WSM

WORKSHOP MANUAL

TRACTOR,ROTARY MOWER, FRONT LOADER

BX1860,BX2360,BX2660, RCK48-18BX,RCK54-23BX, RCK60B-23BX,RCK48P-18BX, RCK54P-23BX,LA203,LA243

Kubota

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KiSC issued 06, 2009 A

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.

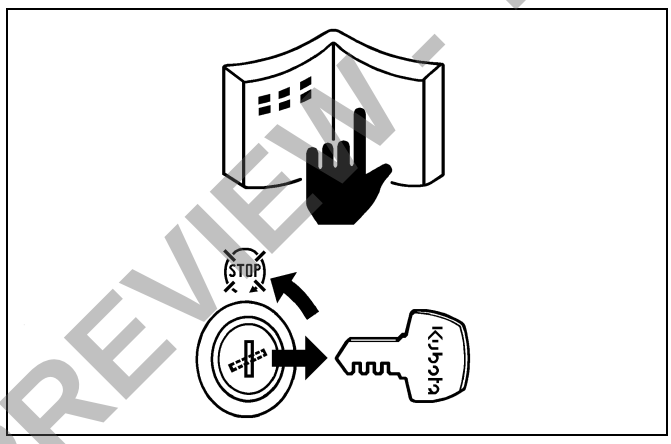
⚠ DANGER : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ 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 machine safety decals.
- Clean the work area and machine.
- Park the machine on a firm and level ground, and set the parking brake.
- Lower the implement to the ground.
- 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			BX1860	BX2360	BX2660
PTO power			10.2 kW (13.7 HP)*	13.2 kW (17.7 HP)*	14.5 kW (19.5 HP)*
Engine	Maker		KUBOTA		
	Model		D722-E3-BX-2	D902-E3-BX-2	D1005-E3-BX
	Type		Indirect Injection, vertical, water-cooled, 4-cycle diesel		
	Number of cylinders		3		
	Bore and stroke		67 × 68 mm (2.64 × 2.68 in.)	72 × 73.6 mm (2.83 × 2.90 in.)	76 × 73.6 mm (2.99 × 2.90 in.)
	Total displacement		719 cm^3 (43.9 cu.in.)	898 cm^3 (54.8 cu.in.)	1001 cm^3 (61.1 cu.in.)
	Engine gross power		13.4 kW (18.0 HP)	17.1 kW (23.0 HP)	19.0 kW (25.5 HP)
	Rated revolution		3200 min^{-1} (rpm)		
	Maximum torque		44.9N·m (4.6kgf·m, 33.1 lbf·ft)	56.1 N·m (5.7kgf·m, 41.4lbf·ft)	60.2 N·m (6.1 kgf·m, 44.4 lbf·ft)
	Battery		12 V, RC : 62 min., CCA : 435 A	12 V, RC : 80 min., CCA : 535 A	
	Fuel		Diesel fuel No. 1 [below −10 °C (14 °F)], Diesel fuel No. 2 [above −10 °C (14 °F)]		
Capacities	Fuel tank		25 L (6.6 U.S.gals, 5.5 Imp.gals.)		
	Engine crankcase (with filter)		2.9 L (3.1 U.S.qts., 2.6 Imp.qts.)	3.1 L (3.3 U.S.qts., 2.7 Imp.qts.)	3.5 L (3.7 U.S.qts., 3.1 Imp.qts.)
	Engine coolant		2.5 L (2.6 U.S.qts., 2.2 Imp.qts.)	2.7 L (2.8 U.S.qts., 2.4 Imp.qts.)	2.9 L (3.1 U.S.qts., 2.6 Imp.qts.)
	Recovery tank		0.4 L (0.4 U.S.qts., 0.4 Imp.qts.)		
	Transmission case		11.6 L (3.06 U.S.gals, 2.55 Imp.gals.)		
Dimensions	Overall length (without 3P)		2035 mm (80.1 in.)	2120 mm (83.5 in.)	
	Overall length (with 3P)		2340 mm (92.1 in.)	2425 mm (95.5 in.)	
	Overall width (min. tread)		1145 mm (45.1 in.)		
	Overall height (with ROPS)		1760 mm (69.3in.)	1785 mm (70.3 in.)	
	Overall height (Top of seat)		1230 mm (48.4 in.)	1255 mm (49.4 in.)	1330 mm (52.4 in.)
	Wheel base		1340 mm (52.8 in.)	1400 mm (55.1 in.)	
	Minimum ground clearance		150 mm (5.9 in.)	175 mm (6.9 in.)	
	Tread	Front	880 mm (34.6 in.)	910 mm (35.8 in.)	
		Rear	820 mm (32.2 in.)		
Weight (with ROPS)			570 kg (1256.6 lbs)	585 kg (1289.7 lbs)	636 kg (1402.1 lbs)
Clutch			N / A		
Travelling system	Tires	Front	16 × 7.50 – 8	18 × 8.50 – 10	
		Rear	24 × 12.00 – 12	26 × 12.00 – 12	
	Steering		Hydrostatic type power steering		
	Transmission		Main: hydrostatic transmission, High-Low gear shift (2 forward and 2 reverse)		
	Brake		Wet disk type		
	Min. turning radius (without brake)		2.18 m (7.15 feet)	2.3 m (7.5 feet)	
Hydraulic system	Hydraulic control system		Directional control, auto-return lever system		
	Pump capacity		23.5 L/min. (6.2 U.S.gals./min., 5.2 Imp.gals./min.)		
	Three point hitch		SAE Category I		
	Max. lift force	At lift points	5390 N (1210 lbs)**		
		24 in. behind lift points	3040 N (680 lbs)**		
PTO	Rear PTO	PTO shaft	SAE 1-3/8, 6 splines		
		Revolution	1 speed (540 min^{-1} (rpm) at engine 3142 min^{-1} (rpm))		
	Mid	PTO shaft	USA No. 5 (KUBOTA 10-tooth) involute spline		
		Revolution	1 speed (2500 min^{-1} (rpm) at engine 3043 min^{-1} (rpm))		

NOTE: * Manufacture's estimate The company reserves the right to change the specifications without notice.
** See and check "IMPLEMENT LIMITATIONS".

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5. TIGHTENING TORQUES

[1] GENERAL USE SCREWS, BOLTS AND NUTS

Screws, bolts and nuts whose tightening torques are not specified in this Workshop Manual should be tightened according to the table below.

