Engine

General Information and Maintenance GI-1

GI General Information GI-1

Precautions GI-1
How to Use This Manual GI-6
Model Identification Information GI-7
Lifting Points GI-12
Tow Truck Towing GI-13
Tightening Torques of Standard Bolts GI-14
Terminology GI-15

MA Maintenance MA-1

Preparation MA-1
General Maintenance MA-2
Periodic Maintenance MA-3
Recommended Oils and Lubricants MA-4
Engine Maintenance MA-6
Chassis and Body Maintenance MA-11

Engine EM-1

EM Engine Mechanical EM-1

Precautions EM-1
Preparation EM-3
Engine Structure Overview EM-6
Drive Belts EM-8
Air Cleaner and Air Duct EM-10
Intake Manifold EM-12
Exhaust Manifold and Three Way Catalyst EM-14
Ignition Coil and Spark Plug EM-15

Fuel Injector and Fuel Rail EM-17
Timing Belt EM-21
Camshaft and Rocker Arm EM-24
Oil Seal EM-27
Cylinder Head and Valves EM-30
Cylinder Block and Crankshaft EM-37
Oil Pan and Oil Strainer EM-50
Positive Crankcase Ventilation EM-52
Engine Assembly Removal and Installation EM-53
Trouble Diagnosis EM-56
Service Data and Specifications EM-59

LU Lubrication System LU-1

Precautions LU-1
Preparation LU-1
Engine Oil LU-2
Oil Filter LU-4
Oil Pump LU-6
Service Data and Specifications LU-8

CO Cooling System CO-1

Precautions CO-1
Preparation CO-2
Cooling System Circuit CO-3
Engine Coolant CO-4
Radiator CO-6
Cooling Fan CO-8
Water Pump CO-9
Water Inlet and Thermostat Assembly CO-10
Water Outlet and Water Piping CO-12
Trouble Diagnosis CO-13

Service Data and Specifications..... CO-15

FL Fuel System..... FL-1

Precautions..... FL-1

Preparation..... FL-2

Fuel System Composition..... FL-2

Fuel Injector and Fuel Rail..... FL-3

Fuel Filter..... FL-4

Feed Pipe Assembly and Vapor Pipe Assembly..... FL-6

Fuel Level and Sensor Unit..... FL-6

Fuel Tank..... FL-9

Fuel Pump..... FL-9

Fuel Evaporative Emission System..... FL-12

Trouble Diagnosis..... FL-14

Service Data and Specifications..... FL-15

ACC Accelerator Control System..... ACC-1

Accelerator Control Unit..... ACC-1

Service Data and Specifications..... ACC-2

EC Engine Control System..... EC-1

Precautions..... EC-1

Preparation..... EC-2

Engine Control System Overview..... EC-3

Engine Control System Components..... EC-9

On-Board Diagnostic (OBD) System..... EC-25

Trouble Diagnosis..... EC-29

Service Data and Specifications..... EC-85

Precautions for multiport fuel injection system or engine control system:

- Before connecting or disconnecting any harness connector for the multiport fuel injection system or ECM:

① Turn ignition switch to "OFF" position.

② Disconnect negative battery terminal. Otherwise, there may be damage to ECM.

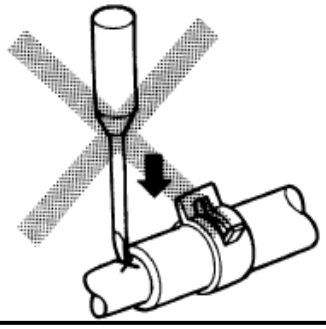
- Before disconnecting pressurized fuel line from fuel pump to injectors, be sure to release fuel pressure.
- Be careful not to shake components such as ECM and sensors.

Precautions for hoses:

1. Hose removal and installation

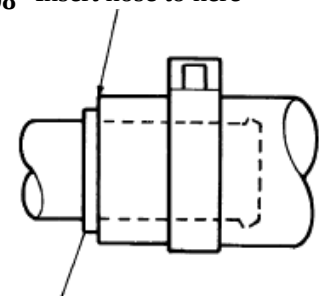
- To prevent damage to a rubber hose, do not pry off it with pointed tool or screwdriver.

