DE12TIS

Shop Manual

65.99897-8095

February 2005

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This documentation may include attachments and optional equipment that is not available in your machine's package. Please call your distributor for additional items that you may require.

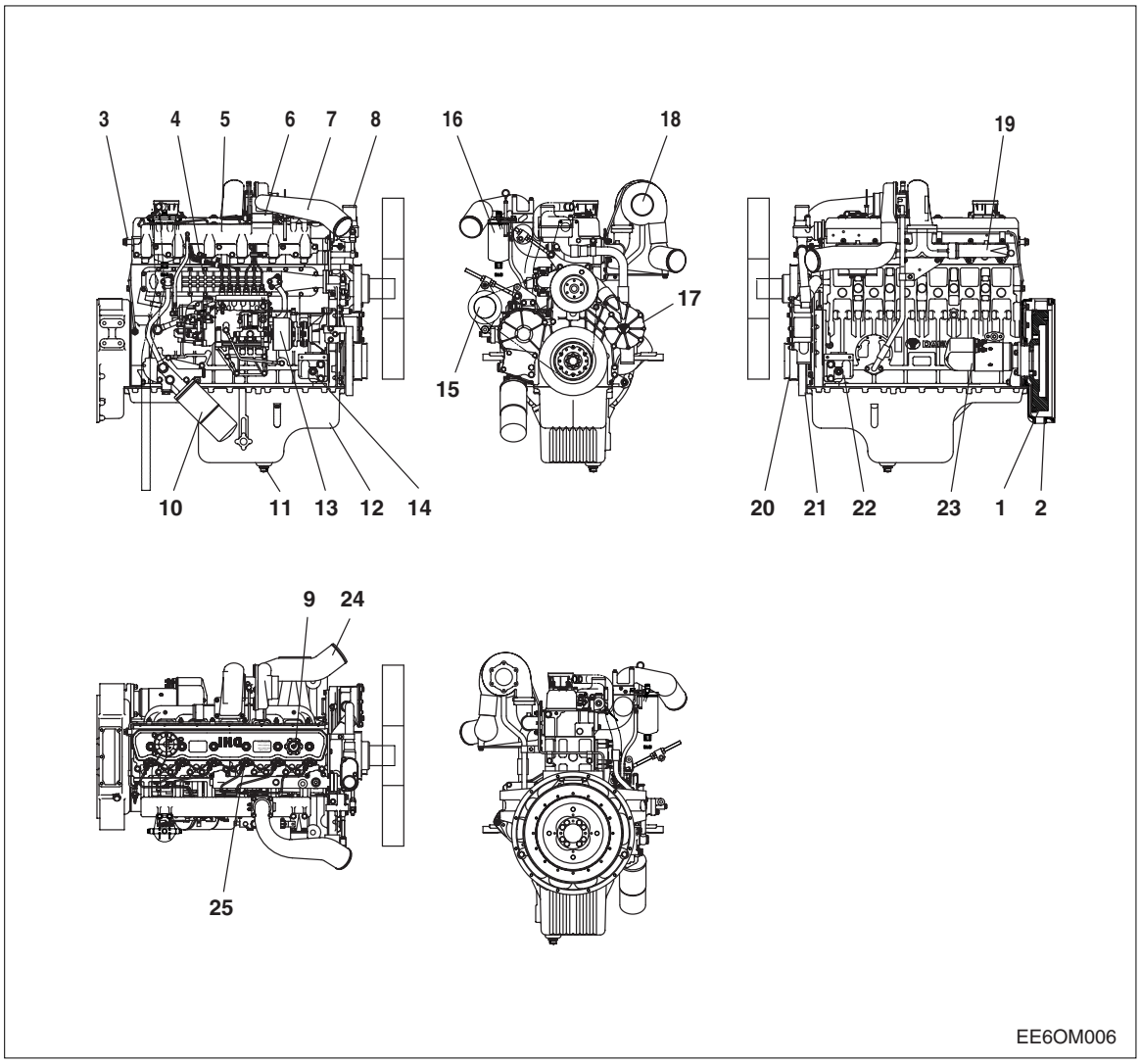
Illustrations used throughout this manual are used only as a representation of the actual piece of equipment, and may vary from the actual item.

65.99897-8095 Shop Manual

1.6. General Repair Instructions

1. Before performing service operation, disconnect the grounding cable from the battery for reducing the chance of cable damage and burning due to short-circuiting.
2. Use covers for preventing the components from damage or pollution.
3. Engine oil and anti-freeze solution must be handled with reasonable care as they cause paint damage.
4. The use of proper tools and special tools where specified is important to efficient and reliable service operation.
5. Use genuine DAEWOO parts necessarily.
6. Used cotter pins, gaskets, O-rings, oil seals, lock washer and self-lock nuts should be discarded and new ones should be prepared for installation as normal function of the parts can not be maintained if these parts are reused.
7. To facilitate proper and smooth reassemble operation, keep disassembled parts neatly in groups. Keeping fixing bolts and nut separate is very important as they vary in hardness and design depending on position of installation.
8. Clean the parts before inspection or reassembly. Also clean oil ports, etc. using compressed air to make certain they are free from restrictions.
9. Lubricate rotating and sliding faces of parts with oil or grease before installation.
10. When necessary, use a sealer on gaskets to prevent leakage.
11. Carefully observe all specifications for bolts and nuts torques.
12. When service operation is completed, make a final check to be sure service has been done property.