Indication on top of bolt	⬡ 4 No-grade or 4T						⬡ 7 7T						⬡ 9 9T		
Material of bolt	SS400, S20C						S43C, S48C						SCr435, SCM435		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit / Diameter	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M6 (6 mm, 0.24 in.)	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8 (8 mm, 0.31 in.)	18 to 20	1.8 to 2.1	13 to 15	17 to 19	1.7 to 2.0	13 to 14	24 to 27	2.4 to 2.8	18 to 20	18 to 20	1.8 to 2.1	13 to 15	30 to 34	3.0 to 3.5	22 to 25
M10 (10 mm, 0.39 in.)	40 to 45	4.0 to 4.6	29 to 33	32 to 34	3.2 to 3.5	24 to 25	48 to 55	4.9 to 5.7	36 to 41	40 to 44	4.0 to 4.5	29 to 32	61 to 70	6.2 to 7.2	45 to 52
M12 (12 mm, 0.47 in.)	63 to 72	6.4 to 7.4	47 to 53	–	–	–	78 to 90	7.9 to 9.2	58 to 66	63 to 72	6.4 to 7.4	47 to 53	103 to 117	10.5 to 12.0	76.0 to 86.7
M14 (14 mm, 0.55 in.)	108 to 125	11.0 to 12.8	79.6 to 92.5	–	–	–	124 to 147	12.6 to 15.0	91.2 to 108	–	–	–	167 to 196	17.0 to 20.0	123 to 144
M16 (16 mm, 0.63 in.)	167 to 191	17.0 to 19.5	123 to 141	–	–	–	197 to 225	20.0 to 23.0	145 to 166	–	–	–	260 to 304	26.5 to 31.0	192 to 224
M18 (18 mm, 0.71 in.)	246 to 284	25.0 to 29.0	181 to 209	–	–	–	275 to 318	28.0 to 32.5	203 to 235	–	–	–	344 to 402	35.0 to 41.0	254 to 296
M20 (20 mm, 0.79 in.)	334 to 392	34.0 to 40.0	246 to 289	–	–	–	368 to 431	37.5 to 44.0	272 to 318	–	–	–	491 to 568	50.0 to 58.0	362 to 419

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[2] STUD BOLTS

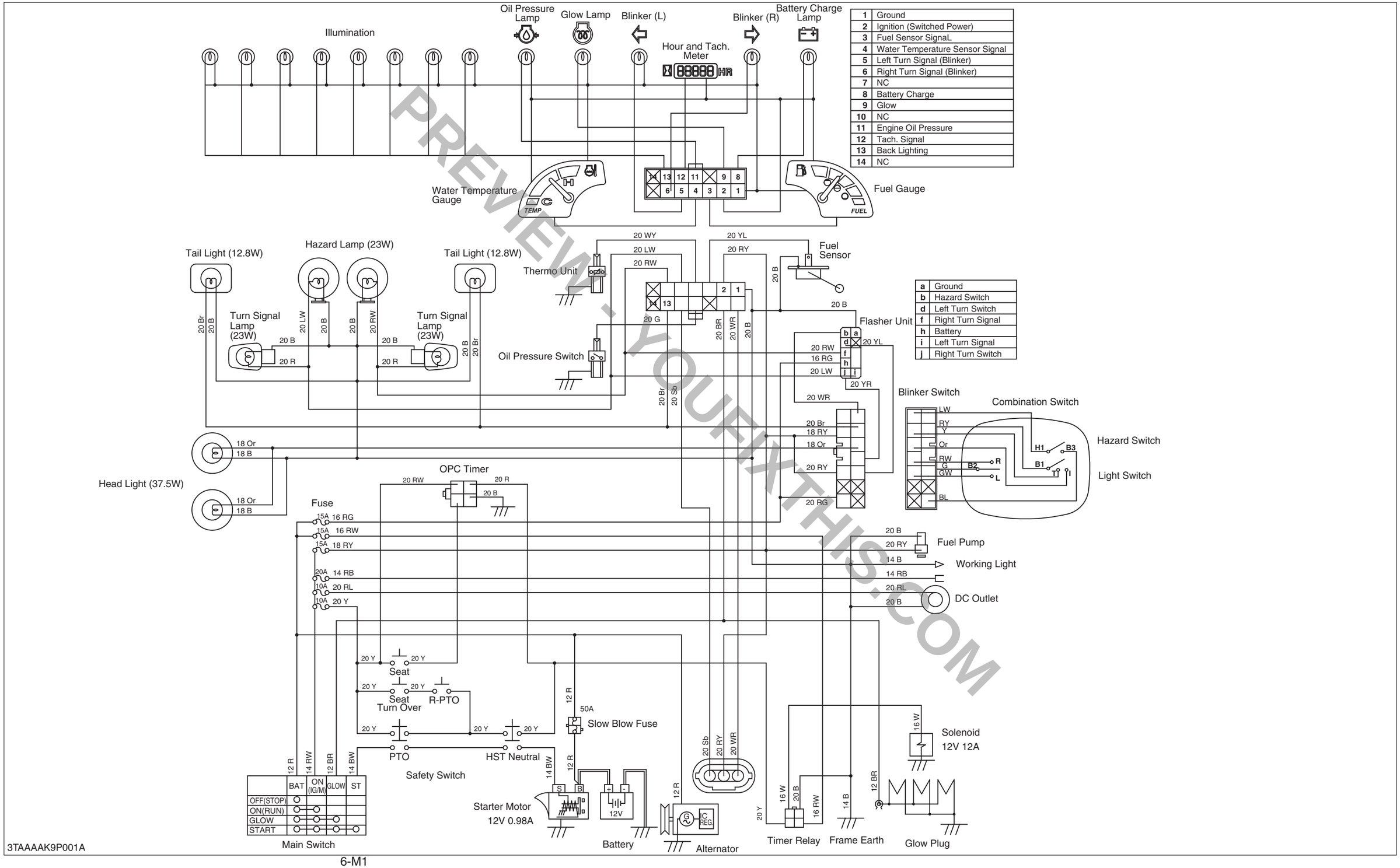
Material of opponent part	Ordinariness			Aluminum		
Unit / Diameter	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M8 (8 mm, 0.31 in.)	12 to 15	1.2 to 1.6	8.7 to 11	8.9 to 11	0.90 to 1.2	6.5 to 8.6
M10 (10 mm, 0.39 in.)	25 to 31	2.5 to 3.2	18 to 23	20 to 25	2.0 to 2.6	15 to 18
M12 (12 mm, 0.47 in.)	29.5 to 49.0	3.0 to 5.0	21.7 to 36.1	31.4	3.2	23.1

