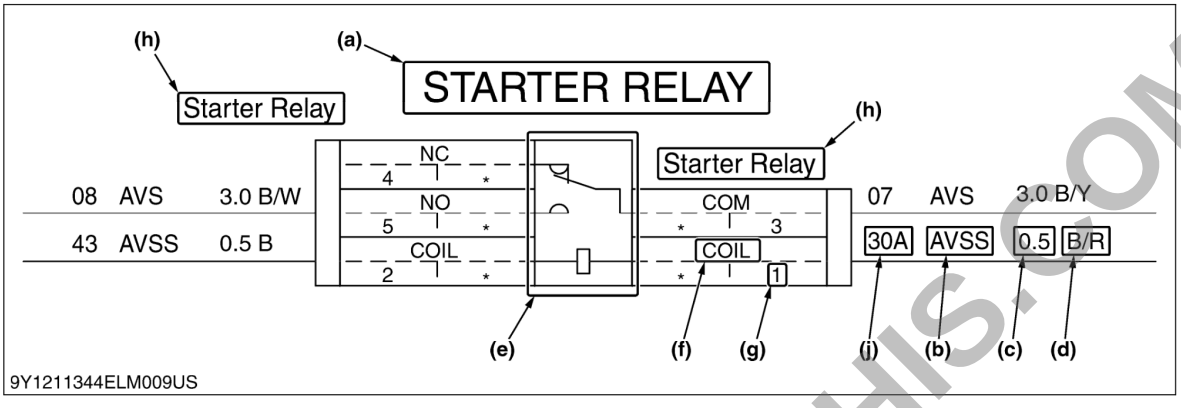
3. READING THE ELECTRICAL CIRCUIT DIAGRAMS

[1] HOW TO READ WIRING DIAGRAM

Electrical Wiring Chart Symbols for Harnesses and Wires



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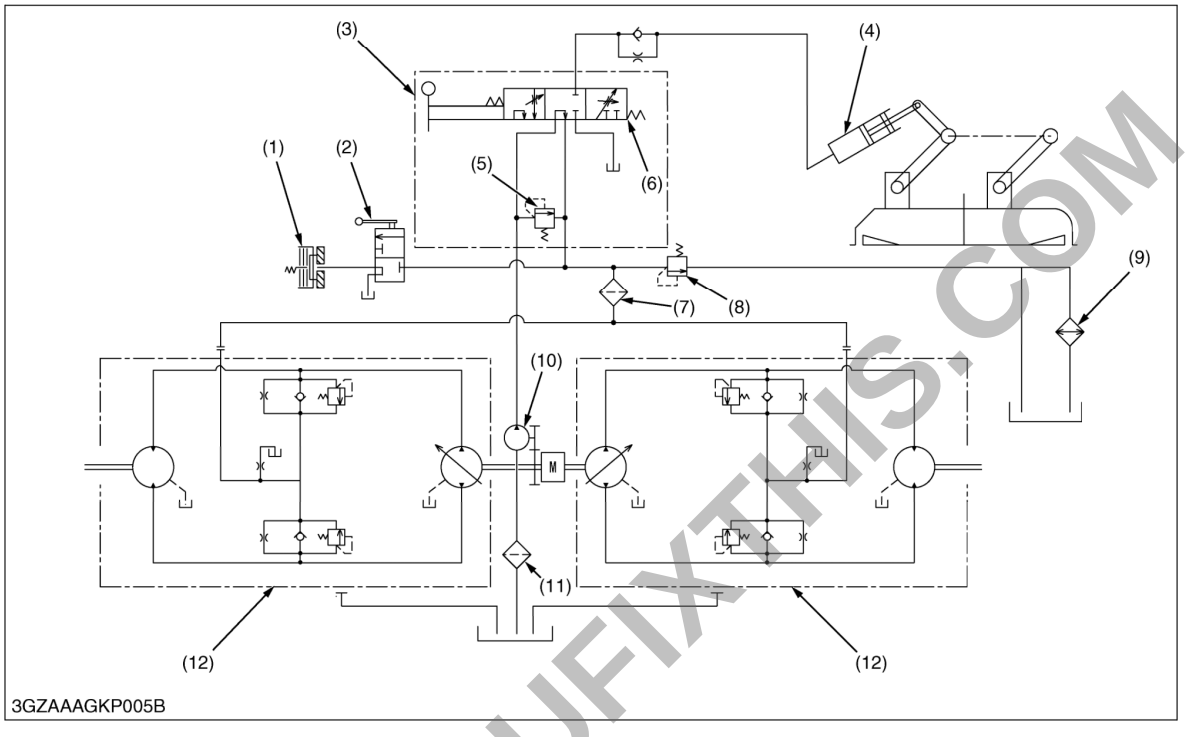
	Item	(Example) Contents of illustration	Reference
(a)	Name of part	STARTER RELAY	
(b)	Wire specification code	All use (common)	
(c)	Wire size	0.50 mm^2	
(d)	Wire color	Black / Red	Wire color page
(e)	Unit symbol	Relay	Unit symbol page
(f)	Pin name	Coil	
(g)	Pin No.	1	
(h)	Connector name	Starter Relay	Connector diagram
(j)	Wire number	30A	