GI007 Do not scratch tube



- To fix the rubber hose securely, make sure that hose insertion length is adequate and clamp position is correct. (If metal tube is equipped with hose stopper, insert hose into tube until it butts up against hose stopper.)

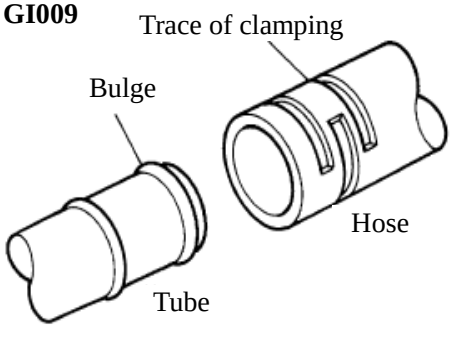
GI008 Insert hose to here



2. Hose clamp

- If old rubber hose is reused, install hose clamp in its original position (at the indentation where the old clamp was). If there is a trace of metal tube bulging left on the old rubber hose, align rubber hose at that position.
- Discard old clamps; be sure to replace with new ones.

GI009



Board-on lift:

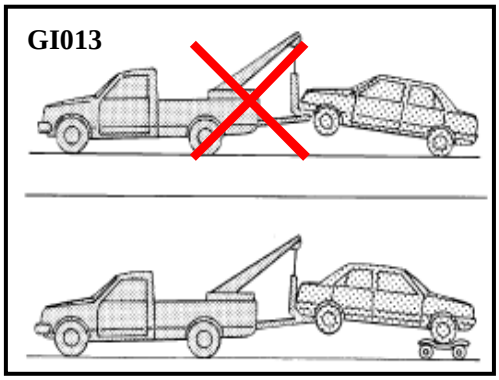
Caution:

- Make sure vehicle is empty when lifting.
- The board-on lift attachment set at front end of vehicle should be set on the front of the sill under the front door opening.
- Position attachments at front and rear ends of board-on lift.

Tow Truck Towing

Caution:

- All applicable local laws regarding the towing operation must be obeyed.
- Be sure to use proper towing equipment to avoid possible damage to the vehicle during towing operation. For more details regarding towing, refer to related instructions on the “Owner’s Manual”.
- Be sure to attach safety chains before towing.



- When towing, make sure that the transmission, steering system and power train are in good order. If any unit is damaged, dollies must be used. It is recommended that the vehicle be towed with the driving (front) wheels off the ground as shown in the above figure.

Vehicle recovery (freeing a stuck vehicle):

- Pull the cable straight out from the front or rear of the vehicle. Never pull on the hook at an angle.
- When towing a vehicle forward, remove front spoiler. Otherwise front spoiler may be damaged by the towing equipment.
- Pulling devices such as ropes or canvas straps are not recommended for use in vehicle towing or recovery.
- Use towing hook only and not other components of the vehicle. Otherwise, the vehicle body will be damaged.
- Use towing hook to free a vehicle stuck in sand, snow, mud, etc. only. Please do not perform long-distance towing using towing hook only.
- When used for freeing a stuck vehicle, the towing hook will be subjected to a large force.
- Keep away from a stuck vehicle.

braking efficiency and driving safety seriously.

- Use DOT 4 brake fluid approved by JAC only at brake fluid change. In addition, it is required that brake lines be cleaned thoroughly. Ensure hybrid use of 2 types of brake fluid will not occur.

Caution:

- Brake fluids are harmful to human health! Therefore, the coolant should be kept properly in its original sealed container and particularly out of reach of children. In addition, take care to prevent brake fluid from corroding automobile finish.
- Pay attention to disposal of brake fluid. It will impair both eyes and skin and spray-painted surfaces. Flush clean with clear water immediately if the fluid spills on your body inadvertently.
- Be sure to keep brake fluid cup clean. Its gland must be tightened to prevent dirt entry.
- When filling brake fluid, wipe clean brake fluid cup gland and filler with a clean rag first and then refill with designated clean brake fluid.
- If the brake fluid is found deteriorated, drain the fluid in brake system and then refill with clean designated brake fluid.

