



# CK Workshop Manual



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# Table of Contents

Part I Engine .....	1
Chapter 1 Engine Assembly (MR479Q, MR479QA, MR481QA) .....	1
Section 1 Routine Inspection .....	1
Section 2 Drive Belt Replacement .....	5
Section 3 Valve Clearance Adjustment .....	6
Chapter 2 Engine Components Replacement (MR479Q, MR479QA, MR481QA) .....	10
Section 1 Engine Components .....	10
Section 2 Engine Components Replacement .....	13
Section 3 Timing Belt Replacement .....	17
Section 4 Camshaft Replacement .....	22
Section 5 Cylinder Head Gasket Replacement .....	28
Section 6 Oil Pump Oil Seal Replacement .....	33
Section 7 Engine Rear Oil Seal Replacement .....	34
Chapter 3 Lubrication System (MR479Q, MR479QA, MR481QA) .....	35
Section 1 Oil Pressure Gage Sensor Replacement .....	35
Section 2 Oil Pump Assembly Replacement .....	36
Section 3 Oil Filter Replacement .....	38
Section 4 Starter Replacement .....	39
Section 5 Generator Replacement .....	40
Chapter 4 Fuel System (MR7131A, MR7151A, MR7161A) .....	41
Section 1 Check Fuel System Pressure .....	41
Section 2 Fuel Pump Inspection .....	42
Section 3 Fuel Injector Replacement .....	43
Section 4 Fuel Pump Replacement .....	45
Section 5 Fuel Emission Control System .....	47
Section 6 Carbon Canister Replacement .....	48
Chapter 5 Exhaust System (MR7131A, MR7151A, MR7161A) .....	50

<b>Chapter 6 Cooling System Inspection</b>	
<b>(MR7131A, MR7151A, MR7161A)</b> .....	<b>52</b>
Section 1 System Check .....	52
Section 2 Water Pump, Thermostat and Radiator Replacement .....	54
<b>Chapter 7 Clutch (MR7131A, MR7151A, MR7161A)</b> .....	<b>56</b>
Section 1 Clutch Replacement .....	57
<b>Chapter 8 Manual Transaxle Assembly</b>	
<b>(MR7131A, MR7151A, MR7161A)</b> .....	<b>59</b>
Section 1 Manual Transaxle Replacement .....	60
Section 2 Vehicle Speed Sensor Replacement .....	61
Section 3 Transmission Case Oil Seal .....	62
Section 4 Transaxle Case Oil Seal Replacement .....	63
<b>Chapter 9 General Engine Troubles and Their Troubleshooting</b> .....	<b>64</b>
Section 1 Overview .....	64
Section 2 General Engine Fault and Troubleshooting .....	64
Section 3 Engine Noise Diagnosis and Troubleshooting .....	77
<b>Chapter 10 Engine Management Unit</b> .....	<b>81</b>
Section 1 System Description .....	81
Section 2 System Component and Working Principle .....	82
<b>Part II Chassis</b> .....	<b>85</b>
<b>Chapter 1 Transmission Control Device</b> .....	<b>85</b>
Section 1 Transmission Control Device .....	85
Section 2 Lever Type Transmission Control Device .....	85
Section 3 Cable Type Transmission Control Module .....	87
<b>Chapter 2 Accelerator Pedal</b> .....	<b>90</b>
Section 1 Accelerator Pedal .....	90
<b>Chapter 3 Clutch Control System</b> .....	<b>91</b>
Section 1 Clutch Control System .....	91
Section 2 Clutch Cable Control Mechanism .....	91
Section 3 Clutch hydraulic Control Device .....	94
<b>Chapter 4 Propeller Shaft</b> .....	<b>97</b>

Section 1 Propeller Shaft .....	97
<b>Chapter 5 Front Suspension System .....</b>	<b>103</b>
Section 1 Front Suspension System .....	103
Section 2 Front Suspension .....	105
Section 3 Front Wheel Alignment .....	106
Section 4 Front Strut Assembly .....	107
Section 5 Lower Swing Arm Assembly .....	110
Section 6 Front Stabilizer Bar and Link Rod Assembly .....	113
<b>Chapter 6 Rear Suspension System .....</b>	<b>116</b>
Section 1 Rear Suspension System .....	116
Section 2 Rear Suspension .....	117
Section 3 Rear Wheel Alignment .....	118
Section 4 Left & Right Rear Strut Assembly .....	119
Section 5 Rear stabilizer bar assembly, strut rod components .....	121
Section 6 Left & Right Trailing Rod Assembly .....	123
Section 7 No. 1 Transverse Arm Assembly .....	124
Section 8 No. 2 Transverse Arm Assembly .....	125
<b>Chapter 7 Wheel .....</b>	<b>126</b>
Section 1 Tire Inspection .....	126
Section 2 Wheel Replacement .....	127
<b>Chapter 8 Power Steering System .....</b>	<b>128</b>
Section 1 Power Steering System .....	128
Section 2 Steering Drive and Control Mechanism .....	130
Section 3 Steering Pipeline Component .....	133
Section 4 Power Steering Gear Retaining Device .....	136
<b>Chapter 9 Brake System .....</b>	<b>139</b>
Section 1 Brake System .....	139
Section 2 Brake Fluid .....	140
Section 3 Brake Pedal .....	141
Section 4 Vacuum Booster with Brake Master Cylinder Assembly .....	143
Section 5 Front Brake Assembly .....	144
Section 6 Rear Brake .....	147
Section 7 Brake Line .....	151

Section 8 Parking Brake System .....	155
<b>Part III Electrical Equipment.....</b>	<b>157</b>
<b>Chapter 1 Survey .....</b>	<b>157</b>
<b>Chapter 2 Starting and Charging System .....</b>	<b>161</b>
Section 1 Starting System (MR479Q MR479QA MR481QA) .....	161
Section 2 Charging System (MR479Q, MR479QA, MR481QA) .....	164
<b>Chapter 3 Combination Meter System .....</b>	<b>171</b>
Section 1 Circuit Diagram of Combination Meter and Location of Multi-pin Plug-in Terminal .....	171
Section 2 Malfunction Symptom Table and Solution Procedure .....	174
Section 3 Combination Meter .....	187
<b>Chapter 4 Wiper and Washer System .....</b>	<b>193</b>
Section 1 Wiper and Washer System Inspection .....	193
Section 2 Replacement and Adjustment .....	196
<b>Chapter 5 Light System .....</b>	<b>198</b>
Section 1 Survey of Light System.....	198
Section 2 Light System Symptom Inspection .....	202
Section 3 Headlamp Replacement .....	211
Section 4 Front Fog Lamp Replacement .....	215
Section 5 Rear Combination Lamp Replacement .....	217
Section 6 High Mounted Stop Lamp Replacement .....	218
Section 7 Interior Dome Lamp Replacement .....	219
Section 8 Rear Row Reading Lamp Replacement .....	220
Section 9 License Plate Lamp Replacement .....	220
<b>Chapter 6 Audio System.....</b>	<b>221</b>
Section 1 Audio System Description .....	221
Section 2 Audio System Connector Terminal Layout .....	224
Section 3 Audio System Inspection .....	225
Section 4 Audio and Video System Replacement .....	238
<b>Chapter 7 SRS (Supplemental Restraint System) .....</b>	<b>242</b>
Section 1 SRS-General Information .....	242
Section 2 Troubleshooting .....	251

Section 3 Removal & Installation .....	262
<b>Chapter 8 MK-20 ABS System.....</b>	<b>272</b>
Section 1 ABS Diagnosis .....	272
Section 2 ABS System Check .....	276
Section 3 Removal and Installation .....	292
<b>Part IV Air Conditioner and Inside &amp; Outside Trim .....</b>	<b>297</b>
<b>Chapter 1 A/C System .....</b>	<b>297</b>
Section 1 The Structure & Working Principle of Refrigeration System .....	297
Section 2 Heating System .....	299
Section 3 A/C controlling system .....	302
Section 4 Service Caution & Notice .....	304
Section 5 The Refrigeration System Operation Procedure .....	305
Section 6 Basic System .....	308
Section 7 A/C System Faults Check & Troubleshooting .....	313
<b>Chapter 2 Inside &amp; outside Trim and Accessory.....</b>	<b>318</b>
Section 1 Configuration Index .....	318
(I) Outside Trim And Front Accessory .....	318
(II) Outside Trim and Rear Accessory .....	319
(III) Front inside trim .....	320
(IV) Rear inside trim .....	321
Section 2 Inside & Outside Trim and Accessories Removal and Installation .....	322
(I) Front Bumper .....	322
(II) Engine Hood .....	324
(III) Outside Rear View Mirror .....	326
(IV) Rear trunk Lid .....	327
(V) Rear Bumper.....	329
(VI) Seat Removal, Installation and Adjustment .....	331
(VII) Seat Belt .....	335
(VIII) Instrument panel and auxiliary console .....	338
(IX) A pillar inside trim and front door sill .....	343
(X) B pillar inside trim .....	344
(XI) Cpillar inside trim and rear door sill .....	345
(XII) Roof inside trim .....	346
(XIII) Carpet and Heat Insulator .....	347

(XIV) Rear trunk Inside Trim .....	348
(XV) Engine Hood Inside Trim .....	349
(XVI) Door .....	350

## **Part V Body.....359**

### **Chapter 1 General Information .....359**

Section 1 Body Structure .....	359
--------------------------------	-----

### **Chapter 2 Body Repair .....369**

Section 1 Body Damage Forms and Requirements for Repair .....	369
---	-----

Section 2 Typical Technology Of Body Panel Repair .....	372
---	-----

Section 3 Repair after Body Damage .....	372
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Section 4 Features and Composition of Automobile Body .....	377
---	-----

Section 5 Painting Technique after Body Repair.....	383
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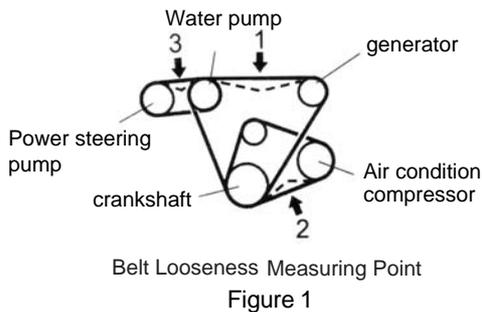
Section 6 Service Data For Body .....	385
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# Part I Engine

## Chapter 1 Engine Assembly (MR479Q, MR479QA, MR481QA)

### Section 1 Routine Inspection

1. Check coolant
2. Check engine oil
3. Check battery
4. Check air cleaner element assembly
5. Check spark plug
6. Check drive belt



Belt deflection See (Table 1)		
Belt pressure: 98N		
	New Belt mm	Old Belt mm
Fan Belt	7 ~ 9	11.5 ~ 13.5
Power steering Belt	5 ~ 6	6 ~ 8
A/C Belt	6.5 ~ 7	8 ~ 9

Notice:

- Check the belt deflection at the specified point See (Figure 1).
- Set tension to specified value when installing new belt.
- Check the deflection to ensure it is below the specified value after the belt runs for over 5 minutes.
- Reinstall the belt which has been running for over 5 minutes. The deflection of the old belt is regarded as the standard for inspection.
- Check V-belt for tension and distortion after the engine cranks for 2 turns.

7. Check ignition timing See (Figure 2)

- a) Warm up the engine.
- b) When using fault diagnosis tester

Connect fault diagnosis tester to fault diagnosis interface socket.

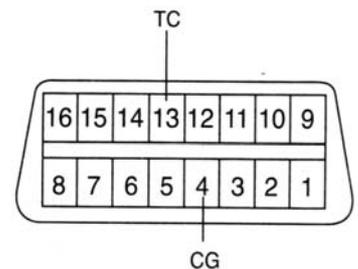


Figure 2

Ignition timing:

MR479Q:  $10 \pm 2^\circ$  BTDC (before top dead center) at idle

MR479QA:  $10 \pm 2^\circ$  BTDC at idle

MR481QA:  $10 \pm 2^\circ$  BTDC at idle

c) When fault diagnosis tester is not used

- (1) Shorting fault diagnosis interface socket 13 (TC) terminal and 4(CG) terminal.

Notice:

- Ensure correct connection, otherwise the engine will be damaged.
- Switch off all electrical appliance system.
- Check when disconnecting cooling fan motor.

- (2) Using timing light to check ignition timing.

Ignition timing:  $10 \pm 2^\circ$  BTDC at idle

Notice:

- (1) Transmission shift lever should be in neutral position when checking ignition timing.
- (2) Running engine at 1,000-1,300rpm for 5s and check at idle.
- (3) Remove the tester on fault diagnosis socket.
- (4) Ignition timing advance angle becomes larger when the engine roate speed is higher.
- (5) Remove timing light.

8. Check engine idle See (Figure 3)

- (a) Warm up the engine.
- (b) Connect fault diagnosis tester to fault diagnosis interface socket.
- (c) Connect tachometer testing pen to fault diagnosis socket terminal 9 when not using fault tester.
- (d) Check idle See (Table 2).

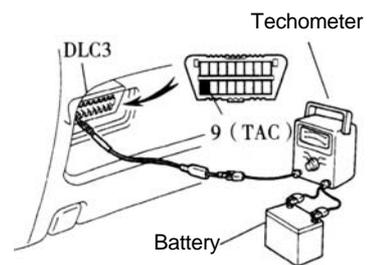


Figure 3

Table 2	
MR479Q	800± 50 (rpm)
MR479QA	800± 50 (rpm)
MR481QA	800± 50 (rpm)

Notice:

- Check idle when cooling fan motor is disconnected.
- Switch off all electrical accessories and A/C.

9. Check compression pressure See (Figure 4)

- (a) Engine switched off.
- (b) Detach high voltage cable.
- (c) Detach spark plug.
- (d) Check the compression pressure in the cylinder.
  - (1) Insert pressure gauge into the hole of the spark plug.
  - (2) Throttle valve full open.
  - (3) Crank the engine, measure the compression pressure.

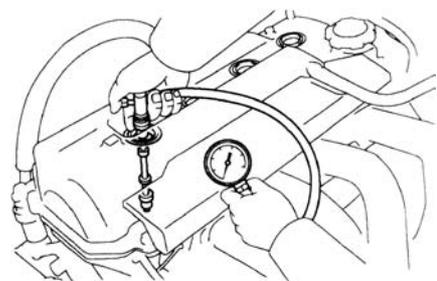


Figure 4

The Min. compression pressure: 980 kPa

The tolerance range of the cylinders pressure: 100 kPa

Notice:

- Ensure sufficient battery power and the engine speed is no less than 250 RPM (revolutions per minute).
  - Check the compression pressure of other cylinders in the same way.
  - Complete the measure as quick as possible.
- (4) If the compression pressure in several cylinder is too low, fill some engine oil to the cylinder via the hole of the spark plug. Check by repeating step 1-3.

Hint:

- If the compression pressure is improved after filling oil, the piston ring or the cylinder may be abraded or damaged.
- If the pressure is still too low, the valve is stagnation or poor seal, or there is a leakage in gasket.

10. Check CO/HC

- (a) Start engine.
- (b) Running engine at 2500rpm for approximately 3 minutes.
- (c) Insert CO/HC meter testing probe into tailpipe at least 40cm during idling.
- (d) Check CO/HC concentration at idle and 2500rpm.

Hint:

- Complete measurement within 3 minutes.
  - Test the CO/HC emission concentration at idle and 2500 rpm on QC/T630-1999 standard.
- (e) Take the following steps to diagnose the fault if the CO/HC concentration does not comply with standard .
- (1) Check the oxygen sensor operation.
  - (2) See (Table 3) for the possible cause and check and repair.

			Table 3
CO	HC	Problems	Causes
Normal	High	Rough idle	1. Fault
			. Incorrect ignition timing
			. Fouled, shorted or improperly clearance of spark plug
			2. Incorrect valve clearance
			3. Leaky intake & exhaust valves
Low	High	Rough idle	4. Leaky cylinders
			1. Air leaks
			. PCV hoses, intake manifold
			. Throttle body
			. Brake booster circuit
High	High	Rough idle (Black smoke from exhaust pipe)	2. Lean mixture gas causing misfire
			1. Clogged air filter
			2. Clogged PCV valve
			. Faulty ECU
			. Faulty fuel pressure regulator
			. Faulty water temperature sensor
			. Faulty air compressor
			. Faulty injectors
. Faulty throttle position sensor			

## Section 2 Drive Belt Replacement

1. Disconnect all engine pipe hose and wire joint. Remove engine assembly from the engine compartment, jack up the body, take out the engine assembly slowly (See Provision 20, Section Two, Chapter Two for detailed information)
2. Remove generator V-belt See (Figure 5)
3. Remove No. 1 V-belt A/C compressor to crankshaft pulley
4. Remove water pump belt See (Figure 6)

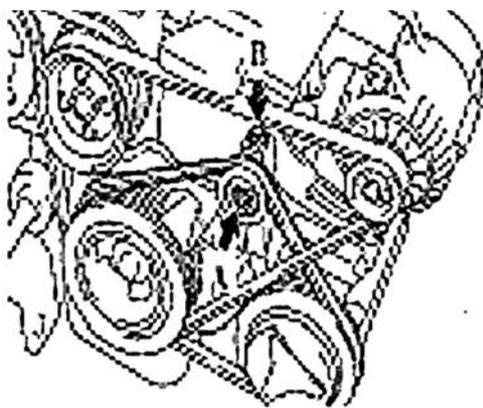


Figure 5

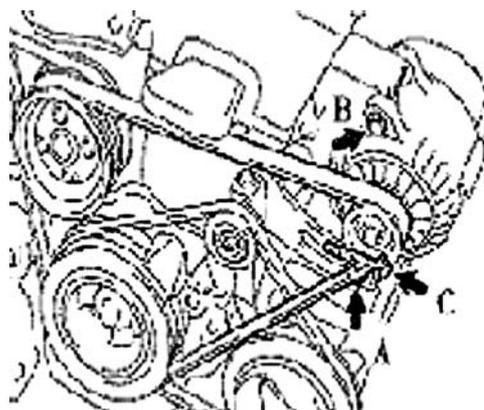


Figure 6

5. Install water pump V-belt
6. Adjust V-belt of steering assisting pump
  - (a) Adjust power steering belt tension, tighten bolt B.
  - (b) Tighten bolt A.  
Torque : 39N. m
7. Install V-belt A/C compressor No. 1 to crankshaft pulley
8. Adjust V-belt A/C compressor No. 1 to crankshaft pulley
  - (a) Adjust A/C belt tension by tightening bolt B.
  - (b) Tighten nut A.  
Torque : 39N. m
9. Install Generator V-belt See (Figure 7)
10. Adjust Generator V-belt.  
Tighten bolt A and then bolt B.  
Torque: Bolt A 18N. m Bolt B 58N. m
11. Check driving belt for distortion and tension

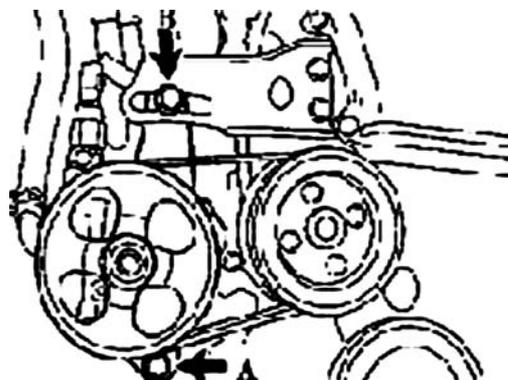


Figure 7

## Section 3 Valve Clearance Adjustment

1. Remove right camshaft timing gear
2. Remove ignition coil and high voltage cable
3. Remove cylinder head cover sub-assembly See (Figure 8)

- (a) Disconnect generator wire joint..
- (b) Disconnect generator circuit.
- (c) Disconnect oil pressure switch connector.
- (d) Disconnect A/C compressor switch connector.
- (e) Open the wire harness clip.
- (f) Remove wire harness from cylinder head cover.
- (g) Separate 2 ventilation hoses from cylinder head cover.

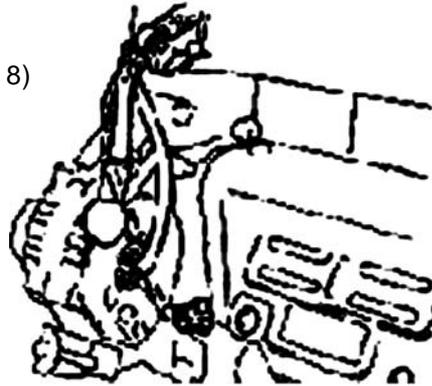


Figure 8

- (h) Remove 4 screw nuts, 4 oil seal gaskets, cylinder head and gasket.

4. Adjust piston of Cylinder 1 to the compression position

- (a) Turn crankshaft pulley, align notch to timing mark "0" on Cylinder 1. See (Figure 9).
- (b) Align mark "K" on camshaft timing pulley to the timing mark on bearing cap. See (Figure 10) Crank 360° if it is not aligned.

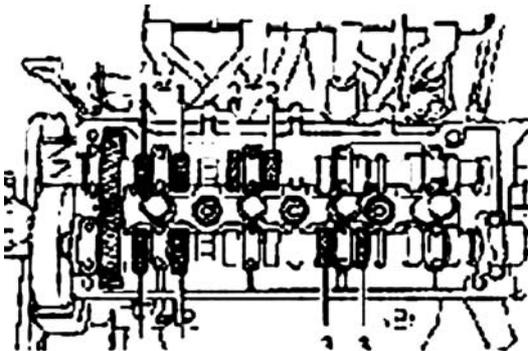


Figure 9

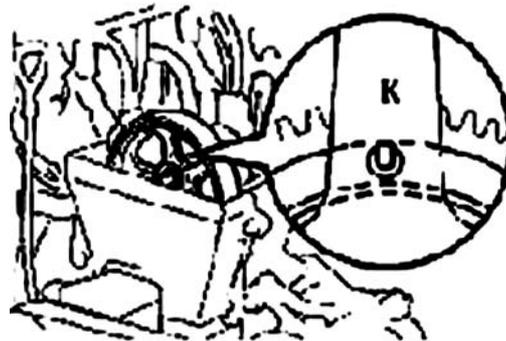


Figure 10

5. Check valve clearance (cool). See (Table 5)

Table 5		
	Intake Valve mm	Exhaust Valve mm
MR479Q	0.20 ± 0.05	0.30 ± 0.05
MR479QA	0.20 ± 0.05	0.30 ± 0.05
MR481QA	0.20 ± 0.05	0.30 ± 0.05

- (a) Turn the crankshaft pulley for 360° . Align notch to timing mark "0" on timing belt cover No. 1.
- (b) Only check the valve as shown in the figure. Valve clearance measurement. See (Figure 11).

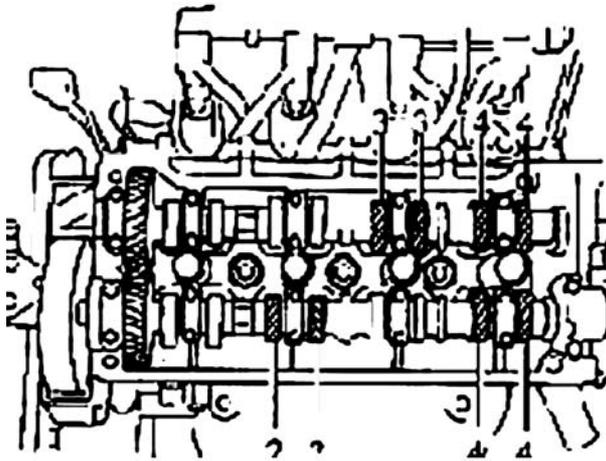


Figure 11

6. Adjust intake valve clearance

- (a) Detach intake camshaft

Notice:

Because the camshaft end play is quite small, keep camshaft horizontal when removing it. If not, cylinder head may be partially damaged by the thrust force → it may stuck or damage camshaft when turning crankshaft. Take the following steps to avoid the damage:

- (1) Turn the pulley to access the hole on the camshaft drive gear where the counter gear is installed. See (Figure 12).

Hint:

The above condition allows the cylinders No. 1 and No. 3 of the intake camshaft to push up the valve tappet.

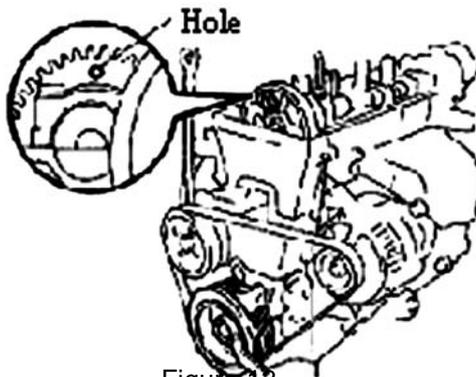


Figure 12

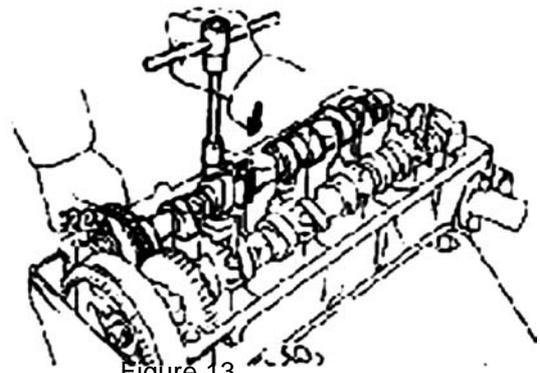


Figure 13

- (2) Remove bolt and bearing cap No. 1.
- (3) Install camshaft counter gear to drive gear with service bolt. See (Figure 13).
- (4) Uniformly loose and remove 8 bearing cap bolts in several passes as shown in the figure. See (Figure 14).
- (5) Remove 4 bearing caps and camshafts.

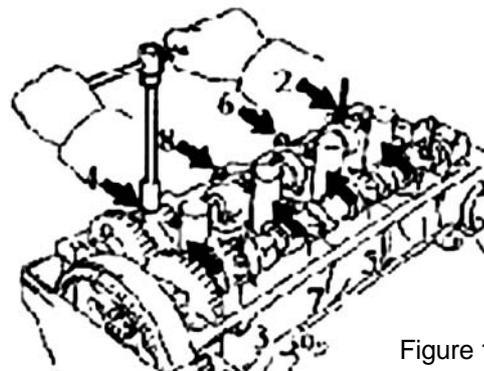


Figure 14

Notice:

Due to the small end play on camshaft, the cylinder head may be damaged by the thrust force when removing it, it may stuck or damage camshaft. Take the following steps to avoid damage:

- (1) Turn the crankshaft pulley to make exhaust camshaft dowel pin is a bit higher than the cylinder head. See (Figure 15).
- (2) Align the matchmark on each gear to engage intake camshaft gear and exhaust camshaft gear. See (Figure 16).
- (3) When the gears are engaged, install the intake camshaft bearing onto bearing journal.

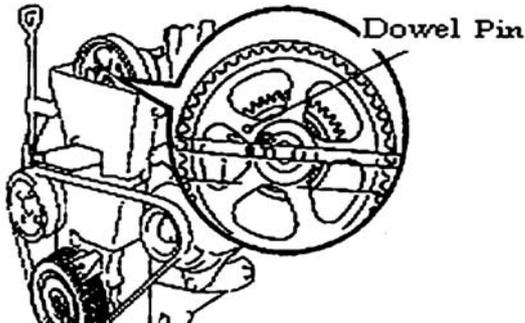


Figure 15

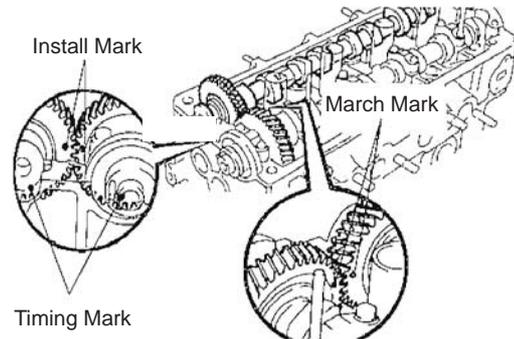


Figure 16

Hint:

The intake camshaft lobe of cylinder 1 and 3 can jack up their own valve tappet.

- (5) Install 4 bearing caps to the right position.
- (6) Apply a light layer of engine oil on the thread and under the head of bearing cap bolts.
- (7) Uniformly install and tighten 8 bearing cap bolts in several times, in the sequence shown in the figure.

Torque: 13N. m

- (8) Remove service screw.
- (9) Install the bearing cap No. 1. in the direction of the forward arrow mark.
- (10) Apply a light layer of engine oil on the thread and under the head of bearing cap bolts.
- (11) Alternatively tighten and install 2 bearing bolts.

Torque: 13N. m

7. Adjust exhaust valve clearance. See (Figure 17)

Remove adjust gasket.

- (1) Crank to keep the camshaft head upward.
- (2) Face valve tappet nick to vehicle front.
- (3) Press valve tappet, put special tool between camshaft and valve tappet.

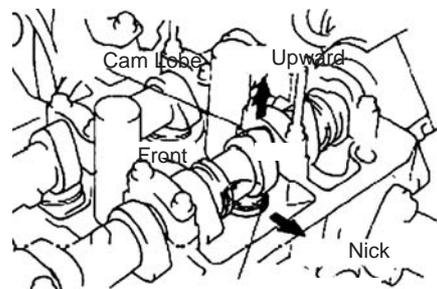


Figure 17

Hint:

- Lean the end with mark "9" into the position in (Figure 18).

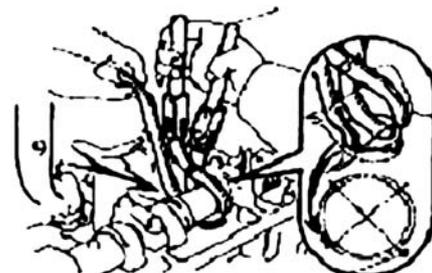


Figure 18

(4) Alternatively press valve tappet with the special tool (A) (B). Check valve clearance. See (Figure 19).

8. Install cylinder head sub-assembly

(a) Remove all old gasket material.

(b) Apply the seal glue to the cylinder head.

(c) Connect wire harness and clip.

(d) Install gasket under of cylinder head.

(e) Install the cylinder head cover with 4 seal gaskets and 4 screw caps.

Torque: 7.8N. m

(f) Install 2 ventilation hoses to cylinder head cover.

(g) Connect generator wire joint.

(h) Connect generator wires.

(i) Connect oil pressure switch connector.

(j) Install wire clip.

(k) Connect A/C compressor switch connector.

9. Install electronic ignition coil and high voltage cable

10. Check engine oil for leakage

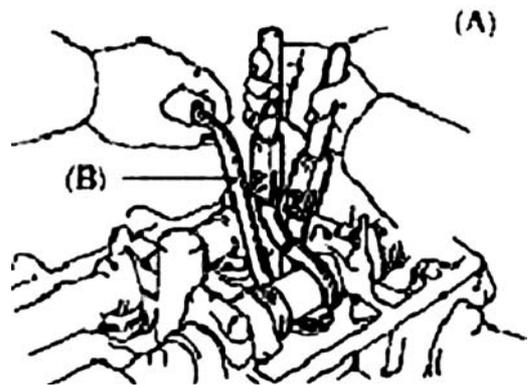


Figure 19

# Chapter 2 Engine Components Replacement (MR479Q, MR479QA, MR481QA)

## Section 1 Engine Components

### Component 1

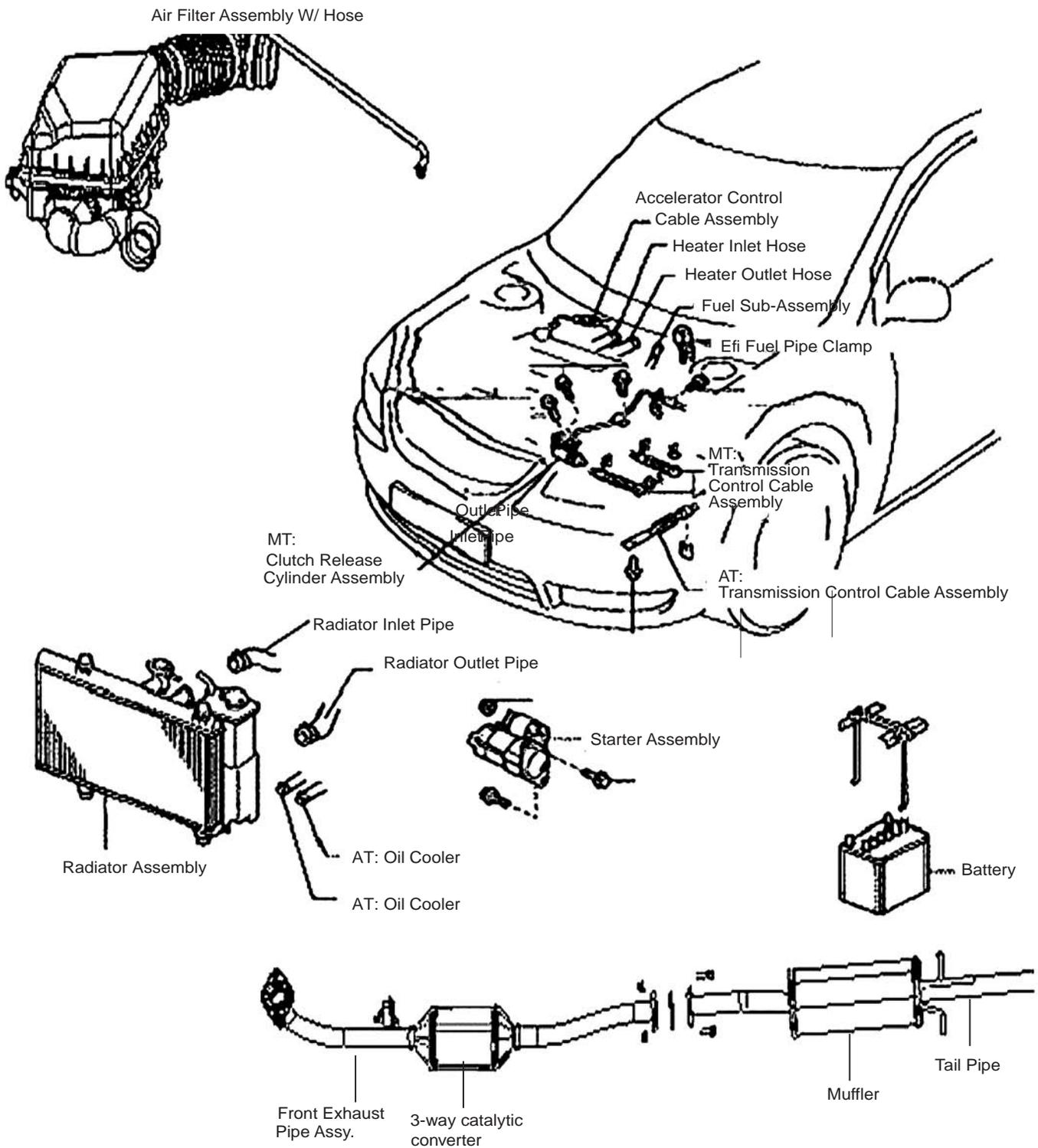


Figure 20

## Component 2

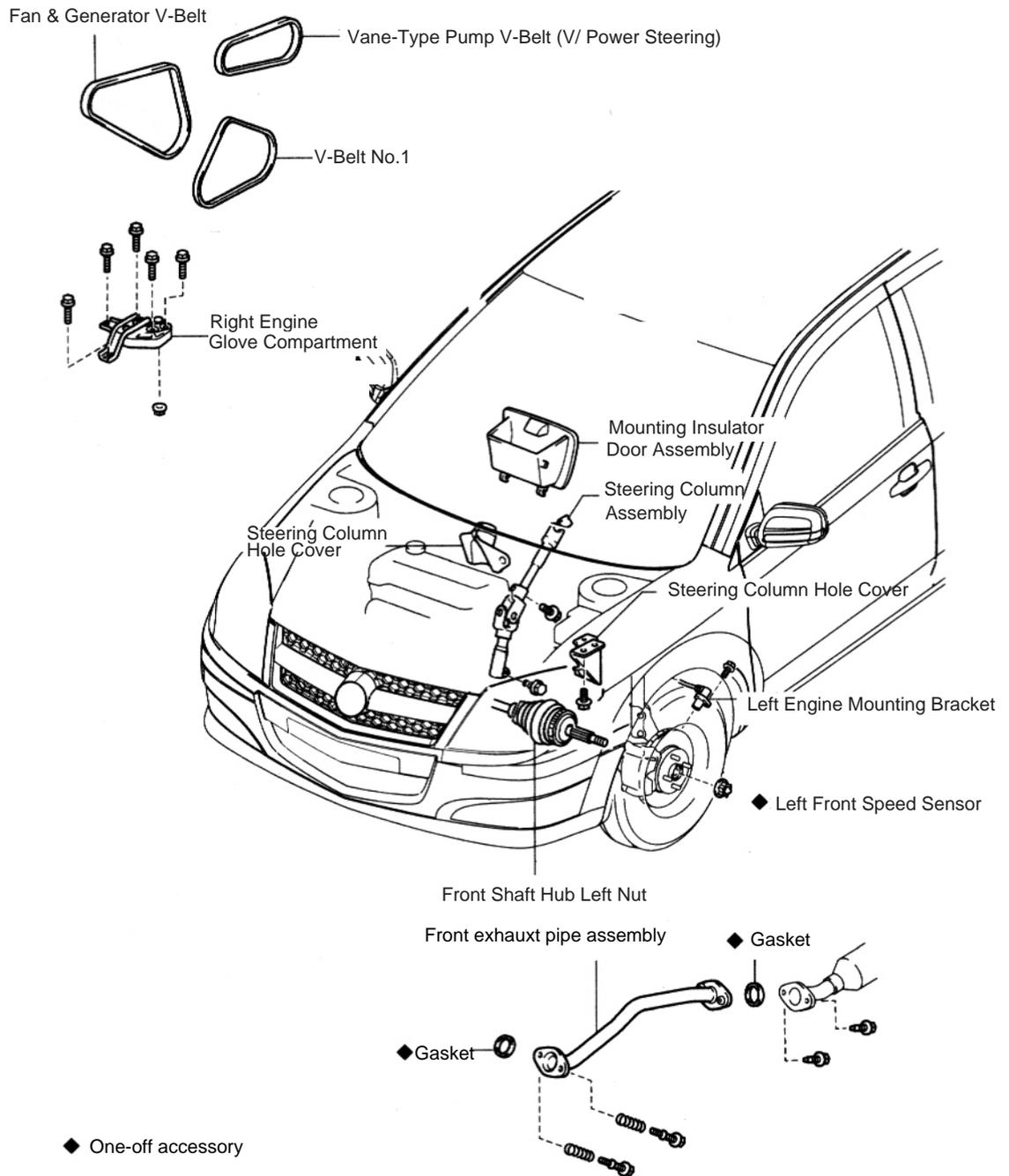


Figure 21

### Component 3

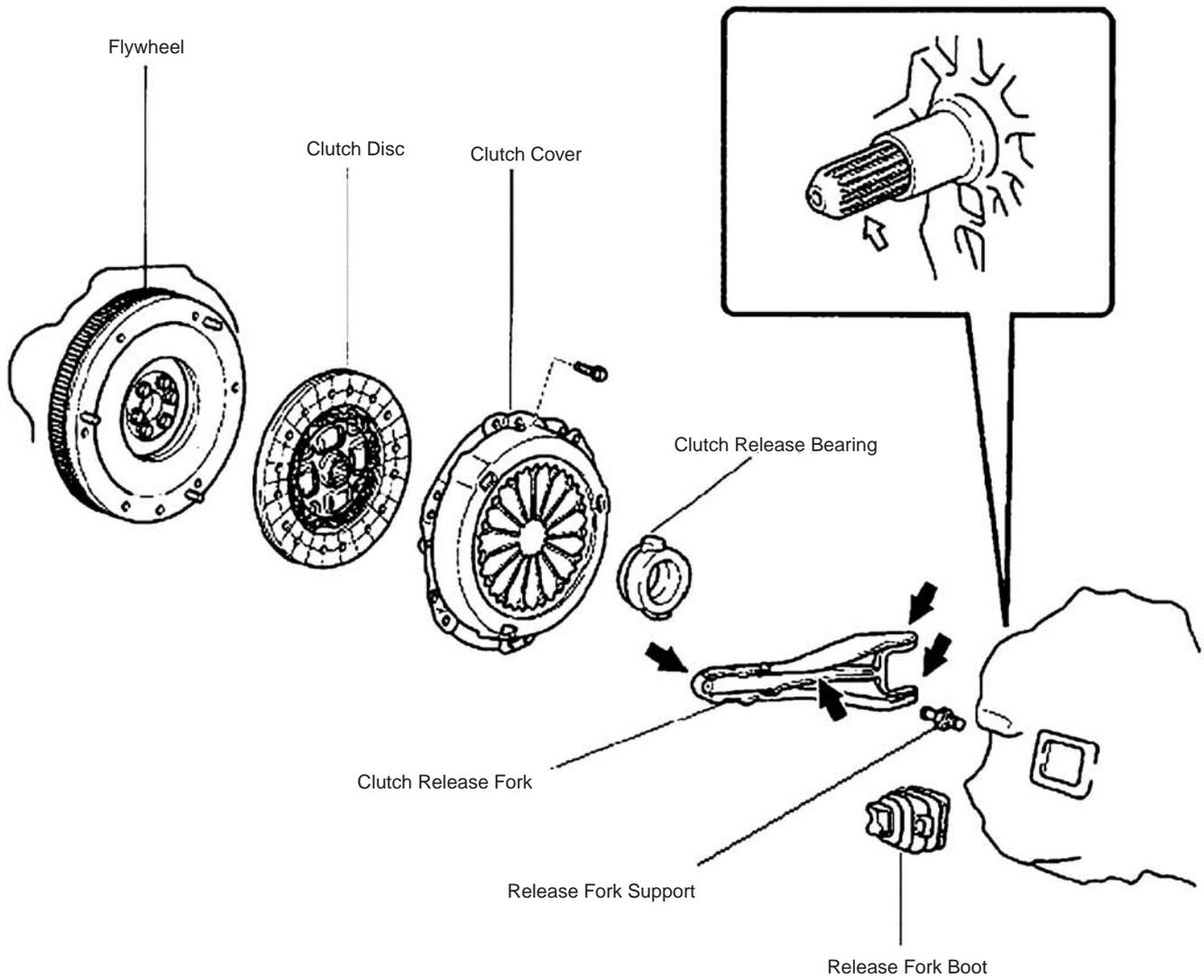


Figure 22

## Section 2 Engine Components Replacement

1. Avoid gasoline ejection when work.
2. Drain the coolant to empty.
3. Remove air filter assembly with hose. See (Figure 23)
4. Remove battery
5. Remove fuel delivery pipe sub-assembly
6. Disconnect water hoses, disconnect heater outlet hose from A/C hose.
7. Loose nut, remove accelerator control cable
8. Remove throttle body assembly
9. Remove power steering pump reservoir assembly
10. Remove front exhaust pipe assembly
11. Remove steering gear boot
12. Separate steering column assembly. See (Figure 24)
13. Remove front wheel hub nut
14. Disconnect front wheel vehicle speed sensor (with ABS)
15. Detach steering tie rod ball stud pin assembly
16. Detach front lower swing arm sub-assembly
17. Detach front propeller assembly. See (Figure 25)

Detach front propeller from the shaft hub with plastic hammer.

18. Disconnect transmission shift cable or gear shift level assembly
19. Disconnect clutch cylinder assembly or disconnect clutch cable
20. Detach engine assembly and transaxle
  - (a) Hoisting engine ;
  - (b) Remove 3 bolts. Detach the right engine mounting bracket. See (Figure 26) ;
  - (c) Remove 1 bolt. Detach the left engine mounting bracket;
  - (d) Remove 1 bolt. Detach the rear engine mounting bracket;
  - (e) Remove engine and transaxle and put them on the pallet;
  - (f) Jack up the body.

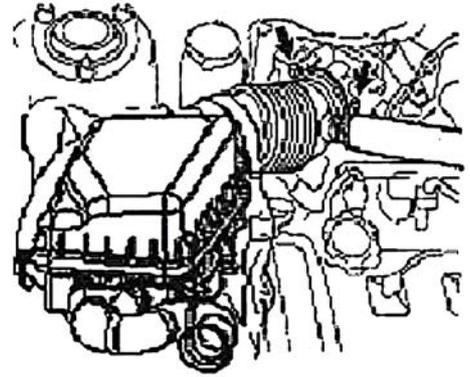


Figure 23



Figure 24

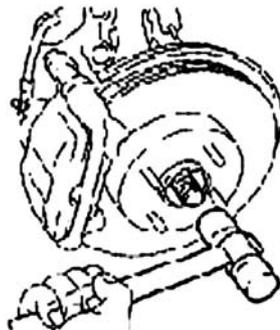


Figure 25

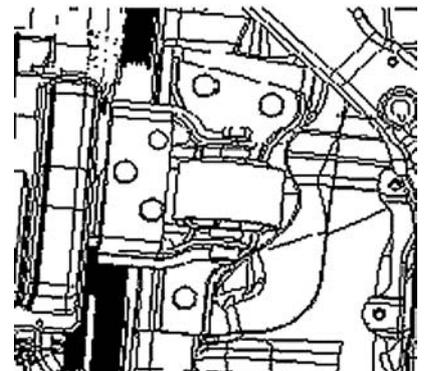


Figure 26

21. Remove radiator assembly
22. Remove engine V-belt
23. Remove No. 1 V- belt (A/C compressor to crankshaft pulley)
24. Remove generator assembly
25. Remove A/C compressor
26. Remove compressor installing No. 1 bracket. Remove 4 bolts and compressor installing No. 1 bracket.
27. Remove starter assembly
28. Remove power steering pump V- belt
29. Detach power steering pump assembly
30. Remove power steering pump, adjust the bracket
31. Detach manual transaxle assembly (Separate automatic transaxle assembly)
32. Detach clutch cover panel assembly.
33. Detach clutch pressure plate assembly.
34. Detach flywheel sub-assembly.
35. Remove engine rear end cover.
36. Remove injector assembly and remove intake manifold.  
Remove 2 bolts and intake manifold support and remove 7 bolts,  
2 nuts, intake manifold and gasket. See (Figure 27).

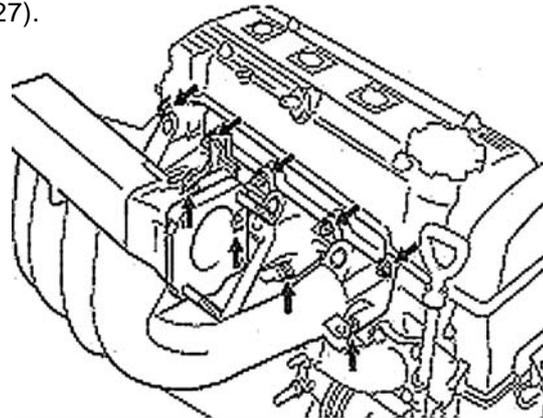


Figure 27

37. Remove knock sensor
38. Remove water temperature gauge sensor
39. Remove crankshaft position sensor
40. Remove engine oil pressure switch
41. Remove water inlet hose housing
42. Remove water outlet hose joint
43. Detach exhaust manifold. See (Figure 28)
44. Remove engine oil filter sub-assembly
45. Remove ignition coil and high voltage cable
46. Install engine sub-assembly
47. Install ignition coil and high voltage cable
48. Install engine oil filter sub-assembly
49. Install exhaust manifold
  - (a) Install new gasket and exhaust manifold stay with  
5 nuts, Torque: 34N. m
  - (b) Install exhaust manifold stay with two bolts.  
Torque: 59N. m
  - (c) Install upper heat shield with 4 bolts. Torque: 17N. m

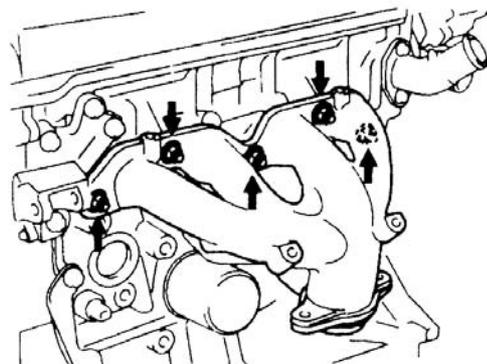


Figure 28

50. Install water outlet hose joint. See (Figure 29, 30)

Diameter of Seal O-ring  
2-3mm Seal Material



Figure 29

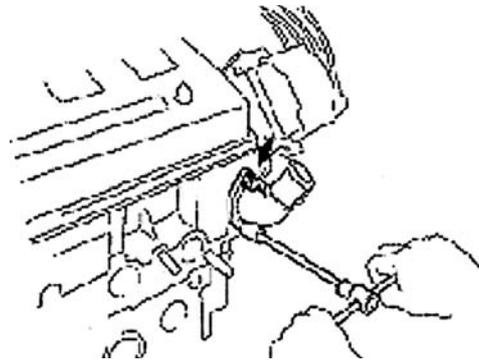


Figure 30

51. Install water inlet hose housing. See (Figure 31, 32)

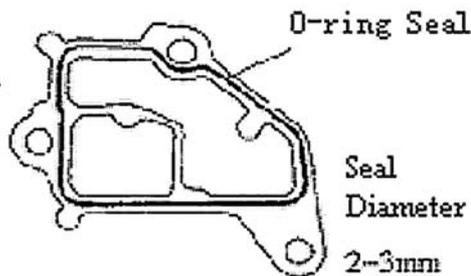


Figure 31

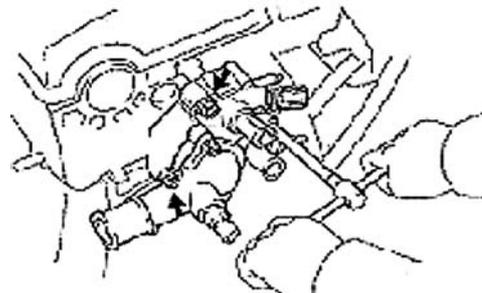


Figure 32

52. Install engine oil pressure switch

53. Install crankshaft position sensor

Torque: 9, 3N. m

54. Install water temperature gauge and water temperature sensor

Torque: 15N. m

55. Install knock sensor

Torque: 44N. M

56. Install intake manifold. See (Figure 33)

Install the intake manifold with new gasket with 7 bolts and 2 nuts. Uniformly tighten bolts and nuts in several time.

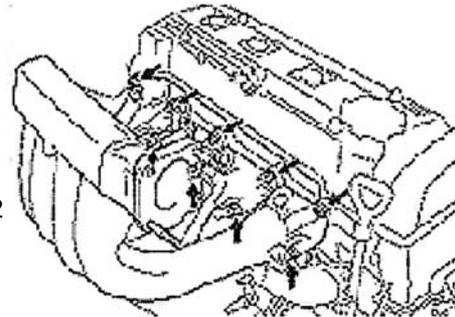


Figure 33

57. Install injector assembly

58. Install rear end cover

59. Install flywheel sub-assembly. See (Figure 34)

(a) Install flywheel to crankshaft.

(b) Install and uniformly tighten and connect bolt as shown in the figure. Torque: 78N. m

60. Install clutch assembly

61. Install flywheel and ring gear. See (Figure 35)

(a) Install the oil thrower, it's chamfer side on crankshaft in the axie direction.

(b) Install flywheel and ring gear on crankshaft.

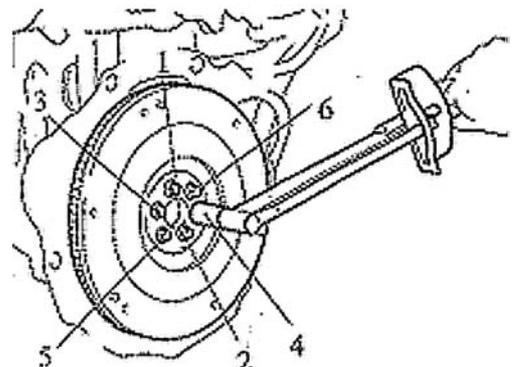


Figure 34

(c) Install and uniformly tighten connecting bolt in the sequence shown in the figure.

Torque: 64N. m

62. Install manual transaxle assembly
63. Install starter assembly
64. Install power steering pump bracket
65. Install power steering pump adjusting bracket with 2 bolts.
66. Connect power steering pump assembly
67. Install engine assembly and transaxle
68. Connect left, right, front and rear lower suspension arm sub-assembly
69. Connect left and right tie rod ball stud pin assembly
70. Connect left, right and front vehicle speed sensor (with ABS)
71. Install left & right nuts on the front shaft hub
72. Install front exhaust pipe assembly
73. Connect steering shaft assembly and steering column hole cover. See (Figure 36)
74. Connect wire harness
75. Install belt adjusting bracket of A/C compressor
76. Connect A/C compressor
77. Install generator assembly
78. Install A/C compressor to crankshaft pulleyV-belt
79. Install generator belt
80. Install engine assembly with transaxle
81. Install radiator assembly
82. Install throttle body assembly
83. Install fuel delivery pipe sub-assembly
84. Install battery
85. Install air filter assembly with hose
86. Install front wheel
87. Fill engine oil
88. Fill coolant
89. Check engine oil for leakage
90. Check engine coolant for leakage
91. Check fuel for leakage
92. Check idle and ignition timing
93. Check CO/HC
94. Check and adjust front wheel alignment
95. Check ABS vehicle speed sensor signal

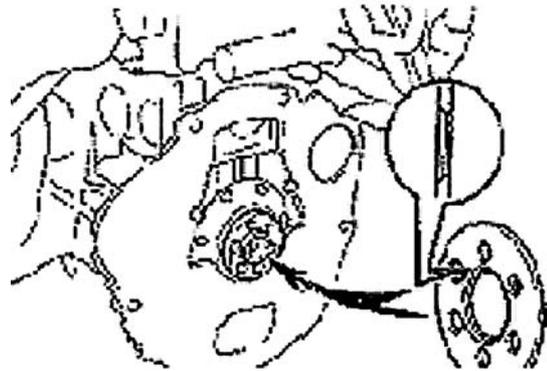


Figure 35

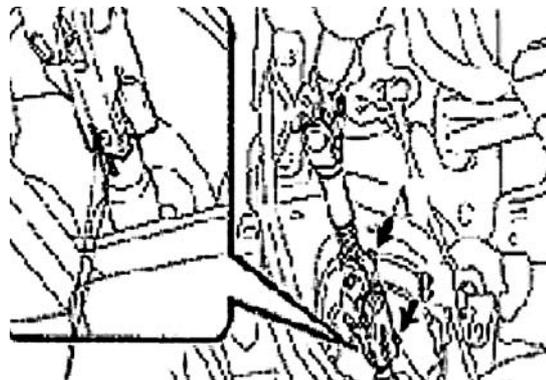


Figure 36

# Section 3 Timing Belt Replacement

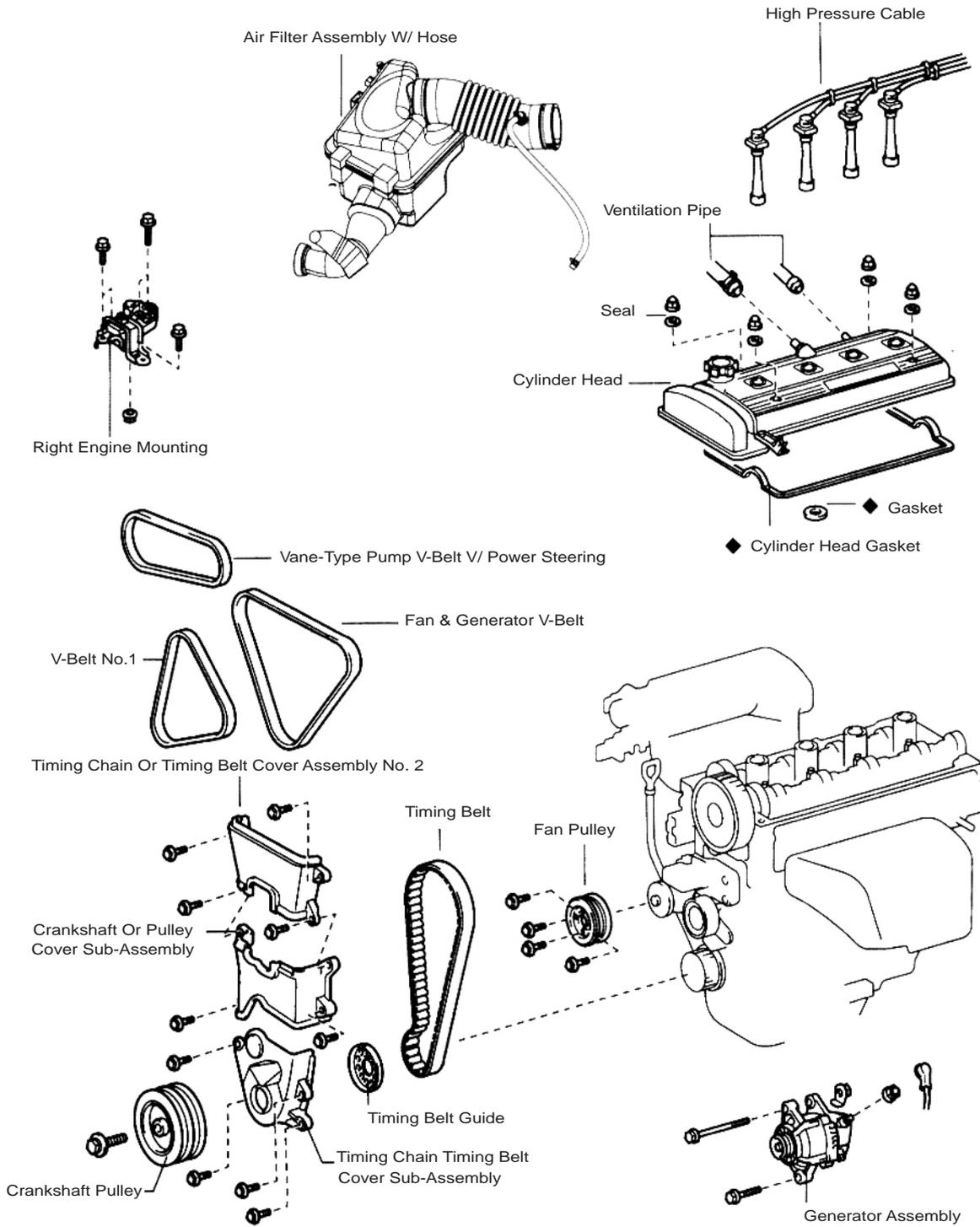


Figure 37

1. Disconnect engine from all the wire harnesses and cables connected to body.
2. Remove air filter assembly with hose. See (Figure 38)
3. Disconnect oil pipe and water hoses
4. Loose positive and negative cables on battery
5. Detach propeller shaft
6. Loose engine left & right rear brackets after hoisting engine
7. Disconnect all the connectors of engine and the body
8. Remove engine per "Provision 20, Section 2, Chapter 2"
9. Remove A/C compressor to crankshaft pulley V-belt
10. Remove power steering pump V-belt
11. Remove water pump fan pulley
12. Remove high pressure cable.
13. Remove cylinder head cover sub-assembly
14. Remove generator assembly. See (Figure 39)
15. Put the piston in Cylinder 1 to TDC compression position
  - (a) Turn crankshaft pulley to align its notch to the timing mark "0" on the timing belt cover. See (Figure 40).
  - (b) Check if the "K" mark on camshaft timing pulley and the timing mark on the bearing cap are aligned. Crank the crankshaft for 360 degrees if not. See (Figure 41).
16. Remove crankshaft pulley
17. Remove timing belt cover
18. Remove crankshaft gear or pulley cover sub-assembly
19. Remove timing belt cover sub-assembly

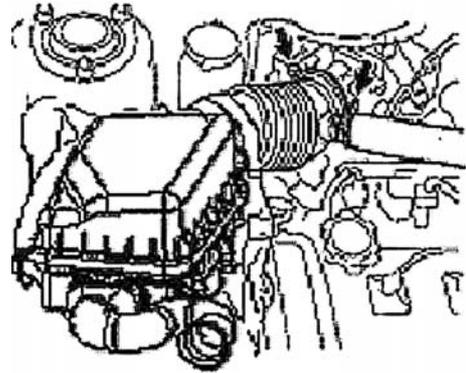


Figure 38

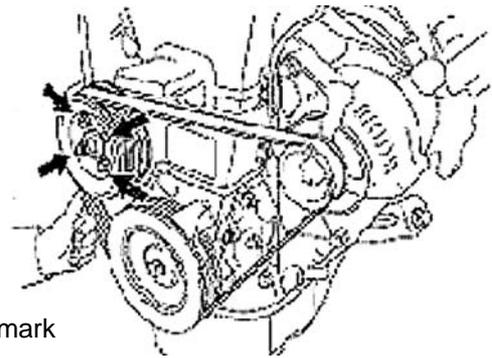


Figure 39

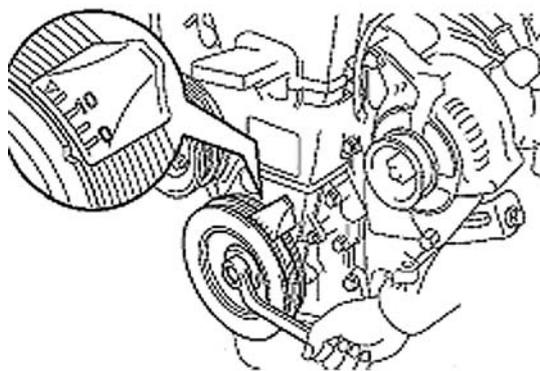


Figure 40

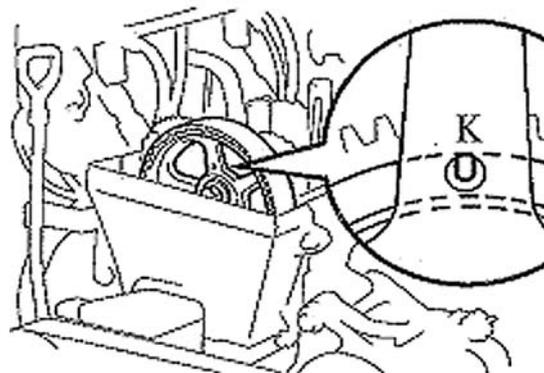


Figure 41

20. Remove timing belt guide wheel

Hint:

(a) Mark on pulley and belt (in engine turning direction) if re-using timing belt (See Figure 42).

(b) Install bolt to the idler pulley. Move pulley to its far left and tighten it temporarily (See Figure 43).

21. Remove spark plug and gasket

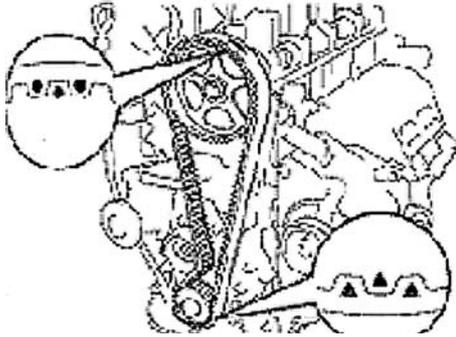


Figure 42

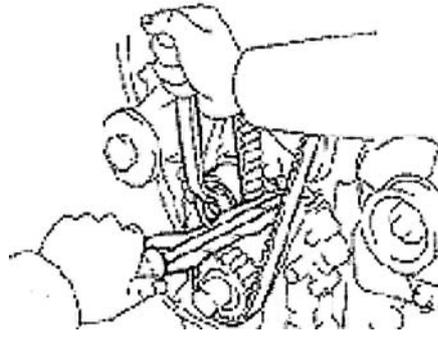


Figure 43

22. Install spark plug and gasket

23. Put the piston in Cylinder 1 to TDC compression position.

See (Figure 44)

(a) Turn camshaft hexagon part. Align the mark "K" on the camshaft timing pulley to the mark on the bearing cap.

(b) Using the crankshaft pulley bolt, turn the crankshaft, align the mark on crankshaft timing pulley to the oil pump.

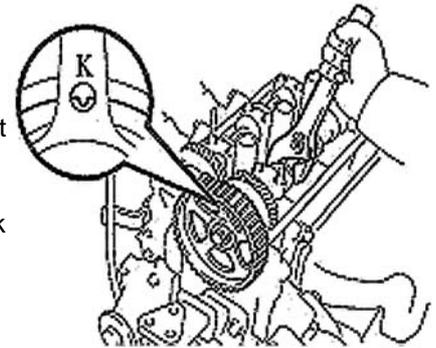


Figure 44

24. Install timing belt. See (Figure 45)

Notice: The engine must be cool.

(a) Install timing belt. Check the tension force between crankshaft timing pulley and camshaft timing pulley.

Hint: Align the marks if re-using the timing belt when removing. The engine's rotating direction should be the same with the arrow's when installing belt.

(b) Check valve timing. Loose idler bolt.

(1) Turn crankshaft from TDC to BDC slowly.

Notice: Crank always in clockwise.

(2) Align each pulley to timing mark as shown in the figure. If the timing mark is not aligned, remove timing belt and reinstall it.

(3) Tighten idler bolt.

Torque: 37N. m

(4) Remove crankshaft pulley bolt.

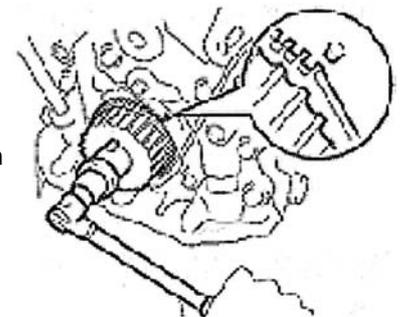


Figure 45

(c) Check timing belt for deflection

Check the belt distort as shown in the figure.

Belt deflection:

20N: 5~6mm

Re-adjust the idler if the deflection does not comply with the regulation.

25. Install timing belt guide wheel. See (Figure 46)

Install guide, place the cup side outward.

26. Install timing belt cover sub-assembly

Torque: 9.3N. m

27. Install crankshaft gear or pulley cover sub-assembly

Torque: 9.3N. m

28. Install timing belt cover

Torque: 9.3N. m

29. Install crankshaft pulley. See (Figure 47)

(a) Align pulley lock key and pulley key groove. Install pulley.

(b) Install pulley bolt Torque: 127N. M

30. Install generator assembly

31. Install water pump pulley

32. Install power steering pump V-belt

33. Install A/C compressor fan to crankshaft pulleyV-belt

34. Install cylinder head cover sub-assembly.

(a) Wipe off all seal packing material.

(b) Apply the seal glue on cylinder head cover as shown in Figure 48.

(c) Install gasket onto cylinder head cover.

(d) Install cylinder head cover with 4 seal gaskets and 4 nuts.

Torque: 7.8N. M

(e) Install 2 ventilation hoses onto cylinder head cover.

(f) Install engine wire harness onto cylinder head cover.

(g) Connect generator wire joint.

(h) Connect generator wire.

(i) Connect oil pressure switch connector.

(j) Install wire clip.

(k) Connect A/C compressor switch connector.

35. Hoist the engine back into the compartment

36. Install left & right rear engine mounting brackets

37. Install ignition coil and high pressure cable

38. Install air filter assembly with hose



Figure 46

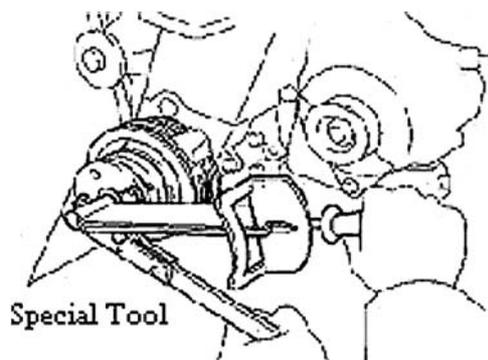


Figure 47

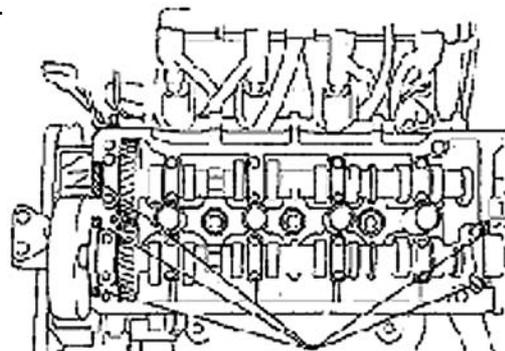


Figure 48

39. Install oil pipe and water hose
40. Install left & right propeller shaft
41. Install left & right front wheel
42. Check engine oil for leakage
43. Install all connected wire harnesses and the cables on engine and vehicle body

# Section 4 Camshaft Replacement

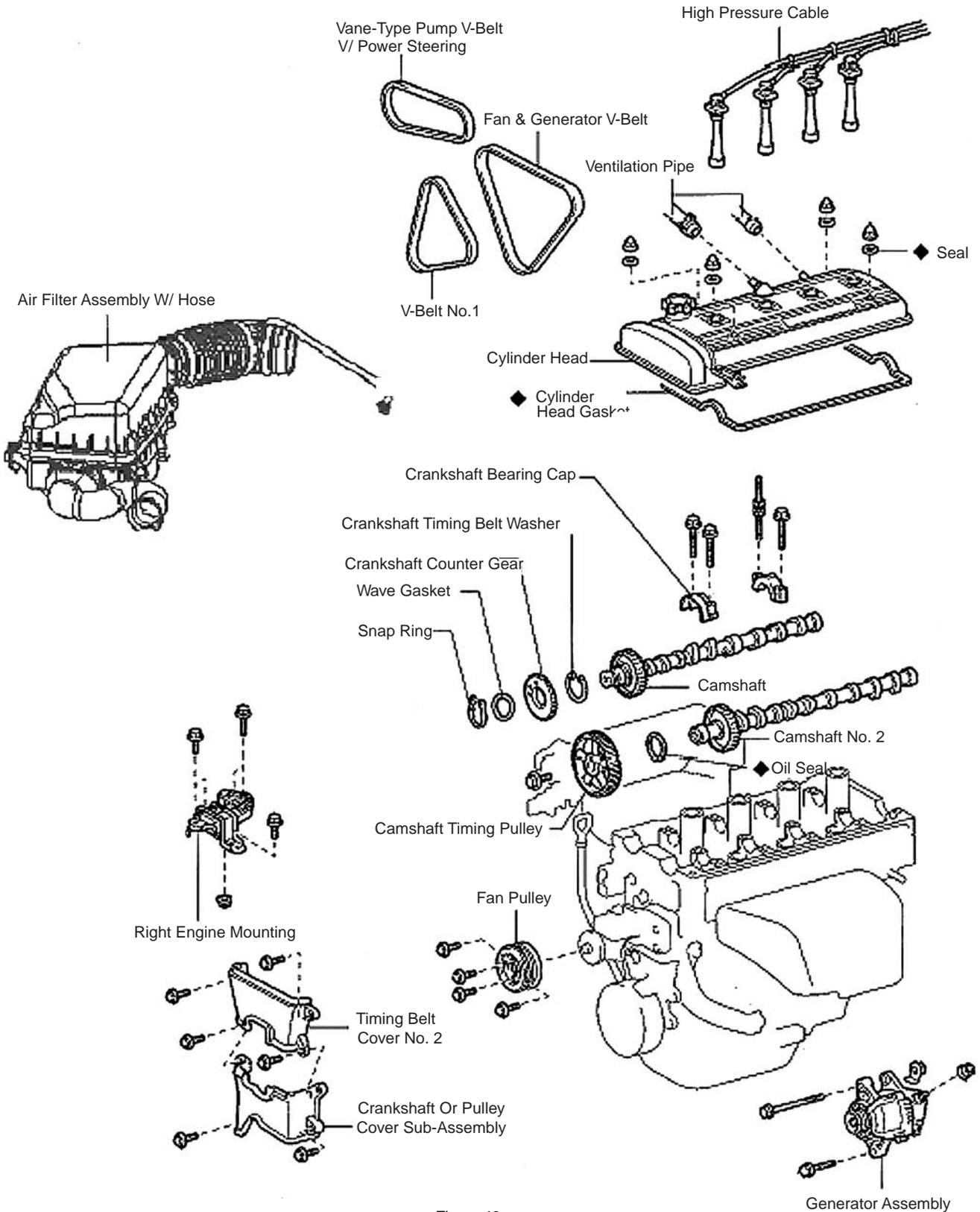


Figure 49

1. Disconnect all connected wire harnesses and the cable on the engine and the vehicle body
2. Remove air filter assembly with hose
3. Disconnect oil pipe and water hose
4. Loose positive and negative cables of the battery
5. Detach propeller shaft
6. Loose left & right rear engine mounting bracket after hoisting the engine.
7. Disconnect all other connectors between the engine and the vehicle body.

8. Remove engine per "Provison 20, Section 2, Chapter 2"
9. Remove A/C compressor to crankshaft pulleyV-belt

10. Remove power steering pump V- belt

11. Remove water pump fan pulley

12. Disconnect ignition coil and high voltage cables

13. Remove cylinder head cover sub-assembly

14. Remove generator assembly

15. Remove cylinder head cover sub-assembly

(a) Disconnect generator wire joint.

(b) Disconnect generator circuit

(c) Disconnect A/C compressor switch connector.

(e) Open wires clips.

(f) Disconnect wire harness from the cylinder head cover.

(g) Disconnect 2 ventilation PCV hoses from cylinder head cover.

(h) Remove 4 screws, 4 seal gaskets, cylinder head and gasket.

16. Remove generator assembly. See (Figure 50)

17. Remove timing belt cover

18. Remove crankshaft gear or pulley cover sub-assembly

19. Put the piston on Cylinder 1 to TDC compression position.

(a) Turn crankshaft pulley. Align its notch to the timing mark "O" on the timing belt cover.

(b) Check if the mark "K" on camshaft timing pulley is aligned to the timing mark on the bearing cap. Turn crankshaft 360° if not.

20. Remove ignition coil assembly

21. Remove timing belt. See (Figure 51)

(a) Mark on the timing belt and the camshaft pulley. The mark on the timing belt to the timing belt cover No. 1 should match.

(b) Remove rubber gasket from timing belt cover.



Figure 50

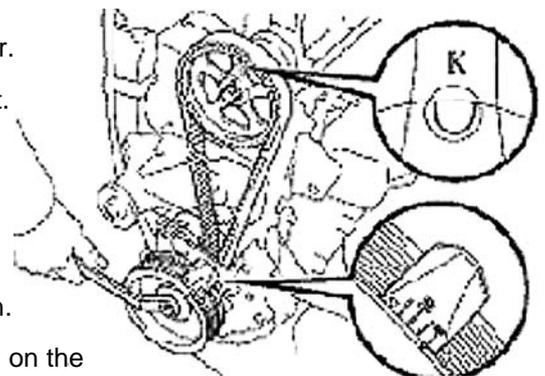


Figure 51

(c) Loosen installing bolt of the idler. See (Figure 52). Move the pulley to its far left and tighten it temporarily.

(d) Remove the belt from the camshaft timing pulley.

Notice:

- Hold the timing belt, the engagement of the crankshaft timing pulley and timing belt will not move.
- Be careful not to drop anything into the timing belt cover.
- Do not let the belt contact oils, water or dirt.

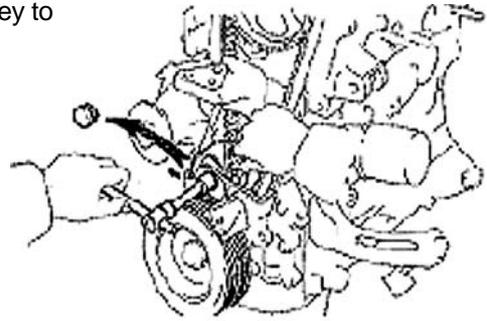


Figure 52

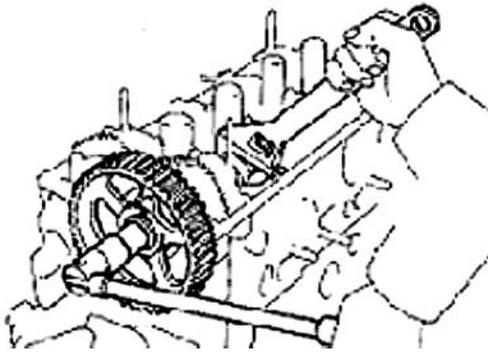


Figure 53

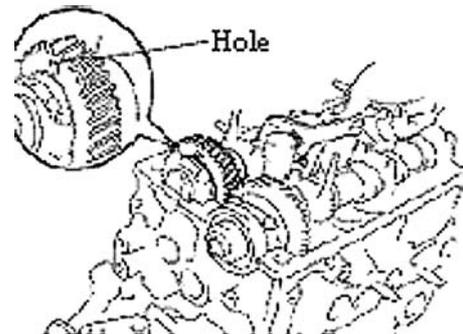


Figure 54

22. Remove the camshaft and the timing pulley. See (Figure 53)

(a) Turn the camshaft hexagon head and loose pulley bolt.

(b) Remove pulley bolt and timing pulley.

23. Remove camshaft. See (Figure 54)

Because the camshaft end play is quite small, keep camshaft horizontal when removing it. Take the following steps to avoid the damage:

(a) Remove the camshaft

(1) Turn the camshaft to access the hole of the counter gear installed on camshaft drive gear.

Hint: The intake camshaft lobe of Cylinder 1 and 3 can push up their own valve tappet.

(2) Remove 2 bolts and bearing cap No. 1.

(3) Install the counter gear on the intake camshaft with the service bolt onto the drive gear.

(4) Uniformly loose and detach 8 bearing cap bolts in several times in the sequence shown in Figure 55.

(5) Remove 4 bearing caps and camshaft.

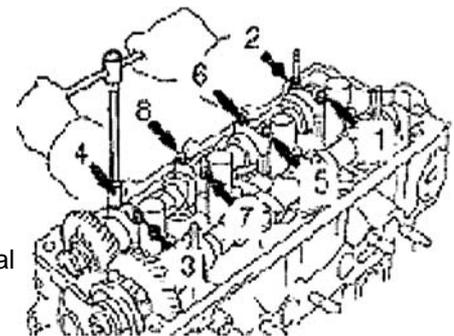


Figure 55

If the camshaft can not be kept horizontal, lift it vertically. Reinstall the bearing cap with 2 bolts. Alternatively loose and detach the bearing cap bolts and lift the camshaft gear. See (Figure 56)

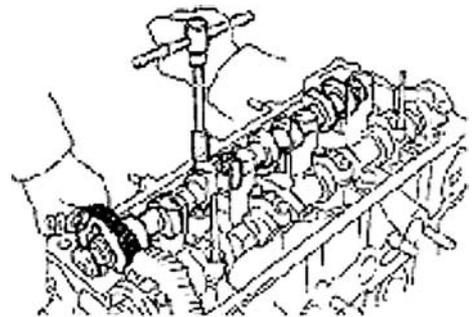


Figure 56

(b) Remove the counter gear of the camshaft.

(1) Clamp the camshaft's hexagon on the vise.

(2) Turn the counter gear clockwise, Remove the service bolt.

(3) Remove the snap ring with a circlip pliers. See (Figure 57).

(4) Remove waved gasket, camshaft counter gear and the camshaft gear spring. See (Figure 58)

24. Remove and install spark plug hole gasket. See Provision 15 and 16, Section 3 Timing Belt Replacement for detailed information. See (Figure 44, 45).

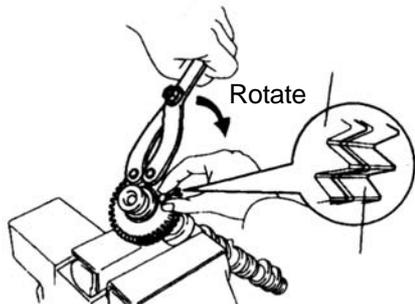


Figure 57

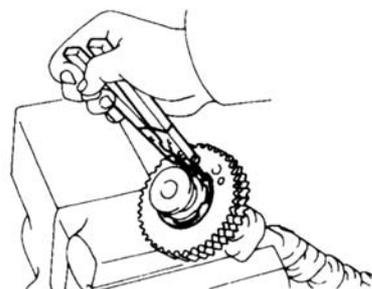


Figure 58

25. Install camshaft

(a) Install exhaust camshaft and turn camshaft counterclockwise to make the dowel pin cross the vertical line a little. See (Figure 59).

(b) Apply grease to a new oil seal lip and install it into the oil seal. See (Figure 60).

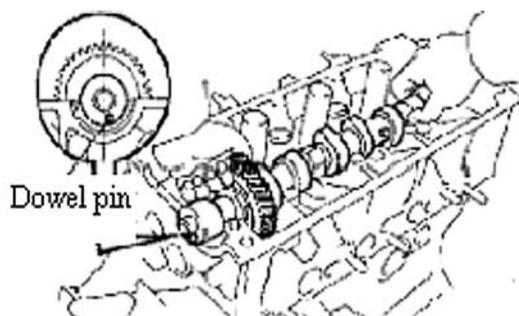


Figure 59

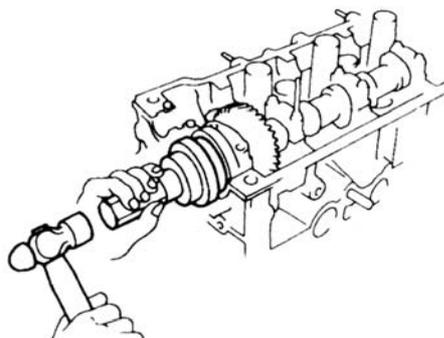


Figure 60

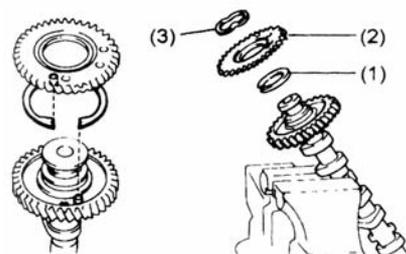


Figure 61

(c) Install camshaft counter gear.

(1) Clamp the camshaft's hexagon head with a vise.

(2) Install camshaft gear spring, camshaft counter gear and waved washer. (Figure 61).

Hint: Align the pin on the gear to the spring end of the counter gear.

(3) Install the snap ring with a circlip plier.

(4) Turn the counter gear clockwise with the special tool. Align the holes on the camshaft drive gear. Install the service bolt.

(d) Install intake camshaft.

(1) Make the exhaust camshaft dowel pin a bit higher than the top of the cylinder head.

(2) Apply grease to camshaft's contact surface.

(3) Install intake camshaft gear to exhaust camshaft gear ,  
Align the matchmarks on each gear. See (Figure 62).

(4) Check the timing marks on the camshaft gear for alignment. See (Figure 63).

Hint: Matchmark is on the top.

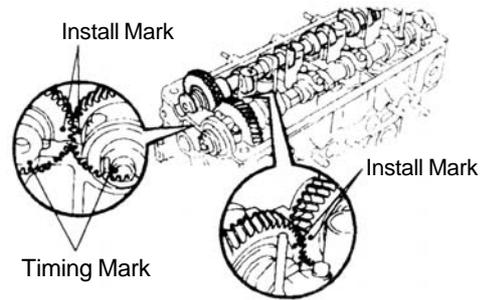


Figure 62

26. Adjust valve clearance

27. Install camshaft timing pulley

Turn the camshaft's hexagon head. Tighten the timing pulley bolt. See (Figure 64).

Torque: 59N. M

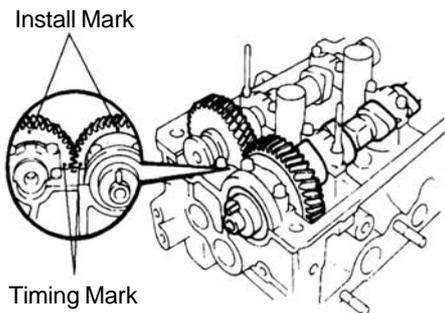


Figure 63

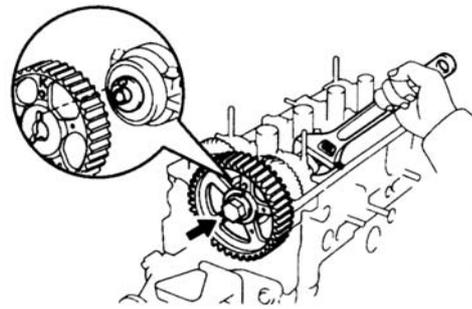


Figure 64

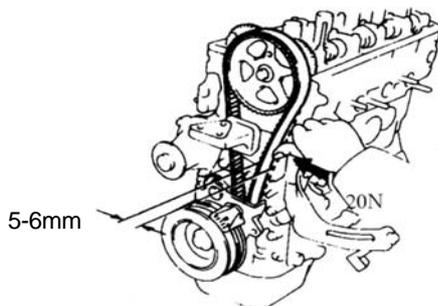


Figure 65



Figure 66

28. Install the timing belt

(a) Align the marks on timing belt and the one on camshaft timing pulley.

(b) Install timing belt. Check tension force between the crankshaft timing pulleys. See (Figure 65).

29. Check valve timing

(a) Loose idler bolt.

(b) Turn crankshaft from TDC clockwise for 2 cycles.

(c) Check and align each pulley to the timing mark as shown in Figure 66. Remove timing belt and reinstall it if not.

30. Install crankshaft gear or pulley cover sub-assembly

Torque: 9.3N. m

31. Install timing belt cover

Torque: 9.3N. m

32. Install generator assembly

33. Install right engine mounting bracket. See (Figure 67)

34. Install cylinder head cover sub-assembly

(a) Install 2 ventilation PCV hoses to the cylinder head cover.

(b) Connect the generator wire.

(c) Install the wire clip.

(d) Connect A/C compressor switch connector.

35. Install water pump pulley

36. Install power steering pump V-belt

37. Install A/C compressor to crankshaft pulley V-belt

38. Install generator V-belt

39. Install left & right rear mounting bracket of engine.

40. Install ignition coil and high voltage cable

41. Hoist the engine back into the compartment

42. Install propeller shaft

43. Install air filter assembly with hose

44. Install oil pipe and water hoses

45. Install left and right front tires.

46. Check engine oil for leakage

47. Install all the wire harnesses and the cables on the engine connected to car body

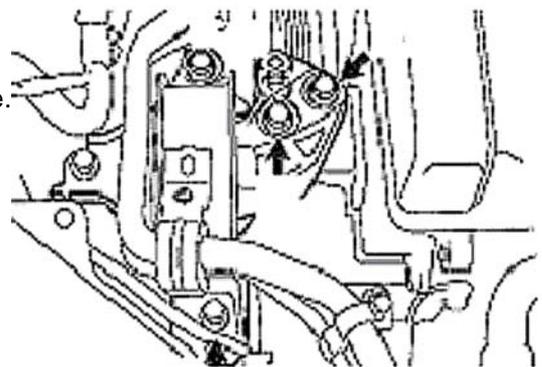


Figure 67

# Section 5 Cylinder Head Gasket Replacement

## Component 1

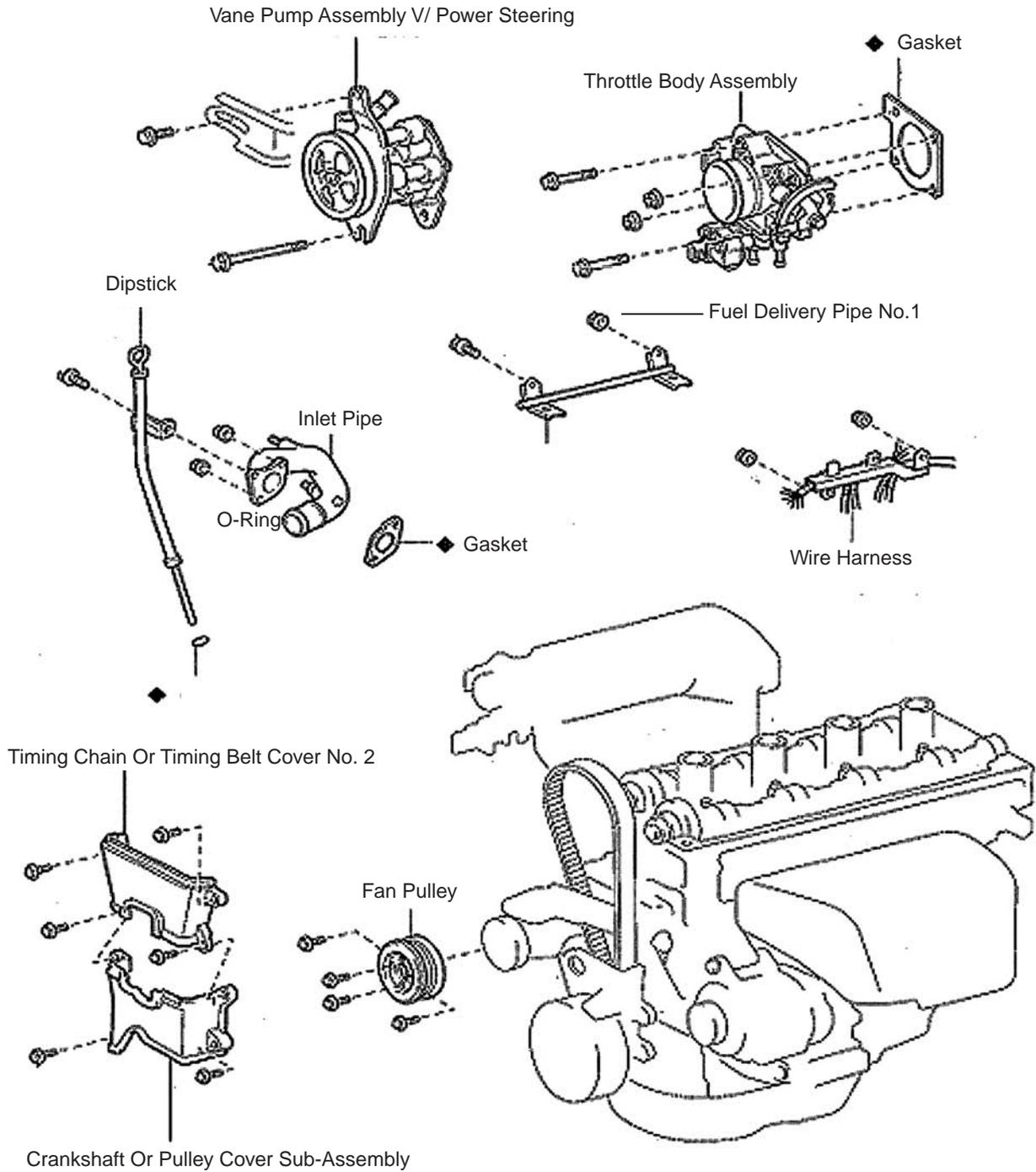


Figure 68

# Component 2

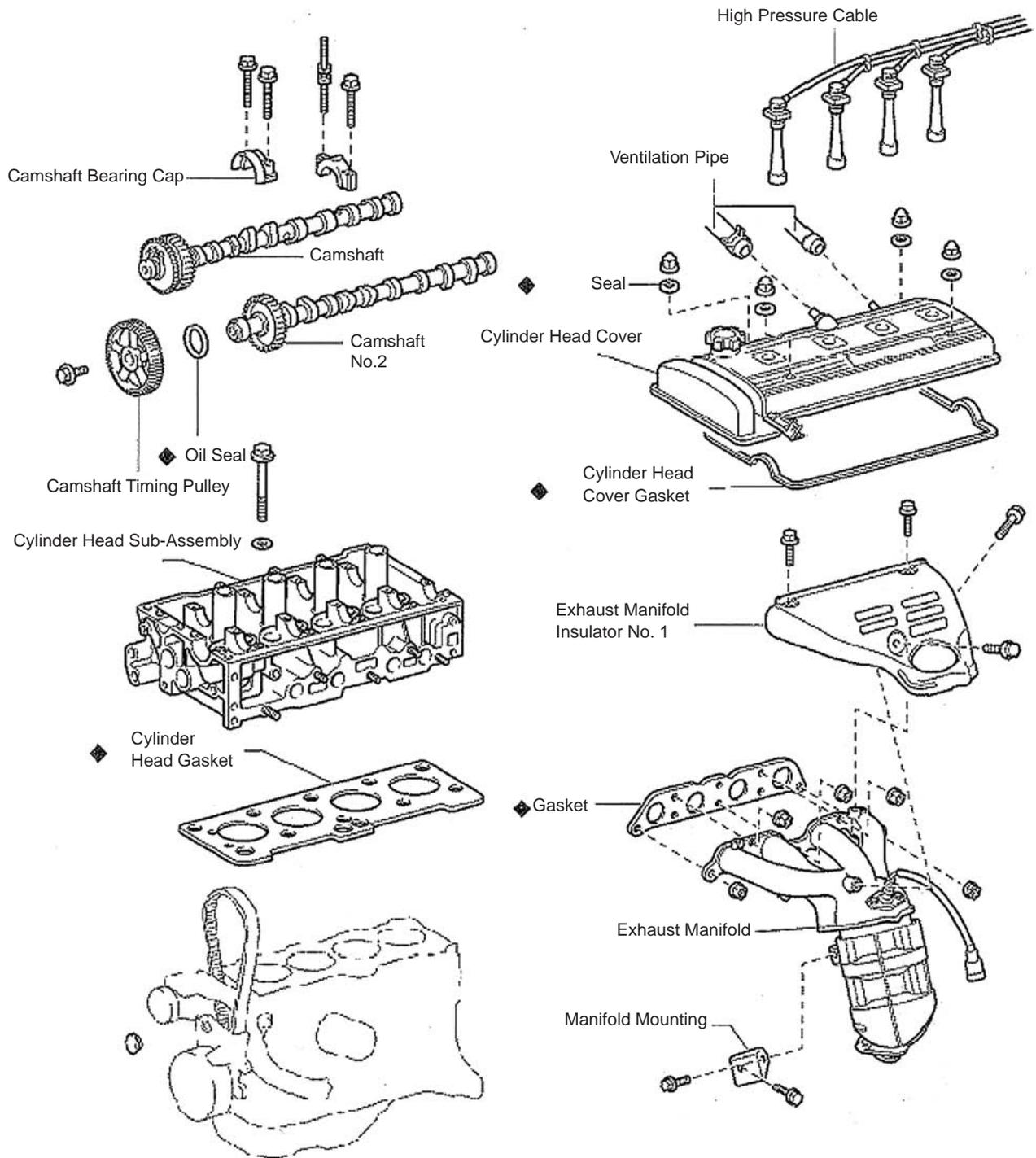


Figure 69

# Component 3

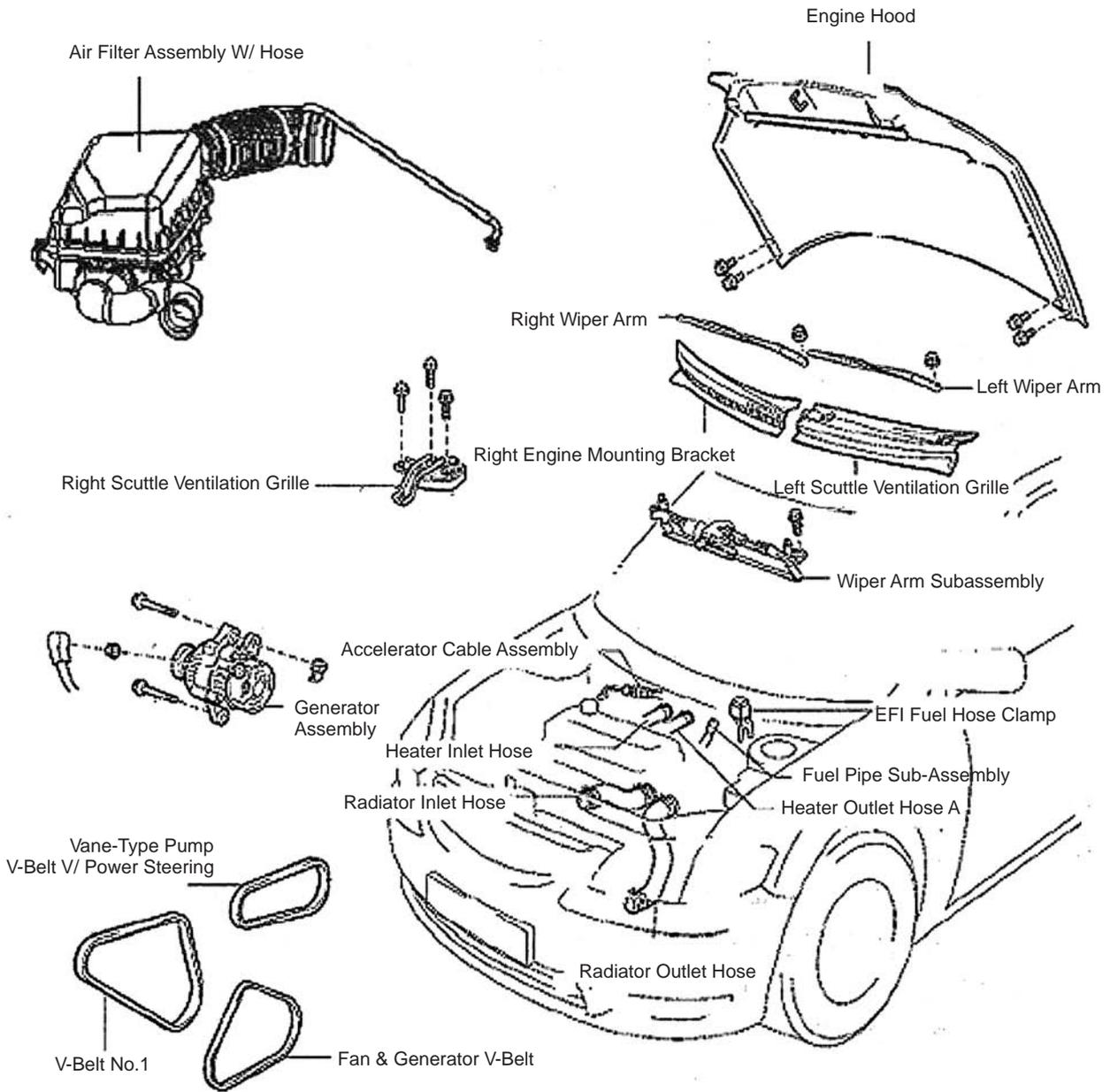


Figure 70

## Replacement

1. Disconnect all the wire harnesses and the cables on the engine connected to the car body.
2. Detach air filter assembly with hose
3. Disconnect oil pipe and water hose
4. Loose positive and negative cables of the battery.
5. Detach propeller shaft. Detach front exhaust pipe assembly
6. Loose engine left & right rear brackets after hoisting the engine.
7. Disconnect all the other connectors between the engine and the car body.
8. See "Provision 20, Section 2, Chapter 2". Lift the car body and take out the engine assembly.
9. Remove A/C compressor to the crankshaft pulley V-belt.
10. Remove power steering pump V-belt.
11. Detach water pump fan pulley.
12. Disconnect ignition coil and high voltage cable.
13. Detach cylinder head cover sub-assembly.
14. Detach generator assembly.
15. Detach the camshaft.
16. Detach the throttle body assembly
17. Detach intake manifold stay No. 2.
18. Take out the dipstick
19. Detach No. 1 fuel delivery pipe
20. Detach the wire harness.
21. Detach the steering assisting pump assembly
22. Detach exhaust manifold. See (Figure 71)
23. Pry cylinder head from the dowel pin on the cylinder block.  
See (Figure 72)
24. Remove the cylinder head gasket.
25. Install cylinder head gasket
26. Install cylinder head sub-assembly
27. Install exhaust pipe assembly.
  - (a) Install the new gasket and exhaust manifold with 5 bolts. Torque: 34N. m
  - (b) Install exhaust manifold stay with 2 bolts.
  - (c) Install upper heat shield with 4 bolts  
Torque: 17N. m

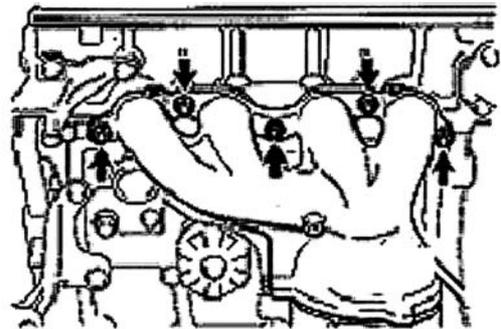


Figure 71

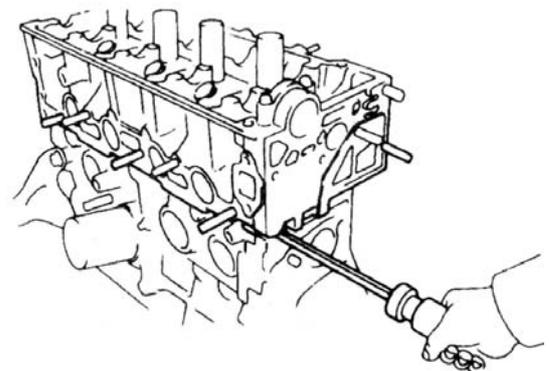


Figure 72

28. Install power steering adjusting pole
29. Install power steering pump assembly
30. Install wire harness.
31. Install No. 1 fuel delivery pipe
32. Set the new gasket on cylinder head with flange upward. Install water inlet hose. See (Figure 73)

33. Install manifold stay No. 2
34. Connect front exhaust pipe assembly
35. Install throttle body assembly
36. Install camshaft
37. Install engine cylinder head cover
38. Hoist the engine back to the compartment.
39. Install engine right left and rear brackets

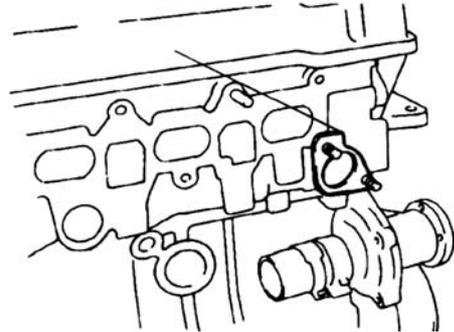


Figure 73

40. Install propeller shaft
41. Install ignition coil and high pressure cables. Install air filter assembly with hose
42. Install oil pipe and water hose
43. Install left & right front tire
44. Install all the wire harnesses and cables on the engine connected to car body
45. Check compression pressure
46. Check CO/HC. Check idle and ignition timing

## Section 6 Oil Pump Oil Seal Replacement

1. Pry with 2 screwdrivers. Detach crankshaft timing pulley.

See (Figure 74)

2. Remove oil pump oil seal. See (Figure 75)

(a) Using a knife, cut off oil seal lip.

(b) Using a screwdriver, pry out the oil seal.

3. Install oil pump oil seal. See (Figure 76)

(a) Smear grease to a new oil seal lip.

(b) on the oil seal with hammer until the edge of the oil pump case is filled with the seal packing.

4. Install crankshaft timing pulley. See (Figure 77)

(a) Align pulley set key to the key groove.

(b) Place the flange face inward. Install timing pulley.

5. Install timing belt

6. Check engine oil for leakage

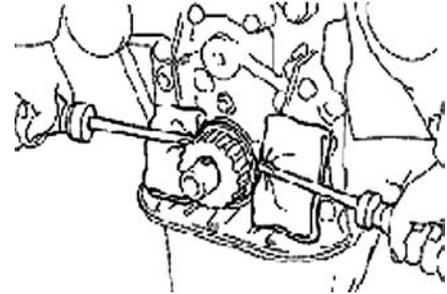


Figure 74

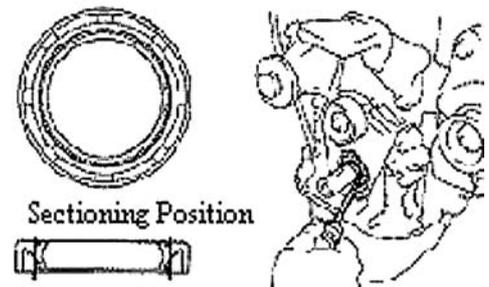


Figure 75

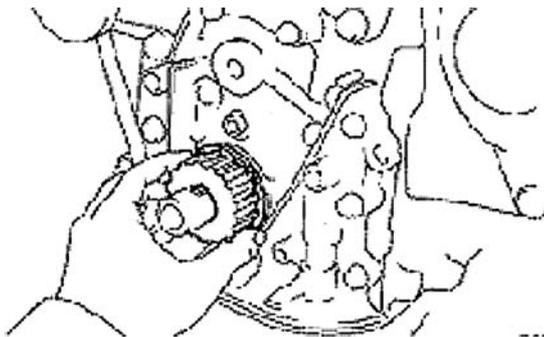


Figure 76



Figure 77

## Section 7 Engine Rear Oil Seal Replacement

1. Detach engine and manual transaxle assembly on "Provision 20, Section 2, Chapter 2"
2. Detach clutch case assembly
3. Remove clutch plate assembly
4. Fix the front end of crankshaft. Detach flywheel.  
See (Figure 78)
5. Remove rear crankshaft end cover
6. Remove engine rear oil seal. See (Figure 75)
7. Install engine rear oil seal. See (Figure 76)
8. Install flywheel sub-assembly. See (Figure 79)
  - (a) Fix crankshaft.
  - (b) Install flywheel to crankshaft. as the sequence shown in the figure,
  - (c) Install and uniformly tighten and install bolt  
Torque: 78N. m
9. Install clutch plate assembly
10. Install clutch case assembly
11. Install manual transaxle assembly

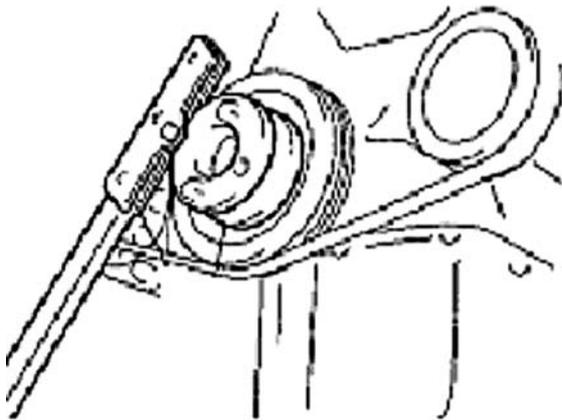


Figure 78

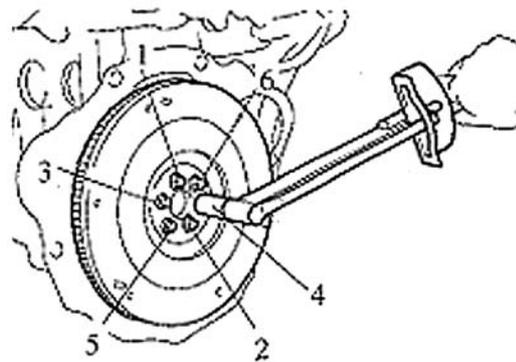


Figure 79

# Chapter 3 Lubrication System (MR479Q, MR479QA, MR481QA)

## Section 1 Oil Pressure Gage Sensor Replacement

### 1. Check oil level

Warm up the engine. Check the dipstick to ensure oil level between "L" and "F" after engine stopped 5 minutes. Check for leakage if it is too low. Fill oil to "F".

2. Check oil for deterioration. Water entry, discolor and dilution. Replace oil if it is obviously deteriorated.

3. Detach oil pressure sensor assembly. See (Figure 80)

4. Install oil pressure gage sensor. See (Figure 81) Start engine to normal operation temperature.

5. Check for oil pressure

6. Smear adhesive on 2 or 3 threads of the oil pressure sensor.

Install oil pressure sensor. See (Figure 82)

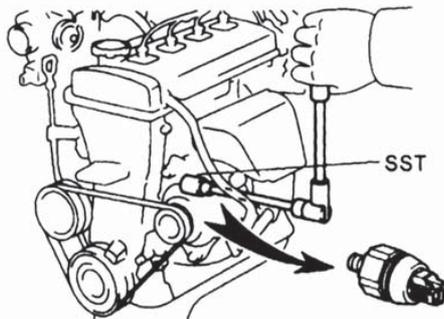


Figure 80

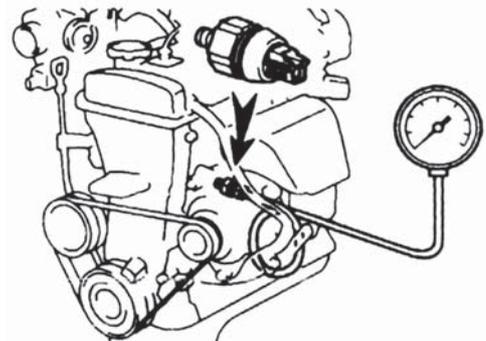


Figure 81

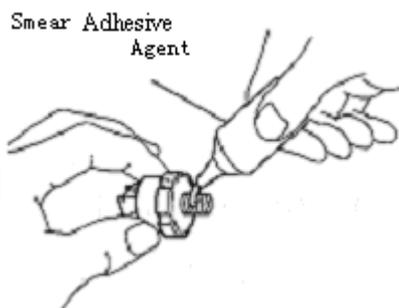


Figure 82

## Section 2 Oil Pump Assembly Replacement

1. Remove timing belt
2. Remove timing belt idler sub-assembly
3. Detach crankshaft timing pulley. See (Figure 74)
4. Remove the dipstick guide
5. Detach oil sump sub-assembly. See (Figure 83)
6. Detach oil strainer sub-assembly. See (Figure 84)
7. Detach oil pump assembly. See (Figure 85)
8. Remove oil pump oil seal
9. Install oil pump oil seal
10. Install oil pump assembly
11. Install oil strainer sub-assembly
12. Install oil sump assembly. See (Figure 86)

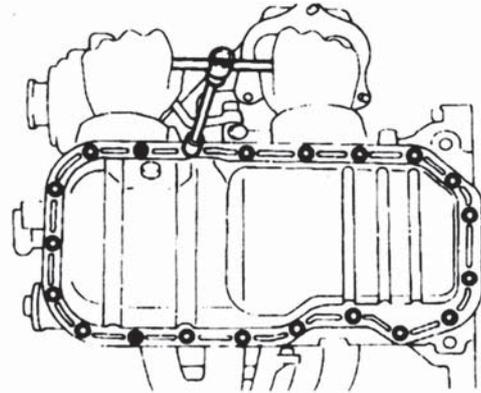


Figure 83

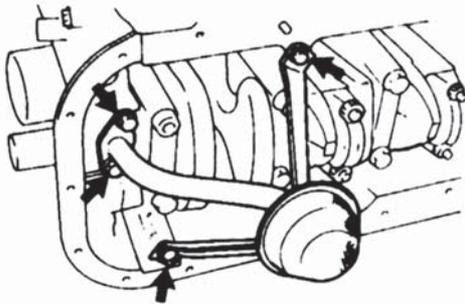


Figure 84

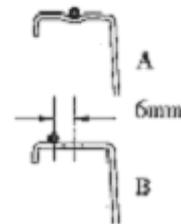
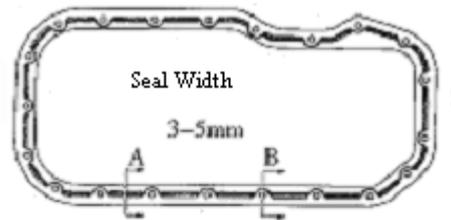


Figure 86

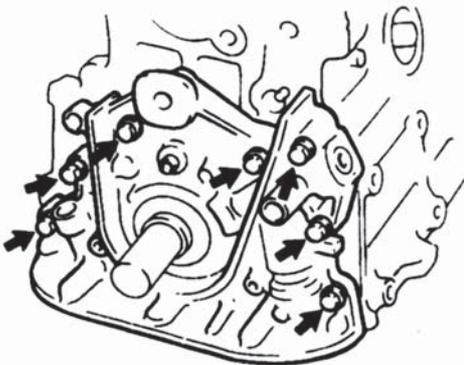


Figure 85

13. Install the dipstick guide. See (Figure 87)
14. Install crankshaft timing pulley. See (Figure 77)
15. Install timing belt idler sub-assembly No.1
16. Install timing belt
17. Fill in engine oil
18. Check oil for leakage

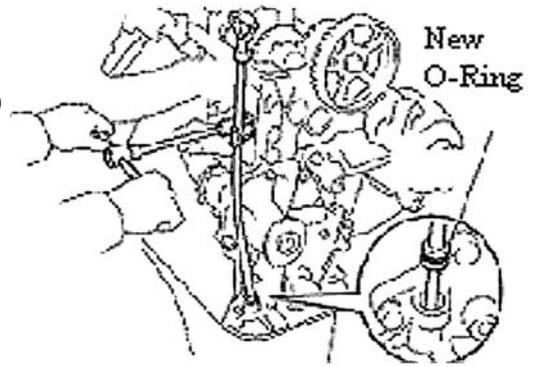


Figure 87

## Section 3 Oil Filter Replacement

1. Detach oil filter sub-assembly. See (Figure 88)
2. Install oil filter sub-assembly. See (Figure 89)

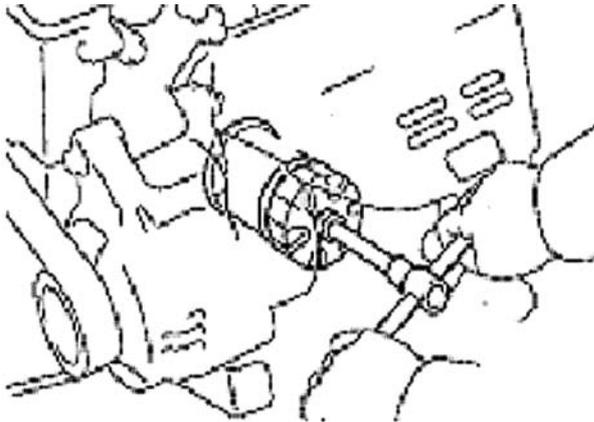


Figure 88

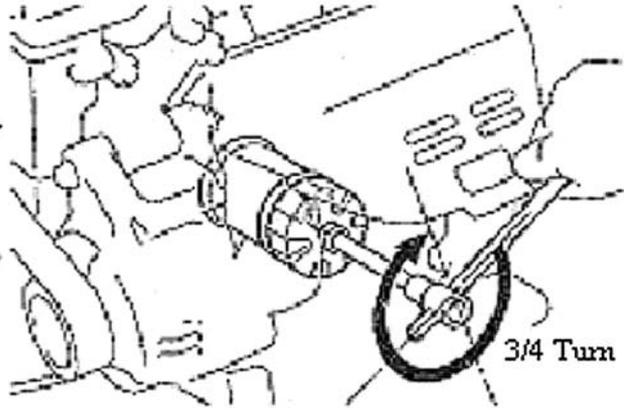


Figure 89

3. Install drain plug

Clean and use new washer to install drain plug.

