WSM

WORKSHOP MANUAL
DIESEL ENGINE

EA330-E3 SERIES

Kubota

KiSC issued 07, 2011 A

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INFORMATION

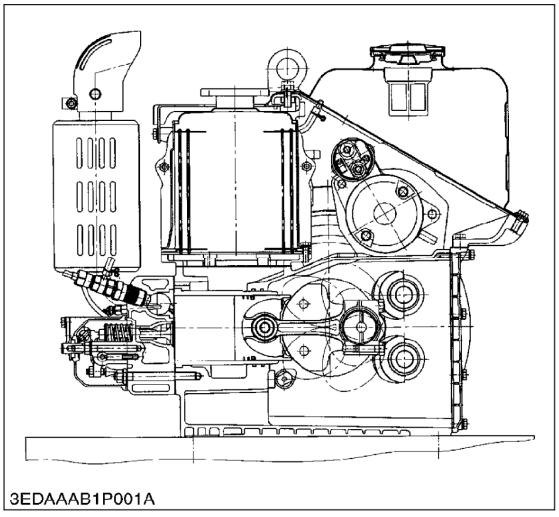
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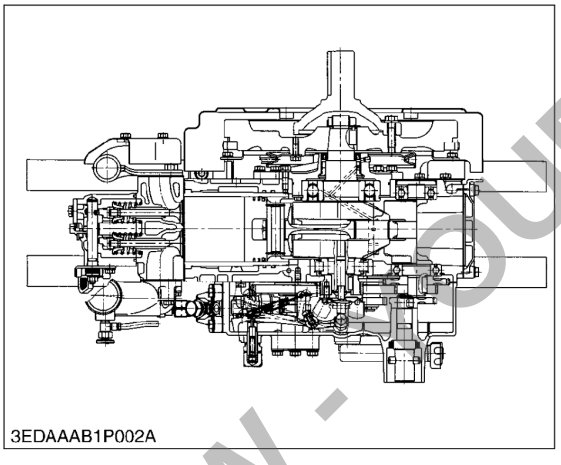
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1. FEATURE



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■ **NOTE**

- **Figure shows EA330 engine**

The EA330-E3 series engines are horizontal, water-cooled 4-cycle diesel engine.

They are incorporated KUBOTA's foremost technologies.

With KUBOTA's exclusive E-TVCS (Three Vortex Combustion System) combustion chamber and 2-shaft dynamic balances, well-known Bosch M type injection pump, they give greater power, low fuel consumption, little vibration and quiet operation.

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3. TIGHTENING TORQUES

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

Screw, bolts and nuts must be tightened to the specified torque using a torque wrench.

Several bolts and nuts such as ones used on the cylinder head must be tightened in proper sequence and to the proper torque.

Item	Size × Pitch	N·m	kgf·m	lbf·ft
Cylinder head (Stud)	M9 × 1.25	25 to 29	2.5 to 3.0	18 to 21
**Cylinder head (Nut)	M9 × 1.25	57 to 61	5.8 to 6.3	42 to 45
**Connecting rod screw	M7 × 0.75	27 to 30	2.7 to 3.1	20 to 22
**Flywheel nut	M20 × 1.5	197 to 215	20.0 to 22.0	145 to 159
Main bearing case mounting screw / nut	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Crankcase cover mounting screw	M6 × 1.0	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8
Gear case mounting screw	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Idle gear shaft screw	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Head cover mounting nut	M7 × 1.0	9.8 to 10	1.0 to 1.1	7.3 to 7.9
**Rocker arm bracket mounting nut	M7 × 1.0	17 to 20	1.7 to 2.1	13 to 15
Oil signal holder	PT 1/8	15 to 19	1.5 to 2.0	11 to 14
Oil signal / Oil Switch	PT 1/8	6.9 to 9.8	0.70 to 1.0	5.1 to 7.2
Oil strainer	M20 ×x 1.5	25 to 34	2.5 to 3.5	18 to 25
Injection pump mounting screw	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Nozzle holder Assembly	M20 × 1.5	49 to 68	5.0 to 7.0	37 to 50
Nozzle holder	–	35 to 39	3.5 to 4.0	26 to 28
Over flow eye joint pipe mounting nut	M12 × 1.5	20 to 24	2.0 to 2.5	15 to 18
Muffler mounting nut	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
Tension pulley pivot screw	M8 × 1.25	20 to 23	2.0 to 2.4	15 to 17
Injection pipe retaining nut	M12 × 1.5	25 to 34	2.5 to 3.5	18 to 25
Injection pump eye joint bolt	M12 × 1.5	25 to 29	2.5 to 3.0	18 to 21
Glow plug	M8 × 1.0	7.9 to 14	0.80 to 1.5	5.8 to 10
Glow plug terminal nut	M4 × 0.7	0.98 to 1.7	0.10 to 0.18	0.73 to 1.3
Radiator mounting screw / nut	M6 × 1.0	5.9 to 7.8	0.60 to 0.80	4.4 to 5.7

