WSM

WORKSHOP MANUAL
DIESEL ENGINE

V1505-T-E4B

Kubota

KiSC issued 03, 2021 A

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INFORMATION

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1. SAFETY FIRST

⚠ SAFETY FIRST

- **This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully.**
- **It is essential that you read the instructions and safety regulations before you try to repair or use this unit.**

⚠ DANGER
- **Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

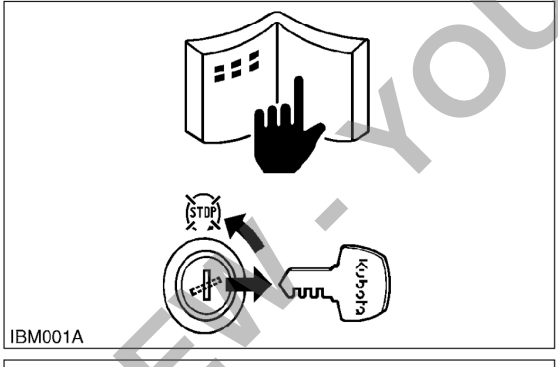
⚠ WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

⚠ CAUTION
- **Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.**

■ IMPORTANT
- **Indicates that equipment or property damage could result if instructions are not followed.**

■ NOTE
- **Gives helpful information.**

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IBM001A


IBM011A

BEFORE YOU START SERVICE

- Read all instructions and safety instructions in this manual and on your engine safety decals.
- Clean the work area and engine.
- Park the machine on a stable and level ground.
- Let the temperature of the engine decrease before you start a job.
- Stop the engine, then remove the key.
- Disconnect the battery negative cable.
- Hang a **"DO NOT OPERATE"** tag in the operator station.

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START SAFELY

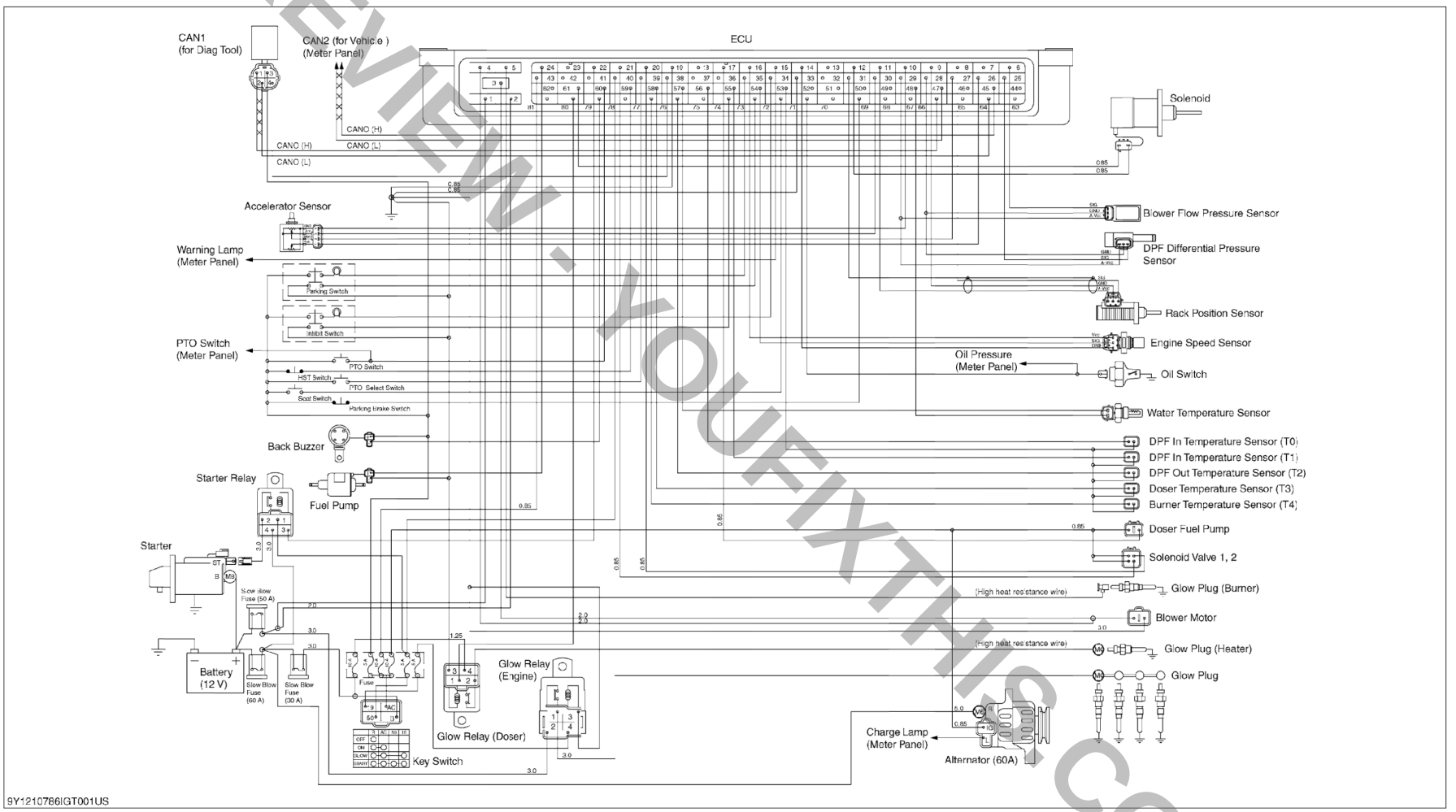
- Do not do the procedures below when you start the engine.
  - short across starter terminals
  - bypass the safety start switch
- Do not make unauthorized modifications to the engine. This can cause damage and decrease the engine life.

