

WSM

WORKSHOP MANUAL

GR2120EU

Kubota

TO THE READER

This Workshop Manual tells the servicing personnel about the mechanism, servicing and maintenance of the GR2120EU. It contains 4 parts: **"Information"**, **"General"**, **"Mechanism"** and **"Servicing"**.

■ Information

This section primarily contains information below.

- Safety First
- Safety Decal
- Specification
- Dimension

■ General

This section primarily contains information below.

- Engine Identification
- Model Identification
- General Precautions
- Maintenance Check List
- Check and Maintenance
- Special Tools

■ Mechanism

This section contains information on the structure and the function of the unit. Before you continue with the subsequent sections, make sure that you read this section.

Refer to the latest version of Workshop Manual (Code No. 9Y021-01870) for the diesel engine that this workshop manual does not include.

■ Servicing

This section primarily contains information below.

- Troubleshooting
- Servicing Specifications
- Tightening Torques
- Checking, Disassembling and Servicing

All illustrations, photographs and specifications contained in this manual are of the newest information available at the time of publication.

KUBOTA reserves the right to change all information at any time without notice.

Since this manual includes many models, information or illustrations and photographs can show more than one model.

I INFORMATION

INFORMATION

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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 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.

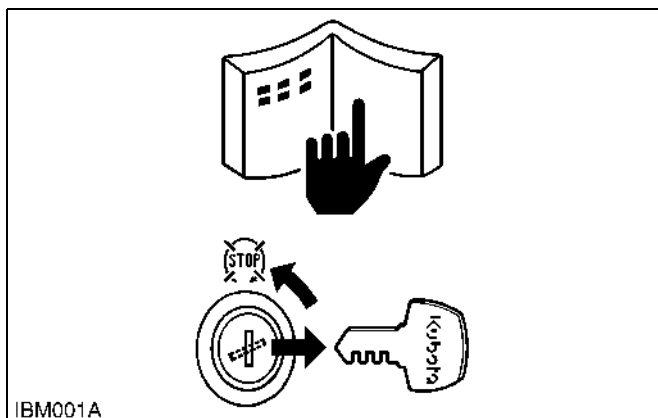
■ IMPORTANT

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

■ NOTE

- Gives helpful information.

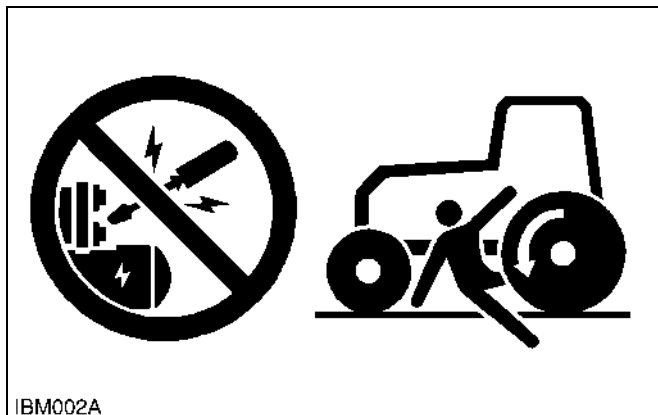
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BEFORE YOU START SERVICE

- 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.

