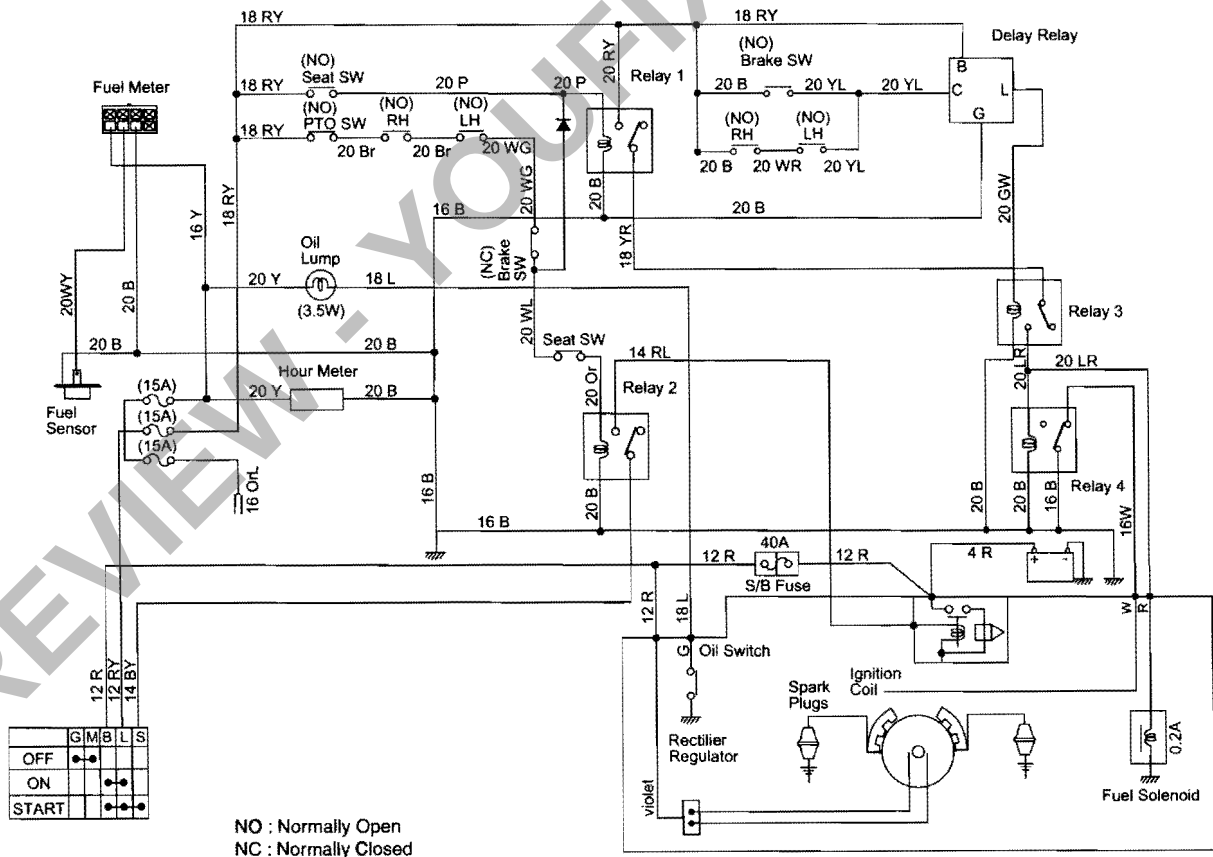


1. WIRING DIAGRAM

Color of Wiring

W.....White	WB.....White / Black	RY.....Red / Yellow
R.....Red	GB.....Green / Black	RL.....Red / Blue
L.....Blue	OrL.....Orange / Blue	LR.....Blue / Red
P.....Pink	YB.....Yellow / Black	YW.....Yellow / White
B.....Black	WG.....White / Green	BW.....Black / White
G.....Green	BrR.....Brown / Red	BR.....Black / Red
Y.....Yellow	WR.....White / Red	WG.....Green / White
Or.....Orange	WY.....White / Yellow	YR.....Yellow / Red
BY.....Black / Yellow	RW.....Red / White	YL.....Yellow / Blue