Torque: 54N. m

4. Oil fill

Capacity:

Oil refill amount with the filter replaced: 3.0L

Oil refill amount without the filter dry fill replaced: 2.80L

Dry fill: 3.3L

5. Check oil for leakage

## Section 4 Starter Replacement

1. Detach starter assembly. See (Figure 90)
2. Install starter assembly

Torque:

Bolt 37N. m

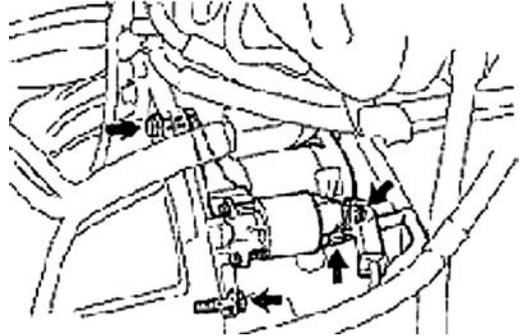


Figure 90

## Section 5 Generator Replacement

1. Detach V-belt of generator
2. Detach generator assembly
  - (a) Disconnect wire joint of generator.
  - (b) Remove wire of generator.
  - (c) Disconnect oil pressure switch interface.
  - (d) Disconnect A/C compressor switch connector.
  - (e) Open wire clips.
  - (f) Detach 2 bolts and generator.
3. Install generator assembly

Torque:

M12 bolt 18N. m

M14 bolt 58N. m
4. Transmit belt tilt and tension state inspection

# Chapter 4 Fuel System (MR7131A, MR7151A, MR7161A)

## Section 1 Check Fuel System Pressure

1. Remove the fuel tank from the vehicle
2. Check the fuel pump running
  - (a) Connect the positive and negative battery terminal to the concerned fuel pump connector. See (Figure 91).

Notice: Do not start engine

The sound of fuel flowing can be heard if there is pressure.

Check fusible link, fuse, EFI open circuit relay, fuel pump, ECU and wire connector if there is no pressure.

- (b) Turn the ignition switch to "OFF" position.

### 3. Check fuel pressure

- (a) Check battery electrical pressure to be above 12V.
- (b) Detach negative terminal cable from the battery.
- (c) Install pressure gage from the fuel delivery pipe. See (Figure 92).
- (d) Connect battery negative terminal.

- (e) Measure fuel pressure

Fuel pressure:

304-343kPa

Check fuel pipe & union, fuel pump, fuel filter if the pressure is too low.

- (f) Start engine. Measure fuel pressure at idle. Fuel pressure: 304-343kPa
- (g) Check fuel pressure and retain the pressure for approximately 5min after the engine stopped.

Fuel pressure: 147kPa

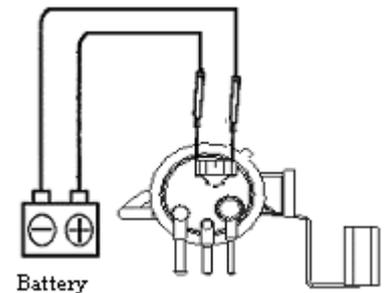


Figure 91

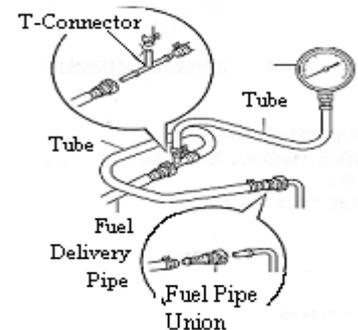


Figure 92

## Section 2 Fuel Pump Inspection

### 1. Fuel pump

(a) Check fuel pump resistance,  $0.2\sim 3.0\ \Omega$  at  $20^\circ$ . Replace fuel pump if the resistance is not as specified.

See (Figure 93)

(b) Fuel pump running:

Check fuel pump by connecting with battery. Replace fuel pump or wire if the running is not as specified.

See (Figure 94).

The test should be conducted within 10s to prevent coil from damage.

### 2. Fuel injector assembly

Injection Volume:  $40\sim 50\text{cm}^3/\text{s}$

Error between each injector: less than  $10\ \text{cm}^3$

Replace injector if the injection volume is not as specified.

(a) Check for leakage: Disconnect the cable from the battery. The fuel drop/min is no more than 1 drop.

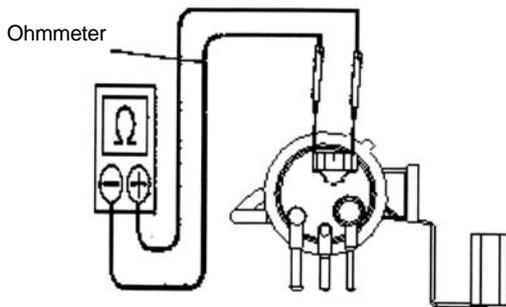


Figure 93

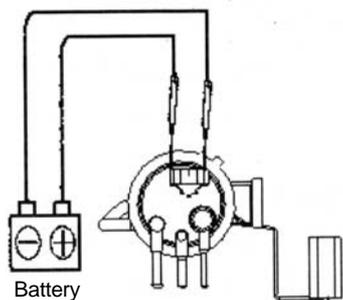


Figure 94

## Section 3 Fuel Injector Replacement

1. Check fuel for ejection.
2. Remove PCV ventilation hoses. See (Figure 95). Remove fuel pipe clamp.
3. Detach fuel hose sub-assembly
4. Detach fuel delivery pipe sub-assembly. See (Figure 96)
  - (a) Press the connector to lock the spring and pull the connector from the injector.
  - (b) Remove 2 screws and detach fuel delivery pipe with injector.
5. Remove fuel injector assembly
6. Install injector assembly
  - (a) Smear a light layer of oil on two O-rings and install them to injector. See (Figure 97).
  - (b) Install 4 injectors to feul delivery pipe by rotating them left and right. See (Figure 98).
  - (c) Install retain frame to each injector.

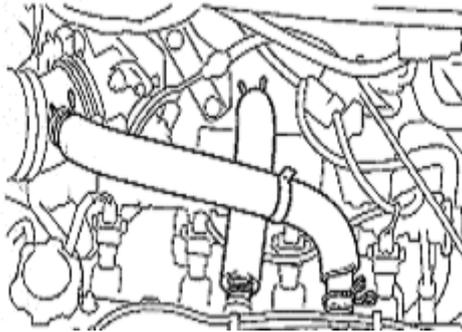


Figure 95

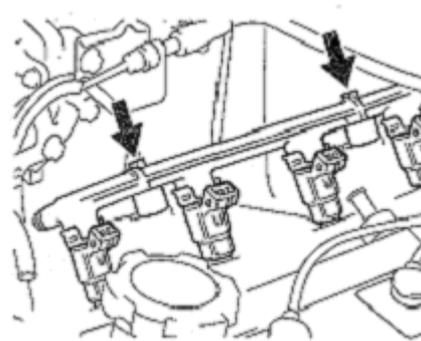


Figure 96

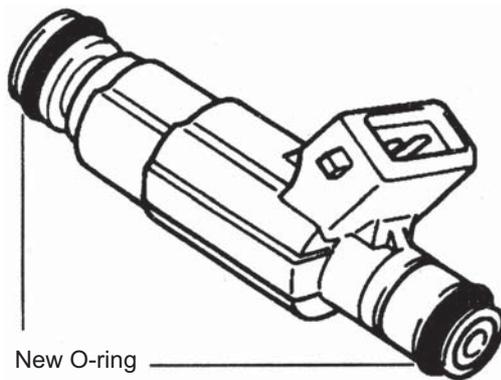


Figure 97

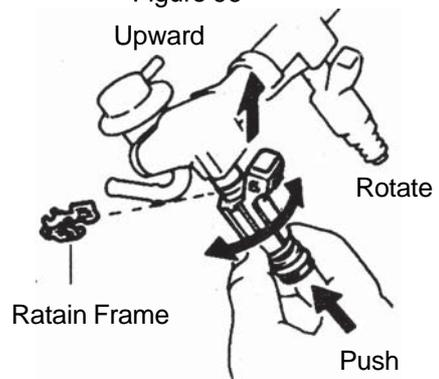


Figure 98

## 7. Install fuel delivery pipe sub-assembly

- (a) Install two washers in intake manifold. See (Figure 99).
- (b) Install 4 injectors and fuel delivery pipe assembly into intake manifold .
- (c) Temporarily install 2 bolts to attach the fuel delivery pipe to intake manifold .
- (d) Check injector for smooth rotation. See (Figure 100).

Hint: If injector doesn't rotate smoothly, replace O-ring with the injector connector upward.

- (e) Tighten the 2 bolts and attach the fuel delivery pipe to intake manifold

See (Figure 101).

Torque: 15N. m



Figure 99

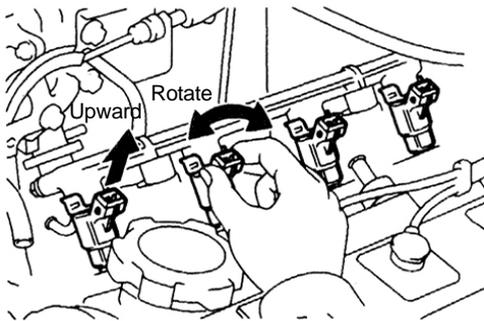


Figure 100

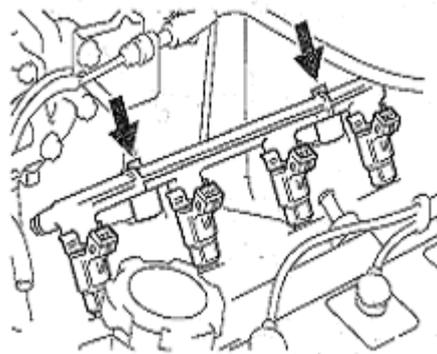


Figure 101

## Section 4 Fuel Pump Replacement

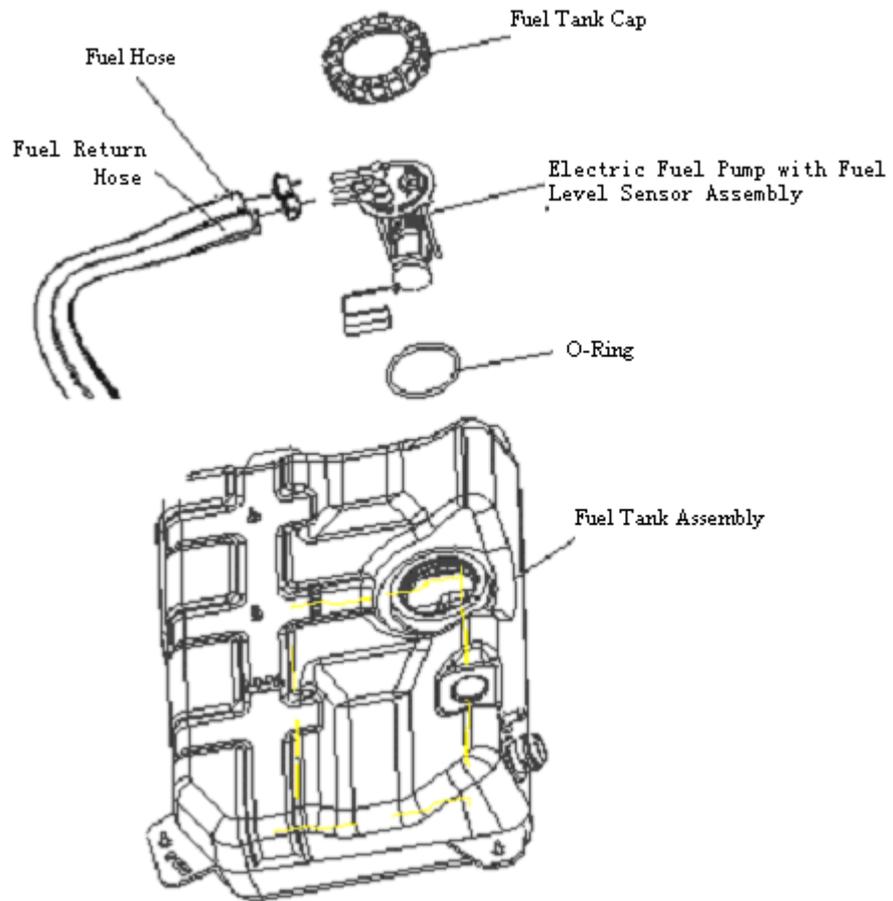


Figure 102

1. Avoid fuel ejection
2. Disconnect fuel tank hose
3. Disconnect fuel tank return hose
4. Disconnect fuel tank gas exhaust hose
5. Detach fuel pump assembly with filter screen. See (Figure 103)

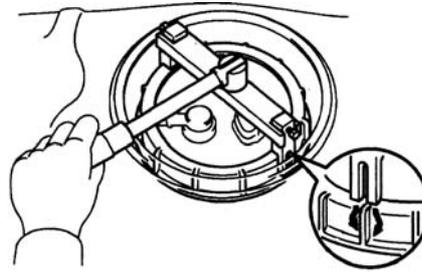


Figure 103

Using special tool, loose fuel tank cap. Be careful not to bend the fuel level sensor arm when pulling out fuel pump.

6. Install fuel pump assembly. See (Figure 104). Replace ring seal .

Align the tab on the fuel pump to the notch on the fuel tank port. Tighten the fuel tank cap with special tool.

Torque: 40N. m

7. Install fuel gas exhaust hose

- (a) Install return hose;
- (b) Install fuel hose;
- (c) Check fuel for leakage.

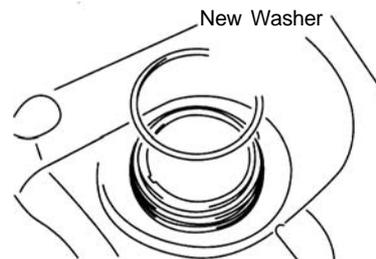


Figure 104

## Section 5 Fuel Emission Control System

1. Check the operation when the fuel is cut off.
  - (a) Warm up the engine for at least 2500rpm. Using sound grade meter, check injector's noise when running. See (Figure 105).
  - (b) The noise from the injector should stop immediately after loosing the throttle. Repeat for several times.
2. Check fuel vapor emission control system. See (Figure 106)
  - (a) Disconnect vacuum pipe after starting the engine.
  - (b) Select "ACTIVE TEST" and "PURGE VSV (Vacuum Solenoid Valve)" from the display on the fault diagnosis tester. Confirm vacuum at VSV port.
  - (c) Connect the vacuum pipe after completing "ACTIVE TEST".
  - (d) After conducting "ECM DATA MONITOR" on the fault diagnosis tester, select "PURGE VSV" to check operation.
  - (e) Start the vehicle after warming up the engine to confirm the VSV status is changed from disconnected to connected. See (Figure 107).
3. Check the fill fuel port cap and gasket for distortion or damage. See (Figure 108)

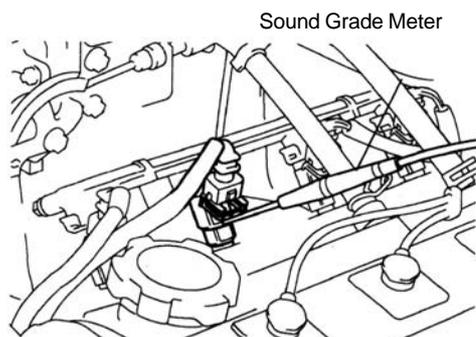


Figure 105

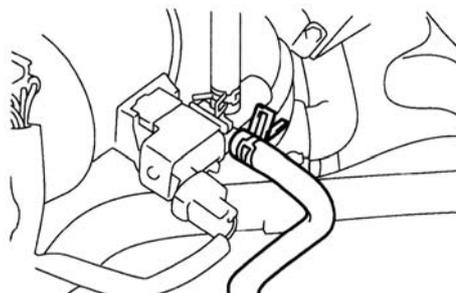


Figure 106

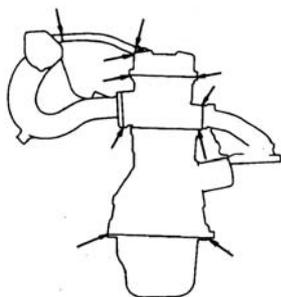


Figure 107

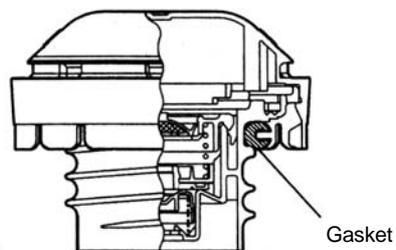


Figure 108

## Section 6 Carbon Canister Replacement

### 1. Check and replace carbon canister

(a) Eye-inspect the carbon canister for crack or damage. See (Figure 109).

(b) Check the carbon canister's operation.

1. Plug the exhaust hole. See (Figure 110).

2. Blow air in through (4.71kpa, 48kgf/cm<sup>2</sup>) fuel tank hole when the exhaust hole is closed. Check and ensure air is blew out from the blow purge hole.

Replace the carbon canister if the operation is not as specified.

3. Blow air in through the fuel tank hole. Check and ensure air flows out from the other hole without resistance.

Replace the carbon canister if the operation is not as specified.

(c) Clean the carbon canister: Plug the blowing tube, bleed air in through (4.71kpa,) fuel tank hole and goes out from the exhaust port. See (Figure 111).

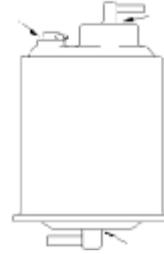


Figure 109

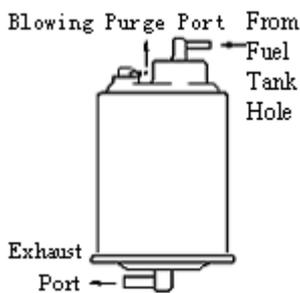


Figure 110

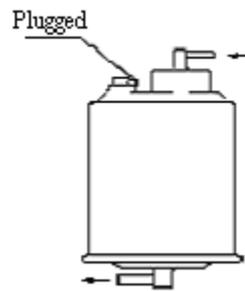


Figure 111

### 2. Vacuum Solenoid Valve (VSV)

(a) Using ohmmeter, check VSV open circuit. The resistance is 27-33  $\Omega$ , when the temperature is 20°. See (Figure 112).

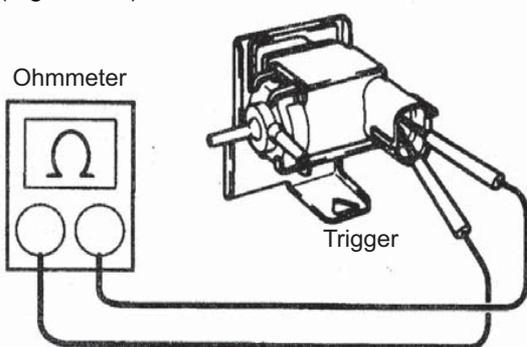


Figure 112

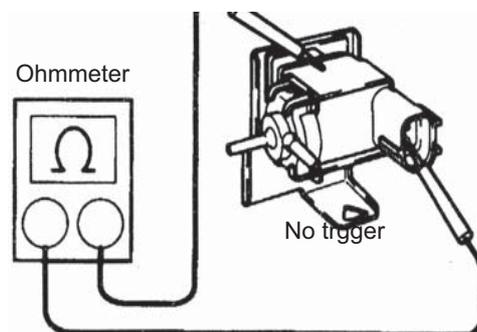


Figure 113

(b) Using ohmmeter, check VSV grounding. Replace VSV if it is continuity. See (Figure 113).

(3) Check VSV operation from hole E to F and that the air flow should be difficult. See (Figure 114).

### 3. PCV sub-assembly

It should be easy for air to pass through the cylinder head.

Notice:

- Do not suck air through valve.
- Never put any object into the valve. Replace PCV if the operation is not as specified.
- Blow air in from the intake manifold side. Check that the air flow should be difficult. Replace PCV if the operation is not as specified. See (Figure 115).

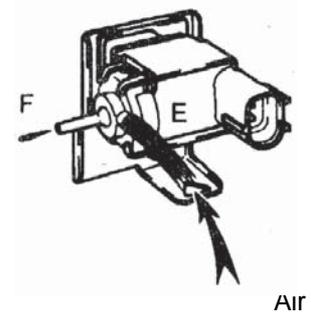


Figure 114

Near cylinder head



Cleaning pipe

Near the intake manifold

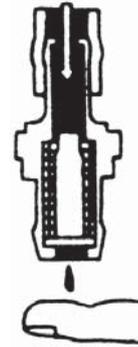


Figure 115

# Chapter 5 Exhaust System (MR7131A, MR7151A, MR7161A)

## Component1

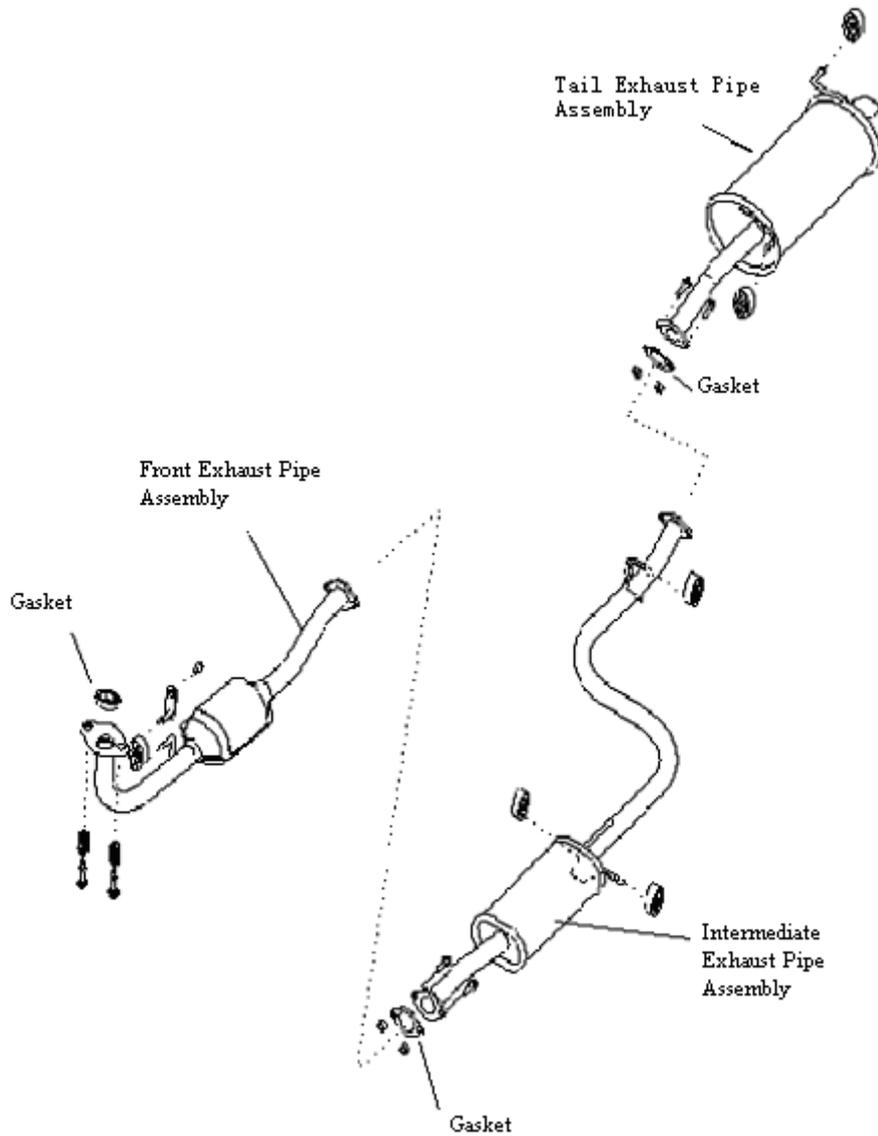


Figure 116

1. Detach tail exhaust pipe assembly

Remove 2 bolts and the tail exhaust pipe assembly.

2. Remove intermediate exhaust pipe assembly

Replace exhaust system

Detach 2 bolts and intermediate exhaust pipe assembly.

3. Detach front exhaust pipe assembly

Remove 2 bolts and front exhaust pipe assembly.

4. Install front exhaust pipe assembly

Using vernier calipers, measure the free length of the spring.

Free length: 42mm

Using the new gasket, install the front exhaust pipe to the exhaust manifold.

Notice:

- Do not use removed gasket any more.

5. Install front exhaust pipe assembly.

Torque: 43N. m

6. Install intermediate exhaust pipe assembly

Using the new gasket, install the intermediate exhaust pipe to the front exhaust pipe.

Torque: 44N. m

7. Install tail exhaust pipe assembly

Using the new gasket, install the tail exhaust pipe to the intermediate exhaust pipe. See (Figure 117).

Torque: 43N. m

8. Check exhaust for leakage

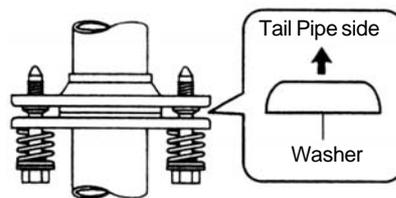


Figure 117

# Chapter 6 Cooling System Inspection (MR7131A, MR7151A, MR7161A)

## Section 1 System Check

1. Check the cooling system for leakage. See (Figure 118)

(a) Fill coolant into radiator. Install the tester onto the radiator cap port.

(b) Start engine.

(c) The water pump pressure is 118Kpa. Check the pressure and ensure the pressure will not drop. If the pressure drops, check the port, radiator and water pump for leakage. If there is no leakage, check the heat exchanger, cylinder block and cylinder head.

Radiator Cap Tester

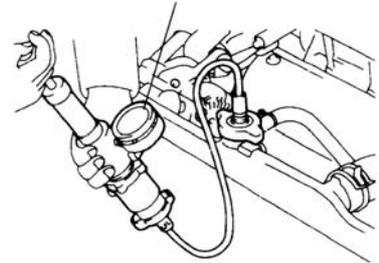


Figure 118

2. Check the engine coolant level in the reservoir.

The coolant level should be between low and full marks.

3. Check coolant quality

(a) Remove radiator cap.

To avoid being scalded, do not remove radiator cap while the engine and radiator are still hot, as fluid and steam can be sprayed under pressure.

(b) There should not be excessive deposits of rust or scale around the radiator, and the coolant should be free from oil.

(c) Reinstall the radiator cap.

4. Thermostat

Hint:

The thermostat temp indicates the valve opening temperature.

See (Figure 119).

(a) Immerse the thermostat in water and gradually heat the water.

(b) Check the valve opening temperature. Valve opening temperature: 80 -- 84° C

(c) Check the valve lift. See (Figure 120, Figure 121). Valve lift: 8mm or mor at 95° C

(d) Check the thermostat is fully closed when the thermostat is at low temperature ( $\leq 77^{\circ}$  C).

5. Radiator cap valve

Standard opening pressure: 93-123kpa

Minimum opening pressure: 78kpa

If the opening pressure is less than minimum, replace the radiator cap.

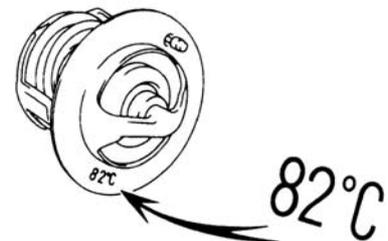


Figure 119



Figure 120

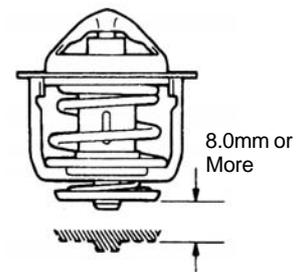


Figure 121

## 6. Fan

- (1) Check the cooling fan operation with low temperature (Lower than 83° C)
  - (a) Turn the ignition switch to “ ON” position.
  - (b) Check that the cooling fan stops.
  - (c) Pull out the water temperature sensor connector. See (Figure 122)
  - (d) Connect the water temperature sensor to car body with the wire and ground the wire.
  - (e) Check the cooling fan operation.
  - (f) Insert water temperature sensor connector.
- (2) Check the cooling fan operation with high temperature (over 93° C)  
See (Figure 123)
  - (a) Start engine and make the coolant temp. higher than 93° C.
  - (b) Check that the cooling fan turns.

Replace it with water temperature switch if it doesn't run)

- (3) Check the cooling fan. See (Figure 124)
  - (a) Disconnect the cooling fan connector.
  - (b) Connect the battery and ammeter to the connector.
  - (c) Check that the cooling fan rotates smoothly and check the reading on the ammeter.  
Standard amperage: 5.7 - 7.7A
  - (d) Reconnect the cooling fan connector.

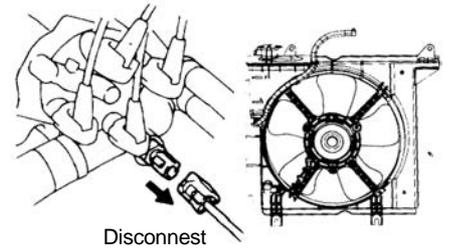


Figure 122

> 93° C

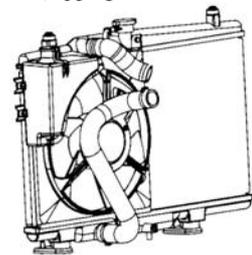


Figure 123

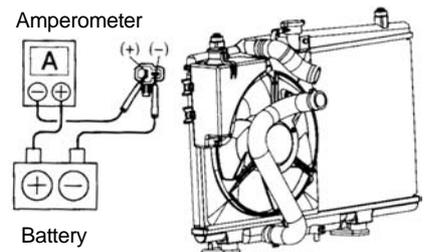


Figure 124

## Section 2 Water Pump, Thermostat and Radiator Replacement

Hoist the engine from the compartment. See "Provision 20, Section 2, Chapter 2".

### 1. Replace water pump. See (Figure 125)

- (1) Drain the coolant.
- (2) Detach timing belt.
- (3) Detach power steering pump assembly.
- (4) Remove the oil dipstick guide.
- (5) Detach water pump assembly.
- (6) Install water pump assembly.
- (7) The installation is in the reverse order of the removal.

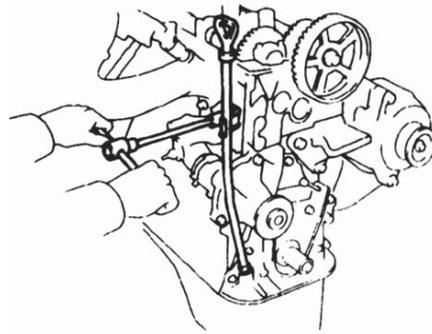


Figure 125

### 2. Replace thermostat

- (1) Remove thermostat (See Figure 126).
- (2) Install thermostat.
  - a. Install a new gasket to the thermostat. See (Figure 127).
  - b. Align the main valve of the thermostat to the top of the stud. Insert the thermostat into the water inlet case.

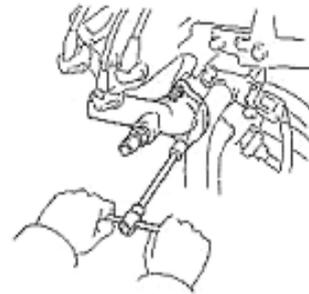


Figure 126

Hint:

The main valve is set at around 10° C as shown in the figure. See (Figure 128).

- (3) Install inlet connector.

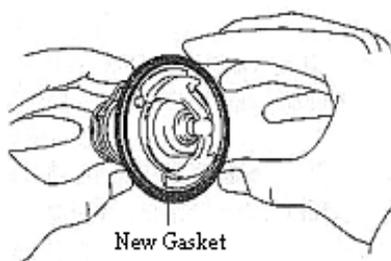


Figure 127

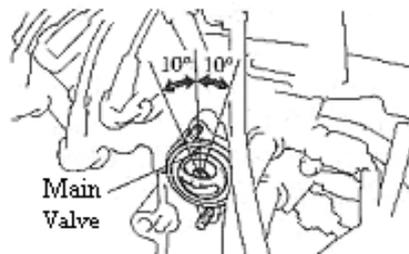


Figure 128

### 3. Replace radiator

- (1) Open radiator cap.
- (2) Open the drain valve and drain the coolant.
- (3) Detach radiator water inlet hose.
- (4) Detach radiator water outlet hose.

- (5) Disconnect auto-transmission oil cooler input pipe (Auto-transmission).
- (6) Disconnect auto-transmission oil cooler output pipe (Auto-transmission).
- (7) Remove 4 bolts from the radiator mounting bracket. See (Figure 129).
- (8) Detach radiator assembly, Remove 3 bolts. Detach the fan and fan shroud. See (Figure 130).

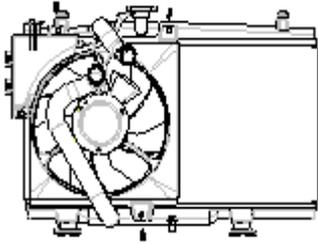


Figure 127

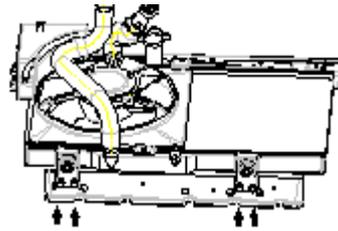


Figure 128

- (9) Install the cooling fan assembly
  - (a) Fix the reservoir assembly on the cooling fan bracket with the bolt. Torque: 16 N. m.
  - (b) Install the fan and fan shroud with 3 bolts. Torque: 7.5N. m.
  - (c) Install the cooling fan assembly to radiator assembly with 3 bolts. Torque: 16N. m.
  - (d) Connect the overflow pipe on the reservoir assembly and radiator assembly. Fix it with the spring band.
  - (f) The installation of the radiator assembly is in the reverse order of the removal.

# Chapter 7 Clutch (MR7131A, MR7151A, MR7161A)

## Component 1 (Hydraulic Manipulation)

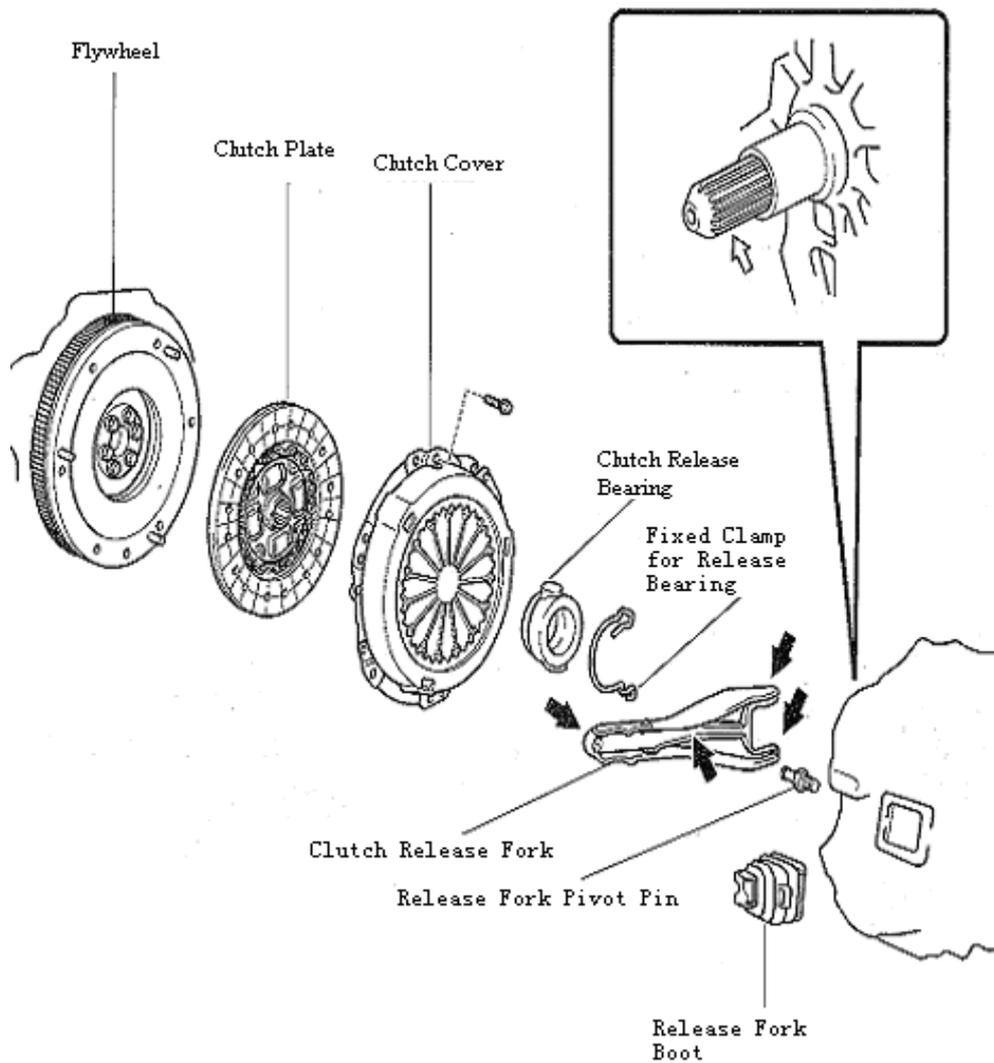


Figure 131

## Section 1 Clutch Replacement

Hoist the engine from the compartment. See "Provison 20, Section 2, Chapter 2".

1. Remove manual transaxle assembly
2. Remove the clutch release fork. See (Figure 132)
3. Detach clutch release fork boot.
4. Detach clutch release bearing
5. Detach clutch release bearing fixed clamp
6. Remove clutch fork pivot pin
7. Align the clutch cover to the mark on the flywheel. Detach clutch cover. See (Figure 133)
8. Remove clutch plate
9. Check and remove clutch plate assembly. See (Figure 134)
10. Check clutch cover. See (Figure 135)

Depth wear: A: 0.6mm

Width wear: B: 5mm

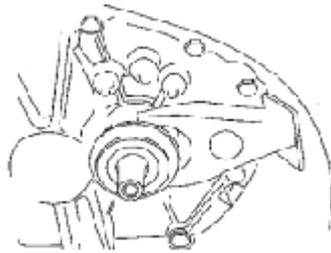


Figure 132



Figure 133

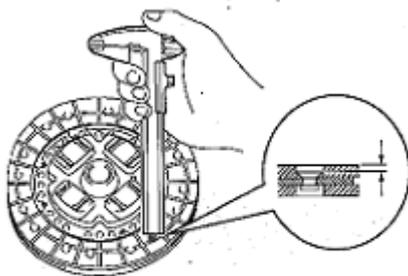


Figure 134

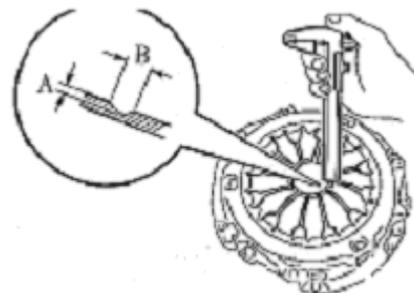


Figure 135

11. Using the dial gauge, check the flywheel runout. See (Figure 136).

The maximum runout: 0.3mm

12. Check clutch release bearing

The bearing is permanently lubricated. There is no need to lubricate or clean.

13. Check clutch plate

14. Install clutch cover. See (Figure 137)

Align the Clutch cover to the mark on the flywheel.

Hint:

(1) Uniformly tighten the bolt in the sequence shown.

Torque: 19 N. m

(2) Shake the clutch plate up and down, left and right to ensure it is centered, then tighten the bolt.

15. Check and adjust the clutch cover. See (Figure 138)

Check the diaphragm tip flatness with the dial gauge with roller.

Max. roughness: 0.5mm.

16. Install the release fork pivot pin

17. Install clutch release fork boot

18. Install clutch release bearing fixed clamp

19. Install clutch release fork

20. Install clutch release bearing

21. Install manual transaxle assembly

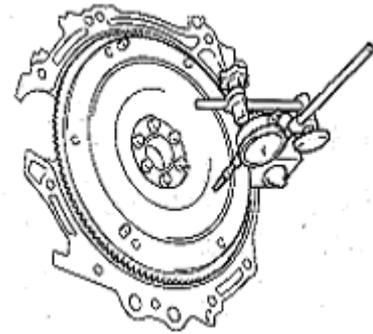


Figure 136

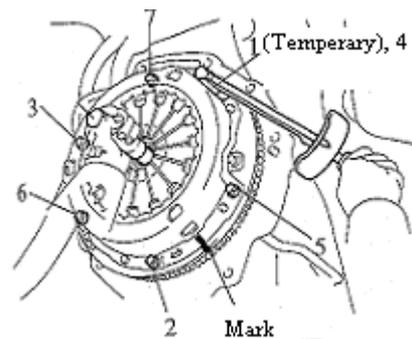


Figure 137

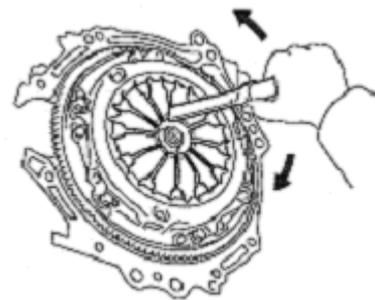


Figure 138

# Chapter 8 Manual Transaxle Assembly (MR7131A, MR7151A, MR7161A)

## Component 1

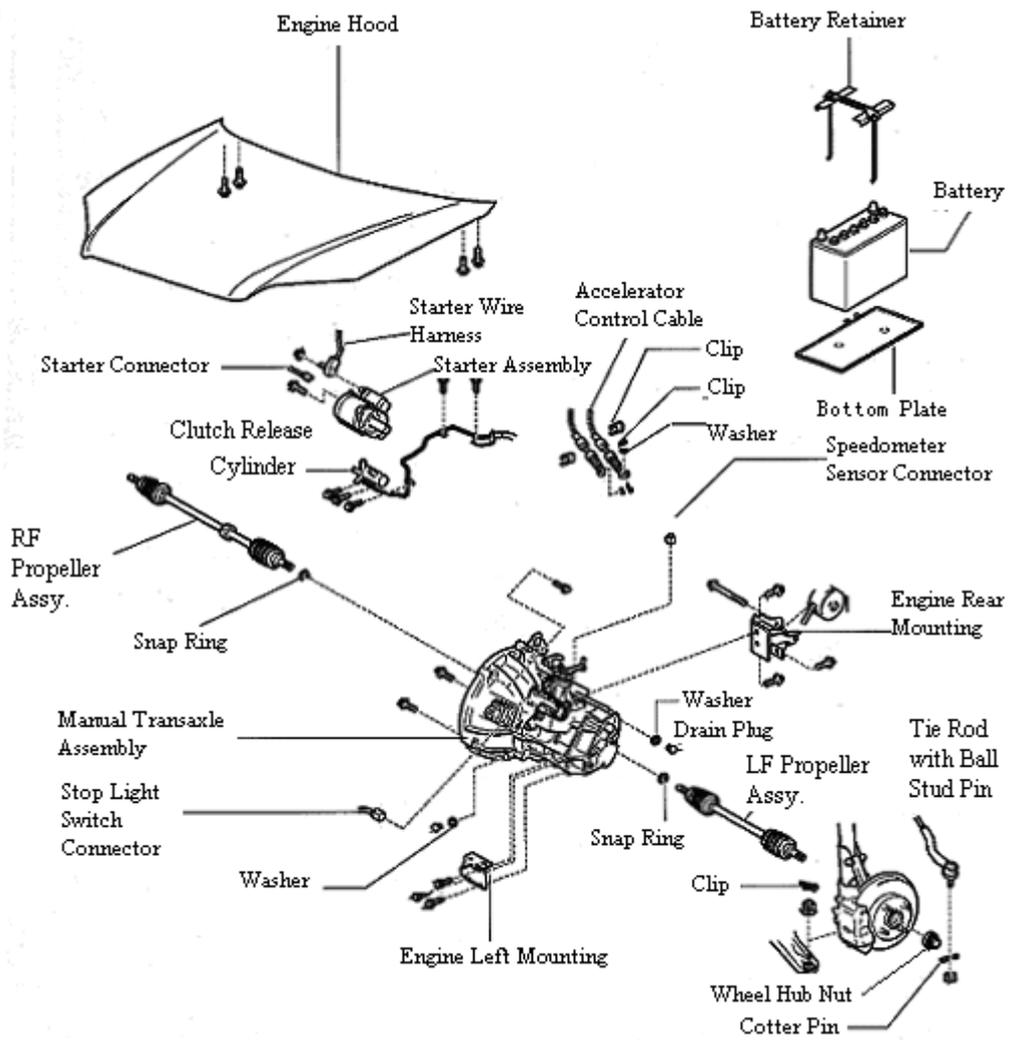


Figure 139

## Section 1 Manual Transaxle Replacement

1. Open the engine hood
2. Remove the battery
3. Remove clutch cylinder sub-assembly. See (Figure 140)
4. Detach transmission shift cable assembly. See (Figure 141)
5. Remove the connector and turn on the back-up lamp switch connector.
6. Disconnect vehicle speed sensor  
Disconnect vehicle speed sensor connector.

7. Detach the front exhaust pipe
8. Drain transmission oil
9. Detach left & right front wheel hub nut
10. Detach left & right front wheel speed sensor (ABS)
11. Detach front balance rod
12. Detach left & right tie-rod with ball stud pin

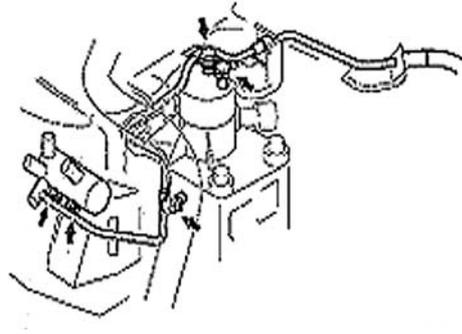


Figure 140

13. Detach front balance rod
14. Detach left & right lower swing arm
15. Detach left & right front propeller assembly
16. Hoist the engine from compartment. See "Provision 20, Section 2, Chapter 2"
17. Detach starter assembly

18. Detach engine mounting bracket
19. Detach manual transaxle assembly
20. Install engine mounting bracket
21. Install manual transaxle assembly
22. Connect engine vibration insulating cushions
23. Install starter assembly

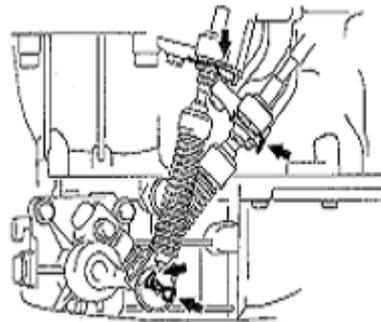


Figure 141

24. Install left & right front propeller assembly
25. Connect left & right lower swing arm
26. Connect left & right tie-rod with ball stud pin
27. Connect front balance rod
28. Connect left & right front speed sensor (ABS)
29. Install left & right front shaft nut
30. Install front exhaust pipe
31. Connect speedometer sensor connector.
32. Connect back-up lamp switch connector.
33. Connect transmission shift cable assembly. See (Figure 141)
34. Install clutch sub-pump assembly. See (Figure 140)

## Section 2 Vehicle Speed Sensor Replacement

1. Disconnect vehicle speed sensor. See (Figure 142)
2. Remove bolt and vehicle speed sensor.
3. Install vehicle speed sensor. See (Figure 142)
4. Connect vehicle speed sensor connector. See (Figure 143)

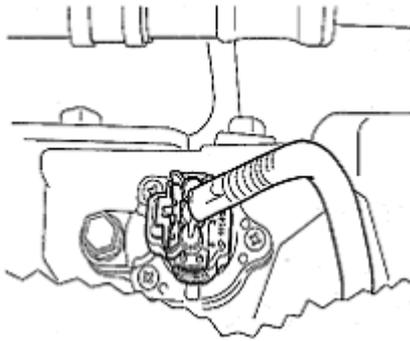


Figure 142

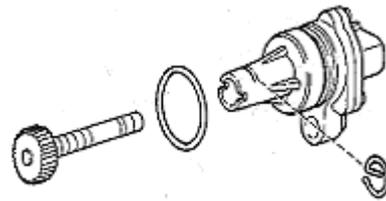


Figure 143

## Section 3 Transmission Case Oil Seal

1. Remove transmission case oil seal. See (Figure 144)
2. Install transmission case oil seal. See (Figure 145)

Notice:

Be careful not to damage oil seal lip.

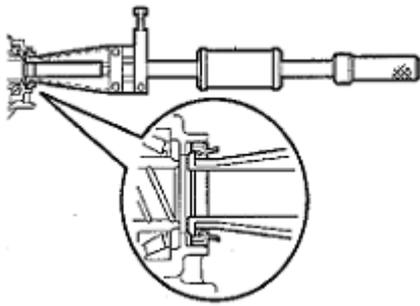


Figure 144

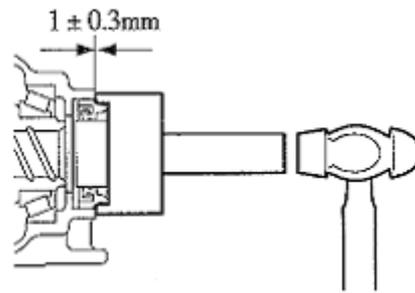


Figure 145

## Section 4 Transaxle Case Oil Seal Replacement

1. Using special tool, remove transaxle case oil seal. See (Figure 146)
2. Install transaxle case oil seal. See (Figure 147)

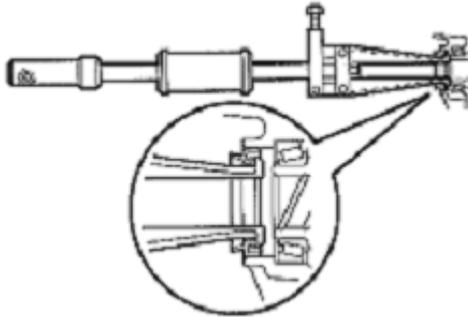


Figure 144

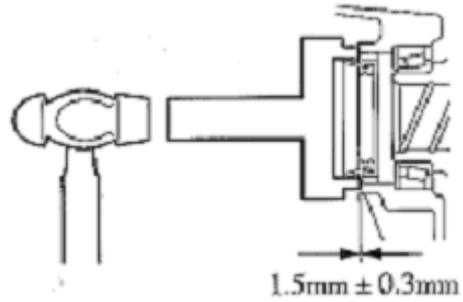


Figure 145

# Chapter 9 General Engine Troubles and Their Troubleshooting

## Section 1 Overview

The wide application of the electronic technologies to the vehicles brings innovation on diagnosis of the vehicle, many varieties of diagnosis instruments that are very effective and efficient for the vehicle diagnosis are innovated. Once the fault occurs, the best choice is to go to service station for help. However, even the most advanced instrument has its limit. For some faults, manual diagnosis is far more convenient and easier than that of instrument. In case of the crack, distortion and leakage of the components, the manual diagnosis is even superior to the instrument diagnosis. The faults occurred shall be carefully analyzed and troubleshot in accordance with the repair manual for normal usage.

## Section 2 General Engine Fault and Troubleshooting

### I. Fuel pipeline and circuit fault causing the engine starting failure

engine starting failure normally include: starter does not run or starter runs but fails to crank the engine, or cranks the engine but cranks slowly; starter can crank but fail to start the engine. There are many causes that result in starting failure, such as failures in starting system, ignition system, fuel injection system and engine mechanical failure.

#### 1. starter does not run or fails to crank the engine or cranks slowly

(1) Symptom: starter does not run or spongy rotation

(2) Causes:

- b. Low battery voltage, excessive battery discharge, damaged generator or failure in charging circuit;
- c. Battery terminal rust and backed out;
- d. Failure in starting circuit, ECU can not receive STA signal;
- e. Damaged starter.

#### 2. engine can not start and crank

(1) Symptom

With the start switch on, starter can crank but fail to start the engine.

(2) Causes

- a. Empty fuel tank;
- b. Electrical fuel pump inoperative;
- c. Injector inoperative;
- d. Low fuel pressure;
- e. Unreasonable starting operation;
- f. Damaged throttle position sensor or no signal is sent to ECU due to the open in throttle position sensor circuit;

- g. Ignition system failure;
- h. Low engine compression pressure.

### (3) Diagnosis and Troubleshooting

- a. First, check the fuel tank for fuel level, turn on the ignition switch, if fuel gauge pointer does not move or fuel level warning lamp lights, then the fuel tank is empty, fuel shall be filled at this time.
- b. Check that the electrical fuel pump for operation. Remove the fuel tank, you may use a wire to connect the two jacks of the fuel pump for short, then turn on the ignition switch. The fuel pump operation sound shall be able to be heard from the fuel tank nozzle or fuel flow can be felt with hand pinching the tube; or remove the return hose on the fuel pressure regulator, check that the fuel flows out; Direct judgment can be made if it is equipped with fuel pressure gage.

If electrical fuel pump is inoperative, check whether the main fuse, main relay, fuel pump relay, fuel pump control circuit and ECU are OK. If all of them are OK, check fuel pump circuit for open, short or damaged check valve. Repair or replacement shall be made when problems are found.

- c. If there is no injection sound in injector, check injector control circuit for fault. You may use a testing lamp with big resistance to be connected to the injector wiring connector, turn on the ignition switch. If the testing lamp lights up, it indicates that the injector has been damaged and shall be replaced; if the testing lamp does not light up, check whether the main fuse, EFI relay, fuse, ignition switch and ECU terminal are OK, repair or replace them if they are not OK.
- d. If there is low fuel pressure, the injection amount would be small and the engine won't start, you should check the fuel filter for block and fuel pump safety valve for damage and check whether the fuel pressure regulator is within the normal range, otherwise those components shall be repaired or replaced.
- e. Electric injection engine normally spot contact start the engine.
- f. Check for open in the throttle position sensor (TPS) circuit.
- g. Check whether there is Diagnostic Trouble Code (DTC), if there is, check it by the DTC; if there is not, check the high voltage spark for intensity, if it is too weak, check spark plug, high voltage wire, high voltage coil, distributor cover for faults, if there are faults, repair or replace them.
- h. Check the compression pressure in the cylinder, insert the compression pressure gauge into the spark plug hole, completely open the throttle, measure the compression pressure while starting the engine. If the compression pressure is less than 980kPa when engine speed is more than 250r/min, remove and inspect the engine and troubleshoot it.

### 3. The engine cranks but can not start

#### (1) Symptom

When starting the engine, starter can crank the engine but fail to start the engine.

#### (2) Causes:

- a. Ignition advance angle is unfavorable;
- b. Ignition is out of sequence, there is misfire;
- c. High voltage spark is too weak;
- d. The fuel pressure is too low;
- e. fuel pressure regulator leakage;

- f. The idle control valve is faulty;
- g. The water temperature sensor is damaged;
- h. The vacuum pressure sensor is damaged;
- i. The air filter is blocked;
- j. The injector leaks;
- k. The compression pressure in the cylinder is too low;
- l. The intake temperature sensor is damaged.

### (3) Diagnosis and Troubleshooting

- a. Check high pressure spark, check whether the high pressure spark on the ignition coil high pressure bus and extension are OK, if the bus spark is weak, replace the ignition coil, if the bus spark is OK while the extension spark is too weak, replace the ignition coil also; In addition, excessive spark plug clearance will influence the starting feature, the clearance of the spark plug shall be adjusted to normal value ( $0.8 \pm 0.1$ mm);
- b. If there is low fuel pressure, check whether the battery voltage is OK, otherwise it shall be troubleshot or replaced; check fuel pump check valve for leakage, check fuel filter and fuel pipe for block, if there are leakage or block, replace or troubleshot them;
- c. If there is leakage for fuel pressure regulator, intake manifold is likely to be mixed with gasoline and it is hard to start, troubleshot or replace them;
- d. Idle control valve can not be opened to maximum position due to mechanical wear, aging or control circuit failure, the idle control valve shall be replaced and the control circuit failure shall be troubleshot;
- e. If the water temperature sensor data is not accurate, it may cause small injection, check the water temperature sensor based on the standard data and calibrate the data;
- f. There is big time lag for intake pressure temperature sensor that makes it somewhat insensitive at low speed and result in inaccurate injection, adjustment or replacement shall be made;
- g. If the air cleaner filter is too dirty, the air flow resistance is excessively big, resulting in hard start, as a result of it, the filter shall be replaced.

In a word, there are many factors causing the starting failure of the engine, analysis shall be made based on the severe conditions of the faults. Generally speaking, check the ignition system first, then check intake system, fuel system, control system, at last check the cylinder pressure, check the DTC before checking the trouble. The diagnosis and troubleshooting procedures for starting failure of the engine are shown in (Figure 148).

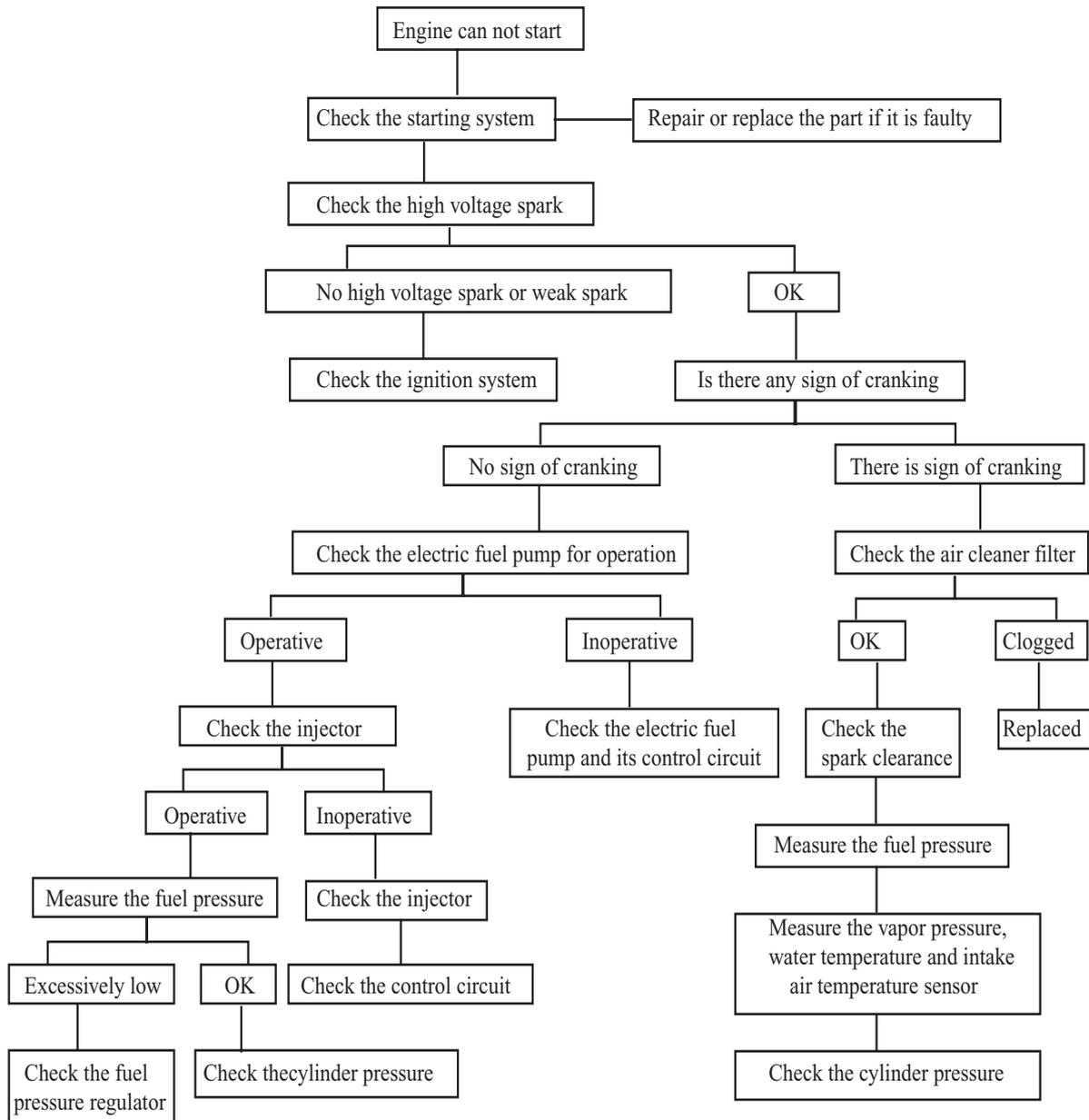


Figure 148

## II. Fuel pipeline and Circuit Fault for Hard Engine Starting

Hard engine starting indicates that starter can crank but fail to start the engine, or it may take multiple consecutive starting efforts or long time rotation to successfully start the engine. For hard start fault, make sure whether it occurs at cold or hot status or regardless of the cold or hot status.

### 1. Symptom

When starting, engine cranks at normal speed, but it takes longer to start or fails to start although cranks.

### 2. Causes:

- a. Air cleaner is clogged;
- b. Intake temperature sensor fault;
- c. Water temperature sensor fault;

- d. Fuel pressure system abnormal;
- e. Idle control valve fault;
- f. Vacuum pressure sensor fault;
- g. Ignition system fault;
- h. The compression pressure in the cylinder is a little lower;
- i. Injector leakage.

### 3. Diagnosis and Troubleshooting

- a. Perform self-diagnosis first, check whether there is any DTC, if there is, find the reason and cause by the DTC;
  - b. If it is hard for cold start but easy for hot start, check water temperature sensor and intake temperature sensor for fault;
  - c. If the engine can not be started quickly in hot condition, the relief of the fuel pressure will be fast, then repair and replacement shall be made;
  - d. If the spark is too weak, check high pressure coil, spark plug clearance and spark plug for carbon deposit, repair or replace them one by one after isolating the problem;
  - e. Intake and exhaust valve is not completely closed, piston ring failure is likely to cause low compression pressure in the cylinder, you should carefully repair intake & exhaust valve and seat, or replace them; failed piston ring shall be replaced.
4. Diagnosis and Troubleshooting for hard starting and trouble shooting procedure. (Figure 149)

## III. Fuel Pipeline and Circuit Faults for Poor Engine Operation

Poor engine operation includes: insufficient power, poor acceleration, poor deceleration, big fuel consumption, rough idle and Engine overheat.

### 1. Insufficient Power

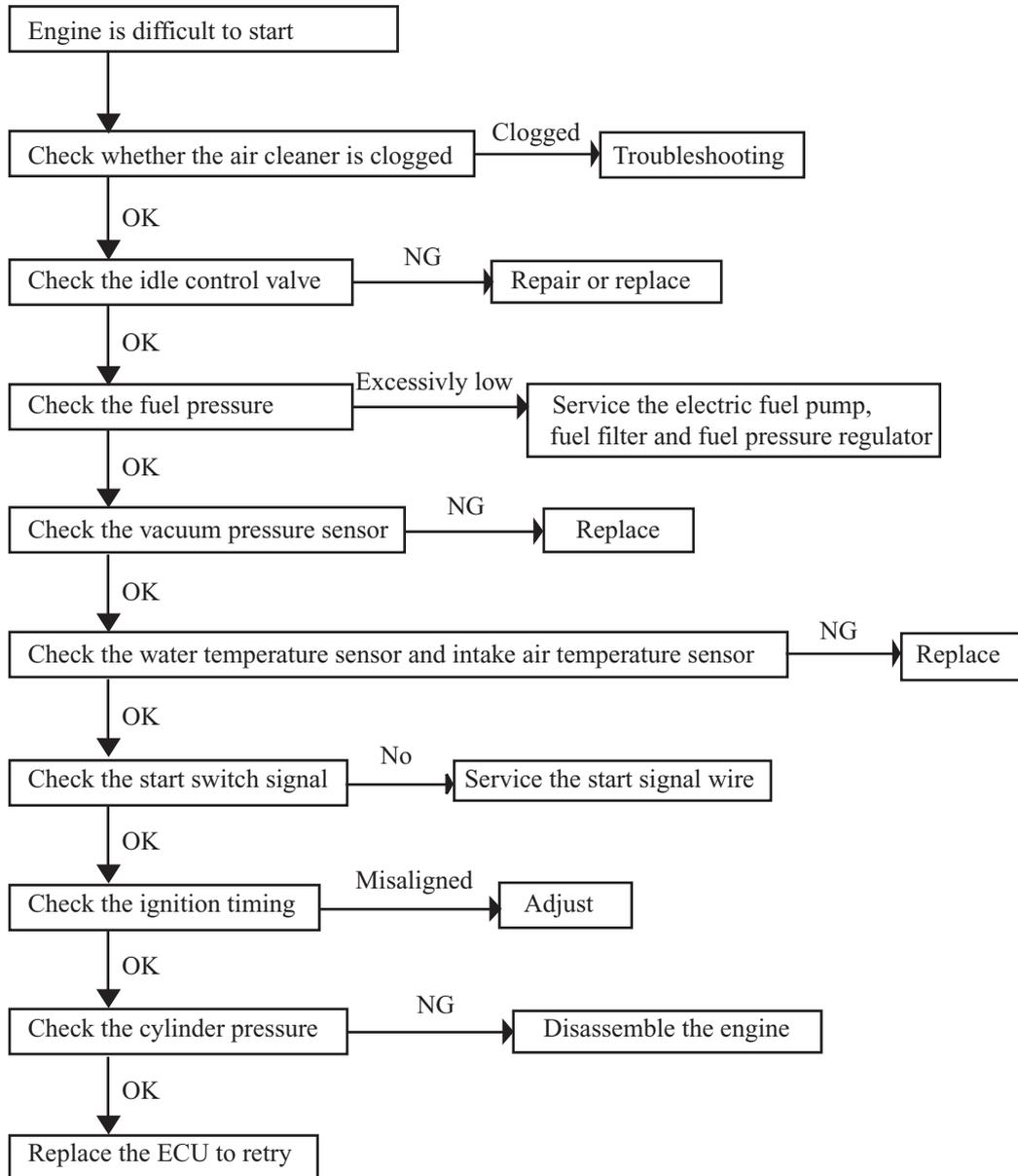
#### (1) Symptom:

Engine operation is normal without load but slow at load, insufficient power when uphill and not improved even if the accelerator pedal is completely depressed, speed can not be increased and unable to reach the maximum vehicle speed.

#### (2) Causes:

- a. Air cleaner is clogged;
- b. Poor intake system seal;
- c. Intake pressure temperature sensor fault;
- d. Low fuel pressure;
- e. Broken pressure adjustor;
- f. Clogged injector or poor atomization;
- g. Throttle position sensor fault;
- h. High pressure spark is too weak;
- i. Improper valve clearance;

- j. Poor intake and exhaust valve seal, failed piston ring, low compression pressure;
- h. Too many carbon deposit in spark plug and combustion chamber;
- k. Water temperature switch and thermostat fault;
- l. Aging of Oxygen sensor;



- m. Incorrect ignition timing;
- n. Check valve fault.

Figure 149

(3) Diagnosis procedure for insufficient engine power (Figure 150)

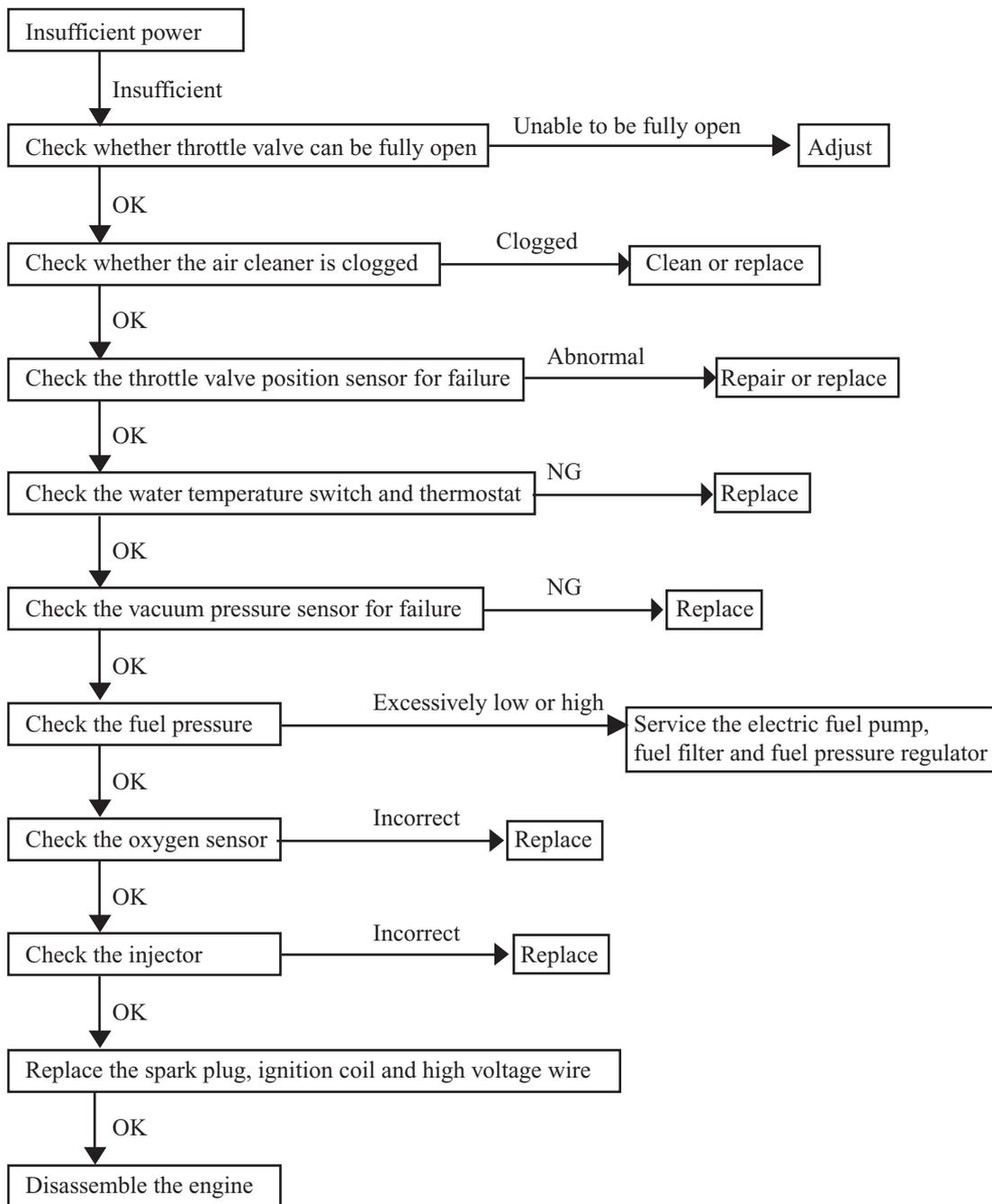


Figure 150

2. Poor deceleration

(1) Symptom

Idling is normal, but the engine is frequently turned off upon sudden release of the accelerator pedal during driving.

(2) Causes and Troubleshooting:

- a. Throttle position sensor is damaged and shall be replaced;
- b. Initial idling is not properly adjusted or automatic idle control is wrong, fuel cut RPM is too low, ECU fault, repair or replace them.

### 3. Poor acceleration

#### (1) Symptom

Engine speed can not be increased immediately after depressing the accelerator pedal, there is time lag, and the acceleration reaction is delayed or there is slight fluctuation during the acceleration.

#### (2) Causes and Troubleshooting

- a. There is fault in throttle position sensor, repair or replace it;
- b. Poor intake system seal, repair it;
- c. There is low fuel pressure, troubleshoot it;
- d. Poor injector operation, clean or replace it;
- e. Intake pressure temperature sensor fault, repair or replace it;
- f. Check valve is damaged and shall be replaced;
- g. Ignition advance angle is not correct and shall be adjusted;
- h. Fuel pressure regulator is damaged and shall be replaced;
- i. Air cleaner is clogged and shall be cleaned or replaced;

#### (3) Diagnosis procedure for poor acceleration (Figure 151)

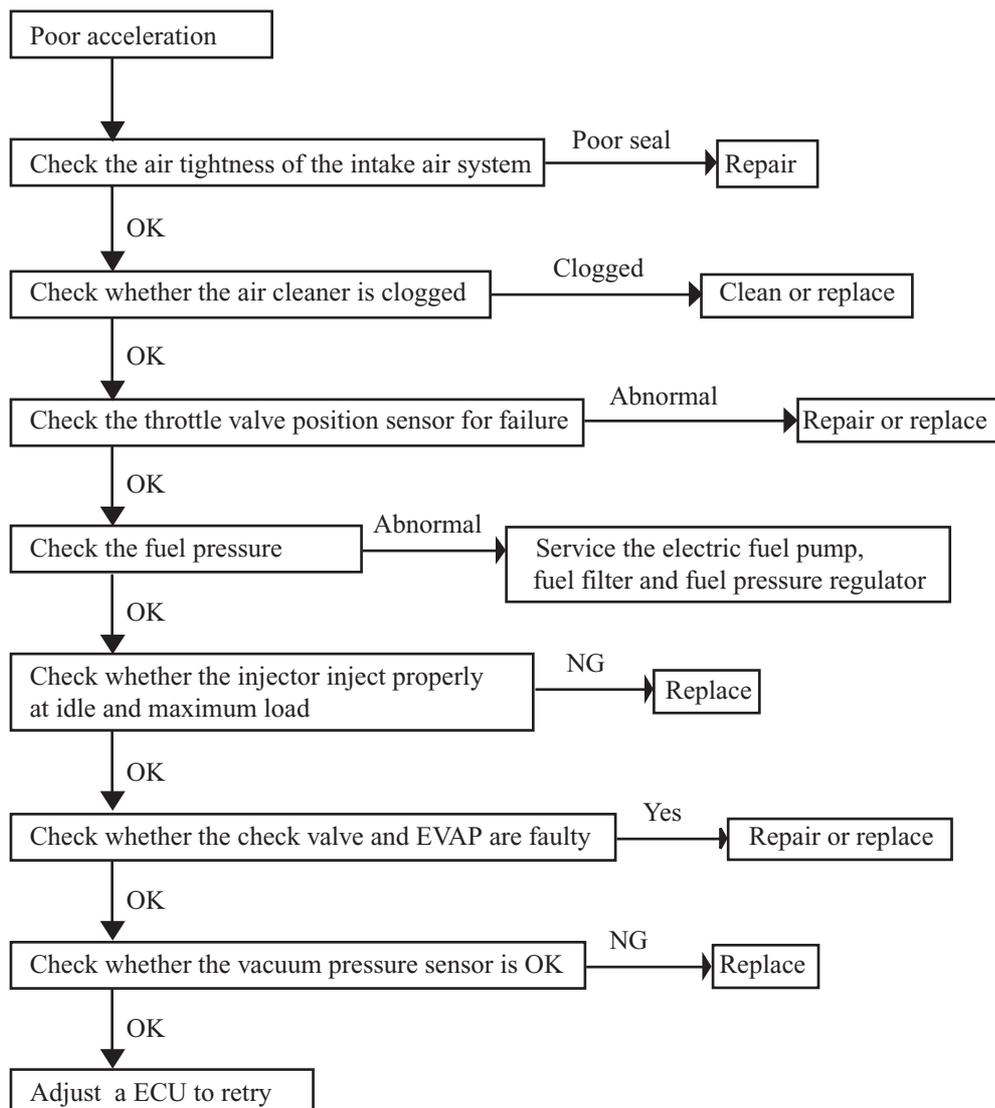


Figure 151

#### 4. Big fuel consumption

##### (1) Symptom:

Engine power is ok, but the fuel consumption is big, exhaust pipe discharges black smoke.

##### (2) Causes and Troubleshooting:

- a. When idling, idle speed is high and shall be adjusted;
- b. Water temperature sensor fault, service or replace it;
- c. Water temperature switch and thermostat fault, repair or replace it;
- d. Oxygen sensor fault, repair or replace it;
- e. Fuel pressure is big and shall be adjusted;
- f. Injector fault (fuel leakage), repair or replace it;
- g. Throttle position sensor fault, repair or replace it;
- h. Fuel pressure regulator is damaged and shall be replaced;
- i. Intake pressure temperature sensor fault, repair or replace it.

#### 5. Unstable idle, liable to be turned off

##### (1) Symptom:

Engine starts normally, but the idle is unstable regardless of cold or hot status, idle speed is too low and the engine is liable to be turned off.

##### (2) Causes and Troubleshooting

- a. Poor idle control valve operation, repair or replace it;
- b. Low idle speed and faulty or improperly adjusted idle control valve, troubleshoot it;
- c. Water temperature sensor fault, repair or replace it;
- d. Poor intake system seal, need to be repaired;
- e. High voltage spark is too weak, spark plug carbon deposit or electrode clearance is too small, need to be repaired, cleared and adjusted;
- f. Pressure sensor fault, repair or replace it;
- g. The compression pressure in the cylinder is too low, need to be serviced;
- h. Fuel line pressure is too low, needed to be serviced;
- i. Air cleaner is clogged, clean or replace it;
- j. Poor injector atomization, fuel leakage, block or big injection variation, need to be repaired;

##### (3) Diagnosis procedure (Figure 152)

#### 6. Unstable idle at cold status, liable to be turned off

##### (1) Symptom

During the cold start, idle is unstable and engine is liable to be turned off, the normal idle is recovered after warming of the engine.

##### (2) Causes and Troubleshooting

- a. Water temperature sensor fault, repair or replace it;
- b. idle control valve fault, repair or replace it.

## 7. Unstable idle or engine shut off at hot status

### (1) Symptom

Idle speed is normal during the cold start and becomes unstable at hot status, idle speed is too low or engine is shut off.

### (2) Causes and Troubleshooting

- a. Idle is adjusted too low, adjust it to normal condition;
- b. Water temperature sensor fault, repair or replace it;
- c. Poor injector operation or big injection variation, repair or replace it;
- d. Poor water temperature switch and thermostat operation, repair or replace it;
- e. Check valve is damaged and needs to be replaced.

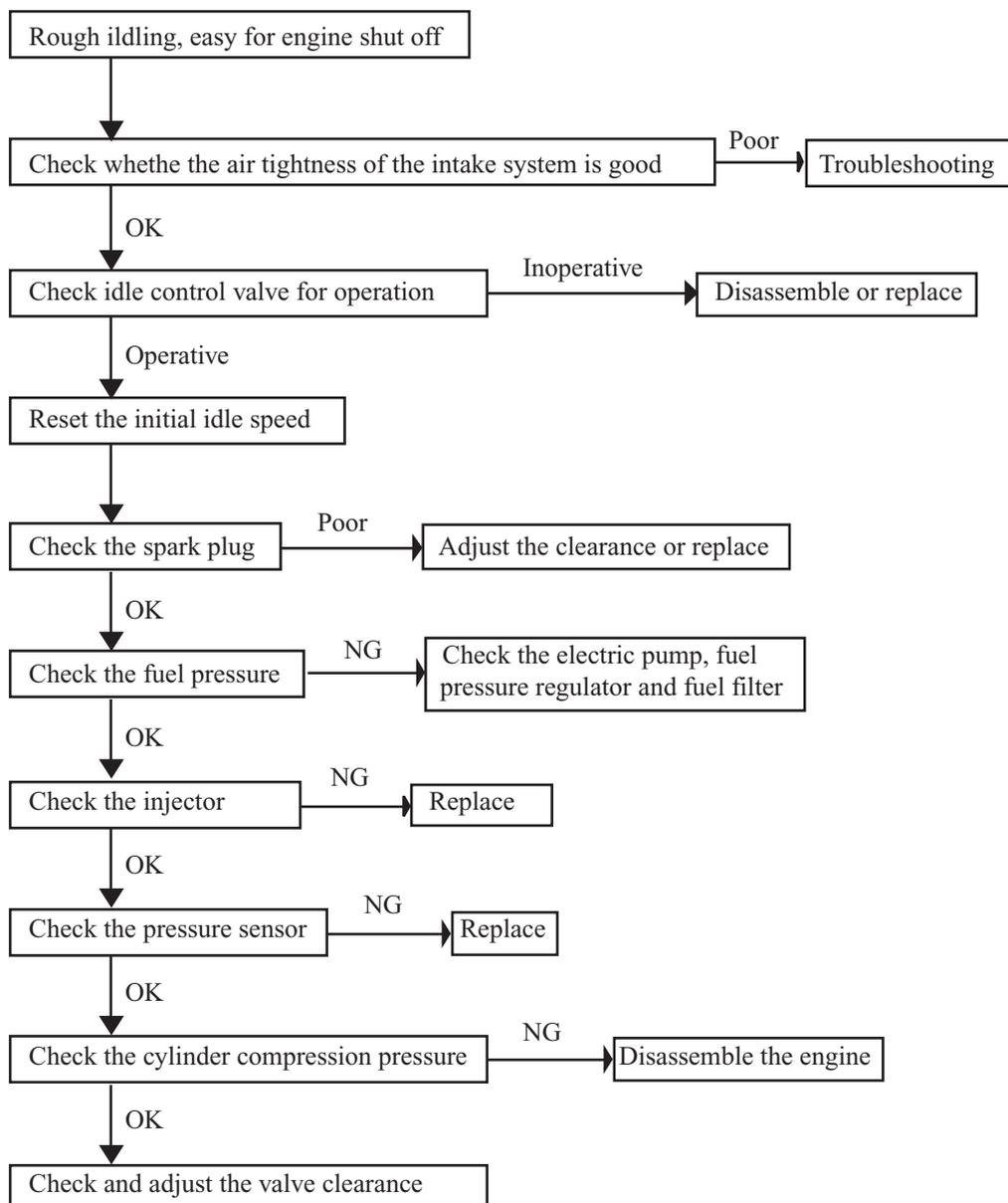


Figure 152

## 8. Idle speed too high at hot status

### (1) Symptom

The engine runs at fast idle during cold start and remains fast idle at hot status, leading to excessively fast idle.

### (2) Causes and Troubleshooting

- a. The initial idle value is not properly adjusted,
- b. High system fuel pipeline pressure, need to be adjusted;
- c. Water temperature sensor fault, repair or replace it;
- d. Water temperature switch and thermostat fault, repair or replace it;
- e. Idle control valve fault, repair or replace it;
- f. Throttle is binding and not tightly closed, repair or replace it;
- g. Fuel evaporation control valve is always open, repair or replace it;
- h. Speed sensor fault, repair or replace it.

## 9. Idle fluctuation

### (1) Symptom

when idling, the engine speed fluctuates.

### (2) Causes and Troubleshooting

- a. Intake pressure temperature sensor fault, repair or replace it;
- b. Check valve is damaged and needs to be replaced;
- c. Water temperature sensor , water temperature switch and thermostat is poorly coordinated, repair, adjust and troubleshoot them;
- d. Oxygen sensor fault, need to be replaced;
- e. Spark plug poor connection, repair or replace it;
- f. Idle control valve and its control circuit fault, repair or replace it;
- g. Idle switch is not closed, need to be repaired.

10. Engine overheat (Table 6)

Table 6

Item	Symptom	Cause		Troubleshooting	
Poor cooling	Insufficient coolant	Bad radiator cover		Repair or replace	
		Water leakage	Bad radiator hose		Replace
			Bad radiator tube strap		Supplement welding, otherwise replace it
			Bad cylinder gasket		Replace
			Cracky cylinder block		Remedy with infiltration technology or replace it
			Poor water pump seal		Replace the seal
	Anti-freeze liquid not replaced			Replace the anti-freeze liquid	
	Bad thermostat			Replace the thermostat	
	Radiator is faulty	Water leakage	Broken weld		Supplement welding
			Corrosion result in pin hole		Fill the pinhole with clear coat, otherwise replace it
		Clogged cooling tube		Repair and dredge	
		Poor ventilation		Improve the ventilation	
	Faulty water pump			Repair or replace the water pump	
	Poor Fan	Faulty fan voltage		Troubleshooting, replace the motor if it is damaged	
		Disabled radiator temperature control switch		Replace	
Water jacket is clogged because of too much scale			Repair and dredge		
Insufficient engine oil (oil leakage or delayed filling)			Repair or replace the oil pan if there is oil leakage, refill the oil if it is not supplemented in time		

11. General engine fault symptom and faulty area (Table 7)

Table 7

Symptom		Difficult to start				Poor idling				Engine off		Poor driving				
		Unable to explode initially	Unable to explode completely	Difficult for cold start	Difficult for hot start	No fast idle	Low idle speed	High idle speed	Rough idling	Idle hunting	At urgent acceleration	When the accelerator pedal is released	During idling	Poor acceleration	Hunting during driving	Insufficient power
Control system	Intake absolute pressure sensor							○	○	○	○	○	○		○	○
	Water temperature sensor		○	○	○	○		○	○		○	○	○		○	
	Revolution speed sensor	○														
	Throttle valve position sensor								○	○	○		○	○	○	○
	Vehicle speed sensor														○	
Fuel system	Fuel pump system	○	○						○				○	○		○
	Fuel pressure regulator	○	○	○	○	○			○				○	○	○	○
	Fuel filter and pipeline	○	○		○								○	○	○	○
	Injector	○	○	○	○	○			○					○	○	○
	Starter signal	○	○													
Ignition system	Ignition coil	○											○		○	
	Spark plug	○	○	○	○				○				○	○		○
	High pressure cable	○							○							
	Ignition timing		○	○				○		○						○
	Igniter in the ECU	○											○	○	○	
Intake air system	Throttle valve			○				○	○	○						○
	Throttle valve body								○	○						○
	Air leakage in the intake air system		○	○		○	○	○	○	○						○
	Air valve			○		○		○	○	○						
Power supply system	ECU power supply circuit	○														
	Ignition switch	○														
	Main relay	○														
	Fuel pump relay	○														

## IV. Exhaust Pipe Discharges Gas with Abnormal Color (or odor)

When there is failure in engine combustion system, the exhaust pipe discharges gas with abnormal color.

### 1. The discharged gas is thickly black

This is caused by incomplete combustion. Since the mixed air is too thick, the combustion is not complete and part of the fuel is discharged without combustion, leading to decrease of engine power. At this moment, you should check fuel pressure regulator, throttle position sensor, injector and ECU system and correct the problems in time.

### 2. Exhaust is blue and stinks

This is caused by large amount of oil vapor mixed in the exhaust gas that enters in the cylinder and participates in combustion. One of the primary reasons is that the piston oil ring is dirty and damaged, and shall be replaced; another reason may be the failure of valve oil seal or excessive clearance between the valve stem and guide bush hole resulting in oil entering the combustion chamber for combustion, oil seal or valve guide bush shall be replaced to resume normal condition.

### 3. Exhaust is white

This is caused by water or fuel vapor mixed in the exhaust. The primary reason is that cylinder head gasket is damaged, resulting in slow infiltration of coolant into cylinder and the water vapor entry into the exhaust pipe after combustion, cylinder head gasket shall be replaced to resume the normal condition.

## Section 3 Engine Noise Diagnosis and Troubleshooting

Abnormal sounds generated during engine operation (e.g. knocking sound, chuckle, hiss, rattle) are called noise.

Engine noise is primarily generated in valve train, connecting rod piston crankshaft components and other accessory system. The following description discusses the diagnosis and troubleshooting of the noise generated in valve train and crankshaft connecting rod mechanism.

### I. Diagnosis and troubleshooting of the noise in valve train

valve train consists of intake & exhaust camshaft , valve, valve bushing, tappet and counter gear.

#### 1. camshaft noise

- (1) camshaft end play is excessively big (normal intake camshaft : 0.030~0.085mm, exhaust camshaft : 0.035~0.090mm) , when it exceeds 0.11mm and noise is generated, replace it;
- (2) Camshaft bend is another cause for noise; it shall be aligned or scraped. ;
- (3) Camshaft journal is excessively worn, resulting in big radial clearance between camshaft and bearing and noise, replace it;

#### 2. Valve group knock noise

- (1) Valve noise is caused by excessive valve clearance, the valve spring seat flange is damaged and shall be replaced;
- (2) Valve spring knock noise is caused by broken valve spring. It shall be replaced;

- (3) Valve free movement noise is caused by dropped valve keeper or broken valve head. It shall be replaced;
  - (4) Noise between the intake & exhaust valve and valve bushing is caused by stagnation valve and bushing that can not be closed, repair the bushing or replace it;
  - (5) Valve and valve seat can not be tightly closed and noise is generated, leading to abnormal engine operation. Valve shall be grinded to fit, otherwise it shall be replaced.
3. Gear noise is mainly caused by excessive wear of the gear which results in excessive clearance, generating the noise during the operation. The counter gear shall be replaced.

## II. Crankshaft connecting rod noise diagnosis and troubleshooting

### 1. crankshaft connecting rod noise cause and troubleshooting

No.	Noise area	Noise cause	Troubleshooting
1	Connecting rod bearing noise	Excessive connecting rod bearing radial play	Replace the bearing
		Connecting rod cover bolt loosened	Tighten
		Connecting rod bearing insert dimension not as specified result in rotation or rupture	Replace the insert
		Connecting rod bearing insert burned	Replace the insert
		Poor lubrication for connecting rod bearing	Drill the lubricant hole to normal, improve the lubricant line
2	Main bearing noise	Excessive main bearing radial play	Replace the main bearing
		Main bearing cover bolt loosened	Tighten
		Main bearing insert burned	Replace the insert
		Poor lubrication for main bearing	Smoothen the lubricant line or enlarge the oil hole
		Main bearing insert dimension not as specified result in rotation or rupture	Replace the main bearing insert
3	Crankshaft axial runout noise	Excessive crankshaft bearing radial play	Adjust (pad) to normal
		Excessive wear of the crankshaft thrust washer	Replace the thrust washer
4	Flywheel impact noise	Flywheel set bolt loosened	Tighten

### 2. Piston ring leakage, knock and noise causes and troubleshooting

Noise cause	Elimination method
Piston ring broken	Replace
Excessive piston ring backlash	Replace
Piston ring contra aperture	Correct (stagger)
Piston ring is locked	Replace
Insufficient elasticity of the piston ring	Replace
Poor seal between the piston and cylinder wall	Replace

### 3. Piston knocking noise causes and troubleshooting

No.	Item	Troubleshooting
Knock when engine is cold	Main bearing oil channel depth and width misaligned or insufficient oil pressure result in poor lubrication of the cylinder wall	Repair or adjust the oil pressure to specification
	Excessively big clearance between the piston and the cylinder wall	Replace the piston to resume the normal clearance
Knock when engine is hot	Connecting rod bent	Correct or replace the connecting rod
	Connecting rod journal is not parallel with the main journal	Replace the connecting rod
	Connecting rod bushing axial declination	Replace the bushing
	Piston counter ellipse	Replace the piston
	Excessively small clearance between the piston and cylinder wall	Repair the cylinder or replace the piston
	Excessively small backlash and end gap for the piston ring.	Repair or replace the piston ring
Poor lubrication for cylinder wall and piston	Dredge the oil line to improve the lubricant splashing problem	
Knock no matter the engine is cold or hot	Piston pin and connecting rod end are installed too tightly	Adjust piston pin tension to normal level
	Connecting rod bearing is assembled too tightly	Adjust the bearing tension to normal level
	Piston skirt ovality is too big	Replace the piston with normal ovality

# Chapter 10 Engine Management Unit

## Section 1 System Description

Engine Control System generally consists of sensor, controller and actuator.

Sensor: convert the physical parameter of the device into electric signal (digital or analog) to monitor the operating condition of the device and send these signals to the controller.

Controller: receive and process information sent from the sensor, and analyze the information to learn the conditions of the device: use predefined control strategy and procedure, determine how to control the device under current conditions; convert the decision into one or more orders and send them to the actuator. The controller contains a microprocessor and stores pre-developed the programs or control software in the memory. The controller can be regarded as the brain of the control system.

Actuator: receive orders from the controller, convert the electric signal into the action of the actuating elements (either action of electric element or mechanical movement). The actions of these elements will change the operating conditions of the device and determine the operation and output of the device.

Large amount of information flows through the entire control system. Engine Control Unit learns the operation of the device from the information sent from the sensor, determines the approach and orders of the control with the input and information stored by itself and ends up in sending the information about the orders to the actuator.

### I. Engine Fuel System Electronic Control System

Engine fuel system electronic control focuses on the quantified electronic control of the fuel, and actually is the electronic control over the excessive air coefficient .

ECU controls the by controlling the fuel injection. When the engine is running, ECU receives the information about the air flow from the sensor and determines the fuel injection by calculations to make the excessive air coefficient of the mixed air reach the predefined value. The control order output by ECU is only a control signal to trigger the injector. ECU output the pulse width and timing in this signal.

The pulse width of injection signal determines the fuel amount of the injection. The pulse is the function of the following parameter. The input and output are modified into closed loop control.

ECU calculate the target - air fuel ratio.

Air flow value.

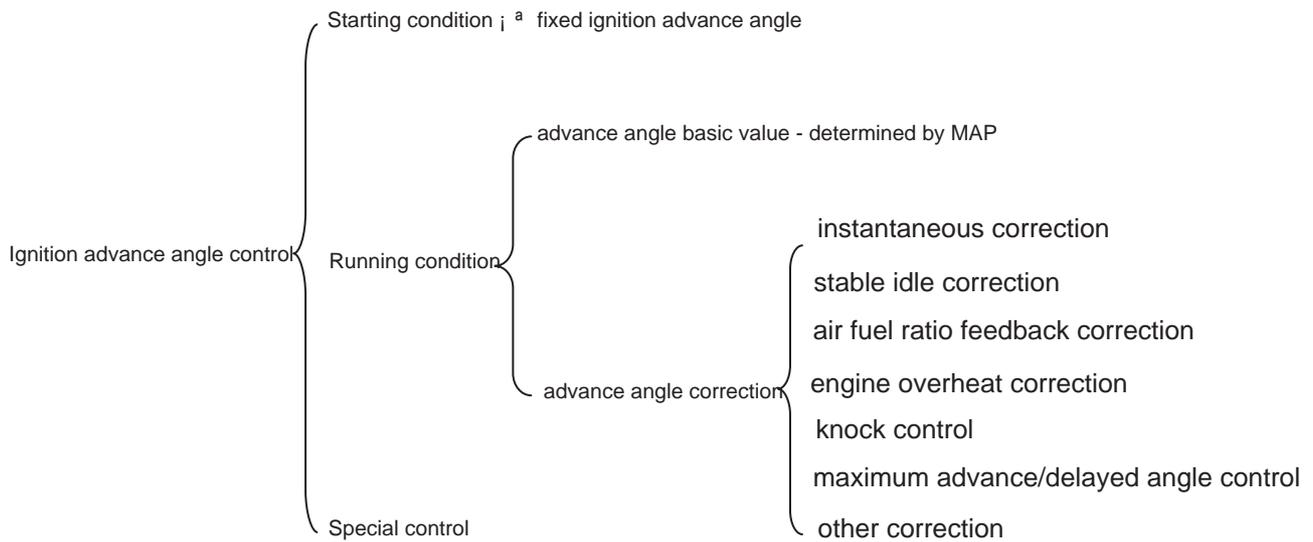
Other operating conditions of the engine, such as throttle position sensor, exhaust manifold oxygen sensor. low feature of the injector.

Engine ignition system electronic control

The control of Engine Control Unit over the ignition includes ignition advance angle control, knock control and ignition power control (dewell angle control).

The control over the ignition advance angle is the basic function of the ignition control. Ignition advance angle = ignition advance angle basic value + correction.

The control over the ignition advance angle also relates to the operating conditions of the engine. The factor varying with the operating conditions can be reflected by the correction factor.



The control over the ignition advance angle is generally open loop control. But this open loop control is different from the general open loop control, ECU test the knock signal with the knock sensor while controlling and outputting ignition advance angle orders in way of open loop. Once the knock occurs, it is converted into closed loop control, and its feedback signal is knock sensor signal. Therefore, basically, it is also a closed loop control.

## Section 2 System Component and Working Principle

ECU receives information from the sensors and sends control signals to actuators after processing and analyzing these information. It plays a role of nerve center in the electronic control system.

ECU hardware consists of input level, micro-computer and output level (see figure 153).

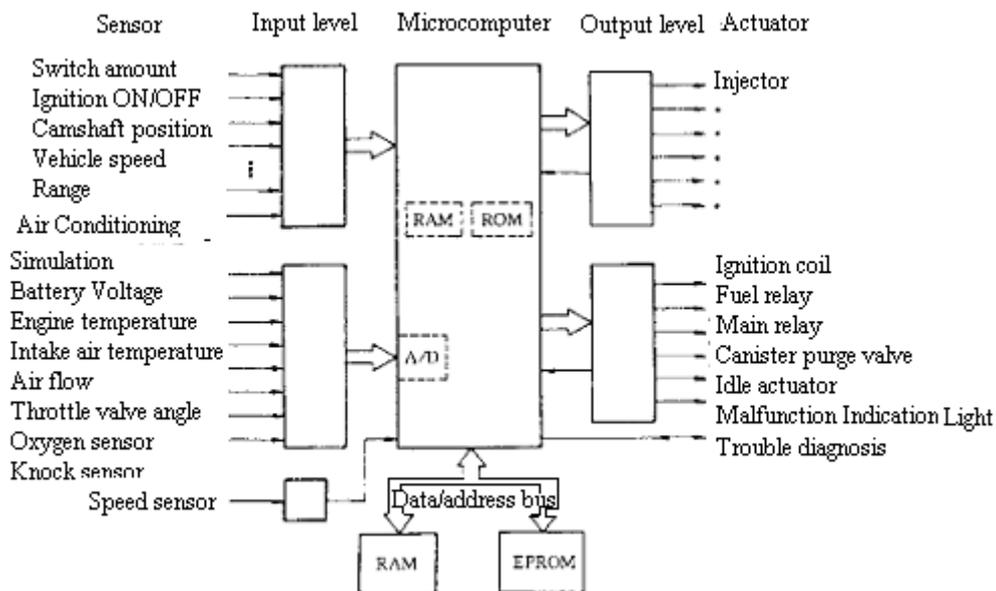


Figure 153

ECU microcomputer consists of microprocessor, memory, clock generator, timer, I/O interface and input level A/D converter that are integrated in a large scale integrated circuit chip, that is SCM (Single Chip Microcomputer).

### 1. Input level

The input signals from the sensor are pre-processed by the input level. The input signals are sent to protected circuit first, sometimes through the signal converter and amplifier, and then sent to microcomputer.

The sensor signal is separated into switch type and analog type. Ignition on/off signal, camshaft position signal, vehicle speed signal and A/C signal are switch type; Signals such as battery voltage, engine temperature, intake temperature, airflow, intake manifold absolute pressure, throttle opening, excessive air coefficient, knock, A/C refrigerant pressure are analog type. Analogy signal can only be processed by the digital microcomputer after being converted into digital signal by A/D converter. Hence, data collection shall be made first for analog signal, and the sampling shall be maintained also.

Speed and crankshaft position reference signal from the sensor is processed in a dedicated circuit to restrain the interference pulse.

### 2. Microcomputer

The microcomputer of the engine electronic control unit is integrated in a single chip microcomputer, consisting of the following:

- (1) Microprocessor, microprocessor is also called as central processing unit (CPU), consisting of the following three parts:
  - Arithmetic logic unit.
  - Register group.
  - Controller.
- (2) System assembly, The data transferred among the internal sections of the single chip microcomputer (SCM) is performed on the internal bus, while that between the SCM and other components is performed on the external bus. The external bus is also called system bus. It is separated into data bus, address bus and control bus.
- (3) Memory, the memory is designed to store the binary data. The primary components of the memory are:
  - Memory.
  - Data register.
  - Address register, address decoder.
    - a. Memory controller
- (4) A/D converter
- (5) I/O interface.
- (6) Clock generator.
- (7) Timer
- (8) CAPCOM unit.
- (9) Watchdog timer.
- (10) Interrupt system.

### 3. Output Level

ECU output level is designed to send control signal to the actuators of the electronic control system based on the orders of the microprocessor in the micro-controller. The microprocessor control the output level by controlling the occurrence position of the pulse, its length and duty ratio.

#### (1) Injection output level

The microprocessor controls the pulse length of the injection output level by making sure whether to trigger to circuit or not in the injection output level.

#### (2) Ignition input level

The ignition output level is designed to amplify the ignition signal from the microprocessor into the primary current of the ignition coil.

#### (3) Electric fuel pump output level

ECU microcontroller control the pump relay through electric fuel pump output level, and then control the on and off of the electric fuel pump based on the current operating conditions.

#### (4) Other output levels

Control the output levels of the idle control valve, carbon canister solenoid valve, malfunction indicator lamp. MR479Q, MR479QA, MR481QA engine idle control are closed loop control system, their injection and ignition control are also closed loop control system.

# Part II Chassis

## Chapter 1 Transmission Control Device

### Section 1 Transmission Control Device

#### Description on Transmission Control Device

This model is equipped with lever and cable transmission control devices, respectively used for 1.3L and 1.5L engine, both of their gears are: 5 forward gears + 1 reverse gear.

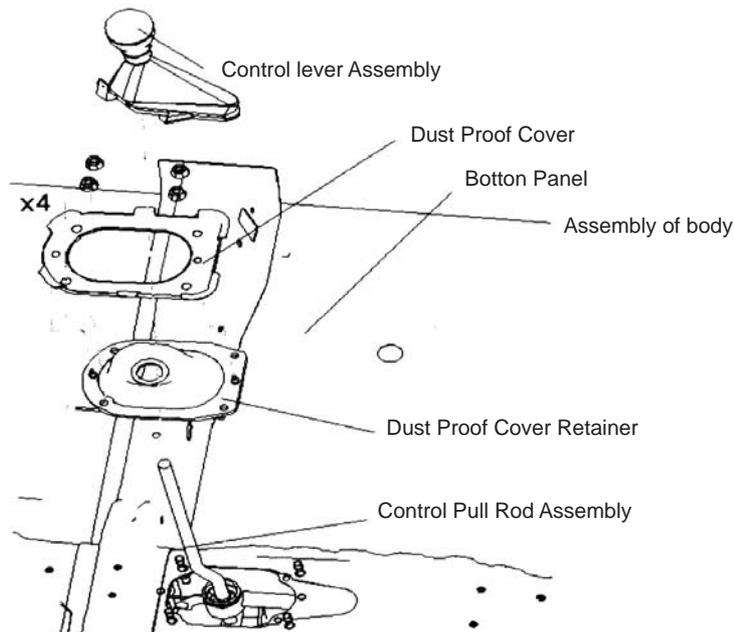
#### PROBLEM SYMPTOMS TABLE

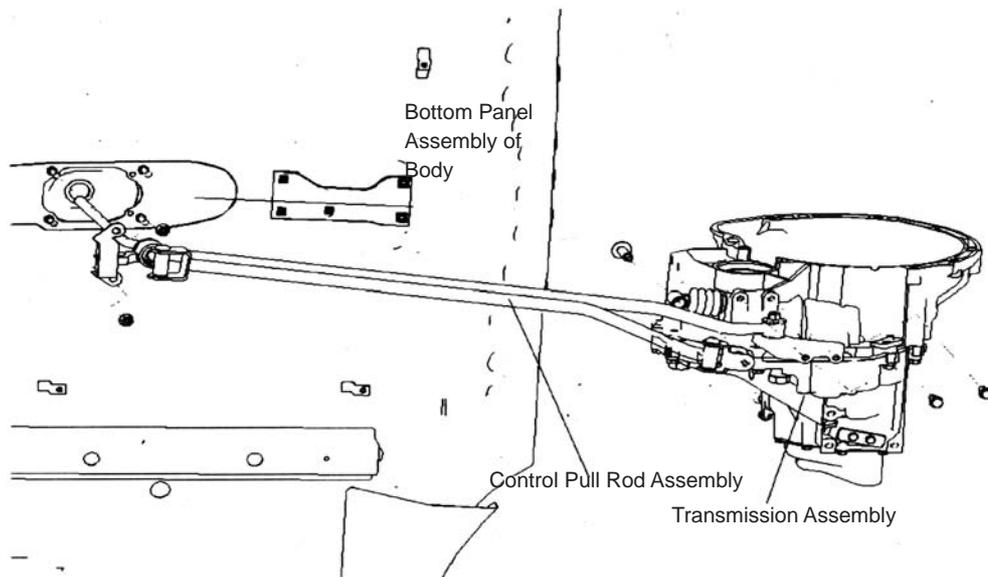
Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

Symptom	Suspected Area
Transmission out of gear	1. Transmission control device selector (position changing) cable (improperly assembled)
	2. Cable or related parts worn
	3. Cable assembly (incorrect)
	4. Transmission (faulty)
Transmission shift difficult	1. Transmission control device selector (position changing ) cable (improperly assembled)
	2. Cable or related parts worn
	3. Cable assembly (incorrect)
	4. Transmission (faulty)

### Section 2 Lever Type Transmission Control Device

#### Components





## Replacement

### 1. Remove shift lever assembly

- (1) Pull upwards to separate the shift lever assembly leather boot from the auxiliary console
- (2) Loosen the shift lever set screw with inner hex wrench. Remove the shift lever assembly counterclockwise

### 2. Remove auxiliary console

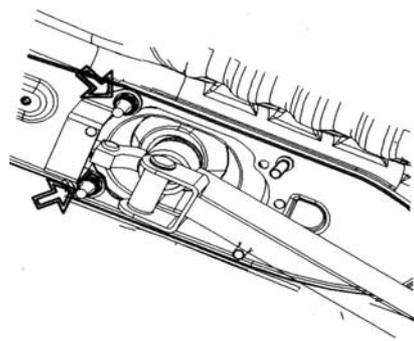
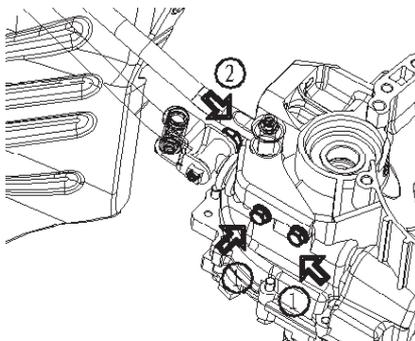
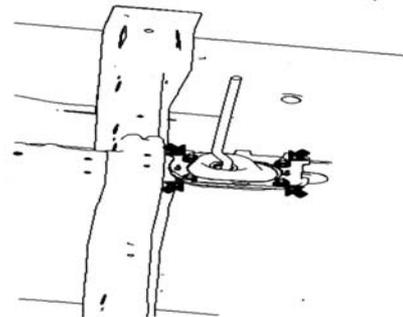
### 3. Remove control lever dust cover

Remove the 4 nuts on the control lever dust cover and the body.

### 4. Remove dust cover retainer

### 5. Remove control pull rod assembly

- (1) Remove the pull rod connecting bolt (Place 2)
- (2) Remove 2 hex flange bolts (Place 1)
- (3) Remove the 2 flange nuts attaching the control pull rod to the body in the trench



### 6. The installation is in the reverse order of the above operation.

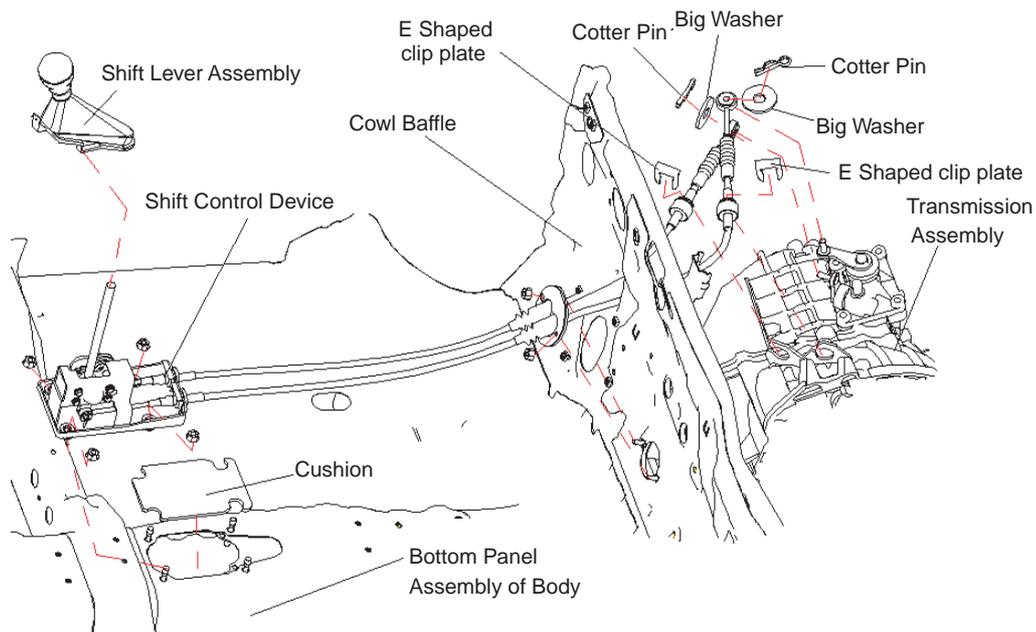
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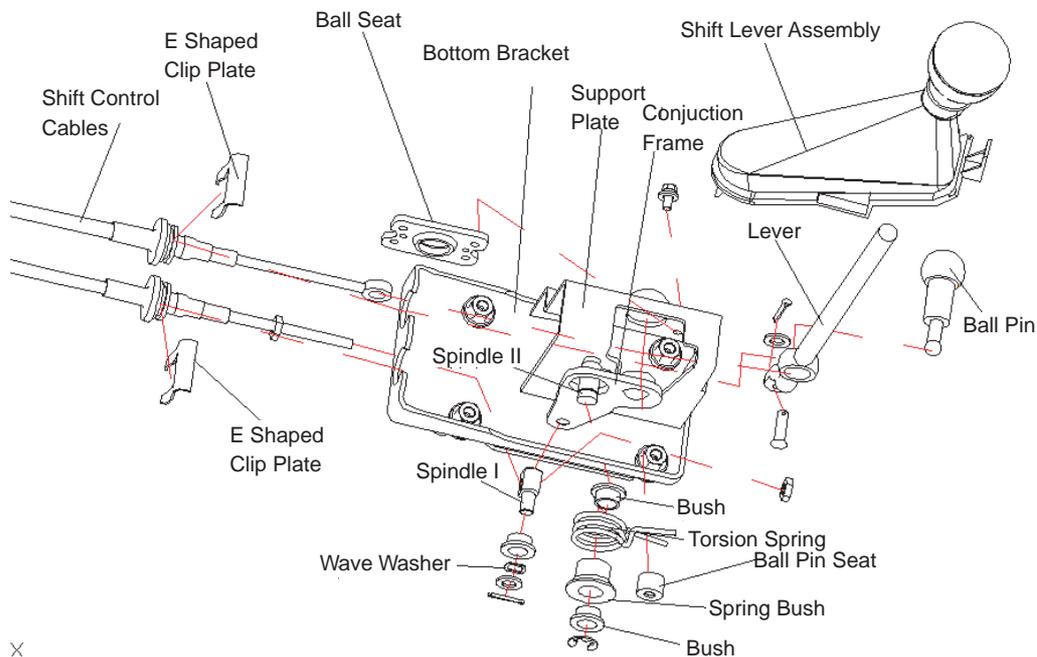
- (1) Pull rod (to transmission) attach bolt torque: 40~50N.m
- (2) The torque of the two nuts attaching the control mechanism to the body: 20~25N.m

- (3) Dust cover retainer shall be assembled well, otherwise the dust seal effect will be affected
- (4) Dust cover fixing nut torque: 20~25N.m
- (5) Make sure the shift number words on the top of shift lever ball face towards the driving direction of the vehicle, properly tighten the set screw of the shift lever
- (6) Check whether the shift control is flexible and reliable; the shift lever shall be vertical when in neutral shift.

## Section 3 Cable Type Transmission Control Module

### Components





x

## Replacement

### 1. Remove shift lever assembly

- (1) Pull upwards to separate shift lever assembly leather boot from the auxiliary console
- (2) Loosen shift lever set screw with inner hex wrench. Remove the shift lever assembly counterclockwise.