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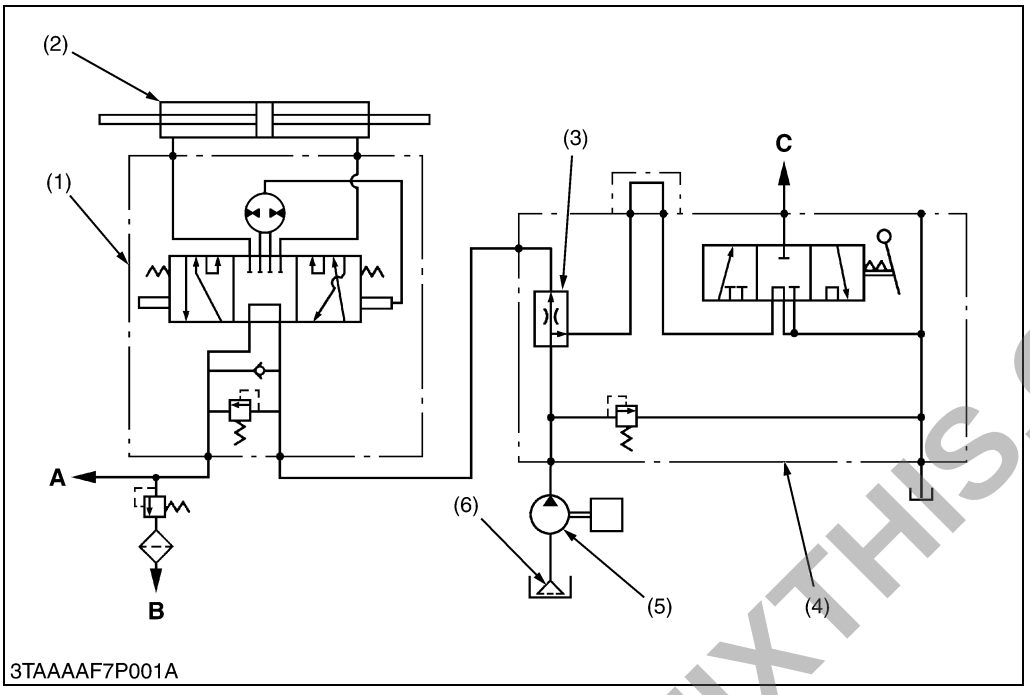
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1. WIRING DIAGRAM



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1. HYDRAULIC CIRCUIT



(1) Steering Controller
(2) Steering Cylinder
(3) Flow Priority Valve
(4) Hydraulic Control Valve Assembly
(5) Hydraulic Pump
(6) Oil Strainer

A : To PTO Clutch Valve
B : To HST
C : To Hydraulic Cylinder

W1012655

This model is provided with a full hydrostatic power steering.

In the full hydrostatic power steering, the steering controller is connected to the steering cylinder with only the hydraulic piping. Accordingly, it does not have mechanical transmitting parts such as steering gear, pitman arm, drag link, etc.. Therefore, it is simple in construction. This steering system consists of the oil strainer (6), hydraulic pump (5), flow priority valve (3), steering controller (1), steering cylinder (2), etc..

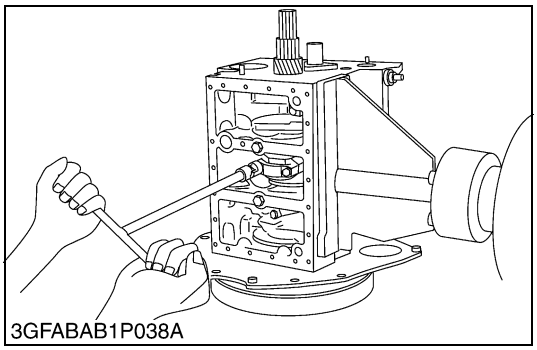
Flow priority valve (3) which located in the hydraulic control valve assembly (4) divides the oil into two direction. One is the control flow to power steering (constantly 9.5 L/min., 2.5 U.S.gals/min., 2.1 Imp.gals/min.), and the other is excessive flow to control valve of implement lift control.

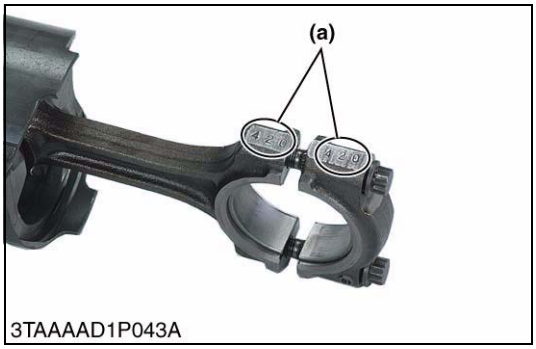
By operating the power steering body, the required amount of oil is fed to the steering cylinder (2).

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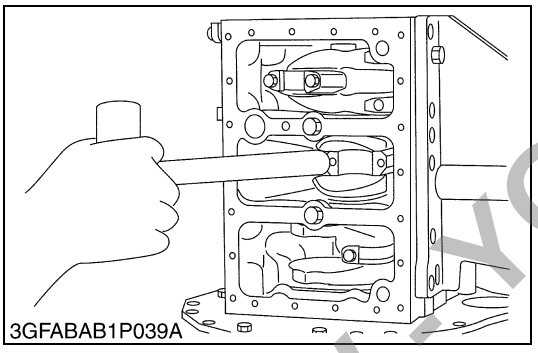
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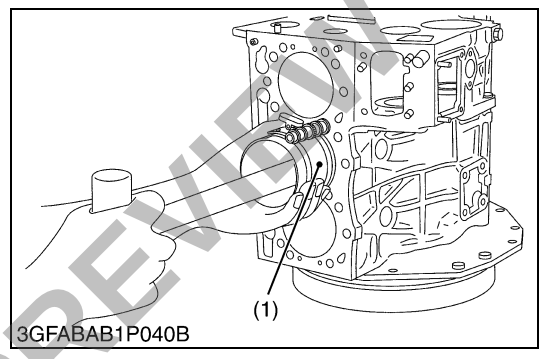
(5) Piston and Connecting Rod


3GFABAB1P038A

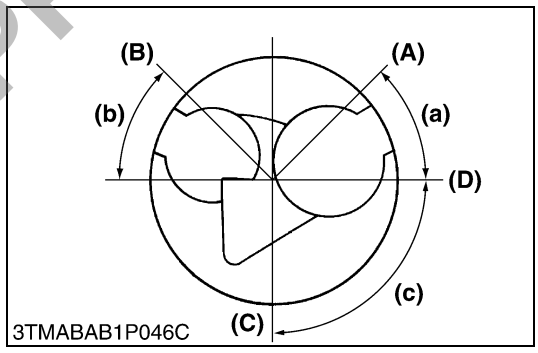


3TAAAAD1P043A


3GFABAB1P039A



3GFABAB1P040B



3TMABAB1P046C

Connecting Rod

1. Remove the connecting rod cap.

(When reassembling)

- Align the marks **(a)** with each other. (Face the marks toward the injection pump.)
- Apply engine oil to the connecting rod screws and lightly screw it in by hand, then tighten it to the specified torque.
  If the connecting rod screw won't be screwed in smoothly, clean the threads.
  If the connecting rod screw is still hard to screw in, replace it.

