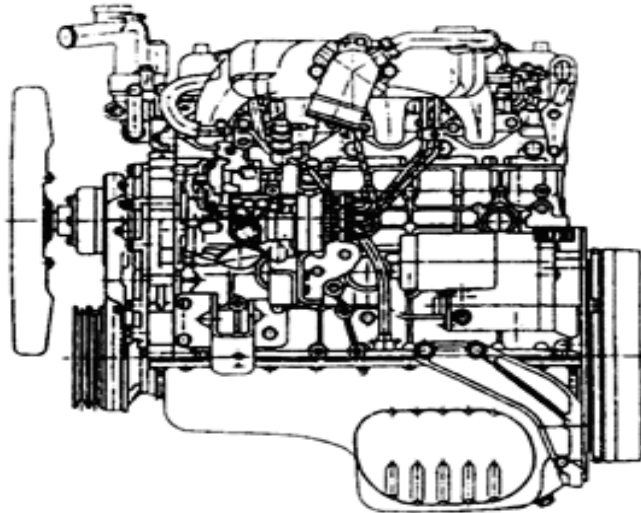




3.4 DA1 Series Engine

3.1 General



4DA1 Series

ω type combustion chamber is adopted in 4DA1 Series engine, and this kind of design provides outstanding economical efficiency of fuel within wide running range.

The cylinder head gasket is piled up with sheet steel.

Tighten the fixing bolts of such parts as cylinder head, connecting rod and flywheel with torque tightening method.

Dry cylinder liner made of chromized steel has high durability.

The piston with automatic heat compensation is supported with cast steel, which is used to reduce the noise resulted from heat expansion and cold engine.

The crankshaft by soft nitrogen treatment has long life. Because of its soft nitrogen treatment, the crankshaft can not be refaced.

Both the crankshaft main bearing and connecting rod bearing are made of aluminum alloy. This kind of bearing is particularly easy to be damaged when encountering foreign matters such as metal chips.

Therefore, it is very important to keep the oil hole and other associated surfaces clean and remove foreign matters.

The crankshaft's soft nitrogen treatment (nitrogen treatment) improves its intensity, and saves the step of refacing crankpin and main journal.

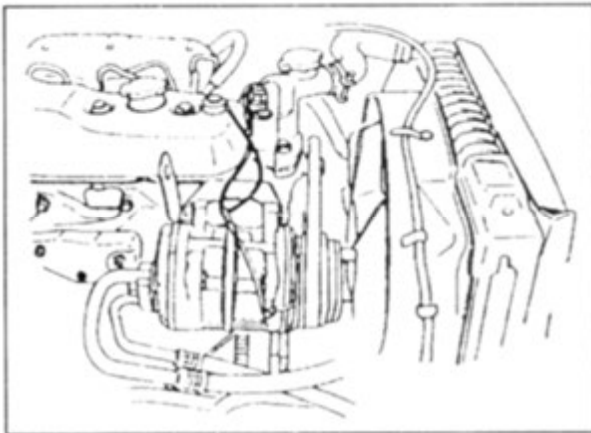
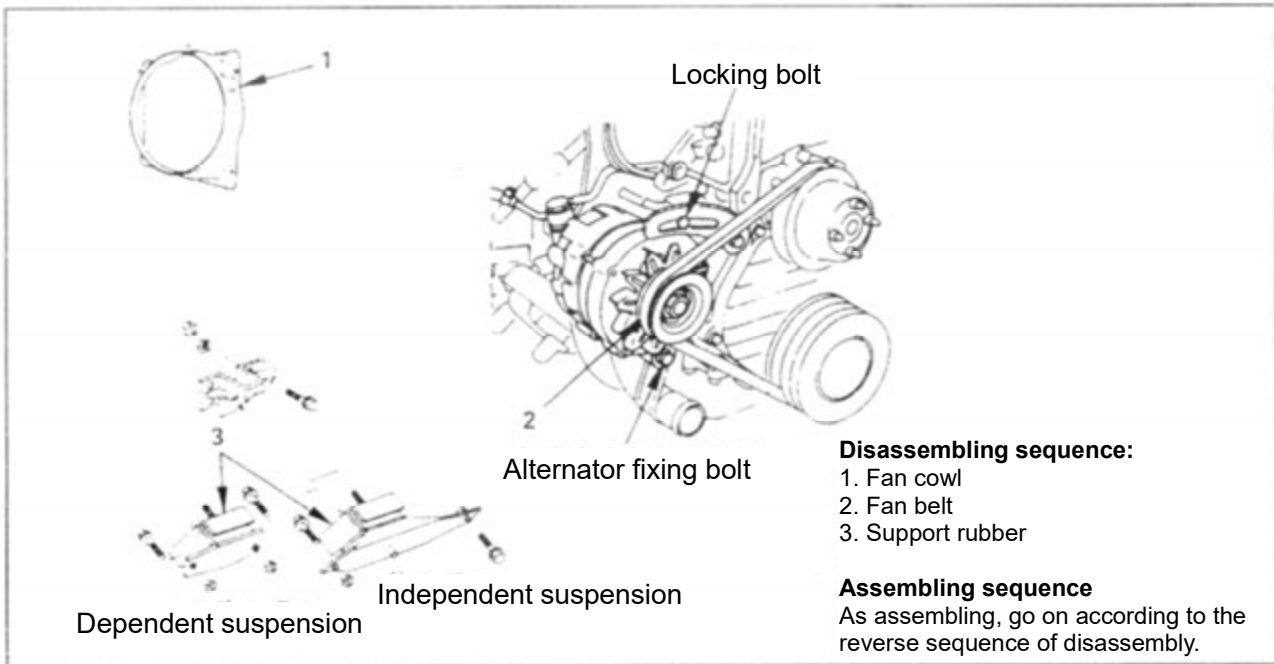
4DA1-1 engine is equipped with fuel injection device for cooling piston in the fuel line, and the fuel is injected toward piston from the fuel line of cylinder block via non-turn valve.

Be careful not to damage the oil nozzle when disassembling and assembling piston and connecting rod.

4DA1 Series is direct injection engine, and the fuel injector had five holes, which enables inlet air and fuel injection to gain optimum mixing ration.



3.2 Right support of engine



Disassembly

Preparation:

- Remove the ground cables of battery.

1. Fan guard

- Remove the storage tank hose and fan guard.

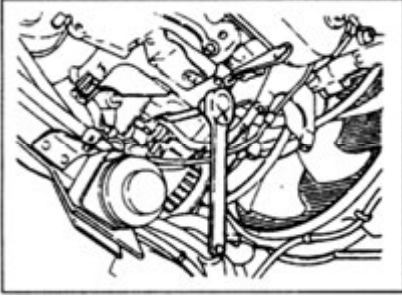
2. Fan belt

- Remove locking bolts of adjusting plate.
- Loosen the alternator fixing bolt and then remove the fan pulley drive belt.



3. Support rubber

- Remove the two fixing nuts at the beam side.




- Remove the generator from the engine.
- Remove the support rubber nut from engine foot rest side.
- Lift the engine to remove the support rubber.


 **Assembly**

3. Support rubber

- Lift the engine to install the support rubber.
- Tighten the fixing nut(s) to the specified torque.

 **Engine foot rest side** N • m

8

 **Beam side** N • m

40

2. Fan pulley drive belt

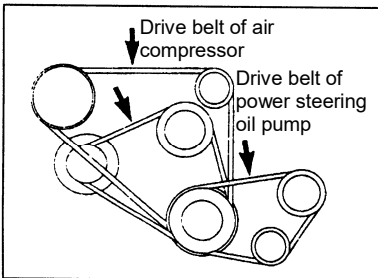
- Install the fan pulley drive belt.
- Press the middle part of fan pulley drive belt with 100N force to let the belt go down for 8-10mm.
- Tighten the fixing nut(s) to the specified torque.

 **Generator fixing bolt** N • m

37.5

1. Fan guard

- Install the fan guard and tighten the storage tank hose.





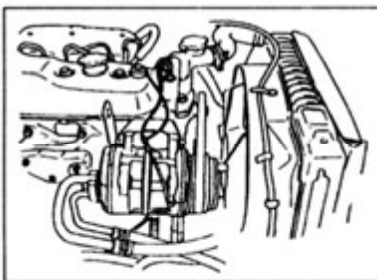
3.3 Left support of engine

Independent suspension
Dependent suspension

Disassembling sequence:

1. Air-intake duct
2. Fan cowl
3. Support rubber

Assembling sequence
As assembling, go on according to the reverse sequence of disassembly.

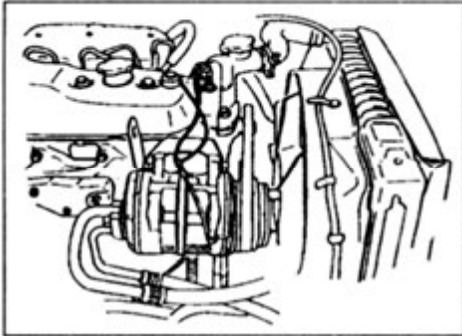


Disassembly

Preparation:

- Remove the ground cables of battery.
1. **Air-intake duct**
 - Remove the air-intake duct.
 2. **Fan guard**
 - Remove the storage tank hose and fan guard.
 3. **Support rubber**
 - Remove the two fixing bolts at beam side.

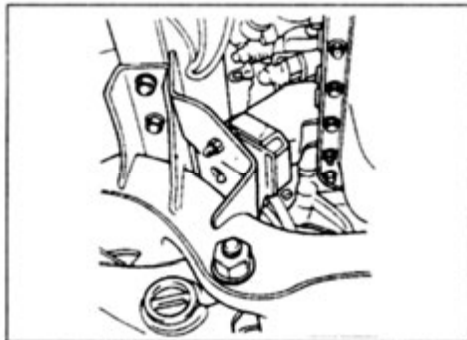




- Remove the support from engine foot rest side.
- Remove the support rubber nut from engine foot rest side.
- Lift the engine to remove the support rubber.



Assembly



3. Support rubber

- Lift the engine to install the support rubber.
- Tighten the fixing nut(s) to the specified torque.



Engine foot rest side

N • m

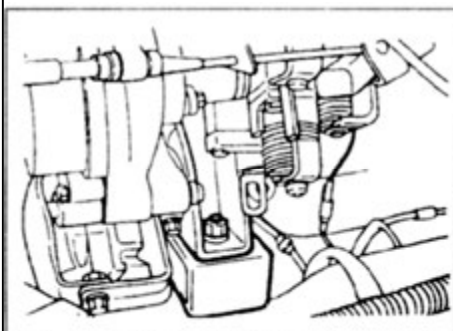
82



Beam side

N • m

40



2. Fan guard

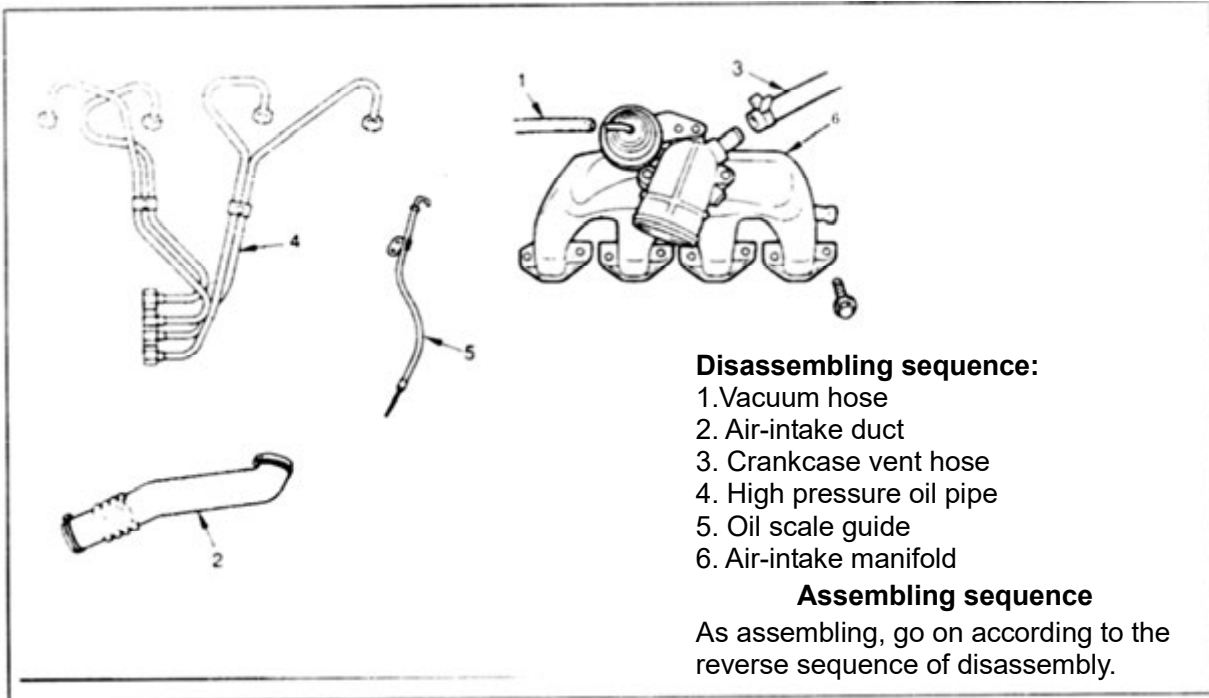
- Install the fan guard and tighten the storage tank hose.

1. Air-intake duct

- Install the air-intake duct.
- Connect the ground cables of battery.



3.4 Air-intake manifold



Disassembly

Preparation:

- Remove the ground cables of battery.
- Discharge coolant completely.

1. Vacuum hose

2. Air-intake duct

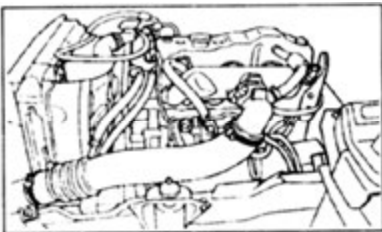
3. Crankcase vent hose

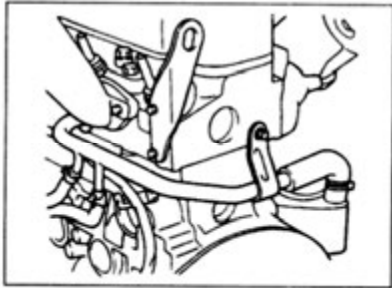
4. High pressure oil pipe

- Unscrew high pressure oil pipe clip.
- Loosen the taper nut(s) at injection pump side.
- Loosen the taper nut(s) at injector side, remove the pipe and put it aside.

5. Oil scale guide

- Remove the fixing bolt(s) and disassembly the oil scale guide.





6. Air-intake manifold

- Remove the fixing bolt(s) and nut(s) of manifold.

Assembly

6. Air-intake manifold



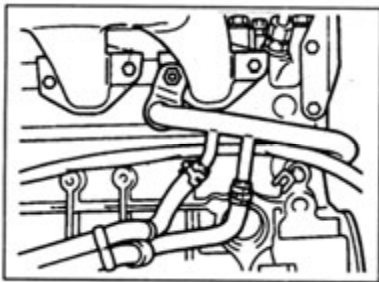
- Tighten the fixing bolt(s) and nut(s) to the specified torque.

Bolt and nut	N • m
	20



5. Oil scale guide

- Install the guide and tighten it together with the manifold.



4. High pressure oil pipe

- Connect the high pressure oil pipe and tighten the taper nut(s) to the specified torque.

Taper nut torque	N • m
	30

- Install the clip of high pressure oil pipe at the original position.

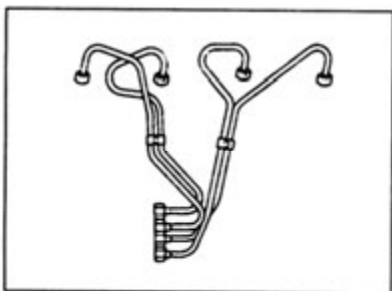
3. Crankcase vent hose

2. Air-intake duct



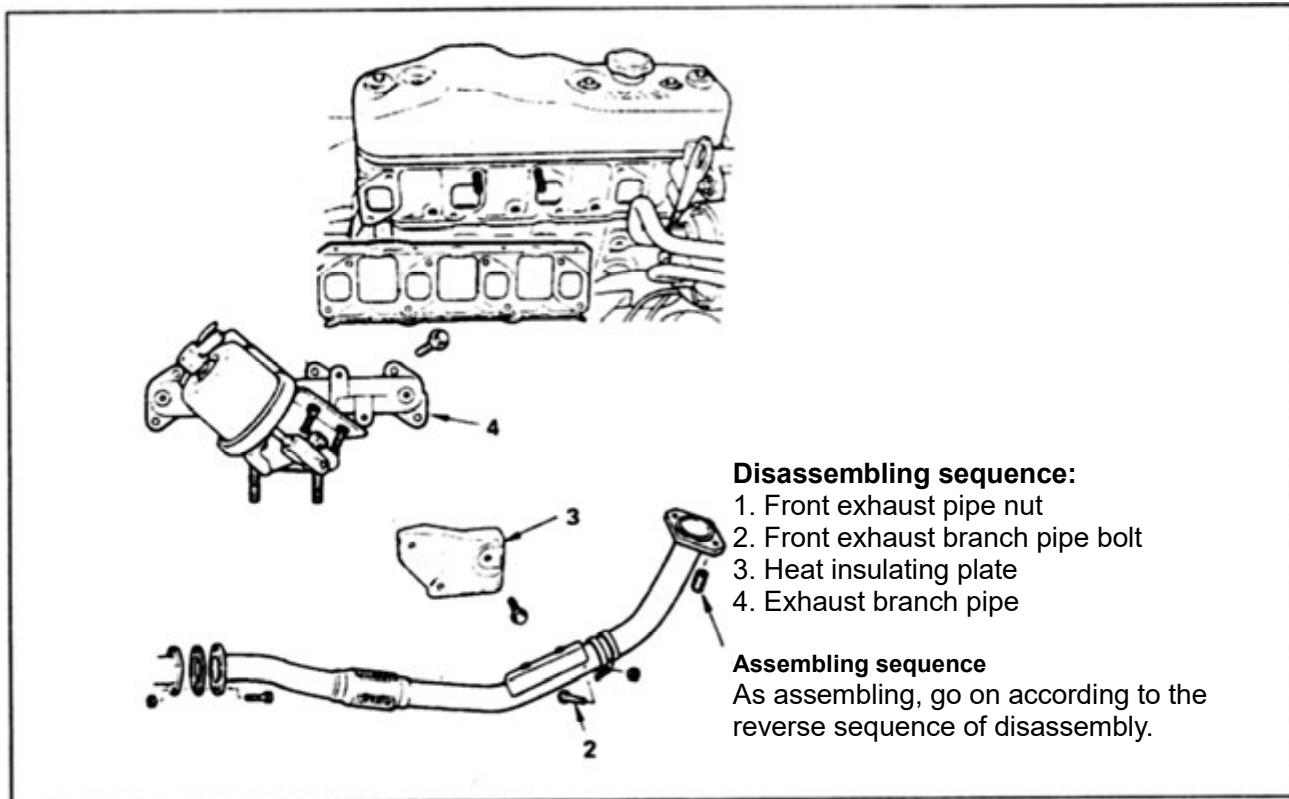
1. Vacuum hose

- Connect the ground cables of battery.
- Add some coolant.
- Start the engine and check whether the coolant leaks.





3.5 Exhaust manifold



Disassembling sequence:

1. Front exhaust pipe nut
2. Front exhaust branch pipe bolt
3. Heat insulating plate
4. Exhaust branch pipe

Assembling sequence

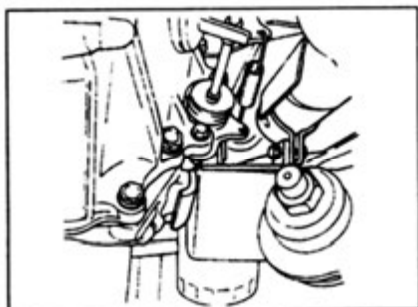
As assembling, go on according to the reverse sequence of disassembly.

Disassembly

Preparation:

- Remove the ground cables of battery.

1. Front exhaust pipe nut
 - Remove the fixing nut(s) at exhaust manifold side.
2. Front exhaust pipe support bolt.





3. Heat insulating plate

4. Exhaust manifold

- Remove the bolt(s) and nut(s) of manifold, and then dismount the manifold and gasket(s).



Assembly

4. Exhaust manifold

- Tighten the fixing bolt(s) and nut(s) to the specified torque.

Manifold bolt torque	N.m
----------------------	-----

30



3. Heat insulating plate

- Install the heat insulating plate and tighten the bolt(s) to the specified torque.

Heat insulating plate bolt torque	N.m
-----------------------------------	-----

25



2. Front exhaust pipe support bolt

- Tighten the fixing bolt(s) to the specified torque.

Support bolt torque	N.m
---------------------	-----

40



1. Front exhaust pipe nut

- Tighten the fixing nut(s) to the specified torque.

	N.m
--	-----

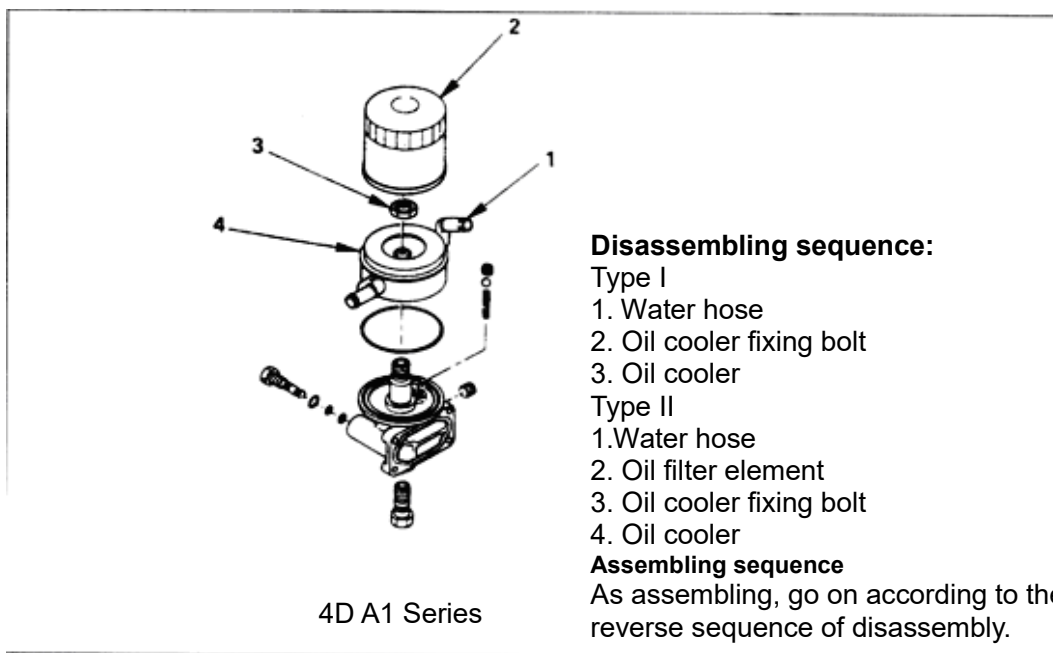
40

- Connect the ground cables of battery.
- Start the engine and check whether the coolant leaks.

cardiagn.com



3.6 Oil cooler



Disassembling sequence:

- Type I
 1. Water hose
 2. Oil cooler fixing bolt
 3. Oil cooler
- Type II
 1. Water hose
 2. Oil filter element
 3. Oil cooler fixing bolt
 4. Oil cooler

Assembling sequence

As assembling, go on according to the reverse sequence of disassembly.

4D A1 Series



Disassembly

Preparation:

- Remove the ground cables of battery.
- Discharge the coolant completely.
- Place the wiping cloth at oil cooler 9 to prevent oil immersion.

1. Water hose

- Remove water inlet and outlet hoses.

2. Oil filter element

3. Fixing nut of oil cooler

4. Oil cooler

Inspection

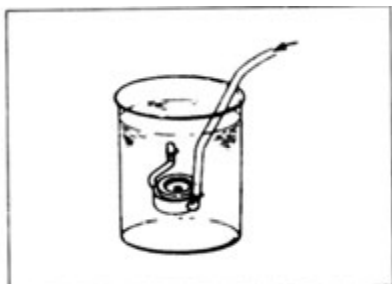


Relief valve

1. Install an oil pressure gauge at the position where the oil line is near oil filter.
2. Start the engine and check the opening pressure of the relief valve.

Opening pressure of relief valve kg/cm²

	4.7
--	-----

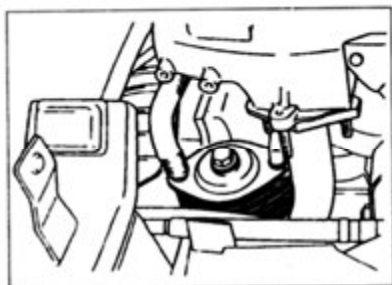


3. Oil cooler

Inspection of water passage leakage

1. Block one end of the oil cooler water passage.
2. Immerse the oil cooler into the water.
3. Add compressed air at the other end of the oil cooler water passage.

(2kg/cm²(28.5pai/19.60kpa)), bubbles rising on the surface indicates that there is leakage with the water passage.



Assembly

3. Oil cooler

- Install O ring onto the oil filter and place the oil cooler.

2. Fixing nut of oil cooler

Tighten the fixing nut(s) of oil cooler to the specified torque.

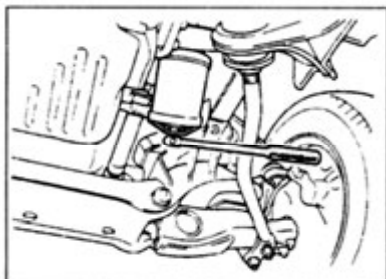
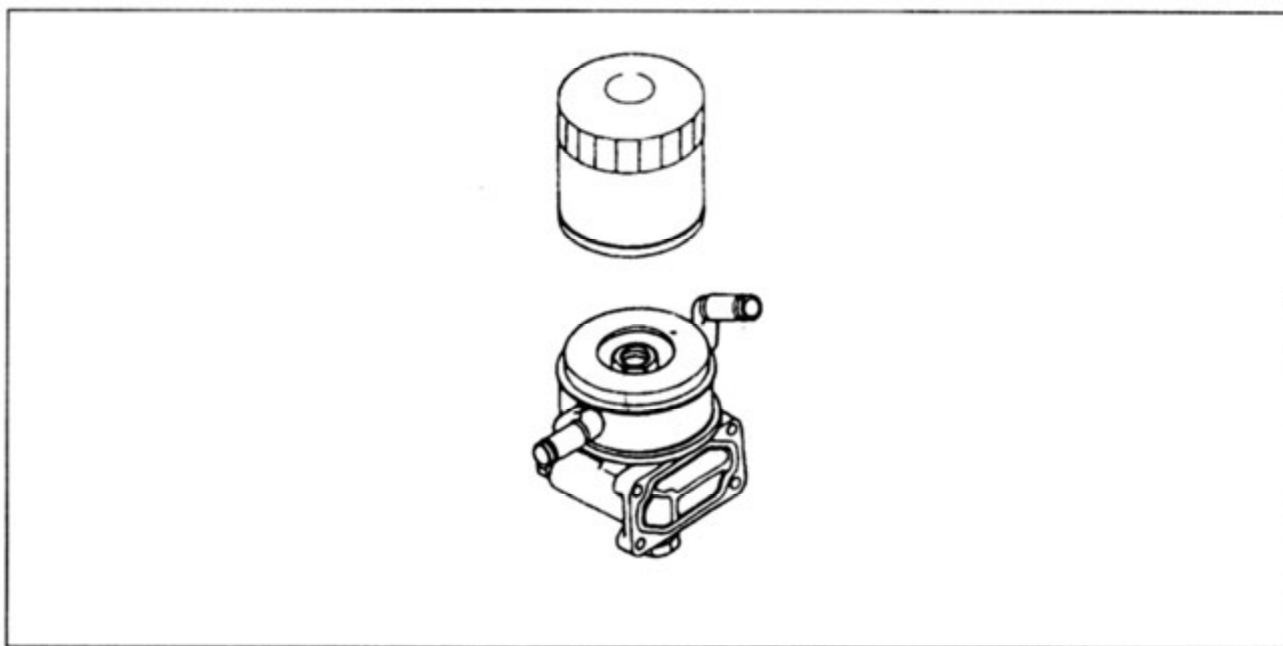
Oil cooler nut torque	N.m
	30



30

1. Water hose

- Connect the water hose.
- Connect the ground cables of battery.
- Start the engine and check whether the oil leaks.

x Oil filter element**Disassembly**

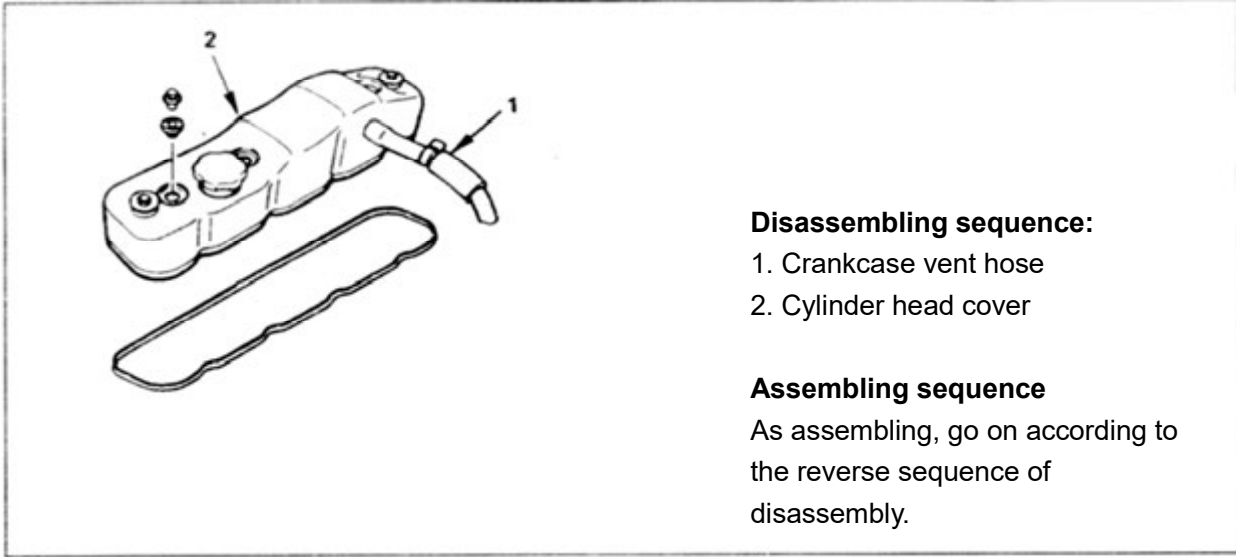
- Place a container under the oil filter to receive oil.
- Remove the oil filter element with a filter wrench.
- Filter wrench: 1010300FA-9101

**Assembly**

- Coat a thin layer of oil on the oil filter O ring.
- Screw new oil filter element into the filter until the sealing surface is jointed with O ring.
- Tighten the oil filter with the filter wrench, and screw down another $1\frac{1}{8}$ circles for I type, while screw down another $1\frac{1}{4}$ circles for II type.
- Start the engine and check whether the oil leaks from the oil filter.



3.8 Cylinder head cover

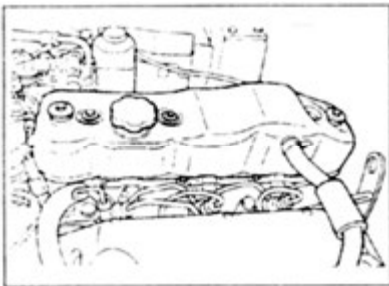


Disassembling sequence:

1. Crankcase vent hose
2. Cylinder head cover

Assembling sequence

As assembling, go on according to the reverse sequence of disassembly.



