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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

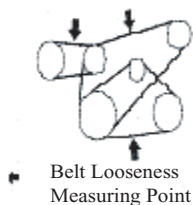


Figure 1

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.

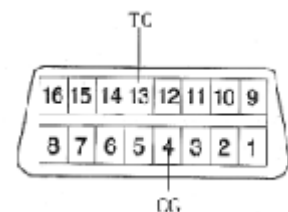


Figure 2

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).

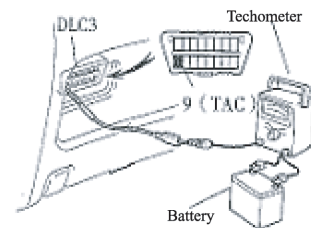


Figure 3

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.

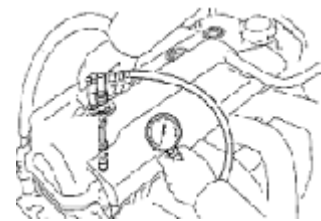


Figure 4

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)

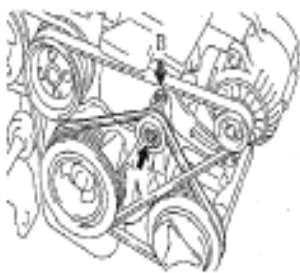


Figure 5

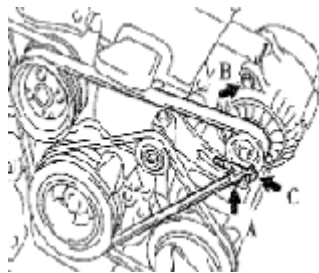


Figure 6

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

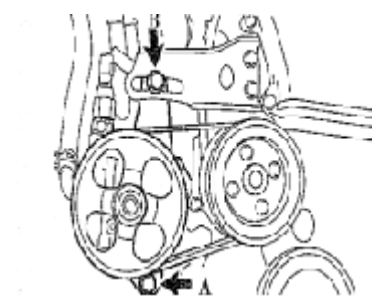


Figure 7

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

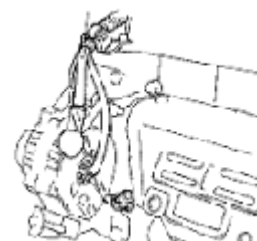


Figure 8

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.

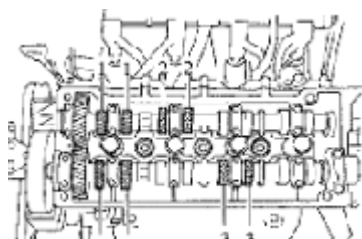


Figure 9

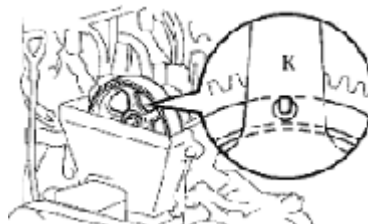


Figure 10

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).

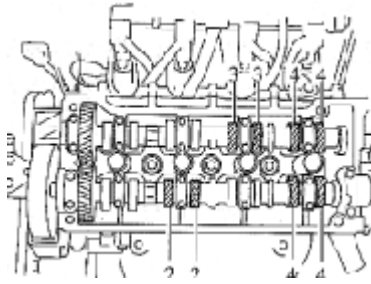


Figure 11

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.

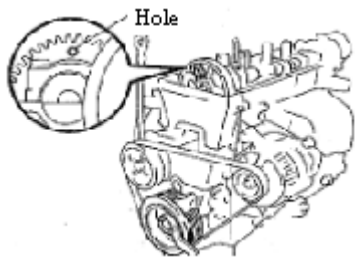


Figure 12

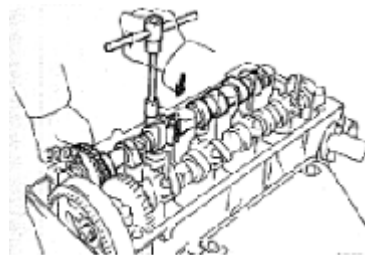


Figure 13

(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.

