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.**

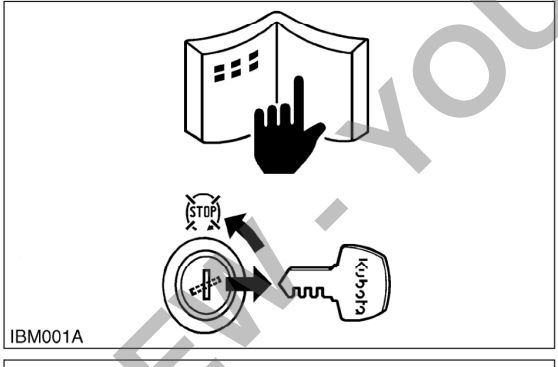
⚠ WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

⚠ 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.**

WSM000001INI0001US1



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.

WSM000001INI0010US0

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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3. SPECIFICATIONS

[1] NORTH AMERICA AND CANADA MODELS

Model			ZG222SA	ZG222A	ZG227A	ZG227LA
Engine	Model		KGZ770-E2-MA3		KGZ770-E2-MA2	
	Maximum engine power (Gross)		16.4 kW (22 HP)*1		20.1 kW (27 HP)*1	
	Type		Air-cooled gasoline engine			
	Number of cylinders		2 (V-Twin)			
	Bore and stroke		84.2 × 69 mm (3.31 × 2.72 in.)			
	Total displacement		768 cm^3 (46.9 cu.in.)			
	Rated revolution		3200 min^{-1} (rpm)			
	Fuel		Automobile unleaded or regular gasoline			
	Starter		Electric starter with battery			
	Lubrication		Full pressure lubrication			
	Cooling		Forced air cooled			
	Battery		U1-10 (12 V, RC: 22 min, CCA: 300, CA: 365)			
Capacities	Fuel tank		27 L (7.1 U.S.gals, 5.9 Imp.gals)			
	Engine crankcase (with filter)		1.8 L (1.9 U.S.qts, 1.6 Imp.qts)		2.0 L (2.1 U.S.qts, 1.8 Imp.qts)	
	Transmission including rear axle gear case		7.5 L (7.9 U.S.qts, 6.6 Imp.qts)*3			
Dimensions	Overall length		2096 mm (82.5 in.)			2126 mm (83.7 in.)
	Overall width Without mower deck		1210 mm (47.7 in.)			
	Overall height	With ROPS upright	1775 mm (69.9 in.)			
		With ROPS folded	1340 mm (51.9 in.)			
	Wheel base		1295 mm (51.0 in.)			1325 mm (52.2 in.)
	Minimum ground clearance		130 mm (5.12 in.) with 48S, 48P		130 mm (5.12 in.) with 54P	130 mm (5.12 in.) with 60P
	Tread	Front	870 mm (34.3 in.)			905 mm (35.6 in.)
		Rear	930 mm (36.3 in.)			
Weight (with Mower Deck)			500 kg (1102 lbs) with 48S	530 kg (1168 lbs) with 48P	540 kg (1190 lbs) with 54P	560 kg (1235 lbs) with 60P
Travelling system	Tires	Front	13 × 5.0-6 (4PR) Rib			
		Rear	23 × 10.5-12 (4PR) Turf			
	Travelling speeds	Forward	0 to 9.0 km/h (0 to 14.5 mph)*2			
		Reverse	0 to 5.0 km/h (0 to 8.0 mph)*2			
	Steering		2-Hand levers			
	Transmission		2-Hydrostatic transmission with gear			
	Parking brake		Wet multi disc / foot applied, released			
	Min. turning radius		0 mm (0 in.)			
PTO	Revolution		1 speed (2530 rpm at 3200 engine rpm)			
	Drive system		Shaft drive, KUBOTA 10 tooth in involute spline			
	Clutch type		Wet multi discs			
	PTO brake		Wet single disc			

■ **NOTE**

- **Specifications and design subject to change without notice.**

***1: Power (HP) specifications for indvidual gasoline engine models are rated pursuant to Society of Automobile Engineers (SAE) J1940 based on gross output testing performed in accordance with SAE J1995 without the air cleaner and muffler.**