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5. WIRING DIAGRAM



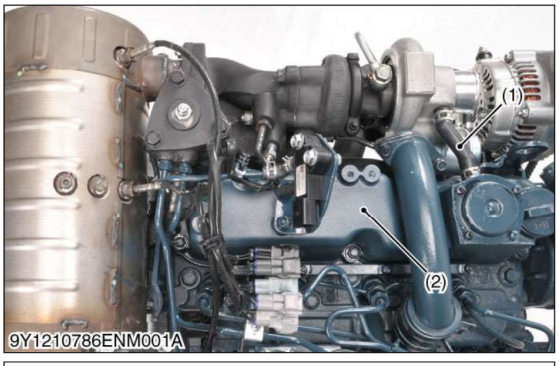
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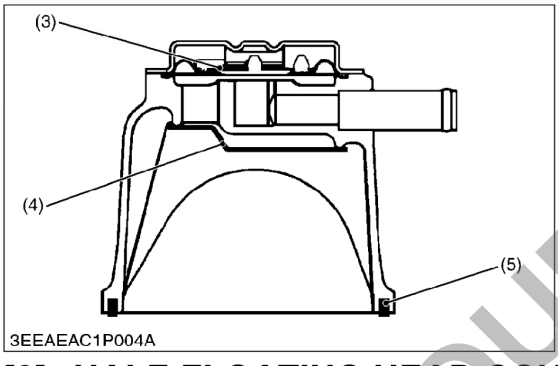
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1. ENGINE BODY

[1] CLOSED BREATHER





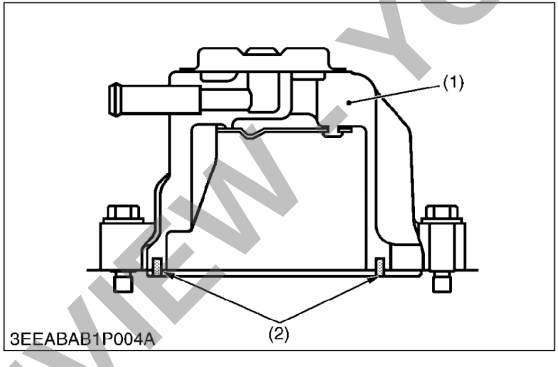
Closed breather system has been adopted to prevent the release of blow-by gas into the atmosphere.

After its oil content is filtered by oil shield (4), the blow by gas in fed back to the intake manifold through breather valve (3) to be used for re-combustion.

(1) Breather Hose
(2) Cylinder Head Cover
(3) Breather Valve
(4) Oil Shield
(5) Rubber Packing

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[2] HALF-FLOATING HEAD COVER



The rubber packing is fitted in to keep the cylinder head cover 0.5 mm (0.02 in.) or so off the cylinder head. This arrangement helps reduce noise coming from the cylinder head.