2. Checking brake lines and cables

Check brake lines and parking brake cables for improper positions, leaks, wear, chafing and aging, etc.

3. Checking disc brake

1) Brake disc

Check condition, wear, and damage.

2) Brake caliper

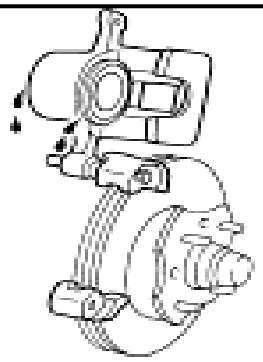
Check for oil leaks.

3) Brake shoe

Check for wear and damage.

(Refer to service data of Chassis section.)

MA006



Checking steering gear and linkage:

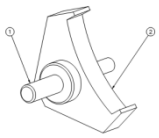
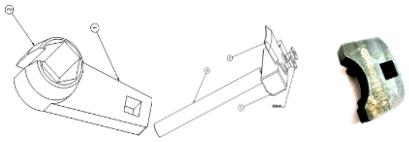
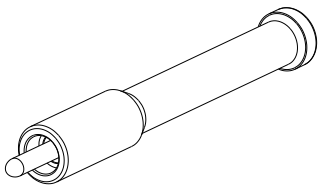
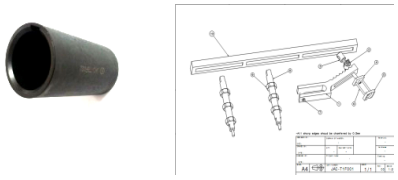
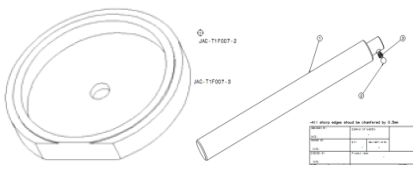
Steering gear:

1) Check gear housing and boots for looseness, damage and grease leakage.

2) Check connection with steering column for looseness.

Steering linkage:

Check ball joint, dust boots and other parts for looseness, wear, damage and grease leakage.

SN	Tool	Outline drawing	Number	Description
5	Flywheel stopper		JAC-T2F008	Fixing flywheel
6	Valve spring compressor		JAC-T2F010	Compressing valve spring
7	Oil pan remover		JAC-T2F014	Removing oil pan
8	Valve oil seal installer		JAC-T2F007	Installing valve oil seal
9	Camshaft oil seal installer		JAC-T2F002	Installing engine camshaft oil seal
10	Crankshaft front oil seal guide		JAC-T2F025	Guiding during installation of crankshaft front oil seal
11	Crankshaft front oil seal installer		JAC-T2F003	Installing engine crankshaft front oil seal
12	Crankshaft rear oil seal installer		JAC-T2F006	Installing crankshaft rear oil seal

List of Accessory Materials for Engine Assembly

Caution:

- Please do not use a wire brush for cleaning.
- Check spark plug electrode surface for ablation. If necessary, please replace.

3) Ignition cable

- Check ignition cable for damage or fracture.
- Check resistance of ignition cable.

No. 1 cylinder: 5.8KΩ

No. 3 cylinder: 2.9KΩ

If the resistance is out of the standard, please replace.

Installation:

1. Install spark plug with a spark plug socket and tighten to 25N·m.
2. Install ignition coil and tighten its bolt to 10N·m.
3. Connect spark plug secondary cable and ignition coil harness connector, and secure the cable to its clip.
4. Install spark plug cover and tighten its bolt to 3N·m.

Fuel Injector and Fuel Rail

Removal:

Warning:

- Before handling fuel system, be sure to read "Precautions" in page EM-1.

