operation of the brake system without ABS).
3. Measure the pedal stroke, if it does not conform to specification, repeat the operation as described in item (2).
   - Repeat the two operations above for over 10 times, if the brake pedal stroke does not conform to specification, rerun it after replacing and mount the HECU (wet type) that is used for after sales service.
   - If the brake pedal stroke conforms to the specification, terminate the bleeding / oil filling operation.
4. Precautions of bleeding / oil filling:

   Run the ABS and if found brake pedal soft, then use analyzer to perform bleeding mode operation. If there is no counterforce when applying the brake pedal, repeat the action of applying/releasing the pedal till terminate bleeding mode.
   - Bleeding mode: repeatedly start-up/stop the control unit of HECU with 2-second intervals, and close solenoid valve for 1 minute, then keep the drive motor running.
   - After the bleeding mode operation, the operation of item 2 and 3 must be performed.

Ⅱ Diagnosis and Maintenance of ABS

2.1 Summary of Operating Principle of ABS

Wheel speed sensor collects the signals of wheel speed, and then transmits to the electronic control unit, which works out each wheel speed, and finally calculates vehicle deceleration as well as the slip rate of wheel. According to the calculated parameters, the ABS electronic control unit regulates the brake pressure in the braking process via hydraulic control unit so as to achieve wheel lockup. When ABS is out of service, electronic braking force distribution system still can regulate the braking force of rear wheel to guarantee that the rear wheel will not be locked before front wheel, thus to ensure wheel safety. Once the ignition switch is turned on, ABS will proceed self-checking. If malfunction occurs, electronic control unit will automatically deactivate ABS function and turn on ABS warning lamp. In this case, brake system will run as without ABS.

2.2 Regulating Process of ABS

The regulating process of wheel brake pressure is as below:

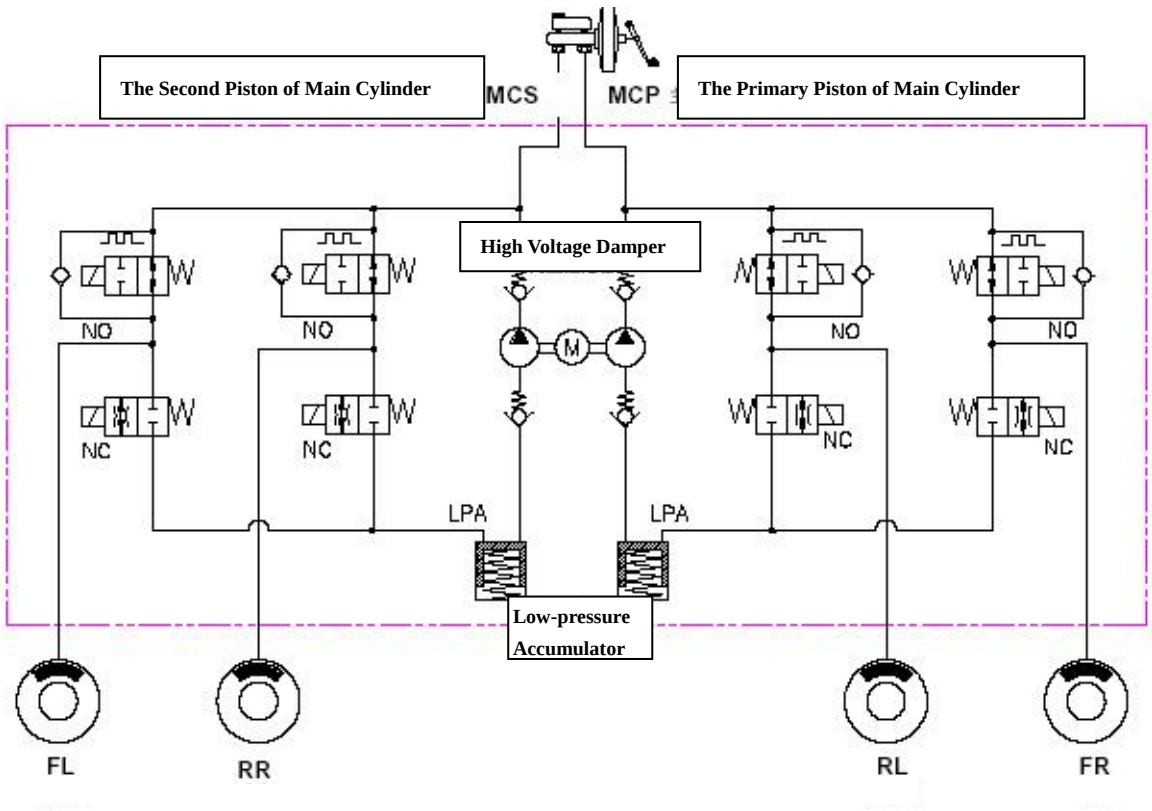
1) Pressurizing phase: when braking, the brake pressure will be generated via vacuum booster and master cylinder. In this case, the normally open valve opens, and the normally closed valve closes, then brake pressure gets into wheel brake, and the wheel speed is quickly reduced till the ABS electronic control unit identifies that wheel tends to lock up via speed sensor.
2) Pressure maintaining phase: when the ABS electronic control unit identifies that wheel tends to lock up via speed sensor signals, the control unit will close the normally open valve immediately. In the mean time, normally closed valve will be still closed.
3) Depressurizing phase: if wheel still tends to lock up at pressure maintaining phase, the ABS will start depressurizing phase. In this case, electronic control unit sends out command to open normally closed valve and close normally open valve. Then hydraulic pump goes into operation, and the brake fluid is returned from wheel cylinder to the brake master cylinder via low pressure accumulator, then the brake pedal shakes due to the reduction of brake pressure, and the wheel lockup level is reduced, finally the wheel speed begins to increases.
4) Boosting phase: in order to achieve optimum braking effect, when wheel speed reaches certain value, ABS electronic control unit again opens the normally open valve and close the normally closed valve. With the increase of brake pressure, the wheel again is subject to braking and deceleration. The pressure regulating frequency of ABS is 2 ~ 4 circles per second.

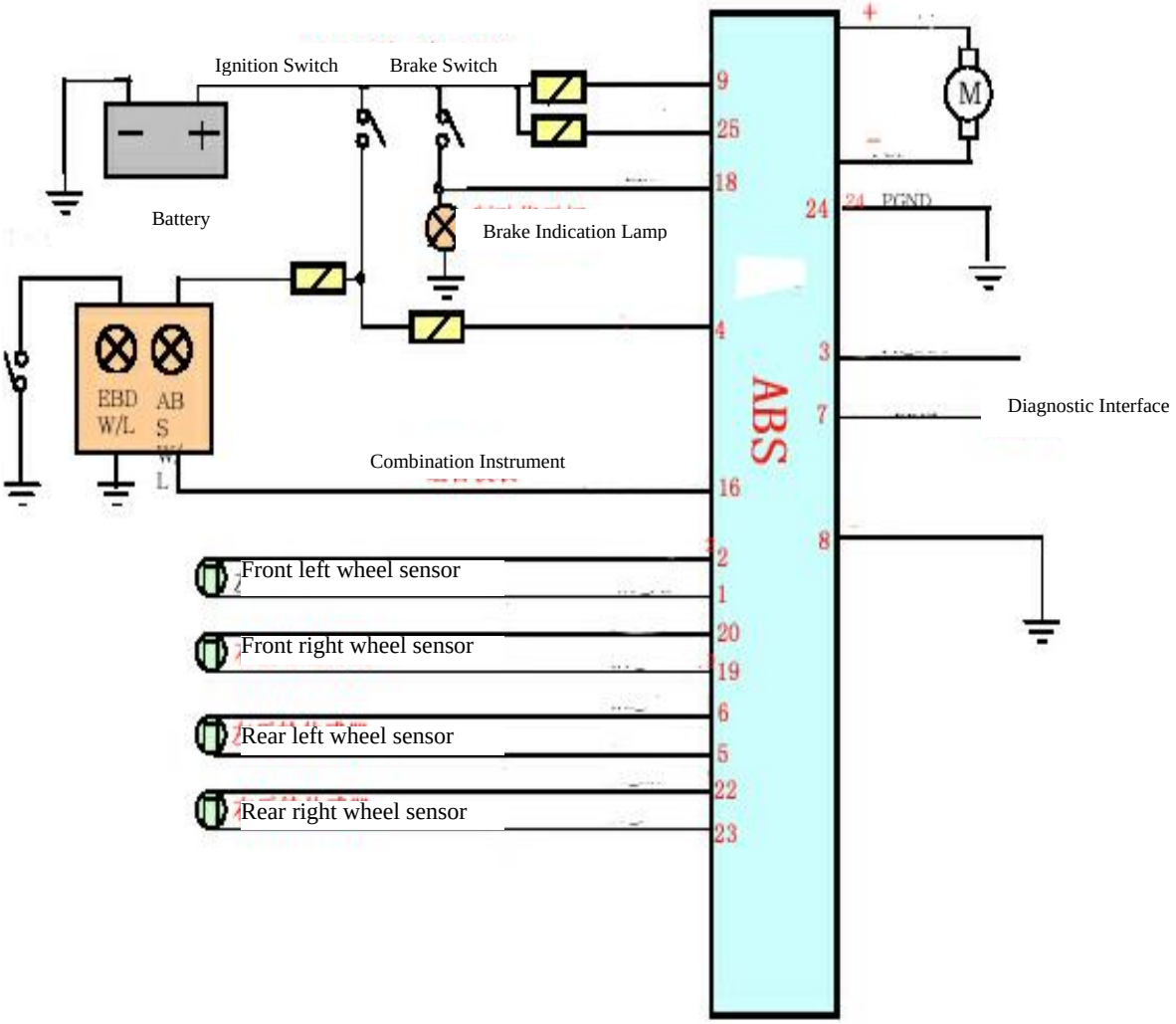
2.3 The Working Process of EBD

When braking only part of the wheel, especially when steering, the electronic brake-force distribution (EBD) function will be activated. Speed sensor will sent out speed signals of four wheels, and the electronic control unit will figure out wheel speed as well as slip rate according to these signals. If the slip rate of rear wheel exceeds some set value, the hydraulic control unit will adjust, control and reduce rear brake pressure to guarantee that rear wheel will not be locked before the front wheel. Compared to conventional braking force distribution of proportioning valve, electronic braking force distribution function guarantees higher adhesion of wheels as well

as rational braking force distribution. When ABS is working, electronic braking force distribution function will be deactivated. The boosting and pressure maintaining of EBD is just the same as the working process of ABS, however, their depressurizing controls are differed in some cases. When rear wheel tends to lock up, the normally open valve of rear wheel will be closed, normally closed valve will be opened, and the wheel brake pressure will be reduced. Unlike ABS, in this case, hydraulic pump does not work, and the brake fluid that is discharged in depressurizing process will be temporarily stored within low-pressure accumulator. After finishing the braking operation, release the brake pressure inside the brake pedal master cylinder. In the meantime, open the normally open valve and normally closed valve again, and the brake fluid inside the low pressure accumulator will be returned into master cylinder via normally open valve and normally closed valve. The low-pressure accumulator will be drained to stand by for the next ABS or EBD operation.

2.4 ABS Brake Schematic Diagram




Ignition Switch
Brake Switch
Battery
Brake Indication Lamp
EBD W/L
ABS W/L
Combination Instrument
Front left wheel sensor
Front right wheel sensor
Rear left wheel sensor
Rear right wheel sensor
ABS
M
PGND
Diagnostic Interface
9
25
18
24
4
3
7
16
8
2
1
20
19
6
5
22
23

2.5 Malfunction Code List

Malfunction code	Malfunction name	Malfunction code	Malfunction name
C1 200	Front-left sensor: open or short circuit over the ground	C1 101	Excessive low battery voltage (<9.4v)
C1 201	Front-left sensor or gear ring interference	C1 102	Excessive High battery voltage (＞16v)
C1 202	Air gap malfunction or incorrect gear ring	C1 604	HCU hardware malfunction
C1 203	Front right sensor: open circuit or short circuit over the ground	C2 112	Solenoid valve fuse and solenoid valve relay malfunction
C1 204	Front right sensor malfunction or gear ring interference	C2 402	Motor malfunction
C1 205	Air gap malfunction or incorrect gear ring	C1 274	Sensor short circuit over the ground or open circuit
C1 206	Rear-left sensor: Open circuit or short circuit over the ground	C1 275	Sensor signal malfunction
C1 207	Rear-left sensor malfunction or gear ring interference		
C1 208	Air gap malfunction or incorrect gear ring		
C1 209	Rear-right sensor: open circuit or short circuit over the ground		
C1 210	Rear-right sensor malfunction or gear ring interference		
C1 211	Air gap malfunction or incorrect gear ring		

2.6 ABS Malfunction

Malfunction Location	Malfunction Type	Malfunction Symptom	Warning Lamp	
			ABS	EDS
Vehicle harness	Brake line mounting error	Wheel lockup malfunction or brake deflection	Lamp off	Lamp off
	Brake oil leakage	ABS and EBD start-up malfunction		
	Wire mounting error	Unable to brake		
	Bleeding malfunction	ABS performance degradation	Lamp off	Lamp off
Motor	Motor operational malfunction	ABS unable to start up	Lamp on	Lamp off
ECU	ECU power supply malfunction	ABS／EBD unable to start up	Lamp on	Lamp on
	Valve power line malfunction	ABS／EBD unable to start up	Lamp on	Lamp on
	Motor power line malfunction	ABS unable to start up	Lamp on	Lamp off
	ECU imperfect earth	ABS／EBD unable to start up	Lamp on	Lamp on
	ECU malfunction	ABS／EBD unable to start up	Lamp on	Lamp on
Wheel speed sensor	Sensor short circuit or broken circuit	1 malfunction occurs: ABS unable to start-up	Lamp on	Note)
	Gear ring malfunction Sensor interference Air gap malfunction	ABS wrong start up ABS／EBD unable to start up	Lamp on	Note)
G Sensor	Short circuit/broken circuit	ABS unable to start up	Lamp on	Lamp off

Note) when one sensor fails: EBD warning lamp is off (EBD starts up),
When two sensors fail: EBD warning lamp is on (EBD does not start up).

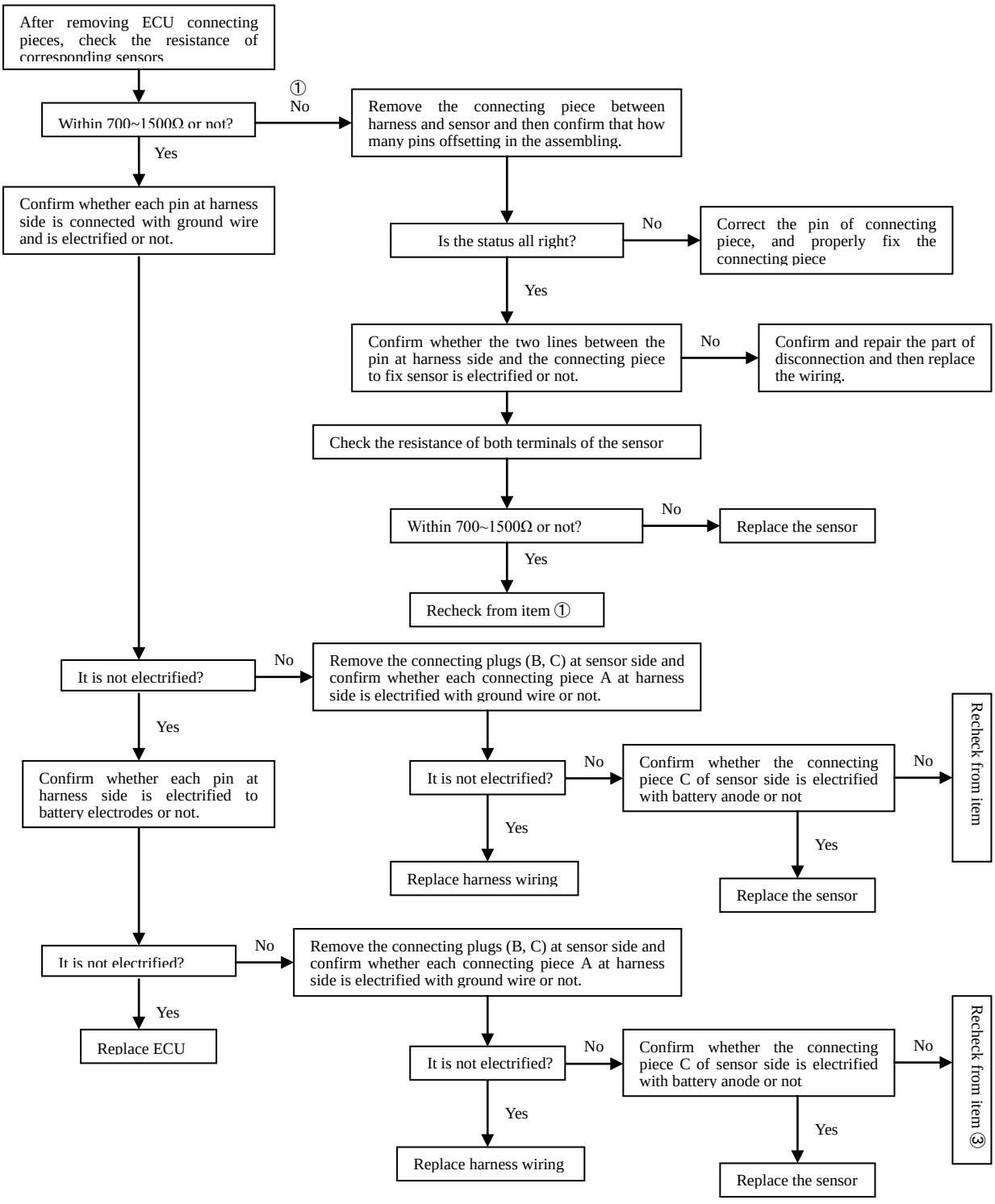
2.7 Troubleshooting

Malfunction	Malfunction Type	Measures
C1 200 C1 203 C1 206 C1 209	Sensor short circuit / broken circuit The anode or cathode of sensor has short circuit/broken circuit over the ground	1. Measure the voltage between harness plug pin2, 5, 20, 22 and the ground (normal voltage scope: 2-4V). 2. Sensor voltage less than 2V indicates sensor broken circuit or ground wire short circuit or sensor connector plug disengagement. 3. Replace sensor if broken circuit occurs, however, for short circuit, only after confirming the short-circuit condition can it be decided whether replace the sensor or not.
C1 202 C1 205 C1 208 C1 211	Air gap malfunction Excessive air gap, or sensor short circuit (resistance is zero), or gear ring is not properly mounted.	1. Inspect the air gap to ensure it meets the specification. 2. Inspect the resistances of both sides of the sensor to ensure they meet the specification. 3. Employ analyzer to ensure the normal condition of the speed of four wheels (slowly increase to 60Km/h) 4. Inspect the gear ring to confirm whether it meets the specification or not
C1 201 C1 204 C1 207 C1 210	Gear ring and sensor interference Install a nonstandard gear ring	1. Inspect the air gap to ensure it conforms to standard. 2. Inspect the gear ring and gear wheel to ensure they conform to specification 3. Inspect the area in-between gear ring and sensor to see whether there exist impurities or not. 4. Inspect sensor resistance to see whether it is normal or not
C1 101 C1 102	Battery voltage malfunction Excessive high or low battery volt	1. Inspect the main ground wire to ensure the contact is in good condition (check the resistances between chassis ground wire and No. 8 / 25 of ABS to see whether they are less than 1 ohm). 2. Check the voltage of the No. 4 pin of the joint and the ground to see whether it is within normal voltage scope or not (normal voltage is 9.4~16V).
C1 402	Motor fuse or motor malfunction	1. Firstly confirm when the malfunction occurs, during parking or at a speed over 20Km / h. (If it is uncertain, after eliminating the malfunction then reconfirms it.) 2. Inspect the voltage between No. 25 pin of harness plug and ground. If voltage inspection confirms that harness and fuse are normal, it can be confirmed it belongs to motor malfunction.
C1 112	Valve fuse relay malfunction a) Main relay or fuse disconnection b) Main relay short circuit	1. If it belongs to a) condition, inspect the voltage between No. 9 pin of harness and ground wire. If there is no voltage, ensure the normal condition of fuse and harness. 2. If the above voltage is normal, then it can be confirmed that there exists malfunction inside the ABS control unit, so it shall be
C1 604	ECU internal circuit or valve coil malfunction	Replace

C1 274	G sensor short circuit or broken circuit	1. Firstly disconnect the connector at harness side, and connect the harness sensor battery anode with the No. 15 pin of short cathode, and then perform ground connection. Finally measure the malfunction voltage of No. 13 pin short circuit or broken circuit as well as the voltage of No. 15 pin (normal voltage scope is between 0.6 ~ 4.5V). 2. Sensor voltage less than 2v indicates sensor broken circuit or ground wire short circuit or sensor connecting piece plug disengagement. 3. Confirm whether there is supply power (IGN1) for G sensor (normal voltage scope shall be between 10 - 16V). 4. If there is no problem occurs to item 1, 2 and 3, but there still exist errors, it can be confirmed as ECU internal circuit troubles.
	The anode or cathode of sensor has short circuit / broken circuit over the ground	

2.8 Diagnosis Procedures

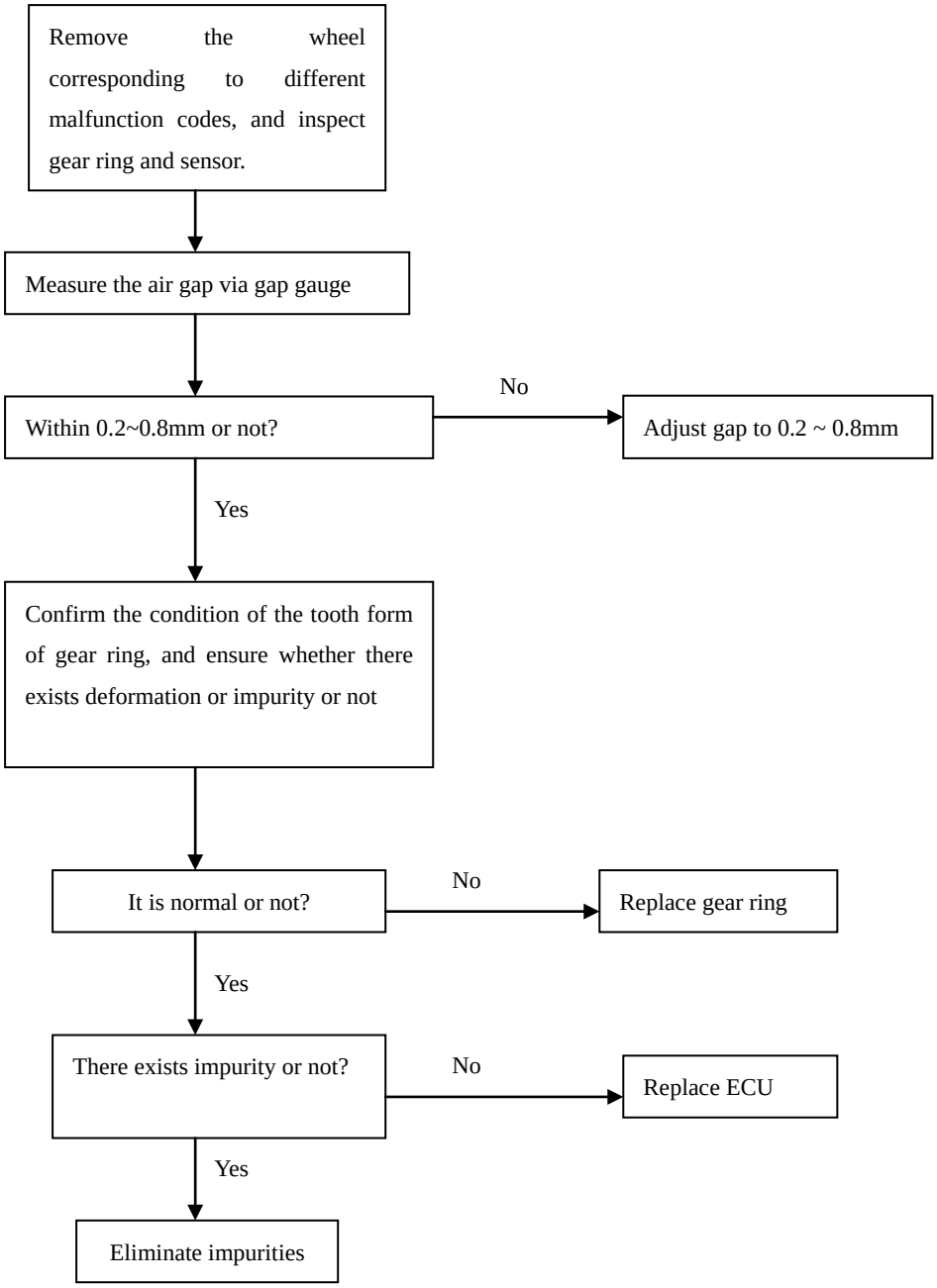
2.8.1 Sensor Short Circuit/ Open Circuit Malfunction C1 200, C1 203, C1 206, C1 209



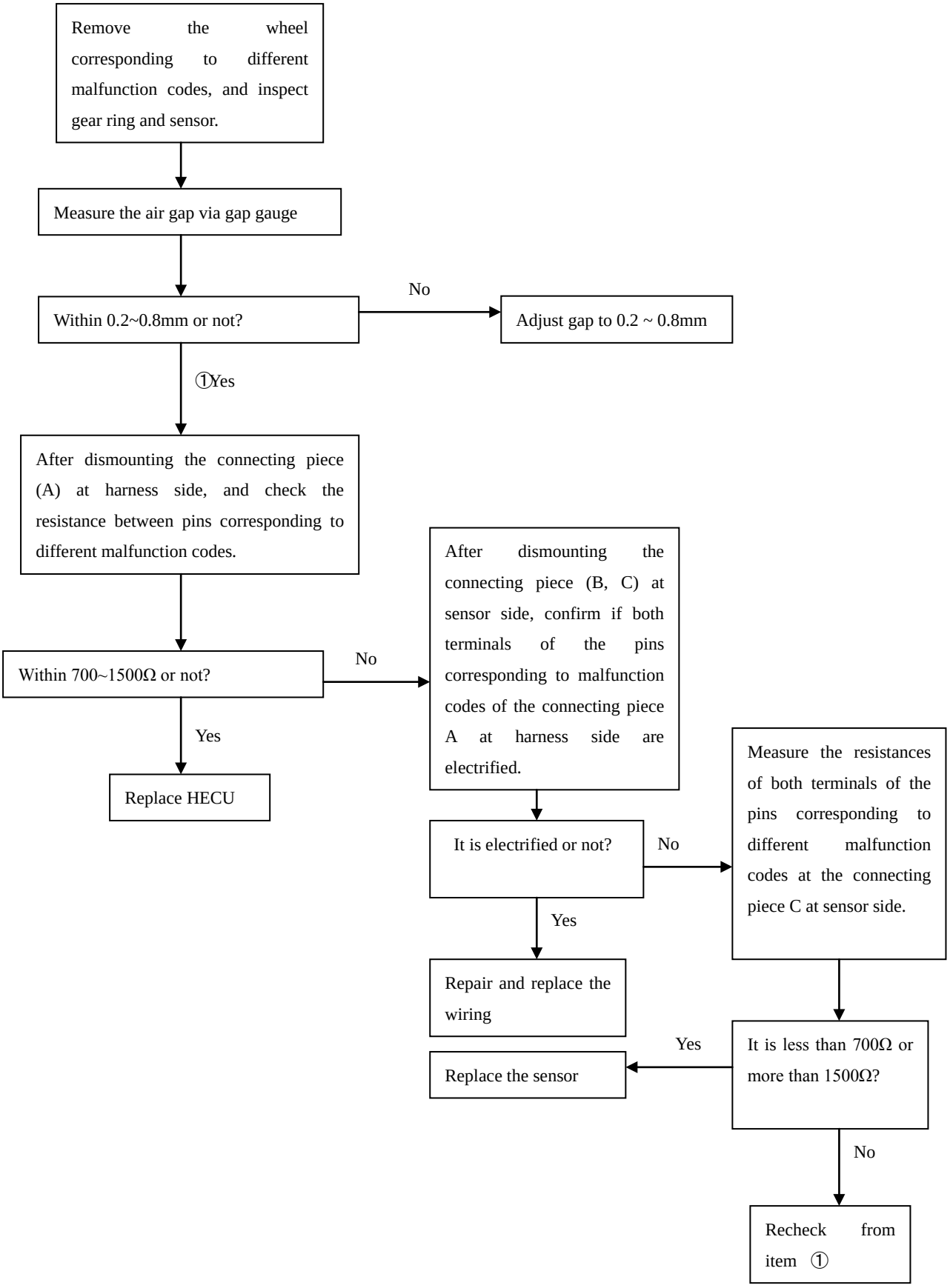
Remark: Reference of connecting piece classification

Harness sensor

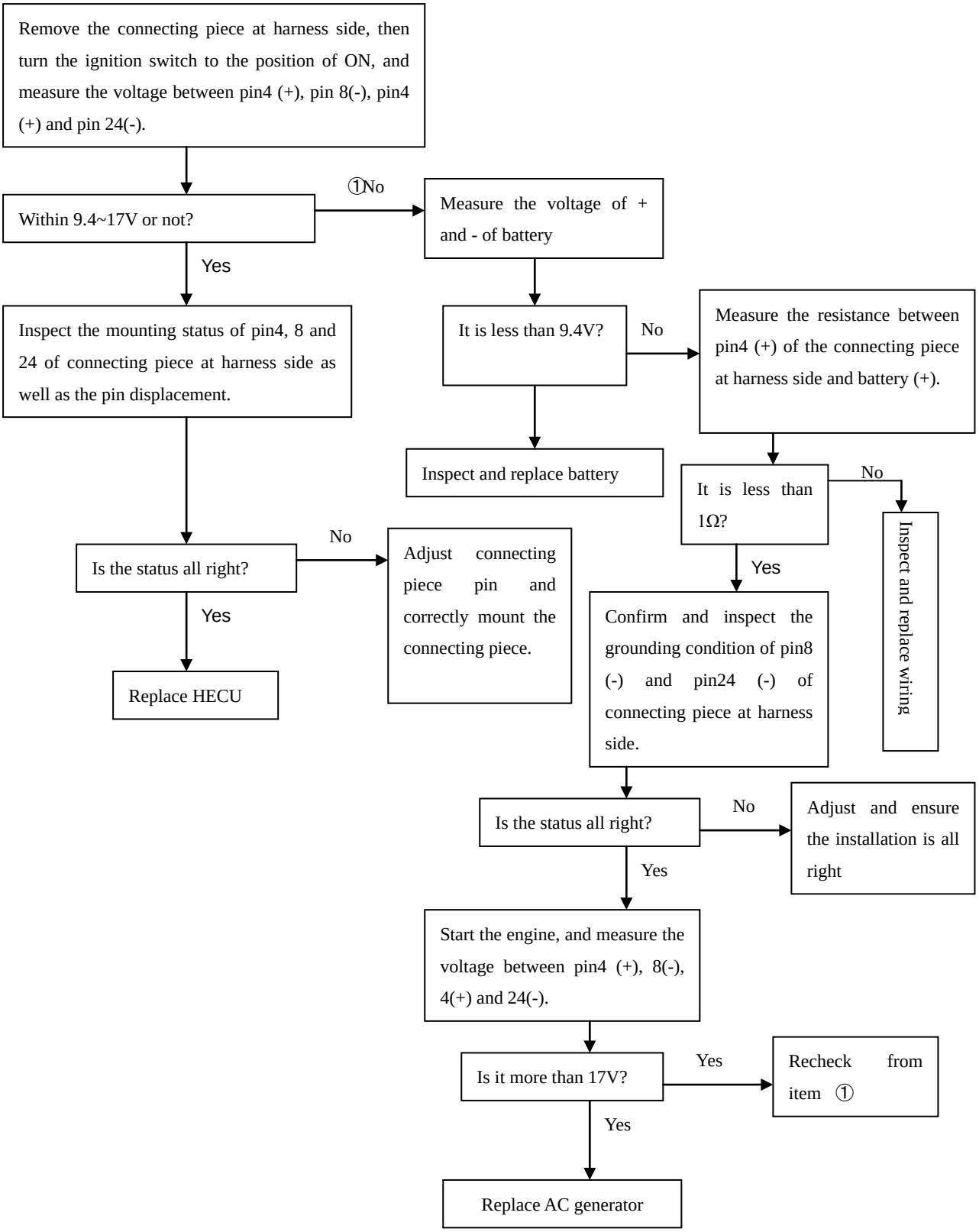
2.8.2 Gear Ring and Sensor Interference C1 201, C1 204, C1 207, C1 210



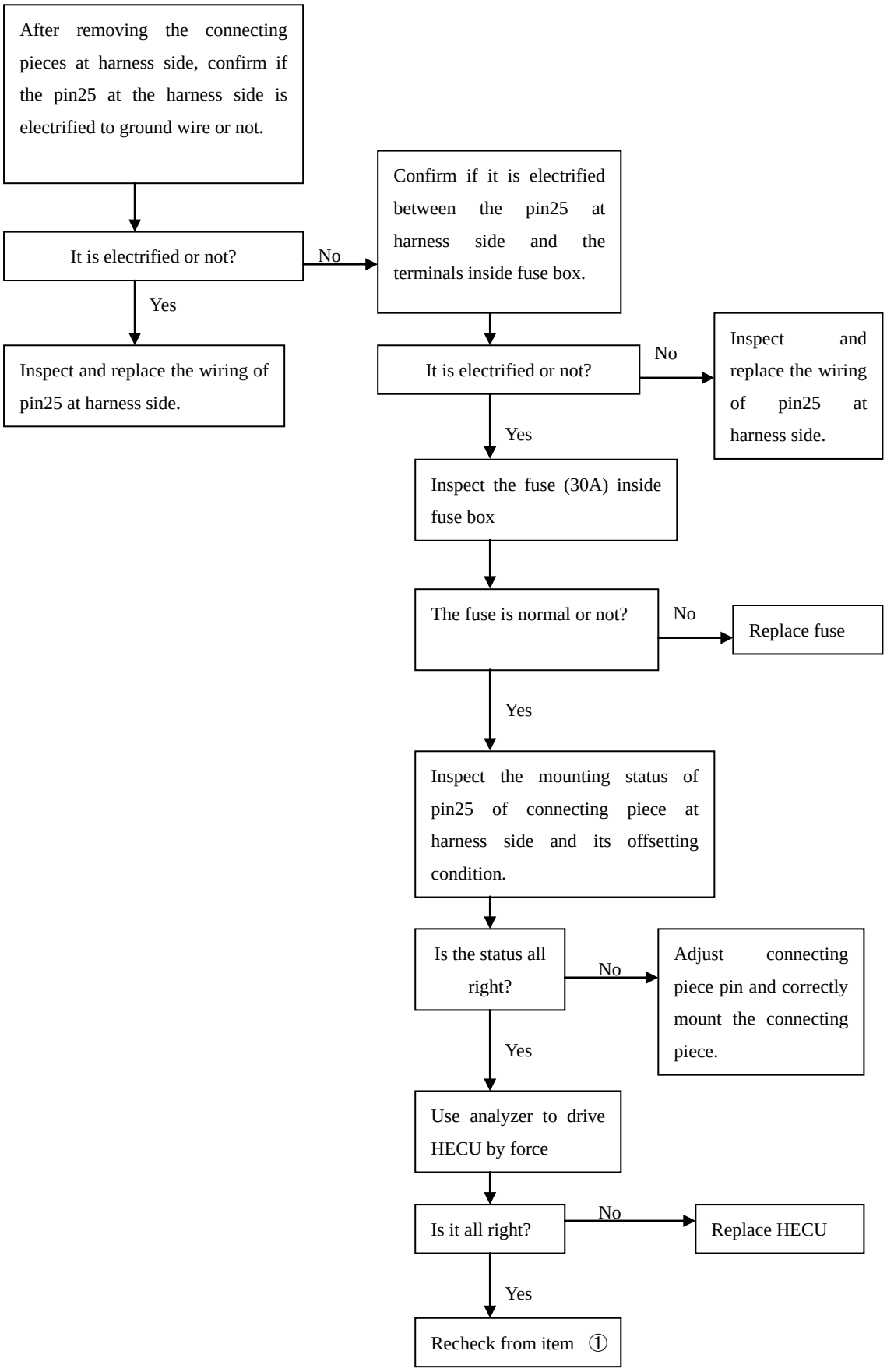
2.8.3 Air Gap Malfunction C1 202, C1 205, C1 208 and C1 211.



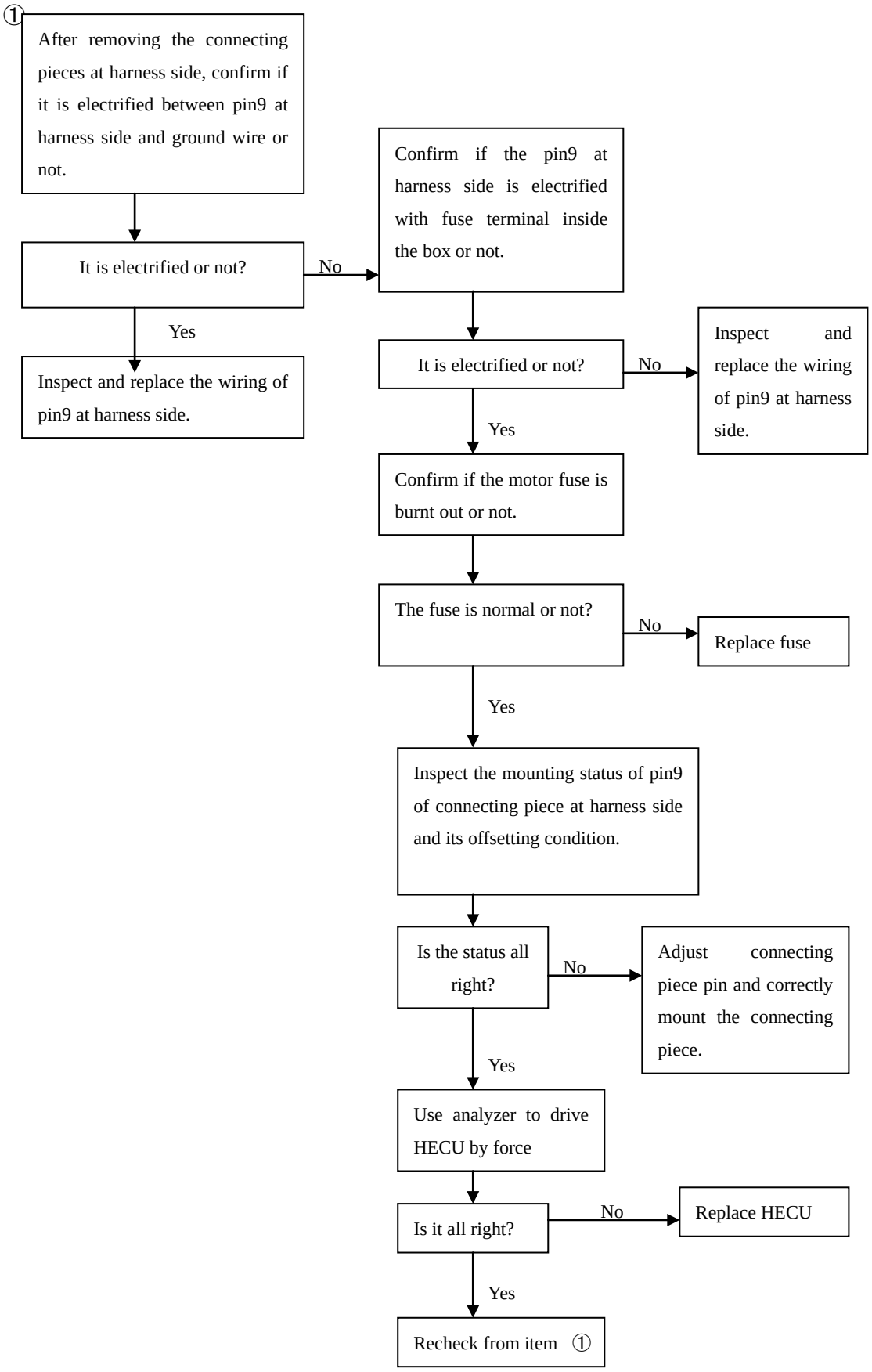
2.8.4 Battery Malfunction C1 101 and C1 102.