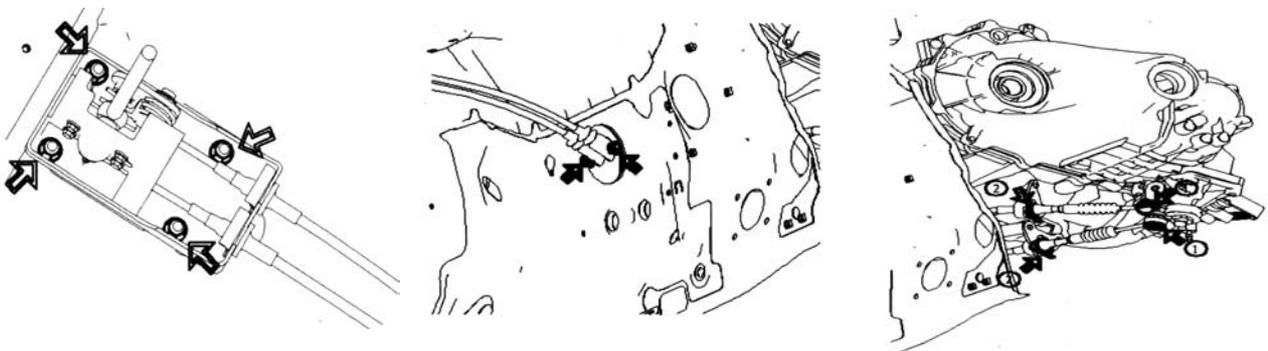
### 2. Remove the auxiliary console

### 3. Remove the 4 nuts connecting manual shift assembly and the floor

### 4. Remove the shift cushion

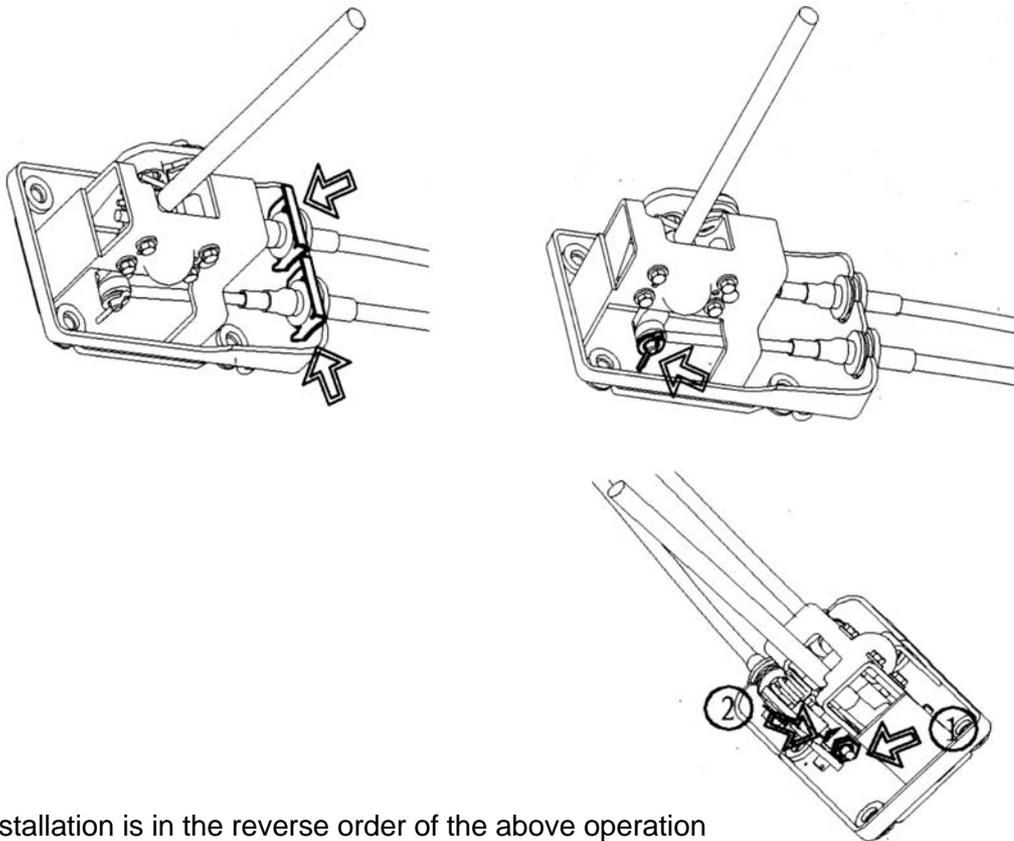
### 5. Remove transmission control device assembly

- (1) Remove the set nut on the cable seal press plate
- (2) Remove the cotter pin and the flat washer connecting the cable and the rocker arm on the transmission
- (3) Remove the E-shaped clip plate on the cable bracket retaining the cable



6. Separate the manual shift assembly from the transmission control cable assembly

- (1) Remove the E-shaped clip plate between the transmission control cable assembly and manual shift assembly
- (2) Remove the cotter pin and flat washer between the selector cable and shift assembly
- (3) Remove the locking nut connecting the cable and the shift assembly



7. Installation is in the reverse order of the above operation

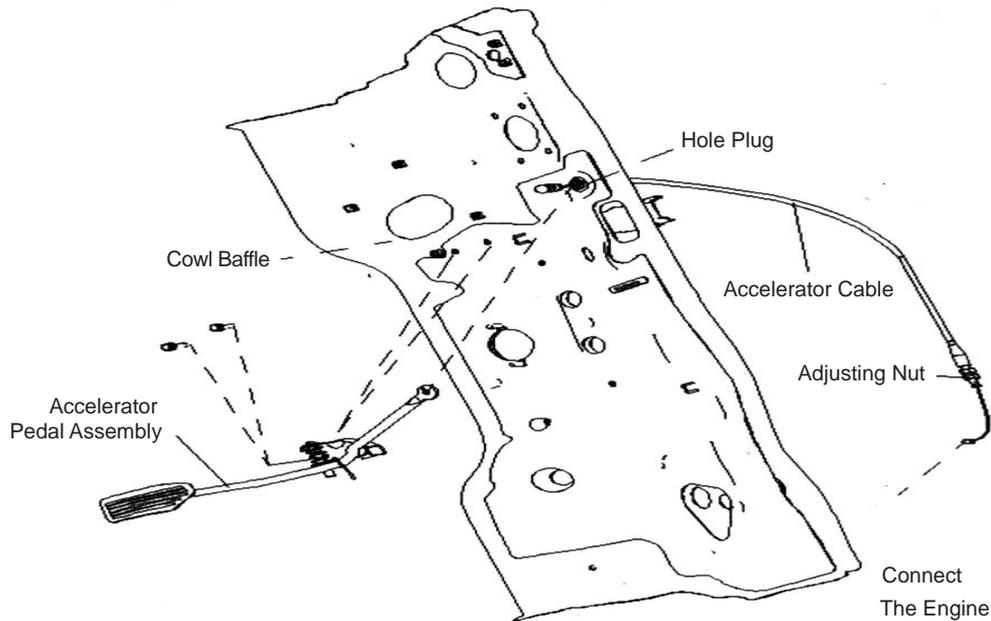
Notice:

- (1) All the E-shaped clip plate and lock pins should be assembled correctly. Otherwise, the shifting will be impacted.
- (2) The shift device cushion should be correctly assembled. Otherwise, it will affect the seal effect
- (3) Torque of the 4 nuts attaching the shift assembly to the floor: 20~25N.m
- (4) The set nut attaching the selector control cable to the shifter shall be adjusted properly (if the set nut is improperly adjusted, the shift operation will be affected), when in neutral shift, the shift lever shall be in correct position (you must check whether the shift control is flexible and reliable in the meantime), after the adjustment is completed, tighten the two nuts
- (5) Make sure the shift number words on the top of shift lever ball face towards the driving direction of the vehicle, properly tighten the set screw of the shift lever

# Chapter 2 Accelerator Pedal

## Section 1 Accelerator Pedal

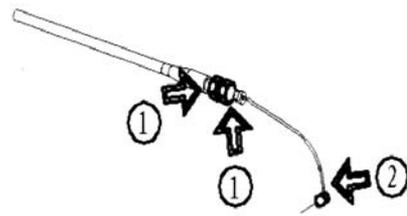
### Components



### Replacement

#### 1. Remove the accelerator cable

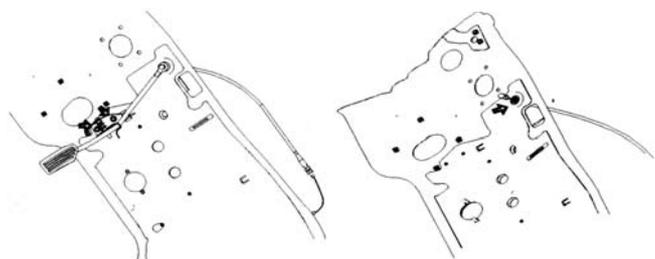
Loosen the set nut attaching the accelerator cable to the accelerator cable bracket on the engine, remove the accelerator cable from the throttle valve rocker arm



#### 2. Remove accelerator pedal

(1) Remove two set nut between the accelerator pedal and vehicle body

(2) Separate the accelerator cable



#### 3. Detach the accelerator cable

4. Install the accelerator cable and accelerator pedal assembly in the reverse order of the above procedure.

#### Notice:

(1) Accelerator pedal assembly fixing bolt torque: 20~25N.m

(2) Properly adjust the position of the accelerator cable set screw to ensure the adequate tension of the accelerator cable

(3) Check whether the accelerator control is flexible and reliable

# Chapter 3 Clutch Control System

## Section 1 Clutch Control System

### Clutch operating system description

This model is equipped with hydraulic and cable clutch control system, respectively used for 1.3L engine 1.5L engine.

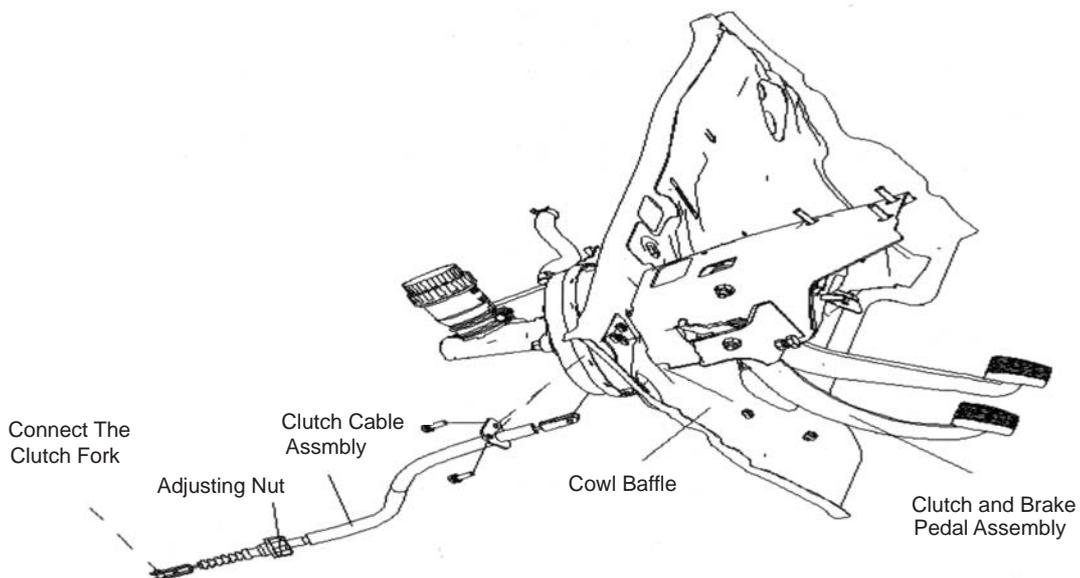
Symptom	Suspected Area
Clutch slips	1. Clutch pedal position (Too low)
	2. Control mechanism (Stagnation)
	3. Clutch pedal free stroke (too large)
Clutch does not release	1. Hydraulic pipe line (Air in line)
Clutch noisy	1. Control system (Incorrect assembly & adjustment)
	2. Clutch assembly (Faulty)

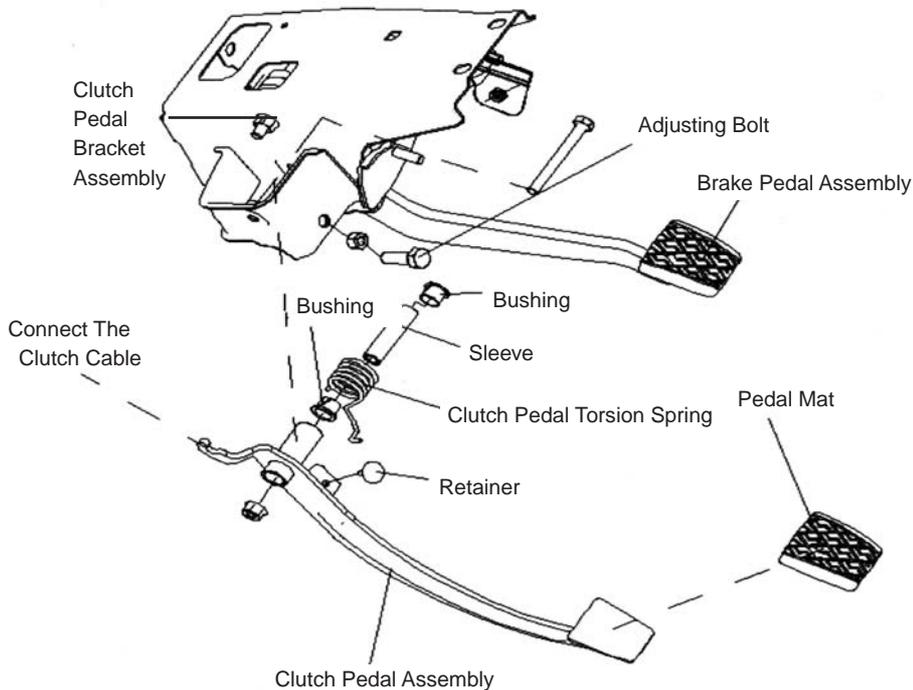
### PROBLEM SYMPTOMS TABLE

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

## Section 2 Clutch Cable Control Mechanism

### Components





## Adjustment

### 1. Check and adjust clutch pedal height

The clutch pedal height should be 180~186 mm. Adjust the pedal by adjusting bolts.

### 2. Check and adjust clutch pedal stroke and free stroke

(1) The clutch pedal stroke: 134~142mm

(2) The clutch pedal free stroke: 10~30 mm

If the clutch pedal stroke and free stroke are not within specification, adjust it by adjusting the location of the adjusting nut on the clutch cable. Re-adjust the clutch pedal height if necessary.

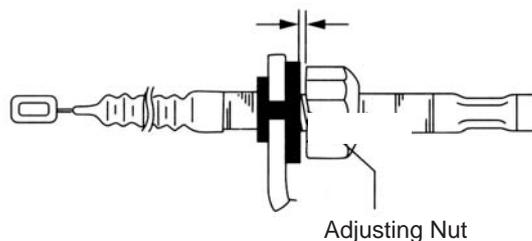
### 3. Check that the clutch pedal operates in flexible and reliable way

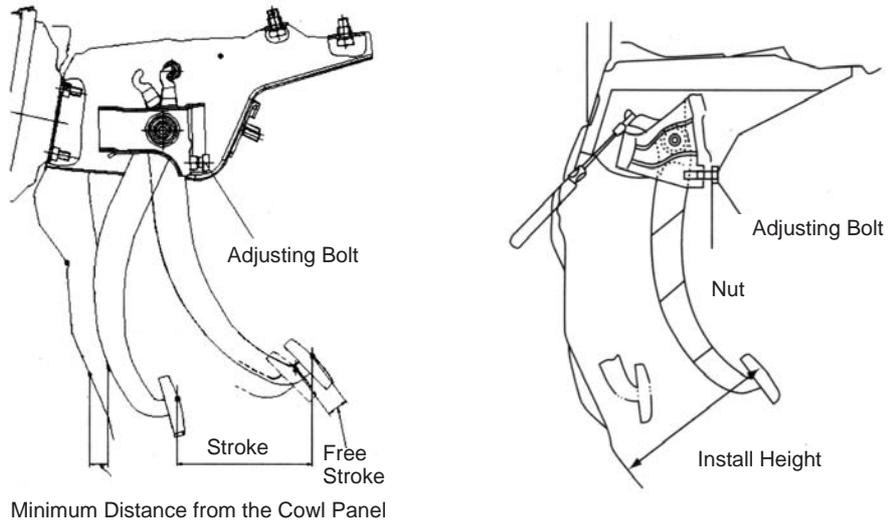
Notice:

(1) Make sure the clutch is fully applied and completely released when control the clutch pedal.

(2) The clutch pedal must have certain free stroke. Otherwise, the full application of the clutch may be impacted

(3) Tighten the lock nut after adjustment

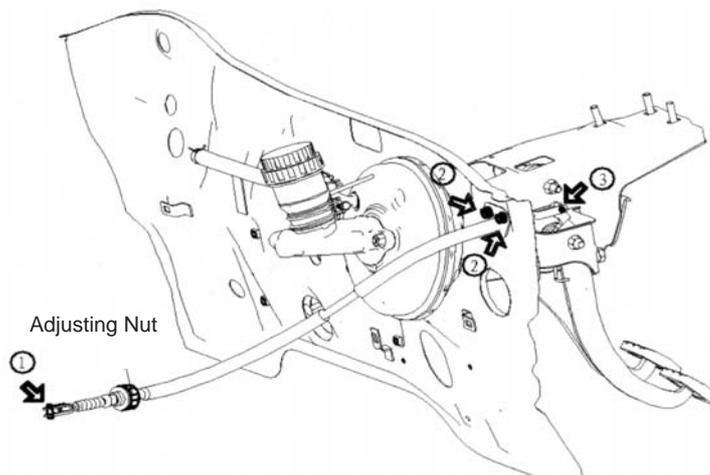




## Replacement

### 1. Remove the clutch cable

- (1) Loosen the clutch adjusting nut. Separate the clutch cable from the accelerator rocker arm
- (2) Remove the 2 set bolts from the clutch cable on the cowl panel
- (3) Separate the clutch cable from the clutch pedal



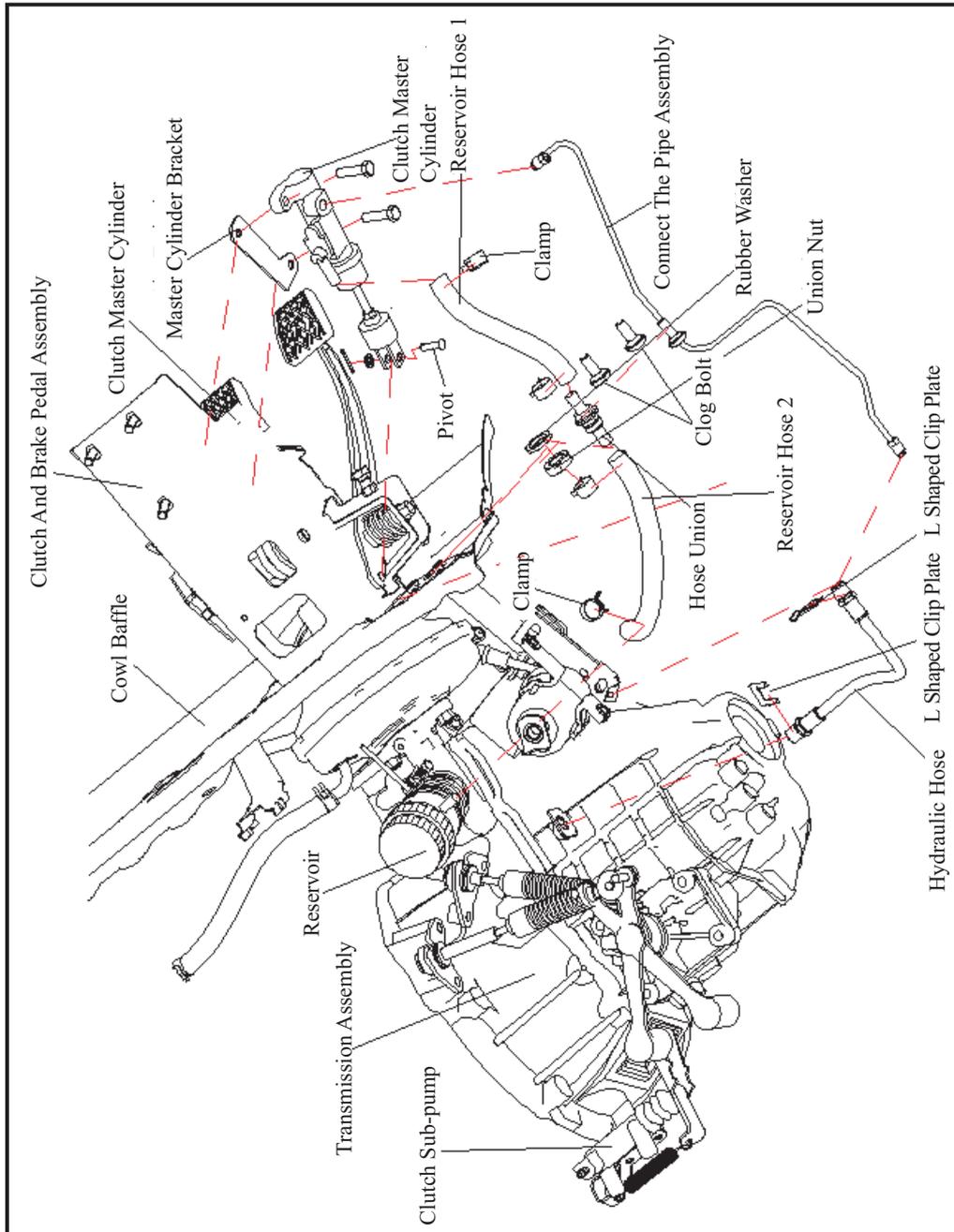
### 2. Install the clutch cable assembly in the reverse order of the above procedure.

Notice:

- (1) The clutch cable assembly on the cowl panel set bolt torque : 20~25N.m
- (2) Check and adjust the pedal according to the above-mentioned requirement in "Adjustment".

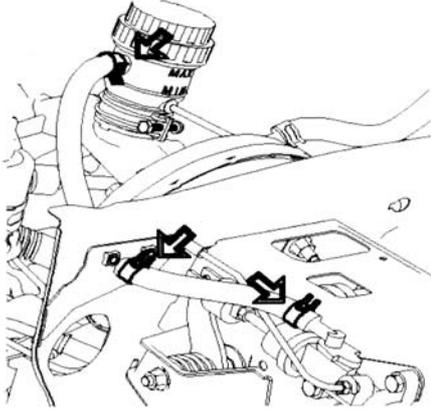
## Section 3 Clutch hydraulic Control Device

### Components

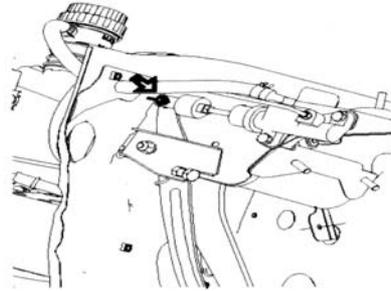


## Replacement

1. Remove the reservoir hose 1 and reservoir hose 2



Notice: Clutch hydraulic control system and hydraulic brake system share the reservoir. Prevent the brake fluid from overflowing when removing the reservoir hose.



2. Disconnect the connection with the pedal

Remove the lock pin, flat washer, pin shaft to separate the clutch hydraulic control master cylinder from the clutch pedal

3. Remove the connecting pipe

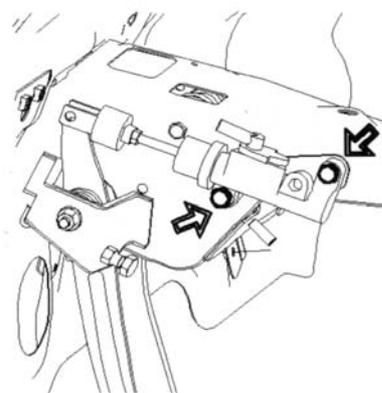
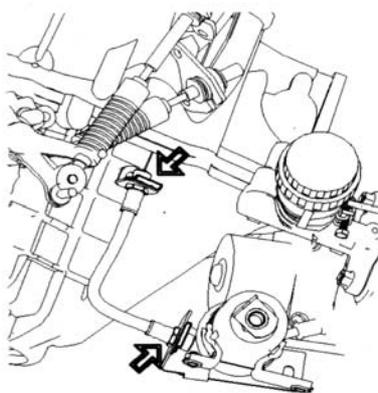
Loose the threaded connector connecting pipe and the clutch master cylinder. Remove the connecting pipe.

4. Remove the clutch pedal assembly

Remove the nuts, bolts, 2 bushing, sleeve, clutch pedal assembly

5. Remove the hydraulic hose

Loosen the union thread connecting clutch hydraulic hose and pipe. Remove E-shaped clip plate fixing the both ends of the clutch hydraulic hose



6. Remove clutch hydraulic control master cylinder

Remove the 2 fixing bolts between the clutch hydraulic control master cylinder and the pedal bracket

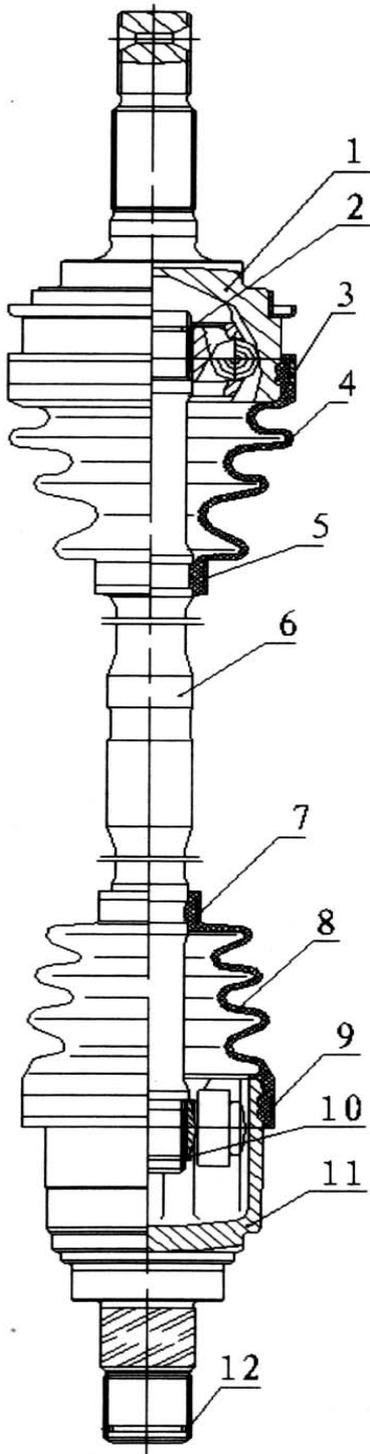
7. Install and replace the parts in the reverse order of the above procedure

Notice:

- (1) Be careful not to leak brake fluid onto other objects or paint surface. Clean it immediately to avoid damage.
- (2) Do not damage the seal rubber when installing and removing the pipe and make sure the installation is correct
- (3) Clutch pedal set thread torque : 20~25N.m
- (4) Clutch hydraulic control master cylinder set bolt torque : 20~25N.m
- (5) Torque of the union thread connecting the pipe and clutch master cylinder:  
12~16N.m
- (6) Torque of the threaded connector connecting the clutch hydraulic hose and pipe:  
12~16N.m
- (7) Bleed the air in the clutch hydraulic control system
- (8) Check the clutch hydraulic control system for leakage
- (9) Check the clutch hydraulic control system for reliable working
- (10) Check the brake fluid level. Fill the brake fluid of the same brand if necessary.
- (11) Check the clutch pedal installation height stroke and free stroke
  - a . The clutch pedal installation height: 180~186 mm
  - b . The clutch pedal stroke: 134~142mm
  - c . The clutch pedal free stroke: 10~20 mm



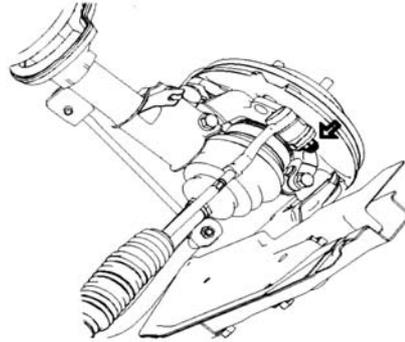
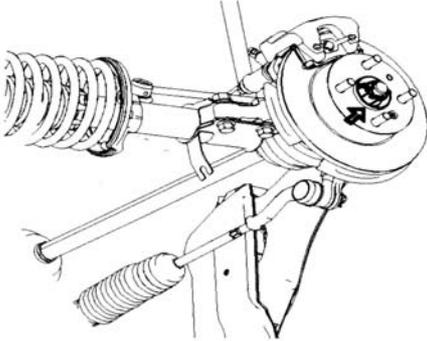
## Components



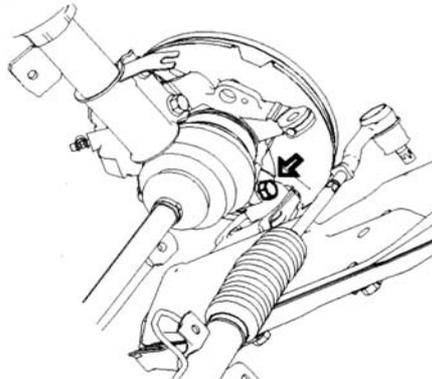
1. Rzeppa Constant velocity universal joint
2. Snap ring
3. Clip Band
4. Rzeppa Type Constant velocity universal joint boot
5. Band
6. Shaft
7. Band
8. Tripod constant velocity universal joint boot
9. Band
10. Snap ring
11. Tripod constant velocity universal joint
12. Snap ring

## Service

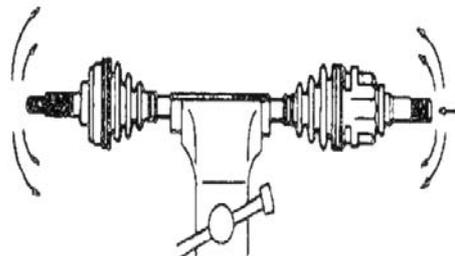
1. Remove the front wheel
2. Remove the ABS sensor signal wire
3. Remove the propeller shaft fixing nut
  - (1) Remove the cotter pin of the propeller shaft fixing nut
  - (2) loosen the propeller shaft fixing nut



4. Separate the steering tie rod
  - (1) Remove the cotter pin and the nut
  - (2) Separate the tie rod ball stud pin from the knuckle.
5. Detach the swing arm assembly.



- (1) Remove the lower swing arm assembly ball stud pin lock bolt and nut
  - (2) Detach the lower swing arm assembly ball stud pin from the knuckle
6. Remove the constant velocity propeller shaft assembly Appropriately pull the brake outward, use a rubber hammer or brass bar to tap the propeller shaft to remove it  
Notice: Actions shall be taken to prevent the propeller from being dropped off, do not damage the boot and the oil seal
7. Inspect the propeller shaft assembly
  - (1) Check the tripod constant velocity universal joint for looseness



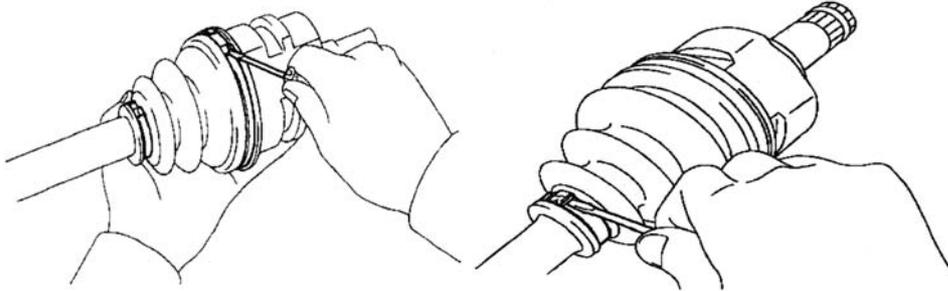
- (2) Check the sliding shaft for smooth movement

(3) Check the Rzeppa Constant velocity universal joint for looseness

(4) Check the boot for damage

Notice: Check that the propeller shaft assembly is placed horizontal.

8. Disassemble the tripod constant velocity universal joint boot Use screwdriver to loose the tripod constant velocity universal joint boot band, remove the boot



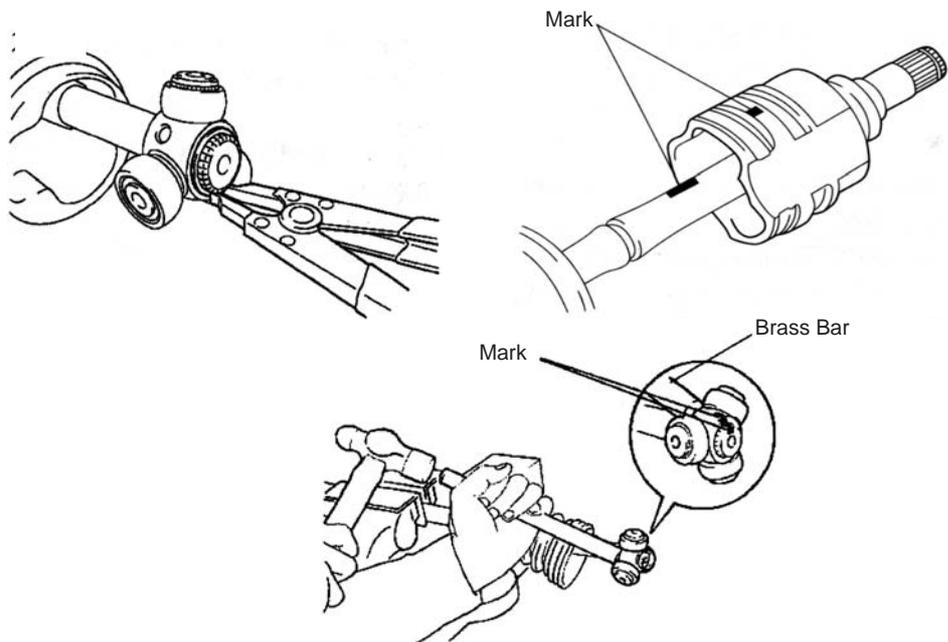
Notice: Replace the band if it is distorted

9. Disassembly the tripod constant velocity universal joint

(1) Remove the old grease

(2) Use the mark pen to place a matchmark on the inboard and outboard joint

Notice: Do not punch the marks



(3) Remove the outboard knuckle

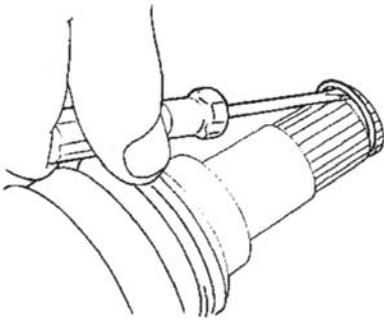
(4) Use snap ring pliers to remove the snap ring

(5) Use mark pen to place matchmarks on the tripod ball joint and outboard joint

(6) Use brass bar and hammer to remove the tripod ball joint

Notice: Do not tap the roller

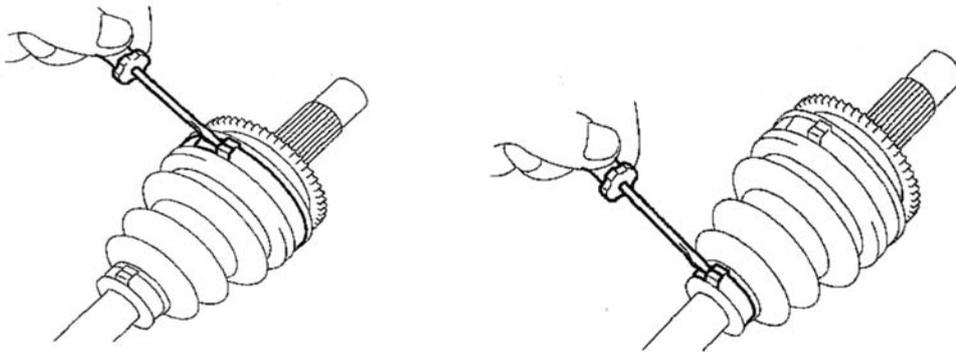
10. Remove the snap ring on the spline shaft end of the tripod constant velocity joint



Notice: Do not damage the snap ring, or it shall be replaced

11. Disassemble the Rzeppa Constant velocity universal joint boot Use screwdriver to loosen the Rzeppa Constant velocity universal joint boot band, remove the boot

Notice: Replace the band if it is distorted



12. Disassemble the Rzeppa Constant velocity universal joint

- (1) Remove the old grease
- (2) Use the mark pen to make a matchmark on the inboard and outboard joint

Notice: Do not punch the marks

13. Installation is in the reverse order of removal procedure

Notice:

- (1) Apply proper amount of long life grease as specified when assembling the tripod velocity universal joint and Rzeppa Constant velocity universal joint, and then assemble it according to the matchmark.
- (2) Keep both sides of the spline shaft clean, the boot intact and the band assembled into place
- (3) The tripod constant velocity joint spline shaft and the differential shall be assembled into place, with the snap ring opening facing down, use rubber hammer to tap it appropriately when necessary
- (4) Propeller shaft attaching nut torque: 145~155N.m, install the cotter pin
- (5) Steering knuckle lower swing arm assembly ball stud pin retaining bolt and nut torque: 80~90N.m
- (6) Tie rod ball stud pin attaching nut torque: 27~39N.m, install the cotter pin

- (7) Install front wheel, wheel nut torque: 95~115N.m
- (8) Make sure that the propeller shafts for 1.3L engine and 1.5L engine are not interchanged at the time of replacement
- (9) Check the ABS sensor signal, check and adjust the front wheel alignment if necessary.

# Chapter 5 Front Suspension System

## Section 1 Front Suspension System

Description on front suspension structure

This model uses strut swing arm independent suspension with stabilizer bar.

The shock absorber upper end is flexibly connected to the body through the shock absorber mounting seat, the lower end is rigidly connected to the steering knuckle. The coil spring encloses the shock absorber (coil spring geometrical axial line does not coincide with that of the shock absorber piston rod), and is supported between the upper and lower spring seats.

Both ends of the stabilizer bar are connected to the shock absorber through the strut bar ball pin and the intermediate part is supported on the lower front body by the rubber bushing and support frame.

The front cushion sleeves the shock absorber piston rod head to restrict the wheel jump limit position and plays the role of buffer.

The thrust ball bearing, installed between the spring upper seat and the shock absorber mount, is used for the relative rotation upon steering of the shock absorber rigidly connected to the steering knuckle to the shock absorber mount flexibly connected to the body.

"L" type lower swing arm is secured to the lower engine compartment with the press plate through elastic rubber bushing and hinge, and its outer end is connected to the steering knuckle through the ball stud pin which is attached to the lower swing arm by 3 high intensity bolts. The ball stud pin can be removed and replaced when it is worn.

The ball seat material is saturated polyester containing oil, featured in comparatively high intensity and wearability and good self-lubrication performance. Proper amount of grease has been added during the assembly and there is no need for additional filling during the normal operation.

Item	Parameter	Item	Parameter
shock absorber operating cylinder diameter /mm	$\varnothing 50$	Wheel camber	$0^{\circ}\pm 30'$
shock absorber piston rod diameter /mm	$\varnothing 20$	Wheel toe-in/mm	$0\pm 3$
shock absorber stroke/mm	175	Kingpin inclination	$12^{\circ}14'$
		Caster of kin pin	$2^{\circ}23'$
Remark: the wheel alignment parameter in the table is at free load.			

See the table for the front suspension technical parameters

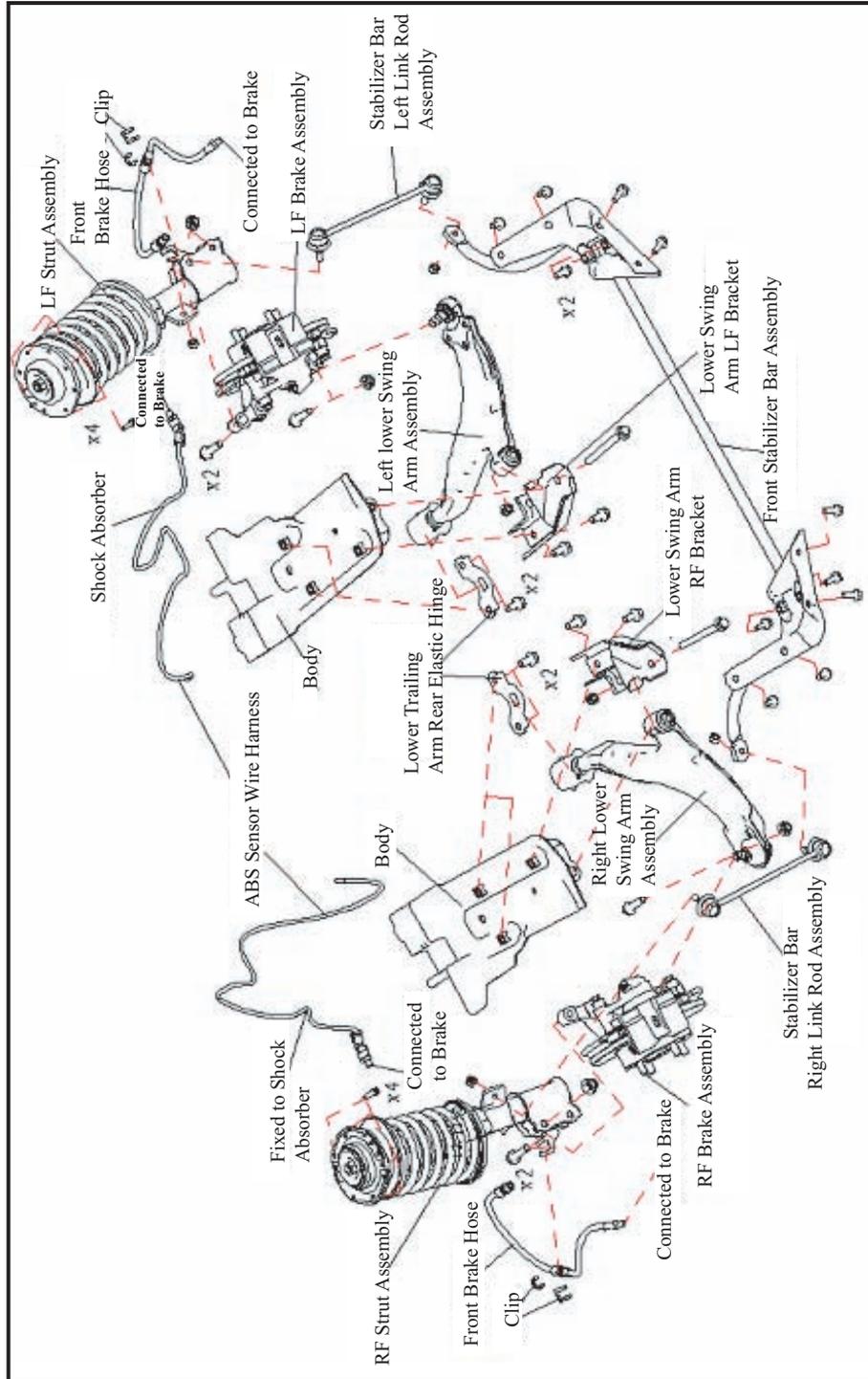
## PROBLEM SYMPTOMS TABLE

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace parts.

Symptom	Suspected Area
Deviation	1. Tires (Worn or improperly inflated)
	2. Wheel alignment (Incorrect)
	3. Steering system joint(Loose or worn)
	4. Hub bearing (Worn)
	5. Steering gear (Out of adjustment or worn)
	6. Suspension parts (Worn or damaged)
Body Descent	1. Vehicle (Overloaded)
	2. Spring (stiffness not comply with or damage)
	3. Shock absorber (Worn)
Sways	1. Tire (Worn or improperly inflated)
	2. Steering linkage (Loose or damaged)
	3. Stabilizer bar (Bent or broken)
	4. Shock absorber (Worn or damaged)
Front wheel shimmy	1. Tire (Worn or improperly inflated)
	2. Tire (Dynamic balance is not as specified)
	3. Shock absorber (Worn or damaged)
	4. Wheel alignment (Incorrect)
	5. Ball stud pin (Worn or damaged)
	6. Hub bearing (Worn or damaged)
	7. Steering linkage (Loose or worn)
	8. Steering gear (Out of adjustment or worn)
Abnormal tire wear	1. Tire (Worn or improperly inflated)
	2. Wheel alignment (Incorrect)
	3. Shock absorber (Worn or damaged)
	4. Suspension parts (Worn or damaged)

# Section 2 Front Suspension

## Components



## Section 3 Front Wheel Alignment

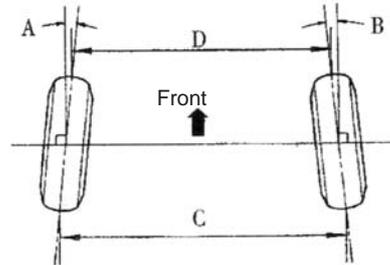
### Adjustment

1. Inspect tire
2. Inspect toe-in

#### Toe-in

Tire Pressure	220KPa
Toe-in	C-D: $0 \pm 3\text{mm}$

If the toe-in is not as specified, adjust the tie rod (but the left and right tie rods must be adjusted symmetrically).



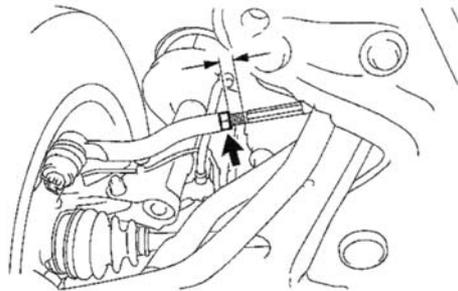
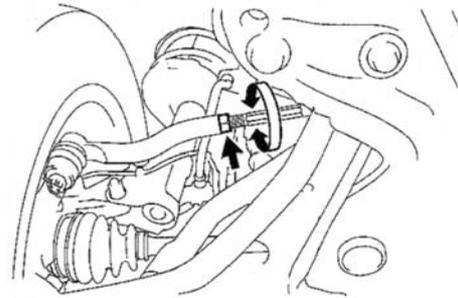
#### 3. Adjust toe-in

- (1) Loose the tie rod end lock nut.
- (2) Turn the left and right tie rod in the same direction for same revolutions.

Hint: Adjust the toe-in to the specified value.  
Only adjust the one-side tie rod is not allowed.

- (3) Make sure the left and right tie rods are of the same length.  
(The difference should be less than 0.5mm).
- (4) Tighten the lock nut of tie rod.

Torque: 45~50N.m

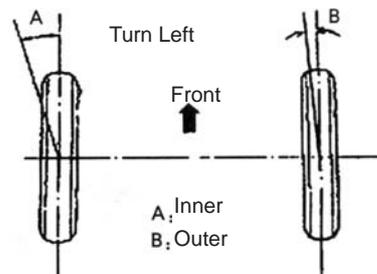


#### 4. Inspect wheel limited turn angle

Turn the steering wheel fully and measure the turning angle.

Wheel angle:

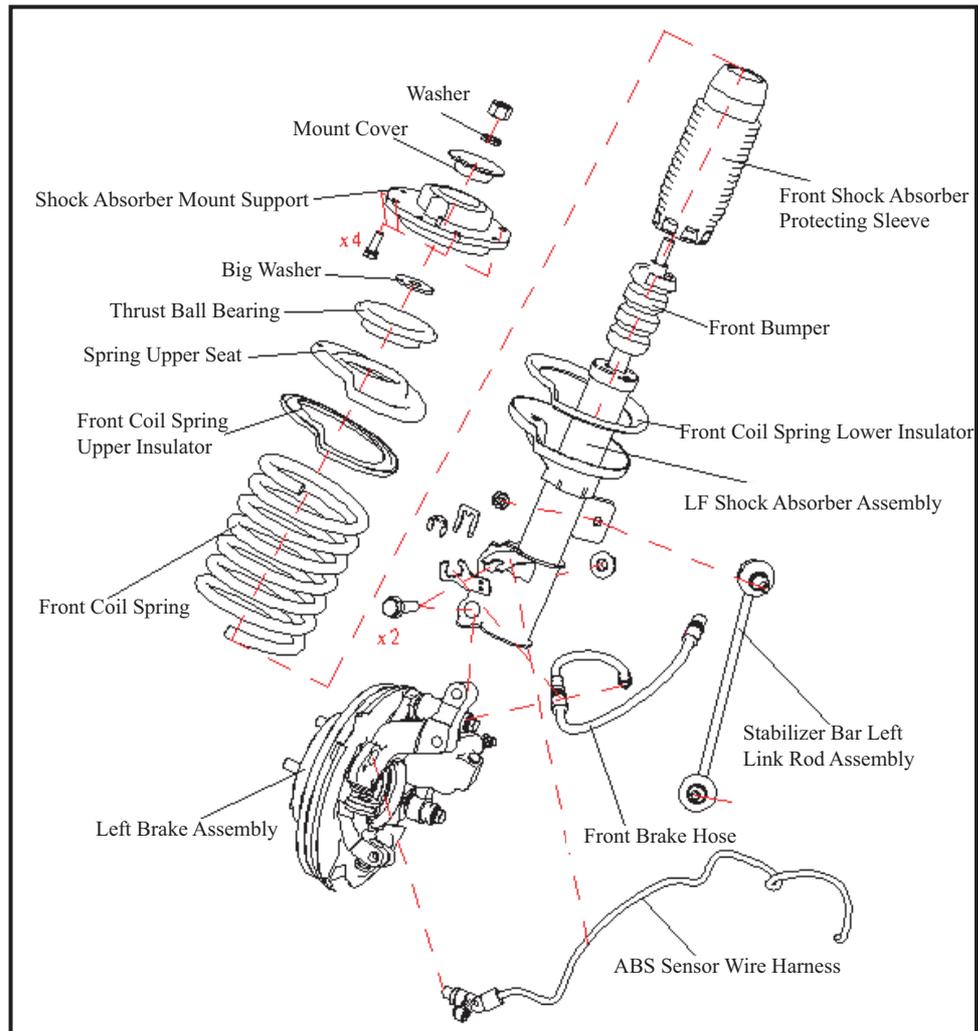
Inside wheel angle	$37.6^\circ$
Outside wheel angle	$33.3^\circ$



If the wheel angle is less than the specified value, check whether the length of the right and left tie rod ends.

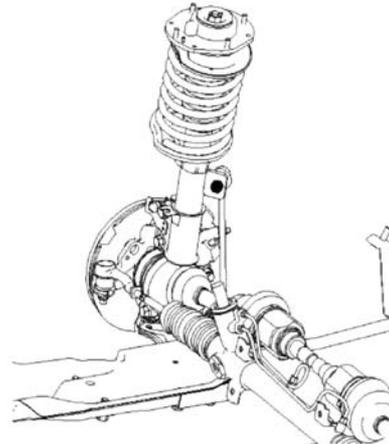
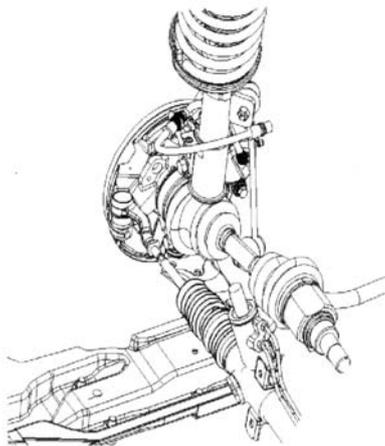
## Section 4 Front Strut Assembly

Components:



## Replacement

1. Remove the front wheel.
2. Remove the ABS sensor from the steering knuckle. Separate the sensor and signal wire from the wire harness bracket on the front shock absorber.



3. Separate the front brake hose

Remove 2 clips and separate the front brake hose from the front shock absorber bracket.

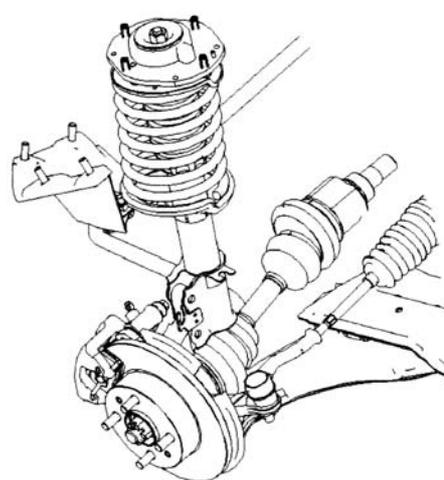
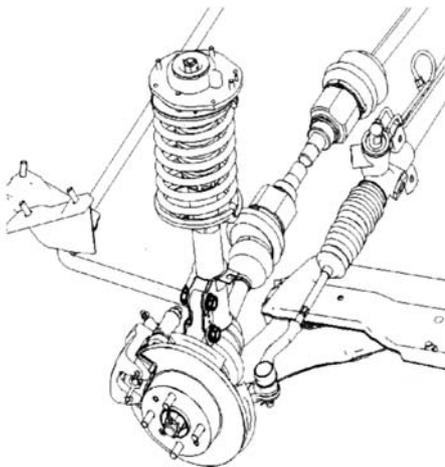
4. Remove the stabilizer bar link rod assembly

Remove the nut connecting the stabilizer bar link rod assembly and the shock absorber.

5. Remove the front shock absorber with the coil spring

- (1) Remove the nuts and bolts connecting the shock absorber and brake.
- (2) Remove the 4 nuts connecting the front shock absorber and vehicle body.

Notice: reliable object shall be used to support the brake assembly!



6. Disassemble the front strut assembly

- (1) Remove the nut on the shock absorber.

Notice: the elasticity of the spring is recovered!

- (2) Remove the washer, collar, shock absorber mount seat and big washer.
- (3) Remove spring upper seat, front coil spring , front shock absorber boot, front dumper, front coil spring lower insulator.

7. Assemble the front strut assembly

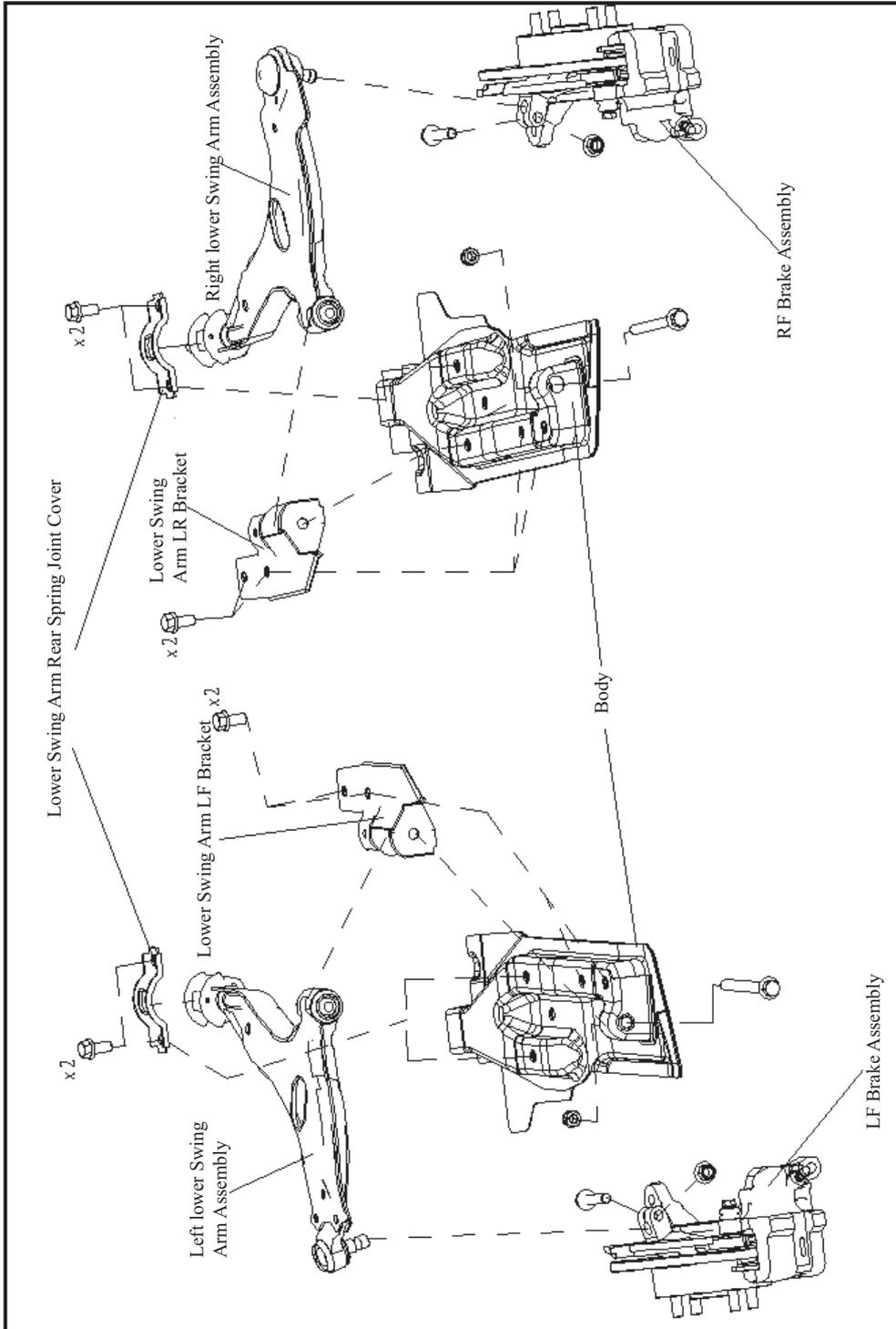
The assembly of the front strut assembly is in the reverse order of disassembly.

Notice:

- (1) Use special fixture when installing the nut on the shock absorber piston rod, be careful not to let the spring rebound. Torque: 80~90 N.Sm.
- (2) Install the 4 bolts attaching the front strut assembly to the body. Torque: 25~30N.m.
- (3) Install the 2 bolts and nuts of the front strut assembly and the brake.  
Torque: 90~100N.m.
- (4) Install the attaching nuts on the stabilizer bar link rod assembly and shock absorber.  
Torque: 50~60N.m.
- (5) Install the ABS sensor and secure the signal wire.

# Section 5 Lower Swing Arm Assembly

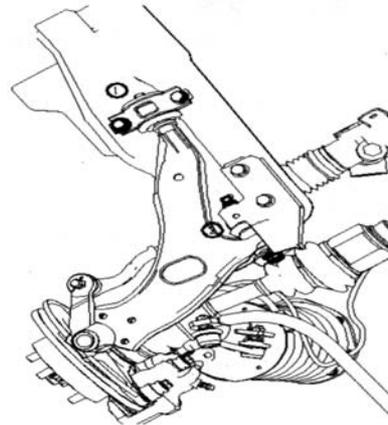
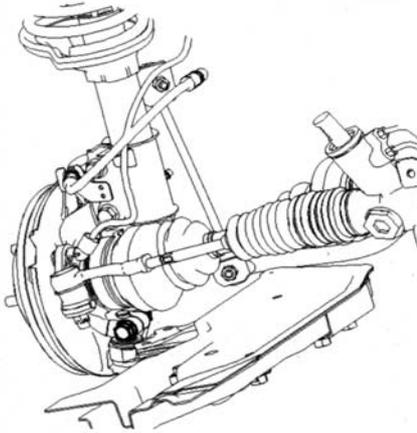
## Components



## Replacement

### 1. Remove lower swing arm assembly

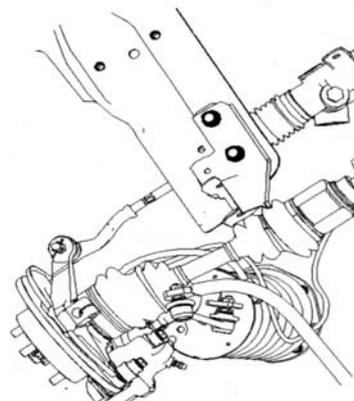
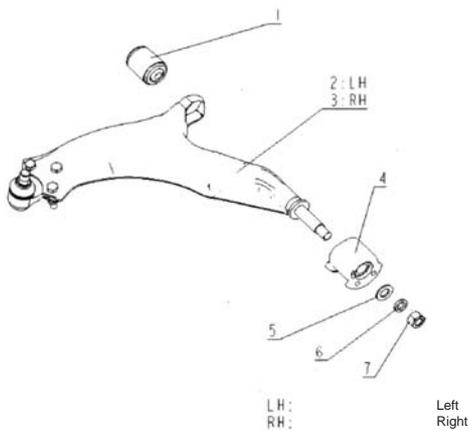
- (1) Remove the bolts and nuts between the lower swing arm assembly and front brake.
- (2) Remove the 4 bolts on lower swing arm rear spring joint cover.



- (3) Remove the bolts and nut between lower swing arm assembly and lower swing arm front bracket

### 2. Remove the swing arm assembly

Remove the swing arm assembly as shown in the figure.



3. Remove lower swing arm front support frame

Remove the 4 bolts connecting the lower swing arm front support frame and vehicle body.

4. Disassemble lower swing arm assembly

Disassembly of lower swing arm assembly is in the reverse order of the assembly.

Notice: Do not tighten type 1 hexagon nut

5. Install lower swing arm front support frame

Attach the lower swing arm front support frame to the vehicle body with bolts .

Torque: 80~90N.m

6. Install lower swing arm assembly

- (1) Install the bolts and nuts connecting the lower swing arm assembly and lower swing arm front support frame.

Notice: Do not tighten the bolts

- (2) Attach the left lower swing arm assembly ball stud pin to the steering knuckle with bolts and nuts.

Torque: 80~90N.m

- (3) Install the attaching bolt between the lower swing arm rear spring joint cover and the body.

Torque: 80~90N.m

7. Set nut

- (1) Lower the vehicle and center the front wheel.

Be careful of the security

- (2) Tighten the bolts connecting lower swing arm assembly and lower swing arm front support frame

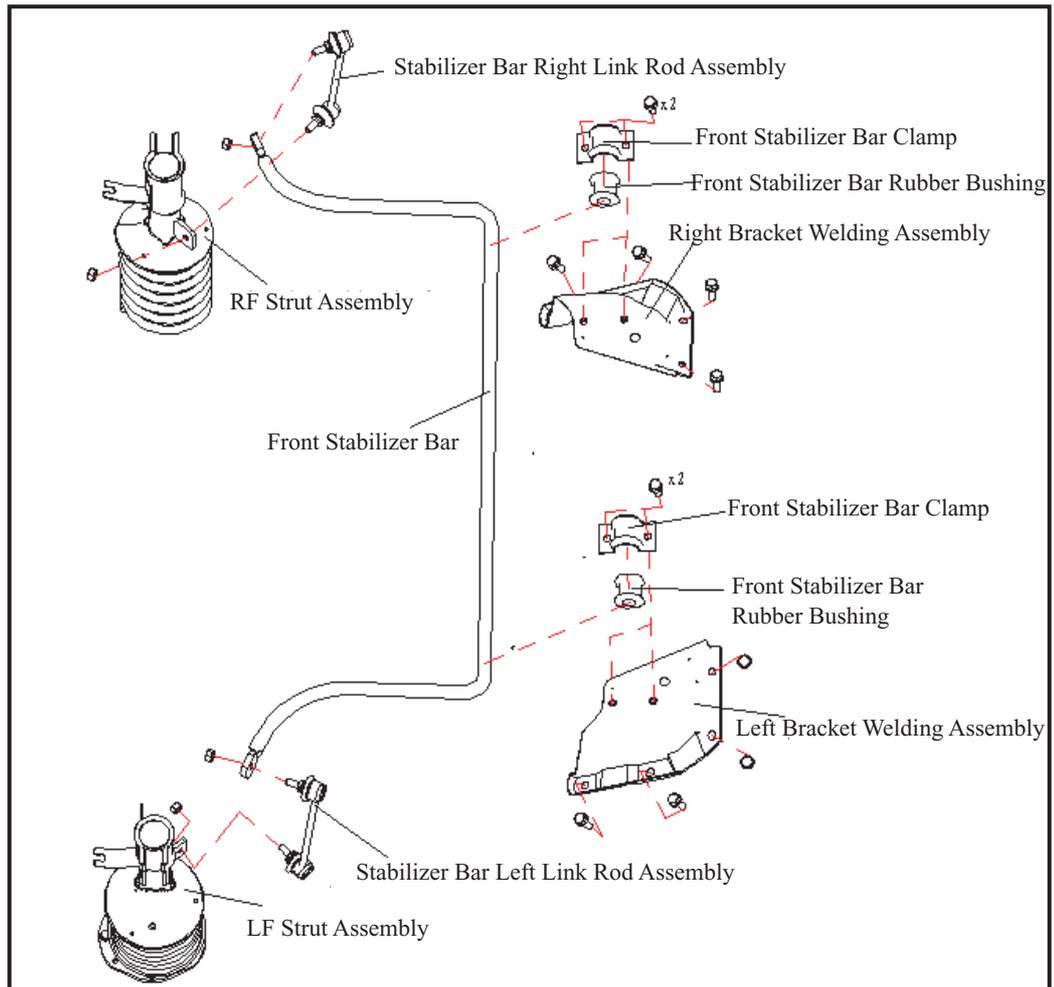
Torque: 90~100N.m

- (3) Tighten the set nuts on the lower swing arm assembly rear spring joint

Torque: 90~100N.m

## Section 6 Front Stabilizer Bar and Link Rod Assembly

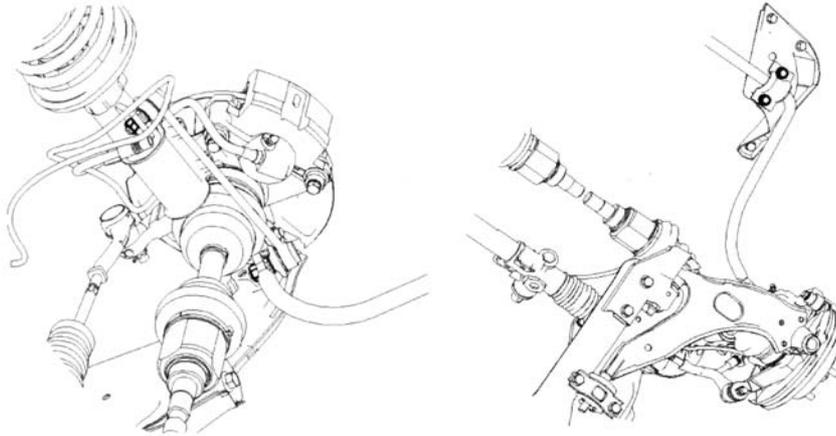
### Components



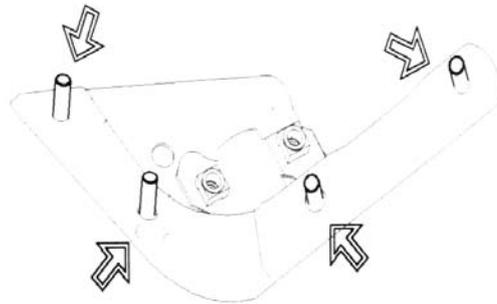
## Replacement

### Hint

1. Remove the stabilizer bar left link rod
  - (1) Remove the nuts connecting the stabilizer bar left link rod and front shock absorber.
  - (2) Remove the nut connecting the stabilizer bar left link rod and the left side of stabilizer bar.



2. Remove the front stabilizer bar  
Remove the 4 bolts, front stabilizer bar rubber bushing, front stabilizer bar clamp.
3. Remove the front stabilizer bar left support frame welding assembly  
Remove the nuts connecting the stabilizer bar left support frame welding assembly and vehicle body.



4. Install the front stabilizer bar support frame welding assembly  
Set the front stabilizer bar support frame welding assembly to the vehicle body with bolts.  
Torque: 50~60N.m

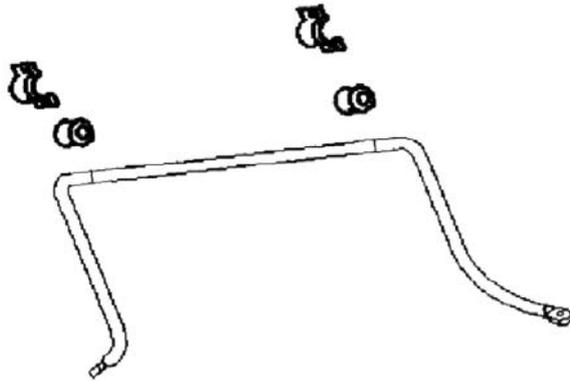
5. Install the front stabilizer bar

Install stabilizer bar, 2 rubber bushings, the front stabilizer bar clamp and 4 bolts.

Torque: 50~60N.m

Notice:

- (1) Align the inner rubber bushing with the mark on the stabilizer bar.
- (2) The 4 bolts connecting the stabilizer bar clamp and front stabilizer bar support frame welding assembly differ in length. The two short ones are close to engine.



6. Install stabilizer bar link rod assembly

- (1) Attach the stabilizer bar link rod to the stabilizer bar with nuts.

Torque: 40~50 N.m

- (2) Attach the stabilizer bar link rod to the front shock absorber bracket with nuts.

Torque: 40~50 N.m

# Chapter 6 Rear Suspension System

## Section 1 Rear Suspension System

### Rear suspension structure description

This model uses strut independent rear suspension with stabilizer bar.

Rear suspension consists of the parallel front and rear double transverse arms, trailing rod, rear stabilizer bar and rear strut assembly. The shock absorber and cone coil spring are arranged eccentrically.

See the table below for the major technical parameters of the rear suspension

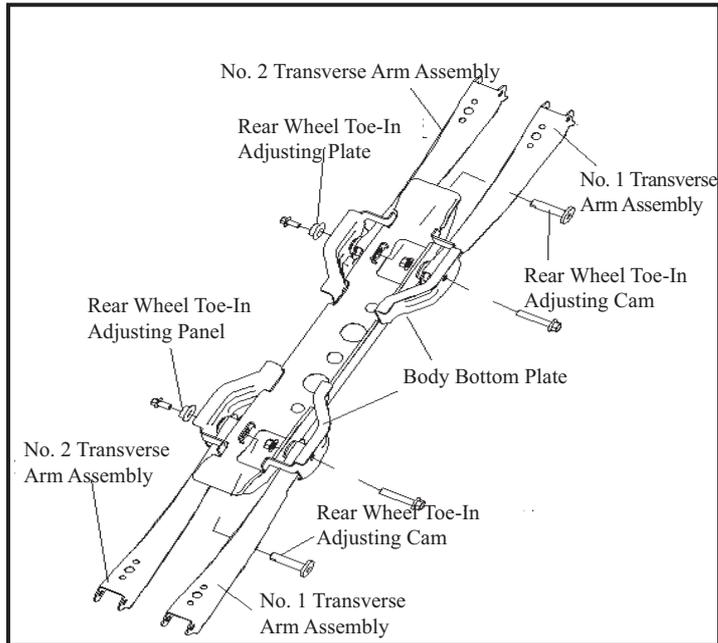
Items	Parameter	Items	Parameter
Shock absorber operating cylinder diameter /mm	∅ 56	Camber	-20' ± 30'
Shock absorber piston rod diameter/mm	∅ 18	Wheel toe-in/mm	1 ~5
Shock absorber stroke/mm	230mm		
Remark: Wheel alignment parameter is at free load			

### Problem Symptoms Table

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

Symptom	Suspected Area
Deviation	1. Tires (Worn or improperly inflated)
	2. Wheel alignment (Incorrect)
	3. Hub bearing (Worn or damaged)
	4. Suspension parts (Worn or damaged)
Body Descent	1. Vehicle (Overloaded)
	2. Spring (Stiffness small)
	3. Shock absorber (Worn)
Sways	1. Tire (Worn or improperly inflated)
	2. Wheel (not within specification)
	3. Shock absorber (Worn)
Rear wheel shimmy	1. Tire (Worn or improperly inflated)
	2. Wheel alignment (Incorrect)
	3. Shock absorber (Worn)
	4. Wheel (not within specification)
Abnormal tire wear	1. Tire (Worn or improperly inflated)
	2. Wheel alignment (Incorrect)
	3. Shock absorber (Worn)
	4. Suspension parts (Worn)





## Section 3 Rear Wheel Alignment

### Inspection

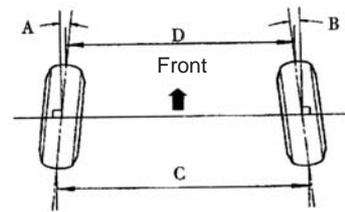
#### 1. Inspect tire

Standard inflation pressure: 220 Kpa

#### 2. Inspect rear wheel toe-in

Toe-in	C - D: 1 ~ 5 mm
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If the rear wheel toe-in is not within the specification, adjust it via rear wheel toe-in adjusting cam.



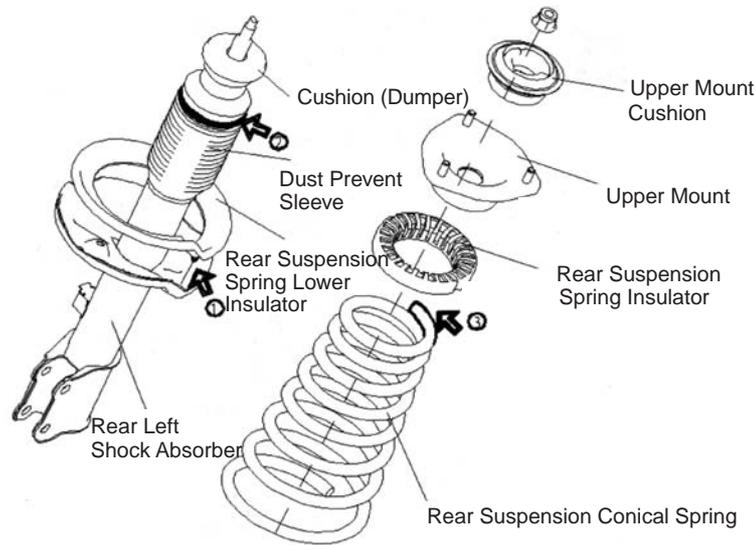
#### 3. Inspect the camber

Camber	$-20' \pm 30'$
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Notice: If the camber is not within the specification, check the suspension parts for damage/low performance. Replace it if necessary.

## Section 4 Left & Right Rear Strut Assembly

### Components



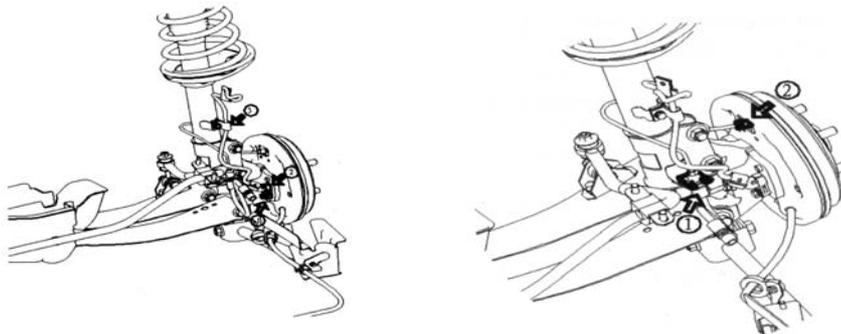
### Replacement

1. Remove the rear wheel

2. Remove ABS sensor

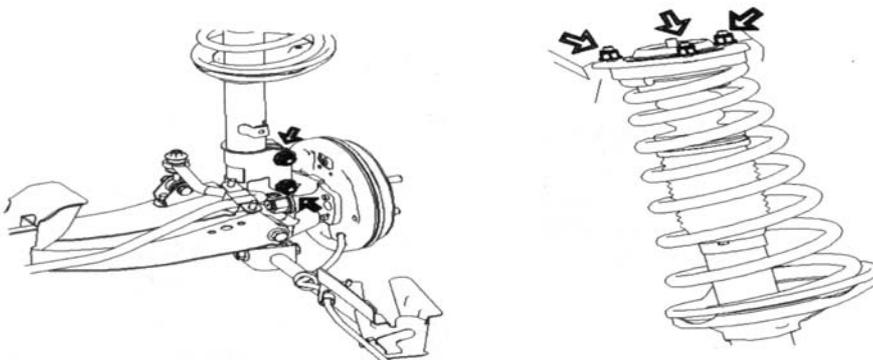
(1) Remove ABS rear wheel sensor retaining bolt. Remove the sensor.

(2) Remove the retaining bolt of ABS rear wheel sensor on rear shock absorber bracket



3. Separate brake pipe and rear strut assembly

Remove the elastic clip on the pipeline bracket attaching the brake pipeline



4. Remove the left and right rear strut assembly

(1) Remove the threaded connect of the rear strut assembly and rear brake assembly

(2) Remove the 3 nuts attaching the rear suspension upper mount to the body

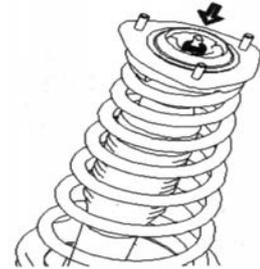
Caution: reliable object shall be used to support the rear brake assembly! Make sure that the brake pipeline is not affected or damaged!

5. Disassembly the left, right rear strut assembly

(1) Set the rear strut assembly with special tool. Remove the nut on the top of the rear shock absorber piston

Caution: The spring may rebound!

(2) Remove the rear suspension upper mount, rear suspension upper mount cushion, rear suspension spring upper insulator, rear suspension spring, rear shock absorber cushion, rear shock absorber dust preventing sleeve, rear suspension spring lower insulator in order



6. The assembly is in the reverse order of the disassembly.

Caution:

(1) when installing the nut on the shock absorber piston rod upper end, use special fixture and be careful that the spring may rebound!

Torque : 32~38N.m

(2) Rear strut assembly to body thread torque : 32~38 N.m

(3) Strut assembly to rear brake assembly thread torque : 81~96 N.m

(4) Install the ABS rear wheel sensor and the secure the signal wire

(5) When securing the brake line, make sure that the brake line does not interfere with other parts

(6) Wheel nut torque : 95~115N.m

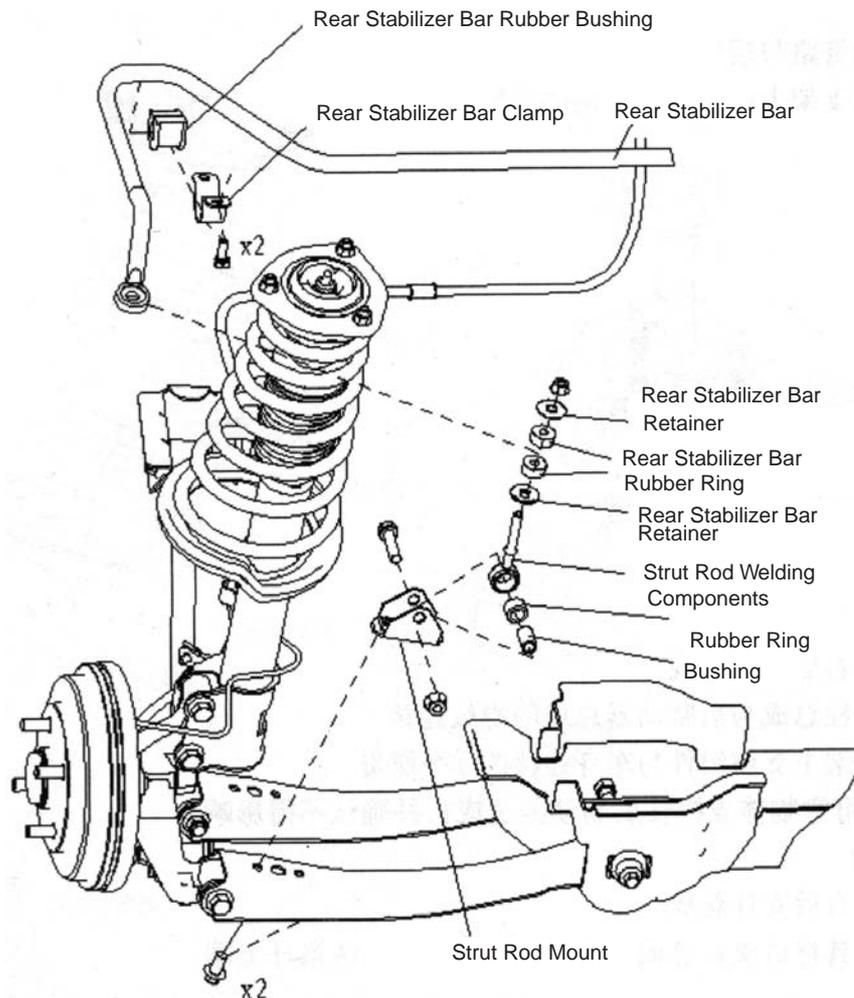
(7) Check the brake system for leakage, bleed air in the brake system as necessary

(8) Check whether the ABS signal is normal

(9) Check rear wheel alignment, adjust it as necessary

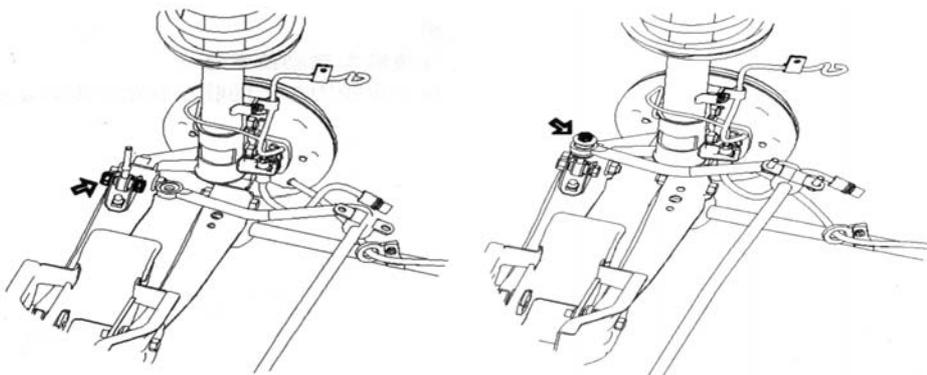
## Section 5 Rear stabilizer bar assembly, strut rod components

### Components



### Replacement

1. Separate rear stabilizer bar assembly and strut rod components
  - (1) Remove the nut connecting the rear stabilizer bar and mount
  - (2) Remove the rear stabilizer bar retaining ring and the rubber ring
  - (3) Remove the 4 bolts connecting rear stabilizer bar and vehicle body



2. Remove the strut rod components

Remove the thread connecting strut rod and No. 2 transverse arm assembly

3. Disassemble the strut rod components

4. Disassemble the rear stabilizer bar assembly

(1) Remove the rear stabilizer bar clamp

(2) Remove the rear stabilizer bar rubber bushing

5. The installation is in the reverse order of the removal.

Caution:

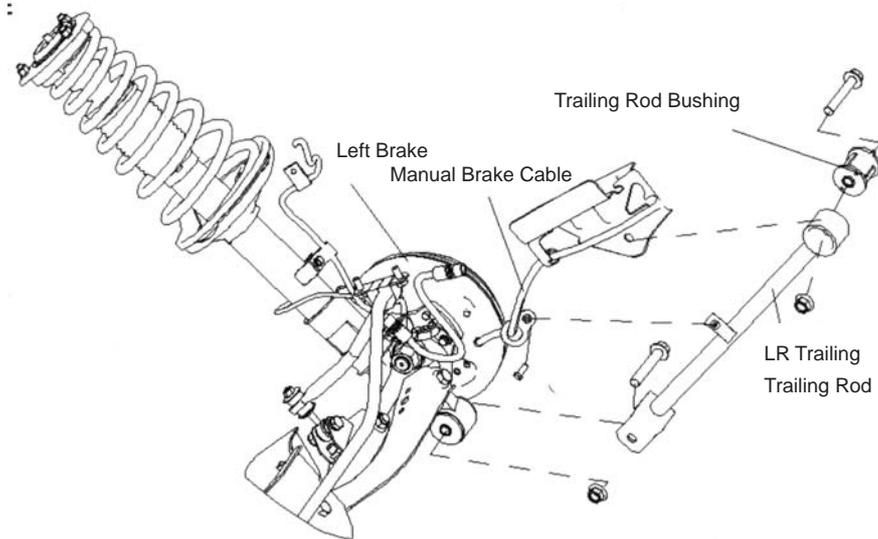
(1) The torque of the bolt attaching the stabilizer bar assembly to the body: 22~25N.m

(2) The torque of the bolt attaching the strut rod components to No. 2 the transverse arm assembly: 22~25N.m

(3) The torque of the nut attaching the rear stabilizer bar to the strut rod components:  
22~25N.m

## Section 6 Left & Right Trailing Rod Assembly

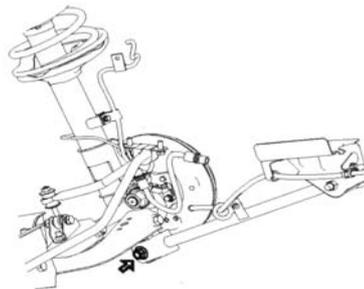
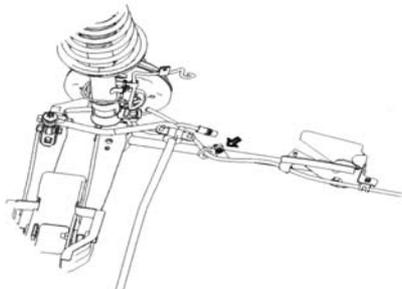
### Components



### Replacement

1. Separate parking brake cable assembly

Remove the parking brake cable set bolt on trailing rod

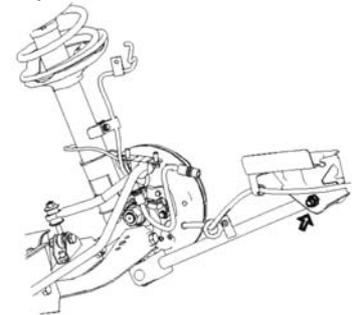


2. Remove the trailing rod assembly

(1) Remove the bolt connecting the trailing rod assembly and rear brake assembly.

(2) Remove the bolt connecting the trailing rod assembly and vehicle body

3. The parts installation is in the reverse order of the removal

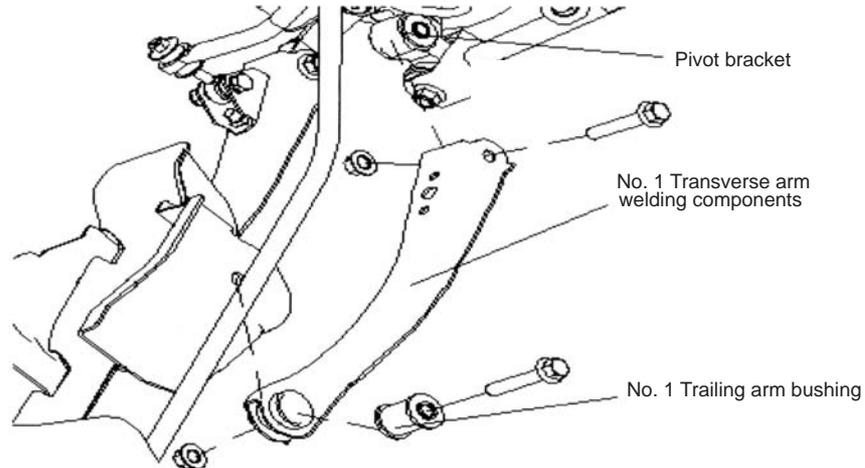


### Caution:

- (1) The torque of the bolt attaching the trailing rod assembly to the body: 81~ 96N.m
- (2) The torque of the bolt attaching the trailing rod assembly to the rear brake assembly: 81~96N.m
- (3) The above bolts shall be tightened to the specified torque at Non-load.
- (4) Check rear wheel alignment, adjust it as necessary

## Section 7 No. 1 Transverse Arm Assembly

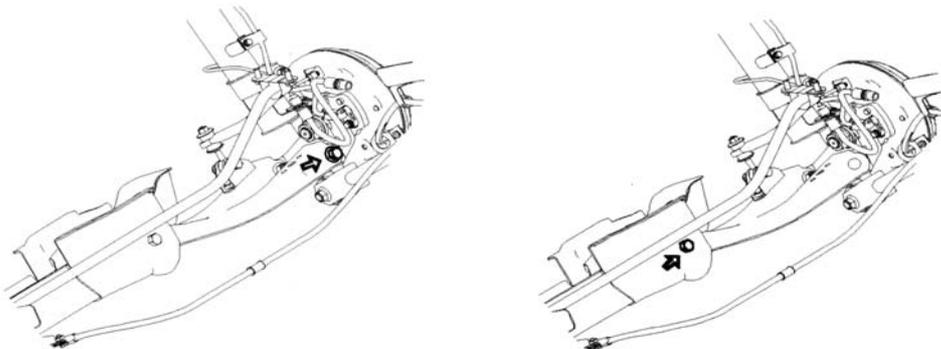
### Components



### Replacement

1. Remove transverse arm assembly No. 1

- (1) Remove the bolt connecting the No. 1 transverse arm assembly and rear brake assembly
- (2) Remove the bolt connecting the No. 1 transverse arm assembly and vehicle body



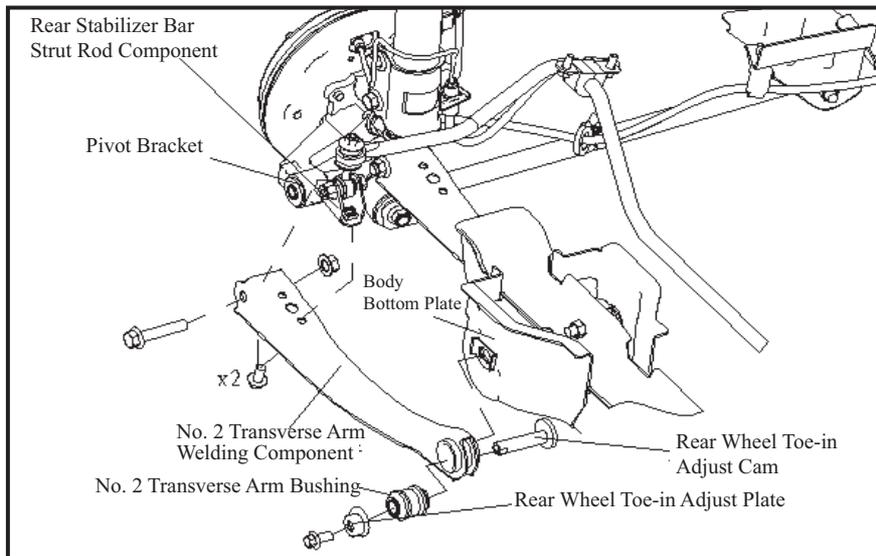
2. Install the No. 1 transverse arm assembly

- (1) The torque of the thread attaching the transverse arm to the body: 81~ 96N.m
- (2) The torque of the thread attaching the transverse arm to the rear brake assembly: 81~96N.m

3. Check the rear wheel alignment, replace it as necessary.

## Section 8 No. 2 Transverse Arm Assembly

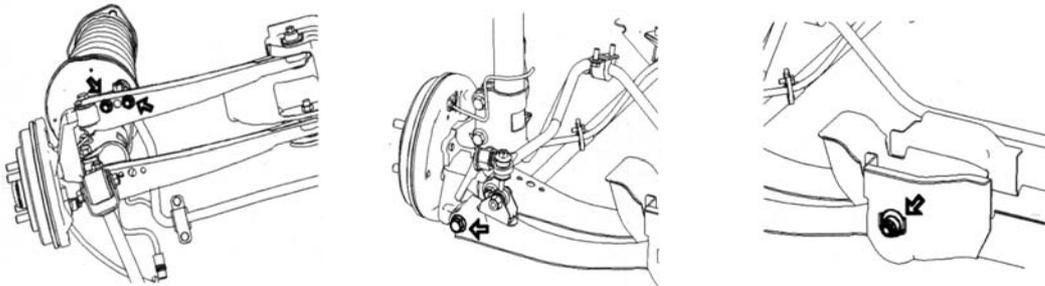
### Components



### Replacement

1. Remove the strut rod mount component

Remove the strut rod mount component bolt on the No. 2 transverse arm assembly



2. Remove transverse arm assembly No. 2

- (1) Remove the bolt connecting the No. 2 transverse arm assembly and rear brake assembly
- (2) Remove the bolt connecting the No. 2 transverse arm assembly and vehicle body, rear wheel toe-in adjust plate and rear wheel toe-adjust cam

3. Install No. 2 transverse arm assembly

- (1) Use the nut, rear wheel toe-in adjust cam, rear wheel toe-in adjust plate to attach the No. 2 transverse arm assembly to the body

- (2) Install the No. 2 transverse arm assembly to the rear brake wheel hub. Torque : 81~96N.m

- (3) Use the bolt to attach the strut rod component to the No. 2 transverse arm assembly. Torque : 22~25N.m

4. Check the rear wheel alignment, adjust it by adjusting the rear wheel toe-in adjust cam and adjust plate. After the adjustment, tighten the bolts to torque 45~55N.m

# Chapter 7 Wheel

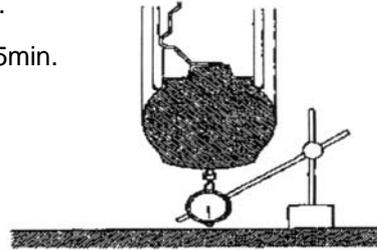
## Section 1 Tire Inspection

### Inspection

1. Check the tires for appearance and proper inflation pressure.

Check for inflation pressure after the vehicle stops for over 15min.

Tire module	Tire inflation pressure (Kpa)
175/65 R14 82H	220



2. Using a dial gauge, check the runout of tire.

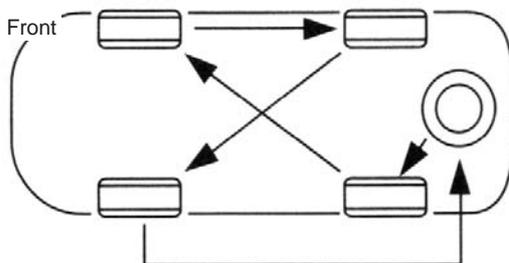
The tire runout should be no more than 3.0mm

#### Notice

- (1) You must use specified tire and special wheel rim provided by the authorized service center, otherwise it may affect the normal safe running of the vehicle and even result in accidents!
- (2) If the wheel rim is damaged, you must go to the authorized service center for service and replacement! Never use the wheel rim of any other model!

3. Changing tire position

It is recommended to change the tire for each 10000km driving. See the figure for where to change each tire



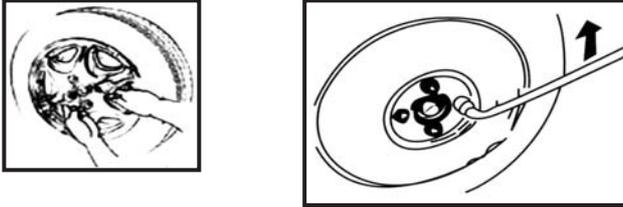
4. Inspect wheel dynamic balance

The imbalance should be no more than 8.0g. Otherwise, there will be extra vibration and noise when driving.

## Section 2 Wheel Replacement

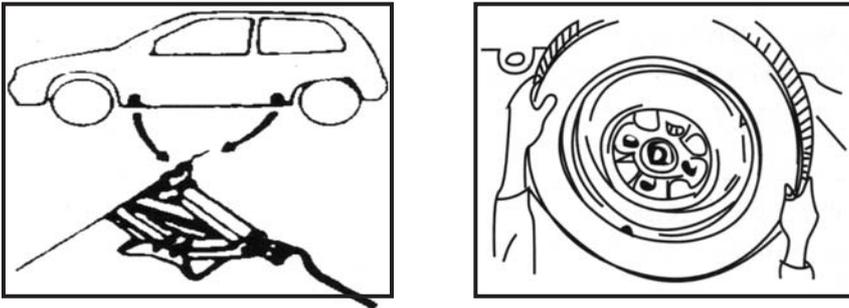
### Replacement

- (1) Pry the edge of the wheel rim trim cover with screwdriver to remove the wheel rim trim cover



- (2) Loosen every tire nut with tire nut wrench.  
(3) Four jacks support the vehicle body, two at each side as shown in the figure.

The jack should be near to the to-be-replaced wheel with solid base.



- (4) Remove the wheel nut.

Caution:

- (1) Make sure the parking brake control handle has been pulled up before jacking up the vehicle
- (2) Wheel nut torque : 95~115N.m
- (3) Check the four wheel alignment when necessary

# Chapter 8 Power Steering System

## Section 1 Power Steering System

### Power Steering System Description

Power Steering System consists of the steering wheel, steering transmit device, power steering fixed device and steering pipelines. The steering gear is rack and pinion type.

Major parameters for steering system:

Item		Parameter
Steering Wheel total revolutions		3.26
Maximum Front Wheel Turn Angle	Inner	37.6°
	Outer	33.3°
Minimum Turning Diameter		≤ 10.5m

Cautions:

#### 1. Cautions for steering system

Make sure of the correct replacement of parts, incorrect replacement might affect the performance of the steering system and lead to driving accidents.

#### 2. Cautions for SRS System

This vehicle is equipped with SRS (Supplemental Restraint System), driver side air bag and front passenger side air bag.

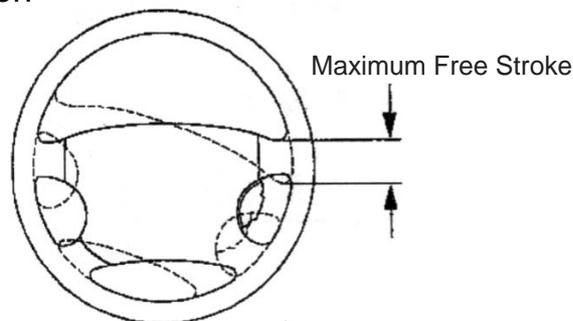
Failure to carry out service operations in the correct sequence could cause the unexpected deployment of the air bag during servicing, possibly leading to a serious accident.

## Symptom Table

The table below is helpful to find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. Repair or replace these parts or assemblies if necessary.

Symptom	Likely Cause
Heavy steering	1. Tire (improperly inflated)
	2. Power steering fluid (insufficient)
	3. Front wheel alignment (incorrect)
	4. Steering knuckle (worn)
	5. Swing arm ball stud pin joint (worn)
	6. Steering column (bent or binding)
	7. Power steering pump assembly (Worn)
	8. Power steering gear assembly (Fault)
Poor return	1. Tire (improperly inflated)
	2. Front wheel alignment (incorrect)
	3. Steering column (bent or binding)
	4. Power steering gear assembly (Oil pressure too low)
Excessive clearance and play	1. Steering knuckle (worn)
	2. Swing arm ball stud pin joint (worn)
	3. Intermediate shaft, sliding yoke (worn)
	4. Front wheel bearing (worn)
	5. Power steering gear assembly (worn)
Abnormal noise	1. Power steering pump fluid level (low)
	2. Steering system ball joint (worn)
	3. Power steering pump assembly (damaged)
	4. Power steering gear assembly (damaged)

## On-vehicle inspection



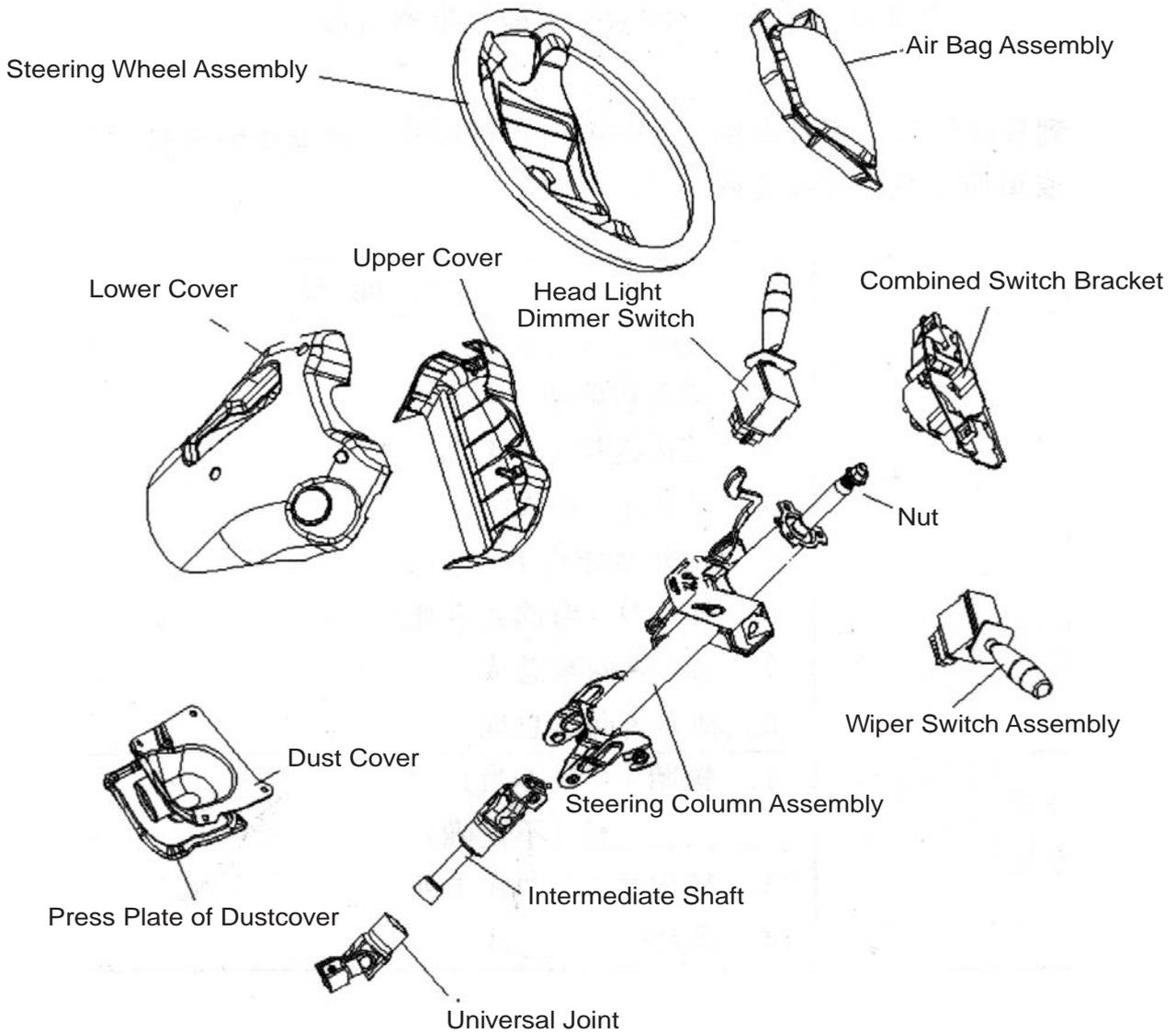
### 1. Check steering wheel free stroke

- (1) Stop vehicle and keep the tires straight ahead.
- (2) Rotate the steering wheel lightly, check the steering wheel free stroke.

Maximum free stroke: 30mm

## Section 2 Steering Drive and Control Mechanism

### Components



## Replacement

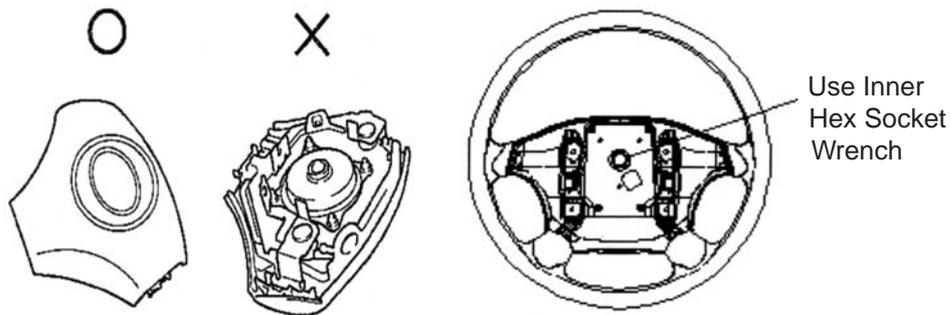
1. Cautions (refer to Steering System Cautions)
2. Make sure the wheels are placed straight ahead
3. disconnect the battery negative terminals
4. Remove the air bag assembly

Remove two screws on both sides and pull out the wiring harness connector

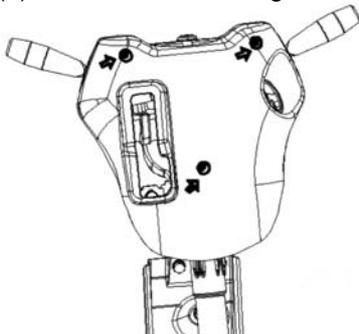
Notice: Do not pull air bag wire harness when removing the air bag assembly!

Warning:

- ◆ Make sure the upper surface of the air bag assembly is kept upward when placing it!
- ◆ Do not disassemble the air bag assembly!



5. Remove steering wheel assembly
  - (1) Remove the nut.
  - (2) Remove the steering wheel cover set bolt.
  - (3) place the matchmarks on the steering wheel and main shaft assembly.
  - (4) Use special tool to remove the steering wheel assembly.
6. Remove the steering column upper and lower cover
  - (1) Remove 3 screws.
  - (2) Remove the steering column upper and lower cover.

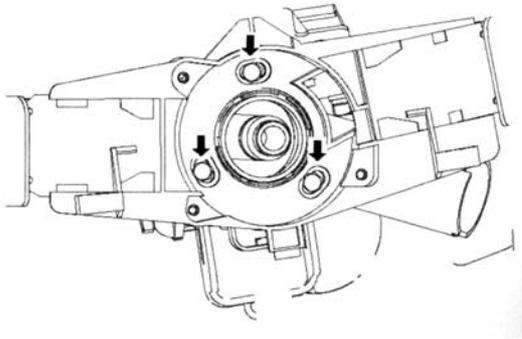


7. Remove the combination switch assembly

(1) Remove 3 set screws.

(2) Disconnect headlamp dimmer switch and wiper and washer switch wire harness

(3) Remove the combination switch assembly



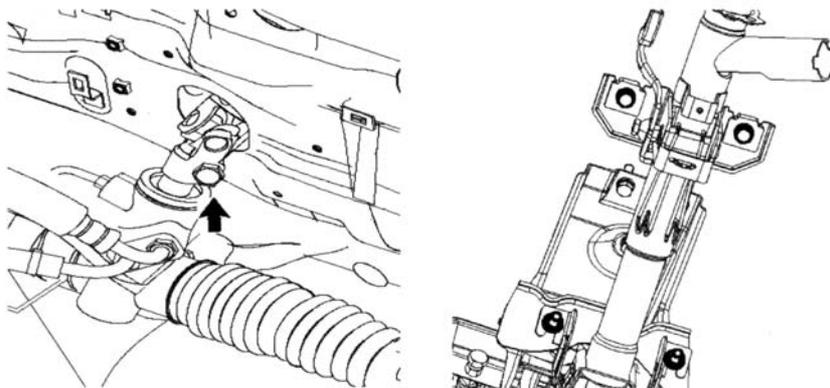
8. Disconnect the universal joint

Remove the locking bolt between the joint yoke and the power steering gear

9. Remove steering column assembly.

(1) Remove the wire harness connector on the steering column assembly

(2) Remove 2 bolts, 2 nuts and the steering column assembly



10. Remove ignition switch lock core assembly

(1) Remove the ignition switch wire harness

(2) Remove the screw, then remove the ignition switch assembly

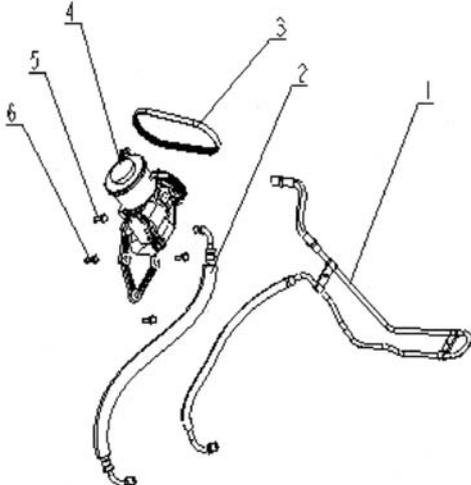
11. Complete the service or replace the steering column assembly, the installation procedure is in the reverse order of the removal

Notice:

- (1) after the installation of the ignition lock core, check the steering lock operation: the steering mechanism lock when the ignition key is pulled out; the steering mechanism unlock when the key is inserted and turned to ACC position
- (2) The torque of the 2 bolts and 2 nuts securing the steer column assembly: 16~26N.m
- (3) connect the wire harness into place and make sure the wiring is good
- (4) After properly adjust the positions of the combination switch and the steering column upper and lower cover, tighten the 3 screws attaching the combination switch and the steering column
- (5) Torque of the universal joint yoke and steering gear assembly locking bolt: 22~34N.m
- (6) Torque of the 4 set bolts of the dust cover and press plate: 16~26N.m
- (7) When installing the steering wheel assembly, align the matchmarks of the steering wheel and steering main shaft assembly,  
Torque of the steering wheel specific inner torx bolt: 40~60N.m
- (7) Check the air bag, it is not allowed to use the air bag parts from another vehicle
- (8) Check SRS warning light

## Section 3 Steering Pipeline Component

### Components



1. Power steering low pressure pipe assembly
2. Power steering high pressure pipe assembly
3. Drive belt
4. Power steering pump with bracket assembly
5. Bolts
6. Washer

## On-vehicle inspection

### 1. check the drive belt

Observe the drive belt for excessive wear and cordline wear. Replace the drive belt if necessary.

Hint: Cracks on the rib side of a belt are considered acceptable. If missing chunks from the ribs are found on the drive belt, it should be replaced.

### 2. Bleed the power steering system

(1) Check the fluid level

(2) Jack up the front of the vehicle and make sure it is safe

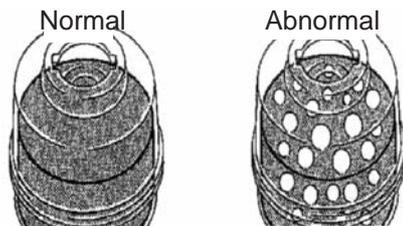
(3) Rotate the steering wheel

a. With the engine off, turn the steering wheel from LH limit position to RH limit position several times

(4) Release the jack and lower the vehicle

(5) Start the engine, run the engine at idle for a few minutes

(6) Turn the steering wheel to left or right limit position and keep it there for 2 - 3 seconds, then turn the steering wheel to the opposite limit position and keep it there for 2 - 3 seconds. Repeat it several



times.

(7) Shut off the engine, check for foaming or emulsification in the reservoir. If there is foaming or emulsification, bleed power steering system repeatedly

(8) Check the fluid level and for leakage

### 2. Check the fluid level

(1) Park the vehicle on a level surface

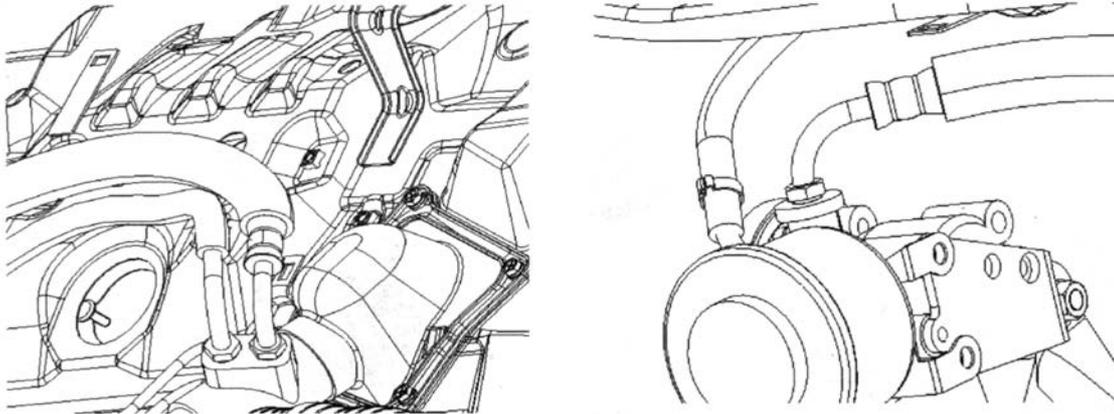
(2) With the engine stopped, check the fluid level in the reservoir. Add power steering fluid ATF DEXRON if necessary.

Hint: the fluid level should be within the range of lowest level and highest level

(3) Check for foaming or emulsification, if there is, drain the power steering system

## Replacement

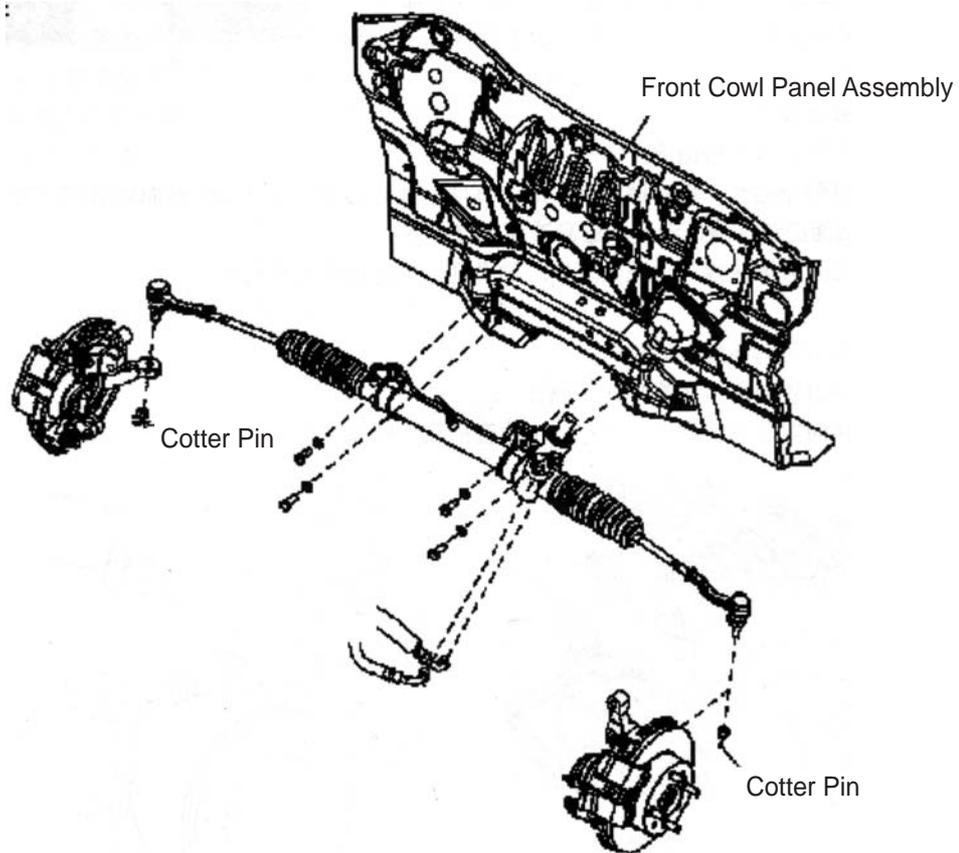
1. Drain the power steering system fluid
2. Remove the power steering high and low pressure pipe
3. Loosen the union screw of the high and low pressure pipe on the steering gear assembly, loosen the pipe clip.