1) Releasing fuel pressure in fuel piping:

① Turn ignition switch to "OFF" position, and remove battery negative (-).

② Open fuel tank cap.

③ Put a thick rag or towel on test port of fuel rail, and depress needle valve to release pressure.

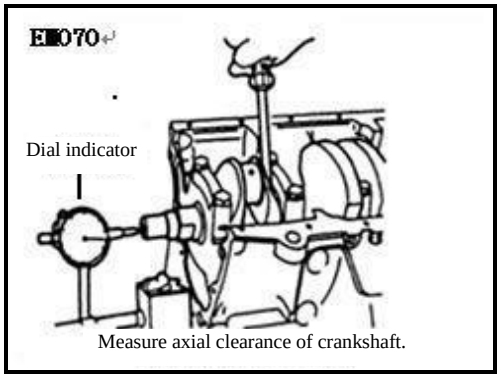

EM016

2) Disconnect intake manifold side PCV hose connector.


EM017

2. After installing main bearing shell, measure axial clearance of crankshaft. If the measurement exceeds the specified limit value, replace crankshaft bearing shell.

Standard value: 0.05-0.25mm



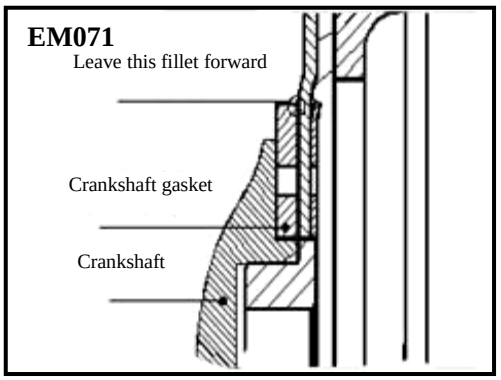
Measure axial clearance of crankshaft.

Caution:

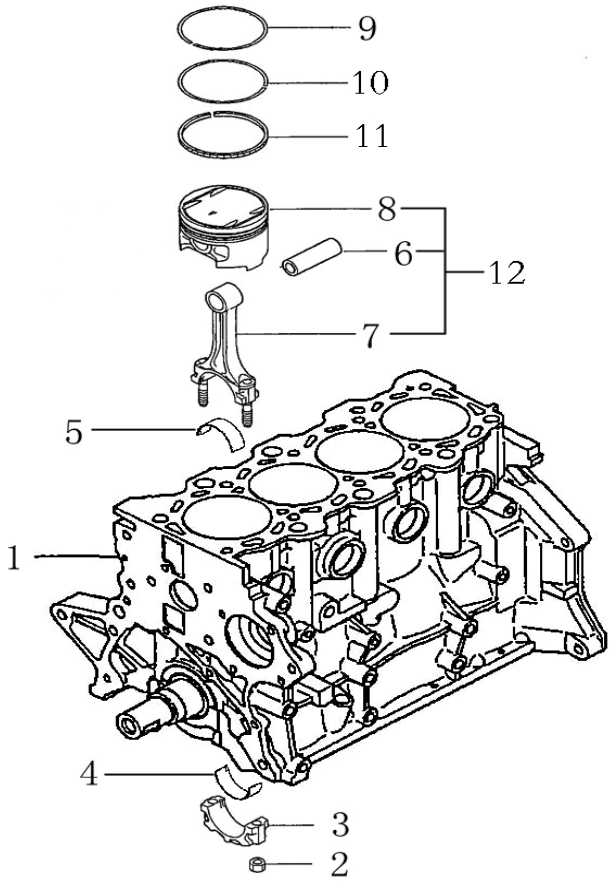
- Also install thrust plate while installing intermediate main bearing shell. When installing, please pay attention to installation direction of thrust plate.

Crankshaft gasket installation:

Install crankshaft gasket with its chamfered side facing flywheel side (as shown in the figure).