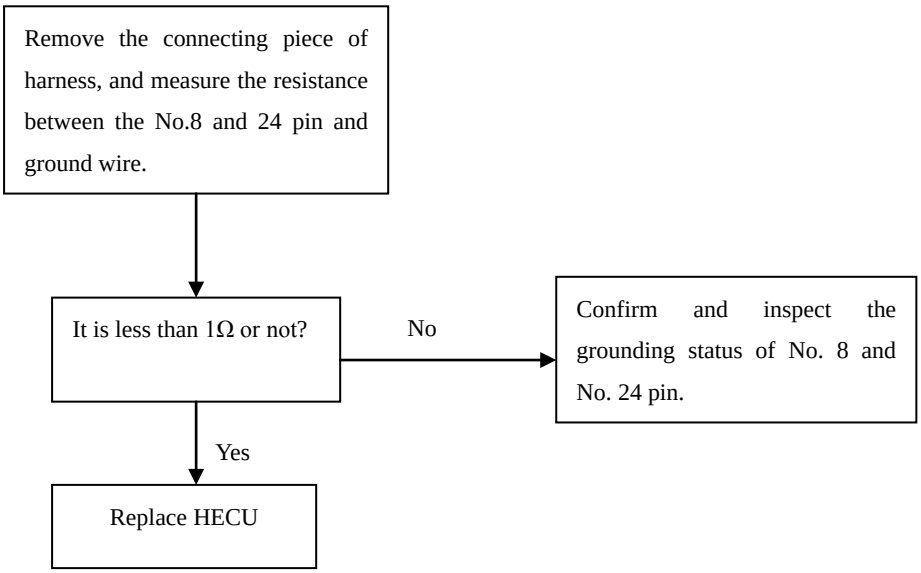
2.8.5 Solenoid Valve Fuse or Solenoid Valve Relay Malfunction C2 112.



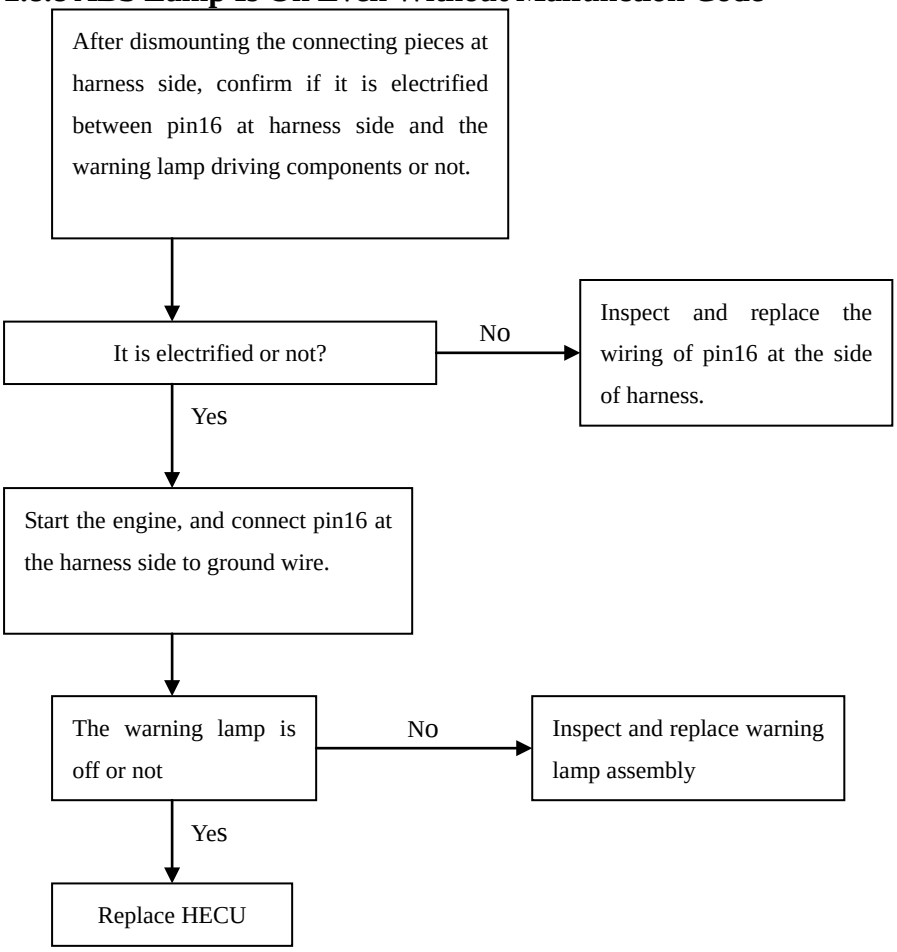
2.8.6 Motor Fuse or Motor Malfunction C2 402.



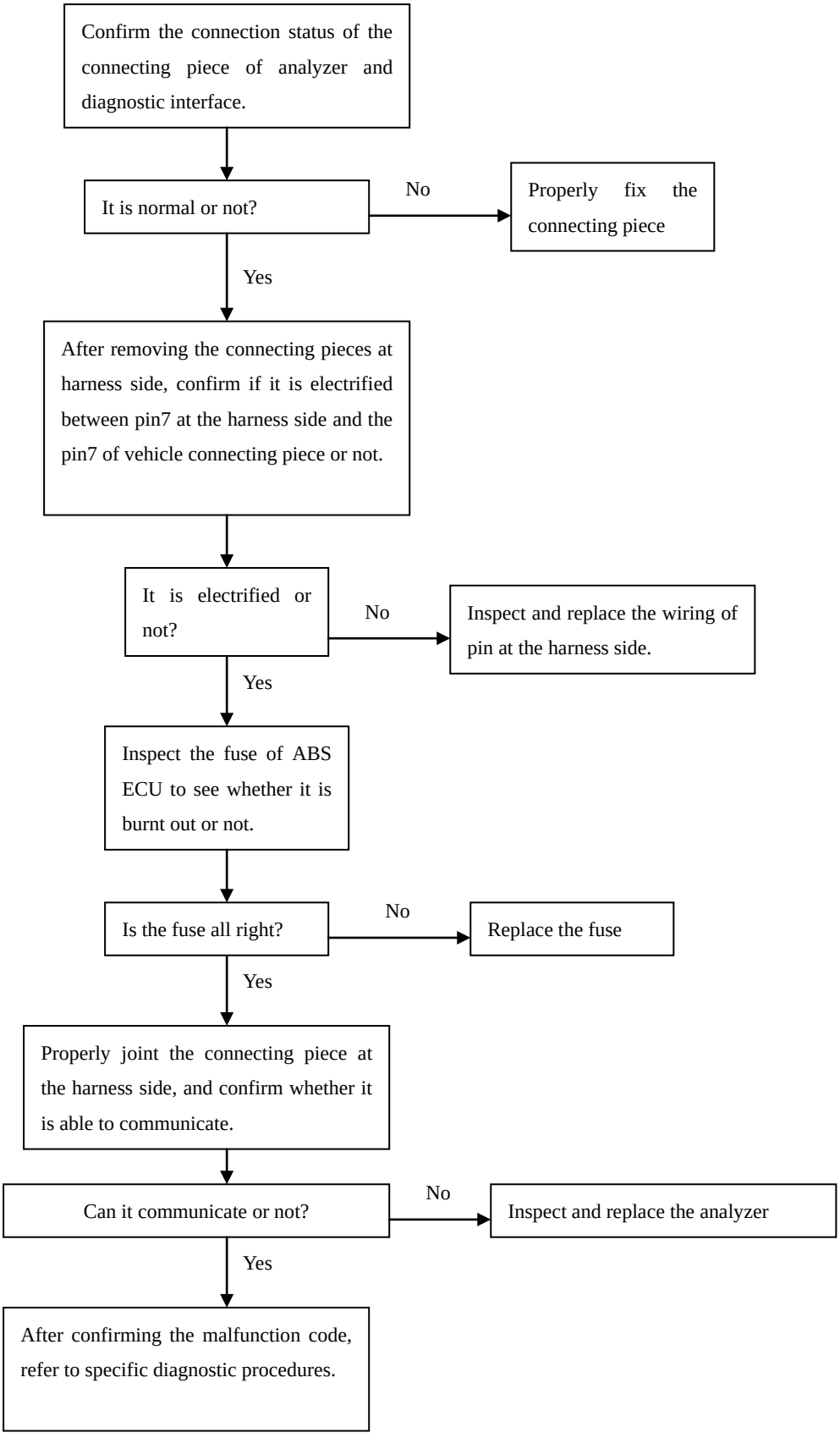
2.8.7 ECU Internal Circuit or Valve Coil Malfunction C1 604



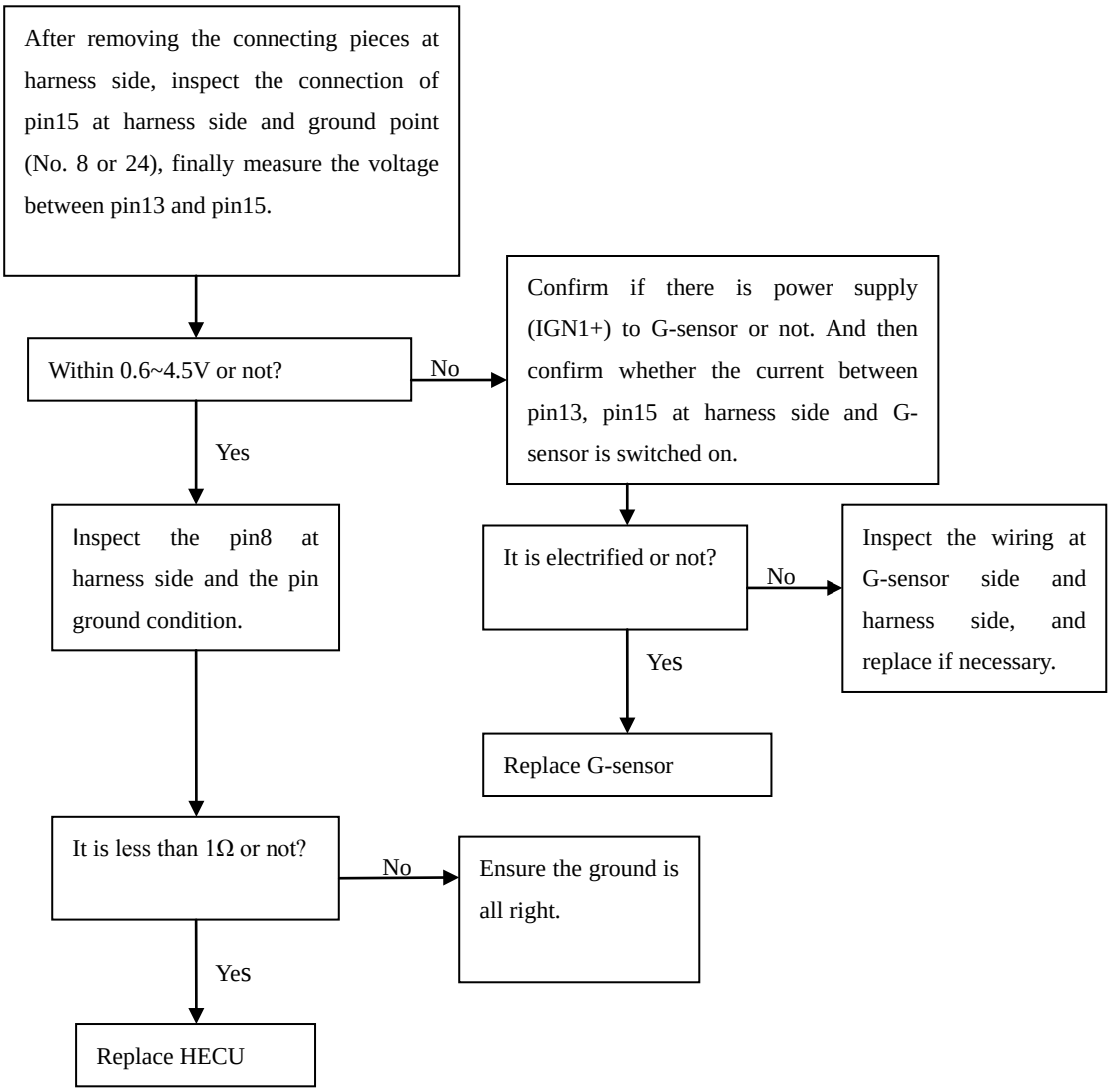
2.8.8 ABS Lamp Is On Even Without Malfunction Code



2.8.9 Unable to Communicate (Analyzer Unable to Communicate with HECU)



2.8.10 G-sensor Short Circuit/Broken Circuit, C1 274

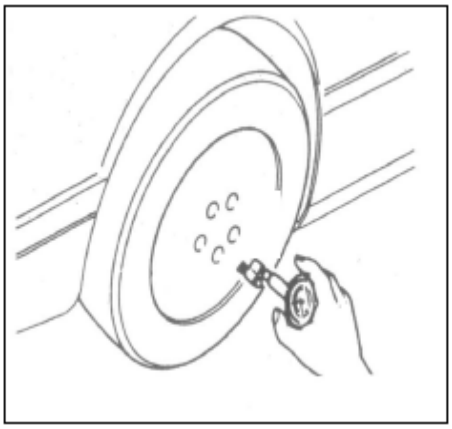


Section Ⅲ Wheel Alignment Inspection and Adjustment

Ⅰ Adjustment before Inspection

1. The Following Inspection Efforts Shall Be Performed Prior to Checking Wheel Alignment.

1）Check tire pressure and adjust to set value.



Standard inflation pressure of cold tire (kpa)

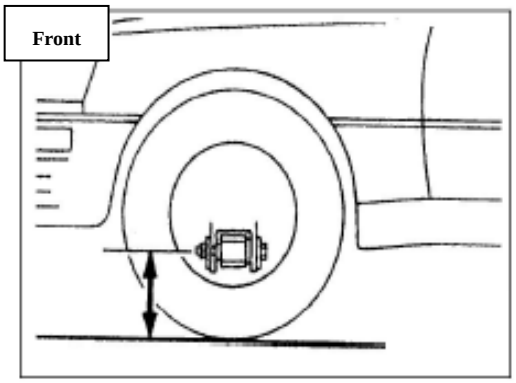
Item	215／70R16（99H）	235／60R16 （100H）	Spare tire
Front wheel	200	200	250
Rear wheel	200	200	

2) Inspect body height

Prior to measuring vehicle height, pressurize tire to specified value (note: the pressure value of right and left tires shall be identical).

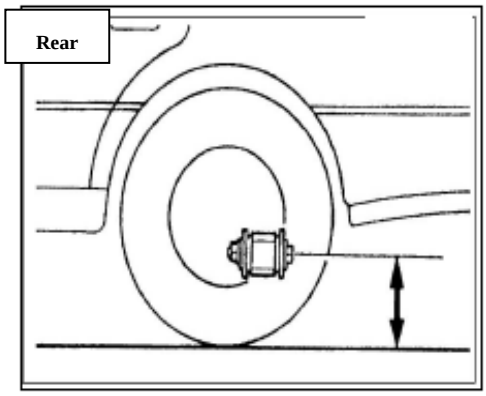
a. Forehead measuring point

Measure the height between the ground and the center point of connecting bolt that joins the lower control arm assembly and the front knuckle. The body height of the left and right wheels shall be identical.



b. Rear measuring point

Check the height between the ground and the connecting bolt that joins the rear axle to the shock absorber. The body height of the left and right wheels shall be identical.



Note: Prior to checking wheel alignment, firstly adjust the vehicle to specified height.

If vehicle height does not conform to standard, inspect the front and rear suspension of the vehicle to confirm whether there exists damage or deformation.

c. Inspect wheel bearing clearance, and replace front-wheel bearing if necessary.

d. Inspect the status of wheel rim and tire.

e. Inspect the loosening level of steering linkage and ball joint.

f. Park the vehicle (without luggage or passengers) on a level ground.

g. Shake the wheel and inspect the loosening status of front suspension.

h. Inspect shock absorber to ensure its normal operation.

a) Inspect and avoid oil leakage.

b) Inspect the mounting bushing to avoid wear.

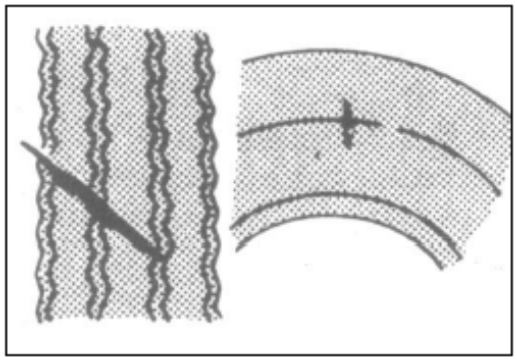
c) Inspect the damping force of shock absorber, and replace if not conform to specification.

Note: fuel tank shall be half-full. Cooling water in radiator and the engine oil shall be at specified height. Tire jack and driver's tools shall be placed at designated location.

2. Wheel Rim and Tire

1) Visual inspection

Inspect the tire and wheel rim, if there exists crack, damage, deformation or other defects, replace wheel or tire. As is shown in the right figure.



Tire Wear

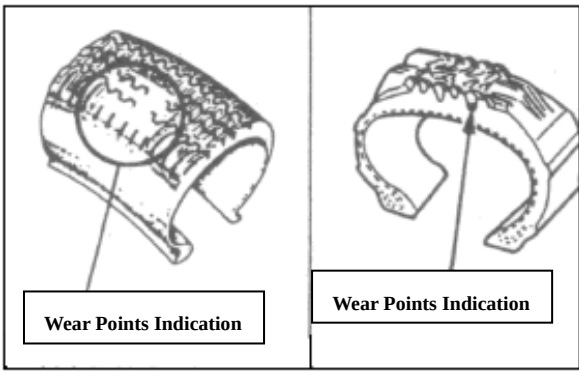
2) Tire wear

a. Refer to the standard tire figure to inspect the tire thread depth of other parts.

Minimum depth: 1.6mm

Tire for snow condition: 50% of the thread depth

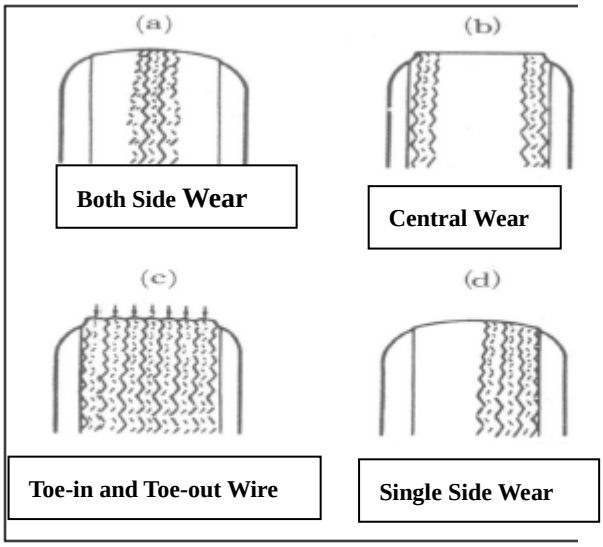
b. If wear indication strip appears, the tire must be replaced.



Tire Wear Point Indication

3) Tire abnormal wear

Tire abnormal wear is shown in right figure.



Tire Wear

Refer to the table below for possible causes and remedies.

	Possible causes	Remedies
(a)	Inadequate tire pressure (both sides wear) High speed turning Tire swap is not performed	Measure and adjust tire pressure. Reduce vehicle speed. Perform tire swap
(b)	Excessive high pressure of tire (central wear) Tire swap is not performed	Measure and adjust tire pressure Perform tire swap
(c)	Incorrect toe-in	Adjust toe-in
(d)	Incorrect camber angle or caster angle Suspension system malfunction Tire unbalance Brake drum or disc out of round Other mechanical problems Tire swap is not performed	Adjust, repair or replace axle and parts of suspension system Repair or replace Perform tire dynamic balancing or replace the tire Calibrate or replace Correct or replace Perform tire swap

4) Precautions of wheel rim and tire

a. Never use defective wheel rim or tire.

b. Aluminum alloy rim is easily to be scratched, therefore, use soft cloth but never use steel brush when cleaning. And never contact the rim with boiling water when washing the vehicle by steam.

c. If abrasive compound (such as turbid water and ground mud) adheres to aluminum alloy rim, please rinse the rim with neutral detergent as soon as possible to avoid damage.

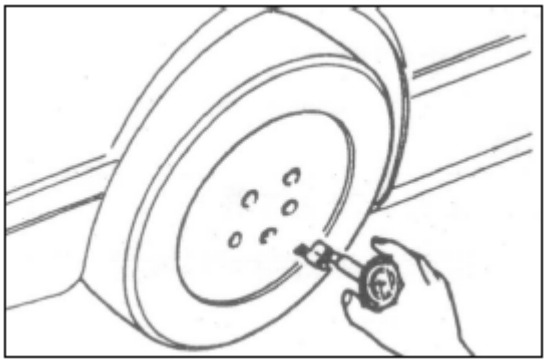
5) Tire replacement

a. Prior to installing tire valve, firstly inspect the wheel to see whether the valve port of the wheel is smooth and burr-free. Then apply glycerol to the valve rubber surface or soak the valve into glycerol solution. Finally use special tools to apply a pressure of 200-400N to press the locating ring on the valve to pass through the wheel valve port, thus it shall be deemed as being installed to proper position (Soap water is allowed to substitute glycerol).

b. Prior to installing tire, apply glycerol or soap water at the periphery of tire bead. Meanwhile, if there is slight mark on the wheel rim, please align the tire uniformity testing mark to the rim slight mark. If there is no slight mark, align the tire dynamic balance testing mark to the position of wire valve. If there is no slight mark on the wheel rim, and the wire has static balancing test mark instead of a dynamic one, align the wheel valve to static balance testing mark.

6) Tire pressure

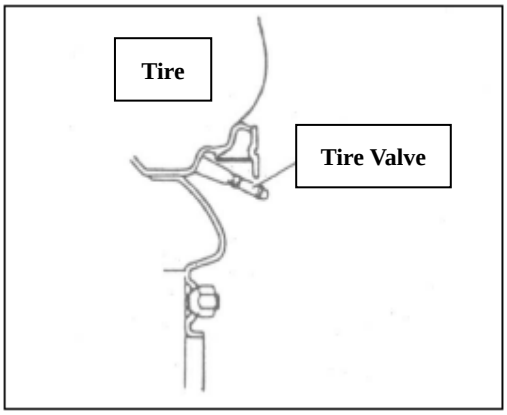
Inspect all of the tire pressures (including spare tire) via barometer, and adjust if necessary. Inflate the tire strictly in accordance with specified pressure value, and the tire pressure shall not exceed the rated pressure by 10% during inflating process. The rated inflation pressure of the spare tire shall be 2.5bar when the spare tire assembly is separately installed, and the spare tire shall be stored separately from the other 4 wheels. Prior to aligning the wheels, inspect and adjust the tire pressure: the front wheel pressure shall be 2.0bar; the rear wheel pressure shall be 2.0bar, as shown in the right figure.



Inspection of Tire Pressure

7) Air leakage

Confirm whether there exists tire valve leakage, as shown in the right figure.

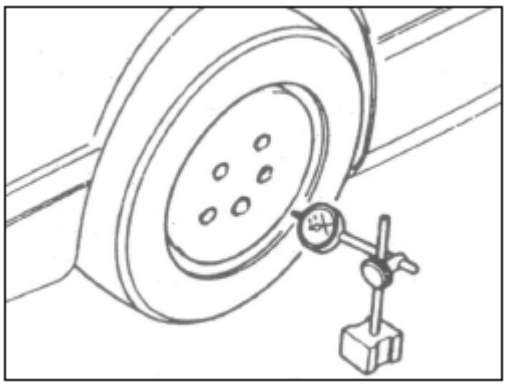


8) Tire unflatness inspection

a. Lift the vehicle, and cautiously support it.

b. Fix a micrometer (Φ10) with a cylindrical contact tip to the rim edge, then measure the unflatness depth, as shown in the figure.

c. Replace the wheel rim if necessary.



Inspection of Tire Unflatness

Note the allowed deformation of wheel rim:

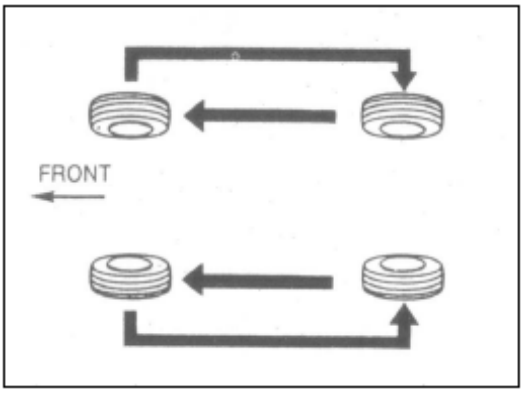
The average maximum allowable unflatness depth at the two edges of the wheel rim shall not exceed:

Steel wheel rim: 5mm

Aluminum alloy wheel rim: 3mm

9) **Tire swap**

In order to prolong the service life of tire and confirm its wear condition, tire swap shall be performed every 6000km (3750 miles), as shown in the figure.



Tire Swap

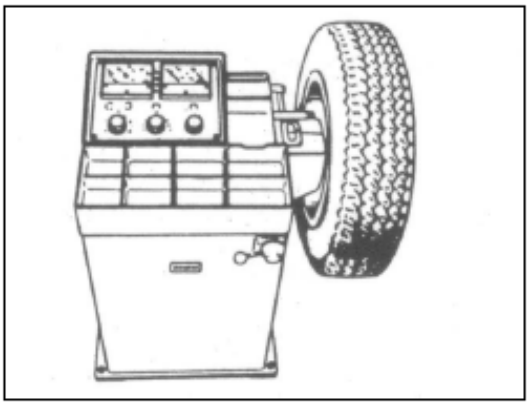
Note:

Front wheels shall use the best ones.

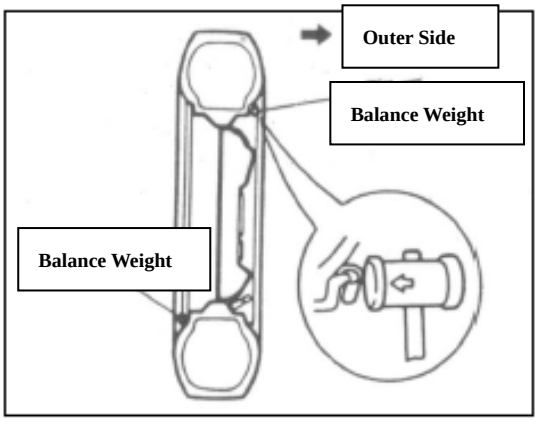
After tire swap, set its pressure to specified value.

10) Wheel balance adjustment

After inflating the tire, tighten the valve cap and perform dynamic balancing test, then fix a proper balance weight at the internal and external fringe of wheel rim. The ultimate unbalancedness of the assembly shall be less than 100g.cm, which is approximately equivalent to a 5g-balance weight located at the internal and external fringe of wheel rim.



Note: It is only allowed to employ one balance weight to each wheel at each side. Moreover, the maximum mass shall not exceed 70g. Avoid excessive knock to the balance weight during installation. If the operator feels the knock is excessive, then timely replace the balance weight. And the replaced balance weight is not reusable.



11) Wheel Removal and Installation

Disassembly procedures:

a. Remove the trim cover of the wheel.

b. Unscrew the binding bolt of the wheel.

c. Remove the wheel.

Installation procedures:

1) When installing wheel and tire assembly, firstly, manually screw bolts to wheel hub for pretension, then use special tools to tighten them in accordance with diagonal method. The tightening torque shall be 100~120Nm. Never use impact wrench so as to avoid wheel damage or excessive loosening or tightening. And never apply grease to wheel bolts. (With respect to the newly mounted wheel and tire assembly, after the first 100km driving, wheel bolt shall be tightened once so as to ensure proper tightening torque. Inspection of wheel bolt tightening torque shall be one of the routine maintenance works).

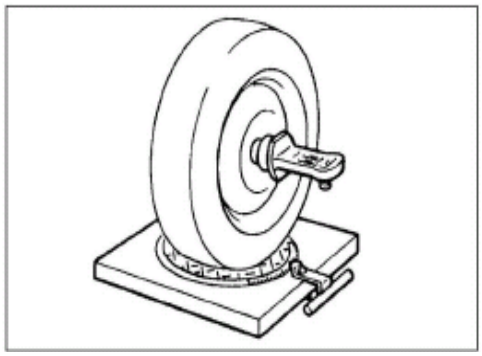
2) Employ right-angled intersection method when tightening the fixing nut, the tightening status shall be similar, and the wheel shall be able to rotate freely. In addition, wheel shall be on the ground when performing final tightening.

3) Mount trim cover or place it as required. Manually flap or employ rubber tools to knock it in when installing cassette-type trim cover.

Ⅱ Rear Wheel Alignment

1. Mount the Wheel Alignment Gauge or Wheel Alignment Tester onto the Wheel.

1) Mount according to manufacturer's specification.

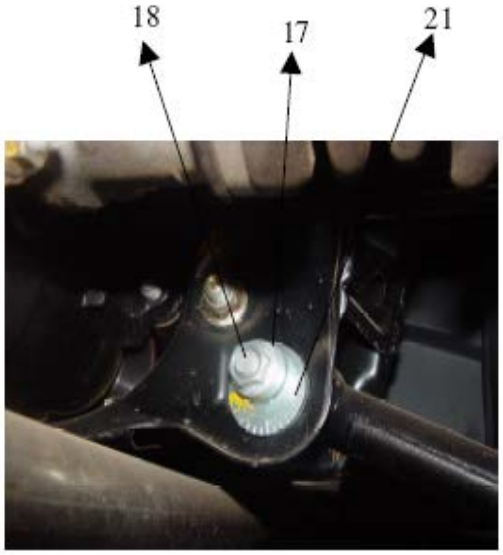


2) Perform detection and adjustment to the vehicle according to specification, and the vehicle alignment requirement is as follows:

General toe-in of rear wheel	18'±30'
Rear wheel camber angle	-54'±30'

2. Adjustment of Rear Wheel Toe-in

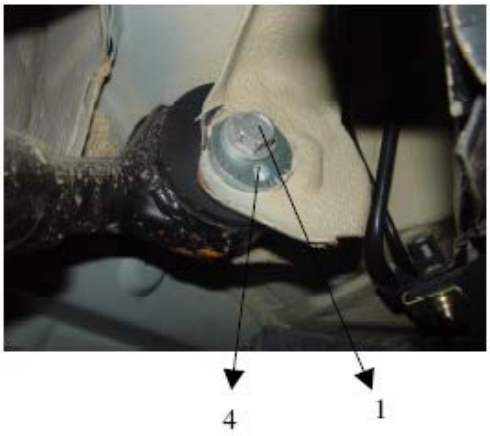
——If the rear wheel toe-in doesn't meet the requirements, use eccentric compensating pipe 18 or eccentric adjust nut 21 to perform adjustment. Loosen the bolt 17, and be cautious to prevent eccentric compensating pipe 18 and eccentric adjust nut 21 from loosening out of the groove, then turn eccentric compensating pipe 18 and eccentric adjust nut 21 till the toe-in value of rear wheel meets the requirement, finally torque the bolt 17 to specification. (The right and left side shall be identical)



3. Adjustment of Rear Wheel Camber Angle

—— If the rear wheel camber angle doesn't meet the requirements, use eccentric compensating pipe or eccentric adjust nut 4 to perform adjustment.

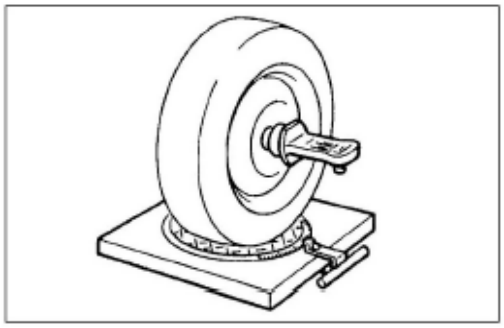
Loosen bolt 1, and be cautious to prevent the eccentric compensating pipe and eccentric adjust nut 4 from loosening out of the groove, then turn eccentric compensating pipe and eccentric adjust nut 4 till the chamber value of rear wheel meet the requirements, and finally torque bolt 1 to specification. (The left and right side shall be identical)



Ⅲ Front Wheel Alignment

1.Mount the Wheel Alignment Gauge or Wheel Alignment Tester onto the Wheel

Mount according to manufacturer's specification.



2. Inspect and Adjust Caster Angle, Camber Angle, Front Wheel Toe-in Angle and Steering angle

The front wheel alignment specification is described as below:

King pin caster angle	$2^0 50' \pm 1^0$
Front wheel camber angle	$-0.85^0 \pm 1^0$
Front wheel toe-in (for single wheel)	±5’
King pin inclination angle	$11^0 30' \pm 1^0$
Max. steering angle of inner wheel	37^0
Max. steering angle of outer wheel	31.2^0

1) Caster angle

Caster angle is secured by structural design; therefore, it is unnecessary to be adjusted during operation.

The Effect of Caster Angle

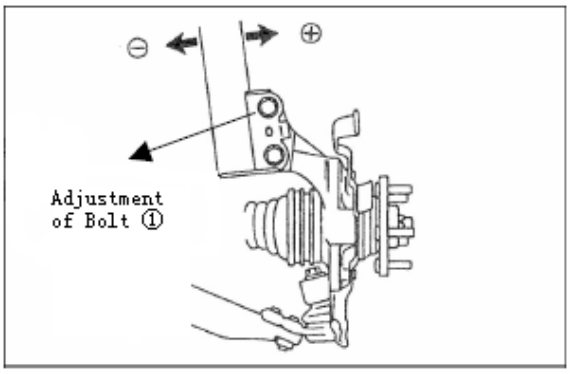
The major function of caster angle is to keep the vehicle driving straight forward. If the caster angle is positive, when turning the front wheel, the vehicle inner side will descend downward and the chassis will consequently ascend. Therefore, the load will be increased and transferred onto steering knuckle. If the caster angle of the two wheels is identical, the vehicle will go back to the direction of straight forward after steering. Increasing positive caster angle will enhance the stability of steering wheel. However, the steering force will increase as well. Reducing positive caster angle will reduce the stability of steering wheel. However, the steering force will be reduced. The caster angle will not affect tire wear, and it is used to stabilize the driving direction and ensure automatic straight returning back to the center when steering. If the vehicle is equipped with a conventional mechanical steering system, the caster angle is usually very small, sometimes even tends to negative value, thus make steering easier. If the vehicle is equipped with power steering device, a larger positive angle is usually set to make the driver feel well when steering. Increasing positive caster angle will result in an increase of steering force as well as increase of vehicle stability when driving forward.

2) Camber angle

Under normal conditions, it is unnecessary to adjust camber angle after assembling independent suspension and wheel steering knuckle. If the wheel camber deviates from tolerance limit due to some other reasons, it shall be calibrated via connecting bolt that joins the independent suspension and the steering knuckle.

a) Prior to calibrating, firstly inspect (visual inspection) whether there are damages to driving components, and then replace the defective ones.

b) If the front-wheel camber angle exceeds deviation limit, loosen the connecting bolt① that joins the front shock absorber and the steering knuckle; finally move the wheel to perform calibration.



3) Front wheel toe-in

Toe-in shall be inspected and adjusted via special wheel alignment detector.

a) Prepare for alignment and adjustment according to specific requirement of the detector, then fix steering wheel facing straight forward via commercially available steering wheel retainer (steering wheel must be located at central position with a deviation not exceeding ±5°). And the lower clamping flange bolt of steering shaft must be horizontal.

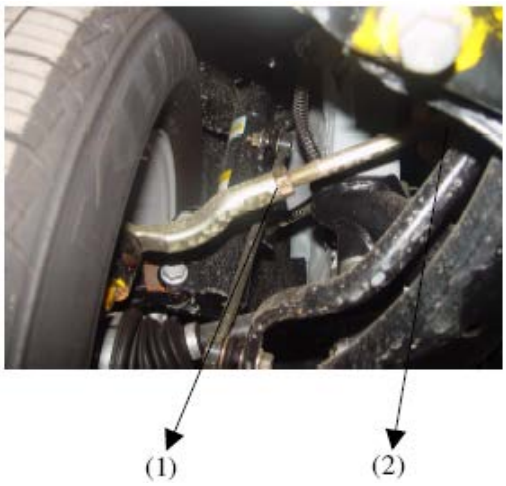
b) Unscrew the lock nut of steering tie rod.

c) Remove the flexible jacket snap ring (2) via pliers.

Note: replace the snap ring if its elasticity is insufficient.

d) Rotate the toe-in adjusting rod to adjust the length to specified value as required.

e) Tighten the lock nut (1), then remount jacket snap ring (2), and inspect the tightening condition of the lock nut and ensure the jacket is properly located.



f) After adjusting the front wheel toe-in, inspect whether steering wheel is horizontal. Otherwise loosen the steering wheel lock nut, and adjust steering wheel to horizontal position, finally torque the steering wheel lock nut to specification (27~33Nm).

4) Inspect front wheel steering angle

After replacing the steering knuckle tie rod joint or adjusting the toe-in, inspect the steering angle. If the front wheel steering angle doesn't conform to the specification, inspect and adjust the length of left and right steering knuckle tie rod.

Ⅳ Guideline of Troubleshooting

Problems	Possible causes	Remedies
Tire undue wear	Incorrect tire pressure	Adjust
Tire noise	Incorrect tire pressure Tire wear	Adjust Inspect, adjust or replace
Road noise or vehicle body vibration	Insufficient tire pressure Tire unbalance	Adjust Adjust
Vertical vibration of steering wheel	Tire and wheel rim excessive deflection Wheel screw cap or axle stub loose Tire unbalance Engine suspension rubber crack or wear Gearbox bracket rubber crack or wear	Replace Lock Adjust Replace Replace
Circular vibration of steering wheel	Tire and wheel rim excessive deflection Wheel screw cap or axle head loose Tire unbalance Tire uneven wear Insufficient tire pressure	Replace Lock Adjust Inspect Adjust
Unilateral deflection of steering wheel	Incorrect tire pressure Wire excessive or uneven wear Steering system malfunction Brake system malfunction Suspension system malfunction	Adjust Inspect Inspect Inspect Inspect
Traveling instability	Right and left tire pressure non-uniform. Wheel rim or tire deformation Wheel screw cap loose Steering system malfunction Suspension system malfunction	Adjust Repair or replace Lock Inspect Inspect
Braking deflects to one side	Right and left tire pressure non-uniform Brake system malfunction	Adjust Inspect
Steering wheel is heavy	Insufficient tire pressure Steering system malfunction	Adjust Inspect
Poor straight returning of steering wheel	Insufficient tire pressure Steering system malfunction Suspension system malfunction Incorrect caster angle of front wheel	Adjust Inspect Inspect Adjust

Chapter 4

Suspension/Transmission and Axle

Section 1 Specification

Fastener Tightening Specifications

Part number	Specification	Torque (N.m)	Quantity	Affixed assembly
Q330C10	M10×1.25	40~50	2	Connecting rod and front stabilizer bar
Q330C10	M10×1.25	40~50	2	Front connecting rod and front shock absorber
Q1420825	M8×25	22~28	4	Fix stabilizer bar clip to subframe
T11-2901011	M10×19	45~55	6	Front suspension strut and vehicle body
T11-2901013	M15×1.5	110~130	4	Steering knuckle and suspension strut
T11-2901015	M15×1.5×55	110~130	4	Steering knuckle and suspension strut
Q330C10	M10×1.25	40~50	2	Connecting rod and rear stabilizer bar
Q330C10	M10×1.25	40~50	2	Connecting rod with lower suspension lever
T11-2919037 (Q184B1280)	M12×1.25×82/80	100~120	2	One on each side to connect upper link with towing arm
Q330B12	M12×1.25	80~101	2	One on each side to connect upper link with towing arm
Q1401282 (Q184B1280)	M12×82	100~120	2	One on each side to connect upper link with rear subframe
Q330B12	M12×1.25	80~101	2	One on each side to connect upper link with rear subframe
Q1401282 (Q184B1280)	M12×82	100~120	2	One on each side to connect lower control arm with towing arm
T11—2919035 (Q184B12100)	M12×94×1.25／95	100~120	2	One on each side to connect lower control arm with rear subframe
T11—2919031	M12	100~120	2	One on each side, fit onto the T11-2919035.
Q334C10	M10×1.25	22~28	4	Two on each side to connect the upper end of rear shock absorber with vehicle body
T11—2915013	M10×19	40~50	2	Connect rear shock absorber with rear shock absorber mounting bracket (T11-3301110)
Q1400820	M8×20	22~28	1	Fix the rear rubber buffer assembly onto the vehicle body
T11-3100111		100~120	23	Wheel nut
Q184C1090	Dacroment Grade 10.9	75~85	1	Soft gasket and bracket of front suspension
Q330C10	Galvanization Grade 10	75~85	1	Front suspension and bracket
Q184B1285	Dacroment Grade 10.9	110~130	1	Soft gasket and bracket of rear suspension
Q330B12	Galvanization grade 10	115~125	1	Rear suspension and bracket
Q184C1260	Dacroment Grade 10.9	75~85	2	Connect the rear axle front suspension with rear driving axle

Q330B12	Dacroment Grade 10.9	115~125	2	Connect rear axle front suspension with rear subframe, there are bolts on the suspension
Q140B1230	Dacroment Grade 10.9	75~85	1	Rear suspension, longitudinal beam of engine and subframe
Q330B12	Nut	110~130	2	Insert from the lower part of subframe, and the bolt is on the suspension. The middle part shall be clamped to the main longitudinal beam of engine.
T11 2402013	Dacroment Grade 10.9	75~85	2	Fix the rear axle rear suspension cushion assembly onto the rear axle
T11 2402011	Dacroment Grade 10.9	75~85	2	Fix the rear axle rear suspension cushion assembly onto vehicle body
T11 2203205	Grade 8	260~280	2	Connect the right and left assembly of front drive shaft with brake disc
T11 2201205	Grade 8	260~270	2	Connect the right and left assembly of rear drive shaft with brake disc
Q32608		20~26	12	Connect the right and left assembly of rear drive shaft with rear axle
T11 2202201	Grade 8.8	58~68	2	Connect intermediate propeller shaft with vehicle body
0142B1030	Grade10.9	75~85	4	Connect intermediate propeller shaft with rear axle
Q330B10	Grade 10	75~85	4	Connect intermediate propeller shaft with rear axle
N0111862	M12×12	35~45	2	Steering knuckle tie rod and steering knuckle
AQl40C1035	M10×1.25(with guide)	74~86	2	Longitudinal beam and flat gasket of vehicle (front) body
T11 2810011	M14×1.5(55)	170~190	2	Subframe and gasket of vehicle (rear) body
T11 2810013	M14×1.5 (118)	170~190	2	Subframe and gasket of vehicle (front) body
Q14081230/40	Bolt	75~85	2	Subframe and longitudinal beam welding assembly
Q330C10	Nut	75~85	1	Subframe and longitudinal beam welding assembly
01420820	M8×20×1.25	22~28	4	Rear stabilizer bar clip and vehicle body
T11-2919035	Grade 10.9	140~160	2	Rear towing arm and vehicle body
AQl84B1220	M12×1.25 ×20	140~160	2	Connect control arm knuckle pin with control arm
T11-2909063	M12×1.25	140~160	4	Connect control arm knuckle pin with control arm
T11-2909061	M12×1.25	140~160	4	Connect control arm knuckle pin with control arm
AQ330B14	M14×1.5	170~190	2	Control arm and subframe
Q184B1275	M12×60	75~85	2	Steering gear and subframe

T11-2909011	M14×1.5	110~130	2	Connect control arm knuckle pin with knuckle assembly
T11-2909013	M14×1.5	170~190	4	Control arm and subframe
AQ330B14	M14×1.5	170~190	2	Rear gum cover of control arm and subframe

Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit in screw fastening, it must be replaced.

