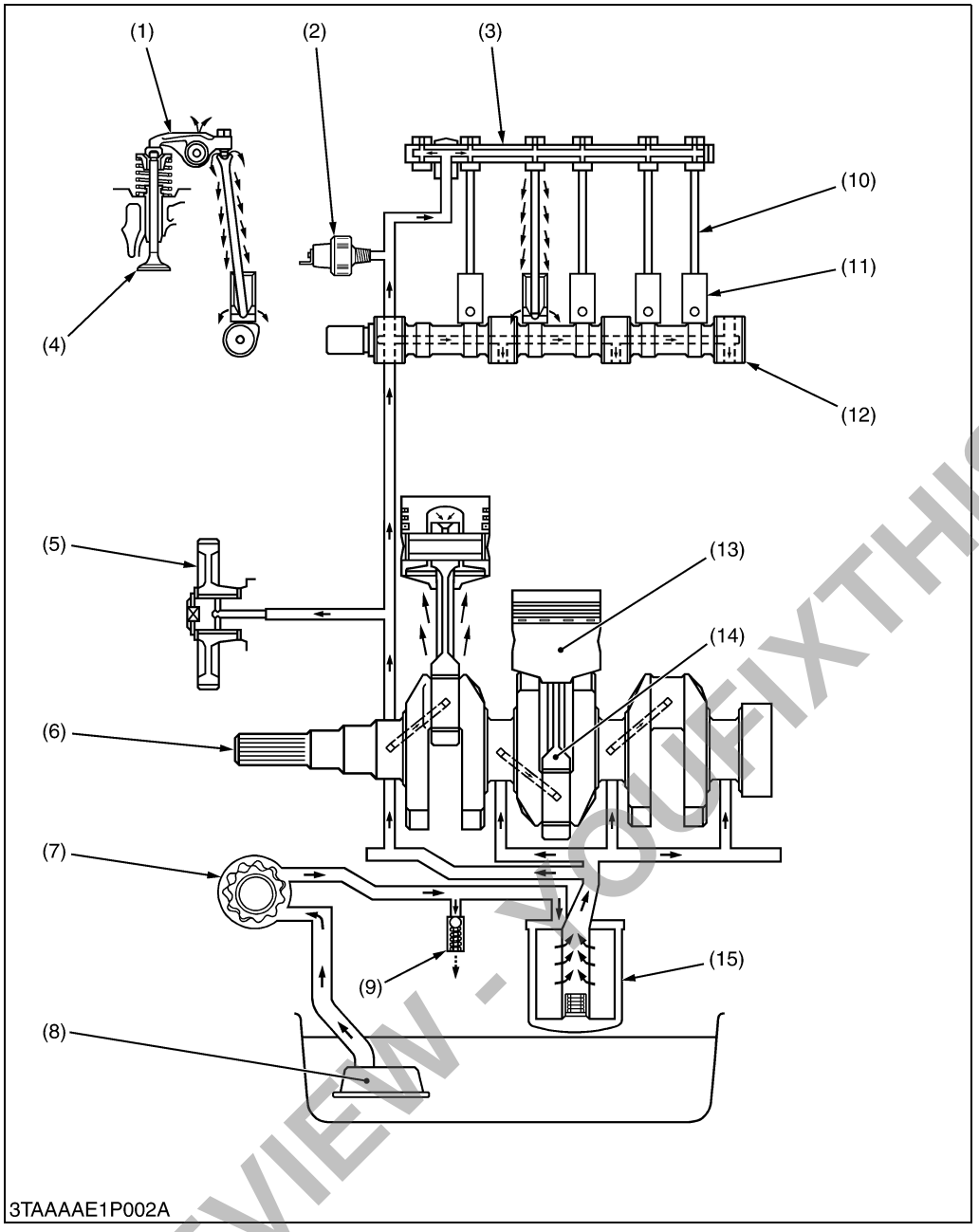
2. LUBRICATING SYSTEM



(1) Rocker Arm
(2) Oil Pressure Switch
(3) Rocker Arm Shaft
(4) Valve
(5) Idle Gear
(6) Crankshaft
(7) Oil Pump
(8) Oil Strainer
(9) Relief Valve
(10) Push Rod
(11) Tappet
(12) Camshaft
(13) Piston
(14) Connecting Rod
(15) Oil Filter Cartridge

This engine's lubricating system consists of oil strainer (8), oil pump (7), relief valve (9), oil filter cartridge (15) and oil pressure switch (2).