Piston and connecting rod:



Exploded View of Piston and Connecting Rod

1-Cylinder block assembly 2-Connecting rod nut 3-Connecting rod cap

Item	Standard value	Limit value
Crank pin clearance (connecting rod journal clearance) mm	0.015~0.048	0.1
Connecting rod big end side clearance mm	0.10~0.25	0.4
Crankshaft and cylinder block		
Crankshaft end play mm	0.05~0.18	0.25
Crankshaft main journal diameter mm	50.0	—
Connecting rod journal diameter mm	48.0	—
Crankshaft main journal clearance mm	0.015~0.048	0.1
Cylinder head gasket surface flatness mm	<0.03	0.1
Total height of cylinder block mm	263.5	—
Cylinder block cylindricity mm	0.01	—
Basic minor diameter of cylinder block mm	81.0	
Piston to cylinder clearance mm	0.02~0.04	—

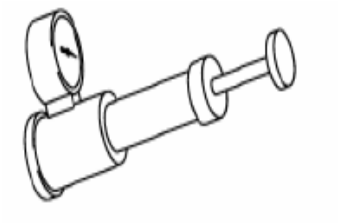
Tightening Torque Specification Table

Item	Unit (N·m)
Engine assembly	
Bolt securing engine right mounting	80±5
Engine right mounting bracket nut	60±5
Bolt connecting engine with transmission	43~55
Engine cover	8~12
Bolt securing accelerator cable and throttle body	15~22
Alternator and ignition system	
Alternator kingpin bolt	34~54
Oil level gauge guide bolt	12~15
Spark plug	19.6~29.4

Preparation

Service tools:

List of Service Tools

Tool	Name	Purpose
	Radiator cap tester	Checking radiator cap and radiator

Essential service material:

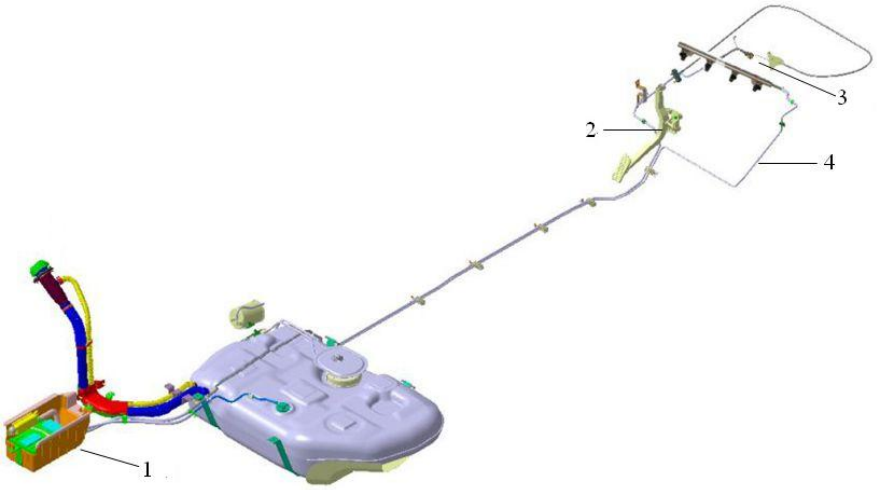
Coolant:

Item	Quantity	Concentration %
High quality ethylene glycol antifreeze coolant	6~6.5L	25~50

Sealant:

Item	Designated sealant	Remark
Water bypass pipe joint	LT648 or equivalent	Semi-dry sealant

Fuel evaporative emission line drawing:



Fuel Evaporative System Line Drawing

1-Canister assembly 2-Hard tube connecting canister with solenoid valve

3-Canister solenoid valve 4-Engine fuel inlet tube

Caution:

■ Please do not use soapy water or any type of cleanser while installing vacuum hose or purge lines.

Component inspection:

1) Canister:

① Canister location:

- The canister is installed on left rear wheel side member and in front of rear bumper of the vehicle.

② Canister removal:



Remove 2 bolts securing protective casing of canister, and take out canister.