Disassembly

Preparation:

- Remove the ground cables of battery.

1. Crankcase vent hose

- Dismantle crankcase vent hose from air-intake duct side.

2. Cylinder head cover



Assembly

2. Cylinder head cover

- Apply oil to the rocker arm and valve spring.
- Install the gasket(s) of cylinder head cover on the cylinder head cover.

The gasket(s) must be flat and without damage.



- Tighten the cylinder head cover nut(s) to the specified torque.

N·m

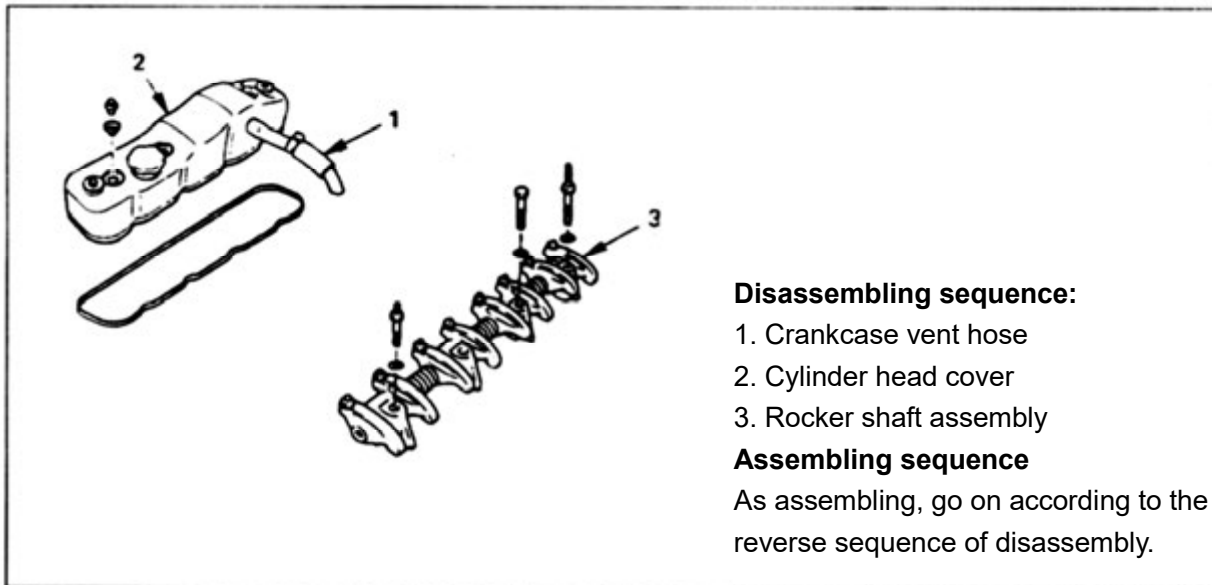
13

1. Connect the crankcase vent hose.

- Connect the crankcase vent hose to the air-intake pipe.
- Connect the ground cables of battery.



3.9 Rocker shaft assembly



Disassembling sequence:

1. Crankcase vent hose
2. Cylinder head cover
3. Rocker shaft assembly

Assembling sequence

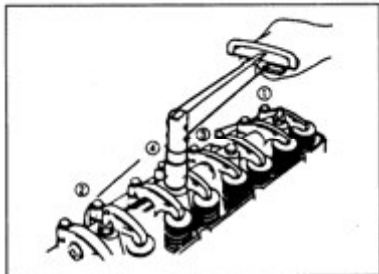
As assembling, go on according to the reverse sequence of disassembly.



Disassembly

Preparation:

Remove the ground cables of battery.



1. Crankcase vent hose
2. Cylinder head cover
3. Rocker shaft assembly

Loosen the bolt(s) and nut(s) of rocker shaft support in sequence and remove the rocker shaft assembly.



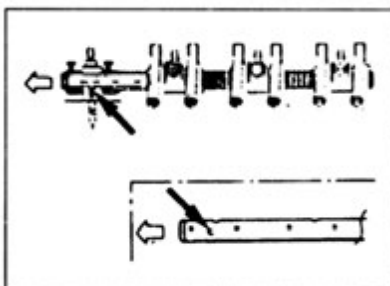
Assembly

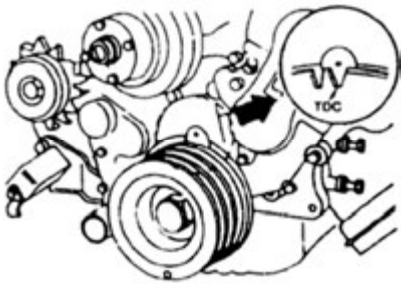
3. Rocker shaft assembly



- Install the rocker shaft so that the bigger oil hole ($\Phi 4$) locates at engine forepart.
- Align the fixing bolts with the holes on the rocker shaft, and tighten them to the specified torque.

N. m

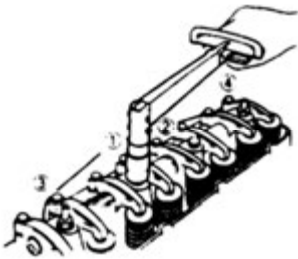




Valve clearance adjustment

① Rotate the crankshaft until TDC line of the crankshaft damper pulley is aligned with timing pointer, and either the first cylinder piston or the fourth cylinder piston is at the top dead center (TDC) of compression stroke.

② Check the nuts of rocker shaft support are loose. Tighten all the loose nuts of the rocker shaft support before adjusting valve clearance.



Rocker shaft support nut torque

N.m

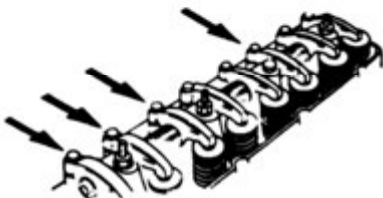
55

③ Check the clearance between intake valve and exhaust valve push rod for the first cylinder. If there is clearance between intake valve and exhaust valve push rod for the first cylinder, the first cylinder piston locates at the top dead center of compression stroke.

If there is no clearance between intake valve and exhaust valve push rod for the first cylinder, the fourth cylinder piston locates at the top dead center of compression stroke.



Top dead center of the first cylinder compression stroke



The piston of cylinder must locate at the top dead center of compression stroke when the valve clearance of the first cylinder or fourth cylinder is adjusted.



Valve clearance (cold state)

mm

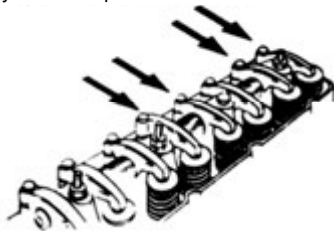
0.3-0.4

④ Loosen the adjustment screw(s) for each valve clearance shown in the drawing.

⑤ Insert a clearance gauge with proper thickness between the rocker arm and valve stem end.



Top dead center of the fourth cylinder compression stroke



- ⑥ Rotate the adjustment screw(s) for valve clearance until a touch of resistance is felt on the clearance gauge.
- ⑦ Tighten the locking nut(s) firmly.
- ⑧ Rotate the crankshaft for 360°.
- ⑨ Then align TDC line of crankshaft damper pulley with timing pointer.
- ⑩ Adjust the clearance of other valves shown in the drawing.

2. Cylinder head cover



- Install the cylinder head cover and tighten the bolt(s) to the specified torque.

N. m

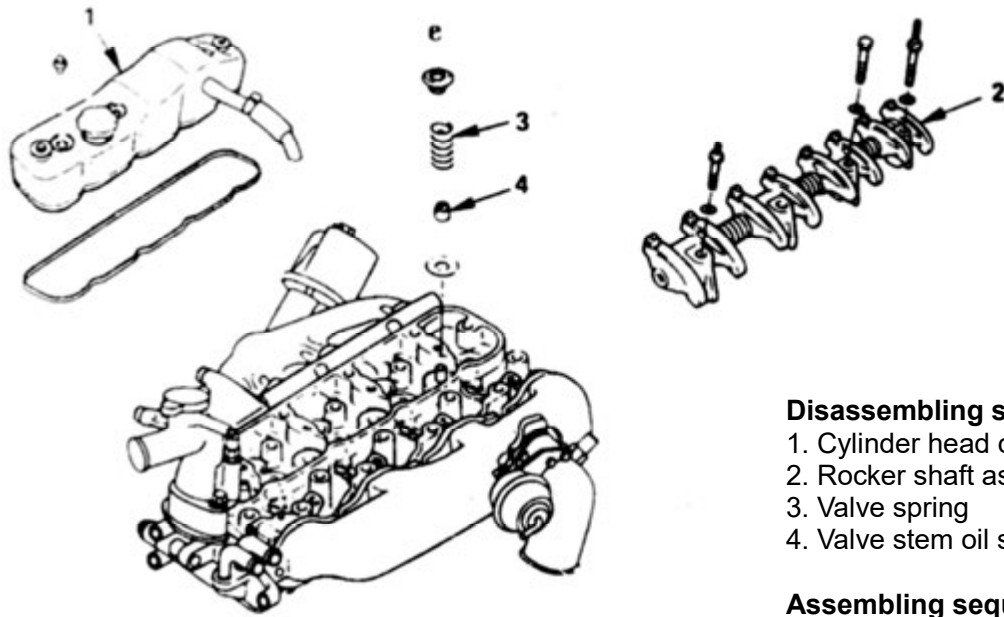
13

1. Crankcase vent hose

- Connect the ground cables of battery.



3.10 Valve stem oil seal and valve spring



Disassembling sequence:

1. Cylinder head cover
2. Rocker shaft assembly
3. Valve spring
4. Valve stem oil seal

Assembling sequence

As assembling, go on according to the reverse sequence of disassembly.



Disassembly

Preparation:

- Remove the ground cables of battery.

1. Cylinder head cover

2. Rocker shaft assembly

- Loosen the bolt(s) and nut(s) of rocker shaft support in sequence and remove the rocker shaft assembly.

3. Valve spring

- Compress the valve spring with a special tool and remove the valve cotter.

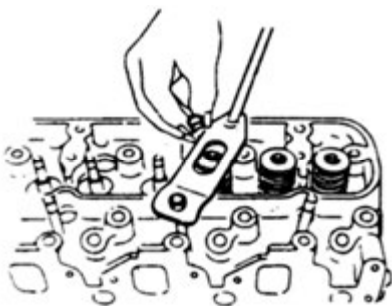


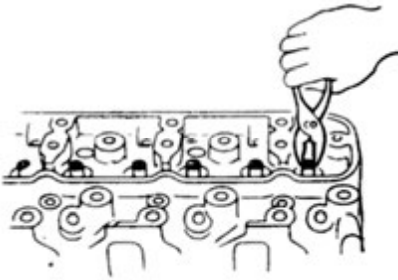
Valve spring compressor: 1003015FA-9101



Caution:

- Place the removed valve springs as the cylinder number sequence.





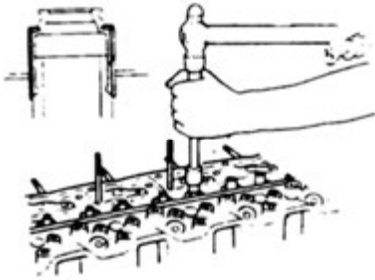
4. Valve stem oil seal

- Remove the valve stem oil seals with pliers.



Caution:

The valve stem oil seal that has been removed should not be used again.



Assembly

4. Valve stem oil seal

- Install new valve stem oil seals on the valve guide with a special tool.

Special tool: 1003016FA-9101

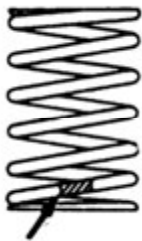
3. Valve spring

- Place upper valve spring retainer on the valve spring.



Caution:

- The colored part of valve spring should be downward.
- Add compressed air to the cylinder from glow plug and lift the valve to set it in place.
- Install the valve cotter with special tool.

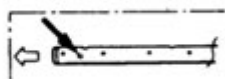


- Valve spring compressor: 1003015FA-9101



2. Rocker shaft assembly

- Install the rocker shaft so that the bigger oil hole ($\Phi 4$) locates at engine forepart.
- Align the fixing bolts with the holes on the rocker shaft, and tighten them to the specified torque.



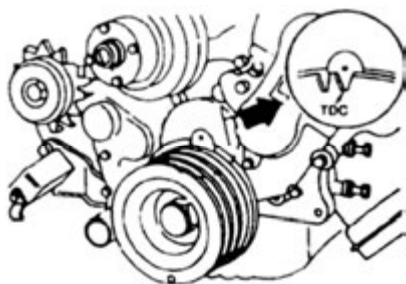
N·m

55

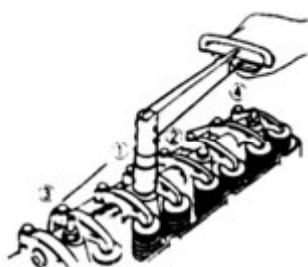
- Valve clearance adjustment



Valve clearance adjustment



- ① Rotate the crankshaft until TDC line of the crankshaft damper pulley is aligned with timing pointer, and either the first cylinder piston or the fourth cylinder piston is at the top dead center (TDC) of compression stroke.



- ② Check the nuts of rocker shaft support are loose. Tighten all the loose nuts of the rocker shaft support before adjusting valve clearance.



Rocker shaft support nut torque	N.m
	55



- ③ Check the clearance between intake valve and exhaust valve push rod for the first cylinder. If there is clearance between intake valve and exhaust valve push rod for the first cylinder, the first cylinder piston locates at the top dead center of compression stroke. If there is no clearance between intake valve and exhaust valve push rod for the first cylinder, the fourth cylinder piston locates at the top dead center of compression stroke.

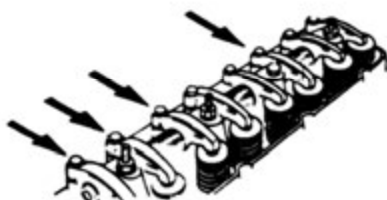


The piston of cylinder must locate at the top dead center of compression stroke when the valve clearance of the first cylinder or fourth cylinder is adjusted.



Valve clearance (cold state)	mm
	0.3-0.4

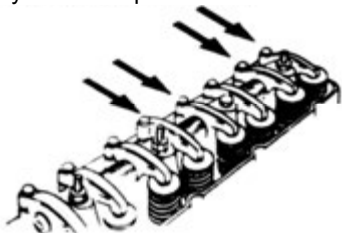
Top dead center of the first cylinder compression stroke



- ④ Loosen the adjustment screw(s) for each valve clearance shown in the drawing.
- ⑤ Insert a clearance gauge with proper thickness between the rocker arm and valve stem end.



Top dead center of the fourth cylinder compression stroke



- ⑥ Rotate the adjustment screw(s) for valve clearance until a touch of resistance is felt on the clearance gauge.
- ⑦ Tighten the locking nut(s) firmly.
- ⑧ Rotate the crankshaft for 360°.



- ⑨ Then align TDC line of crankshaft damper pulley with timing pointer.
- ⑩ Adjust the clearance of other valves shown in the drawing.



1. Cylinder head cover

- Apply oil to the rocker arm and valve spring.
- Install the gasket(s) of cylinder head cover on the cylinder head cover. The gasket(s) must be flat and without damage.
- Install the cylinder head cover and tighten the bolt(s) to the specified torque.

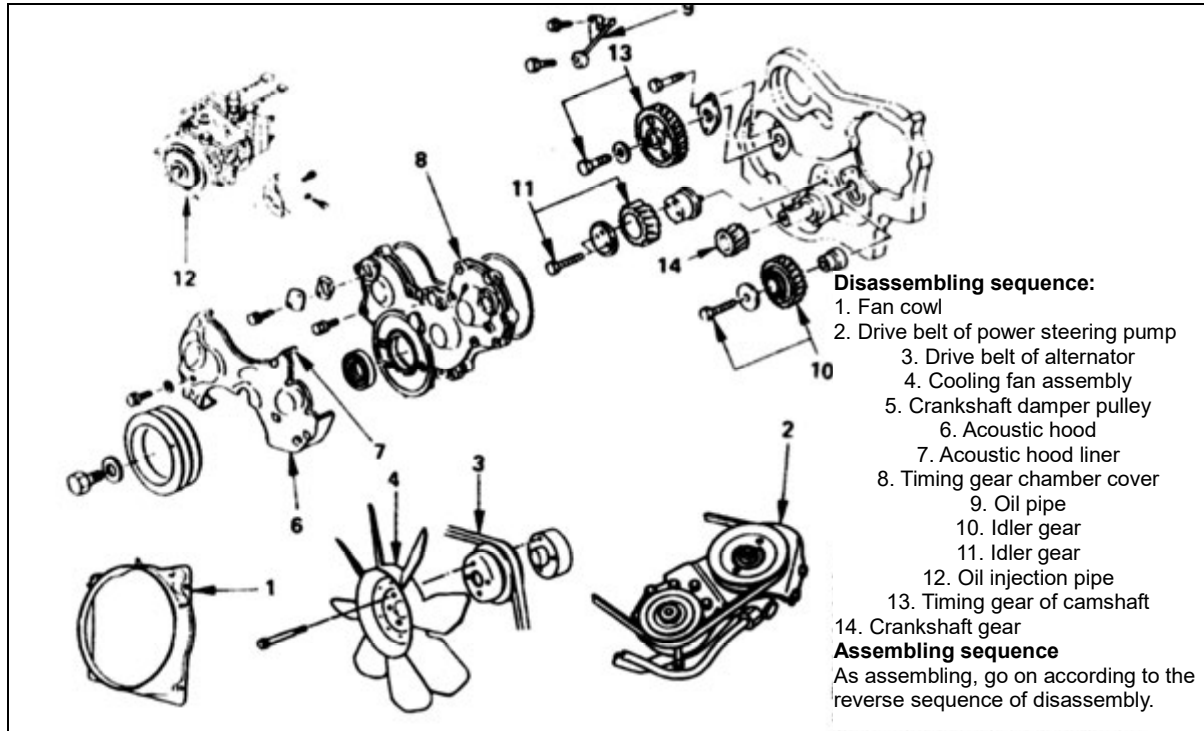


Cylinder head cover bolt torque	N • m
	13

- Connect crankcase vent hose.
- Connect the ground cables of battery.



3.11 Timing gear



Disassembling sequence:

1. Fan cowl
2. Drive belt of power steering pump
3. Drive belt of alternator
4. Cooling fan assembly
5. Crankshaft damper pulley
6. Acoustic hood
7. Acoustic hood liner
8. Timing gear chamber cover
9. Oil pipe
10. Idler gear
11. Idler gear
12. Oil injection pipe
13. Timing gear of camshaft
14. Crankshaft gear

Assembling sequence

As assembling, go on according to the reverse sequence of disassembly.

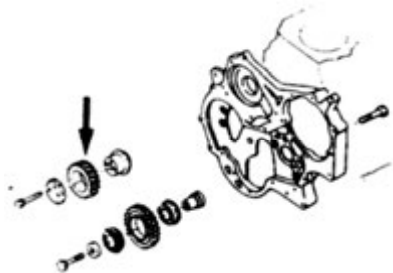
Disassembly

Preparation:

- Remove the ground cables of battery.
- Discharge the coolant completely.

1. Fan guard
2. Power steering pump drive belt
 - Unscrew the bracket bolt(s) and adjusting bolt(s) for power steering pump and remove the drive belt.
3. Alternator drive belt
 - Unscrew the alternator bracket bolt(s) (lower part) and adjusting plate locking bolt(s) and remove the drive belt.
4. Cooling fan assembly
 - Unfasten tight nut(s), and dismount fan assembly, collar and fan pulley.
5. Crankshaft damper pulley
6. Acoustic hood
7. Acoustic hood liner
8. Timing gear chamber cover





9. Oil pipe

10. Idler gear

- 1) Measure the timing gear play of camshaft and crankshaft before disassembling the idler gear.
- 2) First measure the axial clearance for idler gear before disassembling the idler gear.

Note:

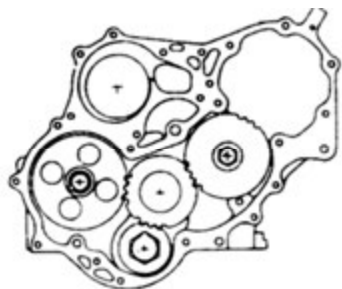
Refer to the following items for details on gear clearance and axial clearance measurement methods.



Timing gear clearance measurement

- 1) Install a dial gauge onto the timing gear to be tested. Fix the gear to be examined and the gear connected to it.
- 2) Swing the gear to be checked left and right as much as possible. Read out the dial gauge readings.

If the measured value exceeds prescribed limit, the timing gear has to be replaced.



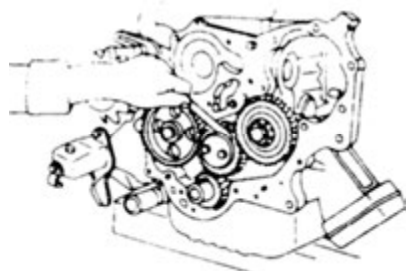
Timing gear clearance mm

Standard	Limit
0.10--0.17	0.30

Axial clearance measurement of idler gear "A"

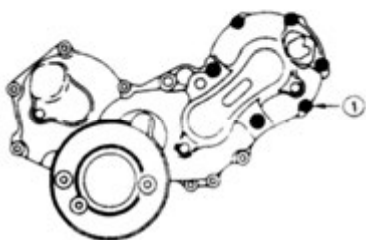
Insert a clearance gauge between the idler gear and thrust ring to measure the clearance and determine the axial clearance of idler gear.

If the measured value exceeds prescribed limit, the thrust ring has to be replaced.



Axial clearance of idler gear mm

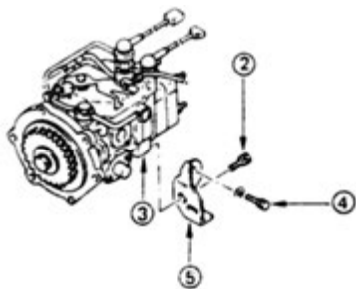
Standard	Limit
0.07	0.2



11. Idler gear

12. Injection pump

1) Remove six injection pump bracket bolts ① from timing gear chamber.



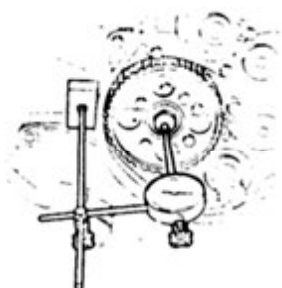
2) Remove rear bracket bolt ② from injection pump bracket ③.

3) Remove rear bracket bolt ④ and bracket ⑤ of injection pump from the cylinder block.

4) Draw out both the injection pump and injection pump timing gear toward the engine backside.

Note:

Cover the hole in injection pump delivery valve body with a cover or equivalents to prevent foreign matters falling into the valve.



13. Camshaft timing gear

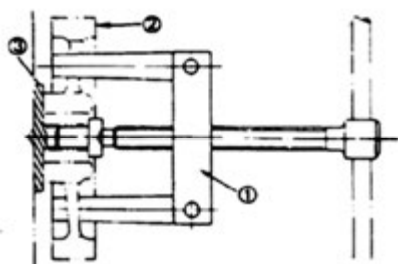
1) Measure the axial clearance of camshaft with a dial gauge.

Measure the clearance before disassembling the camshaft gear. If the axial clearance of camshaft exceeds prescribed limit, the thrust washer has to be replaced.



Axial clearance of camshaft mm

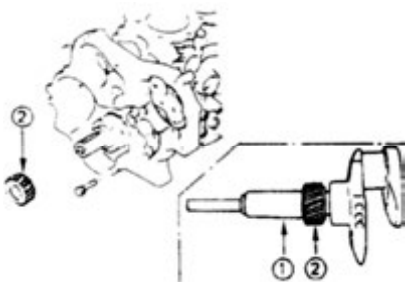
Standard	Limit
0.050--0.114	0.2



2) Remove camshaft timing gear bolt(s) from the camshaft.

Note:

Keep the camshaft fixed to prevent its rotating.



3) Pull out camshaft timing gear② with universal puller ①.

Universal puller: 1007011FA-9101

4) Remove thrust washer ③.

14. Crankshaft gear



Assembly



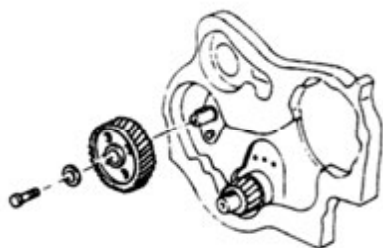
14. Crankshaft gear

1) Install crankshaft gear

2) Install crankshaft gear ② with crankshaft gear erector ①. •

Crankshaft timing gear mark (“X-X”) must face the outside.

Crankshaft gear erector: 1007011FA-9102



13. Camshaft timing gear

1) Install the thrust washer onto the cylinder block.



2) Tighten thrust washer bolt(s) to the specified torque.

N·m

25

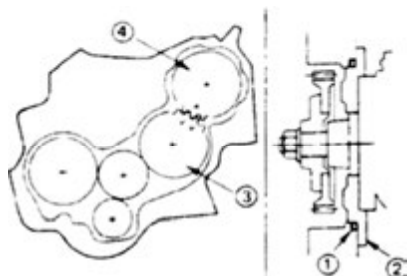
3) Install camshaft timing gear to the camshaft.

The timing gear mark (“Y—Y”) has to face the outside.

4) Tighten the timing gear to the specified torque.

N·m

110

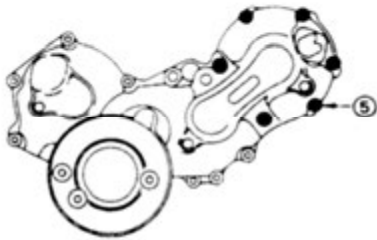


12. Injection pump

1) Install O-ring ① to injection pump flange ②.

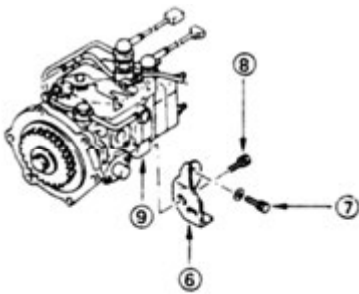
2) Install injection pump to the timing gear chamber.

Align the mark “V-V” of idler gear “B” ③ with the mark “V” of injection pump timing gear ④.



3) Temporarily tighten six nuts ⑤ for injection pump.

The final screwing down of injection pump nuts is conducted after rear bracket bolt(s) of the injection pump is (are) tightened.



4) Install rear bracket ⑥ of injection pump and rear bracket bolt ⑦ on the cylinder block.

5) Mount rear bracket bolt ⑧ to injection pump bracket ⑨.

Do not screw down those bolts.



Rear bracket bolt ⑦ and ⑦ will be tightened to the specified torque after the injection pump nuts are tightened.

6) Tighten the injection pump nuts to the specified torque.

N·m

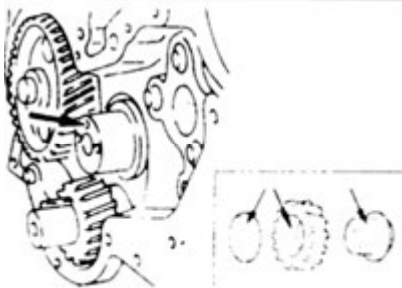
25



7) Screw down injection pump bracket bolt(s) to the specified torque.

N·m

25

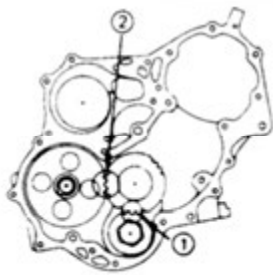


11. Idler gear

1) Apply some oil to the idler gear and its shaft.

The oil hole in idler gear shaft must be toward upward.

2) Arrange idler gear marks “X” and “Y” so that they both face the engine forepart.



- 3) Align idler gear mark "X" with the mark "X—X" of crankshaft timing gear ①.
- 4) Align idler gear mark "Y" with the mark "Y—Y" of camshaft timing gear ②.



- 5) Install the thrust washer and bolt(s) onto the cylinder block.

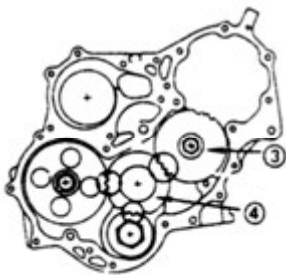


Thrust ring oil hole must be toward upward while its chamfer should face the outside.

- 6) Tighten idler gear bolt(s) to the specified torque.

N·m

20



10. Idler gear

- 1) Apply some oil to the idler gear and its shaft.
- 2) Align mark "Z" of gear "B" ③ with mark "Z—Z" of idler gear "A" ④.
- 3) Tighten idler gear bolt(s) to the specified torque.

N.m

110

9. Lubrication oil pipe

- 1) Install the lubrication oil pipe on the timing gear chamber and idler gear "A".
- 2) Tighten lubrication oil pipe punching bolt ① and bolt ② to the specified torque.

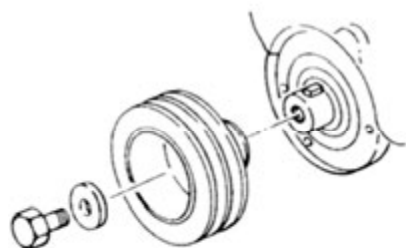
Oil pipe punching bolt torque N • m

20

8. Timing gear chamber cover

- 1) Align timing gear chamber anchor pin with the timing gear chamber, then install timing gear chamber cover.
- 2) Tighten gear chamber cover bolt(s) to the specified torque.





7. Acoustic hood liner

6. Acoustic hood

5. Crankshaft damper pulley

Screw down the crankshaft damper pulley bolt(s) to the specified torque.

Note:

While screwing down the damper pulley, hold the flywheel ring gear to prevent crankshaft rotating.



Pulley bolt torque N · m

210



4. Cooling fan assembly

- Install fan silicone oil clutch and cooling fan assembly (as this sequence) on water pump, and tighten them to the specified torque.

_____ N·m

12.5

3. Alternator drive belt



Install alternator drive belt and adjust the belt tension.

Press the belt center with 100N force.

Drive belt deflection mm

8-10



- Tighten idler gear locking nut(s) to the specified torque.

_____ N·m

25



2. Power steering pump drive belt

- Install power steering pump drive belt and adjust the belt tension.
- Press the belt center with 100N force.

Drive belt deflection mm

8-10



- Tighten idler gear locking nut(s) to the specified torque.

