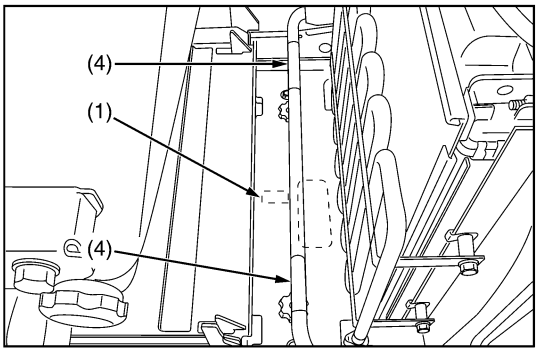
WSM

WORKSHOP MANUAL

ZD1211,ZD1211R,
ZD1211L,ZD1211RL

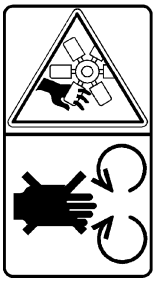
Kubota

KiSC issued 06, 2017 A



(1) Part No. K3111-6591-1

Do not get your hands close to fan belt.



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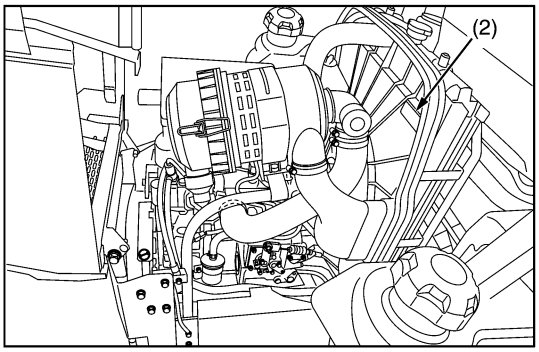

(2) Part No. K3181-6586-1

Do not get your hands close to engine fan and fan belt

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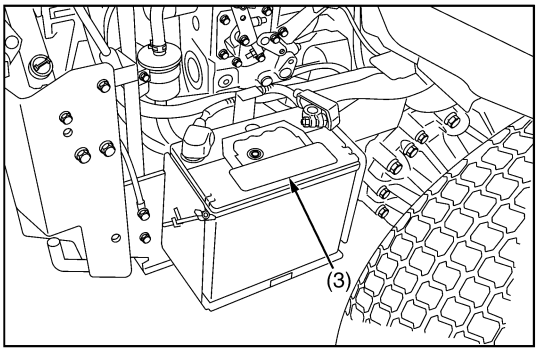
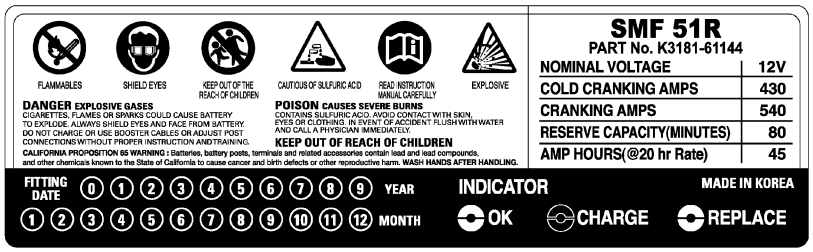


(3) Part No. K3181-6116-1



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(4) Part No. K3441-6593-1

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DANGER / POISON
- SHIELD EYES
  EXPLOSIVE GASES can cause blindness or injury.
- NO SPARKS / FLAMES / SMOKING
- SULFURIC ACID can cause blindness or severe burns.
- Flush eyes immediately with water.
- Get medical help fast.

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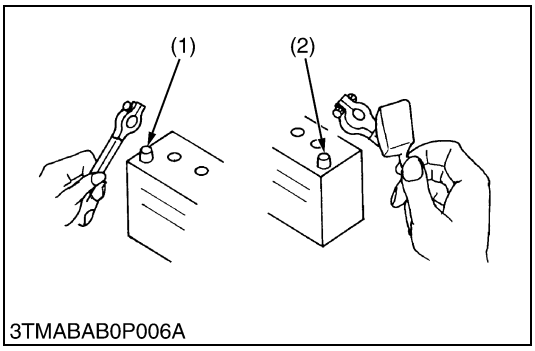
4. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



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To ensure safety and prevent damage to the machine and surrounding equipment, obey the following precautions in handling electrical parts and wiring.

■ **IMPORTANT**

- **Check electrical wiring for damage and loosened connection every year. To this end, educate the customer to do his or her own check and at the same time recommend the dealer to perform periodic check for a fee.**
- **Do not try to modify or remodel any electrical parts and wiring.**
- **When removing the battery cables, disconnect the negative cable first. When installing the battery cables, connect the positive cable first.**

(1) Negative Terminal (2) Positive Terminal

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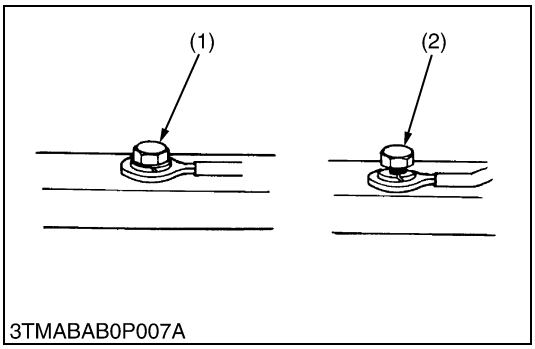
[1] WIRING



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- Securely tighten wiring terminals.

(1) Correct (Securely Tighten)
(2) Incorrect (Loosening Leads to damaged Contact)

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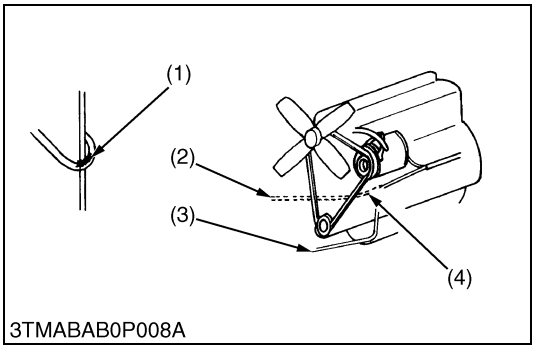

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- Do not let wiring contact dangerous part.

(1) Dangerous Part (Sharp Edge)
(2) Wiring (Incorrect)
(3) Wiring (Correct)
(4) Dangerous Part

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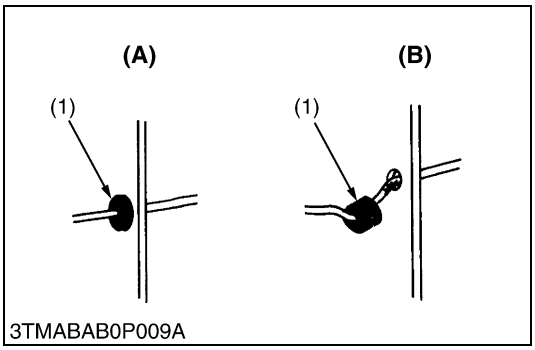

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- Securely insert grommet.

(1) Grommet

(A) Correct
(B) Incorrect

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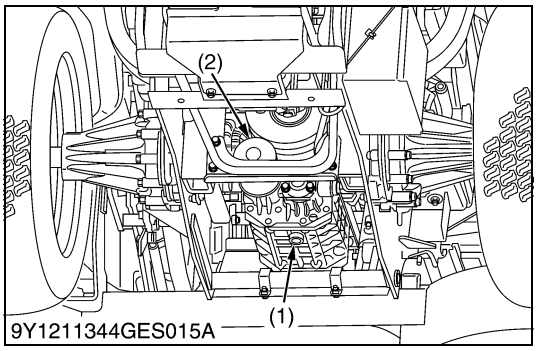
7. MAINTENANCE CHECK LIST

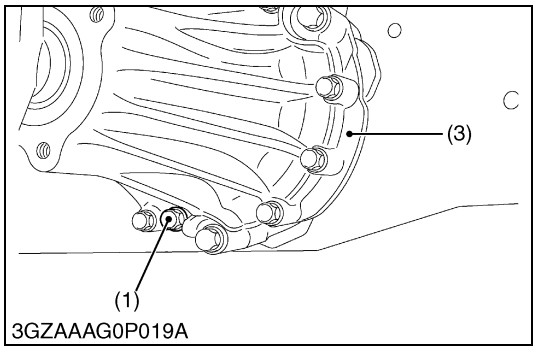
■ **IMPORTANT**

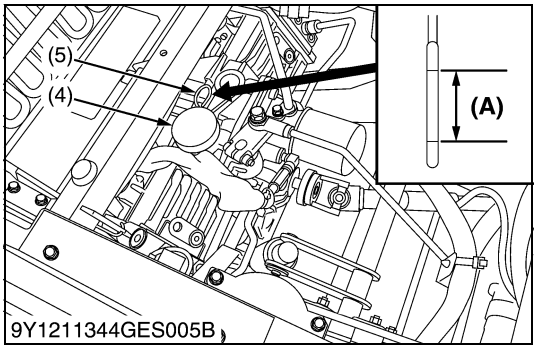
- **The jobs indicated by ★ must be done initially.**
  ***1: The initial 50 hours should not be a replacement cycle.**
  ***2: Air cleaner must be cleaned more often in dusty conditions than in normal conditions.**
  ***3: Every 1000 hours or every 1 year whichever comes faster.**
  ***4: Replace if 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		

[4] CHECK POINT OF INITIAL 400 HOURS







Changing Transmission Fluid and Rear Axle Gear Case Oil (RH and LH)

WARNING

To avoid serious injury:

- **Be sure to stop the engine and remove the key before changing or checking the oil.**
- **Allow transmission case to cool down sufficiently; oil can be hot and may cause burns.**

The fluid in the transmission case is also used for the hydrostatic drive system.