[BX1860, BX2360]

Tightening torque	Connecting rod screw	27 to 30 N·m 2.7 to 3.1 kgf·m 20 to 22 lbf·ft

[BX2660]

Tightening torque	Connecting rod screw	42 to 46 N·m 4.2 to 4.7 kgf·m 31 to 33 lbf·ft

(a) Mark

W10801990

Pistons

1. Turn the flywheel and bring the piston to top dead center.
2. Draw out the piston upward by lightly tapping it from the bottom of the crankcase with the grip of a hammer.
3. Draw out the other piston in the same method as above.

(When reassembling)

- Before inserting the piston into the cylinder, apply enough engine oil to the piston.
- When inserting the piston into the cylinder, face the mark on the connecting rod to the injection pump.

■ **IMPORTANT**

- **Do not change the combination of cylinder and piston. Make sure of the position of each piston by marking. For example, mark "1" on the No.1 piston.**
- **When installing the piston into the cylinder, place the gaps of all the piston rings as shown in the figure.**
- **Carefully insert the pistons using a piston ring compressor (1). Otherwise, their chrome-plated section may be scratched, causing trouble inside the cylinder.**

(1) Piston Ring Compressor

(A) Top Ring Gap
(B) Second Ring Gap
(C) Oil Ring Gap
(D) Piston Pin Hole
(a) 0.79 rad (45 °)
(b) 0.79 rad (45 °)
(c) 1.6 rad (90 °)

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	No fuel	Replenish fuel	G-7
	Air in the fuel system	Bleed	G-30
	Water in the fuel system	Change fuel and repair or replace fuel system	–
	Fuel pipe clogged	Clean	G-25
	Fuel filter clogged	Change	G-25
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	G-7
	Fuel with low cetane number	Use specified fuel	G-7
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S30
	Incorrect injection timing	Adjust	1-S22
	Fuel camshaft worn	Replace	1-S36
	Injection nozzle clogged	Clean or replace	1-S30
	Injection pump malfunctioning	Replace	1-S35
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	1-S37, S40
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S31
	Improper valve timing	Correct or replace timing gear	1-S36
	Piston ring and cylinder worn	Replace	1-S38
	Excessive valve clearance	Adjust	1-S18
Starter Does Not Run	Battery discharged	Charge	G-18
	Starter malfunctioning	Repair or replace	6-S28
	Main switch malfunctioning	Repair or replace	6-S9
	Safety switches malfunctioning	Adjust or replace	6-S11
	Wiring disconnected	Connect	–
Engine Revolution Is Not Smooth	Fuel filter clogged or dirty	Replace	G-25
	Air cleaner clogged	Clean or replace	G-19
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S30
	Injection pump malfunctioning	Replace	1-S35
	Incorrect nozzle injection pressure	Adjust	1-S24
	Injection nozzle stuck or clogged	Repair or replace	1-S30
	Governor malfunctioning	Repair	1-S35

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6. MAINTENANCE CHECK LIST

No.	Item \ Period		Service Interval														Since then	Important		Reference page
			50	100	150	200	250	300	350	400	450	500	550	600	650	700				
1	Engine oil	Change	★			☆				☆				☆			every 200 Hr			G-13
2	Engine oil filter	Replace	★			☆				☆				☆			every 200 Hr			G-13
3	Transmission oil filter	Replace	★			☆				☆				☆			every 200 Hr			G-14
4	Transmission fluid	Change								☆							every 400 Hr			G-24
5	Transmission strainer	Clean	★							☆							every 400 Hr			G-14
6	Front axle case oil	Change								☆							every 400 Hr			G-24
7	Front axle pivot	Adjust								☆							every 400 Hr			G-24
8	Engine start system	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr			G-15
9	Greasing	–	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr			G-16
10	Wheel bolt torque	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr			G-16
11	Battery condition	Check		☆		☆		☆		☆		☆		☆		☆	every 100 Hr	*4		G-17
12	Air cleaner element	Clean		☆		☆		☆		☆		☆		☆		☆	every 100 Hr	*1	@	G-19
		Replace															every 1 year	*2		G-25
13	Fuel filter element	Check		☆		☆		☆		☆		☆		☆		☆	every 100 Hr		@	G-20
		Replace										☆					every 500 Hr			G-25
14	Fan belt	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100 Hr			G-20
15	HST neutral spring	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100 Hr			G-21
16	Brake	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100 Hr			G-22
17	Radiator hose and clamp	Check				☆				☆				☆			every 200 Hr			G-22
		Replace															every 2 years			G-26
18	Power steering oil line	Check				☆				☆				☆			every 200 Hr			G-23
		Replace															every 2 years			G-26
19	Fuel line	Check		☆		☆		☆		☆		☆		☆		☆	every 100 Hr		@	G-20
		Replace															every 2 years			G-26
20	Intake air line	Check				☆				☆				☆			every 200 Hr		@	G-23
		Replace															every 2 years	*3		G-26
21	Toe-in	Adjust				☆				☆				☆			every 200 Hr			G-23
22	Engine valve clearance	Adjust															every 800 Hr			1-S12
23	Fuel injection nozzle injection pressure	Check															every 1500 Hr		@	1-S24
24	Injection pump	Check															every 3000 Hr		@	1-S23
25	Cooling system	Flush															every 2 years			G-27
26	Coolant	Change															every 2 years			G-27
27	Fuel system	Bleed															Service as required			G-30
28	Fuse	Replace																		G-30
29	Light bulb	Replace																		G-31

■ IMPORTANT

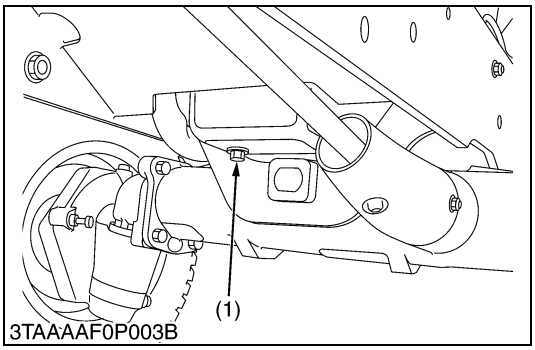
- **The jobs indicated by ★ must be done after the first 50 hours of operation.**
- ***1 : Air cleaner should be cleaned more often in dusty conditions than in normal conditions.**
- ***2 : Every year or every 6 times of cleaning.**
- ***3 : Replace only if necessary.**
- ***4 : When the battery is used for less than 100 hours per year, check the fluid level annually.**
- **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 Warranty Statement in detail.