■ **NOTE**

- **For "**" marked screws and nuts on the table, apply engine oil to their threads and seats before tightening.**

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	No fuel	Replenish fuel	–
	Air in the fuel system	Vent air	–
	Water in the fuel system	Replace fuel and repair or replace fuel system	G-9, 1-M16
	Fuel hose clogged	Clean	–
	Fuel filter clogged	Clean	G-9
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	I-4, G-6
	Fuel with low cetane number	Use the specified fuel	I-4, G-6
	Fuel leak due to loose injection pipe retaining nut	Tighten nut	1-S26
	Incorrect injection timing	Adjust	1-S19
	Fuel camshaft worn	Replace	1-S32
	Injection nozzle clogged	Clean	1-S21, 1-S27
	Injection pump malfunctioning	Replace	1-S19, 1-S20, 1-S31
	Seizure of crankshaft, camshaft, piston, cylinder liner or bearing	Repair or replace	–
	Compression leak	Replace head gasket, tighten cylinder head screw, glow plug, nozzle holder and correct valve seat	1-S13, 1-S27, 1-S28, 1-S29, 1-S46
	Deficient compression	Check top clearance, correct valve recessing, piston ring and cylinder	1-S13, 1-S15, 1-S45, 1-S46, 1-S52, 1-S59
	Improper valve seat alignment, valve spring broken, valve seized	Repair or replace	1-S29, 1-S45, 1-S46
	Improper valve timing	Correct or replace timing gear	1-M5, 1-S33
	Piston ring and cylinder worn	Replace	1-S52, 1-S59
	Excessive valve clearance	Adjust	1-S14

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2. SPECIFICATIONS

Model		EA330-E3-NB1	EA330-E3-NB1-APU-1	EA330-E3-NB1-APU-2
Type		Horizontal, water-cooled, 4-cycle diesel engine		
Number of Cylinder		1		
Bore × Stroke		77.0 mm × 70.0 mm (3.03 in × 2.76 in.)		
Displacement		325 cc (19.8 cu.in.)		
Brake Horsepower	SAE Intermittent	5.15 kW (6.9 HP) / 3000 min^{-1} (rpm)		5.76 kW (7.7 HP) / 3000 min^{-1} (rpm)
	SAE Continuous	4.4 kW (5.9 HP) / 3000 min^{-1} (rpm)		4.8 kW (6.4 HP) / 3000 min^{-1} (rpm)
Cooling System		Radiator		–
Combustion System		Spherical type (TVCS)		
Injection Timing		0.445 rad (25.5 °) Before T.D.C.		
Fuel		No. 2-D S500 or S15, See page G-6		
Lubricating oil		Class CF lubricating oil as per API classification is recommended. For details on recommended lubricating oils. (see page G-6)		
Lubricating System		Forced Lubrication with Trochoid Pump		
Starting System		Electric Start (12V, 0.8 kW)		
Direction of Revolution		Counter-clockwise (Viewed from flywheel side)		
EGR		None		
Cooling Water Capacity		1.2 L (0.32 U.S.gals)		–
Fuel Tank Capacity		4.8 L (1.3 U.S.gals)	–	
Engine Oil Capacity		1.3 L (0.34 U.S.gals)		
Dry Weight		54.0 kg (119 lbs)	43.0 kg (94.8 lbs)	39.0 kg (86.0 lbs)

*Conversion Formula : HP=0.746 kW, PS=0.7355 kW

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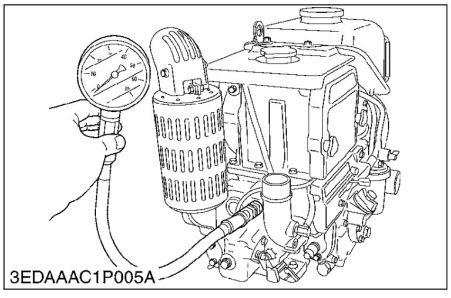
4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

(1) Engine Body



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Compression Pressure

1. Run the engine until warm up.
2. Stop the engine and remove the air cleaner and nozzle holder.
3. Attach a compression tester (Code No. 07909-30204) to the adapter **B** or **H**.
4. After making sure that the speed control lever (1) is set at the stop position (Non-injection), run the flywheel at 320 to 440 min^{-1} (rpm) with starter and read constant maximum on the tester. Execute the test at least twice. (Run the engine the for 5 to 10 seconds for each test.)