1. To drain the transmission oil, place oil pan underneath the transmission case and the rear axle gear case (RH and LH) and remove the drain plug at the bottom of the transmission case and the rear axle gear case (RH and LH).
2. After draining, reinstall the drain plugs.
3. Fill with UDT, SUPER UDT hydrostatic transmission fluid or its equivalent up to the upper line of the gauge.

IMPORTANT

- **It takes time to have the oil poured from the transmission case reach the rear axle case (RH and LH). Pour the regulated amount of oil slowly.**

4. After running the engine for a few minutes, stop it and check the oil level again; add oil to the prescribed level.

IMPORTANT

- **Operate only at low RPM's immediately after changing the transmission fluid and filter cartridge.Keep the engine at medium speed for a few minutes to ensure proper lubrication of all parts so there is no damage to transmission.**
- **Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**
- **Do not mix different brands oil together.**

Transmission fluid capacity (with filter and hose)	12.1 L 12.8 U.S.qts 10.6 Imp.qts

(1) Drain Plug
(2) Transmission Oil Filter
(3) Rear Axle Gear Case LH
(4) Oil Plug and Breather Cup
(5) Dipstick

(A) Oil level acceptable within this range.

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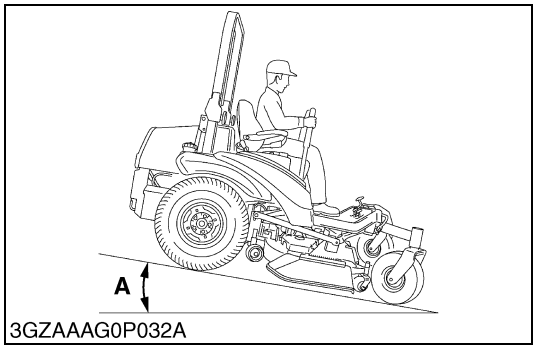

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■ **Check on the slope**
1. Place the machine on a 17 ° ramp.
2. Apply the parking brake.
3. Place the motion control levers in **"NEUTRAL LOCK"** position and shut off the engine.
4. Check that the machine does not move.

■ **NOTE**
- **For parking brake test purposes only use 17 ° ramp.**

(1) Lock Nut
(2) Bolt
A: Under 17 ° Ramp

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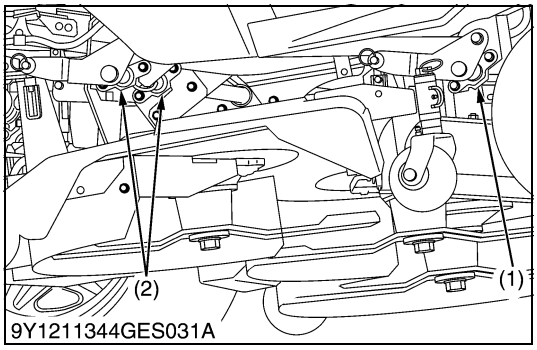

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Greasing Mower Link Bushings

WARNING
To avoid serious injury:
- **Be sure to stop the engine and remove the key before greasing.**

1. Grease the following location.
   If you operated the machine in extremely wet and muddy conditions, lubricate grease fittings more often.

(1) Front Mower Link Bushing (LH, RH) (2) Rear Mower Link Bushing (LH, RH)

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[7] CHECK POINTS OF EVERY 150 HOURS

Changing Mower Gear Box Oil

1. See page G-28.

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[8] CHECK POINTS OF EVERY 200 HOURS

Changing Engine Oil

1. See page G-22.

9Y1211344GEG0036US0

Adjusting Front Axle Pivot

1. See page G-23.

9Y1211344GEG0037US0

Changing Engine Oil Filter Cartridge

1. See page G-22.

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Changing HST Transmission Oil Filter Cartridge

1. See page G-23.

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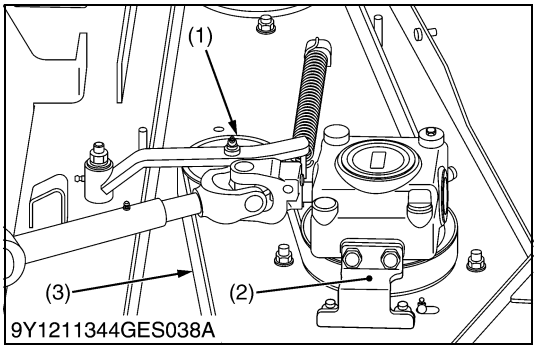

Replacing Mower Belt

1. Remove the mower deck from the machine.
2. Remove the left and right hand shield from the mower deck.
3. Clean around the gear box.
4. Remove the belt from the tension pulley.
5. Remove the right hand bracket which mounts the gear box to the mower deck and slip the belt over the top of the gear box.
6. To install a new belt, reverse the above procedure.

Tightening torque	Bracket mounting screw	77.6 to 90.2 N·m 8.00 to 9.20 kgf·m 57.1 to 66.5 lbf·ft

(1) Tension Pulley
(2) Bracket (RH)
(3) Belt

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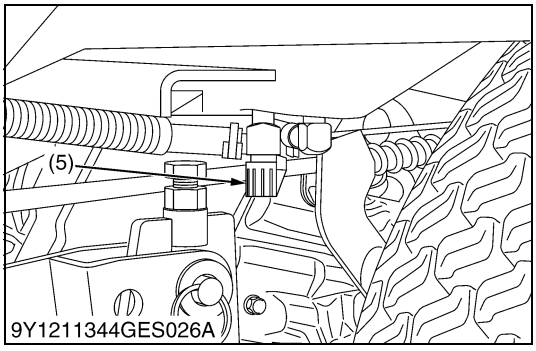

Bleeding Fuel System

Air must be removed:

1. When the fuel filter or lines are removed.
2. When tank is completely empty.
3. After the tractor has not been used for a long period of time.

Bleeding procedure is as follows:

1. Fill the fuel tank with fuel.
2. Close RH tank fuel valve (1) and Open LH tank fuel valve (1).
3. Turn the key switch to **"ON"** position for about 30 seconds. Doing so allows fuel pump to work and pump air out of the fuel system. Do this 3 to 5 times.
4. Close LH tank fuel valve (1) and Open RH tank fuel valve (1).
5. Turn the key switch to **"ON"** position for about 30 seconds. Doing so allows fuel pump to work and pump air out of the fuel system. Do this 3-5 times.
6. Make sure both fuel valves (1) are Open.
7. Start the engine and run for about 30 seconds, and then stop the engine.

(1) Fuel Valve

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10. IMPLEMENT LIMITATIONS

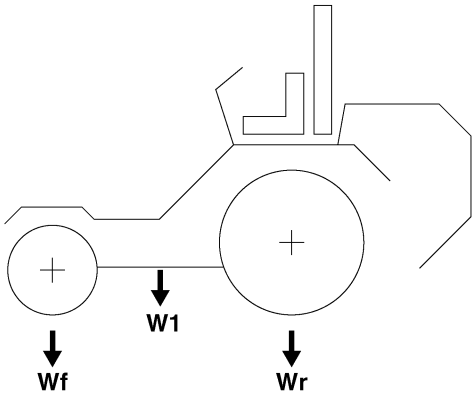
The KUBOTA Machine has been thoroughly tested for proper performance with implements sold or approved by KUBOTA.

Use with implements below may result in malfunctions or failures of the machine, damage to other property and injury to the operator or others.

- Implements are not sold or approved by KUBOTA
- Implements exceed the maximum specifications listed below, or
- Implements are otherwise unfit for use with the KUBOTA Machine

[Any malfunctions or failures of the machine resulting from use with improper implements are not covered by the warranty.]

UNIT	Maximum loading weight		Implement weight W_1	Maximum total weight
	Front axle Wf	Rear axle Wr		
ZD1211, ZD1211R ZD1211L, ZD1211RL	200 kg (440 lbs.)	920 kg (2028 lbs.)	200 kg (440 lbs.)	1120 kg (2468 lbs.)



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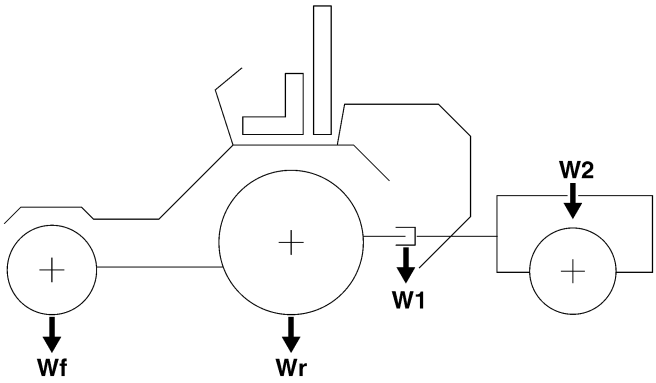
OPTION: When using the hitch kit.

