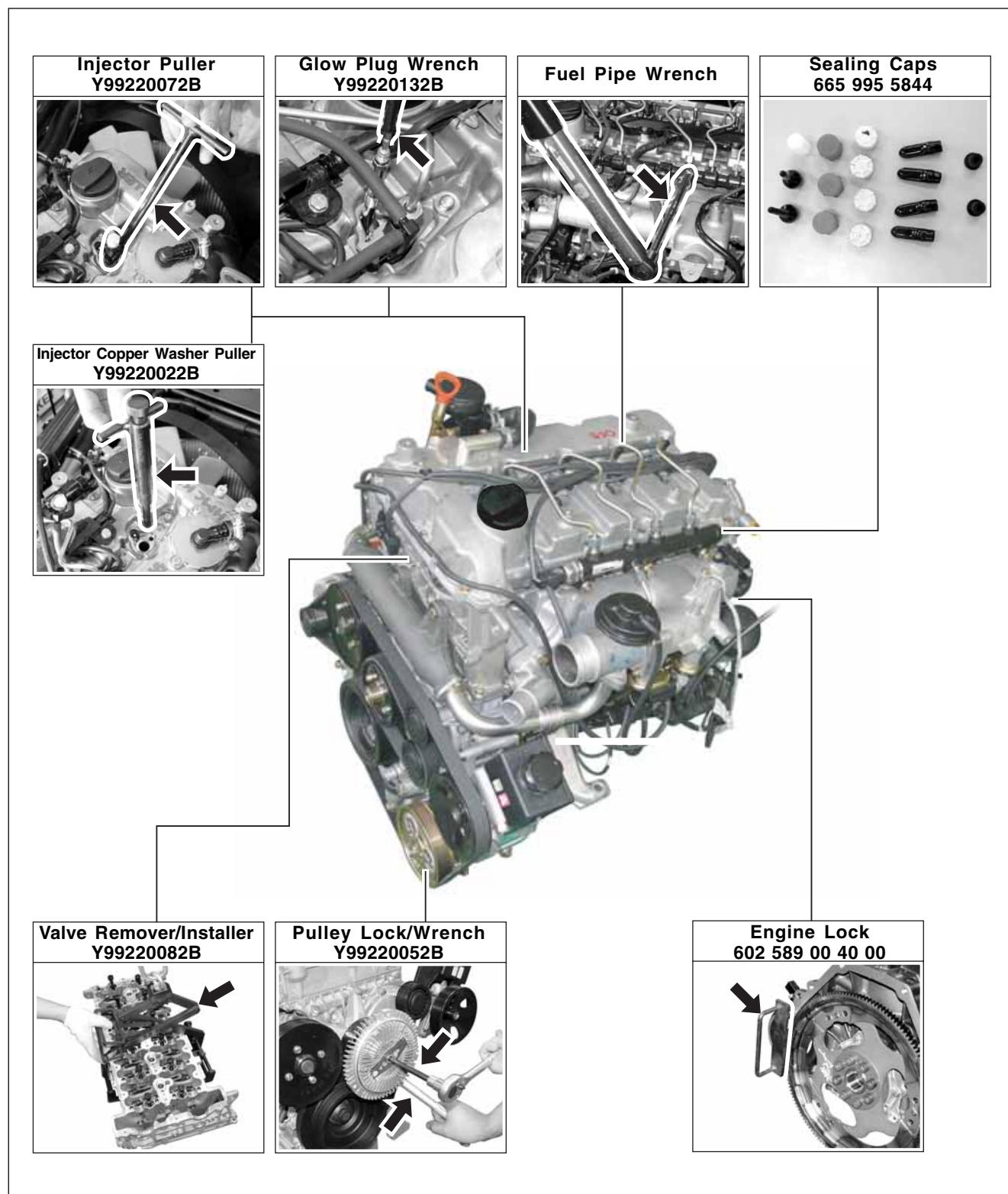


DISASSEMBLY AND REASSEMBLY

COMPONENTS AND SPECIAL TOOLS



Glow Plug Socket



Removal/Installation Device
for HP Pump



Removal/Installation Socket
for High Pressure Pipe



Head Bolt Wrench



CHANGED BY	
EFFECTIVE DATE	
AFFECTED VIN	

INSPECTION BEFORE DISASSEMBLY AND REASSEMBLY

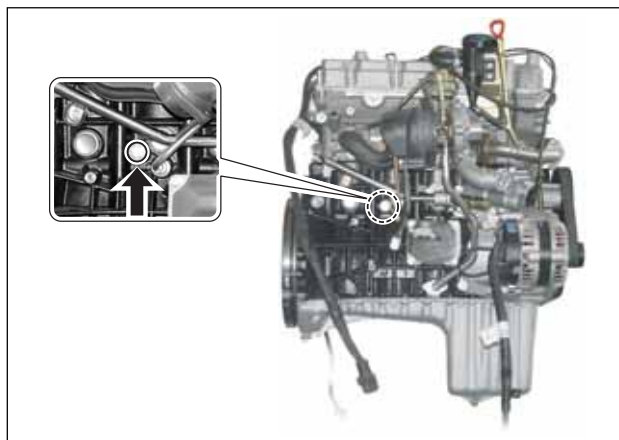
Preparations and Preceding Works

1. Remove the cylinder block drain plug and seal and completely drain the residual coolant from the cylinder block.

Installation Notice

Tightening torque	30 Nm
-------------------	-------

Replace the seal with new one once removed.



2. When the fan belt is installed, gently pump the belt shock absorber mounting bolt (M19) 3 times.
3. Take off the fan belt while pushing the mounting bolt (M19).



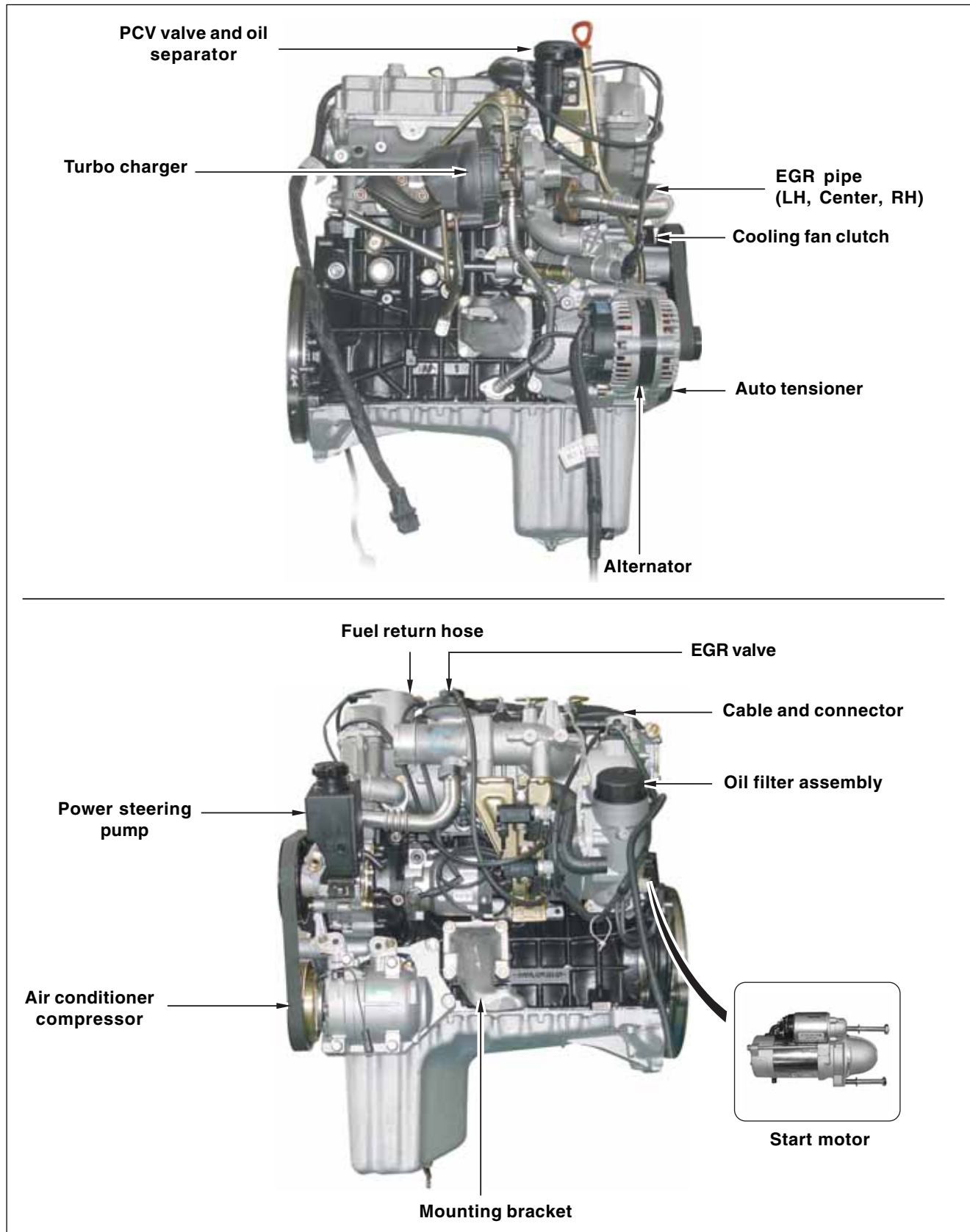
4. Loosen the oil drain plug and completely drain the engine oil.