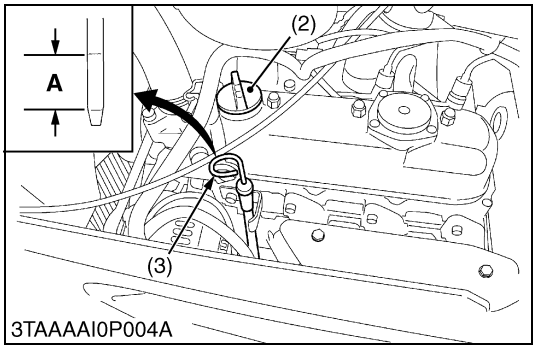
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[2] CHECK POINTS OF INITIAL 50 HOURS





Changing Engine Oil

CAUTION

To avoid personal injury :

- **Be sure to stop the engine and remove the key before changing the oil.**
- **Allow engine to cool down sufficiently, oil can be hot and can burn.**

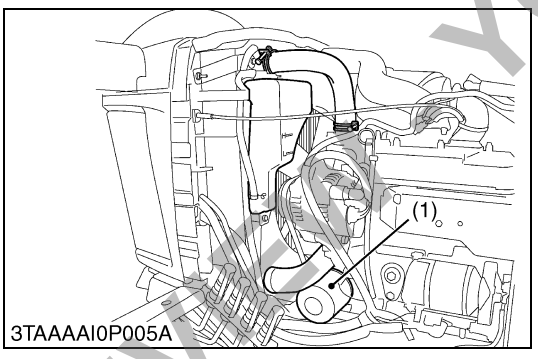
1. To drain the used oil, remove the drain plug at the bottom of the engine and drain the oil completely into the oil pan.
   All the used oil can be drained out easily when the engine is still warm.
2. After draining reinstall the drain plug.
3. Fill with the new oil up to the upper notch on the dipstick.
4. Properly dispose of used oil.

Engine oil	Capacity	BX1860	2.9 L 3.1 U.S.qts 2.6 Imp.qts
		BX2360	3.1 L 3.3 U.S.qts 2.7 Imp.qts
		BX2660	3.5 L 3.7 U.S.qts 2.9 Imp.qts

(1) Drain Plug
(2) Oil Inlet
(3) Dipstick

(A) Oil level is acceptable within this range.

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Replacing Engine Oil Filter

CAUTION

- **Be sure to stop the engine before changing oil filter cartridge.**

1. Remove the oil filter.
2. Put a film of clean engine oil on the rubber seal of the new filter.
3. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hand an additional 1/2 turn only.
4. After the new filter has been replaced, the engine oil normally decrease a little. Make sure that the engine oil does not leak through the seal and be sure to check the oil level on the dipstick. Then, replenish the engine oil up to the specified level.
5. Properly dispose of used oil.

■ **IMPORTANT**

- **To prevent serious damage to the engine, use only a KUBOTA genuine filter.**

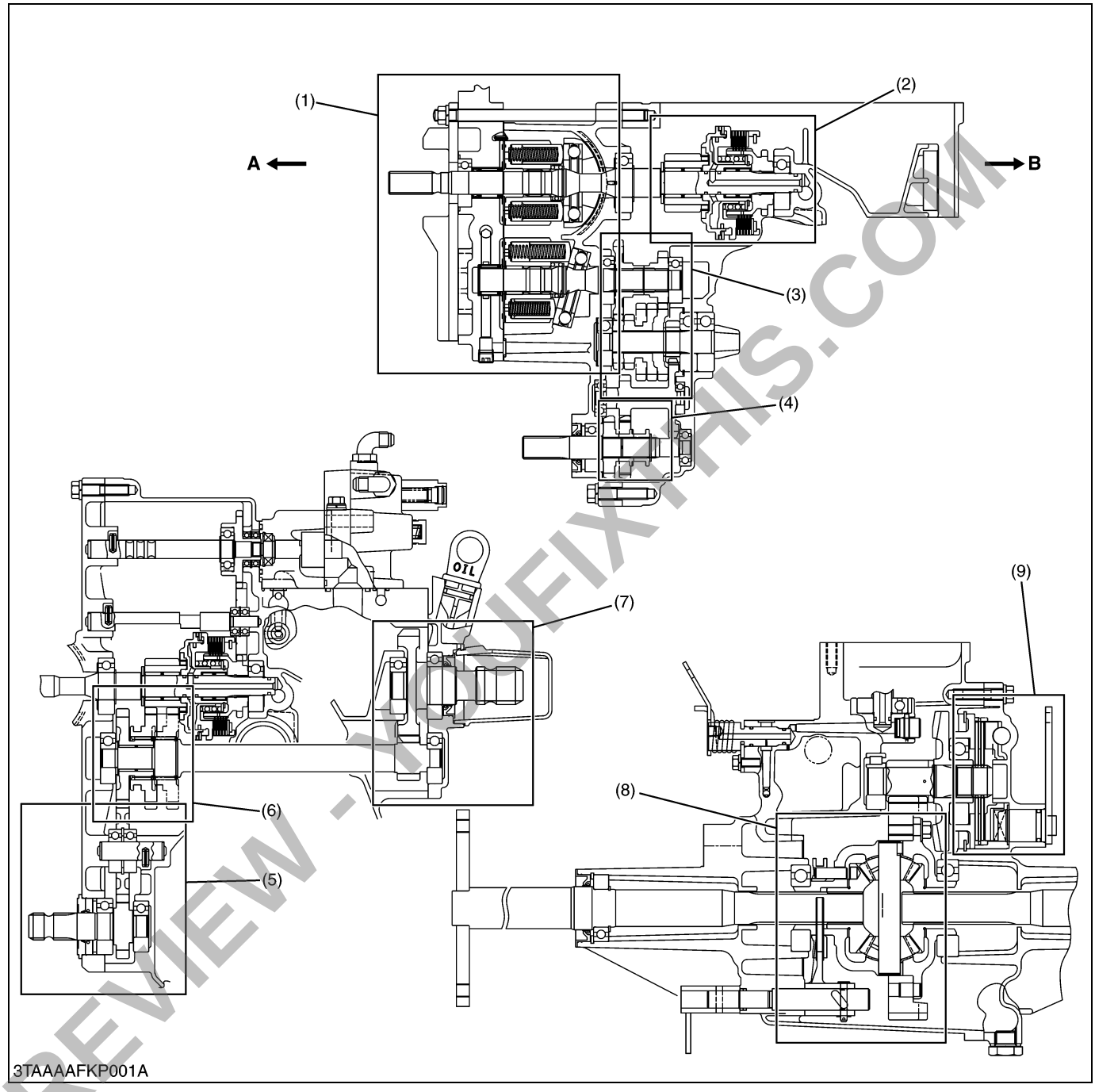
(1) Engine Oil Filter Cartridge

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1. STRUCTURE



(1) Hydrostatic Transmission
(2) PTO Clutch Section
(3) Range Gear Shift Section
(4) Front Wheel Drive Gear Section
(5) Mid-PTO Section
(6) PTO Gear Shift Section
(7) Rear PTO Section
(8) Differential Gear Section
(9) Brake Section

