

CASE

PROFESSIONAL PARTNER

SERVICE MANUAL

4HK1-6HK1 ISUZU ENGINES

9-44061 NA
Replaces 9-44060 NA

Revised 05-2006
Issued 02-2006

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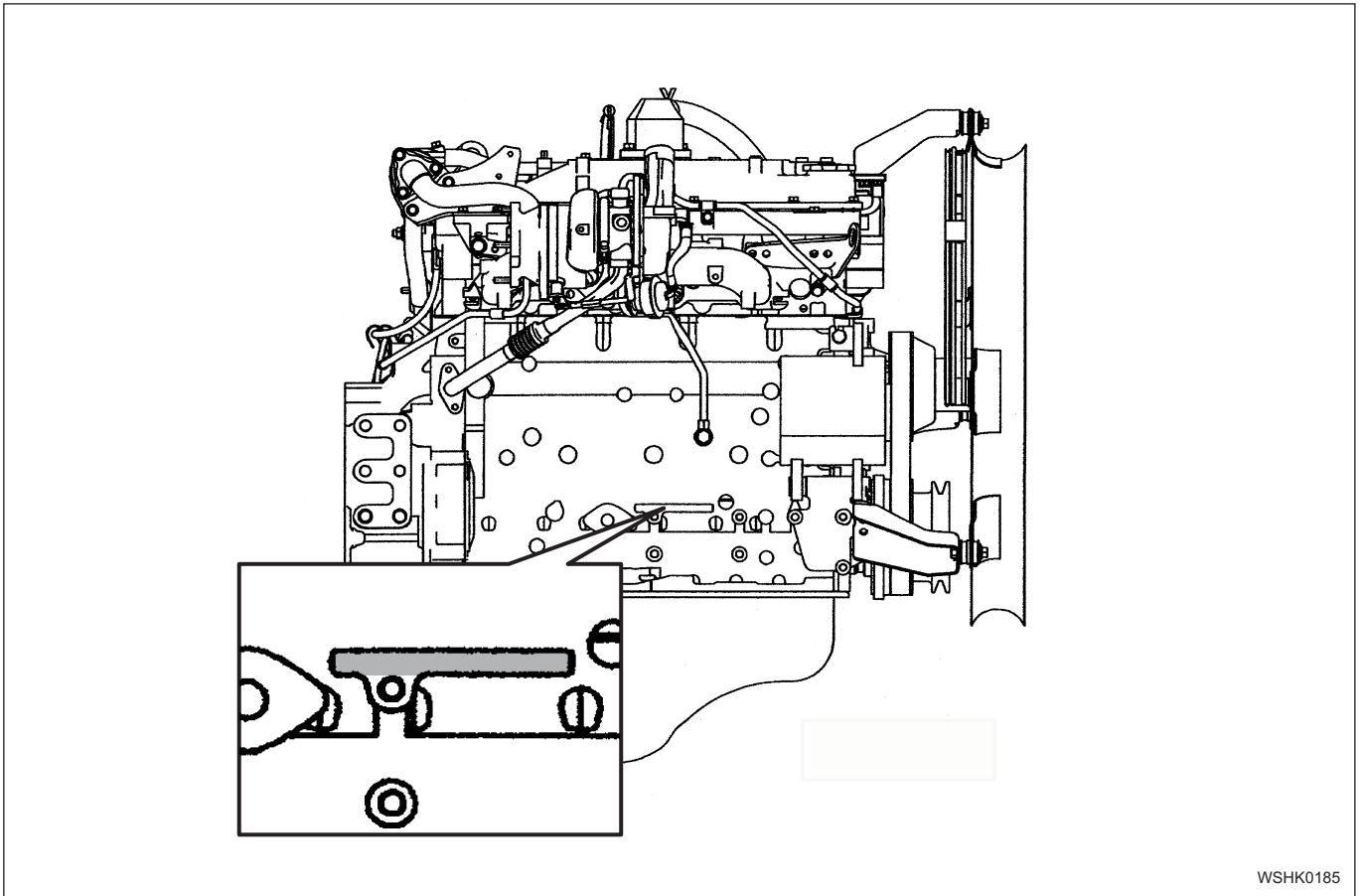
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Reading the model

Engine number stamping position

4HK1



ISUZU DIESEL ENGINE (4HK1, 6HK1)

Precautions on Service Work

Matters that require attention in terms of maintenance

To prevent damage to the engine and ensure reliability of its performance, pay attention to the following in maintaining the engine: When taking down the engine on the ground, do not make the bearing surface of the oil pan touch directly the ground. Use a wood frame, for example, to support the engine with the engine foot and the flywheel housing.

Because there is only a small clearance between the oil pan and the oil pump strainer, it can damage the oil pan and the oil strainer.

- When the air duct or air cleaner is removed, cover the air intake opening to prevent foreign matter from getting into the cylinder. If it gets into it, it can considerably damage the cylinder and others while the engine is operating.
- When maintaining the engine, never fail to remove the battery ground cable. If not, it may damage the wire harness or electrical parts. If you need electricity on for the purpose of inspection, for instance, watch out for short circuits and others.
- Apply engine oil to the sliding contact surfaces of the engine before reassembling it. This ensures adequate lubrication when the engine is first started.
- When valve train parts, pistons, piston rings, connecting rods, connecting rod bearings or crankshaft journal bearings are removed, put them in order and keep them.
- When installing them, put them back to the same location as they were removed.
- Gaskets, oil seals, O-rings, etc. must be replaced with new ones when the engine is reassembled.
- As for parts where a liquid gasket is used, remove an old liquid gasket completely and clean it up thoroughly so that no oil, water or dust may be clung to them. Then, apply the designated liquid gasket to each place anew before assembly.
- Surfaces covered with liquid gasket must be assembled within 7 minutes of gasket application. If more than 7 minutes have elapsed, remove the existing liquid gasket and apply new liquid gasket.
- When assembling or installing parts, fasten them with the specified tightening torque so that they may be installed properly.

Matters that require attention in specifically dealing with this engine.

Holes or clearances in the fuel system, which serve as a passage of fuel, including the inside of the injector, are made with extreme precision. For this reason, they are highly sensitive to foreign matter and if it gets in, it can lead to an accident on the road, for instance; thus, make sure that foreign matter will be prevented from getting in.

When servicing the fuel system, every precaution must be taken to prevent the entry of foreign material into the system.

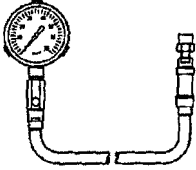

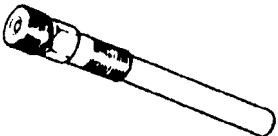
- Before beginning the service procedure, wash the fuel line and the surrounding area.
- Perform the service procedures with clean hands. Do not wear work gloves.
- Immediately after removing the fuel hose and/or fuel pipe, carefully tape vinyl bags over the exposed ends of the hose or pipe.
- If parts are to be replaced (fuel hose, fuel pipe, etc.) do not open the new part packaging until installation.

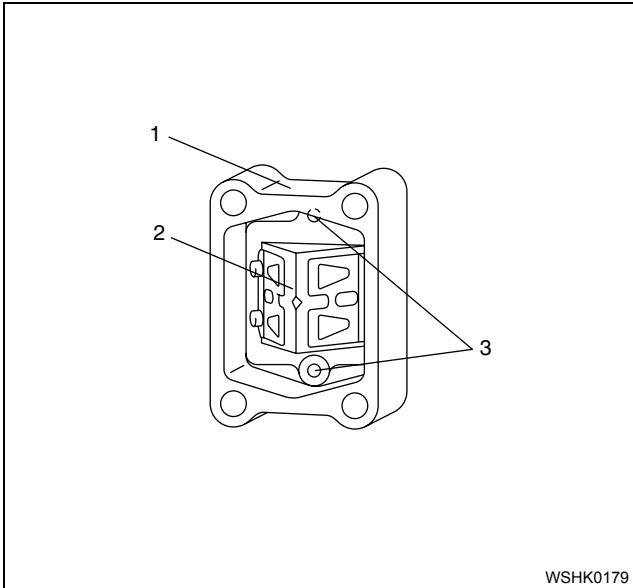
Work procedure

- The fuel opening must be quickly sealed when removing the fuel pipe, injection pipe, fuel injector, fuel supply pump, and common rail.
- The eyebolts and gasket must be stored in a clean parts box with a lid to prevent adhesion of foreign matter.
- Fuel leakage could cause fires. Therefore, after finishing the work, wipe off the fuel that has leaked out and make sure there is no fuel leakage after starting the engine.

Item	Engine model 6HK1	
Injection nozzle type	Multi-hole type 7-hole and $\phi 0.16$ mm (0.0063 in) inside diameter	
Charging system	AC type	
Generator type	24 - 120	
Power output	V/A	IC
Regulator type		
Starting system	Reduction type	
Starter type	24 - 5.0	
Power output	V-kw	
Preheat system type	Glow plug	
Glow plug standard voltage/electric current	V/A	23 - 3.5

Special tool

Illustration	Tool Number/Description
 <p>5884026750</p>	380.002.626 Compression gauge
 <p>5884020080</p>	EN-46722 Compression gauge adapter
	380.002.627 Compression gauge adapter (6HK1)

6HK1**Name**

1. Case ASM
2. Reed Valve
3. Bolt

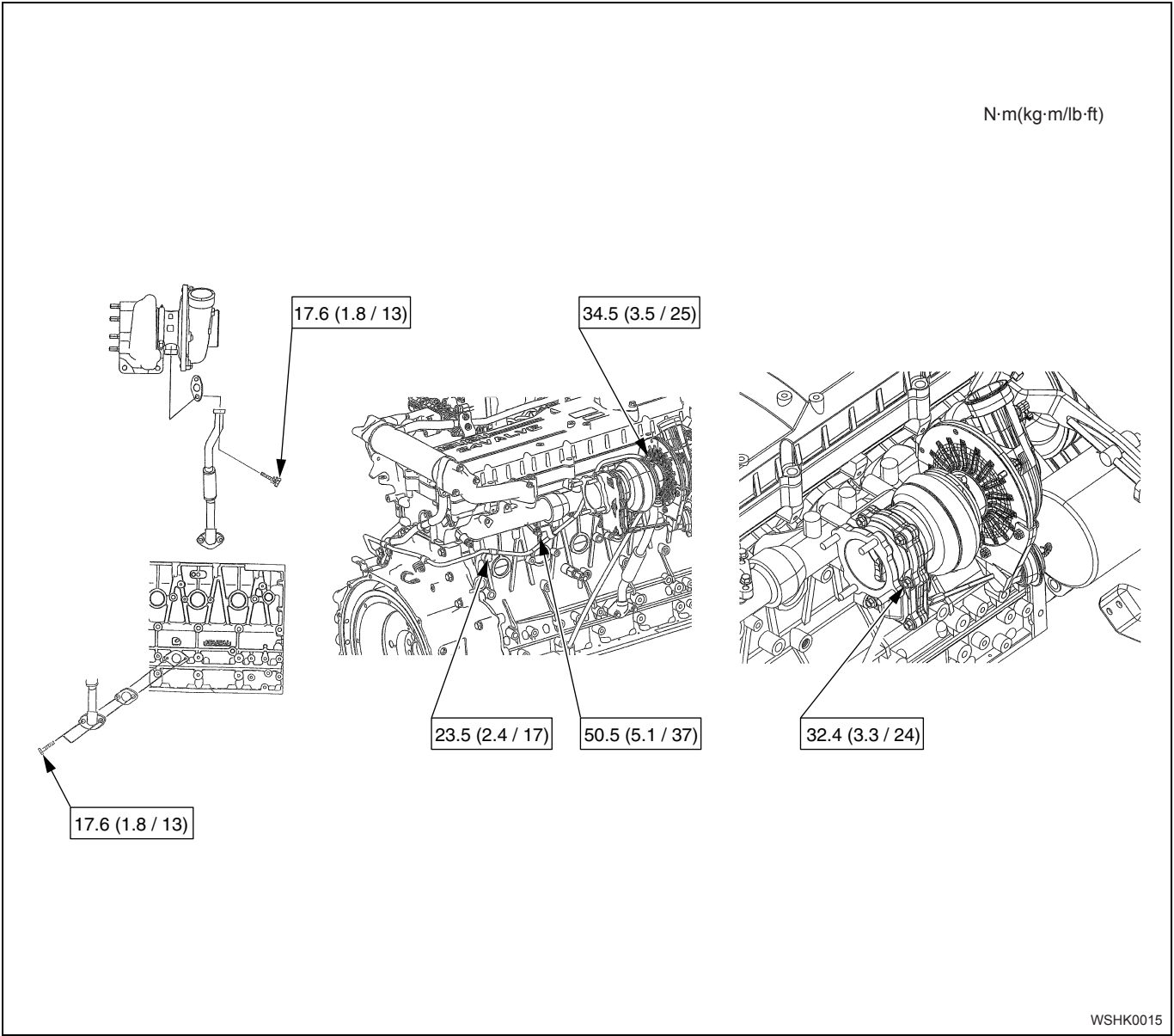
-
4. Install the gasket on the inlet pipe and tighten up with the specified torque.

Tightening torque: 24 N·m (2.4 kg·m/18 lb ft)

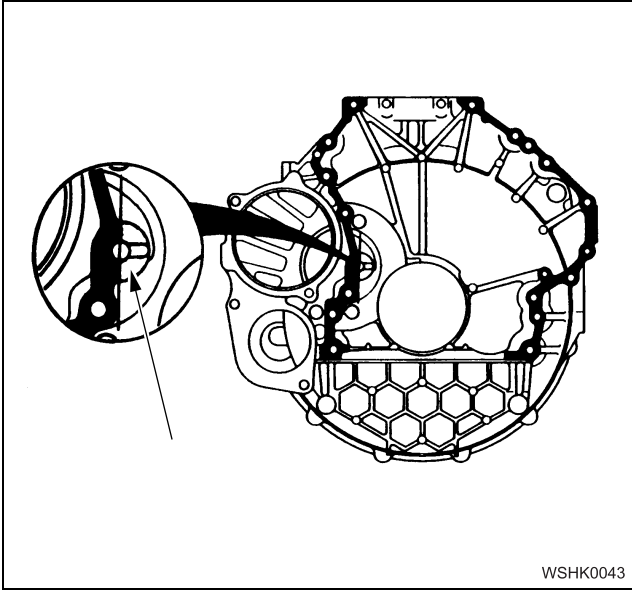
5. Install the common rail.
Refer to the "Common Rail" in the fuel system section.

6HK1

N·m(kg·m/lb·ft)



6HK1



- Align with the knock pin of the cylinder block and install the flywheel housing.

