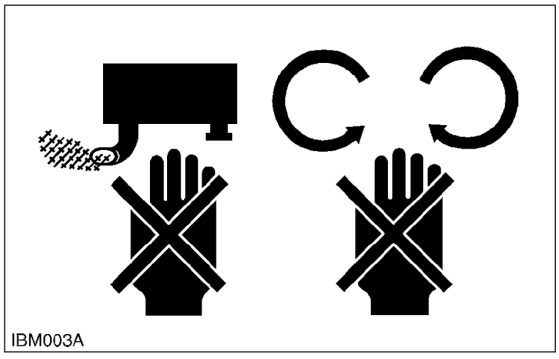
SERVICING

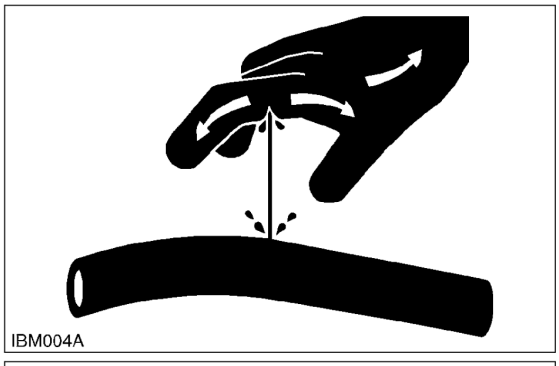
CONTENTS

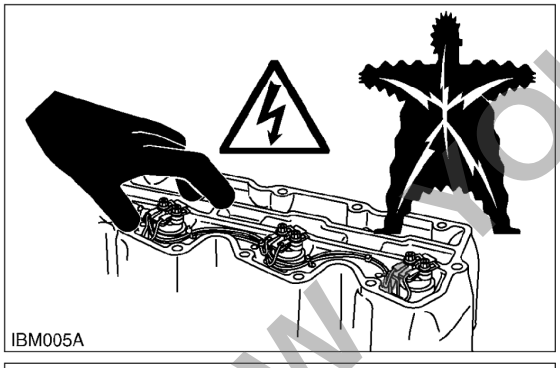
1. TROUBLESHOOTING....1-S1
   [1] ENGINE BODY....1-S1
   [2] ELECTRONIC GOVERNOR....1-S8
2. SERVICING SPECIFICATIONS....1-S10
3. TIGHTENING TORQUES....1-S20
   [1] TIGHTENING TORQUES OF SCREWS, BOLTS AND NUTS FOR GENERAL USE....1-S20
   [2] TIGHTENING TORQUES OF THE SCREWS, BOLTS AND NUTS FOR SPECIAL USE....1-S21
4. CHECKING, DISASSEMBLING AND SERVICING....1-S22
   [1] CHECKING AND ADJUSTING....1-S22
      (1) Engine Body....1-S22
      (2) Lubricating System....1-S25
      (3) Cooling System....1-S25
      (4) Fuel System....1-S28
      (5) Electrical System....1-S36
      (6) Turbocharger....1-S40
      (7) Electronic Governor....1-S41
   [2] DISASSEMBLING AND ASSEMBLING....1-S46
      (1) Draining Engine Oil and Coolant....1-S46
      (2) External Components....1-S47
      (3) Cylinder Head and Valves....1-S48
      (4) Gear Case and Timing Gears....1-S54
      (5) Piston and Connecting Rod....1-S64
      (6) Flywheel and Crankshaft....1-S69
      (7) Starter....1-S72
      (8) Alternator....1-S73
   [3] SERVICING....1-S74
      (1) Cylinder Head and Valves....1-S74
      (2) Timing Gears....1-S82
      (3) Piston and Connecting Rod....1-S88
      (4) Crankshaft....1-S92
      (5) Cylinder....1-S97
      (6) Oil Pump....1-S99
      (7) Starter....1-S99
      (8) Alternator....1-S102