■ **IMPORTANT**

- **Do not operate on slope when pulling loads.**
- **Total towed weight must not exceed combined weight of pulling machine, ballast and operator.**
- **Follow the manufacturer's recommendations for weight limits for towed equipment.**

UNIT	Maximum loading weight		Maximum total weight	Tongue weight W_1	Towing capacity W_2
	Front axle Wf	Rear axle Wr			
ZD1211, ZD1211R ZD1211L, ZD1211RL	200 kg (440 lbs.)	630 kg (1388 lbs.)	830 kg (1829 lbs.)	30 kg (66 lbs.)	100 kg (220 lbs.)



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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

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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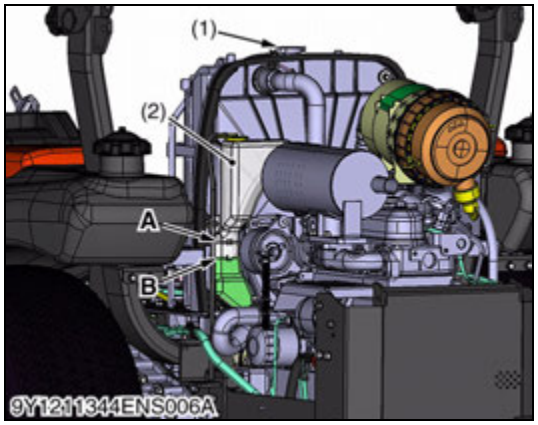

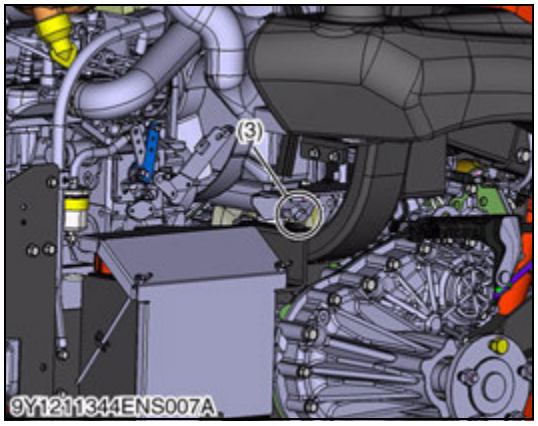

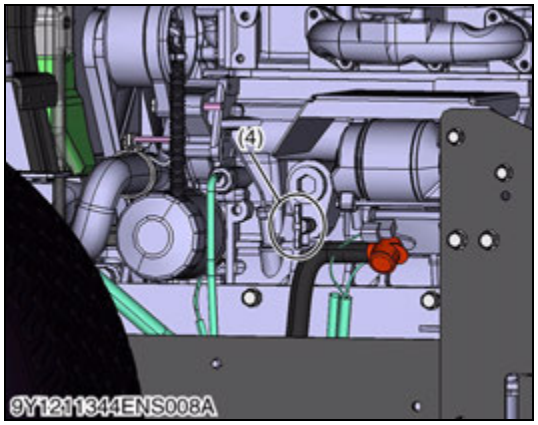

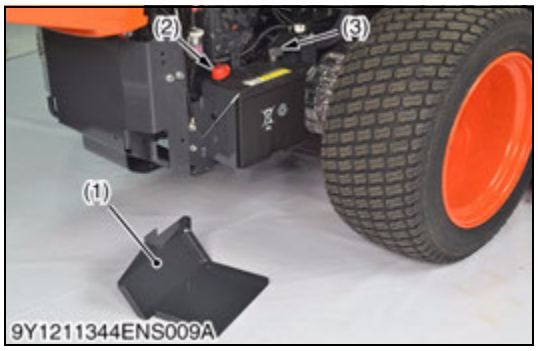

Draining Coolant

CAUTION

- **Never open the radiator cap while operating or immediately after stopping. Otherwise, hot water will spout out from the radiator. Wait for more than 10 minutes to cool the radiator, before opening the cap.**

1. Stop the engine and let cool down.
2. Remove the radiator coolant drain plug (3) and engine coolant drain valve (4) to drain the coolant.
3. Remove the radiator cap (1) to completely drain the coolant.
4. After all coolant is drained, close the drain plugs.

Coolant capacity	Radiator	3.5 L 3.70 U.S.qts 3.08 Imp.qts
	Recovery tank	0.25 L 0.26 U.S.qts 0.22 Imp.qts

(1) Radiator Cap
(2) Recovery Tank
(3) Radiator Coolant Drain Plug
(4) Engine Coolant Drain Valve

A: Upper Level
B: Lower Level

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Battery

WARNING

To avoid serious injury:

- **When disconnecting the battery cables, disconnect the negative cable from the battery first. When connecting, connect the positive cable to the battery first.**

1. Remove the battery cover (1).
2. Disconnect the negative cable (3) from the battery.
3. Disconnect the positive cable (2) from the battery.

(1) Battery Cover
(2) Positive Cable
(3) Negative Cable

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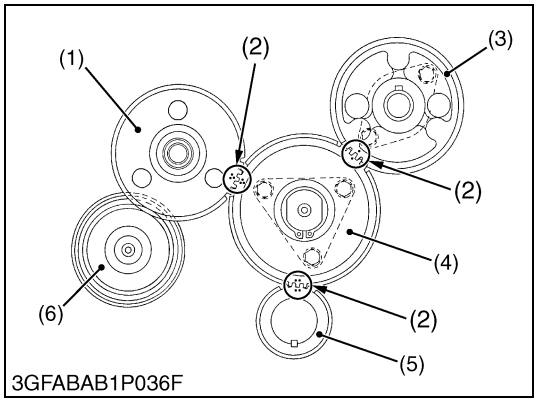

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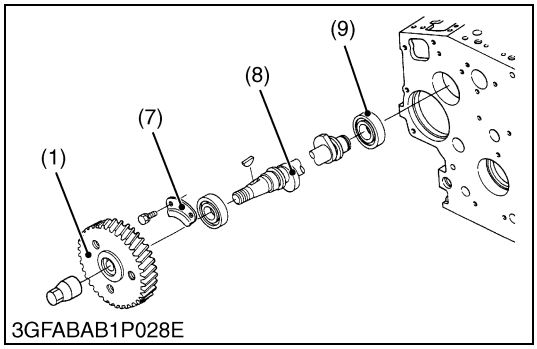

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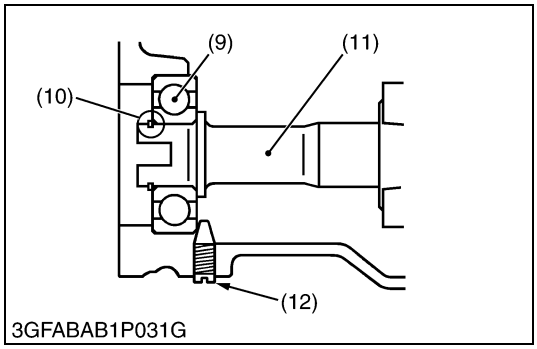

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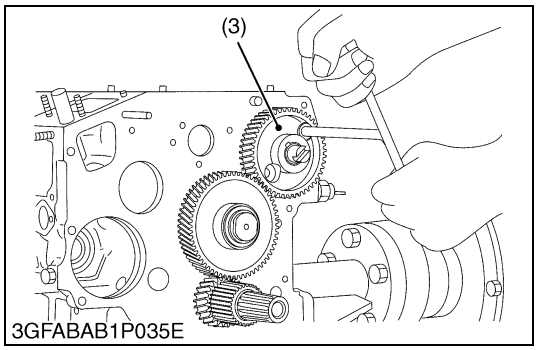

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Cam Gear, Idle Gear 1 and Governor Gear

1. Remove the idle gear 1 (4).
2. Remove the fuel camshaft stopper (7).
3. Draw out the injection pump gear (1) with fuel camshaft (8).
4. Remove the camshaft stopper bolt.
5. Remove the cam gear (3) with camshaft.
6. Remove the external snap ring (10) from the governor shaft (11).
7. Remove the governor gear (6) with governor shaft (11).

■ **NOTE**

- **Three-lever type fork lever**
  To remove the governor shaft, follow the procedures in 5, 6 above and never remove fork lever and the max torque limiter.

(When reassembling)

- Apply engine oil thinly to the fuel camshaft before installation.
- Make sure to assemble the external snap ring of the governor shaft.
- Check the governor shaft for smooth rotation.

■ **IMPORTANT**

- **When replacing the ball bearing of governor shaft, securely fit the ball bearing (9) to the crankcase, apply an adhesive (Three Bond 1324B or equivalent) to the set screw (12), and fasten the screw until its tapered part contacts the circumferential end of the ball bearing.**
- **When installing the idle gear, be sure to align the alignment marks on each gears.**

(1) Injection Pump Gear
(2) Alignment Mark
(3) Cam Gear
(4) Idle Gear 1
(5) Crank Gear
(6) Governor Gear
(7) Fuel Camshaft Stopper
(8) Fuel Camshaft
(9) Ball Bearing
(10) External Snap Ring
(11) Governor Shaft
(12) Set Screw

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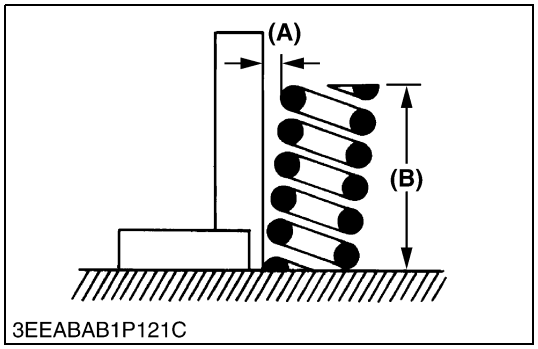

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Free Length and Tilt of Valve Spring

1. Measure the free length **(B)** of valve spring with vernier calipers. If the measurement is less than the allowable limit, replace it.
2. Put the valve spring on a surface plate, place a square on the side of the valve spring.
3. Check to see if the entire side is in contact with the square. Rotate the valve spring and measure the maximum tilt **(A)**. If the measurement exceeds the allowable limit, replace it.
4. Check the entire surface of the valve spring for scratches. If there is any problem, replace it.