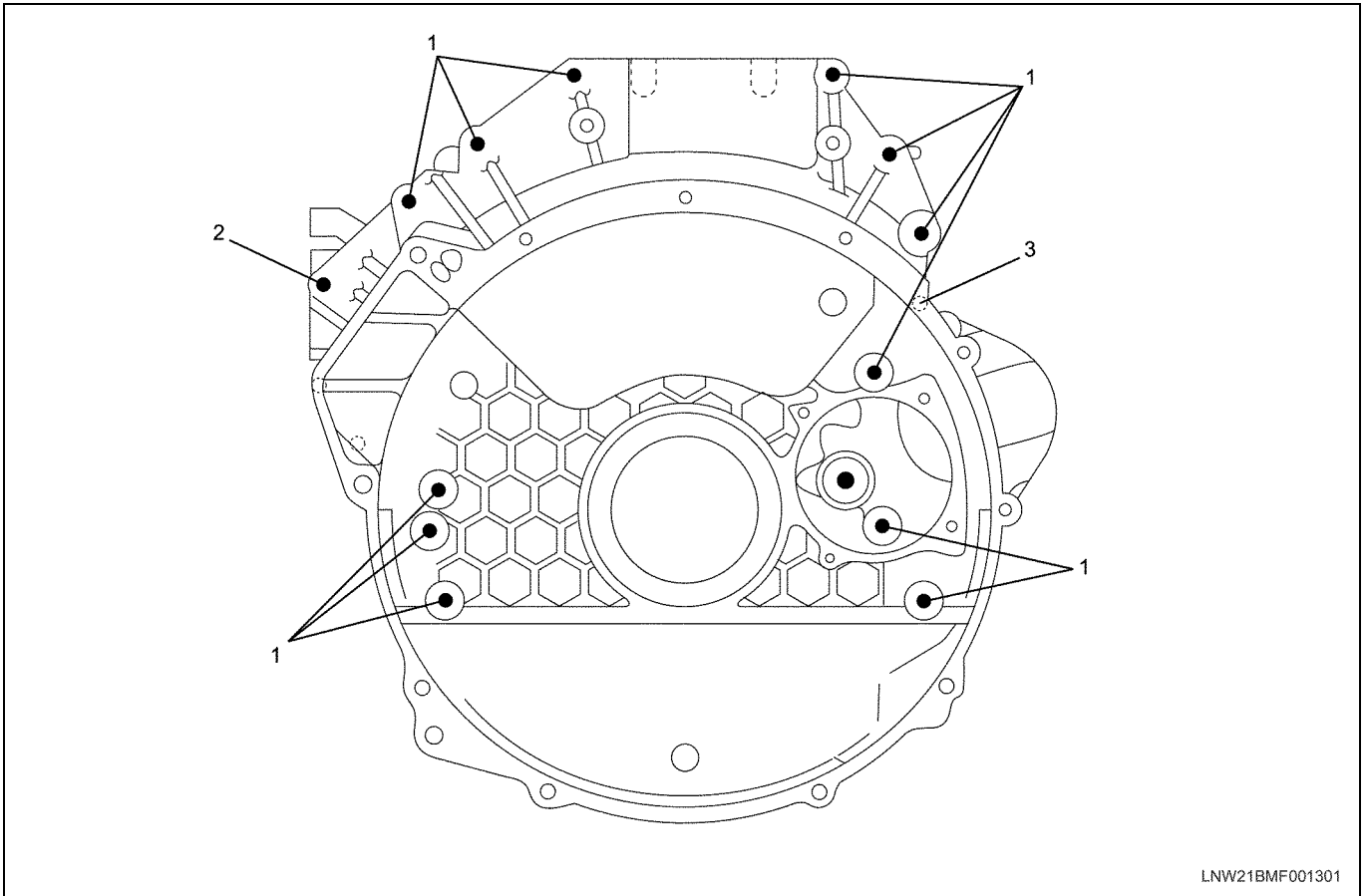
Tightening torque of the flywheel housing (4HK1):

N·m (kg·m/lb ft)

1 = 96 (9.8/71) 2 = 77 (7.9/57) 3 = 38 (3.9/28)

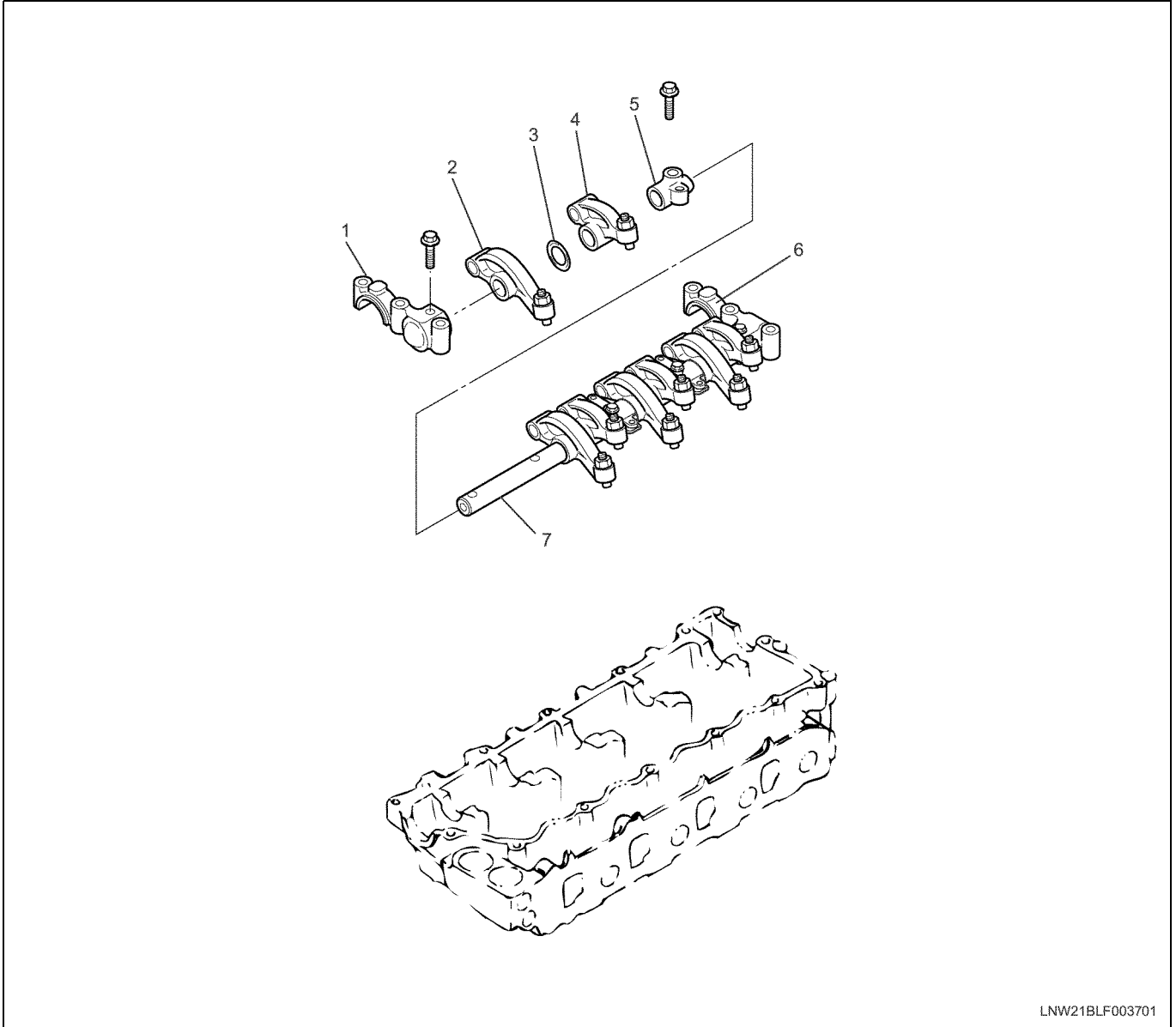
- Tighten up the Mark 3 from the cylinder block side.

4HK1



Rocker Arm Shaft ASM

Components



LNW21BLF003701

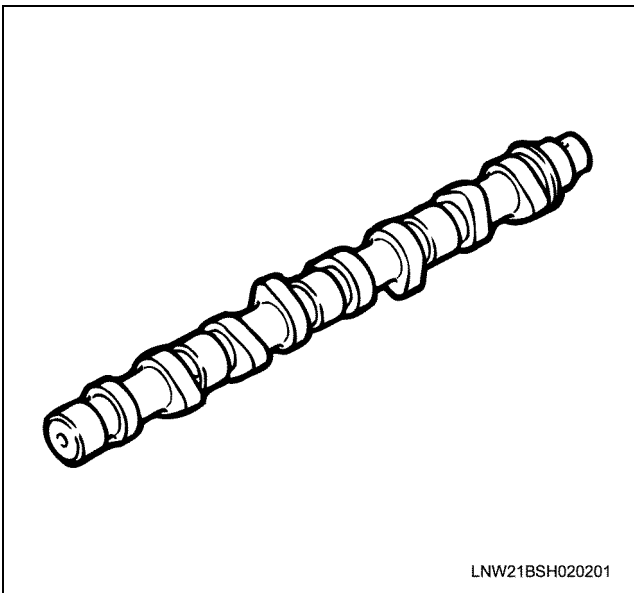
* 4HK1 is shown for illustration.

Name

- | | |
|---------------------|-----------------------|
| 1. Camshaft Bracket | 5. Rocker Arm Bracket |
| 2. Rocker Arm | 6. Camshaft Bracket |
| 3. Wave Washer | 7. Rocker Arm Shaft |
| 4. Rocker Arm | |

Removal

1. Remove the cylinder head cover.
Refer to "Cylinder Head Cover".
2. Remove the rocker arm shaft ASM.
 - Along with the camshaft bracket, remove the rocker arm shaft ASM.

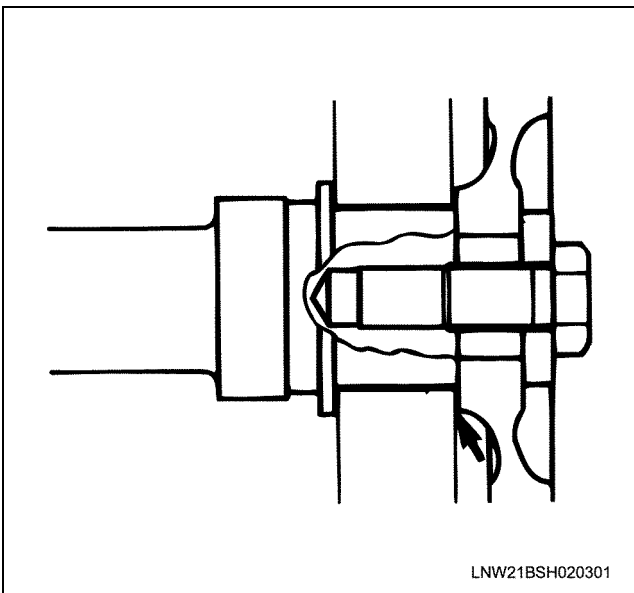


LNW21BSH020201

5. Check the axial play of the camshaft.
- Use a thickness gauge to measure an end clearance of the camshaft gear and the camshaft bracket.
 - If the measurement exceeds the limit, replace the camshaft gear or the camshaft.

End clearance of the camshaft		mm (in)
Standard	0.085 – 0.205	(0.033 – 0.008)
Limit	0.25	(0.009)

Caution:
Measure an end clearance of the camshaft before disassembling.

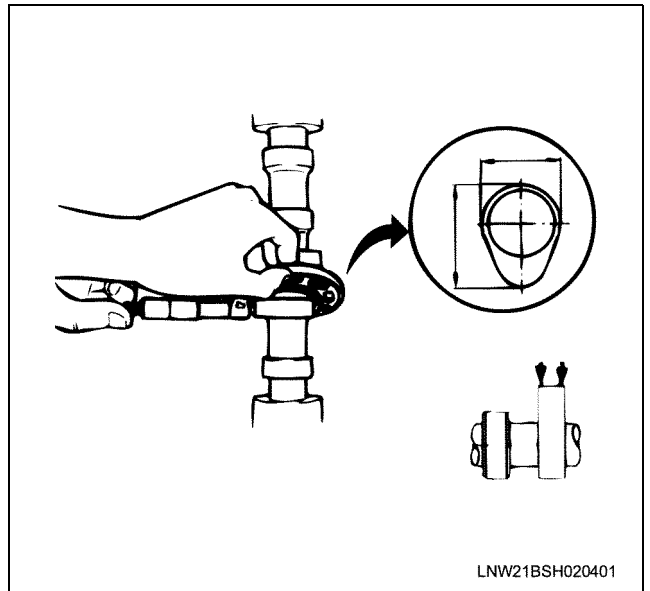


LNW21BSH020301

6. Check if the cam lobe is worn.
- Use a micrometer to measure the height of the cam lobe.

- If the height of the cam lobe is the limit or less, replace the camshaft.

Height of the cam lobe	mm (in)	
	Intake air	Exhaust
Standard	52.8 (2.08)	54.5 (2.15)
Limit	51.8 (2.04)	53.5 (2.11)



LNW21BSH020401

7. Check if the camshaft journal is worn.
- Use a micrometer to measure wear which is not even with a diameter of the camshaft journal.
 - If the measured uneven wear exceeds the limit, replace the camshaft.

External diameter of the camshaft journal part	mm (in)
Standard	39.950 – 39.975 (1.5728 – 1.5738)
Limit	39.850 (1.5688)

Partial wear of the camshaft journal part	mm (in)
Limit	0.05 (0.0019)

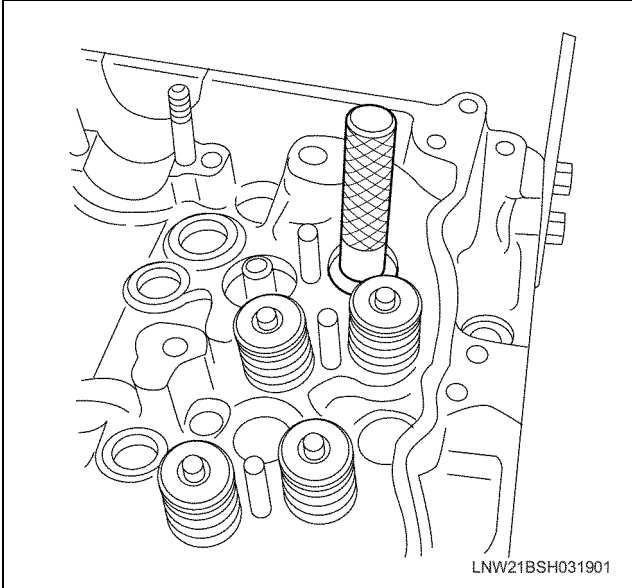
Special tool

4HK1

Use acceptable: Valve stem seal installer:

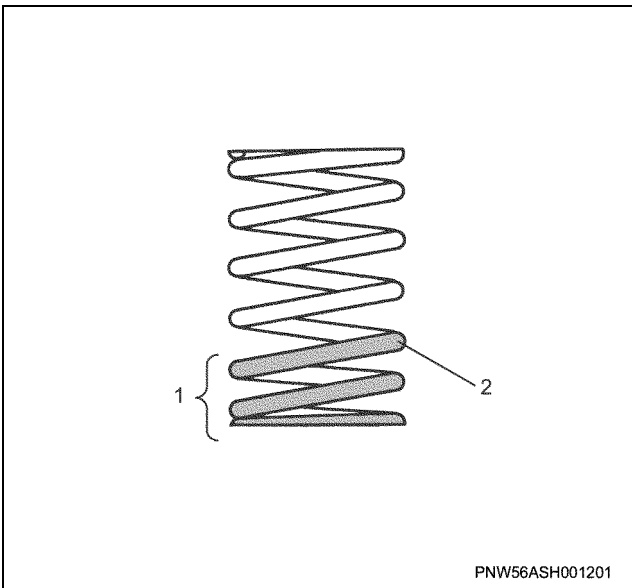
6HK1

Use acceptable: Valve guide oil seal installer:



2. Install the valve spring.
 - Install it with the paint mark or the narrow side of the spring pitch being the lower side (cylinder head side).