1) Pretension to 100N.m, then loosen capstan nut and tighten to 120N.m, finally rotate 90°. If the cotter pinhole cannot be aligned with capstan nut, loosen it and return to the next hole. Then fix it by cotter pin.

2) Pretension to 50N.m, and then tighten to 90Nm, finally rotate 45^0 to 60^0.

3) Tighten to 90N.m and then rotate 30^0 to 45^0.

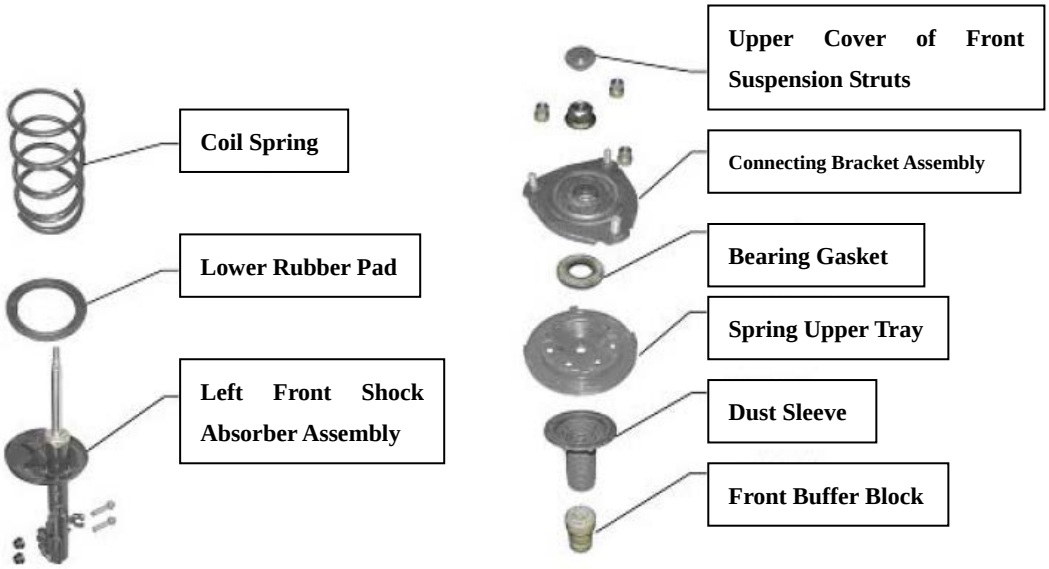
4) Tighten to 50N.m and then rotate 90^0 to 105^0.

Section 2 Removal and Installation of Front Shock Absorber

The front axle of Chery SQR7246/7247/7206 automobile employs on-off type steering driving axle, and the suspension is McPherson independent suspension. The front suspension of SQR7246/7247/7206 automobile performs dual functions such as driving and steering. The upper end of the suspension is connected to vehicle body, whereas the lower end is joined to steering knuckle. The camber angle is adjusted via the connecting bolt that joins suspension and steering knuckle.

Ⅰ Exterior Identification

1. Disassembly drawing:



——Place lower rubber pad 68 on the tray of front shock absorber 52. Fit front buffer block 64 and front dust cover 62 over the piston rod of front shock absorber. And then fit coil spring 66. Compress the front coil spring to less than 275mm, then mount front spring upper tray 60, bearing gasket 58 and attachment bracket assembly 56 (including bearing) in sequence, finally torque nut 54 to specification and loosen the compressor of coil spring.

——When assembling, the two terminals of front coil spring shall contact with the corresponding set locations on the spring tray.

——Pay close attention to the mounting angle of front spring upper tray to prevent bearing from damage due to wrong fixing.

2. Removal and installation of front shock absorber

Disassembly procedure:

1) Jack the vehicle and then remove front wheels.

2) Remove hose, vehicle speed sensor cable of ABS (if available), hose bracket and brake cable clip from shock absorber.

3) Remove the steering knuckle with brake disc assembly from shock absorber.

a) Unscrew two nuts and bolts that join the shock absorber and the steering knuckle with brake disc assembly.

b) Unscrew the bolt that connects steering knuckle tie rod knuckle pin and steering knuckle with brake disc assembly, and then loosen the knuckle pin.

c) Unscrew the bolt that connects the front connecting rod to the shock absorber, and then loosen the front connecting rod.

d) Unscrew the bolt that connects the steering knuckle with brake disc assembly to control arm knuckle pin.

e) Unscrew the driving bolt from the front wheel.

f) Remove the steering knuckle with brake disc assembly from shock absorber.

Installation tips: apply engine oil to nut thread.

4) Remove both shock absorber and coil spring.

a) Remove the three nuts joining the shock absorber to vehicle body.

b) Remove the shock absorber together with coil spring.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

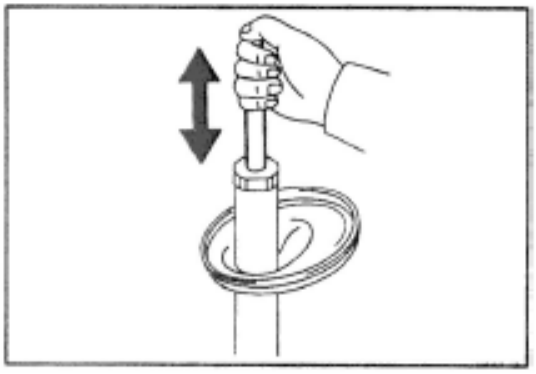
b) After installation, torque each bolt to specification.

c) Check the wheel alignment after installation

3. Inspection

1) Inspect shock absorber.

a) Inspect shock absorber for oil leakage, and replace if necessary. Then inspect the damping force of shock absorber, and replace it if not conform to the specification.

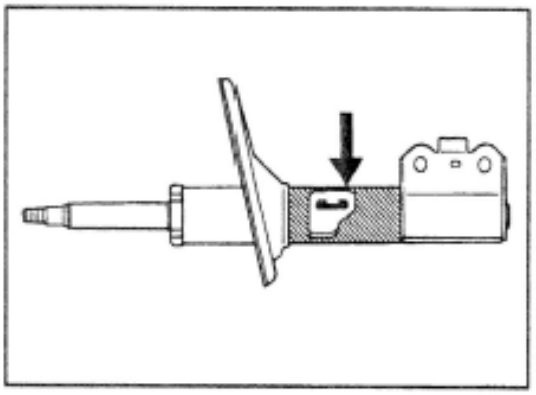


b) Inspect the thrust bearing for excessive wear or abnormal noise of block. Then inspect the lower spring seat for cracks or deformations. Subsequently inspect the limit stop for damages. Finally inspect the stop pad for wear, crack or deformation. **And** replace defective parts.

Note: Refer to the following procedures when discarding shock absorber.

2) Disposal of front shock absorber

a) Stretch the shock absorber rod as far as possible.



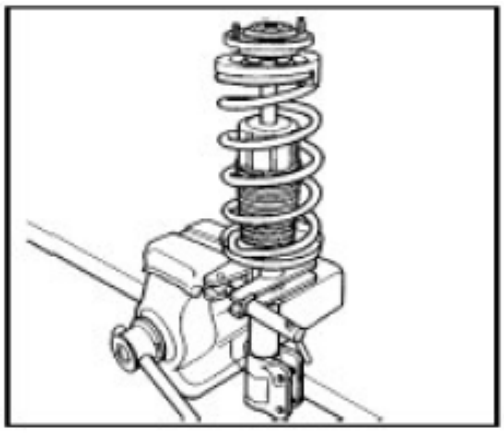
b) Discharge the gas inside the shock absorber cylinder by bit to drill a hole in the cylinder body (as shown in the figure).

Caution: The gas discharged is hazardous-free, however, and be cautious to scrap iron splashes when drilling the cylinder body.

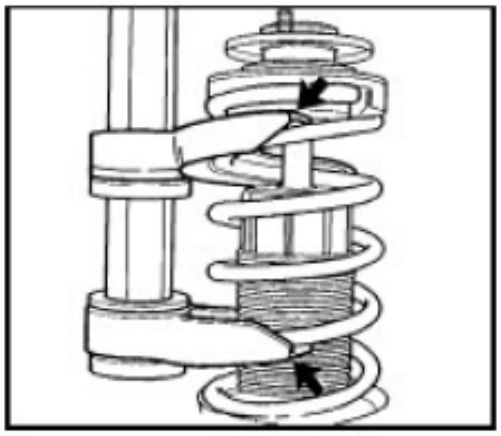
4. Removal and installation of shock absorber bracket, shock absorber bracket components and/or spring

Removal and installation of spring

1) If the assembly fixture cannot be fixed onto the workbench, fix it into bench vice.



2) Fix a pair of claws that match the spring diameter into the spring compressor.

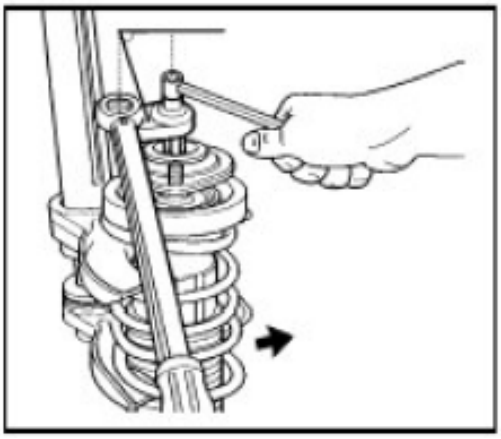


Disassembly procedures

1) Loosen the spring compressor, then locate the claws between the top and bottom of springs (As shown by the arrow).

2) Compress the spring till the spring is released from spring seat.

3) Remove the shock absorber support bracket with limiter and washer from connecting rod via ratchet wrench (as shown in the figure) that is used to unscrew lock nut.

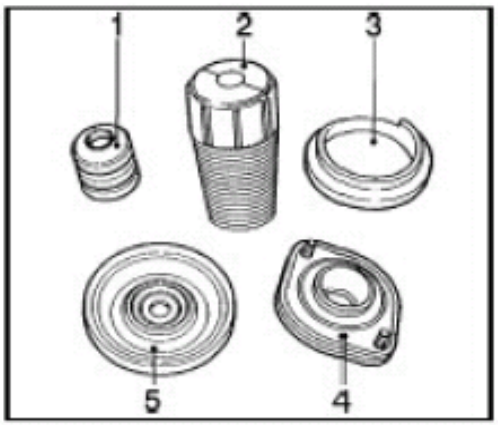


4) Remove the upper spring seat with absorber block.

5) Remove the spring compressor with spring and dust cover.

6) Remove buffer block.

7) Inspect the disassembled parts according to damage and wear condition.



a) Buffer block.

b) Dust cover.

c) Vibration isolator.

d) Shock absorber support bracket.

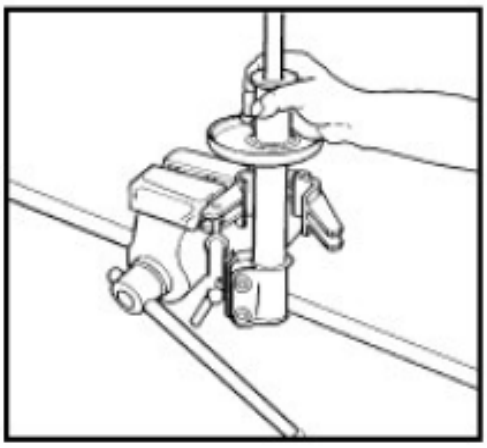
e) The upper spring seat with bearing and limiter.

8) If the used shock absorber needs to be replaced, firstly remove wheel speed sensor harness bracket from the shock absorber, then fix it onto a new shock absorber (if there is no wheel sensor

harness bracket, then directly replace the shock absorber).

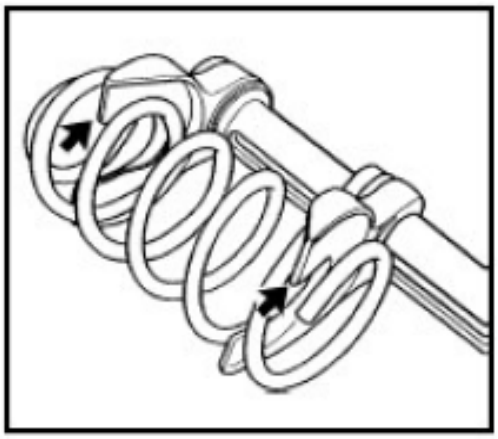
Installation procedures

1) Mount the new shock absorber into the assembling fixture.



2) If it is necessary to replace the used spring, loosen the spring, and then take out the used spring from the spring compressor.

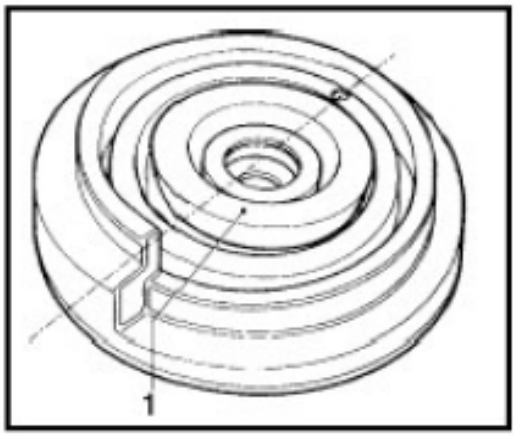
3) Insert the new spring into the spring compressor, then remain one circle at the upper part and one and a half circles at the lower part of the spring (as is shown by the arrow).



4) Compress the spring till the distance between the two claws is less than or equal to 120mm.

5) Confirm the position of buffer block limiter 1.

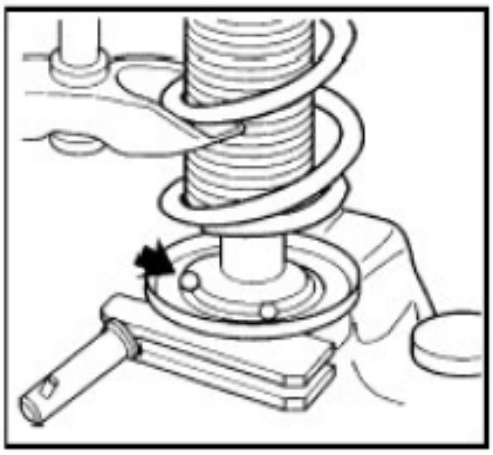
6) Fix the buffer block and pull the piston rod to the bottom.



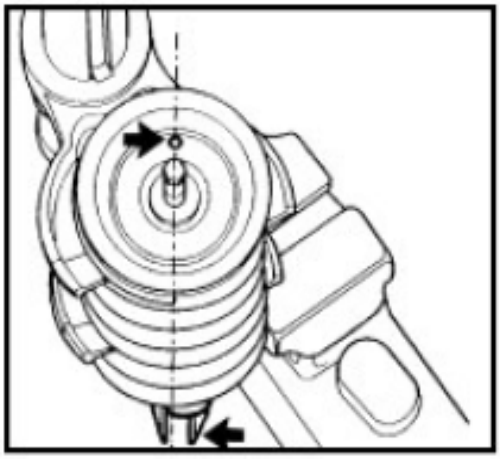
7) Place the spring onto spring seat.

Important cautions:

The spring end shall be located in the spacing hole (as shown by the arrow).



8) Fix the upper spring seat affixed with absorber block to the position where the punched hole offsets to tightening location of lower spring bracket by 180^0 (As shown by the arrow)

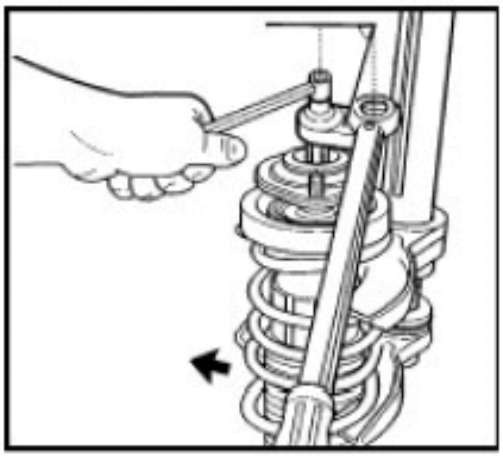


9) Fix the spacer bearing and localizer.

10) Tighten it by a new lock nut.

11) Tighten the new lock nut.

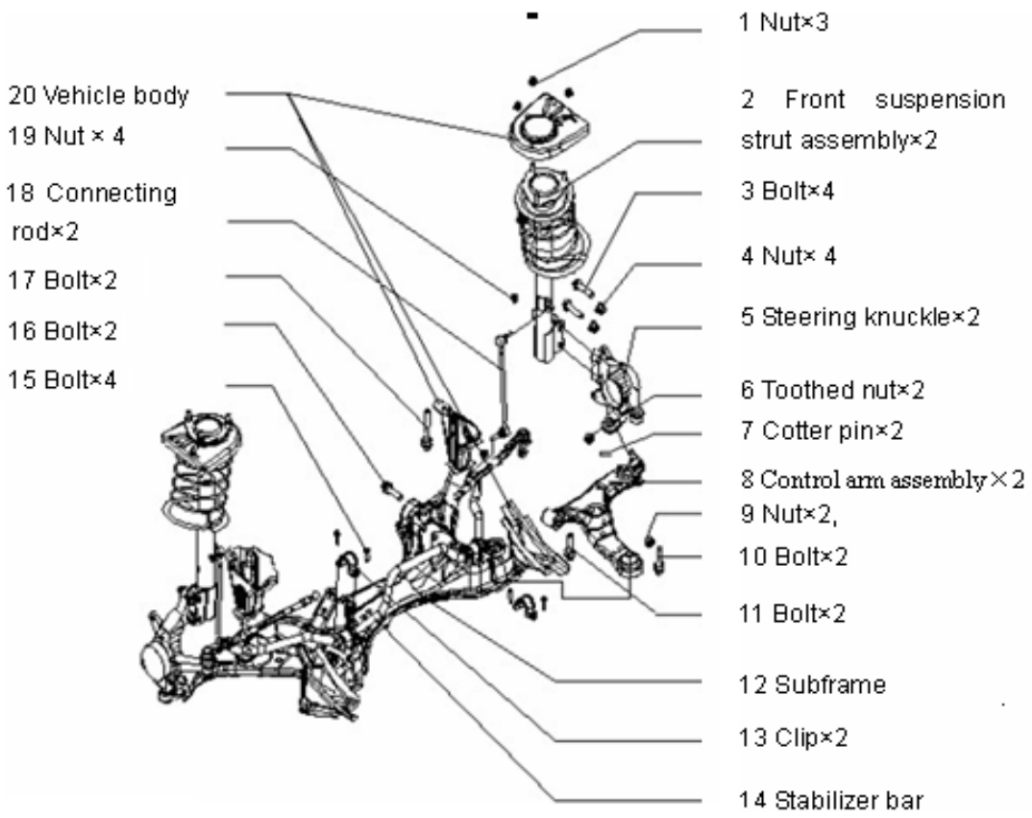
Important cautions: vertically use torque wrench(as shown in the figure).



Section 2 Front Axle and Front Suspension

Ⅰ Exterior Identification

Disassembly drawing:



——Join the control arm assembly 8 to subframe 12 with bolt 10, nut 9 and bolt 16, then torque to specification, and the left and right side torque shall be identical.

—— Join front suspension strut 2 to steering knuckle 5 by bolt 3 and nut 4, then torque to specification, and the left and right side torque shall be identical.

—— Join front suspension strut with knuckle assembly to the control arm knuckle pin by toothed nut 6 and cotter pin, then torque to specification, and the left and right side torque shall be identical.

——Respectively join the upper and lower end of front connecting rod 18 to front suspension strut assembly 2 and stabilizer bar 14 by nut 19, and then torque to specification, and the right and left torque shall be identical.

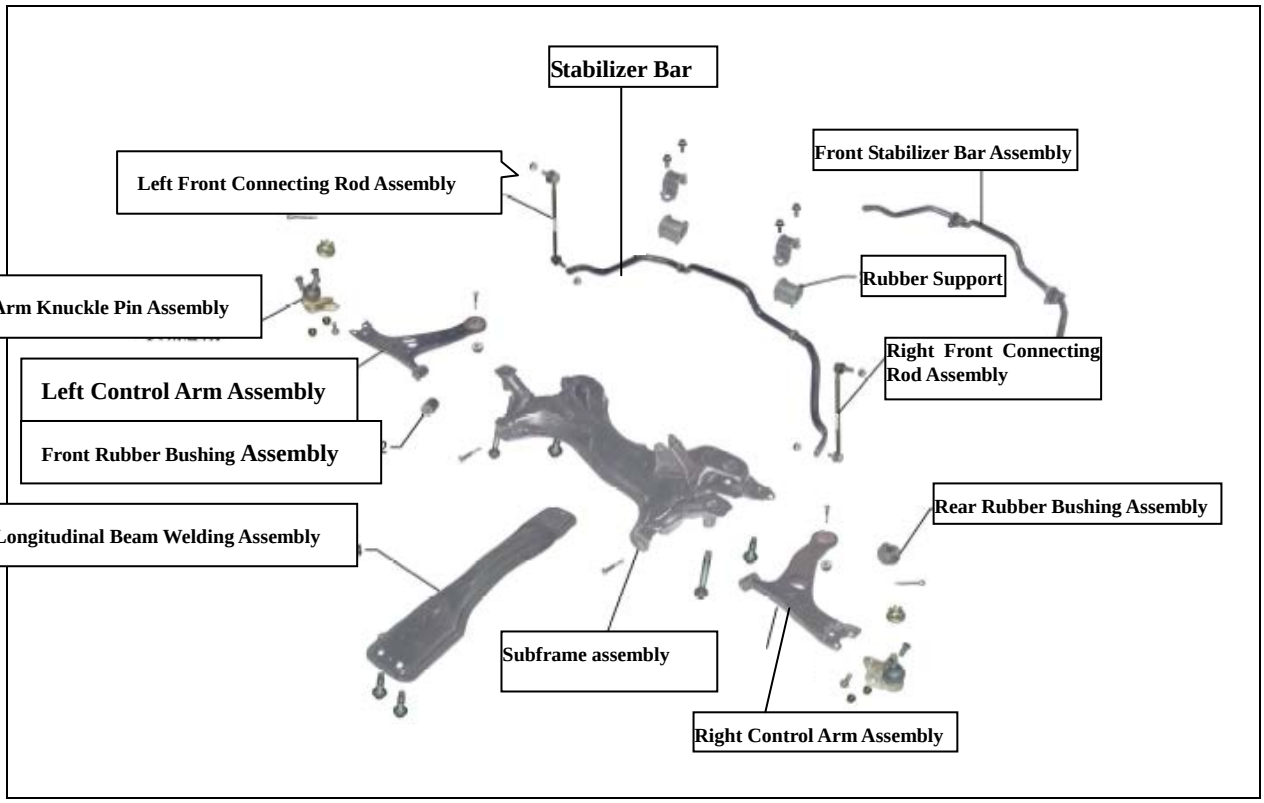
—— Respectively join the front and the rear subframe to vehicle body by bolt 17 and bolt 4, then torque to specification, and the left and right side torque shall be identical.

——Make the three studs of the front suspension strut assembly 2 go through the mounting holes

of vehicle body, then employ nut 1 to tighten them to specified torque, and the right and left side torque shall be identical.

Ⅱ Structural Drawing of Front Axle

Disassembly drawing:



Ⅲ Removal and Installation of Control Arm Assembly

Disassembly procedures:

1) Unscrew the connecting bolt that joins control arm and subframe.

2) Unscrew the connecting bolt that joins control arm knuckle pin and steering knuckle with brake disc assembly.

3) Unscrew the connecting bolt that joins the rear gum cover of control arm and subframe.

4) Remove the control arm from the vehicle.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

Ⅳ Removal and Installation of Control Arm Knuckle Pin

Disassembly procedures:

1) Remove the control arm assembly (Refer to the removal and installation section of control arm assembly).

2) Unscrew the connecting bolt that joins control arm to control arm knuckle pin.

3) Remove the control arm knuckle pin

Assembly procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

Ⅴ Removal and Installation of Front Connecting Rod

Disassembly procedures:

1) Unscrew the connecting bolt that joins front connecting rod and shock absorber.

2) Unscrew the connecting bolt that joins front connecting rod and front stabilizer bar.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

Ⅵ Removal and Installation of Front Stabilizer Bar Bushing

Disassembly procedures:

1) Unscrew the fixing bolt of the left and right connecting rod bushing.

(2) Loosen the fixing clip of balance bar bushing, then move the balance bar forward, and finally take out the bushing.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

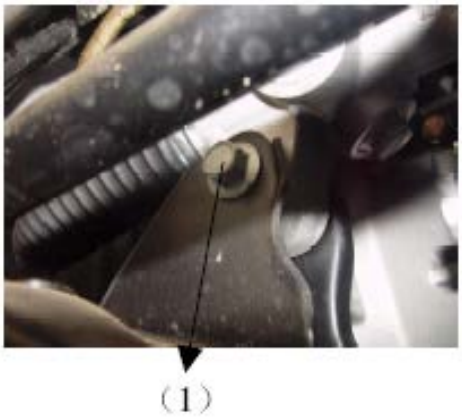
Ⅶ Removal and Installation of Subframe Assembly

Disassembly procedure

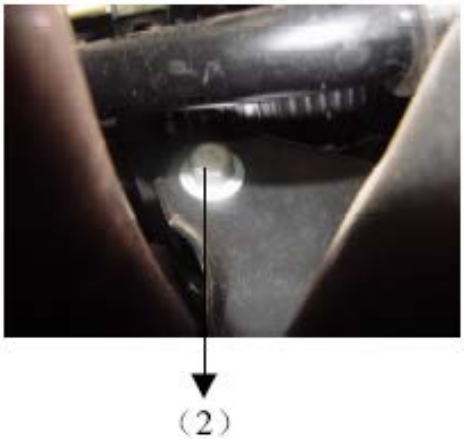
1) Remove the left and right control arms (Refer to the removal and installation of control arms).

2) Unscrew the connecting bolt that joins front connecting rod and stabilizer bar (Refer to the removal and installation of connecting rod).

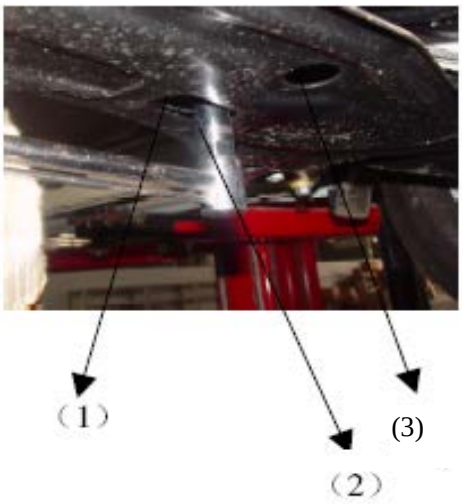
3) Unscrew the two connecting bolts (1) and (2) that joins steering gear and subframe.



(1)



4) Unscrew the connecting bolt and nut that joins subframe assembly and longitudinal beam welding assembly.

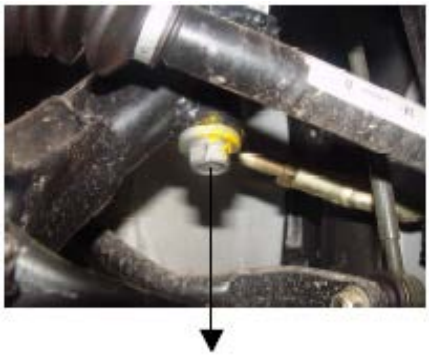


5) Unscrew the four connecting bolts that join subframe to vehicle body.

a) Unscrew the connecting bolt (1), (2), (3) and (4) that join subframe to vehicle body.

b) Remove the subframe assembly

Note: Prior to disassembling subframe, lift up the engine from front compartment so as to avoid engine from falling!



(2)

(3)

(4)

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit in screw fastening, it must be replaced.

b) After installation, torque each bolt to specification.

Ⅷ Removal and Installation of Front Stabilizer Bar

Disassembly procedures:

1) Remove the subframe assembly (Refer to removal and installation of subframe).

2) Remove the front stabilizer bar bushing (Refer to removal and installation of front stabilizer bar bushing).

3) Remove the stabilizer bar.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

Ⅸ Removal and Installation of Longitudinal Beam Welding Assembly

Disassembly procedures:

1) Remove the subframe assembly (Refer to removal and installation section of subframe assembly).

2) Unscrew the connecting bolt that joins engine front suspension and front suspension bracket.

3) Unscrew the two connecting bolts that join longitudinal beam welding assembly to vehicle body.

4) Unscrew the connecting bolt that joins rear suspension of engine to rear suspension bracket.

5) Unscrew the connecting bolt that joins longitudinal beam welding assembly to subframe.

6) Remove longitudinal beam welding assembly

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

X Removal and Installation of Front Drive Shaft

Disassembly procedures:

1) Remove the front steering knuckle with brake disc assembly (Refer to the removal and installation section of steering knuckle with brake disc assembly).

2) Remove the jacket snap ring from the front drive shaft, and then draw out the drive shaft.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

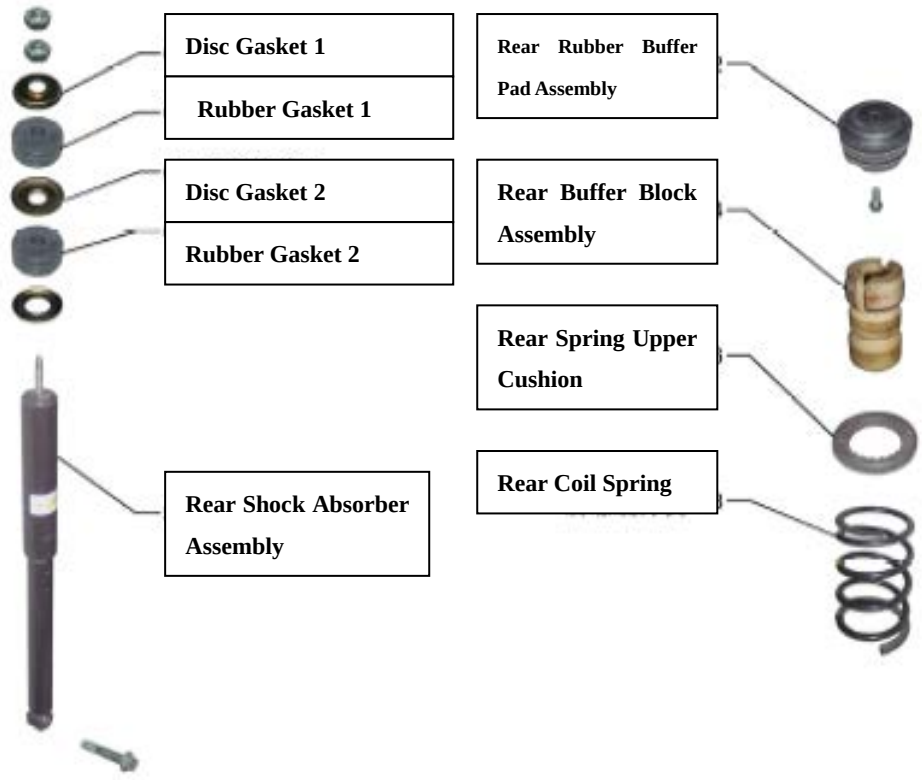
a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

Section 3 Removal and Installation of Rear Suspension Shock Absorber

Ⅰ Exterior Identification of Rear Shock Absorber

Disassembly drawing:



Ⅱ Removal and Installation of Rear Shock Absorber

Disassembly procedures:

1) Remove the protective cap of the rear shock absorber on the lower guard plate of column C.

2) Unscrew the connecting bolt that joins rear shock absorber to vehicle body.

3) Unscrew the fixing bolt that joins shock absorber to rear towing arm.

4) Remove the rear shock absorber.

5) Remove the shock absorber coil spring.

a) Remove the rear shock absorber.

b) Remove the rear connecting rod (refer to the removal and installation section of connecting rod).

c) Manually press the towing arm, and then the coil spring can be removed.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

c) Check the wheel alignment after installation

d) When assembling, first mount coil spring, then mount shock absorber (the towing arm shall be lifted when installing the fixing bolt for shock absorber and rear towing arm).

Ⅲ Inspection of Shock Absorber

1) Inspect shock absorber

a) Inspect shock absorber for oil leakage, replace it if necessary. Then inspect the damping force of the shock absorber, and replace it if not conform to specification.

b) Inspect the thrust bearing to see if there is any excessive wear or abnormal noise stuck; Inspect the lower spring seat for cracks or deformation; Inspect limit stop for damages; and inspect the stop pad for wear, cracks and deformation. Replace the defective parts.

Note: implement the following procedures when discarding shock absorber.

2) Discarding

a) Stretch the shock absorber rod as far as possible.

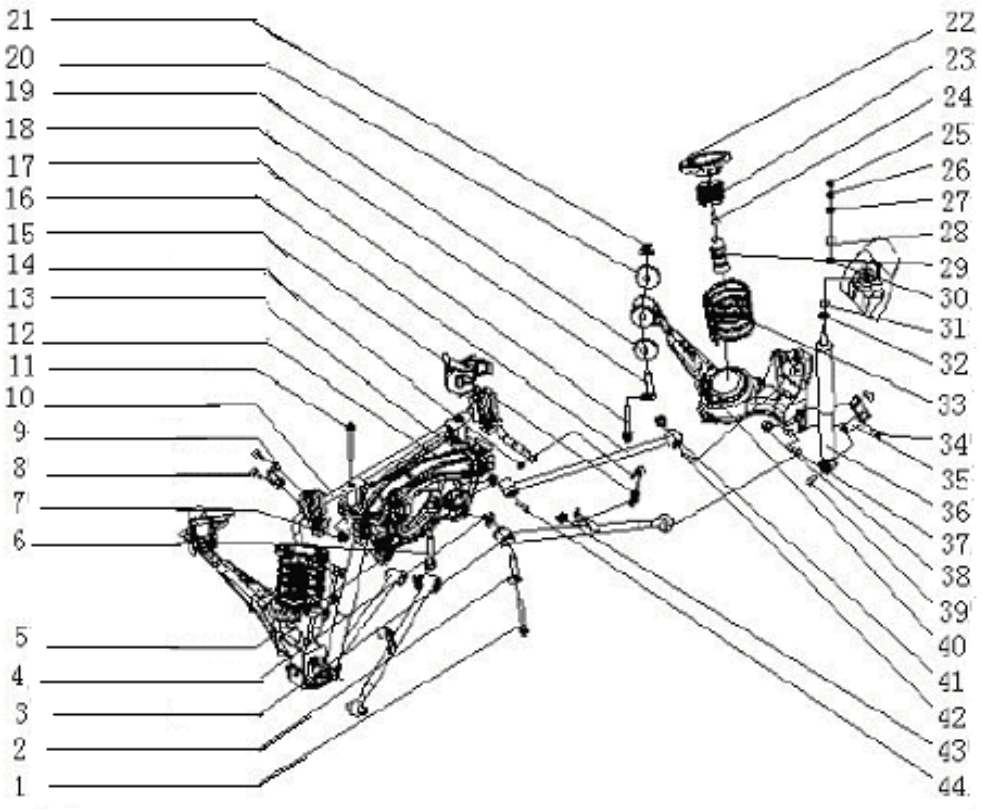
b) Discharge the gas inside the shock absorber cylinder by bit to drill a hole in the cylinder body.

Caution: The gas discharged is hazardous-free, however, be cautious to scrap iron splashes when drilling the cylinder body.

Section4 Removal and Installation of Rear Axle and Rear Suspension

ⅠExterior Identification

Disassembly drawing:



1 Bolt×4
2. Eccentric compensating pipe×4
3. Lower control arm×2
4. Eccentric adjust nut×2
5. Nut×4
6. Bolt×2
7. Nut×2
8. Bolt×2
9. Clip×2
10. Stabilizer bar assembly
11. Bolt×2
12. Rear subframe
13. Nut ×8
14. Nut×4
15. Connecting rod×2
16. Upper link×2
17. Bolt identical to 1
18. Eccentric compensating pipe identical to 2
19. Thin rubber cushion×2
20. Thick rubber cushion×2
21. Eccentric adjust nut identical to 4
22. Rear spring upper cushion×2
23. Buffer block support×2
24. Bolt×2
25. Nut×4
26. Nut identical to 25
27. Gasket×2
28. Buffer jacket×2
29. Rear buffer block×2
30. Gasket×4
3l. Buffer jacket×2
32. Gasket identical to 30
33. Rear coil spring×2
34. Bolt×4
35. Shock absorber mounting bracket×2
36. Shock absorber x 2
37. Bolt×2
38. Nut×2
39. Bolt×2
40. Rear towing arm×2
41. Nut identical to 13
42. Bolt×4
43. Nut identical to 14
44. Stud identical to 41

—— Join the upper link assembly 16 to the upper end of rear subframe assembly 12 by bolt 44 and nut 14, and the left and right sides shall be identical. Do not tighten the fasteners.

—— Join the lower control arm assembly 3 to the lower end of rear subframe assembly 12 by bolt 1, eccentric compensating pipe 2 and eccentric adjust nut 4, and the left and right side shall be identical. Do not tighten the fasteners.

——Join stabilizer bar assembly 10 to vehicle body by bolt 8 and clip 9, and the left and right side shall be identical. Torque the fasteners to specification.

—— Join shock absorber mounting bracket 24 to rear towing arm assembly 40 by bolt 23, and the left and right side shall be identical. Torque the fasteners to specification.

——Join the upper link assembly 16 to rear towing arm assembly 40 by bolt 42 and nut 41, and the left and right side shall be identical. Do not tighten the fasteners.

—— Join the lower control arm assembly 3 to rear towing arm assembly 40 by bolt 37 and nut 38, and the left and right side shall be identical. Do not tighten the fasteners.

—— Join gasket 32 (opening facing upward), buffer jacket 31, gasket 30 (opening facing upward, located at the upper part of vehicle body), buffer jacket 28 (with tooth at both upper and lower end surfaces), gasket 27 (opening facing downward), nut 26and nut 25 to vehicle body, and the left and right side shall be identical. Do not tighten the fasteners. Then screw the rear buffer block 29 into buffer block support seat 23.

—— Using bolt 11 (front, turning-proof, insert from vehicle interior), nut 7 (front, 110~130N.m) and bolt 6 to torque the rear subframe to the vehicle body to specification.

—— Respectively join both the upper and the lower ends of connecting rod to stabilizer bar 10 and lower control arm by nut 14 and 43, and the left and right side shall be identical. Do not tighten the fasteners.