The oil pump sucks lubricating oil from the oil pan through the oil strainer and the oil flows down to the filter cartridge, where it is further filtered. Then the oil is forced to crankshaft (6), connecting rods (14), idle gear (5), camshaft (12) and rocker arm shaft (3) to lubricate each part.

Some part of oil, splashed by the crankshaft or leaking and dropping from gaps of each part, lubricates these parts: piston (13), cylinders, small ends or connecting rods, tappets (11), push rods (10), inlet and exhaust valves (4) and timing gears.

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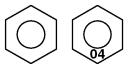
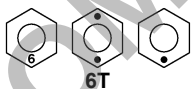
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6. TIGHTENING TORQUES

Tighten screws, bolts and nuts whose tightening torques are not specified in this Workshop Manual according to the table below.

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[1] GENERAL USE SCREWS, BOLTS AND NUTS

Indication on top of bolt	 No-grade or 4T						 7T						 9T		
Indication on top of nut	 No-grade or 4T												 6T		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit	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	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	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	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	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	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	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	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	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

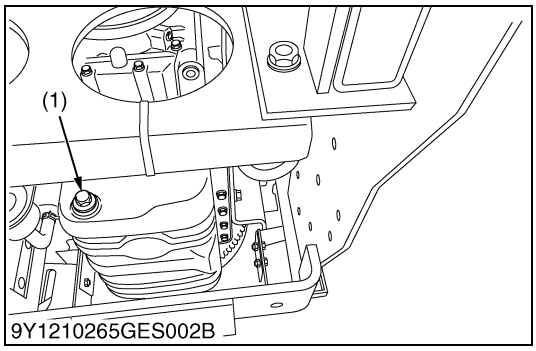
Material of opponent part	Ordinariness			Aluminum		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M8	12 to 15	1.2 to 1.6	8.7 to 11	8.9 to 11	0.90 to 1.2	6.5 to 8.6
M10	25 to 31	2.5 to 3.2	18 to 23	20 to 25	2.0 to 2.6	15 to 18
M12	30 to 49	3.0 to 5.0	22 to 36	31	3.2	23
M14	62 to 73	6.3 to 7.5	46 to 54	–	–	–
M16	98.1 to 112	10.0 to 11.5	72.4 to 83.1	–	–	–
M18	172 to 201	17.5 to 20.5	127 to 148	–	–	–

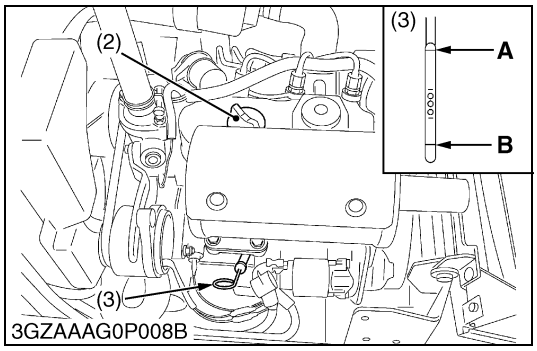
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[2] CHECK POINTS OF INITIAL 50 HOURS





Changing Engine Oil

WARNING

To avoid serious 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 may cause burns.**

1. Start and warm up the engine for approx. 5 minutes.
2. Place an oil pan underneath the engine.
3. To change the used oil, remove the drain plug (1) at the bottom of the engine and drain the oil completely.
4. Screw in the drain plug (1).
5. Fill with the new oil up to upper line on the dipstick (3).