	Paint mark
Intake air	Light blue
Exhaust	Yellow

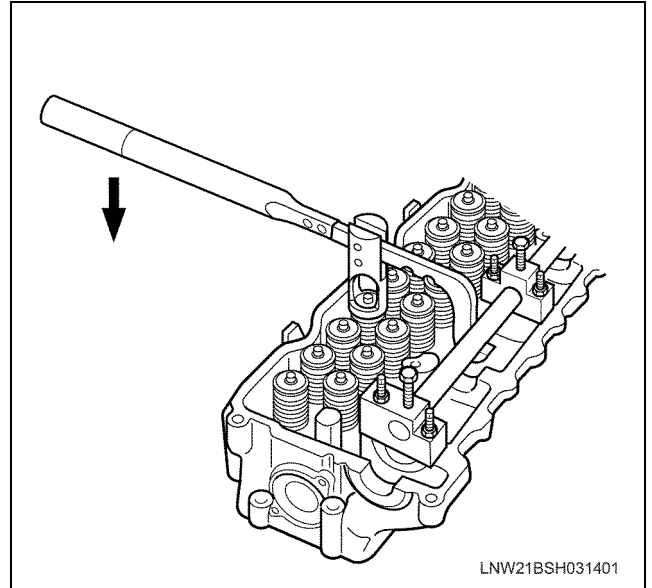


3. Install the spring upper seat.
4. Install the split collar.
 - Apply compressed air over the cylinder from the glow plug holes to keep the valve at the home position.
 - Use a replacer to compress the valve spring and install the split collar.

Special tool

Use acceptable: Valve spring replacer:

Use acceptable: Pivot:



5. Apply engine oil over the bridge and install it.

Caution:

Move it up and down to check if it moves smoothly.

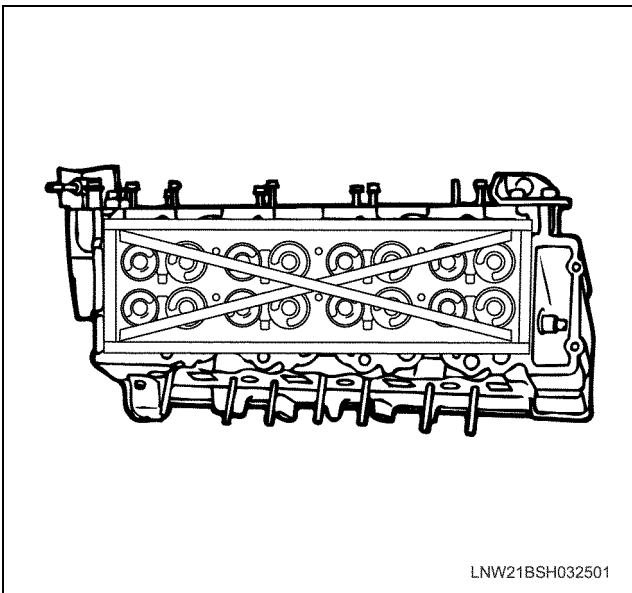
6. Apply engine oil over the bridge cap and install it.

Caution:

Pay full attention so as not to drop the bridge cap in the gear case of the rear part of the cylinder head or the hole into which oil pours back in the front.

Name

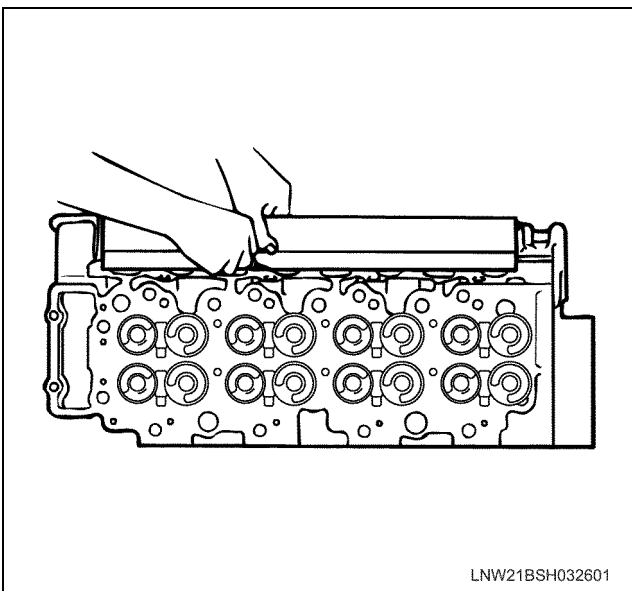
1. Spring Pitch
2. Paint Mark



* 4HK1 is shown for illustration.

- d. Flatness of the surface where the exhaust manifold and inlet cover are installed
- Use a straight edge ruler and sickness gauge to measure the four sides and diagonal lines as shown in the drawing, and replace if they exceed the limit.

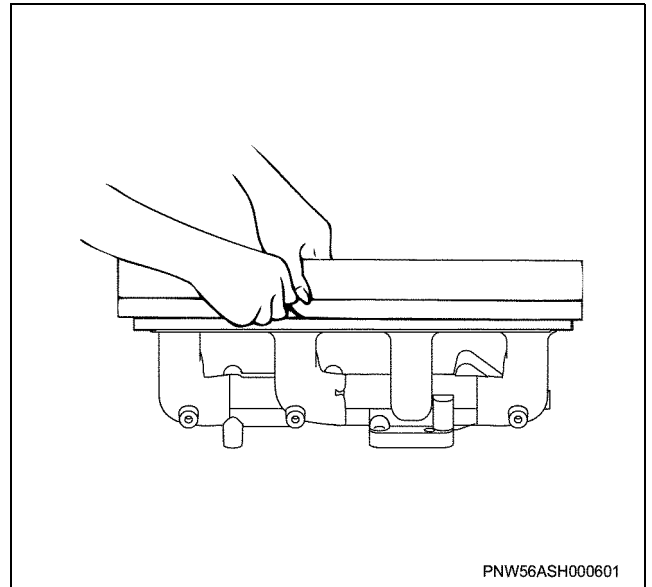
Distortion of the surface where the manifold and cover are installed		mm (in)
Standard	0.05 (0.002) or less	
Limit	0.2 (0.0079)	



* 4HK1 is shown for illustration.

- e. Flatness of the exhaust manifold
- Use a straight edge ruler and sickness gauge to measure the flatness. If it exceeds the limit, replace the exhaust manifold.

Distortion of the exhaust manifold		mm (in)
Standard	0.3 (0.0118) or less	
Limit	0.5 (0.0197)	

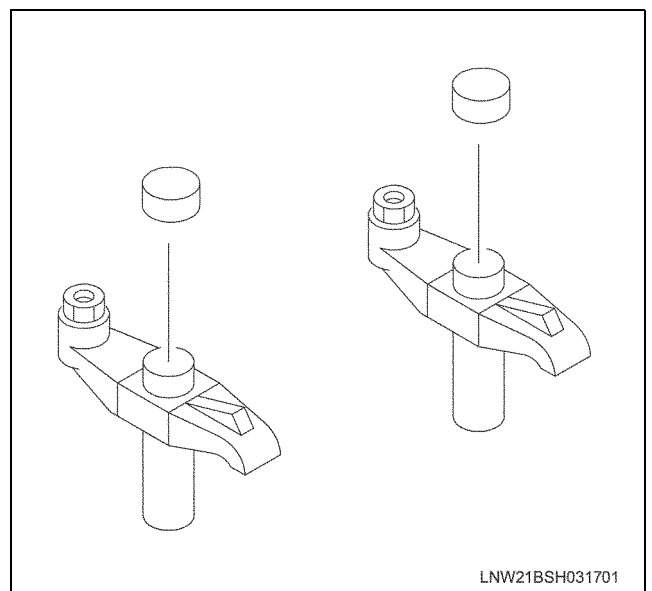


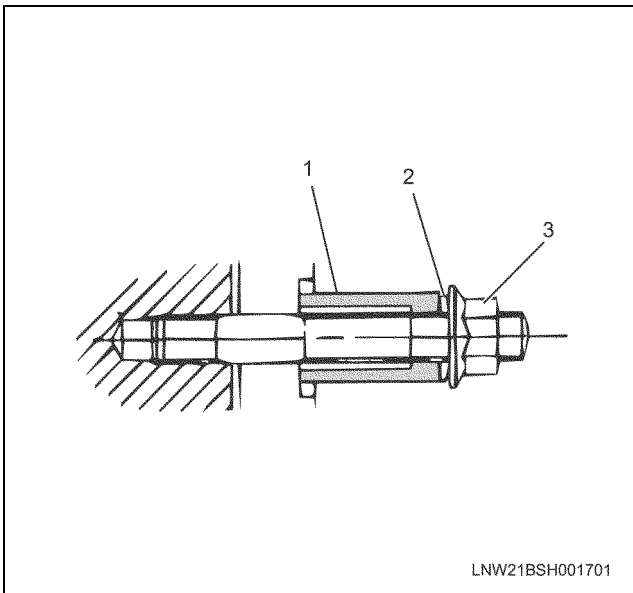
* 4HK1 is shown for illustration.

2. Bridge cap

- Inspect abrasion and deformation of the surface where the cap and the rocker arm adjust bolt contact.
- If the amount of abrasion is 0.1 mm (0.0039 in) or larger, or if it abrades away in a zonal shape, replace it.

Abrasion of the bridge cap		mm (in)
Limit	0.1 (0.0039)	





LNW21BSH001701

Name

1. Distance Tube
2. Conical Spring
3. Nut

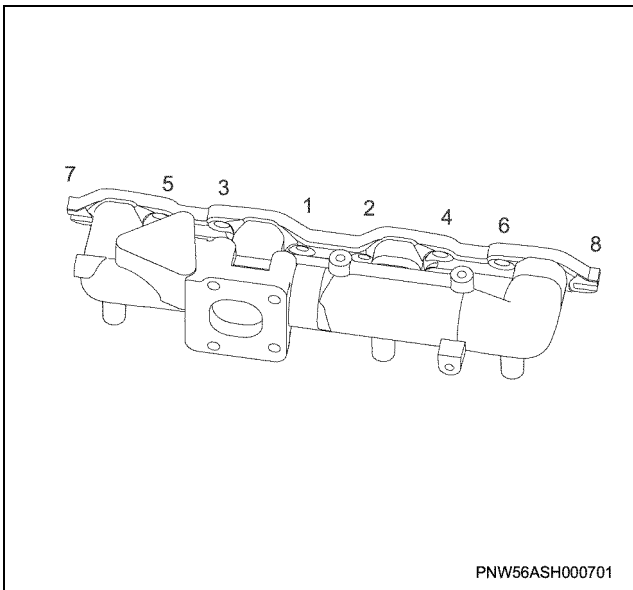
- Tighten the exhaust manifold in the order described in the drawing.

Tightening torque: 34 N-m (3.5 kg-m/25 lb ft)

Caution:

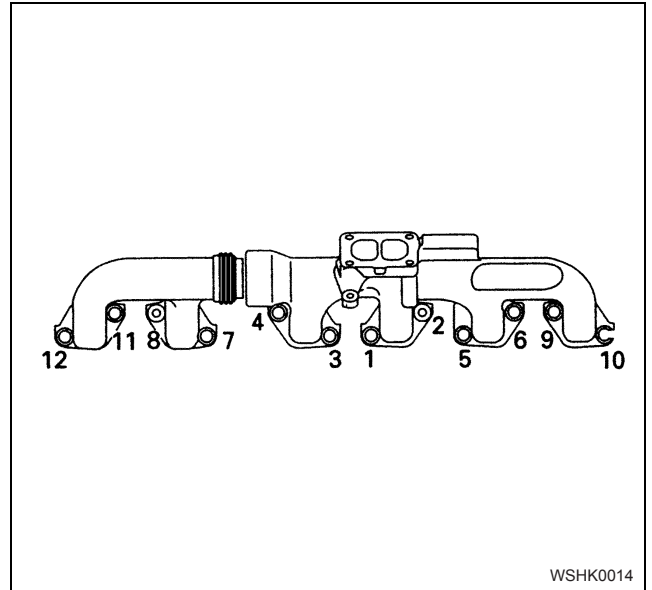
Do not tighten it too much so that it hinders extraction and contraction of the manifold due to heat.

4HK1



PNW56ASH000701

6HK1



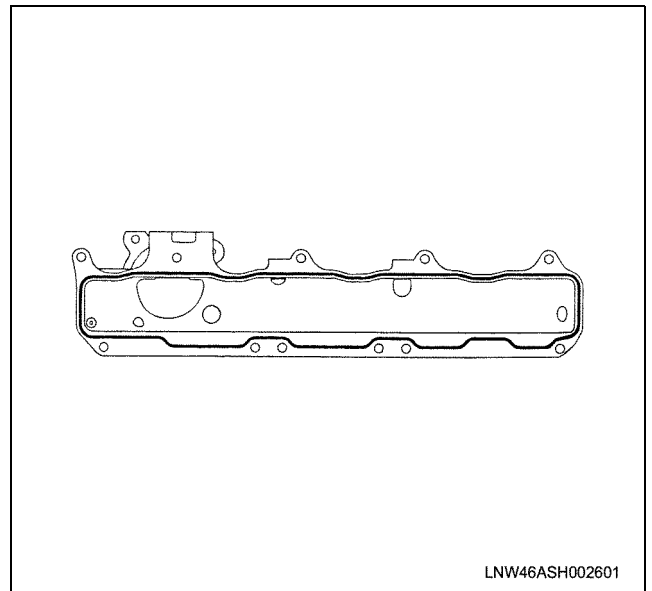
WSHK0014

- Install the heat protector.

Tightening torque: 10 N-m (1.0 kg-m/89 lb in)

16. Install the inlet cover.

- Apply liquid gasket (ThreeBond 1207C or equivalent) in accordance with the groove of the inlet cover, with the bead diameter of $\phi 2.5$ mm (0.0984 in) – 5.5 mm (0.2165 in).