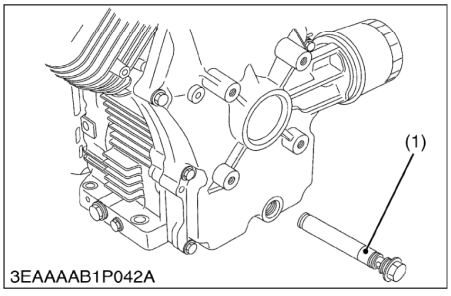
***2: At 3200 min^{-1} (rpm)**

***3: Oil amount when the oil level is at the upper level.**

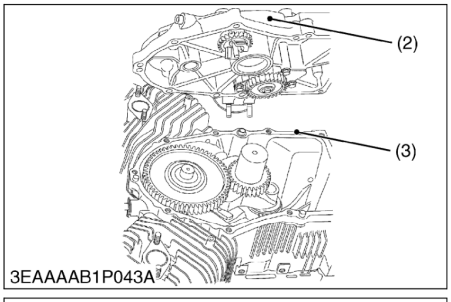
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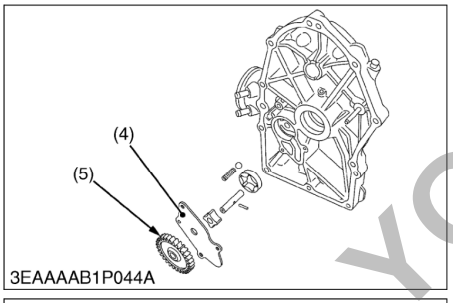
(7) Crankcase Cover and Camshaft



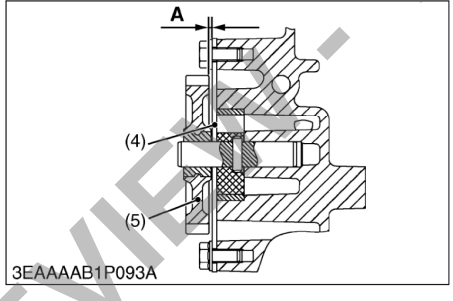
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Crankcase Cover

1. Remove the oil strainer (1).
2. Place the engine with the flywheel at the bottom.
3. Remove the crankcase cover (2).
4. Remove the crankcase cover gasket (3).
5. Remove the oil pump cover (4).

(When reassembling)

- When reinstalling the crankcase cover, make sure that the O-ring is fitted correctly in the O-ring groove.

Tightening torque	Crankcase cover screw	21.6 to 29.4 N·m 2.21 to 2.99 kgf·m 16.0 to 21.6 lbf·ft

Clearance between oil pump gear and cover **A**	Factory specification	0.1 to 0.05 mm 0.004 to 0.01 in.

(1) Oil Strainer
(2) Crankcase Cover
(3) Crankcase Cover Gasket
(4) Oil Pump Cover
(5) Oil Pump Gear

A: Clearance between oil pump gear and cover

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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.
(For general use screws, bolts and nuts: See page G-11.)

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[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.

Item	N·m	kgf·m	lbf·ft
M6 (Standard Screw and Bolt)	6.86 to 14.7	0.700 to 1.49	5.06 to 10.8
M6 (Self tap type)	9.81 to 14.7	1.00 to 1.49	7.24 to 10.8
M8 (Standard Screw and Bolt)	13.7 to 29.4	1.40 to 2.99	10.1 to 21.6