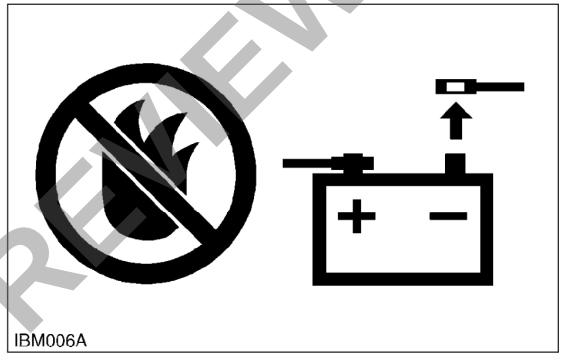
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IBM005A


IBM006A

OPERATE SAFELY

- Do not use the machine after you consume alcohol or medication or when you are tired.
- Put on applicable clothing and safety equipment.
- Use applicable tools only. Do not use alternative tools or parts.
- When 2 or more persons do servicing, make sure that you do it safely.
- Do not touch the hot parts or parts that turn when the engine operates.
- Do not remove the radiator cap when the engine operates, or immediately after it stops. If not, hot water can spout out from the radiator. Only remove the radiator cap when it is at a sufficiently low temperature to touch with bare hands. Slowly loosen the cap to release the pressure before you remove it fully.
- Released fluid (fuel or hydraulic oil) under pressure can cause damage to the skin and cause serious injury. Release the pressure before you disconnect hydraulic or fuel lines. Tighten all connections before you apply the pressure.
- Do not open a fuel system under high pressure. The fluid under high pressure that stays in fuel lines can cause serious injury. Do not disconnect or repair the fuel lines, sensors, or any other components between the fuel pump and injectors on engines with a common rail fuel system under high pressure.
- Put on an applicable ear protective device (earmuffs or earplugs) to prevent injury against loud noises.
- Be careful about electric shock. The engine generates a high voltage of more than DC100 V in the ECU and is applied to the injector.

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PREVENT A FIRE

- Fuel is very flammable and explosive under some conditions. Do not smoke or let flames or sparks in your work area.
- To prevent sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- The battery gas can cause an explosion. Keep the sparks and open flame away from the top of battery, especially when you charge the battery.
- Make sure that you do not spill fuel on the engine.

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3. MAINTENANCE CHECK LIST

To make sure that the engine operates safely for a long time, refer to the table below to do regular inspections.
[D1503-M, D1703-M, D1803-M, V2003-M, V2203-M, V2403-M, V2403-M-T, D1703-M-BG, V2003-M-BG, V2003-M-T-BG, V2203-M-BG, V2403-M-BG]

	Item		Service Interval											
			Every											
			50 hrs	100 hrs	150 hrs	200 hrs	400 hrs	500 hrs	1 or 2 months	1 year	800 hrs	1500 hrs	3000 hrs	2 years
*	Check of fuel hoses and clamp bands		☆											
	Change of engine oil (depending on the oil pan)	(1) Oil pan depth (90 mm, 3.5 in.)	★		☆									
		(2) Oil pan depth (124 mm, 4.88 in.)	★			☆								
*	Cleaning of air cleaner element (replace the element after 6-times cleanings)			☆										
*	Cleaning of fuel filter (Element type)			☆										
	Check of battery electrolyte level			☆										
	Check of fan belt tension and damage			☆										
	Replacement of oil filter cartridge	(1) Oil pan depth (90 mm, 3.5 in.)	★		☆									
		(2) Oil pan depth (124 mm, 4.88 in.)	★			☆								
	Check of radiator hoses and clamp bands					☆								
*	Check of intake air line					☆								
	Replacement of fuel filter cartridge						☆							
	Cleaning of water jacket and radiator interior							☆						
	Replacement of fan belt							☆						
	Recharge of battery								☆					
*	Replacement of air cleaner element									☆				
	Check of valve clearance										☆			
*	Check of injection nozzle											☆		
*	Check of turbocharger												☆	
*	Check of injection pump												☆	
*	Replacement of intake air line													☆
	Replacement of battery													☆
	Replacement of radiator hoses and clamp bands													☆
*	Replacement of fuel hoses and clamps													☆
	Change of radiator coolant (L.L.C.)													☆

★ Change the engine oil and replace the oil filter cartridge after the first 50 hours of operation.
* The items above (* marked) are registered as emission related critical parts by KUBOTA in the U.S. EPA nonroad emission regulation. As the owner of the engine, you are responsible for the performance of the required maintenance above.