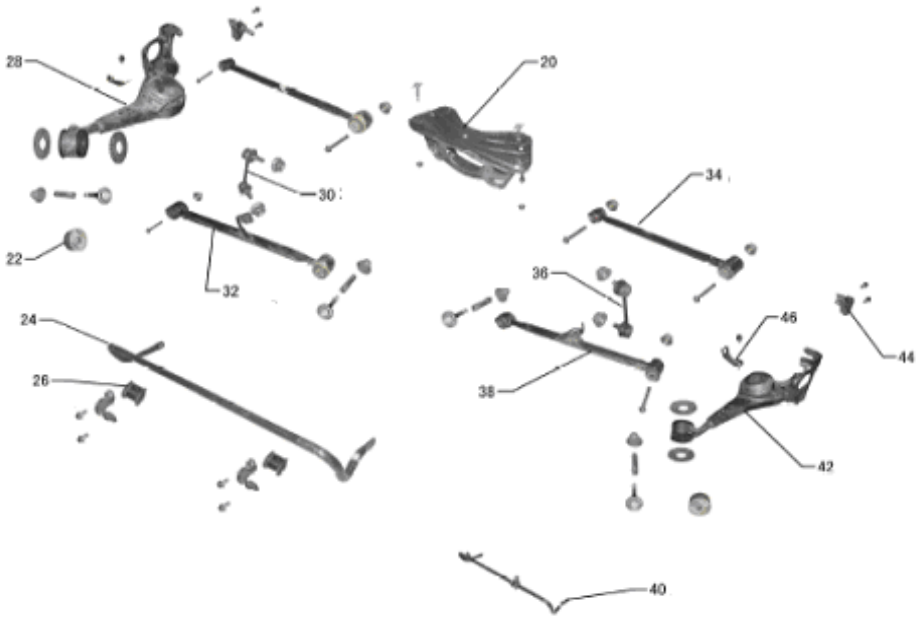
—— Join rear shock absorber 36 to shock absorber mounting bracket 35 by bolt 39, and the left and right side shall be identical. Do not tighten the fasteners.

—— Place rear coil spring 33 onto the mounting seat of rear towing arm 40, and join rear towing arm assembly to vehicle body by bolt 17, eccentric compensating pipe 18, thin /thick rubber pad 19/20 as well as adjust nut 21. The left and right side shall be identical. **Then** torque the fasteners to specification.

—— Torque the above mentioned bolts and nuts (not being tightened) to specification in sequence.

Ⅱ Structural Drawing of Rear Axle

Disassembly drawing:



20. Rear subframe welding assembly
22. Rubber bushing assembly
24. Rear stabilizer bar
26. Rubber support seat
28. Right rear towing arm assembly
30. Right rear connecting rod
32. Rear suspension right lower control arm assembly
34. Rear suspension upper link assembly
36. Left and right connecting rod
38. Rear suspension left lower control arm assembly
40. Rear stabilizer bar assembly
42. Left rear towing arm assembly
44. Left rear shock absorber mounting bracket assembly
46. Left pipeline bracket

Ⅲ Removal and Installation of Rear Connecting Rod Assembly

Disassembly procedures:

1) Unscrew the fixing bolt that joins rear connecting rod and rear suspension lower control arm.

2) Unscrew the connecting bolt that joins rear connecting rod and rear stabilizer bar.

3) Remove the rear connecting rod.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

Ⅳ Removal and Installation of Rear Suspension Lower Control Arm Assembly

Disassembly procedures:

1) Unscrew the connecting bolt that joins rear suspension lower control arm and rear towing arm.

2) Unscrew the connecting bolt that joins rear suspension lower control arm and rear connecting rod.

3) Unscrew the connecting bolt that joins rear suspension lower control arm and rear subframe welding assembly.

4) Remove the rear suspension lower control arm.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

V Removal and Installation of Rear Suspension Upper Link Assembly

Disassembly procedures:

1) Unscrew the connecting bolt that joins rear suspension upper link and rear towing arm.

2) Unscrew the connecting bolt that joins rear suspension upper link and rear subframe welding assembly.

3) Remove the rear suspension upper link.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

Ⅵ Removal and Installation of Rear Towing Arm Assembly

Disassembly procedures:

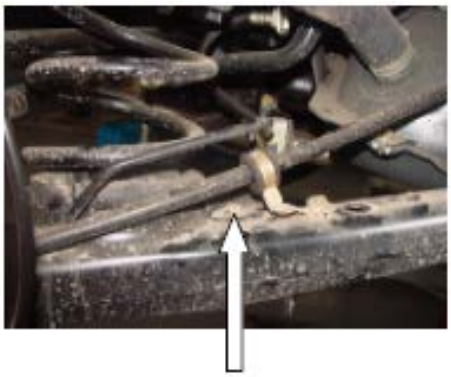
1) Unscrew the connecting bolt that joins rear towing arm and shock absorber hinge bracket.

2) Unscrew the connecting bolt that joins rear towing arm and upper link.

3) Unscrew the connecting bolt that joins rear towing arm and lower control arm.

4) Unscrew the connecting bolt that joins rear towing arm and hand brake cable bracket.

5) Unscrew the connecting bolt that joins rear towing arm and brake line bracket.



6) Unscrew the connecting bolt that joins rear-towing arm to vehicle body.

7) Remove the rear-towing arm.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

Ⅶ Removal and Installation of Rear Drive Shaft

Disassembly procedures:

1) Remove the rear disc brake with brake hub assembly (Refer to the removal and installation section of the rear disc brake with brake hub).

2) Unscrew the connecting bolt that joins rear drive shaft and rear axle.

3) Draw the rear drive shaft out of rear axle.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

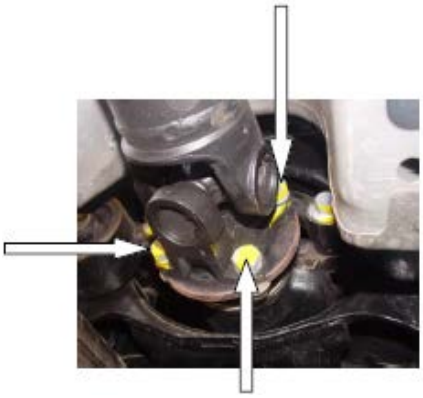
a) Once loosening the binding bolt whose **t**orque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

Ⅷ Removal and Installation of Intermediate Propeller Shaft

Disassembly procedures:

1) Unscrew the four connecting bolts that join intermediate propeller shaft and rear axle.



2) Unscrew the connecting bolt that joins intermediate propeller shaft bracket to vehicle body, and then remove the bracket.

3) Draw the intermediate propeller shaft out of the front cross universal joint.

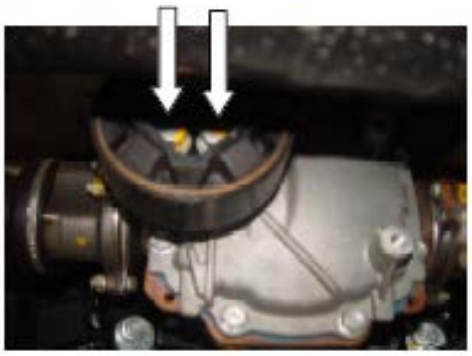
Ⅸ Removal and Installation of Rear Axle

Disassembly procedures:

1) Remove the left and right rear drive shafts (Refer to the removal and installation section of rear drive shaft).

2) Unscrew the connecting bolt that joins rear suspension cushion of rear axle to vehicle body.

3) Unscrew the connecting bolt that joins rear suspension cushion of rear axle and the rear axle, and then remove the rear suspension cushion of rear axle.



4) Unscrew the connecting bolt that joins rear axle and the front suspension cushion of rear axle.

5) Unscrew the connecting bolt that joins rear axle and intermediate propeller shaft (Refer to the removal and installation section of intermediate propeller shaft).

6) Remove the rear axle.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

X Removal and Installation of Rear Subframe Welding Assembly

Disassembly procedures:

1) Remove the intermediate pipe assembly (Refer to the removal and installation section of intermediate pipe assembly).

2) Remove the rear suspension lower control arm (Refer to the removal and installation section of rear suspension lower control arm).

3) Remove the left and right rear drive shafts assembly (Refer to the removal and installation section of rear drive shaft).

4) Remove rear suspension upper link (Refer to the removal and installation section of the rear suspension upper link).

5) Remove the rear axle assembly (Refer to the removal and installation section of rear axle).

6) Unscrew the four bolts that join the rear subframe welding assembly to the vehicle body.

7) Remove the rear subframe welding assembly.

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

XI Removaland Installation ofRear Stabilizer Bar

Disassembly procedures:

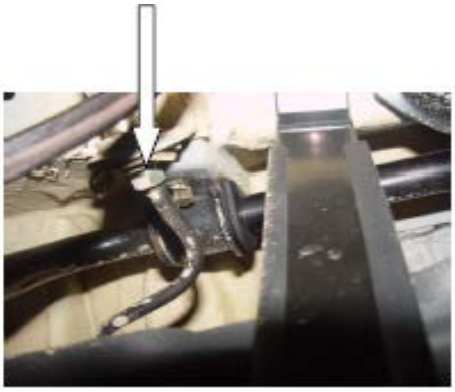
1) Remove the intermediate pipe assembly (Refer to the removal and installation section of intermediate pipe assembly).

2) Remove the intermediate propeller shaft assembly (Refer to the removal and installation section of intermediate propeller shaft).

3) Remove the fuel tank assembly (Refer to the removal and installation section of fuel tank assembly).

4) Unscrew the bolt that joins rear stabilizer bar and rear connecting rod (Refer to the removal and installation section of rear connecting rod).

5) Unscrew the bolt joining the rear brake line and the bracket, and then remove the rear brake line (one at each side).



6) Unscrew the bolt joining rear stabilizer bar to vehicle body. (One at each side).

Installation procedures:

1) Refer to disassembly procedures to perform assembly.

2) Precautions:

a) Once loosening the binding bolt whose torque and angle tightening condition is controlled by yield limit, it must be replaced.

b) After installation, torque each bolt to specification.

Steering System

General Description

T11 employs hydraulic power steering system, which consists of steering pump, steering engine, steering line, steering liquid reservoir, etc.

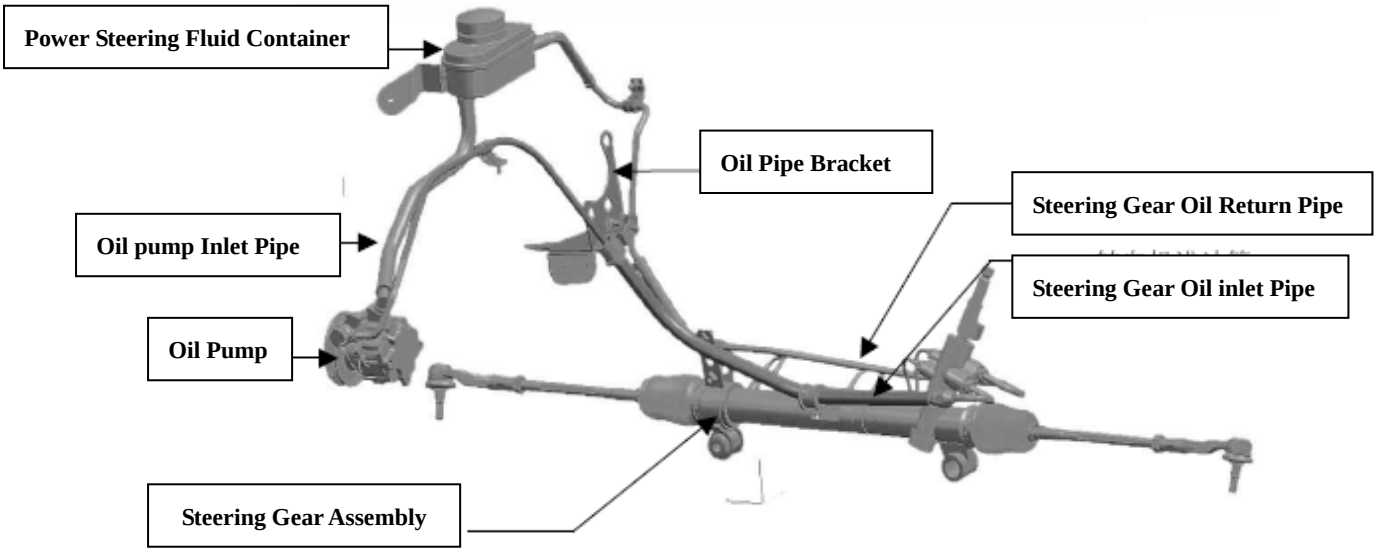
The steering gear is a kind of rack-and-gear power type. It employs rotary plug valve structure and outputs at two terminals. There is a dust cover at the joint of steering link and rack. The piston rod and rack are integrated into a single unit. The length of steering link can be adjusted to fit the toe-in. Steering gear link exterior ball is tightened to the knuckle by self-locking nut, so it is unnecessary to employ lock pin.

Steering pump is a kind of permanent flow vane type, and the maximum working pressure is 8±0.5Mpa. When the speed is between 1250rpm and 3000 rpm, the flow tends downward. When exceeding 3000rpm, the flow is not markedly increased. So it can guarantee satisfied "road felt" when running at high speed. It also improves driving safety when vehicle running at high speed. So please make every effort to avoid steering to the limit position for over 10 seconds when the vehicle is in service.

Steering oil pipe is used to supply steering oil. According to different distances and working characteristics among varied assembly components, the steering oil pipe of T11 is a kind of hybrid type combining steel pipe and hose. The connection between steel pipe and hose of high-pressure oil pipe assembly is a kind of cutting sleeve junction, so it has reliable sealing performance. The connection of oil pipe and steering gear employs bolt and O-ring, which also ensures reliable sealing.

The main functions of steering liquid reservoir include: store oil and supply oil to oil pump and system; radiate heat and reduce the oil working temperature; filter impurities and ensure the cleanliness of working oil and fluid. Oil type shall be Shell Donax ATF, and the implementation standard of automatic gearbox oil shall be Dexron Ⅲ.

Layout



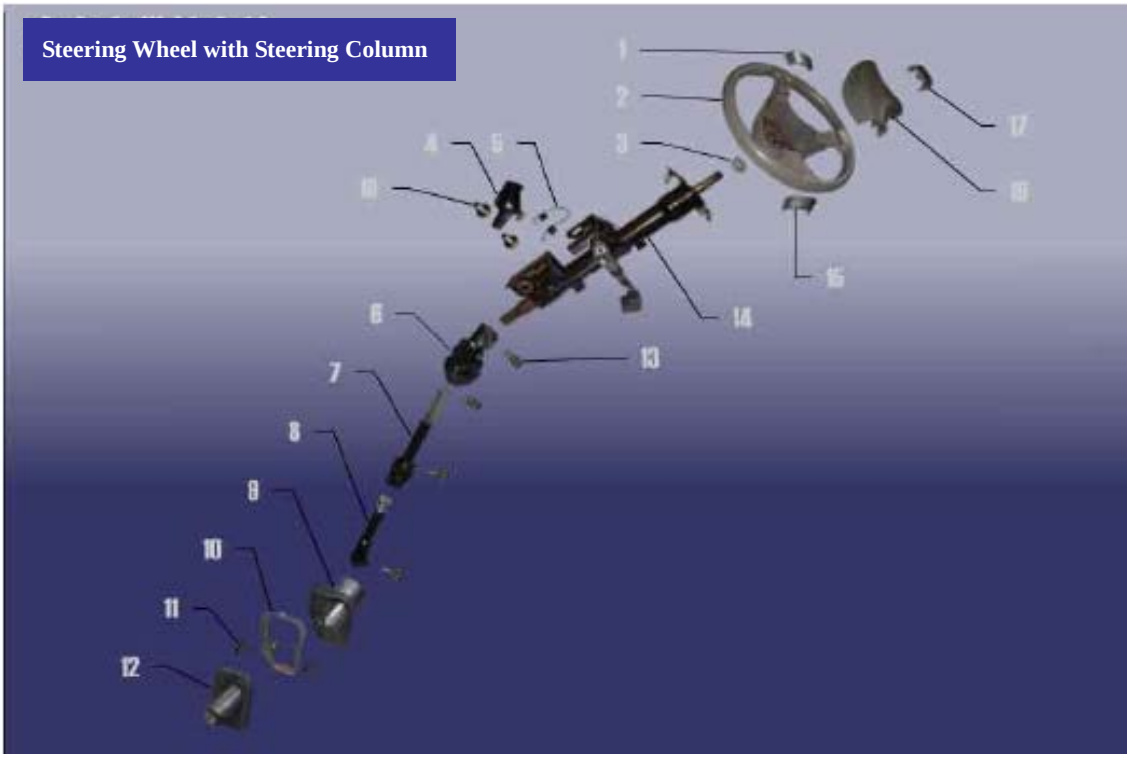
Fastener Tightening Specification

Application	Specification	Tightening torque
Steering wheel fixing nut	M12×1.2 5	27~33N.m
Steering column upper bracket fixing bolt	M8×25	23~27N.m
Steering column lower bracket fixing bolt	M8×50	23~27N.m
Steering column pivot and universal joint fixing bolt	M8×30	20~30N.m
Binding bolt of middle steering universal joint spline	M8×30	25~30N.m
Binding bolt of middle and lower universal joint	M8×30	25~30N.m
Binding bolt of steering gear input shaft	M8×30	25~30N.m
Mounting bolt of power steering gear	M12×65	75~85N.m
Steering gear steering knuckle tie rod and rack clamp nut	M18×1.5	122.6~142.2N.m
Steering gear steering knuckle tie rod and knuckle fixing nut	M12×1.5	35~45N.m
Steering pump and bracket	M8×1.2 5	20~30N.m
Steering pump and engine cylinder housing	M10×1.5	70~80N.m
Tension pulley lock nut	M10×1.25	20~30N.m

Joint Tightening Specification

Application	Specification	Tightening torque
Two oil pipe joints of power steering gear		24.5~34.3N.m
Power steering high pressure hard tube and steering gear	M18×1.5	27~33N.m
Power steering high-pressure oil pipe and steering pump		40~50N.m
Steering gear and oil return pipe joint	M16×1.5	27~33N.m

Disassembly Drawing



1-15-17. Spoke trim cover
2. Steering wheel
3. Steering wheel nut
4. Mounting bracket
5. Adjusting spring
6. Upper universal joint universal joint
7. Lower
8. Intermediate shaft
9. Steering upper shield
10. Jacket fixing bracket
12. Steering lower shield
13. Fixing bolt
14. Adjustable steering column
17. Horn hood assembly
18. Fixing bolt

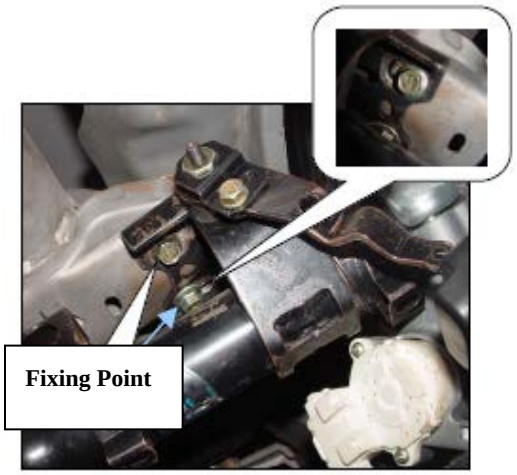
Removal and Installation of Steering System

Steering Column

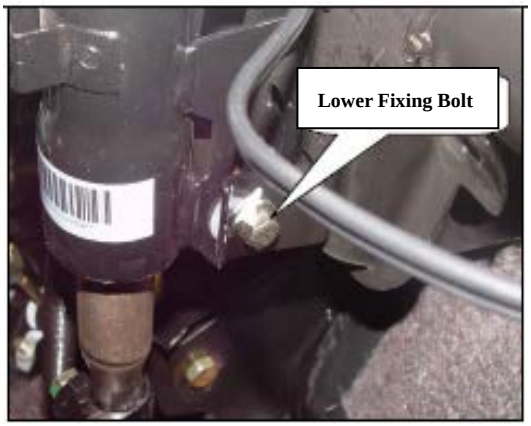
1) Remove the steering wheel (Refer to the section of accessory removal and installation).

2) Remove the left lower shield (Refer to the section of accessory removal and installation).

3) Loosen the upper fixing bolt of steering column.



4) Loosen the lower fixing bolt of steering column.



5) Loosen the intermediate shaft lock nut that connects to the steering gear.

6) Remove the steering upper and lower shield.

7) Remove the steering column assembly.

8) The mounting of steering column shall be performed in accordance with the inverted sequence of removal.

Torque:

Steering wheel nut :27～33N.m

Upper fixing bolt: 25～30N.m

Intermediate shaft and steering gear input shaft: 25～30N.m

Steering Gear

1) Drain the power steering liquid.

a) Lift the vehicle to make the wheel off the ground.

b) Dismount the power steering oil-return hose from power steering liquid reservoir.

c) Put oil-return hose into a tank than can contain the discharged steering liquid.

d) Start the engine, and perform idle running.

e) Turn the steering wheel come-and-go to the limit position.

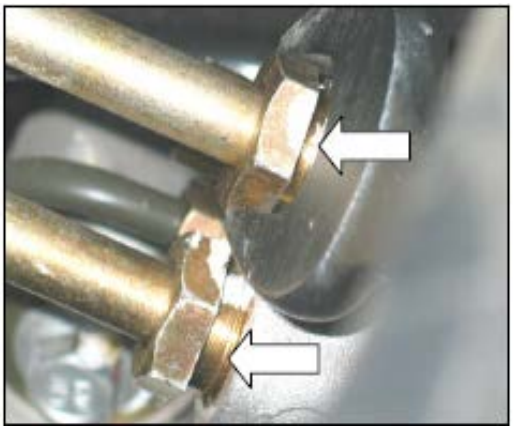
Caution: never keep still when bringing down, otherwise hydraulic system will be damaged.

f) Ensure the steering liquid is completely drained, and then stop the engine.

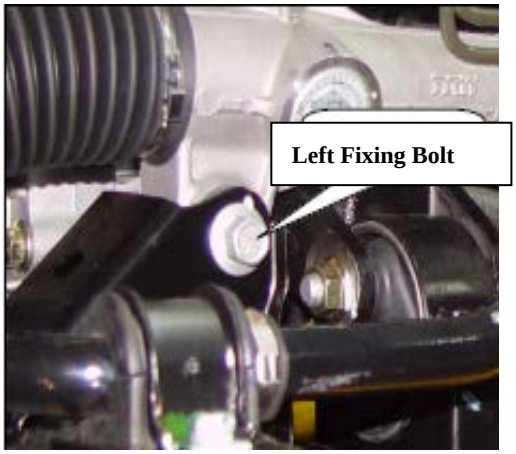
2) Elevate the vehicle.

3) Loosen the upper and lower jacket of steering gear.

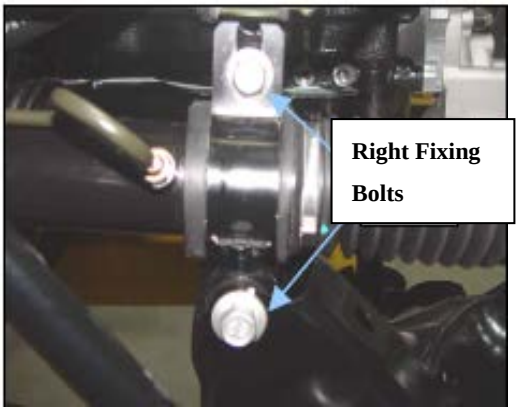
4) Loosen the high and low-pressure oil pipe.



5) Loosen the left side fixing bolt of steering gear.



6) Loosen the right side fixing bolt of steering gear.



7) Loosen the bolt that connects right and left steering knuckle tie rod and the knuckle.

8) Remove the steering gear assembly.

9) The mounting of steering gear shall be performed in accordance with the inverted sequence of removal.

Torque:

Mounting bolt of power steering gear: 75～85N.m

The connection between steering tie rod and the knuckle: 45N.m

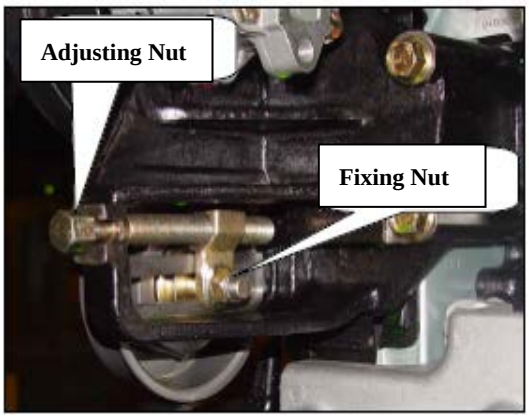
Steering Oil Pump

1) Drain the power steering liquid

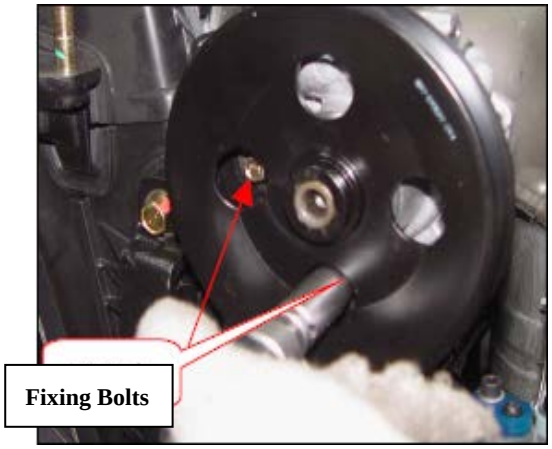
2) Loosen the oil pump belt.

a) Loosen the fixing bolt of tension pulley

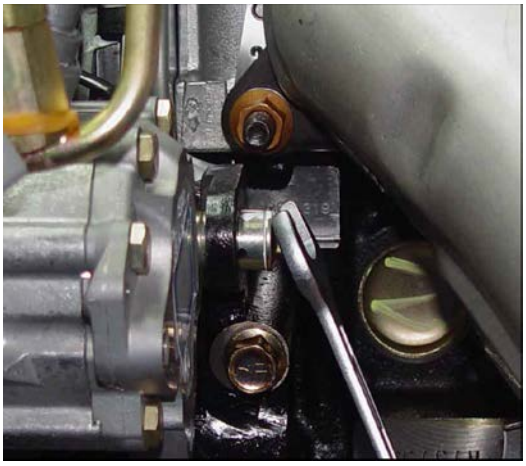
b) Turn the adjusting bolt counterclockwise to loosen the belt.



4) Loosen the two fixing bolts under the pulley.



5) Loosen the fixing bolt at opposite side.



6) Remove the oil pump.

7) The mounting of steering oil pump shall be performed in accordance with the inverted sequence of removal.

Torque:

Tightening of steering oil pump: 20～30N.m

Lock nut of tension pulley: 32～38N.m

Steering oil pump and high-pressure oil pipe: 40～50N.m

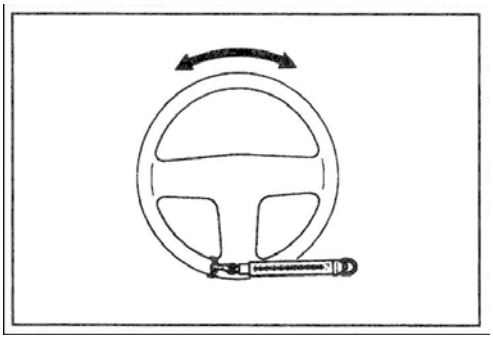
Maintenance Guide

Ⅰ Inspection of Steering Wheel Play

1) Keep the front wheel straightly facing forward when the engine is working (hydraulic system is working).

2) Slightly turn steering wheel to the right and left, and before the steering wheel begins turning, measure the free play of steering wheel circle.

Limit value: 40mm.



3) If the free play exceeds limit value, inspect the gap of steering shaft joint and steering linkage, finally rectify or replace related spare parts according to certain circumstances. If the free play still exceeds limit value, turn steering wheel right ahead when engine stops, finally apply 5N load to the steering wheel circle and inspect the free play again.

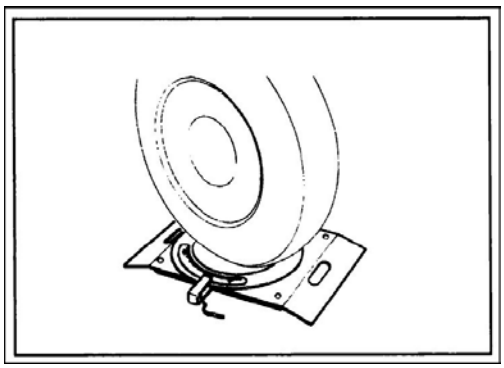
Standard value (steering wheel free play when engine stops): less than 15mm.

If free play exceeds standard value, dismount steering gear housing and inspect the gross torque of pinion gear.

Ⅱ Inspection of Steering Angle

1) Put the front wheel on a steering radius testing device, then measure the steering angle.

Standard value: the inner side wheel shall be 37°45′16″, and the outer side wheel shall be 29°46′34″.

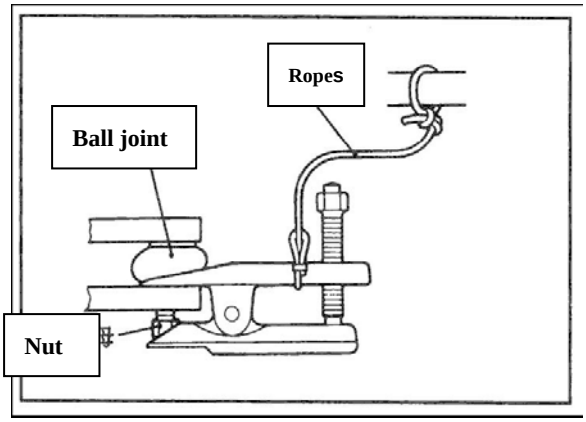


3) When the steering angle exceeds the scope of standard value, the toe-in may have troubles, then adjust the toe-in, finally inspect the steering angle again.

4)

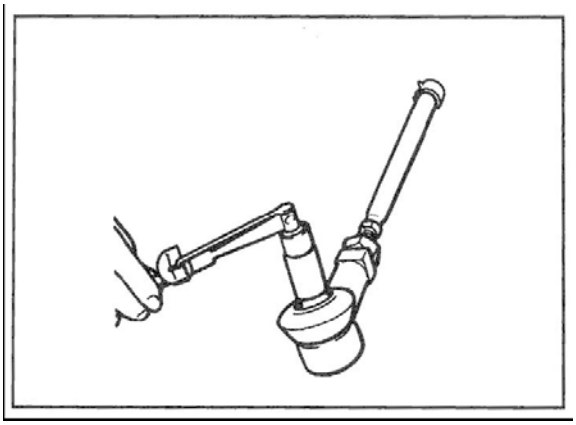
Ⅲ Inspection of the Starting Torque of Steering Tie Rod Ball Joint

1) Apply special tools to disconnect steering tie rod and knuckle.



2) When the starting torque exceeds standard value, replace the steering tie rod end.

3) When the starting torque is less than standard value, inspect ball joint to see whether there exists axial play or engagement problem. If there is no problem, the said ball joint still can be used.

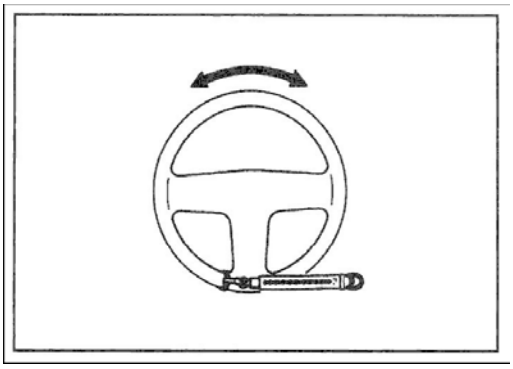


Ⅳ Inspection of Static Steering Force

1) Park the vehicle at a level road, and turn the steering wheel right ahead. Start the engine, adjust engine speed to 1000±100r / min.

Caution: after examining the engine speed, by all means return it back to standard idle speed.

2) Connect a spring balance to the outer circle of steering wheel, then measure the steering force required when turning the steering wheel leftward and rightwards (within 1.5 circles) at dead-ahead position. Additionally, the required steering force shall also be inspected to see whether there exists obvious fluctuation.



Standard steering force: less than 34N.

Fluctuation tolerance: less than 5.9N.

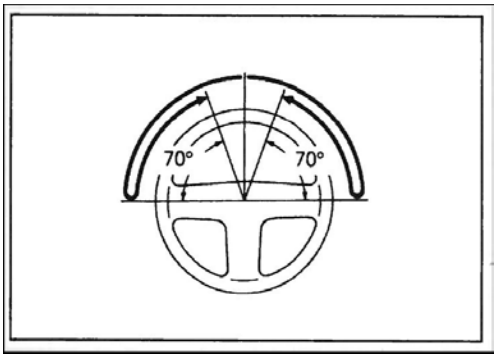
3) If the measured force exceeds standard value, please refer to trouble shooting section for inspection and adjustment.

Ⅴ Inspection of the Performance of Steering Wheel ReturningBack to the Center

This test shall be performed during road performance test and inspect the following contents:

1) Make smooth turn and sharp turn, then check the driving "sense" to ensure there is no difference between left and right turning in terms of steering force and steering wheel returning center.

2) When vehicle speed is between 20 to 30km / h, turn the steering wheel by 90°, after 1 or 2 seconds and release the steering wheel. If steering wheel subsequently returns over 70°, the returning function can be deemed as all right.



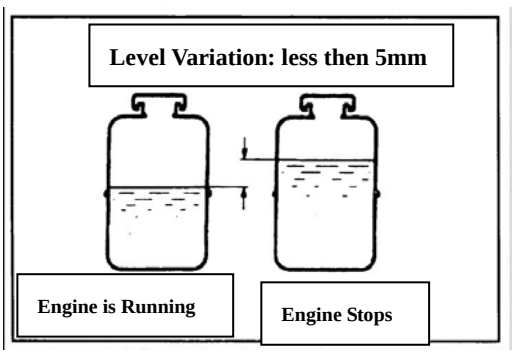
Remark: when rapidly turning the steering wheel, there will be a transient sense of “heavy”, however, this does not indicate it is abnormal (this is because of insufficient oil supply of oil pump during the period of idle speed).

Ⅵ Inspection of Liquid Level

Park the vehicle at a horizontal and level road, and then start the engine. After that, turn the steering wheel for several times to heat the oil to 50 - 60 ℃.

1) When the engine is running, turn the steering wheel left and right to the limit position, and repeat this operation for several times.

2) Check the oil reservoir to see whether there are foams or presents milk-like material, and check the liquid level difference when the engine is off and running. If liquid level variation exceeds over 5mm, the air shall be exhausted.



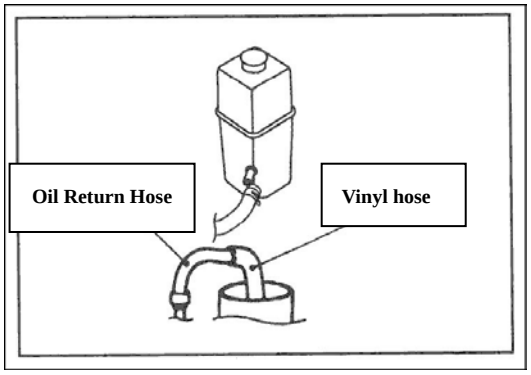
Ⅶ Replacement of Steering Gear Oil

1) Jack the front wheel, and apply rigid bracket to sustain it.

2) Disengage the oil-return hose coupling.

3) Connect vinyl hose onto oil-return hose, and then drain the oil into a container.

4) Disconnect high voltage cable, then discontinuously run the starting motor, in the mean time, turn the steering wheel left and right to the limit position and repeat this operation for several times to discharge all of the steering gear oil.



Caution: never place high voltage cable beside a carburetor or oil outlet pipe.

5) Firmly connect the oil-return hose, and then secure it by fastener.

6) Fill specified steering gear oil into oil reservoir till reach the lower limit position of oil filter, and then exhaust the air. Specified steering gear oil: automatic transmission oil ATF Ⅲ.

Chapter Ⅴ

Body and Accessories

Section 1 Removal and Installation of Accessories

Ⅰ Door and Door Lock

1. Specification

Specifications of Tightening Torque

Specification	Description
36±4	Connection between upper hinge of left/right front door and body
36±4	Connection between upper hinge of left/right front door and door
36±4	Connection between lower hinge of left/right front door and body
36±4	Connection between lower hinge of left/right front door and door
36±4	Connection between upper hinge of left/right rear door and body
36±4	Connection between upper hinge of left/right rear door and door
36±4	Connection between lower hinge of left/right rear door and body
36±4	Connection between lower hinge of left/right rear door and door
36±4	Connection between upper hinge of back door and body
50±5	Connection between upper hinge of back door and door
35±3	Connection between lower hinge of back door and body
50±5	Connection between lower hinge of back door and door
23±2	Connection between left hinge of engine hood and body
23±2	Connection between left hinge of engine hood and engine hood
23±2	Connection between right hinge of engine hood and body
23±2	Connection between right hinge of engine hood and engine hood
l0±l	Connection between rear mounting bracket of front fender and body
l0±l	Connection between left/right front fender and body
l0±l	Connection between water tank crossmember assy. and body

2. Engine Hood

Removal and Installation of Engine Hood

1) Loosen 4 fixing bolts for the hinge, and lift the engine hood.
2) Remove the engine hood.
3) Install in the reversed sequence.

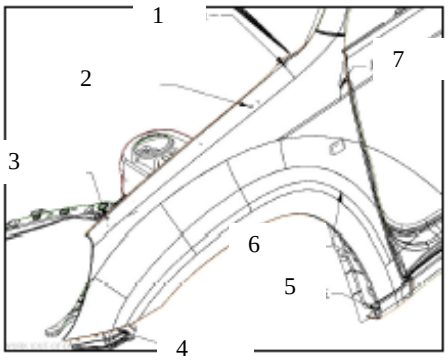
Tightening Torque for cconnection between engine hood and its hinge: 23±2Nm

Part No.: Ql400820 (2 pcs)

3. Removal and Installation of Hinge

1) Removal of fender

The fender is fixed by 7 bolts in tightening torque of 10Nm at the mounting places as shown in the figure.



2) Loosen 2 fixing bolts and remove the hinge.

3) The gap between engine hood and the body can be adjusted by the rubber pad at both sides of the engine hood.

4) Install in the reversed sequence.

Tightening Torque for connection between engine hood and the body: 23±2

Part No.: Q1400820 (2 pcs)

4. Removal and Installation of Doors

Right Front Door

1) Dismantle the fixing bolts for the hinge of front door.
2) Dismantle the fixing bolts of door stopper.
3) Remove the front door.

   Please refer to the removal procedure of right front door for the disassembly of the other doors except the back door.

4) Install in the reversed sequence.

   Tightening torque for connection between left/right front door hinge and body: 36±4

   Part No: T11-6101001 (4 pcs)

   Tightening torque for connection between left/right front door hinge and door: 36±4

   Part No.: T11-6101001 (4 pcs)

   Tightening torque for connection between left/right door stopper and body: 11Nm

   Part No: Q1840616 (2 pcs)

5. Removal and Installation of Back Door

1) Dismantle two fixing bolts connecting back door and hinge.

2) Unplug the wiring harness of back door from the wiring harness of the body.

3) Dismantle two fixing bolts of rear door stopper on body.

4) Remove the wiring harness of back door together with back door.

5) Install in the reversed sequence.

Tightening torque for connection between hinge and body: 36±4Nm

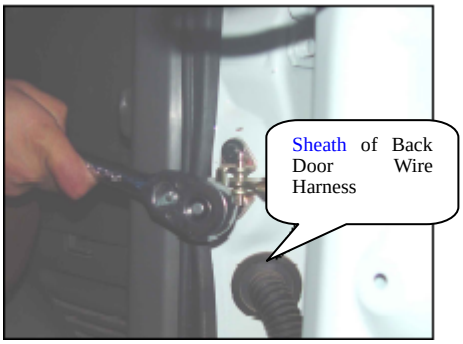
Part No.: T11-6301013 (4 pcs)

Tightening torque for connection between hinge and door: 50±5Nm

Part No.: T11-6301011 (4 pcs)

Tightening torque for connection between back door stopper bracket and the body: 27Nm

Part No.: Q1840816 (2 pcs)



6. Removal and Installation of Lock

Lock of Engine Hood

1) Dismantle the upper part of the lock of engine hood.

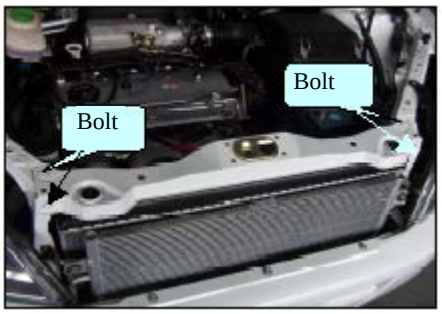
2) Dismantle the lower part of the lock.

Note: The lower part of the lock is riveted, and normally no need to be dismantled. Rivet may be damaged during dismantling.

3) Remove the cable for the lock of engine hood.

   a. Dismantle the beam assembly above the water tank firstly.

   b. Loosen the pull lock of engine hood.



4) Install in the reversed sequence.

Tightening torque for connection between upper part of the lock for engine hood and the body: 11Nm

Part No.: Q1420616 (4 pcs)

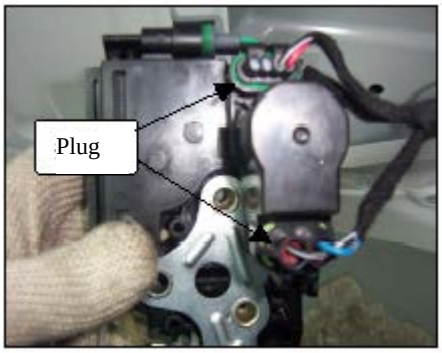
Tightening torque for connection between beam assembly above water tank links and the body: 10 Nm

Part No.: Q1420616 (4 pcs)

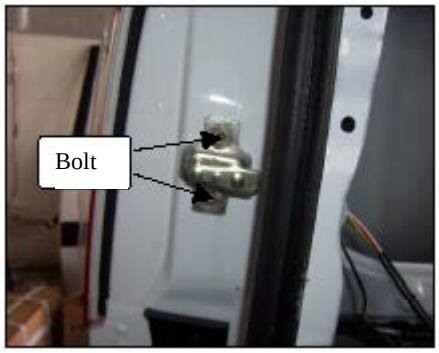
Lock of back door

1) Dismantle the lock body.