Tilt **(A)**	Allowable limit	1.0 mm 0.039 in.

Free length **(B)**	Factory specification	37.0 to 37.5 mm 1.46 to 1.47 in.
	Allowable limit	36.5 mm 1.44 in.

(A) Tilt **(B) Free Length**

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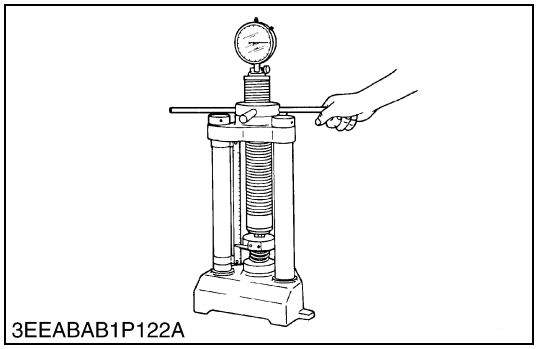
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Valve Spring Setting Load

1. Place the valve spring on a tester and compress it to the same length it is actually compressed in the engine.
2. Read the compression load on the gauge.
3. If the measurement is less than the allowable limit, replace it.

Setting load / Setting length	Factory specification	117.4 N / 31.0 mm 11.97 kgf / 31.0 mm 26.39 lbf / 1.22 in.
	Allowable limit	100.0 N / 31.0 mm 10.20 kgf / 31.0 mm 22.48 lbf / 1.22 in.

9Y1211344ENS0060US0


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Oil Clearance between Rocker Arm and Rocker Arm Shaft

1. Measure the rocker arm shaft O.D. with an outside micrometer.
2. Measure the rocker arm I.D. with an inside micrometer, and then calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the rocker arm and measure the oil clearance again. If it still exceeds the allowable limit, replace also the rocker arm shaft.

Oil clearance between rocker arm and rocker arm shaft	Factory specification	0.016 to 0.045 mm 0.00063 to 0.0017 in.
	Allowable limit	0.10 mm 0.0039 in.

Rocker arm shaft O.D.	Factory specification	11.973 to 11.984 mm 0.47138 to 0.47181 in.
Rocker arm I.D.	Factory specification	12.000 to 12.018 mm 0.47244 to 0.47314 in.

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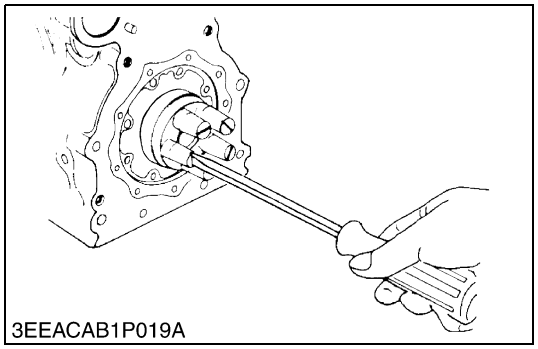
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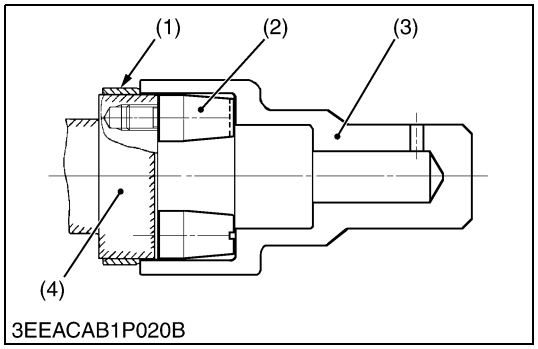

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Replacing Crankshaft Sleeve

1. Remove the used crankshaft sleeve.
2. Set the sleeve guide (2) to the crankshaft.
3. Heat a new sleeve to a temperature between 150 and 200 °C (302 and 392 °F), and fix the sleeve to the crankshaft as shown in figure.
4. Press fit the sleeve using the auxiliary socket for pushing (3).

■ **NOTE**

- **Mount the sleeve with its largely chamfered surface facing outward.**
- **Should heating is not enough, a sleeve might stop halfway, so careful.**

(1) Crankshaft Sleeve
(2) Sleeve Guide
(3) Auxiliary Socket for Pushing
(4) Crankshaft

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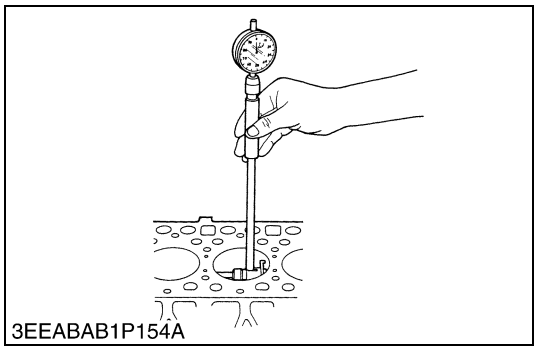
(5) Cylinder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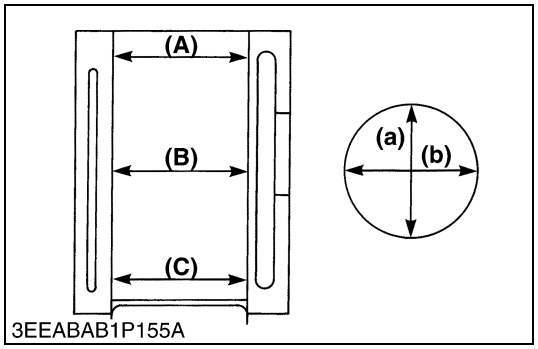

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Cylinder Wear

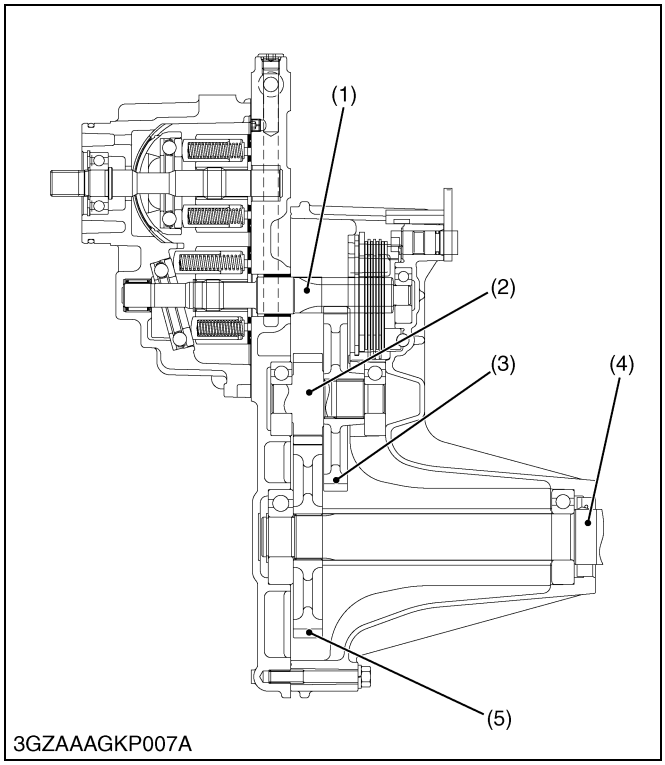
1. Measure the I.D. of the cylinder at the six positions (see figure) with a cylinder gauge to find the maximum and minimum I.D.'s.
2. Get the difference (Maximum wear) between the maximum and the minimum I.D.'s.
3. If the wear exceeds the allowable limit, bore and hone to the oversize dimension. (Refer to "Correcting Cylinder".)
4. Visually check the cylinder wall for scratches. If deep scratches are found, the cylinder should be bored. (Refer to "Correcting Cylinder".)

Cylinder I.D.	Factory specification	78.000 to 78.019 mm 3.0709 to 3.0716 in.
	Allowable limit	78.15 mm 3.077 in.

(A) Top
(B) Middle
(C) Bottom (Skirt)
(a) Right-angled to Piston Pin
(b) Piston Pin Direction

9Y1211344ENS0085US0

(6) Final Reduction Gear Section



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As for this machine, power is transmitted from the 8T gear on the brake shaft (1) to the rear axle (4) through 53T gear (3), 19T gear shaft (2) and 49T gear (5).

Gear Shaft (2)	Gear (5)
19T	49T

(1) Brake Shaft (8T) (HST Motor Shaft)
(2) 19T Gear
(3) 53T Gear
(4) Rear Axle
(5) 49T Gear

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4. CHECKING AND ADJUSTING

Checking Neutral

1. Park machine safely.
2. Set the motion control levers are in the **NEUTRAL** position.
3. Move the PTO lever to **OFF** position and apply the parking brake.
4. With the operator on the seat and start the engine.
5. Move the throttle lever to **Max. speed** position.
6. Release the parking brake.
7. Check the drive wheels, the wheels should not move.
8. If movements is noted, perform adjustment as follows.