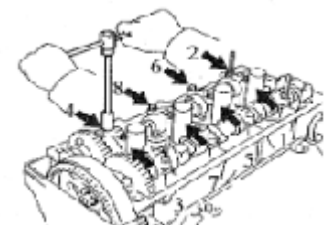


Figure 14

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.

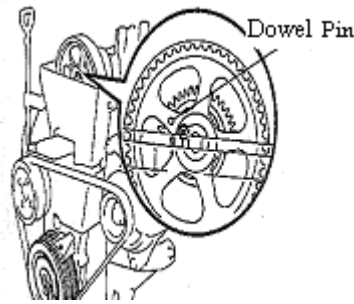


Figure 15

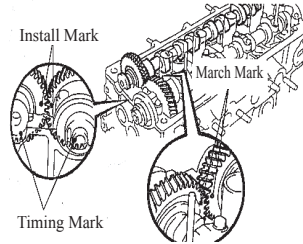


Figure 16

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.

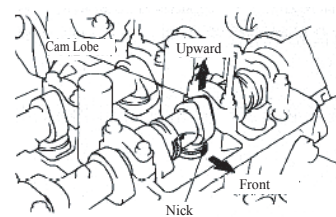


Figure 17

Hint:

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

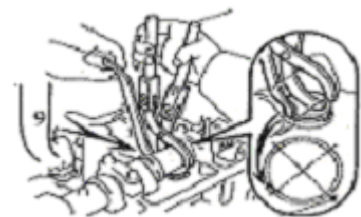


Figure 18

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