IMPORTANT

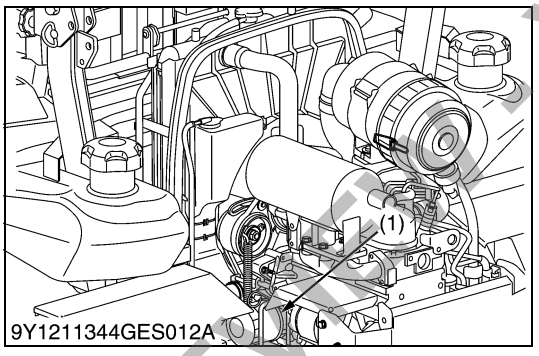
- **When using oil of different manufacture or viscosity from the previous one, remove all of the old oil.**
- **Never mix two different type of oil.**
- **Use the proper SAE engine oil according to ambient temperatures.**
  Refer to "LUBRICANTS, FUEL AND COOLANT".
  (See page G-9.)

Engine oil capacity	3.9 L 4.1 U.S.qts 3.4 Imp.qts

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

A: Upper Level
B: Lower Level

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Replacing Engine Oil Filter Cartridge

WARNING

To avoid serious injury:

- **Be sure to stop the engine before changing the oil filter cartridge.**
- **Allow engine to cool down sufficiently, oil can be hot and may cause burns.**

1. Remove the engine oil filter cartridge (1) with the filter wrench.
2. Apply a slight coat of oil onto the rubber gasket of new cartridge.
3. To install the new cartridge, screw it in by hand. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hand an additional 1/2 turn only. Over tightening may cause deformation of rubber gasket.
4. After the cartridge has been replaced, the engine oil level normally lowers a little. Add engine oil to proper level. Check for oil leaks around filter gasket.

IMPORTANT

- **To prevent serious damage to the engine, element of recommended type must be used. Use only a genuine KUBOTA filter or its equivalent.**

(1) Engine Oil Filter Cartridge

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1. TROUBLESHOOTING

Symptom	Probable Cause and Checking Procedure	Solution	Reference Page
Engine Does Not Start	1. No fuel	Fill fuel	G-9, G-19
	2. Air in the fuel system	Vent air	G-44
	3. Water in the fuel system	Change fuel and repair or replace fuel system	G-9, G-32
	4. Fuel pipe clogged	Clean or replace	G-32
	5. Fuel filter clogged	Replace	G-32
	6. Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	G-9
	7. Fuel with low cetane number	Use specified fuel	G-9
	8. Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S25
	9. Incorrect injection timing	Adjust	1-S15
	10. Fuel camshaft worn	Replace	1-S31
	11. Injection nozzle clogged	Clean or replace	1-S17
	12. Injection pump malfunctioning	Replace	1-S30
	13. Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	1-S28 to 1-S36
	14. Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S25, 1-S27
	15. Improper valve timing	Correct or replace timing gear	1-S31
	16. Piston ring and cylinder worn	Replace	1-S34, 1-S51
	17. Excessive valve clearance	Adjust	1-S12
	18. Key switch malfunctioning	Repair or replace	5-S9
	19. Stop solenoid malfunctioning	Check and replace	5-S12
Starter Does Not Run	1. Battery discharged	Charge	G-30 to G-31
	2. Starter malfunctioning	Repair or replace	5-S10
	3. Key switch malfunctioning	Check and replace	5-S9
	4. Wiring disconnected	Connect	5-S6