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1. TROUBLESHOOTING

[1] ENGINE BODY

Symptom	Probable Cause	Solution	Reference Page
The engine does not start	No fuel	Fill up the fuel	G-12
	Air in the fuel system	Bleed the air	G-12
	Water in the fuel system	Change the fuel and repair or replace the fuel system	–
	The fuel hose is clogged	Clean or replace	G-12
	The fuel filter is clogged	Replace	G-21
	The viscosity of fuel or engine oil at low temperature is too high	Use the specified fuel or engine oil	I-4, G-10
	The cetane number of fuel is low	Use the specified fuel	I-4
	Fuel leakage because of loose injection pipe retaining nut	Tighten the retaining nut	1-S48
	Incorrect injection timing	Adjust	1-S28, 1-S30
	The fuel camshaft is worn out	Replace	1-S63
	The injection nozzle is clogged	Clean or replace (IDI)	1-S34, 1-S35, 1-S36, 1-S49
		Repair or replace (DI)	1-S34, 1-S35, 1-S49
	The injection pump is defective	Repair or replace	1-S31, 1-S32, 1-S33, 1-S54, 1-S55, 1-S56
	Seizure of the crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	1-S62, 1-S63, 1-S64, 1-S65, 1-S66, 1-S67, 1-S68, 1-S92, 1-S93, 1-S94, 1-S95, 1-S96, 1-S97, 1-S98
	Compression leakage from the cylinder	Replace the head gasket, tighten the cylinder head screw, glow plug and nozzle holder	1-S48, 1-S49, 1-S50, 1-S51

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Blinking Pattern of Glow Lamp	Cause	Refer to Checking
(1-Long and 1-Short) 3EEAAAB1P005A	Overrunning (more than 115 %)	Solenoid
(1-Long and 2-Short)  3EEAAAB1P006A	Low oil pressure	Oil sensor
(1-Long and 3-Short)  3EEAAAB1P007A	Defect of alternator	Alternator
(1-Long and 4-Short)  3EEAAAB1P008A	Coolant temperature is abnormal	Water temperature sensor
(1-Long and 5-Short)  3EEAAAB1P009A	Emergency stop switch operated	Emergency stop switch
(2-Long and 1-Short)  3EEAAAB1P010A	Abnormality of speed sensor	Speed sensor
(2-Long and 2-Short)  3EEAAAB1P011A	Solenoid malfunction	Solenoid
(2-Long and 4-Short)  3EEAAAB1P012A	Disconnection of water temperature sensor	Water temperature sensor
(2-Long and 5-Short)  3EEAAAB1P013A	Short circuit of water temperature sensor	Water temperature sensor
(2-Long and 6-Short)  3EEAAAB1P014A	Disconnection of alternator **L** Terminal	Alternator **L** Terminal

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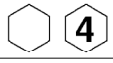
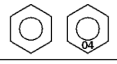
3. TIGHTENING TORQUES

Use a torque wrench to tighten the screws, bolts and nuts to the specified torque. Tighten the screws, bolts and nuts used, such as on the cylinder head in the correct sequence and torque.

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[1] TIGHTENING TORQUES OF SCREWS, BOLTS AND NUTS FOR GENERAL USE

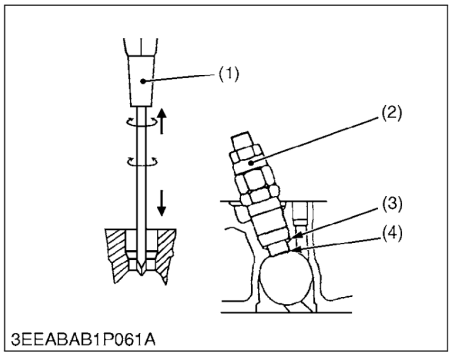
If the tightening torque is not specified, refer to the table below for the none specified torques values.