2) DE12TIS

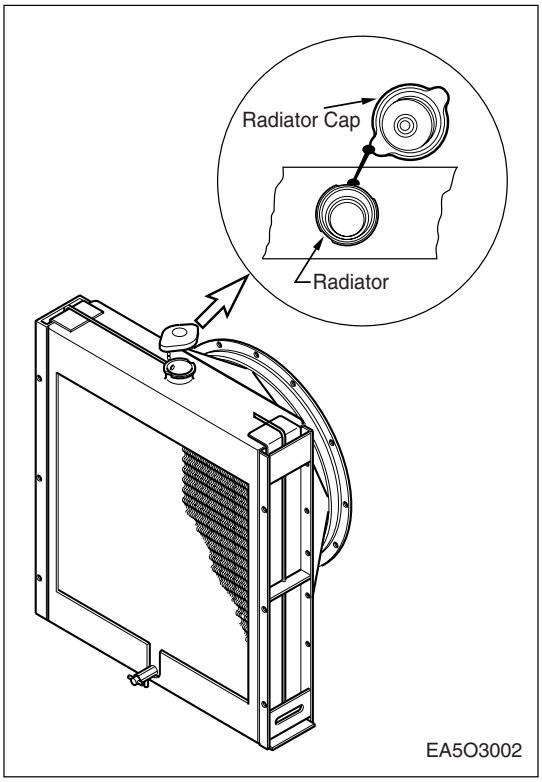


1. Fly wheel
2. Flywheel housing
3. Lifting hook
4. Oil cooler
5. Intake manifold
6. Air heater
7. Air pipe
   (Intercooler to intake manifold)
8. Water outlet
9. Oil filler cap
10. Oil filter
11. Oil drain plug
12. Oil pan
13. Fuel injection pump
14. Mounting bracket
15. Alternator
16. Fuel filter
17. Cooling water pump
18. Turbocharger
19. Exhaust manifold
20. Crank shaft pulley
21. Vibration damper
22. Mounting bracket
23. Starting motor
24. Air pipe
    (Turbocharger to intercooler)
25. Fuel injection nozzle

2.7.1. Coolant pressure cap

- Check the pressure valve opening pressure using a expansion tank cap tester.
- Replace the filler cap assembly if the measured valve does not reach the specified limit. (pressure valve opening pressure : 0.9 kg/cm^2)

Caution :
Because it is dangerous to open the pressure cap quickly when coolant is hot, after lowering the inside pressure of the tank by slow-opening at first open it fully.



2.7.2. Cooling water

- Regarding the cooling water that is to be used for engine, the soft water not the hard water must be used.he use of proper tools and special tools where specified is important to efficient and reliable service operation.
- The engine cooling water can be used diluting it with antifreezing solution 40% and the additive for rust prevention (DCA4) 3 ~ 5 %.
- The density of above solution and additive must be inspected every 500 hours to maintain it properly.

NOTE :
The proper density control of antifreezing solution and rust preventing additive will be able to prevent the rusting effectively and maintain the stable quality of engine. For the improper control might give the fatal damage to the cooling water pump and cylinder liners, detail care is needed.

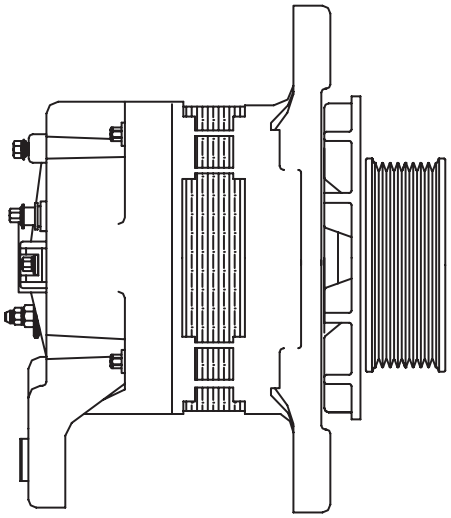
- Since **DE12T, DE12TI, DE12TIA** and **DE12TIS** (diesel engine of **DE12** series) cylinder liner is dry type, particularly the cooling water control should be applied thoroughly.
- The density of antifreezing solution and additive for rust prevention is able to be confirmed by the cooling water test kit (Fleetguard CC2602M) or DAEWOO No. : 60.99901-0038
- How to use the cooling water test kit
  (1) When the cooling water temp. of engine is in the range of 10 ~ 55 ˚C, loosen the plug for cooling water discharge and fill the plastic cup about a half.

2.20.2. Alternator

a) Alternator (24V x 45A)

The alternator is fitted with integral silicon rectifiers. A transistorized regulator mounted on the alternator body interior limits the alternator voltage. The alternator should not be operated except with the regulator and battery connected in circuit to avoid damage to the rectifier and regulator.

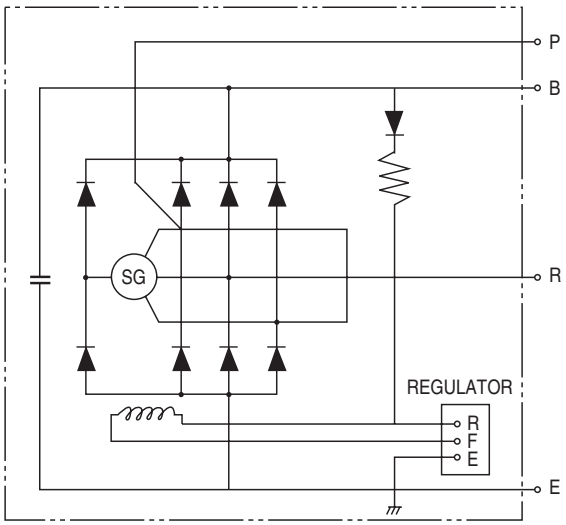
24V X 50A



EE6OM027

The alternator is maintenance-free, nevertheless, it must be protected against dust and, above all, against moisture and water.

Wiring Diagram



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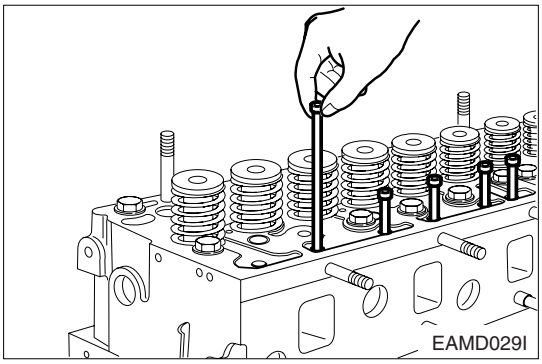
Operate the alternator according to the instructions given in the chapter.