N·m



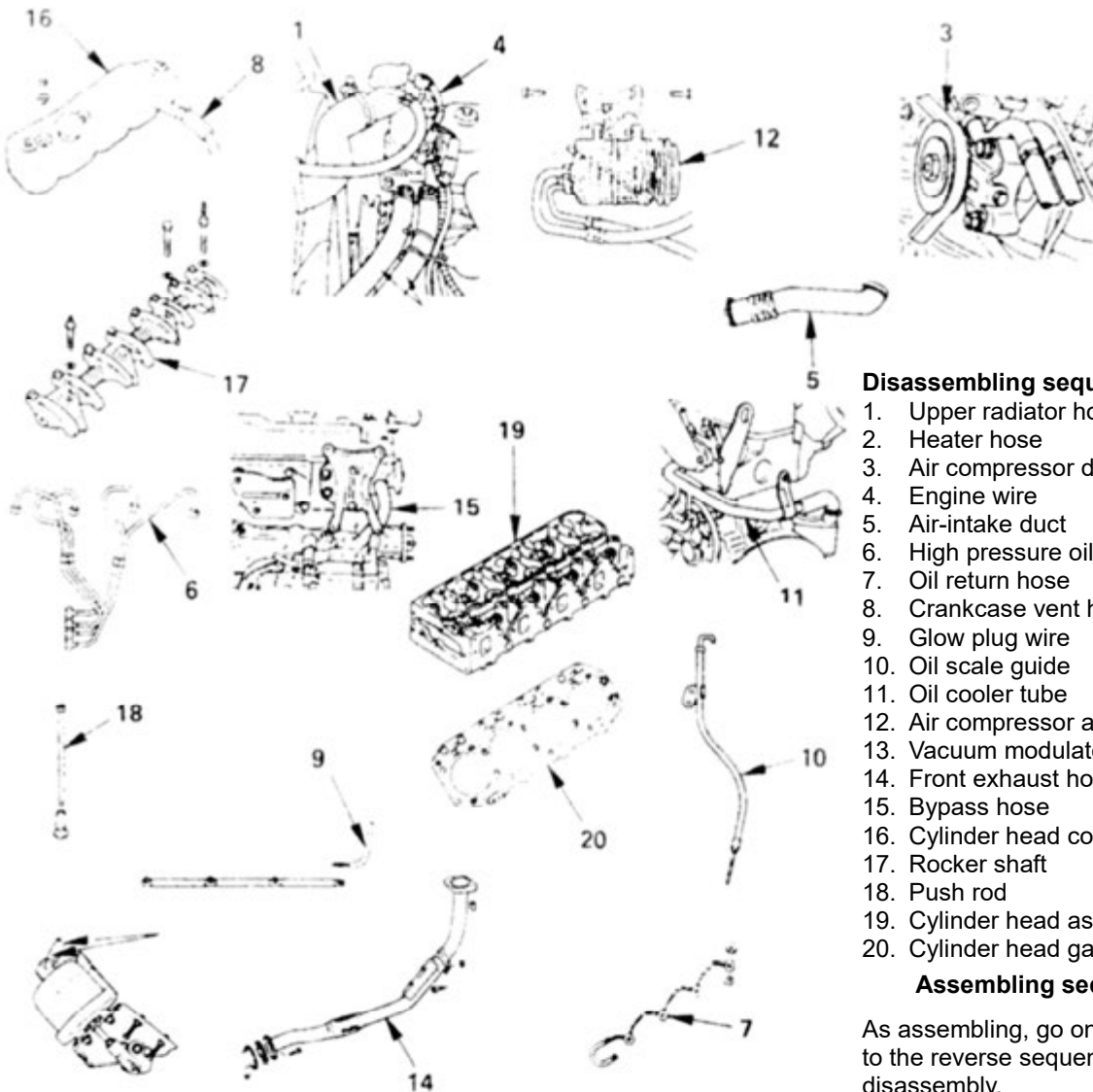
25

1. Fan guard

- Install fan guard and storage tank hose.
- Add some coolant.
- Start the engine and check the coolant leaks.



3.12 Cylinder head assembly and gasket



Disassembling sequence:

1. Upper radiator hose
2. Heater hose
3. Air compressor drive belt
4. Engine wire
5. Air-intake duct
6. High pressure oil pipe
7. Oil return hose
8. Crankcase vent hose
9. Glow plug wire
10. Oil scale guide
11. Oil cooler tube
12. Air compressor assembly
13. Vacuum modulator
14. Front exhaust hose
15. Bypass hose
16. Cylinder head cover
17. Rocker shaft
18. Push rod
19. Cylinder head assembly
20. Cylinder head gasket

Assembling sequence

As assembling, go on according to the reverse sequence of disassembly.

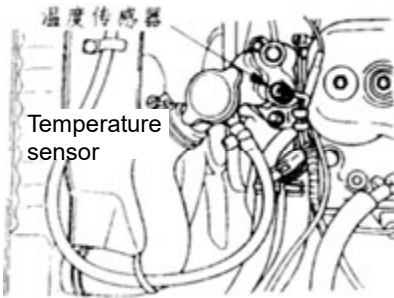
Disassembly

Preparation:

- Remove the ground cables of battery.
- Discharge the coolant in the radiator and engine completely.

1. Upper radiator hose

- Remove the upper radiator hose at engine side.



2. Heater hose

- Remove the heater hose from the heater pipe.

3. Air conditioning compressor drive belt

- Unscrew idler locking nut(s).
- Loosen adjusting bolt(s) and remove the drive belt.

4. Engine wire

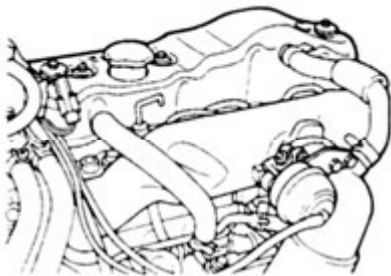
- Detach wire connector from upper thermostat cover component.

5. Air-intake duct

- Remove anchorage clip(s) and air-intake duct.

6. High pressure oil pipe

- Unscrew high pressure oil pipe anchorage clip(s).
- Loosen the taper nut(s) at injection pump side.
- Loosen the taper nut(s) at injection pump side and remove the pipe.



Note:

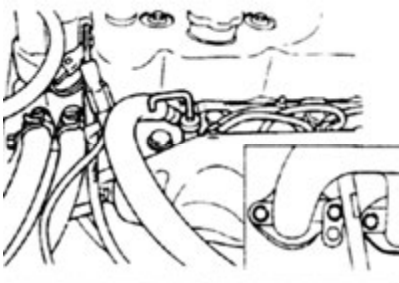
Plug the holes in injector body and delivery valve body to prevent foreign matters falling in.

7. Oil return hose

- Remove the oil return hose at oil return pipe side.

8. Crankcase vent hose

- Dismantle crankcase vent hose(s) from air-intake pipe.



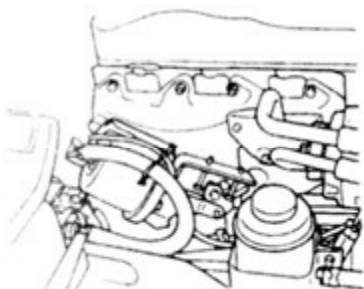
9. Glow plug wire

10. Oil scale guide

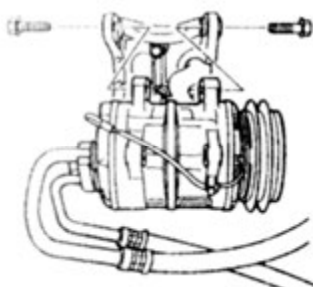
- Remove oil scale guide out of the cylinder head.

**11. Oil cooler tube**

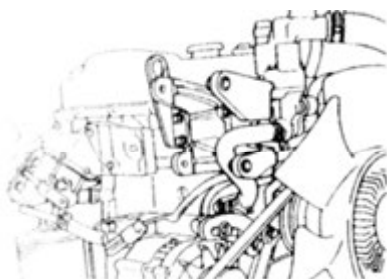
- Dismantle the fixing bolt(s) at rear side of cylinder head.

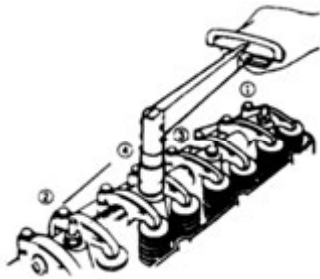
12. Air conditioning compressor assembly

- Remove the wire connector of clutch.
- Remove fixing bolt(s) of the air conditioning compressor and temporarily bind the compressor to the frame side with wires.

**13. Front exhaust pipe**

- Remove exhaust pipe fixing bolt(s) out of the exhaust manifolds.
- Remove exhaust pipe support bolt(s).

14. Bypass hose**15. Cylinder head cover**



16. Rocker shaft

- Loosen rocker shaft support bolt(s) bit by bit as according to the sequence shown in the diagram.



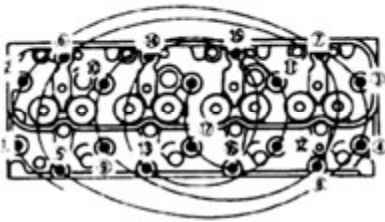
Note:

Disobedience will have unfavorable influence on the rocker shaft.

17. Push rod

18. Cylinder head assembly

- Loosen cylinder head bolt(s) bit by bit according to the sequence shown in the diagram.



Note:

Disobedience will bring unfavorable influence to the lower surface of cylinder head.

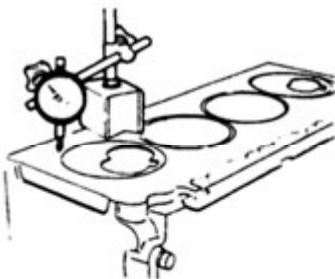
19. Cylinder head gasket

- Remove cylinder head gasket and anchor pin.

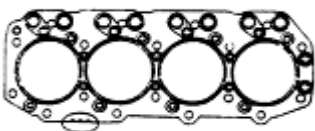


Assembly

19. Cylinder head gasket



Before assembling, carefully remove carbon deposits on piston top and upper cylinder block surface and also clean the place where the gasket is installed.





Note:

18. Cylinder head assembly



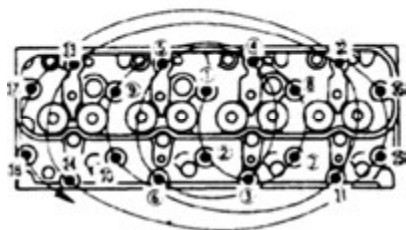
- 1) Install the anchor pin onto the cylinder block.
- 2) Install cylinder head gasket with top mark toward upside.
- 3) Clean the lower cylinder head surface and upper cylinder block surface.
- 4) Mount cylinder head gently.
- 5) Apply oil to the threads and mating surfaces of cylinder head bolts.
- 6) Tighten the cylinder head bolts to the specified torque in three steps according to the sequence shown in the diagram.

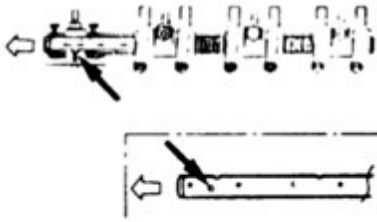
Cylinder head bolt torque N • m

First step	Second step	Third step
65	85	105

17. Push rod

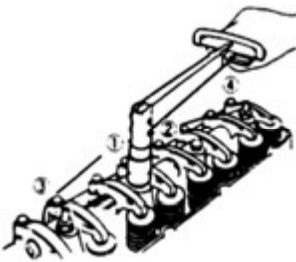
- Apply oil to the push rod and put the rod in cylinder head.





16. Rocker shaft assembly

- 1) Loosen all adjusting screws.
- 2) Install the rocker shaft so that the bigger oil hole ($\Phi 4$) faces engine forepart.

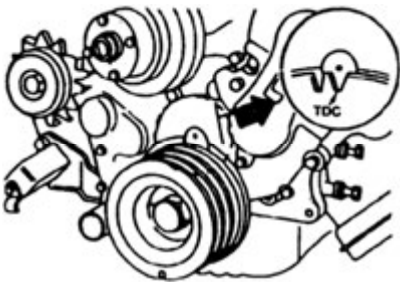


- 3) Tighten the rocker shaft support bolt(s) to the specified torque according to the sequence shown in the diagram.

Rocker shaft support bolt torque	N.m
55	

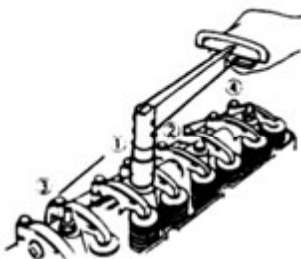
55

- Valve clearance adjustment



Valve clearance adjustment

- ① Rotate the crankshaft until zero scale line of the crankshaft damper pulley is aligned with timing pointer, and either the first cylinder piston or the fourth cylinder piston is at the top dead center (TDC) of compression stroke.



- ② Check the nuts of rocker shaft support are loose.

Tighten all the loose nuts of the rocker shaft support before adjusting valve clearance.

Rocker shaft support nut torque	N.m
55	

55



③ Check the clearance between intake valve and exhaust valve push rod for the first cylinder. If there is clearance between intake valve and exhaust valve push rod for the first cylinder, the first cylinder piston locates at the top dead center of compression stroke. If there is no clearance between intake valve and exhaust valve push rod for the first cylinder, the fourth cylinder piston locates at the top dead center of compression stroke.

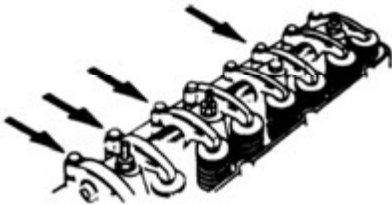


The piston of cylinder must locate at the top dead center of compression stroke when the valve clearance of the first cylinder or fourth cylinder is adjusted.

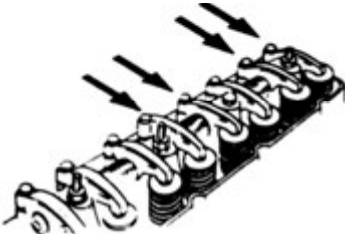
Valve clearance (cold state) mm

0.3-0.4

Top dead center of the first cylinder compression stroke



Top dead center of the fourth cylinder compression stroke



④ Loosen the adjustment screw(s) for each valve clearance shown in the drawing.

⑤ Insert a clearance gauge with proper thickness between the rocker arm and valve stem end.

⑥ Rotate the adjustment screw(s) for valve clearance until a touch of resistance is felt on the clearance gauge.

⑦ Tighten the locking nut(s) firmly.

⑧ Rotate the crankshaft for 360°.

⑨ Then align zero scale line of crankshaft damper pulley with timing pointer.

⑩ Adjust the clearance of other valves shown in the drawing.

15. Cylinder head cover



• Apply oil to the rocker arm and valve spring.



• Install cylinder head cover gasket(s) of on the cylinder head cover.

• The gasket(s) must be flat and without damage.

• Tighten cylinder head cover nut(s) to the specified torque.



Cylinder head cover torque

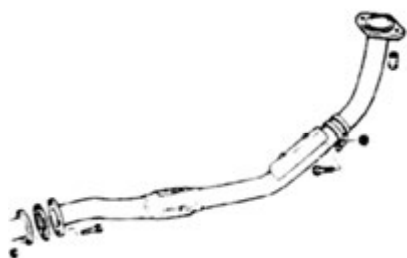
N.m

13



14. Bypass hose

cardiagn.com

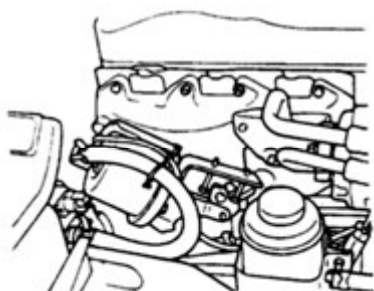


13. Front exhaust pipe

- Connect the pipe with manifold and tighten bolt(s) and nut(s) to the specified torque.

Manifold nut torque	N • m
37	

Pipe support bolt torque	N • m
40	



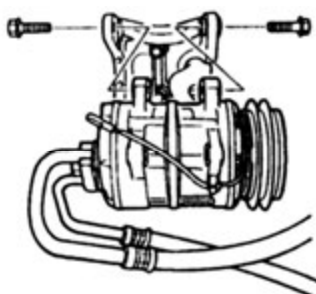
12. Air conditioning compressor assembly

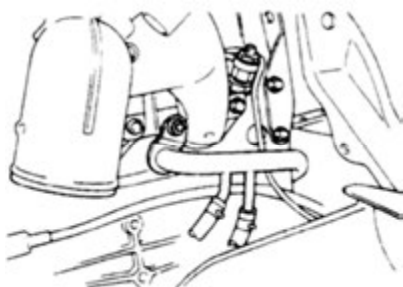
- Install the fixing bolt(s) of air conditioning compressor and screw down the bolt(s) to the specified torque.



Compressor bolt torque N.m

20

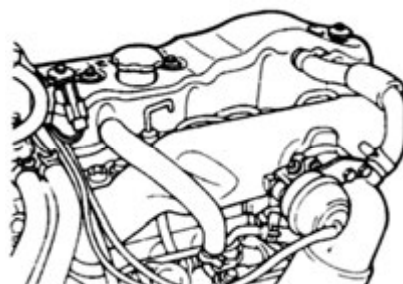




11. Oil cooler tube

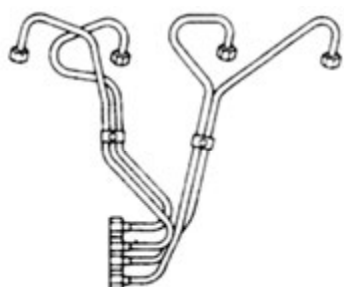
- Install tube bolt(s) and tighten the bolt(s) to the specified torque.

Tube nut torque	N • m
	25



10. Oil scale guide

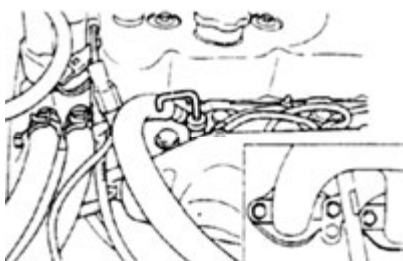
9 Glow plug wire connector



8. Crankcase vent hose

7. Oil return hose

- Install oil return hose with new copper washer.



6. High pressure oil pipe

- Install taper nut(s) at injection pump side.
- Install taper nut(s) at injector side.
- Tighten taper nut(s) to the specified torque.

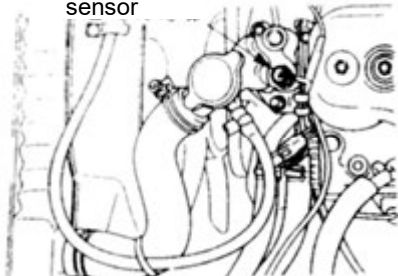
Taper nut torque	N • m
	30

- Assemble the anchorage clip(s) of pipe within specified torque.

5. Air-intake duct



Temperature sensor



4. Engine wire

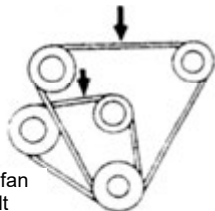
- Connect temperature sensor and thermometer component wire.

2. Air conditioning compressor drive belt

- Check drive belt is worn or damaged, and replace if necessary.
- Check the belt tension, and adjust if necessary.
- Check the tension of drive belt.

4JB1

Air conditioning compressor and power steering pump drive pulley



Alternator and fan pulley drive belt

Apply a force of 100N to the belt center and check the deflection of each belt.

- Deflection standard value

mm

	Sinkage
Alternator and fan pulley drive belt	8—10
Air conditioning compressor drive belt	
Power steering pump drive belt	
Tension adjustment	



Air conditioning compressor

Idler pulley

Adjusting plate

Adjusting bolt

Power steering pump pulley

Fan pulley

Alternator

Alternator bolt

Crankshaft pulley

Adjusting bolt

Idler pulley

Power steering pump and air conditioning compressor drive belts.

- Loosen power steering pump locking bolt and adjust belt tension with the adjusting bolt.

Cooling fan pulley belt

- Loosen alternator bracket and locking bolt(s), and then adjust the belt tension with the adjusting bolt of regulator.



Torque standard value

N.m

Alternator fixing bolt	40
Adjusting plate fixing bolt	25
Adjusting plate locking bolt	25

2. Heater hose

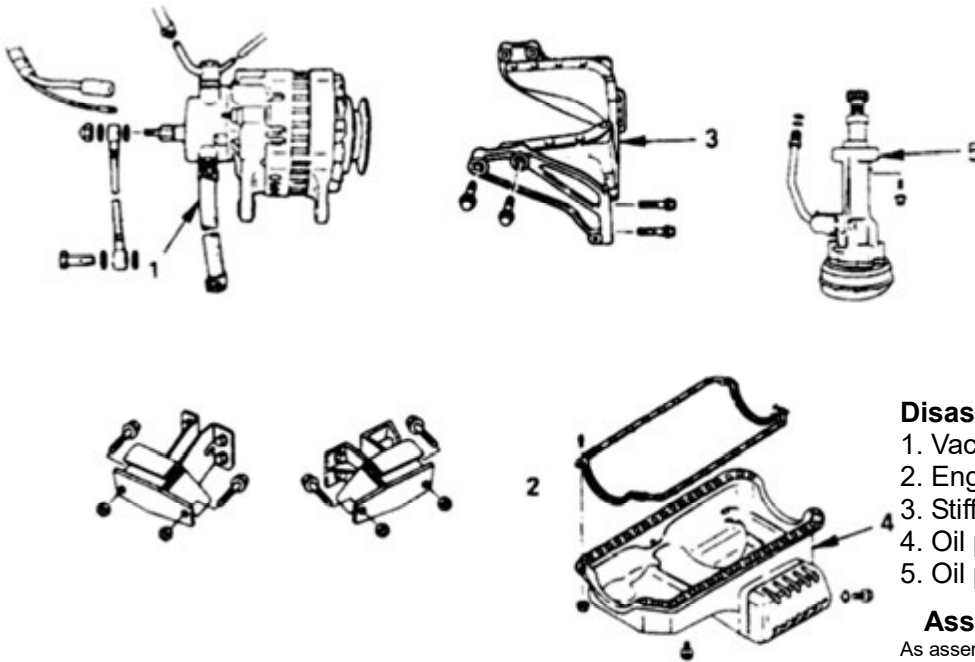
- Install the heater hose, and then tighten the anchorage clip(s) firmly.

1. Upper radiator hose

- Connect the radiator hose, and then tighten the anchorage clip(s) firmly.
- Add some coolant.
- Connect the ground cables of battery.
- Start the engine and check whether the coolant leaks.



3.13 Oil pan



Disassembling sequence:

1. Vacuum oil pump
2. Engine support bolt
3. Stiffener plate
4. Oil pan assembly
5. Oil pump assembly

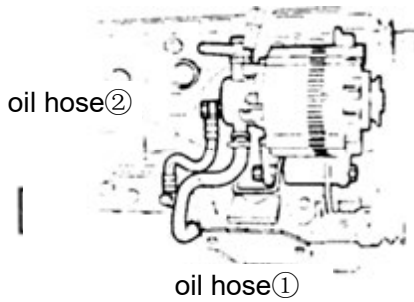
Assembling sequence

As assembling, go on according to the reverse sequence of disassembly.

Disassembly

Preparation:

- Remove the ground cables of battery.
- Lift the automobile.
- Discharge the coolant completely.



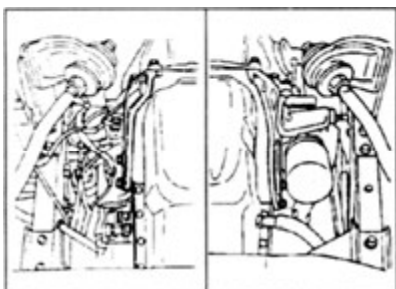
Note:

Install oil drain plug with new gasket.

	N.m
80	

1. Vacuum pump oil hose

- Remove oil hose ① out of the oil pan.

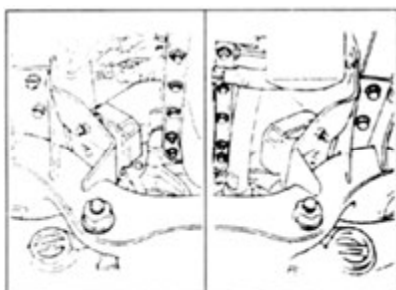


2. Engine support bolt

- Remove engine support bolts at both left and right sides.

3. Stiffener plate and rubber cushion

- Remove exhaust pipe bracket.
- Remove the stiffener plates out of oil pan (both left and right).
- Take out the rubber cushion.



4. Oil pan

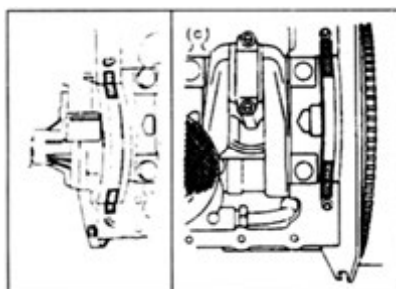
- Lift the engine for about 50mm.
- Remove the oil pan from the cylinder block.

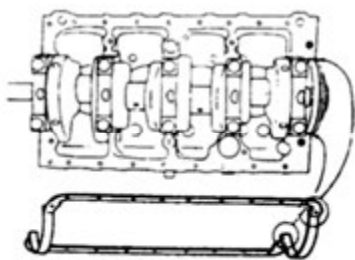


Assembly

4. Oil pan

- Apply recommended liquid sealant or equivalents to the fifth bearing cap arch section, groove and timing gear chamber arch section shown in the diagram.





- Install back lip portion of the gasket into the fifth groove.
- Make sure that the lip portion is compact with the groove.
- Install the oil pan on the cylinder block.



- Tighten oil pan bolt(s) to the specified torque.

Oil pan bolt torque	N • m
---------------------	-------

23.5

3. Stiffener plate and rubber cushion

- Install rubber cushion.
- Install the stiffener plates at both left side and right side and



- tighten bolts to the specified torque.

Engine block side	N.m
-------------------	-----

37.5

Clutch housing side	N.m
---------------------	-----

87



- Install exhaust pipe bracket.

2. Engine support bolt

- Install bracket bolts and tighten the bolts to the specified torque.

Bracket bolt torque	N.m
---------------------	-----

40

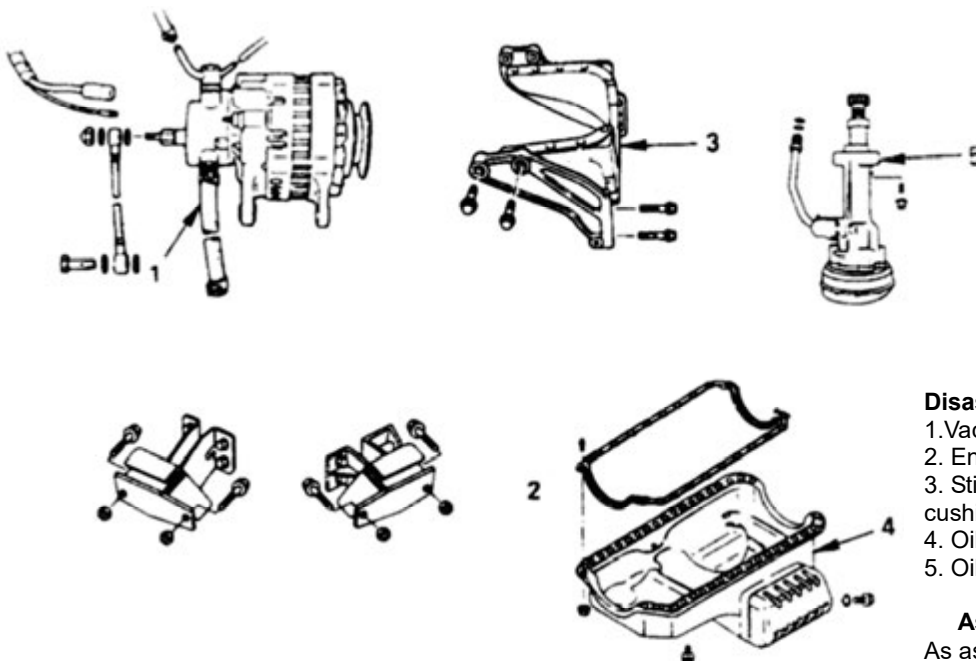
- Install the oil hose on the oil pan.

1. Vacuum pump oil hose

- Add some oil.
- Connect the ground cables of battery.
- Start the engine and check whether the coolant leaks.



3.14 Oil pump assembly



Disassembling sequence:

1. Vacuum oil pump
2. Engine bracket bolt
3. Stiffener plate and rubber cushion
4. Oil pan assembly
5. Oil pump assembly

Assembling sequence

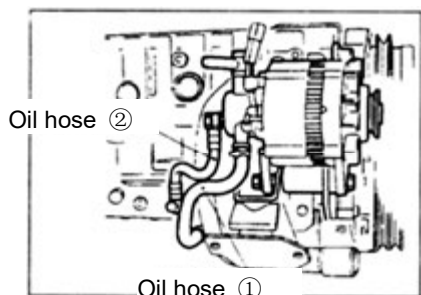
As assembling, go on according to the reverse sequence of disassembly.

Disassembly

Preparation:



- Remove the ground cables of battery.
- Lift the automobile.
- Discharge the oil completely.



Note:

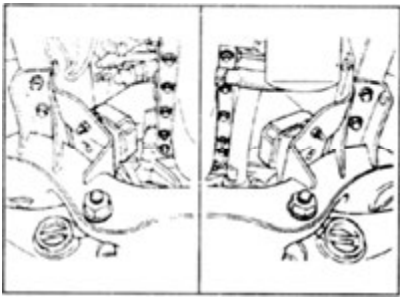
Install oil drain plug with new gasket.

N.m



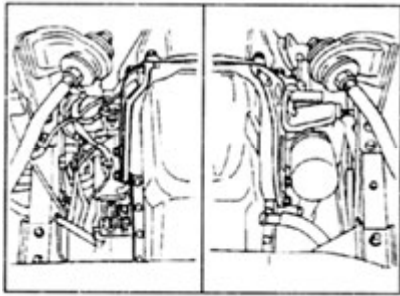
1. Vacuum pump oil hose

- Remove oil hose ① out of the oil pan.



2. Engine support bolt

- Remove engine support bolts at both left and right sides.



3. Stiffener plate

- Remove exhaust pipe bracket.
- Remove the stiffener plates out of oil pan (both left and right).

4. Oil pan assembly

- Lift the engine for about 50mm.
- Remove the oil pan from the cylinder block.

5 Oil pump assembly

- Remove oil pump assembly from the cylinder block.



Assembly

- Prepare some solution containing 80% oil and 20% supramoly.
- Apply solution to the oil pump pinion teeth.

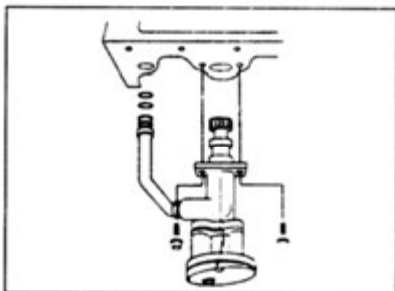


5. Oil pump assembly

- Apply some oil to the oil pipe O-ring and put it into the cylinder block O-ring groove.
- Install the oil pump assembly with oil pipe to the cylinder block, and tighten fixing bolts to the specified torque.




N.m

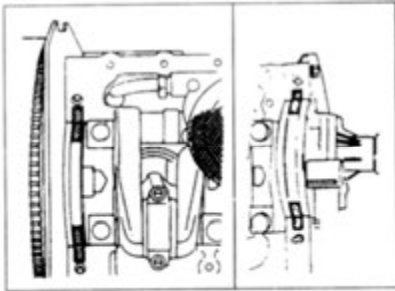


25



 Tighten sleeve nut(s) to the specified torque.

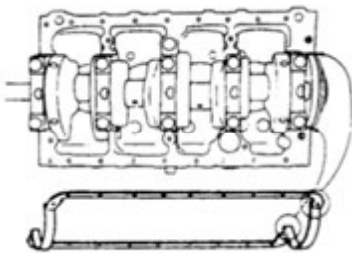
N.m




30

4. Oil pan assembly

- Apply recommended liquid sealant or equivalents to the fifth bearing cap arch section, groove and timing gear chamber arch section shown in the diagram.




- Install back lip portion of the gasket into the fifth groove.
- Make sure that the lip portion is compact with the groove.
- Install the oil pan on the cylinder block.
- Tighten oil pan bolt(s) to the specified torque.

 Oil pan bolt torque N • m


23.5

3. Stiffener plate

- Install the stiffener plate and tighten bolt(s) to the specified torque.

 Engine block side N.m

37.5

 Clutch housing side N.m

87

- Install exhaust pipe bracket.