2) Pull out the plug for wiring harness.



3) Dismantle the lock buckle.



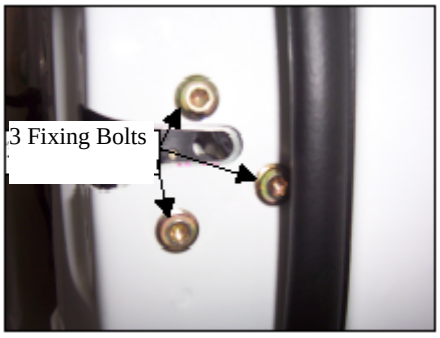
4) Install in the reversed sequence.

Tightening torque for connection between rear door lock and the body: 15Nm
B11-6105011 (3 pcs)

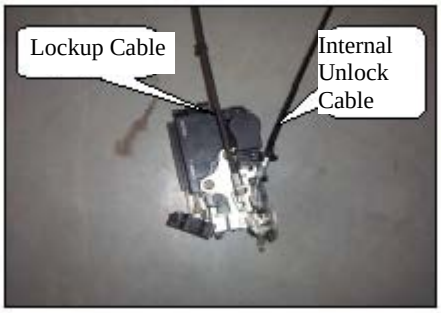
Tightening torque for connection between the lock buckle of rear door and the body: 12±2Nm
B11-6105011 (3 pcs)

Lock of 4 doors

1) Dismantle the lock for the right front door.



2) Remove the internal unlock cable and lock up the lockup cable.



3) Dismantle the lock buckle with screwdriver.

4) Install in the reversed sequence.

Tightening torque for connection between lock assembly and the door: 9±1Nm
B11-6105011 (3 pcs)

Tightening torque for connection between lock buckle and the body: 12±2Nm
Q2580830 (3 pcs)

Note: Please refer to the removal procedure of right front door for the disassembly of the rest three doors.

7. Door Adjustment

Left/Right Back Door

Have the door gap well adjusted with spacer gauge (adjust the gap between back door and triangle window to be 8±1. 5mm, 6±1mm at side fender, and 6±1mm at doorsill, levelness 0-0.5mm as shown by the arrow) and leveled with magnet, then place the nut (Q32008, 2 pcs both upper and down) into the socket of pneumatic wrench and tighten up, torque: 35±3Nm.

Check-up:

(1) Any scratch from the assembly; whether the bolts and nuts are well assembled, and any slip in the thread and so on.

(2) Whether the gap between back door and side fender and the levelness are within the specification, and the edge of back door shall be 0~0.5mm higher than the side fender.

Left/Right Front Door

Have the door gap well adjusted with spacer gauge (the gap of upper section between front door and back door shall be 5.5±0.7mm; 5.5±0.7mm at outside board, 6.5±1mm between front door and pole A, and 6±1mm between front/back door and doorsill, levelness 0-0.5mm as shown by the arrow) and leveled with magnet, then screw the bolt (PART NO:: T11-6101103, 2 pcs both upper and down) into the body for 2~3 turns, finally tighten up with pneumatic wrench, torque: 35±3Nm.

Check-up:

(1) Any scratch from the assembly; whether the bolts and nuts are well assembled,any slip in the thread and so on.

(2) Whether the gap between front door and back door and levelness are within the specification, and the edge height shall be 0~0.5mm.

Rear door

Assemble the rear door and have the levelness and gap between the rear fender and side fender well adjusted to the specification of levelness 0~0.5mm, 5.8±1mm between rear door and the upper part of side fender, 6.4±1mm at the middle part of side fender, and 6.2±1mm at the tail lamp (as shown by the arrow) have the levelness and gap between rear and head cover well adjusted to the specification of 9. 3±1. 5mm; Check the gap between rear door and side fender as well as head cover with the same specification of above, then tighten up the bolts (PART NO:: T11-6301011, 2 pcs both upper and down) by pneumatic gun (the torque between rear cover and hinge, body shall be 50 Nm±3Nm).

Check-up:

Torque check-up: Check the torque at the rear door by torque wrench to be 50+3Nm.

Engine hood

Assemble the engine hood: Have the levelness and gap between engine hood and the fender well adjusted to the specification of 5±0.5mm, levelness 0~0.5mm; Tighten up the bolts (Q1400820, 2 pcs both left and right) by pneumatic bent wrench to fix the engine hood to the hinge (torque 30±4Nm).

Check-up:

(1) Check the matching between engine hood and the fender, and the horizontal aligness with the front end of the fender (0~0.5mm).

(2) Check the matching of 4 doors, front fender and rear door with specification, whether there is any slip thread in the nut and bolt.

Ⅱ Interior

1. Dismantle CD Assembly

1) Lift one end of the decorative cover of cover panel by flat screwdriver, and remove the decorative cover.

2) Dismantle the fixing nut from the CD player by socket wrench.

3) Unplug the plug for wiring harness.

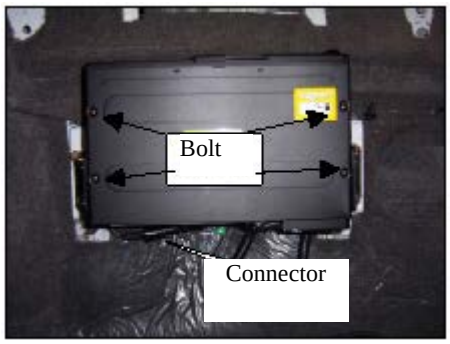
4) Install in the reversed sequence.

Tightening toqure for CD Player fixing nut: 9±3Nm

Part No.: Q17480612 (4 pcs)

2. Dismantle 6-disc Storage Device

1) Dismantle the 4 fixing bolts on the mounting bracket of front passenger.

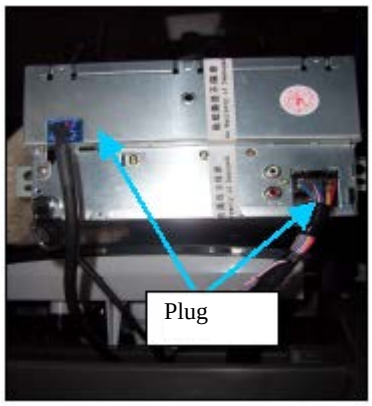


2) Unplug the plug for wiring harness.

3) Remove the strorage device..

Tightening torque for the stroage device bolt: 9±3Nm

Part No.: Q1460616 (4 pcs)



3. Dismantle Control Panel of Air Conditioner

1) Lift one end of the decorative cover of control panel by flat screwdriver, and remove the decorative cover.

2) Unscrew the control panel fixing screws.

3) Remove the control panel of air conditioner.

4) Install in the reversed sequence.

Tightening torque for control panel fixing: 3.5±0.5

Part No.: Q2724813 (2 pcs)

4. Dismantle Steering Wheel

1) Remove the horn cover, and unplug the horn button plug.

2) Dismantle the fixing nut of steering wheel.

3) Remove the steering wheel.

4) Install in the reversed sequence.

Tightening torque for steering wheel: 30±3Nm

Part No.: T11-3404207 (1 piece)

5. Dismantle Instrument Panel

1) Dismantle the steering wheel (Please refer to section *Dismantle Steering Wheel*).

2) Dismantle the CD player (Please refer to section *Dismantle CD Player*).

3) Dismantle the control panel of air conditional (Please refer to section *Dismantle Control Panel*)

4) Dismantle the instrument assembly.

   a. Remove the external decorative cover of the instrument assembly.

   b. Dismantle the fixing screws of the instrument assembly

c. Loosen the fixing nut of the instrument panel.

d. Dismantle the storage box.

e. Loosen the nut under the storage box.

f. Dismantle the lower fender at the left of the instrument panel.

g. Loosen the tapping screw and fixing bolts of the lower fender at left.

h. Prize up the right end board of the instrument panel.

i. Loosen the fixing nut of the right end board.

j. Remove the fender of Pole A.

k. Remove the instrument panel

Note: Install in the reversed sequence.

Torque:

Fixing bolts 7±1Nm

6. Dismantle the Regulator of Right Front Door

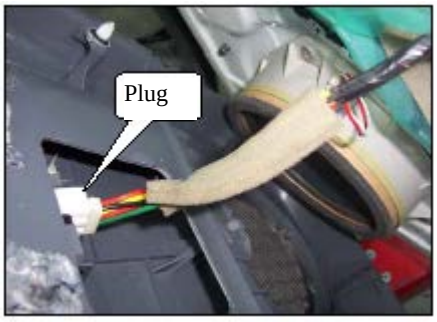
1) Dismantle the fender of right front door.

a. Prize up the protection cover of door handle

b. Loosen the fixing screws

c. Unplug the wiring harness

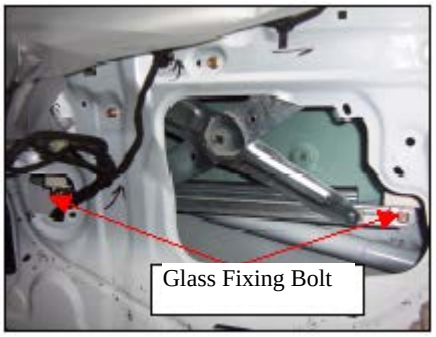
d. Remove the shield inside the door



2) Loosen the cable of inner handle, and remove the protection film.

3) Dismantle the glass of door.

Loosen the fixing bolt for glass by socket wrench.



4) Loosen the fixing bolts for regulator.

5) Remove the regulator.

6) Install in the reversed sequence.

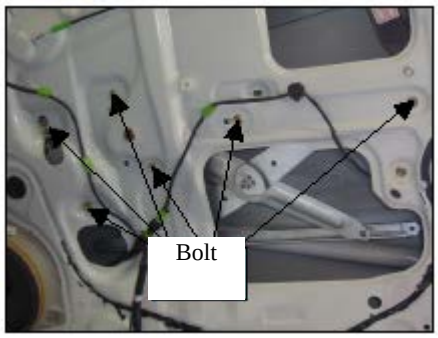
Torque:

Fixing of door glass 11Nm

B1460612 (2 pcs)

Fixing of regulator 11Nm

B1840610 (6 pcs)



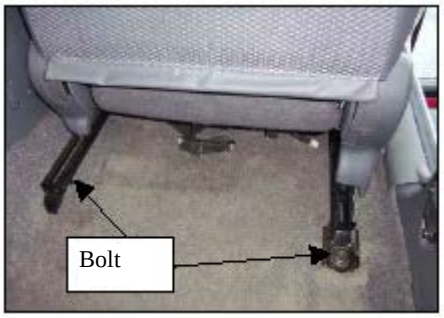
Note: Please refer to the removal procedure of right front door for the disassembly of the rest three doors.

Ⅲ Seat

1. Left Front Seat

1) Move the seat to the furthest front end, and remove the protection cover of guide rail.

2) Loosen the fixing bolts at the back end of the guide rail.

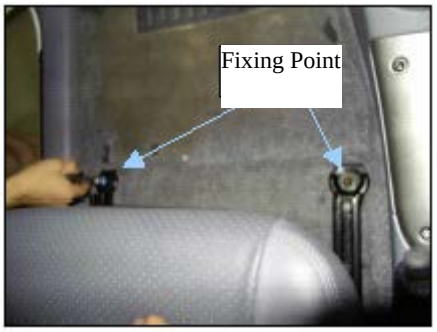


3) Move seat to the furthest back end, and remove the protection cover of guide rail.

4) Loosen the fixing bolts at the front end of the guide rail.

5) Unplug seat heating element, and remove the left front seat.

6) Install in the reversed sequence.



Torque:

Seat guide rail fixing 32Nm

PART NO: T11-68000 15(4 pcs)

Note: Please refer to the removal procedure of left front door for the disassembly of the right front seat.

2. Dismantle Right Rear Seat

1) Open the back door.

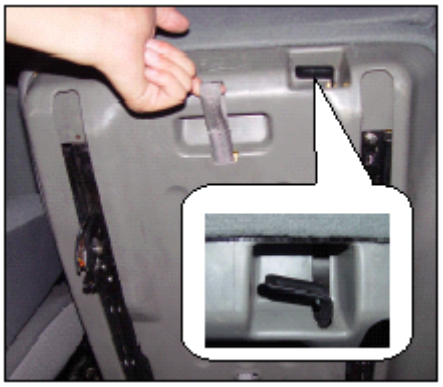
2) Pull the switch upward to fold up the right rear seat.

3) Press the switch of back clip rod to separate the back end of the seat from the back clip rod.

4) Pull up the string behind the seat when it is folded up to open the lock in front of the seat.

5) Now it is possible to lift up the seat.

6) Install in the reversed sequence.



3. Dismantle Erection Base of Rear Seat

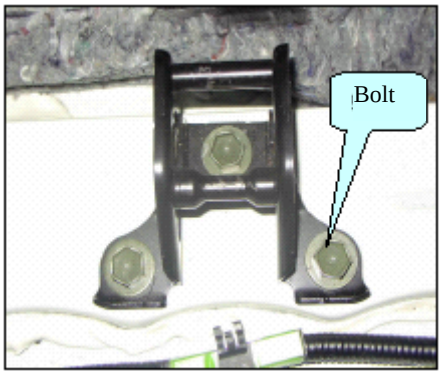
Just loosen the 3 fixing bolts.

Torque:

25±3Nm

Q146C1028F30 (3 pcs)

Note: Please refer to the removal procedure of right back seat for the disassembly of left back seat.



4. Dismantle Safety Belt

1) Remove the protection cover of upper fixing bolts of safety belt.

2) Loosen the fixing bolts.

3) Remove the protection cover of lower fixing bolts of safety belt.

4) Loosen the fixing bolts.

5) Remove the lower garnish of pillar C.

6) Loosen the fixing bolts of safety belt retractor.

7) Install in the reversed sequence.

Torque:

Fix the head plate of safety belt to the lower part of retractor

50±5Nm (1pcs)

Fix the adjusting mechanism to sliding rail

50+5Nm(1pcs)

4. Dismantle Roof Headlining

1) Dismantle the armrest of passenger.

2) Remove the front lamp indoor. (Please refer to section Disassembly of Lamps).

3) Remove the middle lamp indoor. (Please refer to section Disassembly of Lamps).

4) Remove the front lamp indoor. (Please refer to section Disassembly of Lamps).

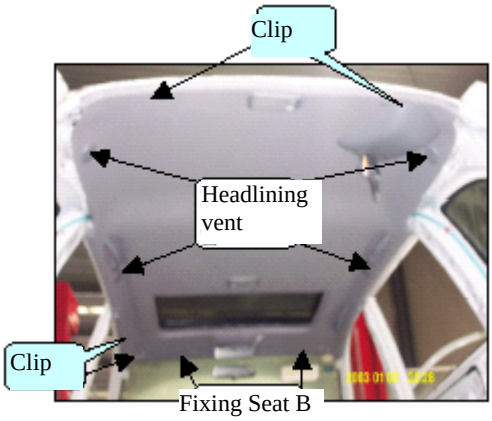
5) Remove the air admission cover.

6) Remove the shields of Pillar A, B and C.

7) Prize up the fixing clip by flat screwdriver.

8) Remove the roof headlining.

9) Install in the reversed sequence.



Ⅳ Exterior

1. Removal and Installaiton of front door outside handle

1) Remove the left front door panel (please refer to Removal and Installaiton of Door Panel) and then the protection film.

2) Prize up the cover in the outside handle.

3) Dismantle the fixing bolts with hexagon spline wrench.

4) Detach the lock element from the link rod, remove the lock element and the cover of left front door.

5) Remove the outside handle.

6) Install in the reversed sequence.

Torque:

Lock element fixing 11Nm

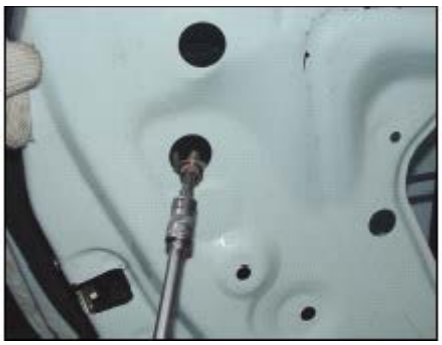
T 11-6 105243 (1 piece)

Note: Please refer to section Disassembly and Assembly of Left Front Door for the outer handle of right front door.

2. Removal and Installation of Rear Door Outside Handle

1) Remove the left rear door panel (please refer to section Removal and Installation of Door Panel).

2) Peel off the protection film and loosen the fixing bolts of handle seat with hexagon spline wrench from one side of the shield.



3) Remove the handle seat.

4) Remove the outside handle.

5) Install in the reversed sequence.

Torque:

Handle seat fixing 11Nm

PART NO: T11-6105243(1 piece)

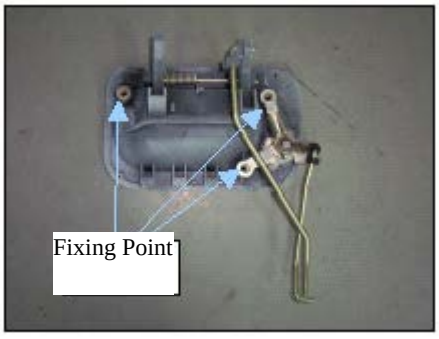
Note: Please refer to the Dismantle of left back door for the right back door.

3. Removal and Installation of Back Door Outside Handle

1) Open the back door.

2) Dismantle the back door panel, and peel off the protection film.

3) Loosen the bolt fixing the outside handle of back door from one side of the door panel.



4) Detach the pushing rod of handle from the lock body, remove the outer handle of rear back door.

5) Install in the reversed sequence.

Note: The lock element is fixed to the handle with two fixing bolts at left back side, remove the handle to detach the pull rod from the lock elment, then remove the lock element.

Torque:

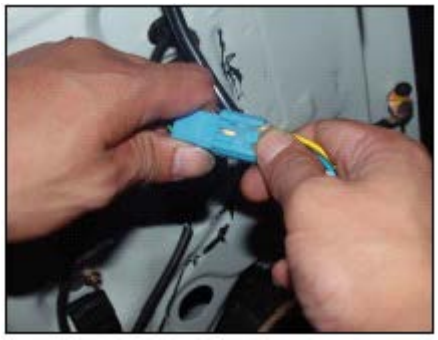
Outside handle of back door fixing 11Nm

PART No.: T11-6305231 (3 pcs)

4. Disassembly and Assembly of Outside Rearview Mirror

1) Remove the triangle block from Pillar A.

2) Dismantle the door panel and unplug the motor-driven outside rearview mirror.



3) Loosen the fixing screw of outside rearview mirror.

4) Remove the outside rearview mirror.

5) Install in the reversed sequence.

Torque:

Outside rearview mirror fixing 11Nm

PART No.: T11-8202011 (3 pcs)

5. Removal and Installation of Front Wiper

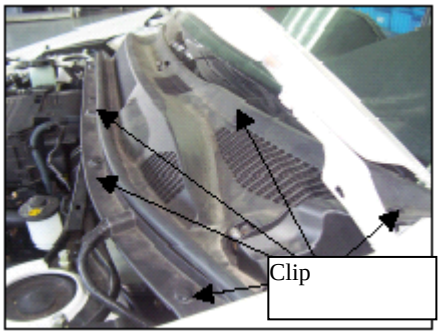
1) Remove the protection cap of the fixing nut from the wiper arm.

2) Loosen the fixing nut from the wiper arm.

3) Remove the wiper assy.

4) Dismantle the lower trim panel of front windscreen.

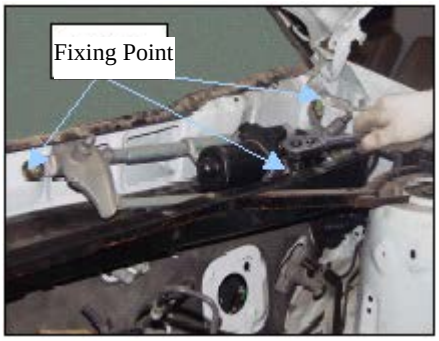
Just dismantle the clips to remove the lower trim panel.



5) Loosen the fixing bolt of linking mechanism.

6) Unplug the motor, remove the linking mechanism assembly.

7) Install in the reversed sequence.



Torque:

Wiper fixing 55±3 Nm

Q3 2210 (1 piece)

Linking mechanism fixing 10±1Nm

B11-5205223 (3 pcs)

6. Rear Wiper

1) Prize up the decorative cap of the fixing nut from the arm of rear wiper.

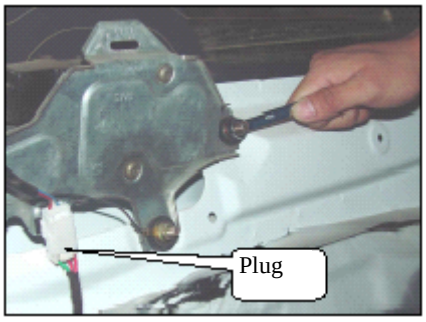
2) Loosen the fixing nut, and remove the wiper arm and the rubber ring.

3) Open the back door.

4) Remove the back door panel.

5) Unplug the wiring harness of wiper, and loosen three fixing bolts.

6) Install in the reversed sequence.



Torque:

Fixing the wiper arm 20±3Nm

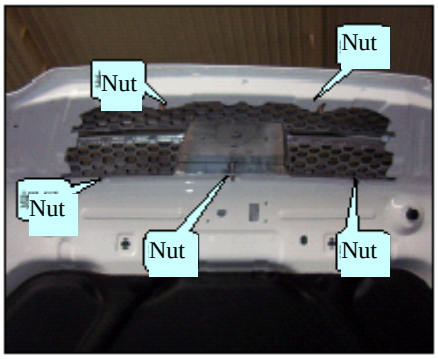
Q3 2208(1pcs)

Fixing the wiper motor 10±1Nm

B11-5205223 (3 pcs)

7. Radiator Grille

1) Open the engine hood.



2) Loosen the fixing bolt of radiator grille.

3) Remove the radiator grille.

4) Install in the reversed sequence.

Torque:

Radiator grille fixing 6±1Nm

Q32005 (5 pcs)

Ⅴ Removal and Installation of All Lamps

1. Tightening Specification of Fasteners for All Lamps

Description	Specification
Headlamp fixing bolts	6±1Nm
Front fog lamp fixing bolts	2. 0±0. 2Nm
Taillamp fixing bolts	5±1Nm
Tapping screw of front ceiling lamp	2±0. 5Nm
Tapping screw of rear ceiling lamp	3±0. 5Nm
High-mounted stop lamp	3±0. 5Nm

2. Specification of Bulbs

Type	Specification
Headlamp	12V 55W
Turning lamp, rear foglamp, reverse lamp	12V 21W
License plate, side turning and high-mounted stop lamp	12V 5W
Stop lamp	12V 21W
Position lamp	12V 5W
Front foglamp	12V 55W
Front/rear ceiling lamp	12V 8W

3. Removal and Installation of Headlamp

1) Open the engine hood.

2) Unplug the turning lamp.

3) Unplug the high/low beam headlamp.

4) Remove the three fixing bolts of headlamp assembly.

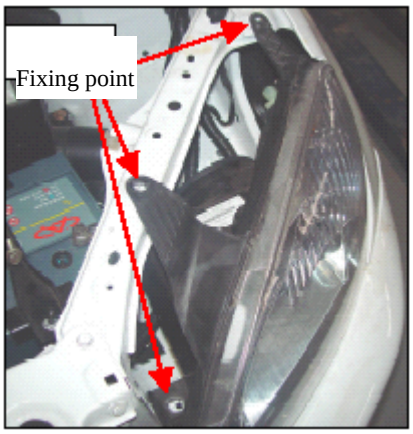
5) Remove the headlamp assembly carefully.

6) Install in the reversed sequence.

Torque:

Headlamp fixing 6±1Nm

PART No.: T11-3772025 (3 pcs)



4. Replacement of Headlamp Bulbs

Replacing of bulbs for high beam and low beam headlamp.

1) Remove the back cover of headlamp.

2) Remove the bulb clip.

3) Remove the bulbs for high beam and dipped headlamp.

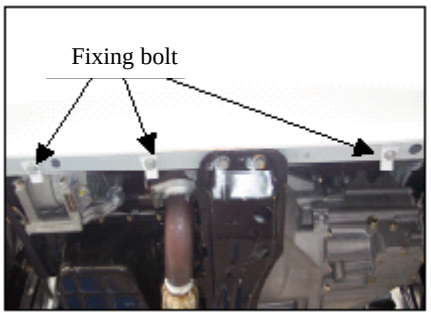
4) Remove the used bulbs, and replace them with new bulbs.

5. Replacing the bulb for front turning lamp

1) Turn the bulb for front turning lamp counterclockwisely to take it out from the bulb seat.
2) Remove the bulb seat.
3) Repalce it with a new bulb.
4) Install the bulb seat to its original place.

6. Removal and Installation of Front Foglamp

1) Dismantle the front bumper.
   a. Dismantle the fixing bolts under front bumper.

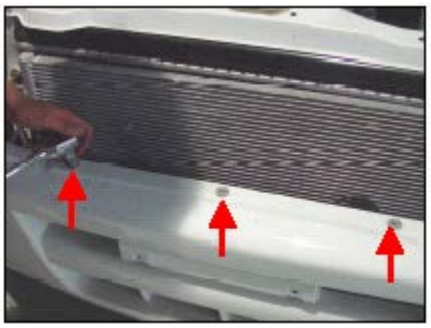


   b. Dismantle the side fixing bolts of front bumper.

   c. Dismantle the connecting bolts of front wheel house at both sides.

d. Dismantle the three fixing bolts at the top of front bumper.

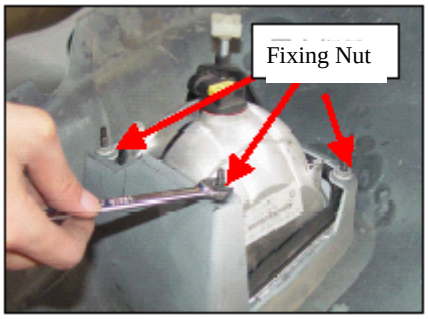
e. Remove the bumper with attention to the top clips at both sides. Unplug the wiring harness for the two foglamps in front.



Note: Please don't overexert while taking out the wiring harness as well as plug for the foglamp.

2) Dismantle front foglamp from the bumper.

Dismantle the three nuts as shown by the arrow by open wrench, and remove the foglamp assembly from the front of the bumper.



3) Install in the reversed sequence.

Torque:

Fixing of front foglamp 2.0±0.2 Nm

Q32006 (3 pcs)

7. Replacement of Fog Lamp Bulb

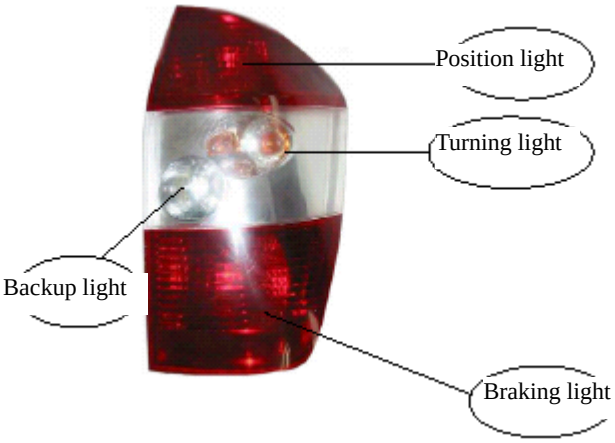
1) Hold the backseat of the bulb and spin it out in counterclockwise.

2) Install the new bulb in clockwise.

3) Install the new bulb of foglamp.

8. Taillamp

1) Position of each bulb in the taillamp assembly.



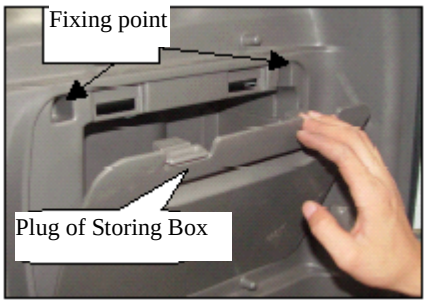
2) Removal and Installation

(1) Open the back door.

(2) Dismantle the lower garnish of Pillar C.

a. Dismantle the tapping screw under the shield.

b. Dismantle the tapping screw inside the plug of storing box.



c. Remove the cage plate of back door, and dismantle the screw underneath.

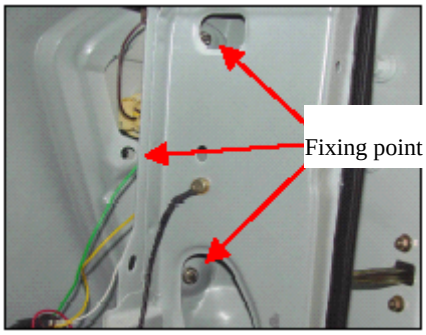
d. Remove the lower garnish of Pillar C.

(3) Dismantle the three fixing nut from the reserved hole on the body.

(4) Unplug the taillamp.

(5) Pull out the taillamp gently.

(6) Install in the reversed sequence.



Torque:

Fixing nut of taillamp 5±1Nm

Q3 2005(3 pcs)

3) Bulb Replacement

(1) Open the plug cover of storing box at rear luggage cabin.

(2) Prize up the internal protection cover by screwdriver. Screw out the bulbs for sidelamps, backup lamp, turning lamp and stop lamp counterclockwisely by hand through the hole.

(3) Replace them with new bulbs.

9. License Plate Lamp

i Removal and installation of license plate lamp

1) The lamp for license plate is attached to the back bumper by its elastic clip seat at both ends.
2) For dismantle, press the clip seat by flat screwdriver, remove the lamp for license plate slowly, and unplug the pluged in.
3) For installation, insert the pluged in, then push the lamp for license plate in.

ii Replacement of license plate lamp bulb

1) Screw off the bulb counterclockwisely when the lamp for license plate is taken out.
2) Replace it with new bulb.

10. Removal and Intallation of Side Turning Lamp

1) Hold the side turning lamp by hand and pull back to remove the lamp slowly.
2) For installation, force it in reversed direction to the place.

11. Removal and Installation of High-mounted Stop Lamp

1) Dismantle the shield for high-mounted stop lamp.

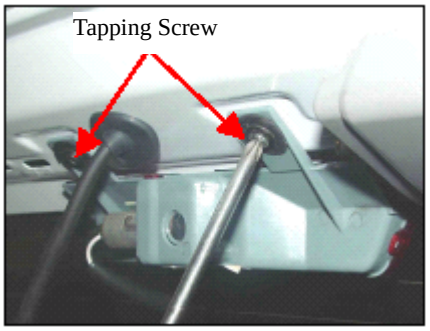
2) Dismantle the fixing screw.

3) Remove the high-mounted stop lamp.

4) Install in the reversed sequence.

Torque:

Fixing of tapping screw 3±0.5Nm

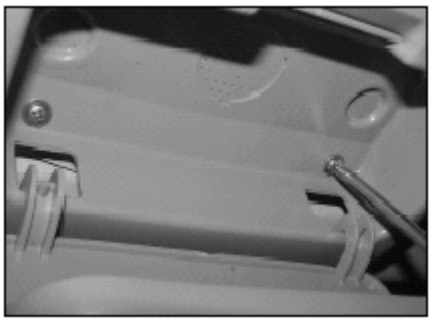


12. Front Ceiling Lamp

i Removal and Installation of Front Ceiling Lamp

1) Open the glasses box.

2) Loosen the tapping screw by cross screwdriver.



3) Remove the front ceiling lamp gently, and unplug the wiring harness.

4) Install in the reversed sequence.

Torque: Fixing of tapping screw 3±0.5Nm

ii **Replacement of front ceiling lamp bulb**

1) Prize up the enclosure by flat screwdriver.

2) Remove the used bulb and replace it with a new bulb.

13. Removal and Installation of Middle Ceiling Lamp

1) Insert a flat screwdriver between the enclosure and lamp cover, and prize up the lamp cover with care.

2) Loosen the fixing screw.

3) Remove the ceiling lamp.

4) Install in the reversed sequence.

Torque:

Fixing of tapping screw 3±0.5Nm

14. Rear Ceiling Lamp

Please refer to the dismantle and assembly procedure of middle ceiling lamp for the rear ceiling lamp .

Ⅵ Replacement of Windscreen

1. Replacement of Front Windscreen

Dismantle Procedure

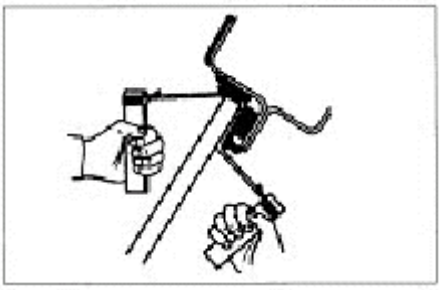
1) Remove the top fillet of windscreen, and cut the fillet as shown in the figure.

Note: Pay attention not to damage the body.

2) Remove the windscreen.

a. Lead a wire string toward outside between the body and the glass.

b. Bind both ends of the string with wooden block or similar stuff.

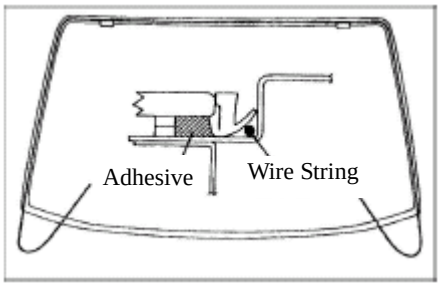


Hint: Apply an adhesive tape at the outside surface to prevent any scratch.

Note:

- ✶ When detach the glass, please pay attention not to damage the paint or any decorative part inside and outside.
- ✶ In order to prevent any scratch to the instrument panel during the disassembly, a piece of plastic can be placed in between the wire string and instrument panel.

c. Pull the string around the glass to cut off F adhesive, and to remove the glass.



Note: While cutting the bond of the glass, please leave as much as adhesive on the body.

Installation Procedure

1) Preparations:

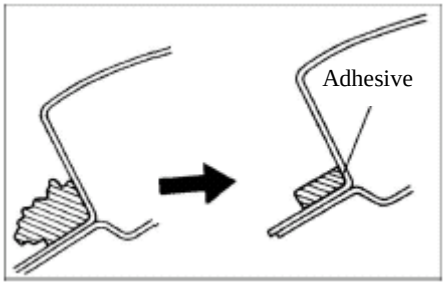
   a. Don't touch the surface after cleaning.

   b. Cut off any coarse on the body.

Hint: Leave as much as adhesive on the body.

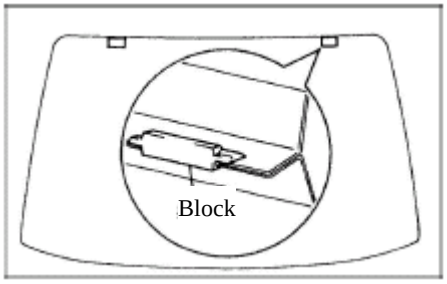
   c. Clean the cutting surface of adhesive with clean cloth soaked with detergent.

Hint: The vehicle surface shall be cleaned even all adhesives are removed.



2) Remove the block.

Remove the block by knife.

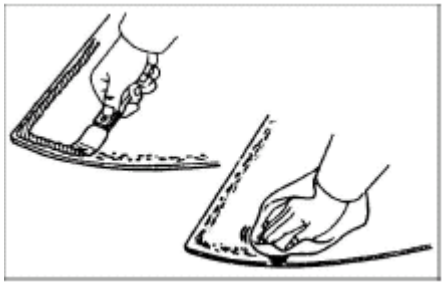


3) Clean the dismantled windscreen.

   a. Remove any adhesive on the glass by scraper.

   b. Clean the glass with detergent

Note: Please do not touch the glass after cleaning.

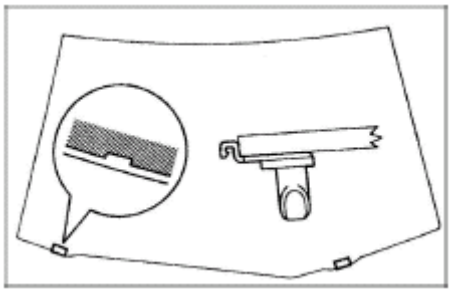


4) Replace the nip in case of necessary.

   a. Remove the block by knife.

   b. Remove the used nip.

   c. Replace it with a new one.

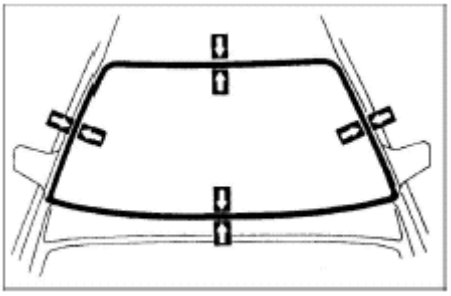


5) Positioning of the glass.

   a. Place the glass to the right position.

   b. Mark both the glass and the body.

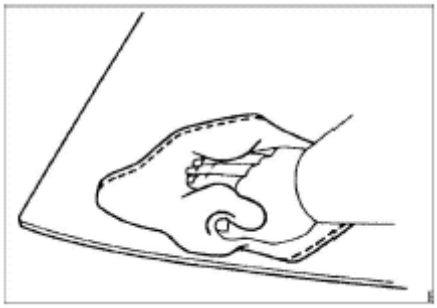
   c. Remove the glass.



6) Clean the contact of the glass.

Clean any dirt on the perimetric surface with detergent.

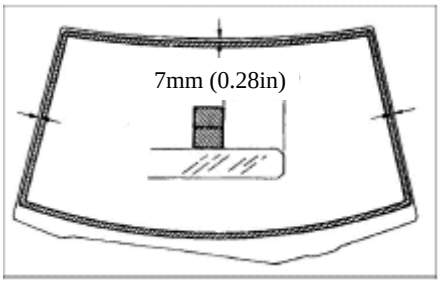
Note: Please do not touch the surface of glass after cleaning.



7) Install waterstop.

Install the waterstop by double sided adhesive tape as shown in the figure.

Note: Please do not touch the surface of glass after cleaning.



8) Paint a layer of primer M at the contact with body.

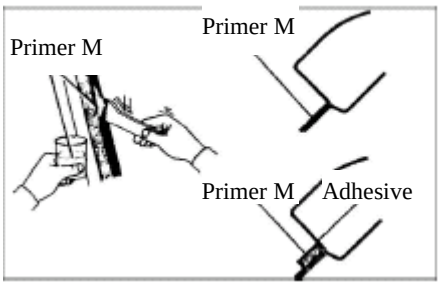
Paint a layer of primer M at the surface of body with brush.

Note:

Please wait for more than 3 minutes to allow the primer drying up.

Please do not paint on the adhesive.

Please do not keep unsealed primer M for future use.



9) Paint a layer of primer G at the contact with glass.

a. Paint a layer of primer G at the glass edge or contact with brush or sponge.

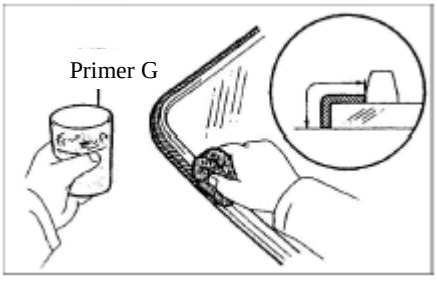
b. Wipe it out with clean cloth before the primer is drying up.

Note:

Please wait for at least 3 minutes to allow the primer drying up.

Please do not paint on the adhesive.

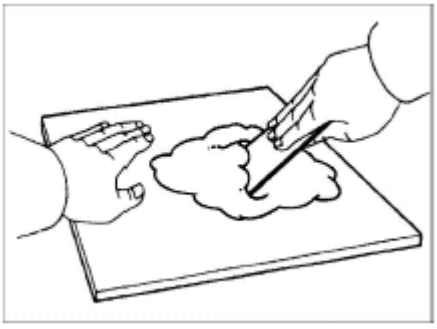
Please do not keep unsealed primer G for future use.



10) Adhesive Mixing.

a. Clean the glass and scraper with solvent.

b. Mix 500g of main solvent with 75g of hardener by scraper on glass or similar stuff.



Note:

Make sure to complete the installation of fillet within the valid period of adhesive.

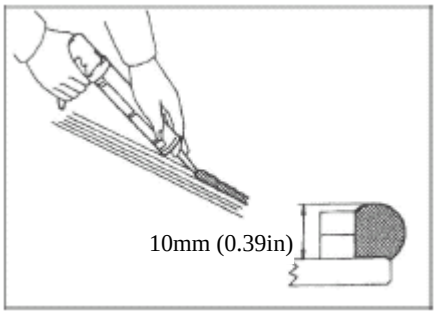
The adhesive shall be mixed within 5 minutes.

11) Adhesive Applying

a. Cut off the tip of the tube, and fill the adhesive into the tube.