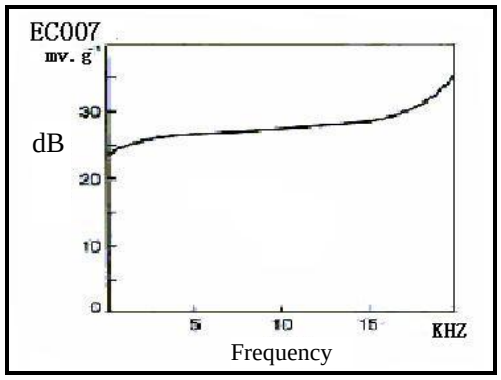
③ Vacuum hose removal:

Using thinnose pliers, loosen clamps connecting canister to fuel tank and canister solenoid valve, and pull off vacuum hose.

2) Canister solenoid valve:

Opening changes of vapor bypass line in canister solenoid valve controls air flow rate. Canister solenoid valve repeats ON/OFF operations according to signals sent by ECM and the opening of the valve changes in order to achieve best engine control. The optimal values stored in ECM depend on different engine conditions. When engine is running, air flow rate of fuel vapor from canister is regulated with changes of air draught.

block. The sensing element of the sensor is a piezoelectric crystal. The vibration of engine cylinder block is transmitted to the piezoelectric crystal by a mass block in the sensor. The piezoelectric crystal generates voltages on its two pole faces when subjected to the pressure caused by vibration of the mass block, so that vibration signals are converted into alternating voltage signals for output. See the figure above for its frequency response characteristic curve. The frequency of the vibration signals caused by engine knock is much higher than that of normal vibration signals of engine, so the ECU can distinguish knock signals from non knock signals after processing the signals from the KS.



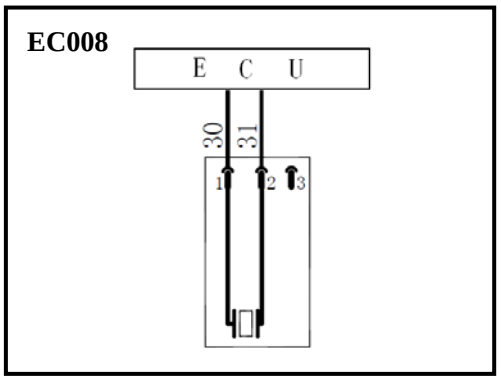
3) Descriptions of component pins:

Pin 1: Connect to 30# of ECU

Pin 2: Connect to 31# of ECU

Pin 3: 3#-connected to shielded wire

4) Symptoms and inspection methods:



- Symptoms: Poor acceleration, etc.
- General sources of trouble: Corrosion to the sensor caused by prolonged contact with fluids such as engine oil, coolant, brake fluid, and water.
- Inspection method:

(With harness connector disconnected), set digital multimeter to OHMs range and then connect two meter pens to 1#, 2# and 1#, 3# pins of the sensor respectively. At normal temperature, its resistance should be greater than 1MΩ. Set digital multimeter to MVs range, and tap in the vicinity of the KS with a hand hammer. Then there should be voltage signal output.

5) Removal and installation:

Removal:

① Disconnect knock sensor harness connector.

② Remove knock sensor lock bolt, and take off the sensor.

Caution:

- Do not drop or damage the sensor.

a fault requiring SVS light to come on in failure mode in the fault memory; the SVS light will go out after engine speed is detected if the fault in the fault memory does not require SVS light to come on in failure mode.

③ In blind code mode with fault memory empty

If the ECU detects that the SVS light is in blind code mode, the SVS light will flash the DTCs corresponding to the faults stored in the fault memory. The SVS will keep lighting up for 4 seconds after ignition switch is turned ON. Then the SVS light will flash at a frequency of 2Hz after an interval of 1 second to indicate “OK” until speed is detected after engine start.