LNW46ASH002601

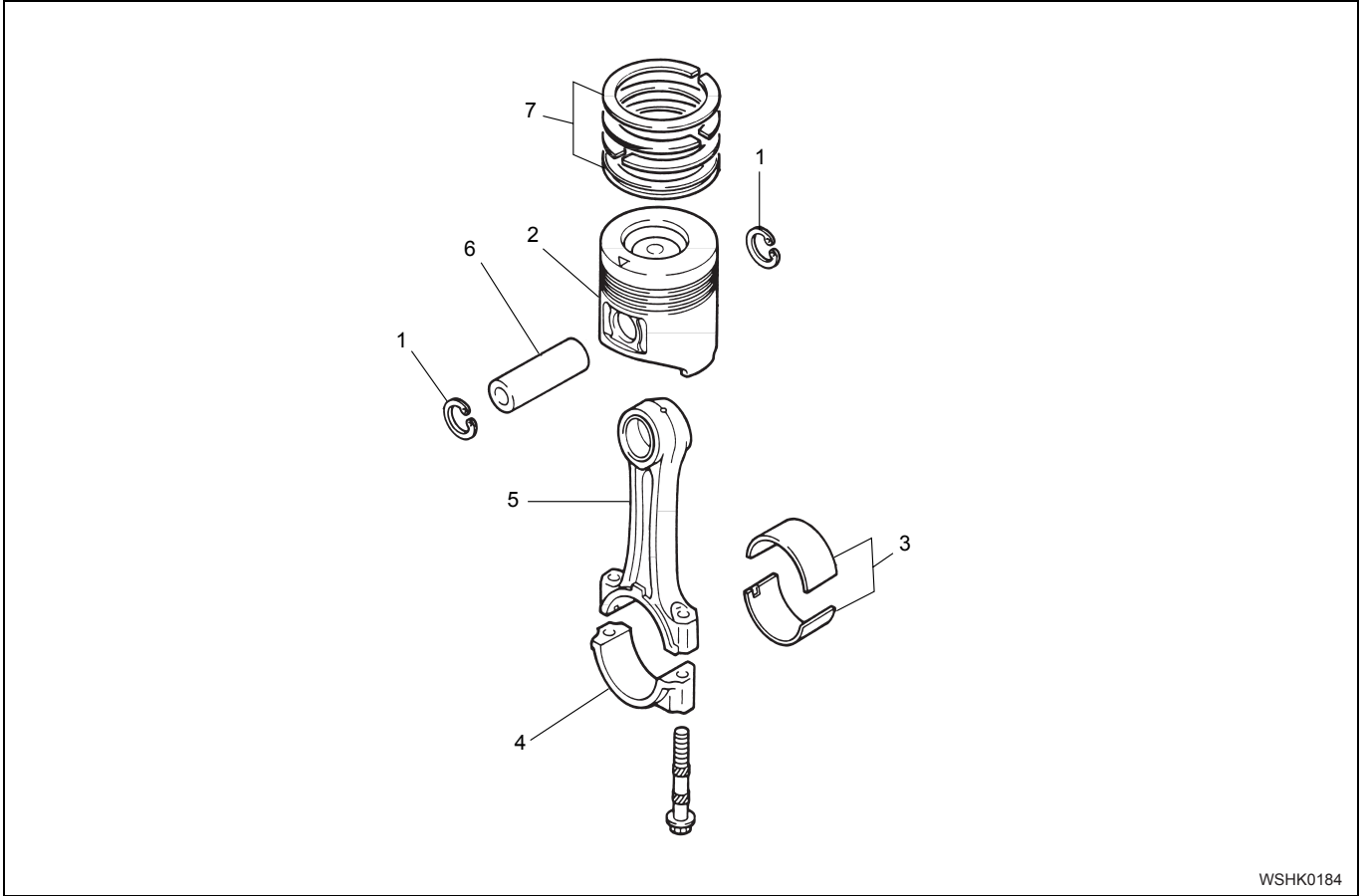
* 4HK1 is shown for illustration.

- Tighten in the order described in the drawing.
- Tighten the stud bolts (6) and (9) jointly with the common rail.

Tightening torque: 22 N-m (2.2 kg-m/16 lb ft)

Piston, Connecting Rod

Components



WSHK0184

Name

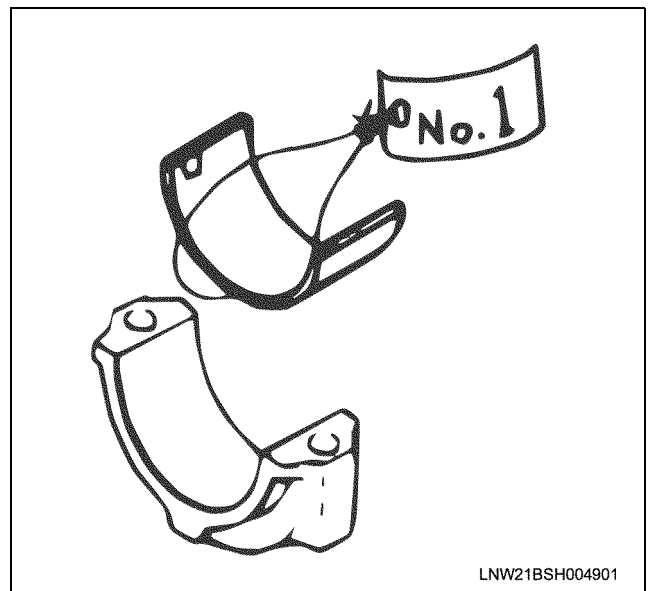
- | | |
|-----------------------|-------------------|
| 1. Snap Ring | 5. Connecting Rod |
| 2. Piston | 6. Piston Pin |
| 3. Bearing | 7. Piston Ring |
| 4. Connecting Rod Cap | |

Removal

1. Remove the oil pan.
Refer to "Oil Pan".
2. Remove the cylinder head cover.
Refer to "Cylinder Head Cover".
3. Remove the rocker arm shaft ASM.
Refer to "Rocker Arm Shaft ASM".
4. Remove the camshaft ASM.
Refer to "Camshaft ASM".
5. Remove the cylinder head.
Refer to the "Cylinder Head".
6. Remove the connecting rod cap.

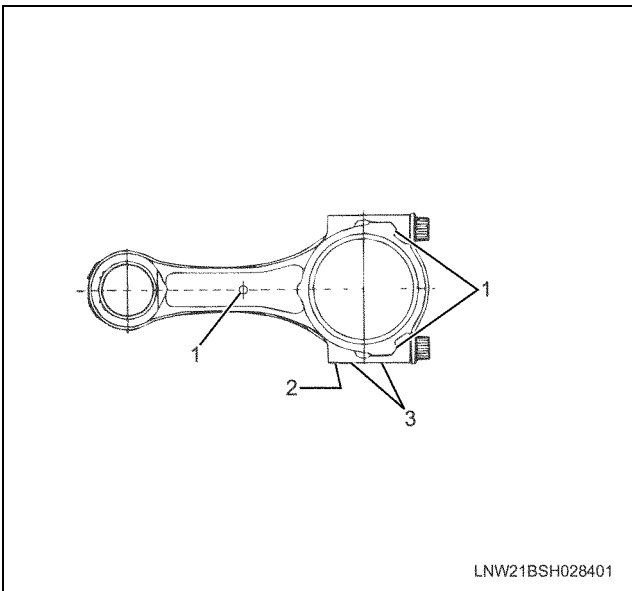
Caution:

Sort the removed bearings according to cylinders by using tags.



LNW21BSH004901

7. Remove the piston and connecting rod.

**Name**

1. Top And Back Recognition Boss
2. Big End Diameter Grade Mark
3. Cylinder Number

- Apply molybdenum disulfide on the screw part and the setting face of the tightening bolt and tighten it with the designated torque.

Tightening torque:

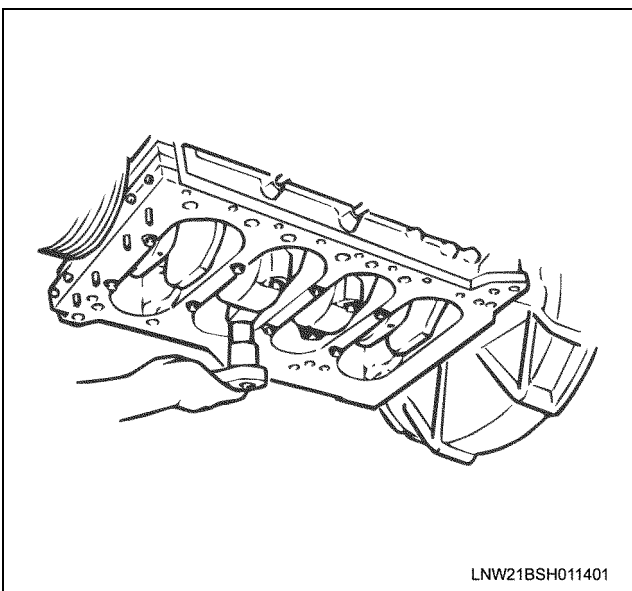
- 1st step = 39 N·m (4.0 kg·m/29 lb ft)
- 2nd step = 60°
- 3rd step = 30°

Special tool

Angle gauge: 380000304

Caution:

Make sure that the crankshaft rotates smoothly.



4. Install the cylinder head.
Refer to the "Cylinder Head".

5. Install the camshaft ASM.
Refer to "Camshaft ASM".
6. Install the rocker arm shaft ASM.
Refer to "Rocker Arm Shaft ASM".
7. Install the cylinder head cover.
Refer to "Cylinder Head Cover".
8. Install the oil pan.
Refer to "Oil Pan".

4HK1

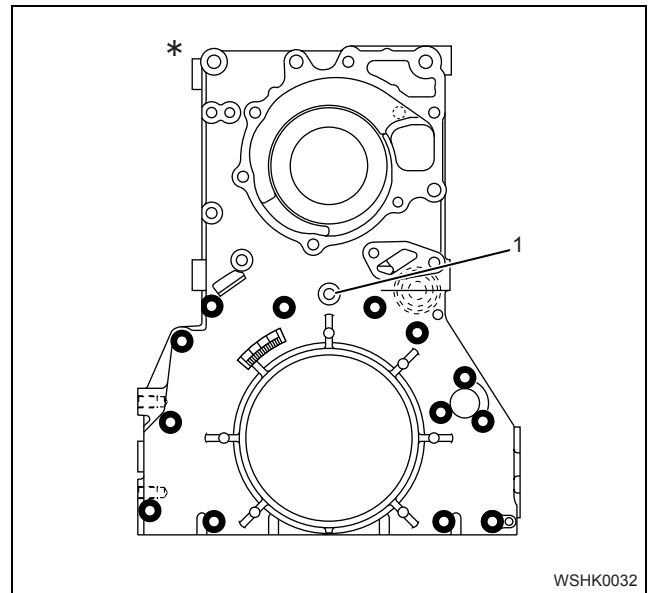
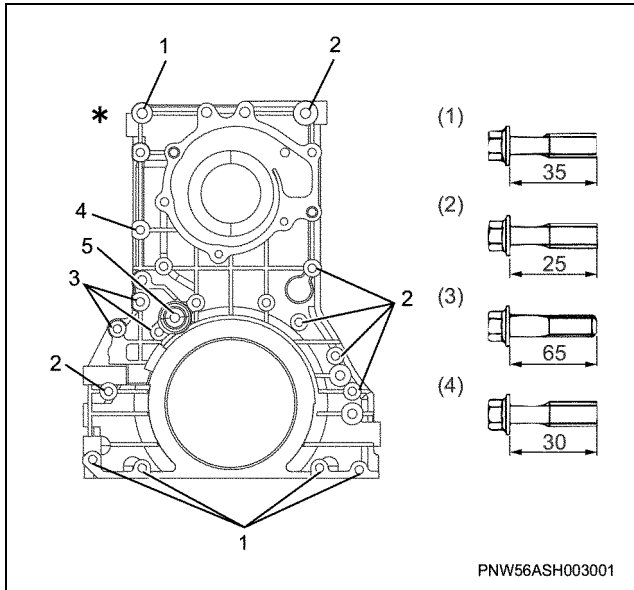
Tightening torque

Front cover bolt: 24 N·m (2.4 kg·m/18 lb ft)

- Tighten bolt with (*) mark together with the adjust plate of the generator.
- Tighten the oil relief valve (5) to the specified torque.

Tightening torque

Oil relief valve: 39 N·m (4.0 kg·m/29 lb ft)



2. Install the water pump.
Refer to the "Water Pump" of the section of the "Cooling System"
3. Install the oil pan.
Refer to "Oil Pan".
4. Install the front oil seal.
Refer to "Crankshaft Front Oil Seal".

Name

1. Bolt: L = 35
2. Bolt: L = 25
3. Bolt: L = 65
4. Bolt: L = 30
5. Oil Relief Valve

6HK1

Tightening torque

Front cover bolts (13 bolts): 18 N·m (1.8 kg·m/13 lb ft)

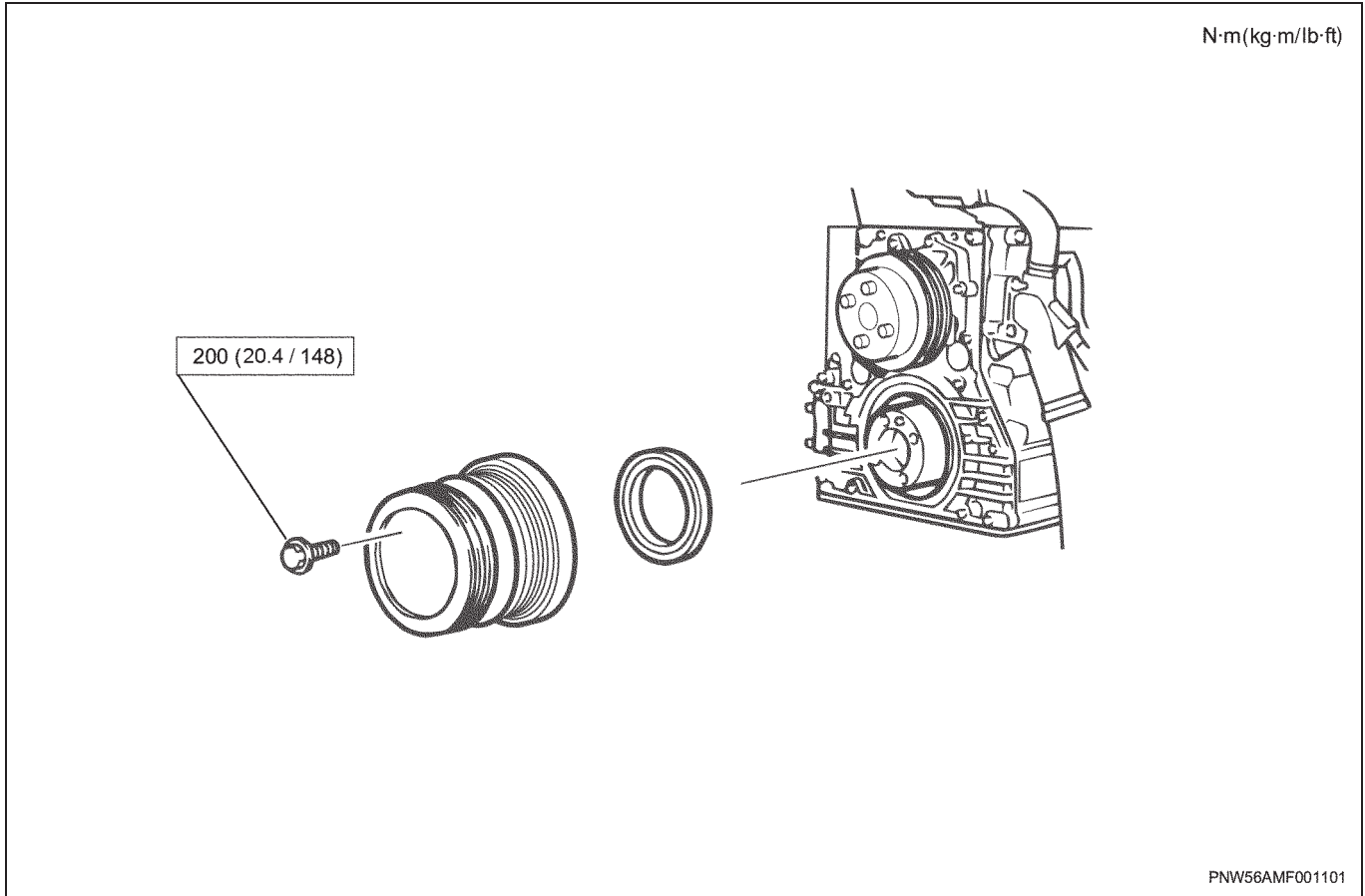
- Tighten bolt with (*) mark together with the adjust plate of the generator.
- When you remove the stud bolt (1), install in original position.

Tightening torque

Stud bolt for water pump: 12.7 N·m (1.3 kg·m/9.4 lb ft)

Torque Specifications

N·m (kg·m/lb·ft)



PNW56AMF001101

* 4HK1 is shown for illustration.