Indication on top of bolt	 No-grade or 4T			 7T		
Indication on top of nut	 No-grade or 4T					
Unit	**N·m**	**kgf·m**	**lbf·ft**	**N·m**	**kgf·m**	**lbf·ft**
M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
M8	18 to 20	1.8 to 2.1	13 to 15	24 to 27	2.4 to 2.8	18 to 20
M10	40 to 45	4.0 to 4.6	29 to 33	49 to 55	5.0 to 5.7	37 to 41
M12	63 to 72	6.4 to 7.4	47 to 53	78 to 90	7.9 to 9.2	58 to 66

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Service Procedure of Nozzle Heat Seal

[D1503-M, D1703-M, D1803-M, V2003-M, V2203-M, V2403-M, V2403-M-T, D1703-M-BG, V2003-M-BG, V2003-M-T-BG, V2203-M-BG, V2403-M-BG]

■ **IMPORTANT**

- **Use a plus (phillips head) screwdriver (1) that has a diameter larger than the heat seal hole (Approximately 6 mm (1/4 in.)).**

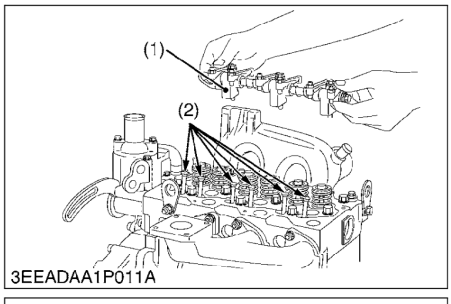
1. Put the screwdriver (1) lightly into the heat seal hole.
2. Turn screwdriver 3 or 4 times each way.
3. While you turn the screwdriver, slowly pull the heat seal (4) out together with the injection nozzle gasket (3).
4. If the heat seal falls, do the above procedure again.

(When reassembling)

- Change the heat seal and injection nozzle gasket when you remove the injection nozzle to clean or for servicing.

(1) Plus Screwdriver
(2) Injection Nozzle
(3) Injection Nozzle Gasket
(4) Heat Seal

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Rocker Arm and Push Rod

1. Remove the screws of the rocker arm bracket.
2. Remove the rocker arm assembly (1).
3. Remove the push rods (2).

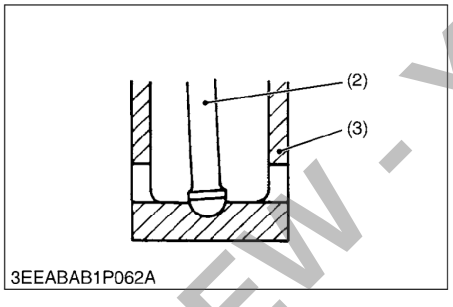
(When reassembling)

- When you put the push rods (2) on the tappets (3), make sure that their ends are correctly engaged with the grooves.

■ **IMPORTANT**

- **After you install the rocker arm, adjust the valve clearance.**

Tightening torque	Rocker arm bracket screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft



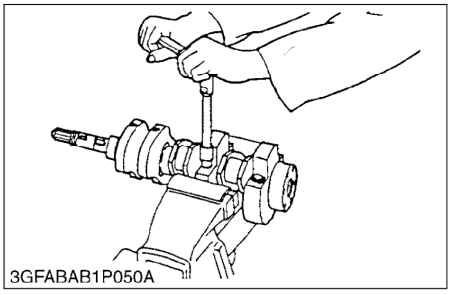
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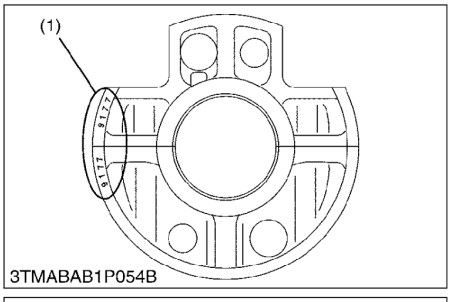
(1) Rocker Arm Assembly
(2) Push Rod
(3) Tappet