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1. HYDRAULIC CIRCUIT



(1) PTO Clutch
(2) PTO Clutch Valve
(3) Hydraulic Control Valve Assembly
(4) Hydraulic Cylinder
(5) Relief Valve
(6) Control Valve
(7) Oil Filter
(8) Regulator Valve
(9) Oil Cooler
(10) Hydraulic Pump
(11) Oil Filter
(12) Hydrostatic Transmission

The hydraulic system of this machine is composed of a hydraulic pump (10), control valve (6), hydraulic cylinder (4) and other components.

This system has the following functions.Oil is supplied by hydraulic pump (10) which is driven by engine.

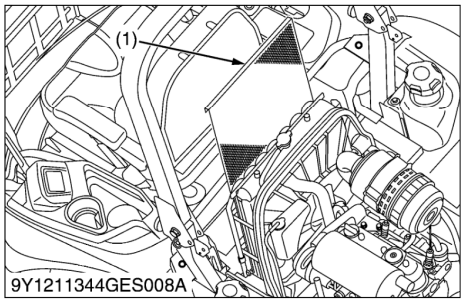
Power from the input shaft (pump shaft) is distributed right and left with the bevel gears and drives each hydrostatic transmission (12).

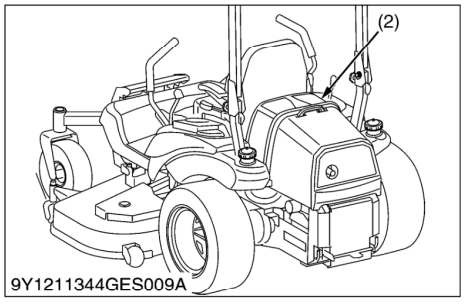
Moreover, oil from the hydraulic pump (10) is sent to the transmission center case through the control valve. On the other hand, oil is regulated with the regulator valve (8) to constant pressure and sent to the hydrostatic transmission (12) and PTO clutch (1).

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Checking and Cleaning Radiator to Prevent Overheating

WARNING

To avoid serious injury:

- **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 without heat shields or guards.**
- **Be sure to stop the engine and remove the key before cleaning.**

■ **IMPORTANT**

- **The air intake area must be clear of debris to prevent the engine from overheating.**

Daily or after every 5 hours of operation, check to be sure the radiator screen and radiator core are clean. Dirt or chaff on the radiator screen or radiator core decrease cooling performance.

1. Remove the radiator screen and bonnet screen, and remove all foreign material.
2. Remove the dust from between the fins and the tube.
3. Tighten the fan drive belt as necessary. For this, refer to page G-33
4. If scale forms in the tube, clean with the scale inhibitor or its equivalent.
5. Each time the panel screen is covered with grass during operation, rub it off the screen with hand. Check the radiator screen from time to time if grass accumulates.
6. If the dust or chaff has accumulated inside of the bonnet, remove the radiator screen and clean inside completely.
   After cleaning, replace the radiator screens properly.