Installation Notice

Tightening torque	25 ± 2.5 Nm
-------------------	-------------



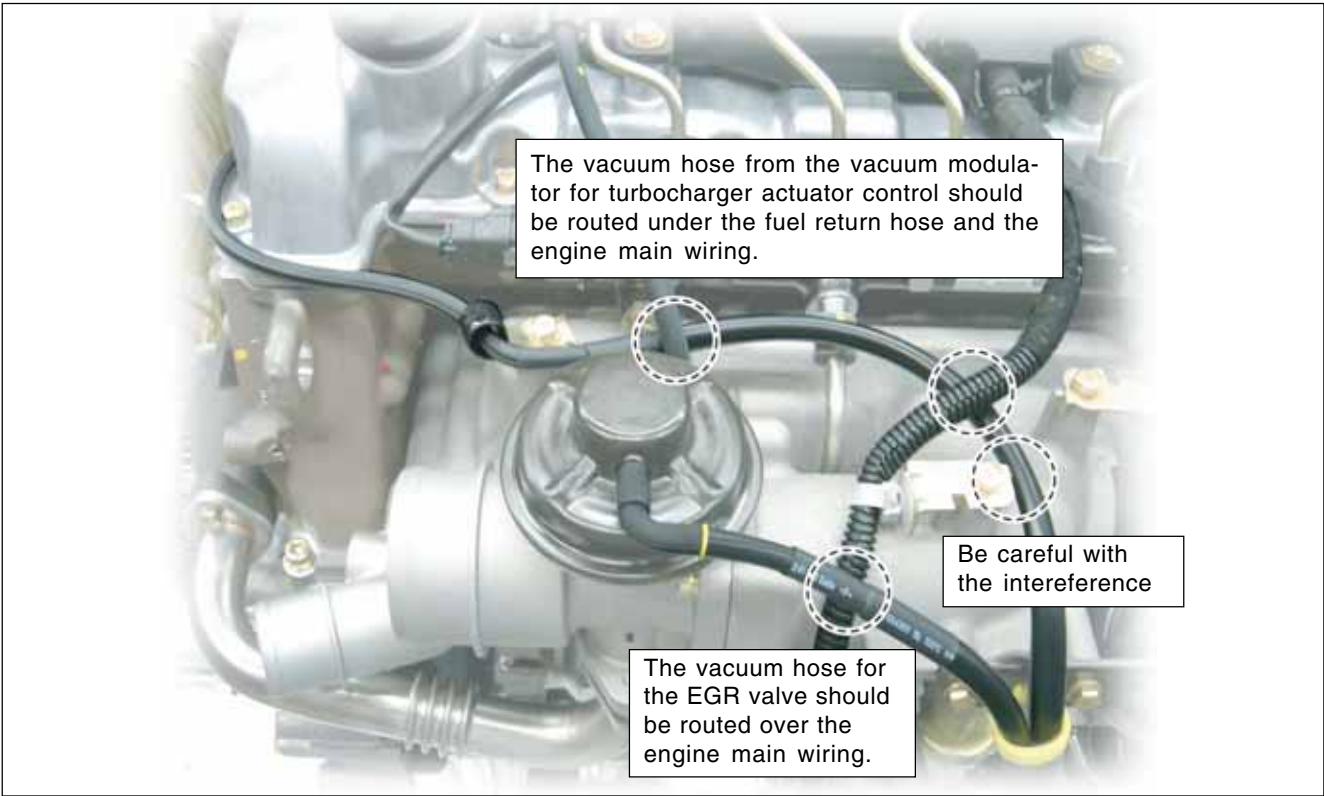
ENGINE ACCESSORIES



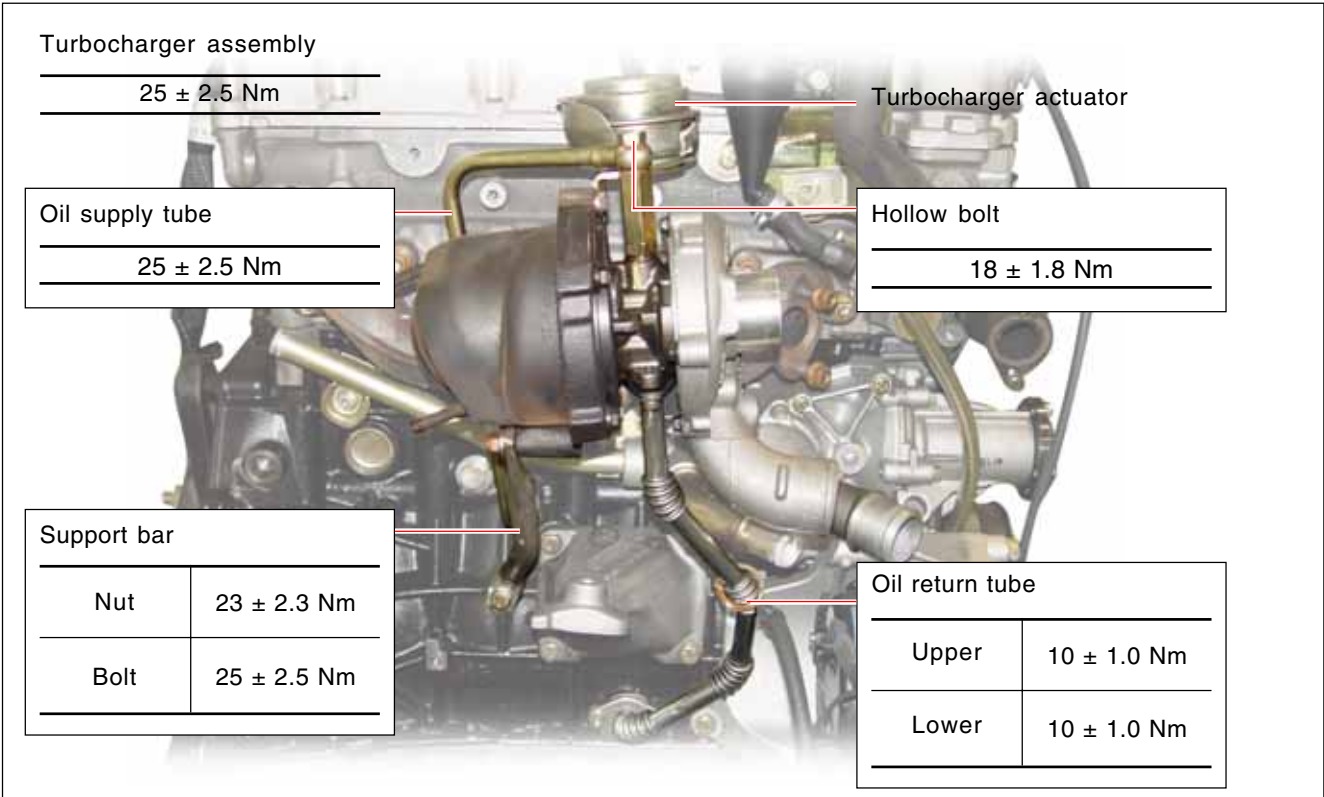
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► Cautions When Installing the Engine