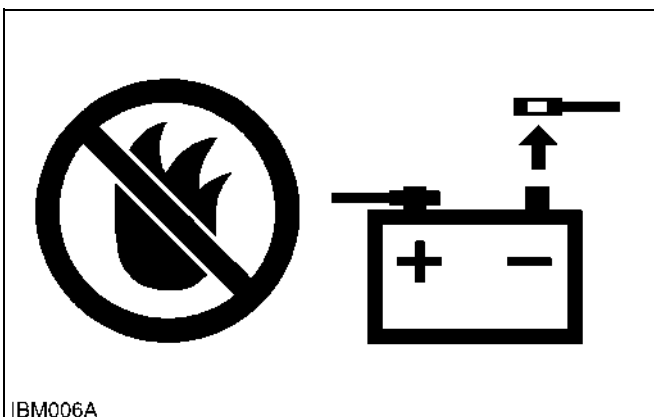
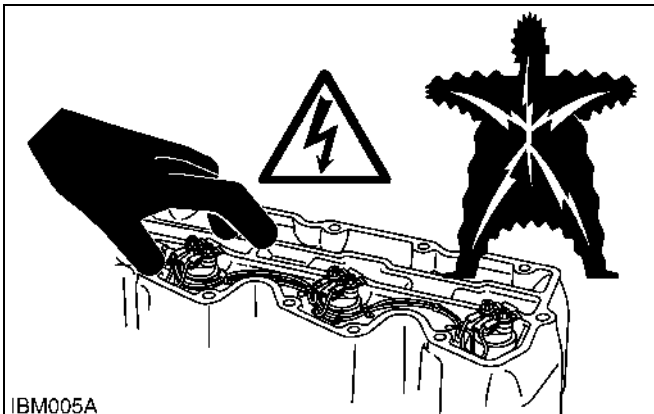
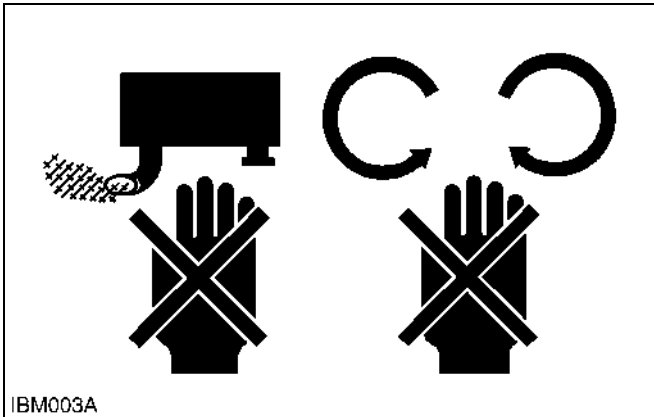
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START SAFELY

- 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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OPERATE SAFELY

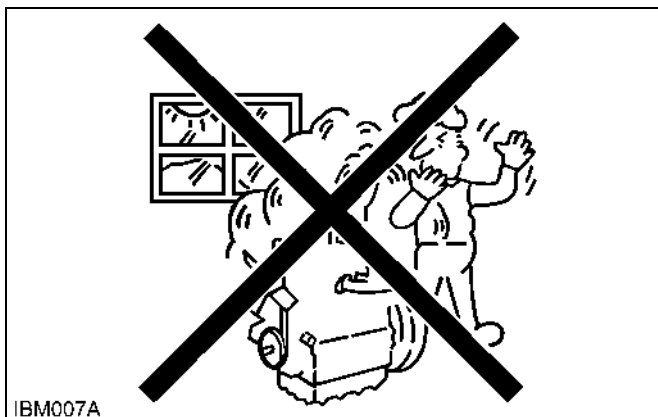
- Do not use the machine after you consume alcohol or medication or when you are tired.
- Put on applicable clothing and safety equipment.
- Use applicable tools only. Do not use alternative tools or parts.
- When 2 or more persons do servicing, make sure that you do it safely.
- Do not operate below the machine that only a jack holds. Always use a safety stand to hold the machine.
- Do not touch the hot parts or parts that turn when the engine operates.
- Do not remove the radiator cap when the engine operates, or immediately after it stops. If not, hot water can spout out from the radiator. Only remove the radiator cap when it is at a sufficiently low temperature to touch with bare hands. Slowly loosen the cap to release the pressure before you remove it fully.
- Released fluid (fuel or hydraulic oil) under pressure can cause damage to the skin and cause serious injury. Release the pressure before you disconnect hydraulic or fuel lines. Tighten all connections before you apply the pressure.
- Do not open a fuel system under high pressure. The fluid under high pressure that stays in fuel lines can cause serious injury. Do not disconnect or repair the fuel lines, sensors, or any other components between the fuel pump and injectors on engines with a common rail fuel system under high pressure.
- Put on an applicable ear protective device (earmuffs or earplugs) to prevent injury against loud noises.
- Be careful about electric shock. The engine generates a high voltage of more than DC100 V in the ECU and is applied to the injector.