(1) Cylinder Head Cover
(2) Rubber Packing

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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 FOR GENERAL USE SCREWS, BOLTS AND NUTS

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

Indication on top of bolt	4 No-grade or 4T			7 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
M7	–	–	–	16 to 18	1.6 to 1.9	12 to 13
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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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	No fuel	Replenish fuel	G-12
	Air in the fuel system	Vent air	G-12
	Water in the fuel system	Change fuel and repair or replace fuel system	–
	Fuel pipe clogged	Clean or replace	G-12
	Fuel filter clogged	Replace	G-16
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	I-5, G-11
	Fuel with low cetane number	Use specified fuel	–
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	–
	Incorrect injection timing	Adjust	1-S19
	Fuel camshaft worn	Replace	1-S38
	Injection nozzle clogged	Clean or replace	1-S21, 1-S22
	Injection pump malfunctioning	Repair or replace	1-S20, 1-S37
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	1-S38, 1-S39, 1-S40, 1-S41, 1-S59, 1-S60, 1-S61, 1-S62, 1-S63, 1-S64
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S33, 1-S34, 1-S35
	Improper valve timing	Correct or replace timing gear	1-S38
	Piston ring and cylinder worn	Replace	1-S39, 1-S40, 1-S41
	Excessive valve clearance	Adjust	1-S15
	Solenoid malfunctioning	Replace	1-S26
	Rack sensor malfunctioning	Replace	1-S37
Starter Does Not Run	Battery discharged	Charge	–
	Starter malfunctioning	Repair or replace	1-S30, 1-S65, 1-S66, 1-S67
	Key switch malfunctioning	Replace	–
	Wiring disconnected	Connect	–

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2. SPECIFICATIONS

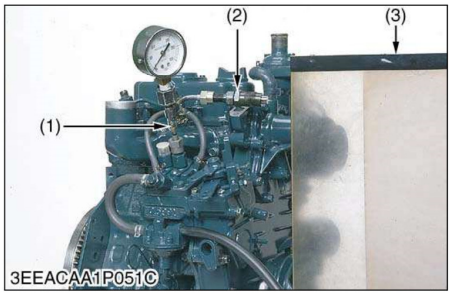
Model	V1505-T-E4B
Number of Cylinder	4
Engine Type	Vertical, water-cooled, 4-cycle diesel engine
Bore × Stroke	78.0 × 78.4 mm (3.07 × 3.09 in.)
Total Displacement	1498 cm^3 (91.41 cu.in.)
ISO Net Continuous	27.2 kW / 3000 min^{-1} (rpm) (36.4 HP / 3000 min^{-1} (rpm))
ISO/SAE Net Intermittent	31.3 kW / 3000 min^{-1} (rpm) (42.0 HP / 3000 min^{-1} (rpm))
SAE Gross Intermittent	33.0 kW / 3000 min^{-1} (rpm) (44.2 HP / 3000 min^{-1} (rpm))
Maximum Bare Speed	3200 min^{-1} (rpm)
Minimum Bare Idling Speed	1050 min^{-1} (rpm)
Combustion Chamber	Spherical type (E-TVCS)
Fuel Injection Pump	Bosch MD type mini pump
Governor	Electronic Governor
Direction of Rotation	Counter-clockwise (viewed from flywheel side)
Injection Nozzle	Mini Nozzle (DNOPD)
Injection Timing	0.3316 rad (19.00°) before T.D.C.
Firing Order	1-3-4-2
Injection Pressure	15.0 MPa (153 kgf/cm^2, 2180 psi)
Compression Ratio	23 : 1
Lubricating System	Forced lubrication by trochoid pump
Oil Pressure Indicating	Electrical type switch
Lubricating Filter	Full flow paper filter (Cartridge type)
Cooling System	Pressurized radiator, forced circulation with water pump
Starting System	Electric Starting with Starter
Starter Motor	12 V, 1.2 kW
Starting Support Device	By glow plug in combustion chamber
EGR	None
Battery	12 V, 75 AH, equivalent
Charging Alternator	12 V, 720 W
Fuel	Diesel Fuel No.2-D (ASTM D975)
Lubricating Oil	Class CJ-4 or CK-4 lubricating oil as per API classification is recommended. For details on recommended lubricating oils, see page G-7, G-11.
Lubricating Oil Capacity	6.7 L (1.8 U.S.gals)
Weight (Dry)	155 kg (342 lbs)