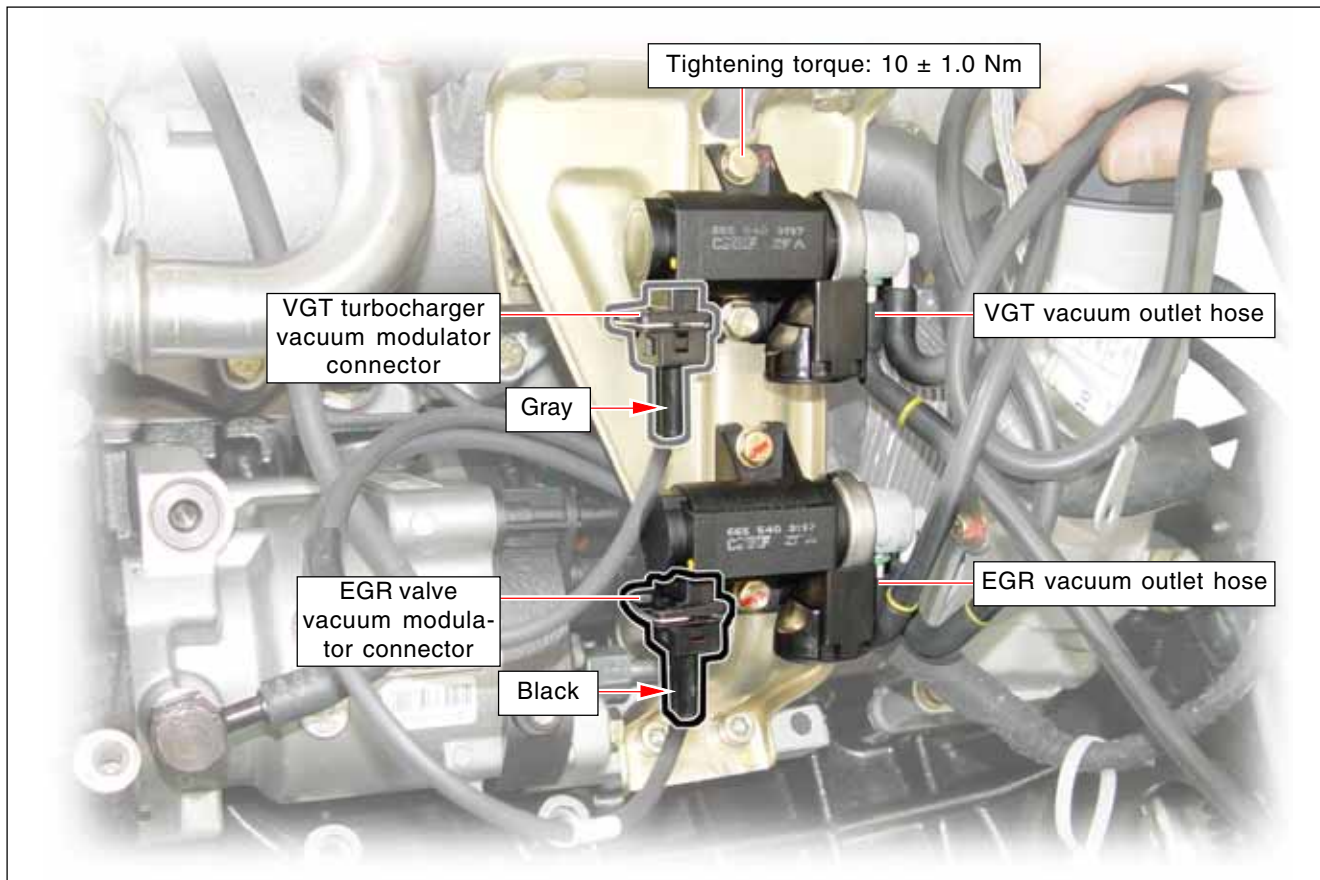
1. Connection of vacuum hose



2. Tightening torque of oil pipes on VGT



3. Vacuum modulator



GENERAL

ASSY

HOUSING

INTAKE

EXHAUST

LUB

COOLING

FUEL

CONTROL

SENSOR

CHANGED BY	
EFFECTIVE DATE	
AFFECTED VIN	

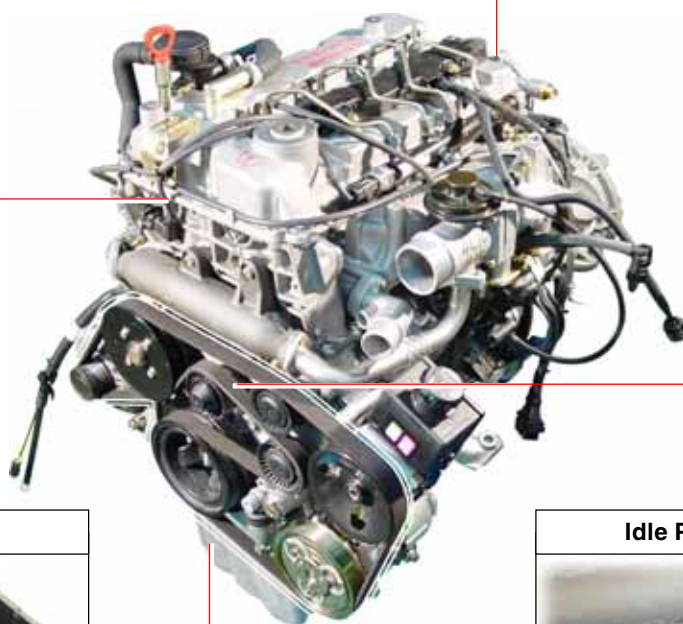
► Sealant for Engine

Applied Locations

Timing Gear Case Cover



Vacuum Pump



Oil Pan



Idle Pulley Bracket



1. Sealant specification:

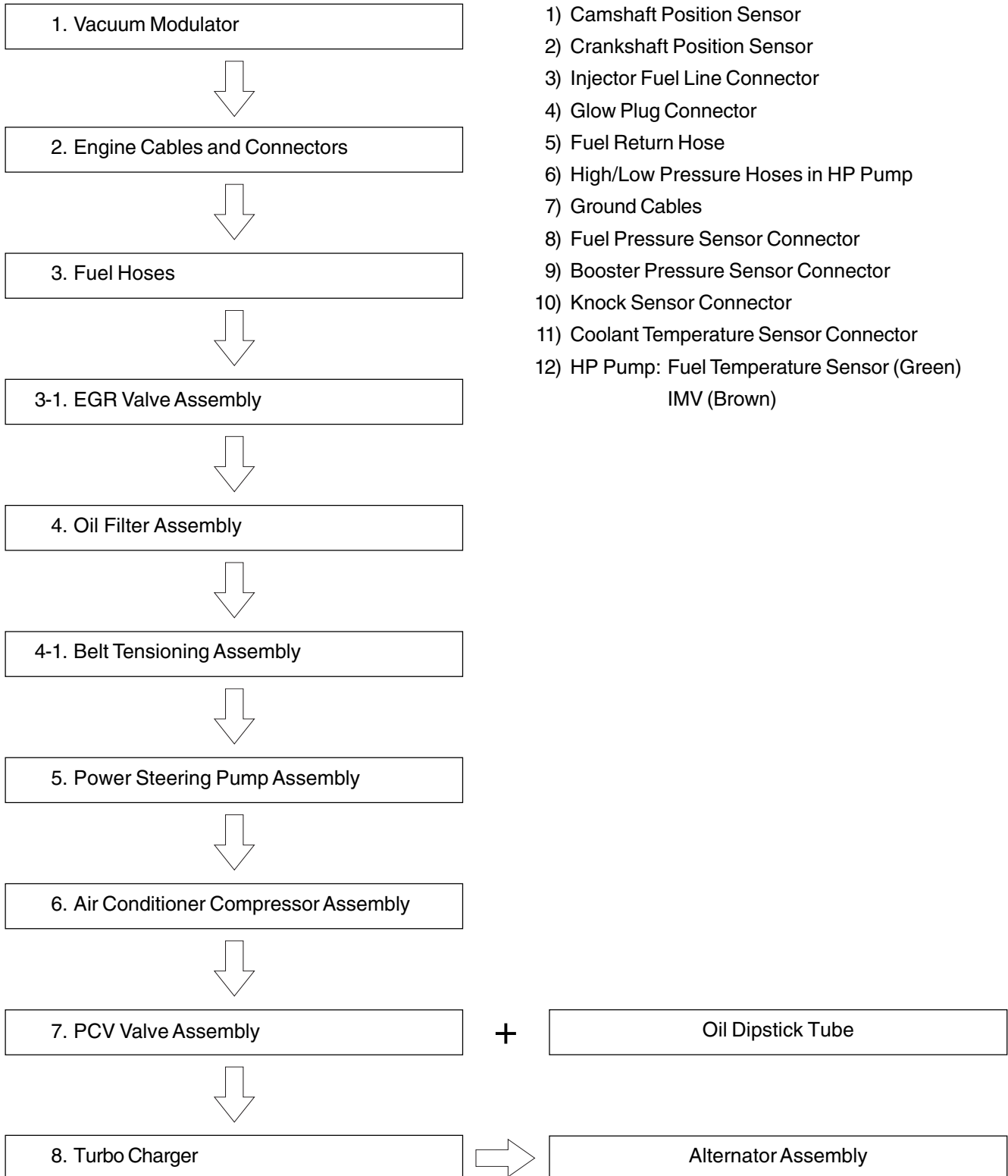
- DB 2210 (Drei Bond)
- Part number: 661 989 56 A0
- Characteristic: It is hardened twice faster than Loctite 5900.

2. Precautions:

- Never use Loctite 5900 on DI engine.
- Be careful not to clog the oil hole with sealant when installing the vacuum pump.

The engine accessories can be removed without any specific order. In general, remove the components from top to bottom. However, be careful not to splash the lubricants to engine and body when disassembly. Especially, avoid getting into other components.

► Removal and Installation Order of Major Accessories



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1. Remove the fuel pipes.
 - 1) Remove the fuel supply pipes between each cylinder and common rail with a special tool.

Installation Notice

Tightening torque	$40 \pm 4.0 \text{ Nm}$
-------------------	-------------------------



NOTICE

- Plug the openings of injector nozzle and common rail with sealing caps after removed the fuel pipes.



NOTICE

- Replace the pipes with new ones. Be careful not to be mixed the fuel pipes because the pipe appearance of D27DT (#1 and #3 cylinders and #2 and #4) are same each other.



- 2) Remove the high fuel pressure pipe mounting bolts with a special tool.
 - High fuel pressure supply pipe at common rail side

Installation Notice

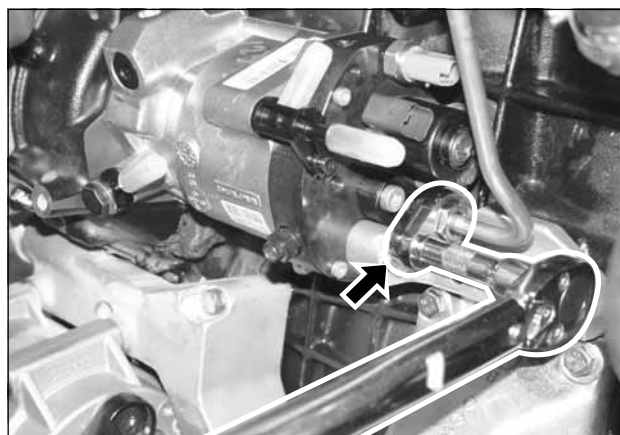
Tightening torque	$40 \pm 4 \text{ Nm}$
-------------------	-----------------------



- 3) High fuel pressure supply pipe at HP pump side

Installation Notice

Tightening torque	40 ± 4.0 Nm
-------------------	-------------



- 4) Unscrew the bracket mounting bolts and remove the high fuel pressure supply pipes.

NOTE

- Special tool: Fuel pipe remover and installer

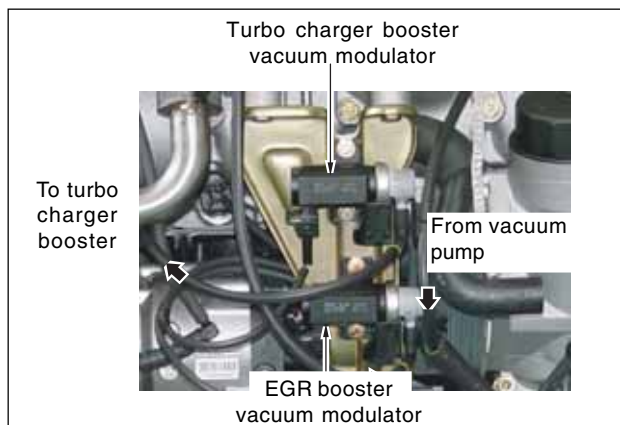


2. Disconnect the vacuum hoses and module cables from the vacuum modulator.



NOTICE

- Put the installation marks on the modulator hoses and connectors.



- 1) Remove the vacuum modulator bracket.
(Upper: 10 M x 2, Lower: 10M x 2)

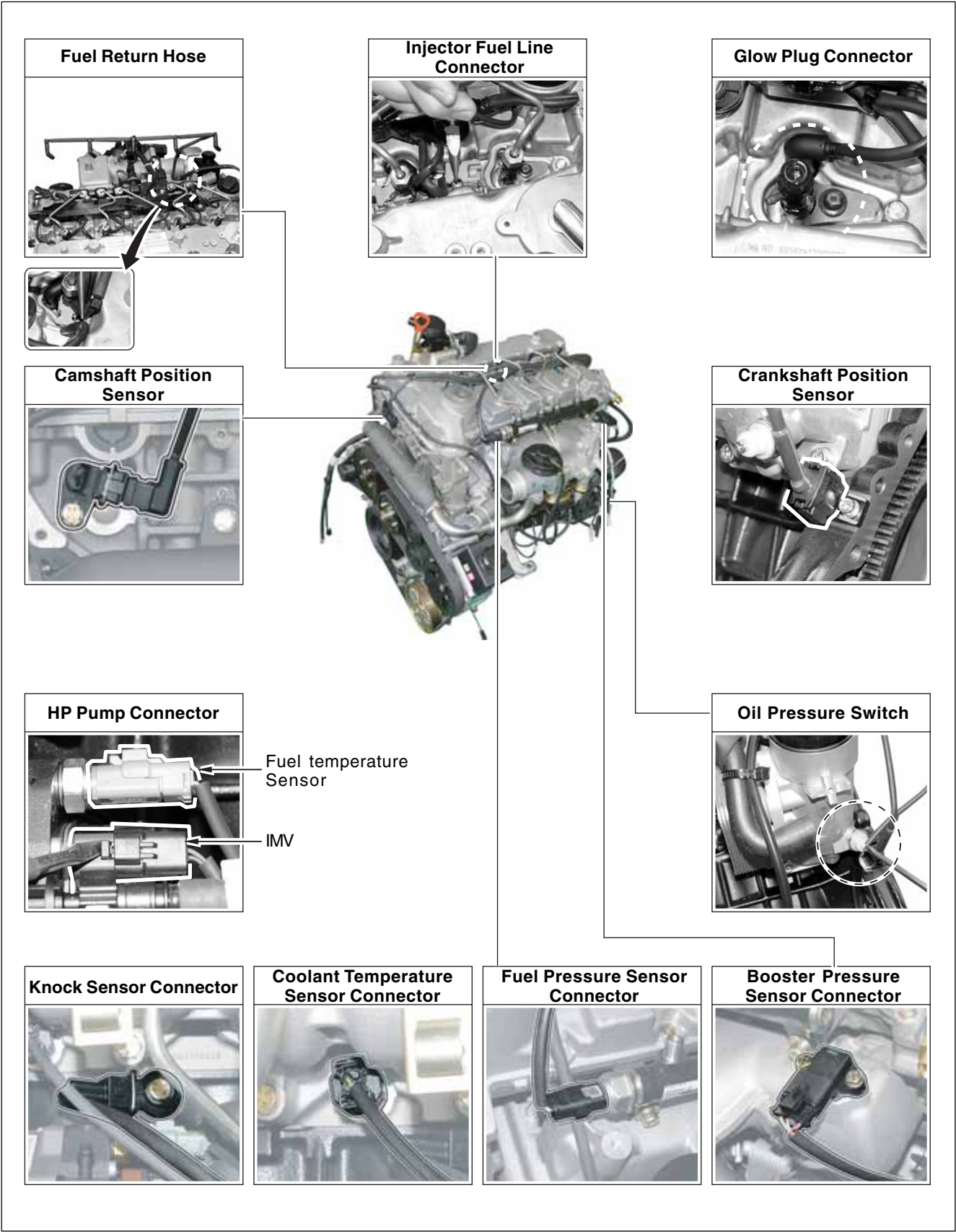
Installation Notice

Upper bolt	25 ± 2.5 Nm
Lower bolt	25 ± 2.5 Nm



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AFFECTED VIN	

3. Disconnect the wiring harnesses and connectors from the engine.



- 1) Remove the cable assembly from the engine.