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3. SPECIFICATIONS

Model			ZD1211	ZD1211R	ZD1211L	ZD1211RL
Engine	Model		D1105			
	Maximum engine power (Gross)		18.5 kw (24.5 HP) (*1) (*2)			
	Type		Liquid-cooled			
	Number of cylinders		3			
	Bore and stroke		78 × 78.4 mm (3.07 × 3.09 in.)			
	Total displacement		1123 cm^3 (68.5 cu.in.)			
	Rated revolution		3000 min^{-1} (rpm)			
	Low idling revolution		1400 to 1500 min^{-1} (rpm)			
	Fuel		Diesel fuel No. 1 [below −10 °C (14 °F)] Diesel fuel No. 2 [above −10 °C (14 °F)]			
	Starter		Electric starter with battery, glow plug, 12 V, 1.2 kW			
	Lubrication		Forced lubrication by gear pump			
	Cooling		Liquid with pressurized radiator			
	Battery		SMF51R (12 V, RC:80 min, CCA:430 A)			
Capacities	Fuel tank		49 L (12.9 U.S.gals., 11 Imp.gals.)			
	Engine crankcase (with filter)		3.9 L (4.1 U.S.qts., 3.4 Imp.qts.)			
	Engine coolant		3.5 L (3.70 U.S.qts., 3.1 Imp.qts.)			
	Recovery tank		0.25 L (0.26 U.S.qts., 0.22 Imp.qts.)			
	Transmission case including rear axle gear case		12.1 L (12.8 U.S.qts., 10.6 Imp.qts.) (*3)			
Dimensions	Overall length		2260 mm (89.0 in.)		2380 mm (93.7 in.)	
	Overall width without mower deck		1510 mm (54.9 in.)		1540 mm (60.6 in.)	
	Overall height	With ROPS upright	2000 mm (78.7 in.)			
		With ROPS folded	1640 mm (64.6 in.)			
	Wheel base		1440 mm (56.7 in.)		1560 mm (61.4 in.)	
	Minimum ground clearance		135 mm (5.31 in.) W/60"		135 mm (5.31 in.) W/72"	
	Tread	Front	1064 mm (41.9 in.)		1250 mm (49.2 in.)	
		Rear	1210 mm (47.6 in.)			
Weight (W/O FUEL, W/MOWER DECK)			760 kg (1676 lbs) with 60"	765 kg (1687 lbs) with 60"	790 kg (1742 lbs) with 72"	805 kg (1775 lbs) with 72"
Travelling system	Tires	Front	15 × 6.0 - 6 (Semi-pneumatic Non Flat Tire) Smooth			
		Rear	26 × 12.0 - 16 (4PR) Turf low profile tire			
	Travelling speeds	Forward	0 to 10.6 mph (0 to 17.0 km/h) (*2)			
		Reverse	0 to 5.3 mph (0 to 8.5 km/h) (*2)			
	Steering		2-Hand levers			
	Transmission		2 - HST w / Gear			
	Parking brake		Wet multi disk / Foot applied, released			
	Min. turning radius		0 mm (0 in.)			
PTO	Revolution		1 speed (2540 rpm at 3000 engine rpm)			
	Drive system		Shaft drive, KUBOTA 10 tooth involute spline			
	Clutch type		Wet multi disks			
	PTO brake		Wet multi disks			

(Specifications and design subject to change without notice)

■ **NOTE**

- ***1: Manufacturer's estimate, SAE J1940**
- ***2: At 3000 engine rpm [ZD1211, ZD1211R, ZD1211L, ZD1211RL]**
- ***3: Oil amount when the oil level is at the upper level.**

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Adjusting Neutral

WARNING

To avoid serious injury:

- **Park the machine on a hard and level surface.**
- **If it is necessary to run engine in an enclosed area, use a gas tight exhaust pipe extension to remove the fumes.**
- **Always try to work in a well-ventilated area.**
- **Lift up and secure with jack stands or blocking the rear of the machine, do not run the machine while adjusting.**
- **Do not adjust only one of the following adjustment; exclude "MOTION CONTROL LEVER POSITION". They are relative each other.**