■ **NOTE**

- **When assembling the panel screen, be sure to fit it in the runners.**

(1) Radiator Screen (2) Bonnet Screen

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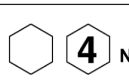
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6. TIGHTENING TORQUES

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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8. CHECK AND MAINTENANCE

WARNING
To avoid serious injury:
- **Be sure to check and service the machine on a level surface with the engine shut off, the key removed and the parking brake securely set or chock the rear wheels.**

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[1] DAILY CHECK

To prevent trouble from occurring, it is important to know the condition of the machine. Check the following items before starting.

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Checking

- Walk around the machine.
  1. Tire pressure, wear and damage
  2. Oil and water leak
  3. Fuel level
  4. Engine oil level
  5. Transmission fluid level
  6. Coolant level in the radiator and the recovery tank
  7. Damage of machine body, tightness of all bolts and nuts
  8. Machine body cleaning
  9. Radiator screen
  10. Hood screen
  11. Brake play
  12. Oiling
  13. Air cleaner primary element
- Mower
  1. Oil leak
  2. Make sure blade bolts are tight.
  3. Belt and blades wear or damage
  4. Check all hardware
  5. Make sure all pins are in place.
  6. Mower deck cleaning
  7. Greasing
     – Universal joint
     – 3 spindle shafts
     – Belt tension pulley
     – Belt tension pivot
     – Front anti-scalp roller pivot boss
     – Front anti-scalp roller
- While sitting in the operator's seat,
  1. Motion control lever
  2. Parking brake
- Turning the key switch "ON"
  1. Performance of the Easy Checker™ light
- Starting the engine
  1. Color of the exhaust fumes
  2. Safety systems.
     If either of these do not operate properly, contact your local KUBOTA Dealer immediately.
  3. Check for abnormal noise and vibration.
- Others
  1. Check the areas where previous trouble was experienced.

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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-20
	2. Air in the fuel system	Vent air	G-46
	3. Water in the fuel system	Change fuel and repair or replace fuel system	G-9, G-33
	4. Fuel pipe clogged	Clean or replace	G-33
	5. Fuel filter clogged	Replace	G-33
	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-S32
	11. Injection nozzle clogged	Clean or replace	1-S17
	12. Injection pump malfunctioning	Replace	1-S31
	13. Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	1-S29 to 1-S38
	14. Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S25, 1-S28
	15. Improper valve timing	Correct or replace timing gear	1-S32
	16. Piston ring and cylinder worn	Replace	1-S35, 1-S55
	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 Operate	1. Battery discharged	Charge	G-31 to G-32
	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-AU	ZD1221R-AU	ZD1221L-AU	ZD1221RL-AU
Engine	Model			D1105	D1305		
	Max. engine power (Gross)		kW (HP)	18.5 (24.8) (*1) (*2) (*3)	21.7 (29.1) (*1) (*2) (*3)		
	Type			Liquid-cooled			
	Number of cylinders			3			
	Bore and stroke		mm (in.)	78 × 78.4 (3.07 × 3.09)	78 × 88.0 (3.07 × 3.46)		
	Total displacement		cm^3 (cu. in.)	1123 (68.5)	1261 (77.0)		
	Rated revolution		rpm	3000			
	Low idling revolution		rpm	1400 to 1500			
	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, 12V, 1.2kW			
	Lubrication			Forced lubrication by gear pump			
	Cooling			Liquid with pressurized radiator			
	Battery			SMF51R (12V, RC:80min, CCA:430A)			
Capacities	Fuel tank		L (U.S.gals.)	49 (12.9)			
	Engine crankcase (with filter)		L (U.S.qts.)	3.9 (4.1)	5.7 (6.0)		
	Engine coolant		L (U.S.qts.)	3.5 (3.7)			
	Recovery tank		L (U.S.qts.)	0.25 (0.26)			
	Transmission case including Rear axle gear case		L (U.S.qts.)	12.1 (12.8) (*4)			
Dimensions	Overall length		mm (in.)	2260 (89.0)		2380 (93.7)	
	Overall width w/o mower deck		mm (in.)	1510 (59.4)		1540 (60.6)	
	Overall height	With ROPS upright	mm (in.)	2000 (78.7)			
		With ROPS folded	mm (in.)	1640 (64.6)			
	Wheel base		mm (in.)	1440 (56.7)		1560 (61.4)	
	Min. ground clearance		mm (in.)	130 (5.12) W/60"		130 (5.12) W/72"	
	Tread	Front		1064 (41.9)		1250 (49.2)	
		Rear		1210 (47.6)			
Weight (W/O FUEL, W/MOWER DECK)			kg (lbs.)	765 (1687) with 60"	780 (1720) with 60"	800 (1764) with 72"	810 (1786) with 72"
Travelling system	Tires	Front		15 × 6.5 - 8 Smooth semi-pneumatic Non flat tire			
		Rear		26 × 12.0 - 16 4PR Turf Low profile tire			
	Travelling speeds	Forward	mph (km/h)	0 to 10.6 (0 to 17.0) (*3)			
		Reverse	mph (km/h)	0 to 5.3 (0 to 8.5) (*3)			
	Steering			2 - Hand levers			
	Transmission			2 - HST w / Gear			
	Parking brake			Wet multi disk / Foot applied, released			
	Min. turning radius		mm (in.)	0 (0)			
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 single disk			