Condition	Causes	Remedies
5) Engine noisy	For noises arise compositely such as rotating parts, lapping parts etc., there is necessity to search the cause of noises accurately.	
(1) Crankshaft	● As the wear of bearing or crankshaft progress, the oil clearances increase.	Replace bearing & grind crankshaft
	● Lopsided wear of crankshaft	Grind or replace
	● Oil supply insufficient due to oil passage clogging	Clean oil passage
	● Stuck bearing	Replace bearing & Grind
(2) Con-rod and Con-rod bearing	● Lopsided wear of con rod bearing	Replace bearing
	● Lopsided wear of crank pin	Grind crankshaft
	● Connecting rod distortion	Repair or replace
	● Stuck bearing	Replace & grind crankshaft
	● Oil supply insufficiency as clogging at oil passage progresses	Clean oil passage
(3) Piston, piston pin & piston ring	● Piston clearance increase as the wear of piston and piston ring progresses	Replace piston & piston ring
	● Wear of piston or piston pin	Replace
	● Piston stuck	Replace piston
	● Piston insertion poor	Replace piston
	● Piston ring damaged	Replace piston
(4) Others	● Wear of crankshaft, thrust bearing	Replace thrust bearing
	● Camshaft end play increased	Replace thrust plate
	● Idle gear end play increased	Replace thrust washer
	● Timing gear backlash excessive	Repair or replace
	● Valve clearance excessive	Adjust valve clearance
	● Abnormal wear of tappet, cam	Replace tappet, cam
	● Turbocharger inner part damaged	Repair or replace
6) Fuel Consumption Excessive	● Injection timing incorrect	Adjust
	● Fuel injection amount excessive	Adjust injection pump

3.1.25. Rocker arm

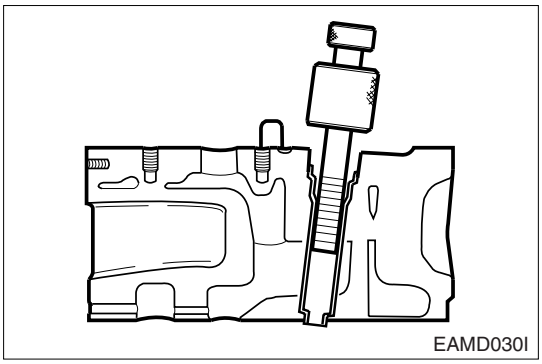
- Unscrew the rocker arm bracket bolts and remove the rocker arm assembly.
- Take off the snap rings to remove the washers and rocker arm, then unscrew the bracket fixing bolts to take off the bracket and springs.
- Take out the push rods.


EAMD029I

3.1.26. Injection nozzle and tube

- Remove the nozzle fixing nuts and extract the nozzles.
- Remove the nozzle tube using nozzle tube removing jig.

NOTE :
Do not disassemble the nozzle tube if coolant or gas, etc. does not come out during engine operation.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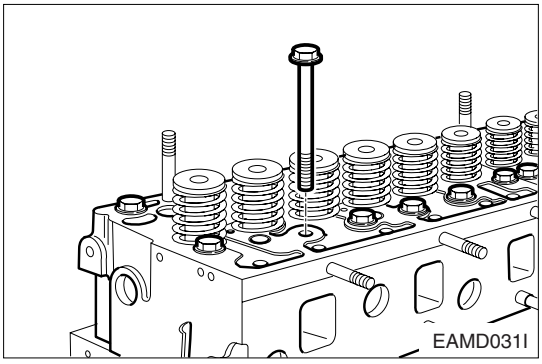
3.1.27. Cylinder head

- Unscrew the cylinder head fixing borts and take off the cylinder head.
- Remove the cylinder head gasket.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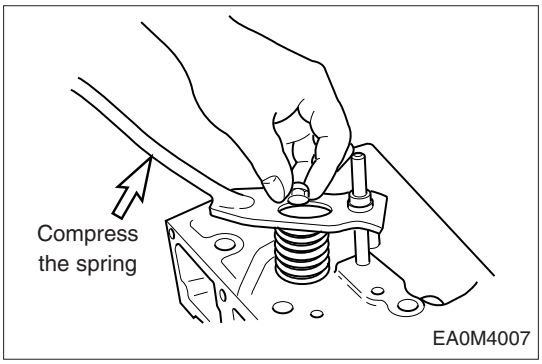
3.1.28. Valve and stem seal

- Compress the valve spring retainer using a jig and take off the valve cotter pins.
- Disassemble the valve springs and retainers.
- Take off the valves.
- Remove and discard the valve stem seal using a general tool as it should not be re-used.



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3.2.4. Rocker arm shaft assembly

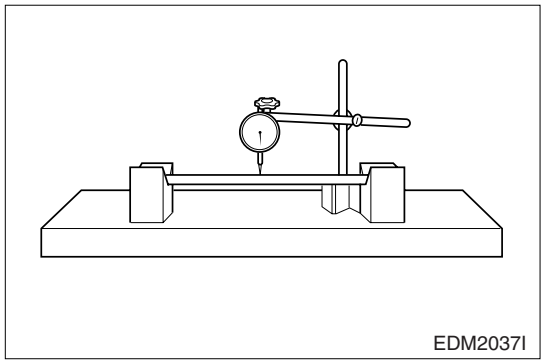
1) Rocker arm shaft

● **Rocker arm shaft run-out**

Place the rocker arm shaft on two V blocks and inspect the shaft for bend using a dial gauge.

● If the amount of this run-out is small, press the shaft with a bench press to correct the run-out. Replace the shaft if the measured value exceeds the limit.

Limit	0.2 mm

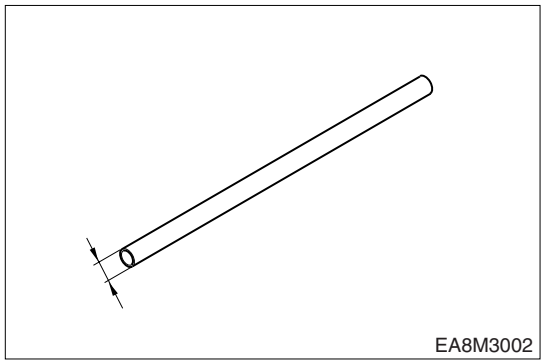

EDM2037I

● **Rocker arm shaft diameter**

With an outside micrometer, measure the rocker arm shaft diameter at the point where the rocker arms have been installed. l

Replace the rocker arm if the amount of wear is beyond the specified limit.