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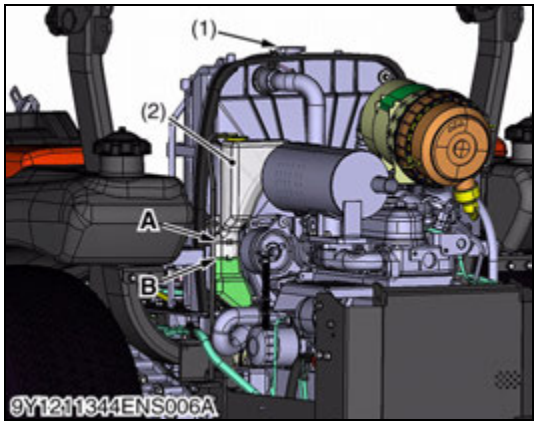

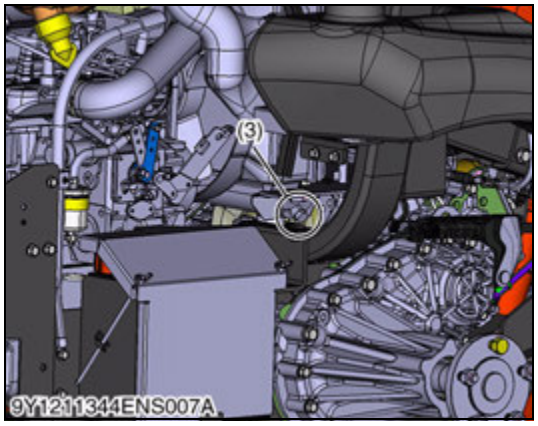

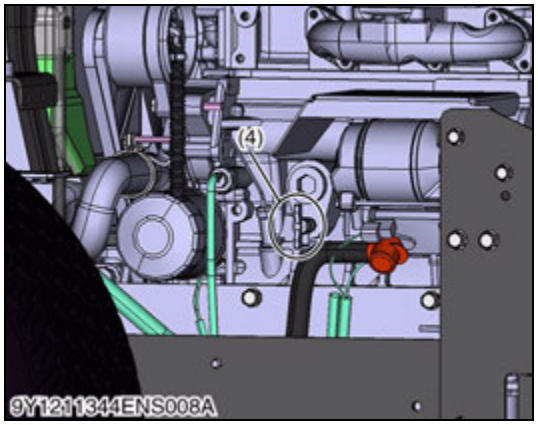

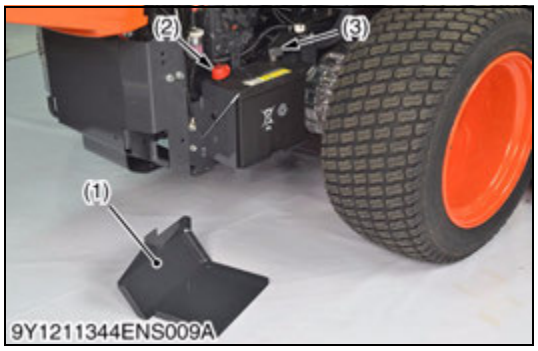

Draining Coolant

CAUTION

- **Never open the radiator cap while operating or immediately after stopping. Otherwise, hot water will spout out from the radiator. Wait for more than 10 minutes to cool the radiator, before opening the cap.**

1. Stop the engine and let cool down.
2. Remove the radiator coolant drain plug (3) and engine coolant drain valve (4) to drain the coolant.
3. Remove the radiator cap (1) to completely drain the coolant.
4. After all coolant is drained, close the drain plugs.

Coolant capacity	Radiator	3.5 L 3.70 U.S.qts 3.08 Imp.qts
	Recovery tank	0.25 L 0.26 U.S.qts 0.22 Imp.qts

(1) Radiator Cap
(2) Recovery Tank
(3) Radiator Coolant Drain Plug
(4) Engine Coolant Drain Valve

A: Upper Level
B: Lower Level

9Y1211344ENS0022US0

Battery

WARNING

To avoid serious injury:

- **When disconnecting the battery cables, disconnect the negative cable from the battery first. When connecting, connect the positive cable to the battery first.**

1. Remove the battery cover (1).
2. Disconnect the negative cable (3) from the battery.
3. Disconnect the positive cable (2) from the battery.

(1) Battery Cover
(2) Positive Cable
(3) Negative Cable

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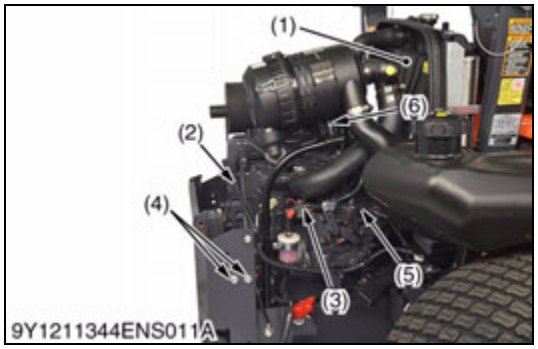

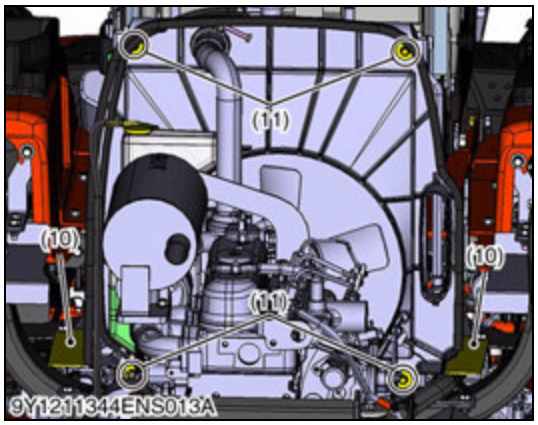

Fan Shroud, Electric Wiring and Others

1. Disconnect the wiring connectors for engine stop solenoid, glow plug, coolant temperature sensor, engine oil pressure switch and dynamo.
2. Remove the positive cable (9) from starter motor.
3. Disconnect the accelerator wire (5).
4. Remove the air filter assembly (6).
5. Disconnect the fuel hoses (3) from engine.
6. Disconnect the water hoses (7), (8).
7. Remove both shroud plates (10).
8. Disconnect fan shroud (1), (11).
9. Remove engine stoppers (4).

(When reassembling)

- When you install the accelerator wire, adjust the wiring length. The stopper lever must hit the idling speed adjusting bolt and the maximum speed adjusting bolt in the stroke of the accelerator lever.

(1) Fan Shroud
(2) Wiring Harness
(3) Fuel Hose
(4) Engine Stopper
(5) Accelerator Wire (Throttle Cable)
(6) Air Filter Support
(7) Upper Hose
(8) Lower Hose
(9) Positive Cable
(10) Shroud Plate
(11) Fan Shroud Bolts

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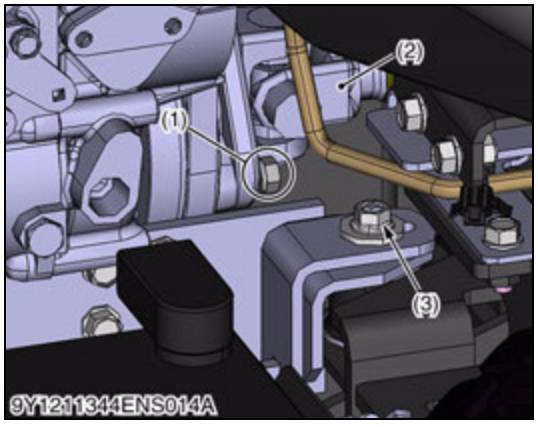

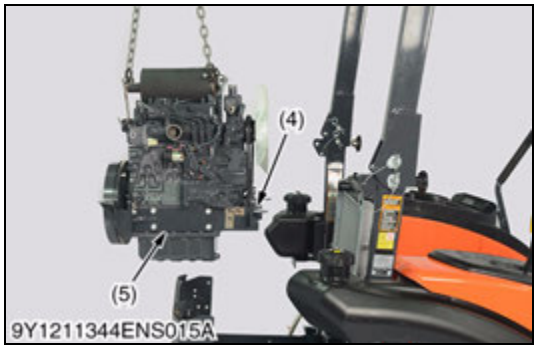

Separating Engine

1. Raise seat.
2. Remove ROPS connecting plate.
3. Remove universal joint mounting screws (1).
4. Disconnect universal joint (2) from Fan drive pulley.
5. Remove engine mounting nuts.
6. Separate the engine.
7. Remove engine support LH (4) and RH (3).

(When reassembling)

- Apply grease to the all splines on the drive shaft.

Tightening torque	Universal joint mounting screw	26.0 to 28.0 N·m 2.7 to 2.9 kgf·m 19.2 to 20.7 lbf·ft
	Engine mounting nut	17.6 to 20.6 N·m 1.80 to 2.10 kgf·m 13.0 to 15.1 lbf·ft

(1) Universal Joint Mounting Screw
(2) Universal Joint
(3) Engine Mounting Nut
(4) Engine Support (LH)
(5) Engine Support (RH)

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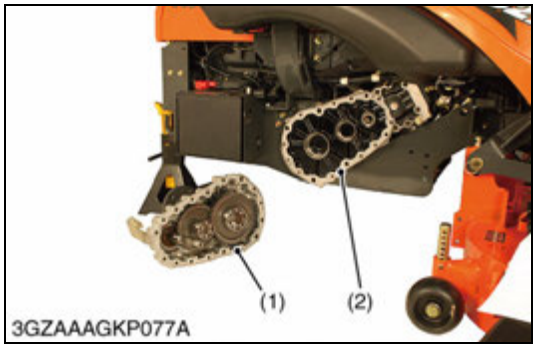

Removing Rear Axle Gear Case

1. Remove the rear axle gear case mounting screws.
2. Separate the rear axle gear case assembly (1) and center section (2).