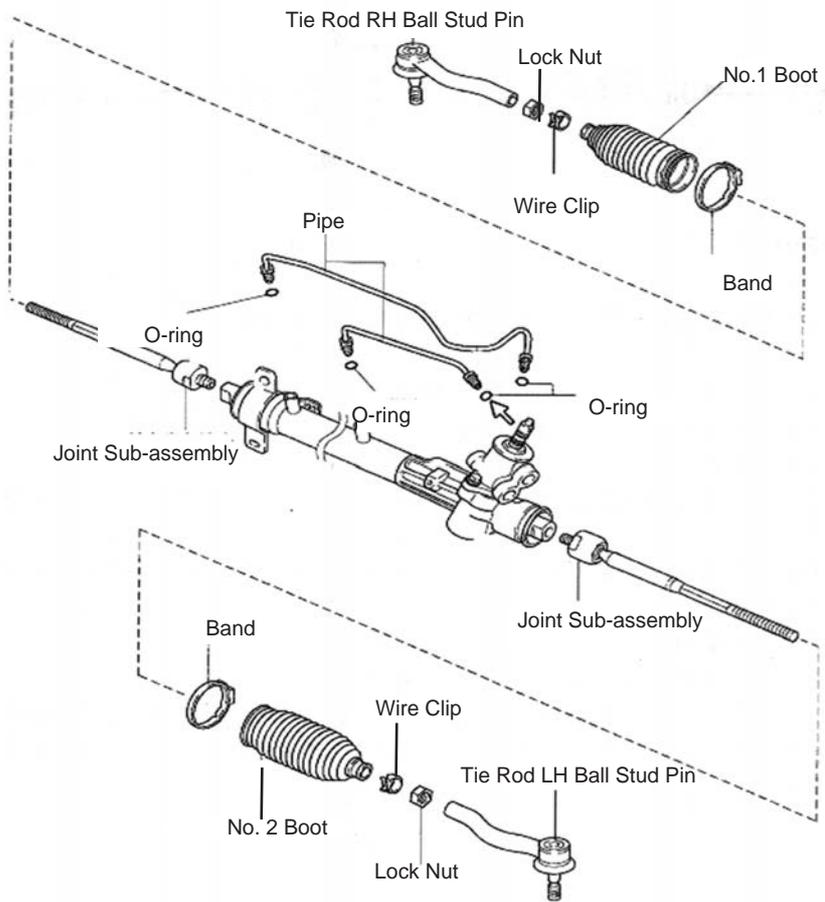


4. Loosen the drive belt
5. Remove the power steering pump with bracket assembly from the engine  
Remove the 4 attaching bolts between the steering pump belt bracket and the engine
6. Install the power steering pump bracket assembly  
Secure the power steering pump bracket assembly to the engine,  
The torque of the M10 bolt is 45~79N.m, the torque of the M8 bolt is 16~26N.m
7. Install the drive belt, make sure the installation position is correct
8. Install the power steering high and low pressure pipe
  - (1) Connect the union thread of the high and low pressure pipe to the steering gear, torque: 19~33N.m
  - (2) Use the retaining clip to secure the low pressure pipe to the cowl baffle panel of the body
  - (3) Connect the union thread of the high pressure pipe to the power steering pump, torque: 19~33N.m
  - (4) Connect the union thread of the low pressure pipe to the reservoir, torque: 19~33N.m
9. Bleed the power steering pipeline system, check the pipeline system for leakage
10. Check the oil reservoir inner fluid level

## Section 4 Power Steering Gear Retaining Device

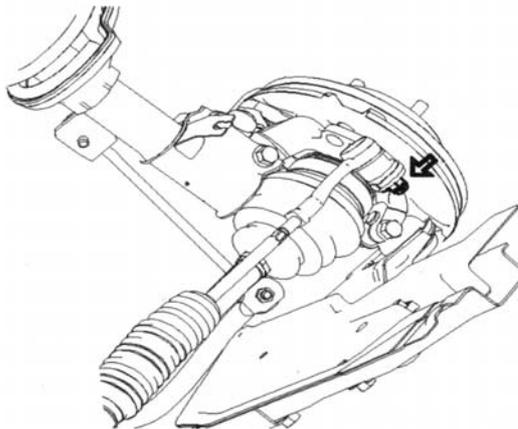
### Components





## Replacement

1. Drain the power steering system fluid
2. Separate the tie rod from the steering knuckle



- (1) Remove the cotter pin, loosen the groove type lock nut
- (2) Separate the tie rod ball stud joint from the steering knuckle taper hole

3. Loosen the union thread of the high and low pressure pipes on the steering gear assembly

4. Remove the boot band and No. 1, No. 2 boots

5. Disconnect the power steering gear assembly from the steering column

Remove the steering gear pinion shaft spline lock bolt on the universal joint yoke

6. Remove power steering gear assembly

Remove 4 steering gear assembly set bolts, remove the power steering gear assembly

7. Installation is in the reverse order of the removal

Notice:

(1) Insert the steering gear pinion shaft spline into the spline hole of the universal joint yoke, make sure that the positions of the notch of the steering gear pinion shaft and the lock bolt of the universal joint yoke are correct

(2) Secure the power steering gear with 4 bolts, torque: 63~93N.m

(3) Tighten the steering gear pinion shaft spline lock bolt on the universal joint yoke, torque: 22~34N.m

(4) Tighten the 4 set bolts of the boot band and boot torque: 16~26N.m

(5) Install the union thread of the power steering high and low pressure pipe to the power steering gear, torque: 19~33N.m

(6) Connect the tie rod ball stud pin with the steering knuckle, make sure that the mating surface of the tie rod ball stud pin and the steering knuckle is clean, tighten the slot nut, torque: 27~39N.m. Install the cotter pin, make sure of the correct installation

(7) Add appropriate amount of specified power steering fluid, bleed the power steering system

(8) Check the power steering pipeline system for leakage

(9) Check the front wheel alignment and front wheel left and right limit turn angle, adjust the toe in if necessary and tighten the tie rod lock nut

(10) Check the position of the steering wheel. It is required that the steering wheel spokes are basically symmetrical when the vehicle is driven straight ahead, reassemble the steering wheel if necessary

# Chapter 9 Brake System

## Section 1 Brake System

### Precaution

1. It's very important to keep the parts and area clean when repairing the brake system.
2. Care must be taken to replace each part properly as it could affect the performance of the brake system and result in a driving hazard.
3. Do not let brake fluid remain on a painted surface when repairing any parts. Wash it off immediately.
4. If any work is done on the brake system or air in the brake pipelines is suspected, bleed the system of air.
5. Check the brake system for leakage after repairing the brake system.
6. Use specified brake fluid. Do not mix with other brand of brake fluid.

### Problem symptoms table

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

Symptom	Cause
Low Brake Pedal	1. Brake system (fluid leaks)
	2. Brake system (air in)
	3. Piston Cup in Sub-pump (worn or damaged)
	4. Rear brake shoe clearance (out of adjustment)
	5. Master cylinder (faulty)
	6. Booster push rod (out of adjustment)
	7. Brake shoe or lining (oily)
	8. Disc/Drum scratched
Brake Stagnation	1. Brake pedal free stroke is too small
	2. Parking brake lever stroke (out of adjustment)
	3. Parking brake cable (sticking)
	4. Rear brake shoe clearance (out of adjustment)
	5. Brake pad or lining (cracked or distorted)
	6. Wheel cylinder piston (stuck or frozen)
	7. Return spring (faulty)
	8. Vacuum booster (faulty)
	9. Brake master cylinder (faulty)

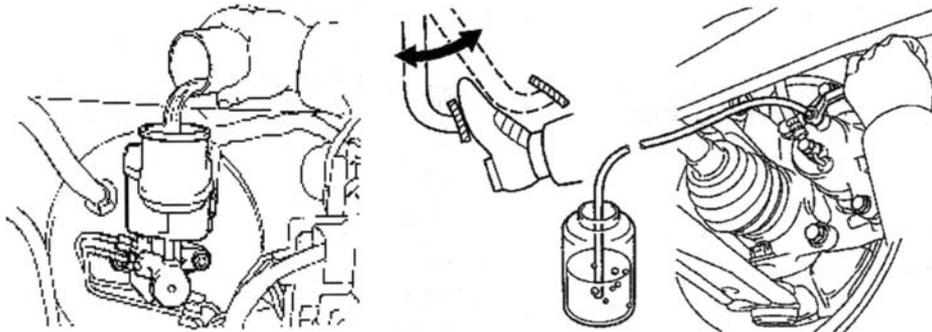
Symptom	Suspect area
Brake Deviation	1. Wheel cylinder piston (stuck)
	2. Brake shoe lining (oily)
	3. Disc (scratched)
	4. Brake shoes or lining (cracked or distorted)
	5. Wheel hub bearing (worn or damaged)
	Tire pressure (not as specified)
Noise from brake	1. Brake shoe lining (damaged)
	2. Installation bolt (loose)
	3. Disc (scratched)
	4. Brake shoe (bad in quality)
	5. Brake shoes lining (oily)
	6. Sound isolating shim damaged
	7. Hold spring of brake shoe (damage)

## Section 2 Brake Fluid

### Bleeding

1. Fill brake reservoir with brake fluid

Brake fluid: JG4 GB10830



2. Bleed brake pipeline system

- (1) Connect the vinyl pipe to the wheel cylinder bleeder plug port
- (2) Depress the brake pedal several times, and then loosen the bleeder plug with the pedal held down.
- (3) At the point when fluid stops flowing out, tighten the bleeder plug, and then release the brake pedal.
- (4) Repeat (2) and (3) until all the air in the fluid has been bled out.
- (5) Repeat the above procedure to bleed the brake pipeline of the air for each wheel cylinder.

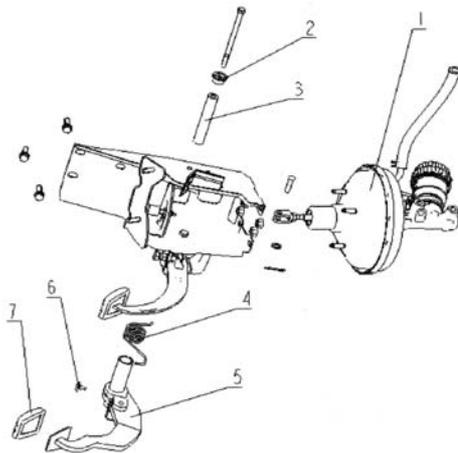
Notice: Fill brake fluid into the reservoir all the time when bleeding.

3. Check fluid level in reservoir

Check the fluid level and fill fluid if necessary.

## Section 3 Brake Pedal

### Components



1. Vacuum Booster Assembly
2. Liner
3. Spacer
4. Torsion Spring
5. Brake Pedal Arm
6. Cushion Gasket
7. Brake Pedal Mat

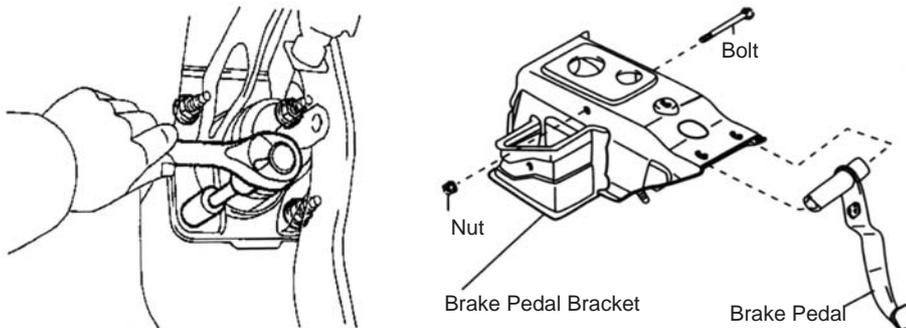
### Replacement:

1. Separate the vacuum booster with brake master cylinder assembly

Remove the cotter pin, flat washer and pivot, separate the vacuum booster with brake master cylinder assembly from the brake pedal

2. Remove the clutch and brake pedal assembly

- (1) Remove 4 nuts connecting the vacuum booster with brake master cylinder assembly and brake pedal support bracket.
- (2) Remove 3 bolts connecting the clutch and brake pedal assembly and front cowl panel cross member. Remove the clutch and brake pedal assembly.



3. Remove the brake pedal

Remove the bolt and nut, Torsion Spring, liner, brake pedal arm assembly, spacer

4. Remove the brake pedal arm assembly

Remove brake pedal mat and cushion gasket from the brake pedal arm.

5. The installation is in the reverse order of removal.

### Notice:

- (1) Apply No 3 molybdenum disulphide lithium base grease to the relatively moving faces.
- (2) After assembling the brake pedal and the brake pedal support bracket, make sure the brake pedal can turn freely.

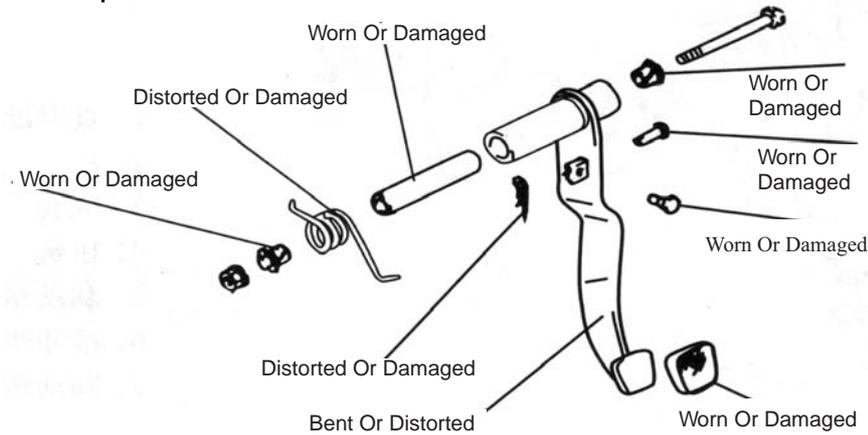
(3) The 3 bolts connecting the brake pedal support bracket and cowl panel cross member

Torque : 16-20N.m

(4) The 4 bolts connecting the brake pedal support bracket and the vacuum booster with brake master cylinder assembly

Torque: 16-20N.m

## Check the brake pedal



### 1. Check and adjust brake pedal height

(a) Brake pedal height from the ground: normal height is 176~181 mm.

(b) Adjust brake pedal height

(1) Loosen the brake lamp switch lock nut

(2) Adjust the brake lamp switch to the right position

(3) Check the brake lamp switch

Make sure the brake lamp is light by depressing the brake pedal for 5~15mm

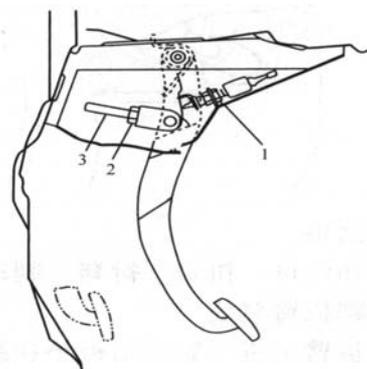
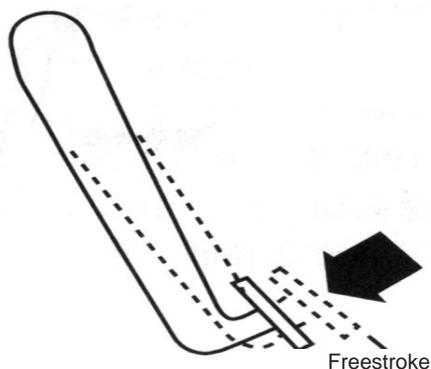
(4) Tighten the brake lamp switch lock nut

### 2. Check pedal freestroke

(1) Shut off the engine and depress the brake pedal several times until there is no more vacuum left in the booster.

(2) Depress the pedal until the resistance begins to be felt

Pedal freestroke should be: 10~30mm



## Section 4 Vacuum Booster with Brake Master Cylinder Assembly

Notice: The vacuum booster with brake master cylinder assembly must be repaired by manufacturer. Replace it if it is faulty.

### On-vehicle inspection

#### 1. Check vacuum booster

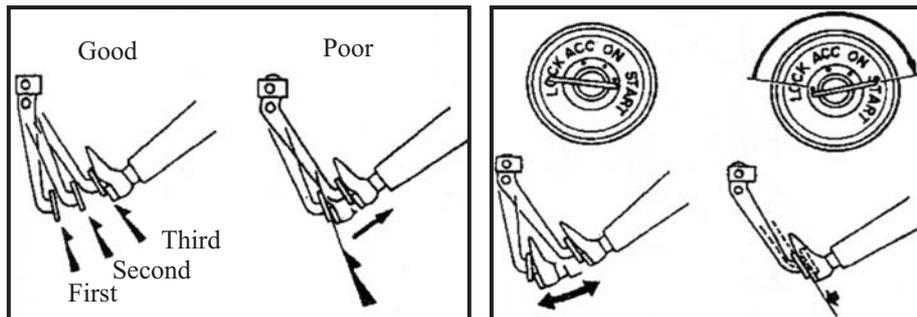
##### (a) Air tightness check

(1) start the engine, run 1 or 2 minutes then shut off. Depress the brake pedal several times slightly.

Hint: if the pedal rises gradually after depressing the pedal, the booster is airtight.

(2) Depress the brake pedal while the engine is running, and stop the engine with the pedal depressed.

Hint: if there is no change in the pedal reserve stroke after holding the pedal for 30 seconds, the booster is air--tight.



##### (b) Operating check

Depress the brake pedal and start the engine. If the pedal goes down slightly, operation is normal.

#### 2. Check the vacuum check valve

(1) Remove the connecting pipe with the check valve

(2) Check the direction from the booster to the engine. Check valve for ventilation. It should not ventilate in the reverse order.

(3) Replace it if it is faulty.

Notice: Pay attention to the matchmark on the connecting hose when connecting the hose with vacuum check valve. Do not install it in reverse order.

### Replacement

1. Remove the brake pipe on the brake master cylinder (master cylinder)

2. Refer to Brake Pedal Replacement for other operation

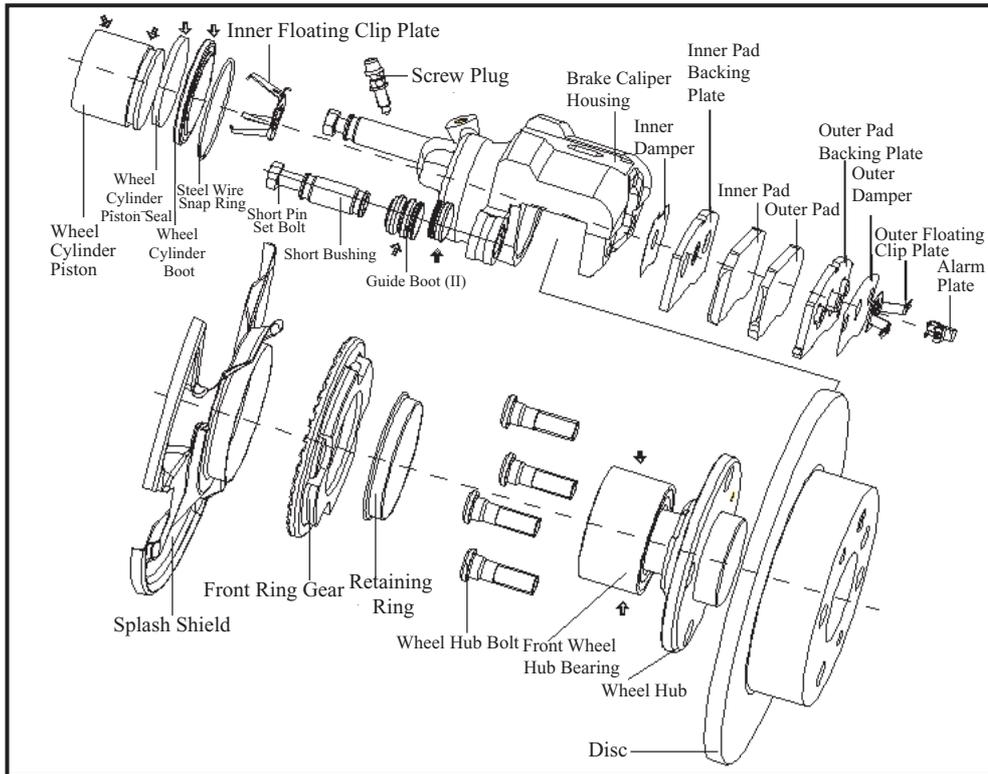
Notice:

(1) The torque of the union thread on the brake master cylinder (master cylinder ) and brake pipe: 12-16 N.m

(2) Bleed all the air in the brake system after installation

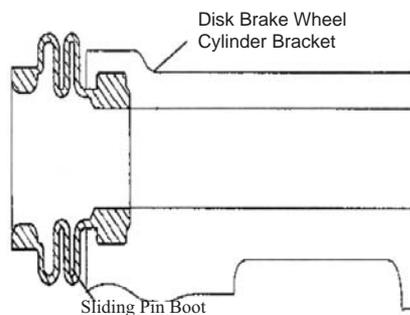
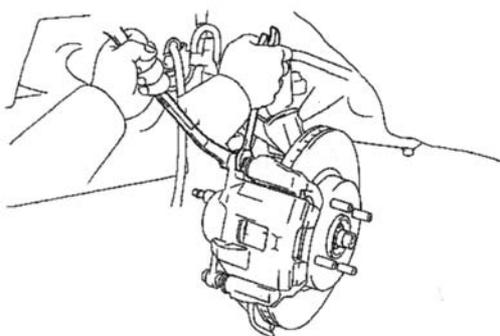
# Section 5 Front Brake Assembly

## Components



## Repairing

1. Remove the front wheel
2. Drain the brake fluid. Remove the brake hose
3. Remove the front brake caliper
  - (1) Remove the brake hose union thread from the front brake cylinder. Disconnect the hose
  - (2) Remove 2 installing bolts



4. Remove the front brake pad
5. Remove the front left disc caliper
6. Remove the sliding pin boot

Remove 2 boots from the brake cylinder support bracket.

7. Remove the brake cylinder guide boot

Remove the clip and boot with screwdriver.



8. Remove the bleeder screw

9. Remove the front brake piston

(1) Put a piece of soft cloth between the brake cylinder and piston.

(2) Blow the piston out from the brake cylinder with the compressed air

**Notice:** Be careful not to put your finger in front of the piston when blowing the compressed air. Be careful of the splashed brake fluid

10. Remove the piston oil seal

Remove the oil seal from the brake cylinder with a screwdriver



11. Check the brake cylinder and piston

Check the cylinder wall and piston for rust and damage

12. Check the thickness of the brake pad

Measure the thickness with a ruler: Standard thickness: 10mm,  
Minimum thickness: 1mm

13. Check the front brake alarm plate

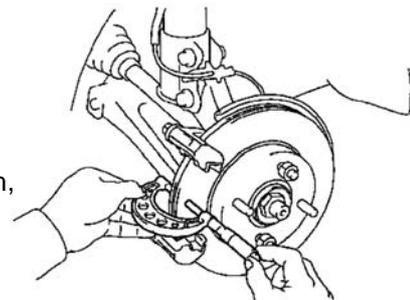
Make sure the alarm plate has enough elasticity, and is not cracked or worn. Clean all rust, dirt and foreign materials

14. Check disc thickness

Measure the disc thickness with micrometer:

Standard thickness: 11mm

Minimum thickness: 10mm



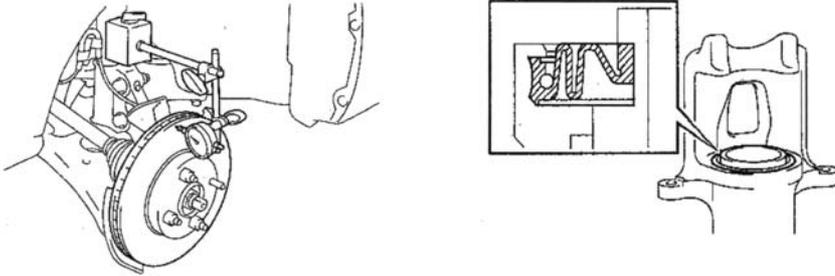
floating

15. Remove the front disc

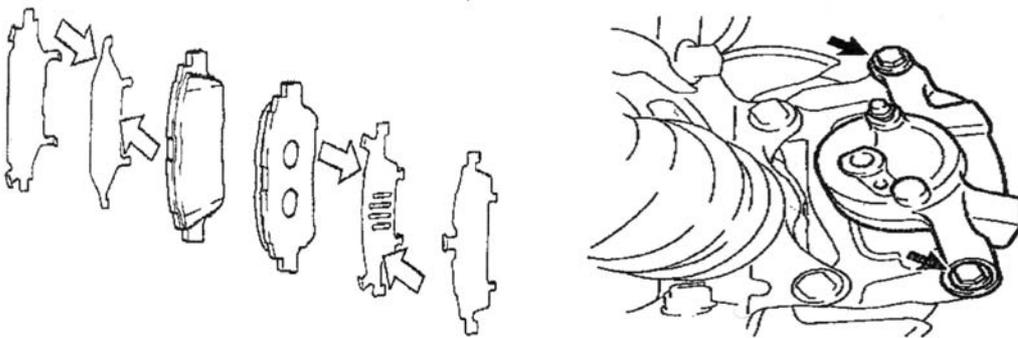
16. Installation is in the reverse order of the above-mentioned procedure

Notice:

- (1) The maximum lateral runout of the disc surface should be no more than 0.05mm (Measured 10mm from the brake disc outside edge)



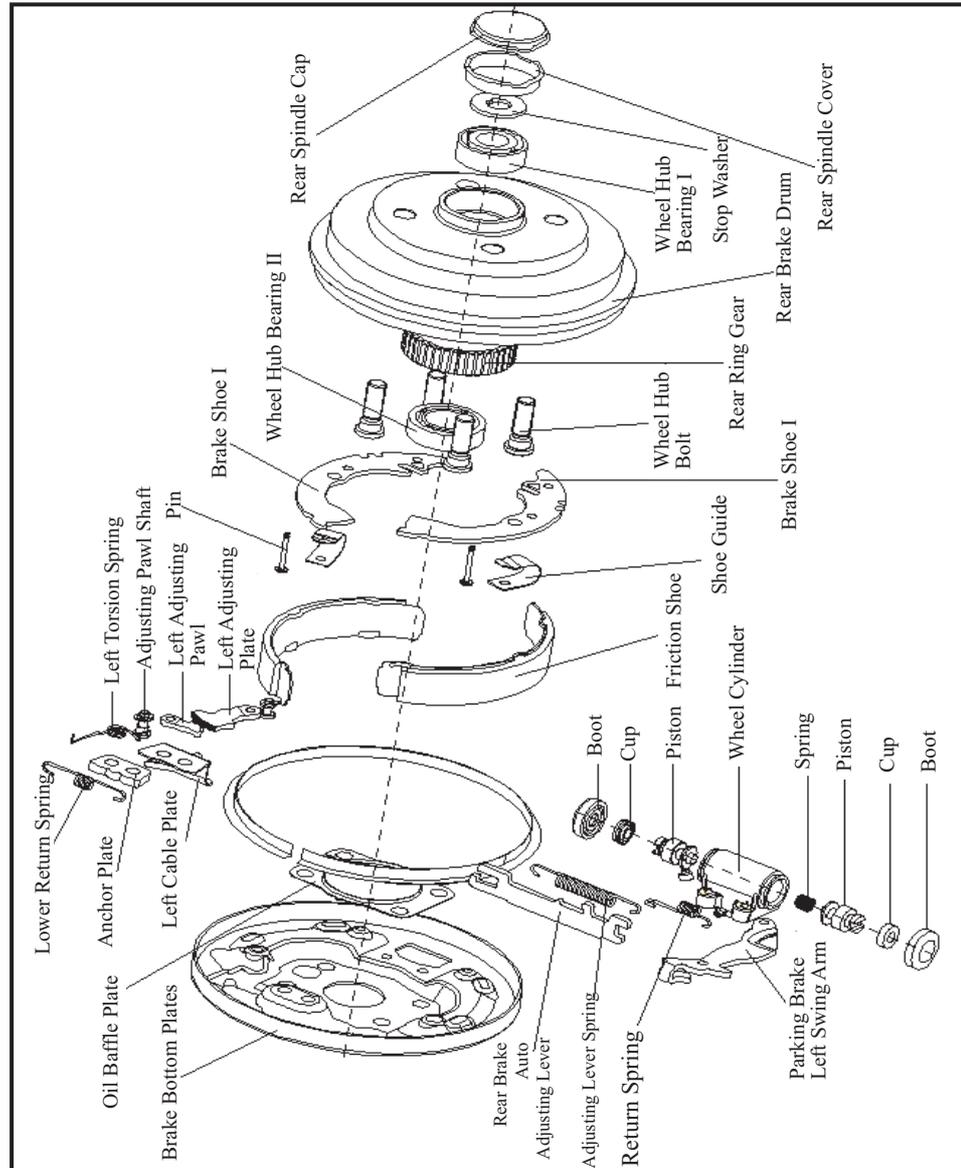
- (2) Be careful not to install the brake cylinder guide boot in the reverse direction
- (3) Make sure the cylinder and the piston oil seal are clean before installing the piston oil seal in the brake cylinder. Apply lithium soap base glycol grease to the piston surface. Never rotate the piston into the brake cylinder by force.
- (4) Install the brake caliper to tighten the bolt torque: 85~90 N.m
- (5) Replace the noise insulator when replacing the worn brake pad. Make sure the clip plate is in normal status. Otherwise, replace the floating clip plate simultaneously.
- (6) Make sure the brake pad and disc surface are clean. Oil or grease is not attached.



- (7) Install the brake hose. Union thread torque: 16~20N.m
- (8) Bleed the air in the brake system. Check the brake system for leakage.
- (9) Install the front wheel. The tire nut torque: 95~115 N.m

## Section 6 Rear Brake

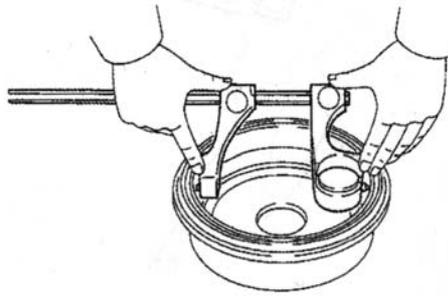
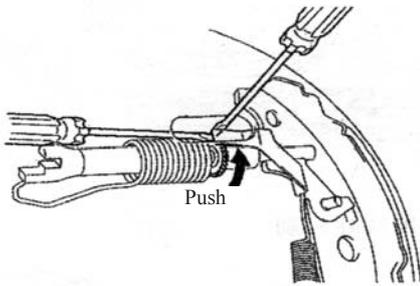
### Components



### Repairing

1. Remove rear wheel
2. Drain the brake fluid
3. Remove the brake drum
  - (1) loose the parking brake handle
  - (2) Remove the cotter pin with a long nose pliers
  - (3) loose the spindle slot nut

(4) remove the brake drum



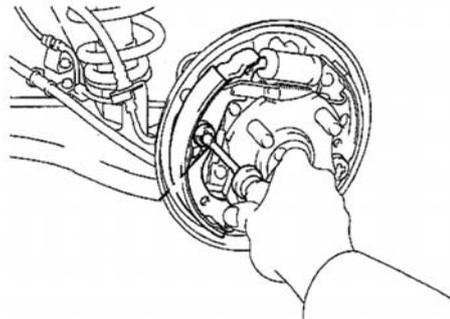
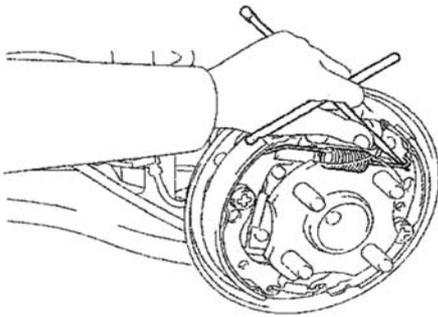
4. Measure brake drum inside diameter

Standard inside diameter: 180mm

Maximum inside diameter: 181mm

5. Separate the parking brake left swing arm. Loose the parking brake cable end joint

Separate the parking brake left swing arm. Remove the parking brake cable end joint with a screwdriver.



6. Remove the brake shoe I, brake shoe II

(1) using special tool, remove brake shoe positioning spring and pin

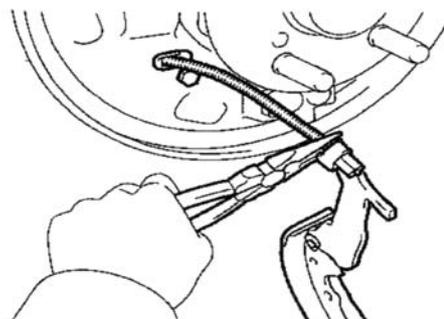
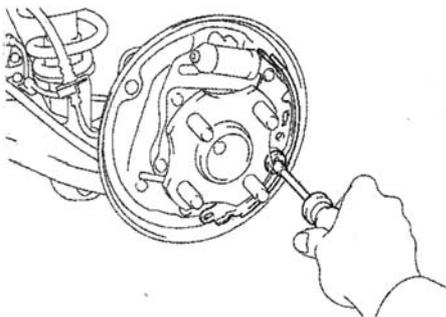
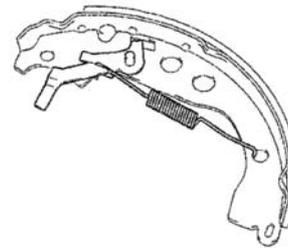
(2) remove brake shoe I and I after separating the return spring

7. Remove the rear brake automatic adjustment lever

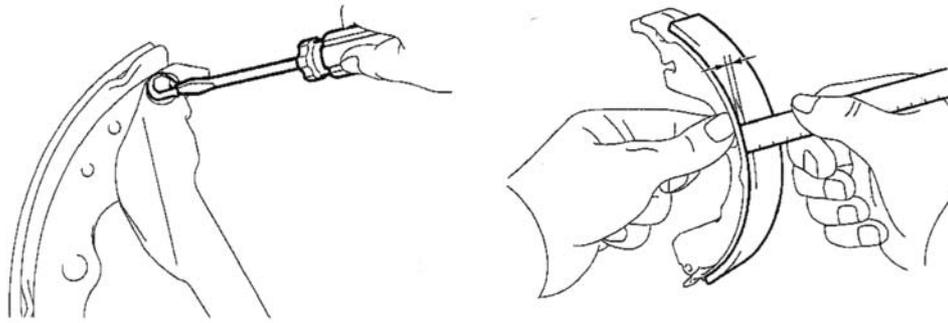
Remove the brake adjustment lever spring and adjustment lever

8. Remove the return spring on the brake shoe

Remove the return spring from the brake shoe



9. Remove the parking brake lever accessory



10. Inspect shoe lining thickness

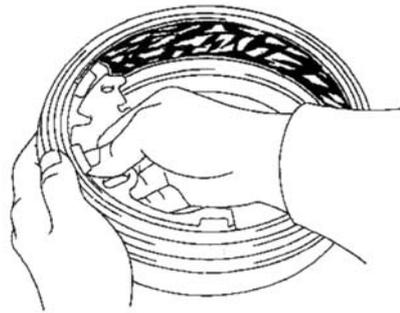
Standard thickness: 4.0mm

Minimum thickness: 1.0mm

Replace the shoe if the lining thickness is less than the minimum or seriously worn.

11. Inspect brake drum and brake shoe lining for proper contact

If the contact between brake drum and shoe lining is improper, repair the lining with a brake shoe grinder or replace the brake shoe.



12. Check brake wheel cylinder

Check the cylinder wall, piston cup for damage

13. Install brake wheel cylinder accessory

(1) Apply lithium soap base glycol grease to 2 brake wheel cylinder cups and pistons

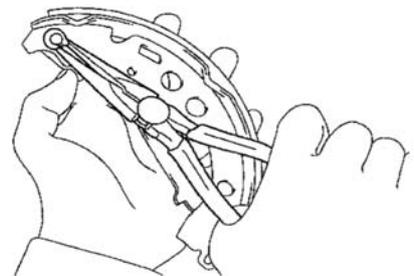
(2) Replace two new cups and boots

14. Install the brake wheel cylinder

Brake wheel cylinder set bolt torque: 9~13 N.m

15. Apply high temperature grease

Apply high temperature grease to the contact surface of anchor plate hole and pin. Smear a thin layer grease to back plate.

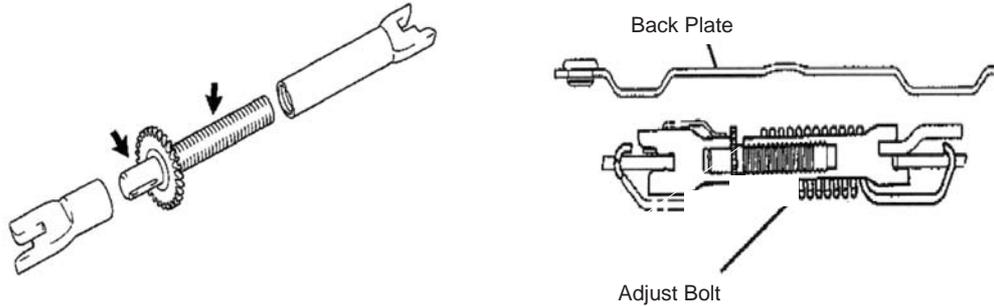


16. Install parking brake swing arm and other accessories

17. Install brake shoe I, II

18. Install brake shoe return spring

19. Install rear brake clearance automatic adjustment lever



20. Adjust the installing position of the brake shoe → install the brake drum

21. Fill the brake fluid

22. Bleed the air in the brake system

23. Check the fluid level in the reservoir

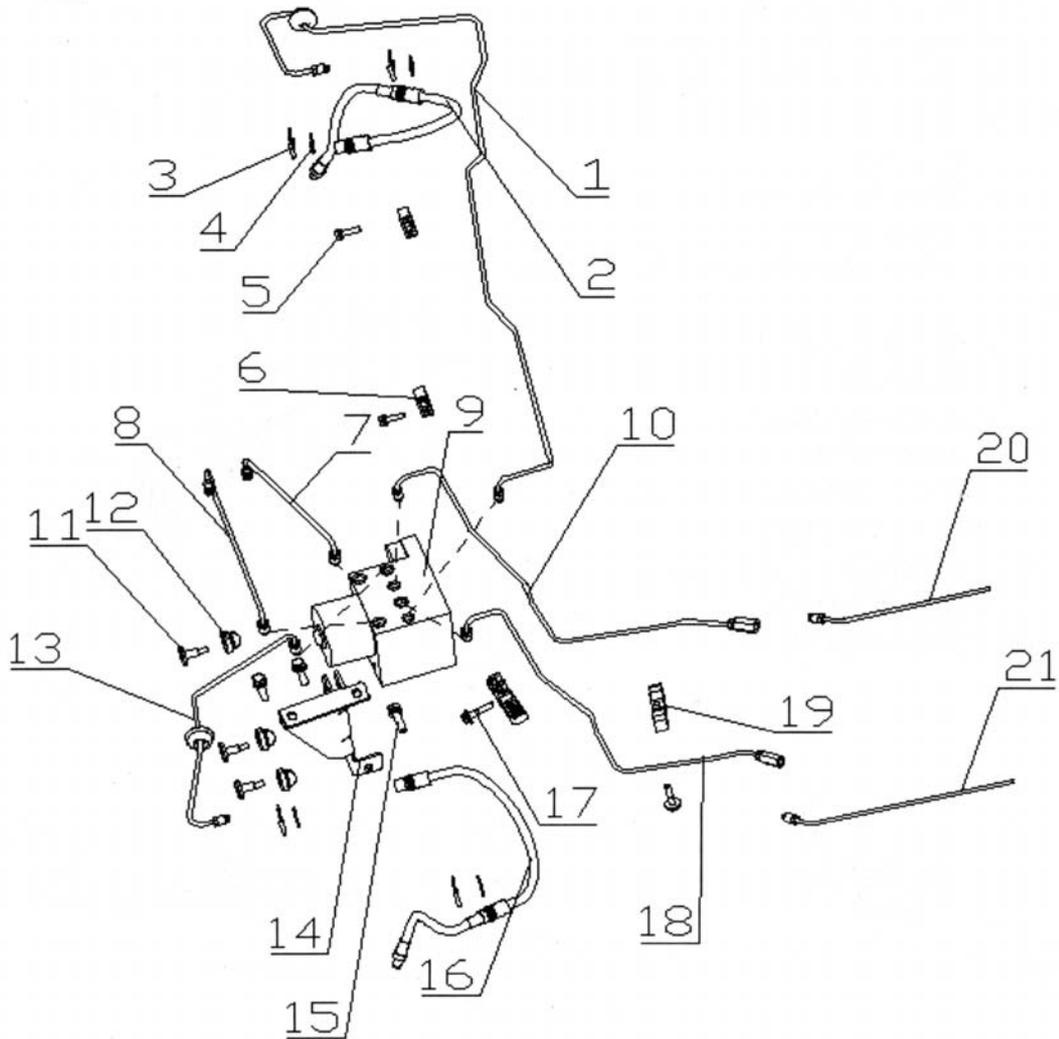
24. Check the brake fluid for leakage

25. Install the rear tire, tire nut torque: 95~115 N.m

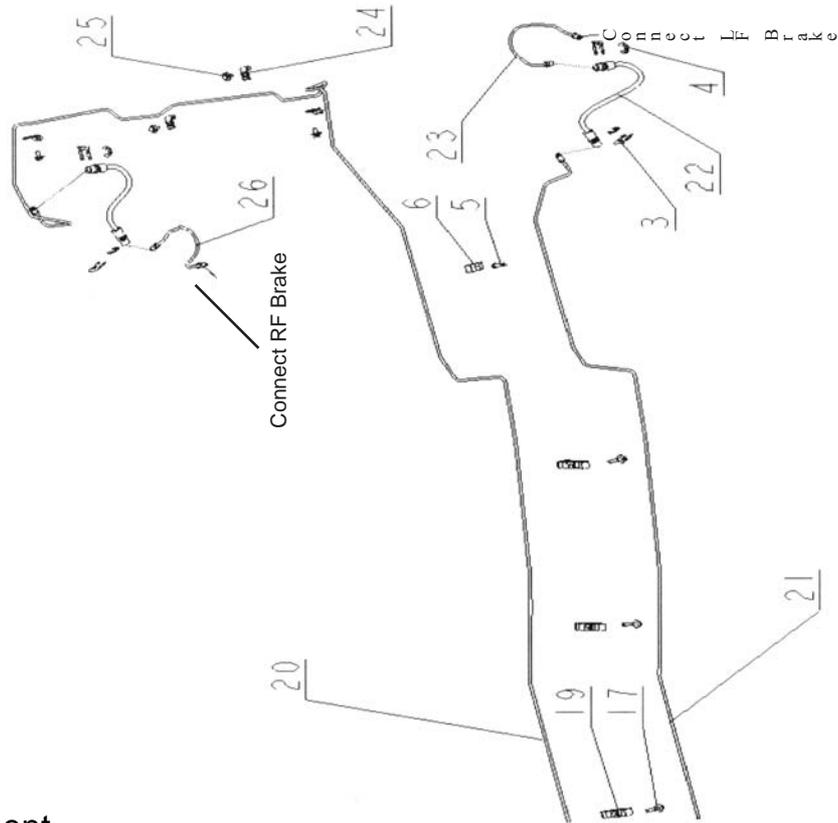
26. Check parking brake operating handle. Check the parking brake control handle stroke and adjust if necessary. (See parking brake system)

## Section 7 Brake Line

### Components

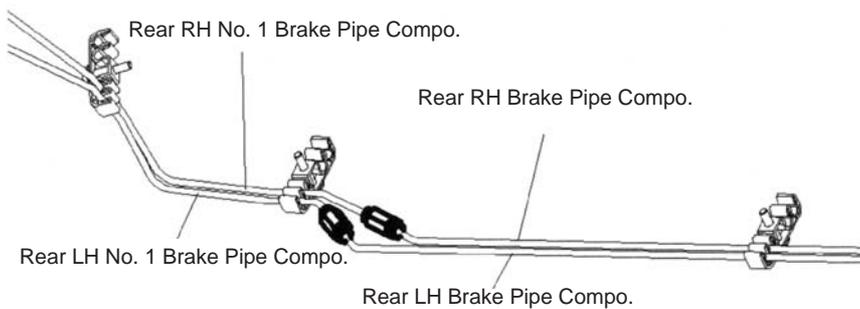


1. RF Brake Pipe Compo    2. Front Brake Hose Assembly    3. L-shaped spring Clip    4. U-shaped Clip  
 5. Hex Bolt Spring Washer and Flat Washer Compo    6. 5-pipe Clip    7. Brake Master Cylinder to Controller No.1 Brake Pipe Compo.  
 8. Brake Master Cylinder to Controller No.2 Brake Pipe Set    9. HECU controller assembly    10. RR No. 1 Brake Pipe Compo.    11. Bolt    12. Insulator  
 13. LF Brake Pipe Compo.    14. HECU Controller Bracket Assembly    15. Hexagon Bolt Spring Washer and Plate Washer Compo.  
 17. Hex Bolt Spring Washer and Flat Washer Compo.    18. LR No. 1 Brake Pipe Compo.    19. 5-Pipe Clip    20. RR Brake Pipe Compo.    21. RL Brake Pipe Compo.  
 22. Rear brake Hose Assembly    23. Rear brake No. 3 Brake Pipe Compo.    24: Single Tube Clip  
 25. Hexagon Bolt Spring Washer and Big Flat Washer Compo.    26. Rear Brake No. 4 Brake Pipe Compo.

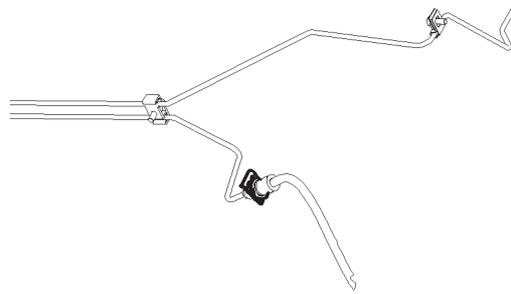
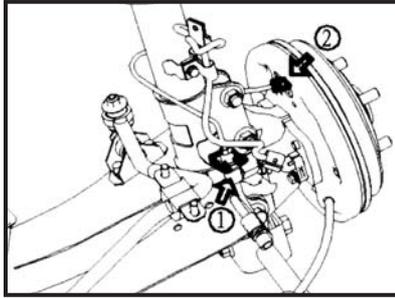


## Replacement

1. Drain the brake fluid in the brake pipeline
2. Separate rear left, right brake pipe compo.
  - (1) Loose union thread. Separate the rear left brake pipe compo. and rear left No. 1 brake pipe compo.
  - (2) Loose union thread. Separate the rear right brake pipe compo. and rear right No. 1 brake pipe compo.



3. Remove the rear brake pipe No 3 & 4 compo.
  - (1) Loose the union thread connecting the hose. Remove E-shaped clip on the pipe bracket. Separate the brake pipe.
  - (2) Remove pipe No. 3 & 4 compo.



4. Remove the rear brake hose compo.

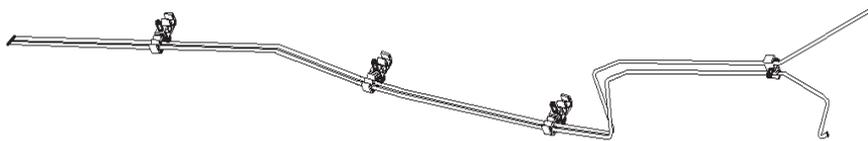
Loose the union thread that connects the rear brake hose to LR and RR brake pipe compo., remove the E-shaped clip on the hose support bracket. Remove the rear brake hose compo.

5. Remove rear left, right brake pipe compo.

(1) Remove a dual tube clip

(2) Remove three 5-pipe clips

(3) Remove rear left, right brake pipe compo.

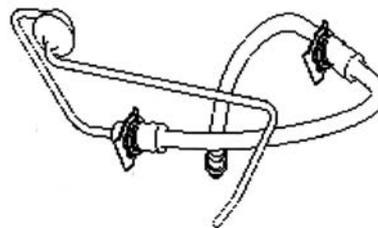
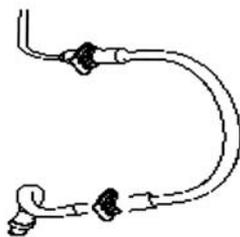


6. Remove front brake hose assembly

(1) Loose the union thread that connects the front brake hose to LR and RR brake pipe

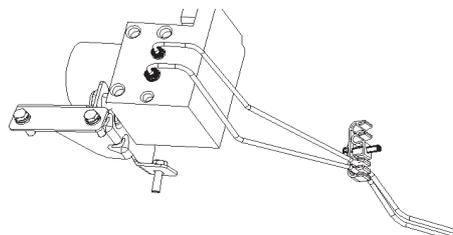
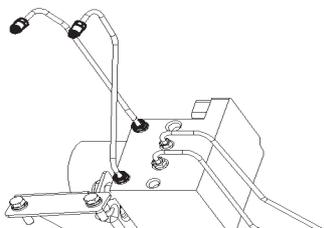
(2) Remove E-shaped clip on the hose bracket

(3) Loose the union thread that connects the front brake hose to the front brake. Remove the front brake hose assembly from the front brake



7. Remove the front left, front right brake pipe compo.

8. Remove the No. 1 & 2 brake pipe compo. which connect the brake master cylinder to HECU controller



9. Remove rear left, right brake pipe No 1 compo.

Loose the union thread that connects the brake pipe compo to HECU controller (ABS module)

10. Separate HECU controller assembly wire harness

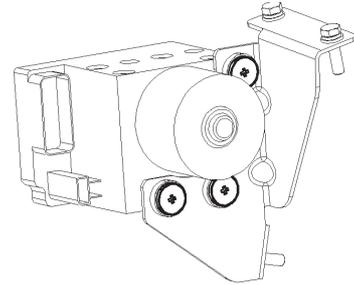
11. Remove HECU controller bracket

Remove the 3 hex bolts connecting the bracket and the body

12. Remove HECU controller assembly from the bracket

Using special wrench, remove 3 inner torx bolts and insulator

13. Installation is in the reverse order of the procedure above



Notice:

(1) The HECU controller bracket to body bolt torque: 20~25N.m

(2) Hose and pipe union thread torque: 12~16N.m

(3) All the hose, pipe should be fixed. The distorted clamp and E-shaped clip should be replaced. Never interfere the hoses and pipes with other parts.

(4) Bleed the brake system

(5) Check the pipeline and the pipe union for leakage

(6) Inspect HECU control system with ABS diagnosis tester

## Section 8 Parking Brake System

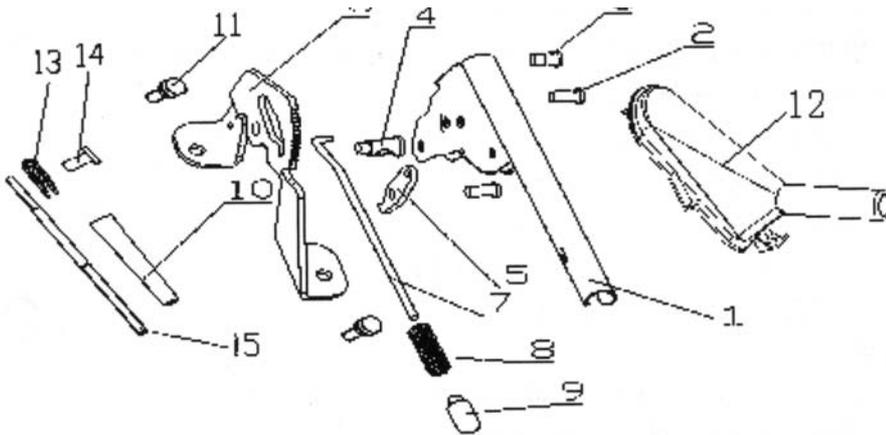
### Problem symptoms table

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

Symptom	Suspect area
Brake Stagnation	1. Parking brake handle (out of adjustment)
	2. Parking brake cable (stuck)
	3. Parking brake shoe clearance (out of adjustment)
	4. Parking brake shoes lining (cracked or distortion)
	5. Return or tension spring (damaged)

### Parking brake operating handle

#### Components



1. Parking Brake Handle    2. Flat-headed Rivet    3. Pin Shaft    4. Flat-headed Rivet    5. Parking Ratchet Pawl    6. Ratchet Plate    7. Connecting Lever    8. Return Spring    9. Plastic Bush  
 10. Adjusting Nut    11. Hex Bolt Spring Washer Compo.    12. Control Lever Boot Assembly  
 13. Equalizer    14. Flat-headed Rivet    15. Adjusting Bolt

#### Adjustment

1. Check the parking brake handle stroke

Parking brake handle stroke: the vehicle is in reliable brake when pulling the parking brake handle up to 4~7 clicks and the brake lamp is ON. The maximum control force should be no more than 196N.

The wheel can turn freely when fully releasing the parking brake handle. Otherwise, please adjust it.

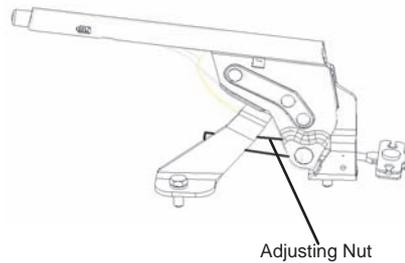
2. Parking brake handle stroke

(1) Remove parking brake handle bushing

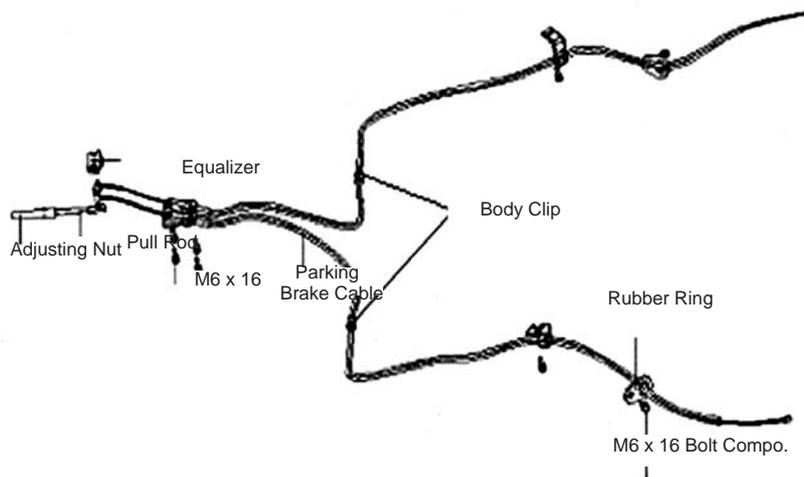
(2) Remove the rear auxiliary console assembly

(3) Turn the adjusting nut to the right position and make sure the brake handle stroke is as specified

- (4) Install auxiliary console rear assembly
- (5) install the parking brake handle bushing



### Parking brake cable Components



### Replacement

1. Remove parking brake control lever boot
2. Remove auxiliary console rear assembly
3. Remove left, right parking brake cable assembly
  - (1) loose the adjusting nut. Separate left, right parking brake cable and parking brake control lever assembly
  - (2) remove parking brake cable retaining clip
  - (3) remove the rear wheel
  - (4) remove the brake drum
  - (5) remove the parking brake cable from parking brake swing arm in the rear brake
4. Install the left, right parking brake cable assembly in the reverse order of the removal
 

Notice: check the parking brake handle stroke. Re-adjust the parking brake handle stroke as specified in adjustment.

# Part III Electrical Equipment

## Chapter 1 Survey

This part refers to the electrical repair of the Free Cruiser, and analyzes the faults from every system. Then some practicable diagnosis procedure and repair ways are given.

### I. HAND-HELD TESTER

1. Before the tester is used, a through reading of the Tester Operation Manual is commended.
2. Connect the tester to the diagnosis interface with a wire. Turn the ignition switch ON. At this time, if the tester and ECU control system cannot communicate, the vehicle or the tester may have faults.
  - (1) Connect the tester lead wire to another vehicle. If the communication is normal, inspect the vehicle diagnosis Busline or power supply circuit.
  - (2) If it still cannot communicate when connecting to the other vehicles, it may have faults on tester itself. Consult the self-inspecting procedure described on the Tester Operation Manual

### II. HOW TO PROCEED WITH TROUBLESHOOTING

The basic operation procedure for troubleshooting is as follows.

1. Customer fault analysis
  - (a) Ask the customer for the conditions and environment when faults happen.
2. Confirm the fault symptoms, and check the DTCs and storage data.
  - (a) Check the battery positive voltage (Voltage: 10 - 14V when the engine is stopped.)
  - (b) Inspect the harness, connector and fuse for open and short, etc. by their appearance.
  - (c) Warm up the engine temperature to the normal operation temperature.
  - (d) Confirm the fault symptoms and check the DTCs.
  - (e) Confirm the test procedure for the parts or systems that need checking.
3. Circuit or part inspection
4. Repair
5. Test for checking
  - (a) After the repair is completed, verify if the fault has been removed.

(If the fault has not appeared yet, a verifying test should be done under the same conditions and environment when the fault first occurred.)

### III. CUSTOMER FAULT ANALYSIS

#### NOTES:

1. When the troubleshooting analysis is underway, make sure to confirm the fault symptom correctly. Remove kinds of suppositions in order to make an exact judgment. In order to find out what on earth the fault is, it is extremely important to ask customers about the fault symptoms and the conditions when faults occurred.
2. The 5 items below are the key points to analyze. Those faults that were considered irrelevant and the repair history, etc are sometimes helpful. Therefore, try your best to collect relevant information, and find out the relationship between the information you collected and the present information, in order to make reference in troubleshooting.

Key points of the Customer fault analysis:

- ① Vehicle model, system name
- ② Date, time, frequency fault occurs
- ③ Pavement conditions
- ④ Running performance, driving and weather conditions
- ⑤ Fault symptom

### IV. FAULT SYMPTOM AND DTCS

#### NOTES:

1. The diagnosis system of the Free Cruiser possesses many features. The first important feature is the DTC Checking. Input a fault from the ECU signal circuit in the form of code, and store it into the ECU memory. The other feature is Input Signal Inspection. Inspect if the signals from different switches are correctly inputted into the ECU. These features can quickly narrow the range of troubleshooting, to make an efficient troubleshooting analysis. In the model of Free Cruiser, the systems below all possess the diagnosis feature.

- ① EFI system
- ② ABS system
- ③ Supplemental Restraint System (SRS)

2. When a DTC is checked, the very important point is: make sure if the fault shown by a DTC still exists, but is normal now. In addition, when checking the fault symptom, you must check if there is direct relationship between the fault shown by the DTC and the fault symptom. Therefore, the DTC should be checked before and after confirming the fault symptom in order to confirm the present conditions. If you do not do so, it is possible to make some unnecessary troubleshooting analysis on normal systems in some certain circumstances, thus making it more difficult to locate the fault or repair according to the fault. So, a DTC check should be done by a normal procedure.

3. The procedure below shows how to make a troubleshooting analysis by checking a DTC and how to make efficient use of DTC check. Then carefully check the result, make a troubleshooting analysis of the DTC and a troubleshooting analysis of the symptom.

- ① Inspect DTC
- ② Record and clear all DTCs
- ③ Confirm fault symptom

- ④ Make a simulation test in a way of symptom simulation
- ⑤ Inspect DTC
- ⑥ Confirm symptom

## V. SYMPTOM SIMULATION

### NOTES:

The most difficult conditions to handle in the fault troubleshooting are that the fault symptom does not appear. Under the circumstances, make sure first to make a comprehensive analysis to the fault described by the customer, then to simulate an environment that is similar or the same with the conditions when the fault of the customer's vehicle occurred. No matter how rich the experience of the technician is and how skillful he is, if he makes a fault troubleshooting analysis without confirming the fault symptom, it is inevitable for him to neglect some important factors and incorrectly guess, which may cause barriers to repair. For example, if a fault occurs only when the engine is cool or if a fault occurs only caused by a vibration from pavement and so on, when the engine is checked in the hot or static state, it is no way to confirm. Because of vibration, high-temperature or seeping water (Vapor) often causes some faults that are difficult to reappear. So, here are some effective symptom simulation tests.

### KEY POINTS OF SYMPTOM SIMULATION TEST:

In the symptom simulation test, no doubt it is important to confirm the fault symptom, but the fault position or fault components must be also found out. So, before the test and the pre-inspection of connection, narrow the range of the circuit where faults may occur according to the fault symptom. Then make a symptom simulation test to see if the circuit measured is normal; the fault symptom is also verified at the same time.

1. Way of Vibration: When vibration may be the major cause of the fault.

For example:

- (a) Use your hand to gently vibrate the sensor that is considered the cause of the fault, in order to check if it is ineffective.
- (b) Softly rock the connector and harness in horizontal and vertical direction.

Notes: Hard rock may cause the relay circuit open.

2. Way of Spraying Water: When rainy weather or wet environment may be the major cause of the fault.

- (a) Spray water on the vehicle to check if the fault occurs.

### NOTES:

- Be sure not to directly spray water into the engine compartment. Spray the water on the face of the radiator to change the temperature and humidity indirectly.
- Be sure not to spray water onto electronic devices and controllers.

3. Way of Heating: When getting warm in the suspected area may be the major cause of the fault.

(a) Use a drier or other similar tool to heat the suspected area to check if the fault occurs.

NOTES:

- The heating temperature must be less than 60; æ£ " 140" H£ ©(The temperature shall not exceed the one that can damage the component.)
- Do not directly heat the ECU parts.

4. Another way: When electrical overload may be the major cause of the fault.

- Connect all electrical loads to check if the fault occurs.

# Chapter 2 Starting and Charging System

## Section 1 Starting System (MR479Q MR479QA MR481QA)

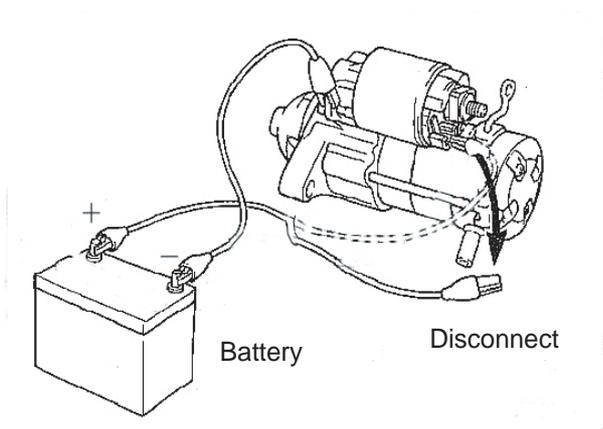
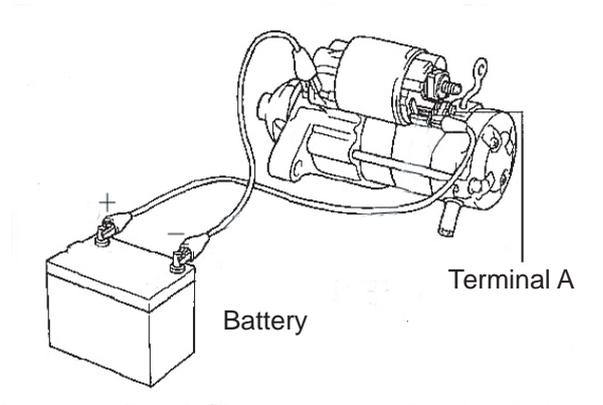
### I. STARTER INSPECTION

#### NOTICE:

These tests must be done within 5 seconds to avoid burning out the coil.

#### 1. INSPECT MAGNETIC SWITCH

- (a) Use wire to connect the starter as shown.
- (b) Connect the magnetic switch and the battery as shown.
- (c) Disconnect the magnet exciting coil from the terminal A.
- (d) Check if the clutch pinion gear is moving out.  
If the clutch pinion gear is not moving out, replace the magnetic switch.
- (e) Connect the battery as shown above. Disconnect the battery positive (+) from the terminal, to make the clutch pinion gear disengaged.
- (f) Check if the clutch pinion gear has returned.  
If the clutch pinion gear has not returned, replace the magnetic switch.

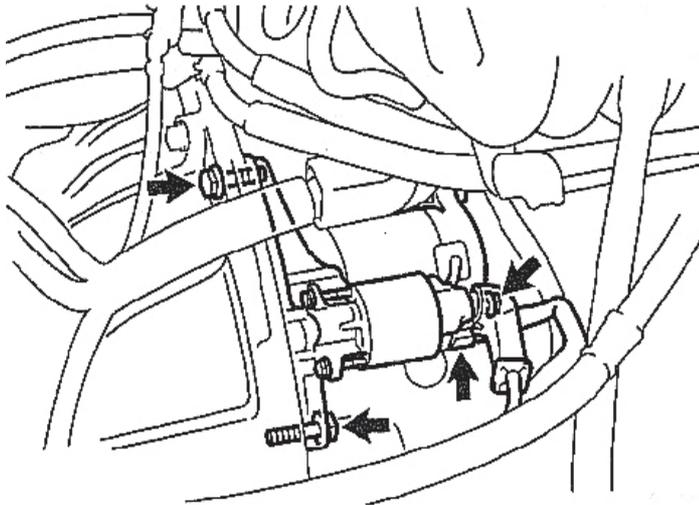




## II. STARTER ASSEMBLY REPLACEMENT (MR479Q, MR479QA, MR481QA)

### 1. REMOVE STARTER ASSEMBLY

- (a) Disconnect the starter connector.
- (b) Remove the nut, and disconnect the starter cable.
- (c) Remove the 2 bolts and the starter assembly.



### 2. INSTALL STARTER ASSEMBLY

Install according to the inverted order of removal.

Torque:

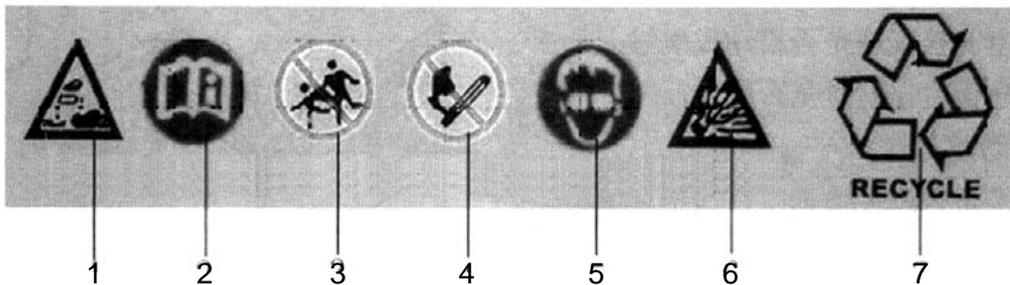
Bolt 37N.m (378kgf.cm, 27ft.lbf)

Harness 9.8N.m(100kgf.cm, 7.0ft.lbf)

## Section 2 Charging System (MR479Q, MR479QA, MR481QA)

### I. BATTERY

Maintenance-free battery is applied in this vehicle. Its termination voltage is 12V. It is connected inline by six 2V single cell in tandem with walls between every pole.



#### 1. BATTERY WARNING SIGNS

1 -- Danger of corrosion

The battery electrolyte is very corrosive. DO NOT overturn the battery.

2 -- Read the instructions for battery

3 -- Children are forbidden to touch the battery

4 -- Avoid fire, electromagnetic wave and strong light.

Avoid electric spark while repair; avoid short.

5 -- Wear protecting glasses

6 -- Danger of explosion

The explosive mixed gas will be produced while charging.

7 -- How to deal with a scrapped battery

The scrapped battery should be delivered to the collection station.

## 2. BATTERY REMOVAL AND INSTALLATION

### HINT:

- (1) The battery is not allowed to contact lubricating grease.
- (2) The battery terminal is only allowed to be softly pulled out, in order to void damaging the battery.

### REMOVAL

- (1) Remove the negative (-) ground cable
- (2) Remove the battery positive (+) cable
- (3) Loosen the fixing clamp on the battery.

### INSTALLATION

Install according to the inverted order of removal.

Tighten the torque

Tighten the battery cable clip to 6N.m (61kgf.cm, 4ft.lbf)

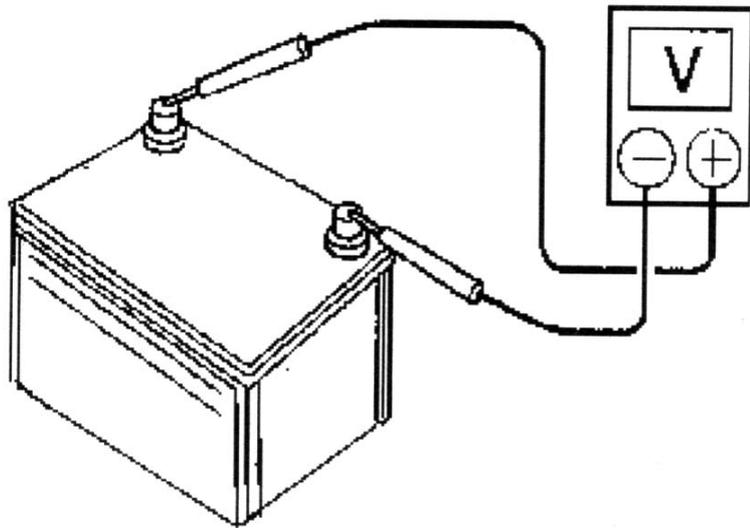
Tighten the fixing clamp to 12N.m (123kgf.cm, 8.6ft.lbf)

## II. CHARGING SYSTEM INSPECTION

### 1. CHECK BATTERY WORKING VOLTAGE

- (a) After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, turn the ignition switch ON and turn on the electrical system (headlight, blower motor) for 60 seconds to remove the surface charge.
- (b) Turn the ignition switch OFF and turn off the electrical systems. Then measure the battery voltage between the negative and positive terminals of the battery.

Standard voltage: 12.5-12.9V at 20° C



#### HINT:

If the voltage is less than specification, charge the battery.

### 2. CHECK BATTERY TERMINALS, FUSE BOX AND FUSE

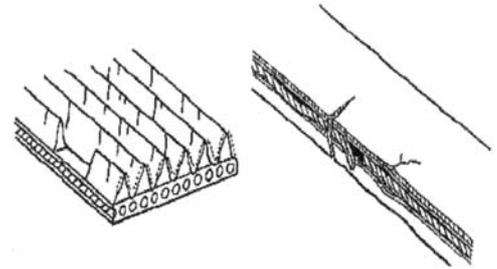
- (a) Check that the battery terminals are not loose or corroded.
- (b) Check if fuse box and fuse for continuity.

### 3. INSPECT DRIVE BELT

(a) Check the belt for excessive wear, frayed cords etc.

HINT:

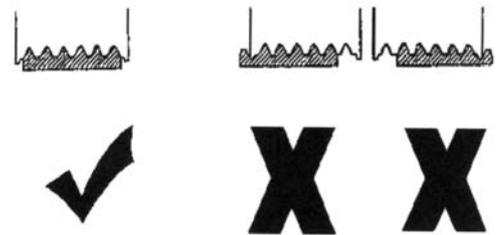
- If any defect has been found, replace the drive belt.
- Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



(b) Check that the belt fits properly in the ribbed grooves.

HINT:

Check with your hand to confirm that the belt has not slipped out of the groove on the pulley.



### 4. CHECK ALTERNATOR WIRING

- Check that the wiring is in good condition.

### 5. LISTEN FOR ABNORMAL NOISES FROM ALTERNATOR

- Check that there is no abnormal noise from the alternator while the engine is running.

### 6. INSPECT CHARGE WARNING LIGHT CIRCUIT

(1) Turn the ignition ON. Check that the charge warning light comes on.

(2) Start the engine. Check that the light goes off.

HINT:

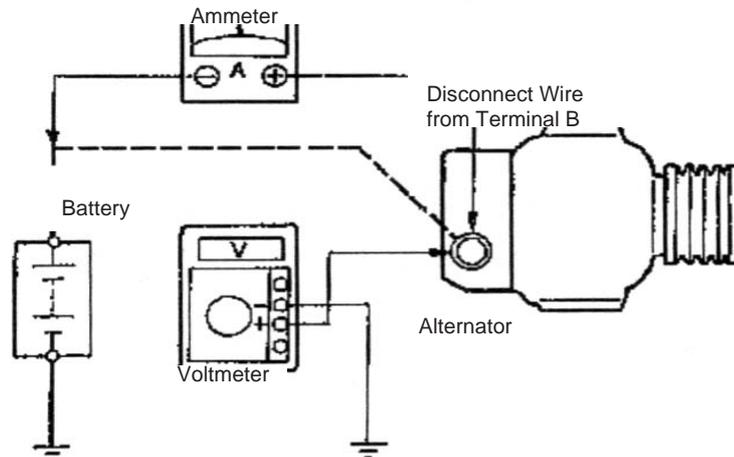
If the light does not operate as specified, troubleshoot the charge warning light circuit.

## 7. INSPECT CHARGING CIRCUIT WITHOUT LOAD

(a) If a battery/starter tester is available, connect the tester to the charging circuit as per instructions.

(b) If a tester is not available, connect an ammeter and voltmeter to the charging circuit as follows.

- ① Disconnect to the wire from terminal B of the alternator and connect it to the negative (-) pole of the ammeter.
- ② Connect the positive (+) pole of the ammeter to terminal B of the alternator.
- ③ Connect the positive (+) pole of the voltmeter to terminal B of the alternator.
- ④ Ground the negative (-) pole of the voltmeter.



(c) Check the charging circuit

- With the engine running from idle to 2,000 rpm, check the reading on the ammeter.  
Standard amperage: 10A or less  
Standard voltage: 13.2V--14.8V

## 8. INSPECT CHARGING CIRCUIT WITH LOAD

(a) With the engine running at 2,000 rpm, turn on the high beam headlights and place the blower switch at "4".  
Check the reading on the ammeter.

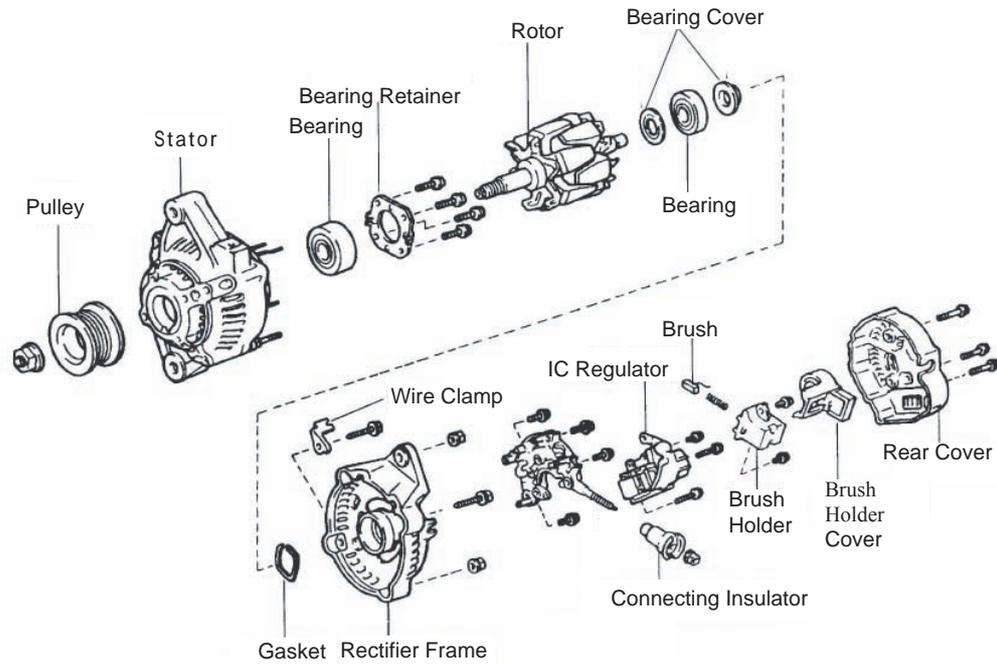
Standard amperage: 20A or more

(b) HINT:

- If the ammeter reading is less than standard amperage, repair the alternator.
- If the battery is fully charged, the indication value will sometimes be less than standard amperage.

### III.ALTERNATOR INSPECTION

#### 1. INSPECT ALTERNATOR



Structure of Alternator

(a) Inspect the rotor winding

① Inspect the resistance of the rotor winding

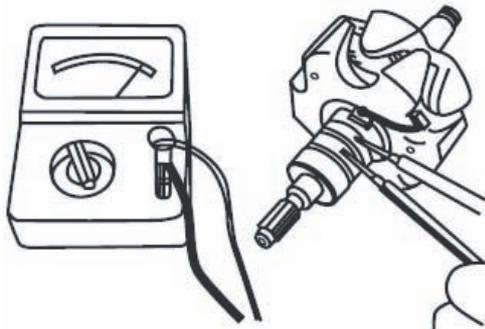
Place the multimeter at R x 1, connect 2 pens and 2 slip rings of the rotor.

Standard resistance: 2.7---3.1Ω ,

② Inspect the rotor bending

Standard: less than 0.5 mm of radial motion

If it is not normal, calibrate or replace the rotor.



Rotor Winding Inspection

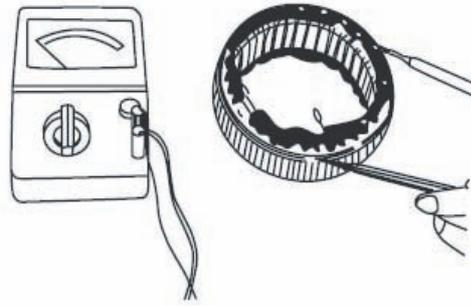
(b) Inspect the stator winding

① Inspect the resistance of the stator winding

Place the multimeter at R x 1, connect 2 pens of the meter to any of the 2 pens wires of the armature winding respectively. There must be continuity. Where the resistance reading is infinitely great shows an open circuit.

② Inspect the winding ground

Place the multimeter at R x 1, connect one pole of the meter to the pole wires of the armature winding respectively and the other pole of the meter to the stator core. If the resistance reading is infinitely great, the armature winding is well-insulated. If not, it needs repairing and replacing.



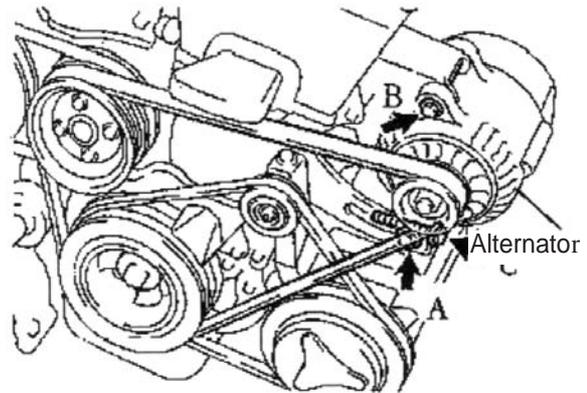
Inspection of Armature Winding Ground

#### IV. ALTERNATOR ASSEMBLY REPLACEMENT (MR479Q, MR479QA, MR481QA)

(a) Disconnect the alternator connector.

(b) Loosen the Bolt A, B, C

(c) Loosen the V-belt. Then remove the alternator.



#### 2. INSTALL ALTERNATOR ASSEMBLY

Torque:

M10 bolt 15N.m (154kgf.cm, 9ft.lbf)

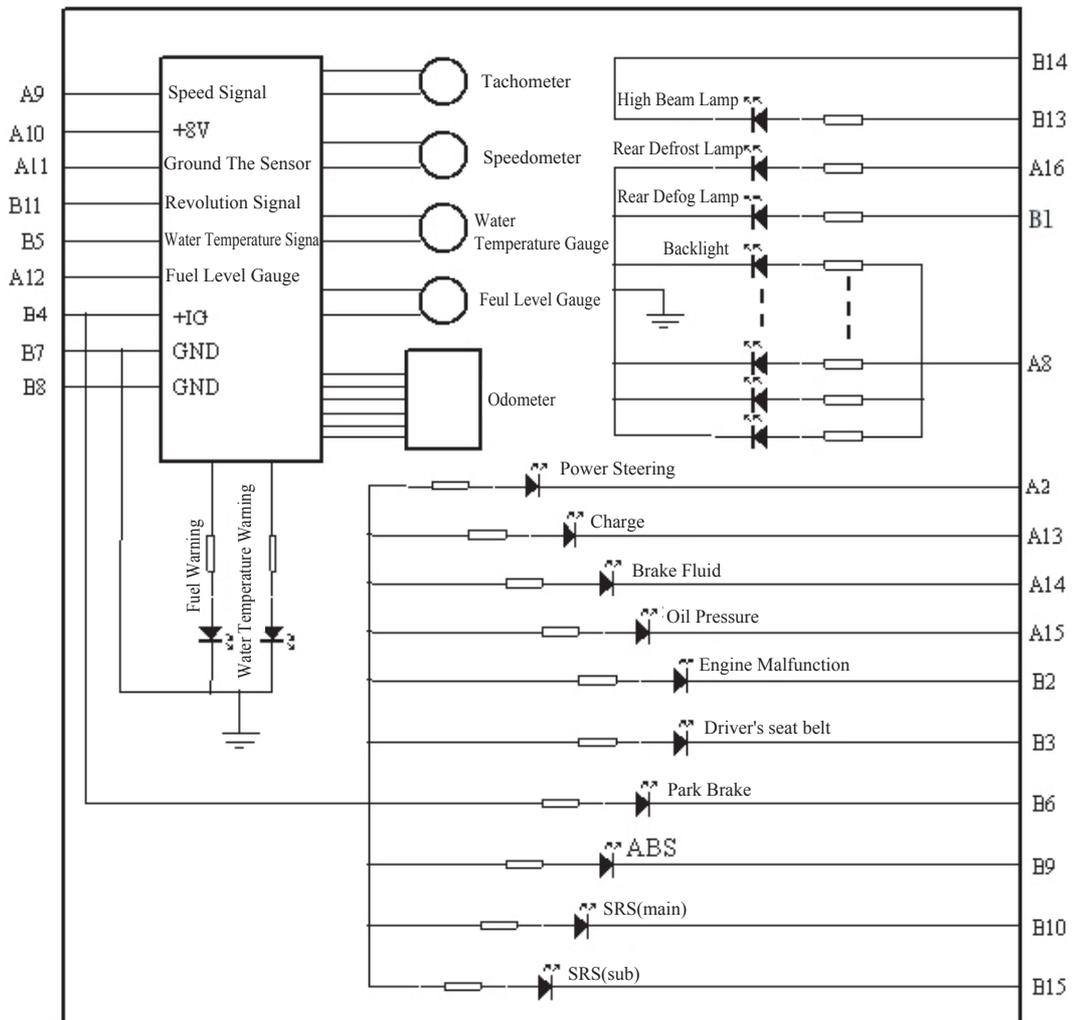
Tension adjustment for V-belt:

When the center of the belt receives a 50N of downward pressure, there is a 10 mm of deflection.

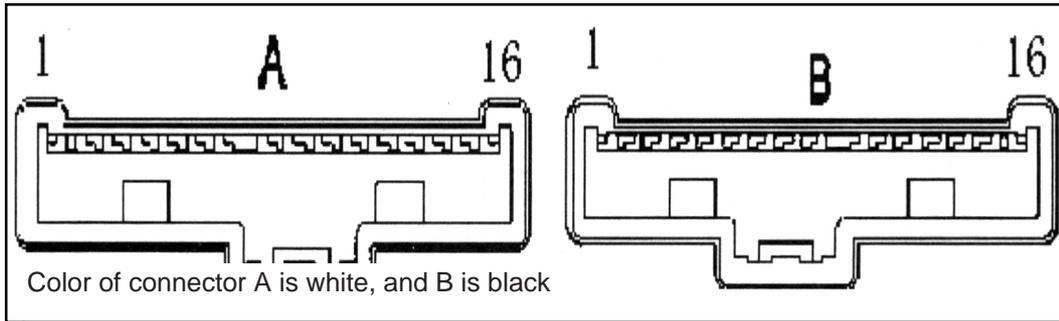
# Chapter 3 Combination Meter System

## Section 1 Circuit Diagram of Combination Meter and Location of Multi-pin Plug-in Terminal

### I. CIRCUIT DIAGRAM OF CONBINATION METER



## II. LOCATION OF HARHESS MULTI-PIN PLUG-IN TERMINAL



(1) HINT:

R -- RE

BI -- BLUE

Y -- YELLOW

B -- BLACK

P -- PIN

G -- GREEN

W -- WHITE

O -- ORANGE

Gr -- GRAY

Br -- BROWN

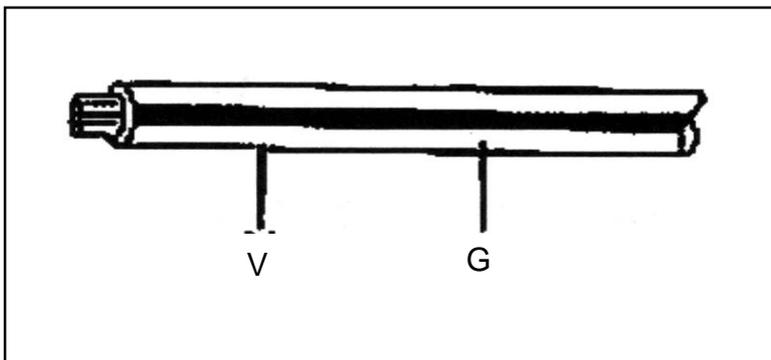
V -- VIOLET

g -- LIGHT GREEN

The first letter represents the base color

The second letter represents the color of the stripe

e.g. VG (violet & green) V-violet, G-green



## 2. DEFINITION OF MULTIPIN PLUG-IN TERMINAL

Terminal No.	Definition of Terminal	Color of Harness	
A	1	Empty	
	2	EPS	VG
	3	Empty	
	4	Empty	
	5	Empty	
	6	Empty	
	7	Empty	
	8	Combination switch (Position lamp	P
	9	Speed sensor groun	B
	10	Speed sensor power sourc	RY
	11	Speed sensor signal output	YR
	12	Fuel senso	B
	13	Alternator	WR
	14	Brake fluid level switc	GR
	15	Oil pressure switc	YG
	16	Rear defrost	YB
B	1	Rear fog lamp	Gr
	2	Engine malfunction	GY
	3	Seat belt switch	R
	4	Power source	Y
	5	Engine coolant temperature senso	YW
	6	Park switch	G
	7	Power source groun	B
	8	Power source groun	B
	9	ABS	R
	10	SRS (Main)	RY
	11	Engine revolution signal	BBI
	12	Live wire (Fire wire)	WG
	13	High beam lamp +	RB
	14	Low beam -	RW
	15	SRS (Sub)	RG
	16	Empty	

## Section 2 Malfunction Symptom Table and Solution Procedure

### I.MALFUNCTION SYMPTOM TABLE

The table below lists the typical malfunction symptoms of the combination meter. These malfunctions can be solved by the procedure in the section of the Malfunction Diagnosis.

Serial No.	MALFUNCTION SYMPTOM
1	The whole combination meter does not operate
2	Speedometer malfunction
3	Tachometer malfunction
4	Water temperature gauge malfunction
5	Fuel gauge malfunction
6	Odometer malfunction

## II. DETAILED SOLUTION PROCEDURE

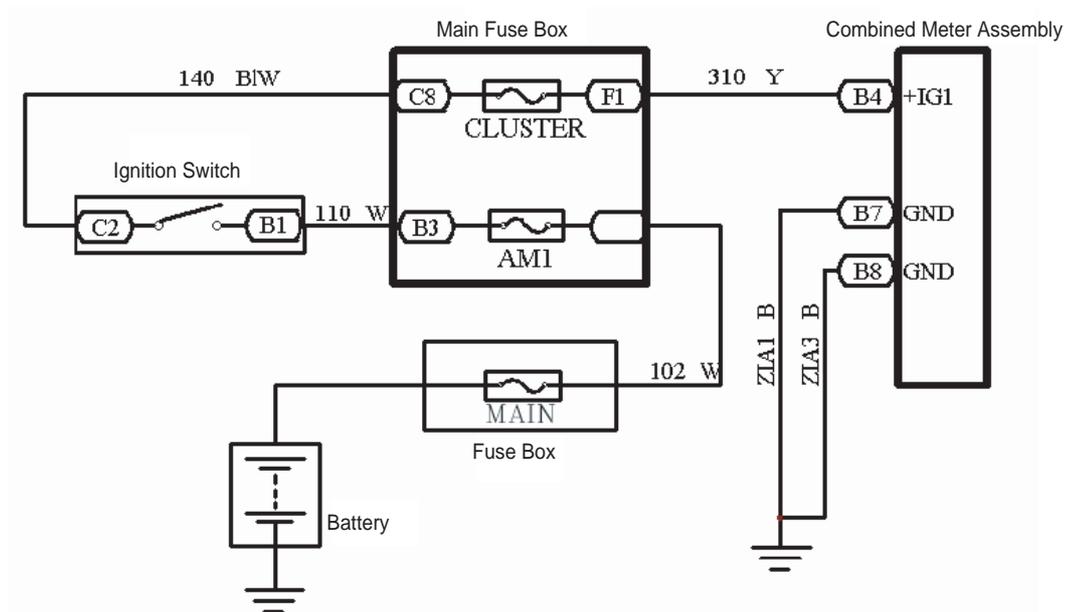
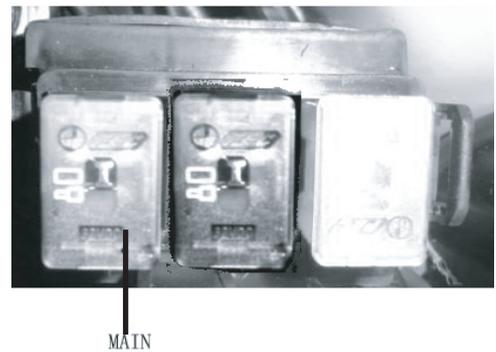
### 1. THE WHOLE COMBINATION METER DOSE NOT OPERATE.

#### (a) Inspect fuse

- ① Check fuse CLUSTER (10A) in the main fuse box for continuity.
- ② Check fuse AM (30A) in the main fuse box for continuity.
- ③ Check fuse MAIN (80A) in the fuse box for continuity.



Result and solution: If a certain fuse is burnt, replace a fuse with the same capacity.



(b) Inspect the combination meter connectors.

① Inspect continuity

- Disconnect the connector from the combination meter assembly
- Inspect continuity between terminals

Standard:

Tester connection	Condition	Standard condition
B7 - ground	Normal condition	Continuity
B8 - ground	Normal condition	Continuity

② Inspect voltage

- Disconnect the connector from the combination meter assembly
- Turn the ignition switch ON
- Inspect voltage between terminals

Standard:

Tester connection	Condition	Standard condition
B4 - ground	Turn the ignition switch ON	10 – 14V

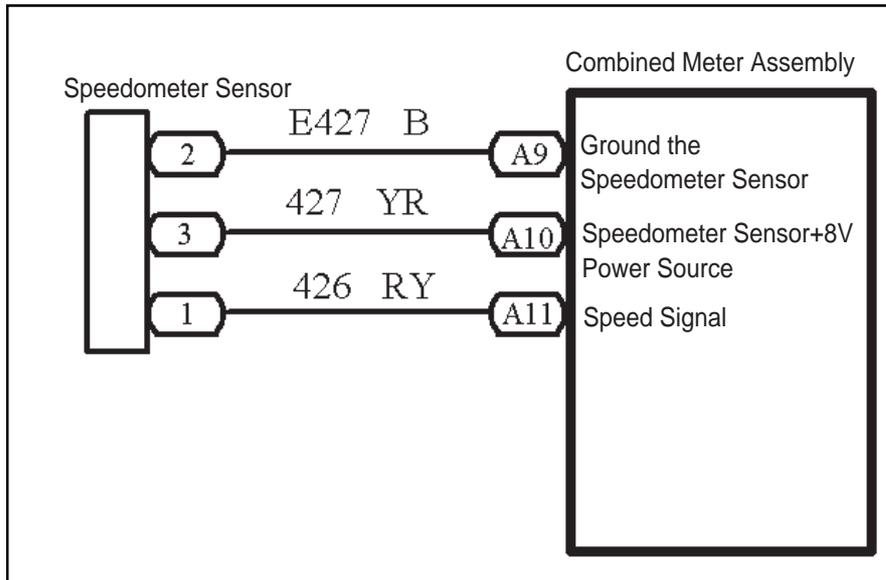
Result and solution:

Normal    Replace the combination meter assembly

Abnormal    Repair or replace the harness or connector

## 2. SPEEDOMETER MALFUNCTION

### CIRCUIT DIAGRAM



### INSPECTION

(a) Inspect the combination meter assembly

- ① Remove the combination meter assembly and retain the connection of connectors.
- ② Inspect continuity
  - Inspect continuity between terminals

Standard:

Tester connection	Condition	Standard condition
A9 - ground	Normal condition	Continuity

③ Inspect voltage between terminals

Standard:

Tester connection	Condition	Standard condition
A10 - ground	Turn the ignition switch to ON	7.5 – 9V

Result and solution:

If it is abnormal, go to (b) Inspect the combination meter assembly speed input signal

If normal, go to (c) Inspect the combination meter assembly

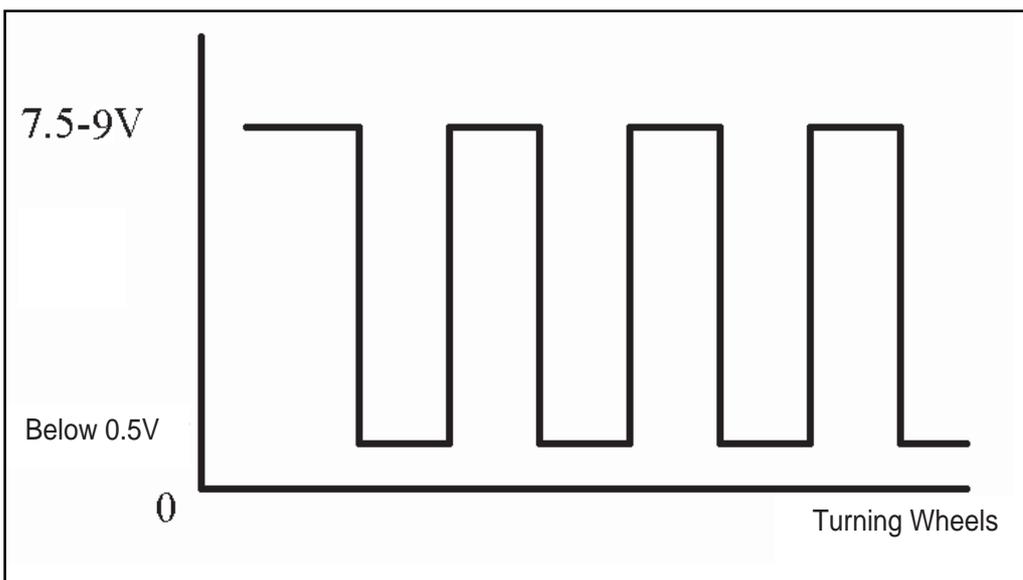
(b) Inspect the combination meter assembly speed input signal

① Inspect voltage

- Hold the front wheels up
- Push the shift lever to NEUTRAL
- Turn the ignition switch to ON
- Slowly turn the front wheel, measure the voltage between terminal A9 and A11

Standard voltage is as follows:

Voltage changes alternately



Result and solution:

Normal Replace the combination meter assembly

If abnormal, inspect the speed sensor

② Inspect the speed sensor

- Inspect continuity

Inspect continuity between terminals

Standard:

Tester connection	Condition	Standard condition
2 - ground	Normal condition	Continuity

- Inspect voltage between terminals

Standard:

Tester connection	Condition	Standard condition
3 - ground	Turn the ignition switch to ON	7.5 – 9V

Result and solution:

Abnormal Repair or replace the harness or connector

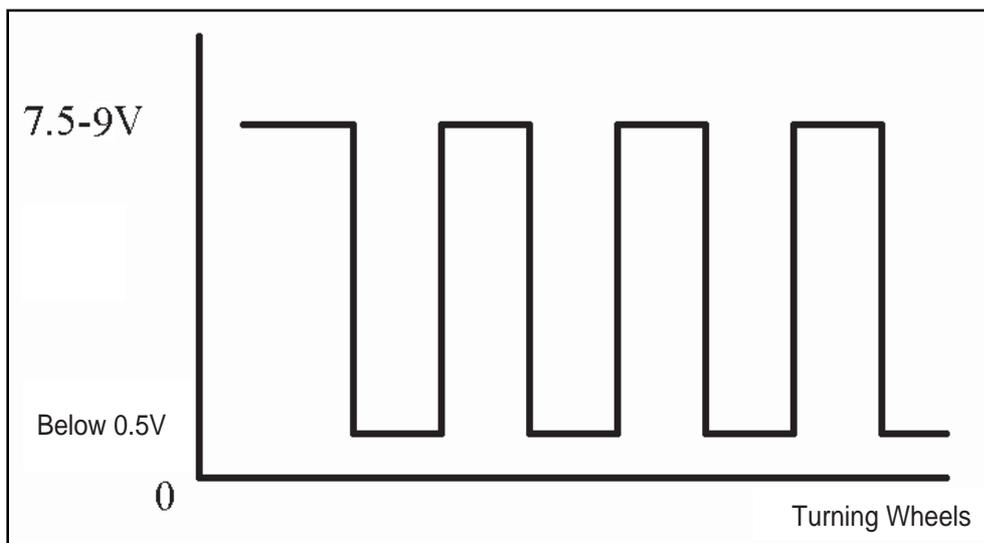
Normal Inspect the speed sensor output signal

③ Inspect the speed sensor output signal

Inspect voltage

- Hold the front wheels up
- Push the shift lever to NEUTRAL
- Turn the ignition switch to ON
- Slowly turn the front wheel, measure the voltage between terminal 1 and 2

Standard voltage is as follows:



Voltage changes alternately

Result and solution:

Normal Repair or replace the harness or connector

Abnormal replace the speed sensor

(c) Inspect the combination meter assembly

- ① Remove the combination meter assembly and disconnect connectors.
- ② Inspect continuity
  - Inspect continuity between terminals

Standard:

Tester connection	Condition	Standard condition
B7 - ground	Normal condition	Continuity
B8 - ground	Normal condition	Continuity

- ③ Inspect voltage between terminals

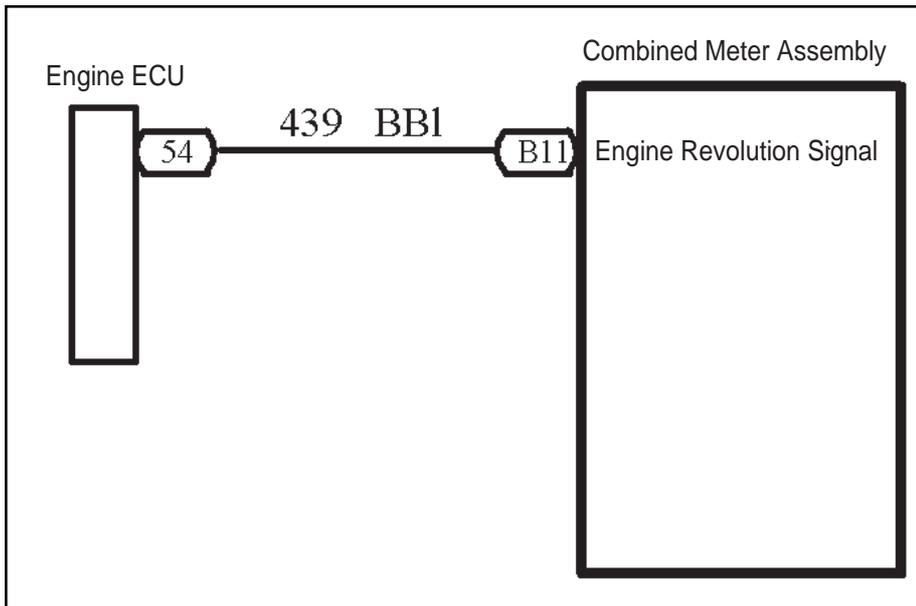
Tester connection	Condition	Standard condition
B4 - ground	Turn the ignition switch to ON	10 – 14V

Result and solution:

Abnormal    Repair or replace the harness or connector

Normal      Replace the combination meter assembly

### 3. TACHOMETER MALFUNCTION CIRCUIT DIAGRAM



#### Inspection procedure

(a) Inspect the combination meter assembly revolution input signal

- ① Remove the combination meter assembly and retain the connection of connectors.
- ② Connect the oscilloscope to the terminal B11 and ground.
- ③ Start the engine
- ④ Inspect the signal wave form

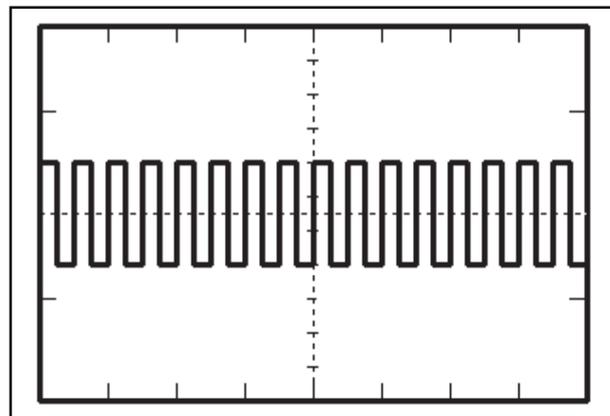
Standard:

Show the correct wave form

#### Result and solution:

Normal Inspect and replace the combination meter assembly

Abnormal Inspect the engine ECU revolution output signal



(b) Inspect the engine ECU revolution output signal

- ① Remove the engine ECU and retain the connection of connectors.
- ② Connect the oscilloscope to the terminal 54 and ground.
- ③ Start the engine
- ④ Inspect the signal wave form

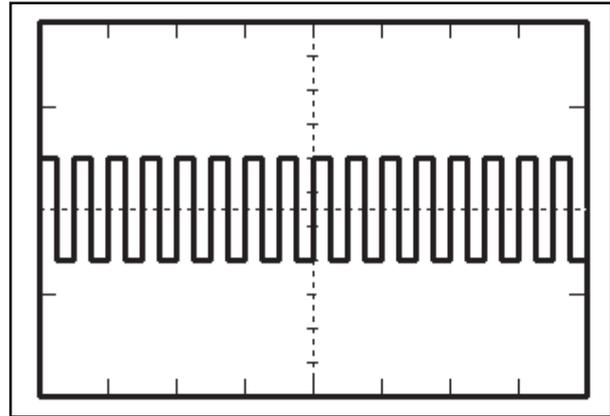
Standard:

Show the correct wave form

Result and solution:

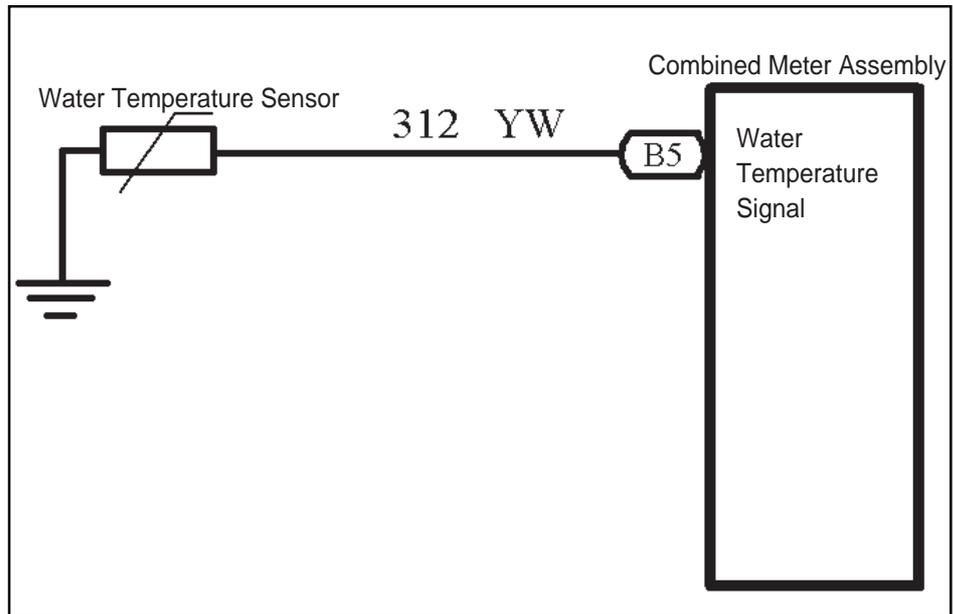
Normal Repair or replace the harness or connector

Abnormal Inspect the engine control system



#### 4. WATER TEMPERATURE GAUGE MALFUNCTION

##### CIRCUIT DIAGRAM



(a) Get the value of water temperature with the diagnosis tester

- ① Connect the diagnosis tester to the diagnosis interface
- ② Turn the ignition switch to ON
- ③ Read the value of engine water temperature displayed on the diagnosis tester

Standard: The same with the actual engine coolant temperature.

##### Result and solution:

If it is normal, the water temperature gauge has no malfunction

If abnormal, Inspect the combination meter assembly

(b) Inspect the combination meter assembly

- ① Inspect resistance
  - Remove the combination meter assembly and disconnect connectors
  - Inspect continuity between terminals

Standard:

Tester connection	Condition	Standard condition
B5 - ground	C(60 °C )	164.5±5Ω
	1/2C(90°C)	56±3Ω
	H(115 °C)	28.7±2Ω

Result and solution:

Normal Replace the combination meter assembly

If abnormal inspect the water temperature sensor

② Inspect the water temperature sensor

- Remove the water temperature sensor and put it into the constant temperature cabinet.
- Adjust the temperature in the constant temperature cabinet and measure the resistance of the water temperature sensor.

Standard:

Condition	Standard condition
C(60°C)	164.5±5Ω
1/2C(90°C)	56±3Ω
H(115°C)	28.7±2Ω

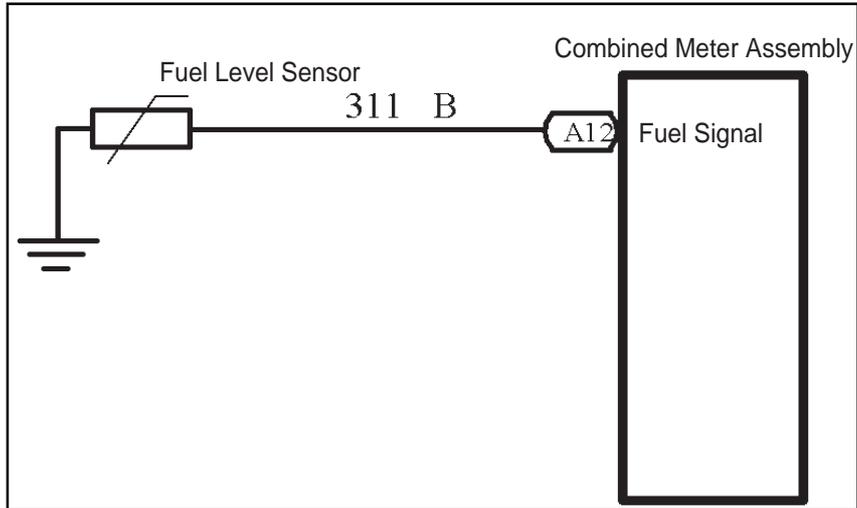
Result and solution:

Normal Repair or replace the harness and connector

If abnormal replace the water temperature sensor

## 5. FUEL GAUGE MALFUNCTION

### CIRCUIT DIAGRAM



(a) Inspect the combination meter assembly

① Inspect resistance

- Remove the combination meter assembly and disconnect connectors
- Inspect continuity between terminals

Standard:

Tester connection	Condition	Standard condition
A12 - ground	E	$110 \pm 6 \Omega$
	1/2	$32.5 \pm 3 \Omega$
	F	$3 \pm 2 \Omega$

Result and solution:

Normal Replace the combination meter assembly

If abnormal inspect the fuel level sensor

② Inspect the fuel level sensor

- Remove the fuel level sensor
- Adjust the height of the fuel level sensor and measure its resistance.

Standard:

Condition	Standard condition
E	$110 \pm 6\Omega$
1/2	$32.5 \pm 3\Omega$
F	$3 \pm 2\Omega$

Result and solution:

Normal: Repair or replace the harness and connector

If abnormal replace the fuel level sensor

#### 6. THE OTHER INDICATORS

Short the ports of the other indicators respectively to the ground or power source in accordance with the Circuit Diagram, the indicators will light correspondingly. If it dose not light, replace the combination meter.

If it lights, repair or replace the harness or connector.

#### 7. ODOMETER MALFUNCTION

Inspect first supposing the problem to be from the speedometer. If the speedometer is normal, the combination meter needs replacing when the odometer is abnormal.

## Section 3 Combination Meter

### I. SYMPTOM AND SUSPECTED AREA

**HINT:**

The table below can help you find the causes of malfunction. The figures in the table show the most possible malfunctions in order of priority. Inspect each part in the order given. If necessary, repair or replace this parts.

**ILLUMINATION:**

Symptom	Suspected Area
All illumination lamps do not light up	1. Dimmer Switch
	2. Harness or connector.
	3. Combination meter assembly
Only one illumination lamp does not light up	1. Combination meter assembly

**WARNING LIGHTS:**

Symptom	Suspected Area
Warning lights of engine do not light up	1. Harness or connector.
	2. ECM
	3. Combination meter assembly
Charge warning light does not light up	1. Harness or connector.
	2. Alternator
	3. Combination meter assembly
Park brake warning light does not light up	1. Harness or connector.
	2. Hand brake switch
	3. Combination meter assembly
Brake malfunction warning light does not light up	1. Harness or connector.
	2. Brake fluid level switch
	3. Combination meter assembly

Symptom	Suspected Area
ABS warning light does not light up	1. Harness or connector.
	2. ABS controller or ABS warning light driver module
	3. Combination meter assembly
SRS warning light does not light up	1. Harness or connector.
	2. SRS controller
	3. Combination meter assembly
SRS (Sub) indicator does not light up	1. Harness or connector.
	2. SRS controller
	3. Combination meter assembly
Oil pressure warning light does not light up	1. Harness or connector.
	2. Oil pressure switch assembly
	3. Combination meter assembly
High beam indicator does not light up	1. Harness or connector.
	2. Headlamp light control switch
	3. Combination meter assembly
Rear fog indicator does not light up	1. Harness or connector.
	2. Headlamp light control switch
	3. Combination meter assembly
Rear defrost indicator does not light up	1. Harness or connector.
	2. Central controller or rear defrost switch
	3. Combination meter assembly
EPS warning indicator does not light up	1. Harness or connector.
	2. Electric Power Steering controller
	3. Combination meter assembly
Water temperature warning indicator does not light up	1. Harness or connector.
	2. Engine coolant temperature sensor
	3. Combination meter assembly
Seat belt warning indicator does not light up	1. Harness or connector.
	2. Seat belt buckle switch
	3. Combination meter assembly

## II. SPEEDOMETER INSPECTION

1. INSPECT THE INDICATING ERROR ALLOWED BY SPEEDOMETER USING A SPEEDOMETER TESTER, AND INSPECT THE OPERATION OF THE ODOMETER.

Analog Meter (Km/h)	
Meter indication	Value displayed on the tester
20	17—23
40	35—40
60	55—60
80	75—80
100	95—100
120	114—120
140	133—140
160	152—160
180	171—180

### NOTICE:

Tire over or under inflation will cause the reading error.

### 2. INSPECT INPUT SIGNAL

- (a) Connect the positive (+) pole of the voltmeter to terminal A-11, and the negative (-) to the terminal A-9.
- (b) When the vehicle runs at 10 Km/h, inspect the voltage between terminal A-11 and A-9 of the combination meter.

Standard: 7 wave forms of the high-low electrical level change per second.

### NOTICE:

Hold the ignition switch ON when inspected, connect the connector.

### 3. INSPECT TACHOMETER

Inspect its operation

- (1) Start the engine, using a handy tachometer to compare.
- (2) The value displayed on the handy tachometer and the value indicated on the tachometer are as follows.

## Analog Meter

Tachometer (r/min)	handy tachometer (r/min)
800	740—860
1000	900—1100
2000	1850—2150
3000	2800—3200
4000	3800—4200
5000	4800—5200
6000	5750—6250

### 4. INSPECT FUEL LEVEL GAUGE

#### (1) Inspect resistance

When the fuel level gauge indicates no fuel, inspect the resistance between terminal A-12 and B-7 on the combination meter connector.

Standard:

Standard indication	Resistance ( $\Omega$ )
E	104—116
Warning point	90—100
1/2F	29—35
F	1 — 5

### NOTICE:

Connector should be disconnected when measured.

### 5. INSPECT WATER TEMPERATURE GAUGE

#### (1) Inspect resistance

When the water temperature is indicated in the red area, inspect the resistance between terminal B-5 and B-7 on the combination meter connector.