Standard	Limit
ϕ23.978 ~ ϕ23.959 mm	ϕ23.75 mm


EA8M3002

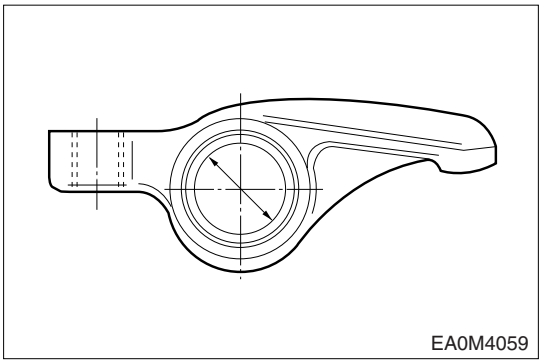
2) Rocker arm

● **Visual check**

Visually check the face of the rocker arm in contact with the valve stem end for scores and step wear. If the wear is small, correct it with an oil stone or grinding paper of fine grain size. Rocker arm with a considerable amount of step wear should be replaced.

● **Diameter of the rocker arm bushing**

Measure the inside diameter of the rocker arm bushing with an inside micrometer or vernier calipers, and compare the measured values with the rocker arm shaft diameter. If the clearance exceeds the limit, replace either bushing or shaft, whichever worn more.


EA0M4059

<Clearance>

Standard	Limit
0.020 ~ 0.093 mm	0.2 mm

3) Wear

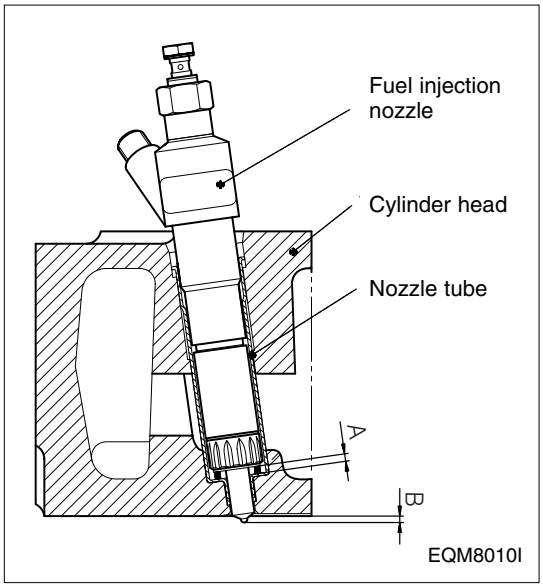
- Assemble the connecting rod to the crankshaft and measure connecting rod big end side clearance using a feeler gauge.
- Assemble the connecting rod to the piston and measure connecting rod small end side clearance.
- If the measured values are beyond the limit, replace the connecting rod.

Limit	0.5 mm

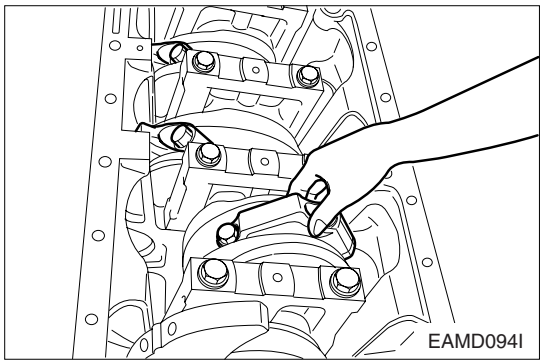
3.2.12. Fuel injection nozzle

- Insert a seal ring and injection nozzle on the cylinder head.
- Measure the clearance between the cylinder head bottom and nozzle tip. If the measured values are beyond the limit, replace the seal ring.

Standard	DE12T/TI/TIA	DE12TIS
A (Thickness of seal ring)	1mm	3mm
B (Projection of nozzle)	3.4 ~ 3.5 mm	2.4 ~ 2.5 mm



● Move the bearing cap with hand, and release and reassemble it if no movement is detected.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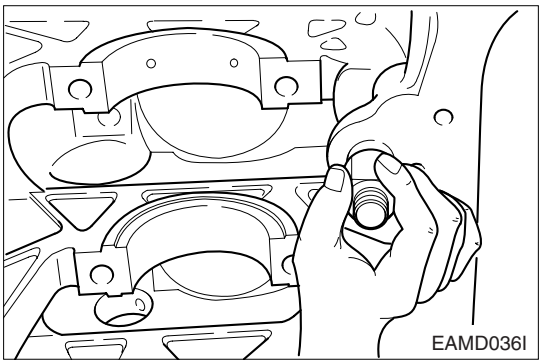
3.3.17. Relief valve

● Assemble the relief valve.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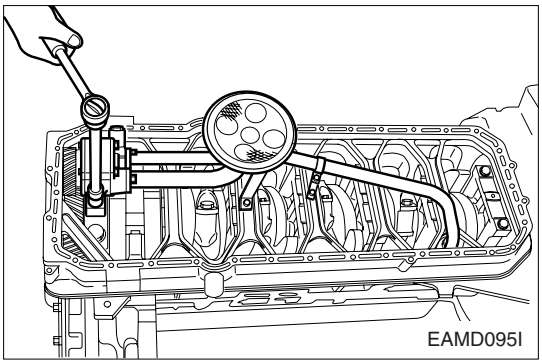
3.3.18. Oil pump and oil pipe

● Install a dowel pin in the No.7 bearing cap, then assemble the oil pump with specified torque.

Torque	4.4 kg·m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● Assemble the oil suction pipe with the delivery pipe, then install the bracket on the bearing cap.

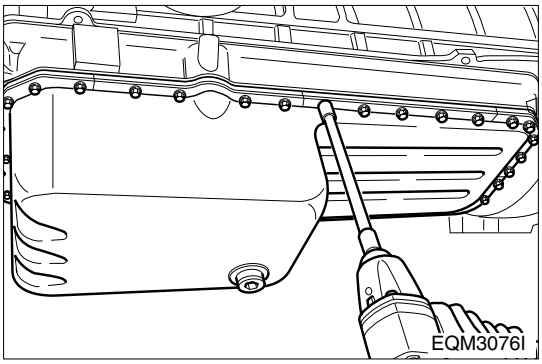
3.3.19. Oil pan

● Mount gasket and put the oil pan thereon.