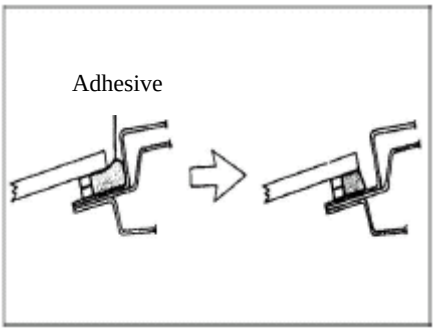
b. Install the tube into sealed glue gun.

c. Apply the adhesive to the glass as shown in the figure.



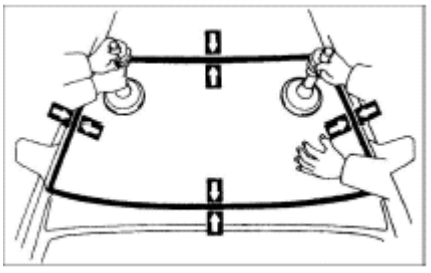
12) Glass Installation.

Hint: Make sure that the waterstop is well sticked to the body as shown in the figure.



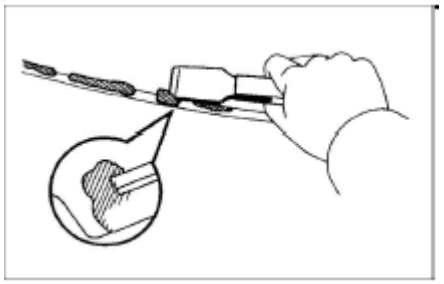
a. Install the glass, and have the marks on the glass well aligned with the marks on the body, then press the edge to push the glass into its place gently.

b. Apply some adhesive on the edge of the glass with scraper.



c. Remove excessive or overflow adhesive by scraper.

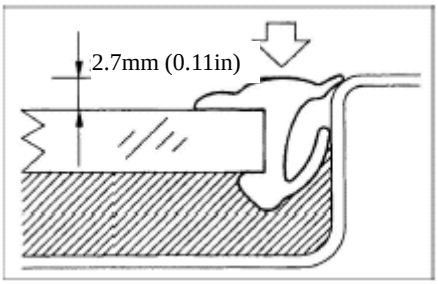
d. Clamp the glass till the adhesive is hardened.



13) Check for any leakage, and have it repaired.

a. Carry out leakage test after the period for hardening.

b. Block any leakage with glue.



14) Install the top fillet for windscreen.

Install the top fillet onto the body, bat it gently with hand to have it well installed.

15) Install the fillet outside.

Install the fillet outside as well as the bolt.

2. Replacement of Rear Windscreen

Dismantle Procedure

1) Remove the lower fillet

2) Cut off the adhesive at both sides of both ends of the fillet by scraper as shown in the figure.

Hint: The tip of the scraper shall be wrapped with tape before use.

Prize up the fillet at six nips by scraper, and remove the fillet.

3) Remove the glass of rear window.

Lead a wire string toward outside between the body and the glass.

Bind both ends of the string with wooden block or similar stuff.

Hint: Please do not damage the two blocks by the wire string.

Remove the glass

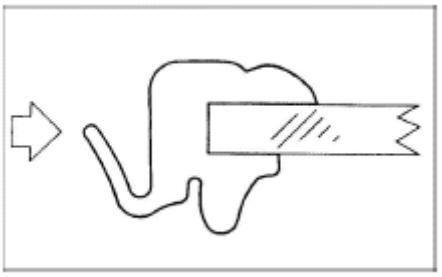
4) Remove the fillet of rear window.

Installation Procedure

1) Install the fillet for rear window

Place the fillet around the glass by hand.

Hint: The rear window glass must be removed for the installation of the fillet.



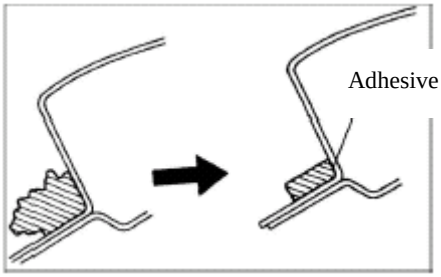
2) Clean and trim the contact with body

Cut off any coarse on the body.

Hint: Leave as much as adhesive on the body.

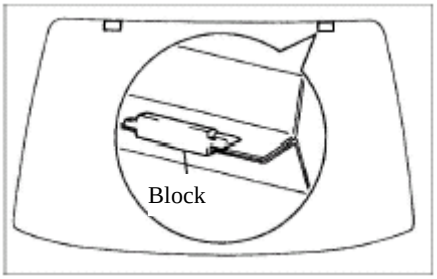
Clean the cutting surface of adhesive with clean cloth soaked with detergent.

Hint: The vehicle surface shall be cleaned even all adhesives are removed.



3) Remove the block.

Remove the block by knief.

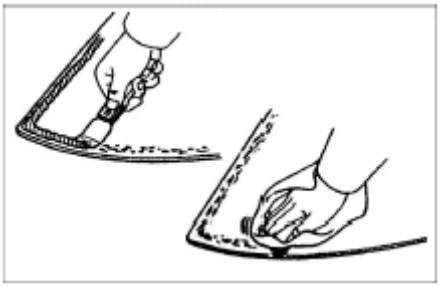


4) Clean the dismantled windscreen.

a. Remove any adhesive on the glass by scraper

b. Clean the glass with detergent

Note: Please do not touch the glass after cleaning.

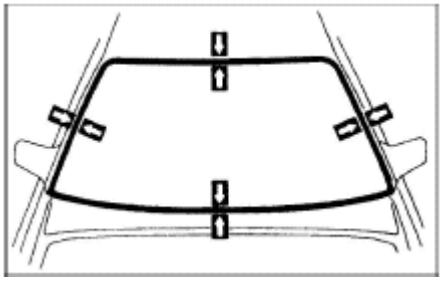


5) Positioning of the glass.

Place the glass to the right position.

Mark both the glass and the body.

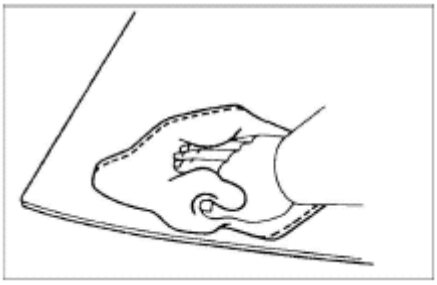
Remove the glass.



6) Clean the contact of the glass.

Clean any dirt on the perimeter surface with detergent.

Note: Please do not touch the surface of glass after cleaning.



7) Paint a layer of primer M at the contact with body.

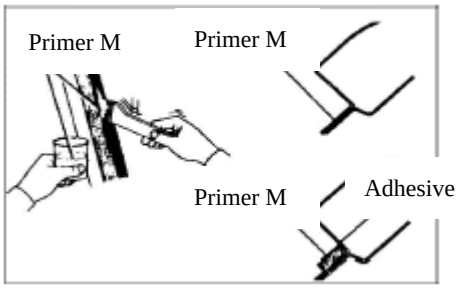
Paint a layer of primer M at the surface of body with brush.

Note:

Please wait for more than 3 minutes to allow the primer drying up.

Please do not paint on the adhesive.

Please do not keep unsealed primer M for future use.



8) Paint a layer of primer G at the contact with glass.

Paint a layer of primer G at the glass edge or contact with brush or sponge.

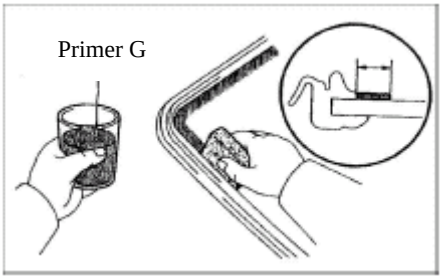
Wipe it out with clean cloth before the primer is drying up.

Note:

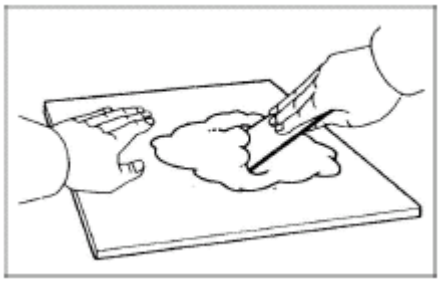
Please wait for at least 3 minutes to allow the primer drying up.

Please do not paint on the adhesive.

Please do not keep unsealed primer G for future use.



9) Adhesive Mixing.



Note:

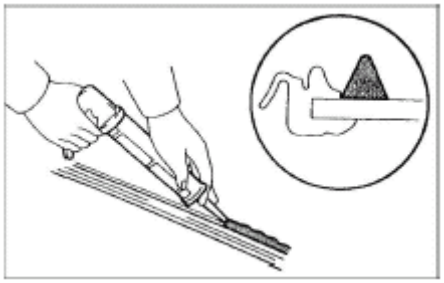
Make sure to complete the installation of fillet within the valid period of adhesive.

The adhesive shall be mixed within the specified time.

Clean the glass and scraper with solvent.

Mix 500g of main solvent with 75g of hardener by scraper on glass or similar stuff.

10) Adhesive Applying

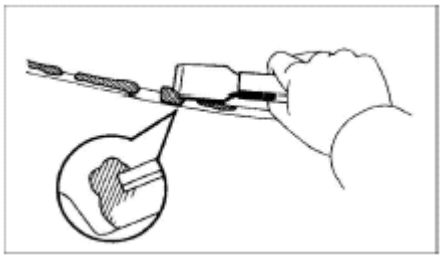


Cut off the tip of the tube, and fill the adhesive into the tube.

Install the tube into sealed glue gun.

Apply the adhesive to the glass as shown in the figure.

11) Glass Installation.



Install the glass, and have the marks on the glass well aligned with the marks on the body, then press the edge to push the glass into its place gently.

Apply some adhesive on the edge of the glass with scraper.

Remove excessive or overflow adhesive by scraper.

Clamp the glass till the adhesive is hardened.

12) Check for any leakage, and have it repaired.

Carry out leakage test after the period for hardening.

Block any leakage with glue.

13) Install the lower fillet outside the rear window.

Install the fillet onto the body and pat it gently with hand.

14) Connect the connector for defogger.

Section 2 Service of Metal Works for Body-in-White

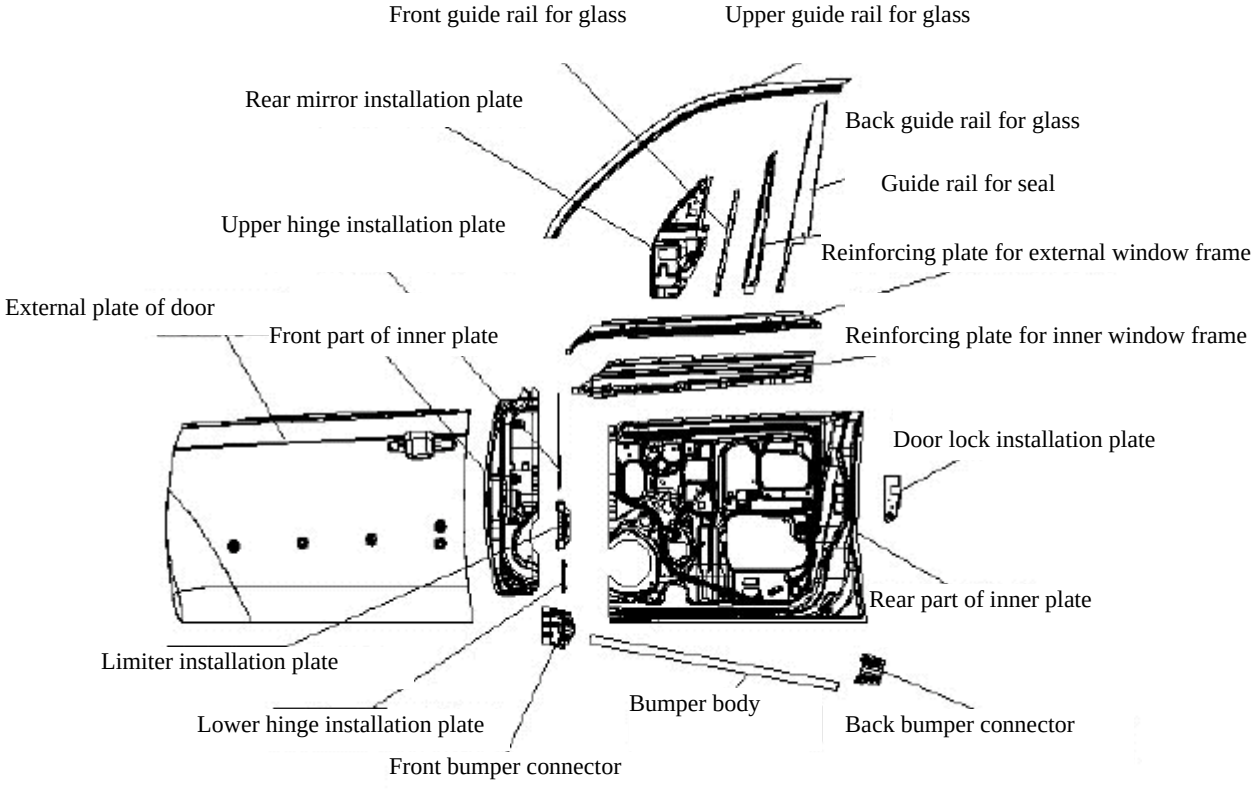
Ⅰ Summary of Service Works for Doors and Bonnets

The body of a sedan is comprised of various frameworks, plates and parts, where door is the most complicated part in technique, involving with these working procedures such as parts punching, welding, parts assembly and general assembly, and with strict requirements both on dimension and technique. Therefore, the service for door is quite difficult, and the requirement in quality is also quite high. Servicemen must have sufficient understanding on the structure of door in order to conduct the service work smoothly.

1. Structure of Door

Generally speaking, door is comprised of external plate, inner plate, window frame, glass slot, hinge, lock as well as accessories for door and window. Inner plate is furnished with accessories such as glass regulator and lock. For secured and reliable assembly, inner plate shall also be partially reinforced. For enhanced safety, the inner side of external plate is normally furnished with side beam. The inner plate and external plate is linked through flanging, adhesive, welding and so on. Aimed at different stress condition, the external plate shall be lamp and the inner plate shall be strong enough for higher wallop.

The door assembly of body-in-white is comprised of less parts, generally including external plate, inner plate, window frame, glass guide rail, window frame reinforcing plate, lock erection plate, hinge reinforcing plate, side beam assembly and so on. A typical door structure is shown in the following sketch.



2. Technique process for the service of door and bonnet

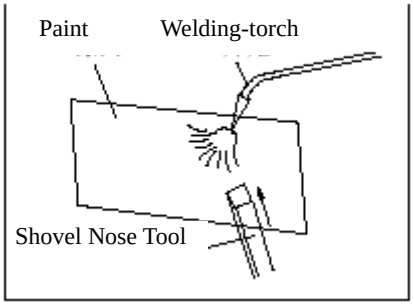
Generally speaking, the basic method for the service of doors and bonnets is of the same for ordinal metal work, both including the following procedures:

(1) Initial check. To measure the relative position, clearance of door and cover with other assemblies in body:

(2) Cleanout of door. Clean any dirt, grease on the door and cover with clean water or detergent, and drying up before check.

(3) Evaluation and Appraisal. Namely through check to evaluate the damage scope and degree on door and cover so as to define the method for service.

(4) Removing of former paint. The former paint shall be removed based on the actual situation after cleaning or before service, especially for these places with obvious rust, crack or sunken; There are manual, heating, mechanical and chemical ways to remove paint.



(5) Inspection after dismantle. This inspection generally includes geometric measurement between various metal works, check on detailed damage of each metal work, defining the type of damage, analyzing the reason and to decide the scheme for service.

3. Major contents in the service of doors and bonnets

Generally speaking, the reason for damage on doors and bonnets is related to the following four aspects: defect in structural design, defect in manufacture, chemical damage in use and physical damage in use. The most outstanding reason of damage is shown in the following types:

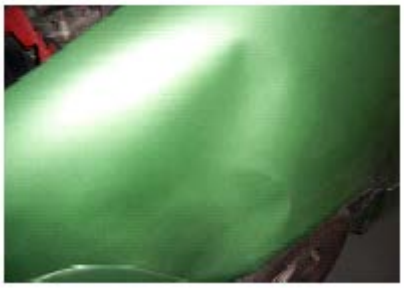
1) Abrasion. Abrasion is resulted from the surface friction which caused by the mutual contact and relative movement between metal works; For instance, the clearance wull be increased due to long term abrasion between the the bore and shaft of hinge, and cause to the drooping of door.

2) Erosion. It is often caused by oxidation of dirt or pollutant on the metal surface; or rust erosion for parts not treated against erosion after welding; or chemical erosion. The erosion is often occurred inside the interlayer of metal work, join or connector of spot welding members.

3) Crack or rupture. Due to the repeated action of stress on metal plates, places with stress concentration and weak structural point tend to be fatigue, hence be resulted in crack, even rupture in the worst case.

4) Sunkin or folding. Sunkin damage is of elastic or plastic deformation resulted from collision or extruding between surfaces of door and cover.

5) Bend or distortion. The damage is mainly of plastic deformation to the door and cover due to overload in using or in case of collision.



Ⅱ Basic Method for the Service of Door and Cover

Aimed at the above types of damages, techniques used for the service of door and cover mainly include sunkin truing, flame correction, welding, mending, and fold removing.

1. Sunken Truing

For sunken and protruding damage on the external plate of door and cover, if it is of indirect damage due to the damage of structural parts or reinforced bar, structural parts shall be corrected firstly, then have the fold of external plate or sunken be corrected. If the rear side of metal plate can be contacted, hand hammer, sizing block or key block, tommy bar, flat punching can be used for the initial repair. For enclosed metal plate or places hardly can be contacted, it can be repaired by inertia hammer, pointed hammer and so on.

The following methods for sunken truing are often used:

(1) Sunken truing by sizing block or hand hammer. Sizing block together with hand harmmer to hammer the metal plate is a method often used. Both sides of the truing metal work shall be accessable by portable sizing block. Sizing block can be used as support for the hand hammer in 2 ways:

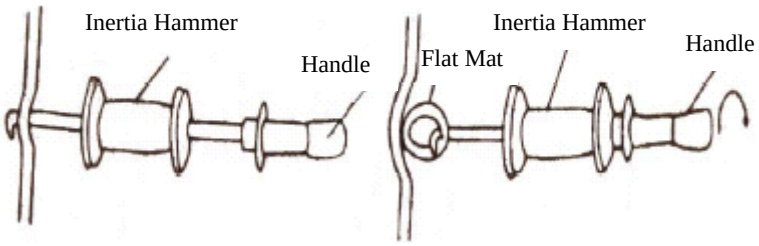
① Hammering on sizing block by hand. This method is suitable for the truing of small, shallow sunken and fold. When hammering on sizing block by hand, the sizing block shall be placed on the back of the metal plate and held by hand tightly, and start to hammer from the protruding in front. Hammering on the protruding will cause the metal plate to shrink and gradually be levelled.

② Hammering on places outside the sizing block by hand. This method is to place the sizing block at the lowest point of sunken metal plate, and hammer on the adjacent high point by hand.

Normally when truing the sunken area by hammer and sizing block, the protruding side of metal plate will be hammered, and the other side is padded by sizing block. First hammered by wooden hammer for a rough shaping, then conduct truing by iron hammer (See Fig 7). For large area of sunken, sizing block shall be placed at the place with slamp sunken, and hammered on places protruding high. Wooden hammer and iron hammer shall be used in turn according to the actual situation.

(2) Repair the sunken by shaping key or tommy bar. Shaping key and tommy bar are manual tools often adopted for the repairing of door and cover too, which can be custom made according to the feature of body. These tools can be extended into limited space in the interlayer of door and cover to lift the sunken area. This method is suitable for sunken area inside a narrow interlayer of door and cover where sizing block and hammer are not accessable. Shaping key can also be used as sizing block to radiate the striking force in a large area.

(3) Eliminate sunken area by sunken puller. Sunken puller is applied to the inner side of the metal plate to repair shallow sunken area which hardly accessable by other tools. There are two operation methods often adopted by sunken puller:



One is called hole-drilling method. Namely to drill a hole at the sunken place by portable drill, then insert a pull rod with thread or hook at the top into the borehole, to draw back the sunken area slowly by moving the inertia hammer on the metal pull rod and repeated bumping on the handle. More than one small hole can be drilled in case of necessary. When the sunken area is levelled, fill these holes by soldering, and have it polished.

Another way is of electrode welding. Namely to weld a pin or mat to sunken area by special spot welding machine, then install a puller on the pin or mat to pull the sunken plate outward till it is levelled. More than one pin or flat mat can be welded based on the actual situation to pull out the sunken area gradually. Finally, break the pin or mat and have the scar polished by grinder. Drilling on metal plate can be avoided in this method, potential erosion is eliminated, hence it is widely adopted.

2. Restoration of Stretched Part

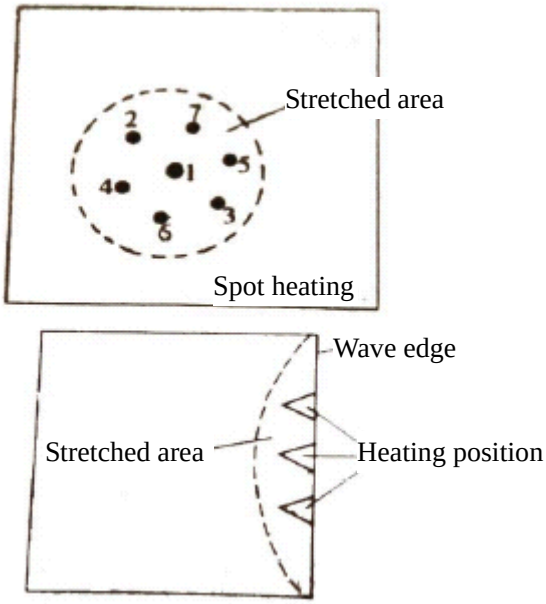
The sunken area of stricken metal plate is often stretched out. Correct operation during the repairing sometime still can't ensure the complete restoration of stretched part, therefore, heating shrinkage is often needed to achieve perfect truing.

(1) Heating position and flame energy. The effect of flame correction is relied on the heating position and flame energy, different heating position will result in different effect for the correction. The heating position shall be at the place with the maximum deformation and the longest stretch, namely the outside of the bending deformation of material. Different flame energy will also result in different effect for the correction. Higher energy, faster heating, and concentrated heat will result in sdtronger shrinkage. For mild steel plate, heating up to cherry red (600C~ 800C) will be enough.

(2) Way of heating. Heating methods often used for flame correction in body service include:

① Spot heating namely that the heating area is at a spot within a specific diameter, which normally at 1530mm. One or more spots can be heated during the correction according to the deformation of metal plate. Spots will be distributed in cinquefoil, which is often adopted to shrink protruding located in the middle of faceplate.

②Triangle heating namely that the heating area is of a triangle, which is often adopted for strip material as well as the correction of edge deformation.



Triangle heating

(3) Cold shrinkage method. When the metal plate is removed from flame, proper cooling method shall be adopted based on the stretching degree of metal plate as different cooling method has different shrinkage.

① Natural cooling Namely to cool it down naturally in ambient environment. It is suitable for deformation with small shrinkage.

② Water cooling To cool down rapidly by covering the heating area with wet cotton cloth, the shrinkage of steel plate is much higher than natural cooling, however the steel may be embrittled.

③ Natural cooling together with hammering It is often used together with hammer and sizing block by swift hammering on the surrounding of heating area to enhance compressive stress and to increase the shrinkage till the place is levelled. Wooden hammer is perferred for the hammering. No excessive striking force is allowed so as to avoid that the metal plate is stretched again.

3. Mend by Replacing the Damaged Part

When the metal plate of door and cover is partially eroded or damaged to the extent which can't be repaired, it shall be mended by replacing the damaged part with updated part through welding.

The mend can be divided into sticking mend and replacing mend.

The technique procedure for replacing mend is as follow:

(1)Checkup the damage to define the scope of mend.

(2) Work out paper sample according to the defined scope of mend.

(3) Prepare the material from metal plate according to the paper sample with proper margin for machining.

(4) Select the right processing method to allow the replacing part have identical surface shape with the part to be cut off.

(5) Clamp the replacing part to original place, mark the outline of the part to be cut off, cut it off by gas cutting or ordinal cut according to the actual situation, and align the joint of repalcing

part with the cut.

(6) Weld the joint with gas welding or CO2 gas protection welding. Carry out spot welding in the span of 3050mm firstly, weld again when it is levelled by striking. For welding line with higher requirement on strength, it shall be welded on both sides.

(7) Hammer the completed welding line with flat hammer to eliminate welding stress, then have it shaped and polished by sand grinder.

4. Fold Repair

Based on the damage extent of metal work, fold can be divided into “live fold’’ and “dead fold’’. “Live fold’’ is of lamp fold which can be eliminated by direct hammering on the most protruding ridge. “Dead fold’’ is of flod with serious damage. As the folded parts are squeezed together, direct hammering on the most protruding ridge may get the flod even worse. This is why it is called as “dead fold’’. The principle to correct flod is to release “dead fold’’ firstly by gradually converting it into “live flod’’, then convert the “live fold’’ into sunken or protruding, and have it repaired according to the method for sunken repairing. The steps for repairing are as follows:

(1) Adopte the method of support and pull to apply a corrective force in the opposite of striking force on the fold of metal work to spread or revive the fold.

(2) Dismantle the metal work with fold damage from the platform. Starting from the inner side of the fold area, prize up and heat the “dead fold’’ with proper tommy bar and torch gun at the same time. Revive the “dead fold’’through repeated heating and prizing up. Finally convert all “dead folds’’ into “live folds’’.

(3) Beat out “live fold’’ from the inner side of the fold area. The hammer shall be fallen the most protruding ridge. Meanwhile, please note that each beat must be supported by the platform. After one side of the fold is roughly levelled, turn to the other side till all folds are fully spreaded.

(4) Measure with the sample, heat and strike the sunkin and protruding places to restore the original shape roughly.

(5) After trial assembly onto the vehicle, check by sample again to make further fine correction, and finally to achieve the requriement.

(6) Fold with partial serious damage which can’t be repaired can be mended by replacing.

Ⅲ Welding of Doors and Bonnets

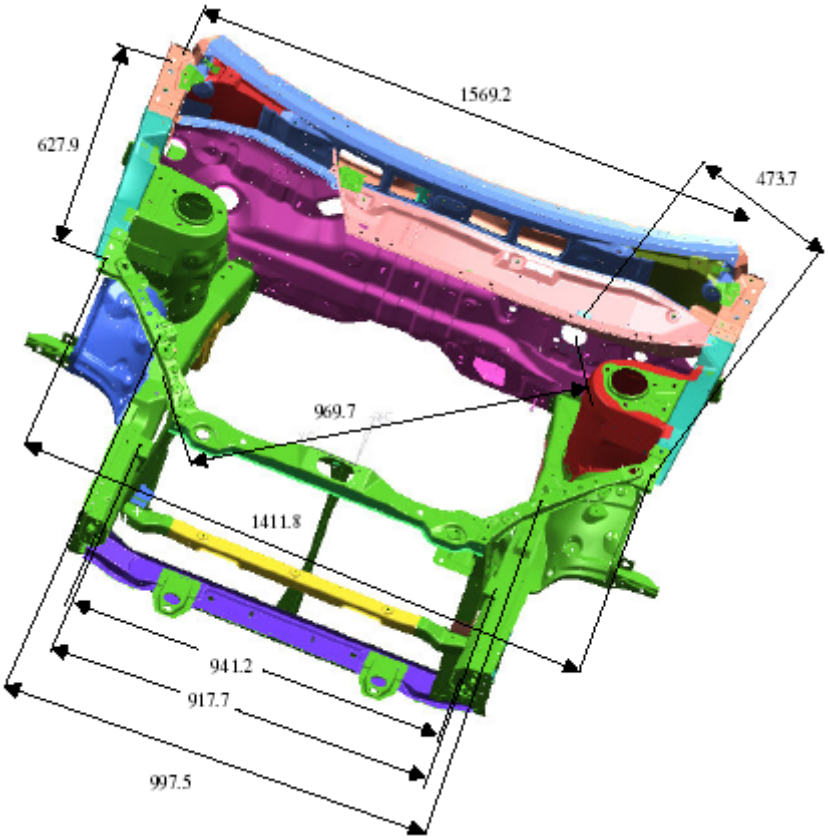
For welding on doors and bonnets, the following welding methods can be selected flexibly: gas weld (oxygen acetylene weld), CO2 gas protection weld, manual arc welding, resistence spot welding, brazing welding and so on. Moreover, in order to maintain the original strength and durability of the body, welding method used for the manufacture of the door and cover shall be adopted as far as possible, and the size and type of welding joint shall be similar with the one adopted in original manufacturer.

In the quality of appearance, the welding spot shall be free from any defect such as burn down, half welding, crack as well as large quantity of burrs, the surface shall be level and pretty without obvious distortion or deformation, and the depth of impress shall be less than 1/5 of the thickness of the plate; Whether the strength of the welding spot is enough or not, non-destructive test can be carried out by flat shovel and iron hammer, where flat shovel is used to check for any seal off between welding spots firstly, then strike by iron hammer to restore the original state; The welding joint shall be free from any splash, tidy and free from any defect such as undercut, overlap, weld penetration on the surface.

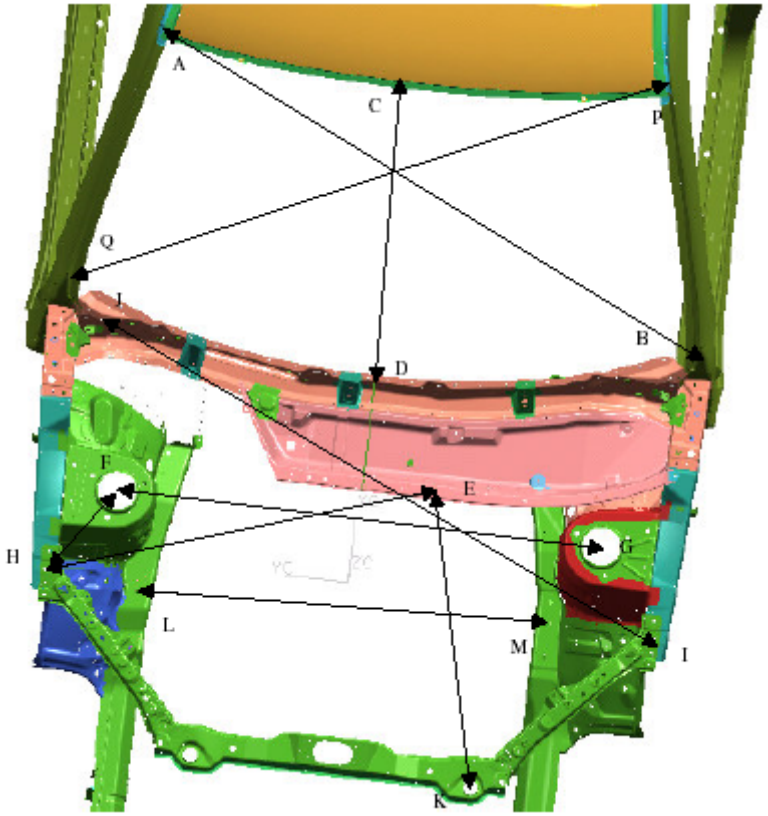
Ⅳ Dimension and Levelness Requirements for Openings on Various Parts of Body

1. Front Structure Part

1) Dimension of Engine Compartment



2) Dimension of Openings in Various Parts

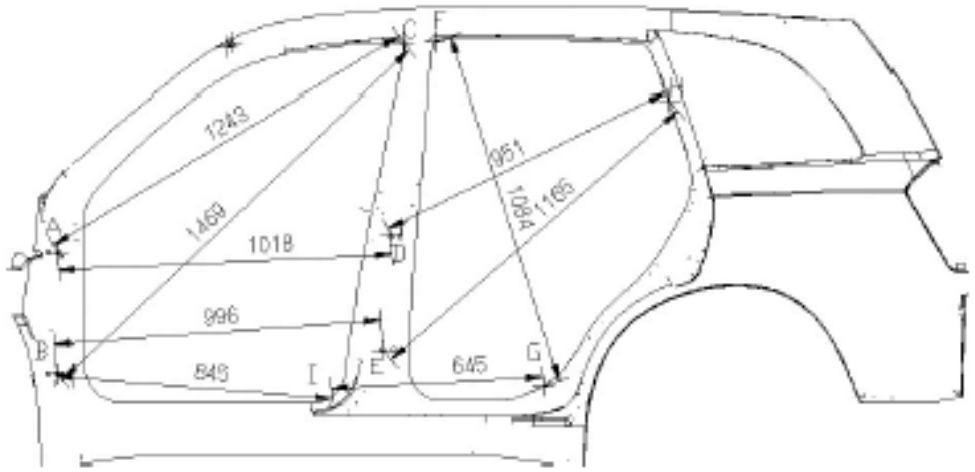


S/N	Control Dimension	Description
AB=PQ	1485.8	Diagonal distance of front windscreen
CD	733.2	Distance of front windscreen atY0
IJ	l 491.6	Center distance between the right end of upper cover of the lower beam of front windscreen and the installation hole of front fender
EH	736.1	Center distance between the upper cover hole of the lower beam of front windscreen and the installation hole of front fender
FH	270.7	Center distance between the hole of front shock absorber and the installation hole of front fender
FG	1126.8	Center distance between the holes of left/right front shock absorber
LM	952.8	Center distance between the holes of left/right engine suspension
KE	690.5	Center distance between the upper cover hole of front windscreen beam and the installation hole of radiator

Note: Sketch of Clearances in the Whole Vehicle, see Appendix: Sketch of PART NO: T11 Surface Clearances-Levelness

2. Side Fender Part

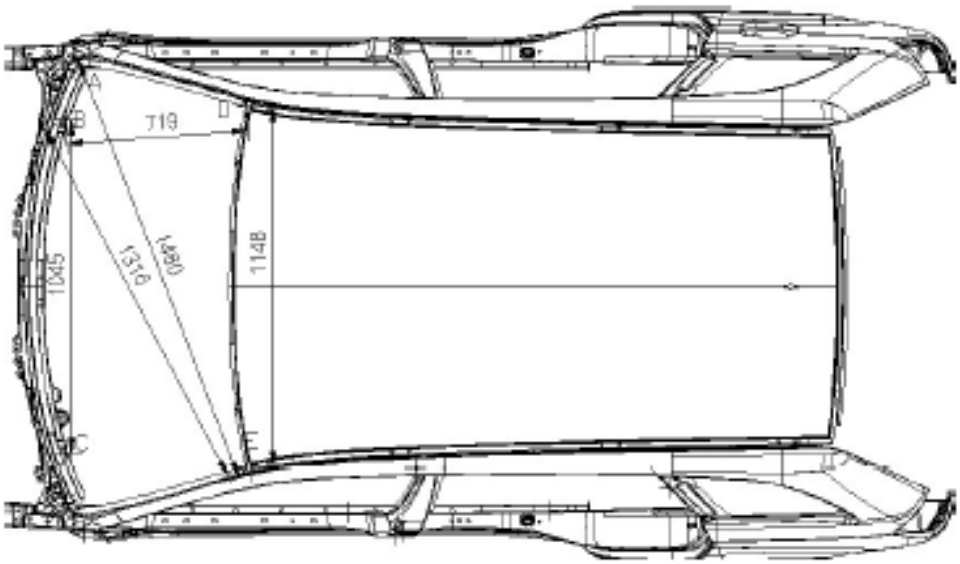
Dimension of Openings in Various Parts



Dimension of body, Left-Right

Remark: Captial letter represents right side of the body, lowercase represents left side of the body (Rear view).