- The specification described above is of the standard engine of each model.
- Conversion Formula: HP = 0.746 kW, PS = 0.7355 kW

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Checking Injection Pump

(Fuel Tightness of Pump Element)

1. Remove the solenoid.
2. Remove the injection pipes and glow plugs.
3. Install the injection pump pressure tester to the injection pump.
4. Install the injection nozzle (2) jetted with the proper injection pressure to the injection pump pressure tester (1). (Refer to the photo.)
5. Run the starter to increase the pressure.
6. If the pressure can not reach the allowable limit, replace the pump with new one or repair with a Kubota-authorized pump service shop.

(Fuel Tightness of Delivery Valve)

1. Remove the solenoid.
2. Remove the injection pipes and glow plugs.
3. Set a pressure tester to the fuel injection pump.
4. Install the injection nozzle (2) jetted with the proper injection pressure to the injection pump pressure tester (1).
5. Run the starter to increase the pressure.
6. Stop the starter when the fuel jets from the injection nozzle. After that, turn the flywheel by the hand and raise the pressure to approx. 13.73 MPa (140.0 kgf/cm^2, 1991 psi).
7. Now turn the flywheel back about half a turn (to keep the plunger free). Maintain the flywheel at this position and clock the time taken for the pressure to drop from 13.73 to 12.75 MPa (from 140.0 to 130.0 kgf/cm^2, from 1991 to 1849 psi).
8. Measure the time needed to decrease the pressure from 13.73 to 12.75 MPa (140.0 to 130.0 kgf/cm^2, 1991 to 1849 psi).
9. If the measurement is less than allowable limit, replace the pump with new one or repair with a Kubota-authorized pump service shop.

Fuel tightness of pump element	Allowable limit	13.73 MPa 140.0 kgf/cm^2 1991 psi
Fuel tightness of delivery valve	Factory specification	10 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm^2 1991 → 1849 psi
	Allowable limit	5 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm^2 1991 → 1849 psi

■ **NOTE**

- **Never try to disassemble the injection pump assembly. For repairs, you are strongly requested to contact a Kubotaauthorized pump service shop.**

(1) Injection Pump Pressure Tester
(2) Injection Nozzle
(3) Protection Cover for Jetted Fuel

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CAUTION

- **Check the nozzle injection pressure and condition after you make sure that there is nobody standing in the direction the fume goes. If the fume from the nozzle directly contacts the human body, cells may be destroyed and blood poisoning may be caused.**

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2. SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Valve Clearance (Cold)		0.145 to 0.185 mm 0.00571 to 0.00728 in.	–
Compression Pressure	V1505-T-E4B	3.14 to 3.53 MPa 32.0 to 36.0 kgf/cm^2 456 to 512 psi	2.26 MPa 23.0 kgf/cm^2 327 psi
• Difference among Cylinders		–	10 % or less
Top Clearance	V1505-T-E4B	0.55 to 0.75 mm 0.022 to 0.029 in.	–
Cylinder Head Surface	Flatness	–	0.05 mm 0.002 in.
Valve Recessing	Intake and Exhaust	−0.050 to 0.25 mm −0.0020 to 0.0098 in.	0.40 mm 0.016 in.
Valve Stem to Valve Guide	Clearance	0.035 to 0.065 mm 0.0014 to 0.0025 in.	0.10 mm 0.0039 in.
• Valve Stem	O.D.	6.960 to 6.975 mm 0.2741 to 0.2746 in.	–
• Valve Guide	I.D.	7.010 to 7.025 mm 0.2760 to 0.2765 in.	–
Valve Face	Angle (Intake)	1.0 rad 60°	–
	Angle (Exhaust)	0.79 rad 45°	–
Valve Seat	Angle (Intake)	1.0 rad 60°	–
	Angle (Exhaust)	0.79 rad 45°	–
	Width	2.12 mm 0.0835 in.	–
Valve Spring	Free Length	35.1 to 35.6 mm 1.39 to 1.40 in.	34.8 mm 1.37 in.
	Tilt	–	1.3 mm 0.051 in.
	Setting Load	74 N / 31.0 mm 7.5 kgf / 31.0 mm 17 lbf / 1.22 in.	63 N / 31.0 mm 6.4 kgf / 31.0 mm 14 lbf / 1.22 in.
Rocker Arm Shaft to Rocker Arm	Clearance	0.016 to 0.045 mm 0.00063 to 0.0017 in.	0.10 mm 0.0039 in.
• Rocker Arm Shaft	O.D.	11.973 to 11.984 mm 0.47138 to 0.47181 in.	–
• Rocker Arm	I.D.	12.000 to 12.018 mm 0.47244 to 0.47314 in.	–