**IMPORTANT**

- If possible, remove the cables after removing the fuel pipes. It makes the operation easier and protect the cables and connectors.

**IMPORTANT**

- Remove the cable screws and ground cable, and then remove the engine cable assembly.

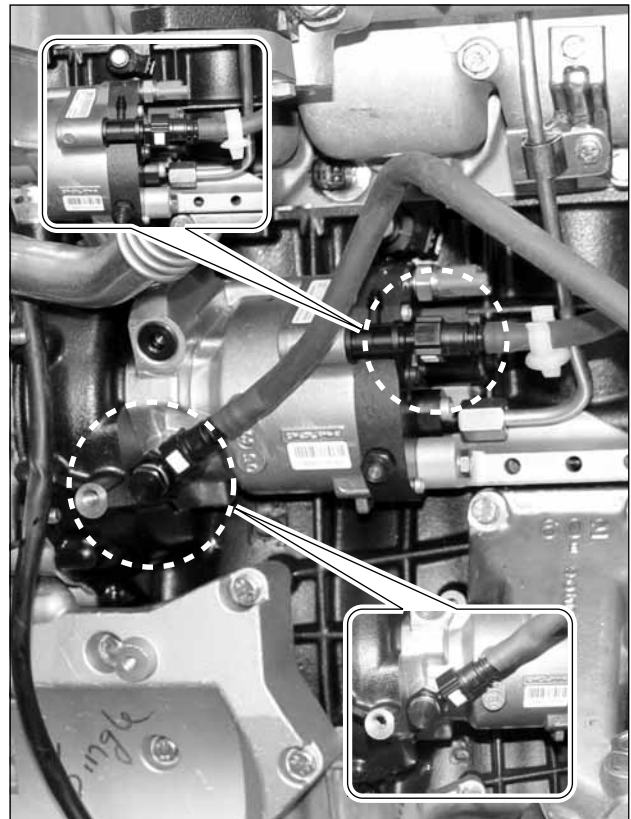
**NOTICE**

- Be careful not to damage the HP pump connecting pipe (venturi) while removing the fuel hose from the HP pump.

4. Disconnect the high and low fuel pressure hoses from the HP pump.

**NOTICE**

- Be careful not to damage the hose connections.
- Plug the openings in HP pump immediately after disconnecting the hoses.



5. Remove the EGR valve and EGR valve pipe.
 - 1) Disconnect the vacuum hose from the EGR valve.
 - 2) Unscrew the EGR valve bolts and EGR #1 pipe connecting bolts and remove the EGR valve and steel gasket.

Installation Notice	D20DT
EGR valve bolt	10 ± 1.0 Nm, M6
EGR valve and center pipe bolt	10 ± 1.0 Nm, M6



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- 3) Remove the EGR valve #1 pipe.

Installation Notice

Center pipe mounting bolt	$25 \pm 2.5 \text{ Nm}$
Center pipe and #1 pipe bolt and nut	$35 \pm 3.5 \text{ Nm}$

- *The EGR #2 pipe should be replaced with new one.*

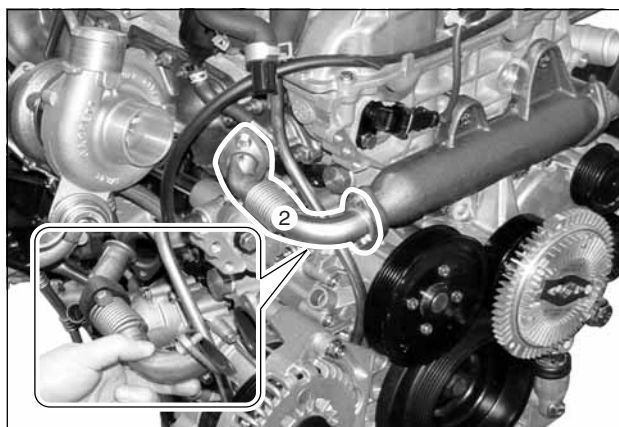


- 4) Unscrew the EGR valve #3 pipe (2) mounting bolts and remove the pipe from the exhaust manifold.

Installation Notice

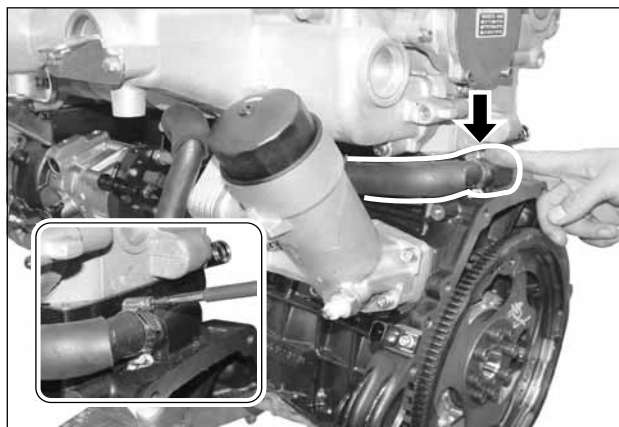
Tightening torque	Nut $35 \pm 3.5 \text{ Nm}$ Bolt $10 \pm 1.0 \text{ Nm}$
-------------------	---

- *The EGR #3 pipe should be replaced with new one.*
- *Make sure that the convex surface of new steel gasket is facing to the bolts.*



6. Remove the oil filter assembly.

- 1) Remove the oil cooler hose.

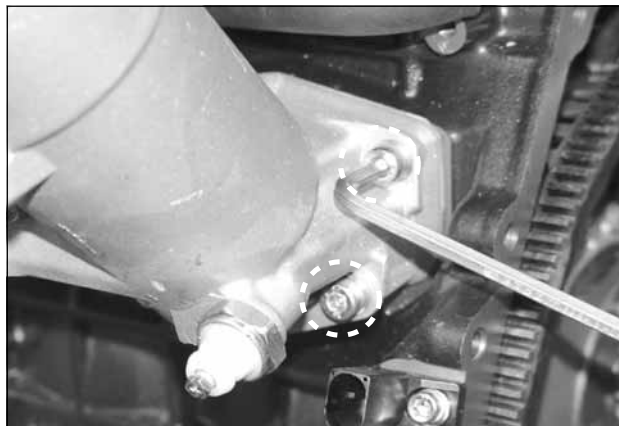


- 2) Remove the oil filter assembly mounting bolts.



NOTICE

- **Be careful not to flow out the residual oil from the engine. If flown out, immediately wipe it out.**



- 3) Remove the oil filter assembly from the cylinder block.

Installation Notice

- **Replace the oil filter gasket with new one.**

Tightening torque	25 ± 2.5 Nm
-------------------	-------------

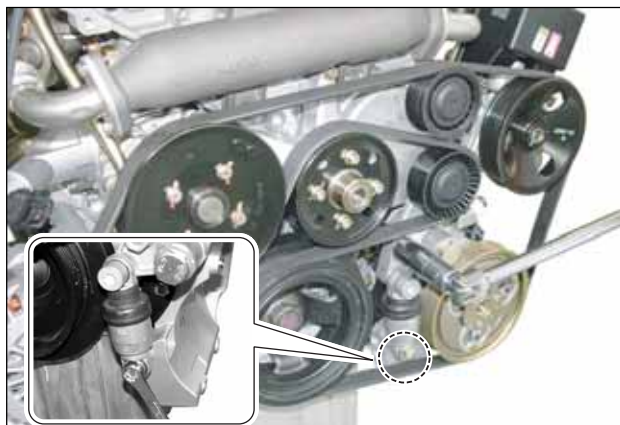


7. Remove the belt tensioning device.

- 1) Remove the shock absorber lower mounting bolt.

Installation Notice

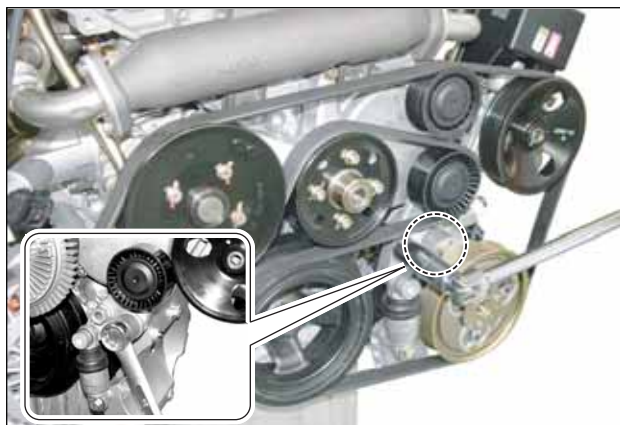
Tightening torque	32 ± 3 Nm
-------------------	-----------



- 2) Remove the shock absorber upper mounting bolt.

Installation Notice

Tightening torque	82 ± 6 Nm
-------------------	-----------

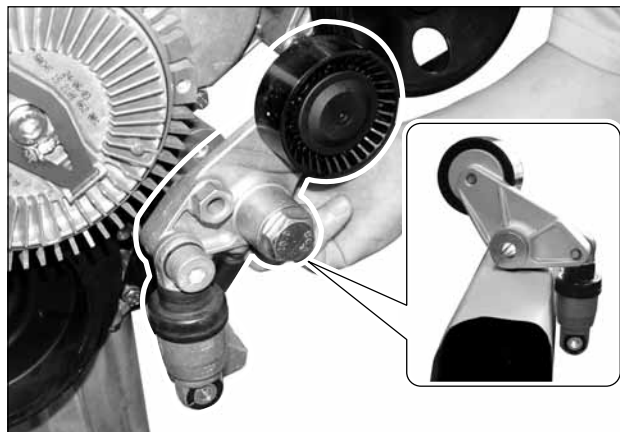


- 3) Remove the belt tensioning device.



NOTICE

- To prevent the oil leaks, store the removed shock absorber assembly with standing up.
- For air bleeding, pump the shock absorber around 3 times after installation.
- Be careful not to damage the rubber parts of the shock absorber when removing.
- To prevent the oil leaks, remove the bolts from bottom to top section. On the contrary, when installing, tighten the bolts from top to bottom section.



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AFFECTED VIN	

8. Remove the power steering pump assembly.
 - 1) Remove the power steering pump mounting bolts.

Installation Notice

Tightening torque	$25 \pm 2.5 \text{ Nm}$
-------------------	-------------------------

- ***Be careful not to flow out the oil.***

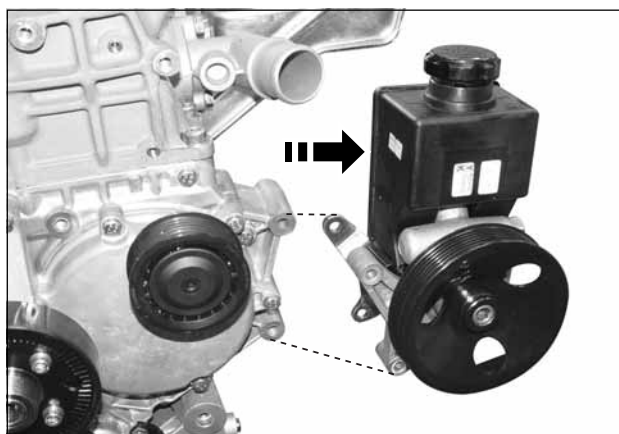


- 2) Remove the power steering pump assembly from the engine.