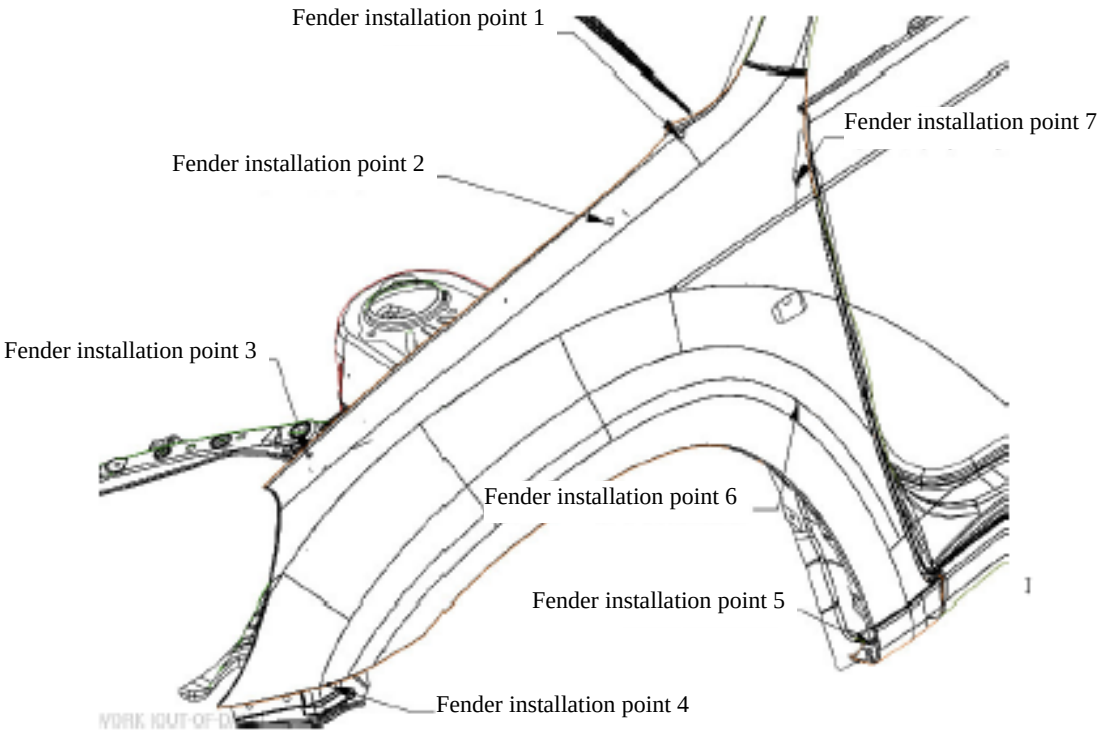
Symbol	Description	Diameter	Symbol	Description	Diameter
Aa	Installation hole of front door upper hinge	9	Ff	Front upper corner of back door guide rail at side fender	
Bb	Installation hole of front door lower hinge	9	Gg U	Support point of back door	
Cc	Upper corner of front door guide rail at side fender		Hh	Rear upper corner of back door guide rail at side fender	
Dd	Installation hole of back door upper hinge	l 3	Ii	Support point of front door	
Ee	Installation hole of back door lower hinge	l 5			

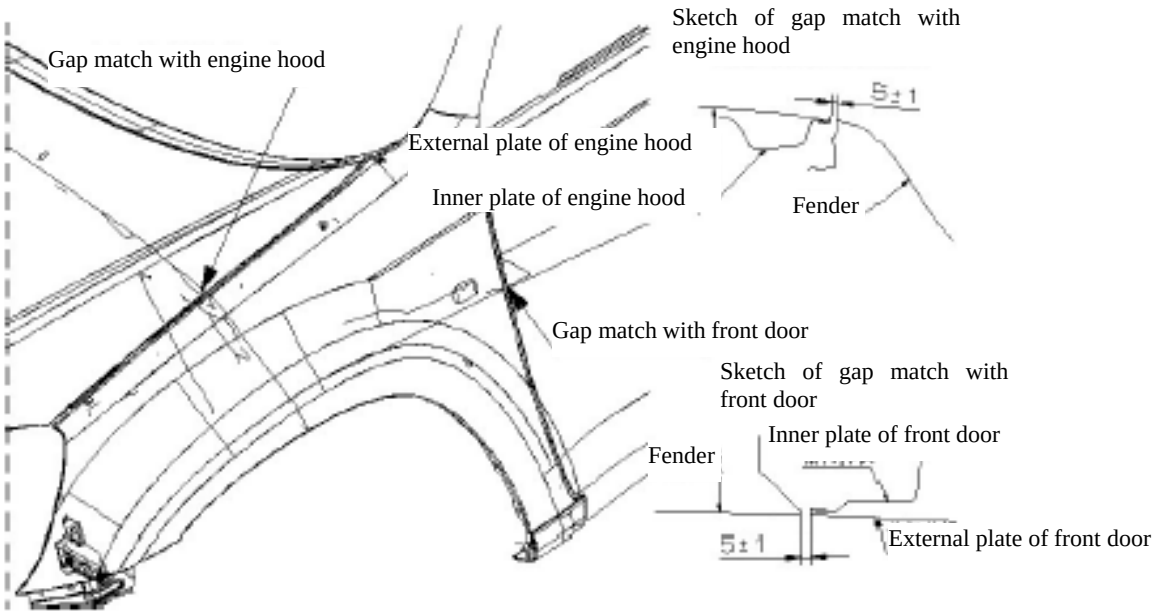


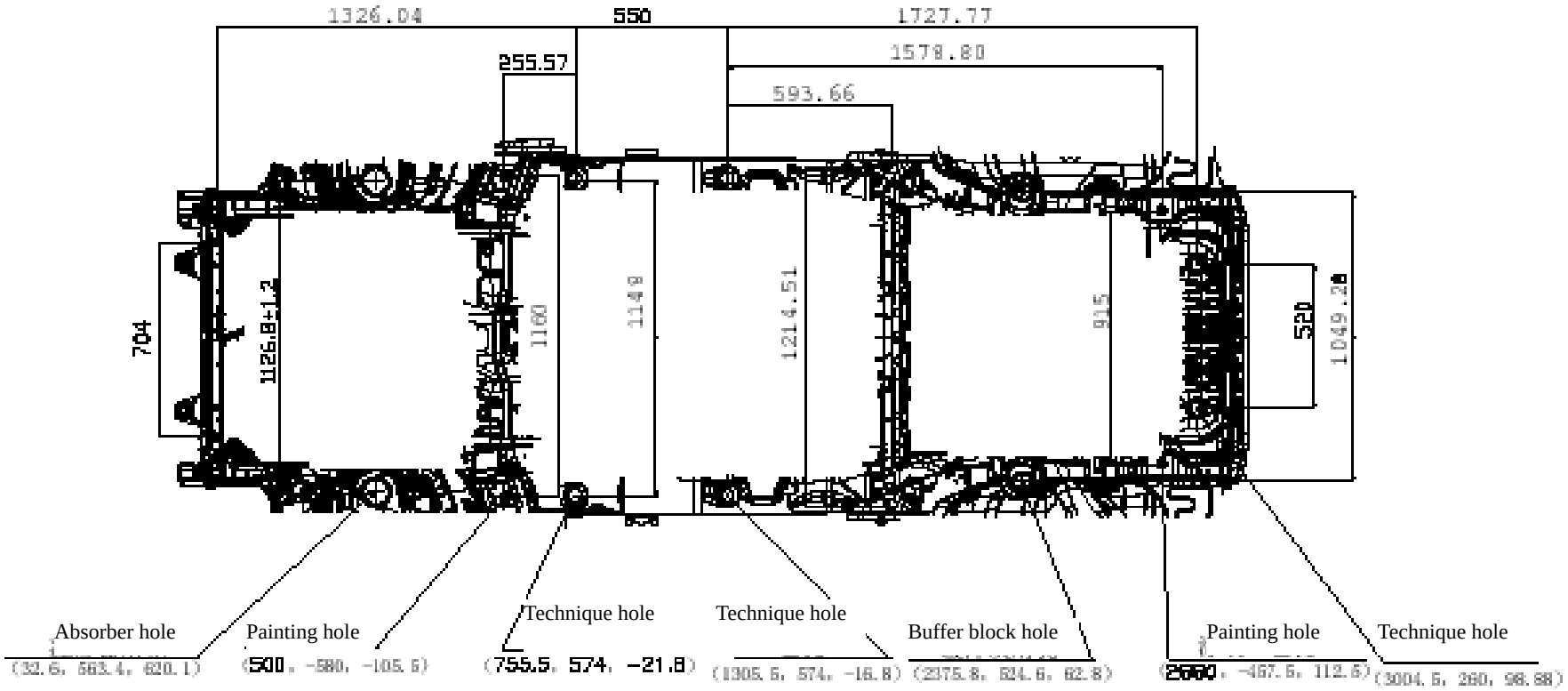
S/N	Description
AE	Diagonal distance of front windscreen
BC	Distance between feature point and upper beam of front windscreen
BE	Distance between feature point and left upper corner of front windscreen
BD	Distance between feature point and right upper corner of front windscreen
DE	Distance between right and left upper corner of front windscreen

3. Service and Replacement of Fender

1) The fender is furnished with 7 fixing bolts tightened in the torque of l0Nm, and installed at the palce as shown in the figure below:

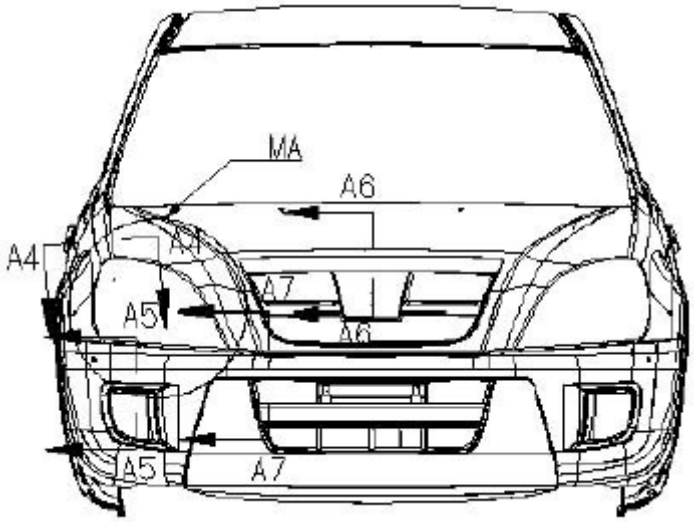




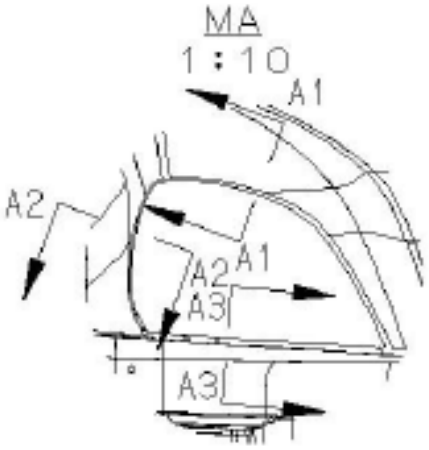

1326.04
550
1727.77
1578.80
255.57
593.66
704
1126.8±1.2
1100
1148
1214.51
915
520
1049.20
Absorber hole
(32.6, 563.4, 620.1)
Painting hole
(500, -580, -105.6)
Technique hole
(755.5, 574, -21.8)
Technique hole
(1305.6, 574, -16.8)
Buffer block hole
(2375.8, 824.6, 62.8)
Painting hole
(2660, -467.6, 112.6)
Technique hole
(3004.6, 260, 98.88)

4. Clearance and Levelness Requirements of Various Parts

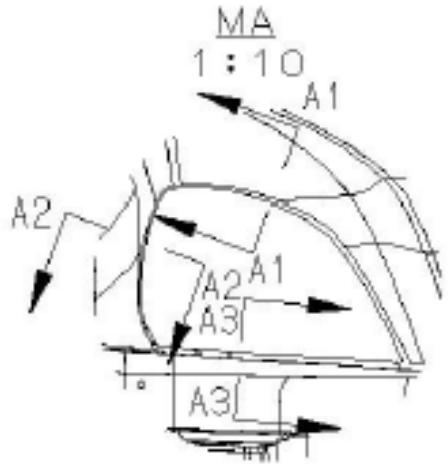
Front View



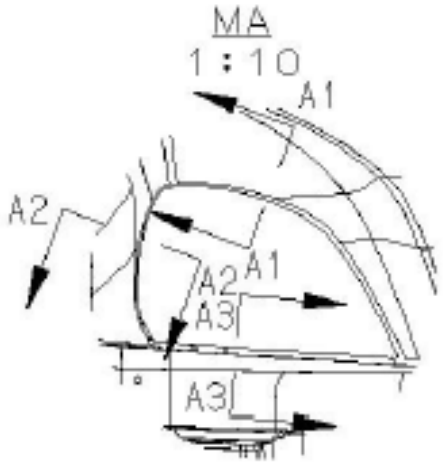
Crosssection A1-A1, requirements on clearance and levelness.



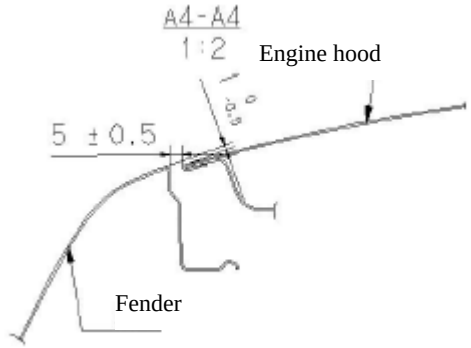
Crosssection A2-A2, requirements on clearance and levelness.



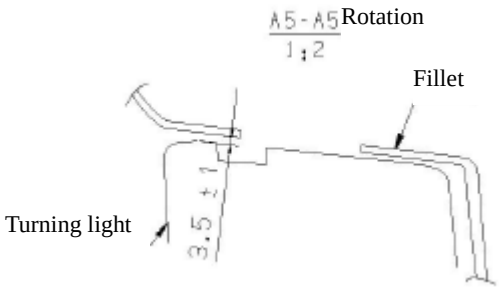
Crosssection A3-A3, requirements on clearance and levelness.



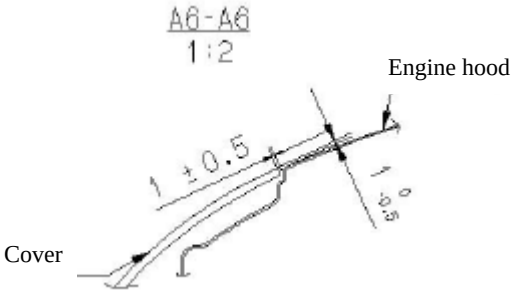
Crosssection A4-A4, requirements on clearance and levelness.



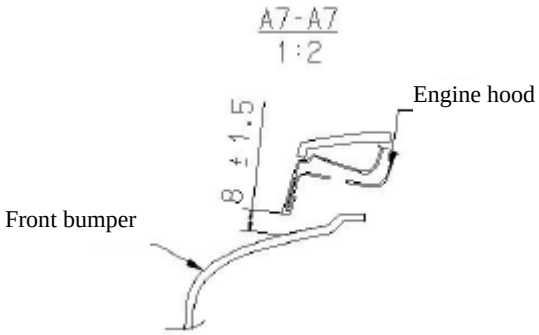
Crosssection A5-A5, requirements on clearance and levelness.



Crosssection A6-A6, requirements on clearance and levelness.

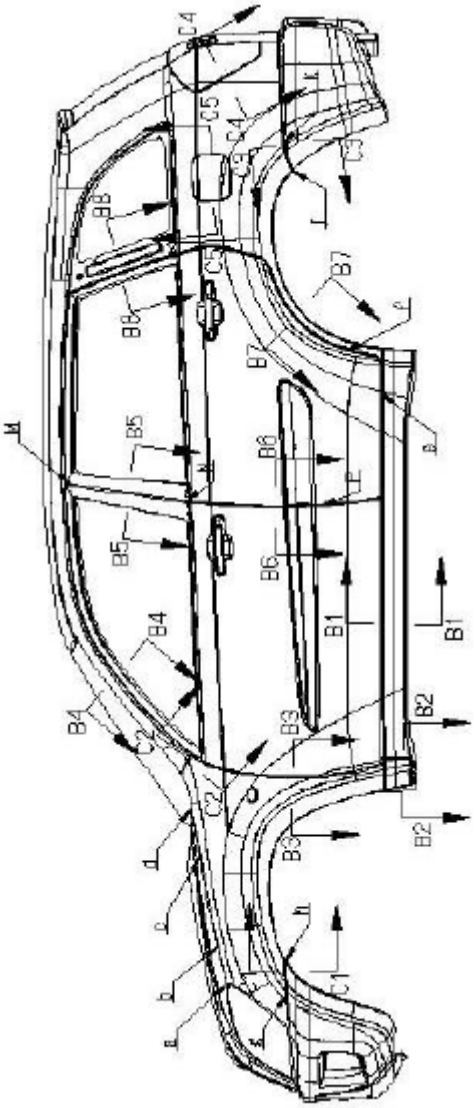


Crosssection A7-A7, requirements on clearance and levelness.



5. Dimension of Body

Side View



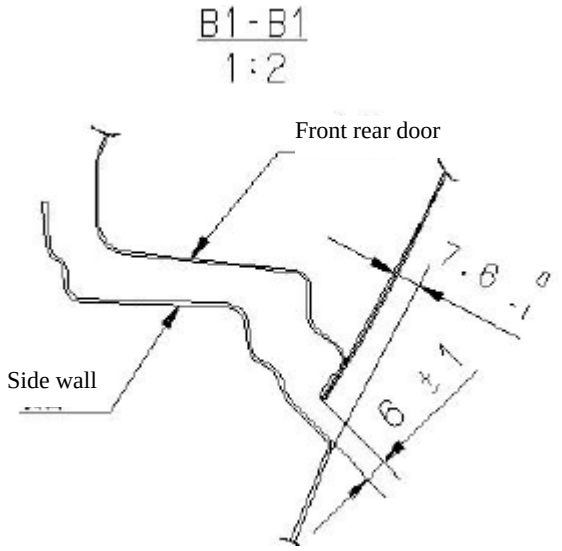
Where: The levelness from point a to b shall be evenly changed from 0 to 1, and the levelness from point c to b shall be evenly changed from 1 to 0.

The clearance from point f to c shall be evenly changed from 6 to 7, and the levelness from point g to h shall be evenly changed from 1 to 0.

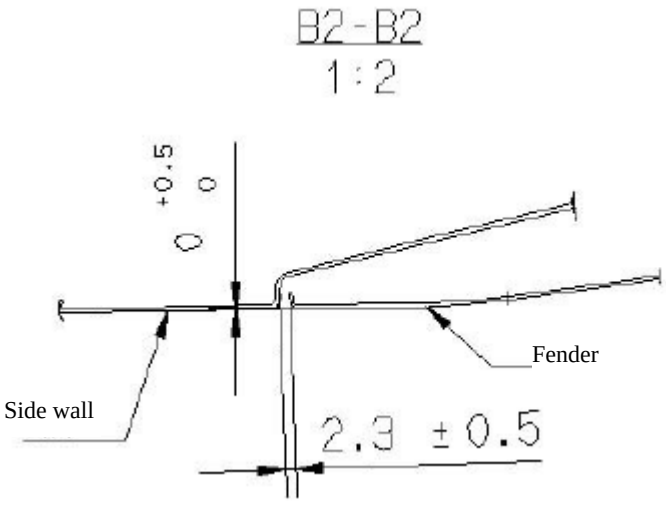
The levelness from point k to j shall be evenly changed from 0 to 1.

The tolerance of clearance between front and back doors at MN, NP sections shall be within 1.2mm.

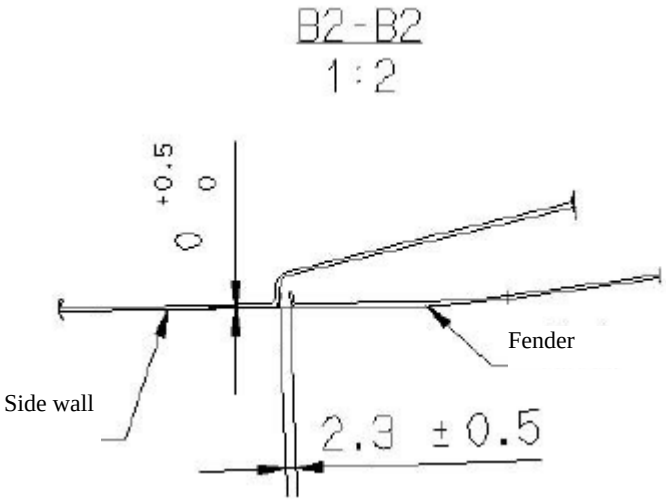
Crosssection B1-B1, requirements on clearance and levelness.



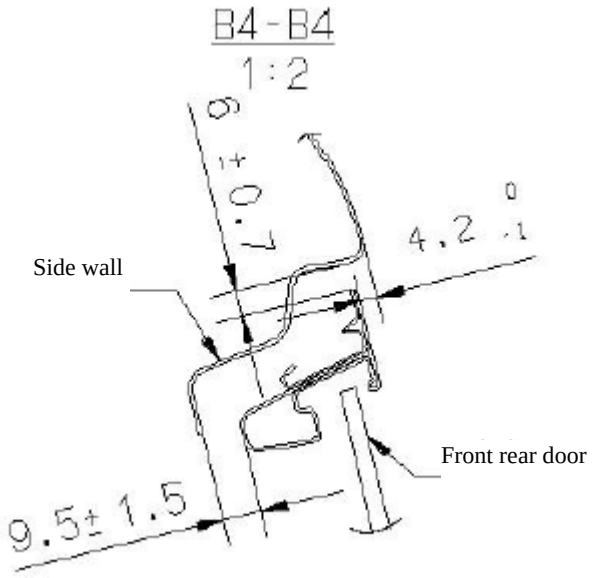
Crosssection B2-B2, requirements on clearance and levelness.



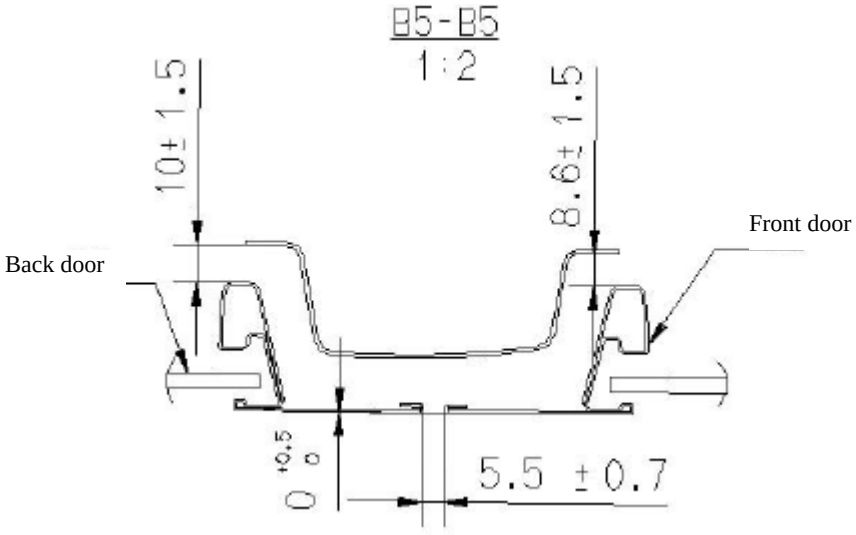
Crosssection B3-B3, requirements on clearance and levelness.



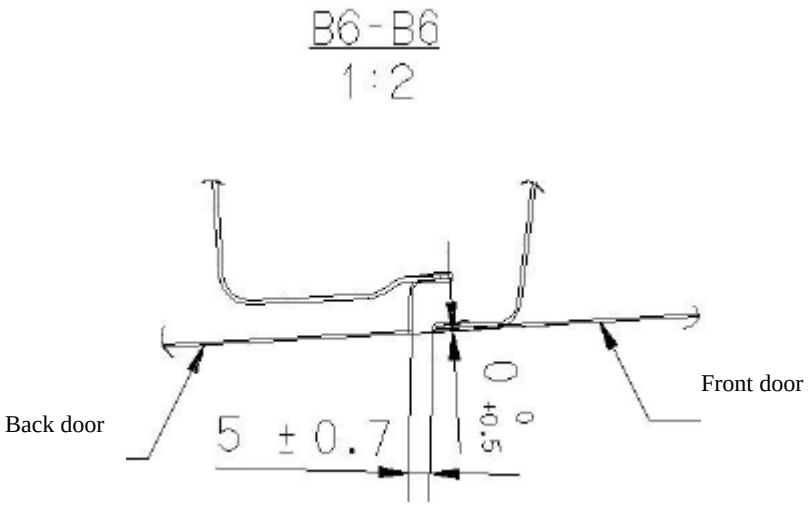
Crosssection B4-B4, requirements on clearance and levelness.



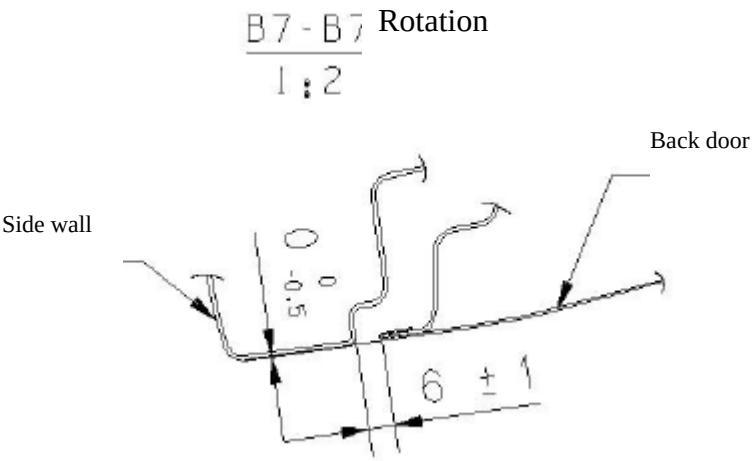
Crosssection B5-B5, requirements on clearance and levelness.



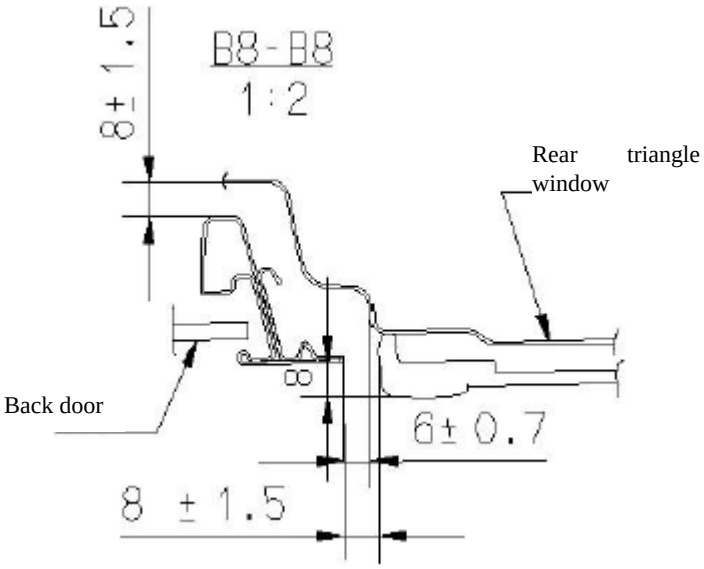
Crosssection B6-B6, requirements on clearance and levelness.



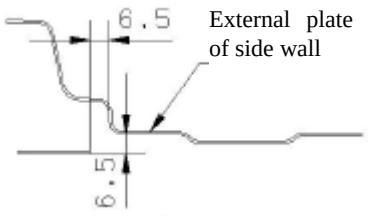
Crosssection B7-B7, requirements on clearance and levelness.



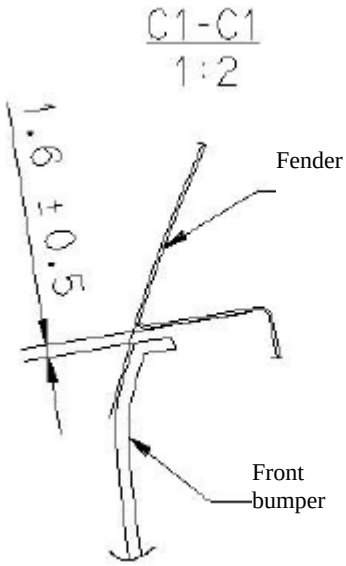
Crosssection B8-B8, requirements on clearance and levelness.



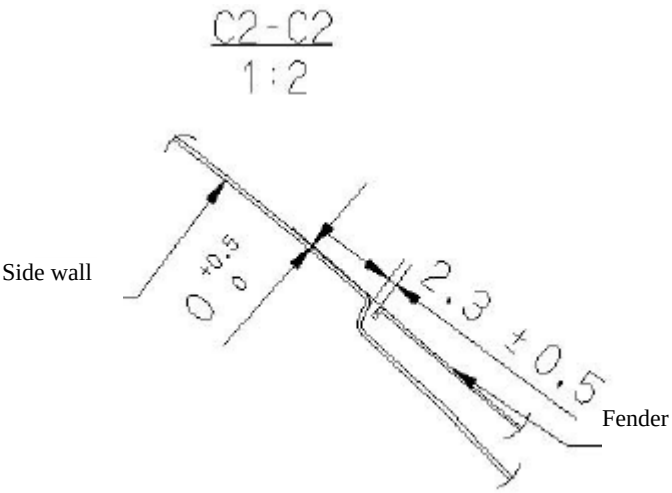
Crosssection B1-B1, requirements on clearance and levelness.



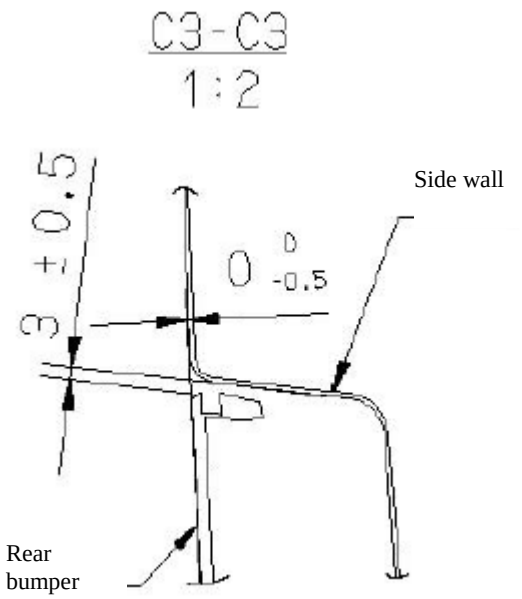
Crosssection C1-C1, requirements on clearance and levelness.



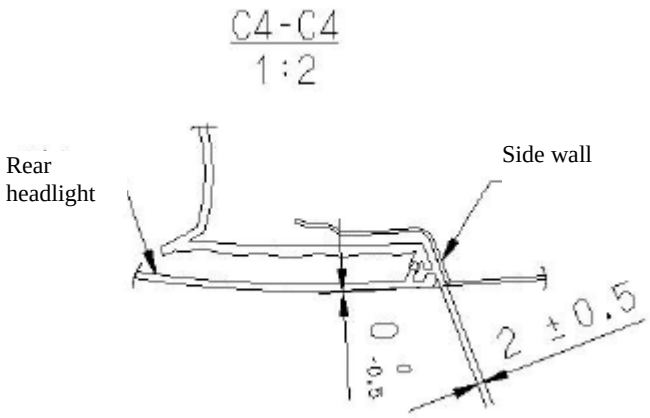
Crosssection C2-C2, requirements on clearance and levelness.



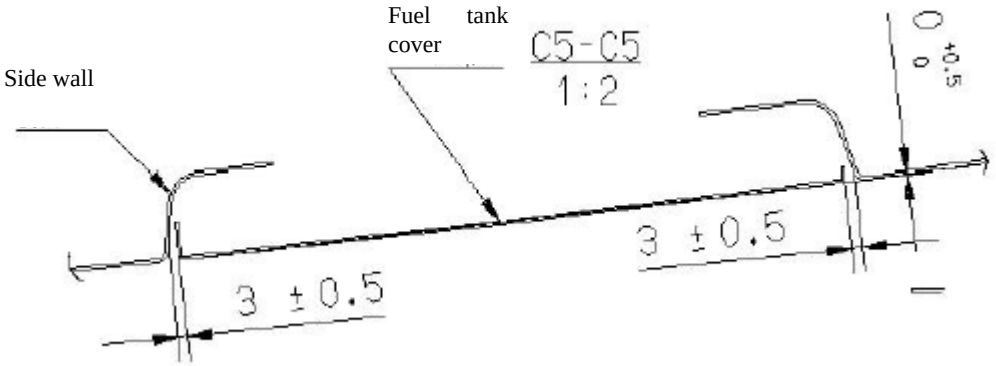
Crosssection C3-C3, requirements on clearance and levelness.



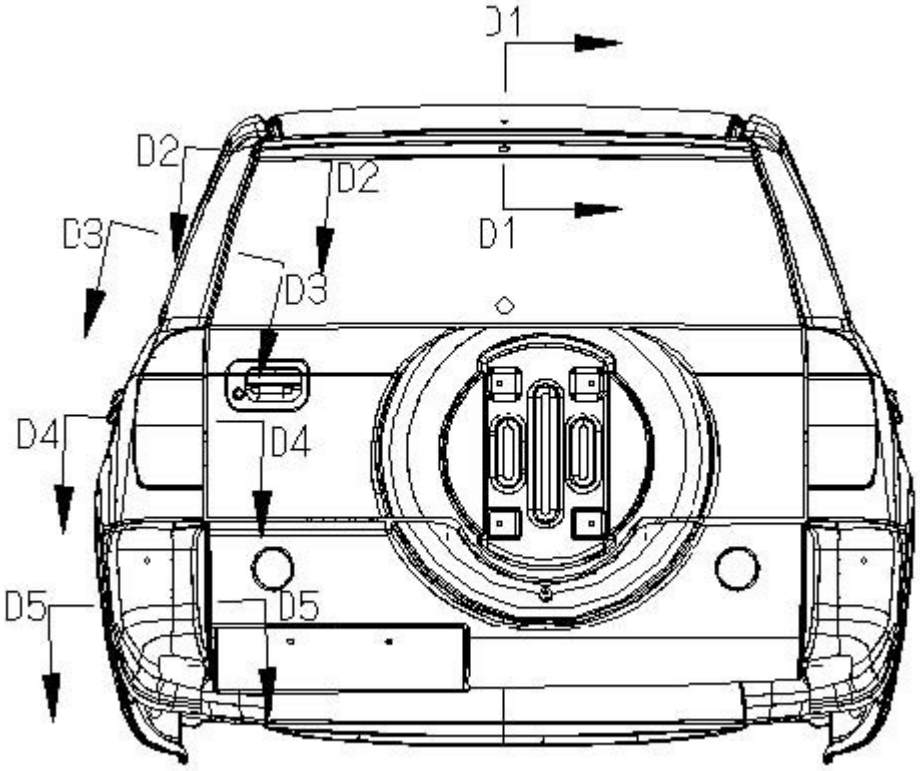
Crosssection C4-C4, requirements on clearance and levelness.



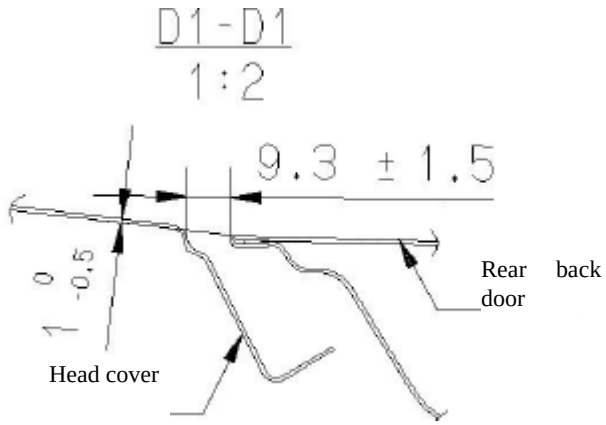
Crosssection C5-C5, requirements on clearance and levelness.



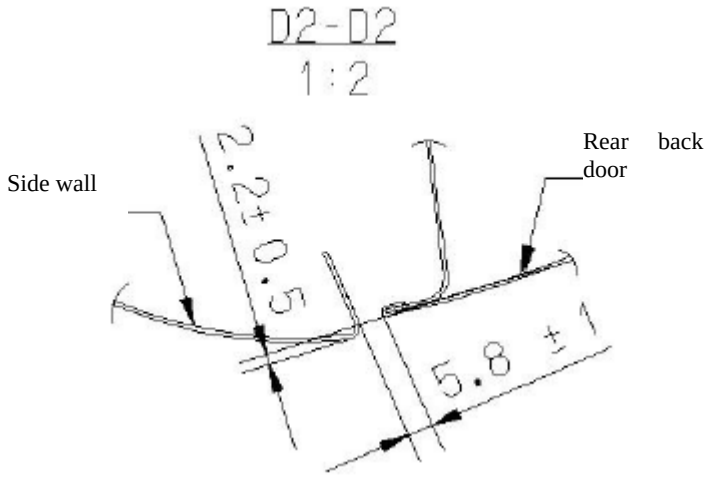
Rear View



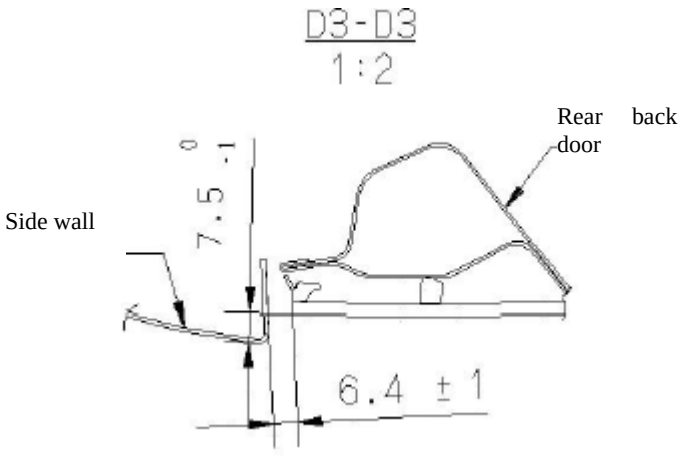
Crosssection C1-C1, requirements on clearance and levelness.



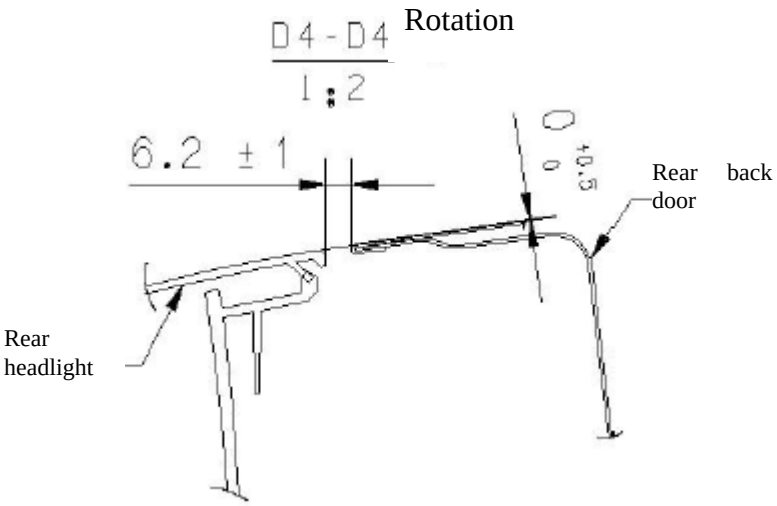
Crosssection C2-C2, requirements on clearance and levelness.



Crosssection C3-C3, requirements on clearance and levelness.



Crosssection C4-C4, requirements on clearance and levelness.



Crosssection C5-C5, requirements on clearance and levelness.

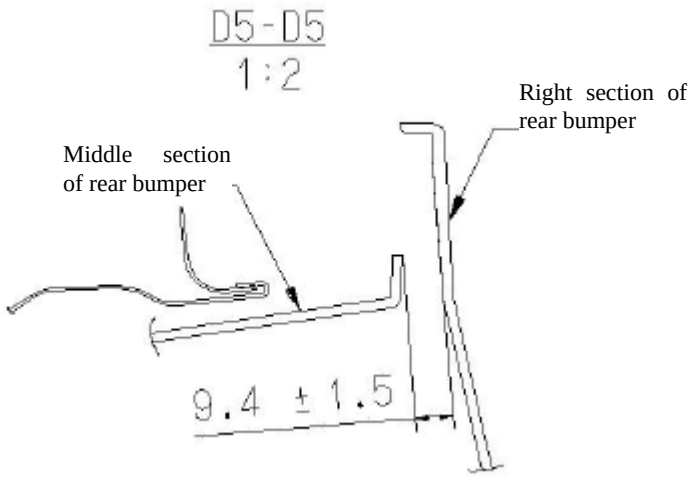


TABLE OF CONTENTS

Diagram Description

1. Circuit Number for Relay Box

30: means the circuit is directly from the battery;
IG1: means the 1st gear of ignition switch;
IG2: means the 2nd gear of ignition switch;
ACC: means the RADIO gear of ignition switch;
31: means the earth wire.

2. Connecting pieces description

For example: The front A/1 means the Terminal 1 (at the instrument wire harness), Connector A of the instrument wire harness and engine compartment wire harness.

ECU/A/1 means the Terminal 1 (at the ECU wire harness), Connector A of the ECU wire harness and instrument wire harness.

QB/A/1 means the Terminal 1, Connector A of the instrument electrical box.

QC/A/1 means the Terminal 1, Connector A of the front compartment electrical box.

F1 (YB) means the Fuse 1 of the instrument electrical box.

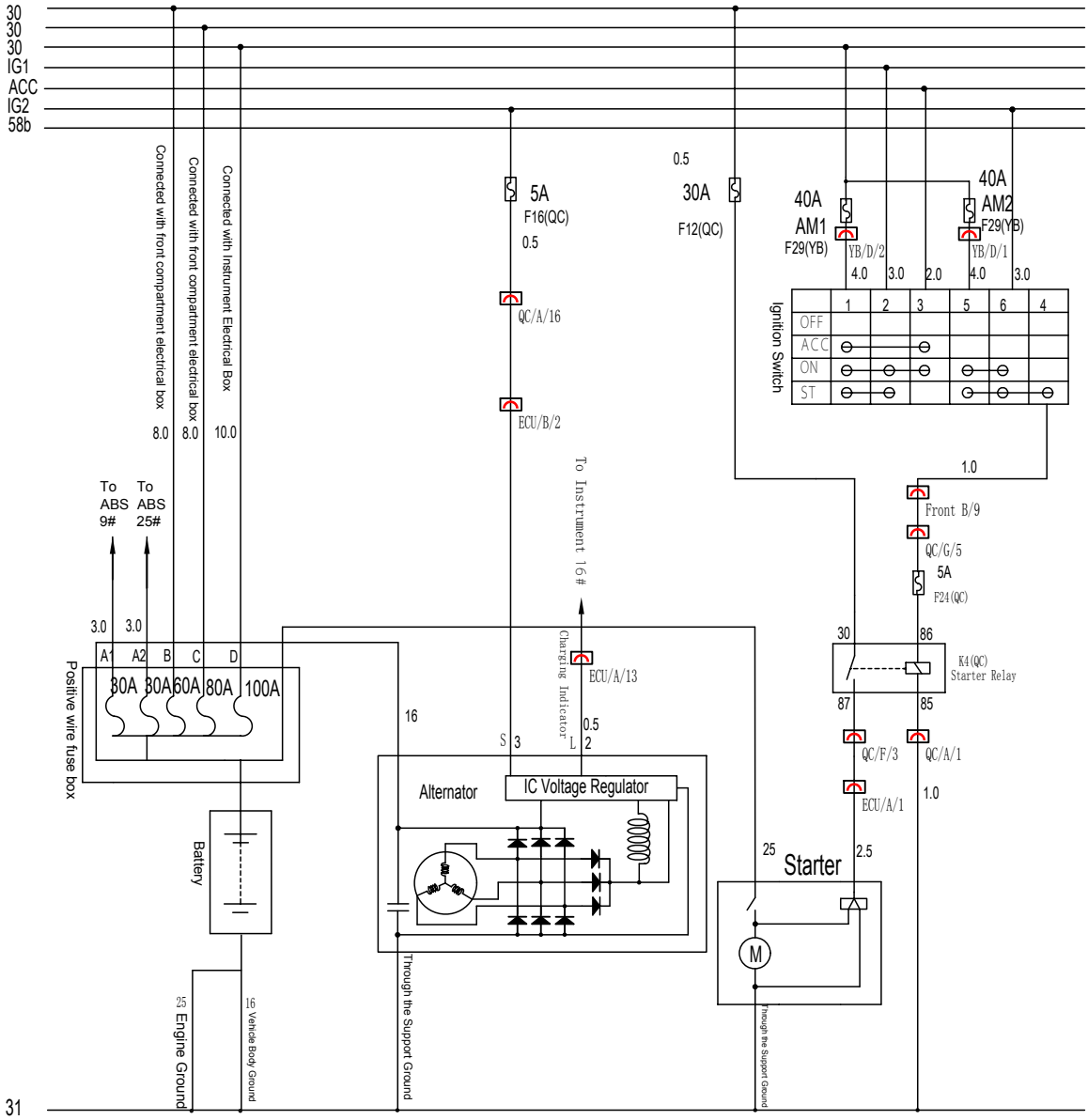
F1 (QC) means the Fuse 1 of the engine compartment electrical box.

3. ISU connecting pieces & terminals description

ISU PE4 means the port A, PE3 means the port B, PE2 means the port C, PE1 means the port D, PE5 means the port E, and PE6 means the port F.