● Place stiffeners and tighten bolts.

● Align the bolt holes with gasket holes to prevent damage to the gasket and tighten to specified torque.

Torque	2.2 kg·m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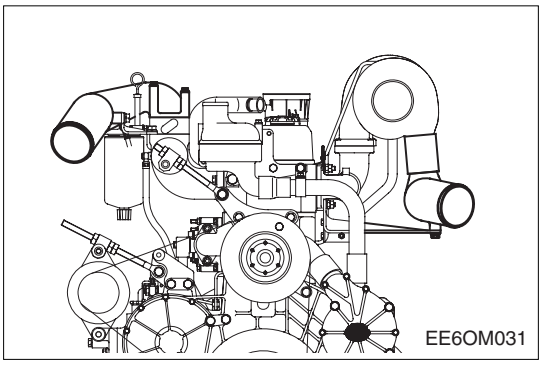
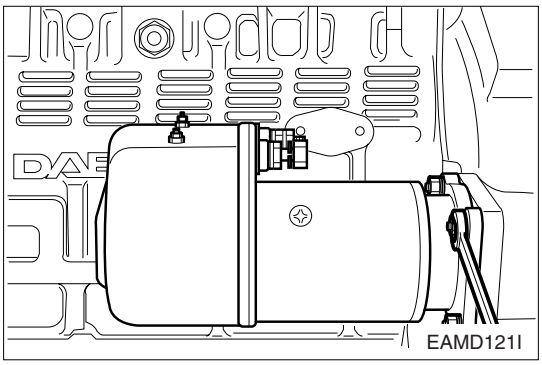
3.3.33. Air pipe

- Semi-assemble the bracket to the intake pipe, connect a rubber hose between the turbocharger and intake pipe using the clamps, then assemble the bracket completely.



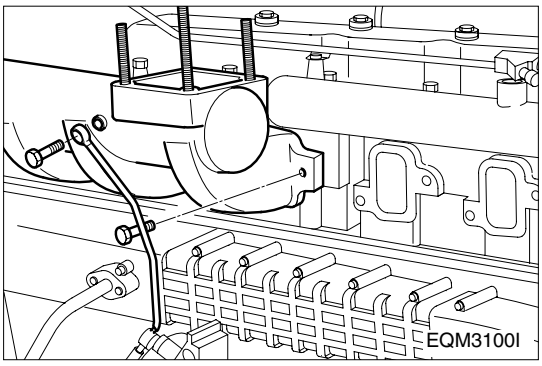
3.3.34. Starter

- Assemble the starter in position on the flywheel housing.



3.3.35. Intake manifold

- Fit a gasket on the intake manifold before assembling the intake manifold.
- Mount the air heater gasket on the intake manifold, then assemble the air heater with the intake manifold.
- Connect the air hoses to the boost compensator mounted on the fuel injection pump.



5.2.4. Replacement of oil filter cartridge

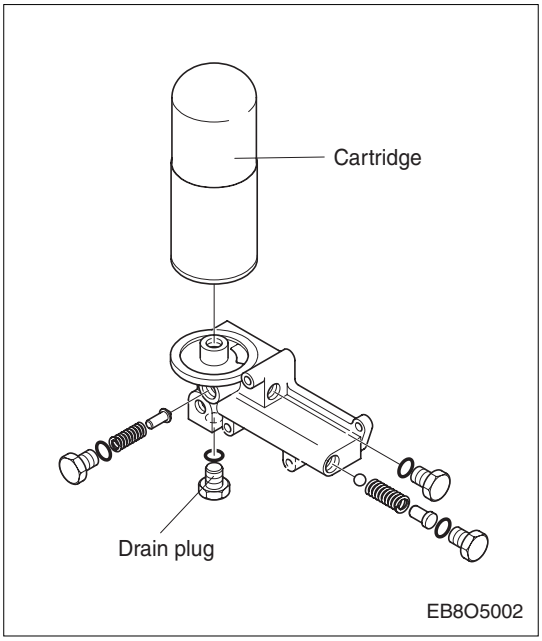
At the same times of oil exchanges, replace the oil filter cartridge.

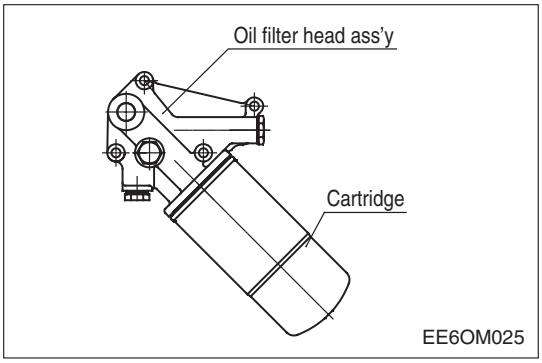
- Drain engine oil by loosening the drain plug on the filter head.

Caution :
Don't forget tightening the drain plug after having drained engine oil.