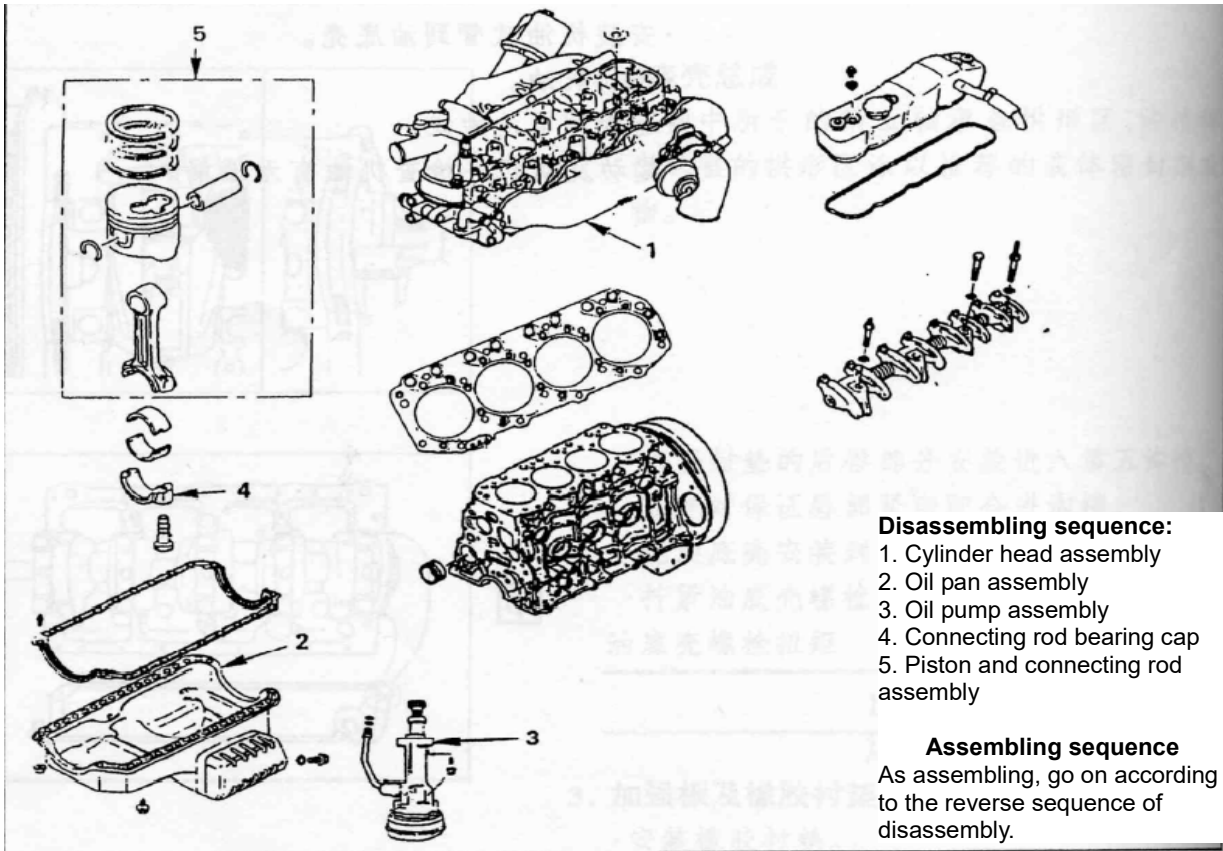
2. Engine support bolt

- Lay down the engine, and install bracket bolts and tighten the bolts to the specified torque.

1. Vacuum pump oil hose

- Install the oil hose on the oil pan.
- Add some oil.
- Connect the ground cables of battery.
- Start the engine and check whether the oil leaks.

3.15 Piston, Piston ring and connecting rod



Disassembling sequence:
 1. Cylinder head assembly
 2. Oil pan assembly
 3. Oil pump assembly
 4. Connecting rod bearing cap
 5. Piston and connecting rod assembly

Assembling sequence
 As assembling, go on according to the reverse sequence of disassembly.

Disassembly

Preparation:

- Remove the ground cables of battery.
- Discharge the coolant completely.
- Discharge the oil completely.

Note

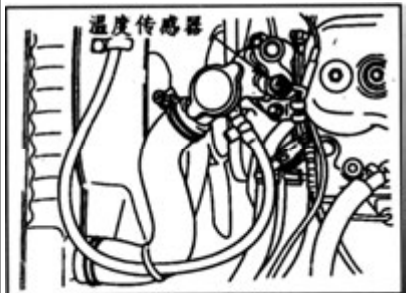
- Install oil drain plug with new gasket.

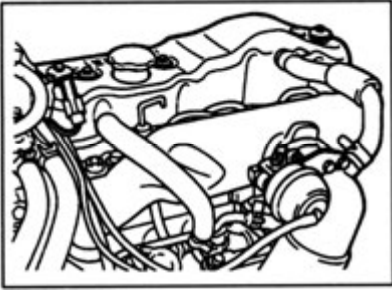
N.m

80

1. Cylinder head assembly

- 1) Upper radiator hose
- Remove the upper heater hose at engine side.
- 2) Heater hose





- Remove the heater hose from the heater pipe.

3) Air conditioning compressor drive belt

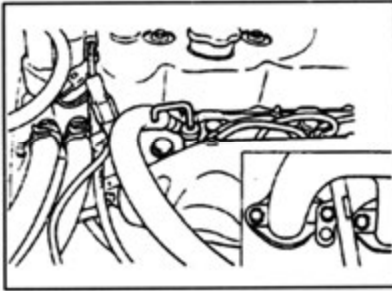
- Unscrew idler locking nut(s).
- Loosen adjusting bolt(s) and remove the drive belt.

4) Engine wire

- Detach wire connector from upper thermostat cover component.

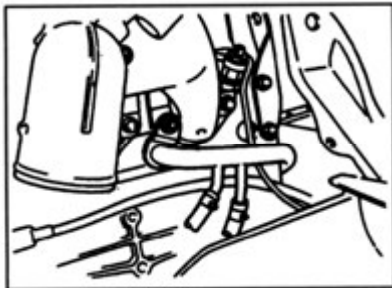
5) Air-intake duct

- Remove anchorage clip(s) and air-intake duct.



6) High pressure oil pipe

- Unscrew high pressure oil pipe anchorage clip(s).
- Loosen the taper nut(s) at injection pump side.
- Unscrew taper nut(s) at fuel injector side and remove high pressure oil pipe(s).



7) Oil return hose

- Remove the oil return hose at oil return pipe side..

8) Crankcase vent hose

- Dismantle crankcase vent hose(s) from air-intake pipe.

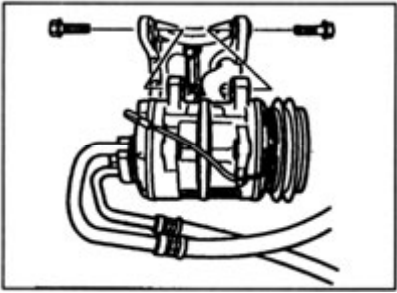
9) Glow plug wire

10) Oil scale guide

- Remove oil scale guide out of the cylinder head.

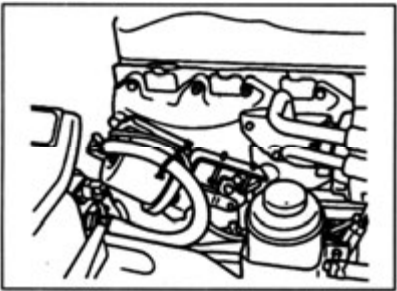
11) Oil cooler tube

- Remove pipe bracket bolt(s) at rear side of cylinder head.
- Remove cooler tube from the cylinder head.



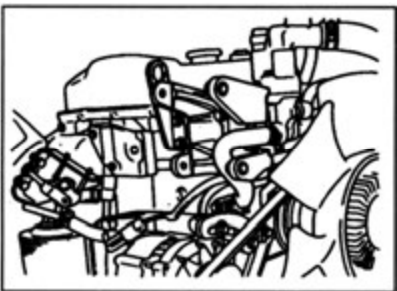
12) Air conditioning compressor assembly

- Remove the wire connector of clutch.
- Remove the wire connector of electromagnetic clutch.
- Remove fixing bolt(s) of the air conditioning compressor and temporarily bind the compressor side with wires.



13) Vacuum modulator hose

- Remove vacuum modulator hose from the vacuum modulator.

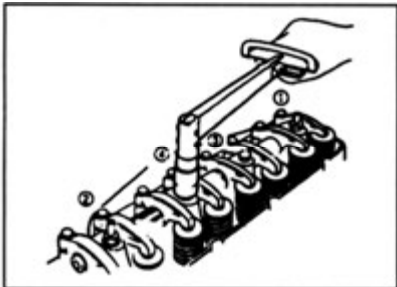


14) Front exhaust pipe

- Remove exhaust pipe fixing bolt(s) from the exhaust manifold.
- Remove exhaust pipe support bolt(s).

15) Bypass hose

16) Cylinder head cover



17) Rocker shaft

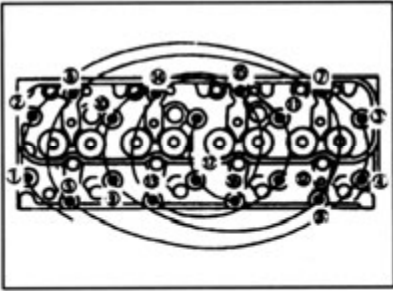
- Loosen rocker shaft support bolt(s) bit by bit according to the sequence shown in the diagram.



Note:

Disobedience will have unfavorable influence on the rocker shaft.

18) Push rod



19) Cylinder head assembly

- Loosen cylinder head bolt(s) bit by bit according to the sequence shown in the diagram.

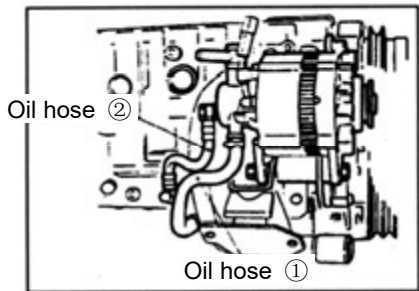


Note:

Disobedience will bring unfavorable influence to the lower surface of cylinder head.

20) Cylinder head gasket

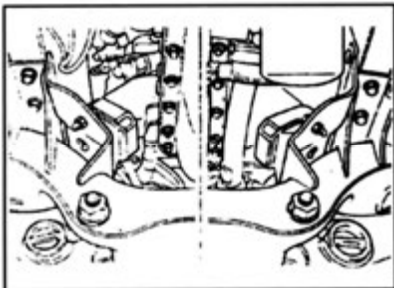
- Remove cylinder head gasket and anchor pin.



2. Oil pan assembly

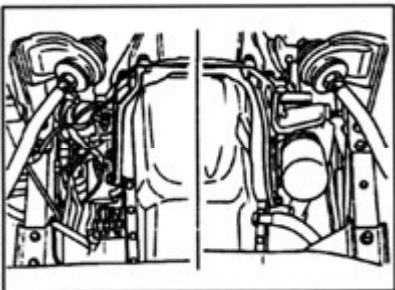
1) Vacuum pump oil hose

- Remove oil hose ① out of the oil pan.



2) Engine support bolt

- Remove engine support bolt(s).



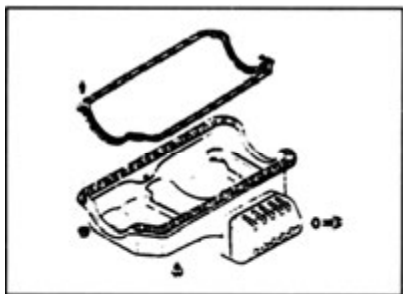
3) Stiffener plate

- Remove exhaust pipe bracket.
- Remove stiffener plate.



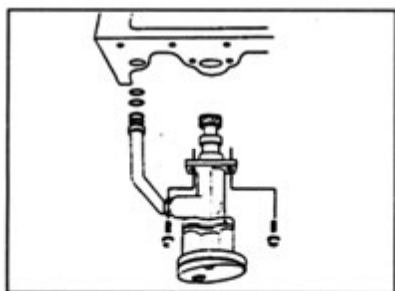
4) Oil pan

- Lift the engine for about 50mm.
- Remove the oil pan from the cylinder block.



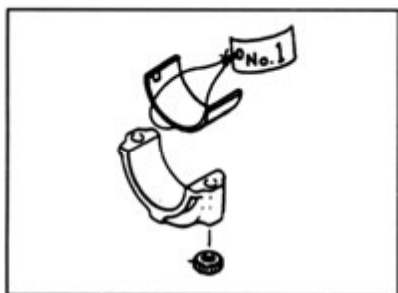
3. Oil pump assembly

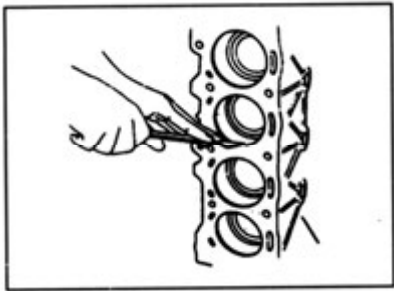
- Remove the oil pump from the cylinder block.



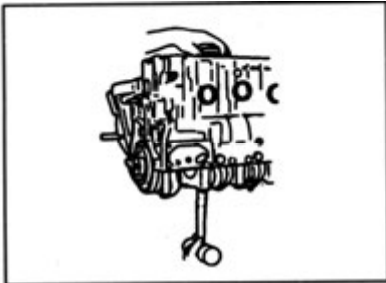
4. Connecting rod bearing cap

- If it is intended to reassemble the lower bearing of connecting rod, please attach a label to each bearing, and mark the disassembling sequence of cylinder and its installation position.

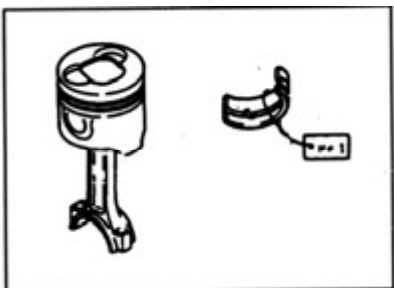




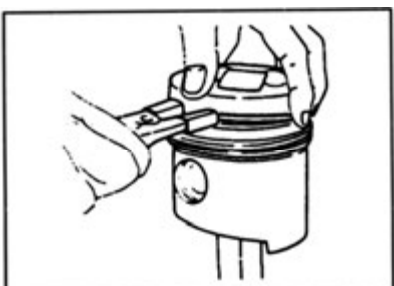
5. Piston and connecting rod with upper bearing
- 1) Scrape carbon deposits on upper cylinder wall with a scraper before disassembling the piston and connecting rod.



- 2) Move the piston to the top of cylinder head, push upward the lower part of connecting rod with a hammer handle or equivalents, then take out the piston and connecting rod.



- 3) If it is intended to reassemble the upper bearing of connecting rod, please attach a label to each bearing, and mark the disassembling sequence of cylinder and its installation position.



- 4) Clamp the connecting rod with a vice.
Take care not to damage the connecting rod.
- Remove each piston ring with piston ring replacer.
- Do not try to remove the piston ring with other tools other than piston ring replacer.
- Excessive tension of piston ring will reduce the elastic force of piston ring.

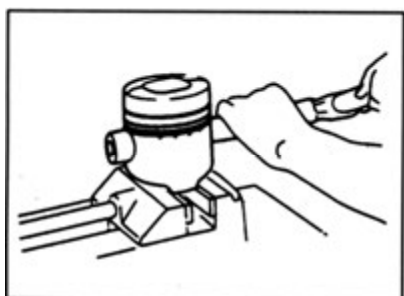


5) Dismantle piston pin retainer with pliers.



6) Gently knock out the piston pin with hammer and bar copper.

If it is intended to reassemble piston and piston pin, please attach a label to each piston and piston pin, and mark the disassembling sequence of cylinder and its installation position.



Assembly

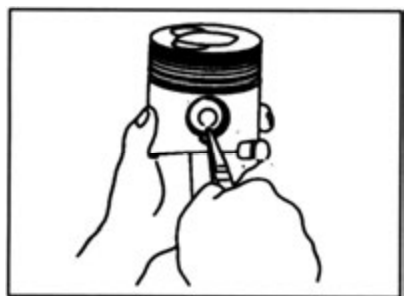
5. Piston and connecting rod with upper bearing

1) Try to push the piston pin into piston pin hole with your finger pressure.

Weigh each piston and connecting rod assembly.

Select the piston and connecting rod set in such a way that the weight difference of various assemblies is within the specified limits.

Model	Assembly mass difference (g)
4DA1	≤ 10
4DA1-1	≤ 8



2) Clamp the connecting rod with a vice.

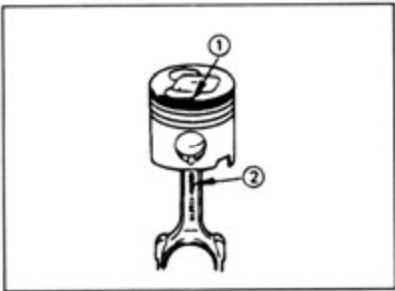
Take care not to damage the connecting rod.

3) Encase piston pin retainer to the piston with pliers.

Note:

When replacing the piston/connecting rod assembly, do not change the piston/piston pin assembly.

x

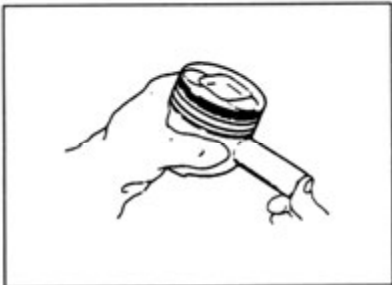


4) Install the piston onto the connecting rod.

Front mark ① on the piston head and connecting rod “F908” casting symbol ⑦ should face the same direction.



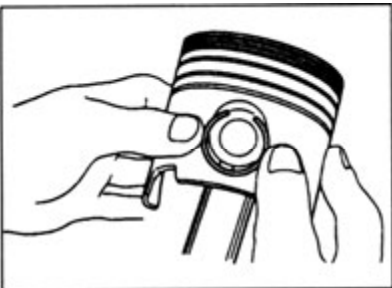
5) Add oil to the piston and piston pin hole.



Push piston pin into the piston with your finger until it touches the piston pin retainer.

6) Press the piston pin retainer into piston retainer groove with fingers.

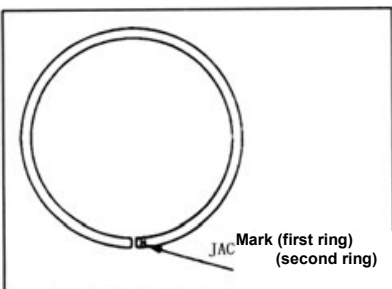
Check whether the connecting rod can freely swing on the piston pin.

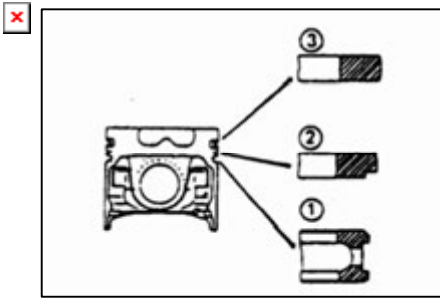


7) Install piston ring and piston packing ring.


The gas ring mark “JAC” should face upward.

Identification mark is shown in the drawing.

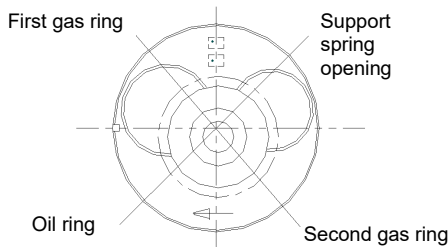




8) Assemble three piston rings with a piston ring replacer.

 The assembling sequence of piston ring is shown in the diagram.


- ① Oil ring
- ② Second gas ring
- ③ First gas ring



Note:

Mount the gas rings with chamfer toward upward.

Install the spiral ring into oil ring groove and make sure that there is no clearance at either side of the packing ring before the oil ring is installed.

 9) Apply some oil to the piston ring surface.


10) Check whether the piston ring can turn freely in piston ring groove.

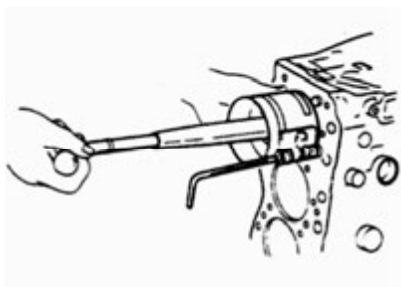
11) The cutout position for placing piston ring is shown in the drawing.

12) Carefully wipe off the foreign bodies on connecting rod bearing back and bearing mating surface.

13) Apply some oil to the upper bearing surface.



 Apply some oil to the cylinder wall.



14) The front mark on piston head must be toward the engine forepart during installation.

Compress the piston ring with a piston ring compressor.



Piston ring compressor: 1004022FA-9101

15) Push in the piston with a hammer handle until the connecting rod touches the crankpin.

In the meanwhile, rotate the crankshaft until the crankpin reaches its bottom dead center.



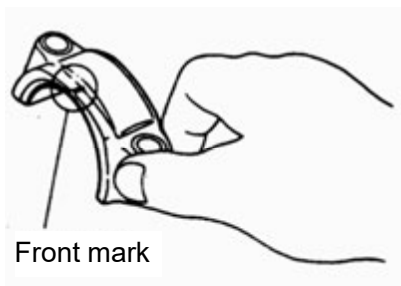
4. Connecting rod bearing cap

1) The front mark on the bearing cap must be toward the engine forepart during installation.

2) Install connecting rod bearing cap.

Align the cylinder sequence mark on connecting rod bearing cap with the one on connecting rod.

3) Apply oil to the thread and mating surface of each connecting rod bearing cap bolt.



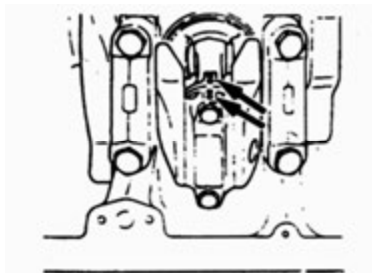
Front mark



4) Screw down connecting rod bearing cap bolt to the specified torque in two steps via torque tightening method.

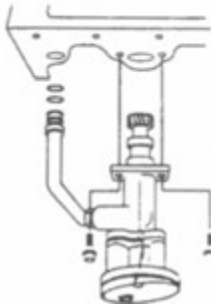
Connecting rod bearing cap bolt torque N • m

First step (sealing torque)	Second step (final torque)
20	85



Note:

Manually rotate the crankshaft to check whether it is flexible.



3. Oil pump assembly

- Prepare some solution containing 80% oil and 20% supramoly.
- Apply solution to the oil pump pinion teeth.
- Apply some oil to the oil pipe O-ring and put it into the cylinder block O-ring groove.
- Install the oil pump assembly with oil pipe on the cylinder block, and tighten fixing bolts to the specified torque.



Oil pump bolt torque	N • m
----------------------	-------



25

- Tighten sleeve nut(s) to the specified torque.

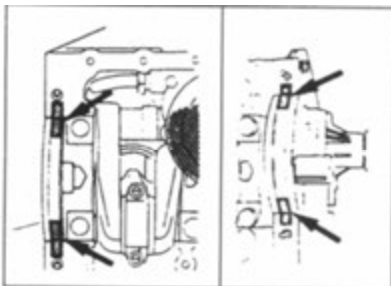


Sleeve nut torque	N • m
-------------------	-------

30

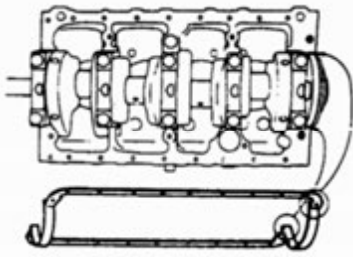
Note:

Be careful not to damage O-ring when tightening the oil pipe bolt(s).



2. Oil pan assembly

- 1) Apply recommended liquid sealant or equivalents to the fifth bearing cap arch section, groove and timing gear chamber arch section shown in the diagram.

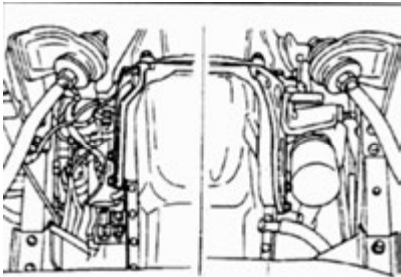


- 2) Install back lip portion of the gasket into the fifth groove.
Make sure the lip portion is compact with the groove.
- 3) Install the oil pan to the cylinder block.
Tighten oil pan bolt(s) to the specified torque.



Oil pan bolt torque N • m

23.5

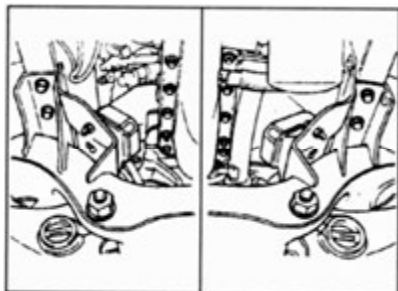


- 4) Install the stiffener plate and tighten bolt(s) to the specified torque.

Engine block side

Stiffener plate bolt torque N.m

30

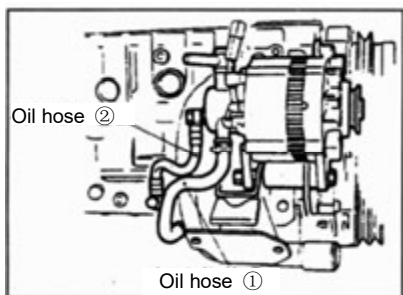


- 5) Install exhaust pipe bracket.
- 6) Install support rubber and tighten nut(s) to the specified torque.

Support rubber nut torque N.m

40

cardiagn.com



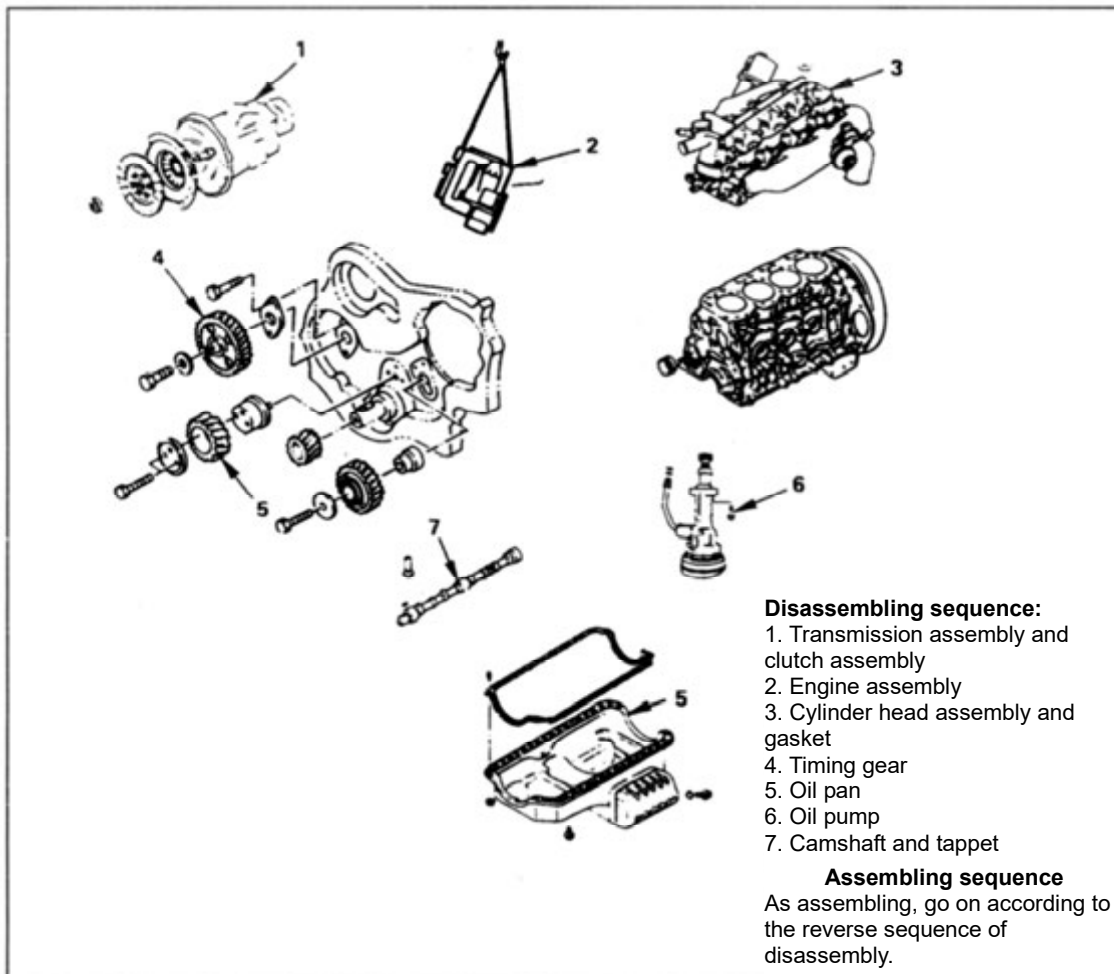
7) Mount vacuum pump oil hose ① to the oil pan.

1. Cylinder head assembly

Refer to “3.12 Cylinder head assembly and gasket”.



3.16 Camshaft and tappet



- Disassembling sequence:**
1. Transmission assembly and clutch assembly
 2. Engine assembly
 3. Cylinder head assembly and gasket
 4. Timing gear
 5. Oil pan
 6. Oil pump
 7. Camshaft and tappet

Assembling sequence

As assembling, go on according to the reverse sequence of disassembly.



Disassembly

Preparation:

- Remove the ground cables of battery.
- Discharge coolant completely.
- Discharge the oil completely.

Note:

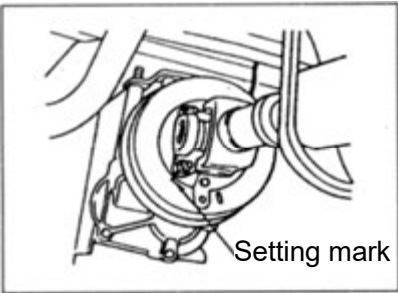
Install oil drain plug with new gasket.



Oil drain plug torque

N • m

80



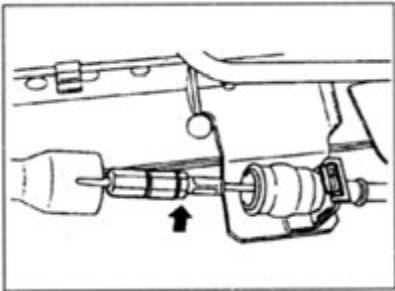
1. Transmission assembly and clutch assembly

- Hoist the automobile and support it with a suitable and safe bench.

1) Transmission

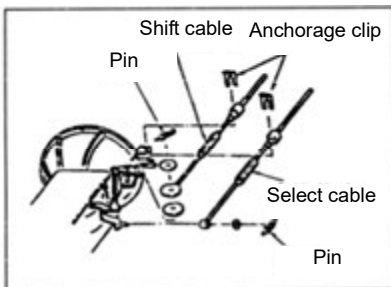
① Transmission

- Make a setting mark on the flange yoke and parking brake drum.
- Disassemble the drive shaft on the flange yoke.
- Move aside the drive shaft and bind it on the frame so as to facilitate maintenance work.



② Parking brake cable

- Move the connecting cover away.
- Dismantle connecting bolts.
- Remove anchorage clips and withdraw bracket cables.

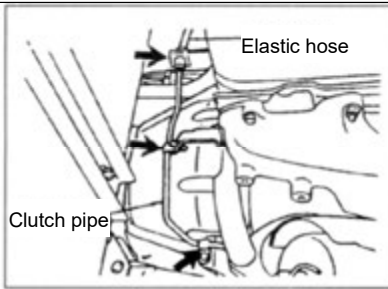


③ Wire connector

- Detach the wire connectors of vehicle speed sensor, neutral switch and backup light switch.