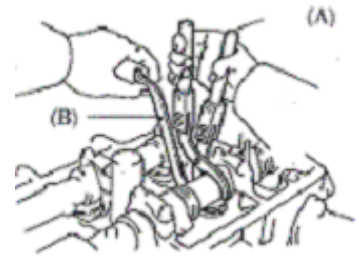


Figure 19

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

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

Section 1 Engine Components

Component 1

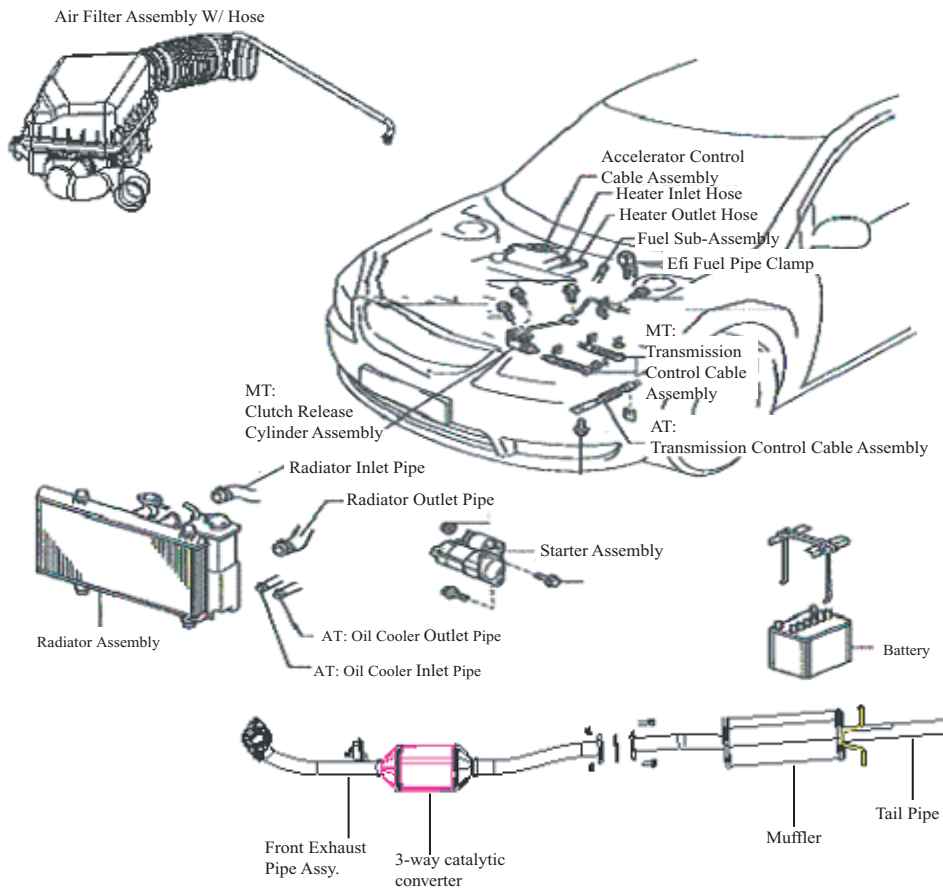


Figure 20

Component 2

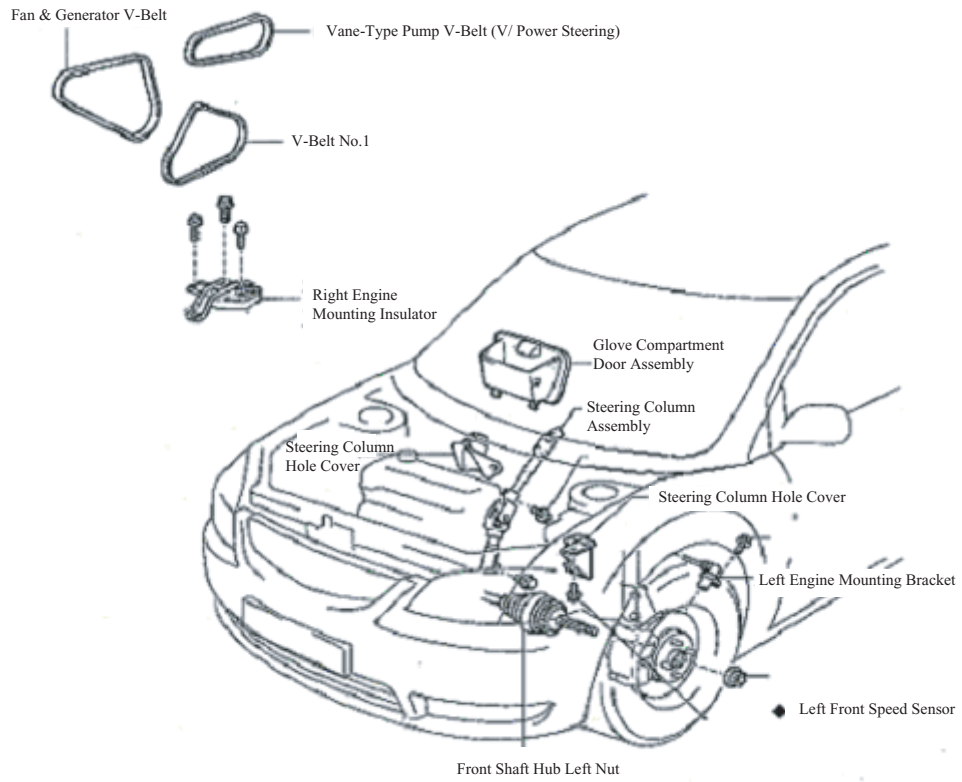


Figure 21

Component 3

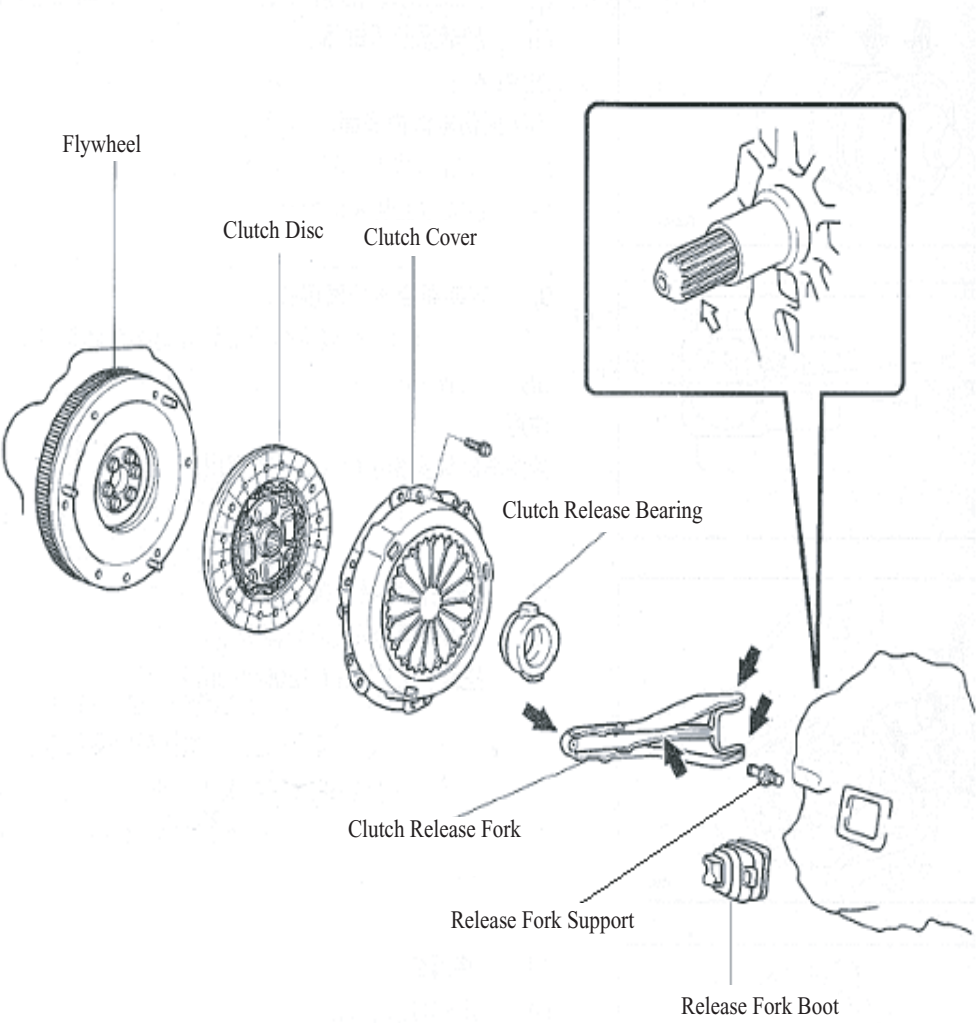


Figure 22

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. Seperate 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)