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

Item	Dimension × Pitch	N·m	kgf·m	lbf·ft
Engine mounting bolt and nut	–	24 to 28	2.4 to 2.8	18 to 20
Cylinder head cover screw	M6 × 1.0	9.80 to 13.8	1.00 to 1.40	7.23 to 10.1
*Cylinder head screw	M10 × 1.5	41.2 to 50.0	4.21 to 5.09	30.4 to 36.8
Crankcase cover screw	M8 × 1.25	21.6 to 29.4	2.21 to 2.99	16.0 to 21.6
*Flywheel screw	M12	100 to 120	10.2 to 12.2	73.8 to 88.5
*Connecting rod screw	M8 × 1.25	21.6 to 27.4	2.21 to 2.79	16.0 to 20.2
Spark plug	M14 × 1.25	9.81 to 19.6	1.00 to 1.99	7.24 to 14.4
Oil pressure switch	PT 1/8	14.7 to 19.6	1.50 to 1.99	10.9 to 14.4
Starter's **B** terminal nut	M8	7.85 to 9.81	0.801 to 1.00	5.79 to 7.23
Drain plug with copper gasket	–	34.3 to 44.1	3.50 to 4.49	25.3 to 32.5
Dust cover screw	M6	9.81 to 14.7	1.00 to 1.49	7.24 to 10.8
Governor lever screw	M8	10.8 to 24.5	1.11 to 2.49	7.97 to 18.0

■ **NOTE**

- **For * marked screws, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.**
- **The letter "M" in Size × Pitch means that the screw, bolt or nut dimension stands for metric. The size is the nominal outside diameter in mm of the threads. The pitch is the nominal distance in mm between two threads.**

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1. TROUBLESHOOTING

The engine malfunctions can result from a large number of cause. The following describes symptoms that are encountered relatively more often than others, their major causes and remedies.

Symptom	Probable Cause	Solution	Reference Page
Starter Does Not Operate	Battery discharged	Charge	G-37
	Improper or imperfect wiring	Check the wiring	–
	Main switch malfunctioning	Replace	–
	Starter malfunctioning	Repair or replace	1-S17, 5-S15
	Safety switch malfunctioning	Replace	5-S8
Engine Does Not Start	No fuel	Fill fuel	–
	Air Cleaner clogged	Clean or replace	G-30
	Fuel pipe clogged	Clean or replace	G-33
	Fuel filter clogged	Replace	G-33
	Spark plug electrodes are wet with gasoline	Dry electrode and restart, being careful not to close choke excessively. Check to see if there is no overflow from carburetor, if affirmative, disassembled and clean carburetor.	–
	No spark forms in spark plug	Disconnected cord and wrong wiring	1-S12
	Only weak spark forms	Damaged ignition coil Damaged ignition control unit	1-S12
	Insufficient compression	Check the valve clearance	1-S9
		Check degree of contact of intake and exhaust valves with their seat	1-S31
		Check the tightening torque on cylinder head screws	1-S21
		Check the wear of piston ring, piston and cylinder	1-S36, 1-S37, 1-S39
	Fuel pump damaged	Repair or replace	5-S10, 5-S11
Improper Low-Speed Operating and Idling	Improper spark plug	Repair or replace	1-S20
	Damaged Igniter	Replace	1-S30
	Damaged carburetor	Clean or replace	1-S19
	Damaged governor	Adjust	1-S10
Engine Speed Does Not Increase	Damaged carburetor	Repair or replace	1-S19
	Damaged governor	Adjust	1-S10

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2. SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Valve Clearance (Cold)	Intake	0.12 to 0.17 mm 0.0048 to 0.0066 in.	–
	Exhaust	0.17 to 0.22 mm 0.0067 to 0.0086 in.	–
Compression Pressure	No. 1 Cylinder	1.19 MPa 12.1 kgf/cm^2 173 psi	0.95 MPa 9.7 kgf/cm^2 140 psi
	No. 2 Cylinder	0.36 MPa 3.7 kgf/cm^2 52 psi	0.20 MPa 2.0 kgf/cm^2 29 psi
Valve Stem to Valve Guide	Clearance	0.045 to 0.075 mm 0.018 to 0.029 in.	0.10 mm 0.0039 in.
• Valve Stem	O.D.	6.940 to 6.955 mm 0.2733 to 0.2738 in.	–
• Valve Guide	I.D.	7.000 to 7.015 mm 0.2756 to 0.2761 in.	–
Valve Face	Angle (Intake)	0.79 rad 45°	–
	Angle (Exhaust)	0.79 rad 45°	–
Valve Seat	Angle (Intake)	0.79 rad 45°	–
	Angle (Exhaust)	0.79 rad 45°	–
	Width	1.13 mm 0.0445 in.	–
Valve Spring	Free Length	45.3 to 45.8 mm 1.79 to 1.80 in.	45.0 mm 1.77 in.
	Tilt	–	1.0 mm 0.039 in.
	Setting Load	127 N / 35.7 mm 13.0 kgf / 35.7 mm 28.6 lbf / 35.7 mm	115 N / 35.7 mm 11.7 kgf / 35.7 mm 25.9 lbf / 35.7 mm
Rocker Arm Shaft to Rocker Arm	Clearance	0.011 to 0.052 mm 0.00044 to 0.0020 in.	0.10 mm 0.0039 in.
• Rocker Arm Shaft	O.D.	11.973 to 11.984 mm 0.47138 to 0.47181in.	–
• Rocker Arm	I.D.	11.995 to 12.025 mm 0.47225 to 0.47342 in.	–
Push Rod	Alignment	–	0.25 mm 0.0098 in.