A : Front Side
B : Rear Side

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2. SERVICING SPECIFICATIONS

[1] BX1860, BX2360

ENGINE BODY

Item		Factory Specification	Allowable Limit
Valve Clearance (Cold)		0.145 to 0.185 mm 0.00571 to 0.00728 in.	–
Compression Pressure **[BX1860]** Difference among Cylinders		2.85 to 3.23 MPa 29.0 to 33.0 kgf/cm^2 413 to 469 psi –	2.26 MPa 23.0 kgf/cm^2 327 psi 10 % or less
Compression Pressure **[BX2360]** Difference among Cylinders		3.53 to 4.02 MPa 36.0 to 41.0 kgf/cm^2 512 to 583 psi –	2.55 MPa 26.0 kgf/cm^2 370 psi 10 % or less
Top Clearance		0.55 to 0.70 mm 0.022 to 0.027 in.	–
Cylinder Head Surface	Flatness	–	0.05 mm 0.002 in.
Valve Recessing	Intake and Exhaust	–0.10 to 0.10 mm –0.0039 to 0.0039 in.	0.30 mm 0.012 in.
Valve Stem to Valve Guide Valve Stem Valve Guide	Clearance O.D. I.D.	0.030 to 0.057 mm 0.0012 to 0.0022 in. 5.968 to 5.980 mm 0.2350 to 0.2354 in. 6.010 to 6.025 mm 0.2367 to 0.2372 in.	0.10 mm 0.0039 in. – –
Valve Face	Angle (Intake) Angle (Exhaust)	0.79 rad 45 ° 0.79 rad 45 °	– –
Valve Seat	Angle (Intake and exhaust) Width	0.79 rad 45 ° 2.12 mm 0.0835 in.	– –
Valve Spring	Free Length Tilt Setting Load	31.3 to 31.8 mm 1.24 to 1.25 in. – 65 N / 27.0 mm 6.6 kgf / 27.0 mm 15 lbf / 1.06 in.	28.4 mm 1.12 in. 1.2 mm 0.047 in. 55 N / 27.0 mm 5.6 kgf / 27.0 mm 12 lbf / 1.06 in.

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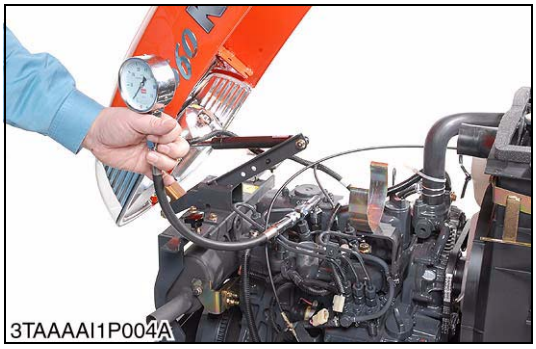
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4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

(1) Engine Body



Compression Pressure

1. Run the engine until it is warmed up.
2. Stop the engine.
3. Remove the air cleaner, the muffler and all glow plugs (or nozzles).
4. Set a compression tester with the adaptor to the glow plug hole (or nozzle hole).
   Nozzle hole : Adaptor **H** (07909-31231)
   Glow plug hole : Adaptor **L** (07909-31301)
5. Disconnect the connector of engine stop solenoid and keep the engine stop position (non-injection). Then, run the engine with the starter and measure the compression pressure.
6. Repeat steps 4 and 5 for each cylinder.
7. If the measurement is below the allowable limit, apply a small amount of oil to the cylinder wall through the glow plug hole (or nozzle hole) and measure the compression pressure again.
8. If the compression pressure is still less than the allowable limit, check the top clearance, valve clearance and cylinder head.
9. If the compression pressure increases after applying oil, check the cylinder wall and piston rings.

■ **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 %.**

[BX1860]

Compression pressure	Factory spec.	2.85 to 3.23 MPa 29.0 to 33.0 kgf/cm^2 413 to 469 psi
	Allowable limit	2.26 MPa 23.0 kgf/cm^2 327 psi

[BX2360]

Compression pressure	Factory spec.	3.53 to 4.02 MPa 36.0 to 41.0 kgf/cm^2 512 to 583 psi
	Allowable limit	2.55 MPa 26.0 kgf/cm^2 370 psi

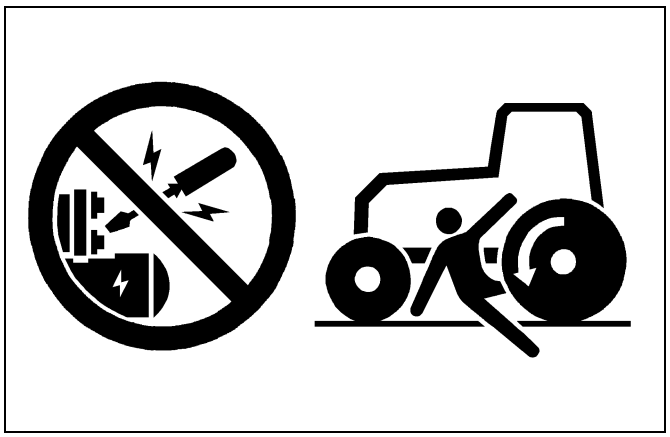
[BX2660]

Compression pressure	Factory spec.	3.73 to 4.11 MPa 38.0 to 42.0 kgf/cm^2 541 to 597 psi
	Allowable limit	2.26 MPa 23.0 kgf/cm^2 327 psi