Special Tool

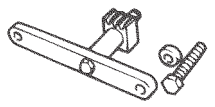
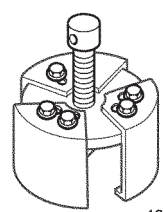
Illustration	Tool Number/Description
 <p>5884022300</p>	<p>380.002.628 Crankshaft stopper</p>
 <p>1852100270</p>	<p>380.002.608 Slinger remover</p>

Illustration	Tool Number/Description
 <p>8943968560</p>	<p>380.001.712 Oil seal setting tool (6HK1)</p>

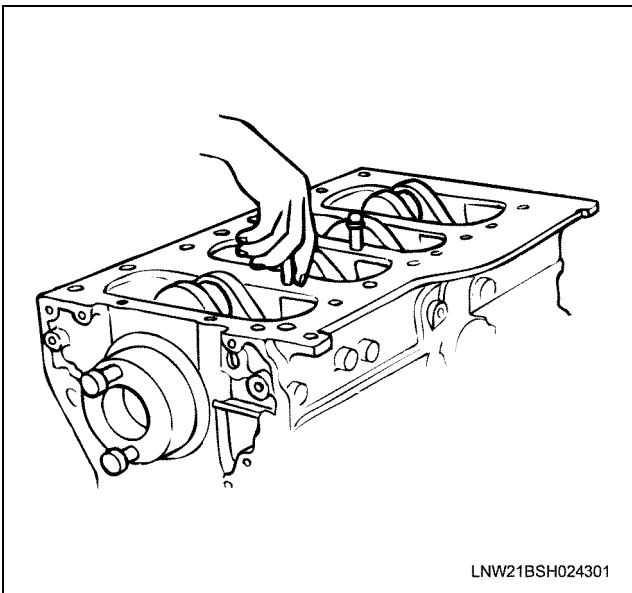
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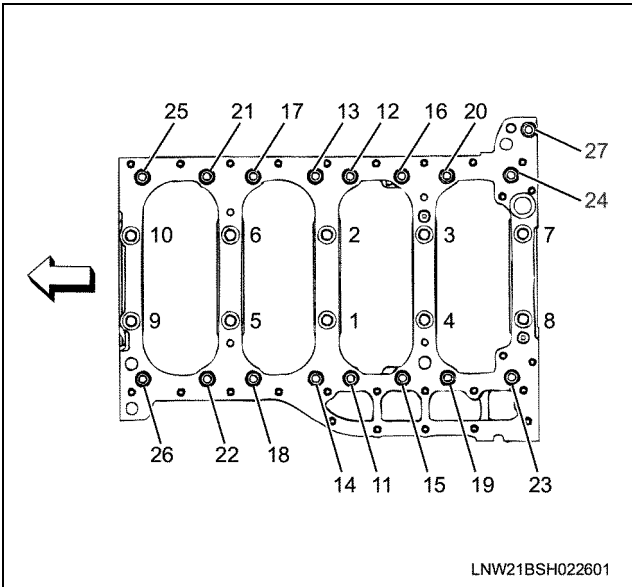
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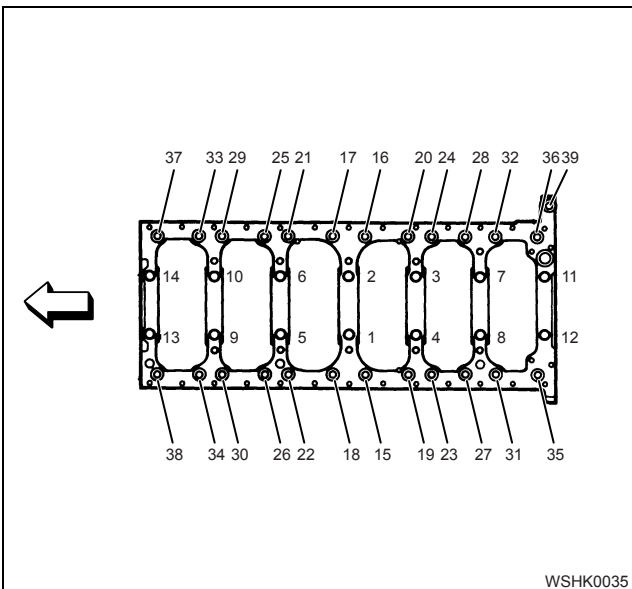
* 4HK1 is shown for illustration.

4HK1



LNW21BSH022601

6HK1



WSHK0035

Tightening torque:

M14 bolt 4HK1: (1 – 10), 6HK1: (1 – 14)

1st step = 98 N·m (10.0 kg·m/72 lb ft)

2nd step = 132 N·m (13.5 kg·m/97 lb ft)

3rd step = 30° – 60°

M10 bolt 4HK1: (11 – 27), 6HK1: 15 – 39

4th step = 37 N·m (3.8 kg·m/27 lb ft)

- Tighten bolts from 1 to 10 (M14) and confirm that they are tightened to a torque of 142 N·m (14.5 kg·m/105 lb ft) or more.

Special tool

Angle gauge: 380000304

Caution:

Do not rotate the crankshaft after tightening the crankcase.

- Loosen the bolts and gently remove the crankcase.
- Measure the widest part of the Plastigauge flattened by tightening the crankcase to determine the clearance.

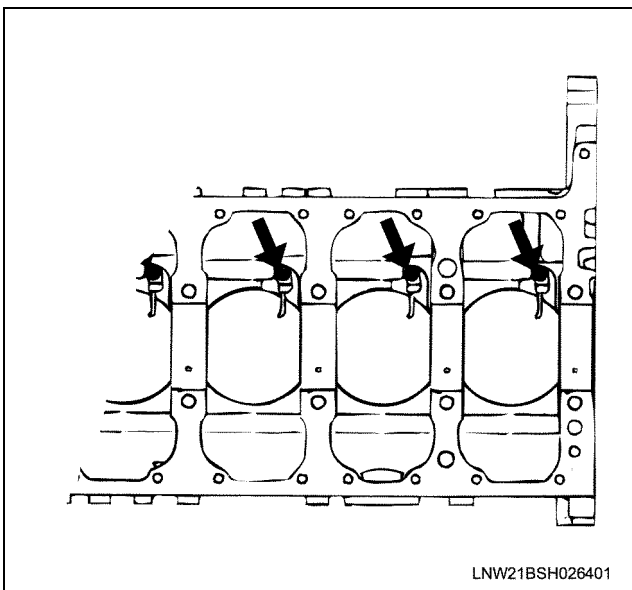
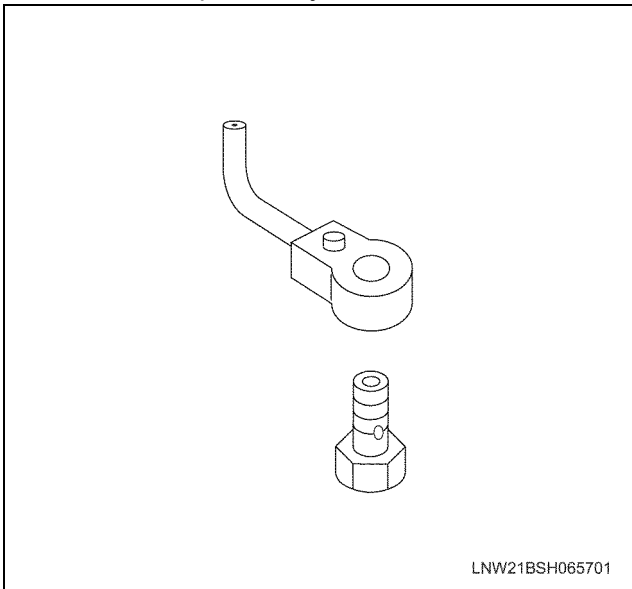
4HK1

Journal oil clearance	mm (in)	
	Standard	Limit
No.1, 2, 4, 5	0.037 – 0.072 (0.0015 – 0.0028)	0.11 (0.0043)
No.3	0.051 – 0.086 (0.0020 – 0.0034)	0.11 (0.0043)

6HK1

Journal oil clearance	mm (in)	
	Standard	Limit
No. 1, 2, 3, 5, 6, 7	0.063 – 0.094 (0.0025 – 0.0037)	0.14 (0.0055)
No. 4	0.093 – 0.124 (0.0037 – 0.0049)	0.14 (0.0055)

9. Remove the water pump.
Refer to the "Water Pump" in the Cooling System Section.
10. Remove the front cover.
Refer to the "Front Cover".
11. Remove the timing gear train.
Refer to the "Timing Gear Train".
12. Remove the oil pump.
Refer to the "Oil Pump".
13. Remove the piston and connecting rod.
Refer to the "Pistons and Connecting Rod".
14. Remove the crankshaft.
Refer to the "Crankshaft".
15. Remove the piston oil jet

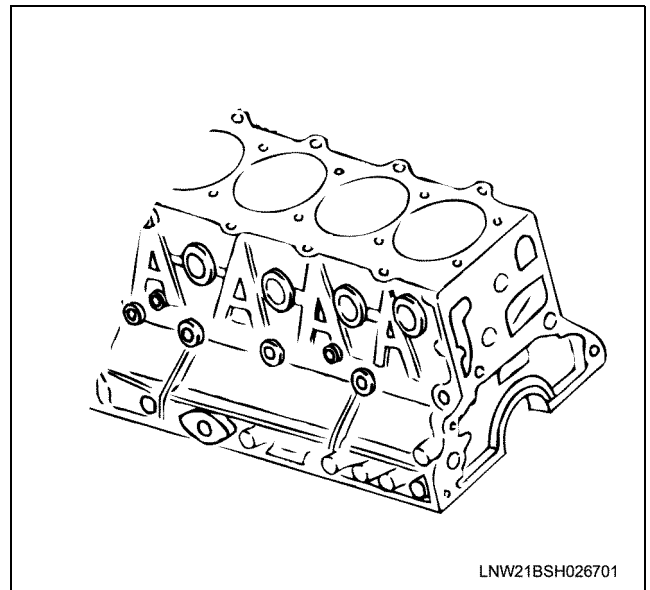


16. Remove the cylinder liner.

If the cylinder liner cannot be pulled free by hand, tap around the lower side of the liner with a hammer grip or similar object to loosen it.

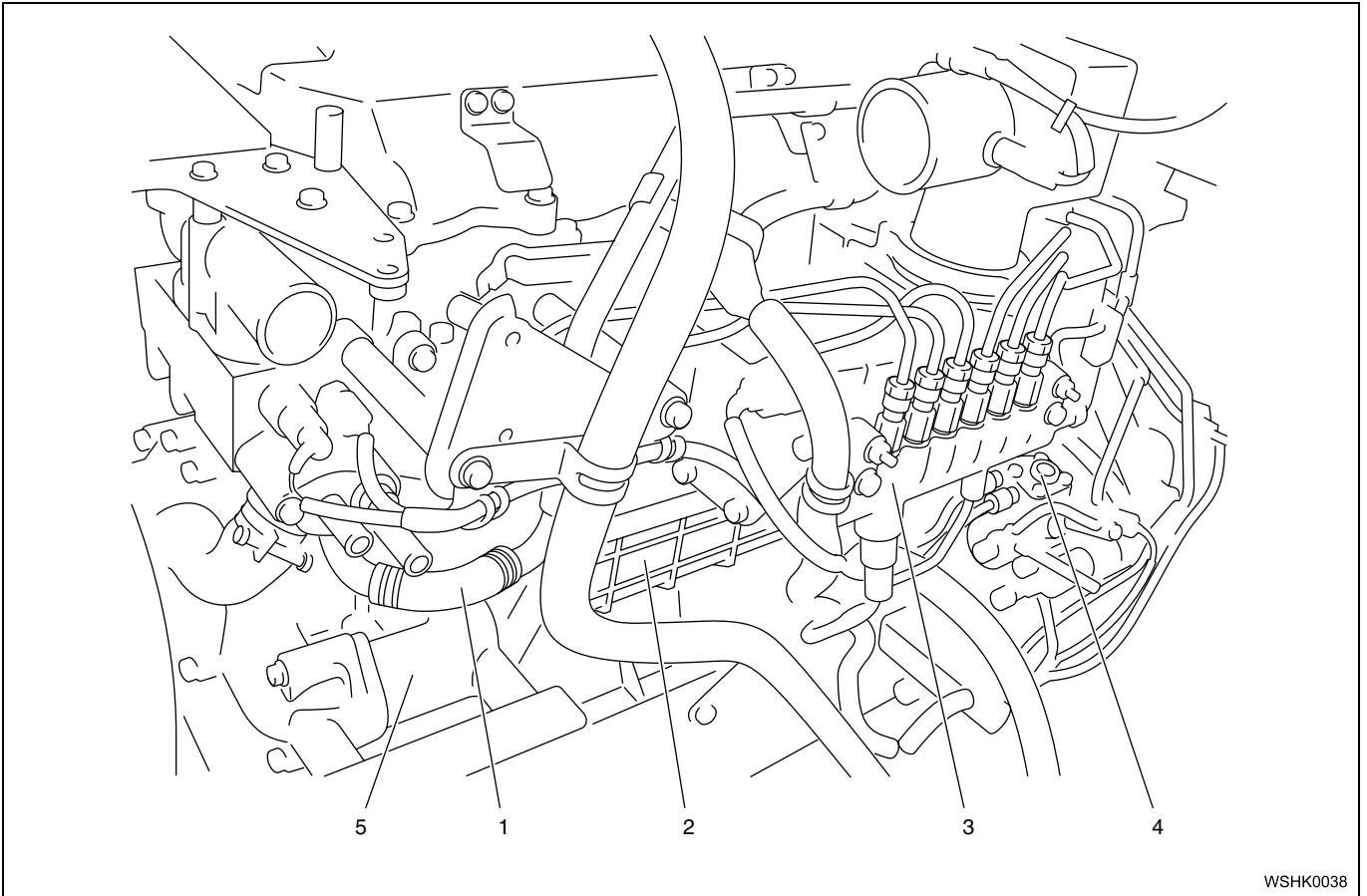
Inspection

1. Carefully remove water stains or other foreign matters on the surface of the cylinder block.
 - Be careful not to damage the cylinder block.
2. Carefully remove the liquid gasket on the crankcase mounting surface.
3. Clean up the cylinder block.
4. Visually inspect the cylinder block.
 - Conduct color check and hydraulic (or pneumatic) test and if you find crack or other damage, replace the cylinder block.



5. Cylinder liner wear measurement
 - Check the internal surface of the liner for flaw or damage.
 - Measure the liner bore diameter at the most worn part (it wears more in the rotation direction) at 15 – 20 mm (0.59 – 0.79 in) from the top end of the liner with the liner installed in the cylinder block. If the wear is over the application limit, replace it.