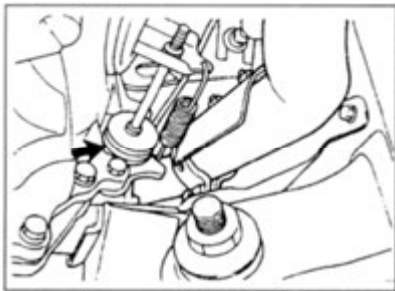
④ Shift and select cables

- Remove the shift and select cables at transmission side.

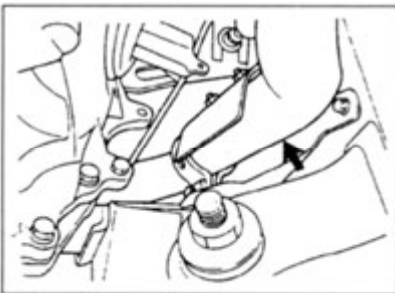


⑤ Clutch slave cylinder

- Remove the clutch hose clips and clip bracket (only for vehicles with right steering wheel).



- Disassemble the lower slave cylinder assembly together with hoses, and bind them to the frame so as to facilitate maintenance work.



⑥ Exhaust brake assembly

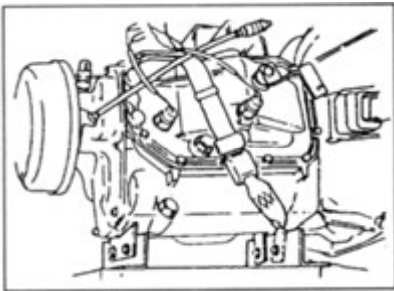
⑦ Front exhaust pipe

⑧ Transmission assembly

Note:

Sometimes the exhaust pipe bracket, gear control bracket and anchorage clips are at mounting positions or directions. In order to prevent this, please make correct mounting marks on those parts.

- Use a transmission jack to jack up the transmission.



Caution:

In order to prevent transmission overturn, use chains or belts to secure it to the jack.

Do not let the transmission hover over the clutch, or it will destroy the clutch.

- Remove nuts securing the transmission bracket at beam side.
- Angles of the engine and transmission have to be adjusted so that they can be easily disassembled.



- Use a jack or crane to jack up the rear part of engine.

Caution:

After jacking up the engine, place a wooden block under it to protect the oil pan.

- Remove the transmission binding bolts.
- Draw out the transmission assembly backwards.

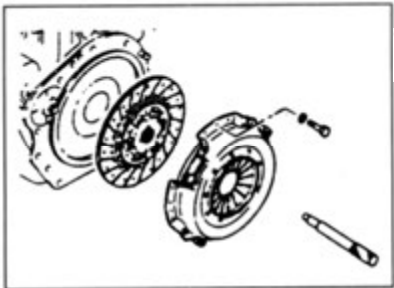
⑨ Bracket

2) Clutch

- Hoist the vehicle and support it with a suitable and safe bench.

Caution:

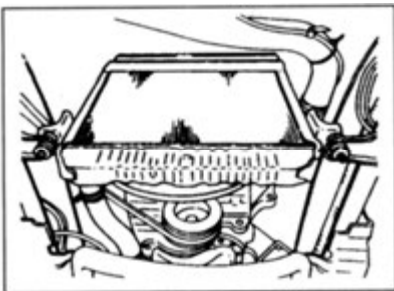
Make sure that no clutch fluid is left on the coating surface, or wash it away immediately.



① Pressure plate assembly

② Driven plate assembly

- Use a guiding centralizer to prevent the driven plate assembly falling freely.
- Mark the flywheel and pressure plate flange to ensure alignment during installation.
- Loosen fixing bolts of the pressure plate assembly.

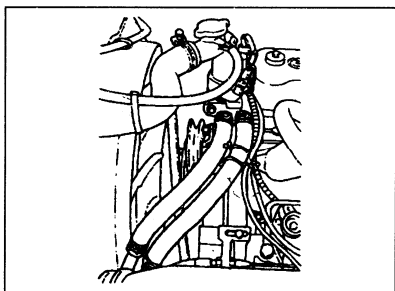


2. Engine assembly

1) Radiator assembly

- Remove the upper and lower hoses of the radiator.
- Remove storage tank hose.
- Remove the shock-absorbing rubber at both sides.
- Remove radiator support.

2) Air intake duct



3) Heater hose

4) Engine control cable

- Unscrew the locking nut(s) at the bracket and remove throttle wire(s) from the injection pump control lever.

5) Glow plug wire

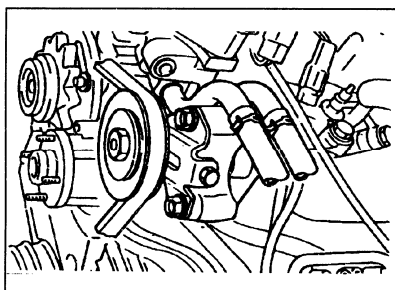
6) Fuel hose

- Remove fuel inlet hose and return hose.

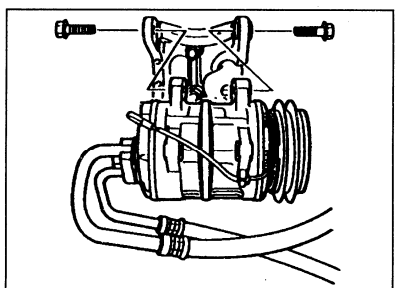
7) Oil pressure switch wire

8) Air conditioning compressor assembly

- Unscrew idler locking nut(s).
- Loosen adjusting nut(s) and remove the drive belt.

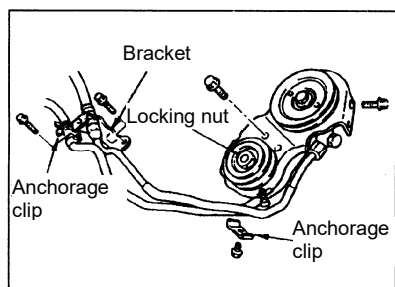


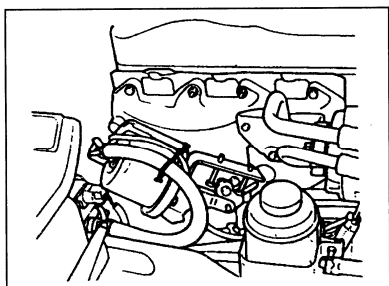
- Remove the wire connector of electromagnetic clutch.
- Remove fixing bolt(s) of the air conditioning compressor and temporarily bind the compressor to the frame with wires.



9) Power steering pump and bracket assembly (power steering type)

- Unscrew idler locking nut(s).
- Loosen adjusting nut(s) and remove the drive belt.
- Remove pipe bracket fixing bolt(s) and anchorage clip (s).
- Remove power steering pump fixing bolt(s) and temporarily bind the pump to the frame with wires.



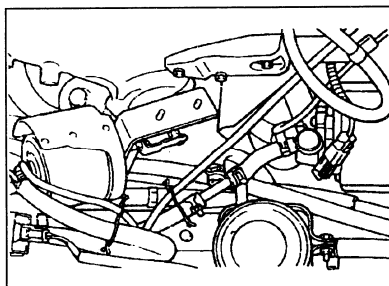


10) Modulator vacuum hose (exhaust brake type)

- Remove the vacuum hose at modulator side.

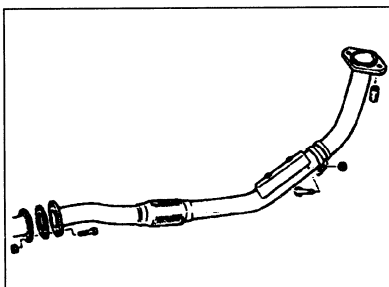
11) Vacuum pump hose (exhaust brake type)

- Remove the vacuum hose at both vacuum tank and solenoid valve sides.



12) Front exhaust pipe

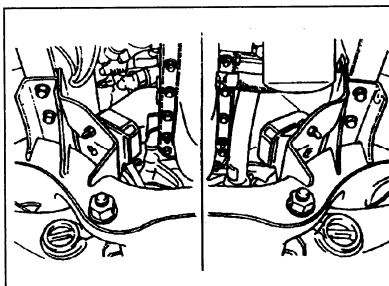
- Remove exhaust pipe fixing bolt(s) from the exhaust manifold.
- Remove exhaust pipe support bolt(s).
- Remove fixing nut(s) from front exhaust pipe.



13) Support rubber

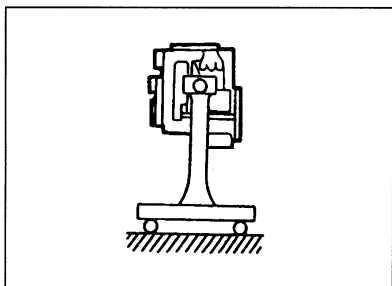
① If mounted at right side

- Remove the two fixing nuts at beam side.



② If mounted at the left side

- Remove the two fixing nuts at beam side.



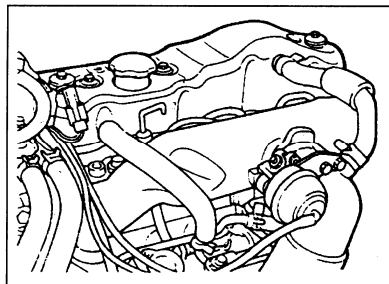
14) Engine assembly

- Slowly hoist the engine with a crane.
- Lift the engine with its front part higher than rear part.
- While taking out the engine assembly, be careful to avoid breaking any oil pipe, brake pipe, etc.
- Place the engine on an engine support.

3. Cylinder head assembly and gasket

1) High pressure oil pipe

- Unscrew high pressure oil pipe anchorage clip(s).
- Loosen the taper nut(s) at injection pump side.
- Unscrew taper nut(s) at fuel injector side and remove high pressure oil pipe(s).

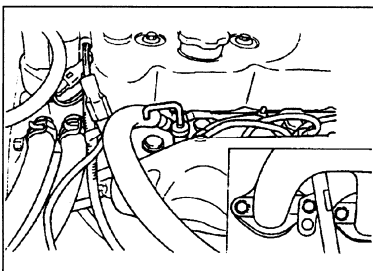


2) Oil return hose

- Remove the oil return hose at oil return pipe side.

3) Crankcase vent hose

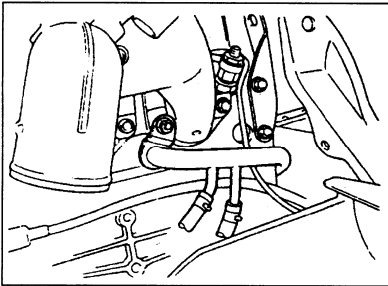
- Dismantle crankcase vent hose(s) from air-intake duct.



4) Glow plug wire

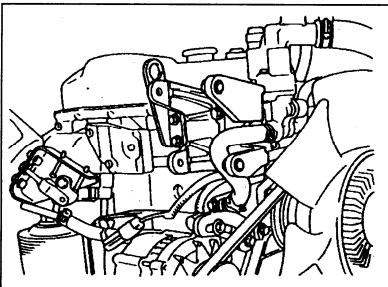
5) Oil scale guide

- Remove oil scale guide out of the cylinder head.



6) Oil cooler tube

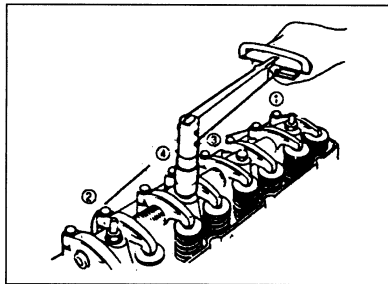
- Remove pipe bracket fixing bolt(s) at rear side of cylinder head.
- Remove oil scale guide out of the cylinder head.



7) Bypass hose

8) Cylinder head cover

- Remove crankcase vent hose and cylinder head cover bolt(s).



9) Rocker shaft

- Loosen rocker shaft support bolt(s) bit by bit according to the sequence shown in the diagram.



Note:

Disobedience will bring unfavorable influence to the rocker shaft.

10) Push rod

11) Cylinder head assembly

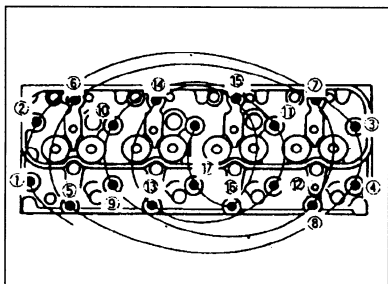
- Loosen cylinder head bolt(s) bit by bit according to the sequence shown in the diagram.



Note:

Disobedience will bring unfavorable influence to the lower surface of cylinder head. 12) Cylinder head gasket

- Remove cylinder head gasket and anchor pin.



4. Timing gear

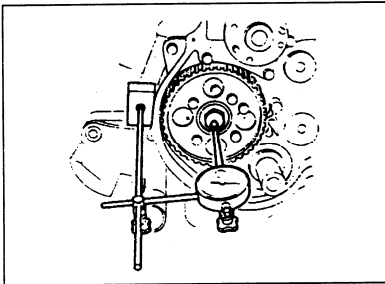
1) Cooling fan assembly

- Unfasten tight nut(s), and dismount the fan assembly and fan pulley.



- 2) Crankshaft damper pulley
- 3) Acoustic hood
- 4) Acoustic hood liner
- 5) Timing gear chamber cover
- 6) Camshaft timing gear

- ① Measure the axial clearance of camshaft with a dial gauge.
Measure the clearance before disassemble the camshaft gear.
If the axial clearance of camshaft exceeds prescribed limit, the thrust washer has to be replaced.



Axial clearance of camshaft mm

Standard	Limit
0. 050—0. 114	0. 2

- ② Remove camshaft timing gear bolt(s) from the camshaft.

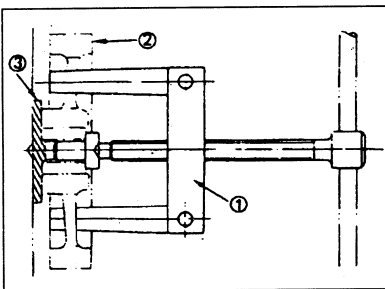
Note:

Keep the camshaft fixed to prevent its rotating.

- ③ Pull out camshaft timing gear ② with a universal puller ①.

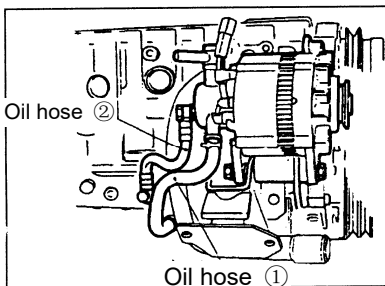


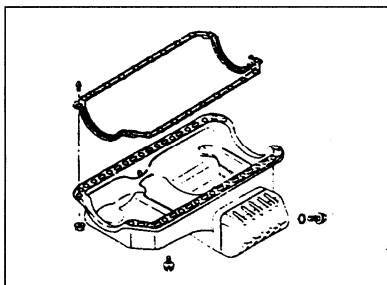
- ④ Remove the thrust washer ③.



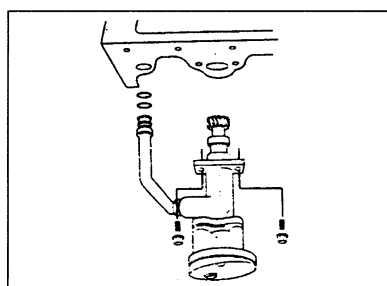
5. Oil pan

- Remove vacuum pump oil hose ① out of the oil pan.



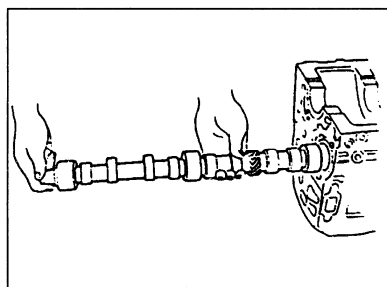


- Remove stiffener plate and rubber cushion from both sides of the oil pan.
- Dismantle oil pan bolt(s) and remove the oil pan from the cylinder block.



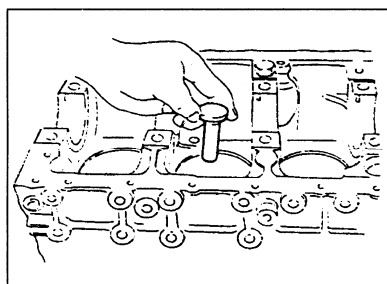
6. Oil pump assembly

- Remove oil pump assembly from the cylinder block.



7. Camshaft and tappet

- Remove the oil pan from the cylinder block.
- Be careful not to damage the camshaft bearing.



- Take out the tappet from the cylinder block.



Assembly

7. Camshaft and tappet



- Coat oil on the tappet and in the installation hole of cylinder block tappet.
- Place the tappet according to the position mark made during removing (if the tappet is intended to be reused).

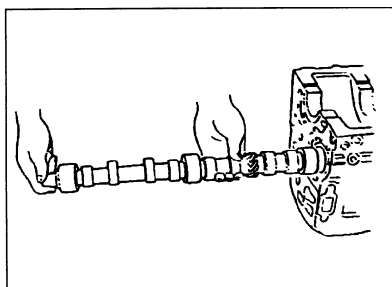


Note:

The tappet must be installed before camshaft is assembled.



- Coat oil on the camshaft and camshaft bearing.
- Install the camshaft on the cylinder block.
Be careful not to damage the camshaft bearing.



6. Oil pump assembly



- Prepare some solution containing 80% oil and 20% supramoly.
- Apply enough solution to the oil pump pinion teeth.



- Apply some oil to the oil pipe O-ring and put it into the cylinder block O-ring groove.
- Install the oil pump assembly with oil pipe on the cylinder block, and tighten fixing bolts to the specified torque.



Oil pump bolt torque	N • m
----------------------	-------

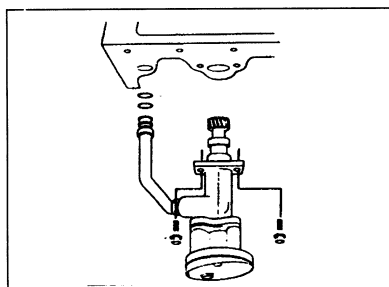
25

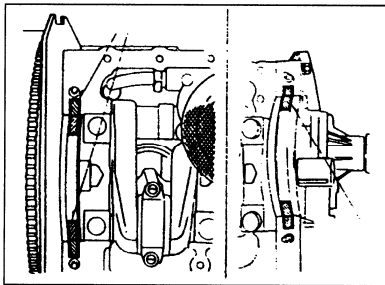


Tighten sleeve nut(s) to the specified torque.

Sleeve nut torque	N • m
-------------------	-------

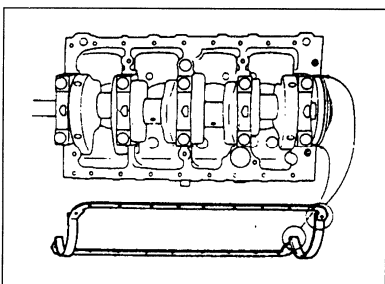
30





5. Oil pan

- Apply recommended liquid sealant or equivalents to the fifth bearing cap arch section, groove and timing gear chamber arch section shown in the diagram.
- Install back lip portion of the gasket into the fifth groove.
- Make sure that the lip portion is compact with the groove.
- Install the oil pan to the cylinder block.
- Tighten oil pan bolt(s) to the specified torque.

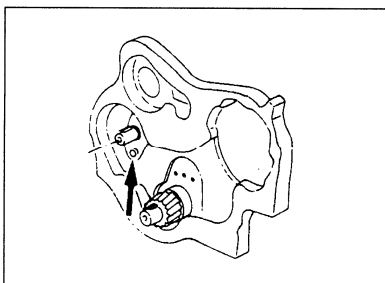


Oil pan bolt torque	N • m
23.5	

4. Timing gear

7) Camshaft timing gear

- Install the thrust washer onto the cylinder block and tighten thrust washer bolt(s) to the specified torque.



	N • m
25	

- Install camshaft timing gear to the camshaft.

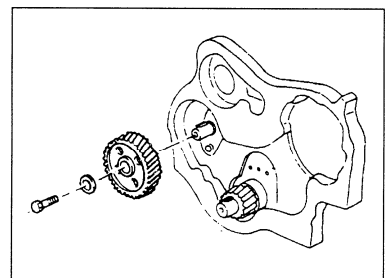
The timing gear mark (“Y—Y”) has to face the outside.

Align idler gear marks “B” “V-V” with injection pump timing gear mark “V”.

Align idler gear marks “B” “Z” with idler gear marks “A” “Z-Z”.

Arrange idler gear setting marks “X” and “Y” so that they both face the engine forepart.

Align idler gear mark “X” with crankshaft timing gear mark “X—X”.





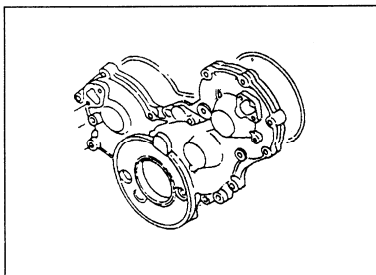
Align idler gear mark “Y” with camshaft timing gear mark “Y—Y”.

- Tighten the timing gear to the specified torque.



Timing gear bolt torque N • m

110



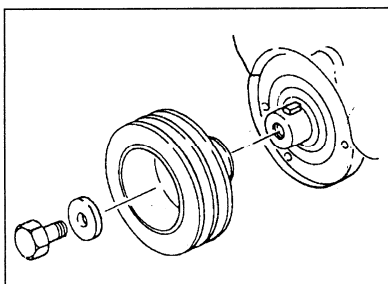
6) Timing gear chamber cover

Align timing gear chamber anchor pin with the timing gear chamber, then install timing gear chamber cover.

Tighten gear chamber cover bolt to the specified torque.

Gear chamber cover bolt torque N • m

25



5) Acoustic hood liner

6) Lower acoustic hood

7) Upper acoustic hood

2) Crankshaft damper pulley

Screw down the crankshaft damper pulley bolt(s) to the specified torque.

Note:

While screwing down the damper pulley, hold the flywheel ring gear to prevent crankshaft rotating.



Crankshaft pulley bolt torque

N • m

210

1) Cooling fan assembly



- Install the fan pulley and cooling fan assembly (in this installation order) on water pump, and tighten those parts to the specified torque.

N·m

12.5



3. Cylinder head assembly and gasket

Refer to “3.12 Cylinder head assembly and gasket”.

2. Engine assembly

14) Engine assembly

- Hoist the engine support with a crane.

13) Support rubber

- Tighten fixing bolts to the specified torque after all of them (left: 2, right: 2) have been inserted into their corresponding holes.

Support rubber bolt torque N.m

40

12) Front exhaust pipe

- Connect exhaust pipe and tighten nut(s) to the specified torque.

Exhaust pipe nut torque N • m

67

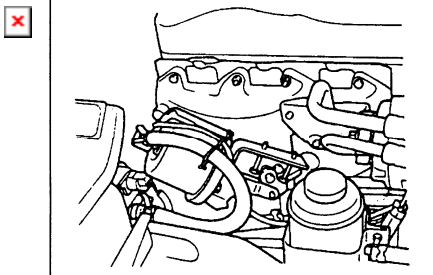
- Install exhaust pipe support bolts and tighten bolts and nuts to the specified torque.

Support bolt and nut torque N • m

40

11) Vacuum pump hose

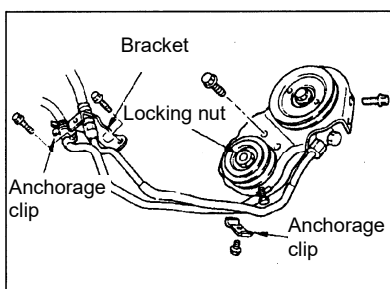
- Install the vacuum hose at both vacuum tank and solenoid valve sides.



- Connect the vacuum hose to the modulator.

9) Power steering pump and bracket assembly (power steering type)

- Install power steering pump and pipe bracket, then tighten bolts to the specified torque.



Pump bolt torque N • m

20

Pipe bracket bolt torque N • m

20



Anchorage clip bolt torque N • m

10



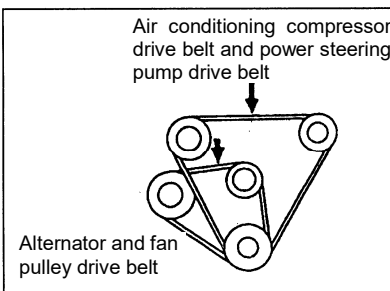
- Install power steering pump drive belt and adjust the belt tension.



- Check drive belt is worn or damaged, and replace if necessary.
- Check the belt tension, and adjust if necessary.
- Press the central section of belt with a force of 100N and check the deflection of each belt.

- Deflection standard value

mm



	Initial tension
Power steering pump drive belt	8—10

- Loosen power steering pump locking bolt(s) and adjust belt tension with adjusting bolt.

10) Modulator vacuum hose



Power steering pump locking bolt torque

N • m



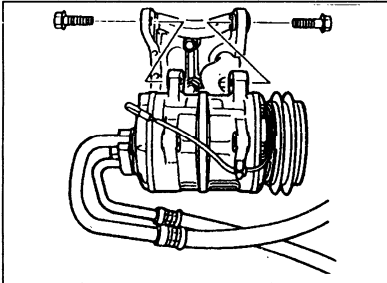
37.5

Idler locking nut torque

N • m



25



8) Air conditioning compressor assembly

- Install the fixing bolt(s) of air conditioning compressor and screw down the bolt(s) to the specified torque.

Compressor fixing bolt torque

N • m

20

- Connect the wire connector of electromagnetic clutch.
- Install air compressor drive belt and adjust the belt tension.
- Check drive belt is worn or damaged, and replace if necessary.
- Check the belt tension, and adjust if necessary.
- Press the central section of belt with a force of 100N and check the deflection of each belt.
- Deflection standard value

mm



Initial tension



Air conditioning compressor drive belt 8—10

- Loosen air conditioning compressor locking bolt(s) and adjust belt tension with the adjusting bolt of adjuster.

Idler locking nut torque

N • m

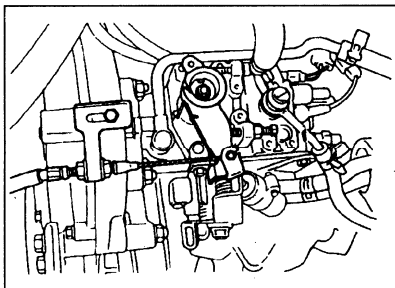
25

7) Oil pressure switch wire

- Connect oil pressure switch wire connector.

6) Fuel hose

- Connect fuel delivery hose and return hose, and then tighten the anchorage clip(s) firmly.

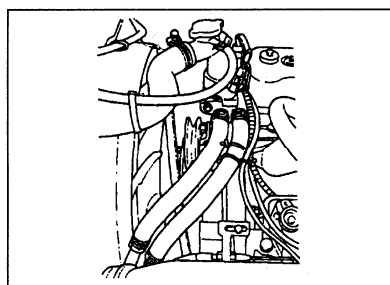


5) Glow plug wire

- Install wire connector and tighten bolt(s) firmly.

4) Engine control cable

- ① Mount the control cable to engine control lever.
- ② Place the throttle lever at fully-off position and pull tight the control cable along the arrow direction to prevent slackness.
- ③ Tighten the throttle cable bracket bolt(s).

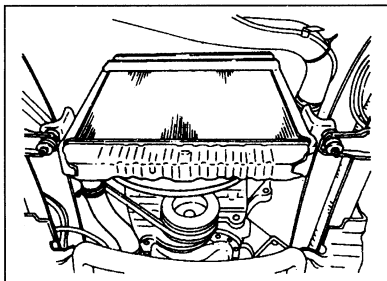


3) Heater hose

- Connect the radiator hose, and then tighten the anchorage clip(s) firmly.

2) Air intake duct

- Connect the air-intake duct, and then tighten the anchorage clip(s) firmly.

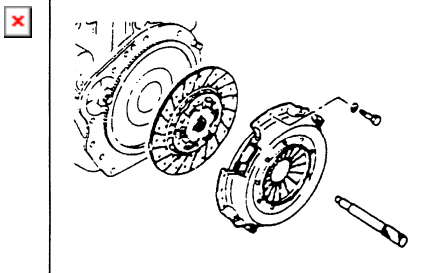


1) Radiator assembly

- ① Install shock-absorbing rubber at both sides.
- ② Mount radiator support.
- ③ Connect the upper and lower hoses of the radiator.
- ④ Connect storage tank hose.

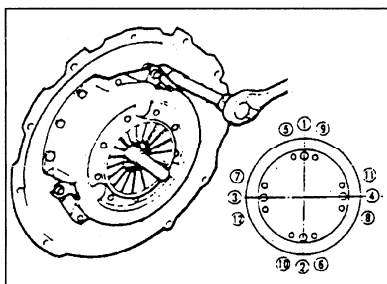
1. Transmission assembly and clutch assembly

2) Clutch



② Driven plate assembly

- Apply multifunctional supramoly grease to the splines of driven plate hub.
- Mount the driven plate assembly with a guiding centralizer.



① Pressure plate assembly

- Screw down pressure plate fixing bolts in turn.



Pressure plate fixing bolt torque

N • m

25

- Remove the guiding centralizer.

Note:

If a new pressure plate is installed, make sure to remove the protection diaphragm spring cable after tightening the pressure plate to the specified torque.

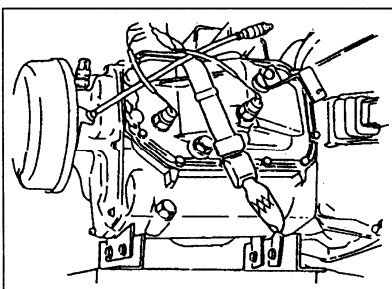
1) Transmission

⑨ Mounting bracket

Mounting bracket nut torque

N • m

69



⑧ Transmission assembly

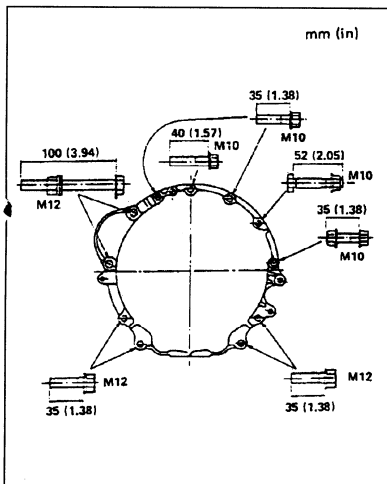
- Use a transmission jack to jack up the transmission.



Caution:

In order to prevent transmission overturn, use chains or belts to secure it to the jack.

- Shift the transmission to high speed gear.
- Tilt the transmission in the same straight line with the engine.
- Rotate parking brake drum outputs to ease the clutch spline engagement.



Clutch cover to flywheel casing bolt torque

N • m

M10: 46

M12: 91

- Hoist the engine and let the transmission enter the rear transmission bracket.



Rear engine support nut and bolt torque

N • m

M10: 40

M12: 69

⑦ Front exhaust pipe



Front exhaust pipe bolt torque

N • m

37

⑥ Exhaust brake assembly



Exhaust brake bolt torque

N • m

17

⑤ Clutch slave cylinder



Slave cylinder bolt torque

N • m

20



- Adjust the slave cylinder before mounting return spring.
 - Unscrew the push rod locking nut.
 - Turn the adjusting nut until it is against the release fork.
 - Back off the adjusting nut by 1½ turns. (The free gap of release fork is about 2mm).
 - Screw down the locking nut.



Push rod locking nut torque

N • m

16

④ Shift and select cables

③ Wire connector



② Parking brake cable

① Drive shaft

- Align previously made marks.

Drive shaft nut torque

N • m

66



- Connect the ground cables of battery.

- Add some coolant.