NOTICE

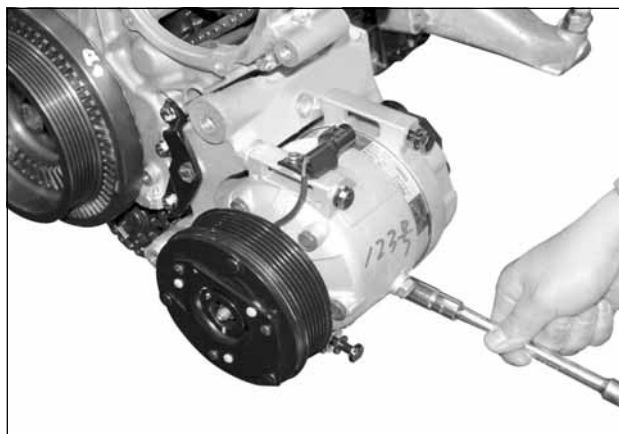
- To prevent the oil leaks, store the removed power steering pump assembly with standing up.



9. Remove the air conditioner compressor assembly.
 - 1) Unscrew the bolts and remove the air conditioner compressor assembly.

Installation Notice

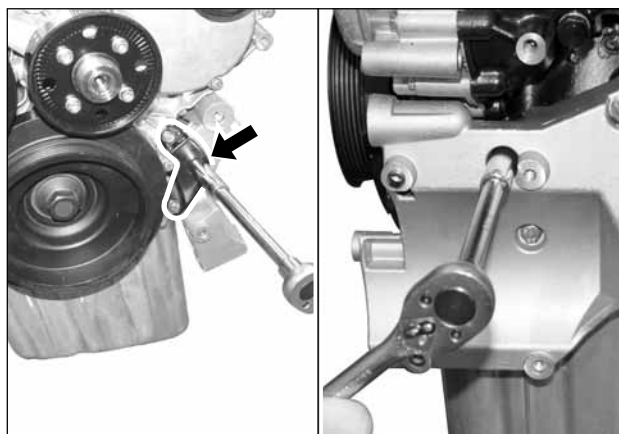
Tightening torque	$25 \pm 2.5 \text{ Nm}$
-------------------	-------------------------



- 2) Unscrew the bolts and remove the air conditioner mounting bracket.

Installation Notice

Front bolt	$25 \pm 2.5 \text{ Nm}$
Side bolt	$25 \pm 2.5 \text{ Nm}$



10. Remove the PCV valve assembly.

1) Remove the PCV valve hose.



2) Remove the PCV valve hose connected to the engine oil hose.



3) Unscrew the PCV valve mounting bolts and remove the PCV valve assembly.

Installation Notice

Tightening torque	$10 \pm 1.0 \text{ Nm}$
-------------------	-------------------------



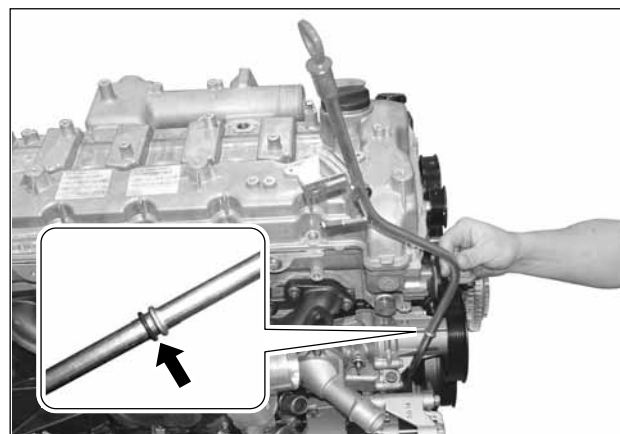
11. Remove the oil dipstick tube assembly.

Unscrew the bracket bolts and remove the dipstick tube with O-ring.



NOTICE

- Insert new O-ring into the oil dipstick tube before installation.



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EFFECTIVE DATE	
AFFECTED VIN	

Installation Notice

Tightening torque	$10 \pm 1.0 \text{ Nm}$
-------------------	-------------------------



12. Remove the turbo charger assembly.

- 1) Unscrew the bolts and remove the oil supply pipe.

Installation Notice

Upper bolt (M19)	$25 \pm 2.5 \text{ Nm}$
Lower bolt (M17)	$20 \pm 2.0 \text{ Nm}$

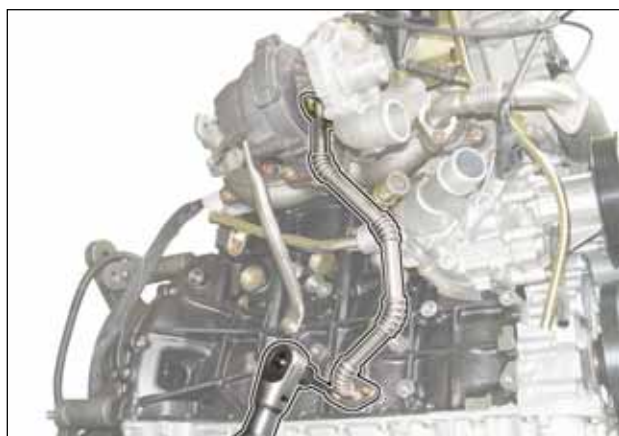


- 2) Unscrew the bolts and remove the oil return pipe.

Installation Notice

- Make sure to install the gasket with correct direction.

Tightening torque	$10 \pm 1.0 \text{ Nm}$
-------------------	-------------------------



- 3) Unscrew the turbo charger mounting bracket bolts.

Installation Notice

Tightening torque	$25 \pm 2.5 \text{ Nm}$
-------------------	-------------------------



- 4) Unscrew the turbo charger mounting bolts to exhaust manifold.

Installation Notice

Tightening torque	25 ± 2.5 Nm
-------------------	-----------------

**NOTICE**

- Use only 12 1/2 wrench.



- 5) Remove the turbo charger assembly.



13. Remove the alternator assembly.

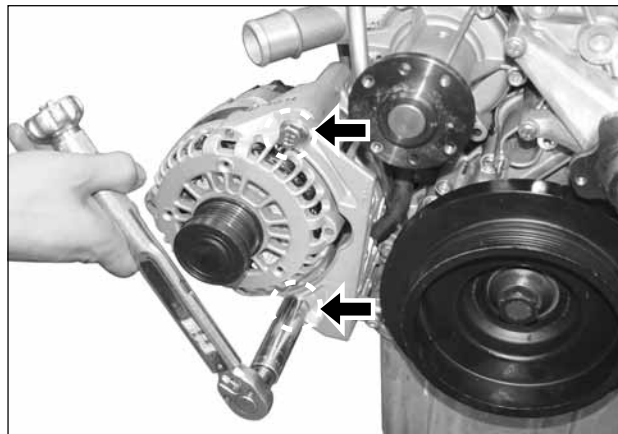
- 1) Unscrew the bolts and remove the alternator.

**NOTICE**

- Alternator Capacity: 140 A

Installation Notice

Tightening torque	46 ± 4.6 Nm
-------------------	-----------------



- 2) Remove the alternator mounting bracket.

Installation Notice

M13 bolt	25 ± 2.5 Nm
Torx 6 bolt	25 ± 2.5 Nm



GENERAL

ASSY

HOUSING

INTAKE

EXHAUST

LUB

COOLING

FUEL

CONTROL

SENSOR

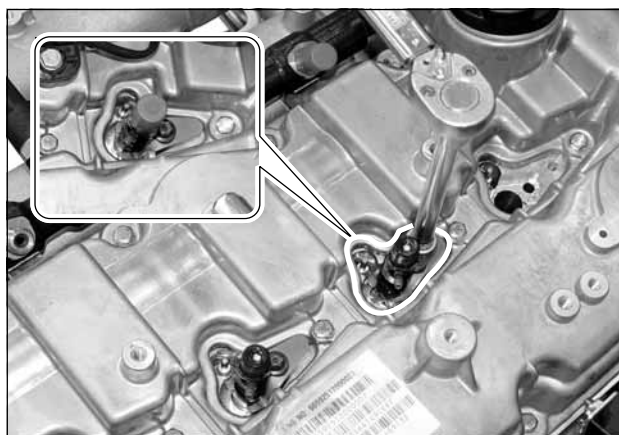
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EFFECTIVE DATE	
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ENGINE OVERHAUL

1. Unscrew the injector nozzle holder bolts (12-sided) and remove the injector bracket.

Installation Notice

Tightening torque	$9 \pm 1.0 \text{ Nm}$, $190^\circ + 10^\circ$
-------------------	--

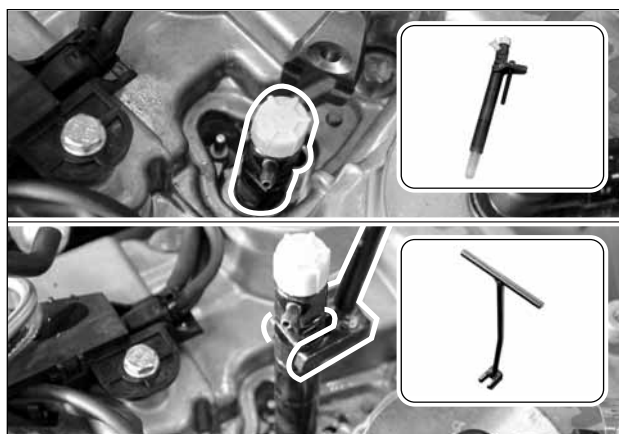


2. Remove the injectors with an injector extractor (special tool).

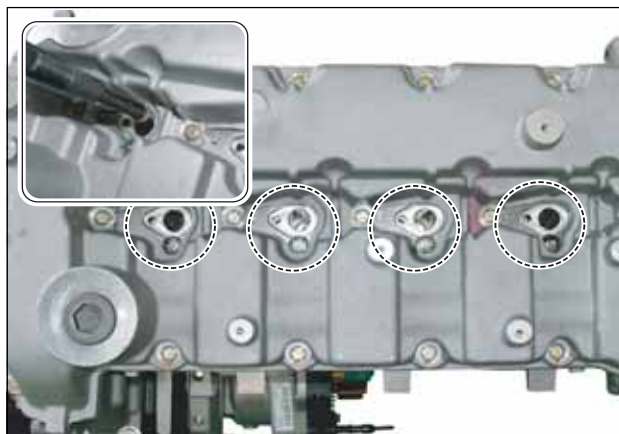


NOTICE

- Be careful not to take off the sealing caps on the injectors and fuel system.
- Replace the copper washers with new ones when installing.



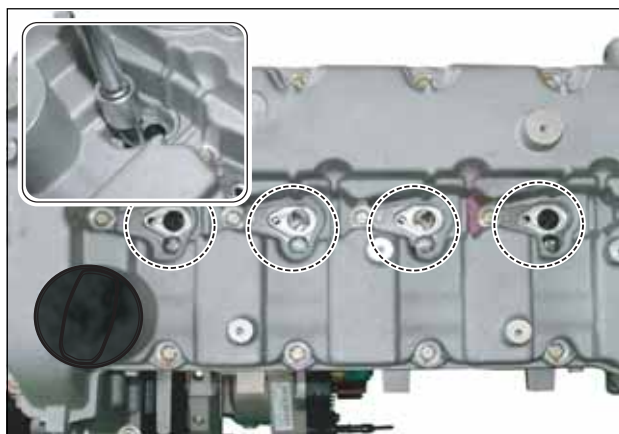
3. If the copper washer is in the injector hole, remove it with a special tool as shown in the figure.



