WSM

WORKSHOP MANUAL
DIESEL ENGINE

V3-E3B SERIES,
V3-E3CB SERIES,
V3-E3BG SERIES

Kubota

KiSC issued 12, 2020 A

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GENERAL

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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 attempt to repair or use this unit.

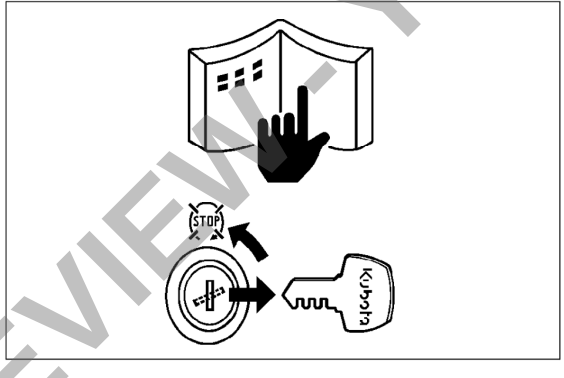
DANGER : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

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, may result in minor or moderate injury.

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

■ NOTE : Gives helpful information.



BEFORE SERVICING AND REPAIRING

- 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 firm and level ground.
- Allow the engine to cool before proceeding.
- Stop the engine, and remove the key.
- Disconnect the battery negative cable.
- Hang a "**DO NOT OPERATE**" tag in operator station.

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SPECIFICATIONS

Model	V3600-E3B	V3600-E3CB	V3600-T-E3B	V3600-T-E3CB	V3800DI-T-E3B	V3800DI-T-E3CB
Number of Cylinder	4					
Type	Vertical, water-cooled, 4-cycle diesel engine					
Bore × Stroke	98 × 120 mm (3.86 × 4.72 in.)				100 × 120 mm (3.94 × 4.72 in.)	
Total Displacement	3620 cm^3 (220.9 cu.in.)				3769 cm^3 (230.0 cu.in.)	
ISO Net Continuous	40.2 kW / 2600 min^{-1} (rpm) (53.9 HP / 2600 min^{-1} (rpm))		51.5 kW / 2600 min^{-1} (rpm) (69.0 HP / 2600 min^{-1} (rpm))		60.9 kW / 2600 min^{-1} (rpm) (81.6 HP / 2600 min^{-1} (rpm))	
ISO / SAE Net Intermittent	46.3 kW / 2600 min^{-1} (rpm) (62.1 HP / 2600 min^{-1} (rpm))		59.3 kW / 2600 min^{-1} (rpm) (79.5 HP / 2600 min^{-1} (rpm))		70.1 kW / 2600 min^{-1} (rpm) (94.0 HP / 2600 min^{-1} (rpm))	
SAE Gross Intermittent	49.8 kW / 2600 min^{-1} (rpm) (66.8 HP / 2600 min^{-1} (rpm))		63.0 kW / 2600 min^{-1} (rpm) (84.5 HP / 2600 min^{-1} (rpm))		74.0 kW / 2600 min^{-1} (rpm) (99.2 HP / 2600 min^{-1} (rpm))	
Maximum Bare Speed	2800 min^{-1} (rpm)					
Minimum Bare Idling Speed	775 to 825 min^{-1} (rpm)					
Combustion Chamber	Spherical Type (E-TVCS)				Reentrant Type, Center Direct Injection Type (E-CDIS)	
Fuel Injection Pump	Bosch Type Mini Pump					
Governor	All speed mechanical governor					
Direction of Rotation	Counter-clockwise (Viewed from flywheel side)					
Injection Nozzle	BOSCH Throttle Type				Bosch P Type	
Injection Timing	0.14 rad (8.0 °) before T.D.C.		0.070 rad (4.0 °) before T.D.C.		0.10 rad (6.0 °) before T.D.C.	
Firing Order	1-3-4-2					
Injection Pressure	13.73 MPa (140.0 kgf/cm^2, 1991 psi)				1st stage 18.63 MPa (190.0 kgf/cm^2, 2702 psi), 2nd stage 23.54 MPa (240.0 kgf/cm^2, 3414 psi),	
Compression Ratio	22.6		21.8		19.0	
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					
Starting Motor	12 V, 3.0 kW					
Starting Support Device	By Glow Plug in Combustion Chamber				Intake Air Heater in Intake Manifold	
EGR	NONE		Internal EGR (2 stage Exhaust Cam)		External EGR (EGR Cooler + Mechanical EGR Valve + Reed Valve)	
Battery	12 V, 136 AH equivalent					
Charging Alternator	12 V, 540 W					
Fuel	Diesel Fuel No. 2-D S500 or S15, see page G-8.					
Lubricating Oil	Class CF lubricating oil as per API classification is recommended. For details on recommended lubricating oils, see page G-8.					
Lubricating Oil Capacity	13.2 L (3.49 U.S.gals)					
Weight (Dry)	264 kg (582 lbs)	245 kg (540 lbs)	275 kg (606 lbs)	252 kg (556 lbs)	288 kg (635 lbs)	281 kg (619 lbs)