1. Turn key switch to **OFF** position.
2. Apply the parking brake.
3. Set the motion control levers (1) to **Neutral lock** position.
4. Raise and latch the seat assembly.
5. Remove the connector from the seat safety switch, then temporarily install a jumper wire across the terminals in the connector of the wiring harness.
6. Raise the rear of machine and block up so that rear wheels can rotate freely.
7. Remove the motion control lever cover.
8. Loosen the lock nuts (3) from the ball joints on the two speed control rods (2).
9. Start the engine.
10. Move the throttle lever to **Max. speed** position.
11. Release the parking brake.
12. Turn the speed control rod (2) to extend the rod length and rotate the rear wheel backward. Then, turn the speed control rod (2) in reverse direction and find a position where the rear wheel stops rotating.
13. Then, turn the speed control rod (2) to shorten the rod length and rotate the rear wheel forward. Then, turn the speed control rod (2) in reverse direction and find a position where the rear wheel stops rotating.
14. After taking steps 12 and 13 above, fix the speed control rod (2) length at the midpoint between the two position. Adjust a speed control rod (2) length to be the center of the HST neutral range.
15. Shut off the machine. Remove jumper wire from wire harness connector and plug connector or into seat safety switch.

IMPORTANT

- **The right and left motion control lever (1) can be adjusted independently.**

(1) Motion Control Lever
(2) Speed Control Rod
(3) Lock Nut

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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.
4. Set a compression tester with the adaptor to the glow plug hole.
5. After making sure that the stop lever is set at the stop position (non-injection), 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 %.**

Compression pressure	Factory specification	3.73 to 4.11 MPa 38.1 to 41.9 kgf/cm^2 541 to 596 psi
	Allowable limit	2.26 MPa 23.0 kgf/cm^2 328 psi

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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		3.73 to 4.11 MPa 38.1 to 41.9 kgf/cm^2 541 to 596 psi	2.26 MPa 23.0 kgf/cm^2 328 psi
Difference among Cylinders		–	10 % or less
Top Clearance		0.55 to 0.75 mm 0.022 to 0.029 in.	–
Cylinder Head Surface	Flatness	–	0.05 mm 0.0020 in.
Valve Recessing	Intake and Exhaust	−0.05 to 0.25 mm −0.0019 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	37.0 to 37.5 mm 1.46 to 1.47 in.	36.5 mm 1.44 in.
	Tilt	–	1.0 mm 0.039 in.
	Setting Load/ Setting Length	117.4 N / 31.0 mm 11.97 kgf / 31.0 mm 26.39 lbf / 1.22 in.	100.0 N / 31.0 mm 10.20 kgf / 31.0 mm 22.48 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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7. MAINTENANCE CHECK LIST

■ **IMPORTANT**

- **The jobs indicated by ★ must be done initially.**
  ***1: The initial 50 hours should not be a replacement cycle.**
  ***2: Air cleaner must be cleaned more often in dusty conditions than in normal conditions.**
  ***3: Every 1000 hours or every 1 year whichever comes faster.**
  ***4: Replace if any deterioration (crack, hardening, scar, or deformation) or damage occurred.**
  ***5: Every 2000 hours or every 2 years whichever comes faster.**
  ***6: When the battery is used for less than 100 hours per year, check the battery condition by reading the indicator annually.**
  ***7: The initial 100 hours should not be a replacement cycle.**
- **The items listed above (@ marked) are registered as emission related critical parts by KUBOTA in the U.S.EPA non-road 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.