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7. MAINTENANCE CHECK LIST

No.	Item		Service Interval												After since	Reference page	Important	
			50	100	150	200	250	300	350	400	450	500	550	600				
1	Engine oil	Change	★		☆		☆		☆		☆		☆		every 100 Hr	G-22	*1	
2	Engine oil filter	Replace	★				☆				☆				every 200 Hr	G-22	*1	
3	Transmission oil filter	Replace	★			☆				☆				☆	every 200 Hr	G-23	*1	
4	Transmission strainer	Clean								★					every 400 Hr	G-25		
5	Transmission fluid and rear axle gear case (R.H. and L.H.) fluid	Change								★					every 400 Hr	G-24		
6	Mower gear box oil	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-27		
		Change			☆			☆			☆			☆	every 150 Hr	G-41		
7	OPC system check	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-27		
8	Greasing (except mower)	–	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-28		
9	Engine start system	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-26		
10	Oiling	–	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-29		
11	Air cleaner primary element	Clean		☆		☆		☆		☆		☆		☆	every 100 Hr	G-30	*2	
		Replace													every 1000 Hr or 1 year	G-46	*3	
	Secondary element	Replace													every 1000 Hr or 1 year	G-46	*3	
12	Carbon canister air element	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-40		
		Replace													every 2 year	G-49		
13	Fuel line	Check		☆		☆		☆		☆		☆		☆	every 1 year	G-33	*4	
		Replace													every 4 years	G-49		
14	Fuel filter element	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-33		
		Replace								☆					every 400 Hr	G-43		
15	Parking brake	Adjust		☆		☆		☆		☆		☆		☆	every 100 Hr	G-36		
16	Battery condition	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-37	*6	
17	Engine shroud panel	Clean		☆		☆		☆		☆		☆		☆	every 100 Hr	G-31		
18	Engine oil cooler fins (ZG227A only)	Clean		☆		☆		☆		☆		☆		☆	every 100 Hr	G-32	*7	
19	Fuel filter bowl	Clean		☆		☆		☆		☆		☆		☆	every 100 Hr	G-35		
20	Throttle cable	Adjust		☆		☆		☆		☆		☆		☆	every 100 Hr	G-39		
21	Spark plug condition and gap	Check				☆				☆				☆	every 200 Hr	G-42		

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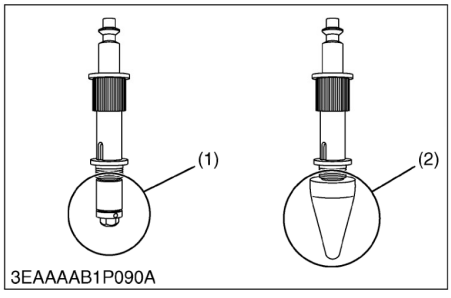
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4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

(1) Engine Body





Compression Pressure

■ **IMPORTANT**

- **Exchange the point of the compression tester for rubber adaptor (2), because it hits the piston if it is standard type. (See the figure.)**