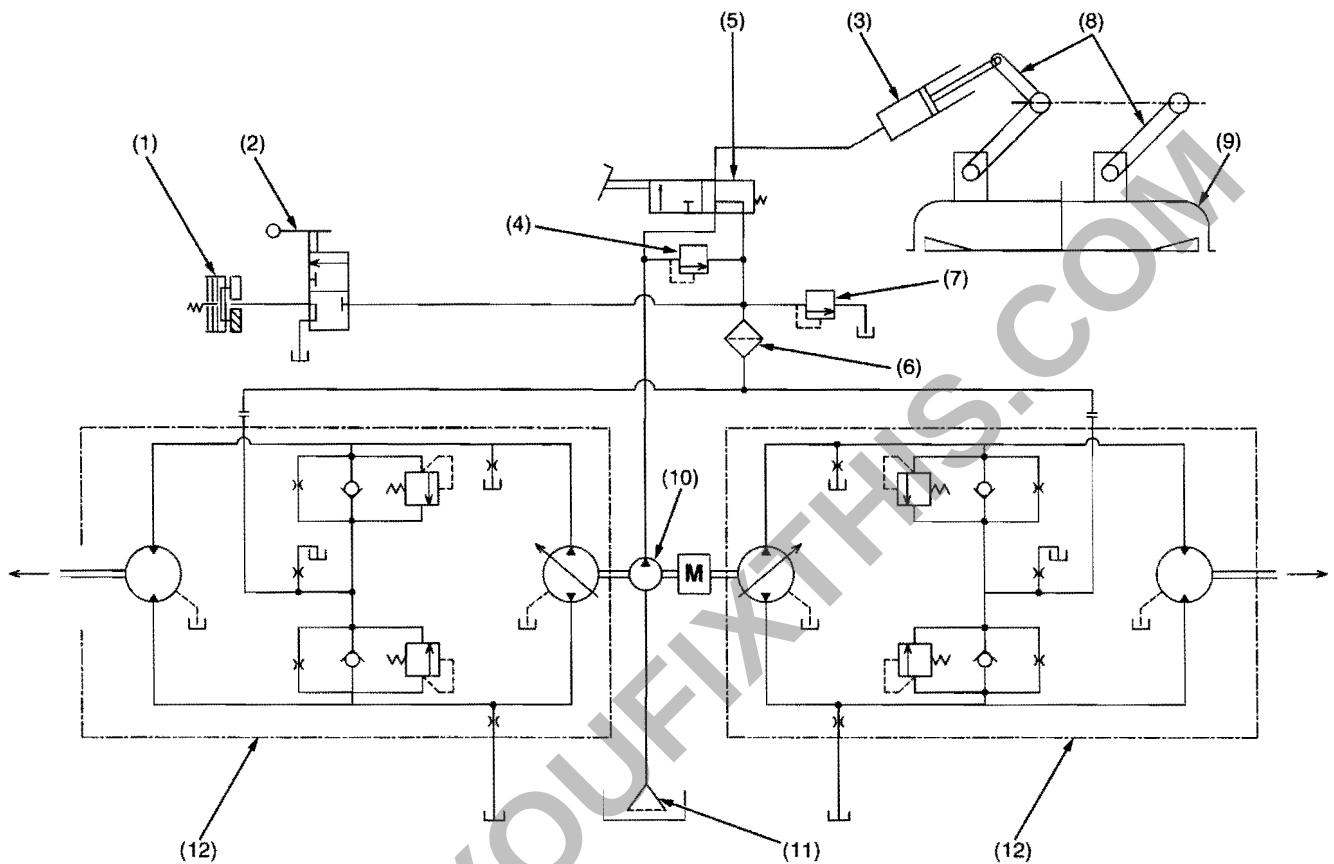
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1. HYDRAULIC CIRCUIT



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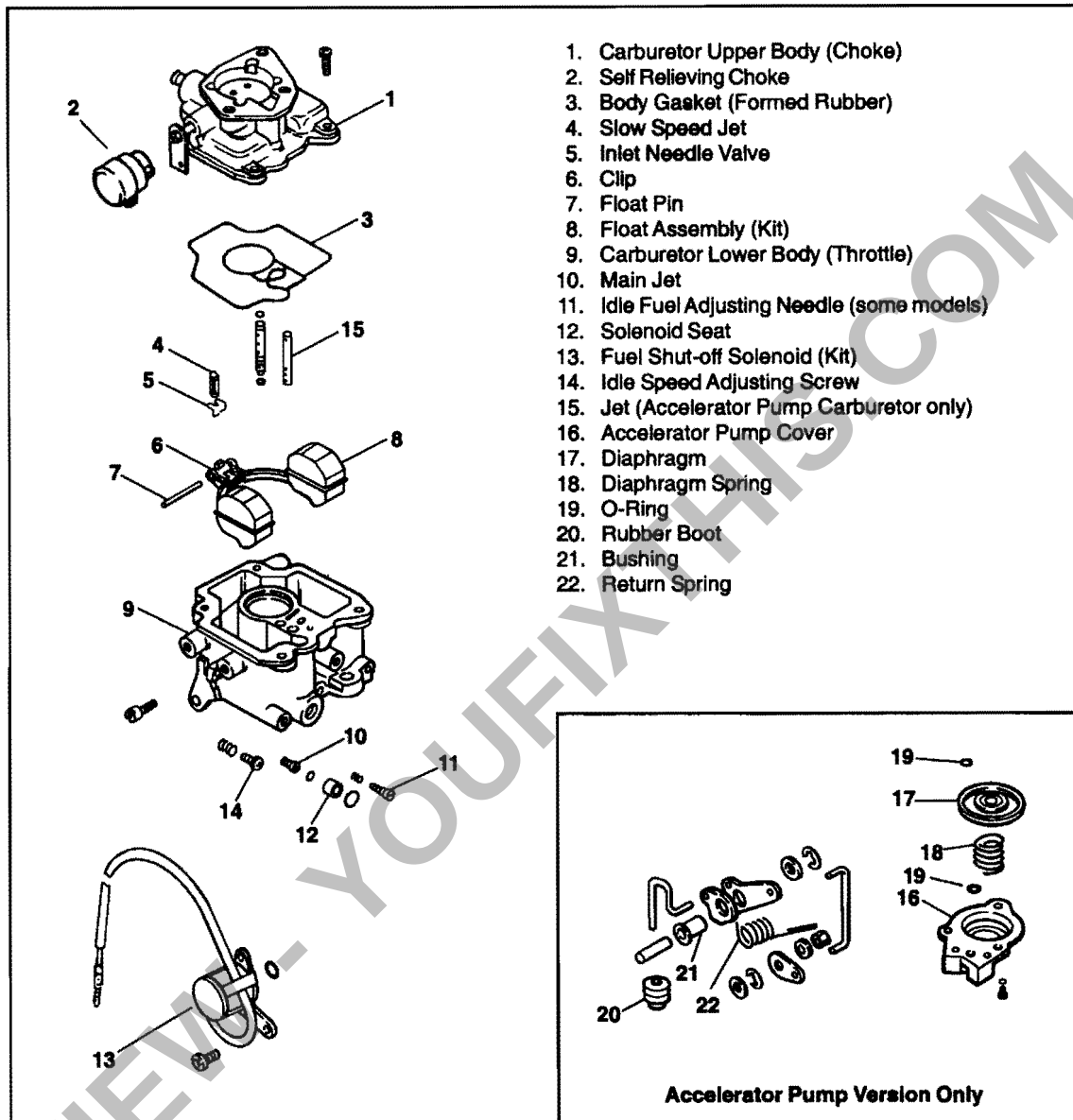