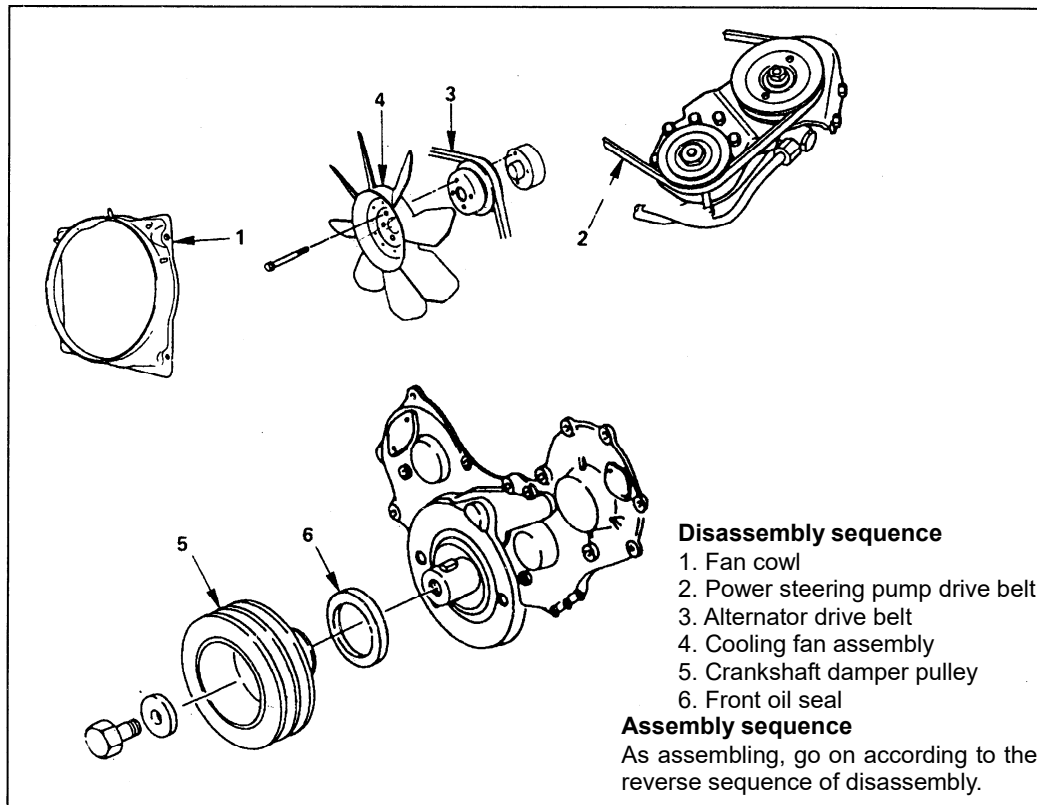


- Add some oil.

- Start the engine and check whether the coolant leaks.



3.17 Crankshaft front oil seal

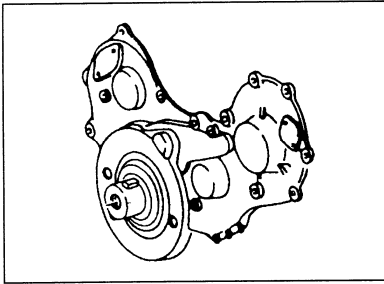


Disassembly



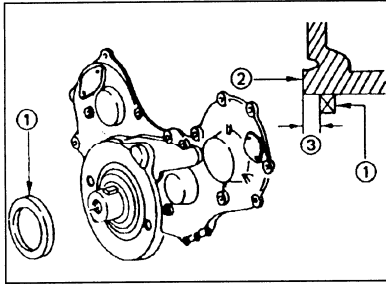
Preparation:

- Remove battery ground cables.
 - Discharge coolant completely.
1. Fan guard
 2. Power steering pump drive belt
 - Unscrew bracket fixing bolt(s) and adjusting bolt(s) of the power steering pump, then remove the drive belt.
 3. Alternator drive belt
 - Unscrew alternator bracket fixing bolt(s) and adjusting plate locking bolt(s), then remove the drive belt.
 4. Cooling fan assembly
 - Unfasten tight nut(s), and dismount the fan assembly, collar and fan pulley.



5. Crankshaft damper pulley
6. Front oil seal
 - Tap around the oil seal with a plastic hammer and a screwdriver, and take out the oil seal out of the gear chamber cover.

Exercise care to avoid damaging the seal mating surface.



Assembly

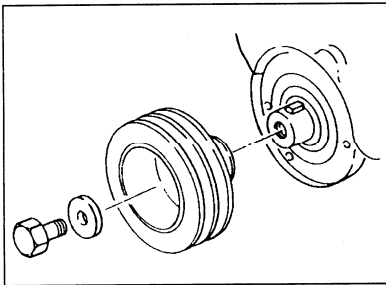
6. Front oil seal
 - Mount the oil seal ① onto the gear chamber cover ② with an erector.



Oil seal erector: 1002420FA-9101

Pay attention to the seal mounting level ③ shown in the diagram.

Mounting depth ③ = 1 mm



5. Crankshaft damper pulley
 - Screw down the crankshaft damper pulley bolt(s) to the specified torque.

Note:



Pulley bolt torque

N·m

210

4. Cooling fan assembly



- Install the fan pulley, spacer block and cooling fan assembly (in this installing order) to a water pump, and tighten those parts to the specified Tightening torque

N·m

12.5

3. Alternator drive belt

- Mount the alternator drive belt and adjust the belt tension.
- Refer to the "Drive belt adjustment" in this section.



2. Front oil seal

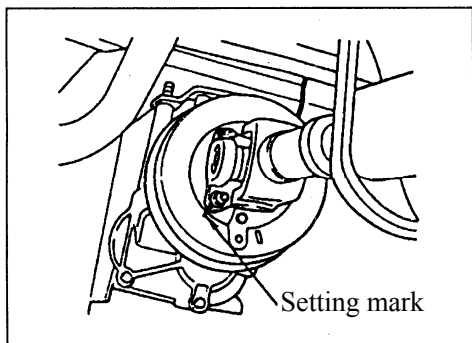
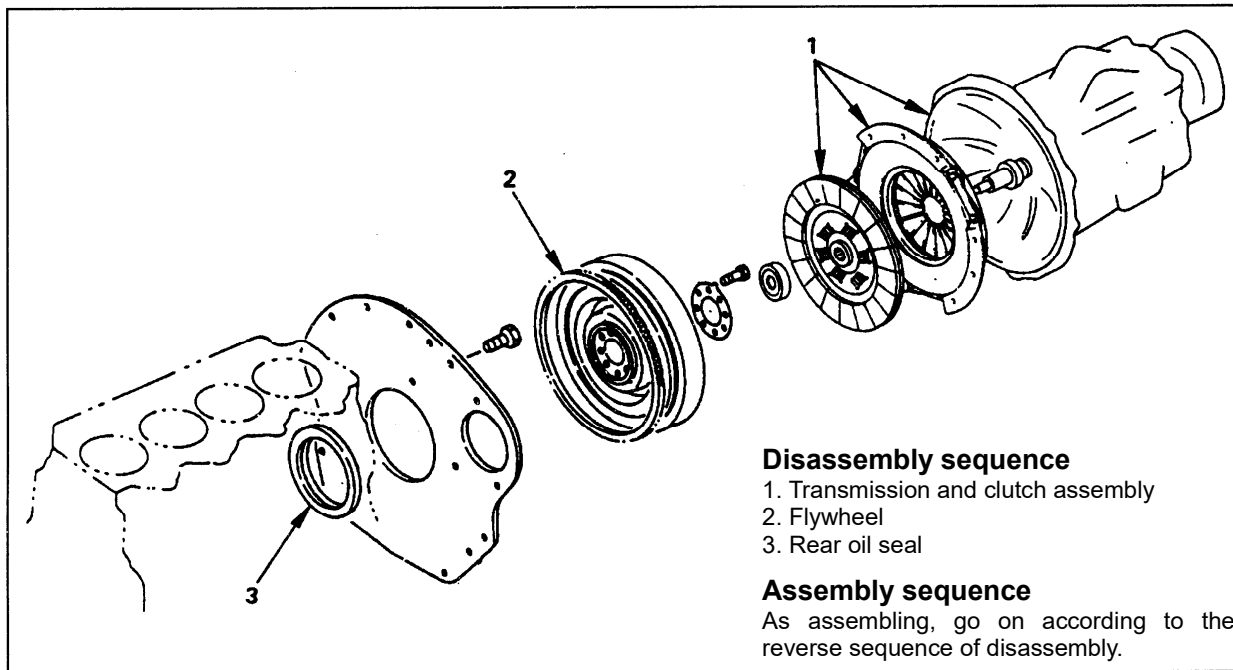
- Mount power steering pump drive belt and adjust the belt tension.
- Refer to the “Drive belt adjustment” in this section.

1. Fan guard

- Install the fan guard and storage tank hose.
- Add in some coolant.
- Start the engine and check whether there is any leakage of the coolant.



3.18 Crankshaft rear oil seal



Disassembly

Preparation:

- Remove the battery ground cable.

1. Transmission and clutch assemblies

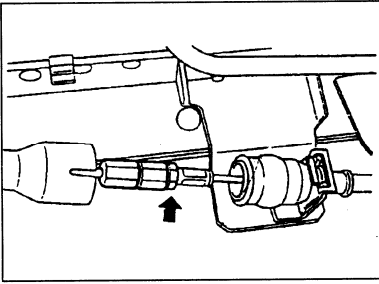
Hoist the car and support it with a suitable and safe bench.

1) Transmission

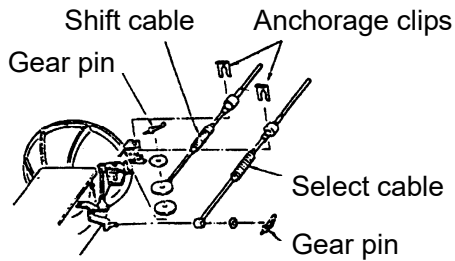
① Transmission

Mark the parking brake drum and flange yoke beforehand.

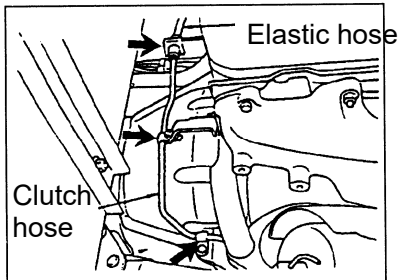
- Remove the flange yoke drive shaft.
- Put the bundled up drum and flange yoke aside so as to facilitate maintenance work.



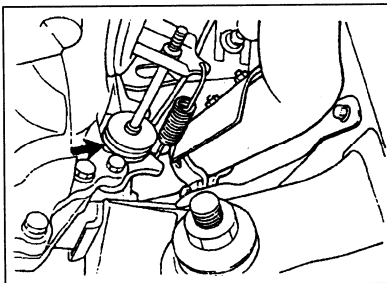
- ② Parking brake cable
 - Detach the connecting hood.
 - Remove connecting bolts.
 - Dismantle anchorage clips and withdraw bracket cables.



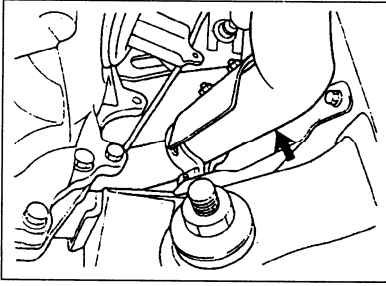
- ③ Wire connector
 - Detach wire connectors of the vehicle speed sensor, neutral switch and back-up light switch.
- ④ Shift and select cables
 - Remove the shift and select cables on transmission side.



- ⑤ Clutch slave cylinder
 - Remove the clutch hose clips and clip bracket



- Disassemble the slave cylinder assembly with Elastic hoses, and bind it to the frame so as to facilitate the maintenance work.

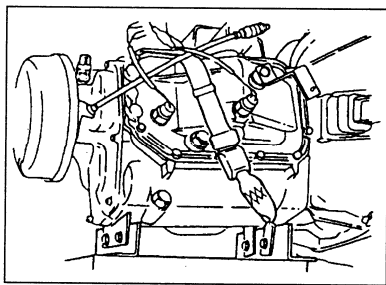


- ⑥ Exhaust brake assembly
- ⑦ front exhaust pipe
- ⑧ Transmission assembly

Notes:

Sometimes the exhaust pipe bracket /gear control bracket and anchorage clips are in the wrong mounting positions or directions. In order to prevent this, please mark correct mounting signs on those parts.

- Use a transmission jack to jack up the transmission.



Caution:

In order to prevent transmission overturn, use chains or belts to secure it to the jack.

Do not let the transmission hover over the clutch, or it will destroy the clutch.

- Remove nuts securing the transmission mounting bracket on the beam side.
- Angles of the engine and transmission have to be adjusted so that they can be easily disassembled.
- Use a jack or crane to jack up the engine rear part.



Caution:

After jacked up the engine, place a wooden block under it to protect the oil pan.

- Remove the transmission binding bolts.
- Draw the transmission assembly backwards.

⑨ Mounting bracket

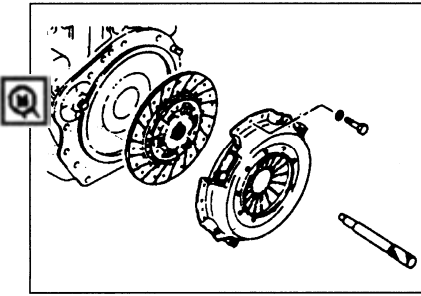
2) Clutch

- Hoist the car and support it with a suitable and safe bench.



Caution:

Make sure no clutch fluid is left on the coating surface, or wash it away immediately.



① Pressure plate assembly

② Driven plate assembly

- Use a guiding centralizer to prevent the driven plate assembly dropping freely.
- Mark the flywheel and pressure plate flange to ensure alignment during installation.
- Loosen fixing bolts in the pressure plate assembly.

2. Flywheel

3. Rear oil seal

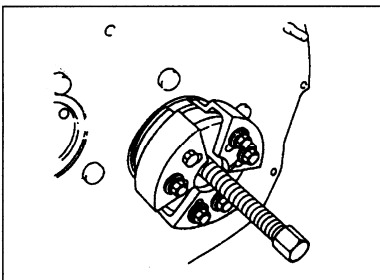
- Push in the oil seal and mount special tools according to the left diagram to dismantle the oil seal.



• Rear oil seal detacher: 1002430FA-9101

Note:

Take care to avoid damaging the crankshaft and oil seal pedestal while removing the oil seal.



Assembly

3. Rear oil seal

- Mount the oil seal to the cylinder block with an oil seal erector.

Rear oil seal erector: 1002430FA-9102



Notes:

Clean the rust and chips off the press-in portion of the oil seal.

Pay attention to the press-in direction.

1) Use two bolts to connect the adaptor of special tools to the crankshaft rear end.

2) Install the oil seal to the periphery of the adaptor.

3) Insert the socket into the adaptor portion and screw down it with a bolt (M12×1.75L=70) until the adaptor tip is against the socket.

4) Remove the adaptor and socket.

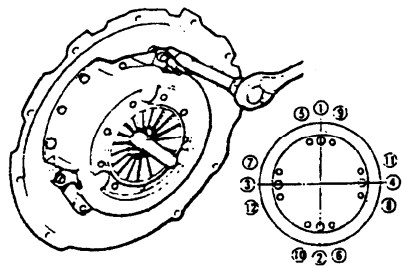
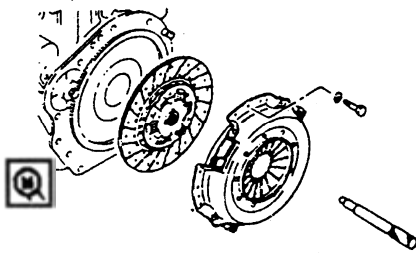
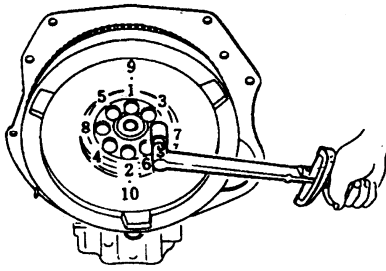
5) Check the oil seal size after it is installed.



Standard value

mm

12. 2—12. 8



2. Flywheel

- Apply some oil to fixing bolts.
- By using of the torque tightening method, screw down the flywheel bolts to the specified torque in two steps according to the left diagram.



Flywheel bolt torque

N·m

Step I	Step II	Step III
25	70	120

1. Transmission and clutch assemblies

2) Clutch

② Driven plate assembly



- Apply multifunctional supramoly grease to the splines of driven plate hub.



- Mount the driven plate assembly with a guiding centralizer.

Guiding centralizer:

1601100FA-9101

① Pressure plate assembly

Screw down pressure plate fixing bolts in turn.



Pressure plate fixing bolt torque

N·m

25

- Remove the guiding centralizer.

Note:

If a new pressure plate is installed, make sure to remove the protection diaphragm spring cable after tightening the pressure plate to the specified torque.

1) Transmission

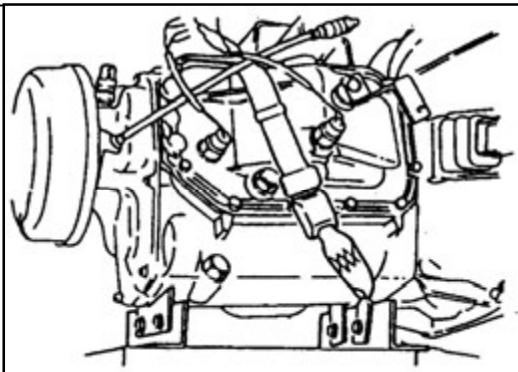
⑨ Bracket



Bracket nut torque

N·m

69



⑧ Transmission assembly

- Use a transmission jack to jack up the transmission.

Caution:

In order to prevent transmission overturn, use chains or belts to secure it to the jack.

- Shift the transmission to high speed gear.
- Make the transmission tilt in the same straight line with the engine.
- Rotate parking brake drum outputs to ease the clutch spline engagement.



Clutch cover to

flywheel casing bolt torque

N·m

M10: 46

M12: 91

- Hoist the engine and let the transmission enter the rear transmission bracket.



Rear engine bracket nut and bolt torque

N·m

M10: 40

M12: 69

⑦ front exhaust pipe



Front exhaust pipe bolt torque

N·m

37

⑥ Exhaust brake assembly



Exhaust brake bolt torque

N·m

17

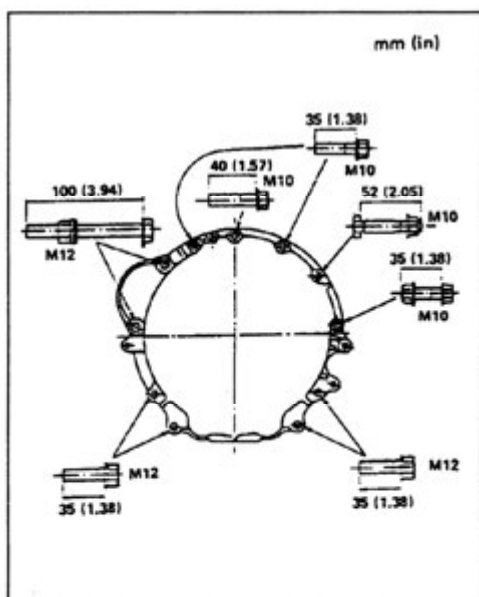
⑤ Clutch slave cylinder



Slave cylinder bolt torque

N·m

19





- Adjust the slave cylinder before mounting return spring.

- a) Unscrew the push rod locking nut
- b) Turn the adjusting nut until it is against the release fork.
- c) Back off the adjusting nut by 1½ turns. (The free gap of release fork is about 2mm/0.1in).
- d) Screw down the locking nut.



- Push rod locking nut torque N·m

16

- ④ Shift and select cables
- ③ Wire connector
- ② Parking brake cable
- ① Drive shaft



- Align previously made marks.

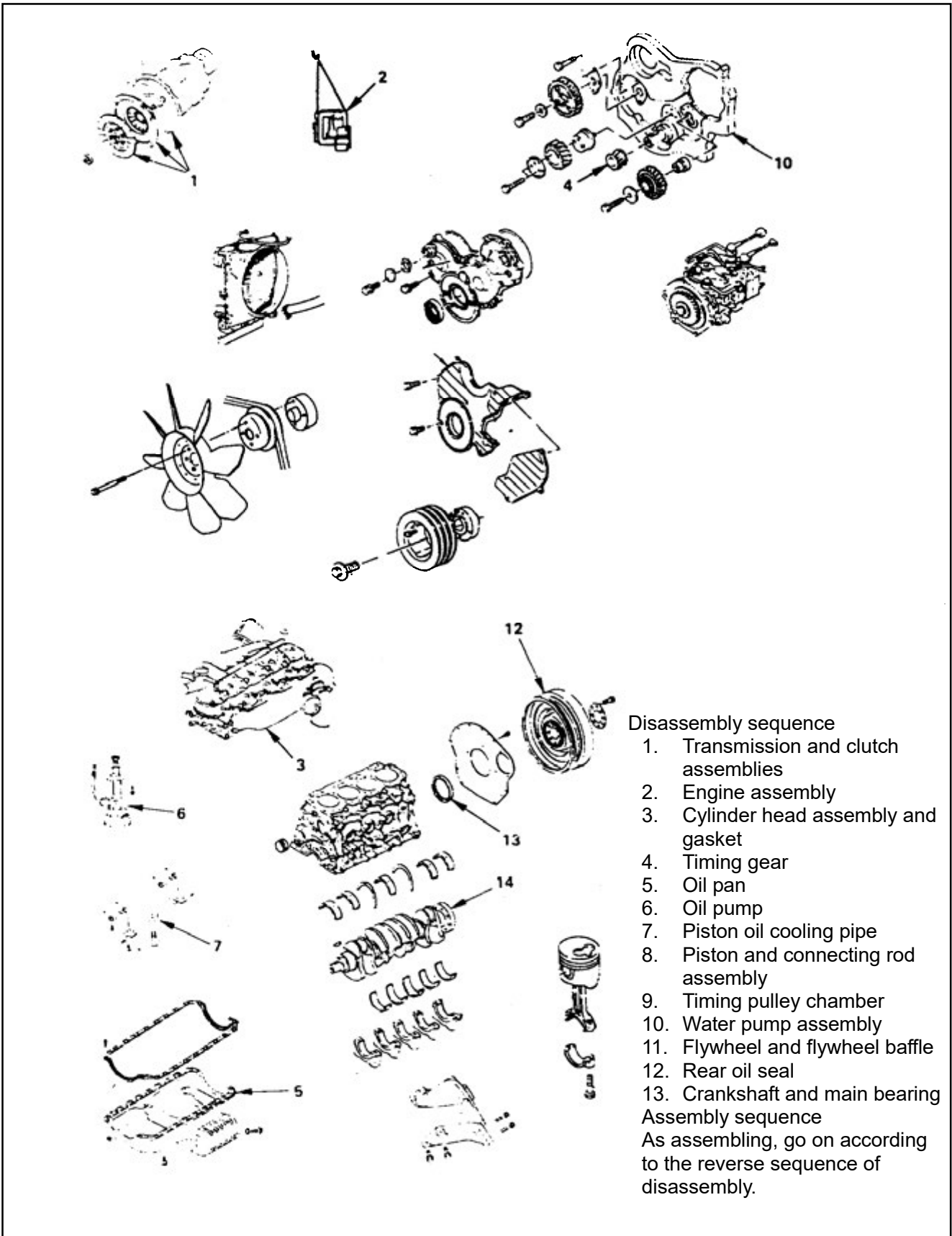
Drive shaft nut torque N·m

66

- Connect battery ground cables.



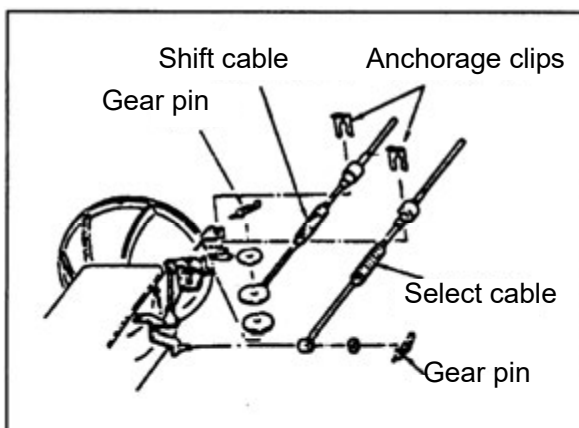
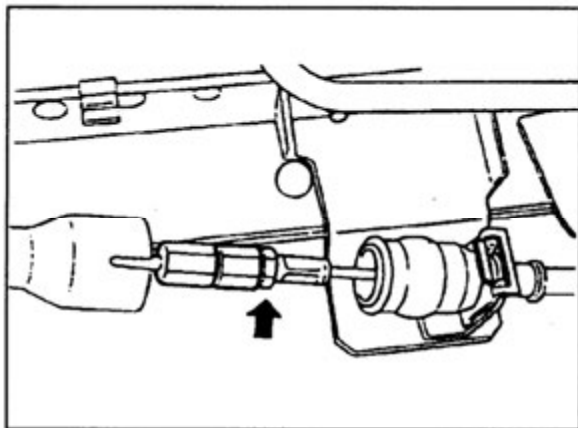
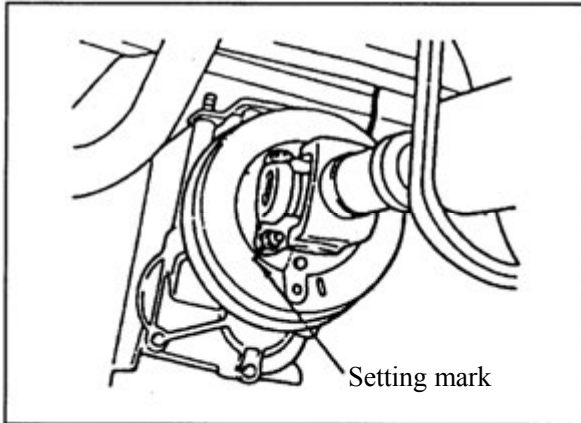
3.19 Crankshaft and main bearing



- Disassembly sequence
1. Transmission and clutch assemblies
 2. Engine assembly
 3. Cylinder head assembly and gasket
 4. Timing gear
 5. Oil pan
 6. Oil pump
 7. Piston oil cooling pipe
 8. Piston and connecting rod assembly
 9. Timing pulley chamber
 10. Water pump assembly
 11. Flywheel and flywheel baffle
 12. Rear oil seal
 13. Crankshaft and main bearing

Assembly sequence
As assembling, go on according to the reverse sequence of disassembly.

cardiagn.com



Disassembly

Preparation:

- Remove battery ground cables.
- Discharge the coolant in the radiator and engine completely.

1. Transmission and clutch assemblies

- Hoist the car and support it with a suitable and safe bench.

1) Transmission

① Transmission

- Mark the parking brake drum and flange yoke beforehand.
- Remove the flange yoke drive shaft.
- Bind the removed drive shaft to the frame so as to facilitate the maintenance work.

② Parking brake cable

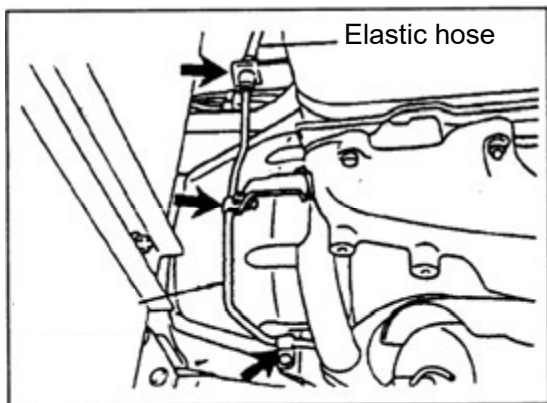
- Detach the connecting hood.
- Remove connecting bolts.
- Dismantle anchorage clips and withdraw bracket cables.

③ Wire connector

- Detach wire connectors of the vehicle speed sensor, neutral switch and back-up light switch.

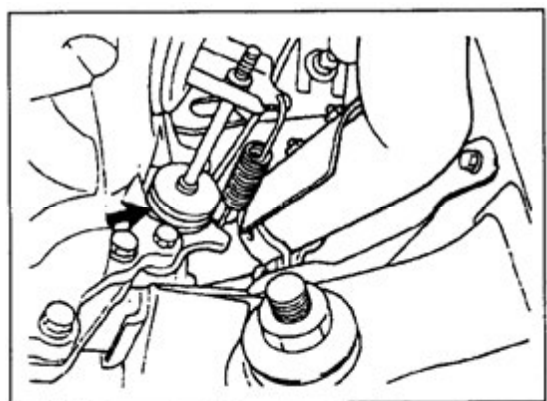
④ Shift and select cables

- Remove the shift and select cables on transmission side.

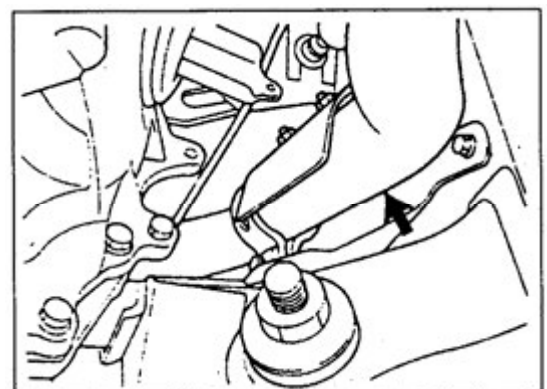


⑤ Clutch slave cylinder

- Remove the clutch hose clips and clip bracket (only for vehicles with right steering wheel).

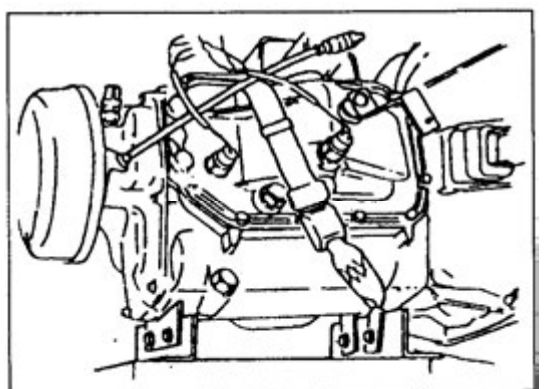


- Disassemble the slave cylinder assembly with Elastic hoses, and bind it to the frame so as to facilitate the maintenance work.



⑥ Exhaust brake assembly

⑦ front exhaust pipe



⑧ Transmission assembly

Notes:

Sometimes the exhaust pipe bracket, gear control bracket and anchorage clips are in the wrong mounting positions or directions. In order to prevent this, please mark correct mounting signs on those parts.

- Use a transmission jack to jack up the transmission.



Caution:

In order to prevent transmission overturn, use chains or belts to secure it to the jack.



Do not let the transmission hover over the clutch, or it will destroy the clutch.

- Remove nuts securing the transmission mounting bracket on the beam side.
- Angles of the engine and transmission have to be adjusted so that they can be easily disassembled.
- Use a jack or crane to jack up the engine rear part.



Caution:

After jacked up the engine, place a wooden block under it to protect the oil pan.

- Remove the transmission binding bolts.
- Draw the transmission assembly backwards.

⑨ Mounting bracket

2) Clutch

- Hoist the car and support it with a suitable and safe bench.