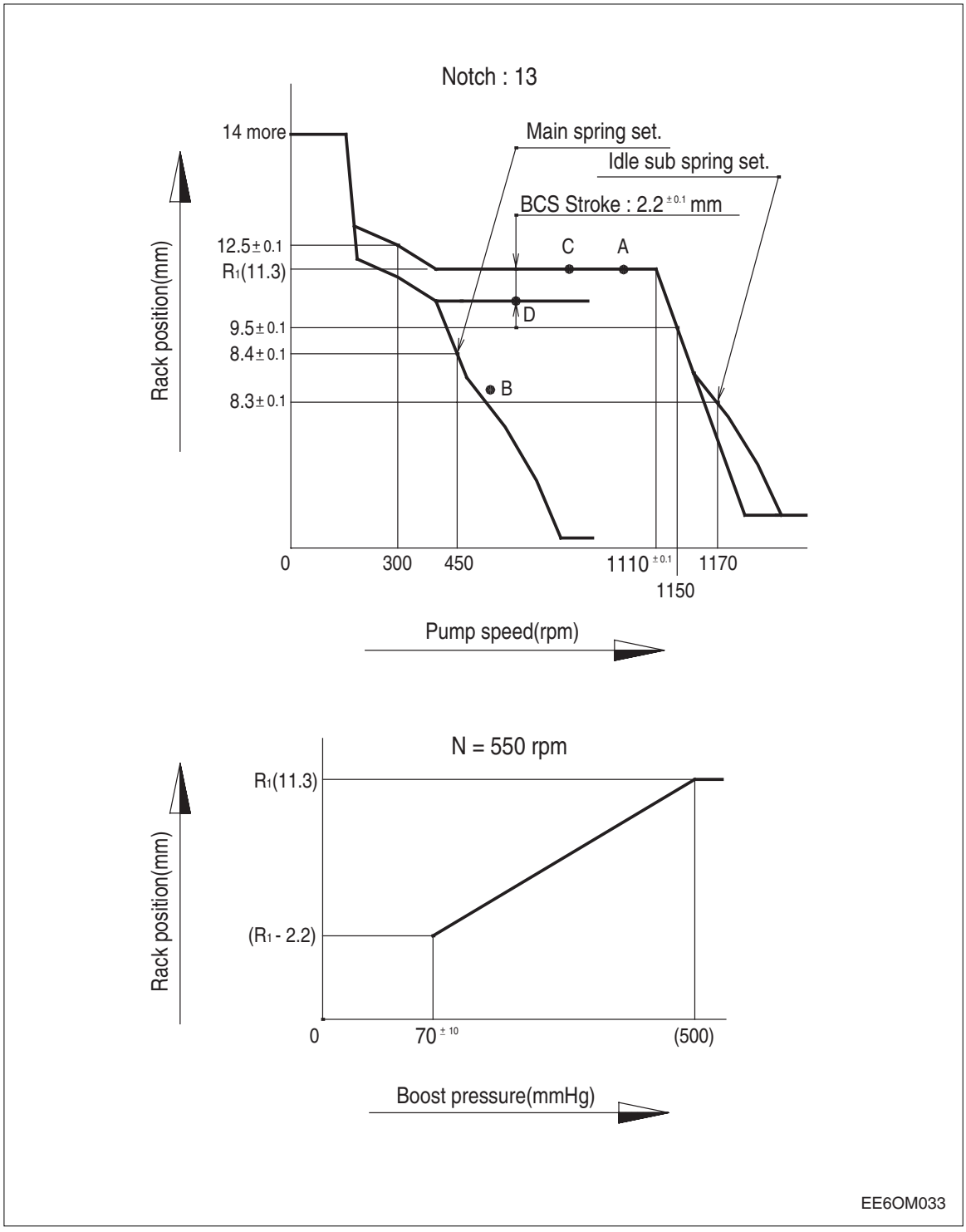
- Loosen the oil filter by turning it counter-clockwise with a filter wrench.
- With a rag wipe clean the fitting face of the filter body and the oil filter body so that new oil filter cartridge can be seated properly.
- Lightly oil the O-ring and turn the oil filter until sealing face is fitted against the O-ring. Turn 1-1/4 turns further with the filter wrench.

Note :
It is strongly advisable to use DAE-WOO genuine oil filter cartridge for replacement.