1. Operate the engine until it is warmed up.
2. Stop the engine.
3. Remove the air cleaner, muffler and all spark plugs.
4. Set a compression tester to the spark plug hole.
5. Let the starter operate 5 to 7 seconds. Read the number value in the position where the compression tester needle stops. Repeat measurement twice or more.
6. If the measurement is below the allowable limit, apply a small amount of oil to the cylinder wall through the spark plug hole and measure the compression pressure again.
7. If the compression pressure is still less than the allowable limit, check the valve clearance and cylinder head.
8. 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.**

Compression pressure	No. 1 Cylinder	Factory specification	1.19 MPa 12.1 kgf/cm^2 173 psi
		Allowable limit	0.95 MPa 9.7 kgf/cm^2 140 psi
	No. 2 Cylinder	Factory specification	0.36 MPa 3.7 kgf/cm^2 52 psi
		Allowable limit	0.20 MPa 2.0 kgf/cm^2 29 psi

(1) Standard Adaptor (2) Rubber Adaptor

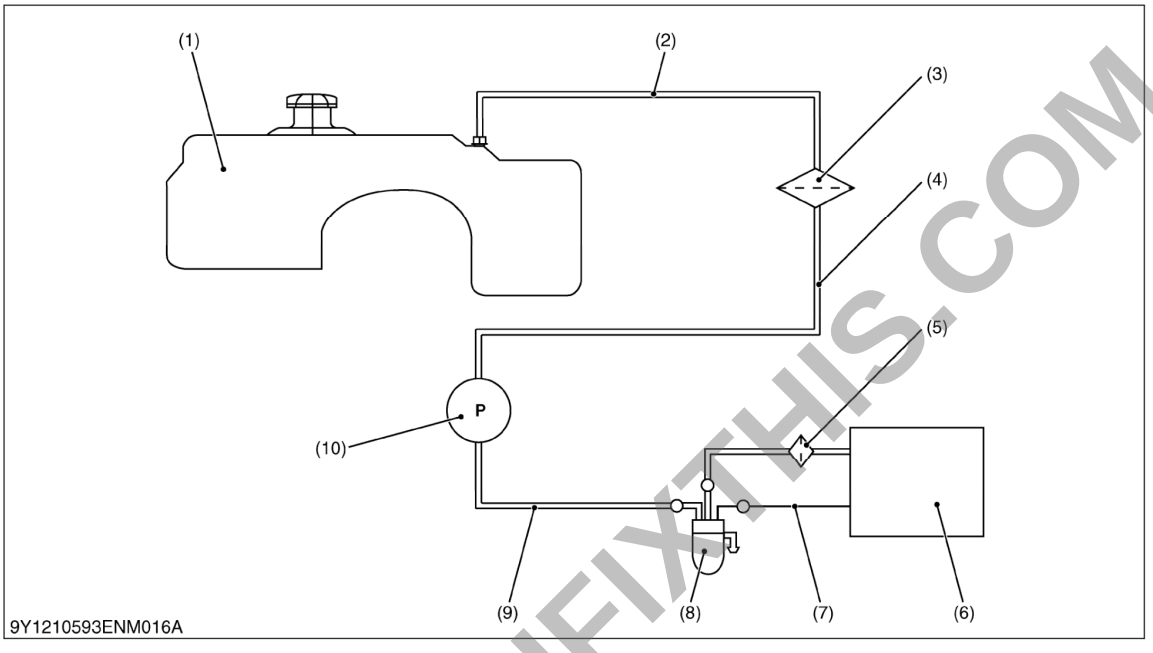
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5. FUEL SYSTEM

[1] FUEL LINE



(1) Fuel Tank
(2) Fuel Hose
(3) Primary Fuel Filter
(4) Fuel Hose
(5) Secondary Fuel Filter
(6) Carburetor
(7) Fuel Draining Hose (From Carburetor)
(8) Fuel Shut-off Valve
(9) Fuel Hose
(10) Fuel Feed Pump

Fuel in the tank is fed by the fuel feed pump (10).

Fuel is sucked from the fuel tank lower portion through the upper portion to the primary fuel filter (3).

When not using the machine in winter season, the remaining fuel in the carburetor may cause carburetor contamination and difficult engine start.