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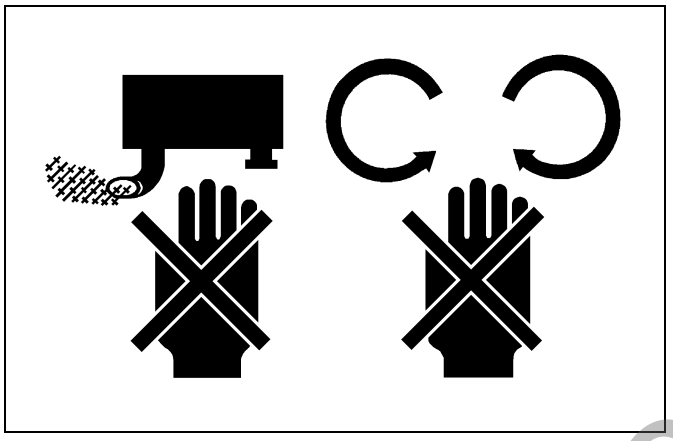
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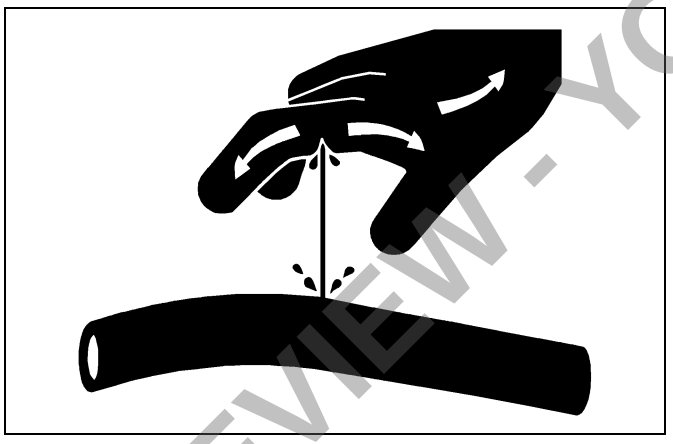
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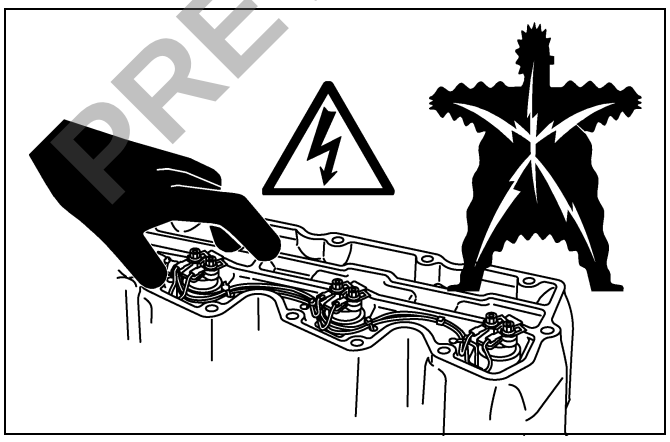


SAFETY STARTING

- Do not start the engine by shorting across starter terminals or bypassing the safety start switch.
- Do not alter or remove any part of machine safety system.
- Before starting the engine, make sure that all shift levers are in neutral positions or in disengaged positions.
- Never start the engine while standing on ground. Start the engine only from operator's seat.





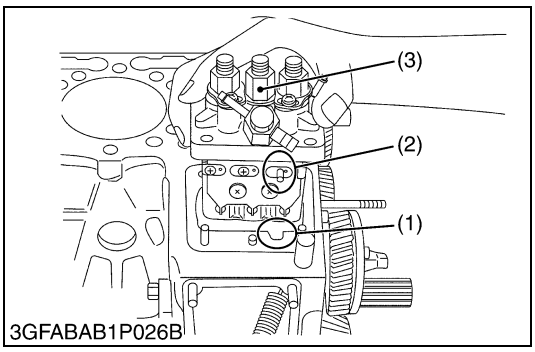


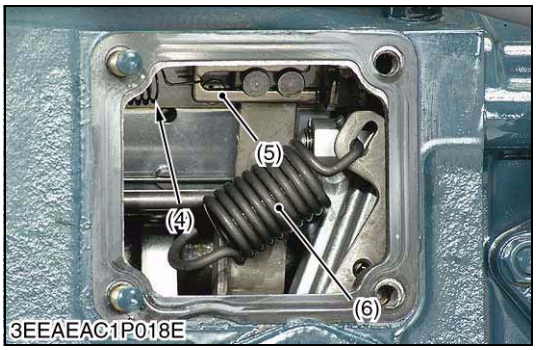
SAFETY WORKING

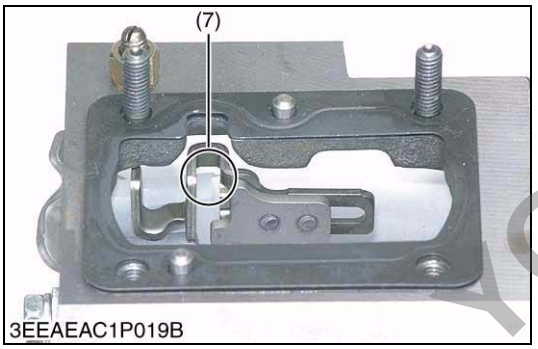
- Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- Wear close fitting clothing and safety equipment appropriate to the job.
- Use tools appropriate to the work. Makeshift tools, parts, and procedures are not recommended.
- When servicing is performed together by two or more persons, take care to perform all work safely.
- Do not work under the machine that is supported solely by a jack. Always support the machine by safety stands.
- Do not touch the rotating or hot parts while the engine is running.
- Never remove the radiator cap while the engine is running, or immediately after stopping. Otherwise, hot water will spout out from radiator. Only remove radiator cap when cool enough to touch with bare hands. Slowly loosen the cap to first stop to relieve pressure before removing completely.
- Escaping fluid (fuel or hydraulic oil) under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or fuel lines. Tighten all connections before applying pressure.
- Do not open high-pressure fuel system.
  High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt repair fuel lines, sensors, or any other components between the high-pressure fuel pump and injectors on engines with high pressure common rail fuel system.
- High voltage exceeding 100 V is generated in the ECU, and is applied to the injector.
  Pay sufficient caution to electric shock when performing work activities.

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Injection Pump

1. Disconnect the start spring (4) on the thrust lever side (5).
2. Align the control rack pin (2) with the notch (1) on the crankcase, and remove the injection pump (3).
3. Remove the injection pump shims.
4. In principle, the injection pump should not be disassembled.

(When reassembling)

- When installing the injection pump, insert the control rack pin (2) firmly into the groove (7) of the thrust lever of fork lever.