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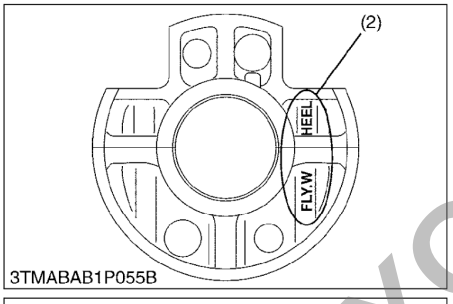
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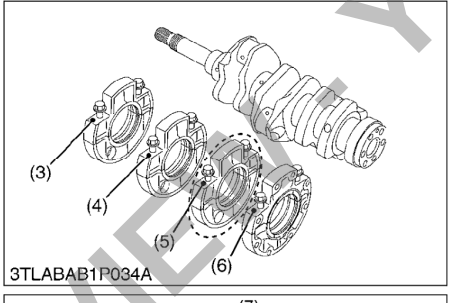

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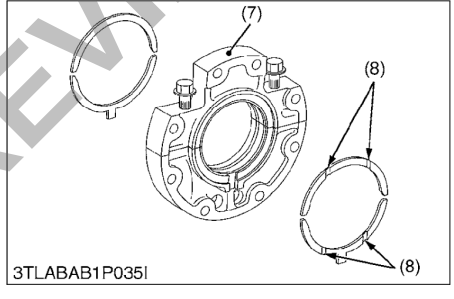
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3TMABAB1P055B



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3TLABAB1P035I

Main Bearing Case Assembly

1. Remove the screws 1 of the main bearing case (7). Then remove the main bearing case.
2. Remove other main bearing cases as above.

(When reassembling)

- Clean the oil channel in the main bearing case.
- Apply clean engine oil on the bearings.
- Align the numbers (1) and mark (2) on the main bearing case.
- When you install the main bearing case 1 and 2, point the mark **"FLYWHEEL"** to the flywheel.
- When you install the thrust bearing, point the oil groove (8) externally.
- Install the main bearing case assemblies in the initial positions. Since the diameters of the main bearing cases are different, install them in the sequence of their marks (A, B for 3 cylinders and A, B, C for 4 cylinders) on the gear case side.
- After you tighten the screw 1 of the main bearing case (7) to the specified torque, make sure that the main bearing case moves smoothly.

Tightening torque	Screw 1 of main bearing case	46 to 50 N·m 4.7 to 5.2 kgf·m 34 to 37 lbf·ft

(1) Alignment Number
(2) Alignment Mark
(3) A
(4) B
(5) C
(6) No Mark
(7) Screw 1 of Main Bearing Case
(8) Oil Groove

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INFORMATION

CONTENTS

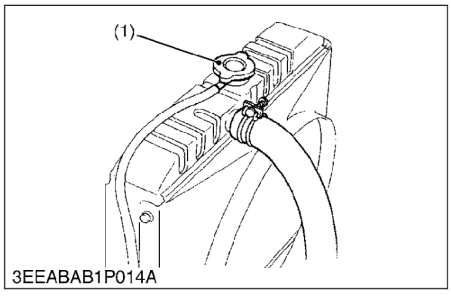
1. SAFETY FIRST I-1
2. SPECIFICATION I-4
3. DIMENSIONS I-15
4. WIRING DIAGRAM I-21

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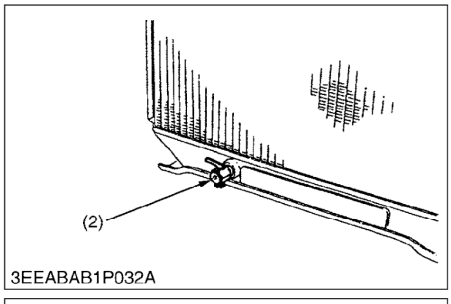
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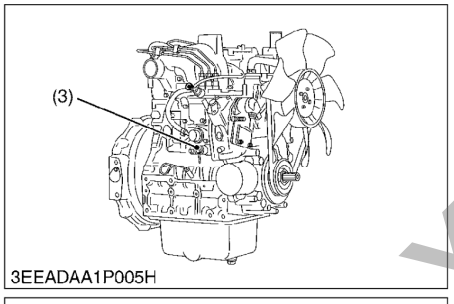
[8] CHECK POINTS FOR EVERY 500 HOURS