Figure 5-8. Carburetor – Exploded View.

Components such as the throttle and choke shaft assemblies, throttle plate, choke plate, low idle fuel needle, and others, are available separately.

Always refer to the Parts Manual for the engine being serviced, to ensure the correct repair kits and replacement parts are ordered. Service/repair kits available for the carburetor and affiliated components are:

Carburetor Repair Kit

- Float Kit
- High Altitude Kit (5,000-10,000 Ft./1525-3048 Meter)
- High Altitude Kit (Over 10,000 Ft./3048 Meter)
- Solenoid Assembly Kit
- Accelerator Pump Seal and Bushing Kit

5. TIGHTENING TORQUES

[1] GENERAL USE SCREWS, BOLTS AND NUTS

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

Indication on top of bolt	No-grade or 4T						7T						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	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M6 (6 mm, 0.24 in.)	7.85 to 9.31	0.80 to 0.95	5.79 to 6.87	7.85 to 8.82	0.80 to 0.90	5.79 to 6.50	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.85 to 8.82	0.80 to 0.90	5.79 to 6.50	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8 (8 mm, 0.31 in.)	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1	16.7 to 19.6	1.7 to 2.0	12.3 to 14.4	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1	29.5 to 34.3	3.0 to 3.5	21.7 to 25.3
M10 (10 mm, 0.39 in.)	39.3 to 45.1	4.0 to 4.6	29.0 to 33.2	31.4 to 34.3	3.2 to 3.5	23.2 to 25.3	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5	60.9 to 70.6	6.2 to 7.2	44.9 to 52.0
M12 (12 mm, 0.47 in.)	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	-	-	-	77.5 to 90.2	7.9 to 9.2	57.2 to 66.5	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	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

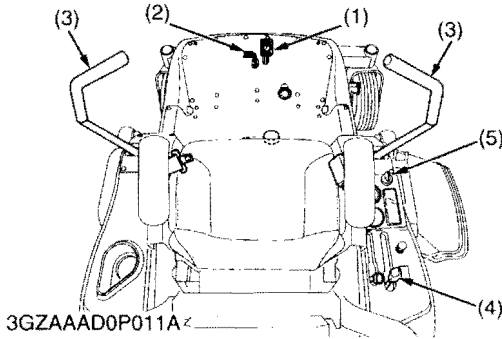
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[2] METRIC SCREWS, BOLTS AND NUTS

Grade	Property class 8.8			Property class 10.9		
Unit	8.8			10.9		
Nominal Diameter	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M8	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
M10	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
M12	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5	103.0 to 117.0	10.5 to 12.0	76.0 to 86.8
M14	124.0 to 147.0	12.6 to 15.0	91.2 to 108.0	167.0 to 196.0	17.0 to 20.0	123.0 to 144.0
M16	196.0 to 225.0	20.0 to 23.0	145.0 to 166.0	260.0 to 303.0	26.5 to 31.0	192.0 to 224.0

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[2] CHECK POINTS OF 25 HOURS



Checking Safety Device

CAUTION

- Do not allow anyone near the machine while testing.
- If the machine does not pass one of the following tests, do not operate the machine.

- Sit on operator's seat for all tests except for Test 1.

■ Test 1 (OPERATOR NOT ON THE SEAT)

1. Securely set the parking brake.
2. Shift the PTO lever (4) to "DISENGAGE" (OFF) position.
3. Set the motion control levers (3) to the "NEUTRAL LOCK" position.
4. Turn the key switch (5) to "START" position.
5. The engine must not crank.

■ Test 2 (OPERATOR ON THE SEAT)

1. Do not set the parking brake. (Release it from Test 1.)
2. Shift the PTO lever (4) to "DISENGAGE" (OFF) position.
3. Set the motion control levers (3) to the "NEUTRAL LOCK" position.
4. Turn the key switch (5) to "START" position.
5. The engine must not crank.