(When reassembling)

- Apply to liquid gasket (Three Bond 1208D or equivalent) to the joint face of the rear axle gear case and center section.

■ **NOTE**

- **If impulse or vibration is applied to the center section after the rear axle gear case assembly (1) was removed, the HST motor-side cylinder block (3) may possibly be deviated as shown in the photo.**
  If this cylinder block (3) should deviate up to the position shown in the photo, it will be unable to be returned to the original position.
  At this time, the center section (2) must be separated for servicing or repair. When the rear axle gear case assembly (1) is removed, therefore, watchful care must be taken so as not to give any impulse and shocks to the center section (2).

Tightening torque	Rear axle gear case mounting screw	40 to 44 N·m 4.0 to 4.5 kgf·m 29 to 32 lbf·ft

(1) Rear Axle Gear Case Assembly
(2) Center Section
(3) Cylinder Block (Motor)

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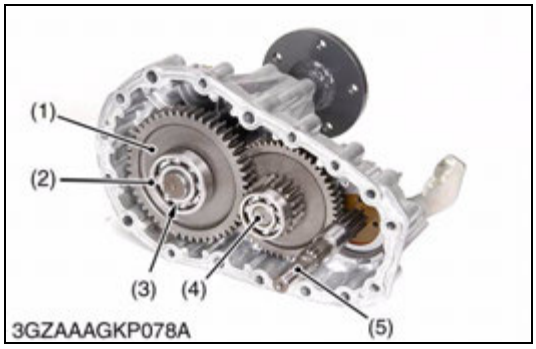

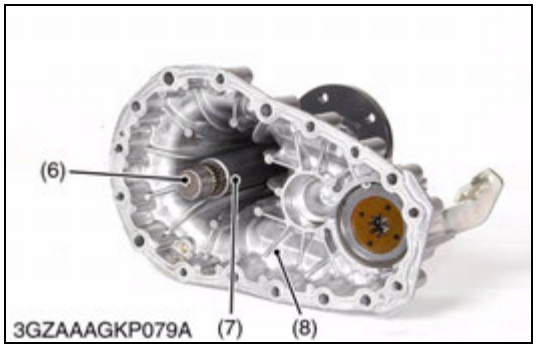

Rear Axle

1. Remove the brake shaft (HST motor shaft) (5).
2. Remove the external snap ring (3) and remove the ball bearing (2) with puller.
3. Remove the final reduction gear (1) and gear shaft (4).
4. Remove the collar (7) and tap out the rear axle (6) from rear axle gear case (8).

(When reassembling)

- Do not damage oil seal.

(1) Final Reduction Gear
(2) Ball Bearing
(3) External Snap Ring
(4) Gear Shaft
(5) Brake Shaft (HST Motor Shaft)
(6) Rear Axle
(7) Collar
(8) Rear Axle Gear Case

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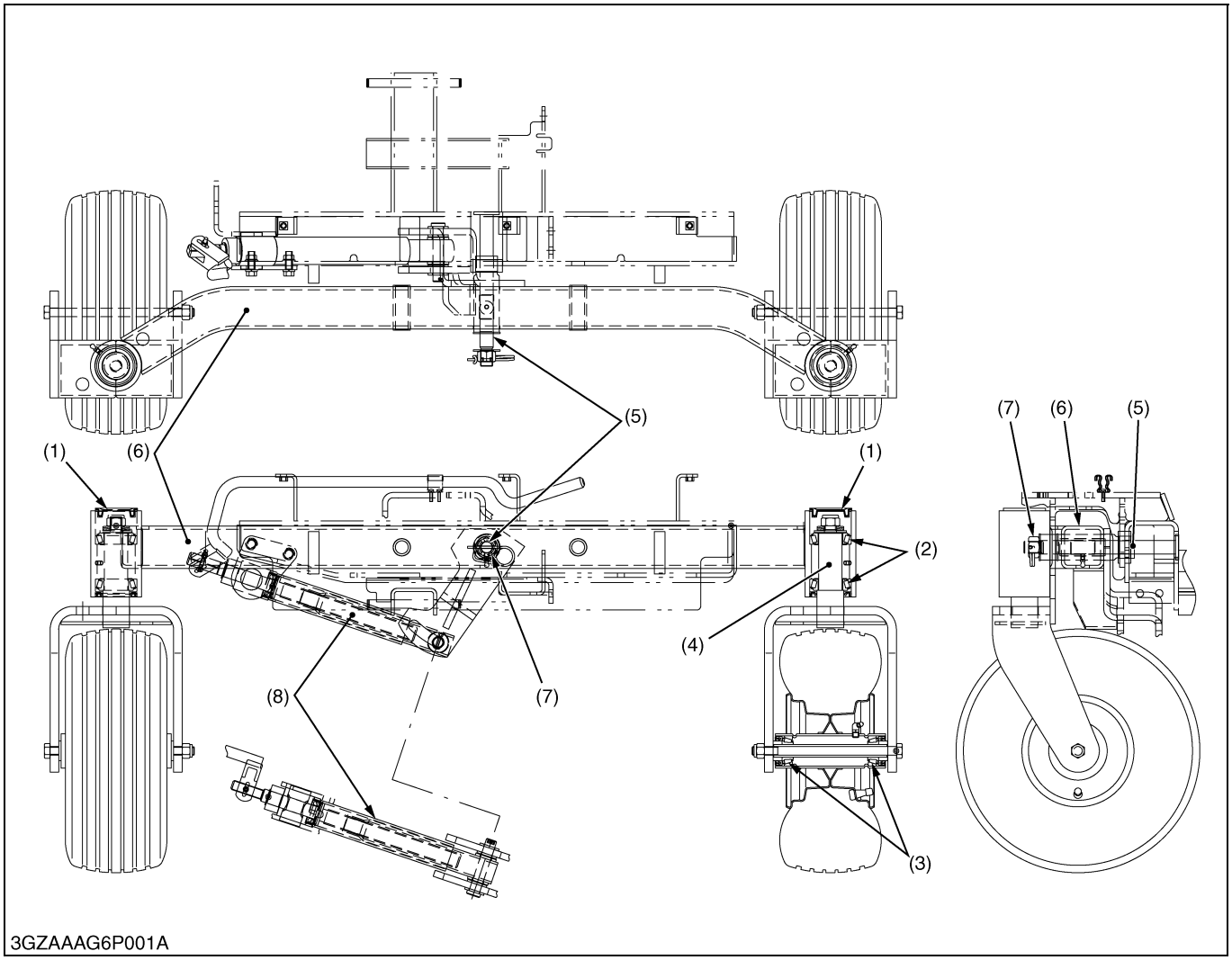
1. STRUCTURE



(1) Cap
(2) Taper Roller Bearing
(3) Taper Roller Bearing
(4) Wheel Bracket
(5) Center Pin
(6) Front Axle
(7) Slotted Nut
(8) Lift Up Adjuster

The front axle is constructed as shown above. The shape of the front axle is relatively simple, and the front axle is supported at its center with the center pin (5), so that steering operation is stable even on uneven grounds in a grass field. And this time, the structure that the front axle can be fixed is adopted.

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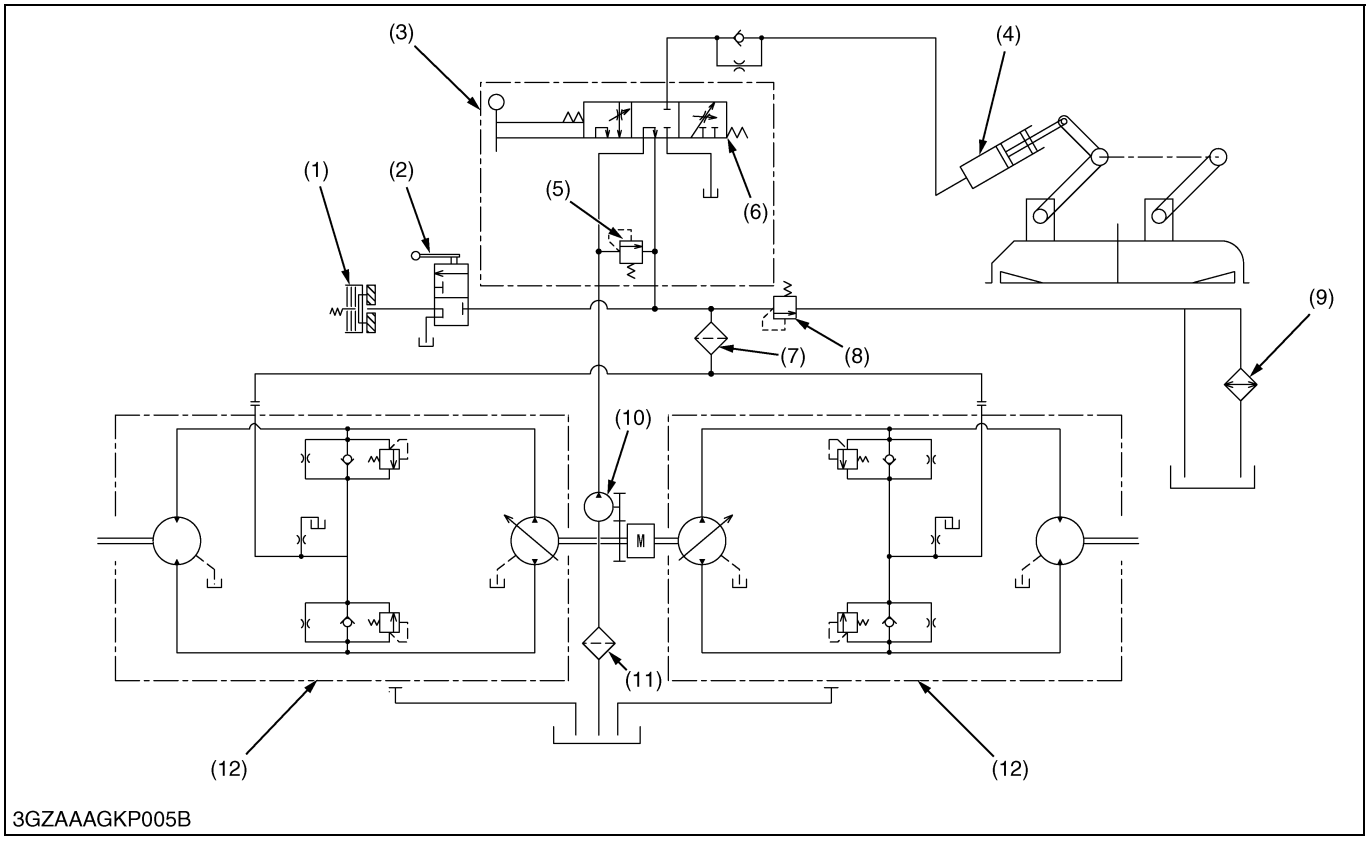
1. HYDRAULIC CIRCUIT