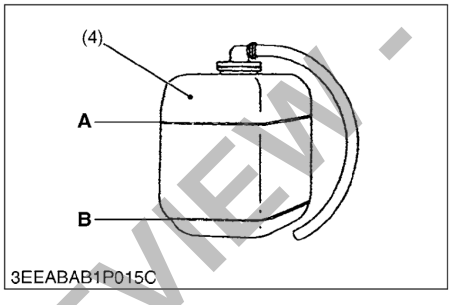
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3EEABAB1P032A



3EEADAA1P005H



3EEABAB1P015C

Cleaning of Water Jacket and Radiator Interior

CAUTION

- **Do not remove the radiator cap when the engine is hot. Then loosen the cap slightly to release unwanted pressure before you remove the cap fully.**

1. Stop the engine and let the coolant temperature decreases.
2. Remove the radiator cap (1) to drain the coolant fully.
3. Open the drain cock (2) and (3).
4. After you drained all coolant, close the drain cocks.
5. Fill with clean water and cooling system cleaner.
6. Obey the directions of the cleaner instruction.
7. After you flush, fill with clean water and anti-freeze until the coolant level is immediately below the port. Install the radiator cap (1) correctly.
8. Fill with the coolant until the "FULL" **A** mark on the recovery tank (4).
9. Start and operate the engine for a few minutes.
10. Stop the engine and let the coolant temperature decreases. Examine the coolant level of radiator and recovery tank (4) and add coolant if necessary.

■ **IMPORTANT**

- **Do not start the engine without coolant.**
- **Use clean and soft water with anti-freeze to fill the radiator and recovery tank.**
- **Make sure that when you mix the anti-freeze and water, the ratio of anti-freeze is less than 50 %.**
- **Make sure that you close the radiator cap correctly. If the cap is loose or incorrectly closed, coolant can flow out and the engine can overheat.**