(Specifications and design subject to change without notice)

(To be continued)

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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-26		
2	OPC system	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-27		
3	Mower gear box oil	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-29		
		Change			☆			☆			☆			☆	every 150 Hr	G-29		
4	Greasing (except mower and mower link bushings)	–	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-28		
5	Throttle cable	Oil	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-29		
6	Greasing (mower link bushings, pivot)	–		☆		☆		☆		☆		☆		☆	every 100 Hr	G-35		
7	Air cleaner primary element	Clean		☆		☆		☆		☆		☆		☆	every 100 Hr	G-30	*2	@
		Replace													every 1000 Hr or 1 year	G-37	*3	
	Secondary element	Replace													every 1000 Hr or 1 year	G-37	*3	
8	Fuel filter element	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-33		@
		Replace								☆					every 400 Hr	G-33		
9	Fan belt	Adjust		☆		☆		☆		☆		☆		☆	every 100 Hr	G-33		
10	Parking brake	Adjust		☆		☆		☆		☆		☆		☆	every 100 Hr	G-34		
11	Battery condition	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-31	*6	
12	Engine oil	Change	★			☆				☆				☆	every 200 Hr	G-23	*1	
13	Engine oil filter	Replace	★			☆				☆				☆	every 200 Hr	G-23	*1	
14	Transmission oil filter [HST]	Replace	★			☆				☆				☆	every 200 Hr	G-24	*1	
15	Front axle pivot	Adjust		★		☆				☆				☆	every 200 Hr	G-24	*7	
16	Transmission fluid and rear axle gear case (R.H. and L.H.) fluid	Change								★					every 400 Hr	G-25		

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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.**

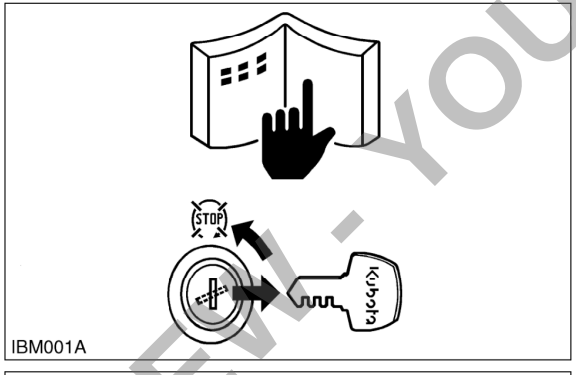
⚠ WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

⚠ 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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GENERAL