6HK1



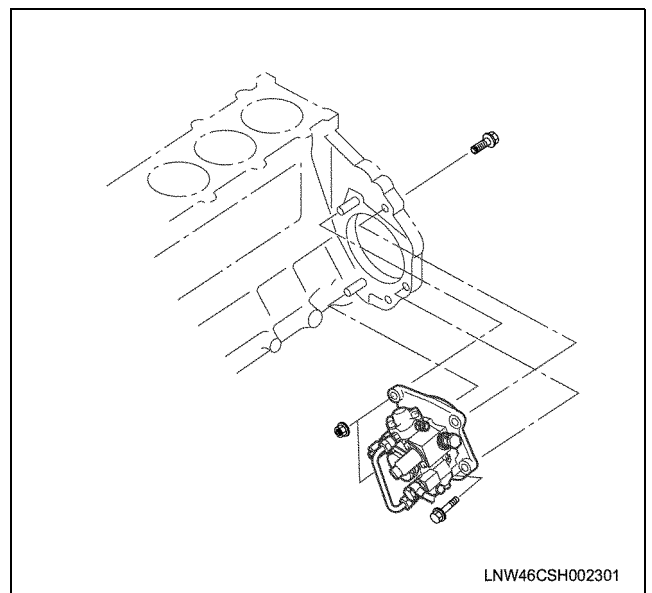
WSHK0038

Name

- | | |
|---------------------------------|---------------------|
| 1. EGR Cooler Water Return Pipe | 4. Fuel Supply Pump |
| 2. Oil Cooler | 5. Suction Pipe |
| 3. Common Rail | |

Removal

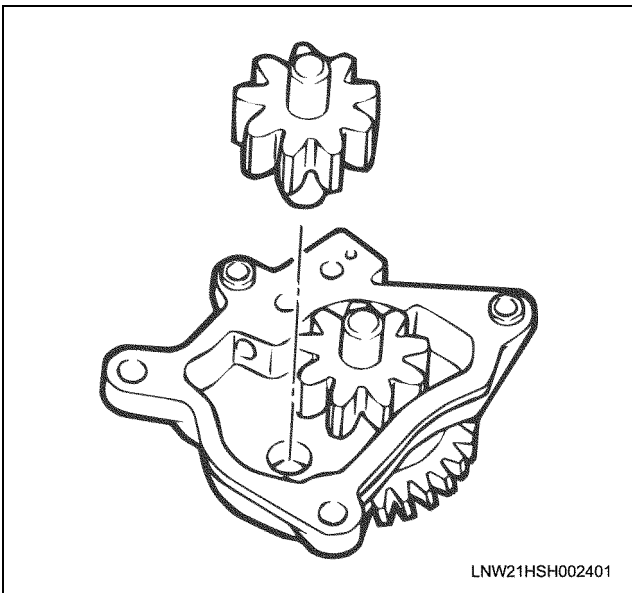
- Remove the common rail.
Refer to the "Common Rail" in the fuel system section.
- Remove the fuel supply pump.



LNW46CSH002301

* 4HK1 is shown for illustration.

- Remove the EGR cooler water return pipe.
 - Remove the brackets to the water pipe at two locations to make the pipe unsupported.



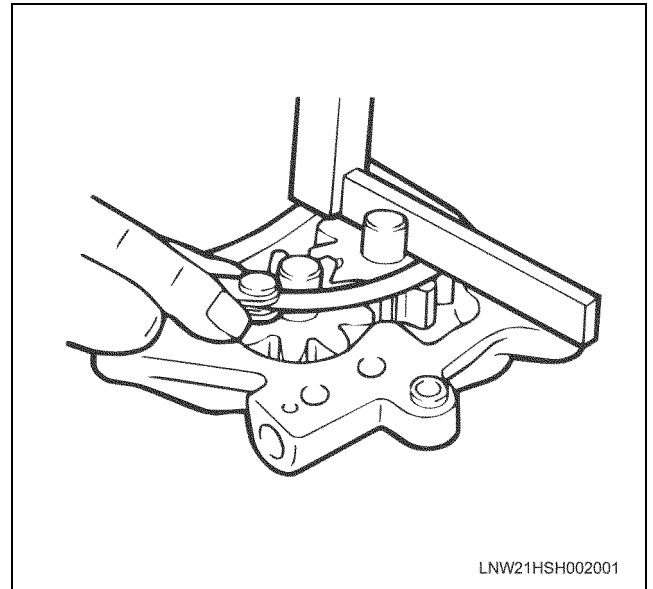
- Measure the clearance between the gear surface and the upper surface of the oil pump body using the thickness gauge and square.
- If the gap between the gear and the body inner wall exceeds the limit, replace the gear ASM or the driven gear ASM.

Clearance between the gear side surface and the upper surface of the oil pump body	
Standard	0.064 – 0.109 (0.0025 – 0.0043)
Limit	0.20 (0.0079)

Inspection

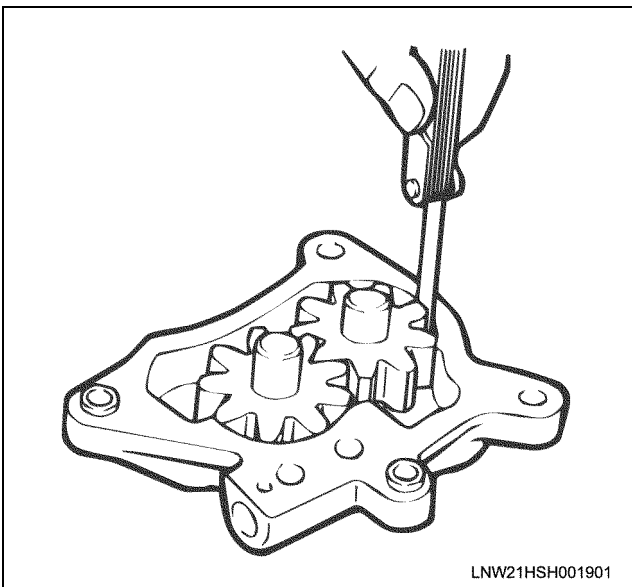
1. Measure the clearance between the gear and the inner wall of the oil pump body.
 - Measure the clearance between the gear and oil pump body using a thickness gauge.
 - If the gap between the gear and the body inner wall exceeds the limit, replace the gear ASM or the driven gear ASM.

Clearance between the gear and inner wall of the body	
Standard	0.125 – 0.220 (0.0049 – 0.0087)
Limit	0.30 (0.0118)



3. Measure the clearance between the driven gear shaft and the bush.
 - Measure the outside diameter of the driven gear shaft using a micrometer.

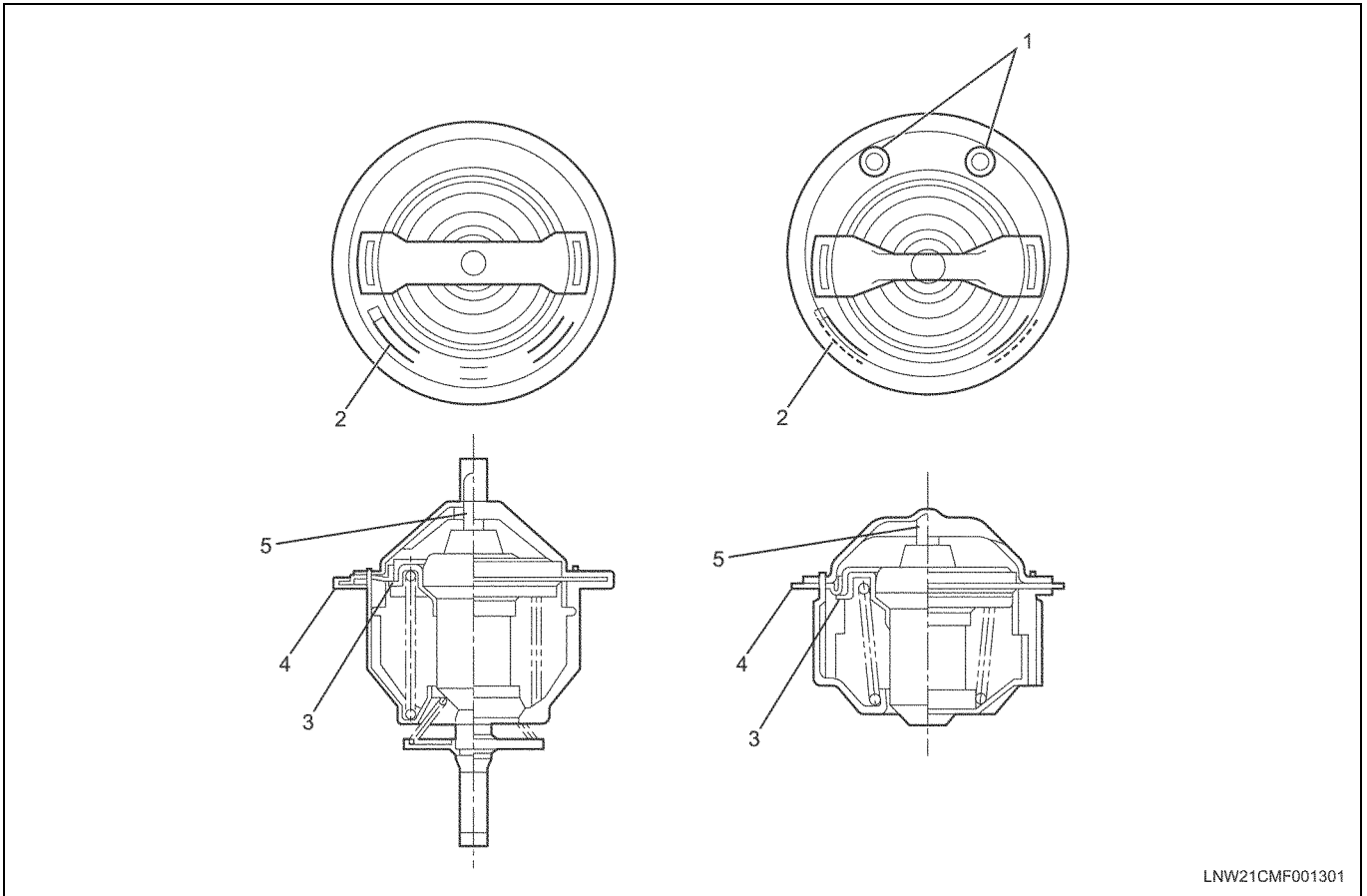
Outside diameter of the driven gear shaft	
Standard	15.989 – 16.000 (0.62949 – 0.62992)
Limit	15.900 (0.62598)



2. Measure the clearance between the gear side surface and the upper surface of the oil pump body.

Thermostat

The thermostat is a wax pellet type and consists of two units, in which one unit (bottom bypass type) has an valve initial opening temperature of 82 °C (180 °F) and the second (inline type) has an valve initial opening temperature of 85 °C (185 °F). It is designed such that the water temperature can be adjusted finely and it is mounted within the thermostat-housing unit.



LNW21CMF001301

Name

- | | |
|---|-----------|
| 1. Jiggle Valve | 4. Gasket |
| 2. Stamp Mark (Valve Initial Opening Temperature) | 5. Piston |
| 3. Valve | |

Function Check

Cooling water level check

- Check the cooling water level within the reserve tank and the level is appropriate when the cooling water level is within the MAX (upper limit) and MIN (lower limit) range. In case the volume of the cooling water is deficient, remove the reserve tank cap and replenish with a mixture of tap water and engine coolant in the ratio of 1:1 until the level comes close to the MAX line.

4HK1

Standard value	
Cooling water level	14 L (14.8 qts) (between MIN and MAX levels)

6HK1

Standard value	
Cooling water level	14.5 L (15.3 qts) (Engine only)

Inspection

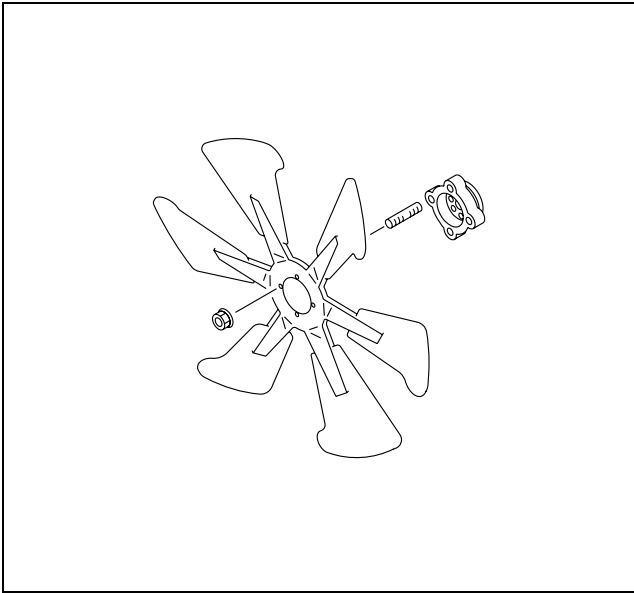
Cooling water leak check

- Use the radiator cap tester and apply a pressure of 200 kPa (29.0 psi) and check for leaks in the locations given below. Check that the radiator hose and heater hose are not damaged or degraded and the hose clamp is not loose.

10. Install the cooling fan.

Tighten the fixing nuts to the specified torque.

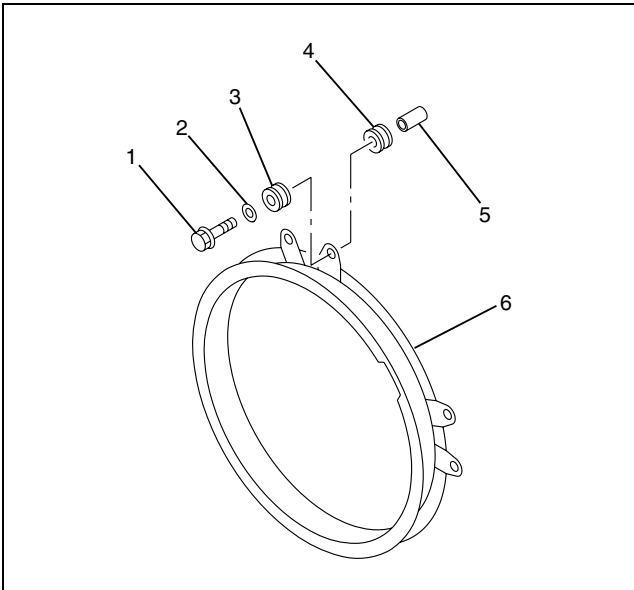
Tightening torque: 52 N·m (5.3 kg·m/38 lb ft)



11. Install the fan guide.

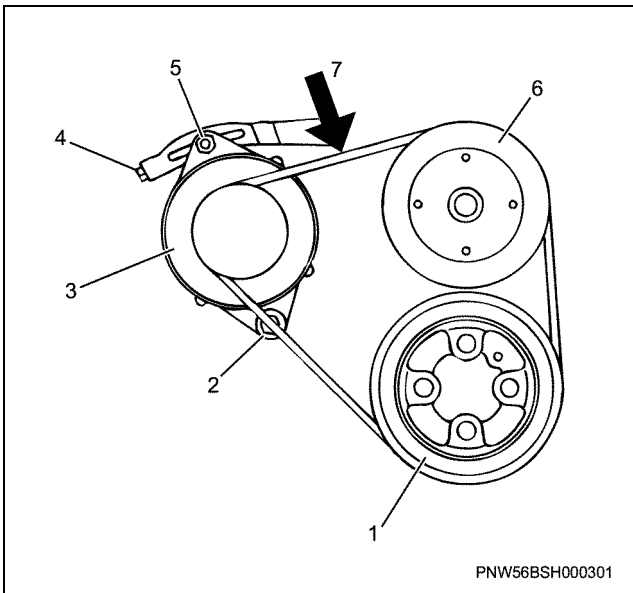
Tighten the fixing bolts to the specified torque.