Fuel draining hose (7) is installed to the position between the carburetor (6) and the fuel shut-off valve (8).

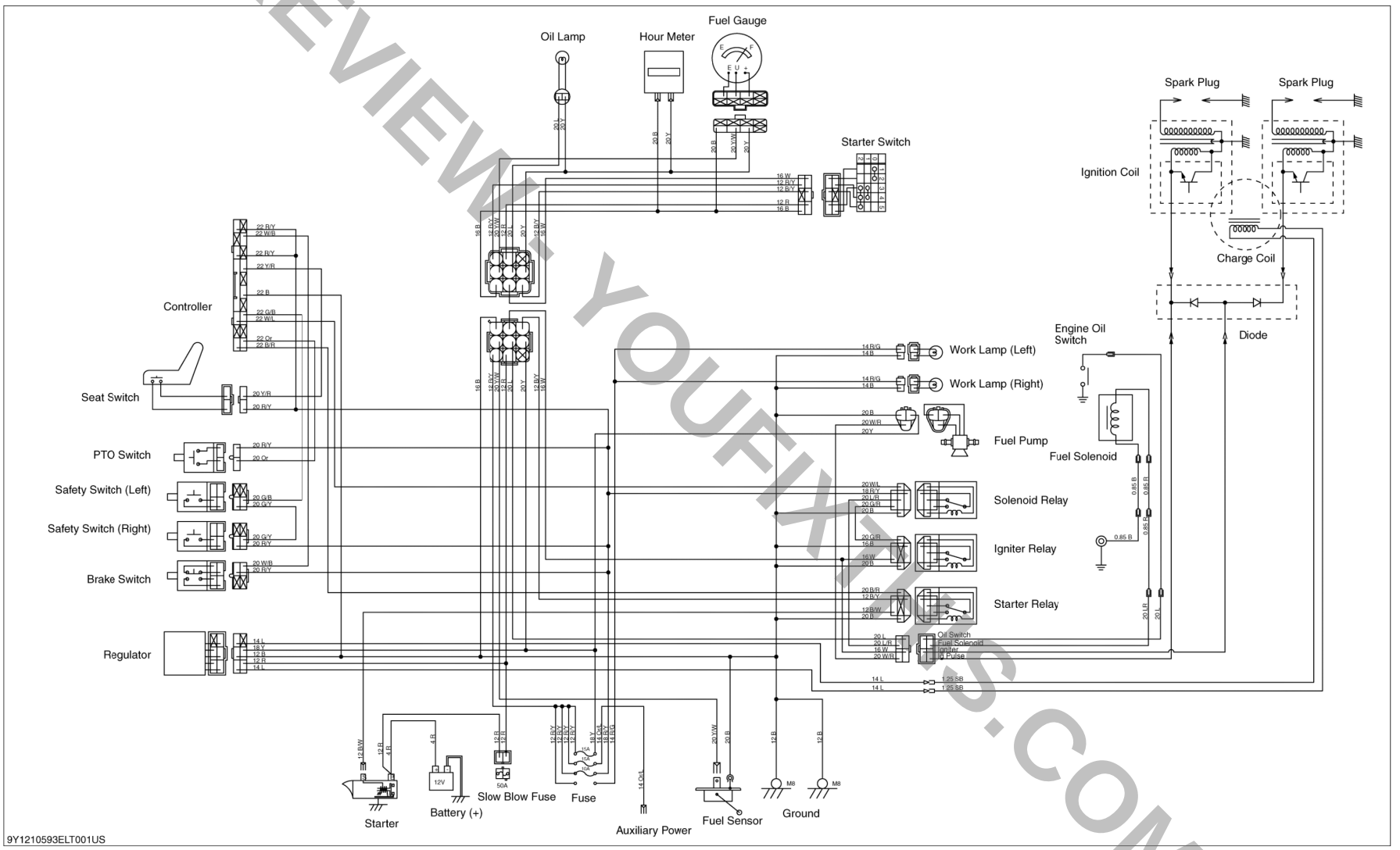
When setting the fuel shut-off valve to the "DRAIN" position, the fuel in the carburetor is drained from the carburetor (6) through the fuel draining hose (7) and the fuel shut-off valve (8) to the outside.