■ **NOTE**

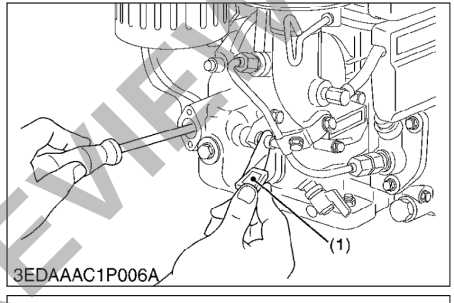
- **Measure specific gravity of the battery electrolyte and ensure that the battery is fully charged.**
- **Compression occurs every second approximately when the engine speed is 320 to 440 min^{-1} (rpm). Try to learn this "feeling" and ensure that the engine is running at this speed range when measuring compression.**

5. If the pressure does not reach the allowable limit, apply a small amount of oil to the cylinder wall through the nozzle holder hole and measure the pressure again.
6. If the pressure raises after applying oil, check the cylinder wall and piston rings.
7. If the pressure is still low, check the top clearance, valve clearance, cylinder head and piston rings.

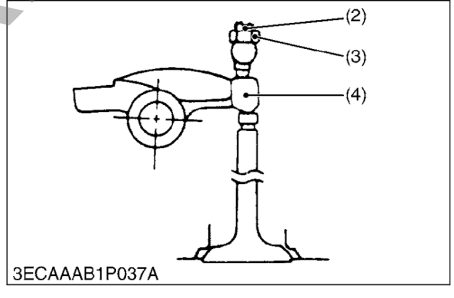
Compression Pressure	Factory specification	3.48 MPa 35.5 kgf/cm^2 505 psi
	Allowable limit	2.60 MPa 26.5 kgf/cm^2 377 psi

(1) Speed Control Lever

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Decompression Device

1. Align the **T** mark on the flywheel to the mark on the fan cover at the top dead center in the compression stroke.
2. Remove the decompression cover from the cylinder head cover.
3. Pull the decompression lever (1) to the operating position.
4. Loosen the lock nut (3) and screw (2) until it contacts the rocker arm (4).
5. From the position where the adjusting screw contacts the rocker arm, further screw in the adjusting screw by one and a half turns (9.42 ± 1.56 rad, 540 ± 90 °).
6. Tighten the lock nut.
7. After adjustment, make sure that the piston does not push up the valve when slightly turning the flywheel with the decompression lever.

Decompression device	Factory specification	0.940 to 1.31 mm 0.0370 to 0.0515 in.

(Adjusting screw pitch: 0.75 mm (0.030 in.))