No.	Item		Service Interval												After since	Reference page		
			50	100	150	200	250	300	350	400	450	500	550	600				
1	Engine start system	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-25		
2	OPC system	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-26		
3	Mower gear box oil	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-28		
		Change			☆			☆			☆			☆	every 150 Hr	G-28		
4	Greasing (except mower and mower link bushings)	–	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-27		
5	Throttle cable	Oil	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-28		
6	Greasing (mower link bushings, pivot)	–		☆		☆		☆		☆		☆		☆	every 100 Hr	G-34		
7	Air cleaner primary element	Clean		☆		☆		☆		☆		☆		☆	every 100 Hr	G-29	*2	@
		Replace													every 1000 Hr or 1 year	G-35	*3	
	Secondary element	Replace													every 1000 Hr or 1 year	G-35	*3	
8	Fuel filter element	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-32		@
		Replace								☆					every 400 Hr	G-32		
9	Fan belt	Adjust		☆		☆		☆		☆		☆		☆	every 100 Hr	G-32		
10	Parking brake	Adjust		☆		☆		☆		☆		☆		☆	every 100 Hr	G-33		
11	Battery condition	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-30	*6	
12	Engine oil	Change	★			☆				☆				☆	every 200 Hr	G-22	*1	
13	Engine oil filter	Replace	★			☆				☆				☆	every 200 Hr	G-22	*1	
14	Transmission oil filter [HST]	Replace	★			☆				☆				☆	every 200 Hr	G-23	*1	
15	Front axle pivot	Adjust		★		☆				☆				☆	every 200 Hr	G-23	*7	
16	Transmission fluid and rear axle gear case (RH and LH) fluid	Change								★					every 400 Hr	G-24		

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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.**

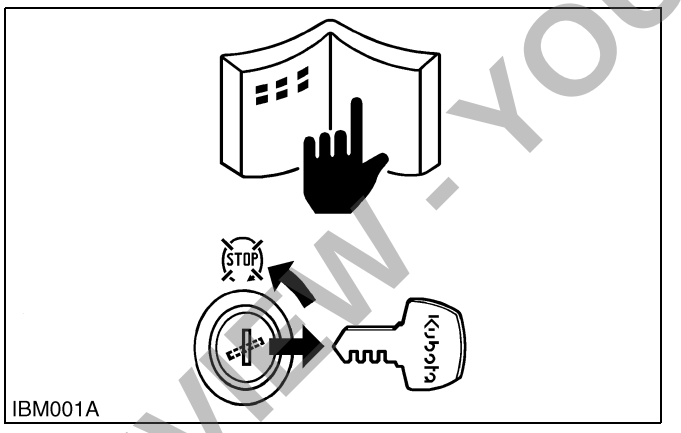
⚠ WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

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

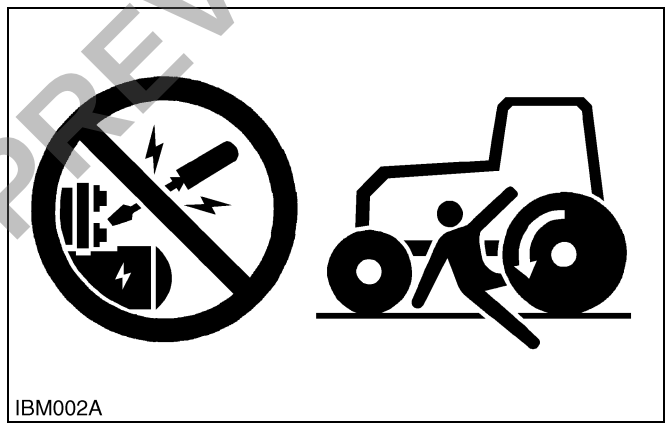
■ IMPORTANT
- **Indicates that equipment or property damage could result if instructions are not followed.**

■ NOTE
- **Gives helpful information.**

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IBM001A


IBM002A

BEFORE YOU START SERVICE

- 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 stable and level ground, and set the parking brake.
- Lower the implement to the ground.
- 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 alter or remove any part of machine safety system.
- Before you start the engine, make sure that all shift levers are in neutral positions or in disengaged positions.
- Do not start the engine when you stay on the ground. Start the engine only from operator's seat.

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INFORMATION

CONTENTS

1. SAFETY FIRST I-1
2. SAFETY DECALS I-4
3. SPECIFICATIONS I-8
4. DIMENSIONS I-10

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