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4. MAINTENANCE CHECK LIST

To make sure that the engine operates safely for a long time, refer to the table below to do regular inspections.

	Item	Service Interval										
		Every										
		50 hrs	100 hrs	200 hrs	400 hrs	500 hrs	1 or 2 months	1 year	1000 hrs	1500 hrs	3000 hrs	2 years
*	Checking fuel hoses and clamp bands	☆										
*	Changing engine oil	★		☆								
*	Cleaning air cleaner element (Replace the element after 6 times cleaning)		☆									
	Cleaning fuel filter element		☆									
	Check fan belt tension and damage		☆									
	Checking battery electrolyte level		☆									
*	Replacing oil filter cartridge	★			☆							
	Checking radiator hoses and clamp bands			☆								
*	Checking intake air line			☆								
	Replacing fuel filter cartridge				☆							
	Cleaning water jacket and radiator interior					☆						
	Replacing fan belt					☆						
	Recharging battery						☆					
*	Replacing air cleaner element							☆				
	Checking rubber hose of differential pressure sensor							☆				
*	Checking intake air line							☆				
	Checking exhaust manifold							☆				
	Checking wiring harness							☆				
	Checking valve clearance								☆			
*	Checking injection nozzle pressure									☆		
*	Checking turbocharger										☆	
	Checking injection pump										☆	
*	Replacing intake air line											☆
	Replacing battery											☆
	Replacing radiator hoses and clamp bands											☆
*	Replacing fuel hoses and clamps											☆
	Changing radiator coolant (L.L.C.)											☆
	Replacing breather hose											☆
	Replacing rubber hose of differential pressure sensor											☆
	Replacing water hose											☆
	Replacing fan belt											☆

★ Change engine oil and replace oil filter cartridge after the first 50 hours of operation.

* The items listed above (* marked) are registered as emission related critical parts by KUBOTA in the U.S. EPA nonroad emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the above instruction.

Please see the emission Warranty Statement in detail.

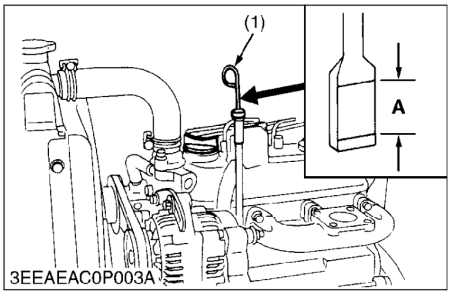
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5. CHECK AND MAINTENANCE

[1] DAILY CHECK POINTS



Checking Engine Oil Level

1. Level the engine.
2. To check the oil level, draw out the dipstick (1), wipe it clean, reinsert it, and draw it out again.
   Check to see that the oil level lies **"A"** between the two notches.
3. If the level is too low, add new oil to the specified level.

■ **IMPORTANT**

- **When using an oil of different maker or viscosity from the previous, drain old oil. Never mix two different types of oil.**

■ **NOTE**

- **Be sure to inspect the engine, locating it on a horizontal place. If set on gradients, accurately, oil quantity may not be measured.**
- **Be sure to keep the oil level between upper and lower limits of the dipstick. Too much oil may cause a drop in output or excessive blow-by gas. On the closed breather type engine in which mist is sucked through port, too much oil may caused oil hammer. While too little oil, may seize the engine's rotating and sliding parts.**

(1) Dipstick **A: Oil Level**

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