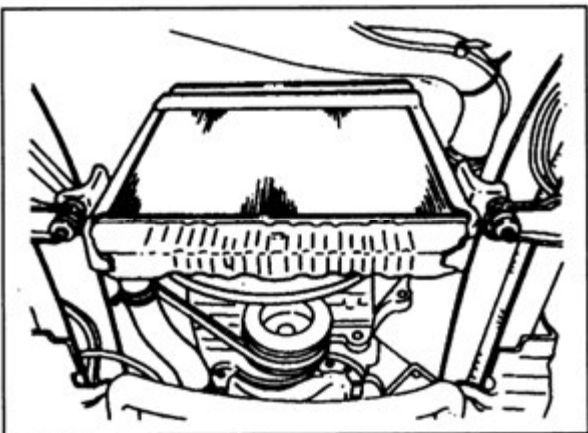
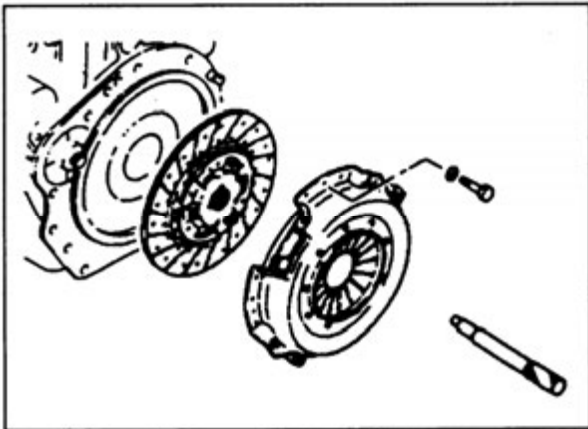
Caution:

Make sure no clutch fluid is left on the coating surface, or wash it away immediately.

① Pressure plate assembly

② Driven plate assembly

- Use a guiding centralizer to prevent the driven plate assembly dropping freely.



- Mark the flywheel and pressure plate flange to ensure alignment during installation.

- Loosen fixing bolts in the pressure plate assembly.

2. Engine assembly

1) Radiator assembly

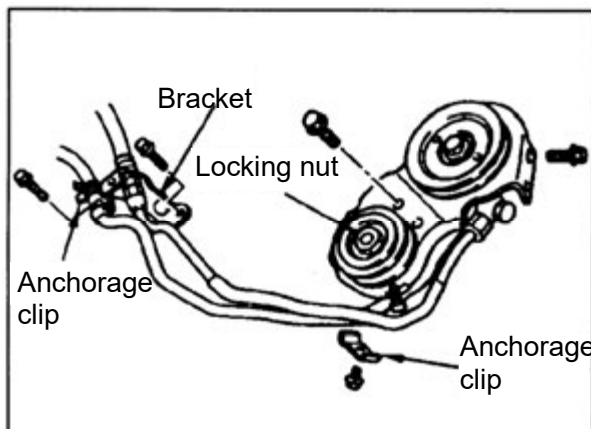
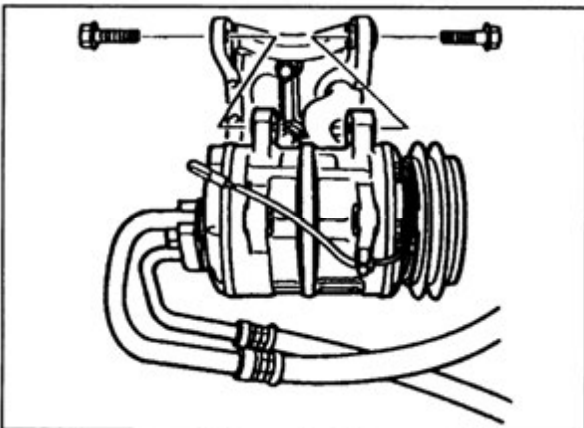
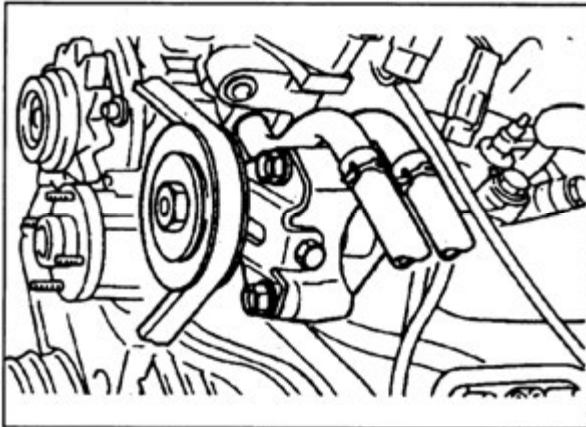
- Remove the upper and lower hoses of the radiator.

- Remove storage tank hose.

- Remove the shock-absorbing rubber on both sides.

- Remove radiator support.

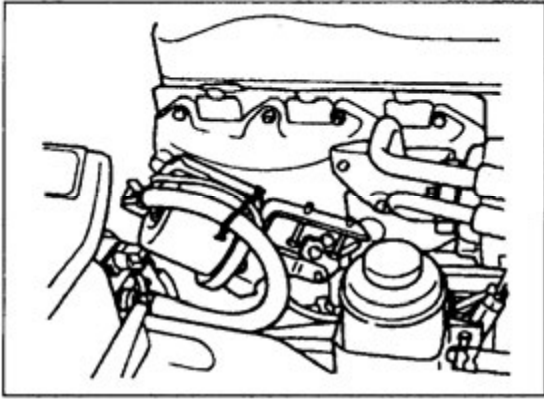
2) Air intake duct



- 3) Heater hose
- 4) Engine control cable
 - Unscrew the locking nut(s) at the bracket and remove throttle wire(s) from the injection pump control lever.
- 5) Glow plug wire
- 6) Fuel hose
 - Remove fuel inlet hose and return hose.
- 7) Oil pressure switch wire
- 8) Air conditioning compressor assembly
 - Unscrew idler locking nut(s)
 - Loosen the adjusting nut(s) and remove the drive belt.

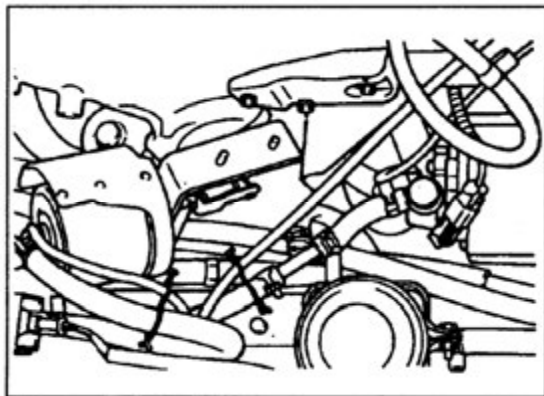
- Remove the magnet clutch wire connector.
- Remove fixing bolt(s) of the air conditioning compressor and bind the compressor to the frame temporarily with wires.

- 9) Power steering pump and bracket assemblies (power steering type)
 - Unscrew idler locking nut(s)
 - Loosen the adjusting nut(s) and remove the drive belt.
 - Remove pipe bracket fixing bolt(s) and anchorage clip (s).
 - Remove power steering pump fixing bolt(s) and bind the pump to the frame temporarily with wires.



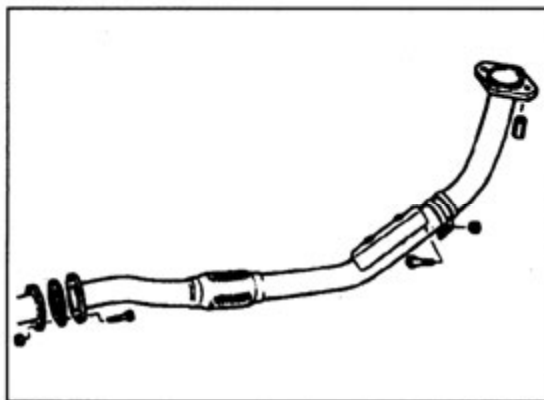
10) Front exhaust pipe

- Remove exhaust pipe fixing bolt(s) of the exhaust manifolds.
- Remove exhaust pipe support bolt(s).
- Remove front exhaust pipe fixing nut(s).



11) Support rubber

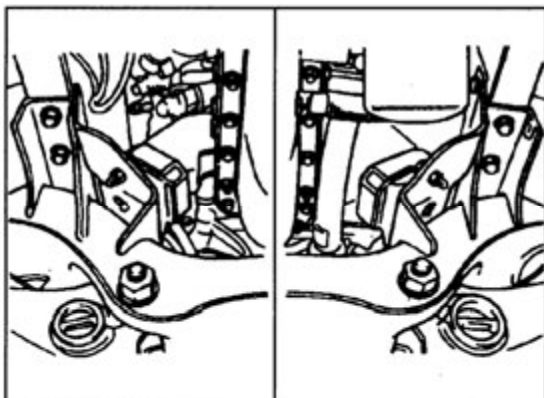
- ① If mounted on the right side
 - Remove the two fixing nuts on beam side.
- ② If mounted on the left side
 - Remove the two fixing nuts on beam side.



12) Engine assembly

- Slowly hoist the engine by a crane.
- Lift the engine with its front part higher than rear part.

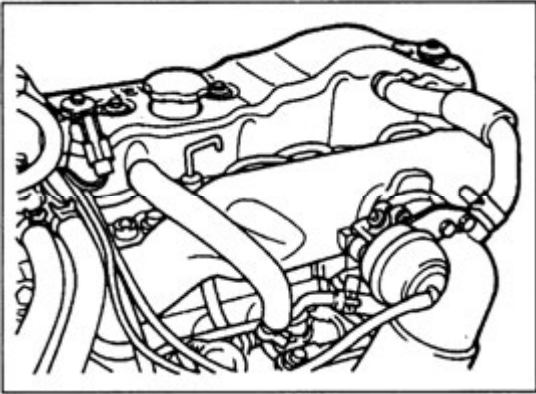
While taking out the engine assembly be careful to avoid breaking any oil pipe, brake pipe, etc.



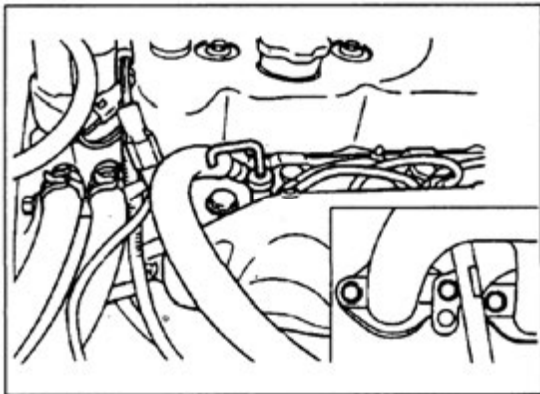
3. Cylinder head assembly and gasket

1) High pressure oil pipe

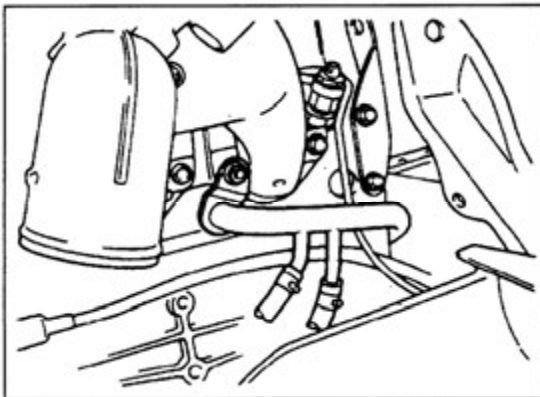
- Unscrew high pressure oil pipe anchorage clip(s).
- Remove taper nut(s) on the injection pump side.
- Remove taper nut(s) on the fuel injector side and high pressure oil pipe.



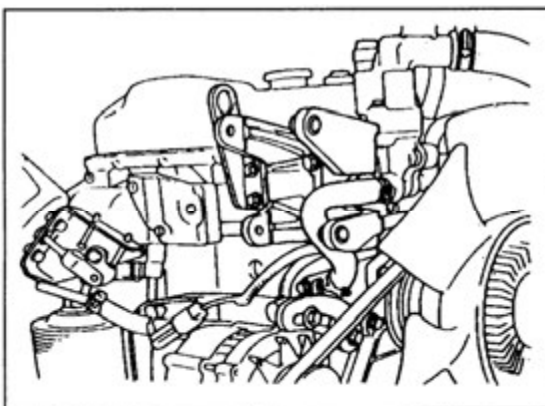
- 2) Oil return hose
 - Remove oil return hose(s) of the injection pump.
- 3) Crankcase vent hose(s)
 - Dismantle crankcase vent hose(s) from the air-intake duct.



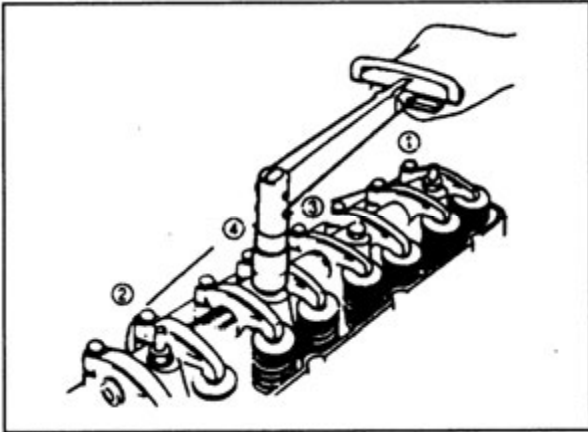
- 4) Glow plug wire
- 5) Oil scale guide
 - Remove oil scale guide out of the cylinder head.



- 6) Oil cooler tube D
 - Remove pipe bracket fixing bolt(s) on the rear side of cylinder head.
 - Remove cooler tube from the cylinder head.



- 7) Bypass hose
- 8) Cylinder head cover
 - Remove crankcase vent hose and cylinder head cover bolt(s).



9) Rocker shaft

- Loosen rocker shaft support bolt(s) bit by bit according to the sequence shown in the diagram.

Note:

! Disobedience will bring unfavorable influence to the rocker shaft.

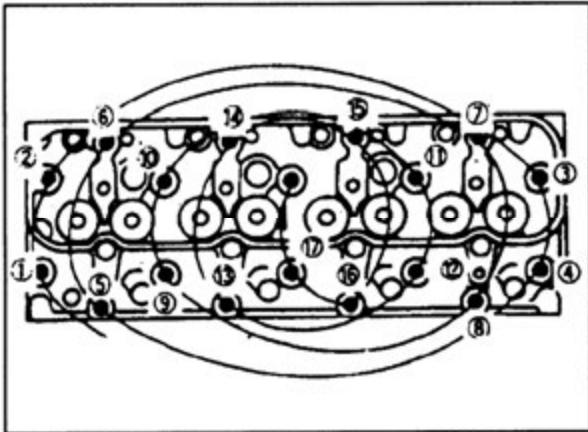
10) Push rod

11) Cylinder head assembly

- Loosen cylinder head bolt(s) bit by bit according to the sequence shown in the diagram.

Note:

! Disobedience will bring unfavorable influence to the cylinder head lower surface.



12) Cylinder head gasket

- Remove cylinder head gasket and anchor pin.

4. Timing gear

1) Cooling fan assembly

- Unfasten tight nut(s), and dismount the fan assembly and fan pulley.

2) Crankshaft damper pulley

3) Acoustic hood

4) Acoustic hood liner

5) Timing gear chamber cover

- Remove oil seal from the timing gear chamber cover.

6) Oil pipe

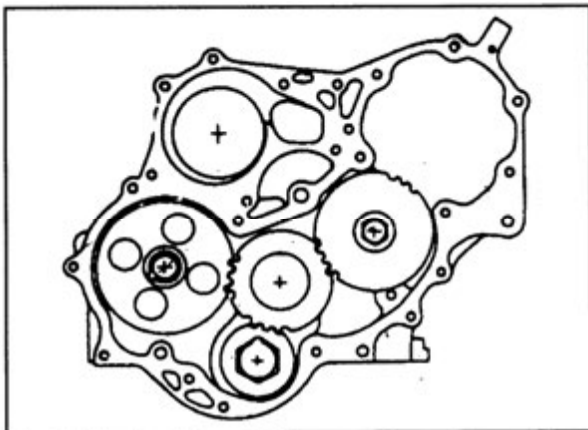
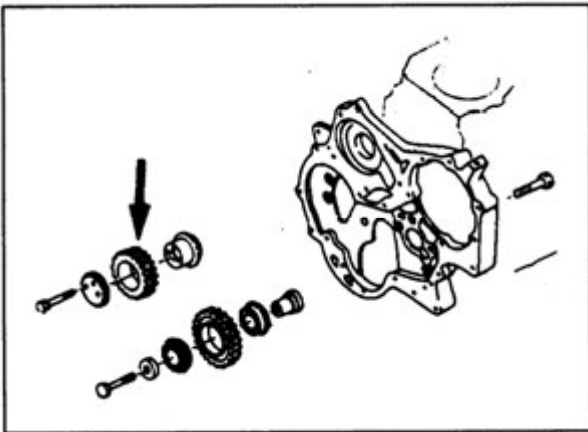
7) Idler gear

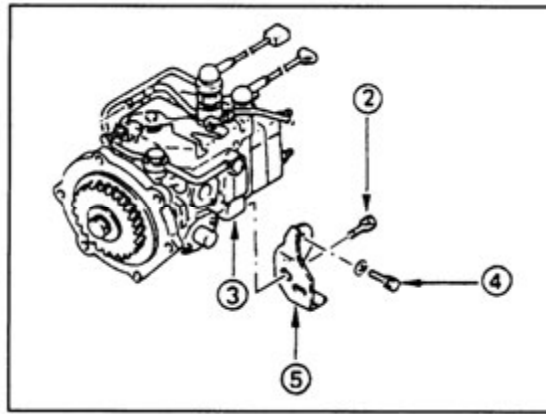
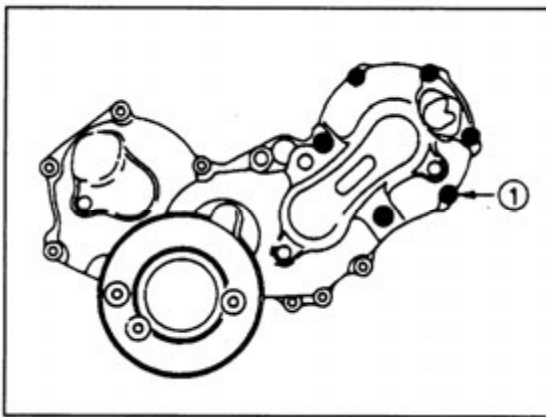
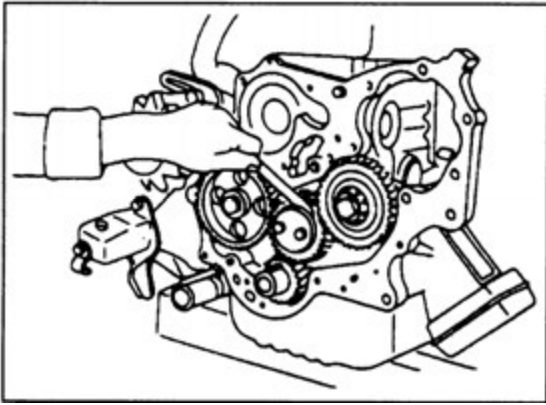
- Measure camshaft and crankshaft timing gear clearances before disassembling the idler gear.

- Measure axial clearance for idler gear before disassembling the idler gear.

Note:

Refer to the following items while measuring gear clearance and axial clearance.





Timing gear clearance measurement



1) Install a dial gauge onto the timing gear to be tested.

Fix the gear to be tested and the gear connected to it.

2) Swing the gear to be tested left and right. Read out the dial gauge readings.

If the measured value exceed prescribed limit, the timing gear has to be replaced.



Timing gear clearance mm

Standard value	Limit
0.10—0.17	0.30

Axial clearance measurement of idler gear "A"

Measure the clearance between idler gear A and thrust ring with a clearance gauge and determine the idler gear axial clearance.

If the measured value exceeds prescribed limit, the thrust ring has to be replaced.

Idler gear axial clearance mm

Standard value	Limit
0.07	0.2

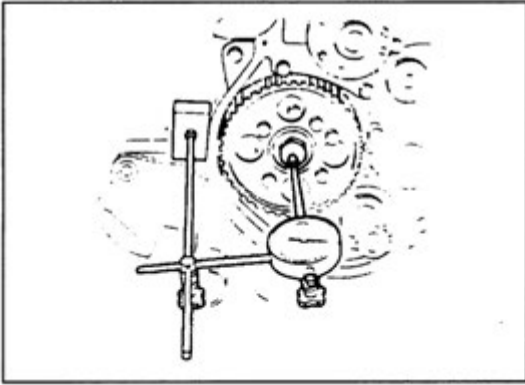
9) Idler gear

10) Injection pump

- Remove six injection pump bracket bolts① from the timing gear chamber.
- Remove rear bracket bolt② from the injection pump bracket③.
- Remove rear bracket bolt④ and bracket⑤ from the cylinder block.
- Drag both the injection pump and injection pump timing gear out towards the engine backside.

Note:

Cover the hole in injection pump delivery valve body with a cover or equivalents to prevent foreign bodies falling into the valve.



11) Camshaft timing gear

- ① Measure the camshaft axial clearance with a dial gauge.

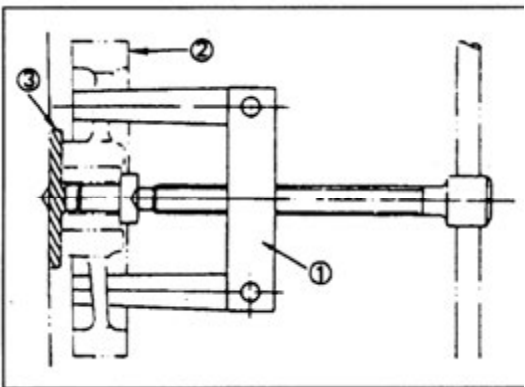
Measure the clearance before disassemble the camshaft gear.



If the camshaft axial clearance exceeds prescribed limit, the thrust washer has to be replaced.

Camshaft axial clearance mm

Standard value	Limit
0.050—0.114	0.2



- ② Remove camshaft timing gear bolt(s) from the camshaft.

Note:

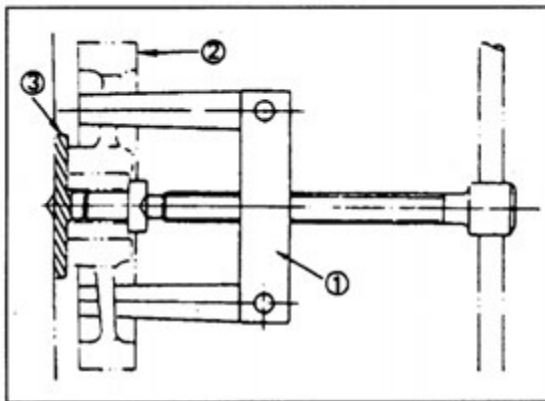
Protect the camshaft against rotating.



- ③ Pull out camshaft timing gear ② with a universal puller ①.

Universal puller: 1007011FA-9101

- ④ Remove the thrust washer ③.

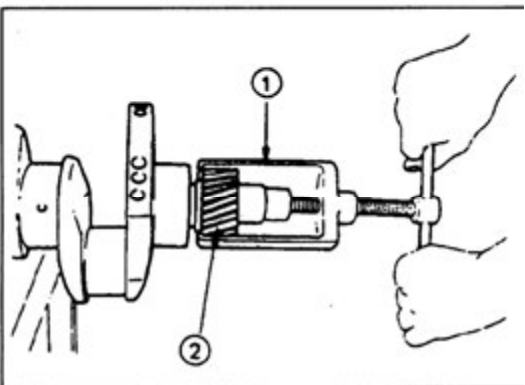


12) Crankshaft gear



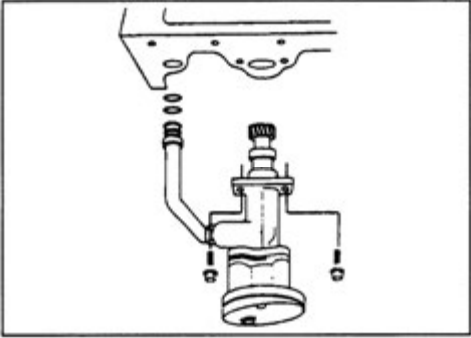
- Detach crankshaft gear ② with crankshaft gear detacher ①.

Crankshaft timing gear detacher:
1007011FA-9101

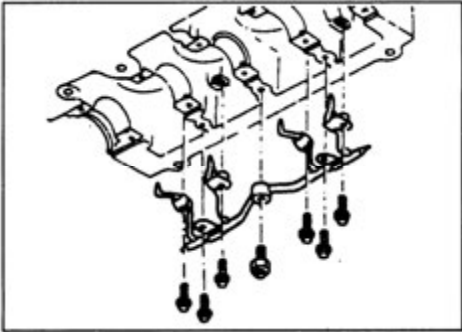


5. Oil pan

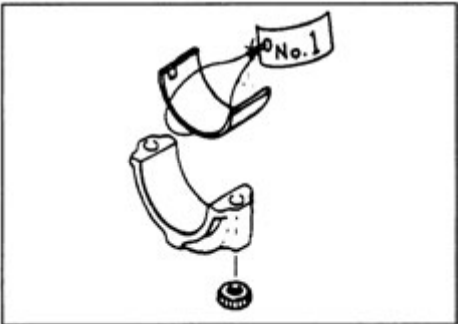
- Remove the stiffener plate from both sides of the oil pan.
- Remove the oil pan from the cylinder block.



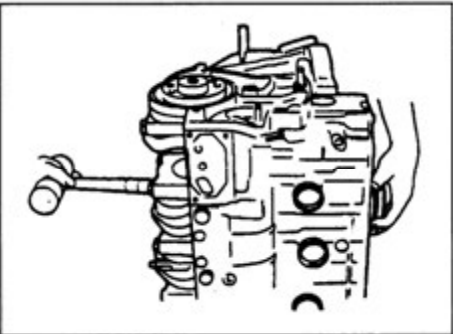
6. Oil pump
- Remove the oil pump from the cylinder block.



7. Piston cooling oil pipe (4DA1-1) / hexagonal head plug (4DA1)
- Remove the oil cooling pipe from the cylinder block.

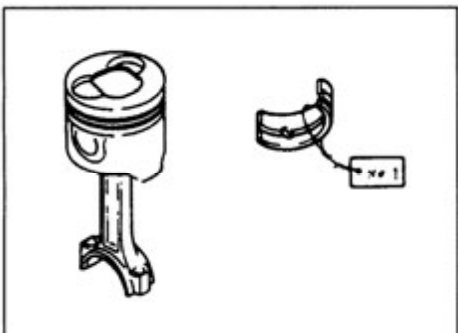


8. Piston and connecting rod assembly
- If it is intended to reassemble the lower bearing of connecting rod, please attach a label to each bearing, then mark the cylinder disassembling sequence and its installation position.

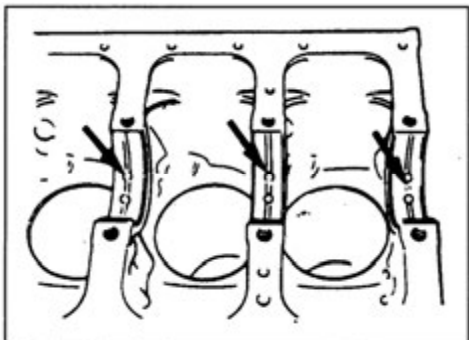
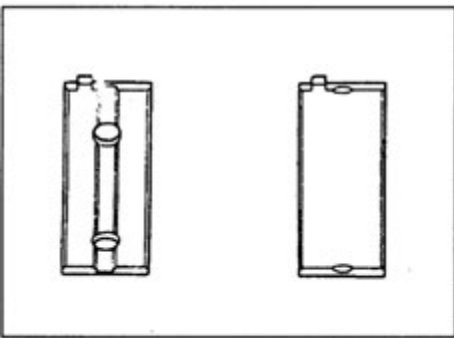
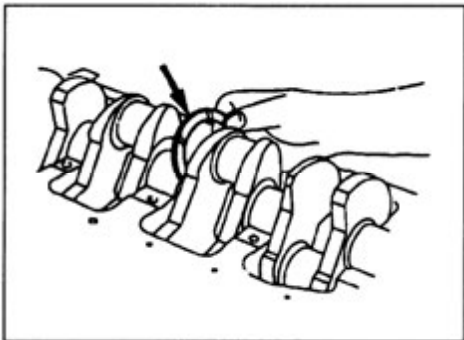
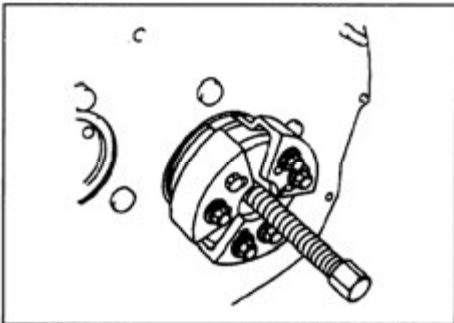
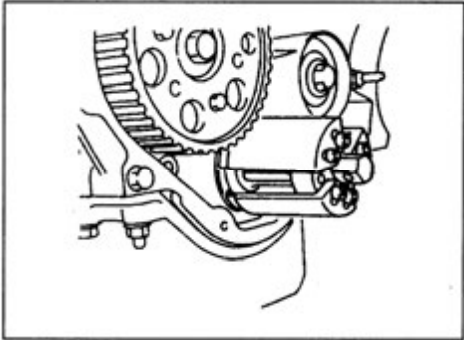


- Scrape carbon deposits on upper cylinder wall with a scraper before disassembling the piston and connecting rod.

Move the piston to cylinder head, push upwards connecting rod underpart with a hammer handle or equivalents, and then take out the piston and connecting rod.



- If it is intended to reassemble the upper bearing of connecting rod, please attach a label to each bearing, then mark the cylinder disassembling sequence and its installation position.




9. Timing pulley chamber
10. Water pump assembly
11. Flywheel and flywheel baffle
 - Install flywheel stopper.
 - Loosen flywheel fixing bolt(s) and remove the flywheel.
 - Disassemble the flywheel baffle from cylinder block.
12. Rear oil seal
 - Push in the oil seal and mount special tools according to the left diagram to dismantle the oil seal.

Rear oil seal detacher: 1002430FA-9101

Note:

While disassembling, take care to avoid damage the flywheel baffle and crankshaft sealing surface.
13. Crankshaft and main bearing
 - 1) Remove main bearing cap and thrust plate.
 - 2) Disassemble the crankshaft carefully.
 - 3) Disassemble the upper crankshaft bearing.

Assembly

13. Crankshaft and main bearing
 - The upper crankshaft bearing has an oil hole and oil groove while the lower bearing doesn't.
 - Apply fresh oil to the upper and lower main bearings.
- 
 - Make sure the main bearings are in the correct positions.
 - Wipe off foreign bodies on the bearings.
 - Mount crankshaft main bearings to the cylinder block and main bearing cap.

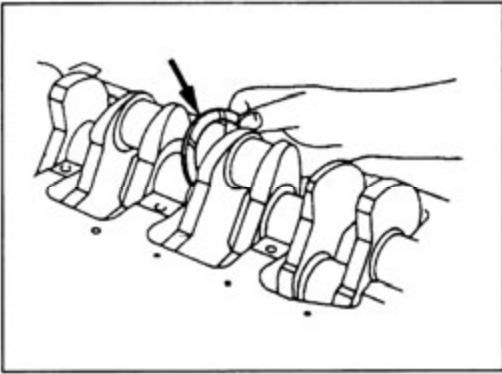
Note:



Do not apply oil to bearing backside and cylinder bearing mating surface.

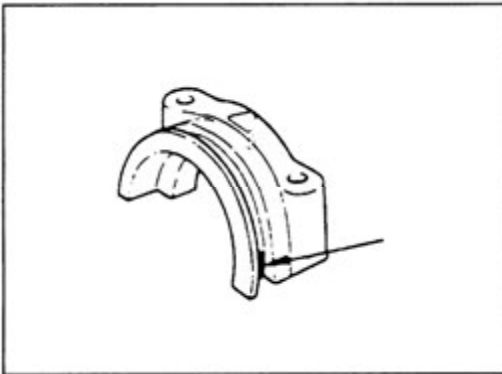


- Bearings should be installed in correct positions.
- Apply fresh oil to the upper and lower main bearings.