(1) Radiator Cap
(2) Drain Cock
(3) Drain Cock
(4) Recovery Tank

A : FULL
B : LOW

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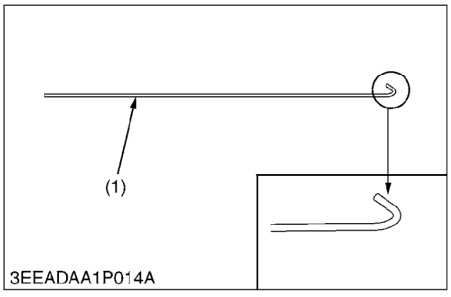
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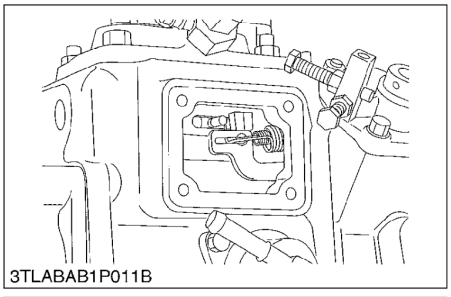
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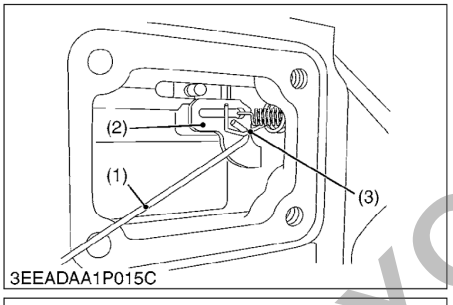
Item		Factory Specification	Allowable Limit
Valve Timing (Exhaust Valve) **[D1803-M-DI, V2403-M-DI]**	Open	0.72 rad (41 °) before B.D.C.	–
	Close	0.2 rad (9 °) after T.D.C.	–
Valve Timing (Exhaust Valve) **[V2003-M-T-BG]**	Open	0.96 rad (55 °) before B.D.C.	–
	Close	0.24 rad (14 °) after T.D.C.	–
Valve Spring	Free Length	41.7 to 42.2 mm 1.65 to 1.66 in.	41.2 mm 1.62 in.
	Setting Load / Setting Length	118 N / 35.0 mm 12.0 kgf / 35.0 mm 26.5 lbf / 1.38 in.	100 N / 35.0 mm 10.2 kgf / 35.0 mm 22.5 lbf /1.38 in.
	Tilt	–	1.0 mm 0.039 in.
Rocker Arm Shaft to Rocker Arm	Oil Clearance	0.016 to 0.045 mm 0.00063 to 0.0017 in.	0.10 mm 0.0039 in.
• Rocker Arm Shaft	O.D.	13.973 to 13.984 mm 0.55012 to 0.55055 in.	–
• Rocker Arm	I.D.	14.000 to 14.018 mm 0.55119 to 0.55188 in.	–
Push Rod	Bend	–	0.25 mm 0.0098 in.
Tappet to Tappet Guide	Oil Clearance	0.020 to 0.062 mm 0.00079 to 0.0024 in.	0.07 mm 0.003 in.
• Tappet	O.D.	23.959 to 23.980 mm 0.94327 to 0.94409 in.	–
• Tappet Guide	I.D.	24.000 to 24.021 mm 0.94489 to 0.94570 in.	–

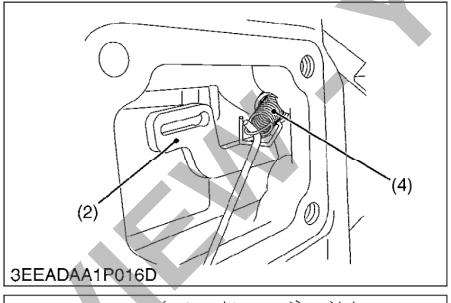
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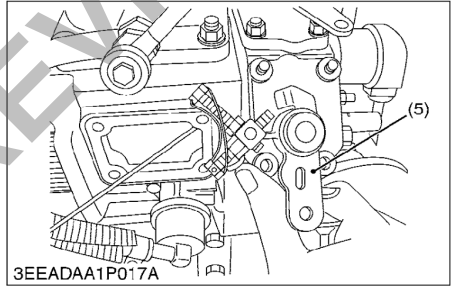
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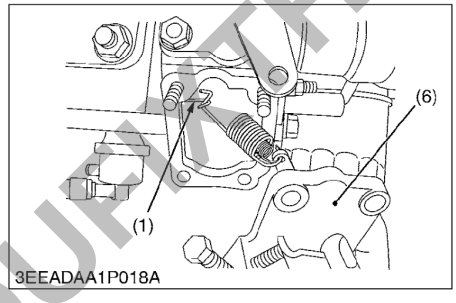


Governor Springs and Speed Control Plate

■ **NOTE**

- **Specified tool (1)**
  1.2 mm (0.047 in.) diameter hard wire with its end hooked, total length 200 mm (7.87 in.).
  The point of the wire is bent like a hook to hang the governor springs.

1. Remove the injection pump cover.
2. Remove the mounting nuts and bolts of the speed control plate (6).
3. Use the specific tool (1) to release the large governor spring (3) from the fork lever (2).
4. Use the specific tool (1) to release the small governor spring (4) from the fork lever (2).
5. Set the speed control lever (5) as you can see in the figure.
6. Remove the speed control plate (6). Do not let the large (3) and small (4) governor springs come off this plate and fall in the gear case.



(1) Specific Tool
(2) Fork Lever
(3) Large Governor Spring
(4) Small Governor Spring
(5) Speed Control Lever
(6) Speed Control Plate

(To be continued)

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