## Standard

Standard indication	Resistance ( $\Omega$ )
C	159.5—169.5
1/2H	53—59
Warning point	26.7—30.7
H	20—24

### NOTICE:

Connector should be disconnected when measured.

#### 6. INSPECT WATER TEMPERATURE WARNING LIGHT

- (a) Disconnect the water temperature sensor connector.
- (b) Turn the ignition ON, the water temperature warning light should go out.
- (c) Ground the terminal B5 of the meter connector, the water temperature warning light should light up.

#### 7. INSPECT OIL PRESSURE WARNING LIGHT

- (1) Disconnect the oil pressure sensor connector.
- (2) Turn the ignition ON, the oil pressure warning light should go out.
- (3) Short connector terminal to the ground with a wire, the oil pressure warning light should light up.

#### 8. INSPECT OIL PRESSURE SENSOR

- (1) Disconnect the connector from the oil pressure sensor .
- (2) Inspect continuity between its terminal and ground.

Engine is stopped: Continuity

Engine runs: No continuity

#### 9. INSPECT PARK BRAKE WARNING LIGHT

- (1) Disconnect the connector from the park brake switch.
- (2) Turn the ignition ON, the park brake warning light should go out.
- (3) Short connector terminal to the ground with a wire, the park brake warning light should light up.

#### 10. INSPECT PARK BRAKE SWITCH

- (1) Disconnect the connector from the park brake switch.
- (2) Pull up the hand brake, inspect continuity between its terminal and ground.

Hand brake is pulled up: Continuity

Hand brake is released: No continuity

#### 11. INSPECT BRAKE FLUID LEVEL WARNING LIGHT

- (1) Disconnect the connector from the brake fluid level sensor.
- (2) Turn the ignition ON, the brake fluid level warning light should go out.
- (3) Directly connect its connector terminal to the harness terminal with a wire, the brake fluid level warning light should light up.

#### 12. INSPECT BRAKE FLUID LEVEL WARNING SWITCH

- (1) Remove the reservoir cap
- (2) Disconnect the connector from the reservoir.
- (3) Inspect continuity between terminals

Float up: No continuity

- (4) Use siphon to take fluid out of the reservoir.

- (5) Inspect continuity between terminals

Float down: Continuity

- (6) Pour the fluid into the reservoir

#### 13. INSPECT THE REAR DEFROST INDICATOR

- (1) Turn the ignition switch ON, and start the engine
- (2) Press the defrost switch, the rear defrost indicator will light up
- (3) Turn the ignition OFF, the rear defrost indicator should go out.

#### 14. INSPECT THE REAR DEFOG INDICATOR

- (1) The rear fog indicator will light up as the rear fog lamp lights, the terminal B1 is at the high electric potential.

#### 15. INSPECT THE SEAT BELT WARNING INDICATOR

- (1) Disconnect the seat belt switch connector in the driver's side, the belt warning indicator should go out at this time.
- (2) Short connector terminal to the ground, the belt warning indicator should light up.

# Chapter 4 Wiper and Washer System

## Section 1 Wiper and Washer System Inspection

### I.WIPERAND WASHER SYSTEM SYMPTOMANALYSIS

#### NOTES:

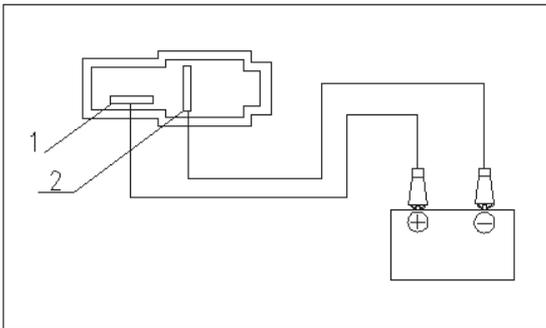
The table below can help you find the causes of malfunction. These figures show the most possible malfunctions in order of priority. Inspect each part in the order given. If necessary, repair or replace these parts.

Symptom	Suspected Area
Front wiper does not operate.	1. Wiper fuse
	2. Wiper switch assembly
	3. Harness
Front wiper in intermittent shift does not operate.	1. Wiper switch assembly
	2. Wiper motor assembly
	3. Harness
	4. Central controller
Front washer motor does not operate	1. Wiper fuse
	2. Wiper switch assembly
	3. Wiper motor assembly
	4. Harness
When the washer switch is placed ON, front wiper does not operate	1. Wiper switch assembly
	2. Wiper motor assembly
	3. Harness
	4. Central controller
Washer fluid dose not jet out	1. Washer hose and nozzle
When the washer switch places on OFF, wiper blade can not return, or stay in a wrong place.	1. Wiper motor assembly (The position of wiper arm)

## II. MALFUNCTION INSPECTION

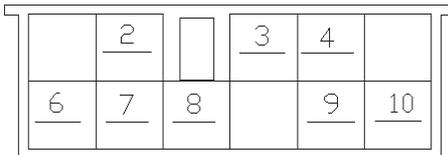
### 1. WASHER PUMP INSPECTION

- (1) Mount washer pump on the can system. Pour washer fluid into the can.
- (2) Disconnect the connector of washer pump.
- (3) Connect the terminal 1 of washer pump to the battery positive (+) and the terminal 2 to the negative (-), as shown below. Inspect that the washer fluid flows out of the can.
- (4) If not, replace the washer pump.



### 2. WIPER SWITCH ASSEMBLY

- (a) Inspect the continuity
  - Inspect each terminal on connector for continuity.



Standard:

Switch position	Tested terminal	Specified condition
MIST	8 (+) —10 (+)	Continuity
OFF	3 (+) —10 (+)	Continuity
INT	8 (+) —6 (+) 3 (+) —10 (+)	Continuity
LO	8 (+) —10 (+)	Continuity
HI	8 (+) —11 (-)	Continuity

### Front washer switch

Switch position	Tested terminal	Specified condition
OFF		No continuity
ON	8 (+) —7 (-)	Continuity

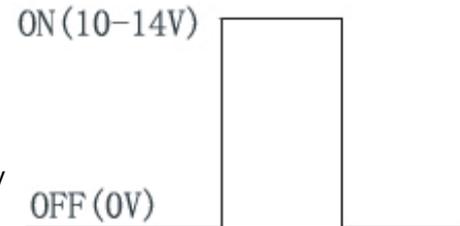
If no continuity, replace the switch.

#### (b) Operation inspection (washer switch)

- ① Turn the washer switch on the position OFF.
- ② Connect the connector terminal 8 to the battery positive (+) and the terminal 2 of wiper connector to the negative (-). Turn the washer switch ON and OFF and then measure the battery voltage between the terminal 8 and terminal 2 of the wiper motor connector.

Standard: as shown on the left

If it is not as specified, replace the switch.



## 3. WIPER MOTOR ASSEMBLY

#### (a) Inspect the low speed shift

- Connect the connector terminal 3 to the battery positive (+) and the connector terminal 2 (E) to the negative (-), check that the motor operates at low speed.

If it is not as specified, replace the motor.

#### (b) Inspect the high speed shift

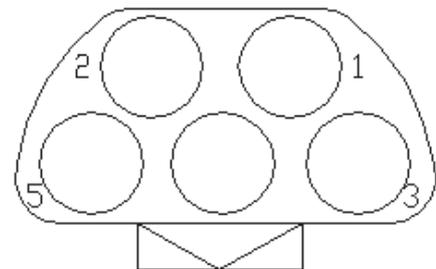
- Connect the connector terminal 3 to the battery positive (+) and the connector terminal 2 (E) to the negative (-), check that the motor operates at high speed.

If it is not as specified, replace the motor.

#### (c) Inspect automatic return

- ① Connect the connector terminal 5 to the battery positive (+) and the connector terminal 2 (E) to the negative (-). Let the motor operates at low speed, disconnect terminal 5 (+) to make the motor stop at a random position.
- ② Connect the terminal 5 and terminal 3, and connect the terminal 4 to the battery positive (+), make the motor restart at low speed.
- ③ Check that the automatic return operates in a normal way.

If it is not as specified, replace the motor.

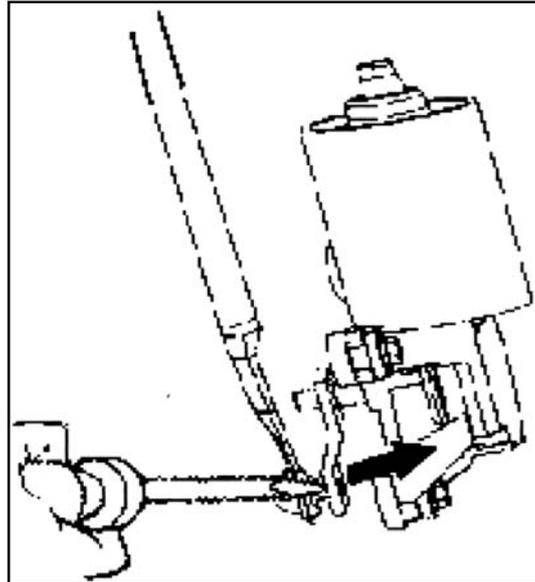
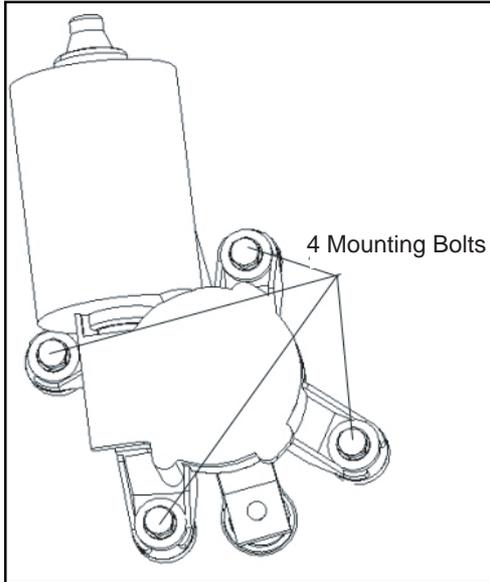


## Section 2 Replacement and Adjustment

### I WIPER MOTOR ASSEMBLY REPLACEMENT

#### 1. REMOVE WIPER MOTOR

- (a) Disconnect the connector.
- (b) Remove the 4 mounting bolts.
- (c) Separate the shaft of the motor crankshaft arm and the wiper link with special tools.



#### 2. INSTALL A NEW WIPER MOTOR

- (a) Press the shaft of the motor crankshaft arm and the wiper link in its position with special tools.
- (b) Lock the 4 bolts in the specified torque.
- (c) Connect the connector.
- (d) Operate the wiper, make the washer fluid spraying on the windshield, check if the operation of wiper and its starting position is normal. If not, remove the wiper arm blades assembly and make some proper adjustment.

Hint: Make the top of the new shaft of the wiper motor crankshaft arm filled with lubricating oil.

### II. WIPER BLADES REPLACEMENT

#### 1. REMOVE BLADES FROM WIPER BLADES ASSEMBLY 1, 2

- Remove blades from wiper blades assembly 1, 2 respectively.

#### 2. INSTALL NEW BLADES

- Install new blades on wiper blades assembly 1, 2 respectively.

### III. WIPER SWITCH ASSEMBLY REPLACEMENT

#### 1. DETACH STEERING WHEEL ASSEMBLY

- (a) Disconnect the main power source of the vehicle.
- (b) Remove the passenger SRS module assembly, and cautiously put it in a safe place.
- (c) Loosen steering wheel lock-bolts and remove the assembly.

#### 2. REMOVE WIPER SWITCH

- (a) Disconnect the connector.
- (b) Remove the 2 tapping screws that are for mounting the wiper switch, take out the wiper switch from the bracket of the combination switch.

### IV. WASHER NOZZLE

#### ADJUSTMENT

#### 1. INSPECT WASHER NOZZLE

- (a) Start the engine, check if the position where the washer fluid from the nozzle sprays the windshield is in the central or upper of the area wiped by the blades.
- (b) Change the direction (horizontal) of the nozzle hole to adjust the point where washer fluid sprays the windshield.

# Chapter 5 Light System

## Section 1 Survey of Light System

### I. COMPOSITION

1. Front combination lamp assembly: turn signal lamp, high beam, low beam, head lamp, front position lamp.
2. Rear combination lamp: turn signal lamp, back-up lamp, rear fog lamp, tail lamp, brake lamp, retro reflector.
3. Front fog lamp
4. Side turn signal lamp
5. High mounted stop lamp
6. Rear trunk lamp
7. License plate lamp
8. Interior dome lamp
9. Rear row reading lamp
10. Door lampshield and bulb assembly

### II. NOTES FOR REPAIR

#### 1. NOTES WHEN REPAIRING ELECTRICAL EQUIPMENTS

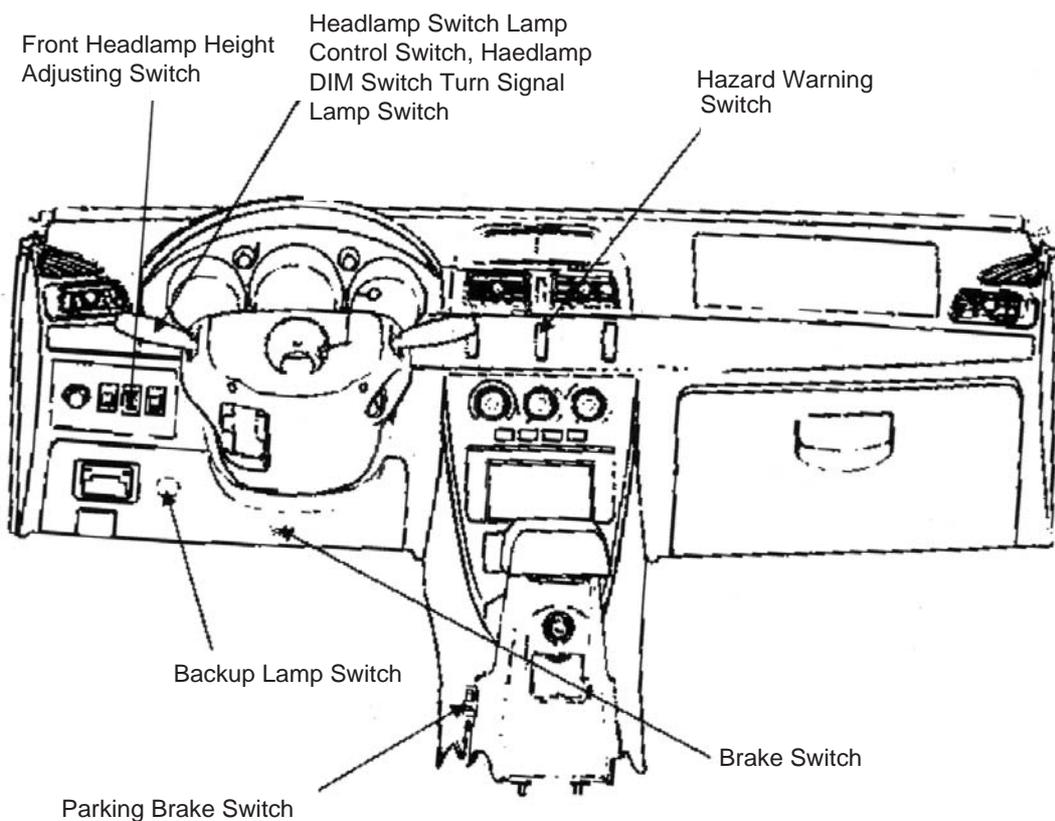
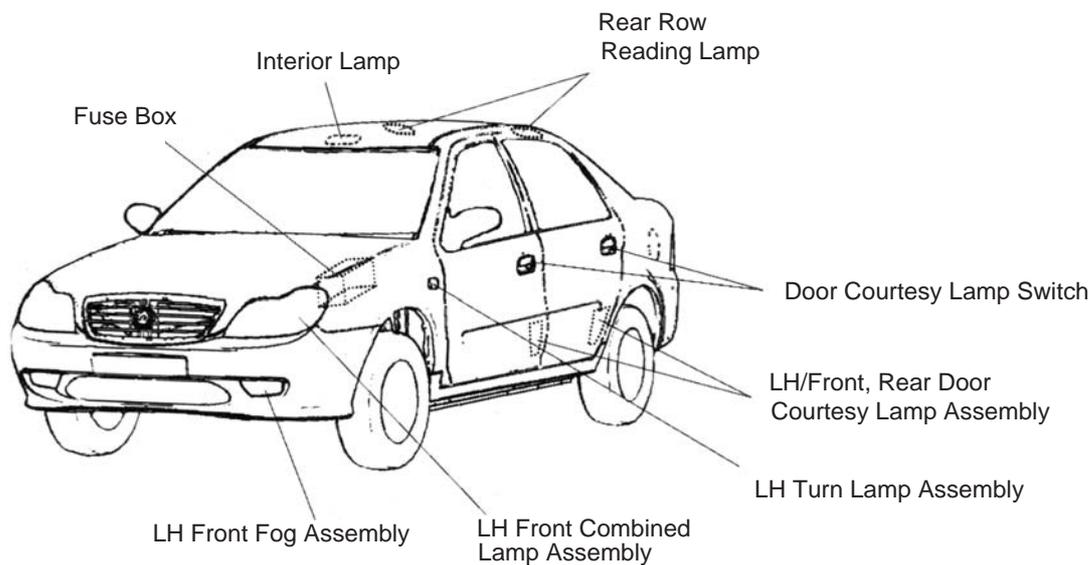
- (a) Disconnect the battery ground cable.
2. Notes when replacing a headlamp bulb
    - (a) Before replacing a halogen bulb, turn the headlamp OFF to make it cool.
    - (b) When installing a new halogen bulb, do not touch the glass part of the bulb with bare hands.
    - (c) If there is oil stain on the surface of halogen bulb (headlamp and front fog lamp) when the lamps are turned ON, its service life will be shortened.
    - (d) Halogen bulbs (headlamp and front fog lamp) have pressurized gas inside and require special handling. They can explode if dropped to ground. The glass fragments will splash up.
    - (e) When replacing, make sure to use the bulbs with the same power, same model.
    - (f) After the bulb is installed, make the lamp holder tight.

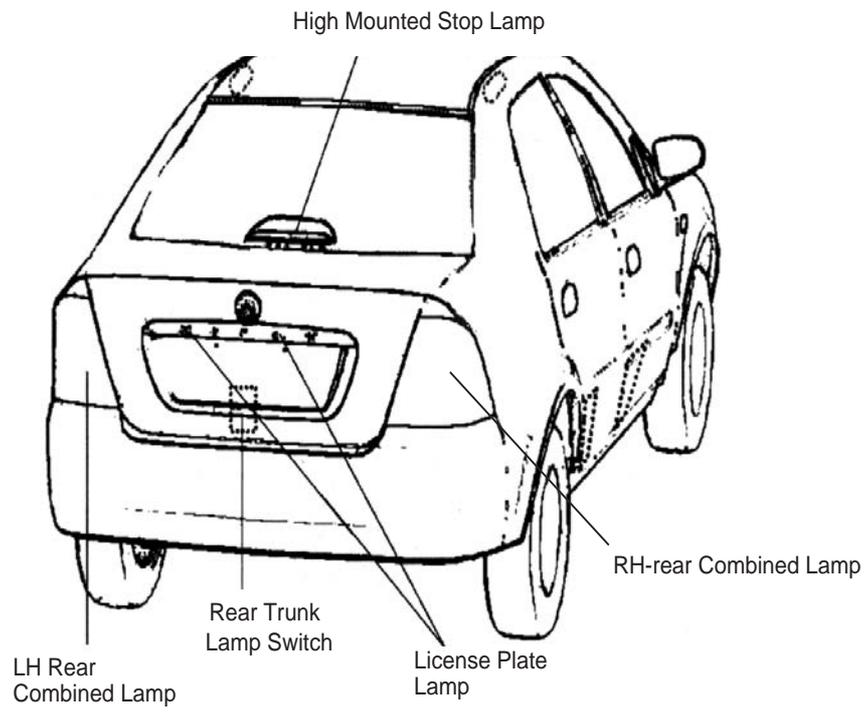
### III. BULB SPECIFICATIONS

Name	Specifications
Headlamp (High beam and Low beam)	H1 12V 55W
Turn signal lamp	P21W 12V 21W
Position lamp	W5W 12V 5W
Front fog lamp	H3 12V 55W
Rear combination lamp (Turn signal lamp)	PY21W 12V 21W
Rear combination lamp (Brake / Position lamp)	P21/5W 12V 21/5W
Rear combination lamp (Rear fog lamp)	P21W 12V 21W
Rear combination lamp (Back-up lamp)	P21W 12V 21W
Interior lamp (dome lamp)	C5W 12V 5W
	W5W 12V 5W
Rear row reading lamp	C5W 12V 5W
Side turn signal lamp	WY5W 12V 5W
High mounted stop lamp (incl. rear trunk lamp)	W5W 12V 5W
License plate lamp	W5W 12V 5W
Door courtesy lamp	W5W 12V 5W

Notes: All bulbs are made by Philips Corp..

#### IV. LOCATION OF LIGHT SYSTEM





## Section 2 Light System Symptom Inspection

### I. LIGHT SYSTEM PROBLEM SYMPTOMS TABLE

**NOTES:**

The table below can help you find the causes of malfunction. These figures show the most possible malfunctions in order of priority. Inspect each part in the order given. If necessary, repair or replace these parts.

**1. HEADLAMP AND TAIL LAMP**

Symptom	Suspected Area
“ Low beam” dose not light (One side)	1. Bulb
	2. LH or RH headlamp fuse
	3. Harness
“ Low beam” dose not light (All)	1. Lamp switch assembly
	2. Harness
“ High beam” dose not light (One side)	1. Bulb
	2. LH or RH headlamp fuse
	3. Harness
“ High beam” dose not light (All)	1. Lamp switch assembly
	2. Harness
Light dose not flash (Dimmer)	1. Lamp switch assembly
	2. Harness
Headlamp is dim	1. Bulb
	2. Harness
Only one side tail lamp lights	1. Bulb
	2. Harness
Tail lamps on both sides do not light (Headlamp is normal)	1. Fuse
	2. Light control switch
	3. Harness
Tail lamps on both sides do not light (Headlamp is abnormal)	1. Beam control switch
	2. Harness

## 2. FRONT FOG LAMP SYSTEM

Symptom	Suspected Area
Front fog lamp dose not light up with light control switch HEADLAMP (Head lamp is normal).	1. Fog lamp fuse
	2. Front fog lamp relay
	3. Light switch assembly
	4. Harness
Only one side front fog lamp dose not light	1. Bulb
	2. Harness

## 3. REAR FOG LAMP SYSTEM

Symptom	Suspected Area
Rear fog lamp dose not light up with light control switch on FRONT FOG LAMP (Small lamp is normal).	1. Bulb
	2. Light switch assembly
	3. Harness
Rear fog lamp dose not light up with light control switch on FRONT FOG LAMP (Small lamp is abnormal).	1. Bulb
	2. Tail lamp fuse
	3. Harness
Only one side rear fog lamp dose not light	1. Bulb
	2. Harness

#### 4. TURN SIGNAL AND HAZARD WARNING SYSTEM

Symptom	Suspected Area
“ Hazard" and “ Turn” does not operate	1. HAZARD Fuse
	2. Central controller
	3. Harness
Hazard warning lamp does not operate (Turn is normal)	1. Hazard warning switch
	2. Harness
Hazard warning lamp is abnormal (Hazard is abnormal)	1. Turn signal switch
	2. Harness
Turn signal dose not light up in one direction	1. Turn signal switch
	2. Harness
Only one bulb dose not light up	1. Bulb
	2. Harness

#### 5. BRAKE LAMP SYSTEM

Symptom	Suspected Area
Brake lamps on both sides do not light up	1. Brake lamp fuse
	2. Brake lamp switch
	3. Harness
Brake lamp remains always ON	1. Brake lamp switch
	2. Harness
Brake lamp dose not light (One side)	1. Bulb
	2. Harness
High mounted Brake lamp dose not light up (Stop lamp is normal)	1. Bulb
	2. Harness

## 6. BACK-UP LAMP SYSTEM

Symptom	Suspected Area
Back-up lamps on both sides do not light up	1. Back-up lamp fuse
	2. Back-up lamp switch assembly
	3. Harness
Back-up lamps on both sides remains always ON	1. Back-up lamp switch assembly
	2. Harness
Back-up lamp dose not light (One side)	1. Bulb
	2. Harness

## 7. INTERIOR LIGHT SYSTEM

Symptom	Suspected Area
Interior lamp dose not light (All)	1. ROOM Fuse
	2. Harness
Room lamp dose not light up Rear row reading lamp assembly is normal	1. Bulb
	2. Room lamp assembly
	3. Harness
One door is ajar, room lamp dose not light up on DOOR, (It is normal on ON)	1. Door courtesy lamp switch
	2. Central controller
	3. Harness
Central LH/RH room lamps do not light up	1. Bulb
	2. Switch
Rear row reading lamp is abnormal (Room lamp assembly is normal)	1. Bulb
	2. Rear row reading lamp assembly
	3. Harness

## 8. DOOR COURTESY LAMP SYSTEM

Symptom	Suspected Area
Door courtesy lamp does not light (Room lamp is normal)	1. Bulb
	2. Door courtesy lamp switch
	3. Harness

## 9. LICENSE PLATE LAMP

Symptom	Suspected Area
License plate lamp does not light (Tail lamp is normal)	1. Bulb
	2. Harness

## 10. REAR TRUNK LAMP

Symptom	Suspected Area
Rear trunk lamp does not light (Room lamp is normal)	. 1 Bulb
	. 2 Rear trunk lamp switch
	. 3 Harness

## II. LIGHT SYSTEM FAULTS INSPECTION

### 1. HEADLAMP COMBINATION SWITCH ASSEMBLY

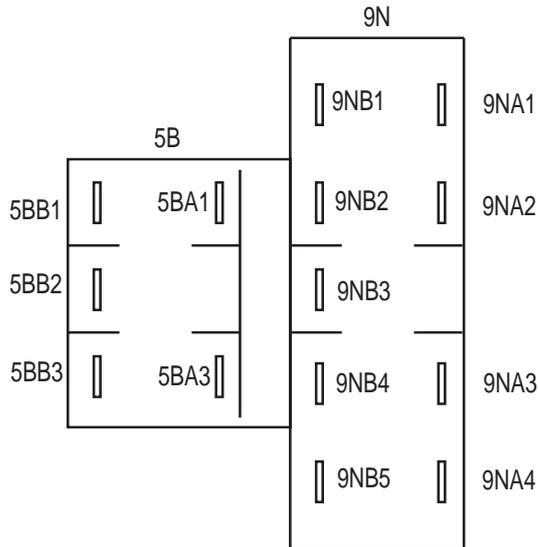
Headlamp Combination Switch Range Illustration

		9NA4	9NA5	9NA2
Turn Switch	Left Turn	○ — ○		
	Straight Run	○	○	○
	Right Turn		○ — ○	

		9NA1	9NB3	9NB2	5BB1	9NB5
Lamp Switch	Horn	○ — ○				
	High Beam		○ — ○			
	Dipped Beam				○ — ○	

Lamp Handle	Fog Light Handle	5BB2	5BB3	9NB4	9NB1	9NB5	5BB1
○	○						
○	Front Fog Lamp		○ — ○				
Position Lamp	○	○ — ○					
Position Lamp	Front Fog Lamp	○ — ○ — ○					
Position Lamp	Front And Rear Fog Lamp	○ — ○ — ○ — ○					
Headlamp	○	○ — ○				○ — ○	
Headlamp	Front Fog Lamp	○ — ○ — ○				○ — ○	
Headlamp	Front And Rear Fog Lamp	○ — ○ — ○ — ○				○ — ○	

Headlamp combined terminal position diagram



(a) Inspect light control switch continuity

Inspect each terminal for continuity when the switch is on every position according to the table.

Switch position	Tested terminal	Condition
OFF	5BB2-5BB3	No continuity
TAIL	5BB2-5BB3	Continuity

If it is not as specified, replace the switch.

(b) Inspect headlamp dimmer switch continuity

Inspect each terminal for continuity when the switch is on every position according to the table.

Switch position	Tested terminal	Condition
LO	5BB1-9NB5	Continuity
HI	9NB2-9NB3	Continuity
PASSING	9NA1-9NB3	Continuity

If it is not as specified, replace the switch.

(c) Inspect turn signal switch continuity

Inspect each terminal for continuity when the switch is on every position according to the table.

Switch position	Tested terminal	Condition
Left turn	9NA4-9NA5	Continuity
Straight run	9NA4-9NA5-9NA2	No continuity
Right turn	9NA5-9NA2	Continuity

If it is not as specified, replace the switch.

(d) Inspect front and rear fog switch continuity

Inspect each terminal for continuity when the switch is on every position according to the table.

Switch position	Tested terminal	Condition
OFF	5BB3-9NB4-9NB1	No continuity
Front fog lamp	5BB3-9NB4	Continuity
Rear fog lamp	5BB3-9NB1	Continuity

If it is not as specified, replace the switch.

2. BACK-UP LAMP SWITCH ASSEMBLY

Inspect back-up lamp switch continuity

Inspect continuity between the 2 terminals when the switch operates according to the table.

Switch position	Tested terminal	Condition
ON (Gearshift lever is on REVERSE)	1/2	Continuity
OFF	1/2	No continuity

If it is not as specified, replace the switch.

3. BRAKE LAMP SWITCH ASSEMBLY

Inspect brake lamp switch assembly continuity

Inspect continuity between the 2 terminals when brake lamp switch operates

Switch position	Tested terminal	Condition
Depress on the brake pedal	1/2	Continuity
Release the brake pedal	1/2	No continuity

If it is not as specified, replace the switch.

4. HAZARD WARNING LAMP SWITCH ASSEMBLY

Inspect hazard warning lamp switch for continuity.

Inspect continuity between the 2 terminals when the switch operates

Switch position	Tested terminal	Condition
ON	1/2	Continuity
OFF	1/2	No continuity

If it is not as specified, replace the switch.

5. DOOE COURTESY LAMP SWITCH ( ON DOOR LOCK ACTUATOR)

Inspect door courtesy lamp switch for continuity.

Inspect continuity between the terminal and the ground when the switch operates.

Switch position	Tested terminal	Condition
ON (The door is well closed)	1 – Ground the body	Continuity
OFF (The door is ajar)	1 – Ground the body	No continuity

If it is not as specified, replace the switch.

6. REAR TRUNK LAMP SWITCH ASSEMBLY

Inspect rear trunk lamp switch for continuity.

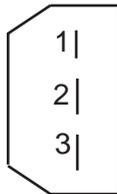
Inspect continuity between the terminal and the ground when the switch operates.

Switch position	Tested terminal	Condition
ON	1 – Ground the body	Continuity
OFF	1 – Ground the body	No continuity

If it is not as specified, replace the switch.

7. ROOM LAMP ASSEMBLY

Inspect each terminal on room lamp assembly for continuity.



	Switch position	Tested terminal	Condition
Interior dome lamp	ON	1-2	Continuity
	OFF	1-2 2-3	No continuity
	DOOR (The door is ajar)	2-3	Continuity
	DOOR (The door is closed)	2-3	No continuity
LR and RR reading lamps	ON (Switch is pressed)	1-2	Continuity
	OFF	1-2	No continuity

If it is not as specified, replace the dome lamp or the switch.

## 8. REAR ROW READING LAMP ASSEMBLY

Inspect rear row reading lamp switch assembly continuity

Inspect continuity between the 2 terminals when the switch operates

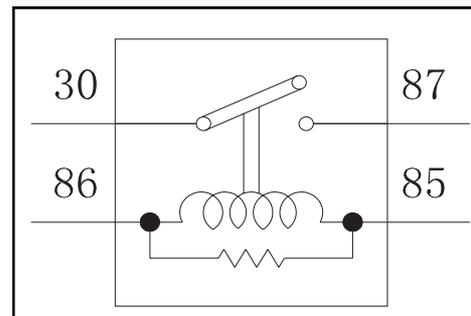
Switch position	Tested terminal	Condition
ON	1/2	Continuity
OFF	1/2	No continuity

If it is not as specified, replace the switch.

## 9. Front fog lamp relay

Inspect front fog lamp relay for continuity

Tested terminal	Condition
86-85	Continuity
30-87	No continuity



(a) Inspect continuity between terminals

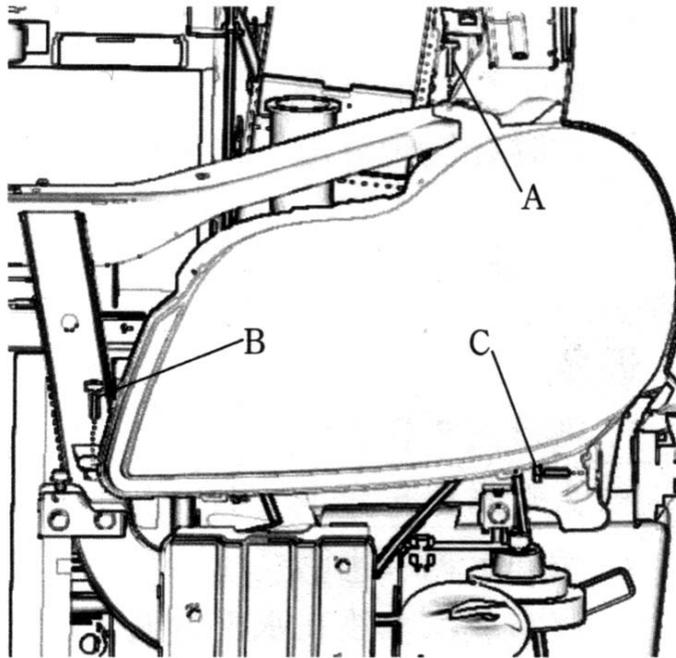
If it is not as specified, replace the relay.

(b) Impose a battery voltage (10V~14V) between terminal 86 and terminal 85, then inspect continuity between terminal 30 and terminal 87. If not, replace the relay.

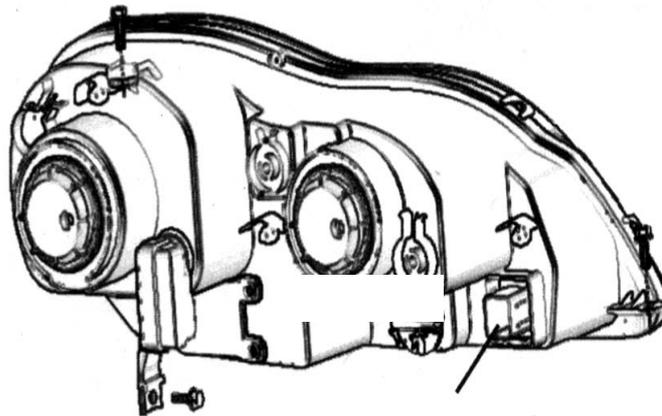
## Section 3 Headlamp Replacement

### I. REMOVAL

1. Remove front bumper (See bumper replacement).
2. Remove the 3 mounting bolts (A, B, C as shown in the illustration) on the headlamp.



3. Remove the electrical connector.

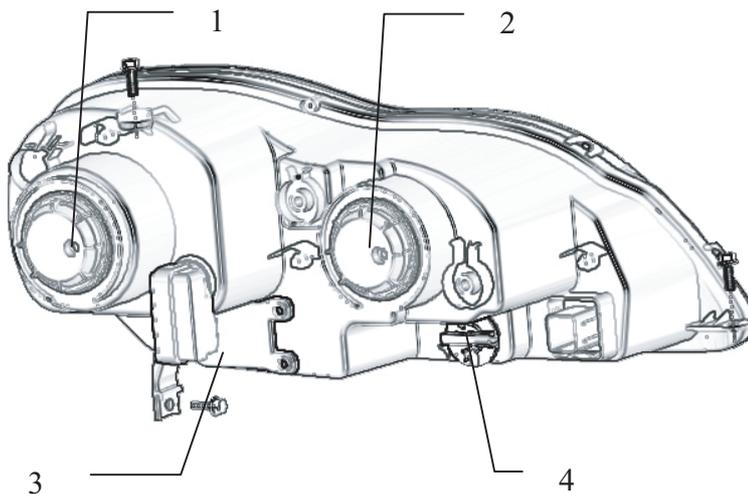


4. Move the assembly forwards and upwards then remove it.

## II.INSTALLATION

1. Install the electrical connector of the headlamp assembly.
2. Install the headlamp assembly and the 3 mounting bolts.
3. Install the front bumper.
4. Adjust the condition of the vehicle.
5. Adjust the headlamp beam.

## III.HEADLAMP BULB REPLACEMENT



1 - LOW BEAM DUST COVER 2 - HIGH BEAM DUST COVER 3 - TURN SIGNAL LAMP DUST COVER 4 - HEADLAMP HOLDER

### 1. Replace the high and low beam bulbs

- Turn and remove the dust cover counter-clockwise
- Pull out the bulb plug
- Press and release the wire clip
- Pull out the lamp-holder, and remove the bulb
- Replace the bulb

### 2. Replace the turn signal lamp bulbs

- Remove the 3 screws on the dust cover with screwdriver
- Turn the lamp-holder counter-clockwise. Pull out the lamp-holder, and remove the bulb
- Replace the bulb

### 3. Replace the headlamp bulbs

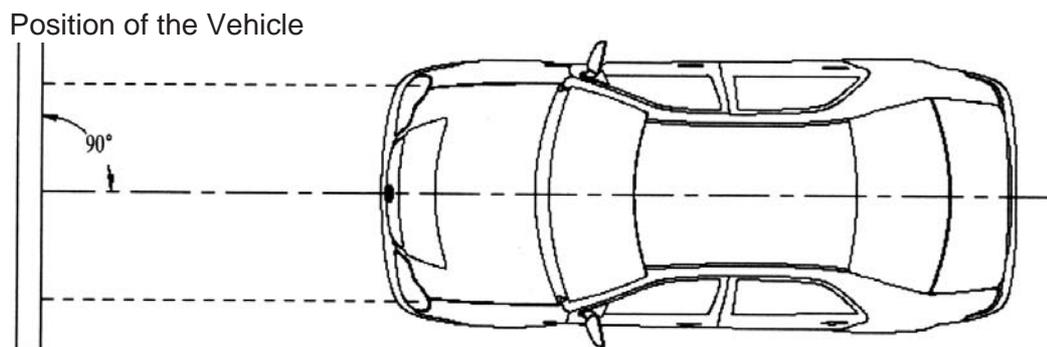
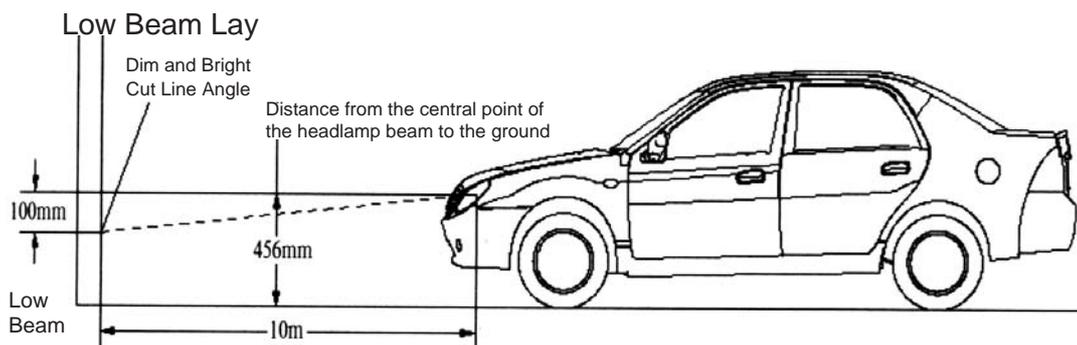
- Turn the lamp-holder counter-clockwise. Pull out the lamp-holder, remove the bulb, and replace the bulb.

## IV. HEADLAMP BEAM ADJUSTMENT

### LOW BEAM

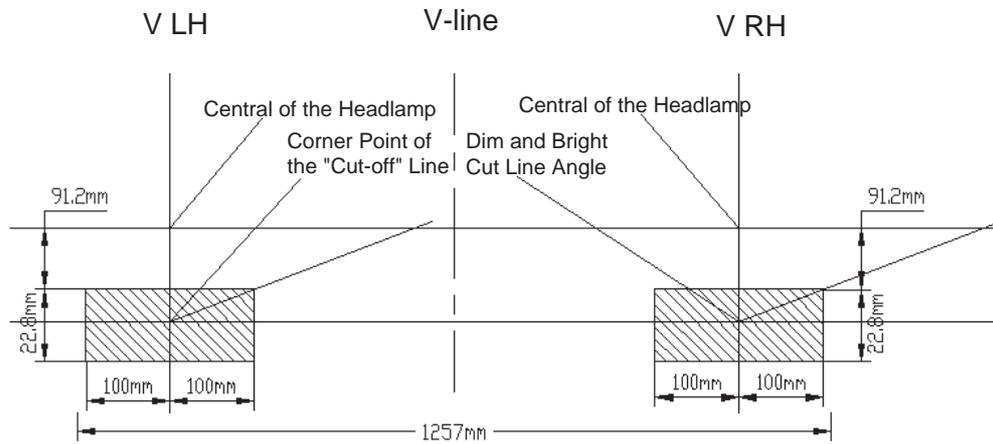
#### 1. Adjust the condition of the vehicle.

- Make sure the body around the headlamp is not deformed
- Tire inflation pressure is the specified value
- Park the no-load vehicle on a level spot
- Sit on the driver's seat and be ready for driving (with a full fuel tank)
- Put the vehicle in front of a wall, and let it be perpendicular to the wall
- Ensure the distance from the headlamps to the wall is 10 m



#### 2. Inspect the headlamp beam

- Set up a screen as shown in the illustration, to adjust the headlamp aim
- Cover the other lamps while a certain headlamp is adjusted.
- Start the engine
- Turn the headlamp low beam ON
- Then turn the adjusting screws controlling the beams. Make the main beam (the brightest point) at the specified height, that is, the corner point of the "cut-off" line is located in the center of the shaded part, as shown in the illustration.

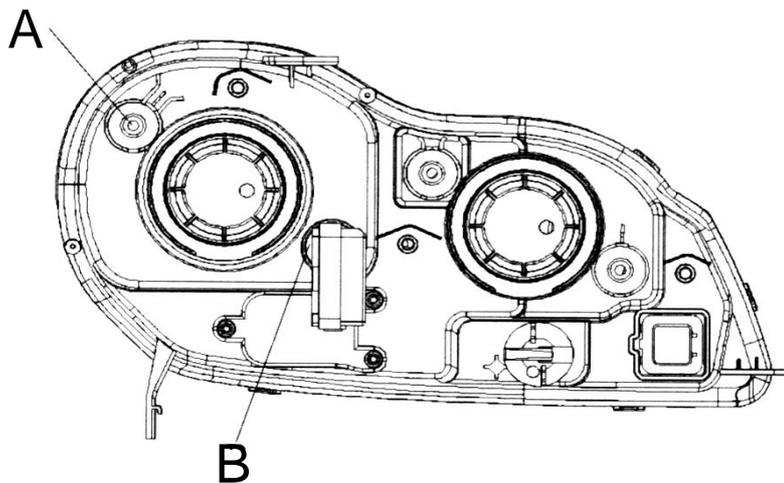


**NOTICE:**

The screw must be tightened when adjusting the headlamps. If it needs loosening for adjusting, you should completely loosen it and then begin to tighten it.

(1) Adjust the positions of the screw bolts, as shown in the illustration below.

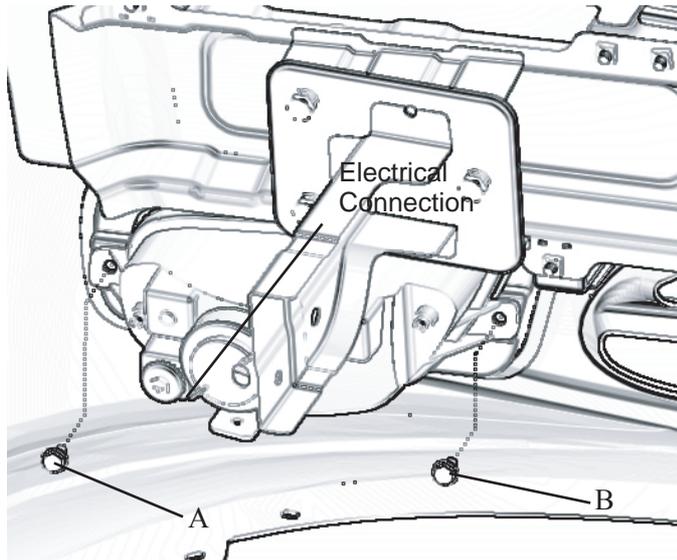
- Turn A for adjustment in horizontal direction within an allowed scope.
- Turn B for adjustment in vertical direction within an allowed scope.



## Section 4 Front Fog Lamp Replacement

### I. REMOVAL

1. Remove the front bumper.(See bumper replacement)
2. Remove the electrical connector.
3. Remove the mounting bolts (A, B as shown in the illustration).



4. Remove the front fog lamp assembly.

### II. INSTALLATION

1. Install the front fog lamp assembly.
2. Install the mounting bolts.
3. Install the electrical connector.
4. Install the front bumper.
5. Adjust the condition of the vehicle.
6. Adjust the front fog lamp beam.

### III. FRONT FOG LAMP BULB REPLACEMENT

1. Press and Turn counter-clockwise, then remove the dust cover
2. Pull out the bulb
3. Replace the bulb

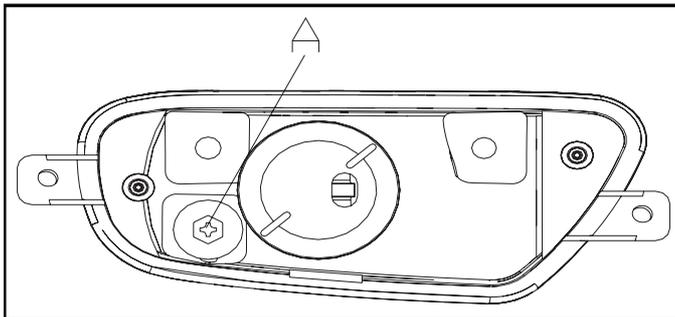
#### IV. FRONT FOG LAMP BEAM ADJUSTMENT

1. Adjust the tire inflation pressure with the standard value
2. Start the engine
3. Turn the fog lamp switch ON
4. Adjust the fog lamp beam.

Turn the bolt A for adjusting fog lamp beam in vertical direction.

#### NOTES:

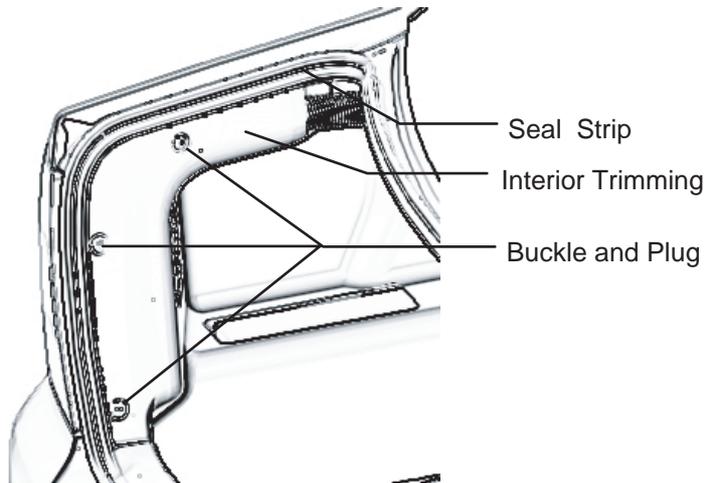
Turn the screwdriver counter-clockwise to make the light beam up, clockwise make the light beam down.



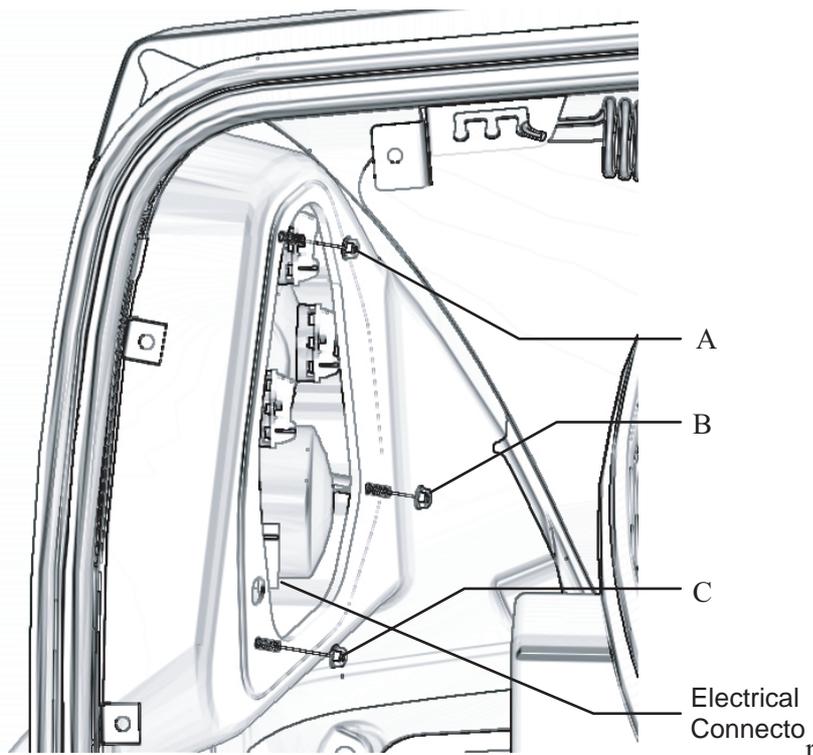
## Section 5 Rear Combination Lamp Replacement

### I. REMOVAL

1. Remove rear trunk seal strip and interior trimming.



2. Remove the 3 mounting bolts (A, B, C as shown in the illustration).



3. Remove the rear combination lamp electrical connector.
4. Pull the rear combination lamp assembly backwards.

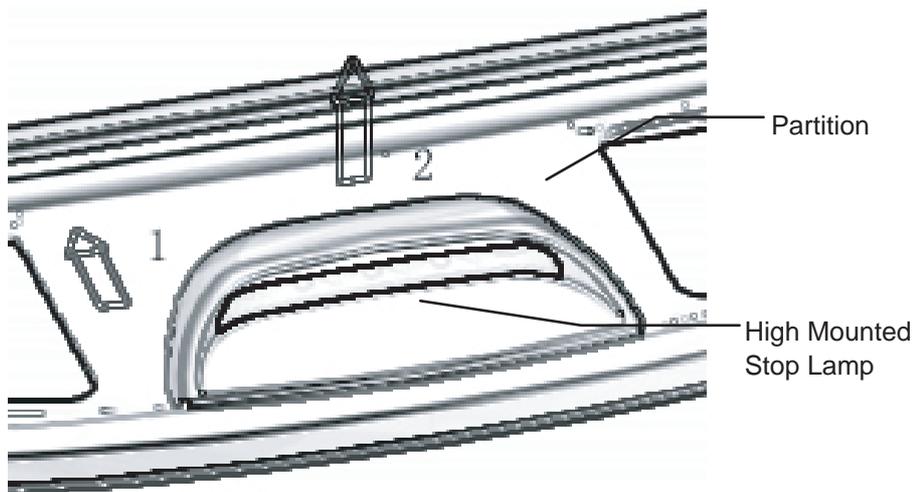
## II. INSTALLATION

1. Install the rear combination lamp and then the 3 mounting bolts.
2. Install the electrical connector.
3. Install the rear trunk interior trim.
4. Install the seal strip.

## III. REAR COMBINATION LAMP BULB REPLACEMENT

1. Remove the O-ring seal.
2. Turn the lamp-holder counter-clockwise. Pull out the lamp-holder.
3. Remove the bulb and replace the bulb.

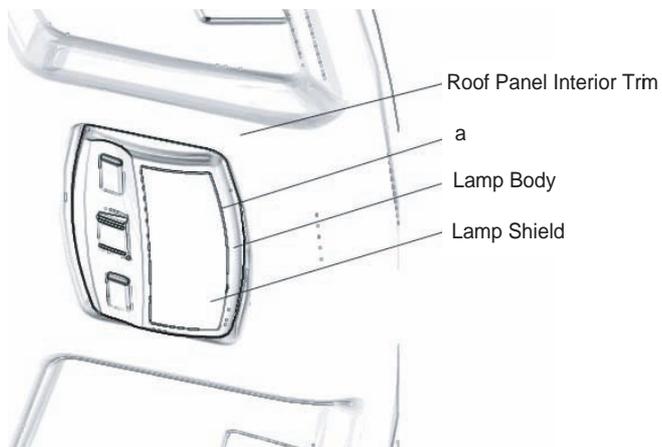
### Section 6 High Mounted Stop Lamp Replacement



- Remove the High mounted stop lamp in direction 1 and 2. (as shown above in the illustration)
- Disconnect the connector.

## Section 7 Interior Dome Lamp Replacement

1. Gently Pry the lamp shield off at the point a with a screwdriver.

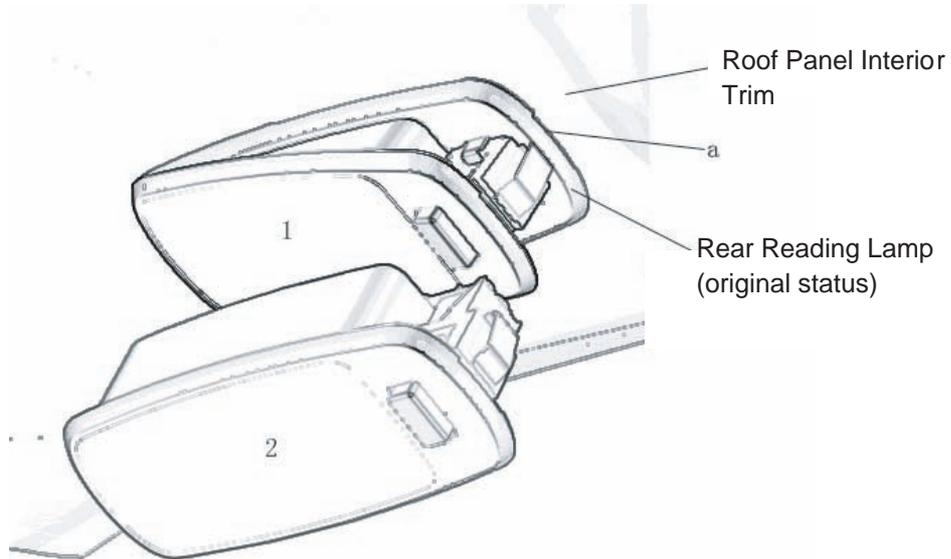


2. Remove the 2 mounting bolts with a screwdriver (take care not to touch the bulb).
3. Pull the High mounted stop lamp assembly downwards.



4. Pull out the electrical connector.

## Section 8 Rear Row Reading Lamp Replacement



1. Gently pry the rear row reading lamp off at the point a with a screwdriver (Position 1 as shown in the illustration).
2. Pull out the rear reading lamp downwards with an angle (Position 2 as shown in the illustration)
3. Remove the electrical connector.

## Section 9 License Plate Lamp Replacement

1. Remove the license plate lamp with a screwdriver.
2. Remove the electrical connector.

# Chapter 6 Audio System

## Section 1 Audio System Description

Description:

### 1. Radio Wave Band

The radio wave bands used in radio broadcasting are as following:

Frequency	30KHZ	300KHZ	3MHZ	30MHZ	300MHZ
Bard	LF	MF	HF	VHF	
Radio wave		AM		FM	
Modulation	Amplitude modulation			Frequency modulation	

LF: Low frequency

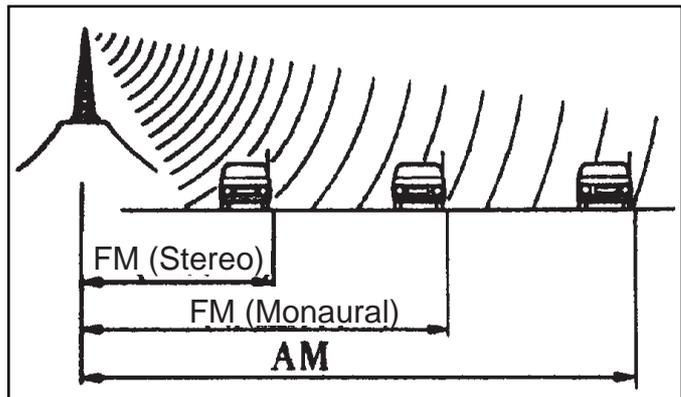
MF: Medium frequency

HF: High frequency

VHF: Very High frequency

### 2. Cover Area

There are great differences in the size of the cover area for AM and FM monaural. Sometimes FM stereo broadcasts cannot be received even though AM comes in very clearly. Not only does FM stereo have the smallest cover area, but it also picks up static and other types of interference ("noise") easily.



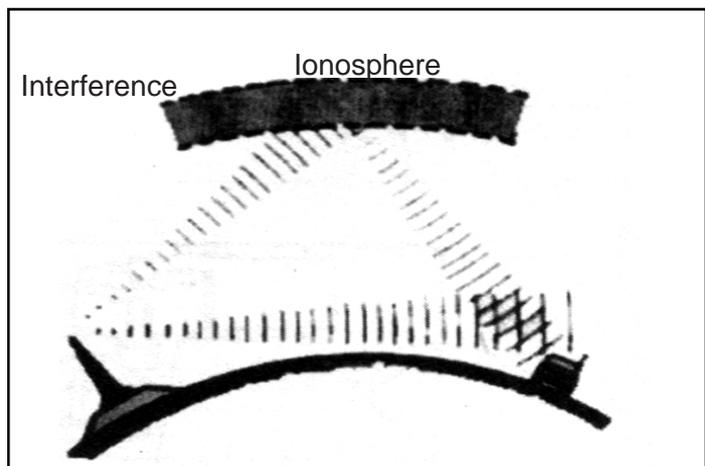
### 3. Reception problems

Hint:

Besides the static noise fault, there are also the faults called "interference", "multipath transfer" and "fade out". These faults are caused not by electrical noise but by the nature of the radio waves themselves.

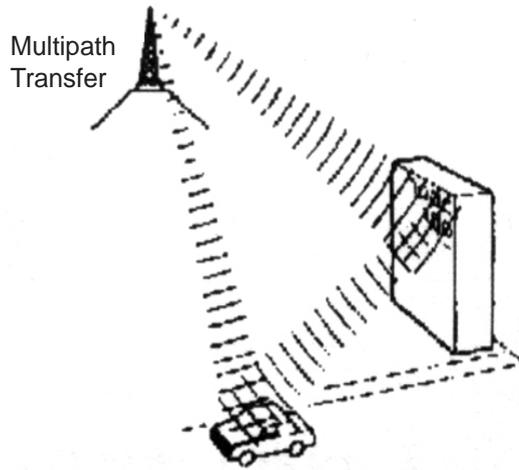
#### (1) Interference

Besides static noise fault, AM broadcasts are also susceptible to other types of noises, especially at night. This is because AM radio waves are reflected by the Ionosphere at night. These radio waves then interfere with the signals from the same transmitter that reach the vehicle's antenna directly. This type of noise is called "interference".



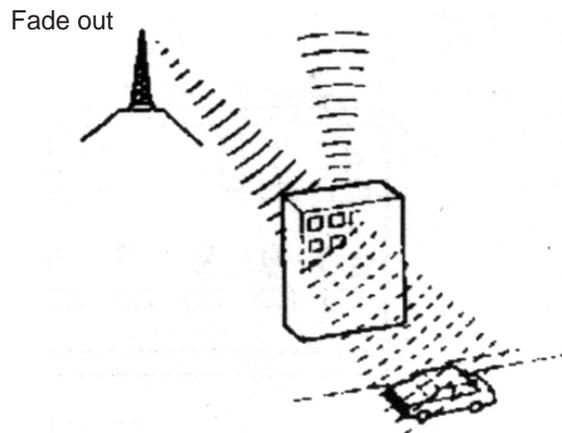
(2) Multipath transfer

Noise caused by bouncing of radio waves off obstructions is called "multipath transfer". Multipath transfer occurs when a signal from the broadcast transmitter antenna reflects off buildings and mountains and interferes with the signal that is received directly.



(3) Fade out

Because FM radio waves are of higher frequencies than AM radio waves, they are reflected off buildings, mountains, and other obstructions. For this reason, FM signals often seem to gradually disappear or fade away as the vehicle goes behind a building or other obstructions. This is called "fade out".



4. Noise faults

For noise troubleshooting it is very important to understand the feedback information from the customers well, so make the best use of the following questionnaire and diagnose the fault accurately.

Radio Wave	Operating condition when noise occurs	Cause
AM	Noise occurs at a specific place.	Strong possibility of foreign noise.
	Noise occurs when listening to faint broadcasting.	There is a case that the same program is broadcasted from each local station and that may be the case you are listening to different station if the program is the same.
FM	Noise occurs only at night.	Strong possibility of the interference from far distant broadcasting.
	Noise occurs while driving and at a specific place.	Strong possibility of multipath transfer interference and caused by the changes of FM waves.

HINT:

In the case that the noise occurrence condition does not meet any of the above, check based on the "Recep-

tion Problems".

## 5. COMPACT DISC PLAYER

Compact Disc Players (hereinafter referred as CD) use a laser beam pick-up to read the digital signals recorded on the CD and reproduce analog signals of the music, etc.

### HINT:

Never attempt to disassemble or oil any part of the player unit.

Do not insert any object other than a disc into the disc box.

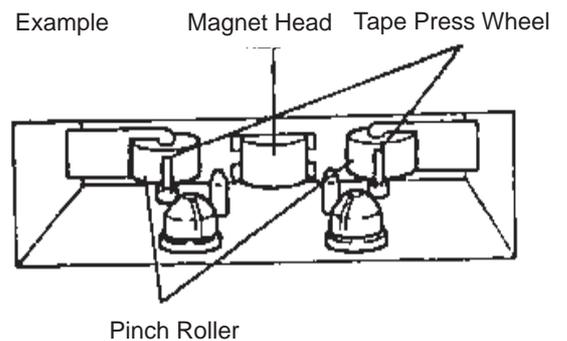
### NOTICE:

CD players use an invisible laser beam which could cause hazardous radiation exposure. Be sure to operate the player correctly as instructed.

## 6. MAINTENANCE

### (1) Tape player/magnet head cleaning:

- ① Raise the cassette door with your finger.  
Next, using a pencil or similar object, push in the guide.
- ② Using a cleaning pen or cotton applicator soaked in cleaner, clean the magnet head surface, pinch rollers and tape press wheel.

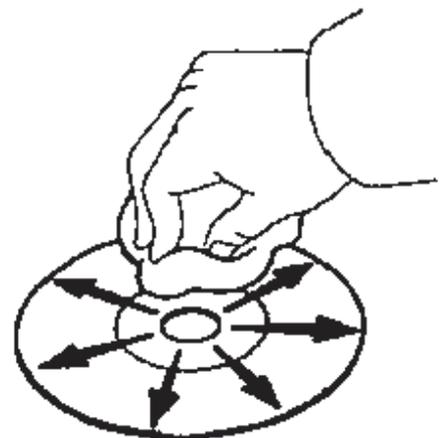


### (2) CD player/disc cleaning:

If the disc gets dirty, clean the disc by wiping the surface from the center to outside in the radial directions with a soft cloth.

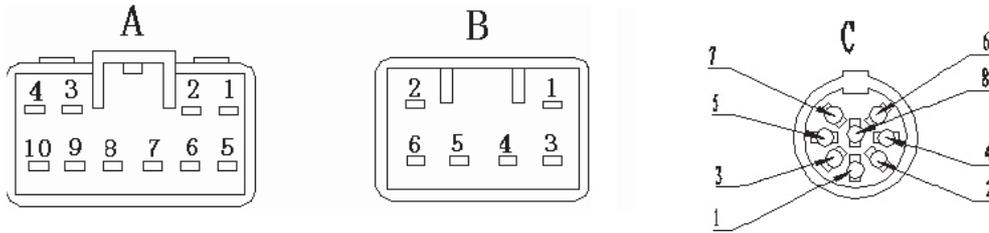
### NOTICE:

Do not use a conventional record cleaner or anti-static preservative.



## Section 2 Audio System Connector Terminal Layout

### 1. Connector terminal layout on wire harness



### 2. Connect terminal definition

Terminal No.	Function	Wire color	Condition	Standard Voltage
A1	FR+	Lg	The audio system is on	Wave form is synchronized with the output sound
A2	FL+	YB	The audio system is on	Wave form is synchronized with the output sound
A3	ACC	RW	Ignition switch turned to ACC	10~14V
A4	B+	R	Constant Status	10~14V
A5	FR-	LgR	The audio system is on	Wave form is synchronized with the output sound
A6	FL-	Y	The audio system is on	Wave form is synchronized with the output sound
A7	GND	B	Constant Status	Continuity
A8	Null			
A9	Null			
A10	TAIL	GW	Position lamp switch turned to ON	10~14V
B1	RR+	PB	The audio system is on	Wave form is synchronized with the output sound
B2	RL+	YR	The audio system is on	Wave form is synchronized with the output sound
B3	RR-	P	The audio system is on	Wave form is synchronized with the output sound
B4	Null			
B5	Null			
B6	RL-	YW	The audio system is on	Wave form is synchronized with the output sound
C1	B+		Constant Status	10~14V
C2	BUS		Audio system is On	Pulse Signal
C3	GND		Constant Status	Continuity
C4	ACC		Ignition switch ACC	10~14V
C5	Null			
C6	R-OUT		The audio system is on	Wave form is synchronized with the output sound
C7	L-OUT		The audio system is on	Wave form is synchronized with the output sound
C8	GND(Audio Frequency)		Constant Status	Continuity

## Section 3 Audio System Inspection

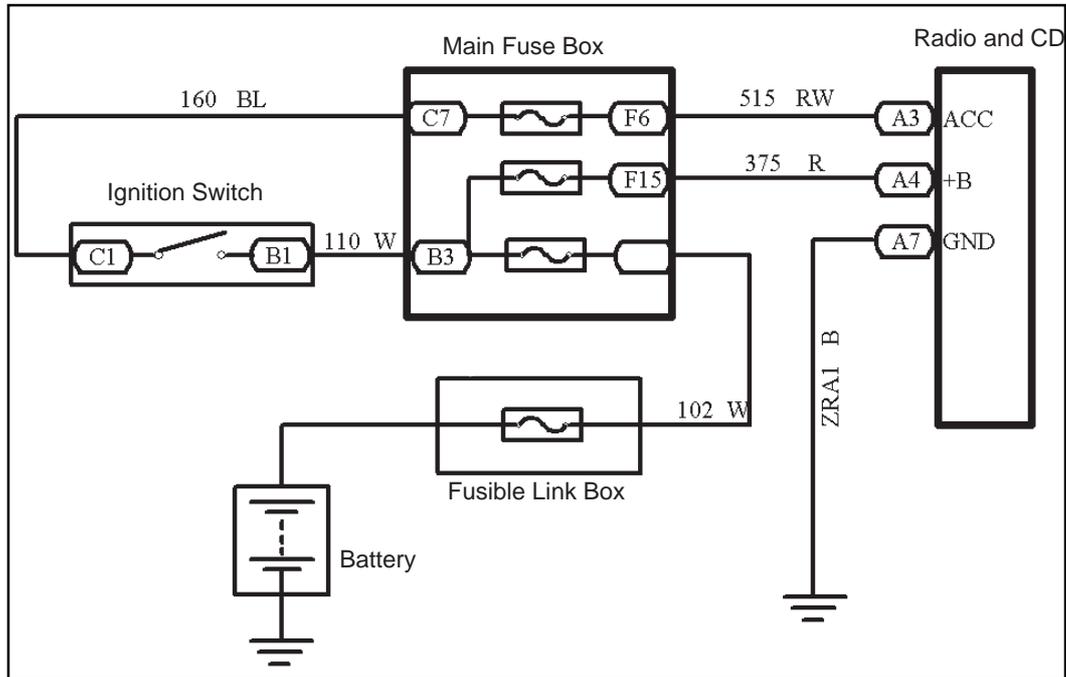
### I Troubleshooting

Symptom	Suspected Area
Radio not operating when power switch turned to " ON" .	1. Radio assembly circuit faulty 2. Radio assembly
The radio backlight does not light up with the illumination switch ON	1. Radio assembly backlight terminal 2. Radio assembly
Speaker soundless in all modes	1. Speaker circuit 2. Radio assembly power circuit faulty 3. Radio assembly
Sound quality poor in all modes (Volume faint)	1. Speaker circuit 2. Radio assembly power circuit faulty 3. Radio assembly
Unable to receive radio broadcast (poor reception)	1. Antenna circuit 2. Radio assembly
The cassette could not be inserted or played	1. Tape 2. Radio assembly power circuit faulty 3. Radio assembly
Cassette tape will not be ejected	1. Tape 2. Radio assembly
Sound quality poor only when playing cassette tape	1. Tape 2. Radio assembly
Tape jammed, malfunction with tape speed or auto-reverse	1. Tape 2. Radio assembly
CD could not be inserted or ejected after inserted.	1. Wire between CD box and main unit 2. CD Player main unit power supply circuit fault 3. CD box 4. CD Player main unit
Power coming in, but CD player not operating.	1. Wire between CD box and main unit 2. CD box 3. CD 4. CD Player main unit
CD can not be taken out	1. Wire between CD box and main unit 2. CD box 3. CD 4. CD PLAYER main unit
Sound quality poor only when playing CD (Volume faint)	1. Wire between CD box and main unit 2. CD box
CD sound jump	1. CD box 2. CD box installation

## II. Inspection

### 1. Power switch system doesn't work

#### Wiring Diagram



#### (1) Check radio assembly (+B, → ACC, → GND)

- ① Check the continuity between terminals under each operating condition as shown in the table below

Standard:

Tester connection	Condition	Standard Status
GND	Constant Status	Continuity

- ② Check the voltage between terminals under each operating condition as shown in the table

Standard:

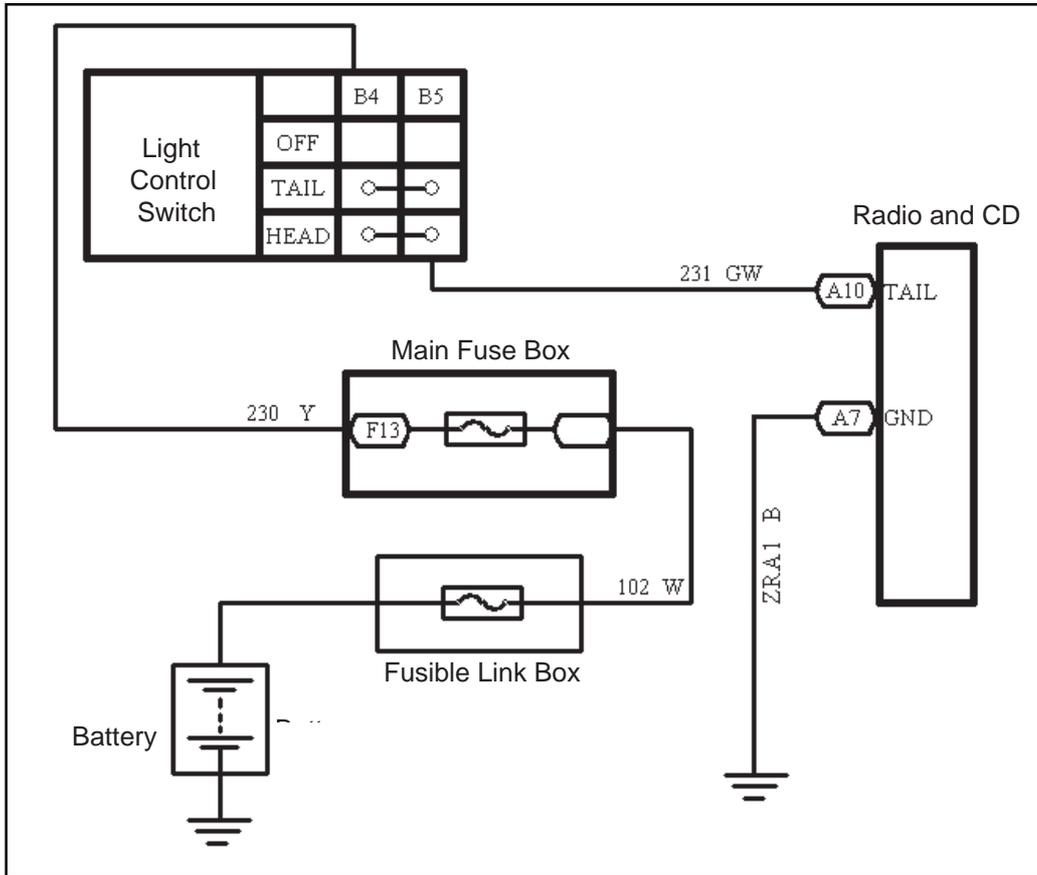
Tester Connection	Condition	Standard Status
+B - GND	Constant Status	10~14V
ACC - GND	Ignition switch ACC or ON	10~14V

Normal: Repair or replace wire harness, connector

Abnormal: Check or replace radio assembly

2. The radio backlight does not light up with the illumination switch ON

Wiring Diagram



(1) Check radio assembly (TAIL)

Check the voltage between terminals under each operating condition as shown in the table below.

Standard:

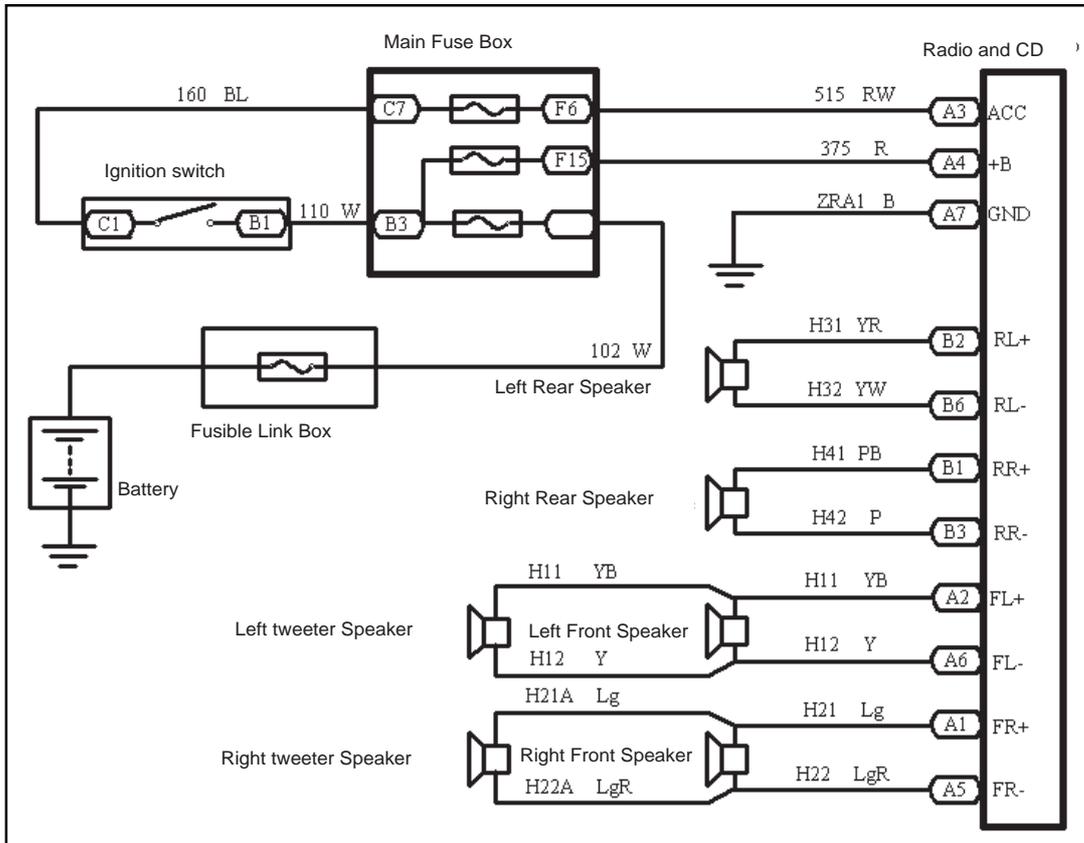
Tester Connection	Condition	Standard Status
TAIL - GND	Combined Switch (Light switch)	10~14V

Abnormal: Repair or replace wire harness and connector

Normal: Check and replace radio assembly

### 3. Speaker soundless in all modes

#### Wiring Diagram



#### (1) Check LCD (Liquid Crystal Display) illumination

- ① Turn ignition switch to ACC
- ② Connect radio assembly continuity
- ③ Switch on position lamp

Standard: Radio assembly LCD light goes on

Abnormal: Go to Step (7)

Normal: Go to Next Step

#### (2) Control volume and adjust volume balance

- Operate the radio assembly to adjust volume balance and find soundless speaker
- Check and replace the radio assembly if all the speakers are soundless
- Check and replace the soundless speakers if some of the speakers are soundless

(3) Tweeter speaker assembly inspection

- ① Disconnect speaker connector
- ② Check resistance

Notice:

Do not remove the speaker during inspection.

Standard Value:  $4\Omega$ ,

Abnormal Replace tweeter speaker assembly

NORMAL Check wire harness and connector

(4) Check front speaker assembly

- ① Disconnect speaker connector
- ② Check resistance

Standard Value:  $4\Omega$ ,

Abnormal: Replace front speaker assembly

Normal: Check wire harness and connector

(5) Check rear speaker assembly

- ① Disconnect speaker connector
- ② Check resistance

Standard Value:  $4\Omega$ ,

Abnormal: Replace rear speaker assembly

Normal: Check wire harness and connector

(6) Check wire harness and connector

Abnormal: Repair or replace wire harness and connector

Normal: Check and replace radio assembly

(7) Check and replace radio assembly (+B, ACC, GND)

- (a) Check the continuity between terminals under each operating condition as shown in the table below.

Standard:

Tester connection	Condition	Standard Status
GND	Constant Status	Continuity

- (b) Check the voltage between terminals under each operating condition as shown in the table below.

Standard:

Tester Connection	Condition	Standard Status
+B - GND	Constant Status	10~14V
ACC - GND	Ignition switch ACC or ON	10~14V

Normal: Repair or replace wire harness and connector

Abnormal: Check and replace radio assembly

#### 4. Unable to receive radio broadcast (poor reception)

##### (1) Check if the radio auto-research function works

Perform the radio auto-research function to see if it works

Normal: Check and replace radio assembly

Abnormal: Check the antenna for noise

##### (2) Check the antenna for noise

① Turn on radio to AM with the ignition switch ACC.

② Touch the antenna of the seated antenna assembly with the tip of the screwdriver. Check the speaker for noise.

Standard: There is noise

Normal: Check and replace radio assembly

Abnormal: Check antenna assembly

##### (3) Check antenna assembly

① Remove the antenna plug from the antenna assembly

② Check for noise

- Connect the radio assembly connector and turn the ignition switch to ACC.
- Turn on the radio to AM
- Insert a flat pan screwdriver or metal object similar to thin wire into the hole in the antenna coaxial cable. Check the speaker for noise.

Standard: There is noise.

Normal: Check and replace radio assembly

Abnormal: Check and replace antenna coaxial cable sub-assembly

#### 5. Cassette tape can not be inserted or played.

##### (1) Check for foreign object

- Check the radio assembly and cassette recorder for foreign object or defect.

Abnormal: Clean foreign object

Normal: Check cassette tape

##### (2) Check cassette tape

- Check if the cassette tape is used to record music or sound.

Replace the tape with another tape and re-check if it is faulty.

##### (3) Replace it with another tape and re-check

- Replace the faulty tape with working tape to see if the same fault will re-occur.

Standard: The function is normal

Normal: The tape is faulty

Abnormal: Check if the radio auto-research function works

(4) Check if the radio auto-research function works

- Perform the radio auto-research function to see if it works

Standard: The operation works.

Normal: Check and replace radio assembly

Abnormal: Check radio assembly (+B, ACC, GND)

(5) Check the radio assembly (+B, ACC, GND)

- ① Check the continuity between terminals under each operating condition as shown in the table below.

Standard:

Tester connection	Condition	Standard Status
GND	Constant Status	Continuity

- ② Check the voltage between terminals under each operating condition as shown in the table below.

Standard:

Tester Connection	Condition	Standard Status
+B - GND	Constant Status	10~14V
ACC - GND	Ignition switch ACC or ON	10~14V

Abnormal: Repair or replace wire harness and connector

Normal: Check and replace radio assembly

6. The tape doesn't eject

- (1) Press "EJECT" and check the operation

- Press "EJECT" of the radio assembly. Check if the tape ejects.

Standard: The tape is ejected.

Abnormal: Check and replace radio assembly

Normal: Check cassette tape

- (2) Check cassette tape

- Check the ejected tape for trademark peeled off or tape box distortion or other issues

Standard: There is nothing wrong with the tape

Abnormal: There is something wrong with the tape

Normal: Replace it with another tape and re-check

- (3) Replace it with another tape and re-check.

- Replace the faulty tape with working tape to see if the same fault will re-occur.

Standard: The fault is cleared

Normal: There is something wrong with the tape

Abnormal: Check and replace the recorder assembly

## 7. Poor sound quality only when playing tape

### (1) Replace it with another tape and re-check

- Replace the faulty tape with working tape to see if the same fault will re-occur.

Standard: The fault is cleared

Normal: There is something wrong with the tape

Abnormal: Check for foreign object

### (2) Check for foreign object

- Check the radio assembly and the cassette player for foreign objects or defects.

Abnormal: Clean foreign objects

Normal: Clean the magnet head and check operation

### (3) Magnet Head Cleaning

① Raise the cassette door with your finger. Next, using a pencil or similar object, push in the guide.

② Using a cleaning pen or cotton applicator soaked in cleaner, clean the magnet head surface, pinch rollers and tape press wheel.

③ Check if the same fault reoccurs.

Normal: The magnet head is dirty

Abnormal: Check and replace radio assembly

## 8. Tape jammed, malfunction with tape speed or auto-reverse

### (1) Check for foreign objects

- Check the radio assembly and tape player for foreign objects and defects

Standard: No foreign objects or defects

Abnormal: Clean foreign objects

Normal: Replace it with another tape and re-check

### (2) Replace it with another tape and re-check

- Replace the faulty tape with working tape (less than 90min) to see if the same fault will re-occur.

Standard: The fault is cleared.

Normal: There is something wrong with the tape

Abnormal: Clean the head

### (3) Clean the magnet head

① Raise the cassette door with your finger. Next, using a pencil or similar object, push in the guide.

② Using a cleaning pen or cotton applicator soaked in cleaner, clean the magnet head surface, pinch rollers and capstans.

③ Check if the same fault reoccurs.

Normal: The head is dirty

Abnormal: Check and replace radio assembly

9. CD can not eject after inserted

(1) Check if the CD box power supply is NORMAL

- ① Turn the ignition switch to ACC
- ② Check the continuity between the CD box terminals under each operating condition as shown in the table below

Standard:

Tester connection	Condition	Standard Status
GND	Constant Status	Continuity

③ Check the voltage between terminals under each operating condition as shown in the table below.

Standard:

Tester Connection	Condition	Standard Status
+B - GND	Constant Status	10~14V
ACC - GND	Ignition switch ACC or ON	10~14V

Normal: Replace CD, DVD box

Abnormal: Check if the head unit side C socket voltage output is NORMAL

(2) Check if the head unit side C socket voltage output is NORMAL

- ① Turn the ignition switch to ACC
- ② Check the continuity between the magnet head unit C socket terminals under each operating condition as shown in the table below

Standard:

Tester connection	Condition	Standard Status
GND	Constant Status	Continuity

③ Check the voltage between terminals under each operating condition as shown in the table below.

Standard:

Tester Connection	Condition	Standard Status
+B - GND	Constant Status	10~14V
ACC - GND	Ignition switch ACC or ON	10~14V

Normal: Replace the signal wire connecting magnet head unit and CD box

Abnormal: Check the radio assembly (+B, ACC, GND)

(3) Check the radio assembly (+B, ACC, GND)

- ① Check the continuity between terminals under each operating condition as shown in the table below.

Standard:

Tester connection	Condition	Standard Status
GND	Constant Status	Continuity

② Check the voltage between terminals under each operating condition as shown in the table below.

Tester Connection	Condition	Standard Status
+B - GND	Constant Status	10~14V
ACC - GND	Ignition switch ACC or ON	10~14V

Abnormal: Repair or replace wire harness and connector

Normal: Check and replace radio assembly

10. Power coming in, but CD player not operating.

(1) Press CD player "OPEN" to see if CD ejects.

No CD does not eject for inspection after being inserted

Yes Check if the right CD is inserted

(2) Check if the proper CD is inserted

① Check if the proper CD is inserted

② Make sure the working CD is music and it is not distorted, cracked, dirty, scratched or defected.

Standard: Working music CD

Description:

Semi-transparent CD or CD of strange shape can not be played.

Music CD recorded in PC CD-ROM and recorded CD-R can not be played.

Adapter is not needed to play 8cm CD.

Abnormal: There is something wrong with CD

Normal: Check and insert a proper CD

(3) Check and insert a proper CD

① Check and insert a proper CD.

② Check if CD is installed in reverse order.

Standard: No

Abnormal: Install the disc correctly

Normal: Clean the disc

(4) Replace it with another CD and re-check.

- Replace the faulty CD with working CD to see if the same fault re-occurs.

Standard: The fault is cleared

Abnormal: There is something wrong with CD

Normal: Check if the radio auto-research function works

(5) Check if the radio auto-research function works

- Perform the radio auto-research function

Standard: The fault is cleared.

Abnormal: Go to Step (9)

Normal: Has sudden temperature change occurred inside vehicle?

(6) Has sudden temperature change occurred inside vehicle?

- Check if sudden temperature change has occurred inside vehicle

Standard: Sudden temperature change has occurred inside vehicle.

Description:

Formulation of dew condensation inside the CD player is due to temperature changes. CD may not play.

Normal: Formulation of dew condensation due to temperature changes (Leave it for a while before using it)

Abnormal: Check the signal wire between the radio and disc box

(7) Check the signal wire for short circuit or open circuit.

Yes Replace the signal wire

No Replace the disc box

(8) Replace the disc box

Standard: The faulty is cleared

Normal: Box faulty

Abnormal: Check the radio assembly (+B, ACC, GND)

(9) Check the radio assembly (+B, ACC, GND)

- ① Check the continuity between terminals under each operating condition as shown in the table below.

Standard:

Tester connection	Condition	Standard Status
GND	Constant Status	Continuity

- ② Check the voltage between terminals under each operating condition as shown in the table below.

Standard:

Tester Connection	Condition	Standard Status
+B - GND	Constant Status	10~14V
ACC - GND	Ignition switch ACC or ON	10~14V

Abnormal: Repair or replace wire harness and connector

Normal: Check and replace radio assembly

11. Sound quality poor only when playing CD (Volume faint)

(1) Replace it with another CD and re-check

Normal: CD failure

Abnormal: Replace the disc box

(2) Replace the disc box

Normal: Box damaged

Abnormal: Check and replace radio assembly

12. CD sound jump

(1) Disc cleaning

- If the disc gets dirty, clean the disc by wiping the surface from the center to outside in the radial directions with a soft cloth.

Notice:

Do not use a conventional record cleaner or anti-static preservative.

Standard: The fault is cleared.

Normal: The disc is dirty

Abnormal: Replace it with another CD and re-check.

(2) Replace it with another CD and re-check.

Standard: The fault is cleared.

Normal: CD failure

Abnormal: Check when it will happen

(3) Check when it will happen

- Check where sound jump will happen

Standard: Drive on bumpy road

Normal: Replace CD box

Abnormal: Compare with other vehicles of the same model

(4) Compare with other vehicles of the same model

- Compare with other vehicles of the same model of no fault. Check for any difference when faulty occurs.

Standard: No difference is found.

Normal: Make sure there is no difference

Abnormal: Check CD box installation

(5) Check CD box installation

- Check CD box installation

Standard: Installation correct

Abnormal: Install CD box correctly

Normal: Has sudden temperature change occurs inside the disk cabin?

(6) Has sudden temperature change occurs inside the disk cabin?

- Check if sudden temperature change occurs inside the disk cabin?

Standard: Sudden temperature change occurs inside the disk cabin.

Description:

Formulation of dew condensation inside the CD player is due to temperature changes. CD may not play.

Normal: Formulation of dew condensation due to temperature changes (Leave it for a while before using it)

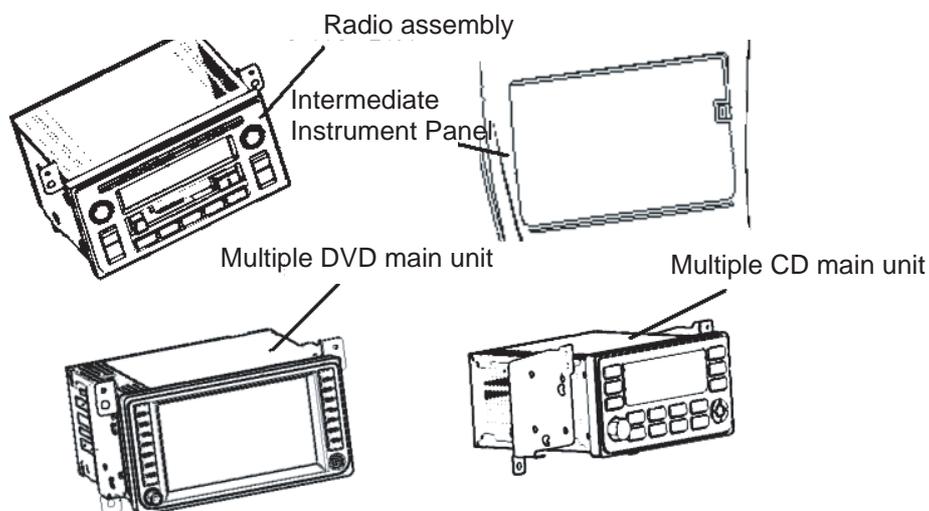
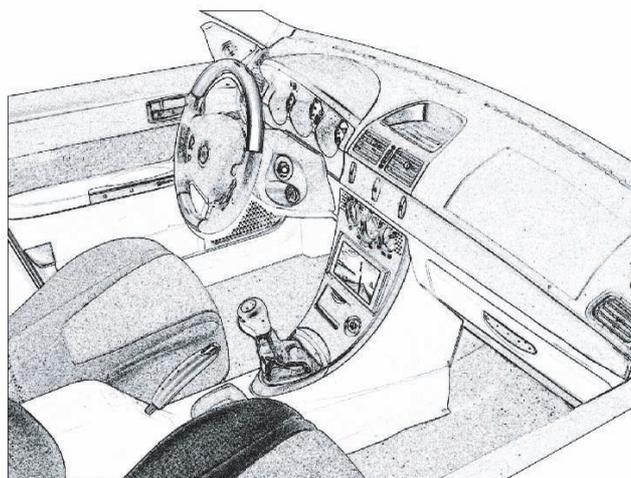
Abnormal: Check and replace CD box

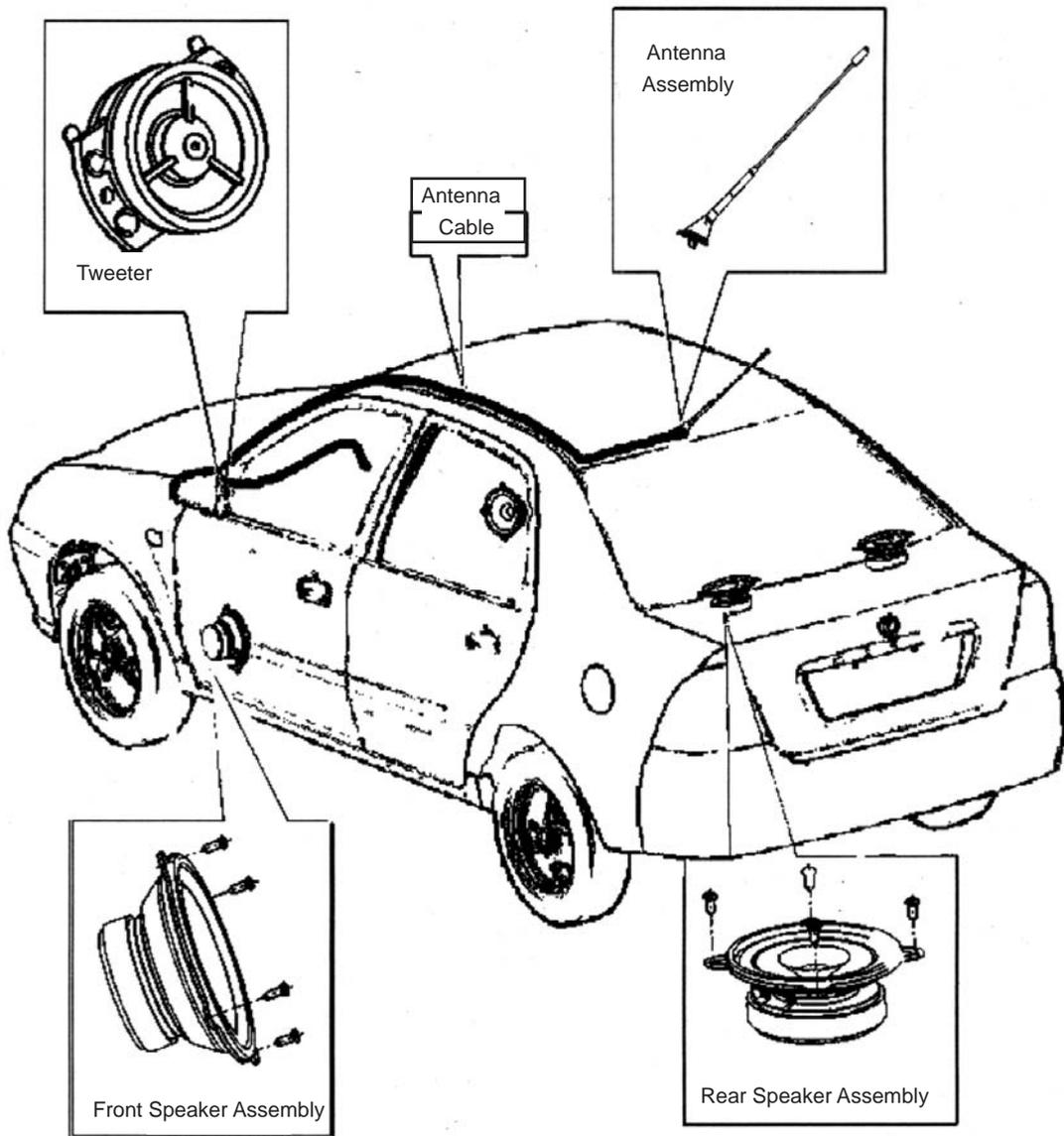
## Section 4 Audio and Video System Replacement

### I. Notice on operation

Please explain to the customer that the AM/FM broadcast channel information will be cleared when removing the battery negative terminal cable. Record the channel information before removing the negative terminal cable if necessary. Reset after connecting the negative terminal cable.

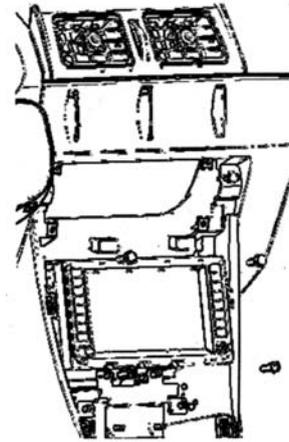
- All cassette tapes and CDs must be taken out before radio removal and installation.
- If the cassette tapes and CDs can not be taken out due to radio fault. Do not take them out by force. Drive the vehicle to Service Station.
- Make sure the grounding bolts are tightened before antenna removal and installation.
- There will be noise when receiving electric wave if the grounding bolts are not tightened.
- Don't touch the speaker cone.





## II. Radio assembly

1. Remove the intermediate instrument panel (See interior trim)
2. Remove the radio assembly
  - ① Remove 4 bolts
  - ② Disconnect connector



## III. Front speaker assembly

1. Remove front outside rear view mirror cover
2. Remove door handle
3. Remove the front door power window switch assembly
4. Remove the front door inside trim plate assembly
5. Remove the front door five-inch speaker assembly
  - ① Disconnect connector
  - ② Remove 4 self tapping screw and speaker assembly

## IV. Tweeter speaker assembly

1. Remove front outside rear view mirror cover
2. Remove tweeter speaker assembly
  - ① Disconnect connector
  - ② Remove 2 self tapping screw and speaker assembly

## V. Rear speaker assembly

1. Remove rear speaker baffle
2. Remove rear speaker assembly
  - ① Disconnect connector
  - ② Remove 4 self tapping screw and rear speaker assembly

## VI. Remove antenna cable

1. Remove the roof interior trim
2. Remove A-pillar trim plate
3. Disconnect connector
4. Remove instrument panel
5. Remove 4 clips and antenna cable

## VII. Overhead antenna assembly

1. Remove the roof interior trim
2. Disconnect connector
3. Remove antenna nut
4. Remove the overhead antenna assembly

## VIII. CD, DVD

1. Remove the left side rear trunk interior trim
2. Disconnect connector
3. Remove 4 bolts and disc box

# Chapter 7

## SRS (Supplemental Restraint System)

### Section 1 SRS-General Information

#### I. PRECAUTION

For safe reasons, read the following precautions before starting any operation.

1. When servicing the SRS, correct sequence and items are described in the following chapter.
2. Instruments and special tools recommended in this chapter shall be used for operation.
3. When servicing the following components, replace them with the new ones if there is a failure.

- (1) SRS ECU
- (2) Clock Spring Module
- (3) Driver Airbag Module
- (4) Passenger Airbag Assembly (Option)

4. If there is any abnormality in the wire harness of the SRS, replace it with a new one. Correct or replace the abnormal wire harness in accordance with Table 1.

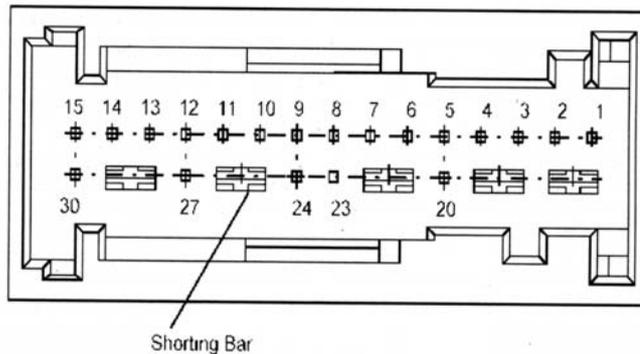


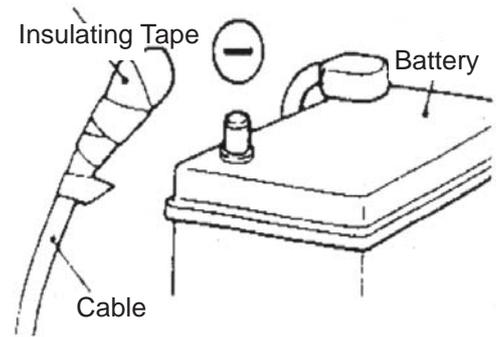
Figure 1

ECU Terminal Description		
No	Designation	Description
1	Belt-pretensioner, Driver, Low	Seat belt pretensioner, driver side, low position
2	Belt-pretensioner, Driver, High	Seat belt pretensioner, driver side, high position
3	Belt-pretensioner, Passenger, High	Seat belt pretensioner, passenger side, high position
4	Belt-pretensioner, Passenger, Low	Seat belt pretensioner, passenger side, low position
5	IGN	Battery voltage
6	GND	Ground-ground wire
7	WL	Airbag warning light
9	K	Diagnostic serial data I/O (K line)
10	DAB Hi	Driver airbag, high position

11	DAB Lo	Driver airbag, low position
13 (Option)	PAB Hi	Passenger airbag, high position
14 (Option)	PAB Lo	Passenger airbag, low position
20	Passenger Airbag Deactivation Indicator	Passenger airbag deactivation indicator light
27	PPD/ Passenger Airbag Deactivation Switch, High	Passenger airbag deactivation switch, high position
30	Crash Output	Crash output

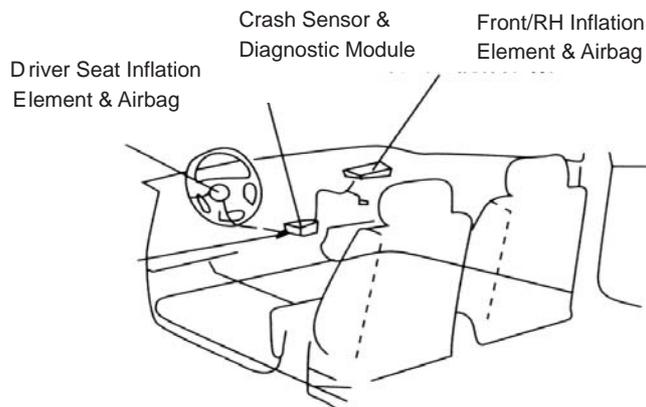
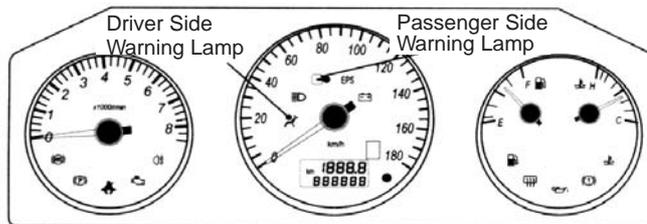
5. Servicing operation shall be carried out 60s after the negative (-) terminal cable is disconnected from the battery. In addition, the disconnected negative (-) terminal cable shall be protected with insulating tape for insulation.

In order to deploy an airbag within a certain time period after the battery is disconnected, condenser in the ECU shall retain some electrical energy. Otherwise, it could lead to a serious accident because of the unexpected deployment of airbag.



6. During spray paint work, ECU, airbag assembly, clock spring assembly, etc shall be removed and kept in place to avoid the effects of overheat. (Over 93; æ)

7. When the SRS is serviced, a diagnostic scan meter is used to clear the DTC to enable the normal work of the warning light.



## II. TEST INSTRUMENTS

Instrument	Designation	Usage
	Diagnostic detector (Hi-DS T Scan meter) Special diagnostic meter	Check system troubles of the SRS, and clear the DTC of ECU

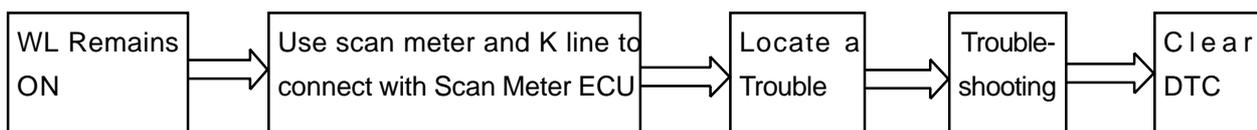
## III. TROUBLESHOOTING

### 1. Basic process of trouble diagnosis

- DTC of the present fault may coexist with that of the history fault.

#### NOTICE:

- After the new SRS ECU is installed, the warning light of the SRS, with the ignition switch ON, will be on for 6s and then go out permanently, indicating SRS works normal. In this case, no service is needed. Otherwise, system diagnosis and service shall be carried out.
- If with the ignition switch ON, the warning light of the SRS is not on, the relevant circuits of the warning light shall be serviced. Then go on with the operation and enable it to work.



### 2. Check SRS warning light

- (1) Turn the ignition switch ON and find out whether the warning light is on.
- (2) Six seconds after the process of ON-OFF, confirm that the warning light goes out permanently.
- (3) Otherwise, diagnosis and checking have to be involved in.

### 3. System Diagnosis

The SRS ECU (HAE2.5) will perform a series of circular diagnostic tests to check the readiness of the SRS functions. This test can avoid unexpected explosion of the restrain system and in the same time ensure the necessary explosion in a crash. If a trouble is detected, the SRS ECU (HAE2.5) will store a proper DTC and turn on the warning light indicating a trouble for service.

#### 4. Trouble Identification

##### (1) Trouble Record (DTC storage)

When the circular diagnostic tests are involved in identification of a trouble, the SRS ECU (HAE2.5) will store relevant codes, first/last diagnosis time and frequency of the trouble in EEPROM.

- SRS ECU (HAE2.5) can store up to 6 troubles, low voltage trouble as well as two crash records (front and side).
- The transmit of the DTCs are carried out in the way that the SRS ECU HAE2.5 via serial data interface of the maintenance procedures assign the codes to the diagnostic detector.

DTCs as recognized by SRS ECU (HAE2.5)		
No.	Trouble Description	Troubleshooting
1	Ignition circuit 1 (driver airbag), high resistance or open circuit	Yes
2	Ignition circuit 1 (driver airbag), low resistance or short circuit	Yes
3	Ignition circuit 1 (driver airbag), ground	Yes
4	Ignition circuit 1 (driver airbag), connected to power source	Yes
5	Ignition circuit 2 (passenger airbag), high resistance or open circuit	Yes
6	Ignition circuit 2 (passenger airbag), low resistance or short circuit	Yes
7	Ignition circuit 2 (passenger airbag), ground	Yes
8	Ignition circuit 2 (passenger airbag), connected to power source	Yes
9	Ignition circuit 3 (driver seat belt pretensioner), high resistance or open circuit	Yes
10	Ignition circuit 3 (driver seat belt pretensioner), low resistance or short circuit	Yes
11	Ignition circuit 3 (driver seat belt pretensioner), ground	Yes
12	Ignition circuit 3 (driver seat belt pretensioner), connected to power source	Yes
13	Ignition circuit 4 (passenger seat belt pretensioner), high resistance or open circuit	Yes
14	Ignition circuit 4 (passenger seat belt pretensioner), low resistance or short circuit	Yes
15	Ignition circuit 4 (passenger seat belt pretensioner), ground	Yes
16	Ignition circuit 4 (passenger seat belt pretensioner), connected to power source	Yes
17	High voltage of power source	Yes
18	Low voltage of power source	Yes
19	Warning light trouble-connected to power source or short circuit of the light bulb	Yes
20	Warning light trouble-ground or filament open circuit	Yes
21	Missing/mistake of the algorithm parameters	No (replace SRS ECU (HAE2.5))
22	Previous crash recorded	No (replace SRS ECU (HAE2.5))

23	Communication trouble	Yes
24	Internal trouble (see the following table)	No (replace SRS ECU (HAE2.5))
25	PADS (passenger airbag deactivation switch), connected to power source or open circuit	Yes
26	PADS (passenger airbag deactivation switch), ground or short circuit	Yes
27	PADS (passenger airbag switch), trouble	Yes
28	Crash output pin, ground	Yes
29	Crash output pin, short circuited to power source	Yes
30	PADI (passenger airbag deactivation switch indicator light) error, connected to power source or light bulb short circuit	Yes
31	PADI (passenger airbag deactivation switch indicator light) error, ground or open circuit	Yes
32	Seat belt pretensioner separate ignition	Yes, up to 5 times
33	Seat belt pretensioner separate ignition for 6 times	No (replace SRS ECU (HAE2.5))

The transmit of the DTCs are carried out in the way that the SRS ECU (HAE2.5) via serial data interface of the maintenance procedures assign the codes to the diagnostic detector.

Diagnostic DTCs		
No.	Trouble Description	DTC
1	Ignition circuit 1 (driver airbag), high resistance or open circuit	B1 346
2	Ignition circuit 1 (driver airbag), low resistance or short circuit	B1 347
3	Ignition circuit 1 (driver airbag), ground	B1 348
4	Ignition circuit 1 (driver airbag), connected to power source	B1 349
5	Ignition circuit 2 (passenger airbag), high resistance or open circuit	B1 352
6	Ignition circuit 2 (passenger airbag), low resistance or short circuit	B1 353
7	Ignition circuit 2 (passenger airbag), ground	B1 354
8	Ignition circuit 2 (passenger airbag), connected to power source	B1 355
9	Ignition circuit 3 (driver seat belt pretensioner), high resistance or open circuit	B1 361
10	Ignition circuit 3 (driver seat belt pretensioner), low resistance or short circuit	B1 362
11	Ignition circuit 3 (driver seat belt pretensioner), ground	B1 363
12	Ignition circuit 3 (driver seat belt pretensioner), connect to power source	B1 364
13	Ignition circuit 4 (passenger seat belt pretensioner), high resistance or open circuit	B1 367

14	Ignition circuit 4 (passenger seat belt pretensioner), low resistance or short circuit	B1 368
15	Ignition circuit 4 (passenger seat belt pretensioner), ground	B1 369
16	Ignition circuit 4 (passenger seat belt pretensioner), connect to power source	B1 370
17	High voltage of power source	B1 111
18	Low voltage of power source	B1 112
19	Warning light trouble-connected to power source or light bulb short circuit	B2 500
20	Warning light trouble-ground or filament open circuit	B2 500
21	Missing/mistake of the algorithm parameters	B1 661
22	Previous crash recorded	B1 650
23	Communication trouble	B1 407
23	Internal trouble (see the following table)	B1 620
24	PADS (passenger airbag deactivation switch), connected to power source or open circuit	B1 527
25	PADS (passenger airbag deactivation switch), ground or short circuit	B1 528
26	PADS (passenger airbag deactivation switch), trouble	B1 529
27	Crash output pin, ground	B1 676
28	Crash output pin, short circuited to power source	B1 677
29	PADI (passenger airbag deactivation switch indicator light) error, connected to power source or light bulb short circuit	B2 505
30	PADI (passenger airbag deactivation switch indicator light) error, ground or open circuit	B2 505
31	Seat belt pretensioner separate ignition	B1 657
32	Seat belt pretensioner separate ignition for 6 times	B1 658

## (2) Internal troubles

The micro controller can check the following items not only in the initiation check but also in the circular diagnostic check.

- ① Trigger transistor of ignition circuit: high-end transistor can be checked not only in the initiation check but also in the circular diagnostic check. However, since the low-end transistor is open when connected in short circuit to power source, it can only be checked in the initiation check to avoid explosion.
- ② The ignition voltage is provided by supercharge converter.
- ③ The acceleration sensor performs selfcheck in the initiation check.
- ④ Range of allowed deviation of acceleration sensor in the circular diagnostic check.
- ⑤ Microcontroller includes AD converter, ROM, RAM, etc.
- ⑥ Status of safety sensor.

### NOTICE

The connectors of the squib circuit contain a shorting bar. When the connector is not connected, the unexpected deployment is caused by the short in the circuit arising from the contact of the positive (+) and negative (-) terminals or the static electricity. If there is poor connection for connectors, the symptom may not be removed even when the shorting bar is connected.

An external watchdog can check the operation situation of the microcontroller. The failure of the microcontroller can trigger the watchdog, which in turn can reset the microcontroller and turn on the warning light.

[Table] Internal troubles predicted by SRS ECU (HAE2.5)

No.	List of Troubles	Trouble Description
1	Microcontroller	<ul style="list-style-type: none"> <li>● AD converter or EEPROM trouble (in case of RAM and ROM failure, the microcontroller will reset and the warning light will light up.)</li> </ul>
2	Passenger airbag ignition circuit	<ul style="list-style-type: none"> <li>● Activate trouble</li> <li>● Check the circuit trouble</li> </ul>
3	Passenger airbag ignition circuit (if realized)	<ul style="list-style-type: none"> <li>● Activate trouble</li> <li>● Check the circuit trouble</li> </ul>
4	Seat belt pretensioner ignition circuit (if realized)	<ul style="list-style-type: none"> <li>● Activate trouble</li> <li>● Check the circuit trouble</li> </ul>
5	Passenger seat belt pretensioner ignition circuit (if realized)	<ul style="list-style-type: none"> <li>● Activate trouble</li> <li>● Check the circuit trouble</li> </ul>
6	Driver airbag ignition circuit (if realized)	<ul style="list-style-type: none"> <li>● Activate trouble</li> <li>● Check the circuit trouble</li> </ul>
7	Passenger airbag ignition circuit (if realized)	<ul style="list-style-type: none"> <li>● Activate trouble</li> <li>● Check the circuit trouble</li> </ul>
6	Ignition voltage	<ul style="list-style-type: none"> <li>● Low</li> </ul>
7	Watchdog/reset	<ul style="list-style-type: none"> <li>● Trouble</li> </ul>
8	Maximum times of explosion of the seat belt pretensioner	<ul style="list-style-type: none"> <li>● 6</li> </ul>
9	Energy storage time (self-support time)	<ul style="list-style-type: none"> <li>● Short</li> </ul>
10	Accelerometer	<ul style="list-style-type: none"> <li>● Range of deviation</li> <li>● Sensor not in steady mode</li> <li>● Sensor selfcheck trouble</li> </ul>
11	Continuous abortion of ignition circuit check	<ul style="list-style-type: none"> <li>● Nonexecution of circular diagnostic test (Repeated algorithm calculation)</li> </ul>
12	Safety sensor	<ul style="list-style-type: none"> <li>● Close for 2 or more than 2 seconds</li> <li>● Safety sensor is open circuit when calculating the trouble with algorithm</li> </ul>
13	Ignition current	<ul style="list-style-type: none"> <li>● All the ignition currents are normal when the current SRS is deployed</li> </ul>
14	No confirmation of side SRS ignition	<ul style="list-style-type: none"> <li>● Even if the SRS ECU (HAE2.5) have received for 5 times the ignition information during the HSIS ignition cycle, the side SRS airbag ignition can not be verified by SRS ECU (HAE2.5).</li> </ul>

### (3) Clear DTCs

When ECU diagnostic tester (Hi-DSTM) receives the "Clear DTCs" command from the serial interface, the DTCs stored in ECU will be cleared off. But if an internal DTC is recorded or there is one crash record, the command will not be executed.