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(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).

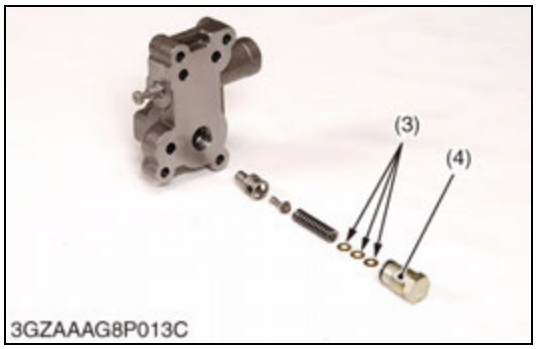
Moreover, oil from the hydraulic pump (10) is sent to the transmission center case through the control valve. On the other hand, oil is regulated with the regulator valve (8) to constant pressure and sent to the hydrostatic transmission (12) and PTO clutch (1).

9Y1211344HYM0001US0

4. CHECKING, DISASSEMBLING AND SERVICING

[1] HYDRAULIC CONTROL VALVE, PUMP AND CYLINDER

(1) Checking and Adjusting



Relief Valve Setting Pressure

1. Remove the plug (2) from the front cover of transmission center case.
2. Install the adaptor (3/8 in., straight thread), hose and pressure gauge.
3. Start the engine and set at maximum speed.
4. Move the control pedal to **"LIFT"** position to operate the relief valve and read the gauge under the engine speed below.
5. If the pressure is not within the factory specification, adjust with the adjusting shims (3).

(Adjusting procedure)

- Remove the plug (1), and remove the plug (4) of relief valve. Then, adjust the thickness of shims.

Relief valve (control valve) at engine speed 1600 min^{-1} (rpm)	Factory specification	5.5 to 7.0 MPa 56 to 71 kgf/cm^2 800 to 1000 psi

Condition

- Oil temperature
  45 to 55 °C (113 to 131 °F)

(Reference)

- Replace the hydraulic pump if pressure does not rise in 5 MPa (50 kgf/cm^2, 700 psi) or more.
- Thickness of shims (3):
  0.2 mm (0.0079 in.)
  0.3 mm (0.0118 in.)
  0.8 mm (0.0315 in.)

(1) Plug
(2) Plug (3/8 in., straight thread)
(3) Shim
(4) Plug

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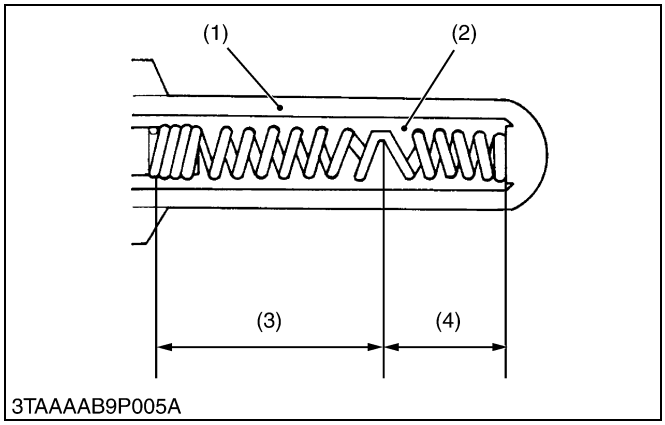
MECHANISM

CONTENTS

[3] GLOW PLUG



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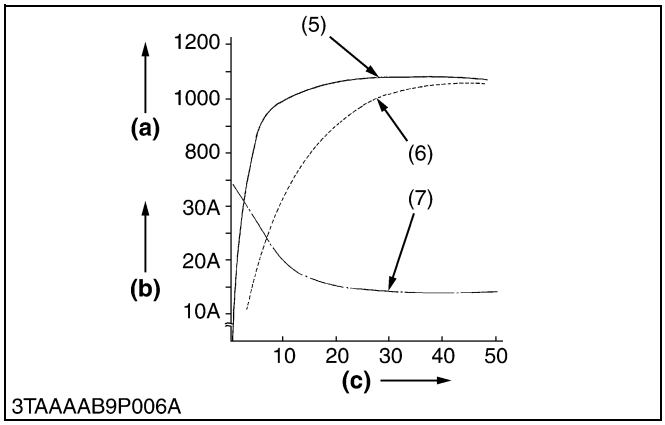

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This plug is a two-material type QGS (Quick Glow System) for quick temperature rise, and has self-controlling function as well as excellent durability.

The heater (4) connected in series to the heater (3), which also functions as the resistor, is incorporated in the sheath tube (1) of the super glow plug.

The resistance of this heater (3) cum resistor is small when the temperature is low, while the resistance becomes large when the temperature rises.

Therefore, because sufficient current is flown to the heater (4) during the initial period of energization, the temperature rises quickly and the resistance grows with the rise in the temperature of the resistor, the flowing current is reduces to prevent the heater (4) from being heated.

The ignition point is in the area of 2 to 3 mm (0.079 to 0.118 in.) from the tip of the plug in order to reduce its projection into the combustion chamber.

(1) Sheath Tube
(2) Insulation Powder
(3) Heater also functioning as a Resistor
(4) Heater
(5) Super Glow Plug
(6) Conventional Quick-heating type Glow Plug
(7) Glow Plug Current

(a) Glow Plug Temperature (°C)
(b) Current (A)
(c) Time (Sec.)

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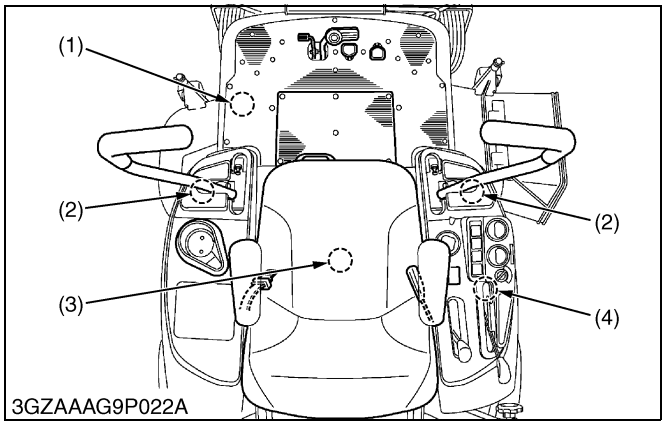
[4] SAFETY SWITCH



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Switches are located at the motion control levers, at the parking brake pedal, at the PTO lever and under the operator's seat.

Function of switch is to control current from main switch to relay.

Switches are changed to **"CLOSE"** or **"OPEN"** electrically by changing the motion control levers, or sitting on the operator's seat or engaging the parking brake.

By selecting either normally open or normally closed contact, the switch function is determined.

Safety switch	Type
Seat switch	Normally open
PTO lever switch	Normally open
Parking brake switch	Normally close
Motion control lever (LH) switch	Normally open
Motion control lever (RH) switch	Normally open

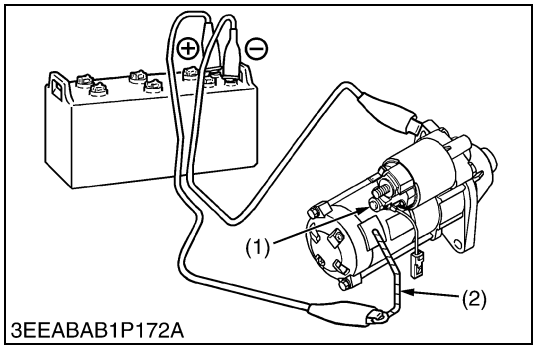
(1) Parking Brake Switch
(2) Motion Control Lever Switch
(3) Seat Switch
(4) PTO Lever Switch

9Y1211344ELM0006US0

SERVICING

CONTENTS

(4) Starter



Motor Test

CAUTION

- **Secure the starter to prevent it 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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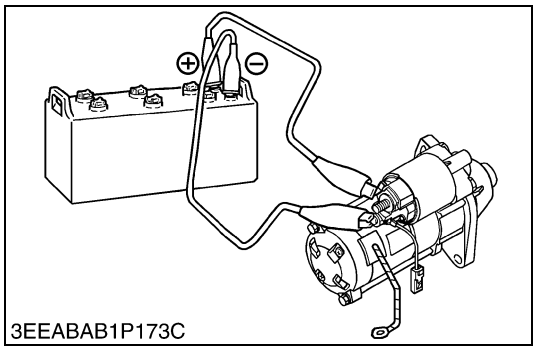

Magnet Switch Test (Pull-in, Holding Coils)

NOTE

- **You must do each test for a start time (3 to 5 seconds), and at half of the rated voltage (6 V).**

1) Checking Pull-in Coil

1. Connect jumper lead from the battery's negative terminal post to the **C** terminal.
2. The plunger should be attached strongly when a jumper lead is connected from the battery positive terminal to the **S** terminal.