Tightening torque: 30 N·m (3.1 kg·m/22 lb ft)



Name

1. Bolt
2. Washer
3. Rubber mount
4. Rubber mount
5. Guide tube
6. Fan guide



Name

1. Crankshaft Pulley
2. Bolt
3. Generator
4. Adjusting Bolt
5. Lock Nut
6. Water Pump Pulley
7. Generator Drive Belt

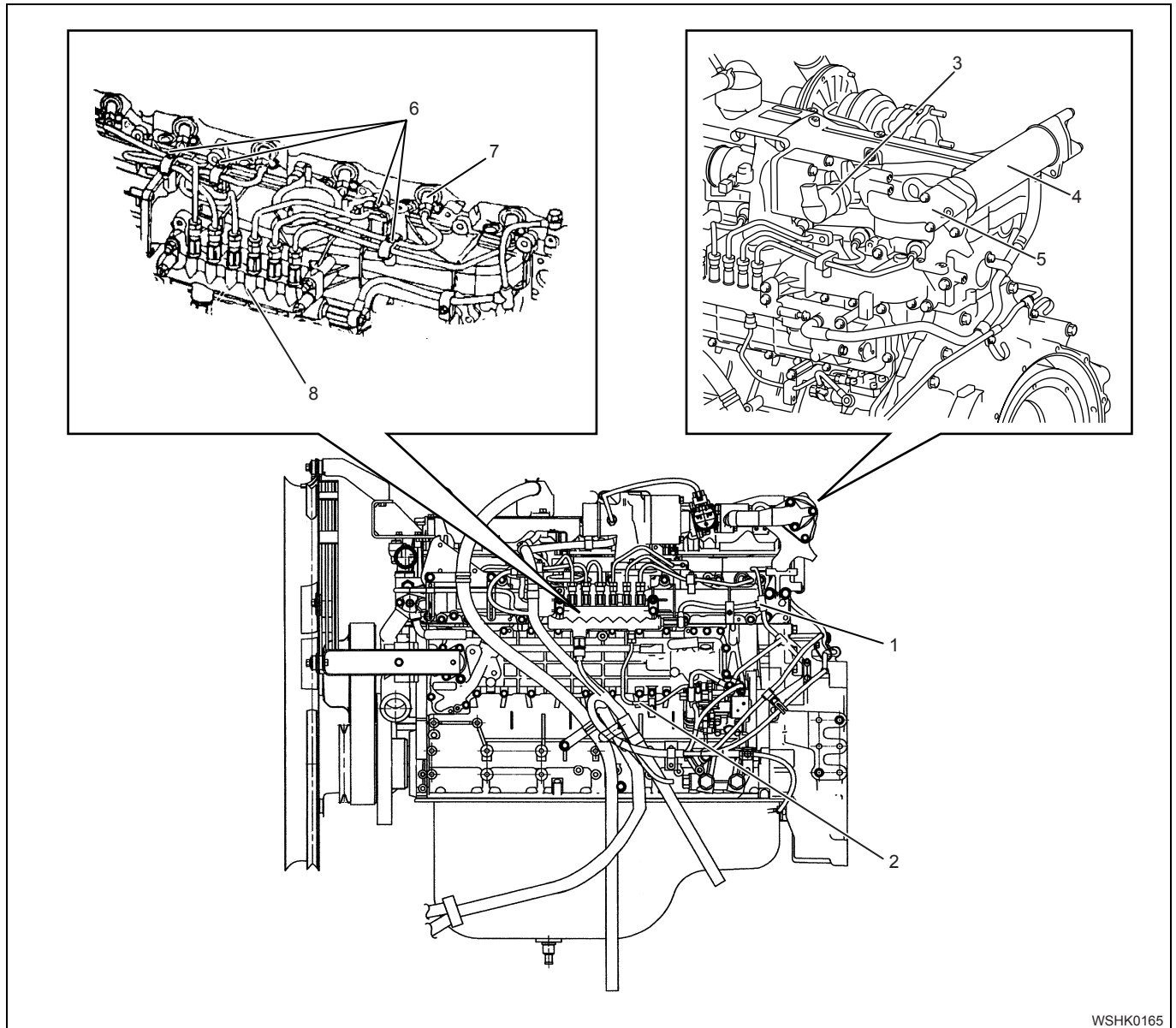
- Do not perform this procedure if the fuel tank is nearly full (fuel approaching or flowing into the fuel filler neck). The forced air will spray fuel from the fuel filler neck.
8. Remove the gauge (1) and hose from the adapter (3).
 9. Remove the adapter (3).
 10. Connect the fuel hose.
 11. Use your hand to operate the fuel filter priming pump. Operate the pump until all the air has been bled from the system.
 12. Start the engine and allow it to idle.
 13. Inspect the fuel system for fuel leakage.

- The connection at the data link connector (DLC) is secure.
- Voltage supply circuit
- DO NOT disturb the tool harness while programming. If an interruption occurs during the programming procedure, programming failure or ECM damage may occur.
- Surrounding environment
 - Surrounding temperature must be between 0 and 50°C (32 and 122°F) during the programming procedure. Excessively low or high temperature may cause the programming failure or ECM damage.
 - Electromagnetic interference (EMI) on the tool harness and ECM may cause the programming failure or ECM damage.

Fuel Injector Flow Rate Programming Procedure

1. Connect the scan tool to the data link connector.
2. Connect the RS-232 to the scan tool and PC.
3. Start TIS 2000 and select the Service Programming System (SPS).
4. In the "Select Diagnostic Tool and Programming Process" screen, select the following menu.
 - Diagnostic tool "Pass-Thru".
 - Select Programming Process "Reprogram ECU".
 - ECU Location on the "Machine".Then, follow the SPS screen instructions.
5. Ensure that ALL programming contents are entered correctly and were programmed successfully by turning OFF the ignition for 30 seconds.
6. Using the scan tool to check each programmed fuel injector flow rate.
7. Start the engine and let idle.
8. Inspect for a proper engine running condition and for no DTCs. Refer to the "Diagnostic System Check – Engine Control" if needed.

6HK1



WSHK0165

Name

- | | |
|-----------------------|------------------------------|
| 1. Fuel Leak Off Pipe | 5. EGR Adapter |
| 2. Fuel Pipe | 6. Injection Pipe Clip |
| 3. EGR Valve | 7. Injection Pipe (#1 to #6) |
| 4. EGR Cooler | 8. Common Rail |

Parts of the fuel system such as the internal part of the fuel injector, holes and clearances that form passages for fuel are finished to a very high degree of accuracy. They are therefore highly sensitive to foreign matter and the entry of foreign matter could cause damage to the fuel passage. Therefore, effective measures should be taken to prevent the entry of foreign matter.

- Cover the removed fuel hose with a lid, keep it facing upward and secure it using wire, etc.

Note:

Cover the areas exposed during part removal to prevent the entry of foreign material into the fuel system.

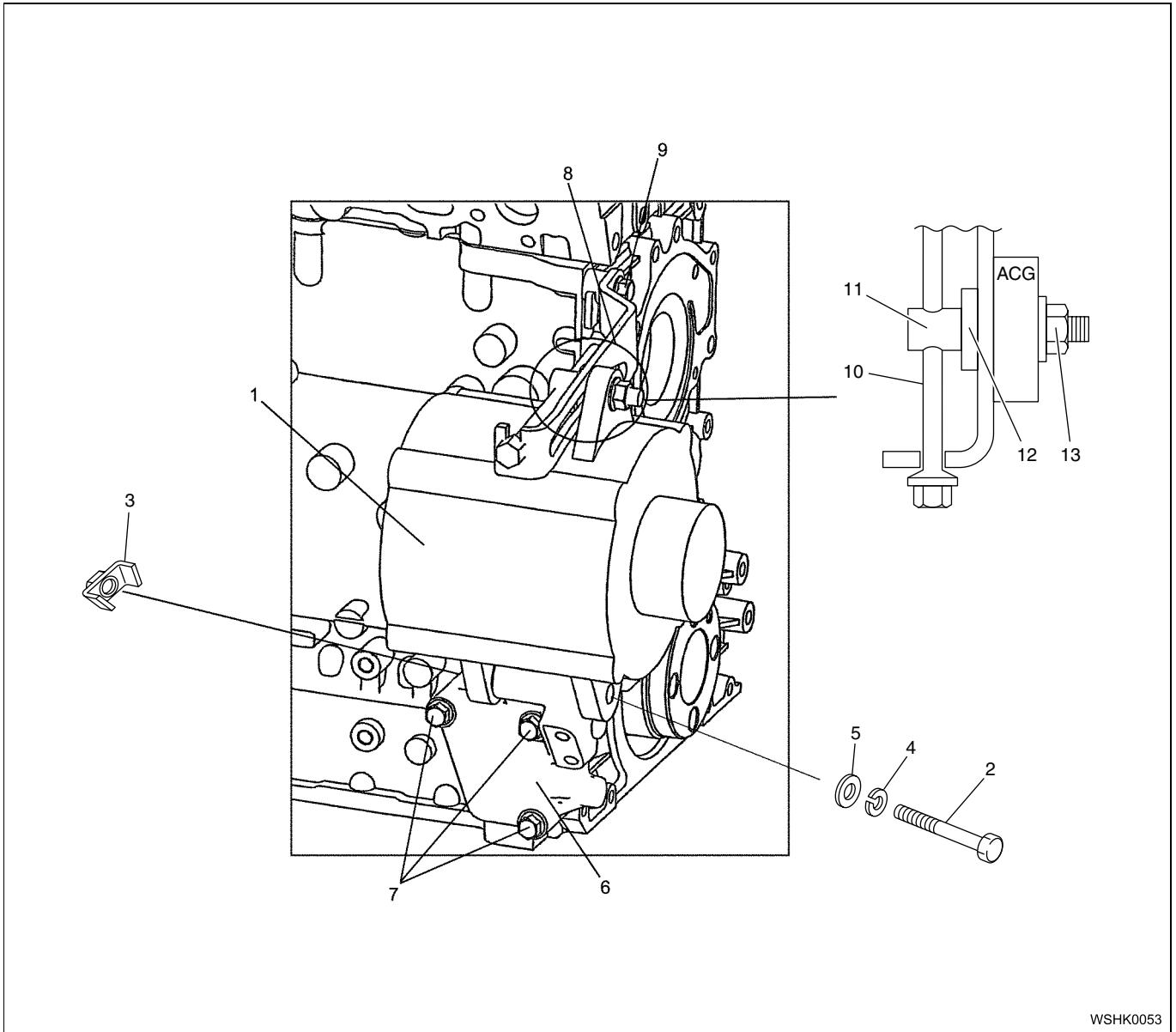
Removal

1. Remove the air intake pipe.
 - Disconnect the connector for the intake air temperature sensor.
2. Remove the fuel leak off hose from the leak off pipe.
3. Disconnect the connected of common rail pressure sensor, and all the connectors.
4. Remove the EGR valve and the EGR adapter.
5. Tape the EGR case holes shut to prevent the entry of foreign material.

Charging System

General Description

The main charging system components are the batteries, the generator and the battery discharge indicator light circuit. The generator is a 120-amp, selfrectifying type with a built-in regulator. The battery discharge indicator light is mounted in the instrument panel.



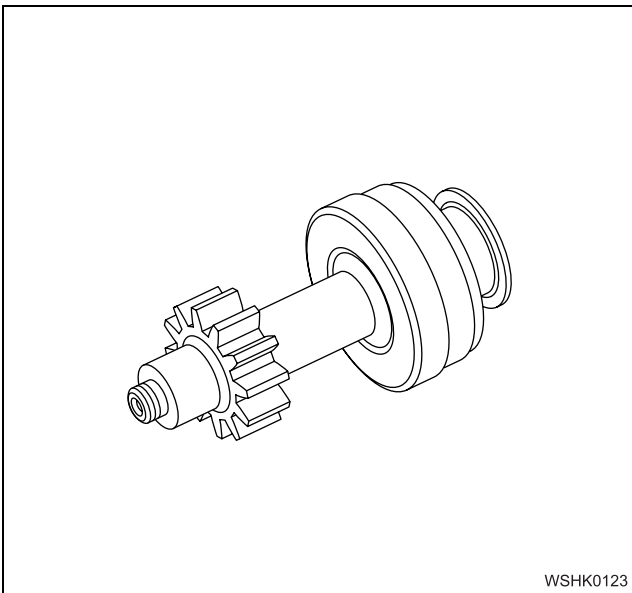
WSHK0053

Name

- | | |
|-----------------------|---------------------|
| 1. Generator | 8. Plate |
| 2. Lower Mount Bolt | 9. Bolt |
| 3. Nut | 10. ACG Adjust Bolt |
| 4. Spring Washer | 11. Sliding Piece |
| 5. Washer | 12. Washer |
| 6. Bracket | 13. Adjust Nut |
| 7. Bracket Mount Bolt | |

Trouble and Action

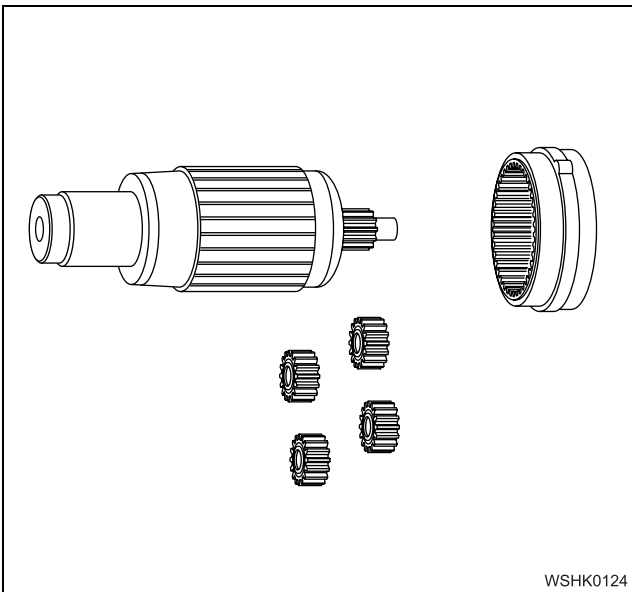
Trouble symptom	Trouble location	Trouble cause	Action to be taken
Charging is impossible.	Wiring and ammeter	Open or short circuit, disconnection	Repair
	Generator.	Open circuit, short to ground, short circuit in each coil	Replace
		Broken diode	Replace
	Regulator	Defective regulator.	Replace
		Poor contact in terminal of regulator	Repair
Insufficient charging	Wiring	Open or short circuit, looseness in connection	Repair
	Generator.	Looseness of generator driven belt	Repair
		Layer or short circuit in field coil	Replace
		Layer or short circuit in stator coil	Replace
		Defective diode	Replace
		Poor contact in each terminal	Repair
	Regulator	Defective regulator.	Replace
		Poor contact in terminal of regulator	Repair
Excessive charging	Regulator	Defective regulator.	Replace
Unstable charging current	Wiring	Intermittent contact or nearly disconnected connection in wiring	Repair
	Generator.	Looseness of generator driven belt	Repair
		Short circuit or nearly disconnected connection in field coil	Repair
		Short circuit or nearly disconnected connection in stator coil	Repair
		Poor contact in each terminal	Repair
	Regulator	Defective regulator.	Replace
		Poor contact in terminal of regulator	Repair
	Noisy generator	Generator.	Improper installation of generator
Defective bearing			Replace
Contact of rotor core and stator core			Repair
Defective diode			Replace
Short circuit in stator coil			Replace



WSHK0123

5. Reduction gear

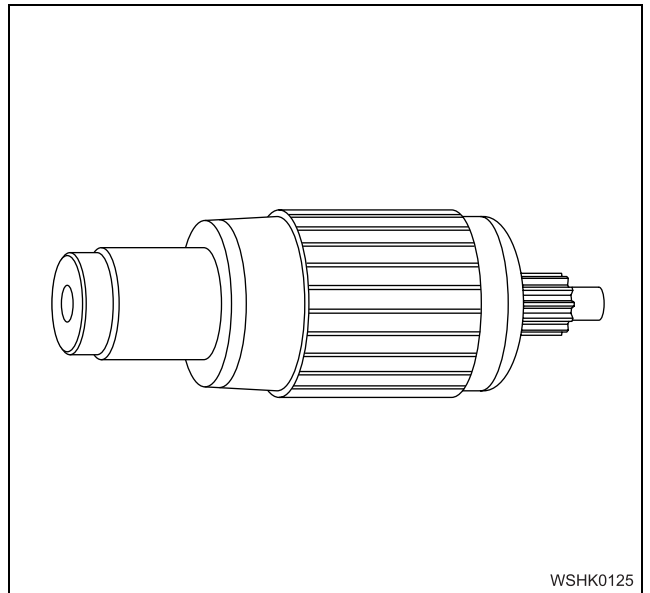
- Check the reduction gear. It is normal if it has no wear.