## 5. Trouble display (Warning light ON)

### (1) Light bulb check

When working voltage is supplied to SRS ECU (HAE2.5) through battery, SRS ECU (HAE2.5) lights up the warning light to check the light bulb. In the initiation stage, the light will be on for 6s at the frequency of 1Hz and then go out. To give notice of the presence of troubles to the driver, the warning light will remain on after the working voltage is supplied. If the history troubles happened for less than 5 times, the warning light will be on for 6s after ignition on and then go out. In the initiation stage, the SRS ECU (HAE2.5) will not check crash and arrest deployment until the circuit of SRS ECU (HAE2.5) goes stable.

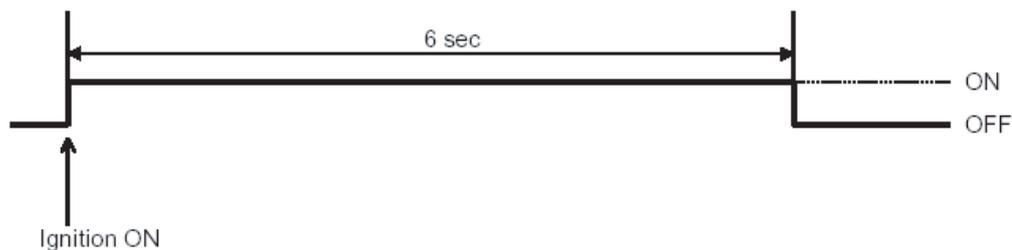
Thus, after ignition on, the display mode of the warning light is one of the following states displayed in the initiation stage:

STATE 1) The warning light will remain on if there is crash record or the history records of the trouble are no less than 5 times. Meanwhile, the warning light will remain on if there is explosion trouble.

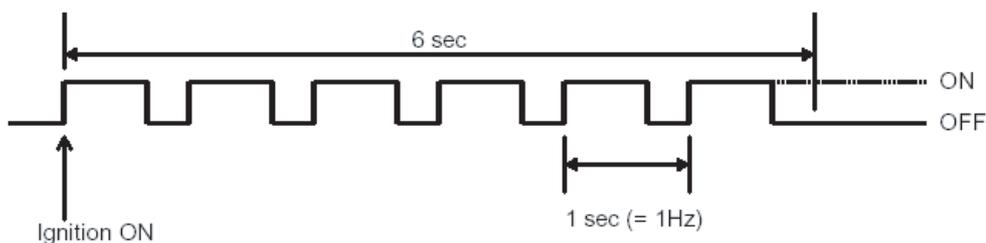


STATE 2) The history troubles are no less 1 time but less than 5.

("Low battery voltage" shall be excluded from the total number of the troubles.)



STATE 3) Normal (i.e. there is no explosion trouble or history trouble.)



## (2) Trouble indication

- ① In case of a trouble, the warning light will indicate. If the external trouble is a history trouble, the indication will be cancelled. When the history trouble happens for no less than 5 times, the indicator light will remain on even if there is no more trouble. "Low battery voltage" shall not be counted in the total number of troubles.
- ② Only a service worker can reset a displayed or history trouble. The internal troubles of a SRS ECU (HAE2.5) or the "crash record" of a trouble cannot be reset, in which case the SRS ECU (HAE2.5) shall be replaced.

## (3) Microcontroller-independent warning light on

Microcontroller with definitive troubles cannot fulfill its functions, thus cannot control the warning light. In this case, the warning light will light up through proper circuit regardless of the microcontroller as stated below:

- Malfunction of the battery supplying power to SRS ECU (HAE2.5): the warning lights are turned on continuously by means of the drive function of the selfcheck light.
- Loss of internal working voltage: the warning light remains on.
- Reset due to trigger failure of the watchdog: the warning light blinks.
- Microcontroller out of work: the warning light always lights up.
- Incomplete insertion of SRS ECU (HAE2.5) connector: the warning light remains on by means of a shorting bar.

The diagnostic procedures can well be illustrated as follows:

If it is found that the SRS warning light remains on, follow the undermentioned procedures to check even if the light goes out eventually. First, a scan meter is used to check the location of the trouble.

Then go on with the checking in accordance with specific methods and procedures for the correspondent location.

- a. If the result indicates that it is an internal trouble or that the SRS is already detonated, replace the ECU directly.
- b. Troubleshooting.

## Section 2 Troubleshooting

### I. LIST OF TROUBLES

No.	Troubleshooting Items	Description
1	SRS warning light is OFF	SRS warning circuit trouble.
2	SRS warning light remains on	SRS warning circuit trouble or external trouble.

#### 1. SRS warning light OFF

Trouble	Checking Status	Possible Cause
SRS warning light OFF	SRS warning circuit trouble	<ul style="list-style-type: none"> <li>· Loss of voltage (fuse circuit break)</li> <li>· Instrument cluster trouble</li> <li>· Trouble of wire harness between instrument cluster and ECU</li> </ul>

### DIAGNOSTIC PROCEDURES

When performing the first diagnostic check, it is advised to shake slightly the harness and connector to see if there is any discontinuous poor contact in circuit. If there is such a problem, make sure that the connections of the connector, terminals and wire harness are correct and undamaged. Otherwise, follow these procedures:

(1) Check other wire harnesses and instrument cluster indicator lights

- ① Turn the ignition switch ON.
- ② Any other light on?

Yes: turn the ignition switch to LOCK, and continue with the next step.

No: check the power supply and ground system (fuse) of the instrument cluster, and continue with step 5.

(2) Check light bulb

#### CAUTION:

Mishandling of SRS components may release unexpectedly airbag and seat belt pretensioner, probably leading to a serious accident. Read the service cautions before handling a SRS component.

- ① Turn the ignition switch to LOCK.
- ② Disconnect the negative (-) terminal cable from the battery and wait for at least 60s.
- ③ Remove the instrument cluster.
- ④ Measure and see if the two pins of the SRS warning light is triggered.

Yes: continue with next step.

No: replace the bulb of the warning light.

(3) Check the connection between ECU and instrument cluster

- ① Turn the ignition switch to LOCK.
- ② Disconnect the negative (-) terminal cable from the battery.
- ③ Disconnect the connector of instrument cluster.
- ④ Check if the related circuits of the warning light are connected or not.

Yes: continue with next step.

No: replace the wire harness, and then continue with step 5.

2. SRS warning light remains on.

Trouble	Checking Status	Possible Cause
SRS warning light remains on	SRS warning light remains on	● Insufficient battery supply
		● ECU internal trouble
		● SRS warning light trouble of instrument cluster
		● Improper connection of ECU connector
		● Poor contact of instrument cluster connector
		● Open circuit or poor contact of ECU power supply fuse
		● Poor connection of ECU connector terminal
		● Poor contact of the wire harness between ECU connector terminal and ground
		● Driver or passenger side circuit trouble of SRS

## DIAGNOSTIC PROCEDURES

To begin the check, first use special diagnostic instruments and ECU to perform communication diagnosis and find out the causes of the trouble. If the communication fails, continue with the following procedures:

(1) Check battery

- ① Check battery voltage.
- ② Is voltage higher than 9V?

Yes: continue with next step.

No: Insufficient battery supply. Check the charging/discharging system, and then continue with step (5).

(2) Check the continuity of the wire harness between ECU and instrument cluster

- ① Turn the ignition switch to LOCK.
- ② Disconnect negative (-) terminal cable from the battery.
- ③ Open the guard plate of the central passage.
- ④ Disconnect the connector of the instrument cluster.
- ⑤ Connect the negative (-) terminal cable of the battery.
- ⑥ Turn the ignition switch ON.
- ⑦ Check whether the voltage of the connector terminal of the instrument is 12V (power supply and instrument connecting wire).

Yes: continue with next step.

No: check the circuit, repair it and continue with step (5).

⑧ Turn the ignition switch to LOCK.

⑨ Check the continuity of the terminal of instrument connector and that of diagnostic interface (check the two ends of K line).

Yes: continue with next step.

No: repair or replace the wire harness. Continue with step (5).

⑩ Make sure to disconnect the negative terminal cable from the battery and wait for at least 60s. Disconnect the ECU connector.

⑪ Disconnect the connectors of the instrument cluster

⑫ Are the connector terminals 5, 7 and 9 and those of instrument cluster continuity?

Yes: continue with next step.

No: replace the wire harness, and then continue with step (5).

⑬ Remove ECU and see whether the terminals are in good condition and whether the shorting bar is broken.

Yes: replace the ECU.

No: reconnect the ECU connector, and then continue with next step.

(3) Make sure of the nonrecurrence of the trouble after repair

① Turn the ignition switch to LOCK.

② Disconnect the negative (-) terminal cable from the battery and wait for at least 60s.

③ Connect all the ECU connectors.

④ Connect the connector of driver airbag assembly.

⑤ Connect the connector of passenger airbag assembly.

⑥ Connect the connectors of driver and passenger seat belt pretensioners (vehicle with pretensioner).

⑦ Connect clock spring connector.

⑧ Connect the negative (-) terminal cable of the battery.

⑨ Turn the ignition switch to ON.

⑩ Is the SRS warning light working normal?

Yes: the trouble is eliminated. Explain the repair procedures to the Customer.

No: recheck symptoms of the trouble. Repeat these procedures from the first step if the trouble reoccurs.

### 3. Internal trouble

DTC B1620	Internal trouble of SRS unit
Checking Conditions	CAUTION
	<ul style="list-style-type: none"> <li>● Condition for running the DTC is to inspect the diagnostic trouble code that may not appear prior to this test. Performing this test may results in body injury or damaged system due to misoperations. Therefore, preparations must be made before checking.</li> <li>● Internal circuit trouble of SRS ECU</li> </ul>
Possible Cause	Internal trouble of SRS unit
Operation	
Replace the SRS unit, see SRS System, Removal & Installation of SRS Unit	

### 4. Power trouble

DTC B1112	Low power source voltage of SRS ECU
Checking Conditions	CAUTION
	<ul style="list-style-type: none"> <li>Condition for running the DTC is to inspect the diagnostic trouble code that may not appear prior to this test. Performing this test may results in body injury or damaged system due to misoperations. Therefore, preparations must be made before checking.</li> <li>● The electrical potential between pins 5 and 6 of the connector of SRS unit is less than 9V.</li> </ul>
Possible Cause	● Low battery voltage
	Trouble in wire harness between battery and SRS ECU

## DIAGNOSTIC PROCEDURES

#### (1) Check battery

- Is the battery voltage measured higher than 9V?

Yes: continue with next step.

No: low battery voltage, check the charging/discharging system.

- See Chapter I, Charging System-Battery Checking

#### (2) Check the wire harness between battery and fuse box

- Remove fuse box and turn the ignition switch ON, without loosening connector.
- Measure and see if the electrical potential between two terminals of the fuse box is more than 9V.

Yes: continue with next step.

No: check the wire harness.

(3) Check the wire harness between the fuse box and the connector of the SRS unit

**CAUTION**

If it is not handled properly, the airbag assembly may be triggered and deployed, leading to serious injury to a person. Therefore, prior to handling, read the service cautions carefully. See service cautions for SRS.

- ① Turn the ignition switch to LOCK.
- ② Loosen the negative (-) terminal cable from the battery and wait for over 1 minute.
- ③ Remove steering column hood.
- ④ Loosen the connector of the clock spring.
- ⑤ Remove glove box (along with passenger airbag assembly)
- ⑥ Loosen passenger airbag assembly connectors.
- ⑦ Remove left trim plate.
- ⑧ Loosen all the SRS unit connectors.
- ⑨ Reconnect the negative (-) terminal cable of the battery and turn ignition switch ON, check whether the electrical potential between pins 5 and 6 (ground) of the connector of SRS unit is higher than 9V.

Yes: continue with next step.

No: replace the wire harness.

- ⑩ Turn the ignition switch to LOCK.
- ⑪ Loosen the negative (-) terminal cable from the battery and wait for over 1 minute.
- ⑫ Remove left trim plate.
- ⑬ Disconnect the adaptor connector of SRS unit.
- ⑭ Reconnect the battery negative (-) terminal cable and turn the ignition switch ON, check whether the voltage between the corresponding pin of the connector and the pin (ground) is higher than 9V.

Yes: completion of trouble diagnosis.

No: replace the wire harness.

5. Driver side trouble

DTC	Driver airbag trouble (high or low resistance, short circuit, ground, etc.)
B1 346	
B1 347	
B1 348	
B1 349	
Checking Conditions	<p><b>CAUTION</b></p> <ul style="list-style-type: none"> <li>● If it is not handled properly, the airbag assembly may be triggered and deployed, leading to serious injury to a person. Therefore, prior to handling, read the service cautions carefully.</li> </ul> <p>See service cautions for SRS</p> <p>If there is driver airbag</p> <ul style="list-style-type: none"> <li>● The resistance between terminals of the SRS unit connectors is out of range.</li> </ul> <p>The wire harness of the driver airbag of SRS is short or open circuited.</p>
Possible cause	<ul style="list-style-type: none"> <li>● Driver airbag assembly trouble.</li> <li>● Clock spring internal trouble.</li> <li>● Trouble of the connector of the circuit between clock spring and SRS ECU.</li> <li>● The wire harness between clock spring and SRS ECU is open or short-circuited.</li> <li>● Incorrect insertion of the connector of the driver airbag generator of SRS.</li> </ul>

## DIAGNOSTIC PROCEDURES

### (1) Check clock spring

#### CAUTION

If it is not handled properly, the airbag assembly may be triggered and deployed, leading to serious injury to a person. Therefore, prior to handling, read the service cautions carefully.

See service cautions for SRS.

- Do the related parts of the clock spring work normal? (Are the pins correctly correlated? There should be no unnecessary short or open circuit, etc). If possible, use a new clock spring to replace the present one.

Normal: continue with next step.

Abnormal: replace the clock spring.

See SRS-Clock Spring, Removal & Installation.

### (2) Ascertain the trouble exists in driver airbag assembly or other parts

- ① Replace with a new driver airbag assembly.
- ② Reconnect the negative (-) terminal cable of the battery.
- ③ Turn the ignition switch ON.
- ④ Any DTC displayed? Can it be cleared?

Yes: replace the driver airbag assembly.

See SRS- Driver Airbag Assembly, Removal & Installation.

No: continue with next step.

### (3) Check the connector of clock spring wire harness

- ① Turn the ignition switch to LOCK.
- ② Loosen the negative (-) terminal cable from the battery and wait for over 1 minute.
- ③ Remove steering column hood.
- ④ Loosen the connector of the clock spring.
- ⑤ Are the connectors of the clock spring normal? (Are the pins correctly correlated? There should be no unnecessary short or open circuit, etc). If possible, use a new clock spring to replace the present one.

Normal: continue with next step.

Abnormal: replace the wire harness.

See SRS-Clock Spring, Removal & Installation.

### (4) Check the wire harness between clock spring and SRS ECU

- ① Turn the ignition switch to LOCK.
- ② Loosen the negative (-) terminal cable from the battery and wait for over 1 minute.
- ③ Remove glove box (along with passenger airbag assembly).
- ④ Loosen passenger airbag assembly connectors.

- ⑤ Remove left trim plate.
- ⑥ Loosen all the SRS unit connectors.
- ⑦ Check the wire harness between the connector terminals of SRS unit and that of clock spring for the following:
  - Ground.
  - Short circuit with power supply.
  - Open circuit.
- ⑧ Is the above-mentioned wire harness normal?
- ⑨ Normal: completion of trouble diagnosis, and install all the parts.
- ⑩ Abnormal: replace the wire harness.

#### 6. Passenger side trouble

DTC	Passenger airbag assembly trouble (high or low resistance, short circuit, ground, etc.)
B1 352	
B1 353	
B1 354	
B1 355	
Checking conditions	<p><b>CAUTION</b></p> <p>● If it is not handled properly, the airbag assembly and retractable seat belt may be triggered and deployed/tensioned, leading to serious injury to a person. Therefore, prior to handling, read the service cautions carefully.</p> <p>See service cautions for SRS.</p> <p>If there is passenger airbag</p> <ul style="list-style-type: none"> <li>● The resistance between pins 13 and 14 of SRS unit connector is out of range</li> <li>● The wire harness between pins 13 and 14 of the SRS unit is short circuited</li> <li>● Pins 13 and 14 of the SRS unit connector are open circuited, e.g. there is no passenger airbag</li> </ul>
Possible Cause	<ul style="list-style-type: none"> <li>● Passenger airbag assembly trouble</li> <li>● Trouble of the connector between passenger airbag assembly and SRS ECU</li> <li>● Trouble of the connector between the SRS unit and ground point</li> <li>● The circuit between passenger airbag assembly and SRS ECU is open or short</li> <li>● The circuit between SRS unit and ground point is open or short</li> <li>● SRS unit trouble</li> </ul>

#### DIAGNOSTIC PROCEDURES

(1) Is there any passenger airbag assembly installed on the vehicle?

Yes: continue with next step.

No: continue with step (5).

(2) Check the cautions of passenger airbag assembly connector

- If it is not handled properly, the airbag assembly may be triggered and deployed, leading to serious injury to a person. Therefore, prior to handling, read the service cautions carefully.

See service cautions for SRS.

- ① Turn the ignition switch to LOCK.
- ② Loosen the negative terminal cable from the battery and wait for over 1 minute.
- ③ Remove the glove box.
- ④ Loosen the passenger airbag assembly connectors.
- ⑤ Is the connector of the passenger airbag assembly normal?

Normal: [DTC of present trouble]

Continue with next step.

[DTC of past trouble]

Continue with next step.

Abnormal: replace the wire harness.

(3) Ascertain the trouble exists in passenger airbag assembly or other part

- ① Connect a new assembly to terminals A and B of the connector of passenger airbag assembly.
- ② Connect the negative (-) terminal cable of the battery.
- ③ Turn the ignition switch ON.
- ④ Any DTC displayed? Can it be cleared?

No: continue with next step.

Yes: replace passenger airbag assembly

See SRS- Passenger Airbag Assembly, Removal & Installation.

(4) Check the wire harness between passenger airbag assembly and SRS ECU

- ① Turn the ignition switch to LOCK.
- ② Loosen the negative (-) terminal cable from the battery and wait for over 1 minute.
- ③ Remove steering column hood.
- ④ Loosen the connector of the clock spring.
- ⑤ Loosen the connectors of driver and passenger airbag assemblies.
- ⑥ Remove left trim plate.
- ⑦ Loosen all the SRS unit connectors.
- ⑧ Check the circuit between the connector terminals of the SRS ECU and that of passenger airbag assembly and the circuit between the connector terminal of the SRS unit and that of passenger airbag assembly for the following:
  - Ground.
  - Short circuit with power source.
  - Open circuit.
- ⑨ Are the above-mentioned wire harnesses normal?

Normal: completion of trouble diagnosis.

Abnormal: replace the related wire harness.

### III. DIAGNOSIS OF CRASHED VEHICLES

Whether the SRS is deployed or not, the checking and maintenance of the crashed vehicle shall be carried out according to the following procedures.

#### 1. Check the diagnostic signal of ECU

- (1) Connect the check connector of the Hi-DS T Scan Meter.
- (2) Read out the diagnostic results from Hi-DS T Scan Meter.

#### 2. Repair procedures

- (1) When the SRS is deployed, the following parts shall be renewed.

- ① Passenger airbag assembly.
- ② ECU.
- ③ Driver airbag assembly.

Check the following parts, if abnormal, replace with new ones.

- ① Clock spring.
- ② Steering wheel, steering column and steering lower shaft component.

The installation status of driver airbag assembly in relation to steering wheel.

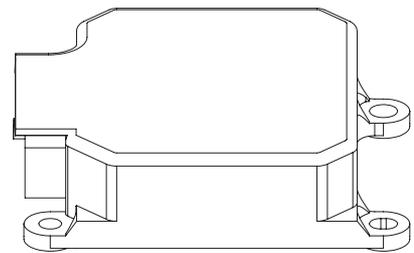
- ① Check and see if there is abnormal noise in the steering wheel, the action of the same is good, or the clearance is normal.
- ② Check the union joint of the wire harness for damage and the terminal for distortion.

#### 3. ECU

- (1) Check the brackets of the ECU Case for recess, crack, distortion, etc.
- (2) Check the union joint for damage and terminal for distortion.
- (3) Check the installation status of the ECU brackets
  - ① Check the hood for recess, crack, distortion, etc.
  - ② Check the union joint for damage, terminal for distortion and wire harness for seizure.
  - ③ Check the case of the gas generator for recess, crack and distortion.

#### NOTICE

Due to shock, when the battery power supply is insufficient, the scan Meter cannot communicate with ECU, the instrument panel wire harness shall be checked and maintained or external power source shall be used.

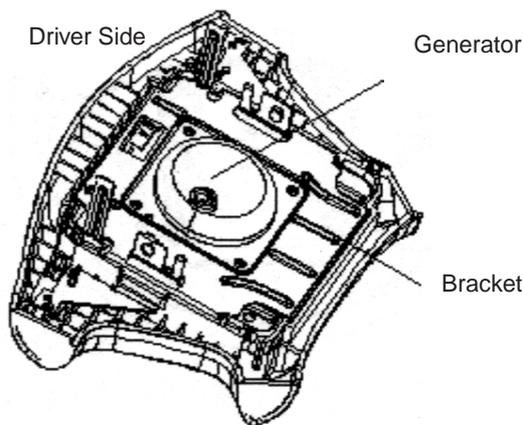


(4) Check the installation status of the airbag assembly.

NOTICE

1. Work must be started 60s after the negative (-) terminal cable is disconnected from battery. The disconnected negative (-) terminal cable shall be protected with insulating tape for insulation.
2. Airbag assembly and clock spring shall not be removed or repaired. They shall be replaced if there is any trouble.
3. Pay enough attention to airbag assembly and clock spring when using, avoiding dropping them onto the ground or into water or oil. In addition, if there is any pitting, crack or distortion on them, replace with new ones.
4. When an airbag is deployed, the deployed surface should face up. It should be kept on a flat surface without any other items on it.
5. Don't keep an airbag in a place where the temperature is higher than 93° C.
6. When an airbag is deployed, it shall be replaced with a new one; simultaneously, check the clock spring, and replace it with a new one if found abnormal.
7. When deal with the deployed airbag, gloves and protective glasses are to be used.
8. When scrapping the undeployed airbag, it shall be discarded after being deployed.

4. Driver airbag assembly (see the figure below)



5. Clock spring (see the figure on the right)

(1) Check the union joint and protecting tube for damage and the terminal for distortion.

(2) Check the case for distortion.

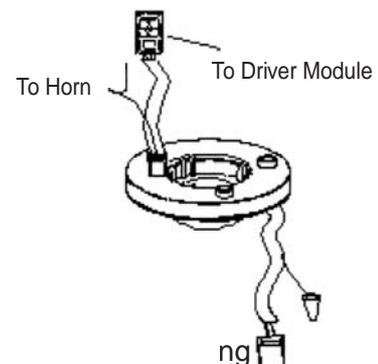
6. Steering wheel, steering column and steering lower shaft component.

(1) Check the installation status of driver airbag assembly.

(2) Check the steering wheel for any abnormal noise and see if the clearance is normal.

7. Check the wire harness joint (instrument panel wire harness).

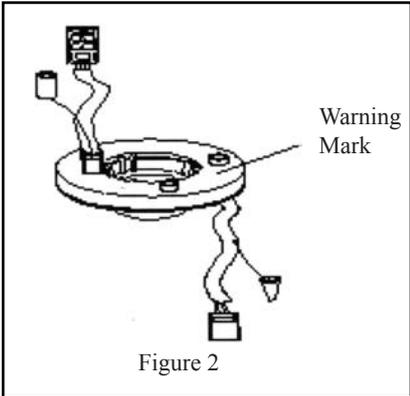
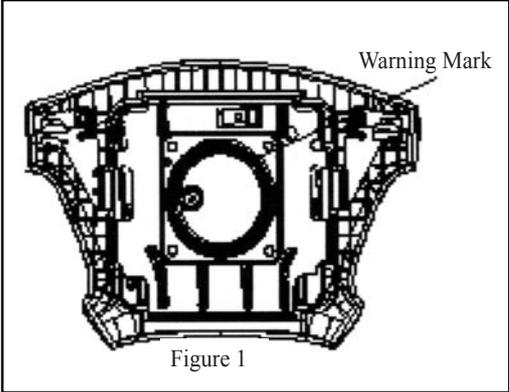
8. Check and see if the wire harness is securely installed, if the joint is damaged and if the terminal is distorted.



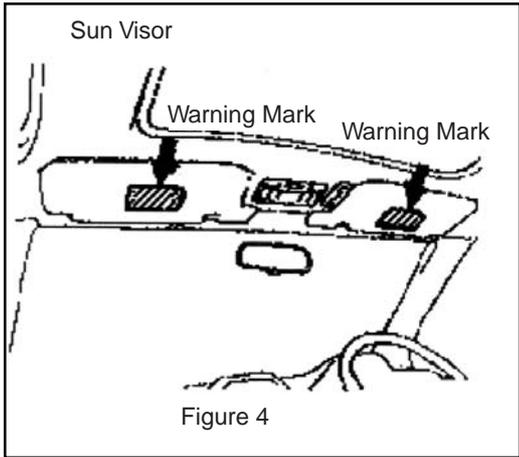
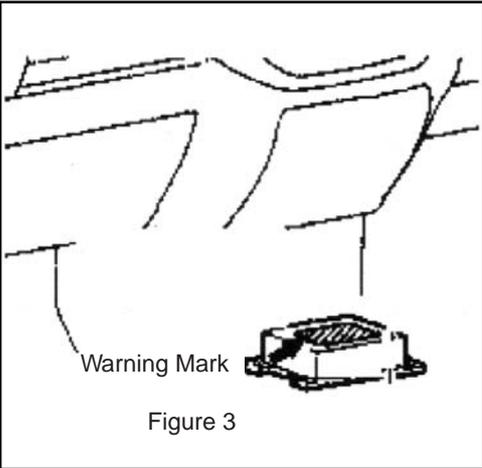
# IV. WARNING MARKS

When using or maintaining an airbag, the warnings shall be indicated. When maintaining, proceed in accordance with the description of mark. In addition, if the mark is damaged or stained, it shall be replaced.

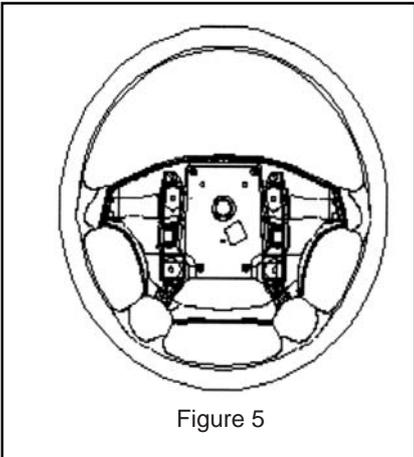
- 1. Driver airbag assembly, see Fig. 1.
- 2. Clock spring, see Fig. 2.



- 3. ECU, see Fig. 3.
- 4. Sun Visor, see Fig. 4.



- 5. Steering wheel, Fig. 5.



## Section 3 Removal & Installation

### I. SRS ELECTRICAL CONTROL UNIT (ECU)

#### 1. Operations prior to Removal

- (1) Turn the ignition switch OFF.
- (2) Remove negative (-) terminal cable of the battery. Put it in a proper position or wrap it up with insulating tape.

#### NOTICE

1. Work must be started 60s after the negative (-) terminal cable is detached from battery. The detached negative (-) terminal cable shall be protected with insulating tape for insulation.
2. Never attempt to dismantle or repair an ECU. If there is any trouble, replace the ECU with a new one.
3. Prevent the ECU from shock or vibration. If pitting, crack or distortion is found, replace the ECU with a new one.
4. Every time an airbag is deployed, the ECU shall be replaced with a new one.
5. When disassembling or maintaining the parts around ECU, attention must be given to avoid contacting the ECU.

#### 2. Removal procedures:

- (1) Remove the central passage side cover plate (or remove auxiliary console).
- (2) Remove the connectors to SRS ECU.
- (3) Remove ECU.

#### 3. Installation procedures:

- (1) Install ECU.
- (2) Install the connectors to SRS ECU.
- (3) Install the central passage side cover plate (or install auxiliary console).
- (4) Connect negative (-) terminal cable of the battery.

#### 4. Key points for Installation:

- (1) Install ECU.
- (2) Check after installation.
  - ① Turn the ignition switch ON.
  - ② The warning light goes on within 6s, and then goes out.
- (3) If the light doesn't go out, check the trouble and eliminate it.

#### NOTICE

If the ECU cannot be installed correctly, the airbag will not act normally.

5. Check:

- ① ECU case for pitting, crack and distortion.
- ② The joint for damage and distortion.

For other ECU checkings, see Troubleshooting.

**NOTICE**

If pitting, crack or distortion is found on an ECU, replace it with a new one.

## II. AIRBAG ASSEMBLY & CLOCK SPRING

1. Operations prior to removal

- (1) Take out the ignition key after the steering wheel and front wheel are adjusted to straightforward direction.
- (2) Remove negative (-) terminal cable from the battery.

2. Removal procedures of the driver airbag assembly:

- (1) Unscrew the screws of the two sides.
- (2) Disconnect the connector of the wire harness.
- (3) Remove the components of airbag assembly.
- (4) Remove steering wheel.

**NOTICE**

Put the removed driver airbag assembly upside down in a clean and dry place for care.

3. Removal procedures of clock spring:

- (1) Remove the driver airbag assembly (disconnect the connector).
- (2) Remove steering wheel gently (see the precautions).
- (3) Open the upper closure of the combination switch, locate and disconnect the connector of wire harness in the lower end.
- (4) Remove clock spring from the steering wheel.

**NOTICE**

Put the removed clock spring in a clean and dry place for care.

4. Installation procedures of the driver airbag assembly

(1) Pre-Check

- Steering wheel
- Connect the wire harness
- Driver airbag assembly

- (2) Screw up the installation screws of the two sides.
- (3) Connection of the negative (-) terminal of the battery
- (4) Check after installation.

5. Installation procedures of clock spring:

(1) Pre-Check

- Thread the line at the upper end of the clock spring through hole on the body part of the steering wheel
- Connection and fixation of the clock spring and steering wheel

(2) Install the upper hood of the combination switch

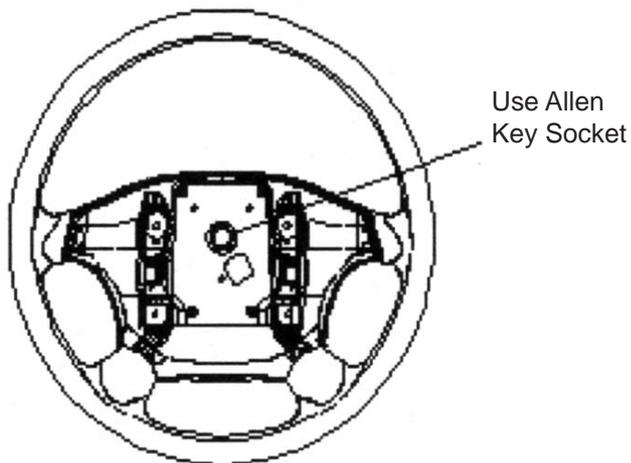
(3) Install the steering wheel

(4) Install the airbag assembly components

(5) Connect the negative (-) terminal cable of the battery

(6) Check after installation

6. Removal of steering wheel (see the figure below)



- (1) Remove the installation screws from the middle and remove the steering wheel.(Disconnect the horn connector)

**NOTICE:**

Due to the tight engagement of the spline and the steering column, it is hard to separate the steering wheel from the column. Don't try to remove the steering wheel by force (otherwise the clock spring under the steering wheel will be damaged). The correct way is to turn the nut on the steering column shaft end for several pitches and then lift the steering wheel upward.

### III. KEY POINTS FOR INSTALLATION

#### 1. Pre-Check

- (1) The new airbag or clock spring shall be checked before being installed.
- (2) Connect negative (-) terminal cable of the battery.
- (3) Connect Hi-DS T to the diagnostic interface (16 connector).

#### NOTICE

In case of scrapping an airbag, it shall be noted that the airbag shall be deployed according to the specified procedures before being scrapped.

When connecting or disconnecting the Hi-DS T, turn the ignition switch OFF first.

- (4) Turn the ignition switch ON.
- (5) Read the diagnostic circuit and see if the other locations than the troubled area of the airbag are normal.
- (6) Turn the ignition switch ON.
- (7) Remove the negative (-) terminal cable from the battery, and protect it with insulating tape for insulation.

#### NOTICE:

Work must be started 60s after the negative (-) terminal cable is disconnected from battery.

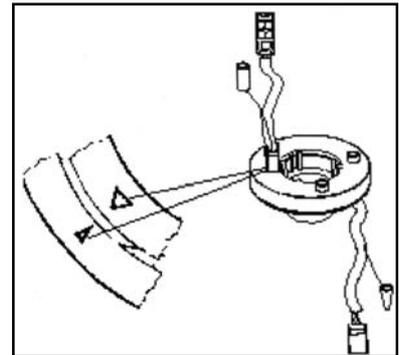
2. Installation of clock spring: align the clock spring and install it to the steering wheel.

- Center alignment of the clock spring

Screw up the clock spring clockwise to the end, rotate it counterclockwise by 2.5 turns, and align it with the mark (see the figure below).

#### NOTICE:

If the center of the clock spring cannot be aligned, the steering wheel will not turn midway, or cause bad performance to the clock spring circuit, consequently hamper the normal action of the airbag.



3. Install the components of the steering wheel and airbag assembly

- (1) When the center of the clock spring is aligned, install the components of the steering wheel and airbag assembly.
- (2) After being installed, rotate the left and right sides of the steering wheel to position, and make sure there is no abnormality.

#### NOTICE

When installing the components of the steering wheel and airbag assembly, attention should be given to protect the wire harness of the clock spring from seizure.

#### 4. Check after installation

- (1) Slightly rotate the steering wheel left and right, make sure that there is no abnormality or noise. (Driver airbag module, clock spring)
- (2) Turn the ignition switch ON.
- (3) The warning light goes on within 6s, and then goes out.
- (4) The trouble shall be eliminated if the warning light remains on when the ignition switch is turned on or after it goes out after 6s.

### IV. CHECKING

#### 1. Driver airbag assembly checking

Check the following items and replace the related components of the airbag assembly if any badness is found. The old components shall be deployed before scrapping.

- (1) Check the hood for pitting, crack, distortion, etc.
- (2) Check the joint of the wire harness for damage and the terminal for distortion.
- (3) Check the case of the gas generator for pitting, crack and distortion.
- (4) Check the installation status of the airbag assembly.

#### NOTICE

If there is pitting, crack or distortion, replace the airbag assembly with new one. The old components of the airbag shall be deployed before scrapping.

The circuit resistance of the airbag assembly (squib) cannot be measured even with a designated tester.

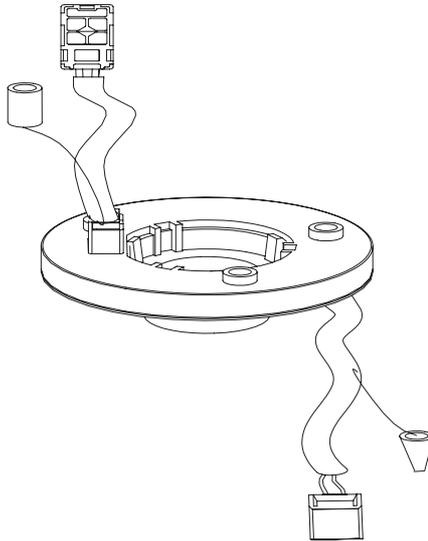
Since there is current flowing in the squib, when a tester is involved in measuring the resistance, sometimes the airbag is unexpectedly deployed in case of static electricity, leading to serious accident.

#### 2. Check the clock spring

Check the following items, and replace the clock spring if any badness is found.

- (1) Check the joint and protecting tube for damage and the terminal for distortion.
- (2) Check the case for damage.
- (3) Check and see if the joint terminal at the upper end of the clock spring are in conduction with that at the lower end.
- (4) A thin probe shall be inserted from the back of the yellow connector of the clock spring.

(5) With reference to the figure below, insert thin probes into the current tester to check the conduction of the terminals.



#### NOTICE

Never insert probe directly from the lower end of the connector.

### V. KEY POINTS FOR SCRAPPING THE AIRBAG ASSEMBLY

The airbag shall be deployed according to the following procedures before scrapping the airbag assembly or a vehicle installed with an airbag.

#### NOTICE

The airbag shall be deployed before being scrapped.

The airbag shall be deployed outside the vehicle before being changed.

The airbag shall be deployed in the vicinity of a smoke detector since smoke will appear when the airbag is deployed.

When being deployed, the airbag will create much noise. People nearby shall wear noise muffler to close their ears. Avoid do the job within the residential areas.

#### 1. Scrapping of an airbag assembly prior to deployment

(1) Deploy inside a vehicle

① Park the vehicle in a flat area

② Disconnect the positive (+) and negative (-) terminal cables from the battery and remove the battery from the vehicle.

③ The airbag assembly shall be deployed according to the following procedures.

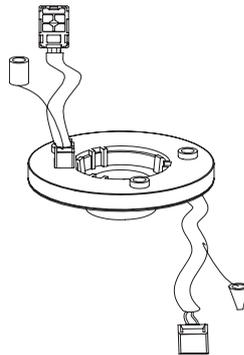
### NOTICE

Work must be started 60s after the positive (+) and negative (-) terminal cables are detached from battery.

#### (2) Driver airbag assembly

① Remove the knee bolster.

② Remove the connector (yellow) that connecting the lower end of the clock spring with the wire harness of the instrument panel (see the figure below).



### NOTICE

Remove the connector of the clock spring from the wire harness of the instrument, the connector will be short circuited automatically, which can avoid the possible serious accident resulted from the deployment of the driver airbag assembly due to static electricity.

③ Tie two 6m plus wire harnesses for deployment to the adaptor wire harness of the airbag, and wrap the connecting points with insulating tape for insulation. The other ends of the wire harness for deployment are connected to each other (short circuited). Unexpected deployment resulted from static electricity shall be prevented.

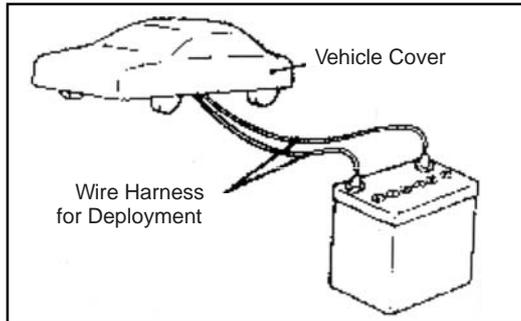
④ From the yellow connector of the clock spring, lead the airbag adaptor wire harnesses out of the vehicle by means of the wire harnesses for deployment (see the figure below).

⑤ To restrain the noise, close all the windows and doors and put on the vehicle cover.

### NOTICE

The glass will likely break up if there is crack. Vehicle covers shall be put on.

- ⑥ Try to disconnect at a location far away from the vehicle the connector of the wire harness for deployment of the driver airbag assembly, connect them with the two terminals of the battery removed from the vehicle and deploy the airbag (see the figure below).



#### NOTICE

Make sure there is no man inside or near the vehicle and then carry out the operations.

After the driver airbag is deployed, the gas generator is of high temperature. Keep it for 30 minutes until it gets cool for use.

If the driver airbag assembly cannot be deployed, discuss the problem with the local Geely service station.

- ⑦ The deployed driver airbag assembly shall be scrapped according to the scrapping procedures.

(3) Deploy outside the vehicle

#### NOTICE:

Keep the airbag over 6m away from a obstacle or person and deploy the airbag in an open flat area.

- ① Disconnect the positive (+) and negative (-) terminal cables from the battery and remove the battery from the vehicle.

#### NOTICE

Work must be started 60s after removal of the battery.

- ② The airbag assembly shall be deployed according to the following procedures.

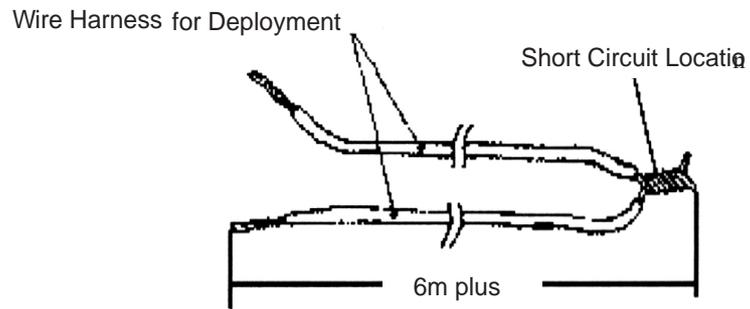
(4) Driver airbag assembly

- ① Remove the driver airbag assembly from the vehicle.

#### NOTICE

When the connector is not connected, the terminals of the driver airbag assembly will be short circuited automatically, preventing the airbag from being deployed unexpectedly. If the airbag is deployed unexpectedly, the deployed surface should face up. It should be kept on a flat surface without any other items on it.

- ② Prepare two 6m plus wire harnesses for deployment, connect the other two ends to avoid unexpected deployment in case of static electricity (see the figure below).

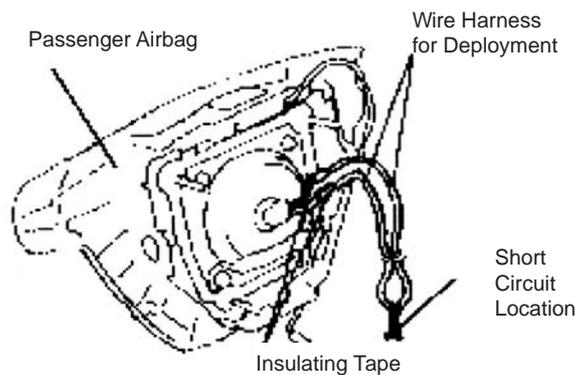


- ③ Touch the body of the vehicle with hands for static electricity elimination.

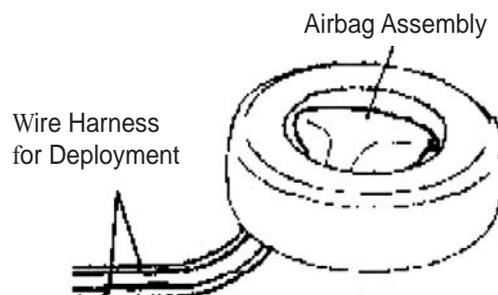
**NOTICE:**

The above-mentioned procedures can prevent the unexpected deployment due to static electricity and shall therefore be performed strictly.

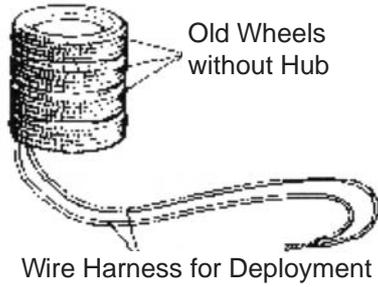
- ④ Cut off the wire harnesses of the driver airbag assembly and connect them with the two wire harnesses for deployment, and make sure to wrap up the connecting location with insulating tape for insulation (see the figure below).



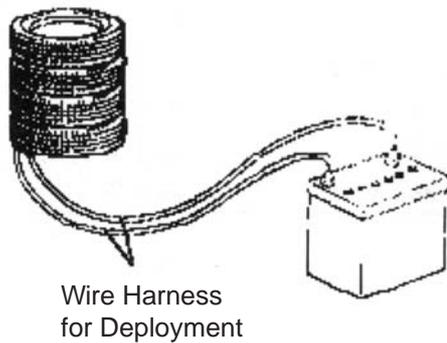
- ⑤ Install the unused bolts on to the inside bolt of the driver airbag assembly, and tie a thick wire securing the wheel rim.
- ⑥ Pass the deployment wire harness of the driver airbag assembly through an old tire with rim, and fix upwards the driver airbag assembly by means of the wire connected to the bolts, etc (see the figure below).



- ⑦ Put three old tires without hubs onto the tire used to fix the driver airbag assembly (see the figure below).



- ⑧ Try to disconnect at a location far away from the vehicle the connector of the wire harness for deployment of the driver airbag assembly, connect with the two terminals of the battery removed from the vehicle and deploy the airbag (see the figure below).



- ⑨ the deployed driver airbag assembly shall be scrapped according to the scrapping procedures.

## NOTICE

Make sure to deploy the driver airbag assembly when there is no person close by.

After the driver airbag is deployed, the gas generator is of high temperature. Keep it for over 30 minutes until it gets cool for use

# Chapter 8 MK-20 ABS System

## Section 1 ABS Diagnosis

### I. Check the ABS Warning Light

1. Check the ABS Warning Light goes on as the following:
  - ① Turn the ignition switch to ON, the ABS Warning Light goes on for about 1.7 seconds and then goes off.
  - ② If the above condition is not satisfied, it indicates that there is a fault, please check the DTC.
  - ③ If the warning light does not light up at all, refer to the Non-DTC fault inspection table.

### II. The Reading of the information status

After connecting the scan meter, turn the ignition switch to  $\text{ON}$ , select the function menu item 01, press OK to confirm, the screen will display the following information:

1. ECU drawing number and its version:  
ABS MK20 IE
2. Code 01901

### III. Read and Clear the DTC

1. After selecting the "02 Read DTC" in the function menu, it displays the total amount of the fault, if there is no DTC, then it displays no DTC. Then, press OK button to proceed to next page to review the DTC and its description. Generally, there is a P or O before the DTC, indicating that it is a Persistent fault or Occasional fault. Persistent fault remains existing all the time, while the Occasional fault can be cleared and is only able to reoccur during the driving.

Note:

The reading of the DTC can not be quitted middle way, you can return to the function menu only after reading all the DTC.

Clear DTC

2. Select function menu item 05, press OK button to clear the DTC, if the DTC can not be cleared, it indicates that the DTC represent exist all the time, if the saved DTC can be cleared, it indicates that it is occasional fault can only be detected during the driving.

#### IV. DTC Display Method

System Problem		Code Displayed
There is no problem current ABS Warning Light does not light up)	Never happened before	No DTC
	Happened before	Occasional DTC
The problem still exists (ABS Warning Light goes on)	Never happened before	Non-occasional DTC
	Happened before	Occasional DTC and Non-occasional DTC

#### V. HCU Diagnosis

Use the scan meter to diagnose the Hydraulic Control Unit (HCU), select the "3 HCU diagnosis" in the options and perform the following procedures.

Step	Action	Screen Display	Normal Result
1		HCU diagnosis – hydraulic pump test	Pump motor operates
2	Depress and hold the brake pedal	LF Wheel——Depress the brake pedal	
3		LF Wheel—— normally open valve open, normally closed valve closed, wheel locked?	Wheel locked
4		LF Wheel—— normally open valve closed, normally closed valve closed, wheel locked?	Wheel locked
5		LF Wheel—— normally open valve closed, normally closed valve open, wheel can rotate freely	Wheel can rotate freely, the pedal rebound, the cylinder motor operating noise is audible
6		LF Wheel—— normally open valve closed, normally closed valve closed, wheel can rotate freely	Wheel can rotate freely
7		LF Wheel—— normally open valve open, normally closed valve closed, wheel locked?	Wheel locked, the pedal sag slightly
8	Release the brake pedal		

- \* Perform the above step 2 - 8 test for each wheel in the following order LF → RF → LR → RR.
- \* If the result of some one of the above steps is different from the normal result, it indicates that the corresponding element fails the normal operation, please check the corresponding element.
- \* You can use “ESC” button to end the test to return the function menu in any place in the screen where there is “return” displayed to return to the function menu.

## VI. Troubleshooting Quick Index

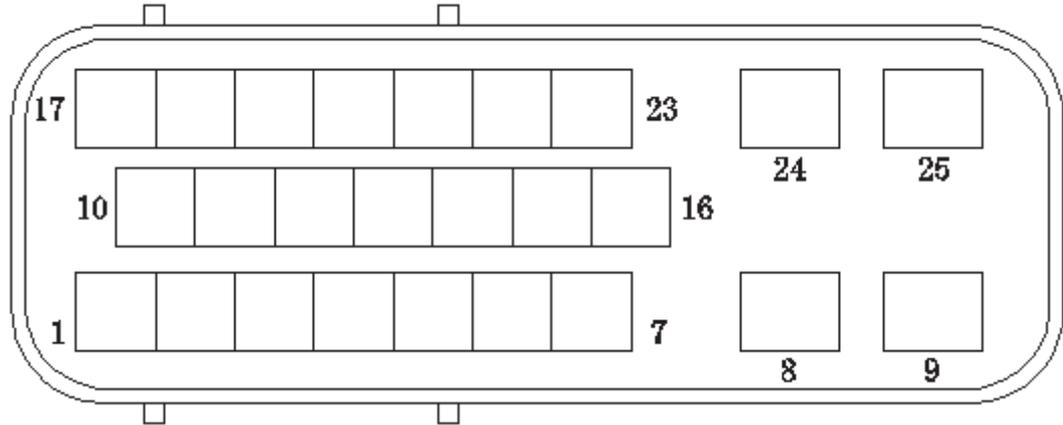
DTC	Fault Description	Diagnosis Result	Inspection Table No.	Reference Page
65535	ECU	Damaged		
1276	ABS hydraulic pump	Motor can not operate	1	275
283	LF Wheel Sensor	Electrical or mechanical fault	2,3,4	276
285	RF Wheel Sensor			277
290	LR Wheel Sensor			278
287	RR Wheel Sensor			
1044	ABS programming error		5	279
668	Power supply terminal 30		6	280
1130	Abnormal ABS operation	Signal is not as specified	7	281

## VII. Non-DTC Problem Inspection Table Index

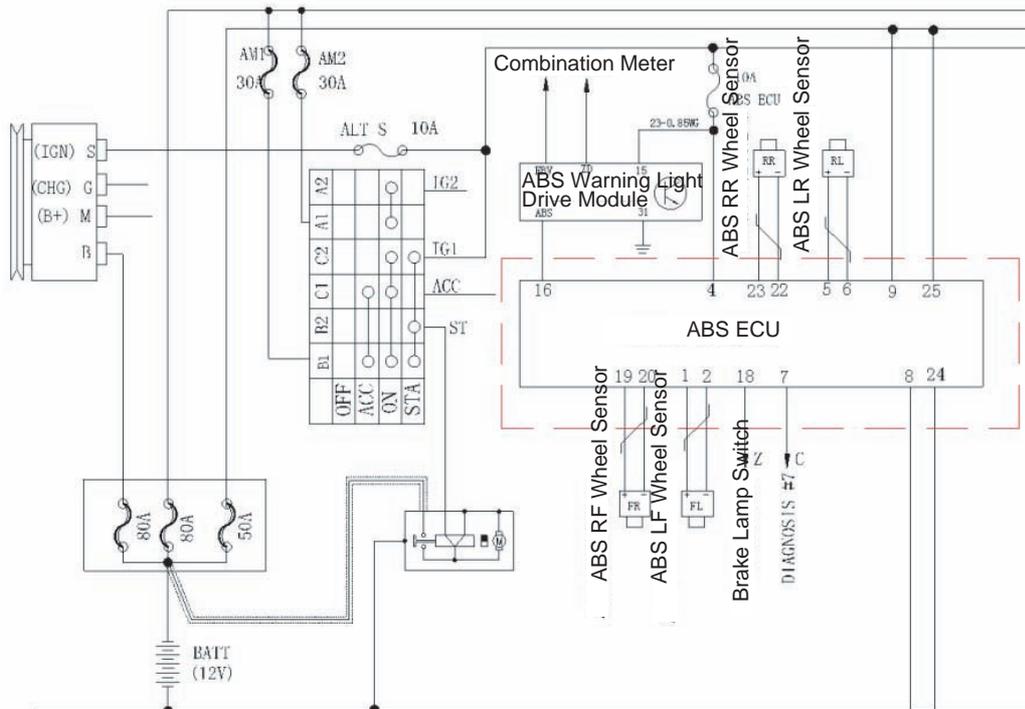
Fault Status		Inspection Table No.	Reference Page
Turn the ignition switch to "ON" (With engine off), ABS Warning Light does not go on		1	282
After the engine is started, the warning light does not go off		2	283
ABS abnormal	The brake force on both sides is not uniform	3	284
	The brake force is insufficient		
	ABS operates when the brake pedal is slightly depressed (vehicle is stationary)		
	ABS operates when the brake pedal is slightly depressed (vehicle is driving)		
When the ABS operates, the brake pedal vibrates severely			
Brake pedal stroke is excessively long		4	285
You need to heavily depress the brake pedal		5	286
No DTC output (failure in communicating with the scan meter)		6	287

## VIII. ABS ECU Connector Pin Layout

ABS ECU Connector (End Views)



Electrical Wiring Diagram

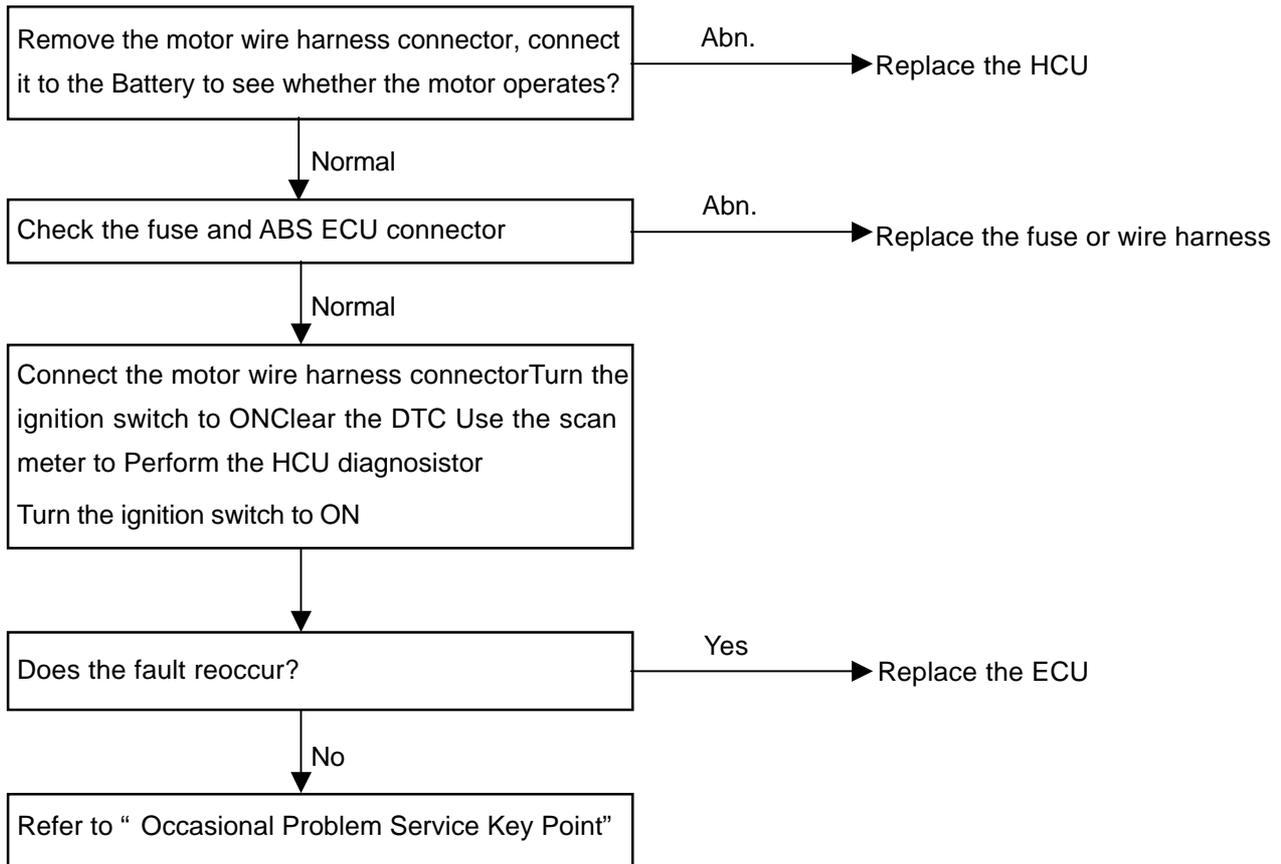


## Section 2 ABS System Check

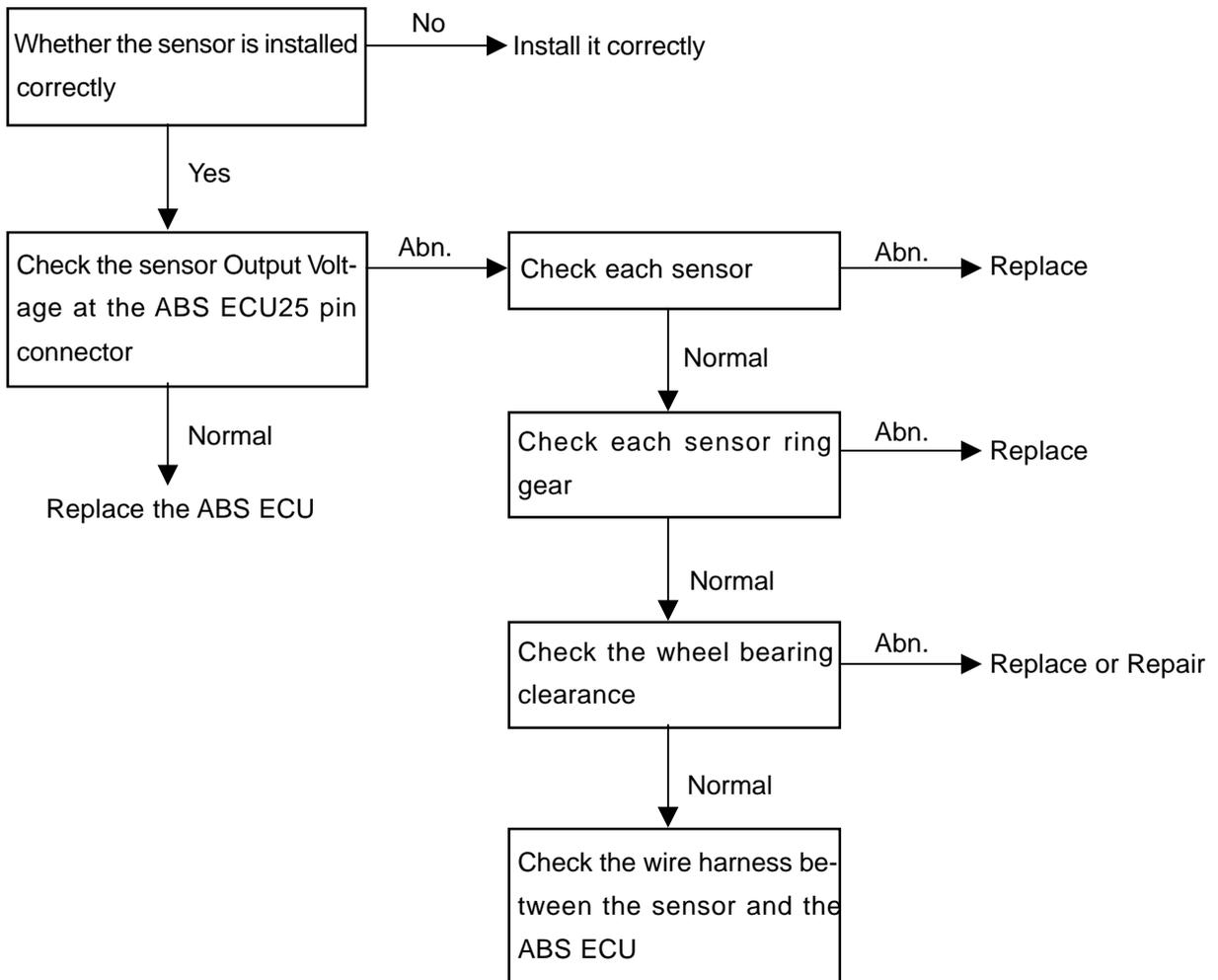
### I. DTC Problem Inspection Table

1 DTC 01276	Likely Causes
<p>[Description] When the vehicle speed exceeds 20km/h, ABS ECU detects that the motor can not operate normally and record this DTC.</p> <p>[Hint] When this problem occurs, one of the possible causes is that the wire harness between the motor and the ECU is disconnected. Use the scan meter to perform the test by activating the HCU function to drive the motor.</p>	<ul style="list-style-type: none"> <li>● Power supply is disconnected or grounded</li> <li>● Motor wire harness is disconnected</li> <li>● Motor is damaged</li> </ul>

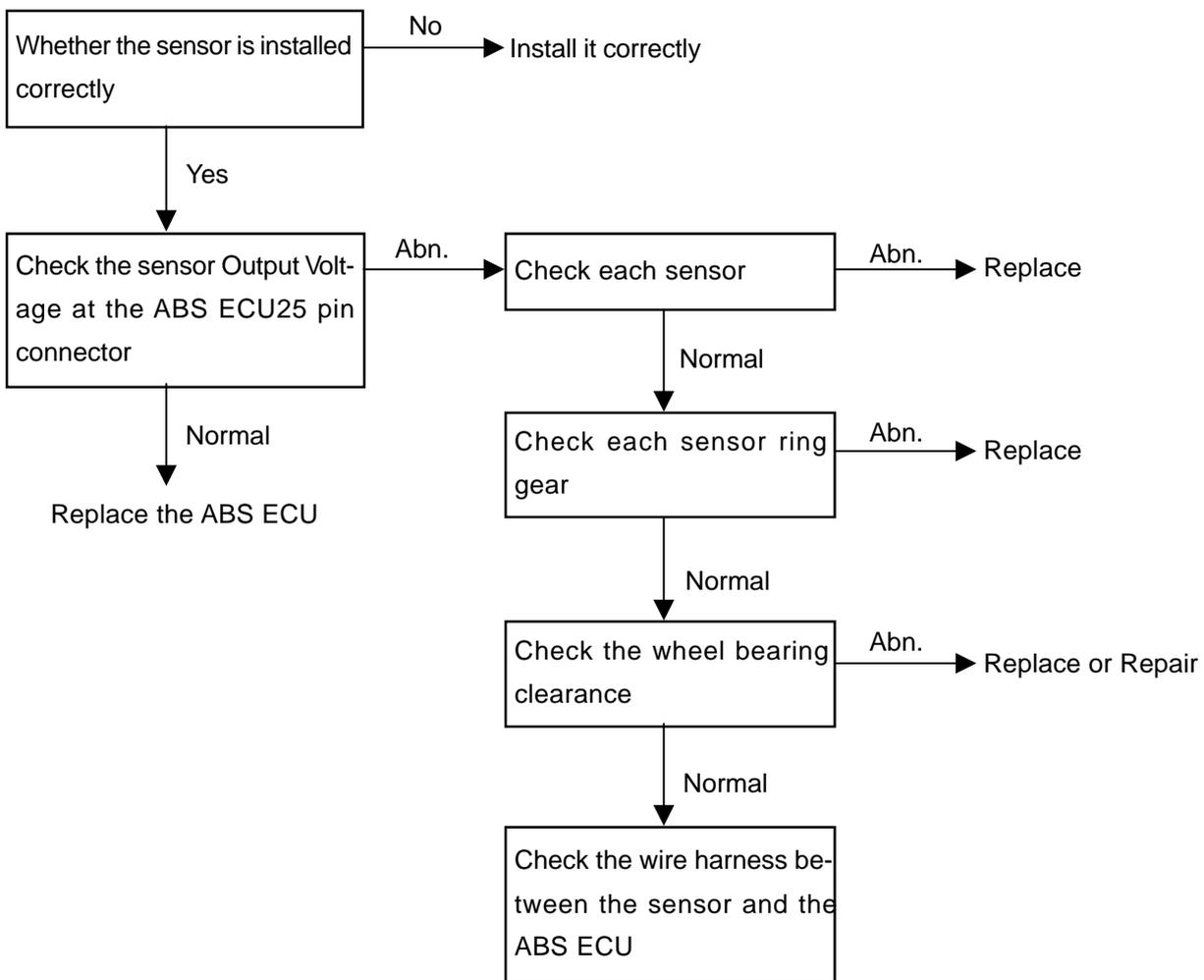
Note: If the Battery is excessively discharged, the motor will not be driven, therefore you must check that the battery voltage is normal before performing the motor driving test. The vehicle must be stationary during the test.



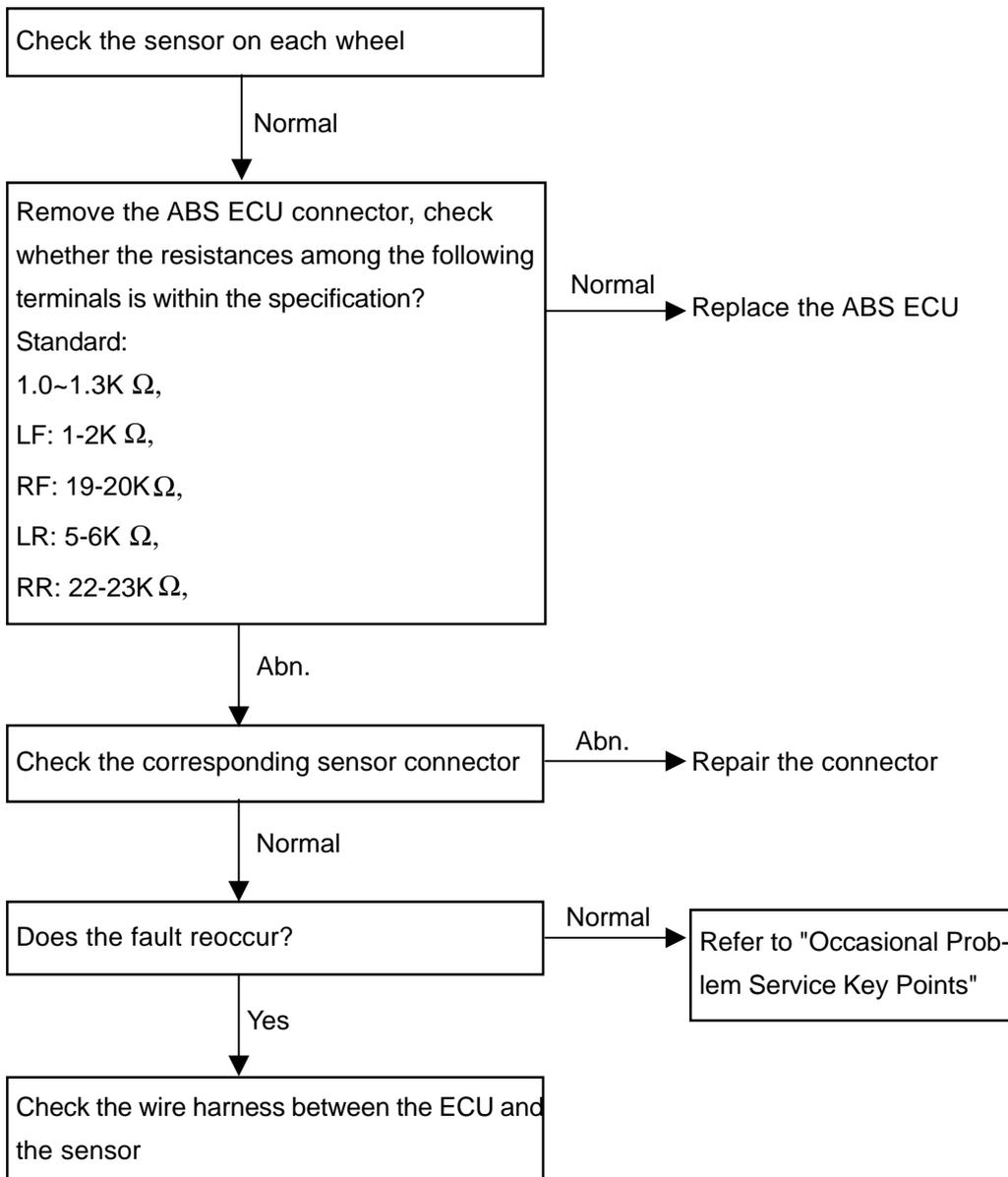
2 DTC 00283,00285,00283,00285,00287,00290	Likely Causes
<p>[Description] When no open in the circuit can be detected and there is no signal output when the vehicle speed exceeds 20km/h, this DTC is set.</p> <p>[Hint] The likely cause may be the sensor inadvertently not installed, short circuit in the sensor coil or wire harness, excessive clearance between the sensor and the ring gear or damaged ring gear.</p>	<ul style="list-style-type: none"> <li>● The sensor is not installed inadvertently</li> <li>● Short circuit in the sensor coil or wire harness</li> <li>● Excessive big clearance between the sensor and the ring gear</li> <li>● The ring gear is not installed inadvertently</li> <li>● ABS ECU failure</li> </ul>



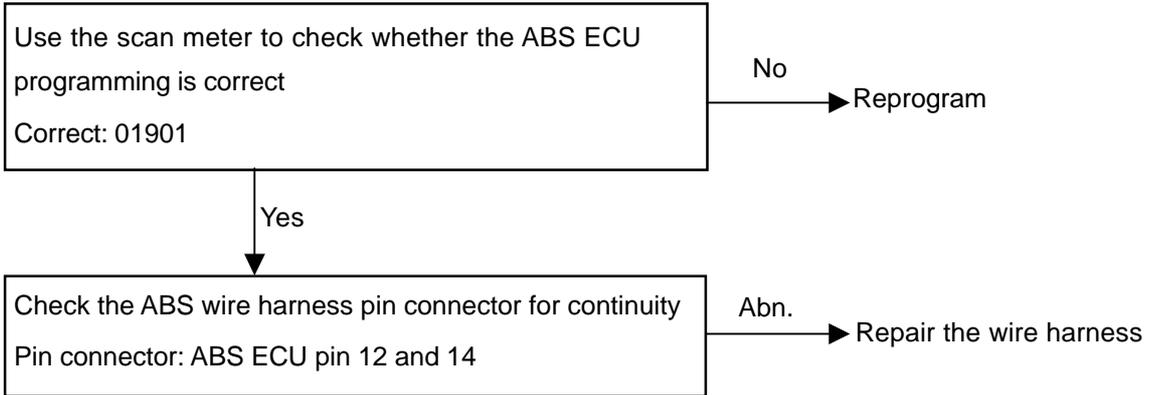
3 DTC 00283, 00285, 00287, 00290	Likely Causes
<p>[Description] When the vehicle speed exceeds 20km/h, if the sensor signal goes beyond the tolerance range, this DTC is set.</p> <p>[Hint] The weak signal may result from the poor connection or short circuit of the sensor coil or wire harness, damaged ring gear or excessively big clearance between the sensor and the ring gear.</p>	<ul style="list-style-type: none"> <li>● The intermittent poor connection or short circuit of the sensor coil or wire harness</li> <li>● Excessively big or small clearance between the sensor and the ring gear</li> <li>● Damaged ring gear</li> <li>● Excessively big bearing clearance</li> <li>● ABS ECU failure</li> </ul>



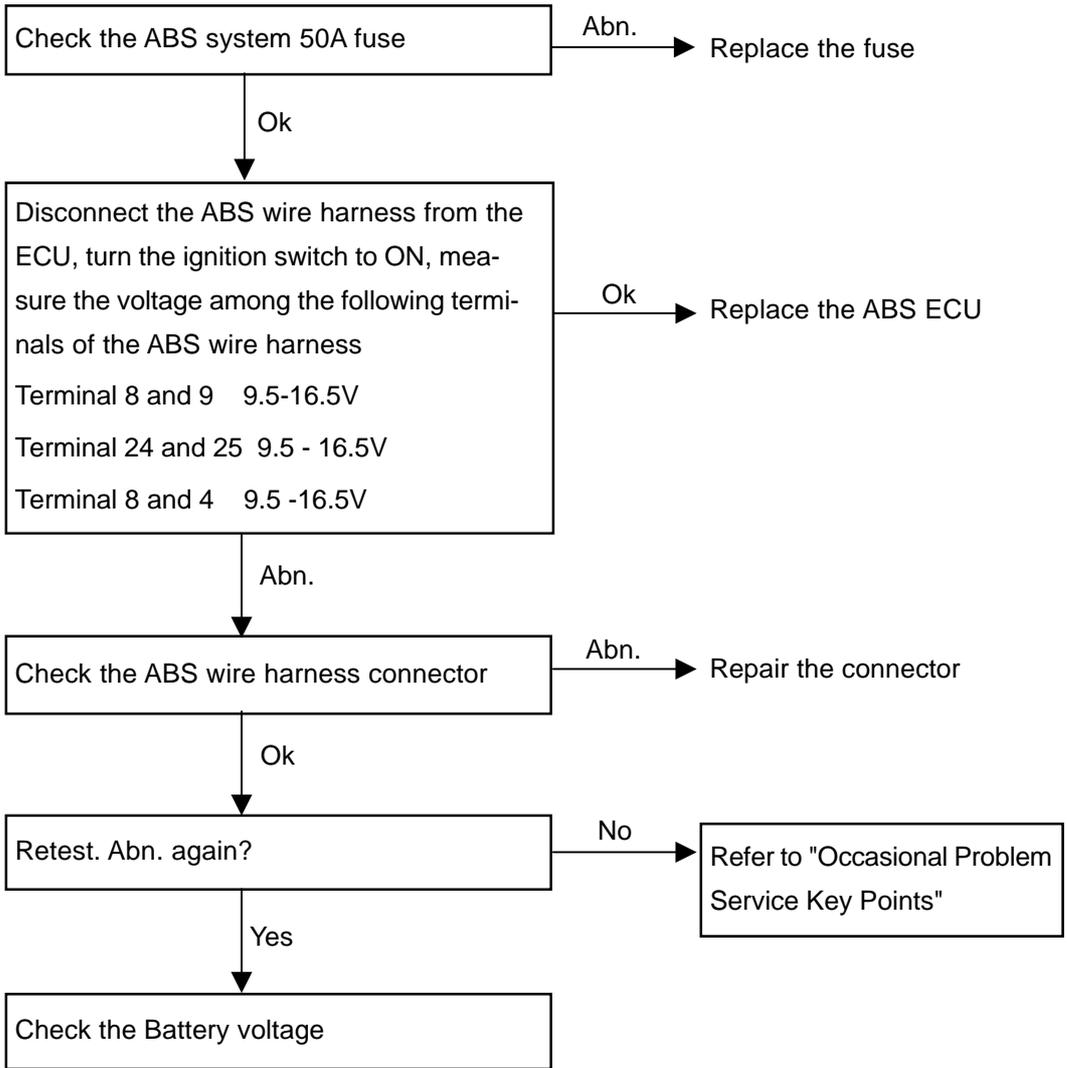
4 DTC 00283, 00285, 00287, 00290	Likely Causes
<p>[Description] When there is recognized open or short circuit in the sensor, this DTC is set.</p> <p>[Hint] The likely cause may be the poor connection of the sensor, short circuit in the coil or wire harness, or fault in the sensor signal processing circuit in the ABS ECU</p>	<ul style="list-style-type: none"> <li>● Open circuit in the sensor connector or coil</li> <li>● Short circuit in the sensor coil</li> <li>● The sensor connector or wire harness is short to ground or power supply</li> <li>● Fault in the sensor signal processing circuit in the ABS ECU</li> </ul>



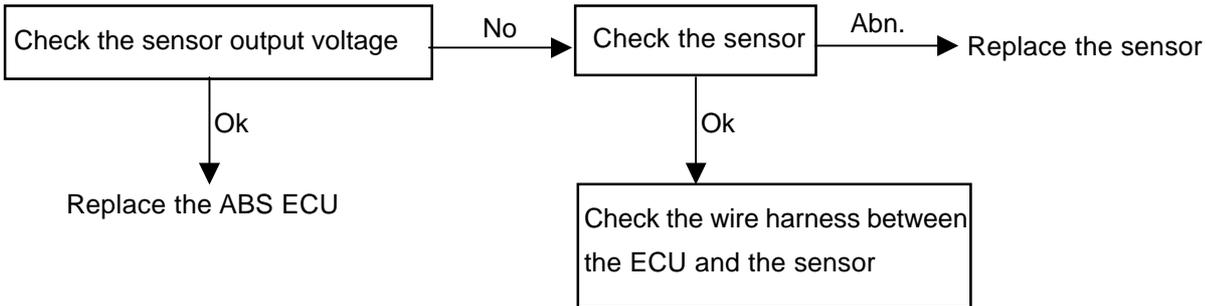
5 DTC 01044	Likely Causes
[Description] When the ECU programming is not consistent with the ABS wire harness pin connection, this DTC is set	<ul style="list-style-type: none"> <li>● ABS wire harness pin connection error</li> <li>● ABS ECU programming error</li> </ul>



6 DTC 00668	Likely Causes
<p>[Description] When power supply terminal 30 does not supply the voltage or the voltage is too high, this DTC is set.</p>	<ul style="list-style-type: none"> <li>● ABS system fuse is broken</li> <li>● Battery Voltage too low or high</li> <li>● ABS wire harness connector is damaged</li> <li>● ABS ECU is damaged</li> </ul>

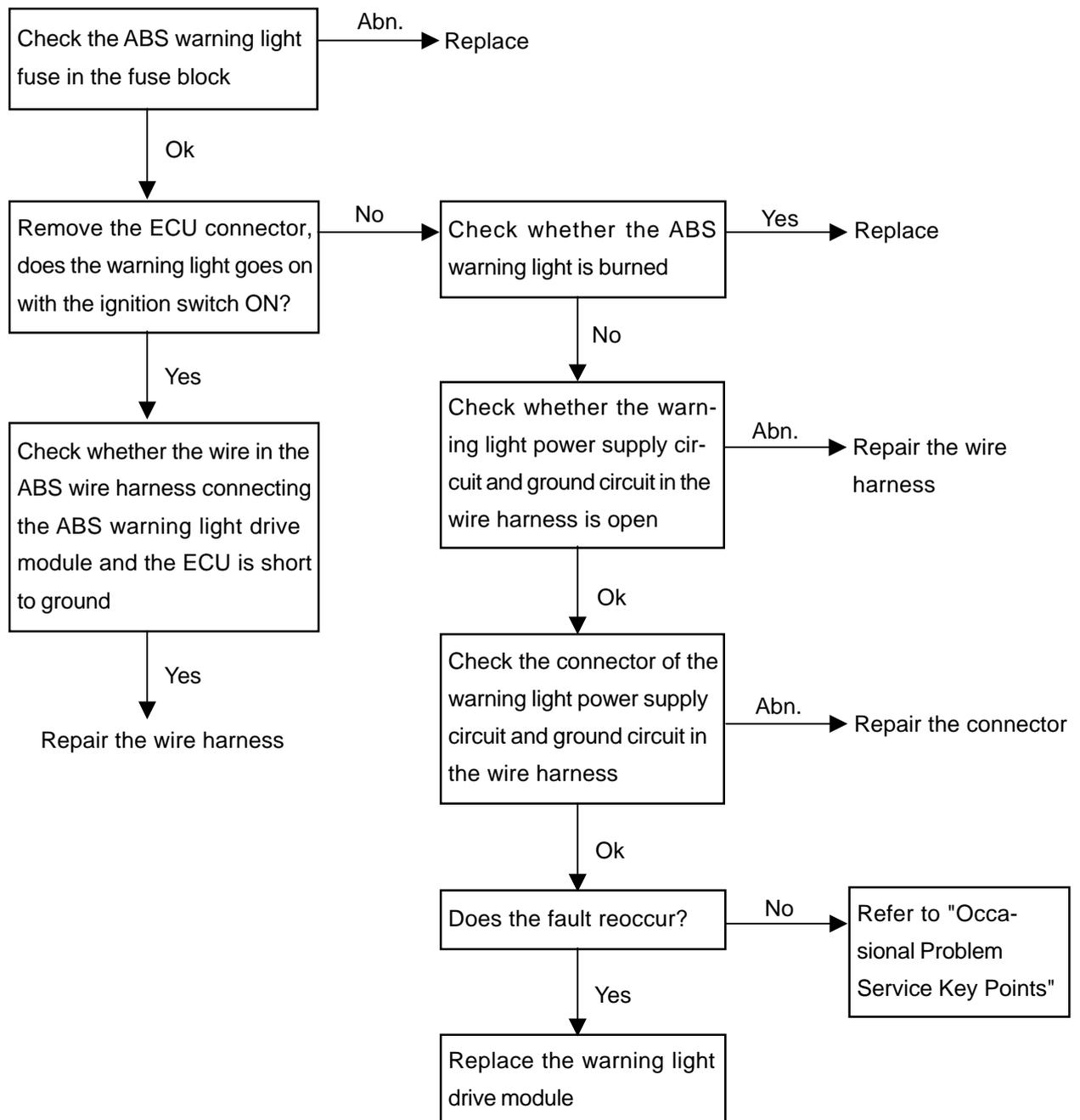


7 DTC 01130	Likely Causes
<p>[Description] When ABS is affected by high frequency electromagnetic wave or the micro-processor determines that the input vehicle speed is suspect, this DTC is set</p>	<ul style="list-style-type: none"> <li>● High frequency electromagnetic wave interference</li> <li>● Damaged sensor or its wire harness</li> <li>● Damaged ABS ECU</li> </ul>



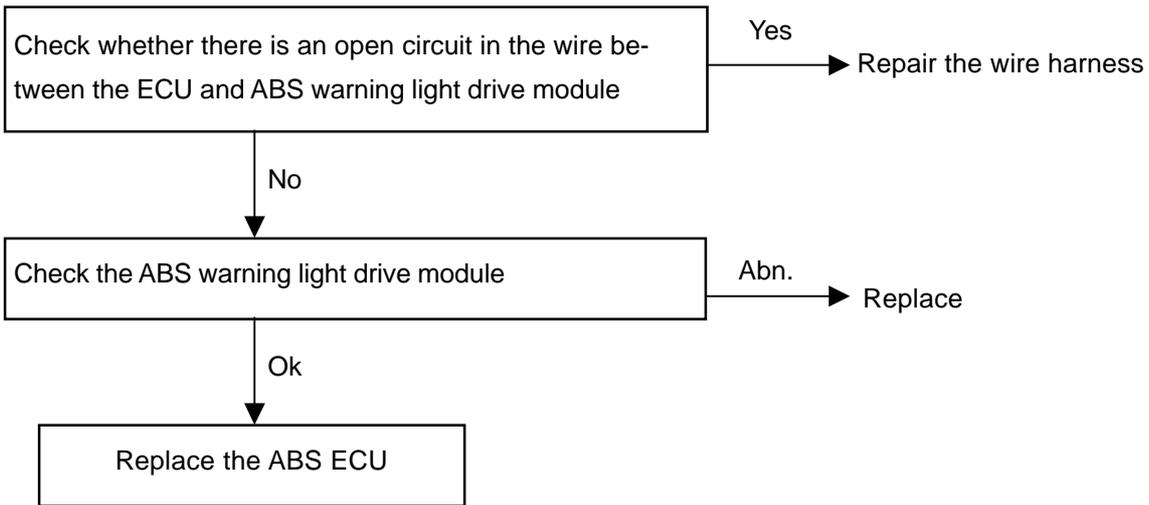
## II. Non-DTC Problem Inspection Table

<p>1 With ignition switch ON (Engine Off), the ABS warning light does not go on</p>	<p>Likely Causes</p>
<p>[Description] ABS Warning Light does not go on, the likely cause may be the open in the warning light power supply circuit, burned bulb or damaged warning light drive module.</p>	<ul style="list-style-type: none"> <li>● Burned fuse</li> <li>● ABS Warning Light Bulb burned</li> <li>● Power supply circuit open</li> <li>● ABS Warning Light Drive Module damaged</li> </ul>

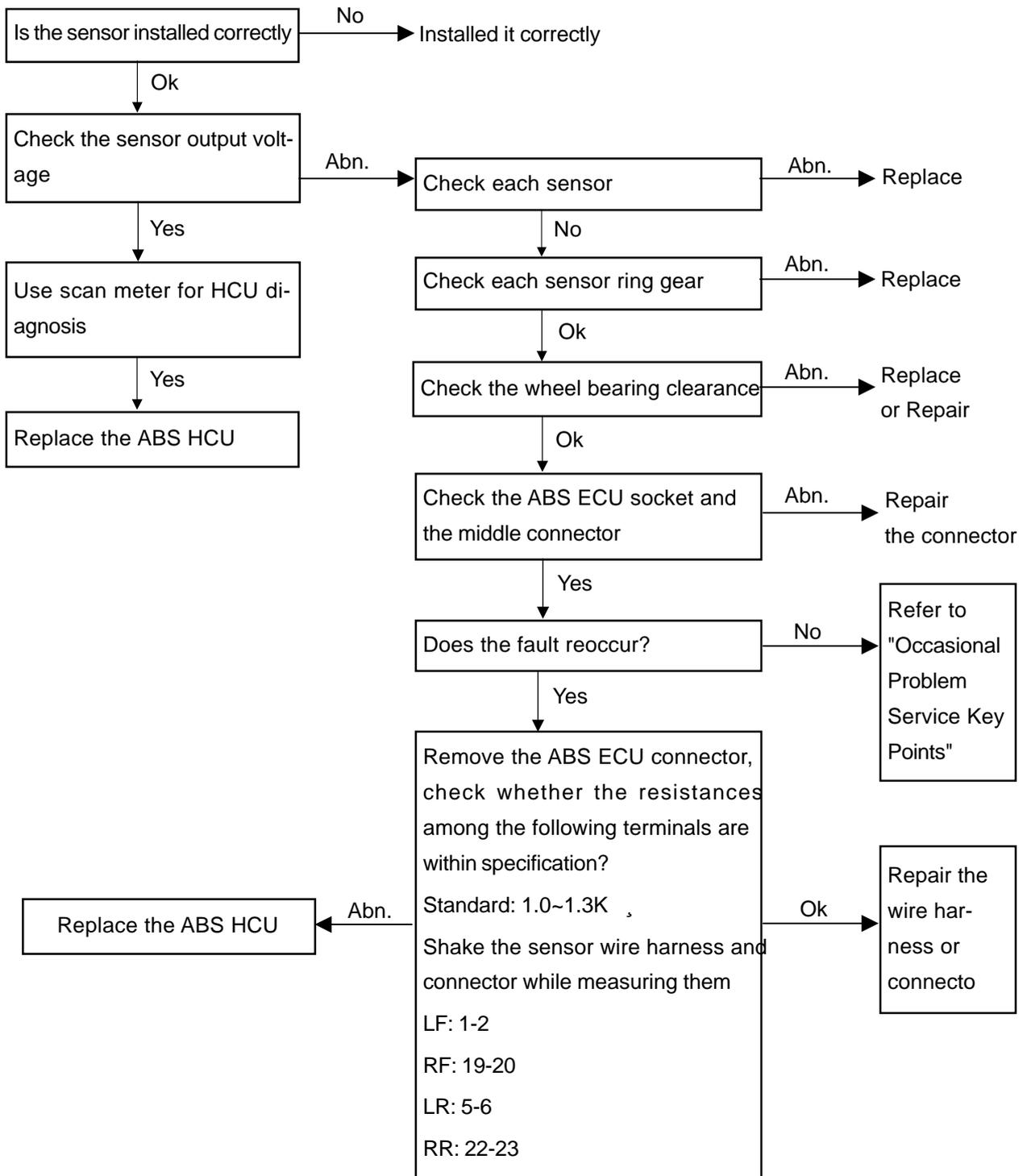


2 After the engine is started, ABS Warning Light is normally on	Likely Causes
[Description] One of the Likely Causes is that ABS warning light drive module is damaged or there is an open in the ABS warning light circuit.	<ul style="list-style-type: none"> <li>● The warning light drive module is damaged</li> <li>● ABS warning light drive module circuit open</li> <li>● ABS ECU is damaged</li> </ul>

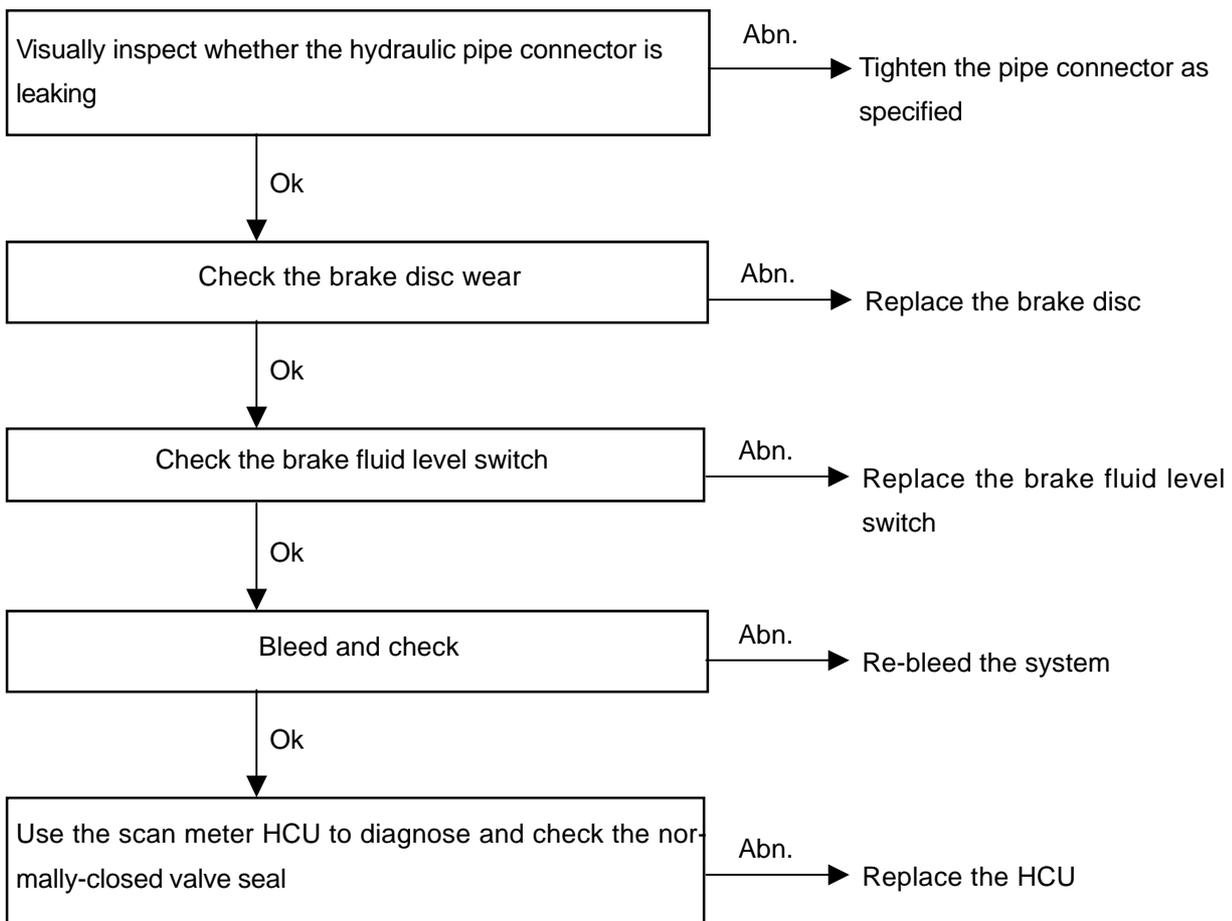
Note: This fault only applies to the condition that the system can communicate with the scanner (ABS ECU Power supply is normal), and there is no DTC set.



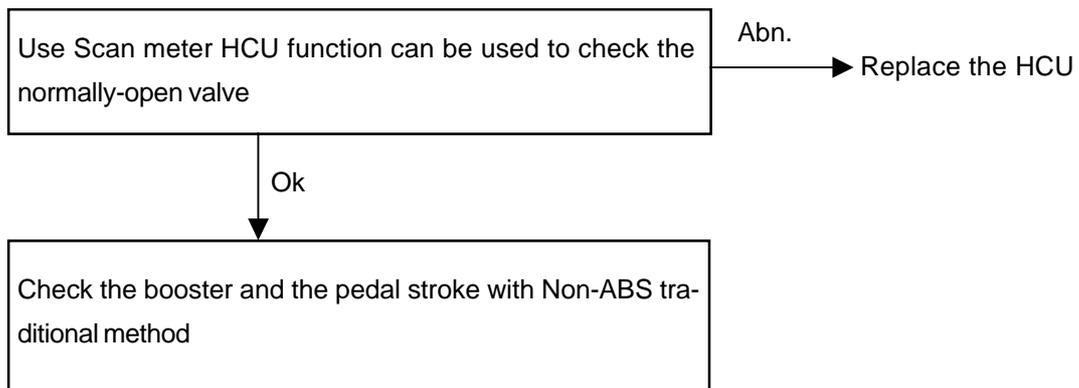
3 Abnormal ABS operation	Likely Causes
<p>[Description] It is in close connection with the driver status and the road conditions and is difficult to diagnose. However, if there is no DTC memory, the following inspections can be performed.</p>	<ul style="list-style-type: none"> <li>● Improperly installed sensor</li> <li>● Sensor wire harness faulty</li> <li>● Damaged sensor</li> <li>● Damaged ring gear</li> <li>● Foreign objects in the sensor</li> <li>● Damaged wheel bearing</li> <li>● Damaged ABS HCU</li> <li>● Damaged ABS ECU</li> </ul>



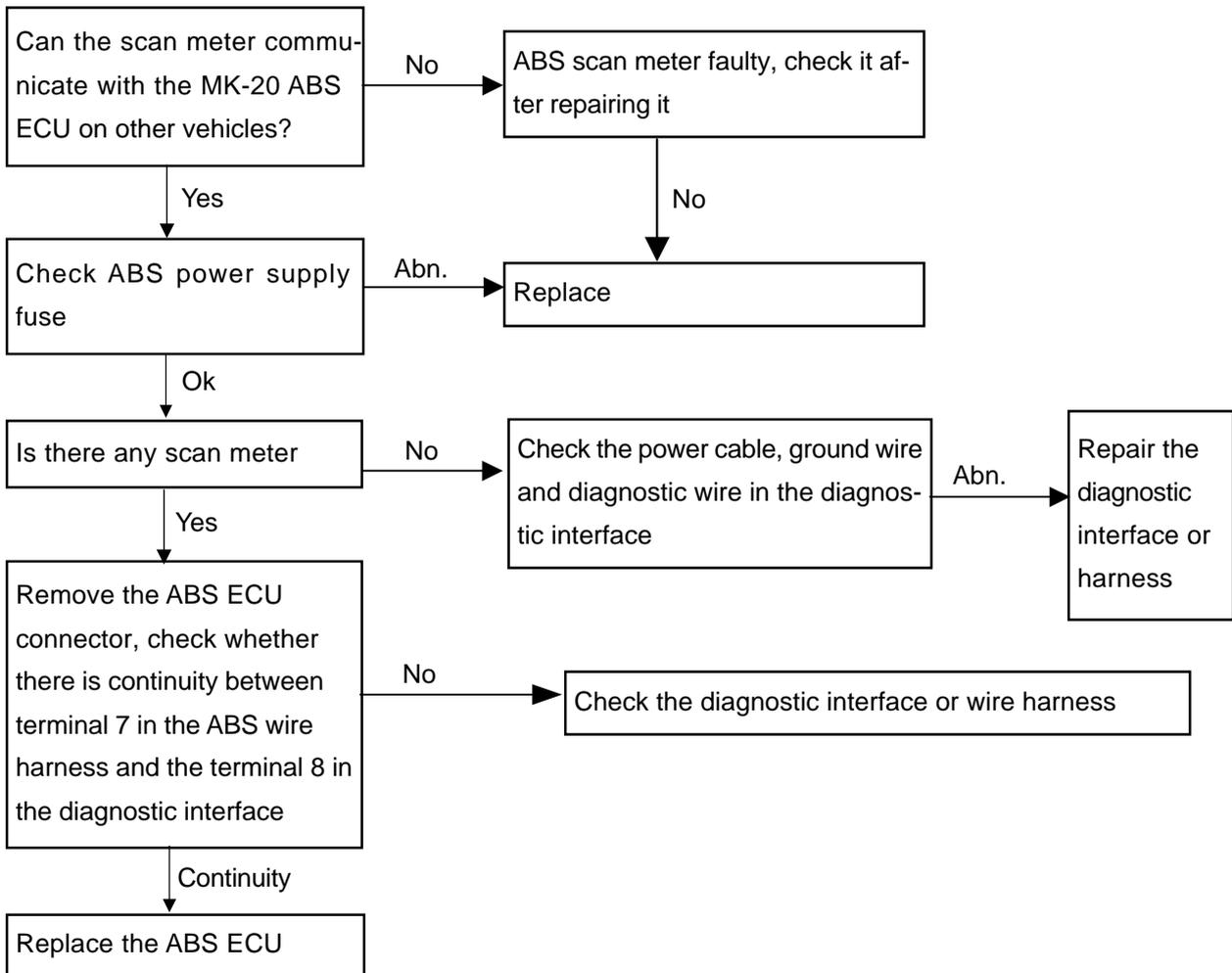
4 Excessively long brake pedal stroke	Likely Causes
[Description] Visually inspect whether there is leakage or mechanical fault. Use bleeding method to check whether there is air in the system. Use the HCU function of the scan meter to test whether the normally-closed valve is leaking.	<ul style="list-style-type: none"> <li>● Brake fluid leakage</li> <li>● Air in the system</li> <li>● Brake disc severely worn</li> <li>● Brake fluid level switch faulty</li> </ul>



5 The Pedal must be depressed heavily	Likely Causes
[Description] Use traditional method to check the booster and the brake pedal stroke. Scan meter HCU function can be used to check the fault of the normally-open valve	<ul style="list-style-type: none"> <li>● Boost faulty</li> <li>● Normally-close valve faulty</li> </ul>



<p>6 No DTC output (can not communicate with the scan meter)</p>	<p>Likely Causes</p>
<p>[Description] It may be the ABS ECU power supply circuit or diagnosis wire circuit that can not communicate with the scan meter</p>	<ul style="list-style-type: none"> <li>● Burned fuse</li> <li>● Diagnosis wire broken or connector disconnected</li> <li>● Damaged ABS ECU</li> <li>● Scan meter faulty</li> </ul>



### III. ABS System Check

Item	Ignition Switch Shift	Terminal Pole	Standard	Unit
Battery Voltage	OFF	25-8	10.1~14.5	V
Battery Voltage (solenoid valve)	OFF	9-24	10.1~14.5	V
Power supply insulation	OFF	8-4	0.00~0.5	V
Ground insulation	OFF	8-24	0.00~0.5	V
Power supply voltage	ON	8-4	10.1~14.5	V
ABS Warning Light	OFF	ECU not connected	Warning light goes off	Visual inspection
	ON		Warning light goes on	Visual inspection
	OFF	Connect ECU	Warning light goes off	Visual inspection
	ON		Warning light goes on for about 1.7 seconds then goes off	Visual inspection
Brake light switch pedal not depressed	ON	8-18	0.0~0.5	V
Brake light switch pedal depressed	ON	8-18	10.0~14.5	V
Diagnostic interface	OFF	Diagnostic interface K & 7	0.0~0.5	Ω
LF Wheel Speed Sensor Resistance	OFF	1-20	1.2~1.3	KΩ
RF Wheel Speed Sensor Resistance	OFF	19-20	1.2~1.3	KΩ
LR Wheel Speed Sensor Resistance	OFF	5-6	1.0~1.3	KΩ
RR Wheel Speed Sensor Resistance	OFF	22-23	1.0~1.3	KΩ
LF Wheel Sensor Output Voltage	OFF	1-2	3.4~14.8	MV/Hz
RF Wheel Sensor Output Voltage	OFF	19-20	3.4~14.8	MV/Hz
LR Wheel Sensor Output Voltage	OFF	5-6	>12.2	MV/Hz
RR Wheel Sensor Output Voltage	OFF	22-23	>12.2	MV/Hz
Speed Sensor Output Voltage Ratio	$\frac{\text{Maximum peak voltage}}{\text{Minimum peak voltage}} \cong 2$			

Item	Key Switch	Action	Standard	Notes
Note: The vacuum booster must have vacuum applied when performing the following inspection.				
LF Wheel normally-open and closed valves seal performance	ON	Depress the pedal	When LF wheel can not rotate, the pedal does not descend	Normally-closed valve inspection
	ON (two valves and pumps are energized simultaneously)	Depress the pedal	LF wheel can rotate freely, the pedal does not descend	Normally-open valve inspection
RF wheel normally-open and closed valves seal performance	ON	Depress the pedal	When RF wheel can not rotate, the pedal does not descend	Normally-closed valve inspection
	ON (two valves and pumps are energized simultaneously)	Depress the pedal	RF wheel can rotate freely, the pedal does not descend	Normally-open valve inspection
LR wheel normally-open and closed valves seal performance	ON	Depress the pedal	When LR wheel can not rotate, the pedal does not descend	Normally-closed valve inspection
	ON (two valves and pumps are energized simultaneously)	Depress the pedal	LR wheel can rotate freely, the pedal does not descend	Normally-open valve inspection
RR wheel normally-open and closed valves seal performance	ON	Depress the pedal	When RR wheel can not rotate, the pedal does not descend	Normally-closed valve inspection
	ON (two valves and pumps are energized simultaneously)	Depress the pedal	RR wheel can rotate freely, the pedal does not descend	Normally-open valve inspection

Note: This inspection uses the "03 HCU diagnosis" of the Scan Meter.

## IV. ABS Operation Inspection

### 1. Check the Wheel Speed Sensor Output Voltage

- ① Check whether the clearance between the wheel speed sensor and the ring gear is within the specification  
For front wheel standard value, refer to "Front Wheel Sensor Installation Drawing"  
For rear wheel standard value, refer to "Rear Wheel Sensor Installation Drawing"
- ③ Jack up the wheel and release the manual brake
- ② Remove the ABS wire harness, measure at the wire harness connector
- ④ Rotate the wheel at the speed of 1/2 turn/second, and use the multimeter or oscilloscope to measure the output voltage  
Terminal 1-2  
Terminal 19-20  
Terminal 5-6  
Terminal 22-23

### Output Voltage

- When use the multimeter to measure  
For front wheel, refer to "Front Wheel Sensor Drawing".  
For rear wheel, refer to "Rear Wheel Sensor Drawing".
  - When use the oscilloscope to measure  
For front wheel, refer to the related standard.  
For rear wheel, refer to the related standard.
- ⑤ The fact that the output voltage is not within the above range may result from the following causes:
    - Excessive clearance between the sensor and the ring gear.
    - Sensor fault.
    - Check the sensor resistance  $1.0 - 1.3k\Omega$ .
    - Select the 4 points on the ring gear to check the clearance (ring gear distortion) between the ring gear and the wheel speed sensor.

### 2. Check the Hydraulic Control Unit (HCU).

- ① Jack up the vehicle, make sure the wheel can rotate freely.
- ② Release the manual brake.
- ③ Turn the ignition switch to ON after connecting the scan meter, do not start the engine this time.
- ④ Refer to the HCU Diagnosis for inspection.

Note: when connecting or removing the scan meter, the ignition switch must be turned to OFF.

## Section 3 Removal and Installation

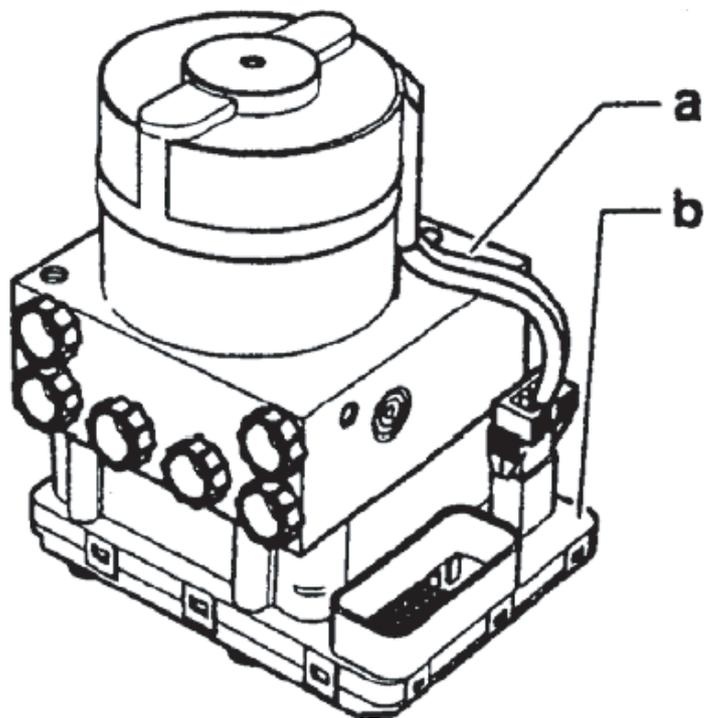
### I. Precautions for Removal

1. Use the scan meter to locate the fault causes before proceeding to service.
2. Wipe the surface clean with the cleaning agent without mineral oil before service; be careful to keep it clean during service, only the lint-free cloth can be used to wipe the removed parts.
3. Only the original spare part can be used, and the package of the new spare part shall not be removed until the installation.
4. Return liquid pump motor and the HCU is a type of integral structure and can not be separated.
5. When the system is opened, do not use compressed air or move the vehicle.
6. Use proper plug to clog each hydraulic outlet as soon as the ABS assembly is removed.
7. Remove other components that may interfere.
8. Please use the DOT 4 brake fluid, do not use the mineral oil.
9. Use the brake fluid to immerse the seal and the O ring, do not use the engine oil or brake grease.
10. After service, check the regular brake system and ABS brake function for normal and reliable operation.
11. Check all hydraulic pipe union for leakage.

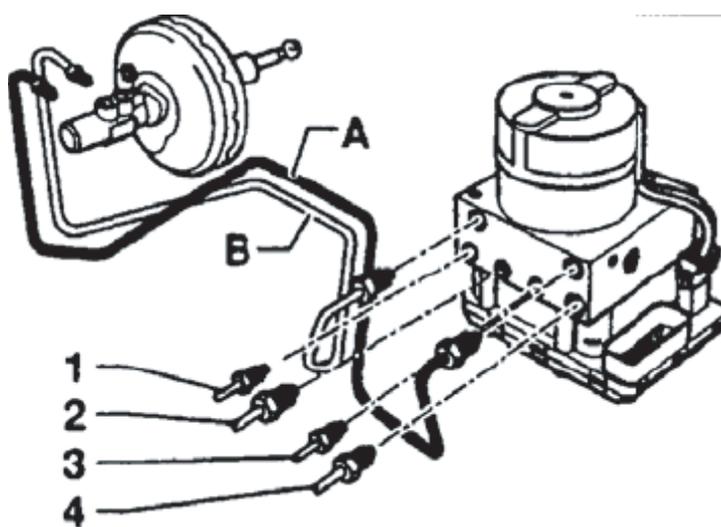
### II. HECU Removal

1. Turn off the ignition switch and disconnect the battery negative ground cable.
2. Remove the wire connector from the ABS HECU assembly.
3. Depress the brake pedal >60mm and hold it with the pedal retainer to close the master cylinder center valve so that the brake fluid will not flow out from the outlet when the system is opened.
4. Put a clean cushion under the hydraulic regulator.
5. Remove the brake pipe (A, B) on the HCU connected to the master cylinder and place the mark, then use a plug to clog the outlet immediately.
6. Remove the brake fluid pipe(1-4) leading to the wheels, then use a plug to clog the outlet immediately.
7. Remove the nut attaching the HECU to the bracket.

8. Remove the whole HECU from the bracket.



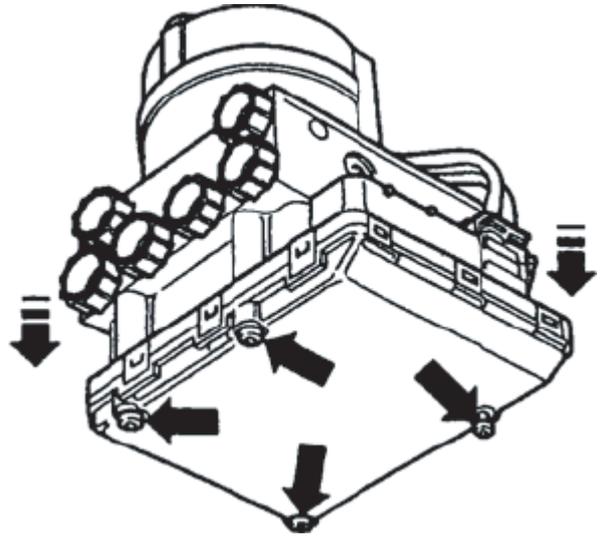
ABS HECU Assembly



ABS HECU Brake Pipe Removal Schematic

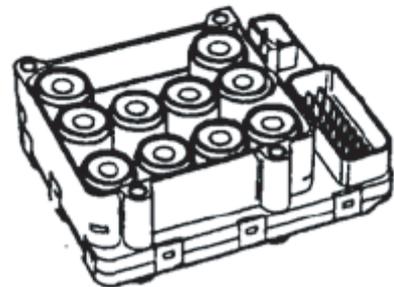
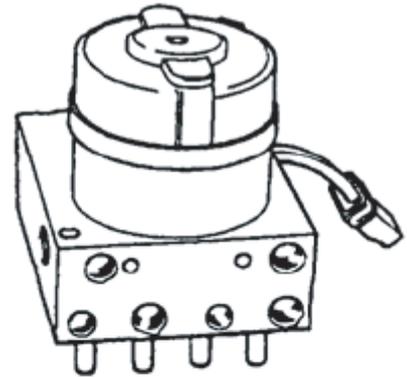
### III. HCU Replacement

1. Depress the retaining clip on the union joint side and remove the cylinder motor wire harness.
2. Remove the 4 screws as shown in the figure, the removed old screw can not be reused.
3. Separate the HCU from the ECU.
4. Install the new HCU to the ECU.
5. Use new screw to attach the ECU to the HCU, tighten the torque: 3+1Nm.
6. Connect the motor wire harness, be careful that the retaining clip shall be in place.



### IV. ECU Replacement

1. Depress the retaining clip on the union joint side and remove the wire harness.
2. Remove the 4 screws as shown in the figure and discard them
3. Remove the HCU from the ECU.
4. Install the new ECU to the HCU.
5. Use the new screw to attach the ECU to the HCU, tighten the torque 3+1Nm.
6. Connect the motor wire harness, be careful that the retaining clip shall be in place.



## V. ABS Assembly Reinstallation

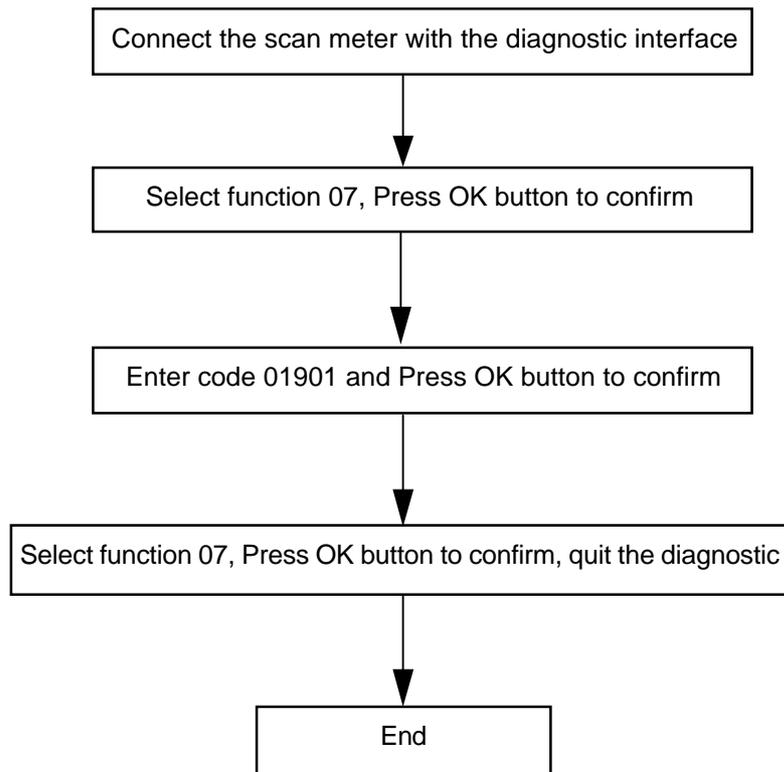
Note: the plug of the ABS assembly hydraulic outlet can only be removed after the brake pipe is installed, lest the foreign object will enter the brake system.

1. Install the ABS assembly to the bracket, tighten the torque: 20+4Nm.
2. Remove the plug of the hydraulic outlet, installed the brake pipe. Make sure that the brake pipe is correctly installed.
3. Install the brake pipe connected to the master cylinder.
4. The brake pipe torque is 12+4Nm (M10 x 1) and 15+3Nm (M12 x 1).
5. Fill the new brake fluid into the reservoir until the liquid level reach the MAX and bleed it as specified.
6. With the ignition switch ON, ABS Warning Light must goes on for 1.7 seconds then goes off.
7. Clear the DTC memory, check if there is DTC again.
8. Drive the vehicle to confirm the ABS function (you must feel that the pedal rebound).