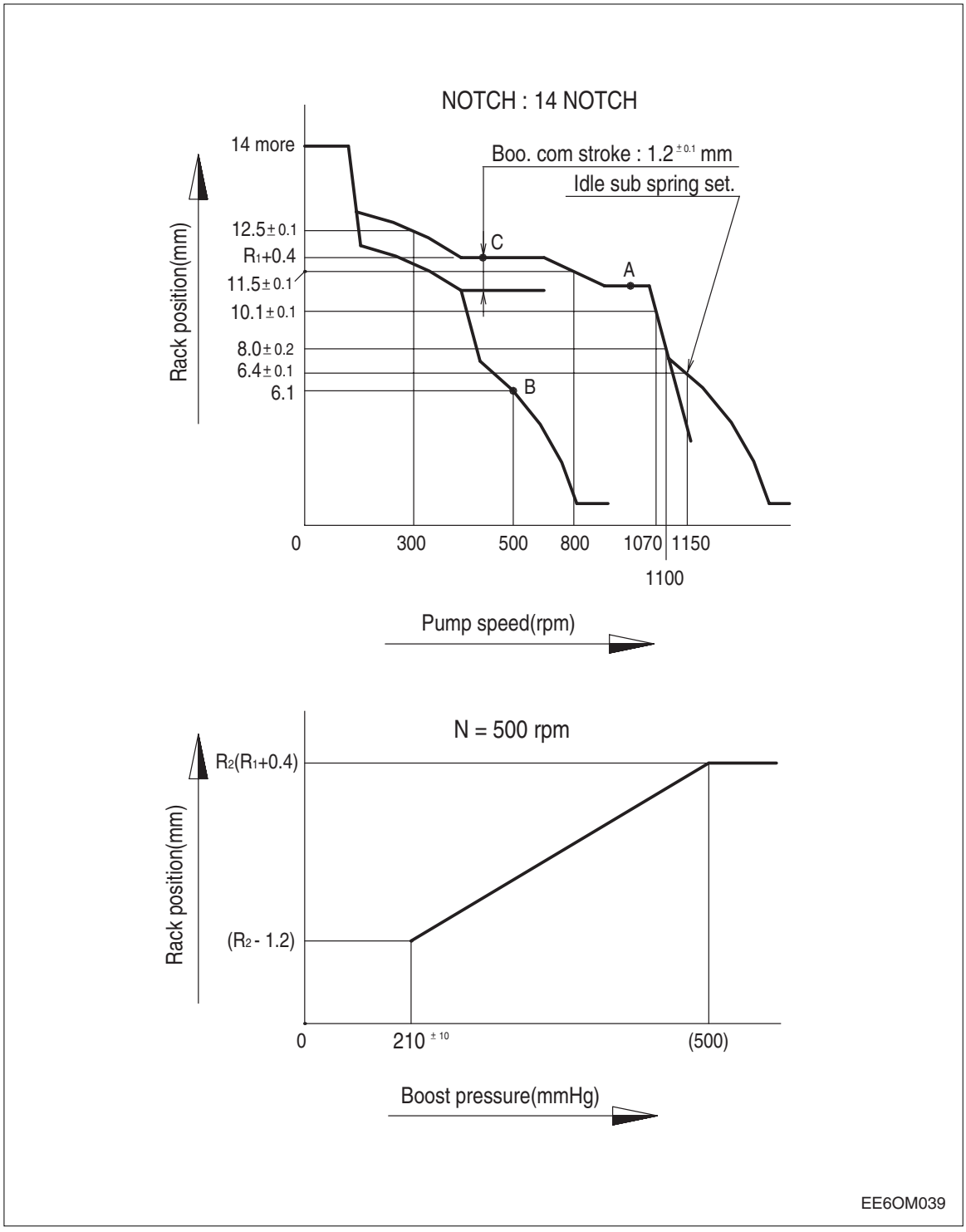




(6) Performance curve of governor



(6) Performance curve of governor

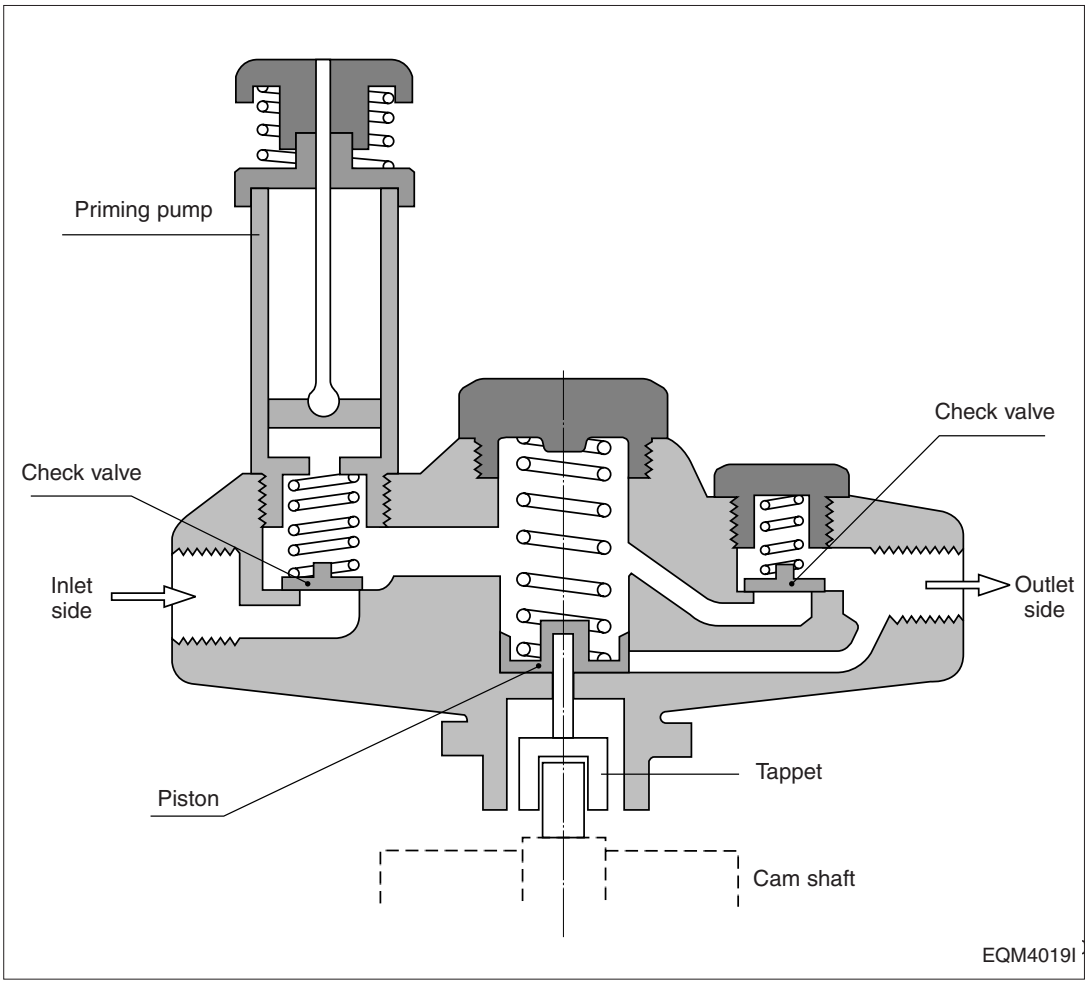


6.1.3. Fuel feed pump

1) General descriptions and construction

The P-type injection pump is mounted with K-ADS or KP type feed pump. These pumps have the same basic construction and operation, and the general descriptions of the KP type pump are given below :

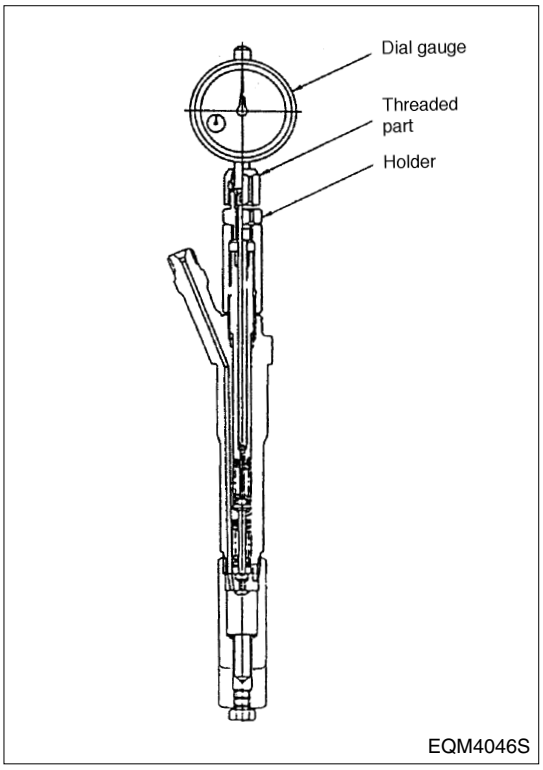
The figures show its construction (right figure) and operation (below figure). The piston in the fuel feed pump is driven by the push rod and tappet via the camshaft of injection pump and performs reciprocating operation to control the suction and delivery of fuel. When the cam reaches the Bottom Dead Center as shown in the figure, the fuel is drawn in through the check valve on the inlet side.