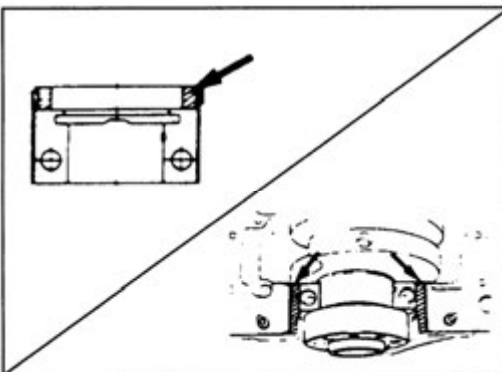


- Install the crankshaft carefully.
- Apply oil to the thrust plate.
- Mount the thrust plate to the third main journal.

The oil groove on thrust plate must be facing the crankshaft.



- Apply recommended liquid sealant or equivalents to the fifth crankshaft bearing cap as shown in the drawing.



- Apply recommended liquid sealant or equivalents to the fifth crankshaft bearing cap surface mating with cylinder block as shown in the drawing.

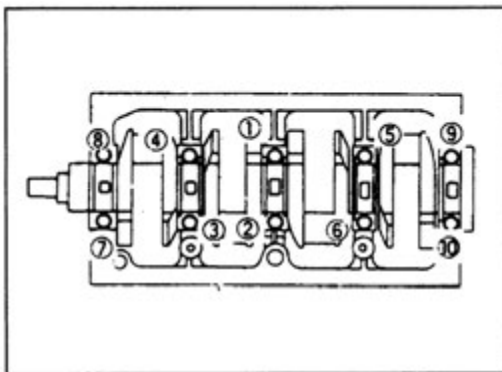
Notes:



Before applying liquid sealant, make sure there is no oil on the main bearing cap mating surface.

Make sure the liquid sealant will not block cylinder thread hole and bearings.

- While mounting bearing caps, arrow signs on each bearing cap must point to the engine forepart.
- Apply oil to crankshaft bearing cap bolts.
- Tighten the crankshaft bearing cap bolts to the specified torque bit by bit as shown in the drawing.

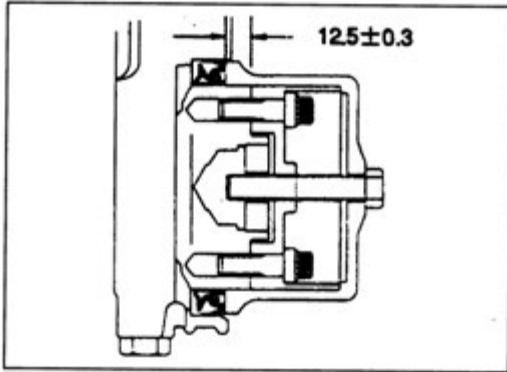


N·m

170

Note:

Manually rotate the crankshaft to check whether it is flexible.



12. Crankshaft rear oil seal

Mount the oil seal to the cylinder block with an oil seal erector.

Rear oil seal erector: 1002430FA-9102

Notes:

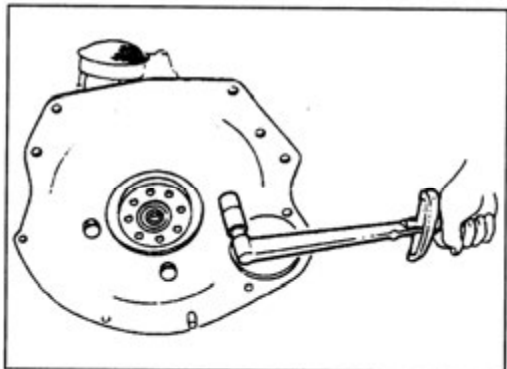
Clean the rust and chips off the press-in portion of the oil seal.

Pay attention to the press-in direction.

- 1) Use two bolts to connect the adaptor of special tools to the crankshaft rear end.
- 2) Install the oil seal to the periphery of the adaptor.
- 3) Insert the socket into the adaptor portion and screw down it with a bolt (M12×1.75L-70) until the adaptor tip is against the socket.
- 4) Remove the adaptor and socket.
- 5) Check the oil seal size after it is installed.



Standard value	mm
12.2—12.8	

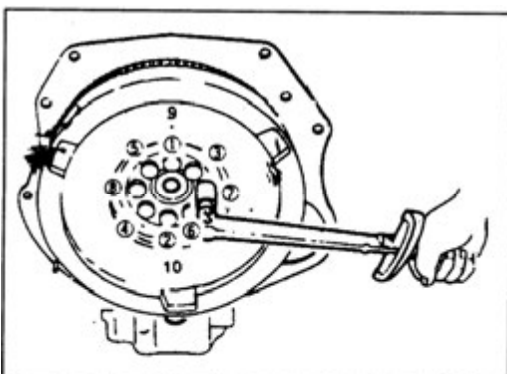


11. Flywheel and cylinder block flywheel baffle

- Align the flywheel baffle with cylinder block anchor pin(s).
- Tighten the flywheel baffle to the specified torque.

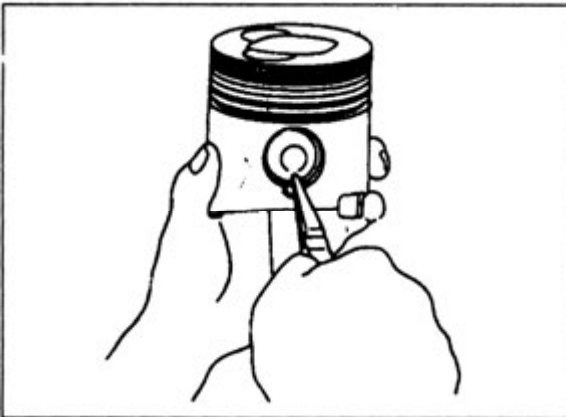
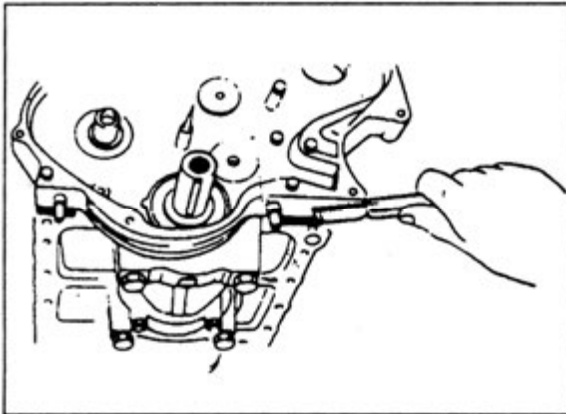
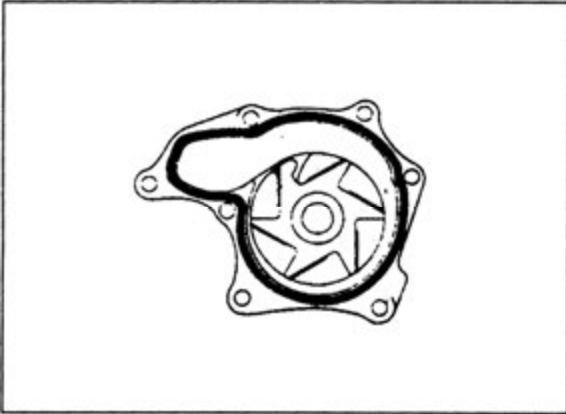


Flywheel baffle bolt torque	N·m
85	



- Lock the crankshaft with hardwood so as to prevent the flywheel rotating.
- Apply oil to flywheel bolt thread.
- Align the flywheel with crankshaft anchor pin(s).
- By using of the torque tightening method, screw down the flywheel bolts to the specified torque in two steps according to the diagram.

Flywheel bolt torque	N·m	
Step I	Step II	Step III
25	70	120



10. Water pump



- Install a O-ring to water pump body.
- Install water pump and tighten the bolt(s) to the specified torque.

Water pump bolt torque	N·m
25	

- Eliminate the gasket burrs.

9. Timing gear chamber

- Install the timing gear chamber to the cylinder block. Exercise care to avoid bending front oil seal.
- Tighten the timing gear chamber and its gasket to the specified torque.



Timing gear chamber Bolt torque	N·m
25	

8. Piston and connecting rod assembly

- 1) Try to manually push the piston pin into piston pin hole.

Weigh each piston and connecting rod assembly.

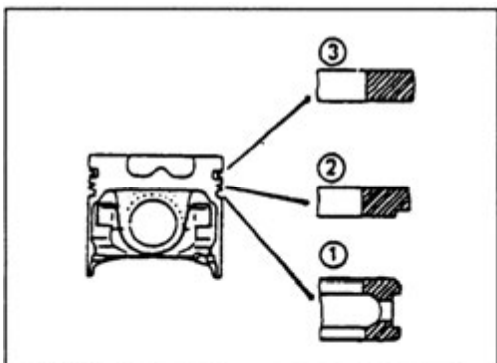
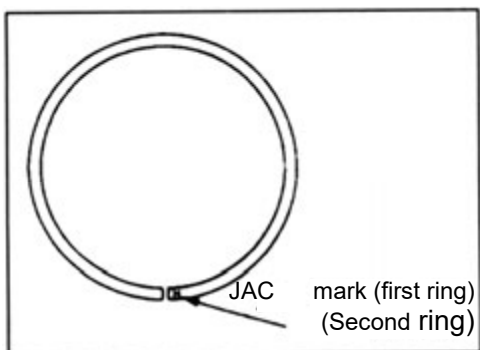
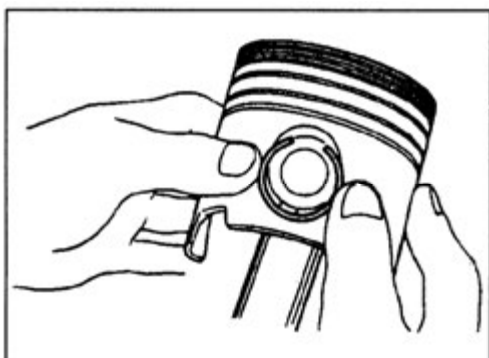
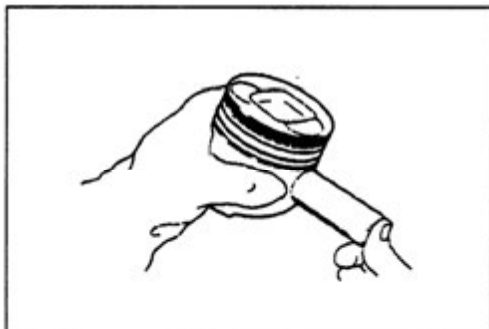
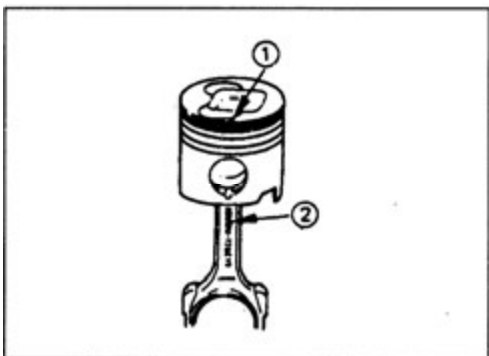
Select the piston and connecting rod set in a way that different assembly weight differences are in the specified limits.

	Weight differences while assembled
4DA1	10
4DA1-1	8

- 2) Clamp the connecting rod by a vice
Take care not to damage the connecting rod.
- 3) Mount piston pin retainer to the piston with pliers.

Note:

When replacing the piston / connecting rod assembly, do not change the piston / piston pin assembly.



4) Install the piston onto the connecting rod. Mark ① on the piston head and connecting rod “F908” casting symbol ② should point to the same direction.



5) Add oil to the piston pin and piston pin hole.

Manually push piston pin into the piston until it is against the piston pin retainer.

6) Manually mount the piston pin retainer into piston retainer groove.

Check whether the connecting rod can freely swing on the piston pin.

7) Install piston ring and piston packing ring. The gas ring mark JAC should face upwards. Identification sign is shown in the drawing.

8) Mount three piston rings with a piston ring erector.

The piston ring mounting sequence is shown in the drawing.

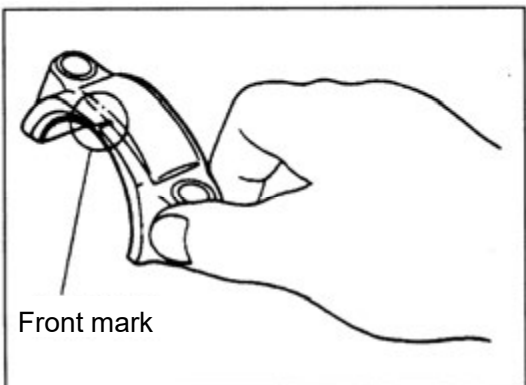
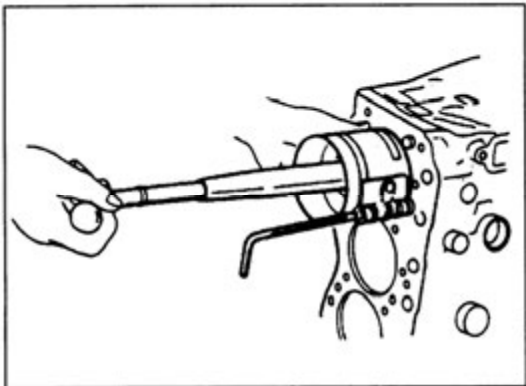
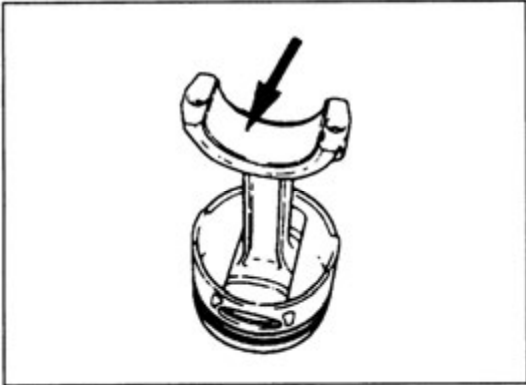
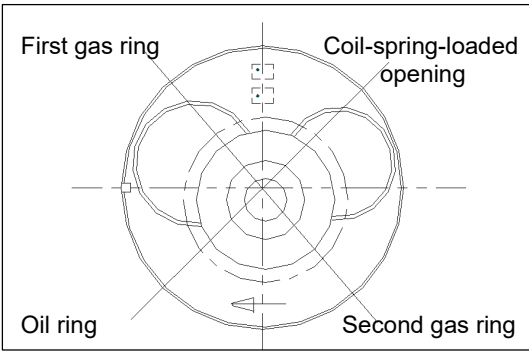
① Oil ring

② Second gas ring

③ First gas ring

Note: When mounting gas rings the chamfer is facing upwards.

Install the helical piston packing ring into oil ring groove and make sure that the packing ring and the oil ring are closely meshed.



9) Apply some oil to the piston ring surface.

10) Check whether the piston ring can turn freely in piston ring groove.

11) The cutout position for placing piston ring is shown in the drawing.



12) Carefully wipe off the foreign bodies on connecting rod bearing backside and bearing seat joint faces.



13) Apply some oil to the upper bearing surface.

Apply some oil to the cylinder wall.



14) While installing, the piston head mark must be towards the engine forepart.

Compress the piston ring with a piston ring compressor.

Piston ring compressor: 1004022FA-9101

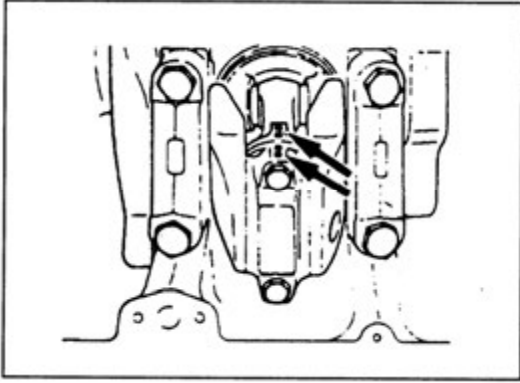
15) Push in the piston with a hammer handle until the connecting rod touches the crankpin. In the meanwhile rotate the crankshaft until the crankpin reaches its bottom dead center.

16) While installing, the bearing cap upper front mark must be towards the engine forepart.

17) Install connecting rod bearing cap.

Align the cylinder sequence mark on connecting rod bearing cap with the one on connecting rod.

✘



18) Apply oil to each connecting rod bearing cap bolt thread and bearing seat joint faces.

19) Screw down connecting rod bearing cap bolt to the specified torque in two steps by utilizing the torque tightening method.



Connecting rod bearing cap bolt torque N·m

First step (sealing torque)	Second step (final torque)
20	85



Note:

Manually rotate the crankshaft to check whether it is flexible.

7. Piston cooling oil pipe (4DA1-1) / hexagonal head plug (4DA1)



- Mount the piston cooling oil pipe to the cylinder block.

Screw down oil pipe bolt and check valve to the specified torque.



4AD1-1 oil pipe bolt torque N·m

①M8X1. 25	20
-----------	----

N·m	
②M6X1. 00	7.5



Oil pressure regulating valve torque

③M16X1. 5	30
-----------	----

4DA1 hexagonal head plug moment

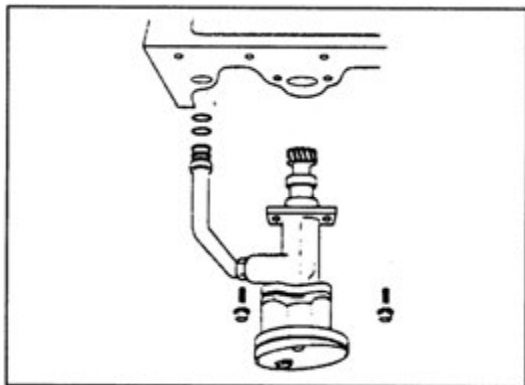
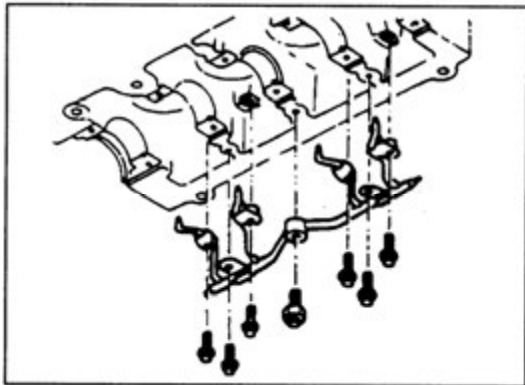
45

Note:

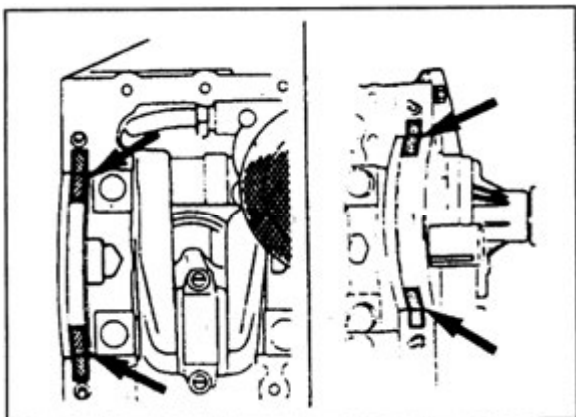
Turn the crankshaft slowly; make sure the piston and the oil injection pipe don't interfere with each other.

6. Oil pump assembly

- Prepare some solution containing 80% oil and 20% supramoly.
- Apply enough solution to the oil pump pinion teeth.
- Apply some oil to oil pipe O-ring and put it into the cylinder block O-ring groove.
- Install the oil pump assembly with oil pipe to the cylinder block, and tighten fixing bolts to the specified torque.



cardiagn.com

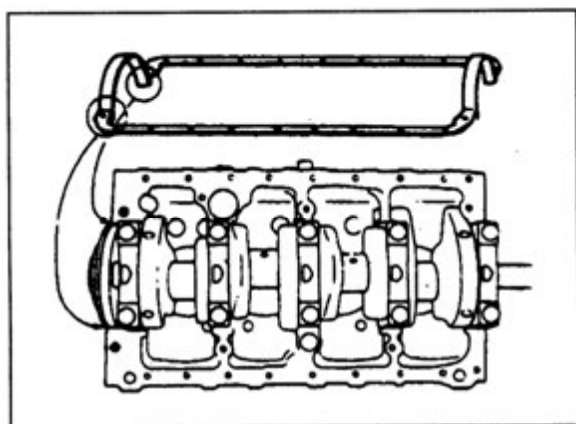


Oil pump bolt torque	N·m
25	

- Tighten sleeve nut(s) to the specified torque.

Sleeve nut torque	N·m
30	

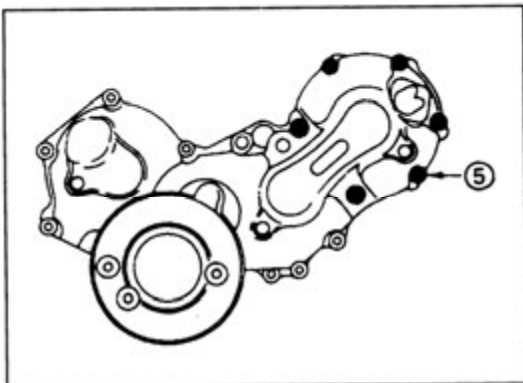
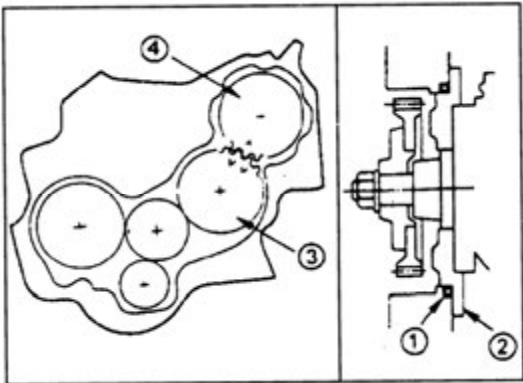
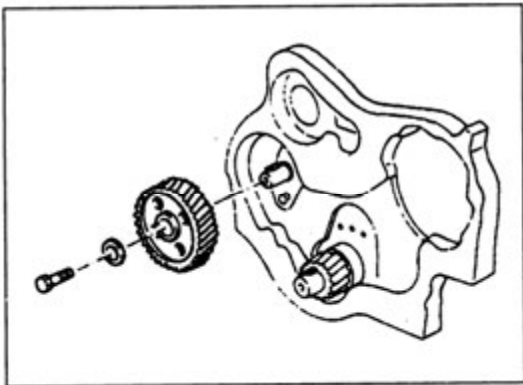
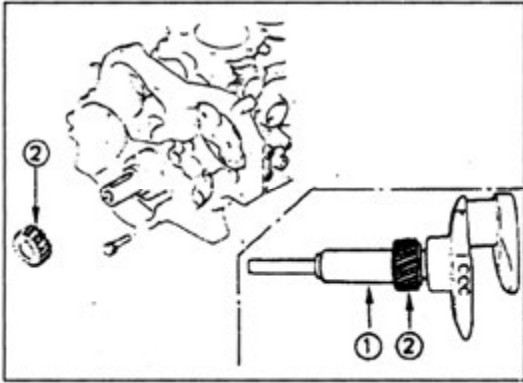
Note:
Be careful not to destroy the O-ring when tightening the oil pipe bolt(s).



5. Oil pan assembly
 - Apply recommended liquid sealant or equivalents to the fifth bearing cap arch section, groove and timing gear chamber arch section.

- Install back lip portion of the gasket into the fifth groove.
- Make sure the lip portion is compact with the groove.
- Install the oil pan to the cylinder block.
- Tighten oil pan bolt(s) to the specified torque.

Oil pan bolt torque	N·m
23.5	



4. Timing gear

12) Crankshaft gear



- Install crankshaft gear
- Install crankshaft gear ② with crankshaft gear erector ①.
- Crankshaft timing gear mark ("X-X") should face outwards.

Crankshaft gear erector: 1007011FA-9102

11) Camshaft timing gear

- Install the thrust washer onto the cylinder block.
- Tighten thrust washer bolt(s) to the specified torque.



	N·m
	25

- Install camshaft timing gear to the camshaft.

The timing gear mark ("Y—Y") has to face outwards.

- Tighten the timing gear to the specified torque.

Timing gear bolt torque	N·m
	110

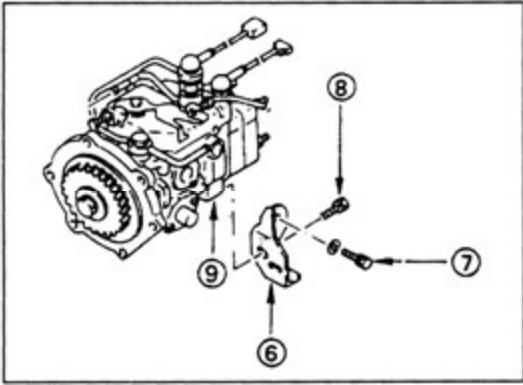
10) Injection pump

- ① Install O-ring ① to the injection pump flange ②.
- ② Install the injection pump to the timing gear chamber.

Align the mark "V-V" of idler gear "B" ③ with the mark "V" of injection pump timing gear ④.

- ③ Temporarily tighten Six injection pump nuts ⑤.

The final screwing down of injection pump nuts is conducted after tightening the injection pump rear bracket bolt(s).



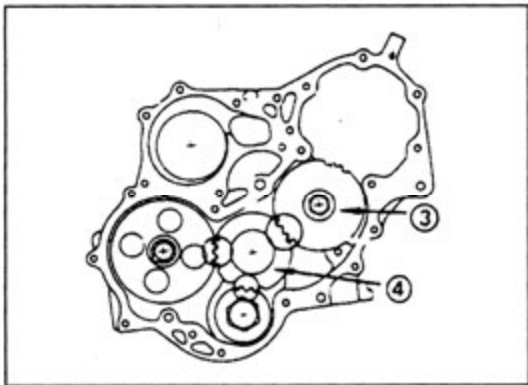
- ④ Install injection pump rear bracket⑥ and rear bracket bolt⑦ to the cylinder block.
- ⑤ Mount rear bracket bolt⑧ to the injection pump bracket⑨.

Do not screw down those bolts.

Rear bracket bolt⑦ and ⑧ will be tightened to the specified torque after tightening the injection pump nuts.

- ⑥ Tighten the injection pump nuts to the specified torque.

Injection pump nut torque	N·m
	30



- ⑦ Screw down injection pump bracket bolts to the specified torque.

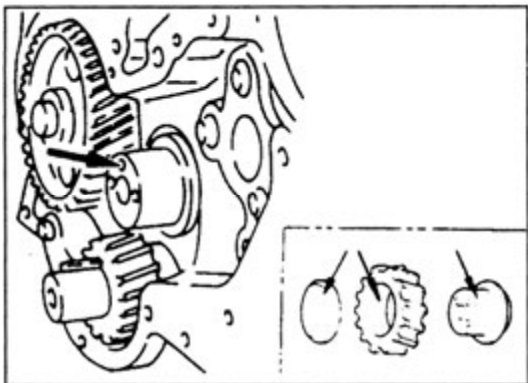
Pump bracket bolt torque	N·m
	25

- 9) Idler gear "B" and its shaft

- ① Apply some oil to the idler gear and its shaft.
- ② Align mark "Z" of gear "B" ③ with mark "Z—Z" of idler gear "A" ④.
- Tighten idler gear bolt(s) to the specified torque.



Idler gear bolt torque	N·m
	110



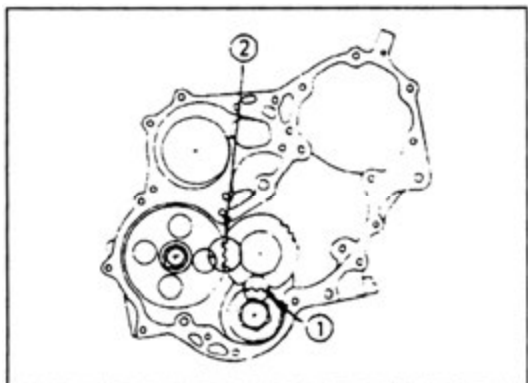
- 8) Idler gear

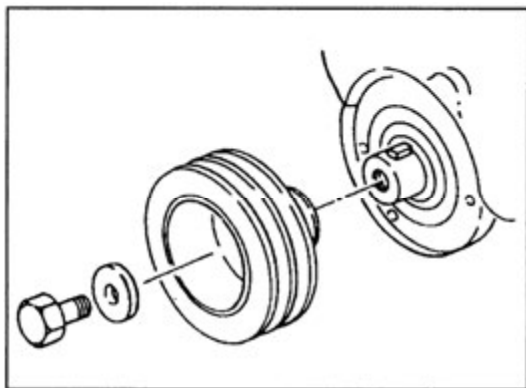
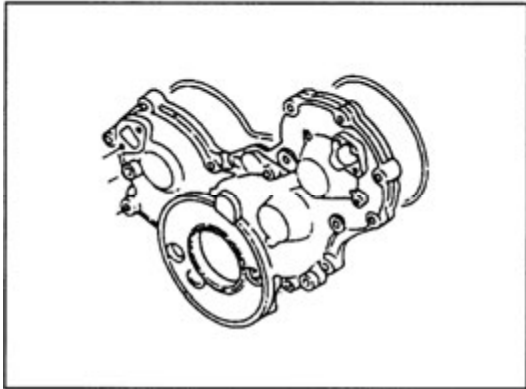
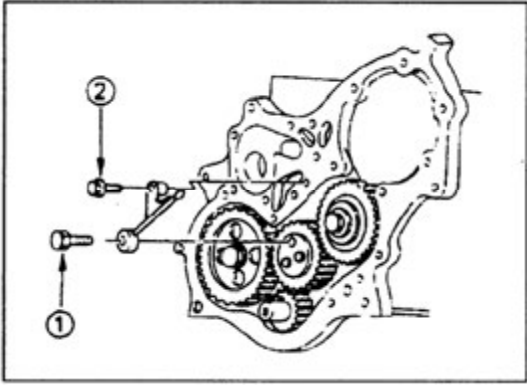
- ① Apply some oil to the idler gear and its shaft.

The oil hole in idler gear shaft must be facing upwards.

- ② Arrange idler gear marks "X" and "Y" so that they both face the engine forepart.
- ③ Align idler gear mark "X" with the mark "X—X" of crankshaft timing gear①.
- ③ Align idler gear mark "Y" with the mark "Y—Y" of crankshaft timing gear②.
- ⑤ Install the thrust ring and bolt to the cylinder body passing through the idler gear.

Thrust ring oil hole must be facing upwards while its chamfer facing outwards.





⑥ Tighten idler gear bolt to the specified torque.

Idler gear bolt torque	N·m
	25



7) Timing gear oil pipe

Install the oil pipe to timing gear chamber and idler gear "A".

Tighten oil pipe eyebolt① and bolt② to the specified torque.

Oil pipe punching bolt torque	N·m
	20

6) Timing gear chamber cover

Align timing gear chamber anchor pin with the timing gear chamber, then install timing gear chamber cover.

Tighten gear chamber cover bolt to the specified torque.

5) Acoustic hood liner

4) Acoustic hood

3) Upper acoustic hood

2) Crankshaft damper pulley



Screw down the crankshaft damper pulley bolt(s) to the specified torque.

Note:

While screwing down the damper pulley, hold the flywheel ring gear to prevent crankshaft rotating.



Pulley bolt torque	N·m
	210

1) Cooling fan assembly

- Install the fan pulley, spacer block and cooling fan assembly (in this installing order) to a water pump, and tighten those parts to the specified Tightening torque.

	N·m
	12.5

3. Cylinder head assembly

2. Engine assembly

1. Transmission and clutch assemblies

"3-1" is referred to the "3.16 shaft and tappet" section.