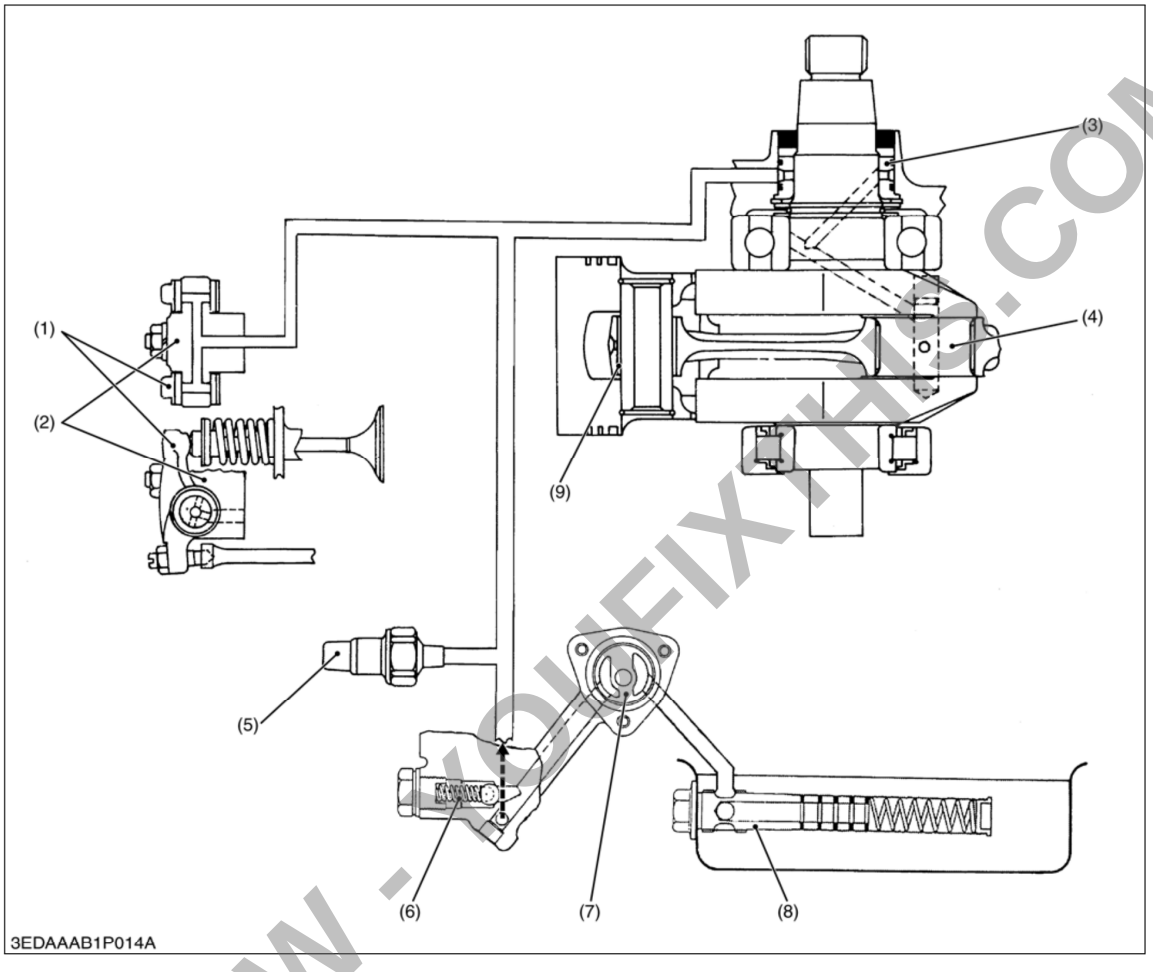
(1) Decompression Lever
(2) Decompression Adjusting Screw
(3) Lock Nut
(4) Rocker Arm

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3. LUBRICATING SYSTEM

[1] GENERAL



(1) Rocker Arm
(2) Rocker Arm Bracket
(3) Oil Filler Ring
(4) Crank Pin Portion
(5) Oil Signal
(6) Relief Valve
(7) Trochoid Pump
(8) Oil Strainer
(9) Piston Pin Bushing

Lubrication is forced on with a trochoid pump.

Lubrication oil is sucked in by the trochoid pump (7) via an oil strainer (8) mounted on the side of the gear case. The pressure of lubricating oil discharged from the trochoid pump is regulated by a relief valve (6) to 200 to 390 kPa (2.0 to 4.0 kgf/cm^2, 29 to 56 psi) (at the rated revolution speed of the engine), and the pressure-regulated oil is then fed to various portions through the oil gallery in the cylinder block.

Lubricating oil sent to the oil gallery in the crankshaft lubricates the crank pin portion (4).

Oil sent to the cylinder head via the oil gallery in the cylinder block lubricates rocker arms (1) via a rocker arm bracket (2).

Other items such as the piston, piston pin bushing (9), cam shaft journal portion, tappet, timing gear and bearings are lubricated by splash of the crankshaft, etc.

An oil signal (5) is provided to enable the judgement whether the oil pressure is 50 kPa (0.5 kgf/cm^2, 7 psi) or more.

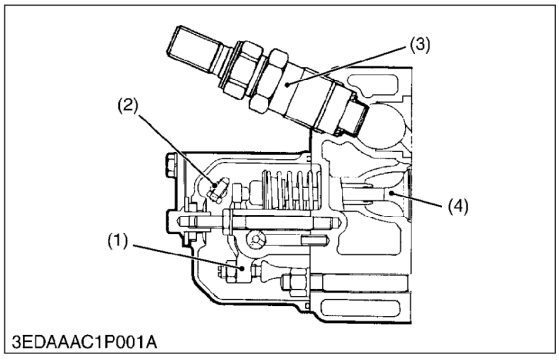
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2. ENGINE BODY

[1] CYLINDER HEAD



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As the cylinder head is subjected to high temperature and high pressure, it is made of special alloy iron.

The cylinder head is installed on top of the cylinder block, it houses the intake and exhaust valves (4), rocker arm (1), injection nozzle (3), and others.