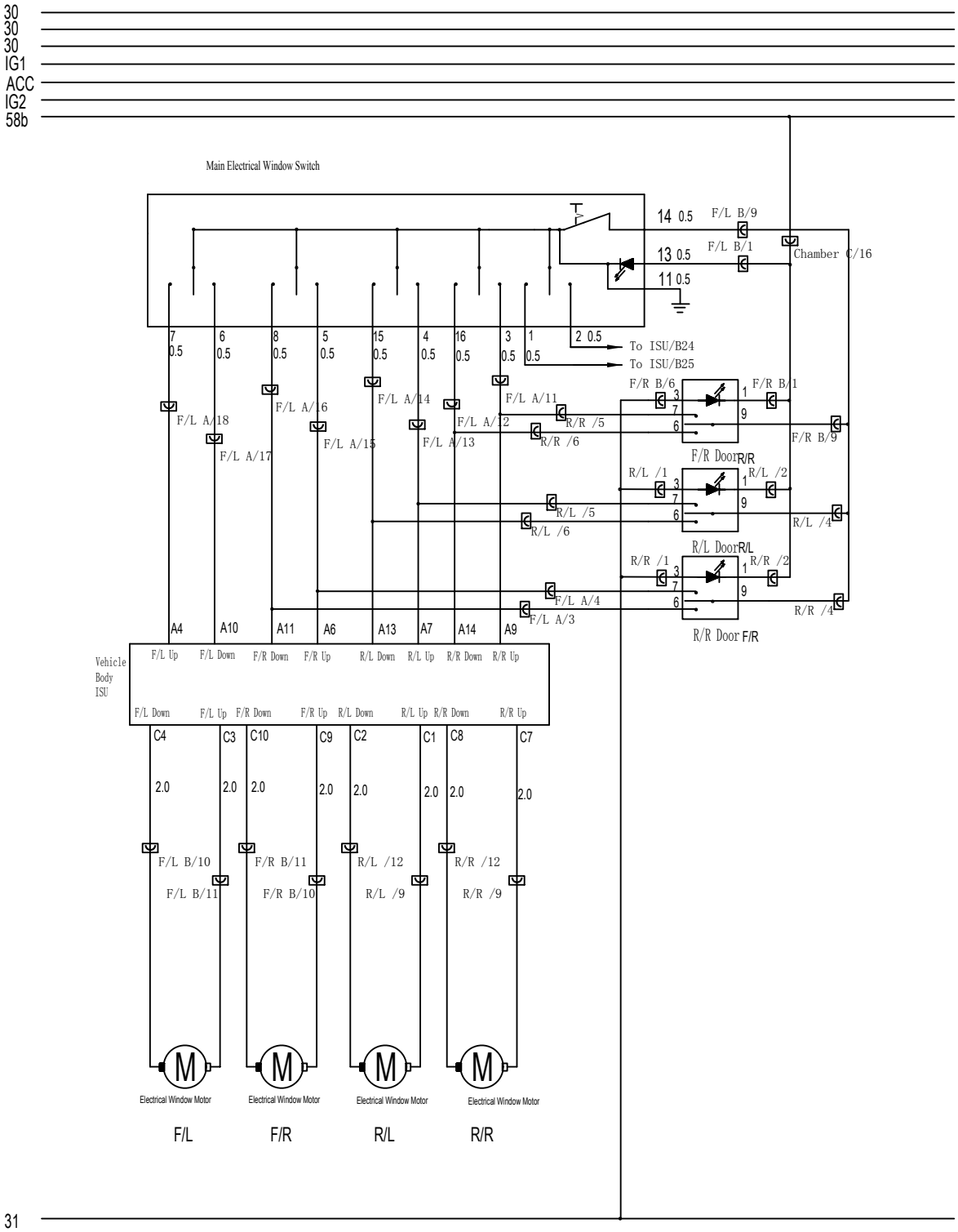
4. The main reference model related to this circuit diagram is the 2.4 model with basic configuration. It is hard to avoid the occurrence of errors due to the limit of time. If you find some unconformities to the actual conditions in the course of use, please contact us, service department of chery international, please send the email to us : fuwubu@mychery.com.

Startup and Charging System

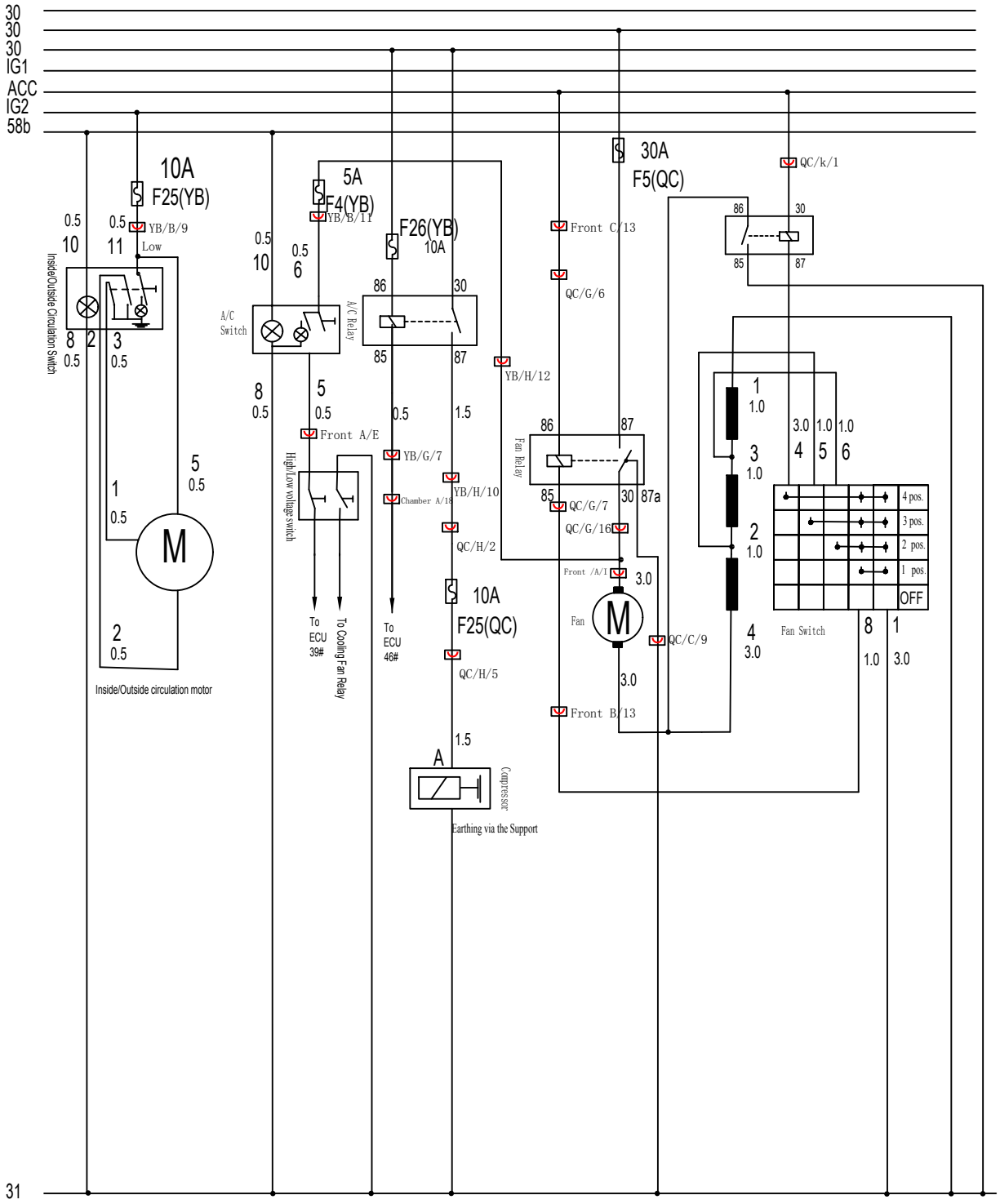


1. The pins 1 and 5 of ignition switch are available for the power supply of battery 30.
2. The pin 2 of ignition switch is applied for the IG1 power supply. This pin is divided into two branches, one of which connects to the instrument electrical box E1; and the other connects to the front compartment electrical box G3 using the connector (front B/10).
3. The pin 2 of ignition switch is used for the ACC power supply. This pin is divided into two branches, one of which connects to the instrument electrical box E4; and the other connects to the front compartment electrical box G6 using the connector (front B/18).
4. The pin 2 of ignition switch is designed for the IG2 power supply. This pin is divided into two branches, one of which connects to the instrument electrical box E2; and the other connects to the front compartment electrical box I6 using the connector (front A/L).

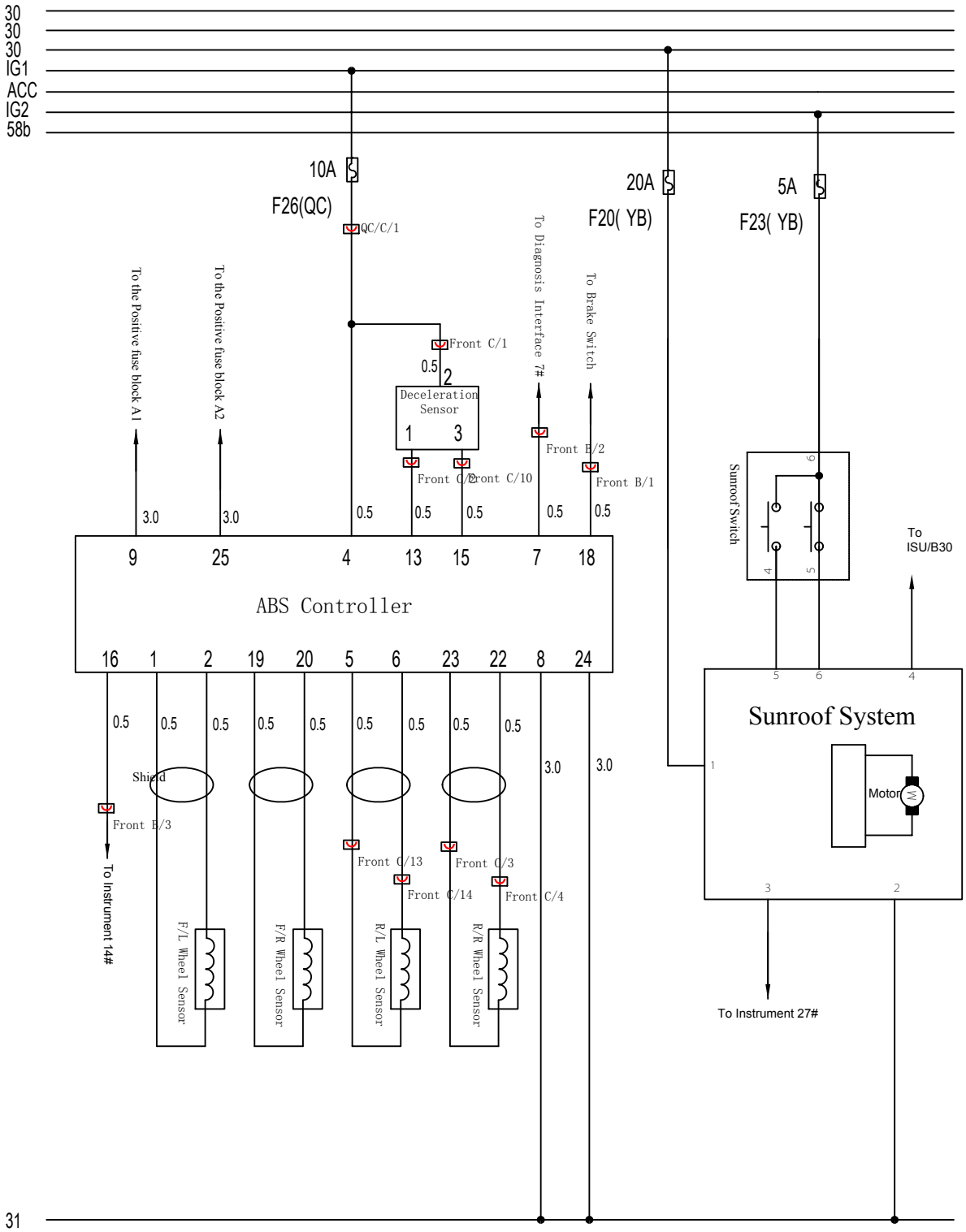
Glass Lift System



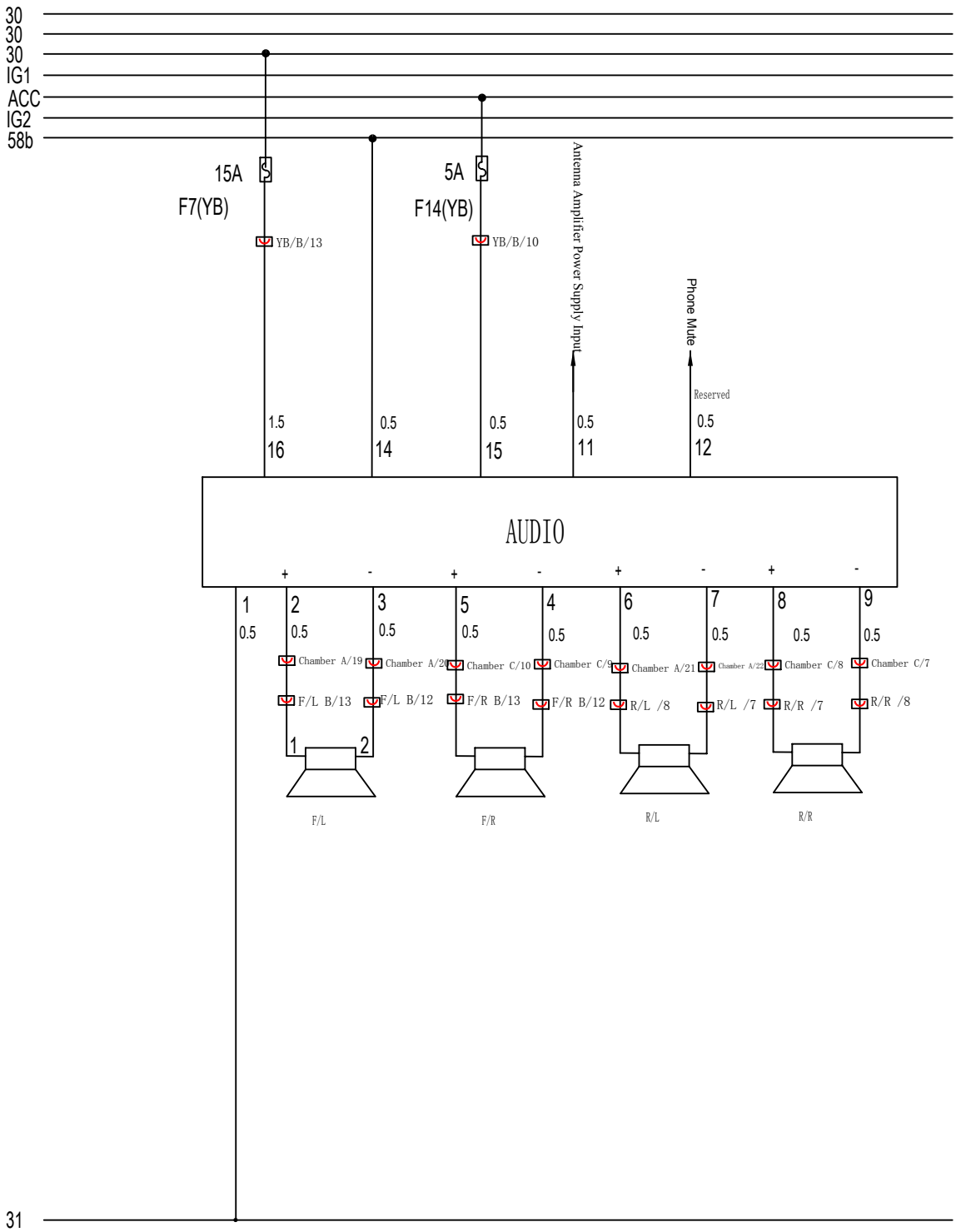
A/C System


30
30
30
IG1
ACC
IG2
58b
31
10A
F25(YB)
YB/B/9
Low
Inside/Outside Circulation Switch
Inside/Outside circulation motor
5A
F4(YB)
YB/B/11
F26(YB)
10A
A/C Switch
A/C Relay
Front A/E
High/Low voltage switch
To ECU 39#
To Cooling Fan Relay
YB/G/7
Chamber A/18
To ECU 46#
YB/H/10
QC/H/2
10A
F25(QC)
QC/H/5
A
Compressor
Earthing via the Support
YB/H/12
30A
F5(QC)
Front C/13
QC/G/6
Fan Relay
QC/G/7
QC/G/16
Front /A/1
Fan
M
QC/C/9
Front B/13
QC/k/1
Fan Switch
4 pos.
3 pos.
2 pos.
1 pos.
OFF

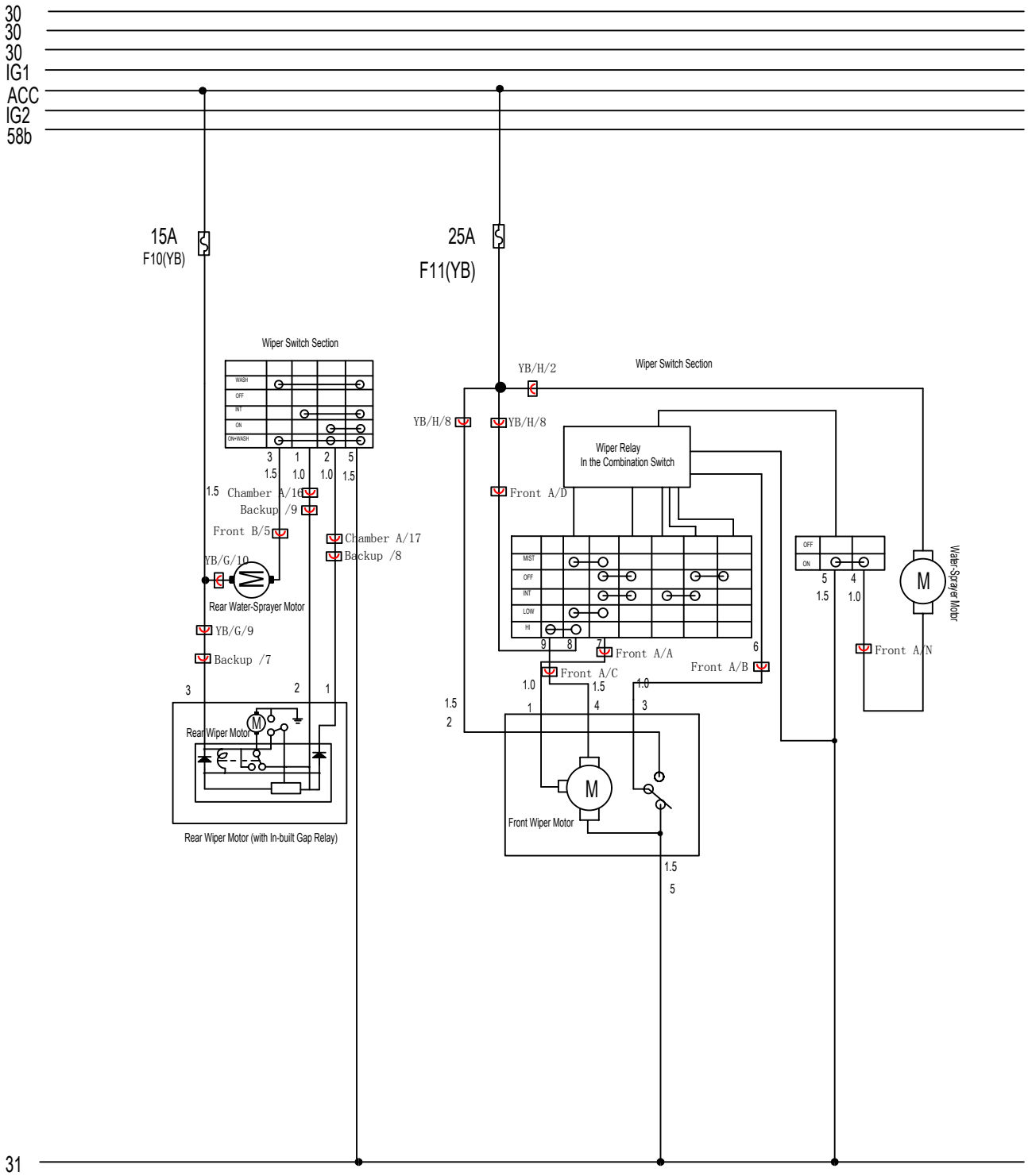
ABS and Sunroof System



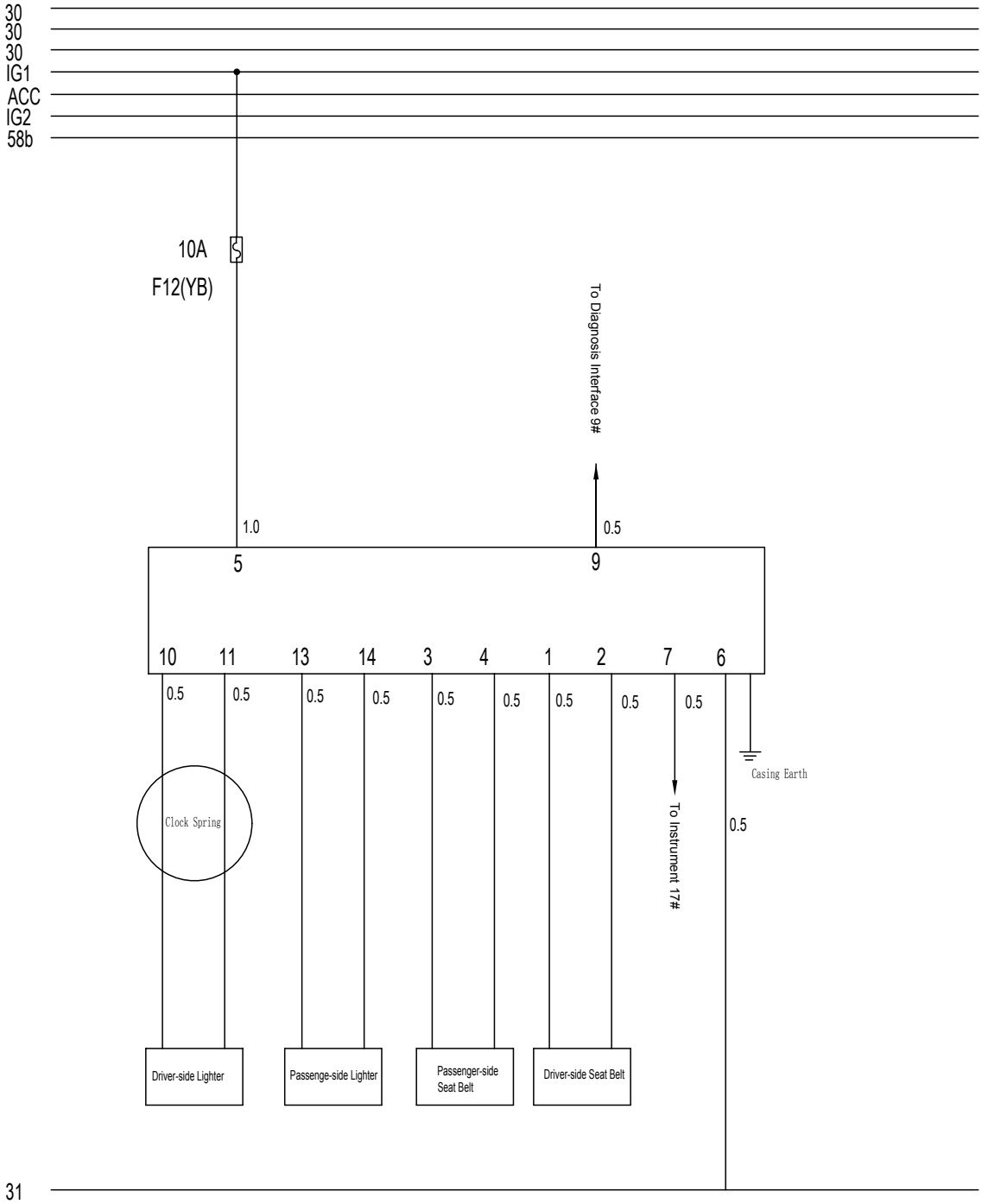
Audio System



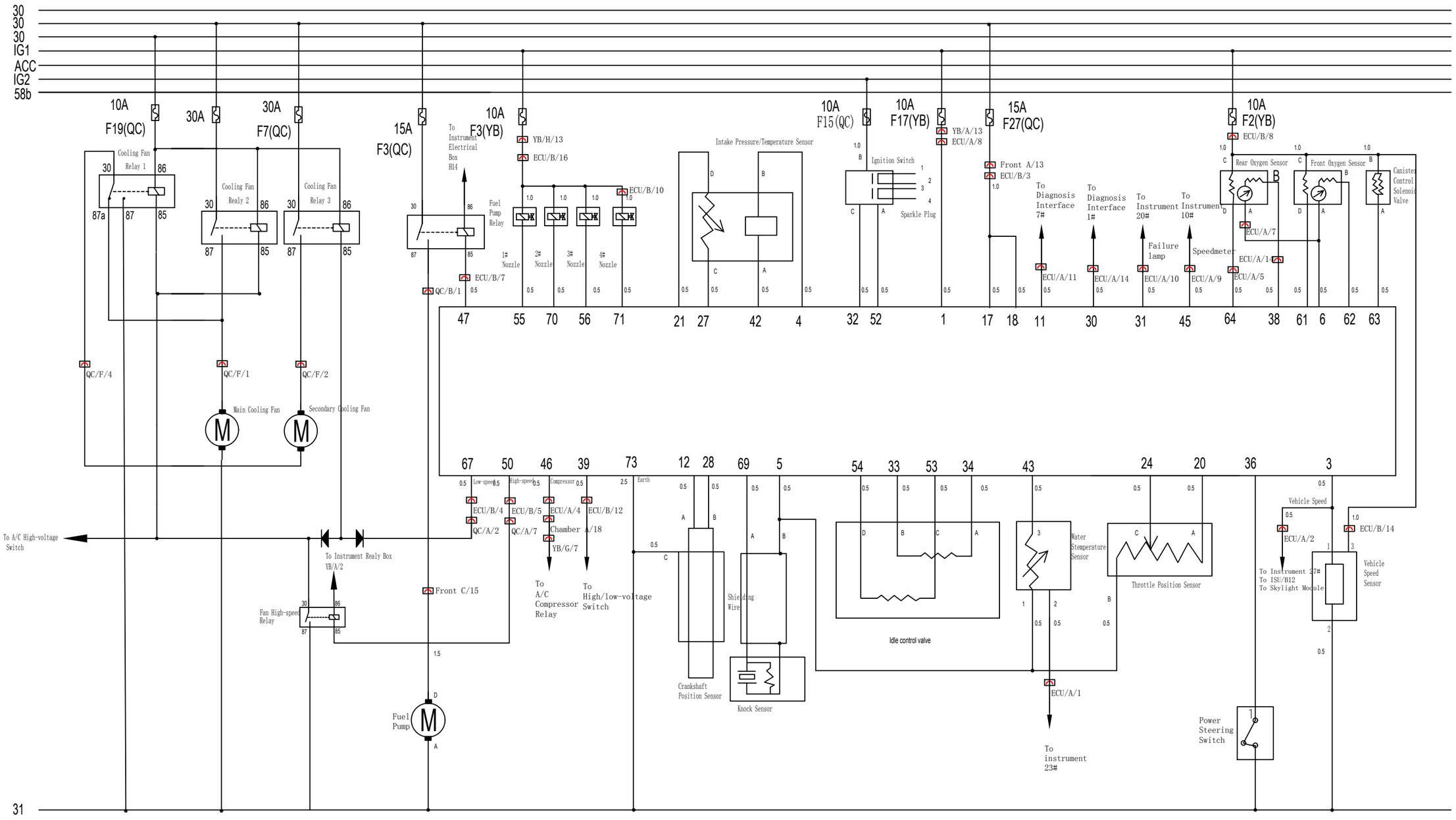
Wiper System



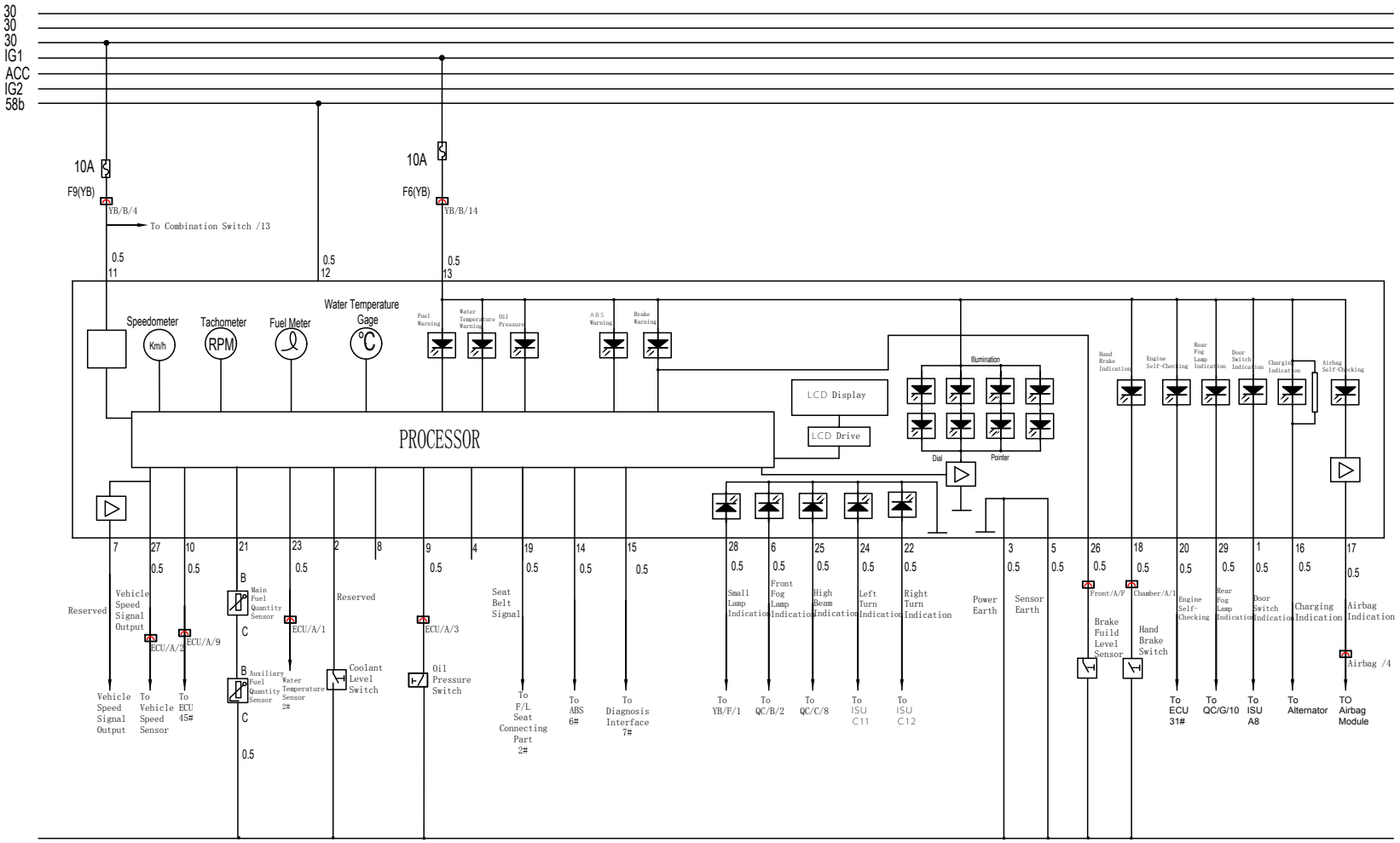
Safety Airbag System



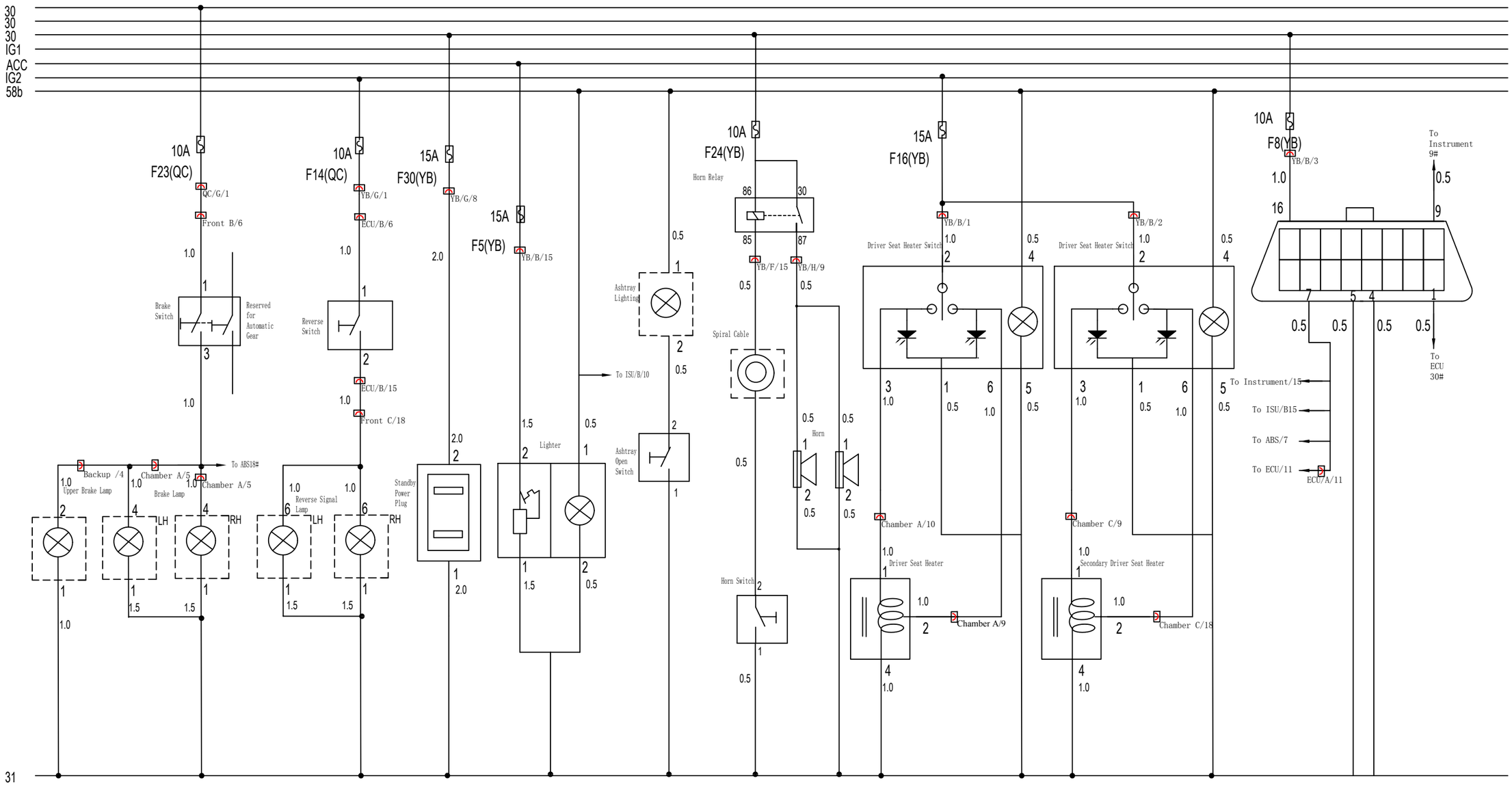
Engine System



Instrument System

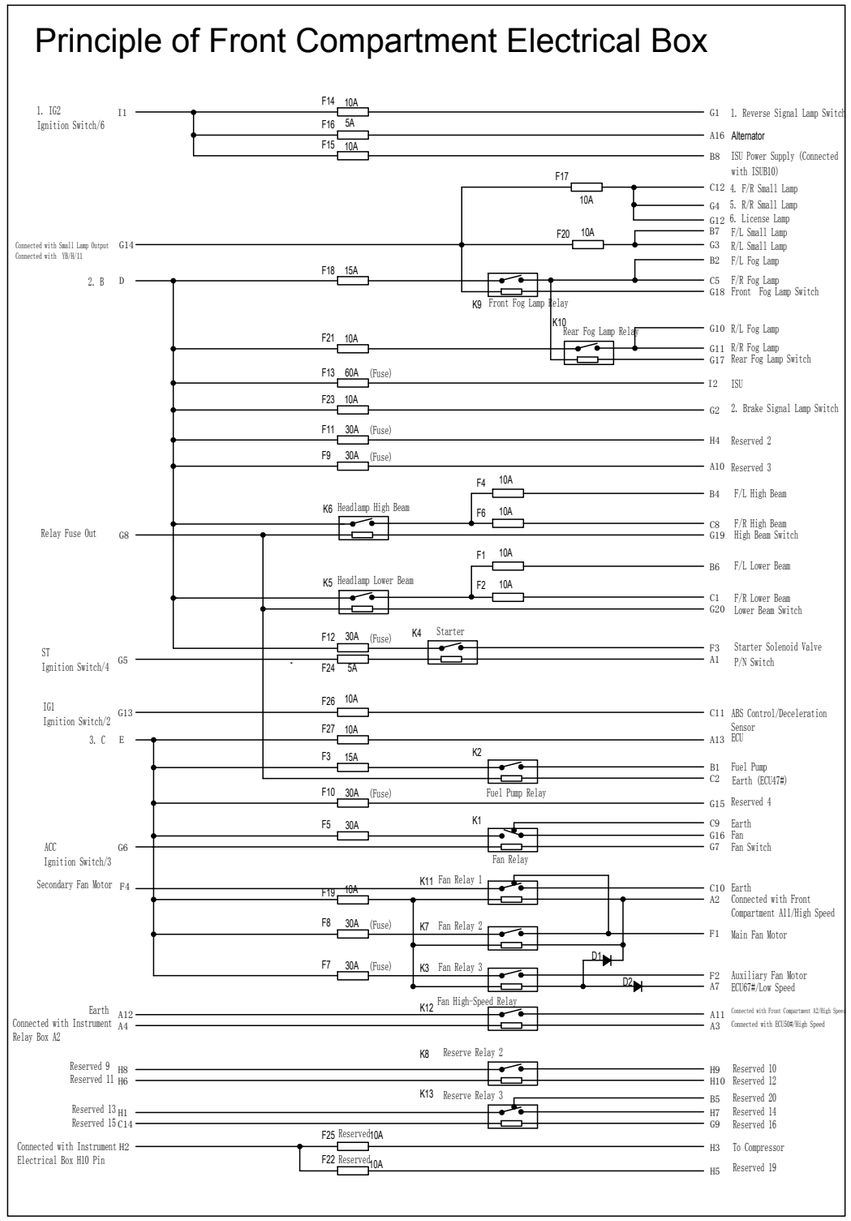


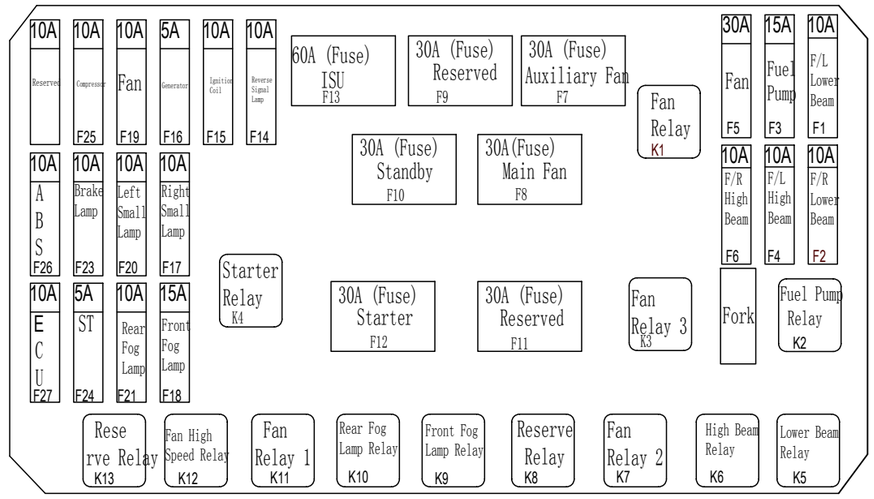
Brake Signal, Reverse Signal, Cigarette Lighter, Reserved Power Supply, Horn, Seat Heater and Diagnosis Interface System

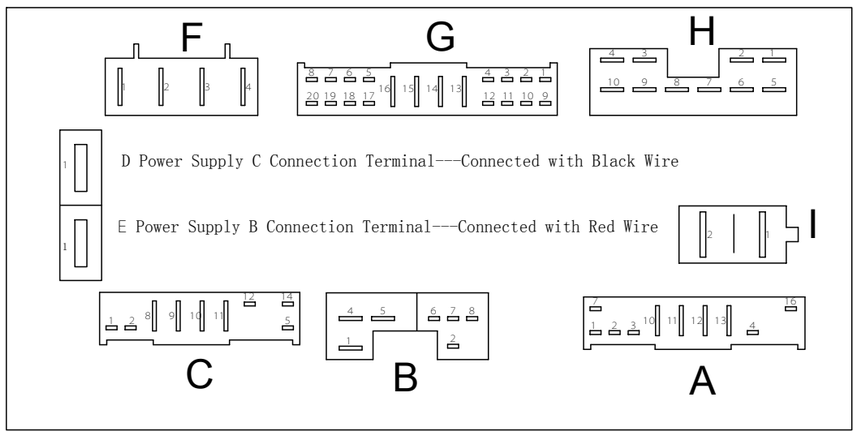


Front Compartment Electrical Box System

Principle of Front Compartment Electrical Box







Instrument Electrical Box System

Principle of Instrument Panel Electrical Box