WSHK0124

6. Bearing

- Check if the bearing outer race rotates smoothly by hand.



WSHK0125

7. Brush height

- Measure the brush height. If it is less than the limit, replace the brush.

		mm (in)
Standard		Limit
17 — 18 (0.669 — 0.709)		10 (0.394)

Disassembly

Caution:

- Before disassembling the starter, put alignment marks on each magnet switch, yoke front bracket and rear bracket to facilitate re-assembly.
- In normal condition, if tap the pinion or stop ring toward the front bracket side, the front bracket will be broken. Therefore, tap the stop ring when the pinion come out to cranking position.

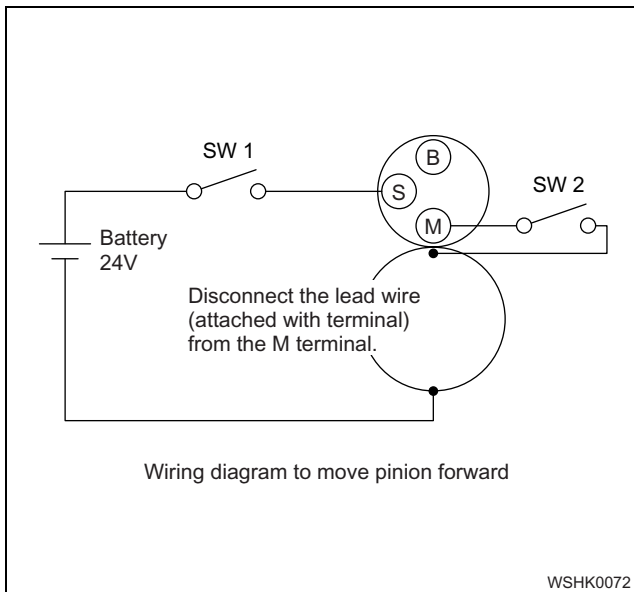
1. Connect the starter to battery as shown in the illustration.

When closing the switches SW1 and SW2, the pinion move forward to the cranking position and the armature rotates.

Then, open the switch SW2 to stop the armature rotating.

Caution:

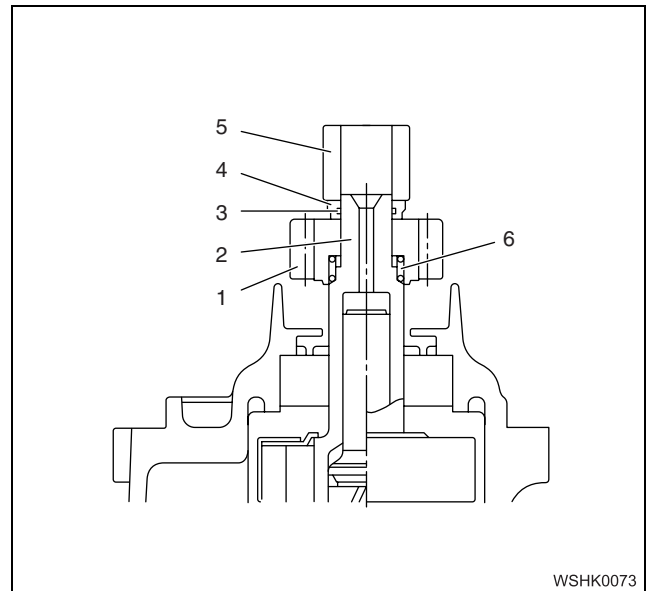
Remove the pinion within 10seconds since heat is generated during electric discharge.



2. Apply the pipe, which just fits the stop ring, on the ring and tap the pipe with a hammer to remove the stop ring toward the pinion side once. Then, remove the snap ring and remove the stop ring, pinion and pinion spring.

Caution:

Do not reuse the snap ring.



Name

1. Pinion
2. Clutch Shaft
3. Snap Ring
4. Stop Ring
5. Pipe
6. Pinion Spring

3. Remove the nut on M terminal of magnet switch and remove the lead wire with terminal.

Caution:

Tightening screw is tight. Use a shock driver to loosen.

4. Remove the brush holder-tightening screw and through bolt. Then, remove the rear bracket and O-ring together.

Caution:

Do not reuse the removed O-ring.

Also, do not reuse also O-ring on tightening screw.

5. Apply a socket (outside diameter 32 mm {1.260 in}) on a commutator of armature. Then, slide the brush on the socket to yoke assembly and O-ring. This facilitates to re-assemble.

Caution:

Do not reuse the removed O-ring.

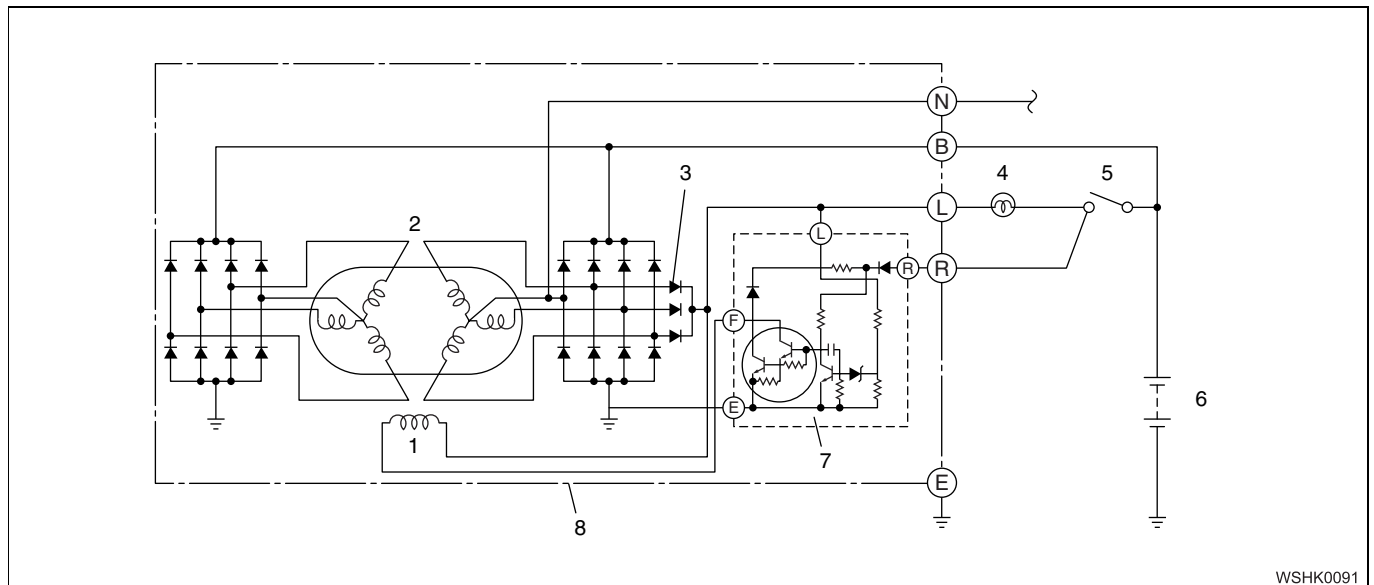
6. Remove the brush from brush holder by pulling up the brush spring, and then remove the brush holder.
7. Remove the armature. Remove a bearing using a general puller.
8. Remove the plate in planetary gear and remove the packing. Then, remove the packing and plate on the lever support.
9. Remove the internal gear, gearshift, overrunning clutch and lever as a unit from front bracket.

Generator (6HK1)

Specifications

Manufacturer		Mitsubishi Electric Co.	
Isuzu Part No.		1-81200-633-0	1-81200-603-2
Model by manufacturer		A009TU3782	A004TU6285
Nominal voltage (V)		24	
Output current (A)		90	50
Rated speed (rpm)		5000	
Output current/Voltage (A/V/rpm)		114/27/5000	50/27/5000
No load voltage (V/rpm)		24/900	
Revolution direction		Clockwise	
Polarity		(-)	
Pulley diameter (P. C. D) (mm/in)		90/3.543	80/3.150

Charging Circuit



WSHK0091

Name

- | | |
|------------------|-----------------|
| 1. Field Coil | 5. Key Switch |
| 2. Stator Coil | 6. Battery 24 V |
| 3. Diode Trio | 7. IC Regulator |
| 4. Charging Lamp | 8. Generator |

Charging circuit and internal circuit are shown in the illustration above.

Charging system consists of IC regulator built-in generator, battery, charging lamp and wires to connect them.

Trouble Diagnosis

Symptom	Trouble cause
No generation of electric power	a. Defective IC regulator b. Open circuit in field coil
Low output	a. Defective diode b. Defective stator coil c. Defective rectifier d. Internal short circuit in field coil
Too high regulated voltage	a. Defective IC regulator
Noise	a. Defective bearing b. Defective rectifier c. Foreign material in generator

Specifications

Item		Standard value and limit	
Isuzu Part No.		1-81200-633-0	1-81200-603-2
Manufacturer code No.		A009TU3782	A004TU6285
Rated output (V-A)		24-90	24-50
Output characteristic (hot)	Voltage (V)	27	27
	Current (A)	105 or more	42 or more
	Revolution speed (r/min)	2,500	2,500
	Voltage (V)	27	27
	Current (A)	114 or more	50 or more
	Revolution speed (r/min)	5,000	5,000
Field coil resistance (Ω : at 20°C)		4.3-5.0	4.4-5.1
Regulated voltage by regulator (V)		28-29	28-29
Revolution direction (viewed from pulley side)		Clockwise	Clockwise

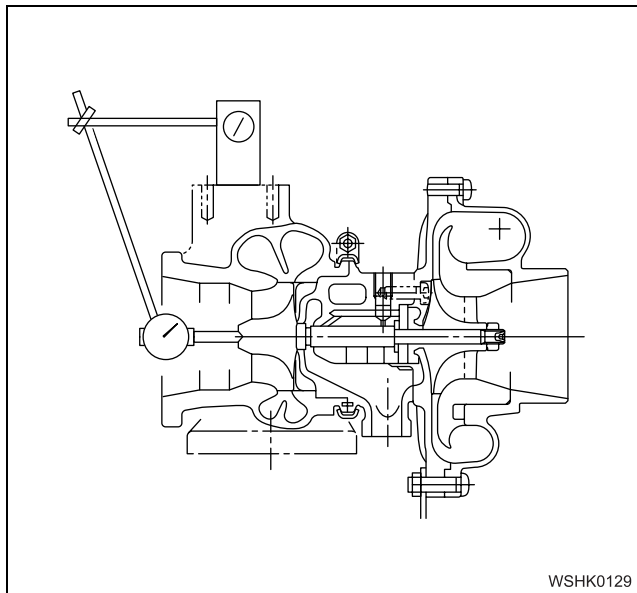
Disassembly

Inspection Prior to Disassembly

- Measurement of axial play of turbine shaft

Axial play		mm (in)
Assembly specifications	0.06 — 0.09 (0.0024 — 0.0035)	
Service limit	0.11 (0.0043)	

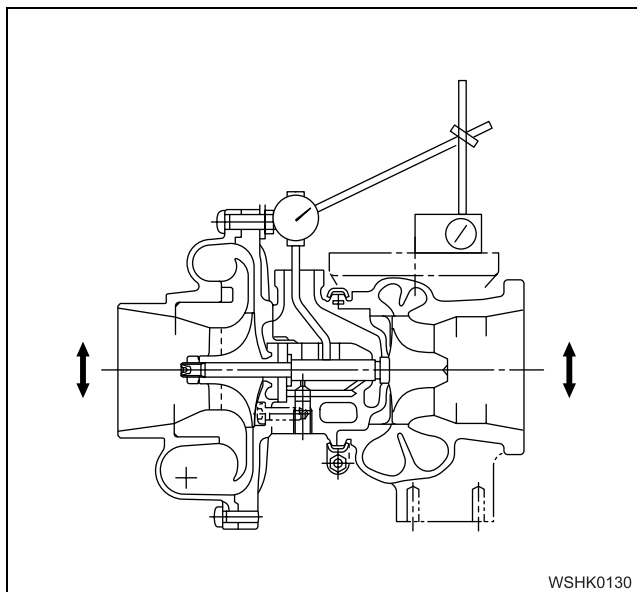
If it exceeds the service limit, check the thrust metal, the thrust bushing, and the oil thrower.



- Measurement of radial play of turbine shaft

Radial play		mm (in)
Assembly specifications	0.10 — 0.17 (0.00394 — 0.00669)	
Service limit	0.205 (0.00807)	

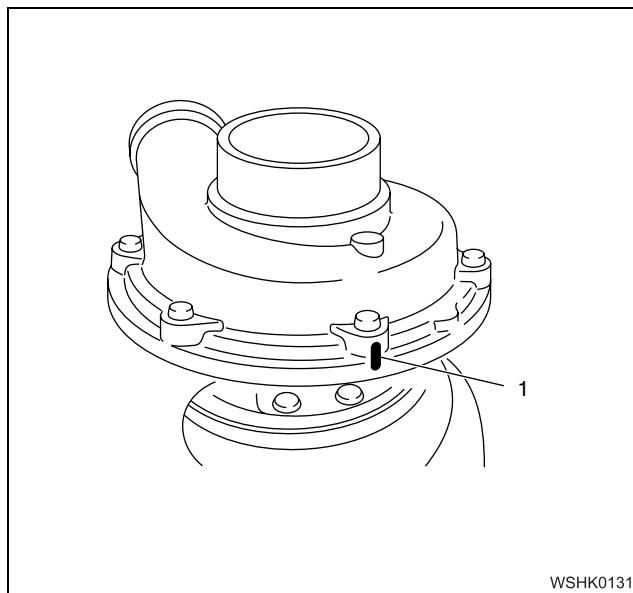
If it exceeds the service limit, check the floating metal.



1. Compressor housing
 - Put alignment marks between the compressor housing and the seal plate, and tap the compressor housing to drive it out.
 - Liquid gasket is applied to the mating surfaces of the compressor and the seal plate.

Caution:

Take care not to damage the impeller during removal of the compressor housing.



Name

1. Alignment Mark

2. Nut
 - The nut is left-hand screw.
3. Compressor impeller
 - Attach the box spanner to the turbine-side shaft end of the turbine shaft, and remove the nut.
 - Remove the impeller from the turbine shaft.
 - Washing of impeller
Soak in the cleaning solvent until the foreign matters soften, and clean it with a plastic scraper or hard brush.

Caution:

Do not use a wire brush.

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