4. Remove the glow plugs with a special tool.

Installation Notice

Tightening torque	15 ~ 18 Nm
-------------------	------------



5. Unscrew the Torx bolts and remove the common rail from the engine.

Installation Notice

Tightening torque	$25 \pm 2.5 \text{ Nm}$
-------------------	-------------------------



NOTICE

- Plug the openings with sealing cap.



6. Remove the booster sensor from the engine.

Installation Notice

Tightening torque	$10 \pm 1.0 \text{ Nm}$
-------------------	-------------------------



7. Unscrew the bolt and remove the camshaft position sensor.

Installation Notice

Tightening torque	$12 \pm 2 \text{ Nm}$
-------------------	-----------------------

Apply Loctite on the thread before installation.



8. Unscrew the bolts and remove the cooling fan pulley while holding it with a special tool.

Installation Notice

Tightening torque	$10 \pm 1.0 \text{ Nm}$
-------------------	-------------------------

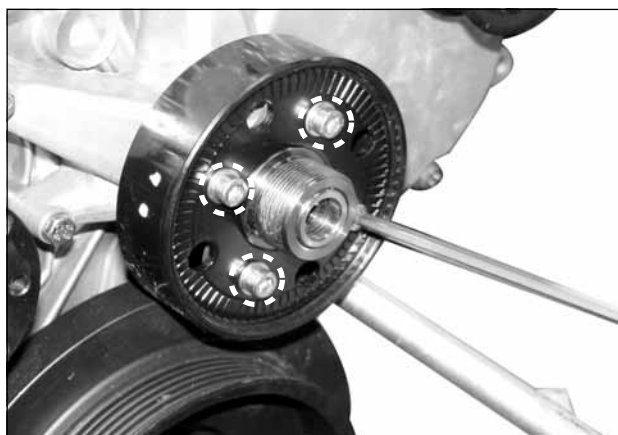


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EFFECTIVE DATE	
AFFECTED VIN	

9. Remove the cooling fan belt idle pulley while holding it with a special tool.

Installation Notice

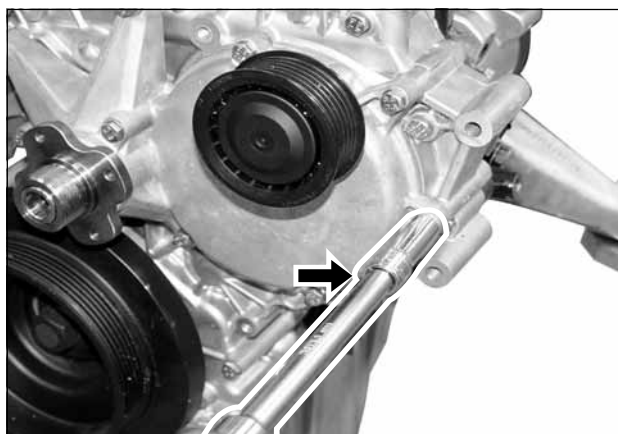
Tightening torque	10 ± 1.0 Nm
-------------------	-----------------



10. Unscrew the bolts and remove the cooling fan bracket assembly (timing chain cover).

Installation Notice

Tightening torque	10 ± 1.0 Nm
-------------------	-----------------



11. Unscrew the bolts and remove the cylinder head cover.

Installation Notice

Tightening torque	10 ± 1.0 Nm
-------------------	-----------------



12. Turn over the engine and remove the oil pan.

Installation Notice

Tightening torque	Nm
M6 x 20: 24 EA	10 ± 1.0
M6 x 35: 3 EA	10 ± 1.0
M6 x 85: 3 EA	10 ± 1.0
M8 x 40: 4 EA	25 ± 2.5



**NOTICE**

- Remove the oil seal residues from the oil pan and apply the liquid gasket on the parting surface.



13. Unscrew the nuts and remove the exhaust manifold.

Installation Notice

Tightening torque	40 ± 4.0 Nm
-------------------	-----------------

**NOTICE**

- The exhaust manifold gasket is removed along with the exhaust manifold. Mark the installation direction to prevent wrong installation. Otherwise, it may cause a sealing trouble.

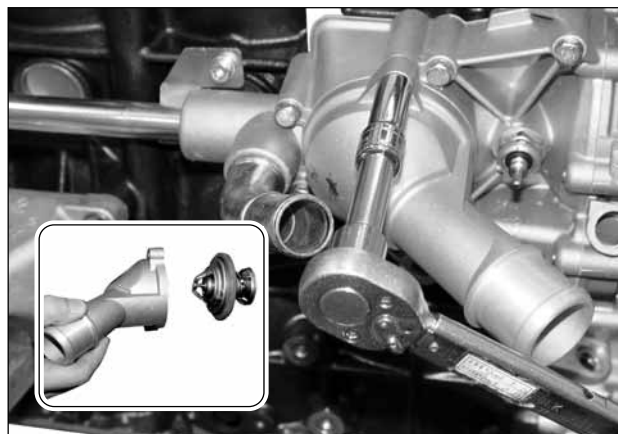


14. Unscrew the bolts and remove the thermostat.

Installation Notice

Tightening torque	10 ± 1.0 Nm
-------------------	-----------------

- *Be careful not to flow out the residual coolant.*



15. Unscrew the bolts and remove the water pump.

Installation Notice

Tightening torque	10 ± 1.0 Nm
-------------------	-----------------



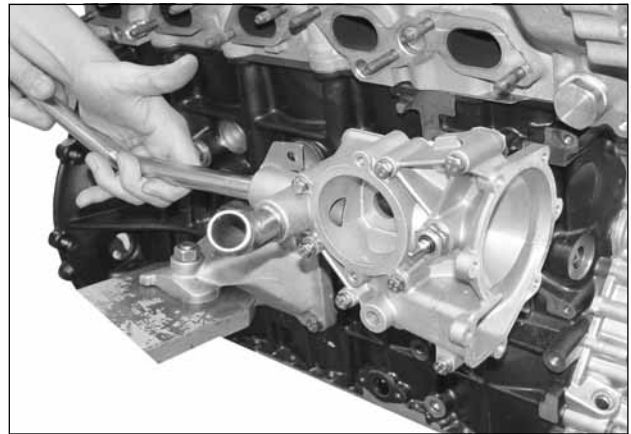
CHANGED BY	
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AFFECTED VIN	

16. Unscrew the bolts and remove the water pump housing.

Installation Notice

Tightening torque	$10 \pm 1.0 \text{ Nm}$
-------------------	-------------------------

- ***Be careful not to flow out the residual coolant.***



17. Unscrew the bolts and remove the coolant inlet port from the intake manifold.

Installation Notice

Tightening torque	$25 \pm 2.5 \text{ Nm}$
-------------------	-------------------------

- ***Be careful not to get the coolant into the intake manifold and engine.***



18. Unscrew the bolts and remove the intake manifold assembly.

Installation Notice

Tightening torque	$25 \pm 2.5 \text{ Nm}$
-------------------	-------------------------



NOTICE

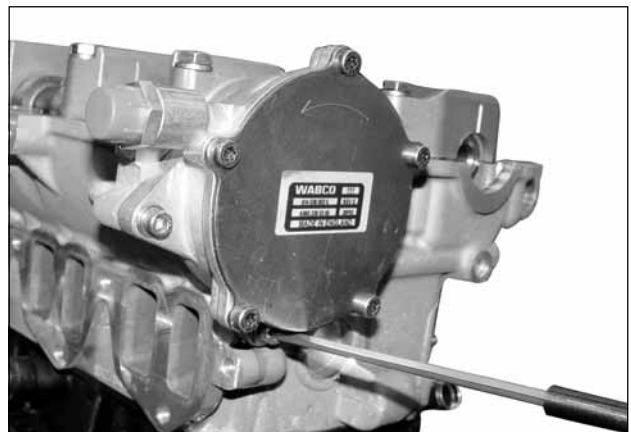
- **Replace the gasket with new one once removed.**



19. Remove the vacuum pump from the cylinder head.

Installation Notice

Tightening torque	$10 \pm 1.0 \text{ Nm}$
-------------------	-------------------------



20. Install the engine lock (special tool) onto the flywheel ring gear so that the engine will not rotate.

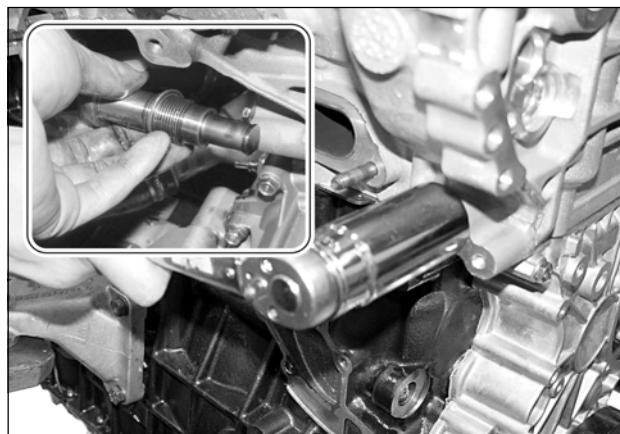


21. Remove the chain tensioner.

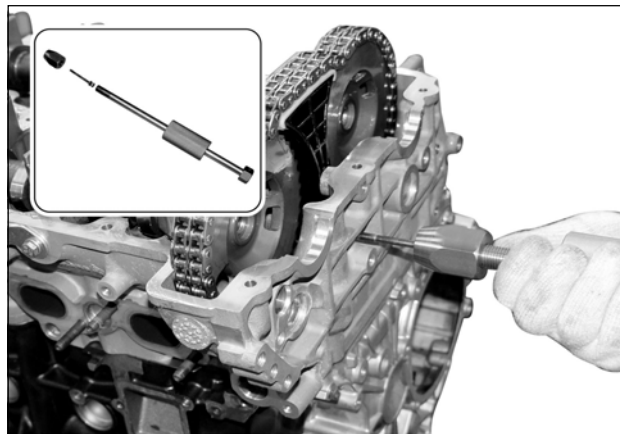
※ **Preceding Works:** removal of EGR pipe and oil dipstick tube

Installation Notice

Tightening torque	$65 \pm 5.0 \text{ Nm}$
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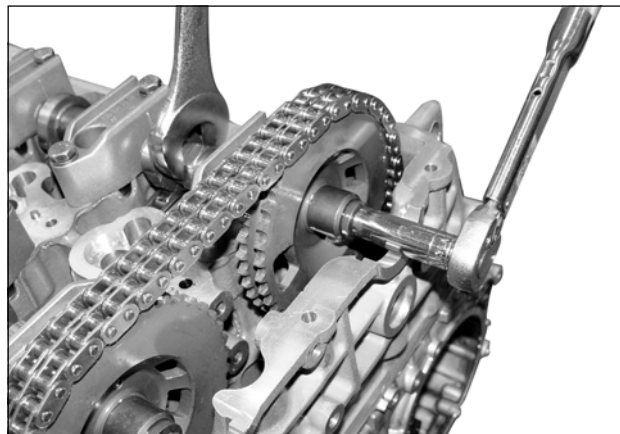
22. Pull out the lock pin and remove the upper chain guide bracket.