■ Test 3 (OPERATOR ON THE SEAT)

1. Securely set the parking brake.
2. Shift the PTO lever (4) to "DISENGAGE" (OFF) position.
3. Grasp the motion control levers (3) and move them inward from "NEUTRAL LOCK" position to "NEUTRAL" position and then release the levers.
4. Turn the key switch (5) to "START" position.
5. The engine must not crank.

■ Test 4 (OPERATOR ON THE SEAT)

1. Securely set the parking brake.
2. Shift the PTO lever (4) to "ENGAGE" (ON) position.
3. Grasp the motion control levers (3) and move them inward from "NEUTRAL LOCK" position to "NEUTRAL" position and then release the levers.
4. Turn the key switch (5) to "START" position.
5. The engine must not crank.

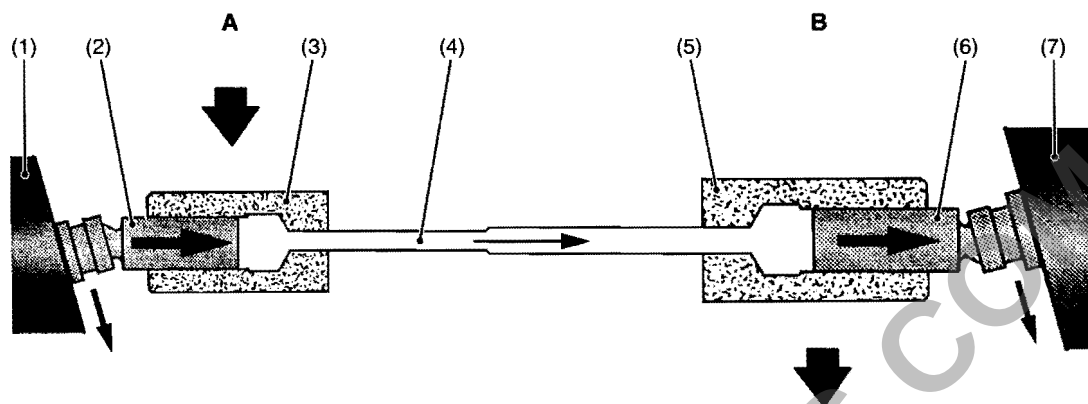
■ Test 5 (OPERATOR ON THE SEAT)

1. Start the engine.
2. Keep the parking brake securely set.
3. Shift the PTO lever (4) to "DISENGAGE" (OFF) position.
4. Grasp the motion control levers (3) and move them inward from "NEUTRAL LOCK" position to "NEUTRAL" position and then release the levers.
5. The engine must shut off after a short time delay.

- | | |
|------------------------------|----------------|
| (1) Parking Brake Pedal | (4) PTO Lever |
| (2) Parking Brake Lock Pedal | (5) Key Switch |
| (3) Motion Control Lever | |

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(2) Pump and Motor



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- (1) Swashplate
- (2) Piston
- (3) Cylinder

- (4) Oil
- (5) Cylinder
- (6) Piston

- (7) Swashplate

- (A) Pump
- (B) Motor

Pump and motor cylinder, each containing pistons, are connected by lines. Cylinders and lines are filled with oil. Pistons ride against swashplates located in pump and motor.

In the pump, as the cylinder rotates, pistons move across the sloping face of swashplate and slide in or out of their cylinder bores. The oil, forced out by the pump pistons, cause the motor pistons to slide out of their cylinder bores.

In the motor, sliding out of the cylinder and moving across the sloping face of swashplate, the pistons rotate the cylinder.

■ Torque rise

Diameter of pump cylinder block is smaller than motor cylinder block. Number of piston in pump cylinder block are five pieces. Seven pieces of piston are in motor cylinder block.

Since oil charged per one revolution from pump cylinder block is less than oil per one revolution from motor cylinder block, pump speeds at pump shaft is reduced at motor shaft and the torque is risen at motor shaft.

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Section 3

Troubleshooting

Troubleshooting Guide

When troubles occur, be sure to check the simple causes which, at first, may seem too obvious to be considered. For example, a starting problem could be caused by an empty fuel tank.

Some general common causes of engine troubles are listed below. Use these to locate the causing factors. Refer to the specific section(s) within this service manual for more detailed information.

Engine Cranks But Will Not Start

1. Empty fuel tank.
2. Fuel shut-off valve closed.
3. Poor fuel, dirt or water in the fuel system.
4. Clogged fuel line.
5. Spark plug lead(s) disconnected.
6. Key switch or kill switch in "off" position.
7. Faulty spark plugs.
8. Faulty ignition module(s).
9. Smart Spark™ malfunction (applicable models).
10. Carburetor solenoid malfunction.
11. Diode in wiring harness failed in open circuit mode
12. Vacuum fuel pump malfunction, or oil in vacuum hose.
13. Vacuum hose to fuel pump leaking/cracked.
14. Battery connected backwards.

Engine Starts But Does Not Keep Running

1. Restricted fuel tank cap vent.
2. Poor fuel, dirt or water in the fuel system.
3. Faulty or misadjusted choke or throttle controls.
4. Loose wires or connections that short the kill terminal of ignition module to ground.
5. Faulty cylinder head gasket.
6. Faulty carburetor.
7. Vacuum fuel pump malfunction, or oil in vacuum hose.
8. Leaking/cracked vacuum hose to fuel pump.
9. Intake system leak.