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

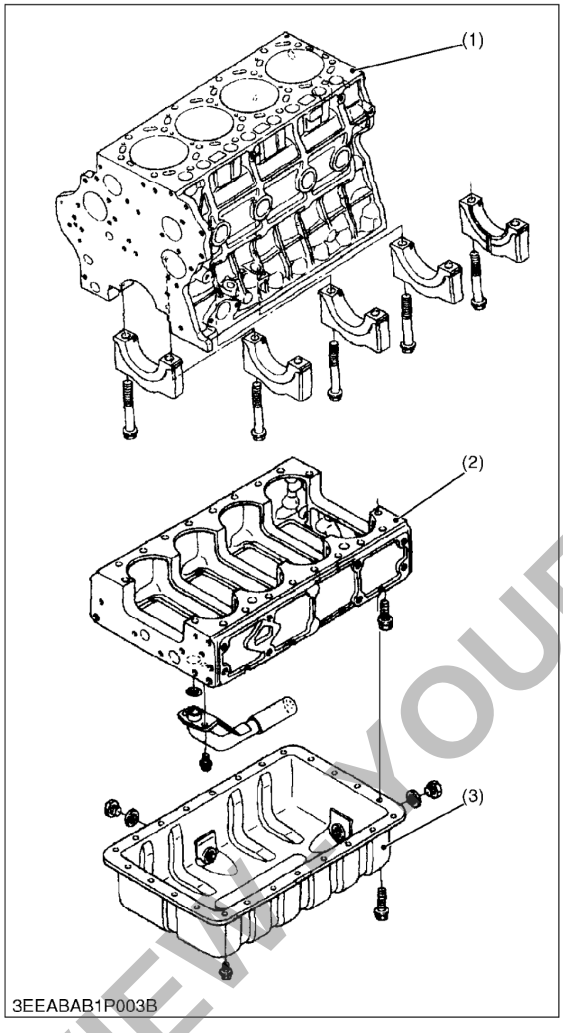
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2. ENGINE BODY

[1] CYLINDER BLOCK



This engine employs separate type crankcases - the crankcase 1 (1) with combustion part and the crankcase 2 (2) which supports the crankcase 1 (1) and reduces noise.

Since it is a hanger type, you can easily assemble / disassemble it. The cylinder is a linerless type which enables good cooling operation, less strain and good abrasion resistance.

(1) Crankcase 1
(2) Crankcase 2
(3) Oil Pan

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3. TIGHTENING TORQUES

Screws, bolts and nuts must be tightened to the specified torque using a torque wrench, several screws, bolts and nuts such as those used on the cylinder head must be tightened in proper sequence and the proper torque.

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

When the tightening torques are not specified, tighten the screws, bolts and nuts according to the table below.

Grade / Nominal Diameter / Unit	Standard Screw and Bolt ④			Special Screw and Bolt ⑦		
	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	48 to 55	4.9 to 5.7	36 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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Screw and bolt material grades are shown by numbers punched on the screw and bolt heads. Prior to tightening, be sure to check out the numbers as shown below.

Punched number	Screw and bolt material grade
None or 4	Standard screw and bolt SS41, S20C
7	Special screw and bolt S43C, S48C (Refined)

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[2] ELECTRONIC GOVERNOR (FACTORY OPTION FOR V3300-E3BG, V3600-T-E3BG / STANDARD FOR V3800DI-T-E3BG)

■ **IMPORTANT**

- **The engine trouble divides into an electronic governor, the main body of the engine, and the operating constancy.**

Engine will not start.