23. Unscrew the bolt and remove the intake camshaft sprocket.

Installation Notice

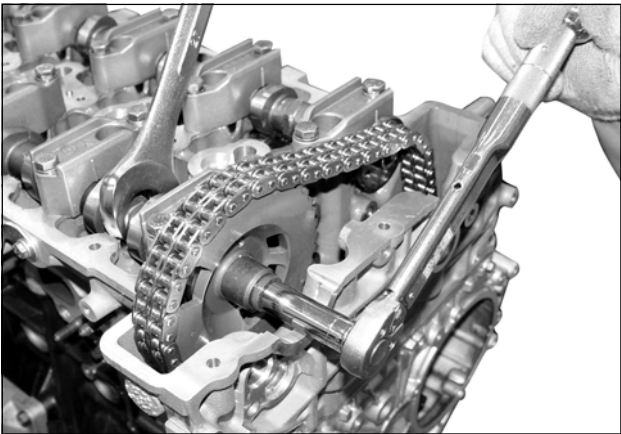
Tightening torque	$25 \pm 2.5 \text{ Nm}$, $90^\circ \pm 10^\circ$
-------------------	--



24. Unscrew the bolt and remove the exhaust camshaft sprocket.

Installation Notice

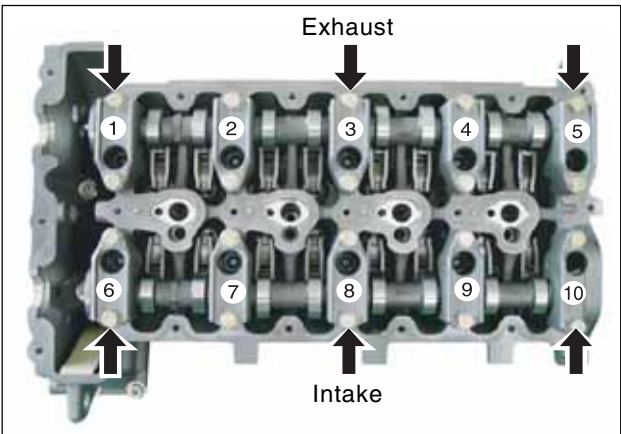
Tightening torque	25 ± 2.5 Nm, 90° ± 10°
-------------------	---------------------------



25. Remove the camshaft bearing cap bolts so that the tightening force can be relieved evenly.

- Intake: #6, #8, #10
- Exhaust: #1, #3, #5

However, there is no specific removal sequence.

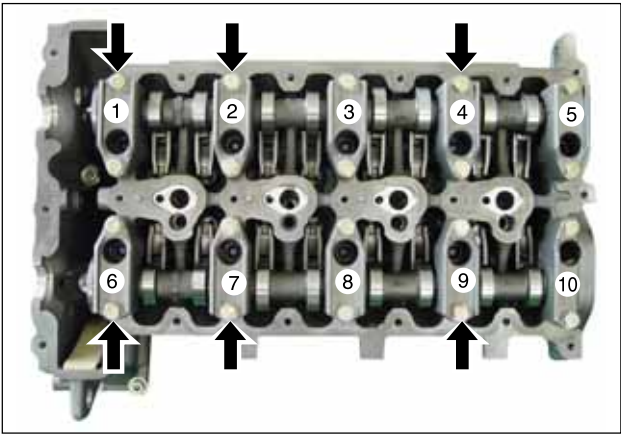


- Intake: #7, #9
- Exhaust: #2, #4

Do not remove the bolts at a time completely. Remove them step by step evenly or camshaft can be seriously damaged.

Installation Notice

Tightening torque	25 ± 2.5 Nm
-------------------	-------------



26. Remove the intake and exhaust camshafts from the cylinder head.



27. Remove the finger follower and the HLA device.



NOTICE

- Avoid contact with hot metal parts when removing the HLA device immediately after stopping the engine.
- Be careful not to be contaminated by foreign materials.
- To prevent the oil leaks, store the removed finger follower and HLA device with standing up.
- If the HLA can be easily pressed in by hand, it indicates the oil inside of HLA has been flown out. In this case, replace it with new one.

28. Pull out the pin and remove the timing chain guide from the engine.

29. Remove the cylinder head bolts according to the numerical sequence.

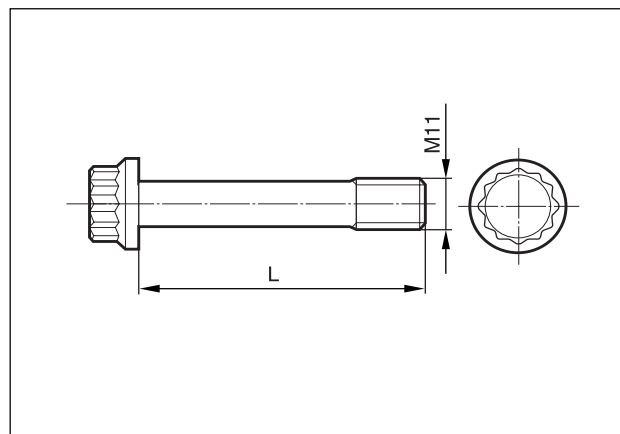
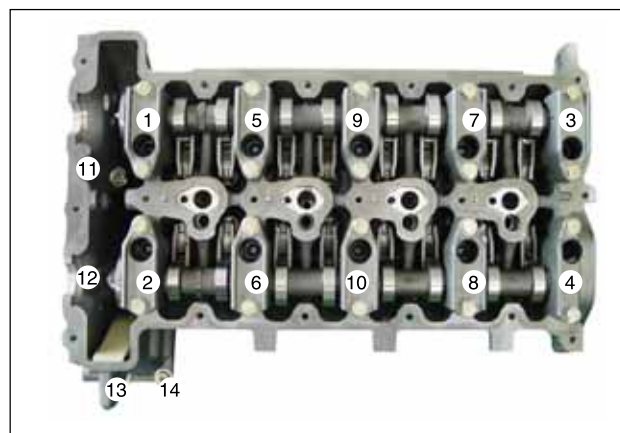
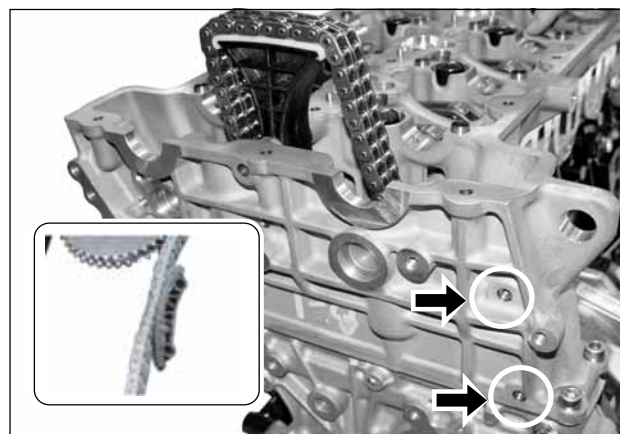
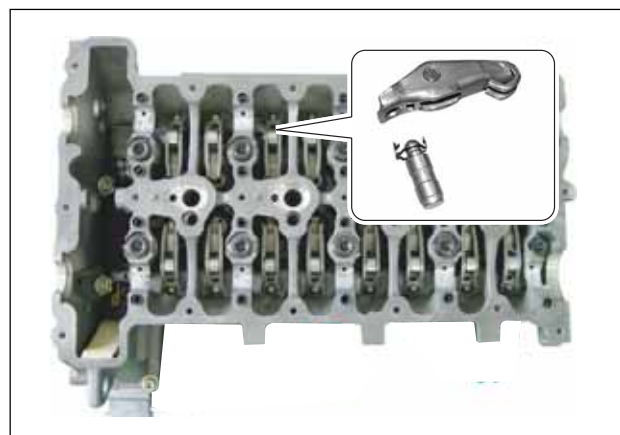
Installation Notice

Tightening torque	Nm
M8 x 25: 2 EA	25 ± 2.5
M8 x 50: 2 EA	25 ± 2.5
M12 x 177: 11 EA	85 ± 5 Nm, 3 x 90° + 10°
M12 x 158: 1 EA (Vacuum pump side)	

30. Measure the length of cylinder head bolts.

If the maximum length is exceeded by 2 mm, replace the cylinder head bolt.

Length when new	Maximum Limit
177 mm	179 mm
158 mm	160 mm



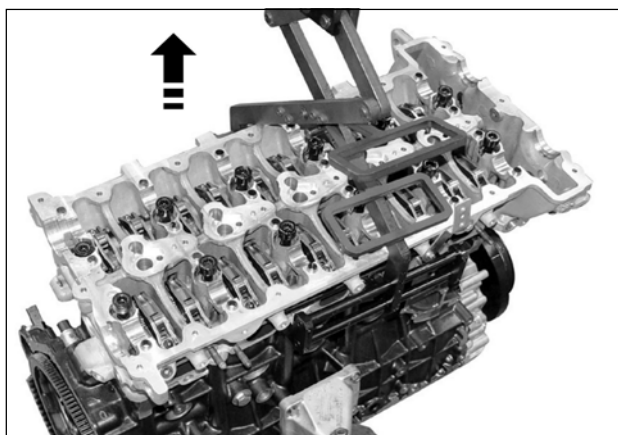
CHANGED BY	
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AFFECTED VIN	

31. Remove the cylinder head.



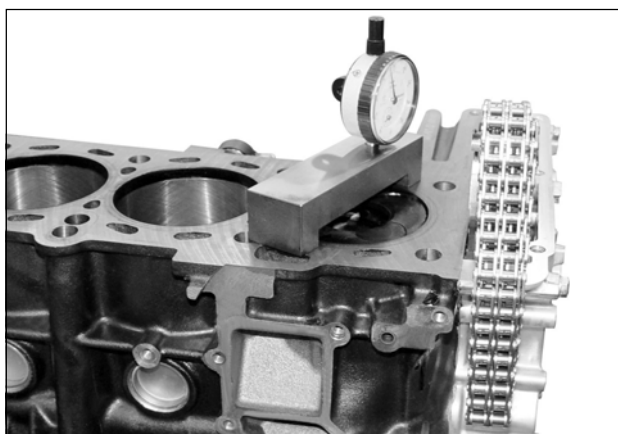
NOTICE

- Inspect the cylinder head surface.
- Store the removed injectors and glow plugs so that they will not be damaged.