Engine Starts Hard

1. PTO drive is engaged.
2. Dirt or water in the fuel system.
3. Clogged fuel line.
4. Loose or faulty wires or connections.
5. Faulty or misadjusted choke or throttle controls.
6. Faulty spark plugs.
7. Low compression.
8. Weak spark.
9. Fuel pump malfunction causing lack of fuel.
10. Engine overheated-cooling/air circulation restricted.
11. Quality of fuel.
12. Flywheel key sheared.
13. Intake system leak.

SPECIFICATIONS

Model			ZG20	ZG23
Engine	Model		GH630H	GH680H
	Type		Forced air-cooled, Horizontal shaft OHV, 4-stroke gasoline engine	
	Number of cylinder		2 (V-Twin)	
	Bore and stroke		77 x 67 mm (3.03 x 2.64 in.)	80 x 67 mm (3.18 x 2.64 in.)
	Total displacement		624 cm ³ (38.1 cu.in.)	674 cm ³ (41.1 cu.in.)
	Maximum horsepower		14.9 kW / 20 HP	17.2 kW / 23 HP
	Maximum torque		44.2 N·m / 2600 min ⁻¹ (4.5 kgf·m / 2600 rpm, 32.6 ft-lbs / 2600 rpm)	51.7 N·m / 2200 min ⁻¹ (5.3 kgf·m / 2200 rpm, 38.2 ft-lbs / 2200 rpm)
	Direction of rotation		Counterclockwise facing the PTO shaft	
	Ignition system		8.5 : 1	
	Compression ratio		Flywheel magnet transistor type	
	Spark plug		Champion 3071	
	Air cleaner		Paper washable form precleaner type	
	Governor		Mechanical type	
	Lubricating system		Forced lubrication by oil pump	
	Cooling system		Forced air cooling	
	Starting system		Electric starter with battery	
	Battery		U1L-9 (12 V, RC : 30 min, CCA : 285, CA : 340)	
	Throttle system		Manual	
	Engine stop system		Key stop	
Capacities	Fuel tank		23 L (6.0 U.S.gals, 5.1 Imp.gals)	
	Engine crankcase		1.9 L (2.0 U.S.qts, 1.7 Imp.qts)	
	Hydrostatic transmission case		7.5 L (7.9 U.S.qts, 6.6 Imp.qts)	
Dimensions	Overall length		1950 mm (76.8 in.)	
	Overall width		1210 mm (47.7 in.)	
	Overall height	With ROPS upright	1775 mm (69.8 in.)	
		With ROPS folded	1320 mm (51.9 in.)	
	Wheel base		1185 mm (46.7 in.)	
	Tread	Front	860 mm (33.9 in.)	
Rear		930 mm (36.6 in.)		
Weight (with mower deck)		Stamped deck	480 kg (1058 lbs) 48 in.	500 kg (1102 lbs) 54 in.

6. MAINTENANCE CHECK LIST

■ 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 non-road emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the following instruction.

No.	Item		Period	Indication on hour meter											Impor- -tant	Refer- -ence page		
				25	50	75	100	125	150	175	200	225	250	275			300	
1	Engine oil	Change		★			☆					☆			☆			G-25
2	Engine oil filter	Replace		★								☆						G-33
3	Transmission fluid	Change										★						G-34
4	Transmission oil filter	Replace		★								☆						G-35
5	Transmission strainer	Clean										☆						G-34
6	Engine shroud panel	Clean					☆					☆			☆	*2		G-30
7	Engine shroud	Clean										★				*3		G-37
8	Safety device	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆			G-20, G-21
9	Greasing (without mower)	—	★	☆		☆			☆			☆			☆			G-23
10	Mower gear box oil	Check		☆		☆			☆			☆			☆			G-23
		Change							☆						☆			G-32
11	Air cleaner	Pre- cleaner element	Clean	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	*1	@	G-21
		Air cleaner element	Replace				☆					☆			☆			G-29
12	Battery condition	Check					☆					☆			☆			G-27
13	Solenoid shift starter	Clean														*3		G-38
14	Parking brake	Adjust					☆					☆			☆	*2		G-31
15	Fuel filter element	Check					☆					☆			☆		@	G-26
		Replace														*2		G-37
16	Fuel line	Check					☆					☆			☆			G-26
		Replace														*2		G-38
17	Spark plug condition and gap	Check										☆						G-36

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.

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BEFORE SERVICING AND REPAIRING

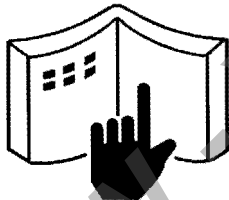
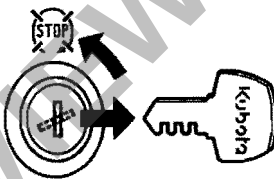
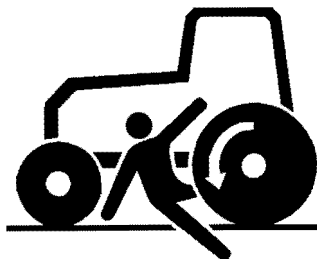
- Read all instructions and safety instructions in this manual and on your machine safety decals.
- Clean the work area and machine.
- Park the machine on a firm and level ground, and set the parking brake.
- Lower the implement to the ground.
- Stop the engine, and remove the key
- Disconnect the battery negative cable
- Hang a **"DO NOT OPERATE"** tag in operator station.