Cause	Corrections	Refer to Checking
Starter Operating but Not Starting the Engine	Check operation of the solenoid	Solenoid
	Check harness of the solenoid	Solenoid
	Check harness of the glow plug / Intake air heater	Glow plug / Intake air heater
Starter Does Not Operate	Check emergency stop switch	Emergency stop switch

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Engine stopped automatically. Engine can be started again and stops again 10 seconds later.

Cause	Corrections	Refer to Checking
Trouble in the electronic governor composition parts	Check blinking pattern of the glow lamp (1)  	Signal pattern sheet (1) Glow Lamp

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Engine speed cannot be controlled.

Cause	Corrections	Refer to Checking
Engine speed does not increase/ decrease	Check slow down switch	Slow down switch
	Check speed switch	Speed switch
	Check operation of the solenoid	Solenoid
	Check harness of speed sensor	Harness
Engine runs rough	Check operation of the solenoid	Solenoid
	Check harness of speed sensor	Harness

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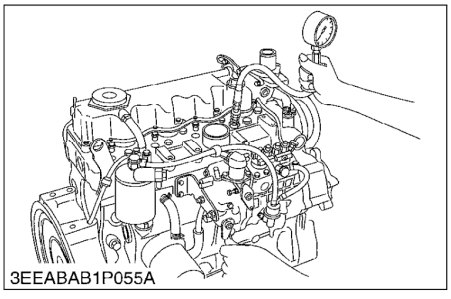
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4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

(1) Engine Body


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Compression Pressure

[V3600-E3B, V3600-T-E3B, V3600-E3CB, V3600-T-E3CB, V3300-E3BG, V3600-T-E3BG]

1. After warming up the engine, stop it and remove the air cleaner, the muffler and all nozzle holders / all glow plugs.
2. Install a compression tester for diesel engines to nozzle holder hole / glow plug hole.
3. After making sure that the stop lever is set at the stop position (Non-injection), run the engine at 200 to 300 min^{-1} (rpm) with the starter.
4. Read the maximum pressure. Measure the pressure more than twice.
5. If the measurement is below the allowable limit, apply a small amount of oil to the cylinder wall through the nozzle hole / the glow plug hole and measure the compression pressure again.
6. If the compression pressure increase after applying oil. check the cylinder wall and piston rings.
7. If the compression pressure is still less than the allowable limit, check the top clearance, valve and cylinder head.

■ **NOTE**

- **Check the compression pressure with the specified valve clearance.**
- **Always use a fully charged battery for performing this test.**
- **Variances in cylinder compression values should be under 10 %.**

Compression pressure	Factory spec.	V3600-E3B, V3600-E3CB, V3300-E3BG	4.31 MPa / 250 min^{-1} (rpm) 44.0 kgf/cm^2 / 250 min^{-1} (rpm) 626 psi / 250 min^{-1} (rpm)
		V3600-T-E3B, V3600-T-E3CB, V3600-T-E3BG	3.92 MPa / 250 min^{-1} (rpm) 40.0 kgf/cm^2 / 250 min^{-1} (rpm) 569 psi / 250 min^{-1} (rpm)
	Allowable limit	V3600-E3B, V3600-E3CB, V3300-E3BG	3.26 MPa / 250 min^{-1} (rpm) 33.2kgf/cm^2 / 250 min^{-1} (rpm) 472 psi / 250 min^{-1} (rpm)
		V3600-T-E3B, V3600-T-E3CB, V3600-T-E3BG	2.99 MPa / 250 min^{-1} (rpm) 30.5 kgf/cm^2 / 250 min^{-1} (rpm) 434 psi / 250 min^{-1} (rpm)

Tightening torque	Nozzle holder assembly	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft
	Overflow pipe assembly retaining nut	20 to 24 N·m 2.0 to 2.5 kgf·m 15 to 18 lbf·ft
	Injection pipe retaining nut	23 to 36 N·m 2.3 to 3.7 kgf·m 17 to 26 lbf·ft