2) Checking Holding Coil

1. Connect jumper leads from the battery's negative terminal post to the body and the battery's positive terminal post to the **S** terminal.
2. Push the plunger in by hand and release it. Then, the plunger should remain being attracted.

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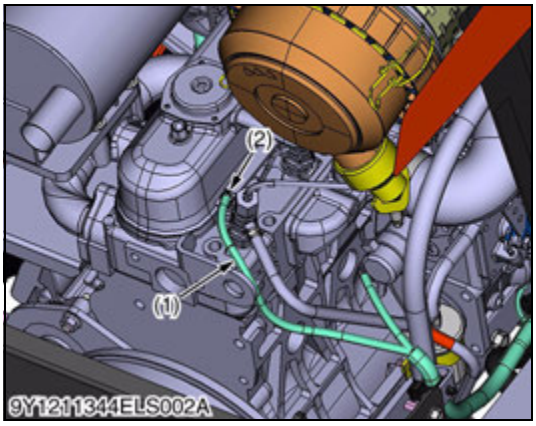
(5) Glow Plug



Lead Terminal Voltage

1. Disconnect the wiring lead (1) from the glow plug (2) 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) Wiring Lead (Positive) (2) Glow Plug

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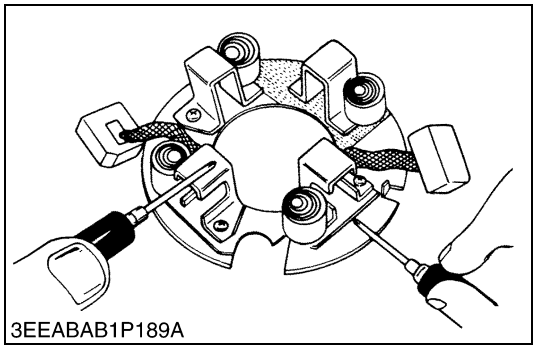
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Brush Holder

1. Check the continuity across the brush holder and the holder support with an ohmmeter.
2. If it conducts, replace the brush holder.

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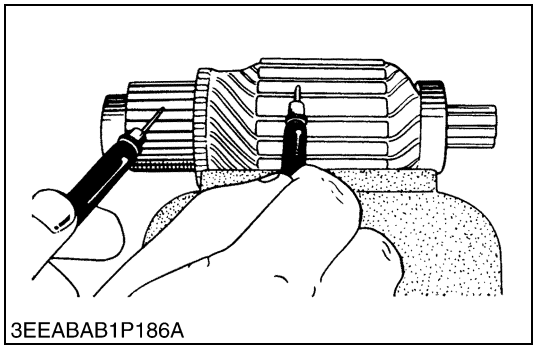
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Armature Coil

1. Check the continuity across the commutator and armature coil core with an ohmmeter.
2. If it conducts, replace the armature.
3. Check the continuity across the segments of the commutator with an ohmmeter.
4. If it does not conduct, replace the armature.

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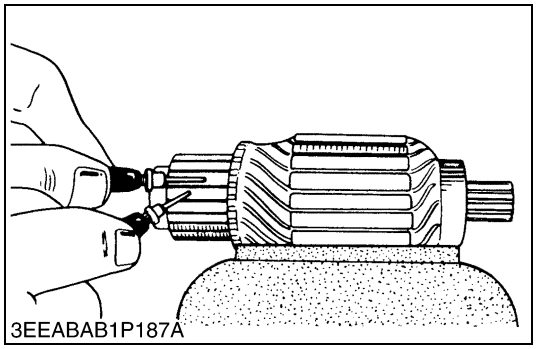
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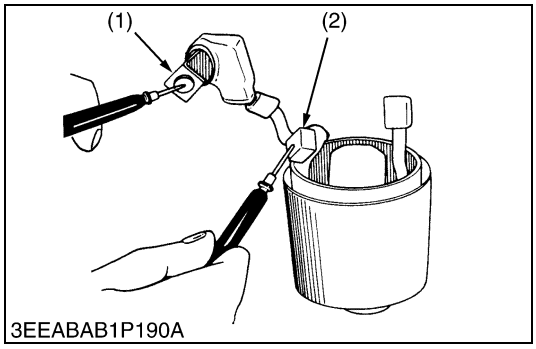

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Field Coil

1. Check the continuity across the lead (1) and brush (2) with an ohmmeter.
2. If it does not conduct, replace the yoke assembly.
3. Check the continuity across the brush (2) and yoke (3) with an ohmmeter.
4. If it conducts, replace the yoke assembly.

(1) Lead
(2) Brush
(3) Yoke

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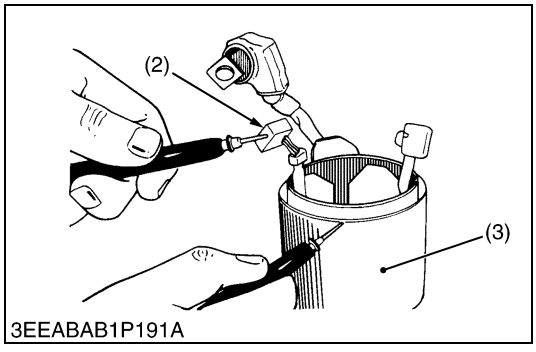

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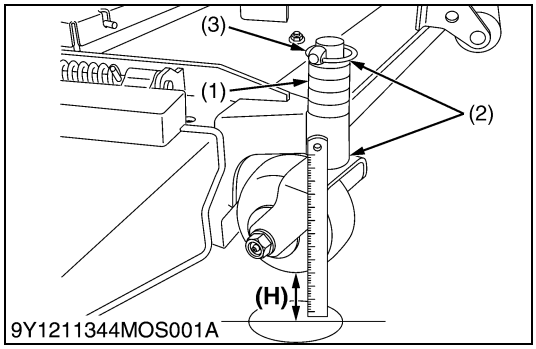
4. CHECKING, DISASSEMBLING AND ASSEMBLING

[1] CHECKING AND ADJUSTING



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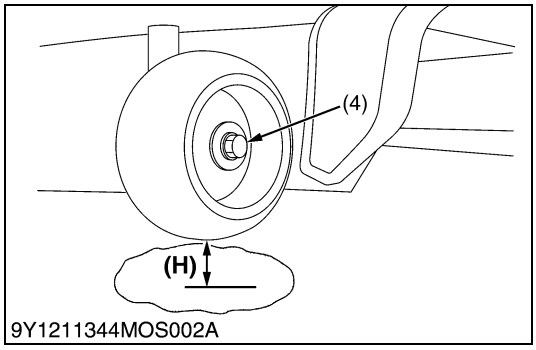

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Adjusting Anti-scalp Rollers

WARNING

To avoid serious injury:

- **Park the machine on a firm and level surface.**
- **Apply the parking brake.**
- **Stop the engine and remove the key.**
- **Wait for all moving parts to stop.**

■ **IMPORTANT**

- **The flattest cut can be achieved by having the anti-scalp rollers adjusted off the ground.**
  Check anti-scalp roller adjustments each time the mower deck cutting height is changed.
  It is recommended that all the anti-scalp rollers be kept off the ground to minimize scuffing.

1. Check the machine wheel pressure.
   Inflate wheels to the correct pressure. (See table below.)

	Tire Sizes	Recommended Inflation Pressure
Front	15 × 6.0 - 6, (Semi-pneumatic Non Flat Tire) Smooth	–
Rear	26 × 12.0 - 16, 4PR Turf low profile tire	83 kPa (0.84 kgf/cm^2, 12 psi)

2. Start the engine.
3. Raise up the mower deck to the transport position.
   (Also the top end of the lift.)
4. Turn the cutting height control dial to adjust height.
5. Lower the mower deck.

■ **Rear side anti-scalp roller**

6. Adjust height of the rear side anti-scalp roller by shifting the pin or the bolt to approximately 19 mm (3/ 4 in.) between rollers and ground.
   Adjust both side rollers to the same height.
7. Install the roller with attaching hardware.

■ **Front side anti-scalp roller**

8. Adjust height of the front side anti-scalp roller by replacing the collar (collar is raised and lowered) or shifting the pin to approximately 19 mm (3/4 in.) between rollers and ground.
9. Adjust both side rollers to the same height.
10. See Anti-scalp roller cutting height adjusting chart.

(1) Collar
(2) Washer
(3) Set Pin
(4) Bolt

(H) 19 mm (3/4 in.)

(To be continued)