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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.

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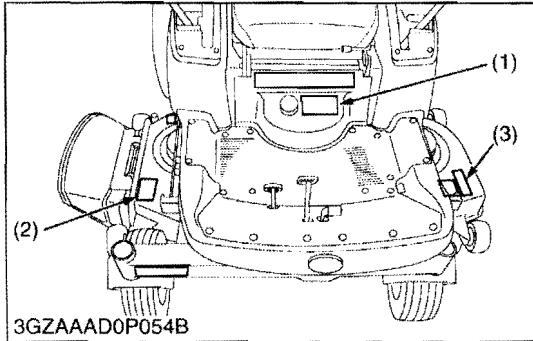
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SAFETY DECALS

The following safety decals are installed on the machine.

If a decal becomes damaged, illegible or is not on the machine, replace it. The decal part number is listed in the parts list.

DANGER, WARNING AND CAUTION LABELS



(1) Part No. K3211-6585-1



(2) Part No. K5617-7312-1



(3) Part No. K5617-7311-1



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Section 1

Safety and General Information

Safety Precautions

To ensure safe operations please read the following statements and understand their meaning. Also refer to your equipment manufacturer's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.



WARNING

Warning is used to indicate the presence of a hazard that *can* cause severe personal injury, death, or substantial property damage if the warning is ignored.



CAUTION

Caution is used to indicate the presence of a hazard that *will* or *can* cause minor personal injury or property damage if the caution is ignored.

NOTE

Note is used to notify people of installation, operation, or maintenance information that is important but not hazard-related.

For Your Safety!

These precautions should be followed at all times. Failure to follow these precautions could result in injury to yourself and others.

 WARNING

Accidental Starts can cause severe injury or death.
Disconnect and ground spark plug leads before servicing.

Accidental Starts!

Disabling engine. Accidental starting can cause severe injury or death. Before working on the engine or equipment, disable the engine as follows: 1) Disconnect the spark plug lead(s). 2) Disconnect negative (-) battery cable from battery.

 WARNING

Rotating Parts can cause severe injury.
Stay away while engine is in operation.

Rotating Parts!

Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the engine with covers, shrouds, or guards removed.

 WARNING

Hot Parts can cause severe burns.
Do not touch engine while operating or just after stopping.

Hot Parts!

Engine components can get extremely hot from operation. To prevent severe burns, do not touch these areas while the engine is running - or immediately after it is turned off. Never operate the engine with heat shields or guards removed.

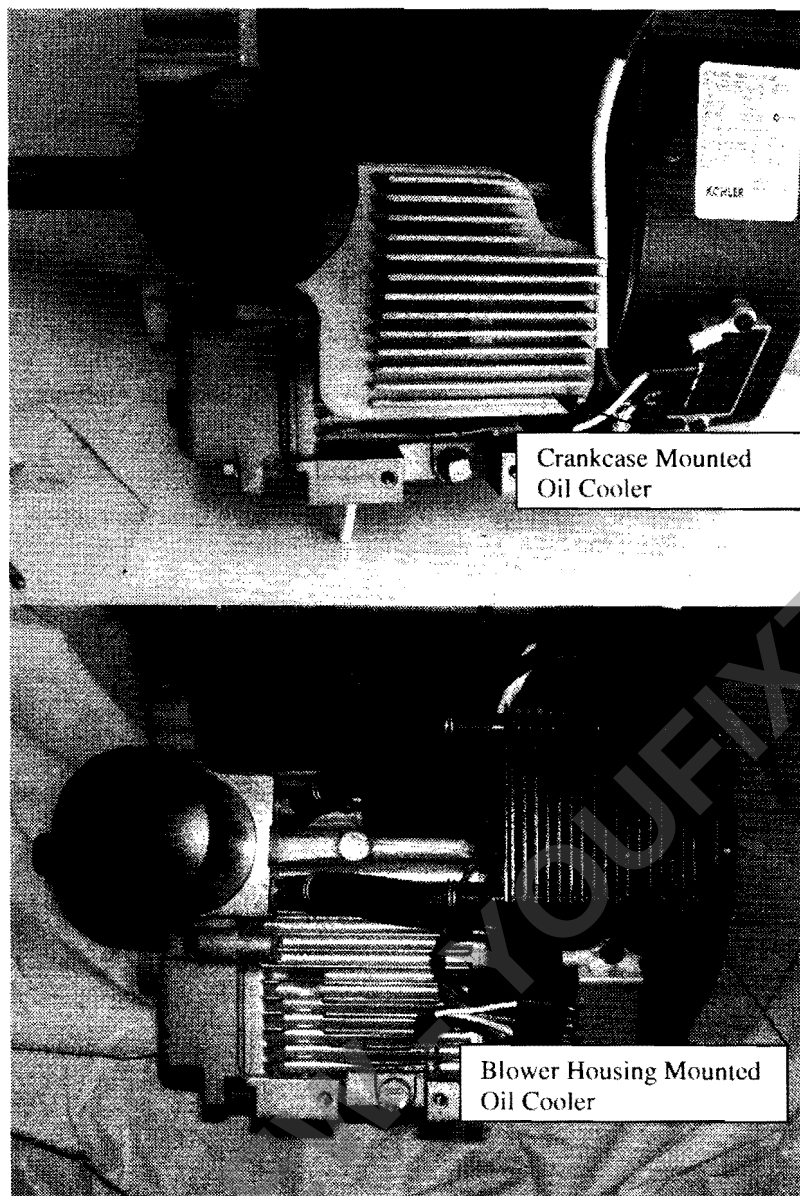


Figure 6-7. Oil Coolers.