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1. TROUBLESHOOTING

[1] ENGINE BODY

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	G-12, 14, 16
	Fuel hose clogged	Clean or replace	G-12, 32
	Fuel filter clogged	Replace	G-14, 16
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	5, 6, G-8, 11
	Fuel with low cetane number	Use specified fuel	5, 6, G-8
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	S-55, 57
	Incorrect injection timing	Adjust	S-29, 30
	Fuel camshaft worn	Replace	S-71, 72
	Injection nozzle clogged	Clean or replace (V3600-E3B, V3600-T-E3B, V3600-E3CB, V3600-T-E3CB, V3300-E3BG, V3600-T-E3BG) Repair or replace (V3800DI-T-E3B, V3800DI-T-E3CB, V3800DI-T-E3BG)	S-33, 34, 35, 55, 57
	Injection pump malfunctioning	Repair or replace	S-31, 32, 73
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	–
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, (glow plug (V3600-E3B, V3600-T-E3B, V3600-E3CB, V3600-T-E3CB, V3300-E3BG, V3600-T-E3BG only)) and nozzle holder	S-55, 56, 57, 58, 59, 60, 61
	Improper valve timing	Correct or replace timing gear	S-79
	Piston ring and cylinder worn	Replace	S-83, 84, 111, 112, 116
	Excessive valve clearance	Adjust	S-25
	Stop solenoid malfunctioning	Replace	S-39

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2. SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Cylinder Head Surface	Flatness	–	0.05 mm 0.002 in.
Top Clearance **[V3600-E3B, V3600-T-E3B, V3600-E3CB, V3600-T-E3CB, V3600-T-E3BG]**		1.05 to 1.27 mm 0.0414 to 0.0500 in.	–
[V3300-E3BG]		0.72 to 0.90 mm 0.0283 to 0.0354 in.	–
[V3800DI-T-E3B, V3800DI-T-E3CB, V3800DI-T-E3BG]		0.701 to 0.930 mm 0.0276 to 0.0366 in.	–
Compression Pressure **[V3600-E3B, V3600-E3CB, V3300-E3BG]**		4.31 MPa / 250 min^{-1} (rpm) 44.0 kgf/cm^2 / 250 min^{-1} (rpm) 626 psi / 250 min^{-1} (rpm)	3.26 MPa / 250 min^{-1} (rpm) 33.2 kgf/cm^2 / 250 min^{-1} (rpm) 472 psi / 250 min^{-1} (rpm)
[V3600-T-E3B, V3600-T-E3CB, V3600-T-E3BG]		3.92 MPa / 250 min^{-1} (rpm) 40.0 kgf/cm^2 / 250 min^{-1} (rpm) 569 psi / 250 min^{-1} (rpm)	2.99 MPa / 250 min^{-1} (rpm) 30.5 kgf/cm^2 / 250 min^{-1} (rpm) 434 psi / 250 min^{-1} (rpm)
[V3800DI-T-E3B, V3800DI-T-E3CB, V3800DI-T-E3BG]		3.47 MPa / 250 min^{-1} (rpm) 35.4 kgf/cm^2 / 250 min^{-1} (rpm) 504 psi / 250 min^{-1} (rpm)	2.56 MPa / 250 min^{-1} (rpm) 26.1 kgf/cm^2 / 250 min^{-1} (rpm) 371 psi / 250 min^{-1} (rpm)
Variance Among Cylinders		–	10 % or less

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3. MAINTENANCE CHECK LIST

To maintain long-lasting and safe engine performance, make it a rule to carry out regular inspections by following the table below.

[V3600-E3B, V3600-T-E3B, V3600-E3CB, V3600-T-E3CB, V3300-E3BG, V3600-T-E3BG]

Item	Service Interval									
	Initial 50 hrs	Every 50 hrs	Every 250 hrs	Every 500 hrs	Every 1000 hrs	Every 1 or 2 months	Every 1500 hrs	Every 3000 hrs	Every 1 year	Every 2 years
Changing engine oil	☆		☆						☆	
Replacing oil filter cartridge	☆			☆						
*Checking fuel hoses and clamps		☆								
*Cleaning air filter element (Replace the element after 6 times cleanings)			☆							
*Cleaning fuel filter			☆							
Checking battery electrolyte level			☆							
Checking radiator hoses and clamps			☆							
*Checking intake air line			☆							
Checking fan belt tension and damage	☆		☆							
*Replacing fuel filter cartridge				☆						
Replacing fan belt				☆						☆
Cleaning radiator interior				☆						
Checking valve clearance					☆					
Recharging battery						☆				
*Checking injection nozzle condition							☆			
*Checking turbocharger								☆		
Checking fuel injection pump								☆		
*Checking injection timing (spill timing)								☆		
*Replacing air filter element									☆	
Changing radiator coolant (L.L.C.)										☆
Replacing radiator hoses and clamps										☆
*Replacing fuel hoses and clamps										☆
*Replacing intake air line										☆
Replacing battery										☆

* 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.

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