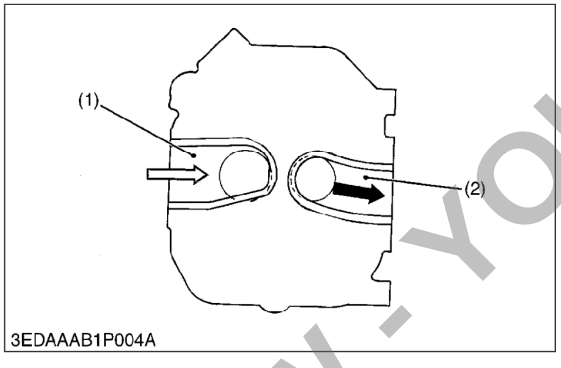
It is also equipped with a decompressor to reduce compression in the cylinder so the crankshaft rotates with less force for staring.

The area of the cylinder head that faces the piston head and forms the combustion chamber has the intake and exhaust holes and nozzle hole. In the other area, a lubricating oil gallery, cooling water gallery, screw hole, and others are machined symmetrically with the cylinder block.

The EA330-E3 engine is equipped with the glow plug for easy starting even in cold weather.

(1) Rocker Arm
(2) Decompression Shaft
(3) Injection Nozzle
(4) Valve

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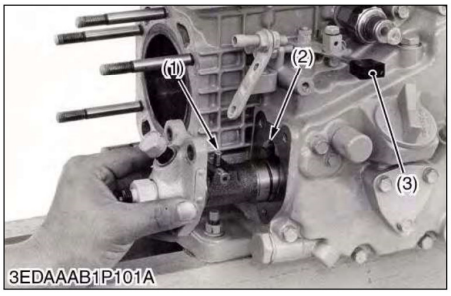
The intake port (1) and exhaust port (2) are cross flow type which open respectively at both sides of the cylinder head. In this cylinder head, less exhaust heat is hardly conducted to the intake port, so that high density air is always inhaled into the cylinder for stable combustion.

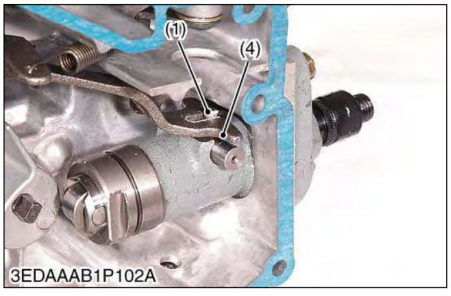
(1) Intake Port
(2) Exhaust Port

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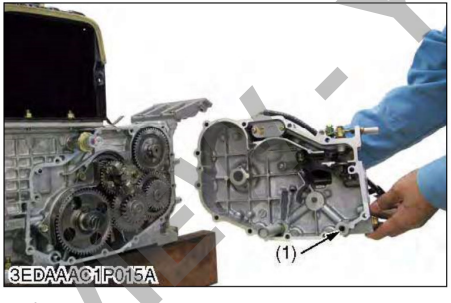
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Injection Pump

1. Remove the injection pump mounting screws.
2. Move the speed control lever (3) and align the control rack pin (1) and notch (2) on the gear case to remove the injection pump.

■ **NOTE**

- **Record the number of injection timing adjusting shims used to adjust the injection timing.**

(When reassembling)

- Apply a thin coat of liquid gasket (Three bond 1215 or equivalent) to the shim.

■ **IMPORTANT**

- **Insert the same number of shims as used before, install the pump and then check the injection timing.**
- **Correctly fit the control rack pin (1) into the groove of the governor lever (4).**

Tightening torque	Injection pump mounting screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft

(1) Control Rack Pin
(2) Notch
(3) Speed Control Lever
(4) Governor Lever

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Oil Pump Cover and Oil Pump (If necessary)

1. Remove the oil pump cover.
2. Remove the gear case.
3. Push out the inner rotor shaft from inside of the gear case.

(When reassembling)

- Apply engine oil in each section (gear case oil pump body, inner rotor shaft, inner rotor, outer rotor.).

■ **NOTE**

- **After installing the gear case to the cylinder block, be sure to fit the inner rotor shaft into the camshaft end groove.**

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Gear Case

1. Remove the gear case.

(When reassembling)

- Dismount the inner rotor shaft of oil pump beforehand.
- Replace the O-ring (1) of the oil gallery connection with a new one.
- Coat the gear case gasket with grease, and take case to avoid any misalignment of the new O-ring or screw holes.

Tightening torque	Gear case mounting screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft

(1) O-ring

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