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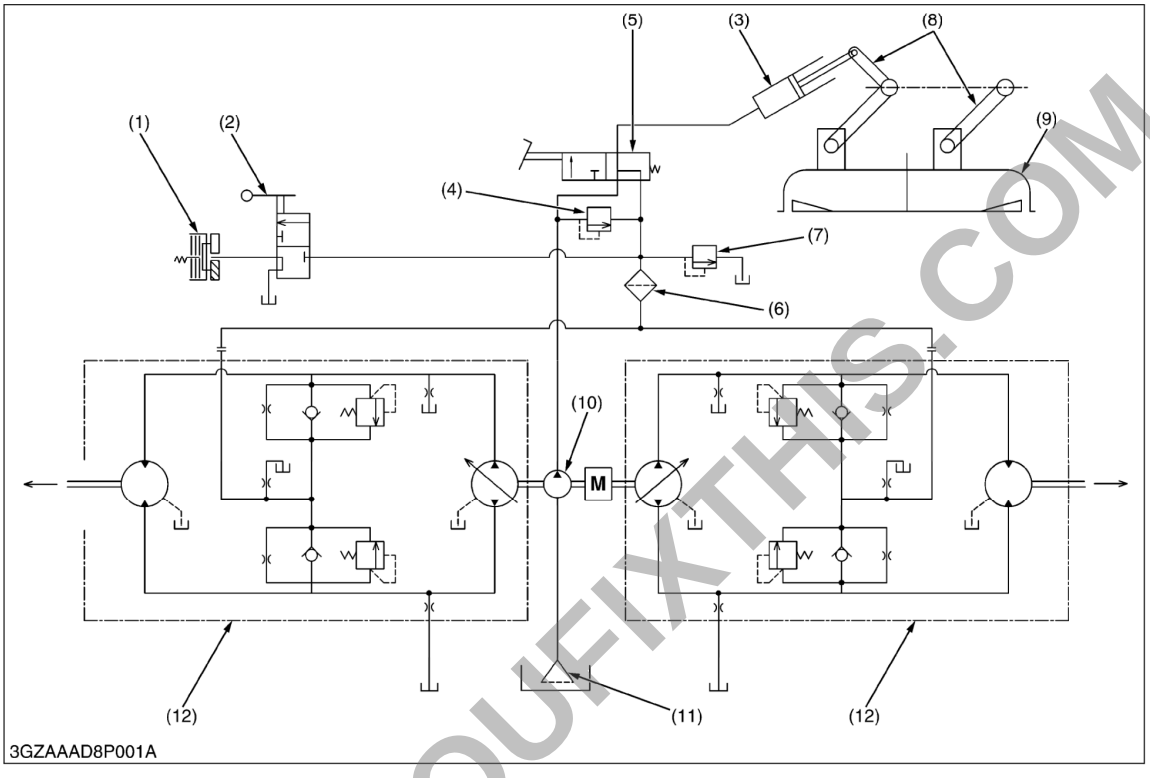
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1. WIRING DIAGRAM



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1. HYDRAULIC CIRCUIT



(1) PTO Clutch
(2) PTO Clutch Valve
(3) Mower Lift Cylinder
(4) Relief Valve
(5) Control Valve
(6) Oil Filter
(7) Regulator Valve
(8) Mower Link
(9) Mower Deck
(10) Hydraulic Pump
(11) Oil Strainer
(12) Hydrostatic Transmission

The hydraulic system of this machine is composed of a hydraulic pump (10), control valve assembly (5), mower lift cylinder (3) and other components.

This system has the following functions.

Oil is supplied by hydraulic pump (10) which is driven by engine.

Power from the input shaft (pump shaft) is distributed right and left with the bevel gears and drives each hydrostatic transmission (12).

Moreover, oil from the hydraulic pump (10) is sent to the transmission centre case through the control valve. On the other hand, oil is regulated with the regulator valve (7) to constant pressure and sent to the hydrostatic transmission (12) and PTO clutch (1).

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