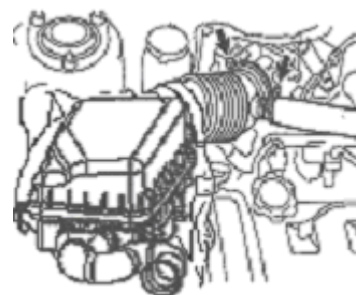


Figure 23



Figure 24

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.

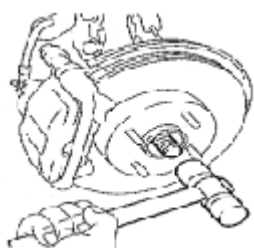


Figure 25

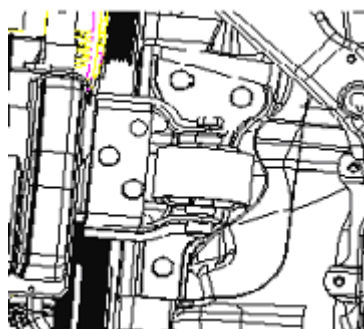


Figure 26

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).
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

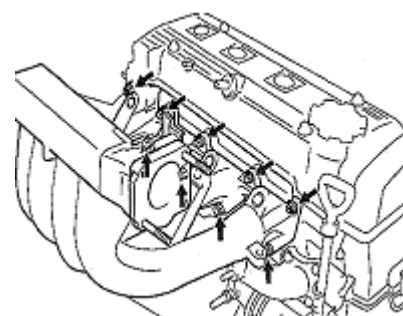


Figure 27

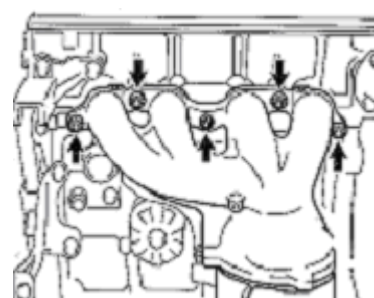


Figure 28