Inspect and clean the oil cooler **every 25 hours of operation** (more frequently under severe conditions). The oil cooler must be kept free of debris.

To service the crankcase mounted oil cooler, clean off the outside fins with a brush or with compressed air.

To service the blower housing mounted style oil cooler, clean the outside of fins with a brush. Remove the two screws holding the cooler unit to the blower housing. Tilt the cooler downward. Clean the inside of cooler with a brush or with compressed air. After cleaning, reinstall the oil cooler onto the blower housing with the two mounting screws.

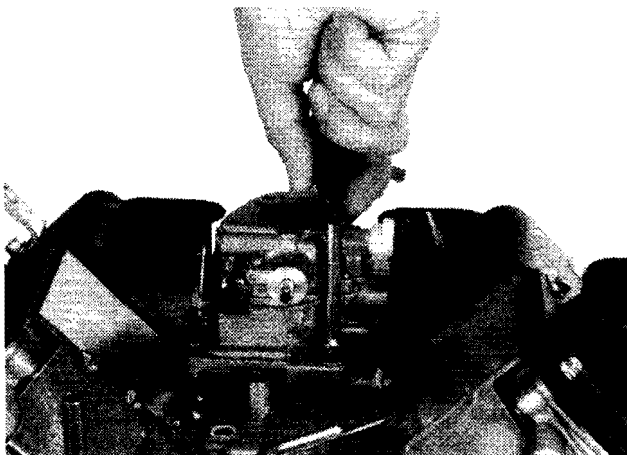


Figure 9-23. Removing Carburetor Mounting Screws.

3. Remove the carburetor, throttle linkage and governor lever as an assembly. See Figure 9-24.

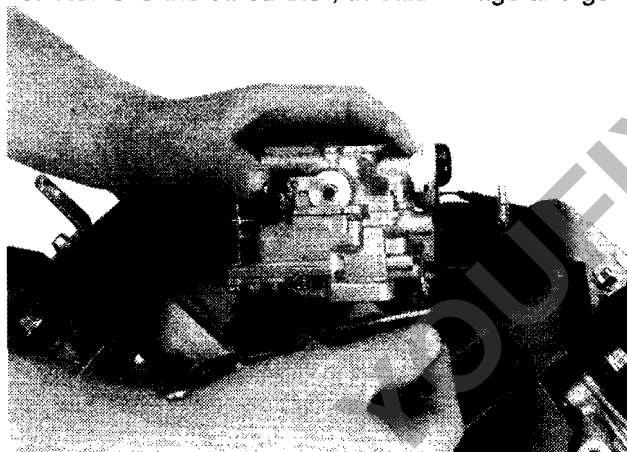


Figure 9-24. Removing Carburetor Assembly with Governor Lever Attached.

4. Remove the carburetor gasket.
5. If necessary, the carburetor, throttle linkage and governor lever can be separated. Reattach the bushings to the linkage following separation to avoid losing them.

Remove Oil Sentry™ (If So Equipped)

1. Disconnect the wire lead from the Oil Sentry™ Switch.
2. Remove the Oil Sentry™ Switch from the breather cover. See Figure 9-25.

Install Flywheel

WARNING: Damaging Crankshaft and Flywheel Can Cause Personal Injury!

Using improper procedures to install the flywheel can crack or damage the crankshaft and/or flywheel. This not only causes extensive engine damage, but can also cause personal injury, since broken fragments could be thrown from the engine. Always observe and use the following precautions and procedures when installing the flywheel.

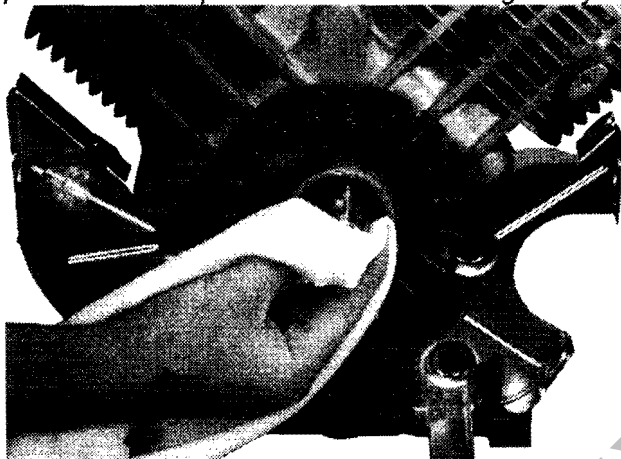


Figure 11-26. Clean and Dry Taper of Crankshaft.