## VI. ECU Program

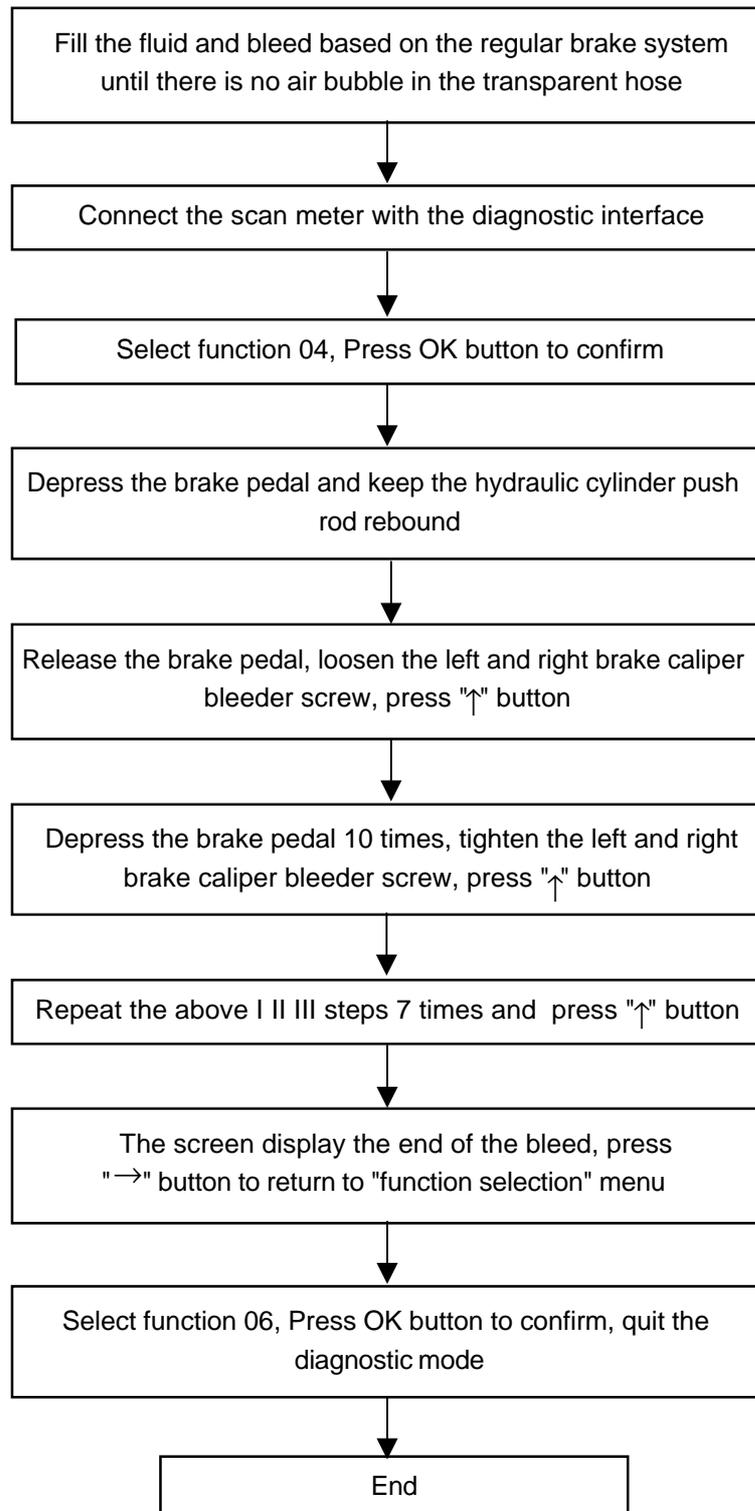
Note: when replacing the HECU or ECU, you shall program the new ECU, otherwise the ABS Warning Light flashes and the system can not operate normally.

Use the scan meter to program the ECU based on the following procedure:



## VII. Fill the liquid and bleed

After replacing the HECU, bleed the second HECU circuit in addition to the filling and bleeding of the regular brake system. Use the scan meter to perform the following procedure:



# Part IV Air Conditioner and Inside & Outside Trim

## Chapter 1 A/C System

A/C system consists of refrigerating and heating system. The Refrigeration system mainly comprises compressor, condenser and evaporator. The refrigerant circulation absorbs the heat in the air and discharge the vapour to lower the temperature in and dehumidify the compartment. The heating system is mainly composed of heat exchanger and heater. It heats the compartment through the heat exchanger by heating the air with the heat from the cooling water in the engine. The control of air temperature, humidity and velocity of flow in the compartment is realized by independent or joint working of heating and Refrigeration system.

### Section 1 The Structure & Working Principle of Refrigeration System

The structure of Refrigeration system is shown in Figure 1.

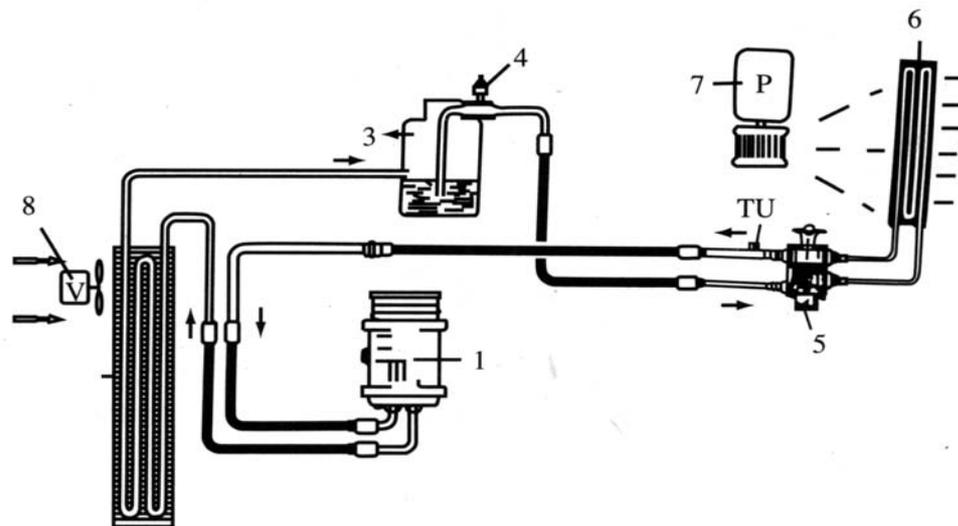


Figure 1 The Structure and Working Principle of Refrigeration System

1. Compressor
2. Condenser
3. Receiver/Drier
4. Pressure Relief Valve
5. Expansion Valve
6. Evaporator
7. Blower

Refrigeration system uses vapor compressing refrigeration cycle, comprising the compressor, condenser, pressure relief valve, evaporator, blower, expansion valve, receiver/drier and pipe.

It's working principle is as shown in the Figure 1. The compressor (1) sucks in the refrigerant gas in the

evaporator (6) via the expansion valve (5) for compression and generates high temperature and pressure vapor which then is cooled into liquid through the condenser (2) and dried in the receiver/drier (3), then restrict the expansion valve and enable certain amount of refrigerant liquid to be vaped into low temperature and pressure vapor in the evaporator, meanwhile, absorb large amount of heat and perform heat exchange with the air sucked in by the blower, then distribute the cooled air to the vehicle compartments. Cycle the operation until the compartments gets the desired temperature.

See Table 1 for the Refrigeration system parameter.

Item	Parameter	
Temperature adjustment method	Control the mixture of cool and hot air	
Compressor	Nominal Refrigeration/W	4200
	Displacement/(mL/r)	108
	Model	SW-5H11
	Electromagnetic Clutch Power Dissipation/W	45
Lubricant /mL	SW-100/135	
Blower	Maximum Airflow/(m <sup>3</sup> /h)	400
	Airflow adjustment	4th Shift Manual
	Motor Power Consumption/W	180
Condenser	Dimension/mm	18×302×630
	Heat Exchange/W	9400
	Air Resistance/Pa	≤156
	Fan Motor Current/A	≤8
	Fan Motor RPM /(r/min)	2900±200
Evaporator	Dimension/mm	86×213×235
	Refrigeration/W	4200
	Thermal Expansion Valve	Inner Balance 1.5 ton
Drive belt	4PK830	
Refrigerant Fill/g	630±20	

Table 1 Refrigeration system parameter

# Section 2 Heating System

Heating system uses mixed temperature adjustment which controls both cold and hot air and is featured in outstanding temperature adjustment performance. The cold and hot air can be completely mixed at each outlet and achieve continuous temperature adjustment. The air duct arrangement on the instrument panel is shown in Figure 2. The air flow channel system is shown in Figure 3.

## I. Heating System Parameter and Structure

Heating system uses water heating structure which uses the engine coolant as the heat source, leads the the coolant into the heating radiator installed in the vehicle compartment and has the interior or exterior air blow across the radiator with the blower to increase its temperature. The system consists of the blower assembly, heating control assembly and heater assembly.



Figure 2 Heating Duct Arrangement

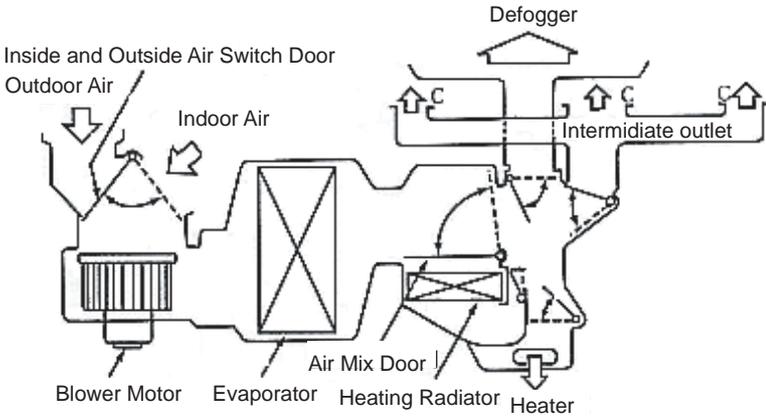


Figure 3 Air Flow Channel System Illustration

## 1. Heating System Parameter

Heating system radiating power, blower fan diameter, power dissipation and heater radiator dimension are shown in the table 2.

Table 2

Heating System Parameter

Dissipation Power/W	4000
Air Flow/(m <sup>3</sup> /h)	280
Power Consumption /W	180
Fan Diameter/mm	140
Overall Radiator Dimension	159.4mmx 140mmx 49mm

## 2. Blower

Blower is located at the lower part of the goods compartment. The door inside the blower case is controlled by the servomotor. The exchange of the air inside and outside the door can be achieved by adjusting the door to import the outdoor air and recirculate the indoor air.

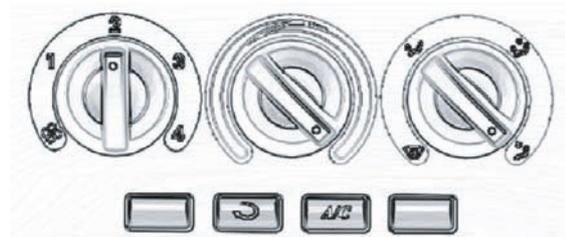


Figure 4 A/C Control Panel

Blower motor uses Permanent magnet DC motor with multiple blade fan. In addition, there are a set of resistance on the blower which adjust the fan, called as adjusting resistor. Blower provides wind supply not only to the heating radiator, but also to the evaporator in the refrigeration system.

## 3. A/C Control Mechanism

A/C control mechanism is located in the middle of the instrument panel. All adjustment except the A/C switch and inside and outside circulation switch are made by rotating the control knob. The A/C control panel is shown in Figure 4.

- ① Temperature adjustment control knob: control the mix ratio of the cold and hot air by adjusting the air mix door, use the control knob to achieve continuous temperature adjustment.
- ② Outlet control knob: use 4 ranges, different types of air flow adjustment available.
- ③ Inside and outside circulation switch: It can toggle between the introduction of outdoor air and recirculation of the indoor air. (press the switch for inside circulation)
- ④ Blower switch: when the plum blossom range is closed, the remaining four ranges are used to adjust the air flow.
- ⑤ A/C switch: as the switch of the refrigeration system, use press-button with built-in A/C indicator.

## 4. Heater

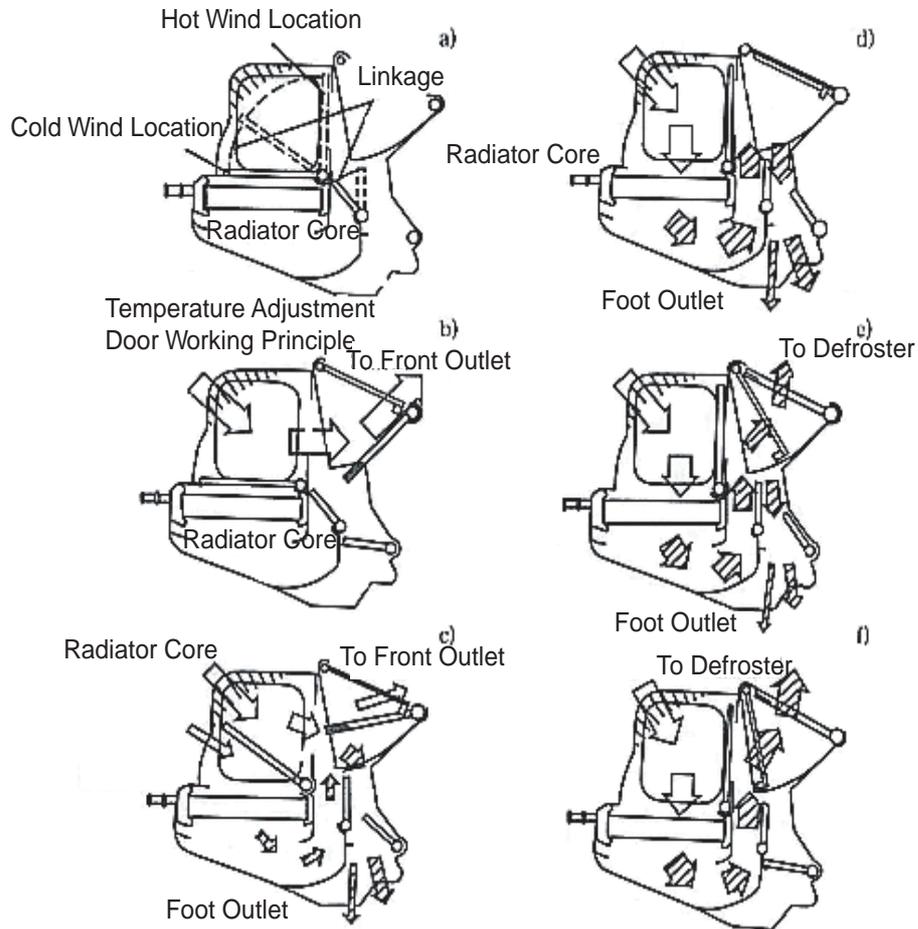


Figure 5 Heater Door Control Diagram

The heater comprises the heater radiator (heat exchanger), the plastic case forming the air duct, connecting rods adjusting different air ducts and the door. The two groups of combination doors in the heater case are connected to the heating control mechanism by the cable. The first group is the two couple action doors adjusting the air mix ratio that are located in the outlet and inlet each; the second group comprises 4 doors controlling the air outlet vents, where the upper center one controls the front outlet vent, each of the upper left and right sides controls a defogger outlet vent and lower foot outlet vent. Figure 5 shows the working principle of temperature adjustment door. The d), c), e), f) in the figure indicate the outlet air flow direction as the result of the adjustment of the control knob in the heating control mechanism panel.

## Section 3 A/C controlling system

### I. Introduction and Composition

In order to ensure the effective operation of the A/C system in any operating condition, some advanced electric control devices are used to protect the A/C system in adverse engine operating condition.

The electrical control part consists of: A/C switch, relay, evaporator temperature sensor, water temperature sensor, pressure switch, ECU...etc.

A/C system circuit diagram is shown in Figure 6.

### II. controlling system feature

- (1) The condenser fan's power is 90W;
- (2) The performance of the condenser fan is controlled by ECU, pressure switch;
- (3) Cut off the electrical power of the A/C compressor clutch when the water temperature reaches 109° C;
- (4) Connect blower switch 9 to rotate the blower motor 6 to ensure A/C normal operation. Connect A/C switch 10 to output A/C request signal to ECU.
- (5) After ECU receives the request signal and the one from the evaporator temperature sensor 17, if the engine is at idle, ECU first increases the engine speed to  $950 \pm 50$  r/min, lest the A/C operation enhance the load and lower the engine speed or result in engine off. And then the ECU can respond. If the engine is in accelerating condition, ECU does not respond immediately either, and respond 5 seconds later after the end of the accelerating condition. ECU send out a A/C control signal from pin 22 to relay 7, command the relay to suction in. With the low pressure switch 11 closed, the compressor 12 starts to work when the magnetic clutch suction on. The condenser relay holds in and condenser blower 13 rotates. When high pressure switch 15 is closed, have the relay 7 hold in and the water tank fan 14 rotates. When the water temperature sensor 16's temperature is higher than 109° C, ECU shut off the output signal of the pin 22 and A/C stops operation.
- (6) When the Refrigeration system pressure is over 1.7MPa, radiator fan will rotate. Disconnect A/C compressor Refrigeration system power supply when the pressure is over 2.6MPa or less than 0.25MPa;

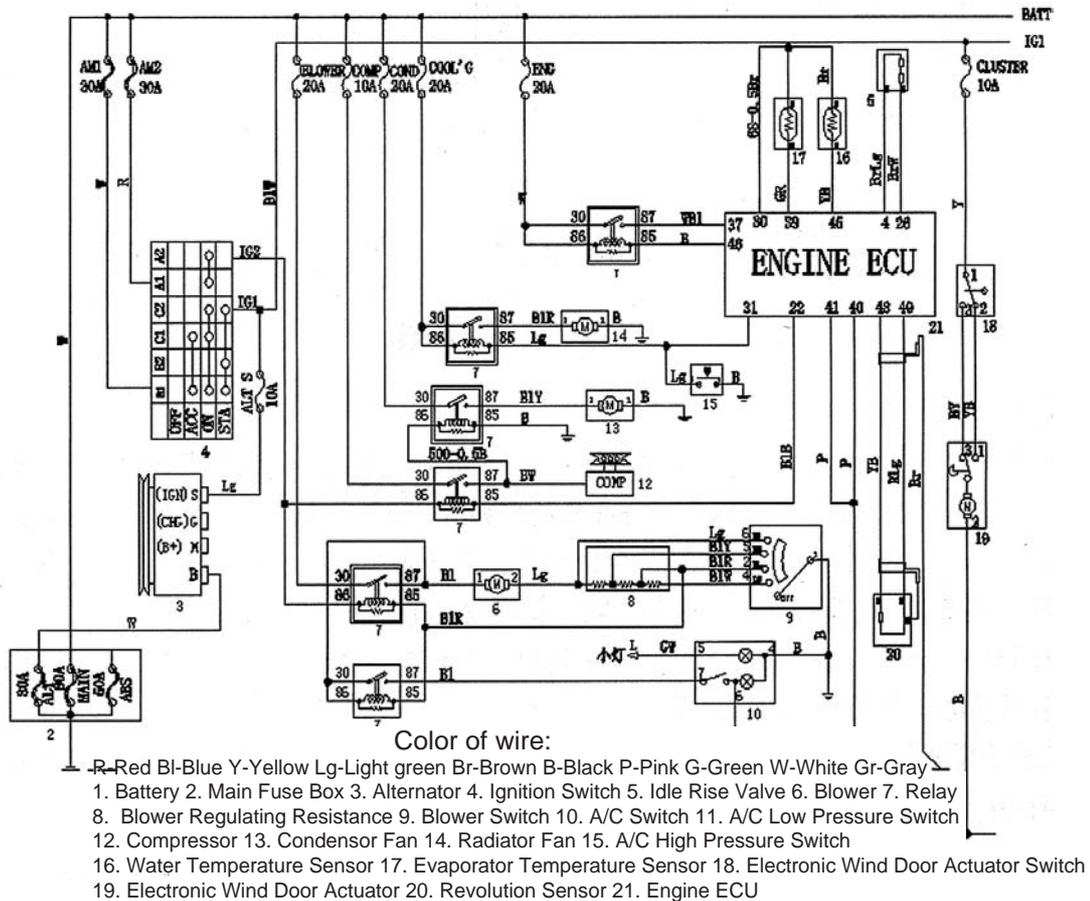


Figure 6 A/C System Electrical Appliance Diagram

### III. Protecting Device

#### 1. Low temperature protection

Evaporator temperature sensor, when the sensed temperature is lower than 3° C, the compressor clutch is de-energized and stops operation.

#### 2. High temperature protection

Water temperature sensor, when the sensed water temperature reaches 109° C, the compressor clutch is de-energized and stops operation.

#### 3. Low pressure protection

When pressure sensed by the pressure switch is lower than 0.25MPa, the compressor clutch is de-energized and stops operation.

#### 4. Voltage protection

When the pressure sensed by the pressure switch reaches 1.7MPa, radiator fan rotates.

#### 5. High pressure protection

When the pressure sensed by the pressure switch reaches 2.6MPa, the compressor clutch is de-energized and stops operation.

#### 6. Normal pressure

When system pressure reaches 0.25MPa~2.4MPa, control the A/C idle speed.

## Section 4 Service Caution & Notice

### I. Service Caution

#### Refrigerant Treatment

- During the treatment, the operator shall be careful not to inhale A/C refrigerant or lubricant vapor. Long-term exposure to the A/C environment will cause the operator's eye, nose and throat liable to stimulation. In addition, based on the consideration on the environment influence, when discharging the HFC-134a from the A/C system, we suggest using the recyclable and rechargeable devices. If sudden system fault occurs, it is recommended to place the device on a ventilated place before starting service.
- For HFC-134a service equipment, it is recommended not to perform the pressurization check or leakage inspection. If these mixture combust, it may result in severe human injury or property loss.
- Please be noticed not to let the refrigerant leak near the spark or other hot objects. If the refrigerant gas contacts the spark or similar heat source (e.g. cigarette or heater), it may generate poisonous gas. The refrigerant is extremely liable to leakage during the transportation. In this case, please eliminate or remove the heat source mentioned above and keep good ventilation.
- It is very dangerous to handle the liquid refrigerant. Only a drop of refrigerant can result in local frostbite on skin if dropped on the skin of the operator. Therefore, it is specified that the operator shall always wear glove and eye protection during the handling of the liquid refrigerant. If liquid refrigerant gets in your eyes or on your skin, Wash the area with much cool water. Go immediately to hospital for professional treatment.

#### Refrigerant Preservation

- Refrigerant preservation container is a high pressure resistant equipment. If it is put in hot treatment, the explosion may arise, and the resulting metal fragments and the splashed liquid refrigerant will result in severe human injury. It is recommended to preserve the refrigerant below 40° C.

### II. Service Notice

#### Insufficient Refrigerant Handling

- If the refrigerant is founded to be insufficient during the fault diagnosis, it is recommended not to add refrigerant because of the following facts: the pressure readings indicated by different pressure gauge are different, thus you will be unable to determine the exact amount of the refrigerant to be added, and excessive or insufficient refrigerant may cause a series of chained negative effects such as damaged refrigerant circulation parts or deteriorated refrigeration effect. Therefore, if the refrigerant is found to be insufficient, it is recommended to drain the refrigerant from the refrigerant circulation pipeline and fill specified amount of the refrigerant.

#### Compressor Oil Handling

- For this type of vehicle, it is recommended to use SW-100 type compressor oil. Use of PAG compressor oil other than the SW-100 type may cause the A/C compressor to be damaged.
- During the operation, please be noticed not to splash the SW-100 type compressor oil onto the vehicle surface. Therefore, if this happens, please wipe it off immediately, otherwise the compressor oil will damage the paint on the vehicle surface.

- Compared with the early used mineral oil, the SW-100 type compressor oil is of comparatively high moisture absorption performance. If you mix the moisture object with the SW-100 type compressor oil, it will damage the Refrigeration system. Therefore, after treating the compressor oil or removing the refrigeration system components, the lid shall be covered immediately to prevent the SW-100 type compressor oil from absorbing the moisture.

## Section 5 The Refrigeration System Operation Procedure

### I. Refill Refrigerant

Notice:

- During the filling of refrigerant into the refrigeration system, be careful that it is required to have the professionals operate under the specified standard and procedure, otherwise it will reduce the A/C efficiency greatly and even damage the refrigeration system components.

Refill the HFC-134a refrigerant

Refill Preparation

1. Install the inflating equipment.
2. Connect the low pressure tube to the low pressure refill valve.
3. Connect the high pressure tube to the high pressure refill valve.
4. Connect the intermediate tube to the vacuum pump.

Vacuumization:

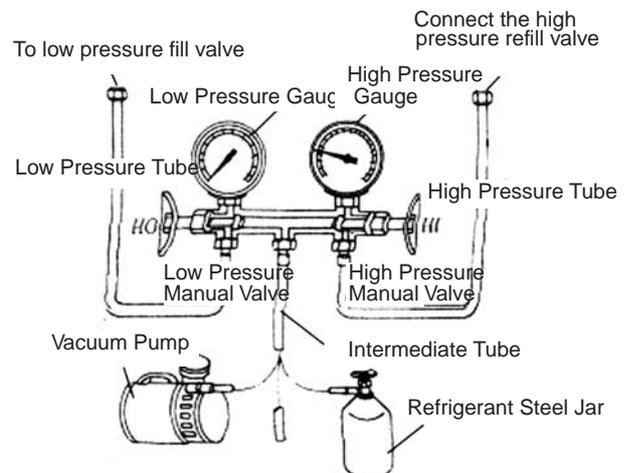
1. Open all valves.

Notice:

- Close all valves of the manifold gauge immediately after the vacuum pump stops operation. If the valve is still open after the vacuum pump stops operation, then the vacuum pump oil will return to refrigerant circulation loop and reduce the A/C efficiency.
2. Start the vacuum pump and run it for 15min.
  3. Check if the readings at high and low sides of the manifold gauge fall within the range of  $-101 \text{ kPa} \{-760 \text{ mmHg}\}$ . Close the valves of the manifold gauge.

Check the air tightness:

1. Stop the vacuum pump and have it wait for 5min.
2. Check the high pressure side of the manifold gauge and the reading at the low pressure side.
  - Check for leakage if the reading changes and vacuumize it again.
  - Refill the new HFC-134a refrigerant if the reading doesn't change.



3. Check for leakage if the reading changes and vacuumize it again.
4. Refill the new HFC-134a refrigerant if the reading doesn't change.

#### Fill the new HFC-134a refrigerant

1. Connect the intermediate pipe to the refrigerant steel jar.
2. Open the refrigerant steel jar valve.
3. Weigh the refrigerant steel jar to charge the right refrigerant volume (refrigerant refill 630g;  $\pm 20$ g).

#### Warning:

- Check for air leakage or any other leakage when refilling large amount of refrigerant into the Refrigeration system. The operator is recommended to fill small amount of refrigerant first to prevent the refrigerant from leakage, which will result in ozonosphere damage.
  - It is very dangerous to open the engine high pressure side valve if filling the refrigerant with the service tank. The pressure in the service tank will rise during the operation, which will result in the service tank explosion. The exploded metal fragment and the splashed refrigerant will hurt the operator badly. Therefore, do close the high pressure side valve when the engine is working.
4. Open the manifold gauge low pressure side valve.
  5. Close the manifold gauge low pressure side valve when the manifold gauge low pressure side reading is increased to  $0.098\text{Mpa}\{1.0\text{kgf/cm}^2\}$ .
  6. Check cooling pipeline/hose for leakage with leak detector.
    - Proceed to step 8 if there is no leakage.
    - Tighten the union joint if there is leakage at the loosened union joint and go to next step.
  7. Re-check the leaked points.
    - Go to next step if there is no leakage after tightening the union joint.
    - If there is still leakage at the same union joint, drain refrigerant and repair the union joint. Repeat the filling procedure and vacuum it.
  8. Open the valve at the low pressure side of the manifold gauge. Fill the refrigerant until the refrigerant tank weight from the one mentioned in Step 3 drop to 250g.
  9. Close the valve at the low pressure side of the manifold gauge.
  10. Start the engine and switch on A/C.
  11. Open the valve at the low pressure side of the manifold gauge. Fill the refrigerant until the refrigerant tank weight from the one mentioned in Step 3 to specified value.
  12. Close the valve at the low pressure side of the manifold gauge and the valve of the refrigerant steel jar.
  13. Stop the engine and A/C compressor.

### Check For Leakage:

1. Using leak detector, check refrigerant steel jar for leakage.
  - Go to Step 3 if there is no leakage.
  - Tighten the union joint if there is leakage at the loosened union joint and go to next step.
2. Re-check the leaked points.
  - Go to next step if there is no leakage after tightening the union joint.
  - If there is still leakage at the same union joint, drain refrigerant and vacuum the union joint.
3. Disconnect the high and low pressure pipe at the refill valve.
4. Install the filling valve cap.

### Check Refrigerant Pressure:

1. Install the manifold gauge.
2. Warm up the engine and run it with constant 1800rpm.
3. Set the rpm of the cooling fan to the HIGHEST.
4. Turn on the A/C switch.
5. Set to internal circulation mode.
6. Set the temperature control mode to the COLDEST.
7. Set to be ventilation mode.
8. Close all door and windows.
9. Measure the environment temperature and the reading of the high pressure side and low pressure side from the manifold gauge.
  - Shoot the Refrigeration system trouble as required if it is not as specified in the technical specification.

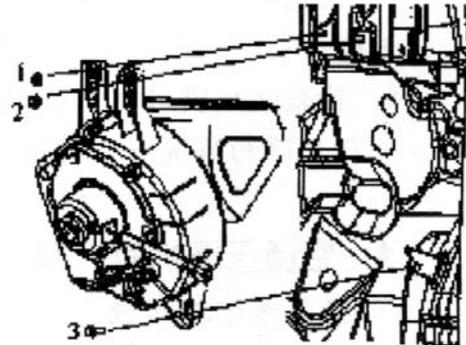
### The Performance Inspection of the Refrigeration System:

1. Check refrigerant pressure.
  - Go to next step if the pressure value is correct.
  - Shoot the Refrigeration system trouble promptly if the pressure value is not as specified in the technical specification.
2. Insert a thermometer into the middle vent port at the driver's side.
3. Warm up the engine and run it at the constant 1800rpm.
4. Set the rpm of the cooling fan to the HIGHEST.
5. Switch on A/C.
6. Set to internal circulation mode.
7. Set the temperature control mode to the COLDEST.
8. Set to Ventilation Mode.
9. Close all doors and windows.
10. Wait until A/C output temperature is constant. (When the environment temperature is 38° C, the temperature at the middle ventilation port at the drivers side is 10° C~16° C. )

## Section 6 Basic System

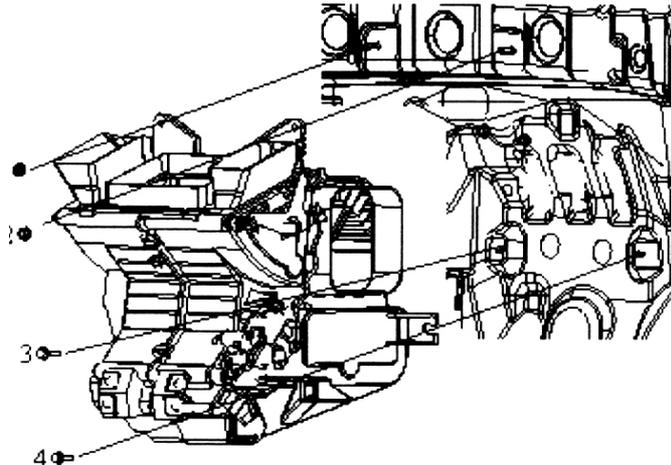
### 1. Blower Removal / Installation

1. Disconnect the negative (-) terminal cable from the battery.
2. Remove instrument panel.
3. Remove motor connector.
4. Remove the resistor connector.
5. Remove the band.
6. Remove bolt. Remove blower.
7. The installation is in the reverse order of the removal.



### 2. Heater Removal / Installation

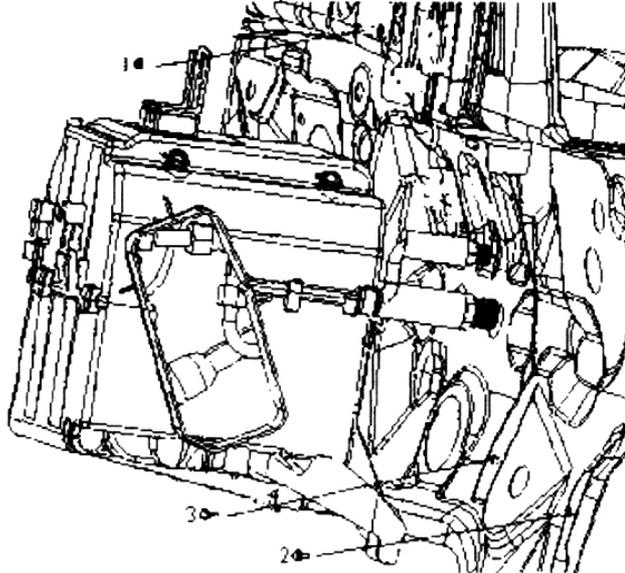
1. Remove water hose No. 1 and 2.
2. Remove instrument panel.
3. Remove the band.
4. Remove 2 wind door cables.
5. Remove heater.
6. The installation is in the reverse order of the removal.



### 3. The Evaporator Removal / Installation

1. Remove evaporator inlet and outlet pipeline.
2. Remove instrument panel.
3. Remove thermistor connector.
4. Remove 2 bands.

5. Remove evaporator.
6. The installation is in the reverse order of the removal.



## The Evaporator Installation Guide

1. Pack certain SW-100 compressor oil into the refrigerant circuit when installing a new evaporator.

Refill: (approximate)

15ml {15 cc, }

## Check Evaporator

1. Remove evaporator.
2. Remove the evaporator core from the evaporator.
3. Check for crack, damage or oil leakage.
  - Replace the evaporator core if any of the above-mentioned fault occurs.
4. Check the fin for bending.
  - Flat it with a flat head screwdriver if it is bent.

## Check Heater

1. Remove the heater.
2. Remove heating core from the heater.
3. Check for crack, damage or refrigerant leakage.
  - Replace the heating core if any of the above-mentioned faults occurs.
4. Check the fin for bending
  - Flat it with a flat head screwdriver if it is bent.
5. Check heater inlet hose and outlet hose for bend or damage.
  - Repair the hose if necessary.

#### 4. A/C Compressor Removal / Installation

1. Disconnect the negative (--) terminal cable from the battery.
2. Drain the refrigerant from the system.
3. Detach the radiator.
4. Loosen the drive belt and then remove the drive belt.

##### Notice:

- If anything moisture or any foreign matter enters into the Refrigeration system for circulation, the cooling performance of the Refrigeration system will obviously deteriorate with abnormal noise. Plug the port immediately after removing any cooling circulation component to prevent anything moisture or any foreign matter from entering the circulation.
5. Remove the compressor inlet and outlet pipe.
  6. Remove magnetic clutch connector.
  7. Remove the compressor.
  8. The installation is in the reverse order of the removal.
  9. Adjust the drive belt.
  10. Check the Refrigeration system performance.

#### 5. The Condenser Removal / Installation

1. Disconnect the negative (--) terminal cable from the battery.
2. Drain the refrigerant from the system.

##### Notice:

- If anything moisture or any foreign matter enters into the Refrigeration system for circulation, the cooling performance of the Refrigeration system will obviously deteriorate with abnormal noise. Plug the port immediately after removing any cooling circulation component to prevent anything moisture or any foreign matter from entering the circulation.
3. Remove the condenser inlet and outlet pipeline to prevent the compressor oil from splashing.
  4. Remove condenser fan connector.
  5. Remove the engine hood lock.
  6. Remove the engine hood lock support brace.
  7. Remove the condenser.
  8. The installation is in the reverse order of the removal.
  9. Check the Refrigeration system performance.

#### The Condenser Installation Description:

1. When installing the new condenser, it is recommended to fill certain SW-100 compressor oil into the refrigerant circuit.

Refill: (approximate)

20ml{20 cc }

## Check the condenser

1. Check for crack, damage or oil leakage.
  - Replace the condenser if any of the above-mentioned faults occurs.
2. Check if the fin area is blocked by dust.
  - Clean it if it is blocked.
3. Check if the fin area bends.
  - If the fin area bends, level it with a flat head screwdriver.

## 6. Refrigeration Pipeline Removal / Installation

1. Remove battery.
2. Drain the refrigerant from the system.
3. Remove air filter.
4. Remove the clamp.
5. Remove the compressor inlet hose.
6. Remove the compressor outlet hose.
7. Remove liquid pipe I.
8. Remove pressure switch connector.
9. Remove the pipe clamp.
10. Remove liquid pipe II.
11. The installation is in the reverse order of the removal.

### Notice:

- If anything moisture or any foreign matter enters into the Refrigeration system for circulation, the cooling performance of the Refrigeration system will obviously deteriorate with abnormal noise. Plug the port immediately after removing any cooling circulation component to prevent anything moisture or any foreign matter from entering the circulation.

### Introduction Of The Refrigeration Pipeline Removal:

#### Nuts union type:

Loose the nuts with 2 wrenches and then remove the refrigeration pipe (or the hose).

#### Slider joint type:

Clip the slider block recess end with pliers or the similar tool and remove the attaching bolt or screw cap.

### Introduction Of The Refrigeration Pipeline Installation:

1. It is recommended to fill some SW-100 compressor oil into the refrigerating circulation when installing a new refrigeration pipe or cooling hose.

Refill: (approximate)

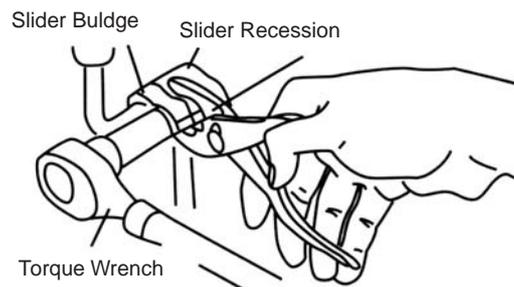
5ml{5 cc}: Refrigeration pipe

10ml{10 cc}: Condenser hose

2. Fill compressor oil to O-ring and other connecting points.
3. Tighten the connecting points.

### Nuts union or slider joint type:

1. Tighten the nuts or the bolts of the connecting points by hand.
2. Tighten the connecting points with specified torque wrench. It is connected with nuts. Tighten the nuts with a wrench or a torque wrench.
3. Clip the slider block recess with pliers or other similar tool and clamp the pipe used to connect slider block. Tighten the bolt or the nuts at the connecting points with a torque wrench.



### 7. A/C control panel removal / installation:

1. Disconnect the negative (-) terminal cable from the battery.
2. Remove the auxiliary console.
3. Disconnect the hot and cold air cable and airflow allocating cable.
4. Remove A/C control panel.
5. Disconnect blower switch connector.
6. Remove the lighting wire harness connector.
7. Remove the inside and outside circulation switch connector.
8. The installation is in the reverse order of the removal.

# Section 7 A/C System Faults Check & Troubleshooting

## I. A/C System Faults Check

Inspection shall be made to isolate the fault area and its cause when the fault of A/C system occurs, and then specific service could be performed. Inspect the whole system before re-using A/C system after a long term of storage.

First step is initial inspection by direct "see, listen and touch". Test the system with the leak detector if necessary.

### 1. Check the Refrigeration System

Under the normal condition, the low pressure pipeline of the A/C refrigeration system takes on a status of low temperature and the high pressure pipeline takes on a status of high temperature, see Figure 16. Based on this rule, you can arrive at the initial judgement about the fault area and its cause by touching the refrigeration system pipeline and elements to feel the surface temperature with your hand.

① High pressure area: compressor outlet condenser → receiver/drier → expansion valve inlet, its temperature change trend is from warm to hot. If the temperature change is not this trend, but instead some part is extremely hot (e.g. condenser surface), it indicates that the part is faulty and the radiation is not good; if some part is extremely cold (e.g. receiver/drier) or there is frost (e.g. at expansion valve inlet), it indicates that the part is faulty and the pipe may be blocked.

② Low pressure area: expansion valve outlet → evaporator → compressor inlet, its temperature change trend is from cool to cold, If the temperature change is not this trend, it indicates that the part is faulty.

③ Compressor: compressor inlet and outlet high & low side shall have apparent feel of temperature difference, if there is no temperature difference, it indicates that there is leakage in the system and the refrigerant has leaked.

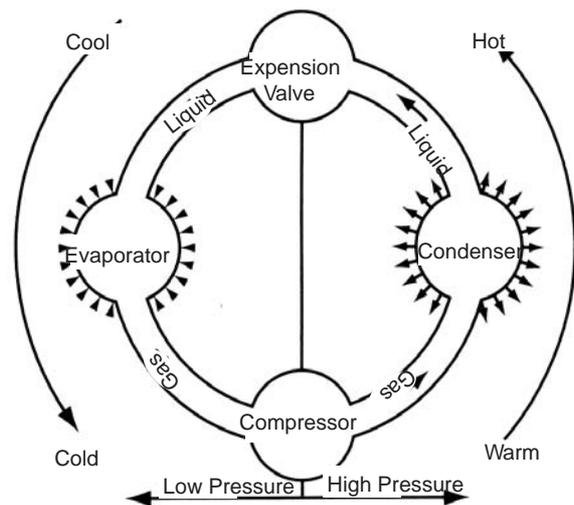


Figure 16 A/C System Process

### 2. Check the Leakage Area

- ① Observe all connecting areas of the refrigeration system or condenser surface for oil stain, if there is oil stain, it indicates that the the refrigerant is leaking (refrigerant and freezing oil leak simultaneously, refrigerant volatilize after leakage and leave the freezing oil remained to be oil stain).
- ② Apply the soap water to the connecting area, if soap bubble occurs, it indicates that there is leakage.
- ③ Check with instrument, the common instrument is halogen leak detector. When using the halogen leak detector for check, the key is the propane flame color depending on which the judgement is made. When there is no leakage, the flame color remains unchanged, when there is a little leakage, the flame is greenish, when there is large leakage, the flame is bluish or purple.

Have a focus inspection on the following area:

- a. Each pipe union joint and valve connection.
- b. All hose, especially near the pipe union.
- c. Compressor shaft seal, front and rear cover, gasket, oil fill plug.
- d. Area on the surface of the condenser and evaporator that is scratched, bruised or damaged.
- e. Expansion valve inlet and outlet connection and temperature sensor element and the welding position.

### 3. Check the Refrigerant

Observing from the sight glass, you may understand the refrigerant status and analyze the possible faults:

Conditions observed	Possible problems
Clear, no air bubble, A/C emits cool wind	Refrigeration system is normal
Clear, no air bubble, A/C emits warm wind	Refrigerant leaked, there is leakage in the system
Occasional air bubble. Expansion valve is frosted	There is water mixed in the refrigeration system
Occasional air bubble.	Insufficient refrigerant or air mixed in the system
Clear, there is oil stripe on the glass	Outlet is not cold, no refrigerant
Foamy and turbid	Excessive freezing oil

### 4. Check Other Parts

Other parts needed to be checked and their check points:

Checked Part	Check Points
Evaporator Condenser	There shall be no dirt and rust on the radiator that hinder the heat exchange; The radiator surface has no damage, fissure and hidden trouble that may cause refrigerant leakage.
Electromagnetic Clutch	Clutch operation is normal. When switched on, the compressor shall operate, clutch can not slip.
Compressor Belt	Belt tension of 250N is normal, belt is not broken and damaged.
Wire	The electromagnetic clutch and blower power cable shall be not damaged and overheated; the connection shall be reliable, and the protective grommet through the metal plate shall be kept good and without damage.
Hose	Refrigerant hose and condenser pipe shall be secured and shall not be damaged by approaching the other overheated parts, moving parts and sharp parts.

## II. A/C System Diagnosis and Troubleshooting

Table 1

Problem Symptom									Possible Cause	Troubleshooting
Abnormal high pressure of the high pressure pipeline	Abnormal low pressure of the high pressure pipeline	Abnormal high pressure of the low pressure pipeline	Abnormal low pressure of the low pressure pipeline	High and low pressure can not be established	Sight glass has air bubble	Compressor inlet side is frosted	Compressor noise	Abnormal heating on the compressor		
									A/C does not refrigerate or the cold air is insufficient	
									Drier filter ices up	
									Evaporator is frosted	
									Abnormal heating on the compressor	
									Compressor noise	
									Compressor inlet side is frosted	
									Sight glass has air bubble	
									High and low pressure can not be established	
									Abnormal low pressure of the low pressure pipeline	
									Abnormal high pressure of the low pressure pipeline	
									Abnormal low pressure of the high pressure pipeline	
									Abnormal high pressure of the high pressure pipeline	
										Excessive refill of refrigerant
										Drain proper amount of refrigerant
										Too little refill of refrigerant
										Repair the gas leak area, refill proper amount of refrigerant
										Refrigerant is leaked all
										Repair the gas leak area, refill proper amount of refrigerant
										There is non-clotted gas in the system
										Loosen receiver and condenser inlet connector, discharge the non-clotted gas
										Excessive freezing oil in the system
										Check compressor freezing oil level, adjust it
										Excessive high temperature of condenser inlet
										Perform the check at the place with good ventilation
										There is dust in the condenser core, air channel within the condenser is blocked or suffocated
										Use compressed air or water to flush and remove the dirt on the condenser
										Condenser fan faulty or broken
										Check the wiring status and the fan motor, correct or replace it
										Excessively low temperature of condenser inlet
										Stop the operation of the refrigeration system
										Drier blocked
										Clean
										Air channel in the evaporator blocked or suffocated
										Remove the dirt on the evaporator
										Evaporator fan fault, poor blower motor wire connection
										Check the wiring status and the fan motor, correct or replace it
										There is dirt in evaporator core
										Use the compressed air to clean the evaporator core

Problem Symptom										Possible Cause	Troubleshooting		
A/C does not refrigerate or the cold air is insufficient	Drier filter ices up	Evaporator is frosted	Abnormal heating on the compressor	Compressor noise	Compressor inlet side is frosted	Sight glass has air bubble	High and low pressure can not be established	Abnormal low pressure of the low pressure pipeline	Abnormal high pressure of the low pressure pipeline			Abnormal low pressure of the high pressure pipeline	Abnormal high pressure of the high pressure pipeline
												Dirt in the evaporator core, or poor fit between the expansion valve sensing unit and evaporator outlet	Check and correct it
												Non-evaporated refrigerant steam enters into compressor	Service the evaporator and its components such as fan
												expansion valve opening is excessively big or faulty, refrigerant supply is excessive	Adjust the expansion valve, check the sensing unit and the evaporator outlet for fitness, replace it as necessary
												Expansion valve opening is too small	Adjust expansion valve
												Expansion valve fault, spinal corrosion or leakage	Replace expansion valve
												The refrigerant pipeline between the expansion valve sensing unit and the expansion valve is damaged or broken	Check and replace the expansion valve and pipeline
												Expansion valve blocked by ice or dirt	Recycle the refrigerant, remove and clean the expansion valve, use the vacuum pump to drain the water in the system and then refill the refrigerant
												Refrigerant pipeline blocked	Disassemble and check the part
												Compressor solenoid clutch, bearing and pulley wear	Check and replace concerned worn parts
												Compressor reed is damaged, exhaust valve leaks	Check and replace the compressor
												Compressor inlet blocked	Check and clean
												Drive belt loose or broken	Replace or replace it
												Excessively low temperature in the vehicle compartments	Adjust the selection switch
												System pipeline leaks	Check the leak area, refill proper amount of refrigerant

Table 2. Problem Cause and Troubleshooting of No Heating:

Area	Problem Cause	Troubleshooting
Heating System	Water temperature sensor damaged	Repair or replace
	Blower motor does not rotate	Repair or replace
	Fan speed adjustment switch damaged	Replace
	Output air temperature adjustment switch damaged	Replace

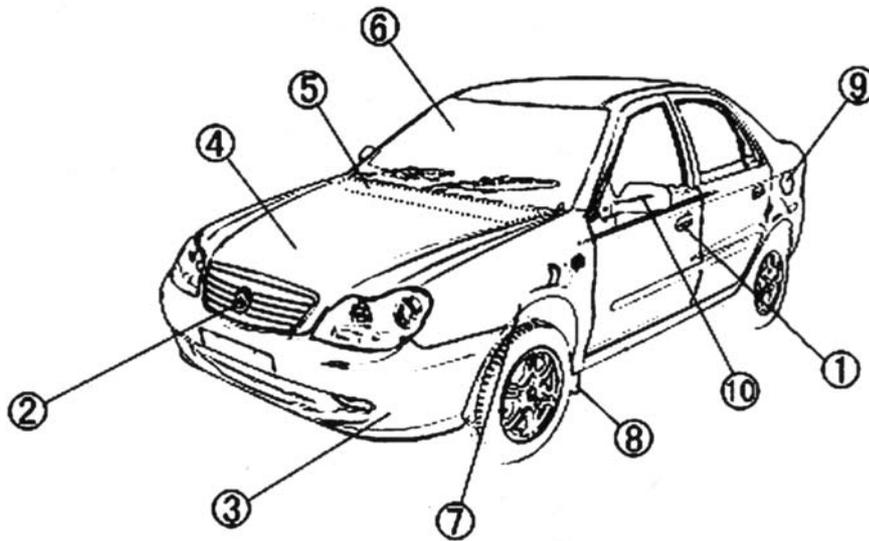
Table 3. Problem Cause and Troubleshooting of Noise:

	Problem Cause	Troubleshooting
Area	Drive belt loose or worn	Replace the drive belt
	Cooling electric fan touches other parts	Service and eliminate the impact
	Blower motor mechanical friction	Service and fill the oil
	No oil on the motor bearing, dry friction	Fill the grease or replace the bearing
	Low battery voltage	Charge the battery

# Chapter 2 Inside & outside Trim and Accessory

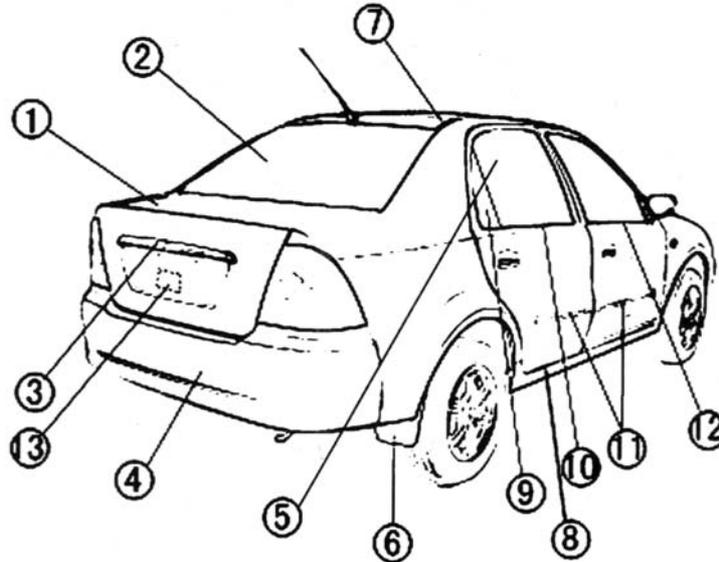
## Section 1 Configuration Index

### (I) Outside Trim And Front Accessory



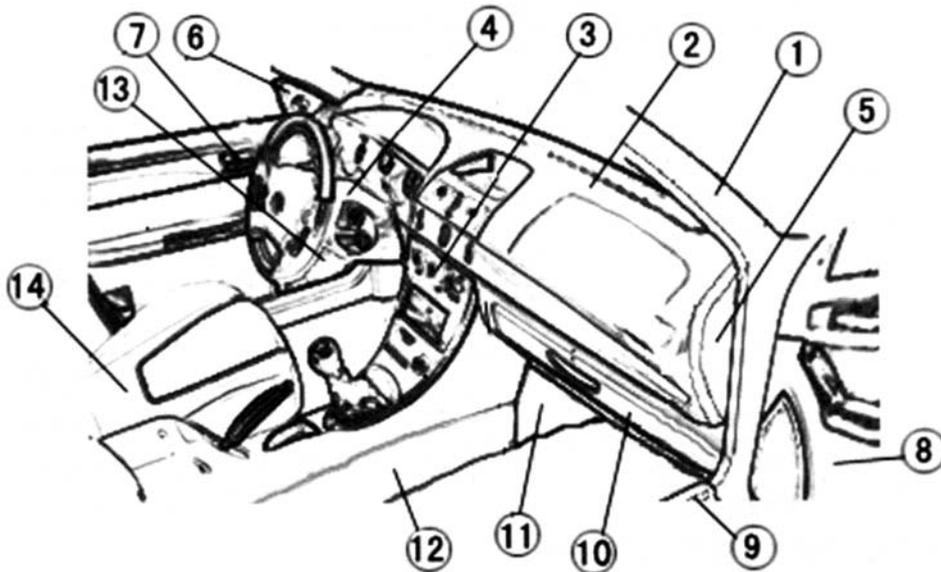
1	Door handle	6	Windshield
2	Radiator grill assembly	7	Front fender (See the engine hood adjustment)
3	Front bumper (See front bumper removal/installation)	8	Front mudguard skirt
4	The engine hood (See the engine hood removal/installation)	9	Fuel fill port cap
5	Cowl vent grille	10	Electric outside rear view mirror (See electric outside rear view mirror removal/installation)

## (II) Outside Trim and Rear Accessory



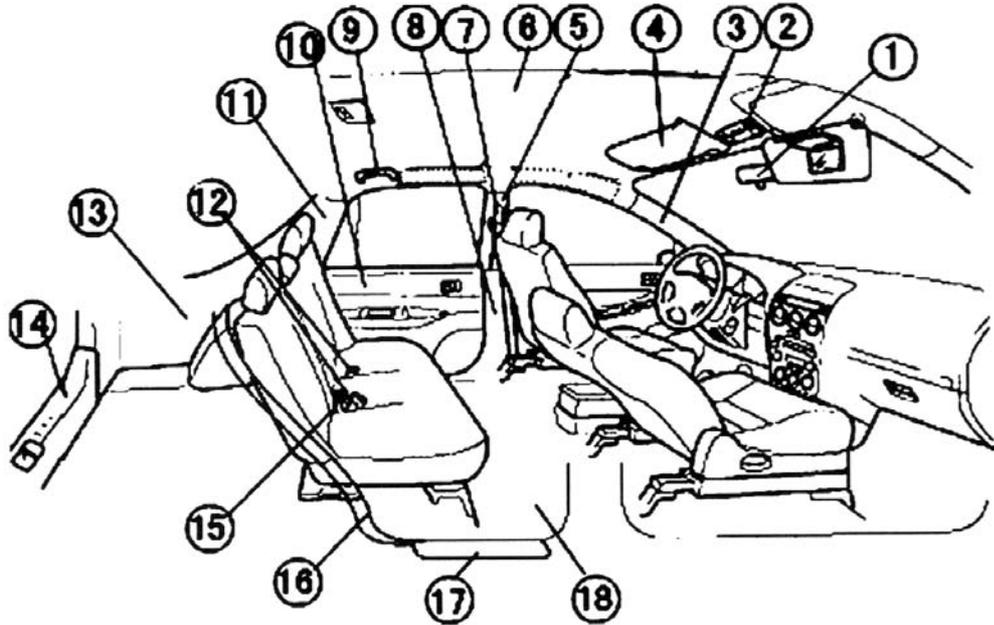
1	Rear trunk lid (See rear trunk lid removal/installation)	8	Outer door sill under the trim board
	Rear trunk lid inside trim and accessory (See rear trunk lid removal/installation)		
	Rear windshield		
2	Rear windshield	9	Quarter Window glass
3	Rear license box (See rear trunk lid removal/installation)	10	Rear door weatherstrip (See rear door removal/installation)
	Rear bumper (See rear bumper removal/installation)		
4	Rear bumper (See rear bumper removal/installation)	11	Rubbing strap
5	Rear door glass (See rear door removal/installation)	12	Front door weatherstrip (See front door removal/installation)
	Rear mudguard skirt		
6	Rear mudguard skirt	13	Rear trunk lock
7	Roof garnish		

(III) Front inside trim



1	A- pillar inside trim	8	Front door insdie trim
2	Instrument panel assembly	9	Front door sill inside trim
3	A/C panel assembl	10	Glove compartment assembly
4	Steering column cover	11	Front end of auxiliary console
5	Instrument panel end shield	12	Auxiliary console assembly
6	Electric outside rear view mirror	13	Lower end shield assembly
7	Front door power window switc	14	Front row seat

(IV) Rear inside trim

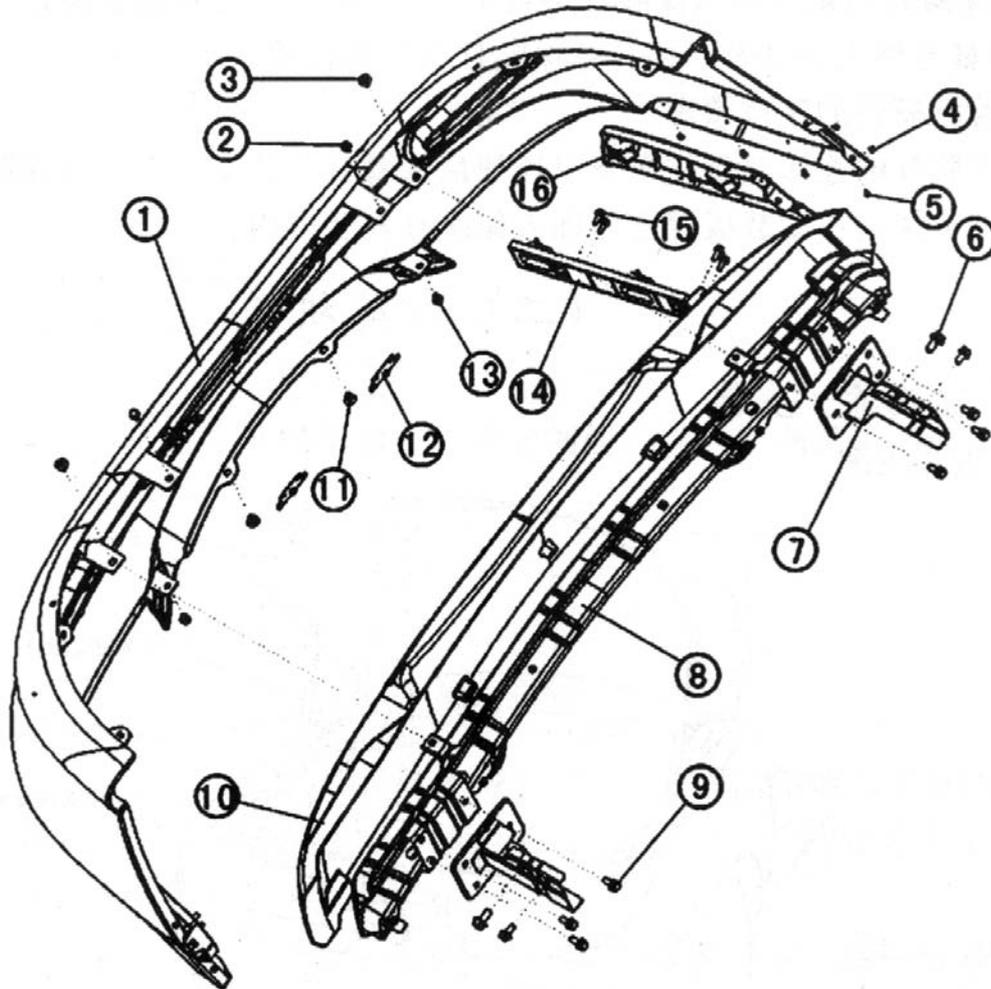


1	Inner rear view mirror	10	Rear door inside trim
2	Interior lamp	11	C- pillar upper inside trim
3	A- pillar inside trim	12	Rear seat belt buckle (See rear seat belt buckle removal/installation) rear trunk inside trim
			13
4	Sun visor	14	Lower rear trim assembly
5	B- pillar upper inside trim	15	Rear seat (See rear seat removal/installation)
			16
7	Front seat belt (See front seat belt removal/installation) (See seat belt inspection)		
8	B- pillar lower inside trim	17	
9	Safe handle	18	Carpet & sound insulator

## Section 2 Inside & Outside Trim and Accessories Removal and Installation

### (I) Front Bumper

The structure is as shown in the figure below:



- |  |  |  |
|--|--|--|
| 1. Front Bumper  | 2. Front Bumper Fixed Screw                                  | 3. Secondary Bumper Assembly Upper Buckle and Plug                 |
| 4. Mounting Plate Cross Head Counter Sunk Self-tapping Screw | 5. Mounting Plate Cross Head Counter Sunk Self-tapping Screw | 6. Front Bumper Mounting Bracket to Body Bolt                      |
| 7. Front Bumper Mounting Bracket Sub-assembly                | 8. Secondary Bumper Assembly                                 | 9. Front Bumper Mounting Bracket to Secondary Bumper Assembly Bolt |
| 10. Front Bumper Cushion                                     | 11. Secondary Bumper Assembly Lower Buckle and Plug          | 12. License Mounting Plate Assembly                                |
| 13. Secondary Bumper Assembly Lower Connecting Bolt          | 14. Front Bumper Mounting Plate Seat                         | 15. Mounting Plate Seat Bolt                                       |
| 16. Front Bumper Mounting Plate                              |  |  |

## 1. Front Bumper Removal and Installation

- (1) Disconnect the negative (--) terminal cable from the battery. Disconnect fog lamp wire;
- (2) Remove the mudguard skirt to front bumper clip;
- (3) Remove the attaching bolt of the the front fender and panel and the front bumper sub-assembly;
- (4) Remove the front bumper set screw and the clip. Remove the front bumper mounting plate and the positioning screw of the seat;
- (5) Remove the bolt which connecting front bumper mounting bracket with the vehicle body;
- (6) Pull the front bumper assembly and the secondary bumper assembly together out of the vehicle body. Separate the front bumper mounting bracket from the rail, front bumper mounting plate from the front bumper mounting plate seat;
- (7) Remove the front bumper mounting plate seat from the vehicle body;
- (8) Remove the secondary bumper assembly and the front bumper mounting bracket sub-assembly;
- (9) Remove front bumper mounting plate;
- (11) Remove front bumper cushion. Remove the front license plate. Remove the mounting plate assembly;
- (12) Remove fog lamp;
- (13) The installation is in the reverse order of the removal.

## 2. Notice For Removal Of The Front Bumper

- (1) Pull the front bumper to separate it from the bumper rail.
- (2) Uniformly pull it by force to prevent the front bumper mounting plate and seat from damage.

### Warning

- ◆ If the front bumper is only separated from the bumper rail on one side, the bumper may drop and result in body hurt. Be careful not to drop the bumper when separating the front bumper from the bumper rail.

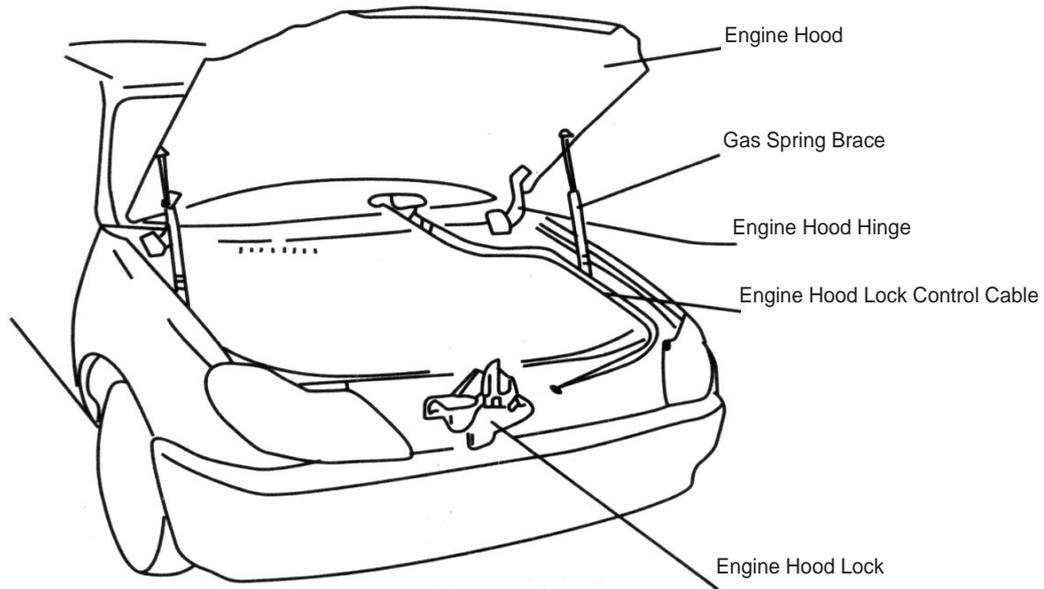
## 3. Notice for installation of the front bumper

- (1) Press the front bumper connecting part to the vehicle body and connect the rear bumper mounting bracket assembly with the bumper rail.
- (2) Be sure to insert the front bumper mounting plate seat into the bumper mounting plate.

## (II) Engine Hood

### Engine Hood Removal / Installation

For engine hood installation, see the figure



Engine Hood Installation Illustration

#### 1. Removal

##### Warning

- It is dangerous to remove the engine hood without support. The engine hood may drop and result in body injury. Work with at least one assistant when removing the engine hood and should follow the procedures below:
  - ① Disconnect windshield washer hose.
  - ② Lift up the engine hood and support it with the spring brace;
  - ③ Remove 2 spring braces under the help of the assistant to prevent the engine hood from dropping down and resulting in body injury;
  - ④ The assistant lifts the engine hood, removes the engine hood hinge bolt and the engine hood;
  - ⑤ Remove the ventilator louver and remove the hinge arm;
  - ⑥ Remove the hinge arm bracket attach bolt. Remove the hinge arm bracket from the body;
  - ⑦ Remove the engine hood lock;
  - ⑧ Remove the engine hood lock control cable.

#### 2. Installation

- ① The installation is in the reverse order of the removal;
- ② Adjust the engine hood;

### 3. Engine Hood Adjustment

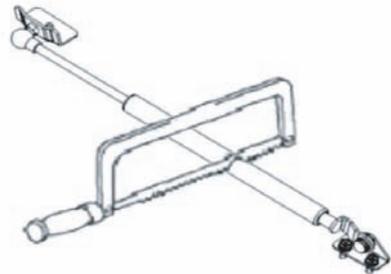
Fix the engine hood to the engine hood hinge with bolts. the engine hood in vertical direction through the hinge hole. Vertically adjust the front by adjusting the engine hood bumper and adjust the engine hood master lock striker. The clearance tolerance is 1.0 mm-3.0 mm, while the flatness tolerance is 0 mm-1.0 mm.

- (1) Open the engine hood
- (2) Loose the bolt between the engine hood and the hinge
- (3) Adjust the clearance between the engine hood and the front fender. Loose the bolt and move the engine hood for adjustment.
- (4) Close the engine hood
- (5) Check for alignment
- (6) Open the engine hood and adjust it as specified
- (7) Adjust the engine hood bumper
- (8) Check for alignment
- (9) Adjust the engine hood master lock striker:  
Loose 3 pin bolts on the engine hood lock. Move the engine hood lock for adjustment.
- (10) T ighten the bolt between the engine and the hinge.
- (11) Close the engine hood

### 4.Processing The Brace

#### Notice

- The air in the brace is of no color, no taste and no poison.
- (1) Wear the eye protection.
  - (2) Level the brace.
  - (3) Cut the brace with the hack saw as shown in the figure on the right.
  - (4) Bleed the air from the brace
  - (5) Abandon the brace



### (III) Outside Rear View Mirror

Attach the outside rear view mirror to the left and right doors. Integrate the outside rear view mirror with the body smoothly using specially designed rubber bushing to make it a whole. The forward and rearward folding of the rear view mirror will not be affected after being knocked. It is also a major way to reduce the whole vehicle's air resistance coefficient.

Attach the lens to the plate with double sided adhesive tape. The plate is connected to the rear view mirror case with the ball hinge to prevent fragment from splashing when it is broken, which may result in injury and it is convenient to replace the broken lens. Pry the plate from the ball socket with the tool when the lens is broken for replacement and press the new one into the ball socket. The case overturn force is designed to be 30N, enabling it liable to overturn when impacted by person or object and hence reducing the mutual damage. The adjust handle of the outside rear view mirror is designed to be built in the vehicle to facilitate the operator's direction adjustment. The optional flat mirror is generally selected for driver side to ensure the sense of reality and distance. Spherical mirror is used for front passenger side to enlarge the rear field of vision. In addition, outside rear view mirror has also the feature of electrical heating and defogging.

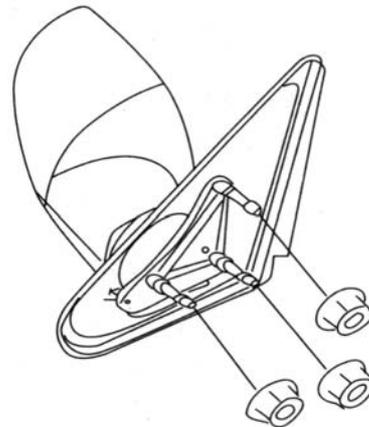
#### Notice

When folding the outside rear view mirror, be careful not to put your finger between the outside rear view mirror and the mirror foot to avoid being crushed!

### Replace the Rear View Mirror

#### Removal

1. Remove battery negative cable.
2. Remove the inside trim.
3. Disconnect electric outside rear view mirror connector.
4. Remove screw and outside rear view mirror retaining clip.
5. Remove electric outside rear view mirror.
6. The installation is in the reverse order of the removal.



#### Installation

1. Position the rear view mirror on the door
2. Tighten the screw from left lower side screw clockwise

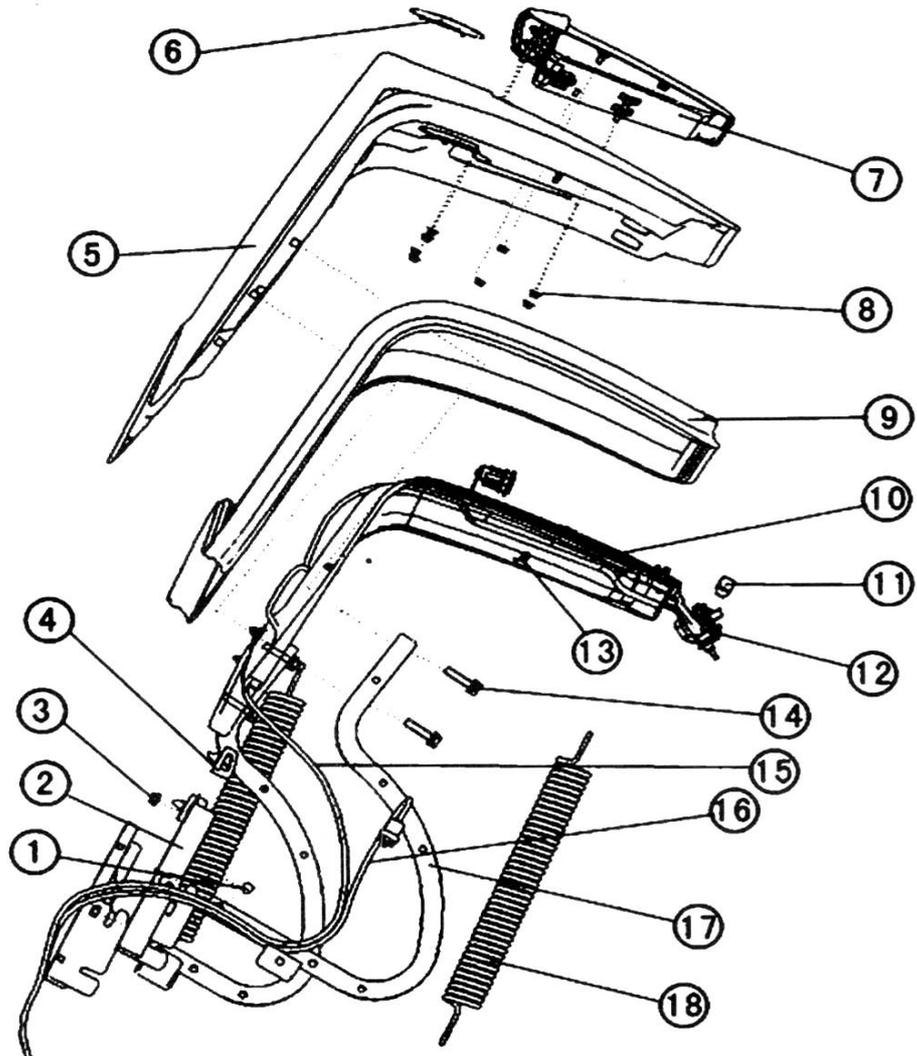
#### Tighten

Tighten the outer rear view mirror screw to 1.5 N.M<sub>i</sub> « 2 N.M

3. Install rear view mirror inside trim cover
4. Install rear view mirror inner adjust handle

## (IV) Rear trunk Lid

Component View:



- |  |   |  |
|--|---|--|
| 1.Rear trunk Lid Hinge Pin                   | 2.Rear trunk Lid Hinge Retainer                         | 3.Rear trunk Lid Hinge Retainer Mounting Nut |
| 4.Rear trunk Door Hinge Cushion              | 5.Rear trunk Lid Outer Panel And Reinforcement Assembly | 6.Geely Logo                                 |
| 7.Rear License Plate Assembly                | 8.Rear License Plate Assembly Mounting Nut              | 9.Rear trunk Lid Weatherstrip                |
| 10.Rear trunk Lid inside Trim Board          | 11.Rear trunk Lid Cushion                               | 12.Rear trunk Door Lock Cylinder Assembly    |
| 13.Rear trunk Lid inside Trim Board Clip     | 14.Rear trunk Lid Hinge Attaching Bolt                  | 15.Rear trunk Door Lock Cable Assembly       |
| 16.Rear trunk Door Oil Filler Cable Assembly | 17.Rear trunk Lid Hinge                                 | 18.Rear trunk Lid Spring                     |

## 1.Rear trunk Lid Removal/Installation

### Warning

It is dangerous to remove the rear trunk lid spring before supporting the rear trunk lid. The rear trunk lid may drop and result in body injury. Fully open the rear trunk lid, support the rear trunk lid before removing the brace.

Remove rear trunk lid under the help of the assistant.

- (1) Disconnect the negative (--) terminal cable from the battery;
- (2) Disconnect rear trunk wire harness connector. Pull the rear trunk lid wire harness out from the rear trunk;
- (3) Remove rear trunk door lock cylinder assembly. Pull out the rear trunk door lock cable;
- (4) Remove rear trunk lid spring;
- (5) Remove rear trunk lid hinge connecting bolt. Remove the rear trunk lid;
- (6) Remove rear trunk lid hinge seat mounting nut. Remove the rear trunk lid hinge seat and the rear trunk lid hinge
- (7) Remove rear trunk door oil filler cable assembly;
- (8) Remove cushion;
- (9) Remove rear trunk lid hinge pin. Remove rear trunk lid hinge from the bracket;
- (10) Remove rear trunk lid weatherstrip;
- (11) Remove rear trunk lid inside trim board clip, Remove rear trunk lid inside trim board;
- (12) Remove rear license plate assembly mounting nut , Remove rear license plate assembly;
- (13) The installation is in the reverse order of the removal.;
- (14) Adjust the rear trunk lid. (See rear trunk lid adjustment)

## 2.Rear trunk Lid Adjustment

- (1) Measure the clearance and height between the rear trunk lid and vehicle body.
- (2) Loose the rear trunk lid hinge mounting bolt or the rear trunk latch mounting screw and reinstall the rear trunk lid if it is not as specified.

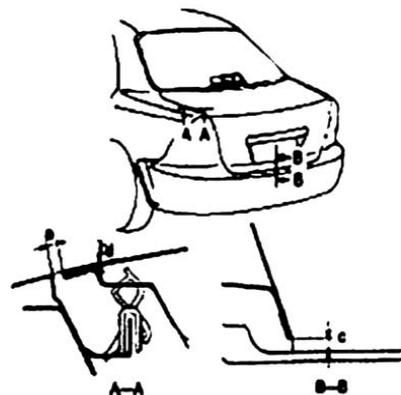
### Clearance

a: 3.74mm

b: 1.0mm

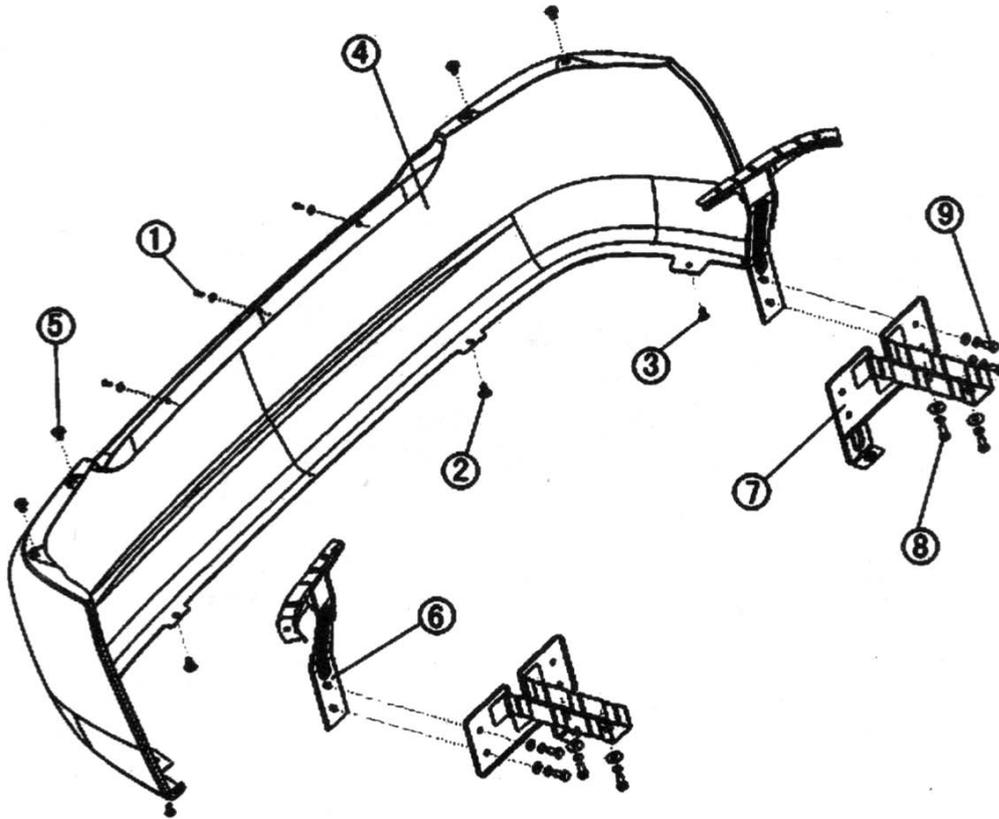
c: 4.0mm

- (3) Tighten the rear trunk lid hinge bolt;
- (4) Close the rear trunk lid



## (V) Rear Bumper

The structure diagram is shown as the figure below:



1.Cross Pan Head Tapping Screw And Big Washer Set 2.Cross Pan Head Screw (GB973 M6X16)  
3.Cross Pan Head Screw (GB973 M6X16) 4.Rear Bumper 5.Clip 6.Rear Bumper Reinforce-  
ment Assembly 7.Rear Bumper Mounting Bracket Assembly 8.Hexigon Bolt and Spring Washer  
Set 9.Hexigon Bolt Spring and Flat Gasket Set

### 1.Rear Bumper Removal/Installation

- (1) Disconnect the negative (--) terminal cable from the battery.
- (2) Remove the cross pan head tapping screw and big washer set.
- (3) Remove 4 hexagon bolt on the mounting bracket.
- (4) Remove 2 cross pan head screw (GB973 M6X16)
- (5) Pull the rear bumper out from the body.
- (6) Remove the cross pan head screw (GB973 M6X16) and hexagon bolt spring and flat gasketset. Remove the rear bumper mounting bracket assembly.
- (7) The installation is in the reverse order of the removal.

## 2. Notice On Removing The Rear Bumper

- (1) Pull the rear bumper out to separate it from the bumper rail.

### Warning

If only one side of the rear bumper is separated from the bumper rail, the bumper may drop and result in body injury. Be careful not to make the bumper drop before separating the rear bumper from the bumper rail.

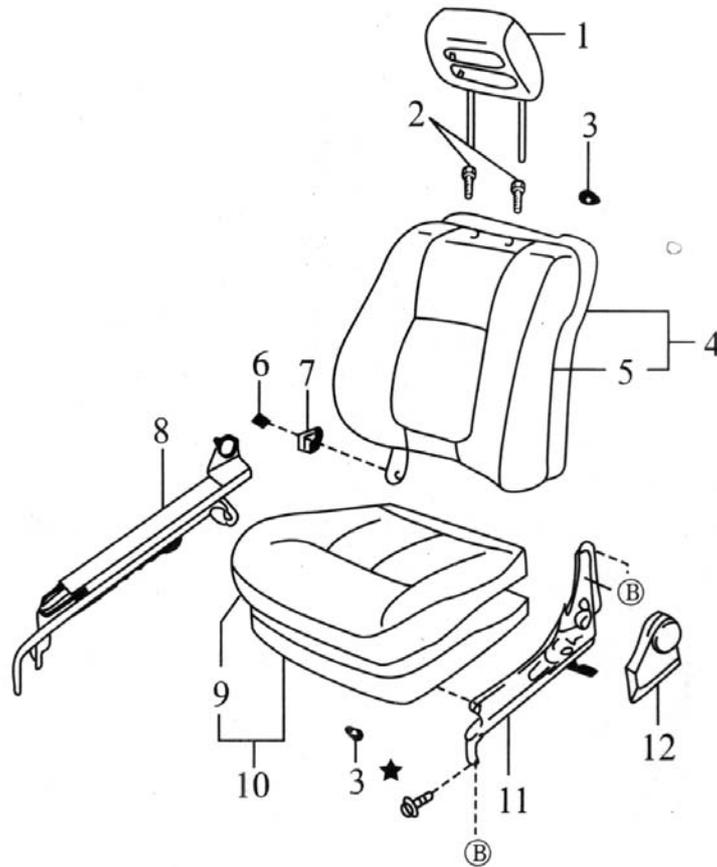
## 3. Notice On Installing The Rear Bumper

- (1) Press the rear bumper joint into the vehicle body to connect the rear bumper mounting bracket assembly and the bumper rail.
- (2) Insert the rear bumper end tab into the corresponding hole of the rear fender to flush with the outer surface.

## (VI) Seat Removal, Installation and Adjustment

### Front Seat

See Figure



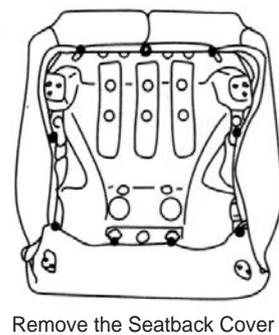
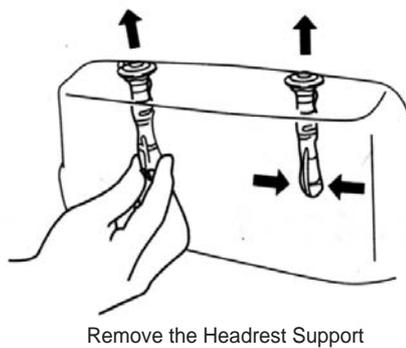
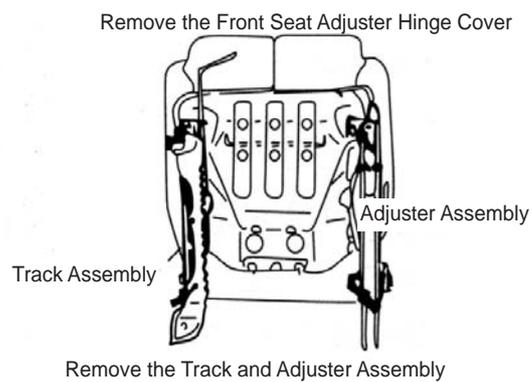
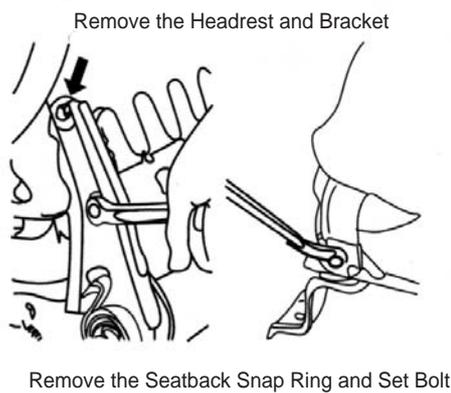
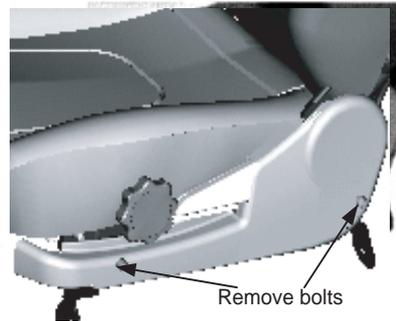
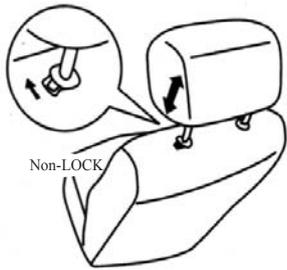
Disassembly of Front Seat

- |                         |                            |                                      |                           |
|-------------------------|----------------------------|--------------------------------------|---------------------------|
| 1.Headrest Assembly     | 2. Headrest Support        | 3.Snap Ring                          | 4.Front Seat Backassembly |
| 5.Front Seat Back Cover | 6.Cap Nut                  | 7.Front Seat Coupling Plastic Gasket |                           |
| 8.Track Assembly        | 9.Front Seat Cushion Cover | 10.Front Seat Cushion Assembly       |                           |
| 11.Adjuster Assembly    | 12.Adjuster Hinge Cover    |                                      |                           |

### 1. Removal

- ① Remove 4 bolts and the seat from the vehicle;
- ② Turn the headrest lock handle to "Non-LOCK". Remove headrest and bracket;
- ③ Remove the attaching screw, Remove adjuster hinge cover from the front seat;
- ④ Remove the 4 snap ring under the rear side of the seat back. Remove the set bolt and nut at the both side of the seat back;
- ⑤ Remove seat coupling plastic gasket;
- ⑥ Remove the seat cushion, track assembly and adjuster assembly;
- ⑦ Press the headrest support and push it upwards by hand in the direction as the Figure shows and remove the headrest support;
- ⑧ Open the seat backcover. Remove the inner coversnap ring. Remove the seat backcover;

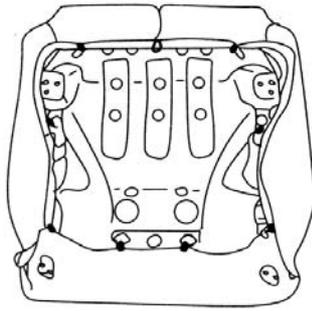
- ⑨ Remove the snap ring under the seat cushion. Open the front seat cushion cover. Remove the inner coversnap ring. Remove the seat cushion cover.



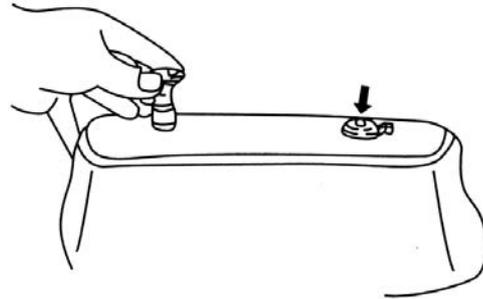
## 2. Installation

- ① Install snap ring at the front and rear seat. Be careful not to foul the cover or get it wrinkled;
- ② Install the snap ring at the front of the seat back. Install the front seat headrest support;
- ③ Install the adjuster and track assembly with bolts;
- ④ Install the coupling plastic gasket. Install the seat back assembly to the seat cushion with bolts and nuts. Install the snap ring to the rear seat back;
- ⑤ Install the adjuster hinge cover with 2 screws;

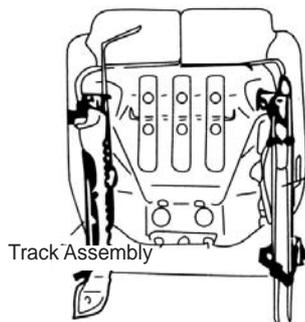
- ⑥ Install the headrest;
- ⑦ Install the front seat with 4 tightening bolts. Torque: 14.72~23.52N.m.



Install Front and Rear Seat Snap Ring

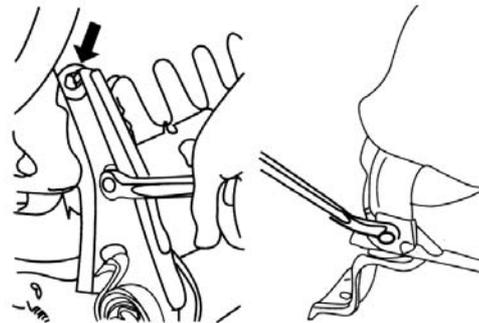


Install Headrest Support



Install Adjuster and Track Assembly

Adjuster Assembly



Assemble the Seatback and Cushion

### 3.Adjust

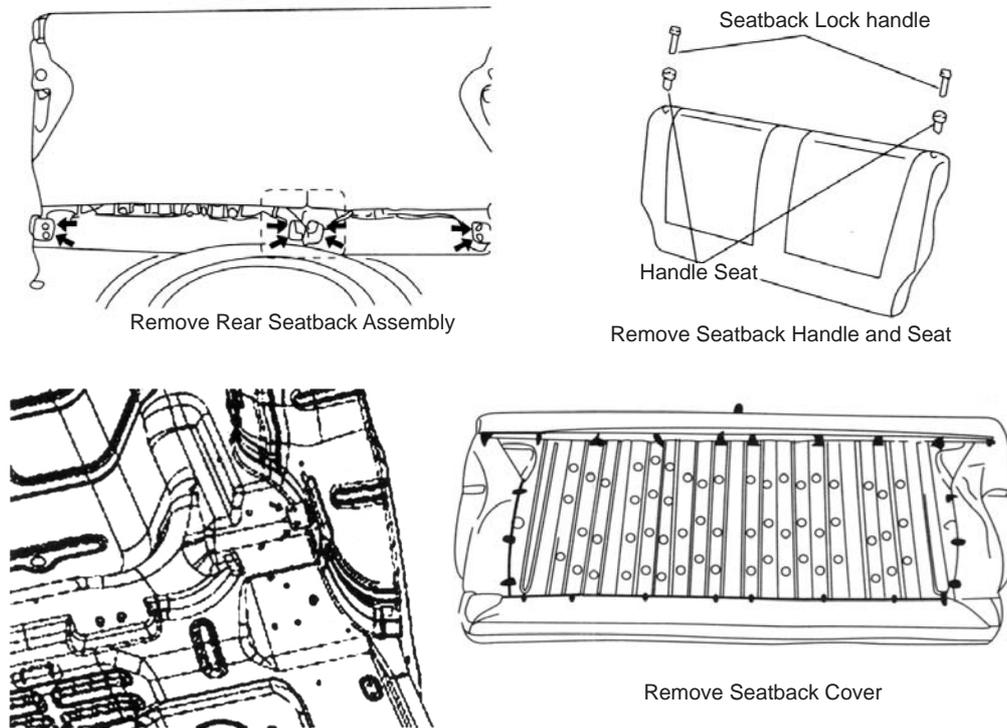
- ① The seat can adjust tilt angle forward in torque  $2^\circ \times 5=10^\circ$  ;  
Adjust backwards  $2^\circ \times 27=54^\circ$  ;
- ② The seat assembly slides forwards 15mm x 4=60mm in torque 15N.m;  
Slide backwards 15mm x 10=150mm;
- ③ The headrest can be adjusted in 3 positions in height.

## Rear Seat

### 1.Rear seat back

- ① Removal
  - a. Lift the rear seat back lock handle upwards. Turn seat back down forwards. Remove 4 set bolts.  
Remove seat backassembly from the vehicle;
  - b. Remove seat back lock handle and handle seat;

- c. Remove the snap ring from the rear seat back. Open the seat back cover. Remove the inside snap ring. Remove the seat cover.



② Re-assembly

- a. Install the snap ring at the inside of the seat back;
- b. Install the snap ring at the rear seat back;
- c. Install the seat back lock handle seat to the rear seat back;
- d. Install the rear trunk carpet to the rear seat back with 10 clips;
- e. Install the rear seat back assembly to the vehicle with 4 bolts. Tighten bolt torque: 3.92~6.86N.m.

## 2.Rear seat cushion assembly

① Removal

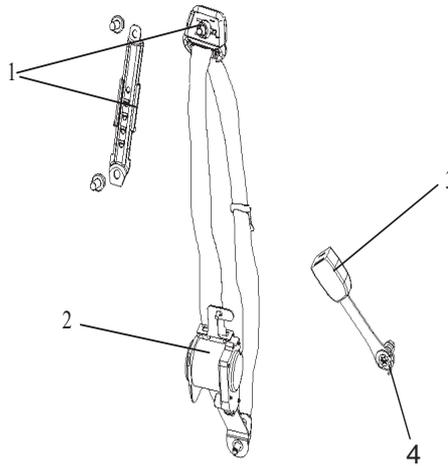
- a. First remove the rear seat back;
- b. Lift the front of the seat cushion. Disconnect the seat cushion from the clamp on the floor, push backwards, separate it from the hook. Remove seat cushion assembly from the vehicle;
- c. Remove the snap ring on the seat cushion;
- d. Remove the snap ring in the cover. Remove cover.
- e. Remove the clamp under the seat cushion;

② Re-assembly

The installation is in the reverse order of the removal.

## (VII) Seat Belt

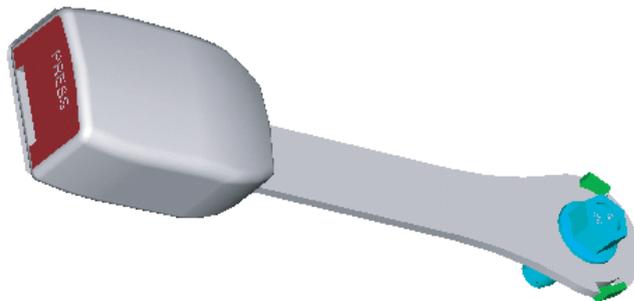
The vehicle seat belt is compulsory for drivers and passengers for safety purpose. It is the facility to prevent the passengers from being hurt or reduce the possibility of being hurt when the vehicle is in emergent drive or traffic accident occurs. Ck-1 front seat adopts Three Points Emergency Lock Retractor Pretension Seat Belt , It is composed of retractor assembly, belt buckle assembly and height adjuster assembly.



1. Height Adjuster Assembly    2. Retractor Assembly    3. Belt Buckle Assembly    4. anchorage

### 1. Belt Buckle

Belt buckle is enclosure type, See Figure



### Replacement Of The Seat Belt Buckle

- (1) Remove the seat adjuster hinge cover;
- (2) Remove the bolt from the belt buckle on the seat side;
- (3) Remove the seat belt buckle from the seat;
- (4) Replace the seat belt buckle.

## 2. Retractor

The retractor is pre-tensioner. The retractor will pre-tension the seat belt when something emergency happens to prevent passengers from being hurt. It can sense the vehicle acceleration and the acceleration of the belt being pulled out.

The retractor belt can be pull out and drawn back freely. It will not be locked at 12° around the safety position, but locked at over 27° . The passenger can move in small area. The pre-tensioner will transmit within 5ms~10ms when something emergency happens to tension and lock the belt.

### Notice:

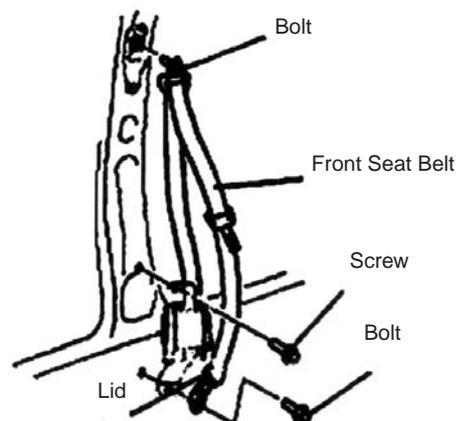
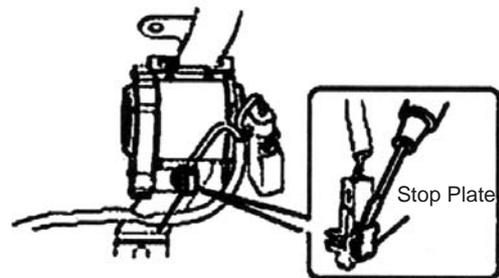
1. Check the product for damage, crack and rust before installation.
2. Put the retractor vertically and the belt can be pulled out. Check if the belt can be pulled out and around. Check if the retractor works.
3. When installing the pretensioned seat belt, check the transmitter head pin for slant and rust. The transmitter in the pretensioned seat belt can be used for 15 years after installation.
4. Check if the belt buckle and the attachment matches the connecting mode of the to-be-installed vehicle module. Check if the opening of the buckle is flexible.
5. See if the screw thread of the nut welded on the cover is clear when installing the bolt. Assemble the bolt after clearing the welding residue if there is any.
6. When the retractor belt is pulled out, there should be no obstacles around the belt (such as, wire harness ect) , Remove the obstacles and make sure the retractor and the belt will not be scratched.

## 3. Front seat belt removal/installation

### Warning:

Do not remove retractor.

- (1) Turn the ignition switch to LOCK.
- (2) Disconnect the negative (--) terminal cable from the battery for 1min.
- (3) Remove B- pillar lower frame.
- (4) Pry the seat belt which is used to install the tension wheel. Use a screwdriver to pry off the stop plate of the seat belt connector with tensioner.
- (5) Disconnect the seat belt connector with tensioner. Remove 2 set bolts on the hang ring and remove the hang ring.
- (6) Remove two set bolts in the retractor and remove the front seat belt.
- (7) The installation is in the reverse order of the removal.



(8) Make sure the warning light of the airbag system on for 6s and off.

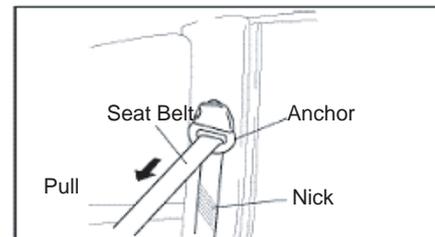
If the warning light of the airbag system is not as specified, it means system fault. Check with the OBD (on-board diagnostics).

## 4. Rear Seat Belt Removal / Installation

### Warning

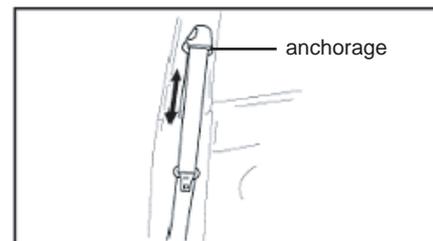
Do not remove retractor.

- (1) Fold rear seat back.
- (2) Remove B pillar upper inside trim.
- (3) Remove rear trunk partition.
- (4) Remove bolt.
- (5) Remove rear seat belt.
- (6) The installation is in the reverse order of the removal.



## 5. Rear Seat Belt Buckle Removal / Installation

- (1) Remove rear seat cushion.
- (2) Remove the bolt.
- (3) Remove rear seat belt buckle.
- (4) The installation is in the reverse order of the removal.



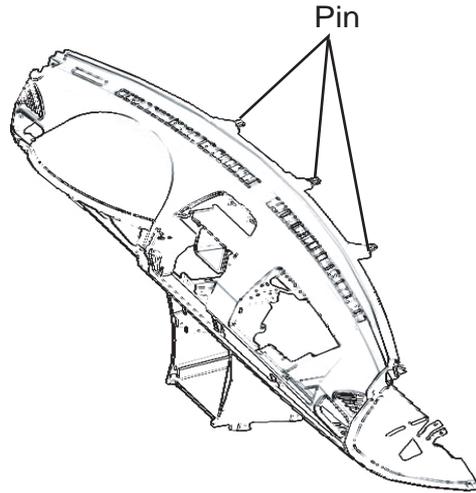
## 6. Seat Belt Inspection

- (1) Ensure correct installation of seat belt.
  - (2) Check the metal component of the seat belt for damage.
  - (3) If the vehicle has been vibrated during the accident, pull out the seat belt from the retractor, observe by eye and touch the seat belt with hand to ensure that there is no scratch (load limit retractor does not operate).
- Replace the seat belt if it is not as specified in the technical specification.

## (VIII) Instrument panel and auxiliary console

### 1. Instrument Panel Removal / Installation

- (1) Disconnect the negative (-) terminal cable from the battery.
- (2) Remove the instrument panel compartment.
- (3) Remove the front and rear auxiliary console.
- (4) Remove combination meter panel.
- (5) Remove instrument cluster.
- (6) Remove the steering column cover.
- (7) Remove the undercover.
- (8) Remove the steering column.
- (9) Remove A pillar frame.
- (10) Remove intermediate instrument panel.
- (11) Remove right side shield.
- (12) Remove left side shield.
- (13) As to the vehicle installed with A/C control mechanism, disconnect the front A/C wire.  
(See the removal and installation of A/C control mechanism)
- (14) Disconnect the instrument panel wire harness connector.
- (15) Remove the bolt.
- (16) Take out the instrument panel from the open driver side door.
- (17) The installation is in the reverse order of the removal.

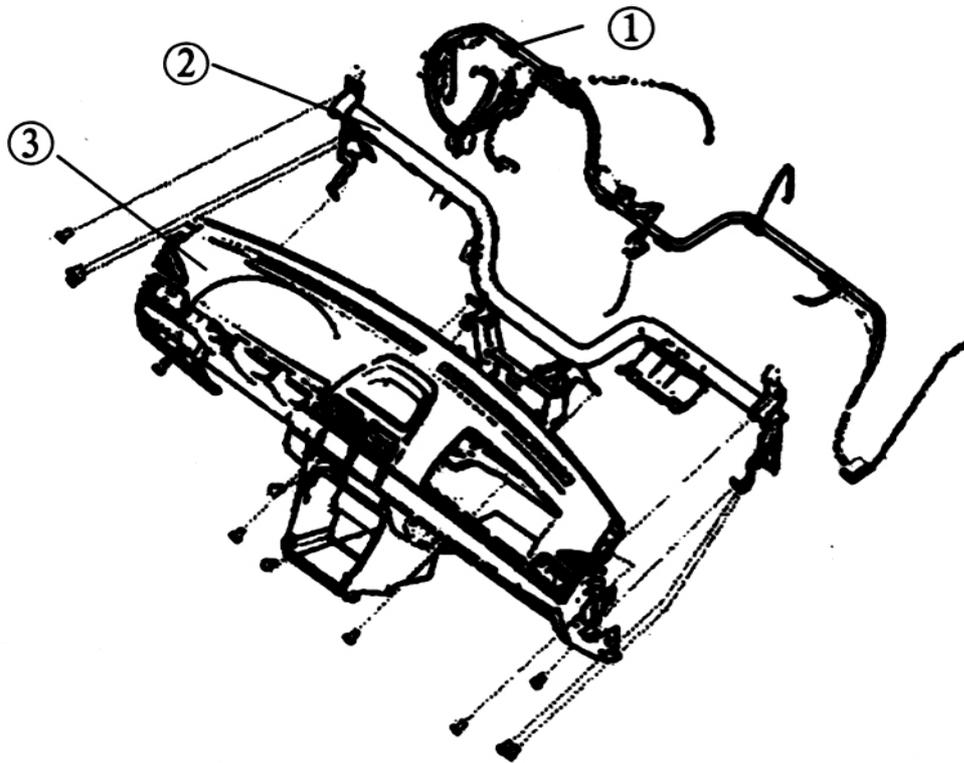


#### Warning

It is dangerous to remove the instrument panel before supporting it. The instrument panel may drop and result in body injury. Have at least one assistant for help to implement the procedures. Remove the supporting pin from the vehicle body to remove the instrument panel

## 2. Instrument Panel Removal/Installation

- (1) Remove the airbag actuator at the driver side.
- (2) Remove the intermediate instrument panel.
- (3) Remove the audio device
- (4) Remove A/C control mechanism.
- (5) Remove in the order below in the figure.
- (6) The installation is in the reverse order of the removal.

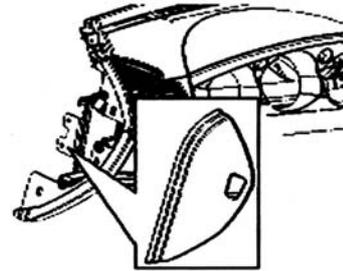


Torque: 18.6--25.5 N.m

1	instrument panel wire harness
2	instrument panel cross member
3	instrument panel

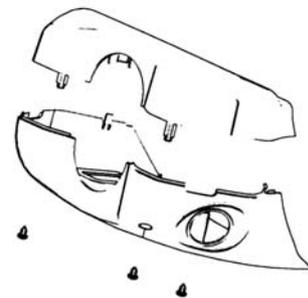
### 3.Side Panel Removal/Installation

- (1) Using the flat screwdriver wrapped with vinyl tape, disconnect the clip.
- (2) Pull the side panel towards yourself and remove the plate from the instrument panel and remove the side panel.
- (3) The installation is in the reverse order of the removal.



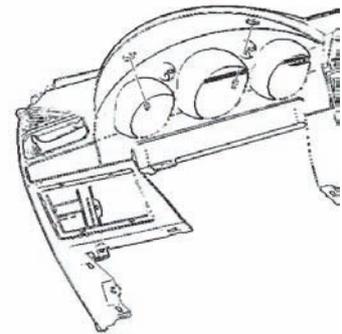
### 4.Steering Column Cover Removal/Installation

- (1) Remove upper cover.
- (2) Remove the ignition key.
- (3) Remove the screw.
- (4) Remove lower cover.
- (5) The installation is in the reverse order of the removal.



### 5.Combination Instrument Panel Removal/Installation

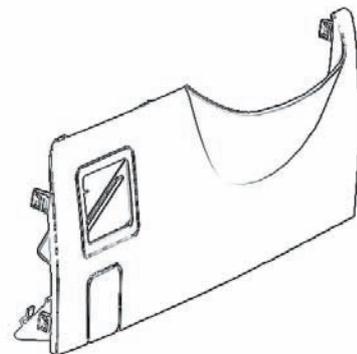
- (1) Remove the screw.
- (2) Using the flat screwdriver wrapped with vinyl tape, disconnect the clip.
- (3) Pull combination instrument panel towards yourself. Remove pillar.
- (4) The installation is in the reverse order of the removal.



### 6.Lower End Shield Removal/Installation

- (1) Using the flat screwdriver wrapped with vinyl tape, disconnect the clip.
- (2) Pull the lower end shield towards yourself and remove clipA and plate B from the instrument panel and remove lower end shield.
- (3) Disconnect the engine hood cable.

The installation is in the reverse order of the removal.

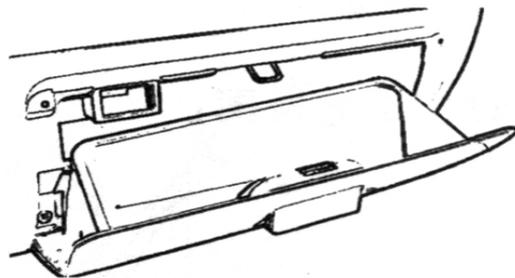
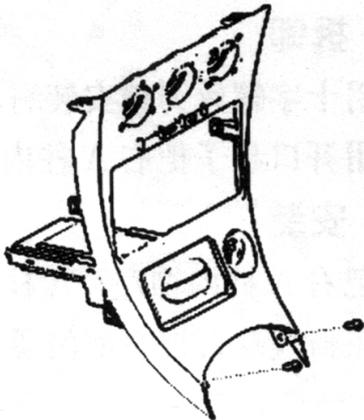


## 7. Intermediate Instrument Panel Removal/Installation

- (1) Disconnect the negative (-) terminal cable from the battery.
- (2) Remove intermediate instrument panel.
- (3) Remove the screw.
- (4) Using the flat screwdriver wrapped with vinyl tape, disconnect the clip.
- (5) Pull the intermediate instrument panel forward and then remove the clip.
- (6) Remove LDC (Liquid Crystal Display) component connector.
- (7) The installation is in the reverse order of the removal.

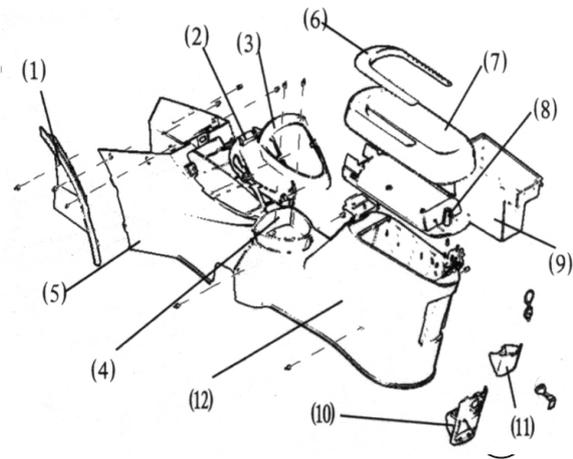
## 8. Glove Compartment Removal/Installation

- (1) Open the glove compartment;
- (2) Pull the glove compartment up and separate it from the instrument panel;
- (3) The installation is in the reverse order of the removal.



## 9. Auxiliary Console Removal/Installation

- (1) For MT vehicle, remove transmission control knob.
- (2) Using the screwdriver wrapped with the vinyl tape, remove the tray.
- (3) Using the screwdriver wrapped with the vinyl tape, remove shift boot frame. Disconnect ignition switch.
- (4) Remove the bolt, screw.
- (5) The installation is in the reverse order of the removal.



## 10. The auxiliary Console Removal/Installation

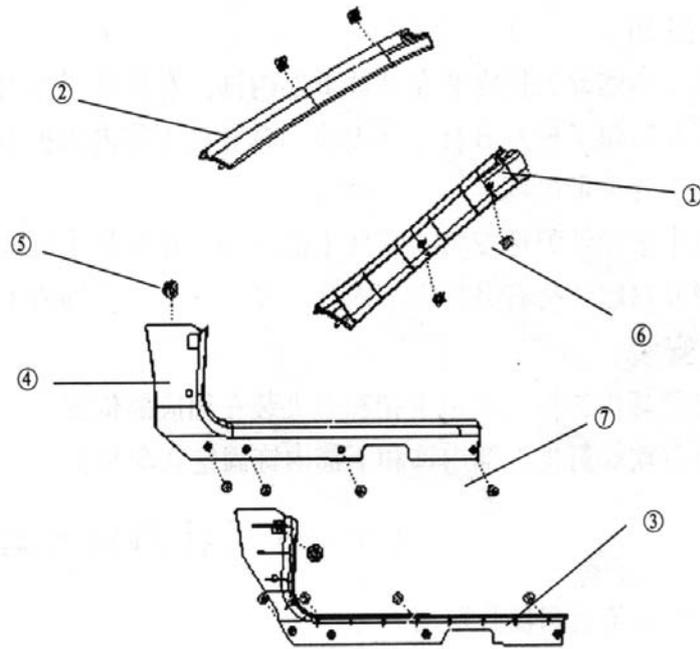
- (1) Remove in the order listed below.

1	Auxiliary console left front end
2	Shift boot frame
3	Shift boot end shield
4	Tray
5	Auxiliary console front part
6	Auxiliary console outer end shield upper plate
7	Auxiliary console outer end shield
8	Auxiliary console inner end shield
9	Auxiliary console compartment
10	Auxiliary console rear end shield
11	Rear ash tray
12	Auxiliary console rear part

- (2) The installation is in the reverse order of the removal.

## (IX) A pillar inside trim and front door sill

A pillar inside trim and front door sill diagram



A pillar inside trim and front door sill diagram

1. Right A Pillar Inside Trim    2. Left A Pillar Inside Trim    3. Right Front Door Sill  
4. Left Front Door Sill    5. D-Clip    6. Steel Clip    7. Cross Slot Head Self-tapping Screw

### 1. Removal

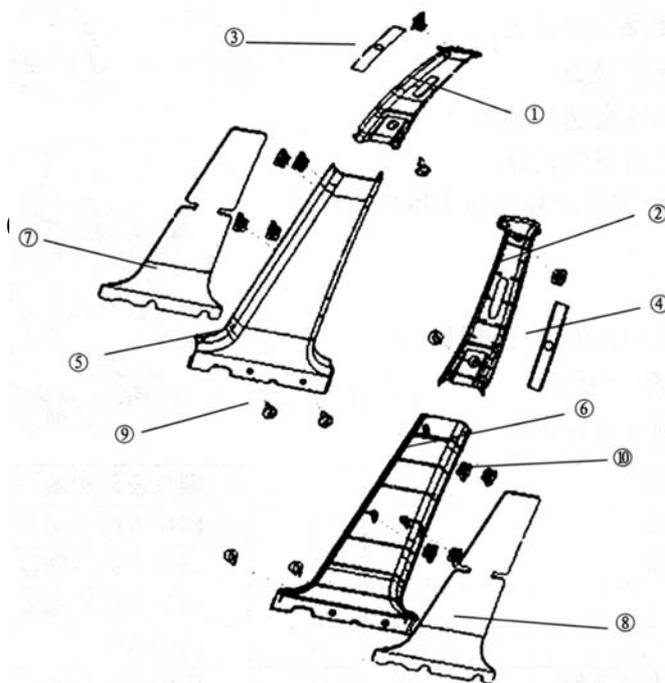
- ① Remove the installed right front door sill, left front door sill self-tapping screw cross screwdriver;
- ② Use an opener to remove the right A pillar inside trim, A pillar inside trim, right front door sill, left front door sill.