32. Measure the piston protrusion from the parting surface.

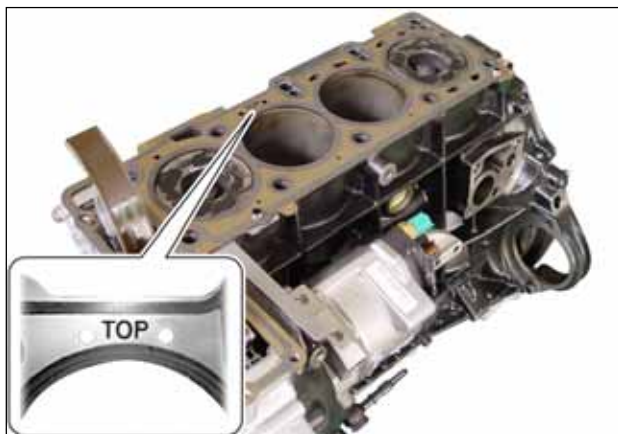
Specified Value: 0.765 ~ 1.055 mm



33. Remove the cylinder head gasket.

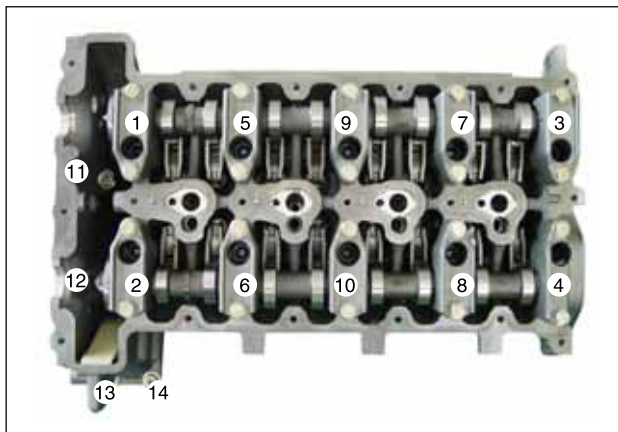
Installation Notice

- **Replace the cylinder head gasket with new one. Make sure to place the "TOP" mark upward.**
- 1. **Put the steel gasket on the cylinder block and position the cylinder head.**
- 2. **Tighten the cylinder head bolts to specified torque and torque angle.**



Tightening torque	Step 1	20 ± 2.0 Nm
	Step 2	85 ± 5.0 Nm
	Step 3	90 ± (3 times) + 10°

- **Apply the oil on the bolt thread when installing.**
- **Always insert new washer first.**
- **The bolts (12) at vacuum pump side are shorter than others.**



34. Turn over the engine and remove the baffle plate.

Installation Notice

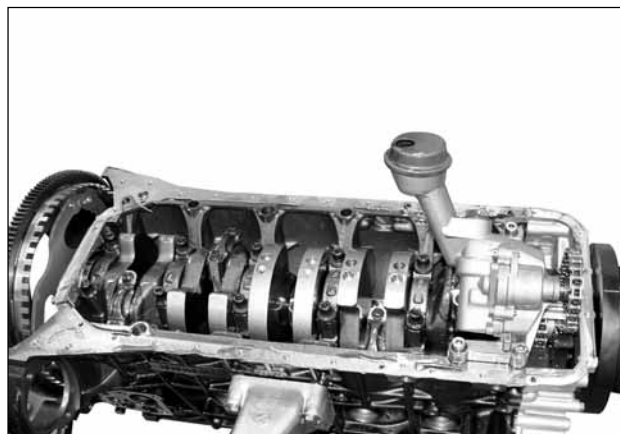
Tightening torque	$10 \pm 1.0 \text{ Nm}$
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35. Unscrew the bolts and remove the oil strainer assembly.

Installation Notice

Tightening torque	$25 \pm 2.5 \text{ Nm}$
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36. Remove the piston assembly from the cylinder block.
1) Unscrew the bearing cap bolts.

Installation Notice

Step 1	$55 \pm 5.0 \text{ Nm}$
Step 2	$90^\circ + 10^\circ$

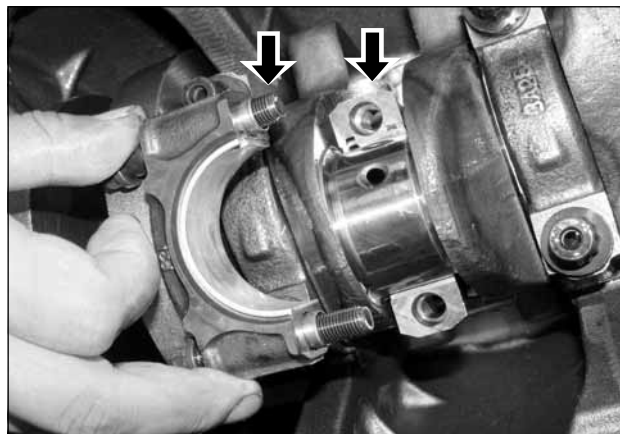
Tighten the bolts from #1 cap.



NOTICE

- Align the oil grooves in bearing cap and connecting rod.

- 2) Remove the bearing caps and lower bearing shells.



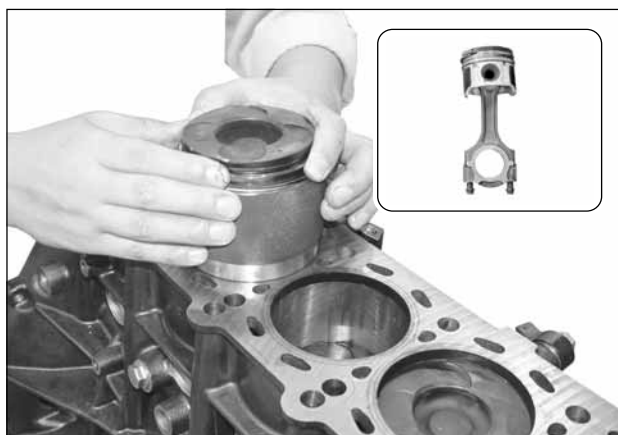
CHANGED BY	
EFFECTIVE DATE	
AFFECTED VIN	

- 3) Remove the piston assembly through the cylinder.



NOTICE

- Do not mix up upper and lower crankshaft bearing shells.

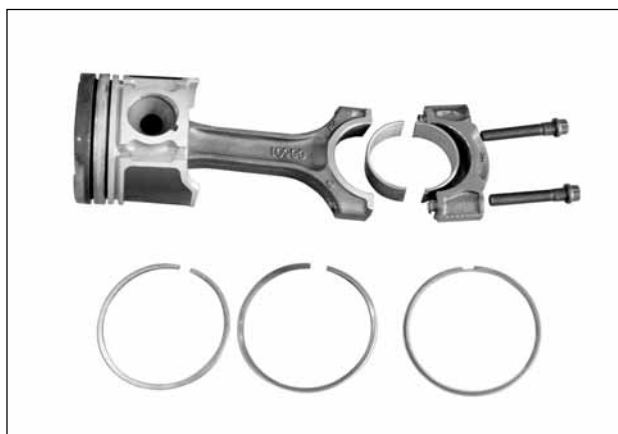


- 4) Remove the snap ring piston pin from the piston.
 5) Disassemble the piston and connecting rod.
 6) Remove the piston rings from the piston.



NOTICE

- Replace the piston ring, bearing and snap ring with new ones.



37. Lock the flywheel and remove the center bolt and crankshaft pulley.

Installation Notice

Tightening torque	200 ± 20 Nm, 180° + 10°
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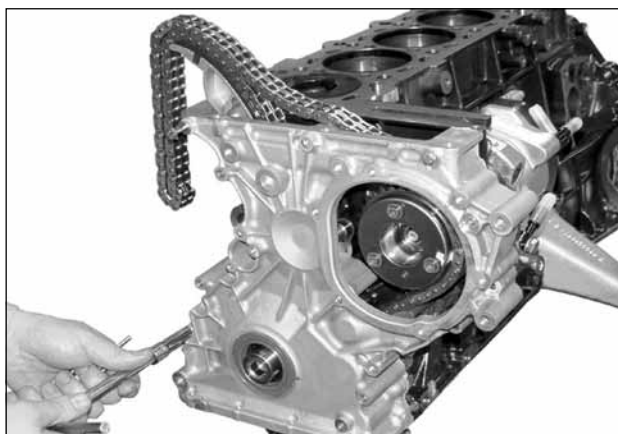


38. Remove the timing chain cover assembly.

- 1) Remove the cover bolts.

Installation Notice

Tightening torque	10 ± 1.0 Nm
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- 2) Hold the timing chain and remove the timing chain cover by tapping it with a rubber hammer and a screwdriver.

**NOTICE**

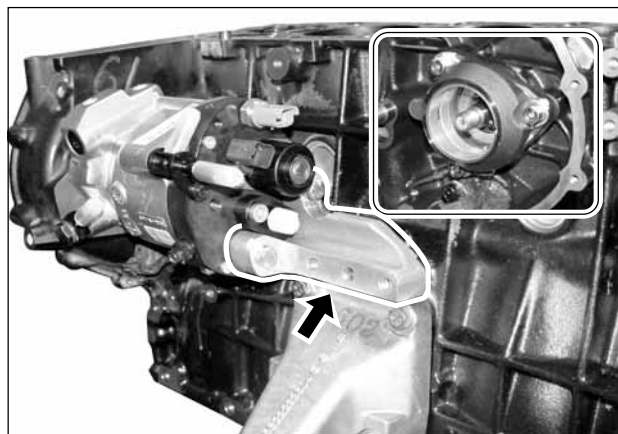
- Apply the sealant on the parting surface.



39. Remove the timing chain guide rail and timing chain.



40. Remove the HP pump bolts and the HP pump bracket bolts.



- 1) Remove the HP pump assembly.



GENERAL

ASSY

HOUSING

INTAKE

EXHAUST

LUB

COOLING

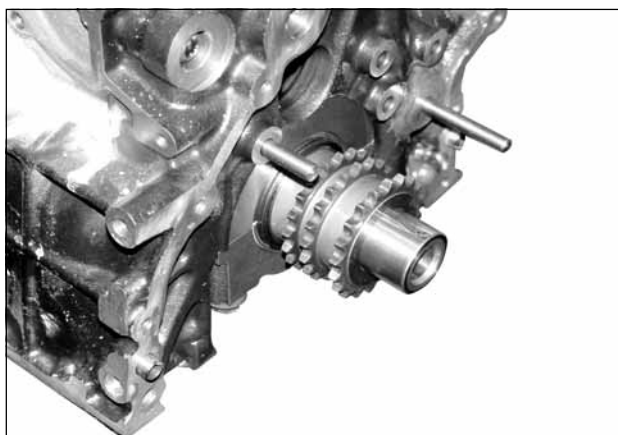
FUEL

CONTROL

SENSOR

CHANGED BY	
EFFECTIVE DATE	
AFFECTED VIN	

41. Remove the crankshaft sprocket with a special tool.



42. Remove the flywheel and the crankshaft strainer.

Installation Notice

Tightening torque	$45 \pm 5.0 \text{ Nm}$, $90^\circ + 10^\circ$
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43. Unscrew the bolts and remove the crankshaft bearing caps.

Installation Notice

Tightening torque	$55 \pm 5.0 \text{ Nm}$, $90^\circ + 10^\circ$
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NOTICE

- Remove the bearing cap bolts from inside to outside with a pair.
- Do not mix up the crankshaft bearing caps and shells.

NOTE

- Install in the reverse order of removal.
- Tighten the fasteners with the specified tightening torques.
- Replace the gaskets and bearings with new ones.
- Make sure to install the gaskets in correct direction.