NOTE: Before installing the flywheel make sure the crankshaft taper and the flywheel hub are clean, dry and completely free of any lubricants. The presence of lubricants can cause the flywheel to be over-stressed and damaged when the hex. flange screw is torqued to specifications.

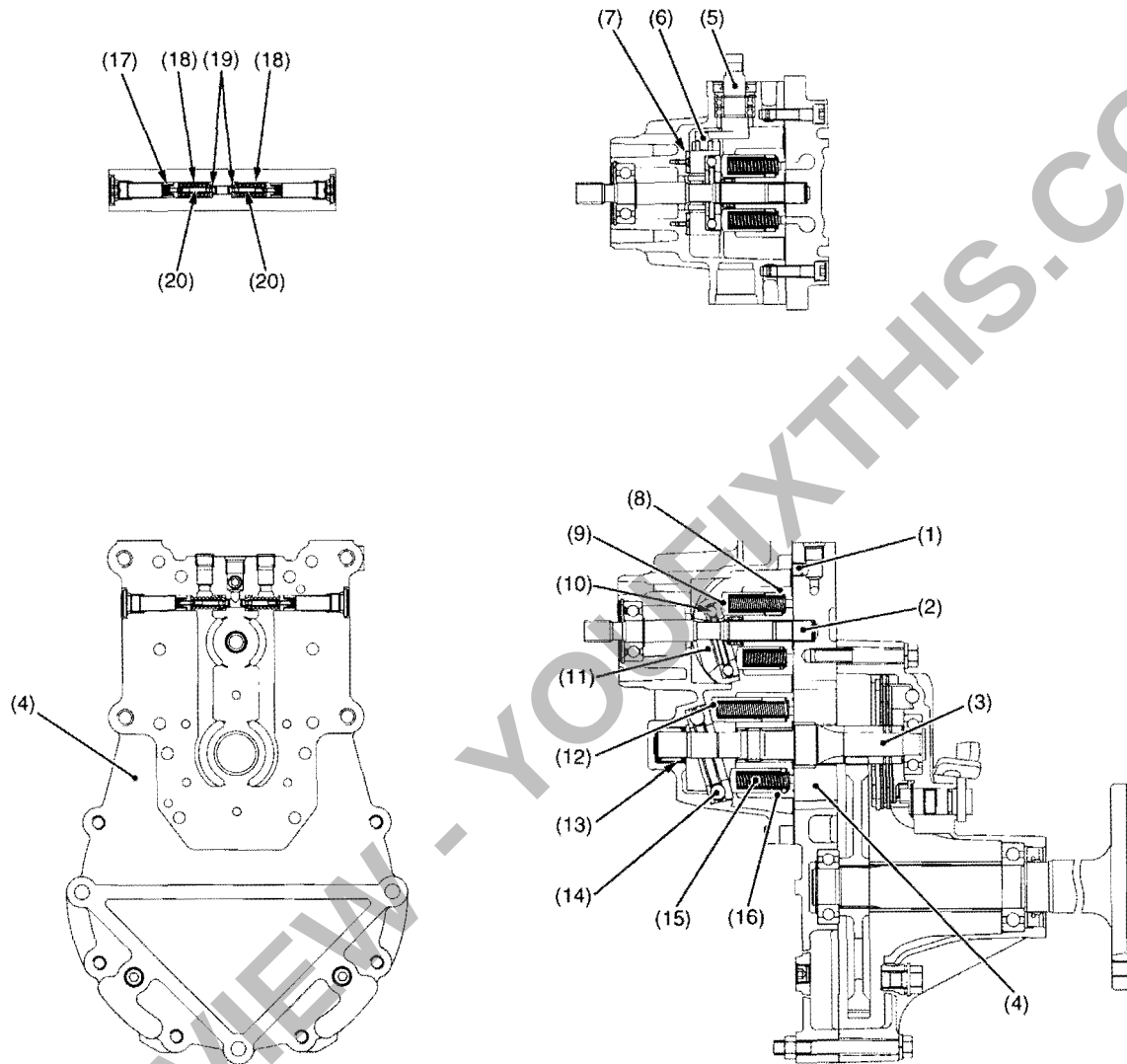


Figure 11-27. Clean and Dry Flywheel Hub.

2. TRAVELLING SYSTEM

[1] HYDROSTATIC TRANSMISSION

(1) Structure



3GZAAADKP002A

- | | | | |
|-------------------------|---------------------------|--------------------------|---------------------------------|
| (1) Lubricating Orifice | (6) Slot Guide | (11) Swashplate | (16) Cylinder Block (Motor) |
| (2) Pump Shaft | (7) Cradle Bearing | (12) Piston (Motor) | (17) Check Valve Spring |
| (3) Brake Shaft (8T) | (8) Cylinder Block (Pump) | (13) Needle Bearing | (18) Relief Valve Spring |
| (4) Center Section | (9) Piston (Pump) | (14) Thrust Ball Bearing | (19) Check Valve |
| (5) Trunnion Arm | (10) Thrust Ball Bearing | (15) Piston Spring | (20) High Pressure Relief Valve |

The hydrostatic transmission consists of variable displacement piston pump, fixed displacement piston motor and valve system.

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