### 2. Installation

- ① Install the right A pillar inside trim, A pillar inside trim, right front door sill, left front door sill to the corresponding position with clip and steel clip;
- ② Fix the right front door sill, left front door sill with a tapping screw.

## (X) B pillar inside trim

B pillar inside trim diagram:



B Pillar Inside Trim Diagram

1. Right B Pillar Upper Inside Trim    2. Left B Pillar Upper Inside Trim    3. Right Deflector  
4. Left Deflector    5. Right B Pillar Lower Inside Trim    6. Left B Pillar Lower Inside Trim  
7. Right B Pillar Lower Inside Trim Sound Insulator    8. Left B Pillar Lower Inside Trim Sound Insulator  
9. Cross Pan Head Tapping Screw    10. Steel Clip

### 1. Removal

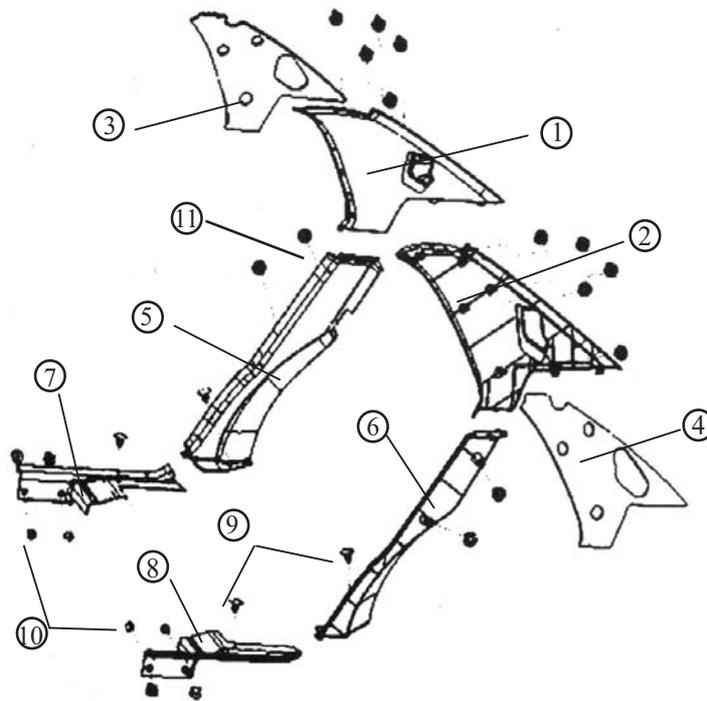
- ① Remove the installed left B pillar lower inside trim, right B pillar lower inside trim tapping screw with a cross screwdriver;
- ② Remove the left B pillar lower inside trim, right B pillar lower inside trim with a opener ;
- ③ Remove the seat belt swing ring;
- ④ Remove the right B pillar upper inside trim, left B pillar upper inside trim tapping screw with the cross screwdriver;
- ⑤ Remove the right B pillar upper inside trim, left B pillar upper inside trim with a opener.

### 2. Installation

- ① Clip B pillar inside trim to the corresponding position with clip and steel clip in order;
- ② Fix the upper inside trim and lower inside trim to the vehicle body with a tapping screw.

## (XI) Cpillar inside trim and rear door sill

C pillar inside trim and rear door sill diagram:



C pillar inside trim& rear door sill diagram

1.Right C Pillar Upper Inside Trim    2.Left C Pillar Upper Inside Trim    3. Right C Pillar Upper Inside Trim Sound Insulator    4. Left Sound Insulator    5. Right C Pillar Lower Inside Trim    6. Left C Pillar Lower Inside Trim    7. Right Rear Door Sill    8. Left Rear Door Sill    9. E-Clip    10. Cross Pan Head Self-tapping Screw    11.D-Clip

### 1. Removal

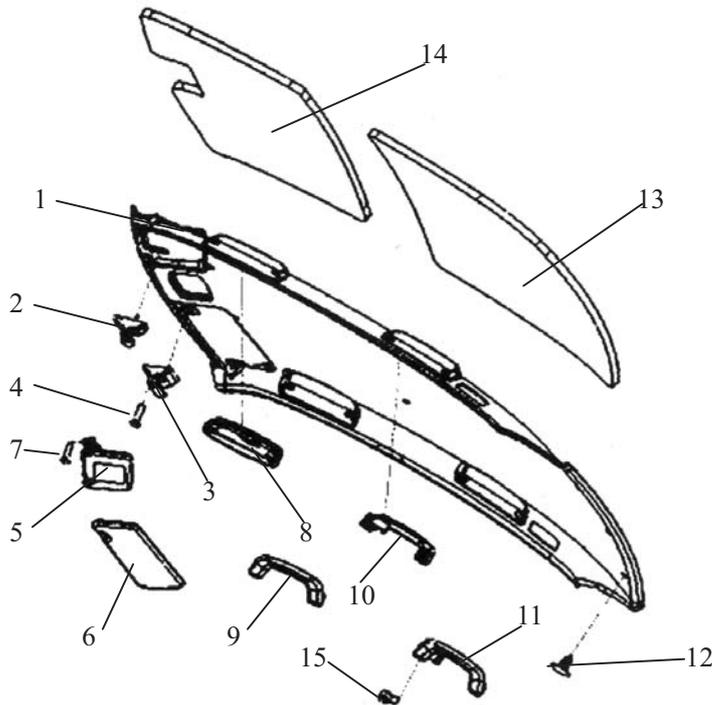
- ① Remove the installed door sill and C pillar lower inside trim tapping screw and E-clip with a cross screwdriver;
- ② Remove C pillar upper inside trim with a opener ;
- ③ Remove C pillar lower inside trim with a opener

### 2.Installation

- ① Clip C pillar inside trim and rear door sill onto the corresponding position in order;
- ② Tap C pillar upper inside trim and C pillar lower inside trim lightly with a rubber hammer to ensure D-clip clipped in the vehicle inner panel;
- ③ Fix the rear door sill onto the vehicle body with a tapping screw.

## (XII) Roof inside trim

### Roof Inside Trim Diagram:



Roof inside trim diagram

- |                                |                               |                                     |                                 |
|--------------------------------|-------------------------------|-------------------------------------|---------------------------------|
| 1. Roof Inside Trim            | 2. Left Sun Visor Bracket     | 3. Right Sun Visor Bracket          | 4. Cross Semi-Countersunk Screw |
| 5. Left Sun Visor Assembly     | 6. Right Sun Visor Assembly   | 7. Cross Counter Sunk Tapping Screw | 8. Glass Box Assembly           |
| 9. Right Front Handle Assembly | 10. Left Rear Handle Assembly | 11. Right Rear Handle Assembly      | 12. E-Clip                      |
| 13. Roof Rear Heat Insulator   | 14. Roof Front Heat Insulator | 15. Cross Slot Head Screw           |                                 |

### 1. Removal

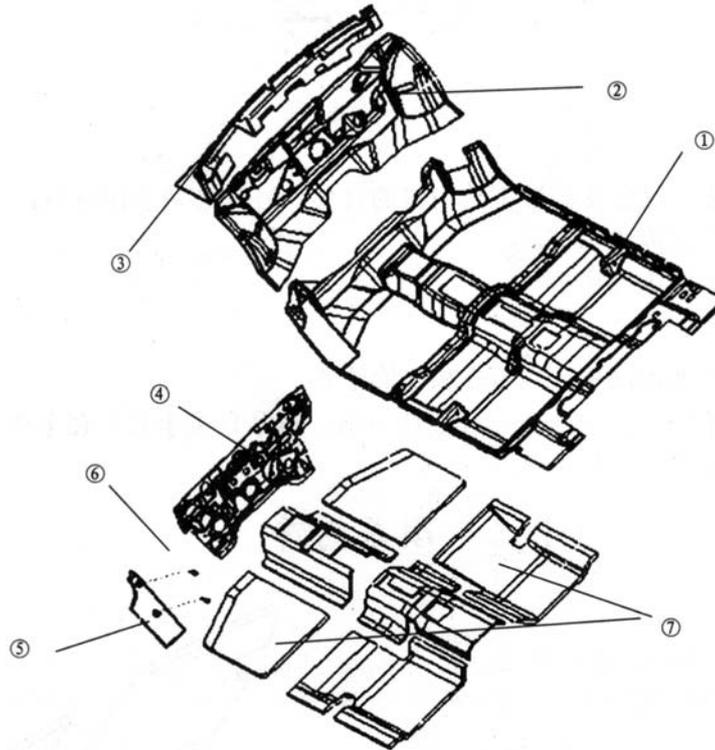
- ① Remove the safe handle, map lamp, left/right A pillar inside trim, left/right B pillar upper inside trim, left/right C pillar upper inside trim;
- ② Remove the screw used to install left/right sun visor assembly with a cross screwdriver. Remove the left/right sun visor assembly
- ③ Remove the plastic clip used to install roof inside trim assembly with opener. Remove the lower dome lamp connector and roof inside trim assembly.

### 2. Installation

- ① Install the dome lamp connector into the corresponding hole and clip the plastic clip onto the corresponding hole in the vehicle body. Fix the roof inside trim assembly;
- ② Install the safe handle to the corresponding position on the trim board on the right front pillar with a tapping screw and clip the safe handle cover;
- ③ Install the left, right sun visor onto the roof inside trim assembly with a tapping screw and fix it to the corresponding hole on the vehicle body;
- ④ Install left/right A pillar inside trim, left/right B pillar upper inside trim, left/right C pillar upper inside trim.

### (XIII) Carpet and Heat Insulator

#### Carpet and Heat Insulator Diagram



Carpet and Heat Insulator Diagram

1. Carpet    2. Cowl Lower Sound Insulator    3. Cowl Upper Sound Insulator    4. Cowl Outer Panel Heat Insulator  
5. Foot Pedal    6. Cross Pan Head Screw    7. Floor Sound Insulator

#### 1. Removal

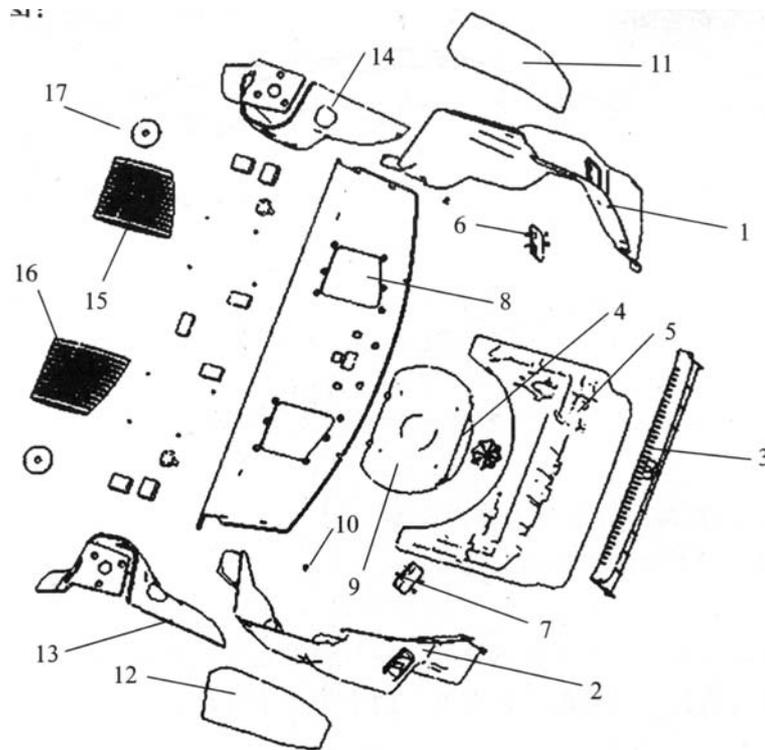
- ① Remove the front and rear seats, left front door sill, right front door sill, right B pillar lower inside trim, left B pillar lower inside trim, right rear door sill, left rear door sill, front and rear part of the auxiliary console;
- ② Remove the cross pan head screw and remove the foot pedal.
- ③ Remove carpet and cowl lower sound insulator, cowl upper sound insulator, cowl outer panel heat insulator.

#### 2. Installation

- ① Install the accelerator pedal assembly, brake and clutch pedal assembly, parking brake control mechanism assembly onto the vehicle body;
- ② Install the carpet to the corresponding hole. Install both sides of the carpet under the left front door sill, right front door sill, right B pillar lower inside trim, left B pillar lower inside trim, right rear door sill, left rear door sill.

## (XIV) Rear trunk Inside Trim

Rear trunk inside Trim Diagram :



Rear trunk Inside Trim Diagram

- |   |   |  |
|---|---|--|
| 1. Right Rear Quarter Trim                      | 2. Left Rear Quarter Trim                 | 3. Lower Rear Board Trim Assembly                |
| 4. Spare Tire Press Plate Assembly              | 5. Rear trunk Stuck Plate                 | 6. Right Rear Combination Lamp Access Hole Cover |
| 7. Left Rear Combination Lamp Access Hole Cover | 8. Rear Partition Inside Trim             |  |
| 9. Rear trunk Miscellaneous Box                 | 10. J-Clip ( Rear Quarter Trim )          | 11. Right Outside Wheelhouse Sound Insulator     |
| 12. Left Outside Wheelhouse Sound Insulator     | 13. Right Rear Wheelhouse Sound Insulator | 14. Right Rear Wheelhouse Sound Insulator        |
| 15. Right Speaker Grill                         | 16. Left Speaker Grill                    | 17. Rear Damper Cover                            |

### 1. Removal

- ① Remove the connector and remove the high mounted stop lamp;
- ② Remove C pillar upper inside trim;
- ③ Remove the rear partition inside trim ;
- ④ Remove the right speaker grill and left speaker grill with a cross screwdriver;
- ⑤ Remove the lower rear board trim assembly clip with opener. Remove the lower rear board trim assembly;
- ⑥ Remove the right rear combination lamp access hole cover, left rear combination lamp access hole cover
- ⑦ Remove the clip installed at the left and right rear quarter trim with a cross screwdriver;
- ⑧ Remove the clip installed at the left and right rear quarter trim with an opener;
- ⑨ Remove the rear damper cover;

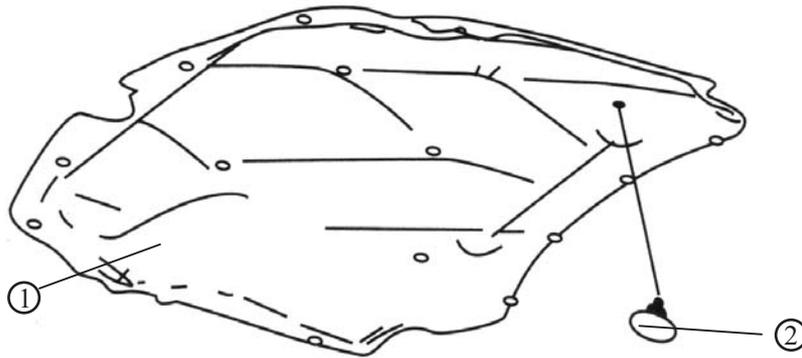
- ⑩ Take out the rear trunk carpet, spare tire cover board and the rear trunk miscellaneous box. Screw the spare tire press plate assembly to take out the spare tire.

## 2. Installation

- ① Clip the rear trunk inside trim onto the corresponding hole in the reserve order of the removal;
- ② Install the right rear and left rear combination lamp access hole cover;
- ③ Install the right and left speaker grill to the rear partition inside trim with a cross screwdriver;
- ④ Install the rear partition inside trim to the vehicle body;
- ⑤ Install the high mounted stop lamp and the C- pillar upper inside trim.

## (XV) Engine Hood Inside Trim

Engine Hood Inside Trim Diagram:



Engine Hood Inside Trim

1. Engine Hood Inside Trim    2. E-Clip

### 1. Removal

- ① Open the engine hood and gas spring;
- ② Remove the clip and remove the engine hood inside trim

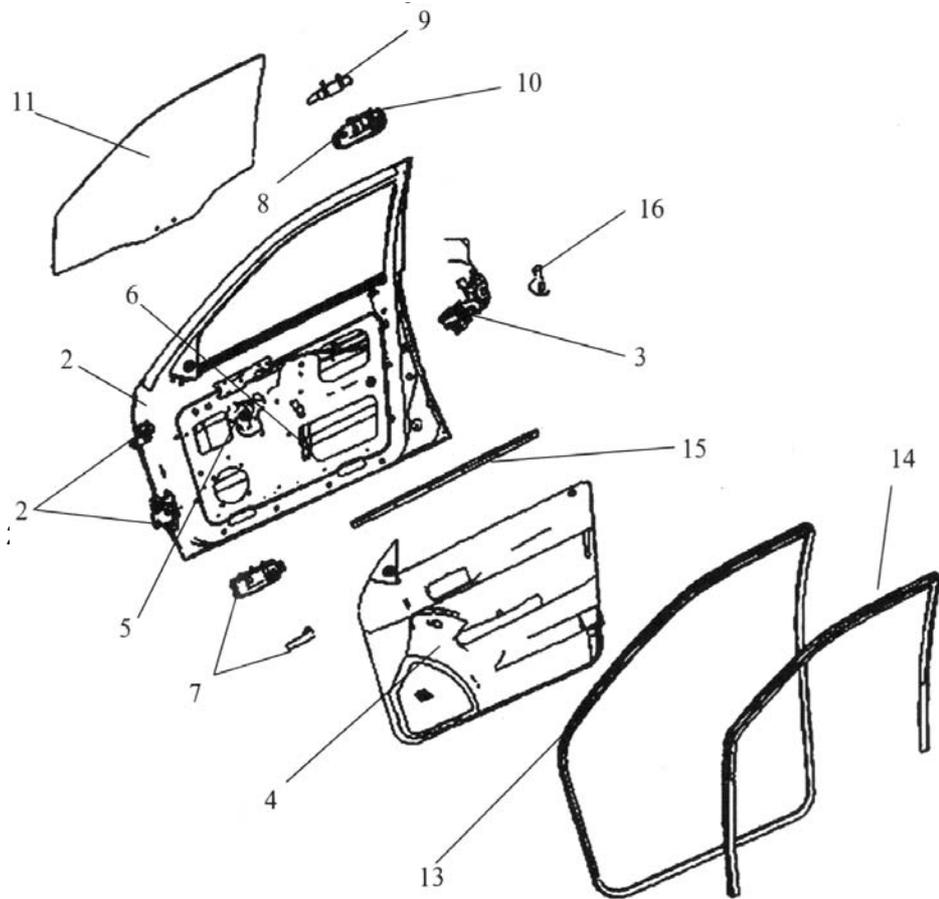
### 2. Installation

- ① Open the installed engine hood and gas spring;
- ② Align the corresponding hole position in the the engine hood inside trim and press the clip in by hand.

## (XVI) Door

### Front Door

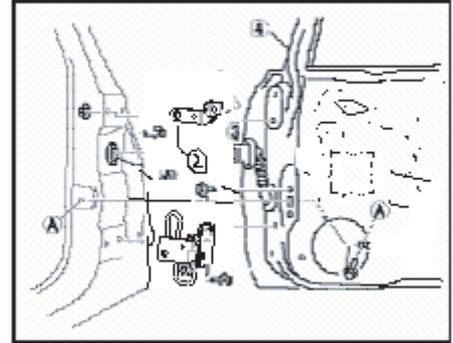
#### Front Door Components:



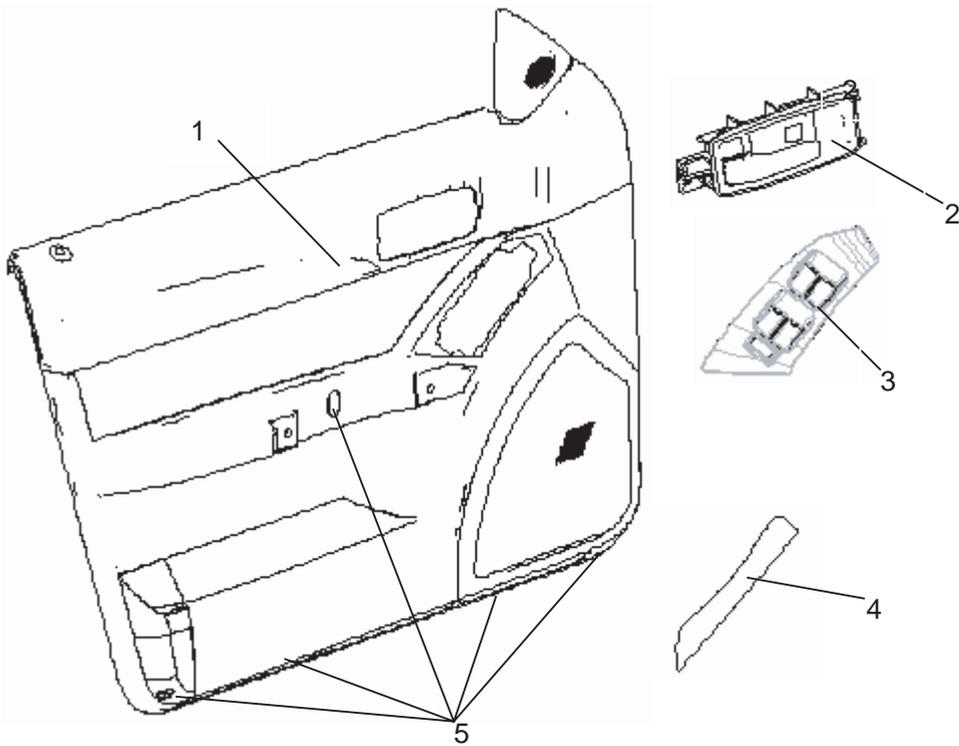
- 1.Front Door    2.Front Door Hinge    3.Front Door Lock And Door Lock Actuator  
4.Front Door Inner Trim Board    5.Power Window Motor    6.Power Window Actuator  
7.Door Inside Handle    8.Protection Device    9.Door Outside Handle    10.Front Door Lock Hole  
11.Front Door Glass    12.Door Window Regulator Run    13. Front Door Weatherstrip A  
14.Front Door Lower Weatherstrip    15.Front Door Weatherstrip B    16.Front Door Lock Striker

## 1. Front Door Removal/Installation

- (1) Disconnect the negative (-) terminal cable from the battery.
- (2) Remove the front fender and remove the front door hinge.
- (3) Remove the connector (See Notice on Removing the Connector for detailed information)
- (4) Remove front door hinges
- (5) Remove the front door
- (6) The installation is in the reverse order of the removal.
- (7) Adjust the front door. (See Door Adjustment for detailed information)



### Front Door inner trim



1. Front Door Inner Trim Board Assembly  
4. Door Handle

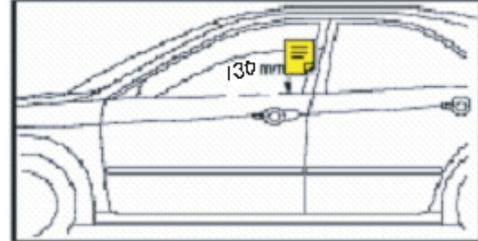
2. Front Door Inner Handle Assembly

3. Trim Board

5. Set Screw

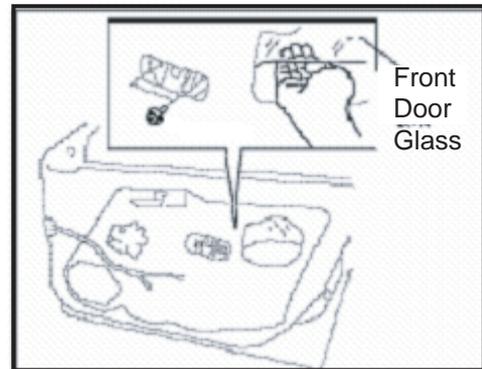
### 1.The Front Door Inner Trim Board Removal/Installation

- (1) Remove the set screw.
- (2) Remove the front door inner trim board assembly.
- (3) Disassemble the inner trim board assembly as required
- (4) The installation is in the reverse order of the removal.



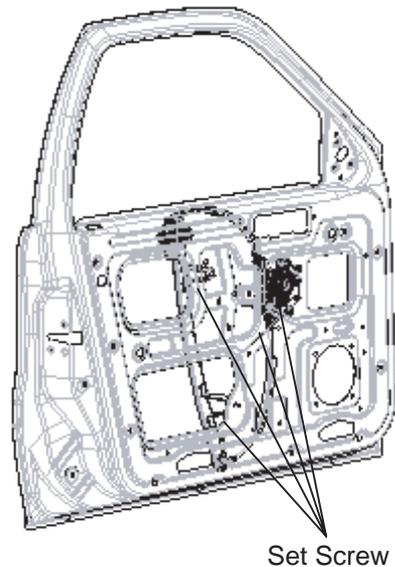
### 2.Front Door Glass Removal And Installation

- (1) Lift the front door window glass, make the distance between the front window glass top and rear door top weatherstrip to be 130mm.
- (2) Disconnect the negative (--) terminal cable from the battery.
- (3) Remove the front door frame.
- (4) Remove the hole cover.
- (5) Remove the screw.
- (6) Insert your hand into the front door component hole to lift the front window glass.
- (7) The installation is in the reverse order of the removal.

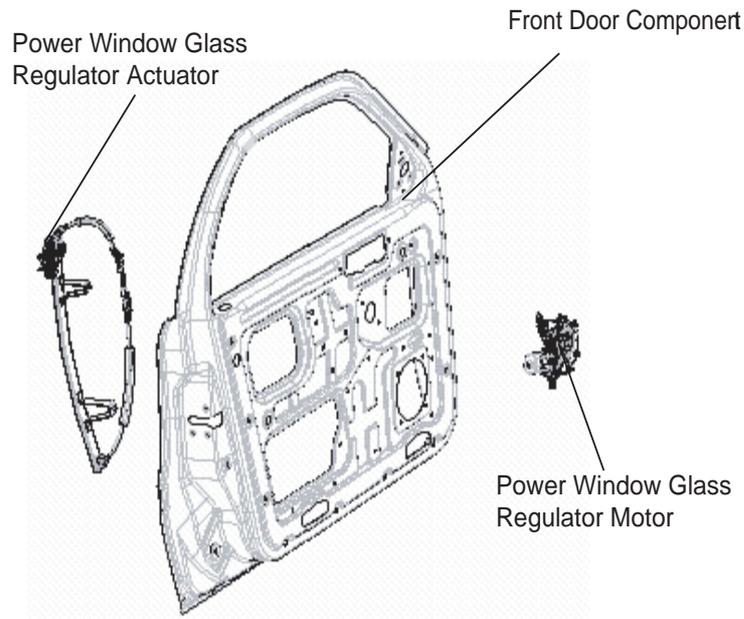


### 3.Glass Regulator Removal/Installation

- (1) Loose the set screw: (See Figure)

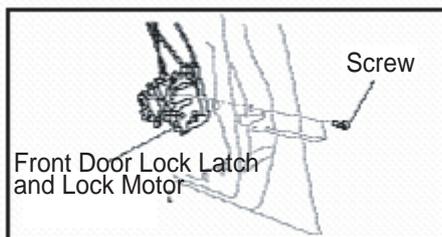


(2) Get the window regulator from the hole in the lower door



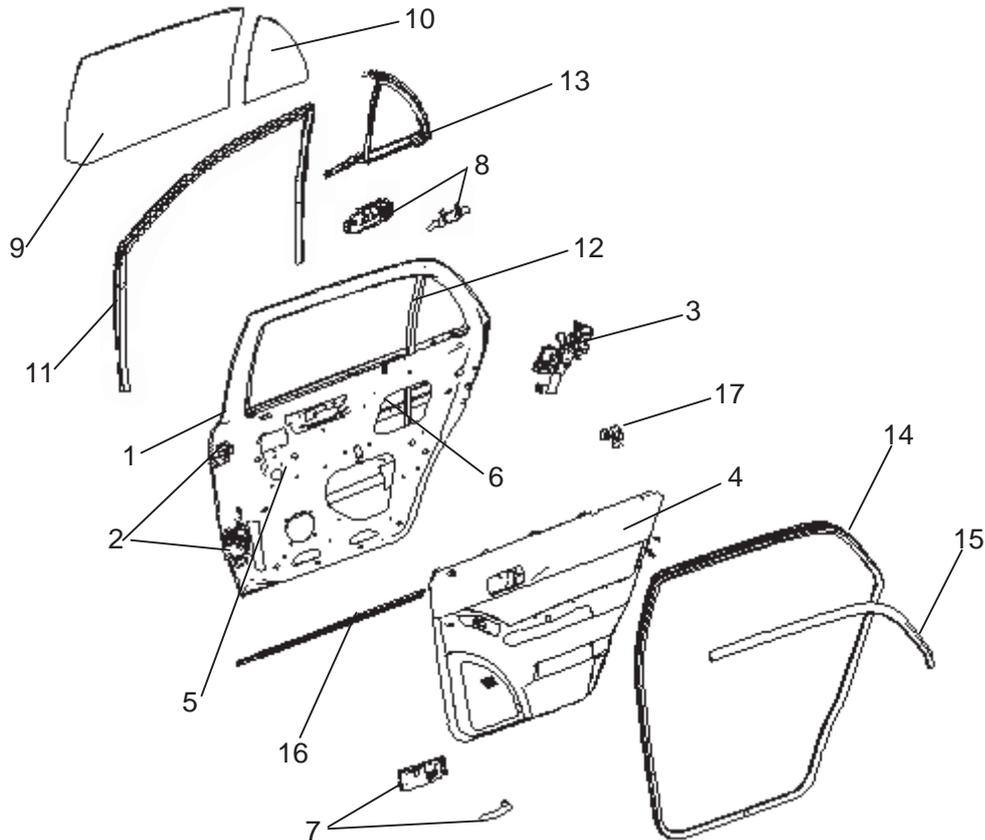
#### 4. Front Door Lock And Door Lock Actuator Removal/Installation

- (1) Remove front door component.
- (2) Remove the screw and then remove the front door lock and the door lock actuator.
- (3) The installation is in the reverse order of the removal.



## Rear door

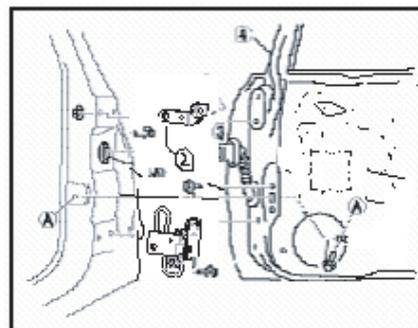
### Rear door Component



- 1.Rear Door      2.Rear Door Hinges      3.Rear Door Lock And Door Lock Actuator  
4.Rear Door Inner Trim Board      5.Power Window Motor      6.Power Window Actuator  
7.Door Inside Handle      8.Door Outside Handle      9.Rear Window Glass      10.Quarter Window  
11.Window Glass Regulator Run      12.Glass Run      13.Quarter Window Weatherstrip  
14. Rear Door Weatherstrip A      15.Rear Door Lower Weatherstrip      16.Rear Door Weatherstrip B  
17.Rear Door Lock Striker

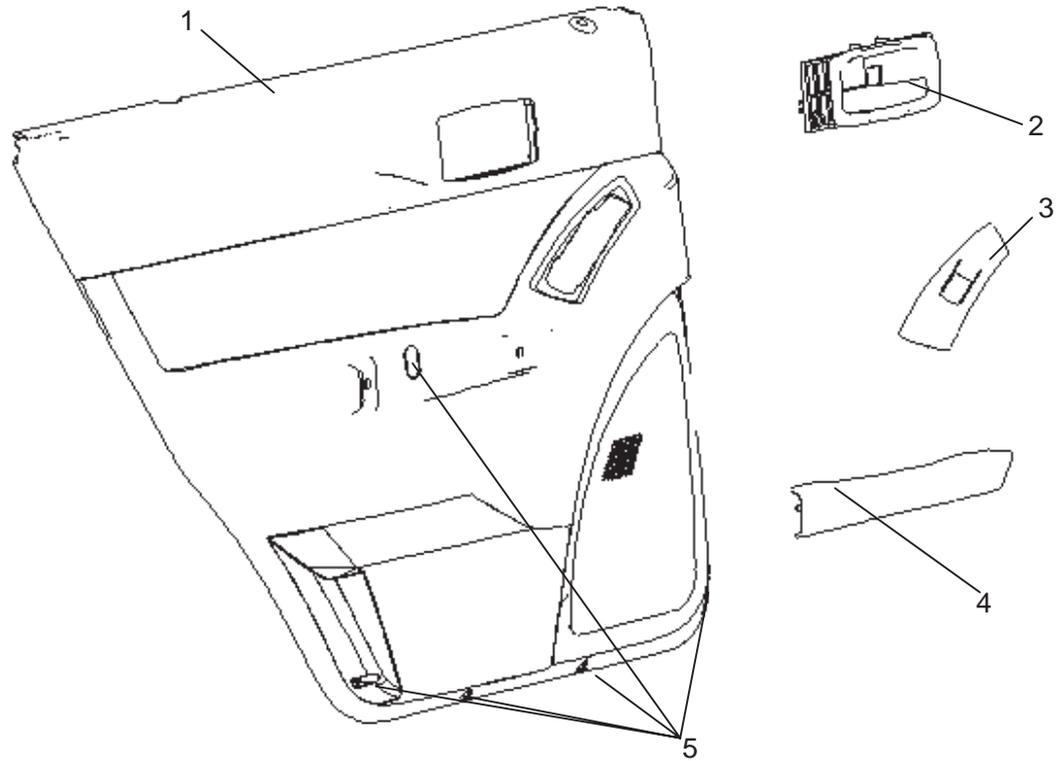
### 1.Rear Door Removal/Installation

- (1) Disconnect the negative (--) terminal cable from the battery.
- (2) Remove the connector.
- (3) Remove rear door hinges.
- (4) Remove the rear door
- (5) The installation is in the reverse order of the removal.
- (6) Adjust the rear door. (See Rear door Adjustment)



## Rear Doorinside Trim

Rear Doorinside Trim Component:



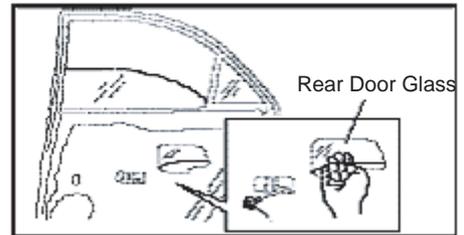
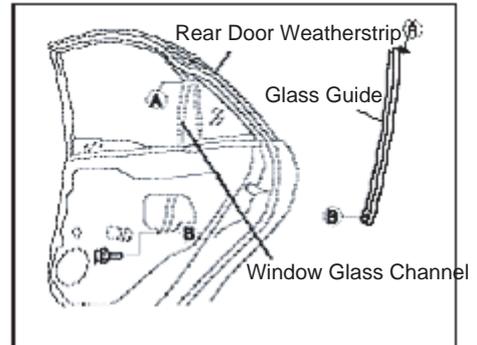
1.Rear Doorinside Trim Board Assembly    2.Rear Door Lock Inner Handle Assembly  
3.Controller Trim Board    4.Door Handle    5.Set Screw

### 1.Rear doorinside trim board removal/installation

- (1) Remove the set screw. (See Figure 5)
- (2) Remove the rear door inside trim board assembly.
- (3) Disassemble the inside trim board assembly as required
- (4) The installation is in the reverse order of the removal.

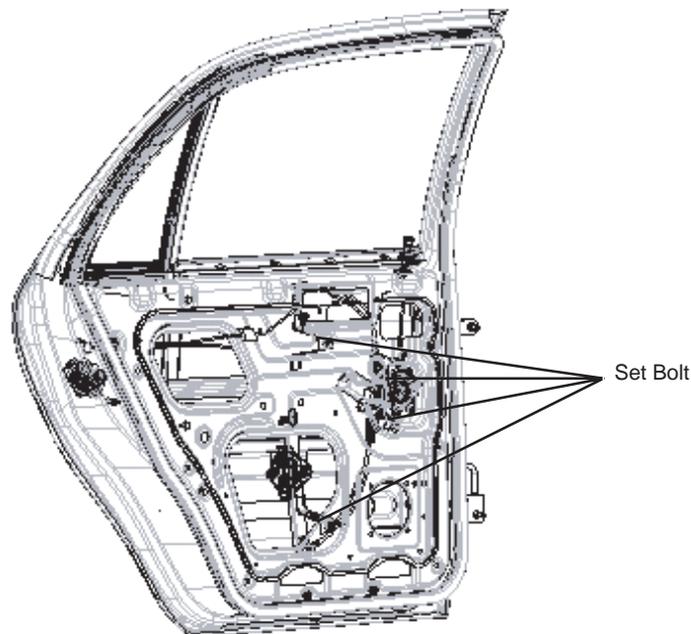
## 2.Rear window glass removal/installation

- (1) Fully drop down the rear window glass.
- (2) Remove the rear window glass frame.
- (3) Remove the bolt.
- (4) Remove the window glass channel from the glass guide
- (5) Insert your hand into the rear door service hole and lift out the rear window glass.
- (6) The installation is in the reverse order of the removal.

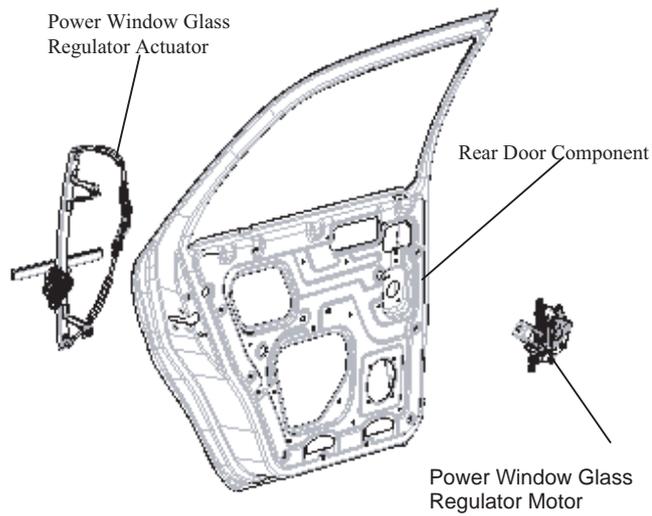


## 3.Rear door glass regulator removal/installation

- (1) Remove the set bolt; (See the figure )

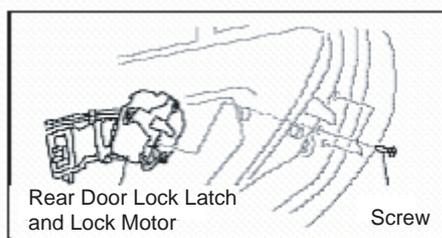


(2) Take out the rear door glass regulator from the square hole under the door;



#### 4. Rear door lock and door lock actuator removal/installation

- (1) Remove the rear door component.
- (2) Remove the screw and then remove rear door lock and the door lock actuator.
- (3) The installation is in the reverse order of the removal.



## Door Adjustment

1. Measure clearance between the front door or the rear door and the vehicle body.
2. Loosen the front door or the rear door hinges assembly bolt or door lock striker assembly screw and reinstall it to the door if the measured result is not as specified in the technical standard.

### Clearance

a: 5mm

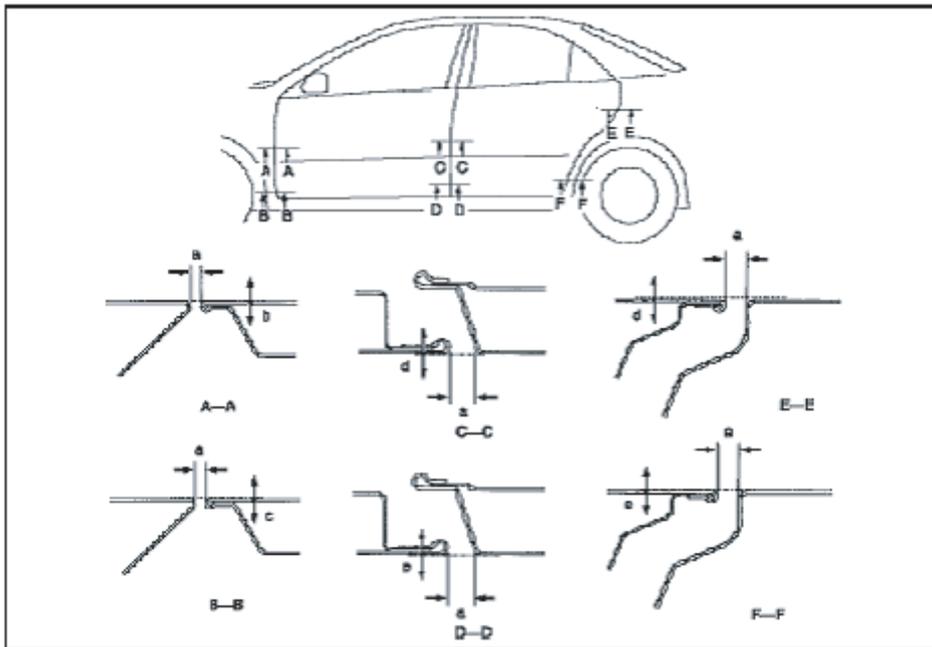
b: 5mm

c: 4.3mm

d: 4.3mm

e: 3.8mm

f: 4.6mm



3. Tighten the bolt or the screw.

# Part V Body

## Chapter 1 General Information

### Section 1 Body Structure

An automobile body is mainly composed of the main body, removable sheet metal parts, interior and exterior trim parts, and body accessories.

#### I. Main Body

The main body is mainly composed of the front sheet metal, cowl parts, floor assembly, LH/RH side wall assembly, Rear back panel assembly, trunk shelf assembly and roof panel assembly, etc. by welding them together, as shown in the Figure 5-1.



Figure 5-1 MAIN BODY

- |                                 |                         |                         |
|---------------------------------|-------------------------|-------------------------|
| 1 Front Sheet Metal, Cowl Parts | 2 Roof Panel Assy.      | 3 LH/RH Side Wall Assy. |
| 4 Rear Shelf Assy.              | 5 Rear Back Panel Assy. | 6. Floor Assy.          |

## (I) Front Sheet Metal, Cowl Parts

The main function of the front sheet metal and the cowl parts is forming an engine compartment to supply the engine and accessories with a protective cover and to absorb the most energy when vehicle encounters frontal impact, protecting mud from being splashed by the front wheels, and meeting the requirements of body design in appearance. It is mainly composed of front cross member assembly, LH/RH front mud guard and front side member assembly, engine hood front support plate assembly, hood lock bracket assembly, cowl assembly, cowl upper assembly.

### 1. Front Cross Member Assembly

The front cross member assembly is mainly composed of the front cross member welding sub-assembly, front cross member bottom plate assembly, LH/RH side member end plate by welding them together, and its dismantle diagram as shown in the Figure 5-2.

### 2. Lh/Rh Front Mudguard And Front Side Member Assembly

LH/RH front mud guard and front side member assembly is mainly composed of LH/RH front mudguards and LH/RH side members by welding them together.

It is mainly used to mount some mounting brackets such as the engine LH/RH side suspension bracket, LH/RH front suspension shock absorber bracket, etc. and to mount the LH/RH front fenders.

### 3. Engine Hood Front Support Plate Assembly

Engine hood front support plate is mainly composed of LH/RH headlamp mounting bracket assembly, hood front support plate sub-assembly, and LH/RH front support plate reinforcement, by welding them together.

Engine hood front support plate assembly is used to mount radiator, engine hood lock, radiator grille, front bumper, and headlamp.

### 4. Engine Hood Lock Bracket Assembly

Engine hood lock bracket assembly is used to mount the engine hood lock, also to strengthen the intensity and rigidity of the front body by connecting the engine hood front support plate and front cross member.

### 5. Cowl Assembly

Cowl assembly is mainly composed of cowl inner and outer plate assembly and cowl lower cross member, by welding them together.

Cowl assembly and front floor, LH/RH front mud guard (LH/RH front pillar), cowl upper baffle is welded together, which forms a framework with great torsional strength. It generates great resistance to lateral impact and rolled deformation.

Cowl inner and outer plate assembly is sandwich structure. 3mm of asphalt plate lies in the interlayer, which is to cut off the noise and heat generated from the engine.

## 6. Cowl Upper Assembly

Cowl upper assembly is mainly composed of cowl upper outer plate, cowl upper LH/RH end plate assembly, instrument panel mounting plate, steering column mounting bracket upper/lower plate, cowl lower inner plate, ventilator cover, etc., by welding them together.

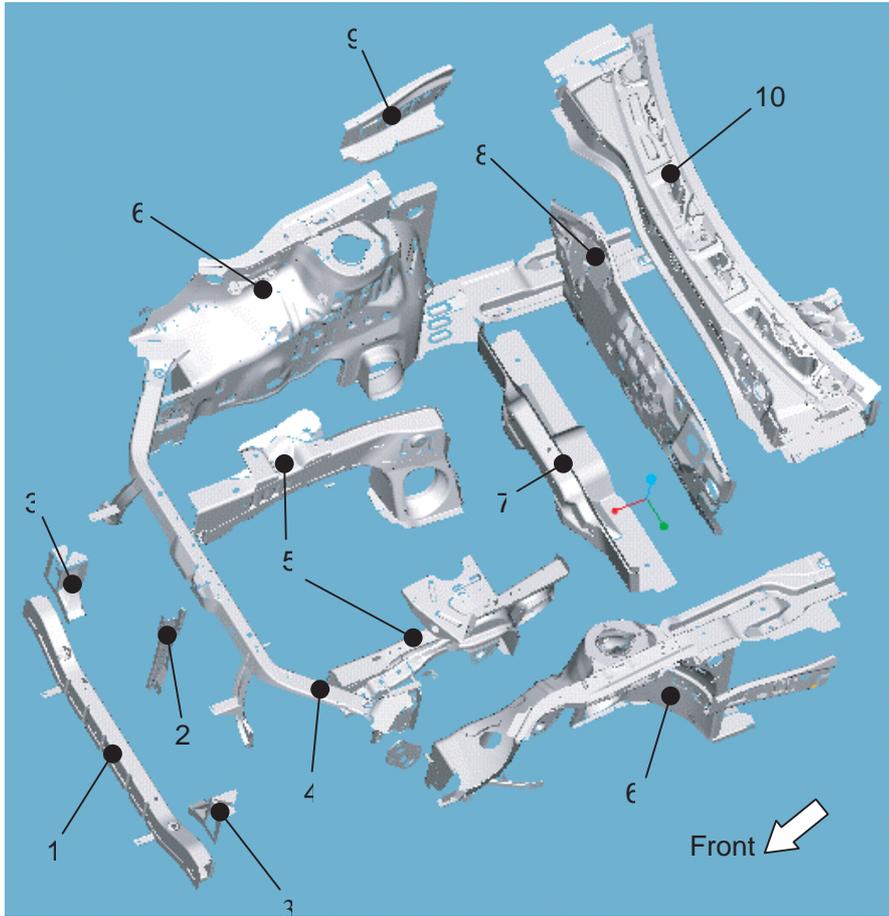


Figure 5-2 Dismantle diagram of front sheet metal and cowl parts

1 Front Cross Member    2 Hood Lock Bracket Assy.    3 LH/RH Side Member End Plate  
4 Engine Hood Front Support Plate Assy.    5 LH/RH Front Cross Member    6. LH/RH Front Mud Guard  
7 Front Cross Member Assy.    8 Cowl Inner And Outer Plate Assy.    9 LH/RH Front Mud Guard  
Reinforcement    10 Cowl Upper Baffle

## (II) Floor Assembly

Floor assembly is the base of the main body and an important structure component to link with assemblies and for load transfer and bearing. The vehicle running performance depends on its intensity and rigidity. Figure 5-3 is the dismantle diagram of the floor parts.

Floor assembly is composed of front floor assembly and rear floor assembly. A protrusile tunnel runs longitudinally in the center of the front floor. The tunnel and the lower floor rail can strengthen its rigidity in longitudinal direction. The lower space of the tunnel is used to mount components such as transmission shift pull rod, park brake drawing cable, exhaust pipes with 3-way catalytic converter. Carpet and sound insulator mat are mounted in the inner side of the compartment. The first and the second cross member, LH/RH side member and side rails which are on the front floor form a frame structure. It can provide great load-bearing capacity to assure strict running requirements for body.

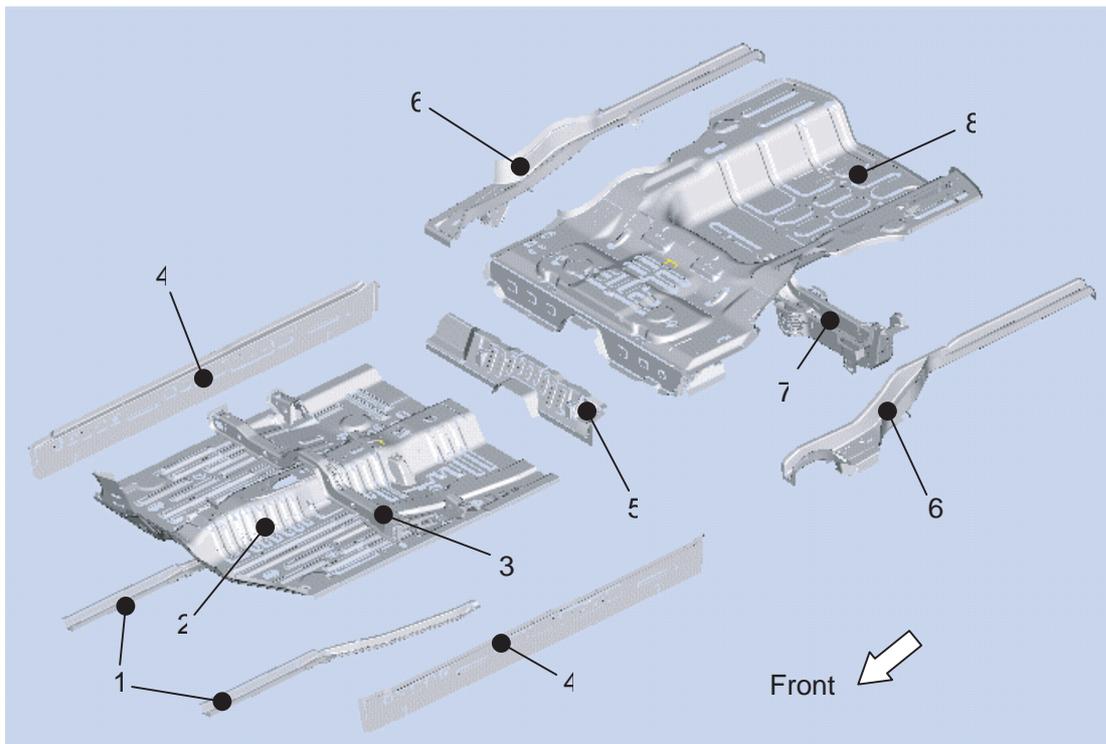


Figure 5-3 Decomposition Diagram of Floor Parts

1 LH/RH Front Floor Side Rail 2 Front Floor 3 Front Floor Cross Member 4 LH/RH Floor Side Member 5 Rear Floor 1st Cross Member 6 LH/RH Rear Floor Side Rail 7 Rear Floor 2nd Cross Member Assy. 8 Rear Floor

### (III) Side Wall Assembly

LH/RH side wall assembly is frame structure. It is mainly composed of parts such as LH/RH front pillar sub-assembly, LH/RH central pillar reinforcement, LH/RH upper side rail, LH/RH floor side rail outer panel, LH/RH side wall inner/outer panel...etc., by welding them together. Figure 5-4 is the dismantle diagram.

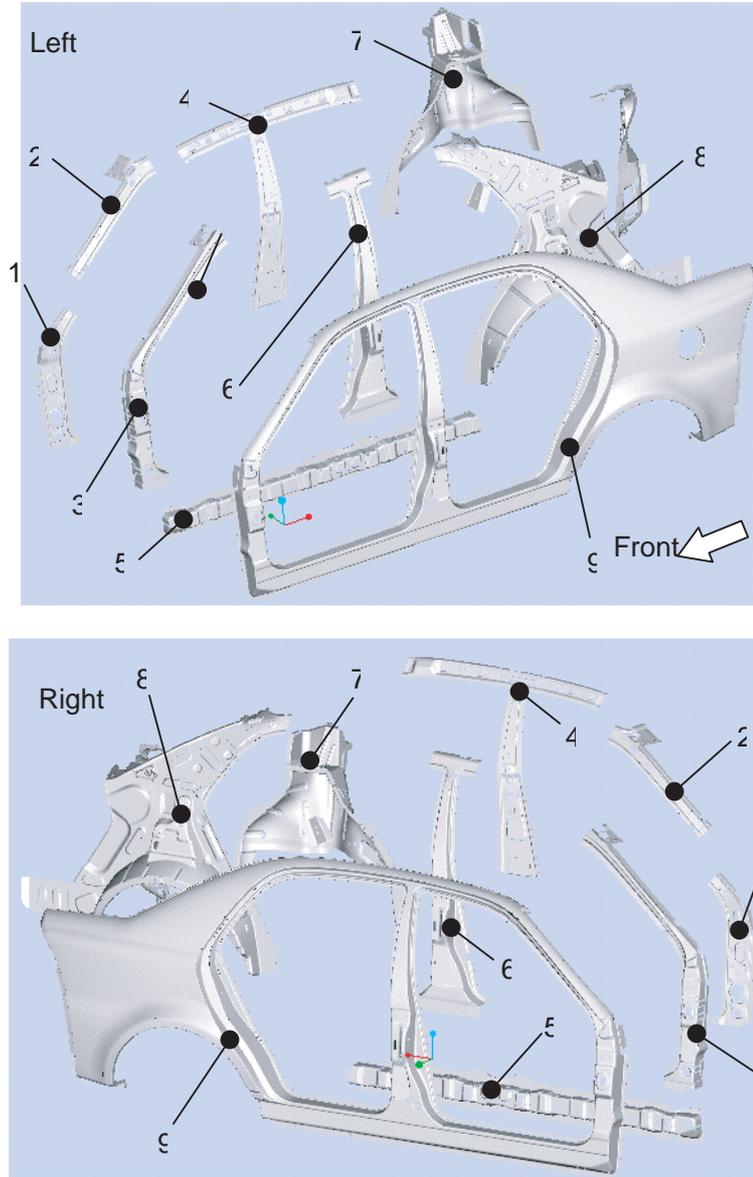


Figure 5-4 Decomposition Diagram of Quarter Parts

- |   |  |  |
|---|--|--|
| 1. LH/RH Front Pillar Inner Plate                             | 2 LH/RH Upper Side Member Front Inner Plate      | 3 LH/RH Front Pillar Outer Plate Reinforcement |
|   | 4 LH/RH Upper Side Member Inner Plate Assy.      |  |
| 5.LH/RH Doorframe Lower Side Member Outer Plate Reinforcement | 6 LH/RH Central Pillar Outer Plate Reinforcement | 7 LH/RH Rear Wheel House Inner Plate Sub-assy  |
| 8 LH/RH Rear Wheel House Outer Plate Sub-assy                 | 9 LH/RH Side Wall Outer Plate                    |  |

#### (IV) Rear Back Panel Parts

Rear back panel assembly is mainly composed of parts such as rear back panel, rear back panel reinforcement, trunk lock mounting plate, trunk lid cross member, etc., by welding them together. Figure 5-5 is the dismantle diagram.

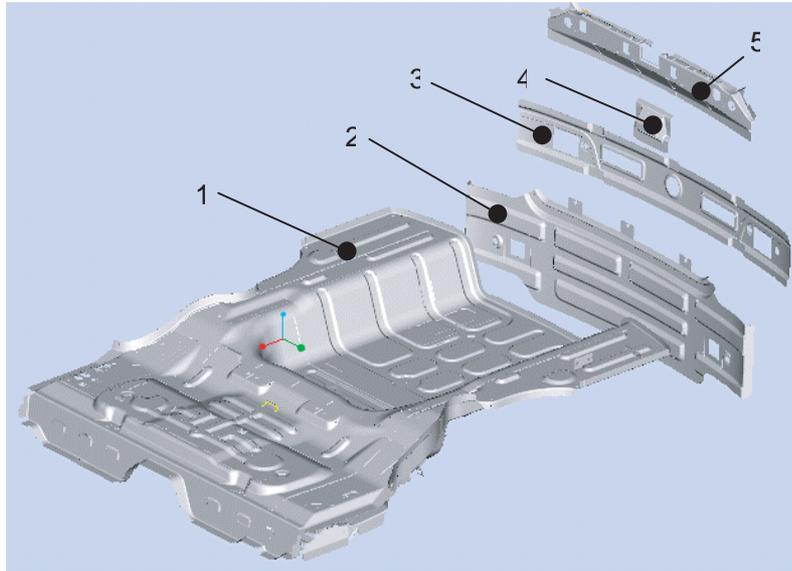


Figure 5-5 Dismantle Diagram of Rear Quarter Assembly

1 Rear Floor      2 Rear Back Panel    3 Rear BackPanel Reinforcement    4 Trunk Lid Lock Mounting Plate    5 Trunk Lid Cross Beam

The rear back panel is used for effect of a cross member to strengthen the intensity of the rear part of the body and form an opening of the trunk.

## (V) Roof Panel Assembly

Roof panel assembly is mainly composed of parts such as roof panel, roof front cross member, roof central reinforcement, roof rear cross member, etc., by welding them together. Shown as the dismantle diagram 5-6. Roof interior trim is mounted inside; and an insulation mat is pasted in its interlayer. Cohesive binder is applied between the front/central/rear cross member and the roof panel in many points. The rainwater from the roof panel flows out of the rear body through roof drip channel that are on the both sides of the roof panel. Cross members and reinforcement members are used to strengthen the rigidity of the roof panel in transverse direction.

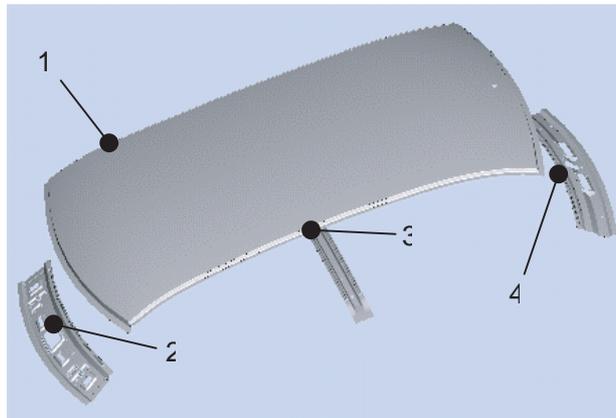


Figure 5-6 Decomposition Diagram of Roof

1 Roof Panel      2 Front Roof Cross Member      3 Roof Central Reinforcement  
4 Rear Roof Cross Member

## (VI) Trunk Shelf Assembly

Trunk shelf assembly is mainly composed of parts such as trunk shelf panel, trunk shelf front reinforcement plate, drip channel etc., by welding them together.

Trunk shelf is welded to the LH/RH quarter, which and rear floor, the back of the quarter form a trunk. Meanwhile, a frame that can resist to torsion is also generated. Figure 5-7 is the dismantle diagram.

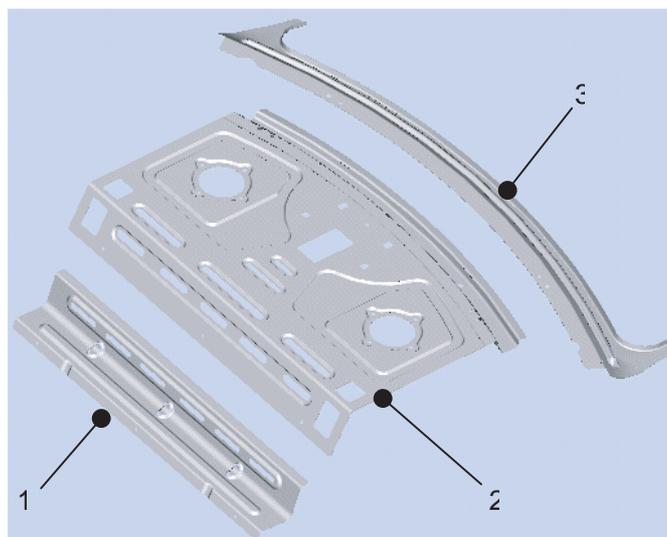


Figure 5-7 Decomposition Diagram of Floor Parts.

1 Trunk Shelf Reinforcement Plate      2 Trunk Shelf Panel      3 Drip Channel

## II. Removable Sheet Metal Parts

### (I) Engine Hood, Front Fender

1. Engine hood is mainly used to protect the engine, meet the whole vehicle design, and make the maintenance convenient. It also has an effect of isolating the engine noise. The engine hood has a double-insurance lock system. The release of the first lock is controlled by the drawing cable that is under the instrument panel. As to the release of the second lock, you should firstly release the first one and the hood will open, and then move the hood lock hook. The double-insurance lock system is designed for safety, especially in the course of running with a high-speed, to prevent the engine hood from being raised, which often causes traffic accidents. The angle of the hood that is fully opened is  $52^{\circ}$ . As shown in Figure 5-8

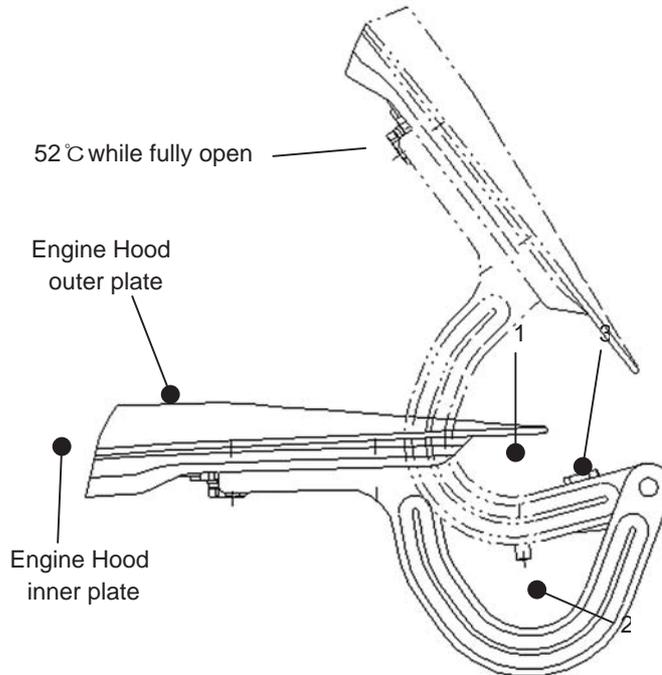


Figure 5-8 Engine Hood Hinge

1 Hinge Bracket    2 Hinge Arm    3 Pin Shaft

### (II) Front Fender

The matching relationship between the front fender and hood, front door is as shown in the Figure 5-9.

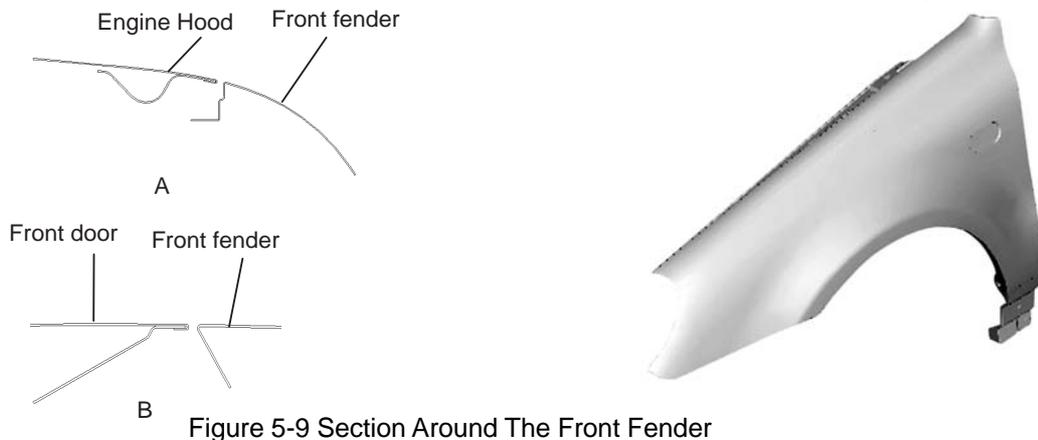


Figure 5-9 Section Around The Front Fender

A) The matching relationship with the hood ( $5\text{mm} \pm 0.5\text{mm}$ )

B) The matching relationship with the front door ( $5\text{mm} \pm 0.5\text{mm}$ )

### (III) Door Assembly

The door adopts limit hinges. The hinge is mounted on the front pillar of the door frame.

A door is mainly composed of the door outer and inner plate, anti-impact bar and door reinforcement plate.

The structure of the door is complicated, because it is a movable part. It is designed to form a sealed compartment with the main body and relevant parts, and also convenient for drivers and passengers to get in and out of the vehicle. And the devices on the door have to bear high-frequency operation. So it must meet very high requirements in reliability and durability.

The inner and outer plates are both molded from a whole steel plate, which is for improving the rigidity and assembly accuracy. In order to assure the safety when the vehicle is crashed on the side of the body; anti-impact bar and central reinforcement plate are equipped in the door.

Door plate assembly is composed of the outer and inner sub-assemblies. Use a special folded edge machine to wrap along the full circle of the door outer plate and the inner plate sub-assemblies to get them together.

As shown in Figure 5-10 & 5-11

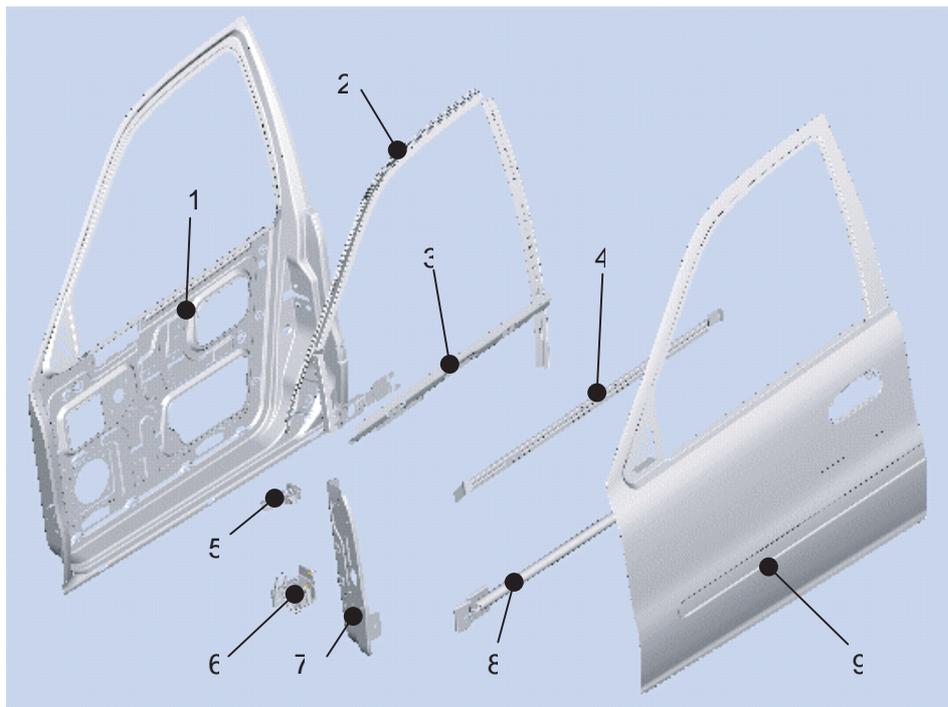


Figure 5-10 Dismantle Diagram of Front Door Plate

- |   |                                  |  |
|---|----------------------------------|--|
| 1 Front Door Inner Plate                      | 2 Front Door Window Glass Rail   | 3 Front Door Inner Upper Reinforcement Plate |
| 4 Front Door Inner Middle Reinforcement Plate | 5 Front Door Upper Hinge         |  |
| 6 Front Door Lower Hinge                      | 7 Front Door Hinge Reinforcement | 8 Door Anti-impact Bar Assy.                 |
| 9 Front Door Outer Plate                      |                                  |  |

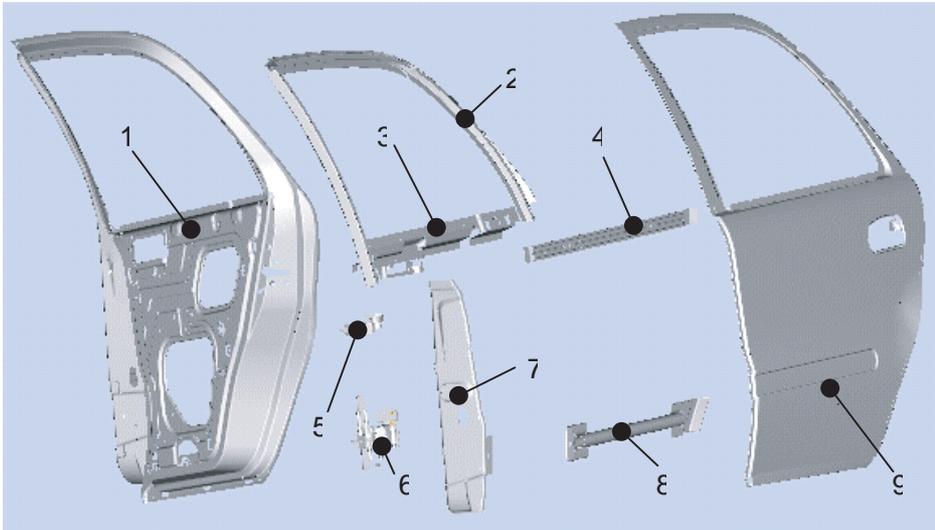


Figure 5-11 Dismantle Diagram of Rear Door Plate

- 1 Rear Door Inner Plate      2 Rear Door Window Glass Rail      3 Rear Door Inner Upper Reinforcement Plate      4 Rear Door Inner Middle Reinforcement Plate      5 Rear Door Upper Hinge  
 6 Rear Door Lower Hinge      7 Rear Door Hinge Reinforcement      8 Door Anti-impact Bar Assy.  
 9 Rear Door Outer Plate

#### (IV) Trunk Lid Welding Assembly

Trunk lid assembly is mainly composed of parts such as trunk lid outer plate, trunk lid inner plate, trunk lid hinge mounting plate, trunk lid lock mounting plate, etc., by welding them together. As shown in Figure 5-12

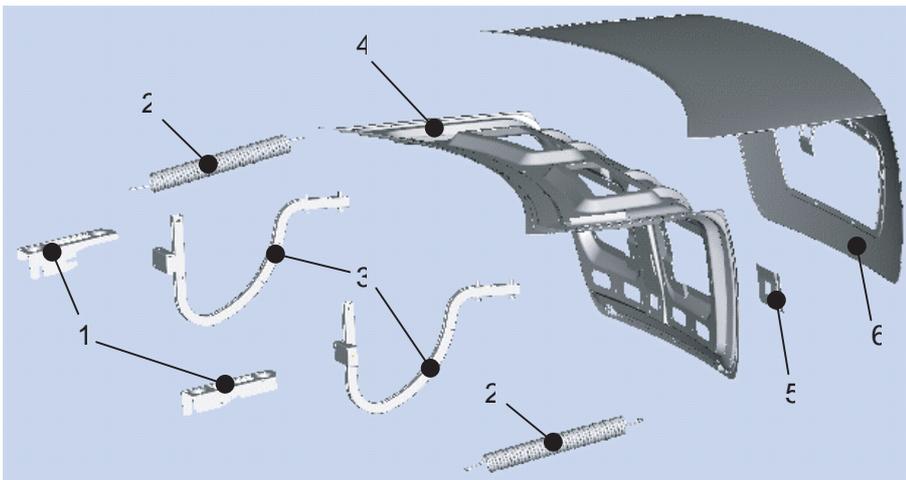


Figure 5-12 Decomposition Diagram of Trunk Lid

- 1 Hinge Mounting Plate      2 Hinge Spring      3 Trunk Lid Hinge      4 Trunk Lid Inner Plate  
 5 Trunk Lid Lock Mounting Plate      6 Trunk Lid Outer Plate

# Chapter 2 Body Repair

## Section 1 Body Damage Forms and Requirements for Repair

### I. Body Damage Forms

The body damage forms are deformation caused by crash, overload, fatigue and corrosion, and tearing, rusting, water & dust leaking.

The damage of the body is caused not only by overload, also by being often in an abnormal operating status when the door or other parts are damaged. However, at most times, accidents like crash and turnover result in bending and torsioning deflection because of the great overload on partial areas.

General conditions of the body damage are as follows:

#### 1. The Front Central Is Crashed (Figure 5-13)

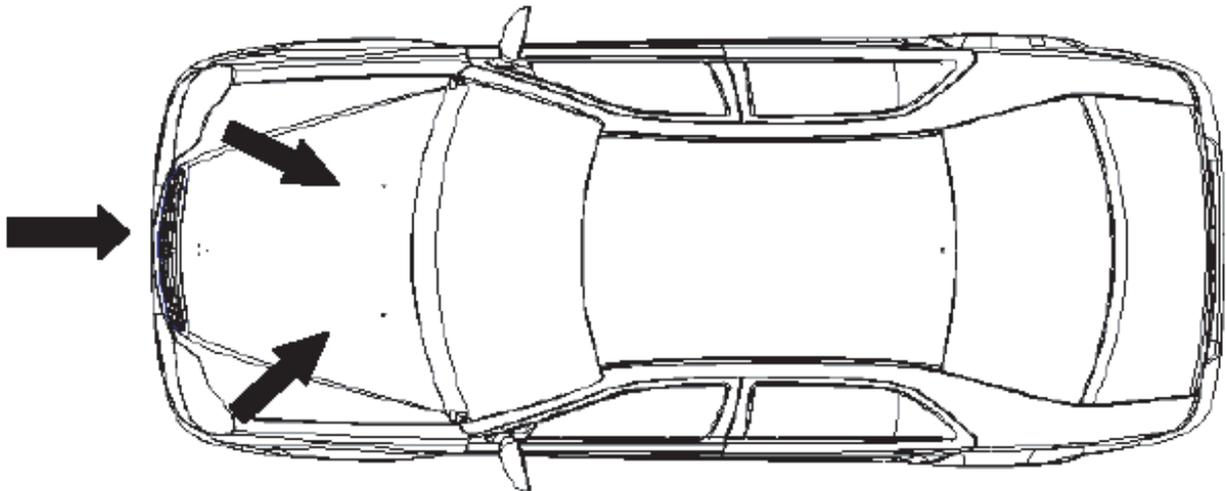


Figure 5-13 The Front Central Is Crashed

Because the front central is damaged by outside force, the left and right hood is usually stretched inwards; therefore, the following are the key places to inspect.

- ① Nearby the left and right mounting place of the hood;
- ② Nearby the left and right mounting connection place of the front cross member.

2. Crashed By Outside Force Ahead Or From The Left Side (Figure 5-14)

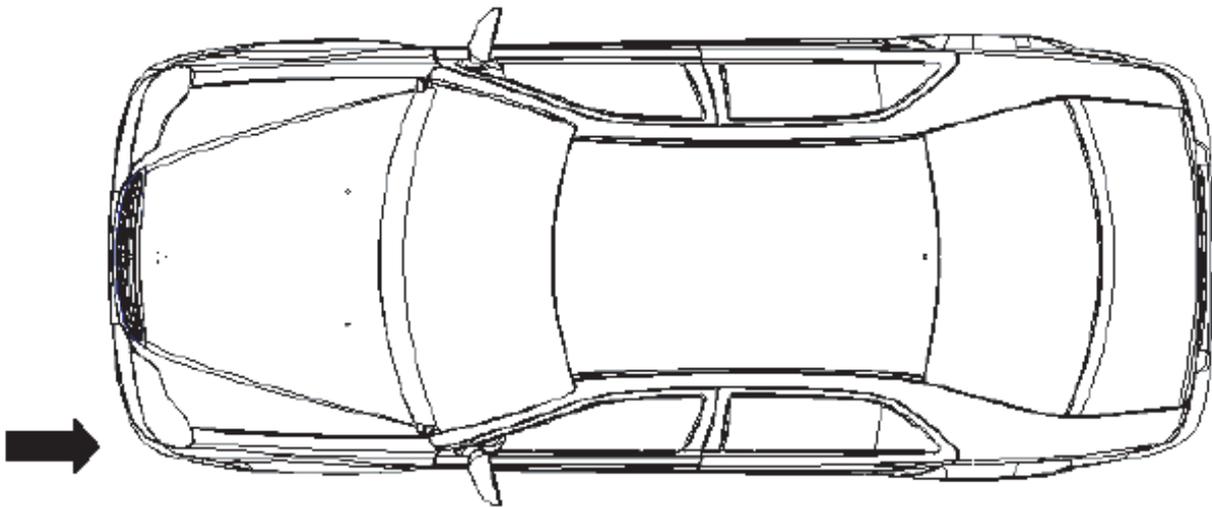


Figure 5-14 Crashed By Outside Force Ahead Or From The Left Side

Figure 5-14 shows the situation when the front is pressed or the left side is crashed by outside force. Under this kind of situation, the outside force spreads from the left (or right) of the hood to the front suspension mounting place, to get this part easily deformed.

3. Crashed By Outside Force Forming An Angle To The Center Line Of The Vehicle (Figure 5-15)

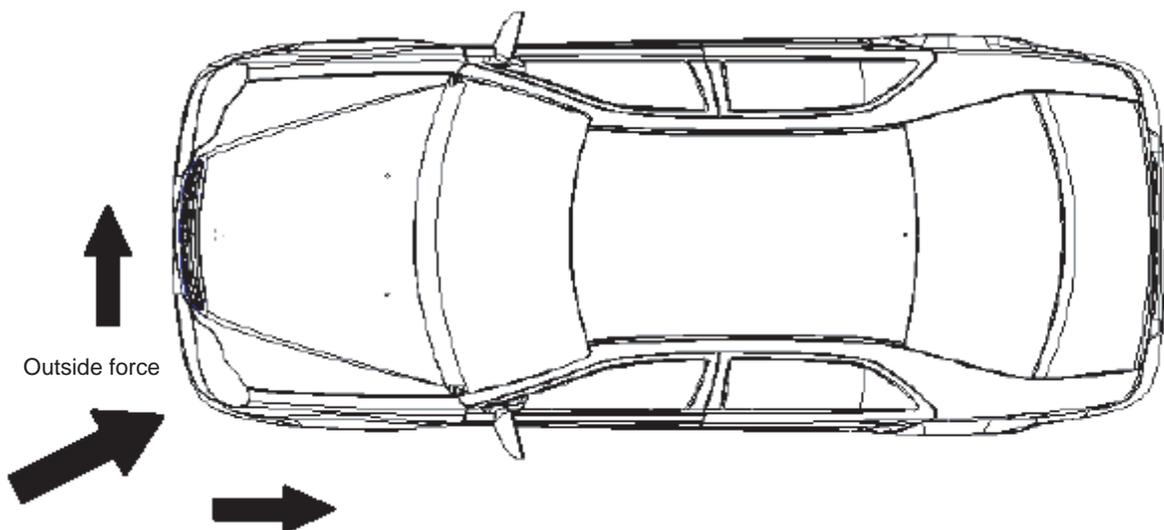


FIGURE 5-15 Outside Force Forming An Angle to The Center Line of The Vehicle

Figure 5-15 shows the situation when it is crashed by outside force forming an angle to the centerline of the vehicle. When the force is too great, the hood bottom and the front window side column will be affected.

#### 4. Crashed By Perpendicular Outside Force In the Middle of The Vehicle (Figure 5-16)

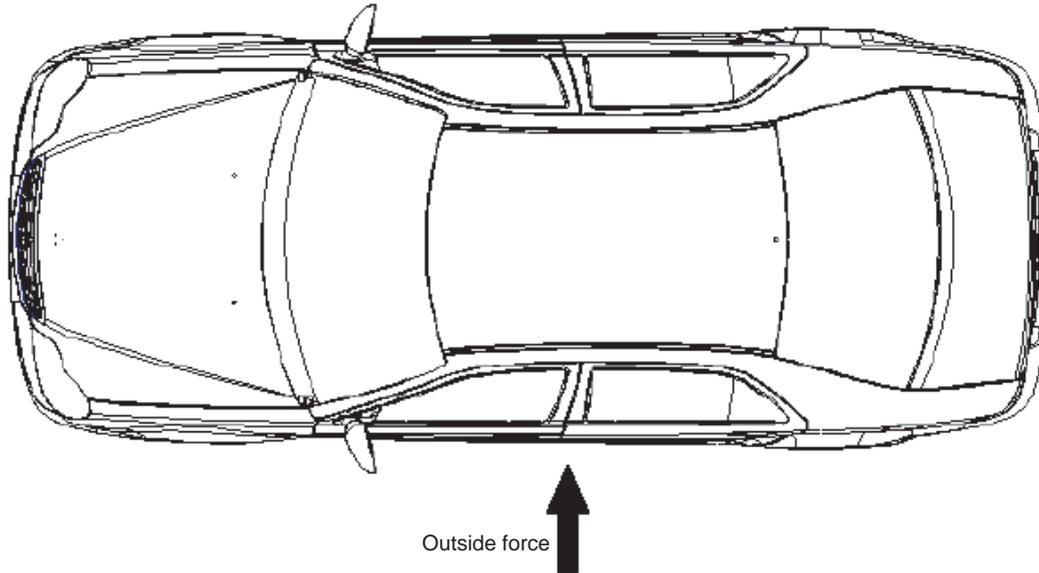


FIGURE 5-16 Perpendicular outside Force in the Middle of the Vehicle

Figure 5-16 shows the situation when the middle of the vehicle is pressed by perpendicular outside force. So, the places should be inspected are as follows:

- ① Front window side pillar upper and lower mounting place;
- ② Side window central pillar upper and lower mounting place;
- ③ Deformation of the side window rear pillar;
- ④ Deformation of the roof panel and its frame.

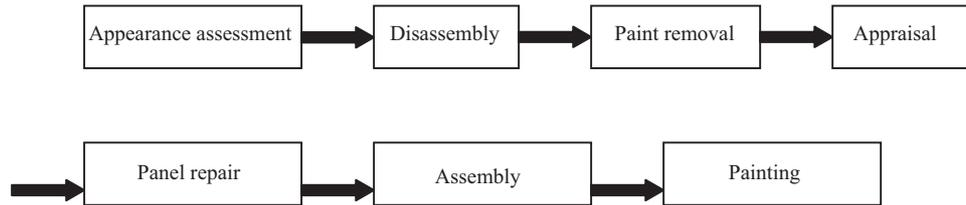
The damage when the back of the vehicle is affected by outside force is generally the same with the front. But, the structural features should be fully considered during inspection.

## II. Requirements Of Body Repair

1. Because of the integral body construction and the thin steel sheet, during the procedure of panel operation, strengthen the force-loading part after reshaping, and take measures to reduce partial stress in those places where stress gathers.
2. After the panel operation, specially make sure to spread rust-proof primer on the inner and outer surfaces to avoid rusting.
3. When repairing the body, you can either repair the broken piece or cut off the part which has serious deformation and then weld a new piece ordered from the manufacturer to the body.
4. When reshaping and welding a new piece, make sure that major control points on the body can be restored into the range of design requirements.
5. After repair, as to its intensity and durability, they should be no worse than the new body.
6. After repair, the exterior trimming of the body should meet the requirements of a new body and also the modern aesthetics and ergonomics etc that are raised by customers.

## Section 2 Typical Technology Of Body Panel Repair

The flow line of the repair technology is as follows:



## Section 3 Repair after Body Damage

Body repair methods include calibration, reshaping, strengthening, partial replacement and renewing of a whole part. CO<sub>2</sub> gas protecting welding should be adopted when welded.

### I. Reshaping

#### 1. Calibration

The deformation of the body is usually caused by an accident. You can calibrate it by propping to its former location. When calibrating, impose force in the opposite direction of the outside force or deformation force. Under the most circumstances, calibration in a cool status can be adopted. The internal stress can be removed by partial heating. Then you can do some corresponding aging treatment.

It is better to use body calibration machine for car body calibration. Geometric dimension and tolerance can be restored to the former standard. Power, economy and comfortableness can be assured.

The body repair begins with a process of preliminary calibration or rough calibration. The body deformation can be removed by propping back to its former location. The angle of the applied force for propping back should be almost the same with the outside force that causes damage. Reaction force should be imposed at the back of the pulling action point to make the propping force adjustable. Inspect the deformation during the process of propping back. Proper heating is applied on correspondent parts to remove internal stress.

#### 2. Strengthening

When partial damage, break or crackle occur on structural components, strengthening is allowed, especially to be applied in those parts where damage often occurs. Willful strengthening or repair welding should be avoided, because it will affect the stressing status on body.

The main ways of strengthening are sleeving and bracket reinforcement.

#### 3. Partial And Whole Part Replacement

The parts that are badly rusted should be partially replaced. What is broken and damaged should be replaced with a new one. The post pillar is pressed and molded adopting thin sheet. Parts and components are brought from manufacturers. When they are molded by you, material, section dimension, and thickness etc should accord with their original design requirements. When the broken post pillar (incl. cross member) is wholly replaced, the connection way must be the same with the original one.

## II. Repair of Body Outer Plate

### 1. Types Of Outer Plate Damage

#### ① Break or crackle

The body always vibrates as the vehicle runs; and it bears an alternating load. When the vehicle suddenly accelerates, sharply turns and emergently brakes, the body will be affected by inertia force. When the vehicle runs on a rough road, the body will get bent and deformed by torsion.

If the vehicle experiences this kind of outside force in a long term, the outer plate of the body will get broken and cracked on the parts that stress concentrates and the structure is weak.

It is easy for the stress to concentrate at the turning, edging and narrow places of the body outer plate, for example, it is easy for the 4 corners of the slide door sash to get broken and cracked.

#### ② Corrosion

The corrosion of the body outer plate is mostly caused by mud accumulated on the surface of the metal, which results in rust. Only in some special situations, it is caused by contacting chemical materials, which belongs to chemical corrosion. When the metal outer plate corrodes, the rust is generated on the outer plate, and then peels off layer by layer, so that holes appear and become bigger and bigger. Rust is easily generated on the outer plate of the skirt, drip channel, and at the joints of doors and sashes, and at the interlayer formed by outer plate and frame jointing places.

#### ③ Recess

Recess is a kind of structural damage, caused by crash or squeezing on the outer plate of the body. As to slight recess, the metal dose not extend. It belongs to plastic deformation. When it is seriously impacted and squeezed, the metal outer plate will be torn. For the vehicles running on city, side wall outter plates being crashed and scratched is common.

#### ④ Bending and torsion

Beading and torsion deformation belongs to mechanic damage. Many causes result in this kind of situation, such as body being crashed or squeezed, an alternating load in vibrating as the vehicle runs, sudden acceleration, emergent brake, sharp turn and running through a bad pavement, etc. Those can all result in bending and torsion deformation on body outer plate.

Slight deformation should be confirmed by inspection. For serious bending and torsion deformation, they can be easily found by appearance. The deformation information can be usually defined according to the clearance between door frame and their relative position changes.

#### ⑤ Breakup Welding

Outer plate being breakup welding is caused by bad welding between metal plates.

## 2. Repair Of Outer Plate

### ① Repair of crackle

The crackle on the metal outer plate can be repaired by CO<sub>2</sub> gas Protecting welding. When welded, the two sides of the metal plate should be aligned, and then spot-weld on the outside of the outer plate. If the crackle length is less than 50mm, it should be welded from the crackle end, and along the run of the crackle and the outside edge. If the crackle length is very long, it should be spot-welded in some intervals, and then weld the crackle in several sections. So, it can prevent the crackle metal from being over-burnt and warping because of an extremely high temperature.

If the crackle appears on the place that is greatly loaded and it is very convenient to weld, 2-step welding can be adopted, that is, After spot-welding on the outside, then you can first weld on the inside of the crackle. After that, a welding seam is then applied on the outside in the same run.

After the welding finishes, put a backing block under the crackle, and then use a hammer to gently knock on the outside of the crackle to remove the remaining welding stress. Finally, trim the appearance of the crackle to make it smooth and convenient to apply paint.

### ② Repair of partial damage of the outer plate

When the outer plate has partial rust or serious damage and even cannot be repaired, it can be mended by cutting off the damage or pasting a new one on it.

How to cut off the damage:

- a. Confirm the area that needs cutting;
- b. Cut a paper example;
- c. Cut the metal plate according to the paper example;
- d. Paste the metal piece cut onto the surface of the area that needs cutting off;
- e. Use a draw needle tip to make an outline along the sides of the metal piece. And cut off the damaged or rusted area along the outline;
- f. Use a wooden hammer or a backing block to smooth the cut, and use a file to file the burr, to assure that the cut is parallel with both sides of the substitute piece and the clearance should be no more than 1mm;
- g. Substitute the damaged area with the piece. Use pliers to hold it and spot-weld the joint in an interval of 50mm for fixation;
- h. Weld in sections. First weld the central part and then the left and right in turn, to avoid deformation;
- i. Use a hammer or block to knock on the seam to remove the remaining stress. And use a file or hand grindstone to grind the seam to make it smooth to the plates around. Finally, paint the substitute piece.

### ③ Repair of uneven damage of the outer plate caused by crash

When the outer plate is crashed, a concave pit appears on it. The repair should be taken from the point C (Figure 5-17). Put the block on the top of the protrusion area, use a hammer to knock it and correspondingly change the position of the block. After the protrusion area is knocked down to the level, most of concave in B area will spring back. It is already very much like the former outline of the plate. As to some little remaining depressions, use a block with a same radian with the plate and use a hand to press the block upwards. Knock the top point of the concave with a hammer (Figure 5-19).

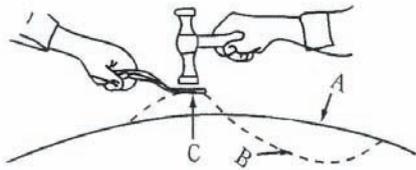


Illustration 5-18 Panel Flattening (A)  
A Concave Point B Protrusion Point C Knocking Point

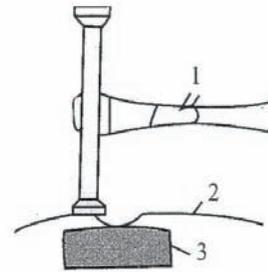


Illustration 5-19 Panel Flattening (B)  
1 Hammer 2 Panel Parts 3 Backing Block

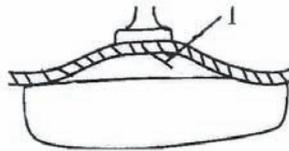


Figure 5-20 Heat and flatten the protrusion  
1 heating point

At the beginning of knocking it, make your force slightly greater. In the finishing period of repair, make your force softer and try your best to reduce the beating times. Make sure not to knock one point for too many times to avoid extending on partial area of the metal plate, which may make the repair complex.

As to the concave with a comparatively big radian, a backing plate whose area should be comparatively big can be put under the center of the concave. Directly push up the depressed plate by a propping-up tool. Sometimes, the concave place can be heated to dark red to reduce the pushing force. A slight rise is recommended when pushing up. (Figure 5-20)

Heat-shrinkable method:

After the concave area is pushed up, if the plate is greatly stretched and its area is too big to repair, the heat-shrinkable method can be adopted.

Use oxygen-acetylene flame to heat to cherry red. The area of heating depends to its extension degree. The heating area should be bigger (Diameter approx. 20-30mm), when it is seriously extended or the area is big. If it is slightly extended or the area is small, the heating area should be smaller (Diameter approx. 10-15mm). Quickly knock the heated points with a wooden hammer while they are hot. A backing block is recommended to push it up. After it cools down, use an iron hammer to gently knock for smoothness.

The shrinkage order is from the highest point gradually to the center and then to the edge. Heat and then flatten the extended area repeatedly, till the plate is completely flat. If the protrusion is very high, first compress the whole protrusion to its half. After it cools down, heat the former heating point to remove the rest half of the protrusion.

When the method is applied, it must be specially noted that you'd better not use the heat-shrinkage method to avoid side effects. Especially for thin plates, prevent them from being melted through hole..

When the outer plate is lightly crashed and the depressed area belongs to elastic deformation, you may press its inside to recover to its former shape.

Some depressed area can be repair by prying which is a repair method without disassembling parts. You

can make a reshaping repair according to lever principle by making use of different clearances. To repair by prying without disassembling parts can maintain the original assembling quality and improve the working efficiency.

#### ④ Repair of outer plate breakup welding

Outer plate being breakup welding is caused by bad welding between welding wire and metal plates. For the general breakup welding of the welding seam, a new welding can be applied after removing the welding wire accumulated at the joint. For the breakup welding of spot-welding, you can use a one-side spot welder to spot-weld nearby the breakup welding points. The new points are 10-15mm away from the original points. Before spot-welding, you should clean up the greasy dirt and rusty spot at the welding points and also make sure that the plates are well aligned.

For the breakup welding that occurs at the flanging edges, an intermittent gas welding can be applied at the edge of the plate to make the plate edge melted after the 2 plates are well aligned. The every seam length of the intermittent weld is about 30mm, and the interval of welding seam can refer to the former welding interval.

Another repair method for outer plate breakup welding is plug welding. It is better to apply CO<sub>2</sub> gas protecting welding. Drill a hole of diameter 6mm on the outer plate, and then press and well paste the 2 plates. Fill the hole with welding wire by CO<sub>2</sub> gas protecting welding. When welding, the welding wire moves in circular way directing to the inner plate to have the inner and outer plates merged together. After welding, polish and trim the surface, and then paint.

# Section 4 Features and Composition of Automobile Body

## I. Features of Body

Because the body is integral body construction, the main body is concurrently used as frame to support all load. The 3-compartment-5-door layout adopted gets the space availability the biggest and favorable to arrange the space of drivers and passengers. (Figure 5-21)

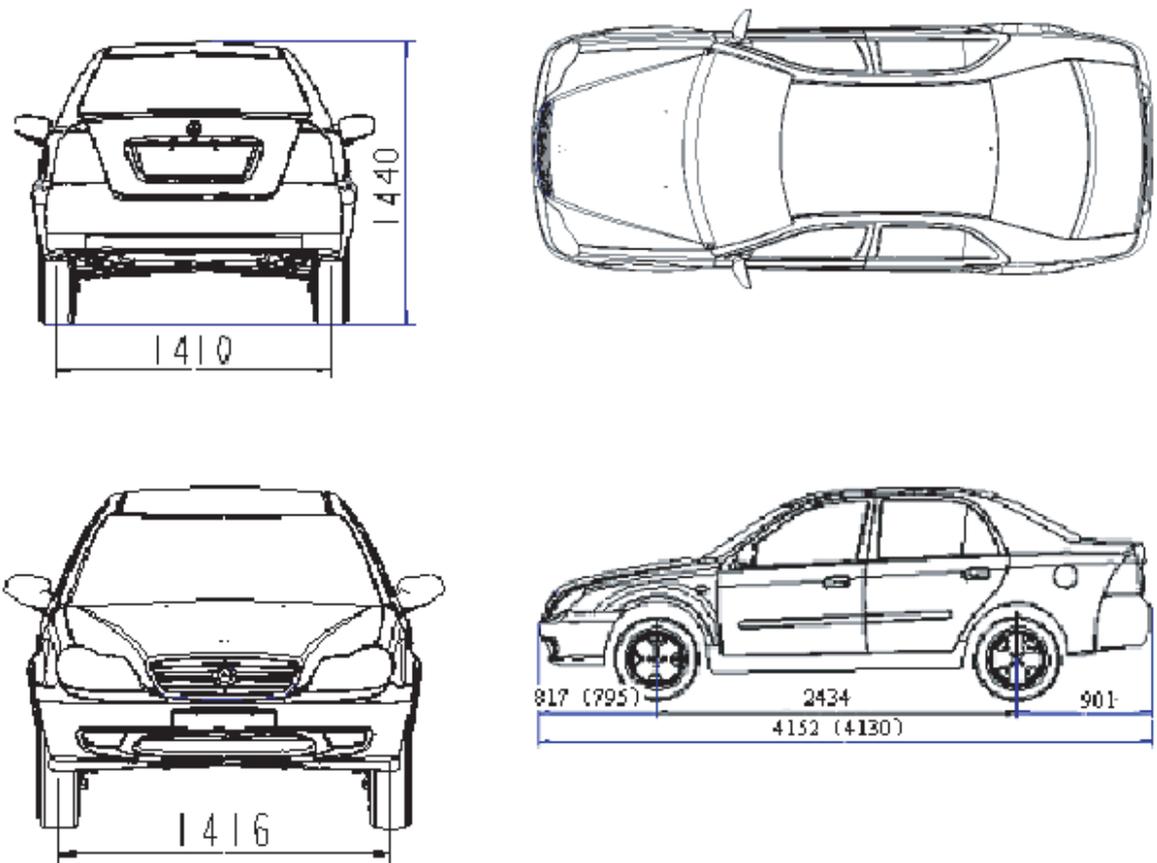


Figure 5-12 Outside Dimensions

## 1. Material Of punching Parts

In order to improve the rigidity of the body, high-tensile steel plate is adopted in many key parts of the body to reinforce the body on the place that force concentrates (Figure 5-22).



(Figure 5-22) High-Tensile Steel Plates

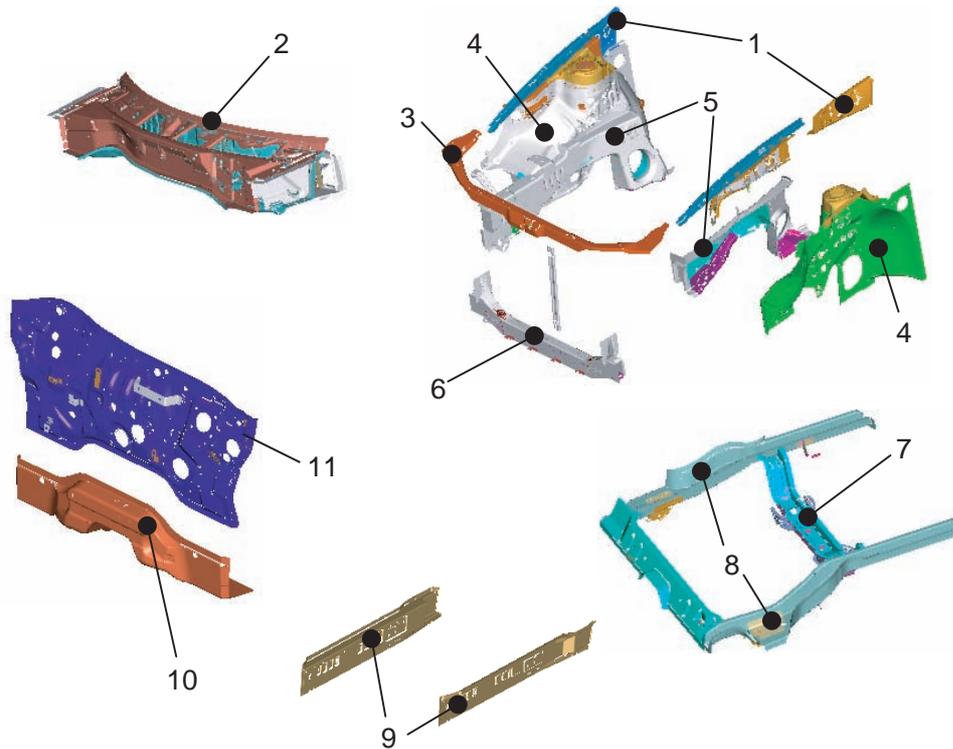
1. Engine Hood Outer Plate  
4. Trunk Lid Outer Plate

2. LH/RH Fender

3. LH/RH Central Pillar Inner Plate

5. LH/RH Door Outer Plate

In order to avoid corroding and effectively extend the service life of the punching parts, galvanized steel sheet with different specifications is widely adopted on the body (Figure 5-23).



(Figure 5-23) Galvanized Steel Plates

- |                                 |                               |                                       |
|---------------------------------|-------------------------------|---------------------------------------|
| 1. LH/RH Mudguard Reinforcement | 2 Cowl Upper Baffle           | 3 Radiator Support                    |
| 4 LH/RH Front Mudguard          | 5 LH/RH Front Side Member     | 6 Front Low Cross Member              |
| 7 Rear Floor 2nd Cross Member   | 8 LH/RH Rear Floor Side Rails | 9 LH/RH Floor Side Member Inner Plate |
| 10 Cowl Lower Cross Member      | 11. Cowl Panel                |                                       |

## 2. Vibration Reduction And Sound Insulation

### ① Take measures on the structure of the body

- a. Reasonably layout reinforcing ribs to improve the rigidity of parts and to reduce noise by restraining vibration.
- b. Fill the floor joint seam with sealant to strengthen the floor sealing and weaken the noise.
- c. Increasing the thickness of the cowl is very effective to insulate sound. The cowl is adopted sandwich structure, (Figure 5-24) that is, the cowl is welded by two steel plates (Cowl and heat insulating board), and in the interlayer of the 2 plates lies a heat insulating pad (the material of it is asphalt piece).

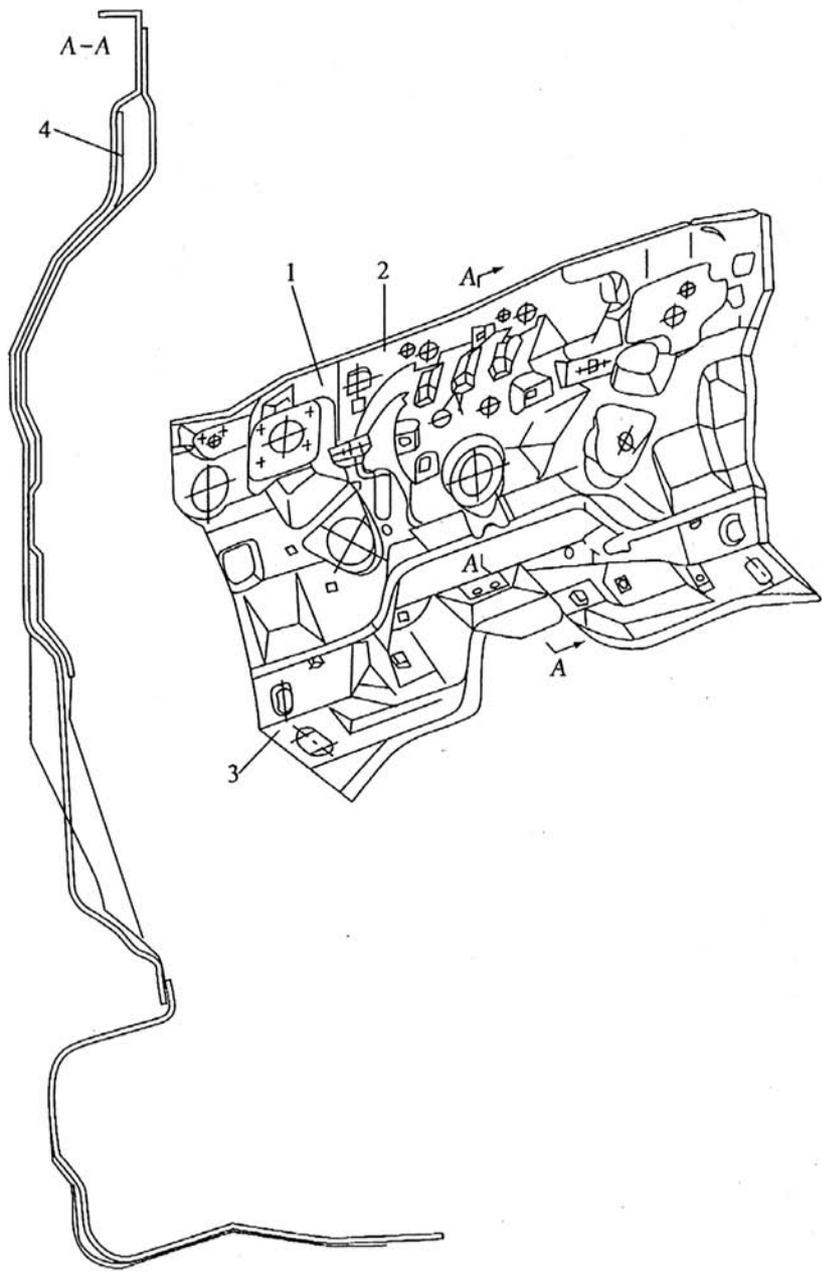


Figure 5-24 COWL

1. Cowl 2. Heat Insulating Protecting Board 3. Front Cross Member 4. Heat Insulating Pad

- ② Adopt sound insulating material to reduce the noise in the compartment.

For the heat, vibration and sound insulation of the body, they are a systematic engineering. Besides you take measures on effectively improving the rigidity of the body and sealing technique, the following measures can be taken in the body design and manufacturing:

- a. Sound insulating material: paste a layer of asphalt board on the floor and FR/RR fenders. Add insulation pads on the cowl and the floor.
- b. Sound absorbing material: adopt formed carpet which is composed of front floor carpet and rear floor carpet.

The FR/RR floor carpets are integrated with the floor and sound absorbing pad. It is required that the floor and the pad will not peeled when torn by outside force.

### 3. Sealing

An elaborate concern is taken from design and manufacturing on the body sealing. Sealing is very important for the operation performance of dust prevention, water proofing, corrosion prevention, heat protection, heat preservation, noise reduction, etc. Especially, the floor and cowl are located in the harshest outside environment. The mud splashing from road, dust and sand, wheel noise, engine noise and hot air will get in the interior environment by every opening.

After the body assemble welding completes, apply a line of sealant on all joints of the body to avoid water and vapor permeating into the metal joint and also to ensure the quality for the following painting.(Figure 5-25).

Besides, a layer of stone-strike proofing paint is applied on the bottom of the body. The paint has good sealing effect. For the sealing of mounting parts on the body, traditional methods are generally adopted, such as rubber sealing ring, cover, rubber strip, special-shaped sealing strip, etc. But in order to make more minute and rigorous considerations in design and manufacturing of structural parts and the stability of the dimension relationship of contacting sealing. For windshield and rear back door glass, a natural-curing high-tensile sealant is adopted in sealing. It represents the advanced modern techniques in reliability and mounting technology.

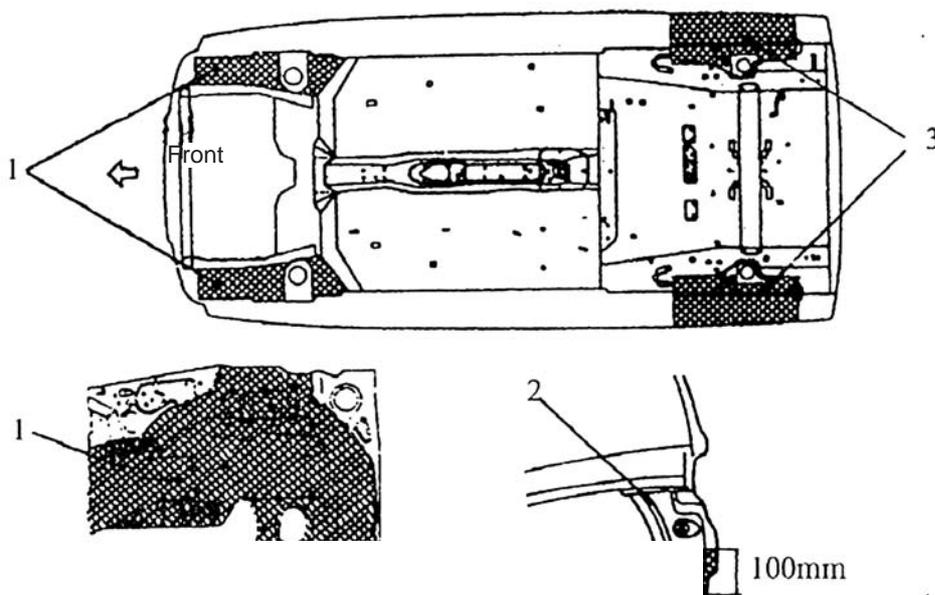


Figure 5-39 Area Where Chloride Ethylene Plastisol Is Applied  
1. Front Mud Guard 2. Rear Side Wall 3. Rear Wheel House

#### 4. Surface Treatment Of Body

The consideration of the body surface treatment is very strict, careful and considerate. Although it is not high-grade car, it is nearly the same with the high-grade car on the surface treatment.

##### ① Application of Galvanized Steel Plate

In order to prevent the steel plates from rusting, all outside punching parts are made by galvanized steel plate.

##### ② Phosphatization

Phosphatization is also called pre-treatment of painting. After degreasing cleaning to the body, a layer of zinc phosphate is applied on the body. The layer thickness is controlled less than  $3\mu\text{m}$ , which can take effect as the first protecting layer and also is favorable to adhesion of the coating used in the next step.

##### ③ Cathode Electrophoresis

Electrophoretic painting shows its high efficiency and quality, safety, economy, etc. in actual application. Four kinds of electrochemical phenomena (dielectric, electrophoresis, Electrodeposition, electroosmosis) appear in the course. The feature and the advantage of cathode electrophoresis is multiply better than anode electrophoresis. None is better than it and the technique management is also extremely strict.

##### ④ Intermediate Coating

The intermediate coating is one located between the base coating (primer) and the surface coating. The function is mainly to improve the flatness of the workpiece surface and the base coating and to create a good base for top paint. The brilliance and fullness of the painting layer and the decorating effect of the coating will be greatly improved.

##### ⑤ Final Coating

The final coating on a vehicle is the last coating in multilayer coatings. It will directly influence the decorating effect, weather resistance and the appearance of the vehicle. Choosing final coating is very strict. Match, economy and operational easiness should be considered. The performance of all items can reach the national and company standard. The appearance of the paint film is flat, smooth, plump, etc.

##### ⑥ Protecting coating for storage

When left in an open air for a long term (more than 3 months) or transferred by sea, a layer of water soluble protecting wax should be applied on the surface of the body. Ultraviolet absorbing material is added in the protecting coating. Clean it with detergent or fresh water before selling to make the brightness of the painting reappear.

## Section 5 Painting Technique after Body Repair

Partial painting is needed when the vehicle crashes, parts rust, surface bubbles and color changes. The painting techniques after repair are as follows:

### I. Base Treatment (Pre-Treatment)

1. Peel the layer of painting and the coating on the panel.
2. Remove the edges and corners and polish the steel surface where painting peeled and the paint film at the edges.
3. Cleaning and degrease. Clear up the dust and dirt and remove the oil, etc with degreaser.

### II. Base Coating Procedure

1. Apply primer. Apply air drying type paint on the metal surface.
2. Air dry or heat dry (infrared drier) the primer.
3. Apply putty. Apply air drying type oil-base putty and Polyester-base putty on the panel surface that needs repairing.
4. Air dry or heat dry the putty.
5. Manually polish the putty to make it smooth.
6. Manually polish with water to clear up tracks caused by sand paper.
7. Clear up the dust and the greasy dirt, and dry the putty polishing liquid.
8. Clean the greasy dirt on the polishing surface.
9. Use shield cover or paper to keep out the area that need not repairing.

### III. Intermediate Coating Painting

1. Paint the second primer.
2. Air dry or heat dry.
3. Apply putty, and let it dry. Then look for sandhole or sand paper tracks.
4. Manually polish with water.
5. Clean it and let it dry by air. (The times of applying putty and polishing depends on the smoothness of the surface)

### IV. Preparation For Applying Final Paint

1. Shielding. Shield the area that needs not painting with paper.
2. Clear up the dust and degrease. Clear up the dust and oil on the painting surface.
3. Toning. Mix paints to get the color the same with the final paint.
4. Mixing paints.

## V. Final Paint Applying

1. Apply final paint. Apply fast drying final paint for 3 or 4 times and synthetic resin paint for 2 or 3 times.
2. Air dry or heat dry.

## VI. Polishing

1. After painting, you can polish with wax to remove the repairing paint shadow for decoration consideration.
2. Take off the shield. After painting, take off the paper, and clean the paint scattered on the other area.
3. Inspect the quality of appearance.

## Section 6 Service Data For Body

### I. Service Data For Body (Table 5-1)

TABLE 5-1 Service Data For Body

Content	Service Data
Reshaping clearance between engine hood inner and outer plate	3mm±0.5mm
Clearance between LH/RH fender and hood	5mm(0,-1mm)
Clearance between LH/RH headlamp and hood	7mm±0.5mm
Clearance between front bumper and fender	≤1mm
Clearance between LH/RH headlamps and bumper, fender	5mm(0,-1mm)
Clearance between fender and LH/RH doors	5mm(0,-1mm), Height error ≤0.5mm
Clearance between hood and bumper	7mm±0.5mm
Clearance between radiator grille and hood	0.5mm
Cowl ventilator cover hole and wiper shaft are homocentric. Coaxial Degree	No more than 2mm
Clearance between door and side wall	5mm(0,-1mm)
Clearance between door and sill	7mm±0.5mm
Clearance between fuel fill port cover and side wall	3mm±0.5mm
Clearance between rear bumper and side wall plate	1mm±0.5mm
Clearance between Rear tail lamp and side wall plate	1mm±0.5mm
Clearance between windshield and drip channel	4—5mm
Glass is lower than drip channel	0.5—1mm
Clearance between glass and roof panel	4.5—7mm and lower than 0.5—1mm
Trunk lid folding edge, spot-welding interval	250—300mm Height of welding spot is no more than 1mm
Trunk lid inner plate flanging sides are higher than outer plate	1—1.4mm
Clearance between trunk lid and side wall plate	5mm(0,-1mm)
Clearance between trunk lid and rear combination lamp	5mm(0,-1mm)
Clearance between trunk lid and bumper	7mm±0.5mm
Height difference of parts which is bilateral symmetry on the outside body	No more than 5mm
Height of trunk lid limit block is proper. Height of the sealing strip when the trunk lid is locked	12mm