④ In blind code mode with fault (s) in fault memory

If the ECU detects that the SVS light is in blind code mode, the SVS light will flash the DTCs corresponding to the faults stored in the fault memory. The SVS will keep lighting up for 4 seconds after ignition switch is turned ON. Then the SVS light will display DTCs stored in the memory in the form of BC after an interval of 1 second. If all faults entering the memory have been displayed by the SVS light in the form of BC, the SVS will go out until exiting blink code mode.

Four fault types:

1) Maximum fault: Signal exceeds upper limit of normal range.

2) Minimum fault: Signal exceeds lower limit of normal range.

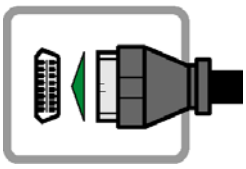
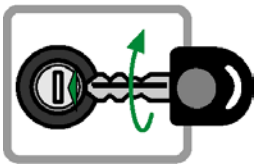
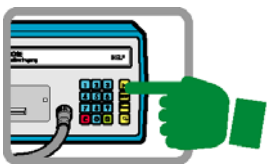
3) Signal fault: No signal.

4) Unreasonable fault: Improper signals are present.

Basic service procedure:

For vehicles with OBD functions, their troubleshooting should generally follow the procedure below:

Service Procedure Chart for OBD Malfunctions

	1. Connect diagnostic test equipment to diagnostic interface, and turn on the equipment.
	2. Turn ignition switch ON.
	3. Read fault-related information [DTCs, freeze frames (FFs), etc.]; refer to the service manual and recognize faulty components and fault types; prepare maintenance scheme according to fault-related information and experience.

Diagnosing DTCs:

■ All related ECU pins mentioned hereunder are subject to actual wiring diagrams.

1) DTC P0030: Front oxygen sensor heater control circuit open

<table>
<tr><td colspan="4">Step 1: Read “Mode 3” and “Mode 7” with a diagnostic tester.</td></tr>
<tr><td colspan="2">Read result 1</td><td colspan="2">Read result 2</td></tr>
<tr><td>In Mode 3</td><td>In Mode 7</td><td>In Mode 3</td><td>In Mode 7</td></tr>
<tr><td>Fault information available</td><td>Fault information not available</td><td>Fault information not available</td><td>Fault information available</td></tr>
<tr><td>P0030</td><td></td><td></td><td>P0030</td></tr>
<tr><td colspan="2">Maintenance tips:
The fault has been recognized. Its causes may be the following:
1) An open circuit exists between the circuit connected to ECU pin and 2# pin of front oxygen sensor.
2) The circuit connecting 1# pin of front oxygen sensor to main relay is open.
3) An open circuit exists between 1# and 2# pins of front oxygen sensor.</td><td colspan="2">Maintenance tips:
The fault has not been finally recognized. It may be an intermittent fault. Check the following:
1) Measure line resistance between ECU connector pin and 2# pin of front oxygen sensor. Judge if the measurement is normal.
2) Measure resistance between 1# pin of front oxygen sensor and main relay. Judge if the measurement is normal.
3) Measure resistance between 1# and 2# pins of front oxygen sensor. Judge if the measurement is normal.</td></tr>
</table>

2) DTC P0031: Front oxygen sensor heater control circuit short to ground

<table>
<tr><td colspan="4">Step 1: Read “Mode 3” and “Mode 7” with a diagnostic tester.</td></tr>
<tr><td colspan="2">Read result 1</td><td colspan="2">Read result 2</td></tr>
<tr><td>In Mode 3</td><td>In Mode 7</td><td>In Mode 3</td><td>In Mode 7</td></tr>
<tr><td>Fault information available</td><td>Fault information not available</td><td>Fault information not available</td><td>Fault information available</td></tr>
<tr><td>P0031</td><td></td><td></td><td>P0031</td></tr>
<tr><td colspan="2">Maintenance tip:
The fault has been recognized. Its cause may be the following:
1) Short to ground exists in the circuit connected to ECU pin.</td><td colspan="2">Maintenance tip:
The fault has not been finally recognized. It may be an intermittent fault. Check the following:
1) Measure resistance to ground of ECU pin and check that it is normal.</td></tr>
</table>