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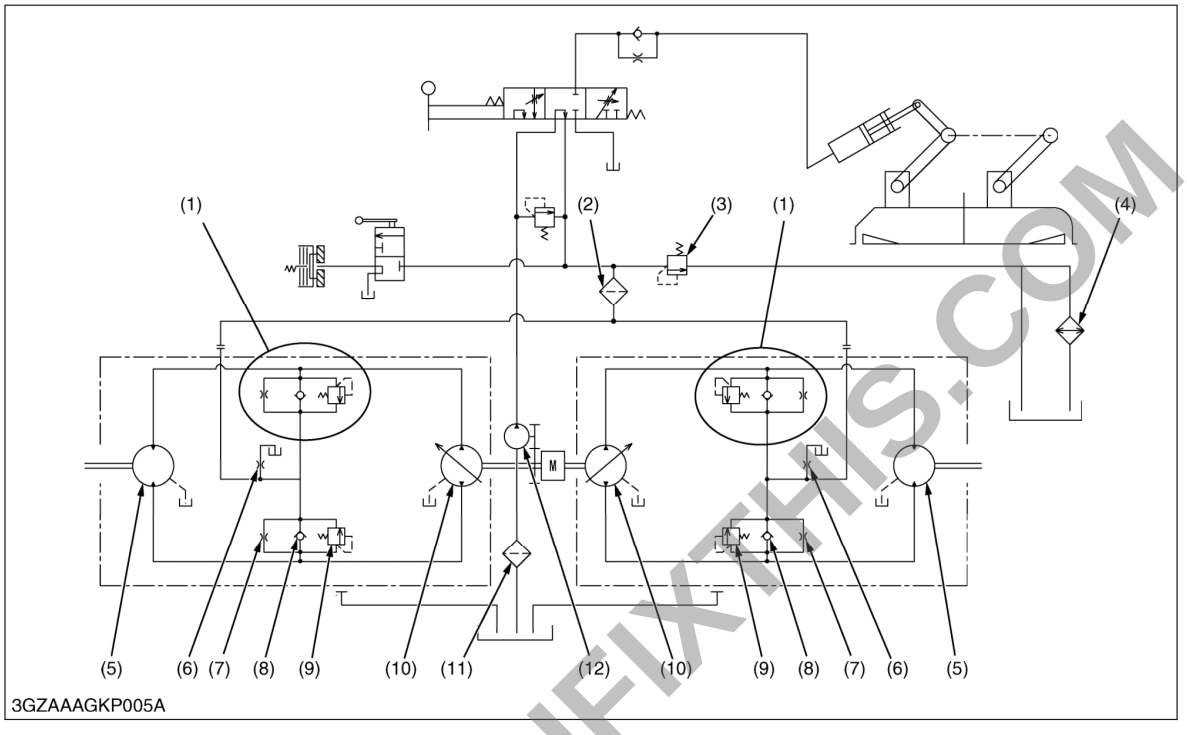
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I INFORMATION

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(4) Power Trains Operation



(1) Check and High Pressure Relief Valve
(2) Oil Filter
(3) Regulator Valve (Charge Relief Valve)
(4) Oil Cooler
(5) Motor
(6) Lubricating Orifice
(7) Neutral Orifice
(8) Check Valve
(9) High Pressure Relief Valve
(10) Pump
(11) Suction Oil Filter
(12) Hydraulic Pump

■ Neutral

With the motion control levers in the **NEUTRAL** position, the piston springs in the pump block in the pumps force the swash plates to a position that is parallel to the pump body. With the swash plates parallel to the pump body, the pistons do not reciprocate in the cylinder block, they merely rotate, and no oil is being drawn in or discharged from the pump. The machine is in a zero displacement position and the machine remains stationary.

Oil returning from the HST housing and hydraulic pump is directed through the regulating valve before returning to the transmission case.

■ Forward

As the motion control levers are pushed forward, the swash plates in the pumps move from the neutral position (parallel to the pump body) to a forward angle position. Piston springs inside the cylinder bores force the pistons against the swash plates.

As the cylinder block rotates, the pistons follow the contour of the swash plate, moving outward, drawing oil into their bores. As the cylinder block continues to rotate, the pistons are forced into their bores, discharging oil under pressure.

High-pressure oil from the pumps is routed to the motors, driving the machine forward.

■ Reverse

Reverse operation is controlled by reversing the angle applied to the pump swash plates, reversing the flow of high-pressure oil to the motors.

(Reference)

Regulating valve setting pressure (PTO clutch operating pressure)	At engine speed min^{-1} (rpm)
0.65 to 0.75 MPa (6.7 to 7.6 kgf/cm^2, 95 to 100 psi)	1600

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