■ **NOTE**

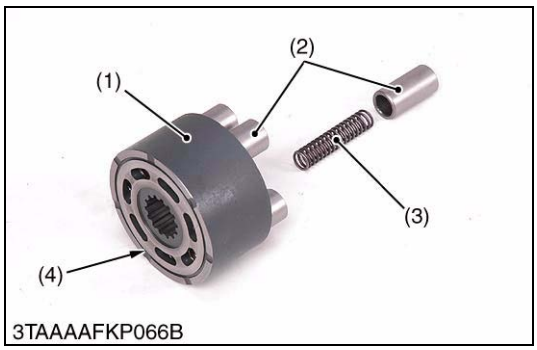
- **Addition or reduction of shim (0.05 mm, 0.002 in.) delays or advances the injection timing by approx. 0.0087 rad (0.50 °).**
- **In disassembling and replacing, be sure to use the same number or new gasket shims with the same thickness.**

(1) Notch
(2) Control Rack Pin
(3) Injection Pump
(4) Start Spring
(5) Thrust Lever
(6) Governor Spring
(7) Groove

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Cylinder Block Assembly

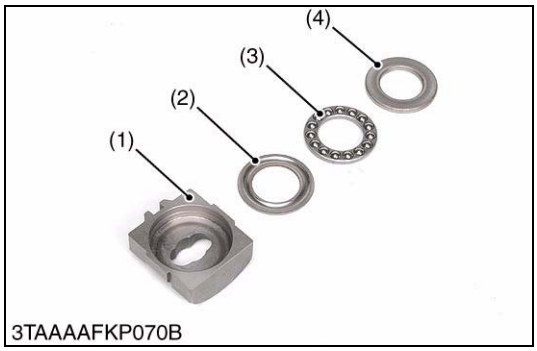
1. Check the cylinder blocks (1) and the pistons (2) for scratches and wear.
2. If there are scratch or worn, replace the cylinder block assembly.
3. Check the pistons for their free movement in the cylinder block bores.
4. If the piston or the cylinder block is scored, replace the cylinder block assembly.
5. Check the polished face (4) of the cylinder block for scoring. If it is scored, replace the cylinder block assembly.

■ **IMPORTANT**

- **Do not interchange the pistons between the pump cylinder block and the motor cylinder block. Pistons and cylinder blocks are matched.**

(1) Cylinder Block
(2) Piston
(3) Spring
(4) Polished Face

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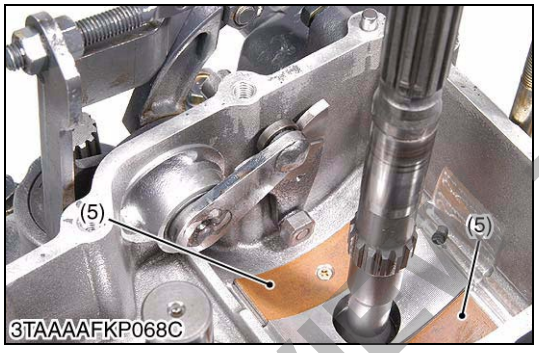
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Thrust Washer, Thrust Roller Bearing, Thrust Plate and Cradle Bearing

1. Check the thrust bearing (3) for scratches and excessive wear.
2. If it is worn, replace it.
3. Check the thrust plate (4) for scratches and excessive wear. If it is worn or scored, replace it.
4. Check the cradle bearing (5) for excessive wear. If it is worn, replace it.

(1) Swashplate
(2) Thrust Washer
(3) Thrust Bearing
(4) Thrust Plate
(5) Cradle Bearing

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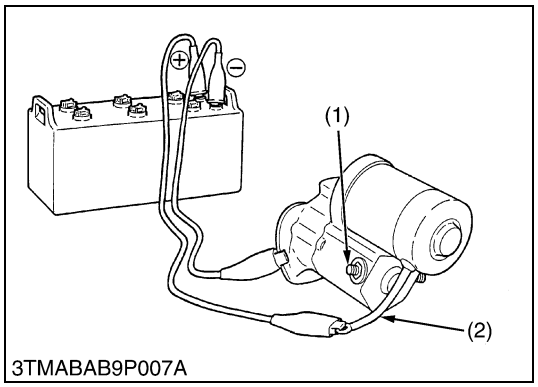


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(3) Starter



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Motor Test

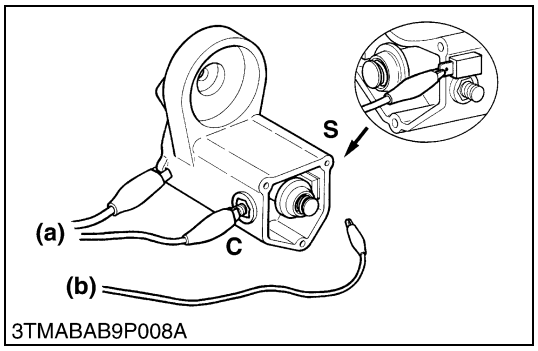
CAUTION

- **Secure the starter to prevent if from jumping up and down while testing the motor.**

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter.
3. Remove the starter from the engine.
4. Disconnect the connecting lead (2) from the starter **C** terminal (1).
5. Connect a jumper lead from the connecting lead (2) to the battery positive terminal post.
6. Connect a jumper lead momentarily between the starter motor housing and the battery negative terminal post.
7. If the motor does not run, check the motor.

(1) **C** Terminal (2) Connecting Lead

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3TMABAB9P008A

Magnet Switch Test (Pull-in, Holding Coils)

1. Remove the motor from the starter housing.
2. Prepare a 6 V battery for the test.
3. Connect jumper leads from the battery negative terminal to the housing and the starter **C** terminal.
4. The plunger should be attracted and the pinion gear should pop out when a jumper lead is connected from the battery positive terminal to the **S** terminal. It's a correct.
5. Disconnect the jumper lead to the starter **C** terminal. Then the pinion gear should remain popped out. It's a correct.

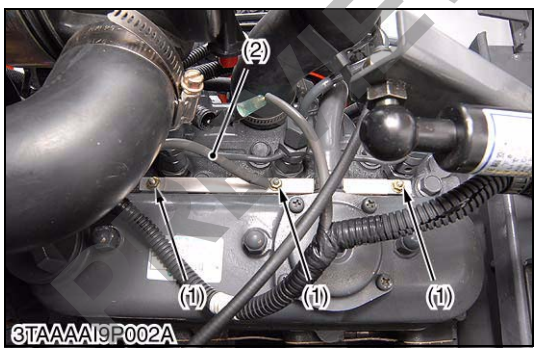
■ **IMPORTANT**

- **Testing time must be 3 to 5 sec..**

C : C Terminal **(a) To Negative Terminal**
S : S Terminal **(b) To Positive Terminal**

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(4) Glow Plug



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Lead Terminal Voltage

1. Disconnect the wiring lead (2) from the glow plug (1) after turning the main switch off.
2. Turn the main switch key to the **"PREHEAT"** position, and measure the voltage between the lead terminal and the chassis.
3. Turn the main switch key to the **"START"** position, and measure the voltage with a voltmeter between the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or main switch is faulty.

Voltage (Lead terminal – Chassis)	Main switch key at **"PREHEAT"**	Approx. battery voltage
	Main switch key at **"START"**	Approx. battery voltage

(1) Glow Plug (2) Wiring Lead (Positive)

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