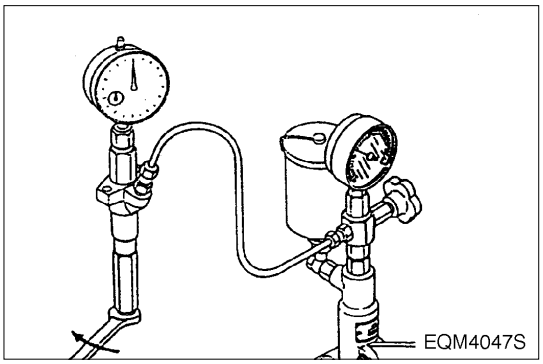
f. Install the dial gauge on the holder assembly so that the pin is brought into contact with the upper end of the push rod, then fix the pin with the nut.

NOTE 1 :
Fix the dial gauge so that a stroke of 2 mm or so can be measured.

NOTE 2 :
Overtightening the nut may cause a sticking of the dial gauge seat.

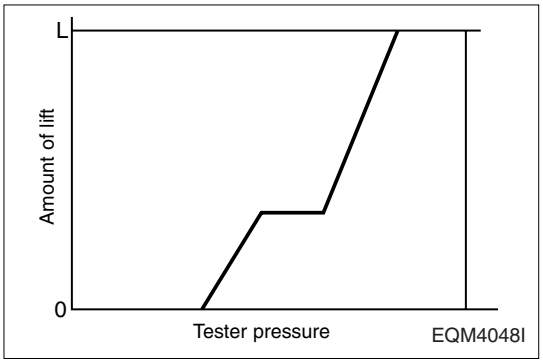


g. Assemble the nozzle and nozzle holder assembly to the nozzle tester and zero the dial gauge.
h. Operate the nozzle tester, bleed the retaining nut, and check for fuel leakage.



I. Operate the nozzle tester and increase the tester pressure up to 350 ~ 450 kgf/cm^2 in order that the needle valve can be fully lifted. Then, record the full lift value “L”.

NOTE :
This testing is to be made in order to check the nozzle seat portion for unusual wear or whether the nozzle assembly is a standard item.



● **Replacing thermostat and precautions for handling**

(1) Precautions for handling

The wax pallet type thermostat does not react as quickly as bellows type one to a variation of temperature of coolant. Such relatively slow reaction is mainly due to the large heat capacity of the wax pellet type thermostat. Therefore, to avoid a sharp rise of coolant temperature, it is essential to idle the engine sufficiently before running it. In cold weather, do not run the engine at overload or overspeed it immediately after engine starting.

(2) When draining out or replenishing coolant, do it slowly so that air is bled sufficiently from the entire cooling system.

(3) Replacing thermostat

If the thermostat is detected defective, retrace with a new one.

6.4.5. Walk-around check and servicing

As the condition of turbocharger depends greatly on how well the engine is serviced, it is very important to maintain the engine in accordance with the specified maintenance procedure.

1) Intake system

Pay particular attention to the air cleaner when servicing the intake system.

In the case of wet-type air cleaner, if the level of oil surface is lower than specified, cleaning effect is poor; if too high, the cleaner draws in oil to foul the case.

Especially, if the rotor is fouled, the sophisticatedly-tuned balance is broken to create vibration and to cause seizure and unusual wear to the bearing.

Therefore, it is very important to use a good quality air cleaner all the time.

In the case of dry-type air cleaner, it is essential to clean it to reduce intake resistance as much as possible.

2) Exhaust system

Pay particular attention to prevent gas leaks and seizure when servicing the exhaust system because leakage of exhaust gas from discharge pipes, turbocharger fixing portions, etc. lowers charging effect.

As such components as turbine chamber that becomes red-hot during operation use heat resisting steel nuts, do not interchange these nuts with ordinary steel nuts. In addition, apply anti-seizure coating to fixing nuts on the portions as designated.

3) Fuel system

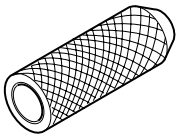
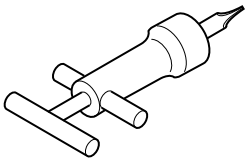
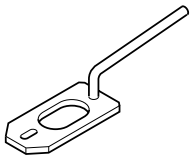
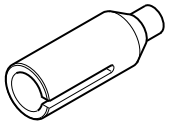
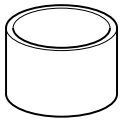
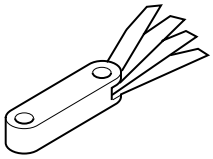
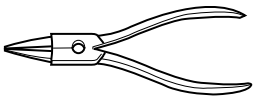
If the full load stopper regulating the maximum injection volume and the maximum speed stopper regulating the maximum speed in the fuel injection pump are adjusted without using a pump tester, the turbocharger rotates at excessively rapid speed and may suffer damage. Besides of it, if spray pattern from the fuel injection nozzles is bad or the injection timing is incorrect, temperature of exhaust gas rises up to affect the turbocharger adversely. To avoid such trouble, be sure to make a nozzle test.

4) Lubricating system

Pay particular attention to oil quality and oil filter change intervals when servicing the lubricating system. Deteriorated engine oil affects adversely not only the engine but torso the turbocharger. Suggested engine oils for the turbocharger-mounted engine are as follows :

Engine model	Recommend oil	
	SAE No.	API No.
DE12T/TI/TIA	SAE 15W40	above CD or CE
DE12TIS	SAE 15W40 SAE 10W40	ACEA-E2 or ACEA-E3 (API CH-4)

* If long oil change intervals are to be used, ACEA-E3 oil must be used.

No.	Part No.	Figure	Tool Name	Remark
10	EF.123-066		Valve stem seal punch	
11	EU.2-0131		Valve clearance adjust ass'y	
12	EF.123-065		Valve spring press	
13	EU.2-0647		Crankshaft gear punch	
14	EF.123-079		Piston sleeve	DE12/T/TI/TIS
	EF.120-208			Use all engine
15	60.99901-0027		Feeler gauge	
16	T7610001E		Snap ring plier	
17	T7621010E		Piston ring plier	