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PREVENT A FIRE

- Fuel is very flammable and explosive under some conditions. Do not smoke or let flames or sparks in your work area.
- To prevent sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- The battery gas can cause an explosion. Keep the sparks and open flame away from the top of battery, especially when you charge the battery.
- Make sure that you do not spill fuel on the engine.

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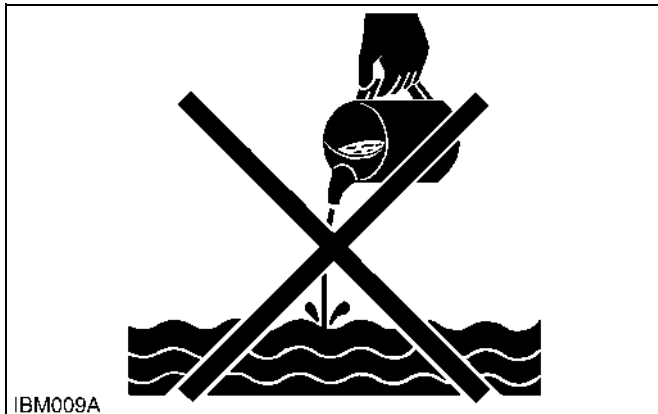


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KEEP A GOOD AIRFLOW IN THE WORK AREA

- If the engine is in operation, make sure that the area has good airflow. Do not operate the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.

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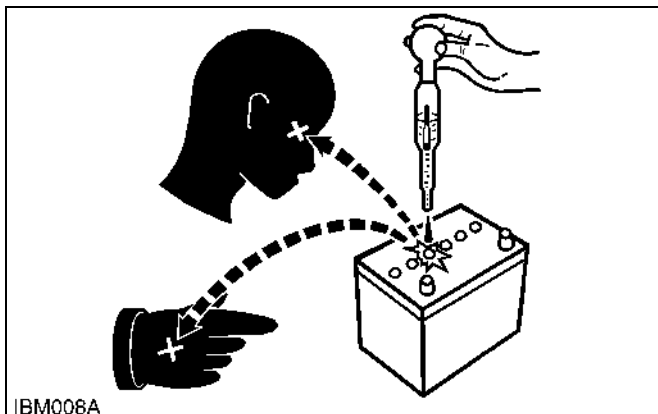


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DISCARD FLUIDS CORRECTLY

- Do not discard fluids on the ground, down the drain, into a stream, pond, or lake. Obey related environmental protection regulations when you discard oil, fuel, coolant, electrolyte and other dangerous waste.

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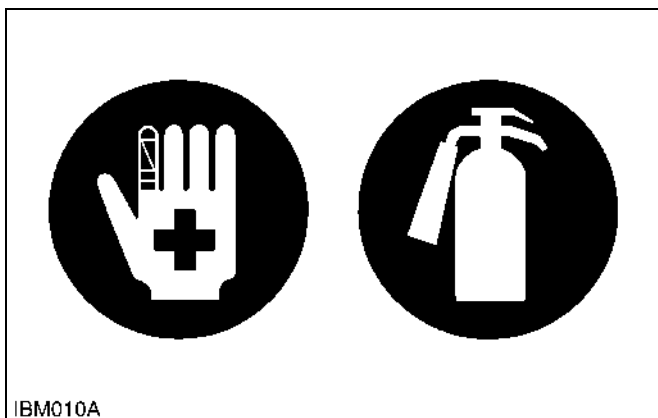


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PREVENT ACID BURNS

- Keep electrolyte away from your eyes, hands and clothing. Sulfuric acid in battery electrolyte is poisonous and it can burn your skin and clothing and cause blindness. If you spill electrolyte on yourself, clean yourself with water, and get medical aid immediately.

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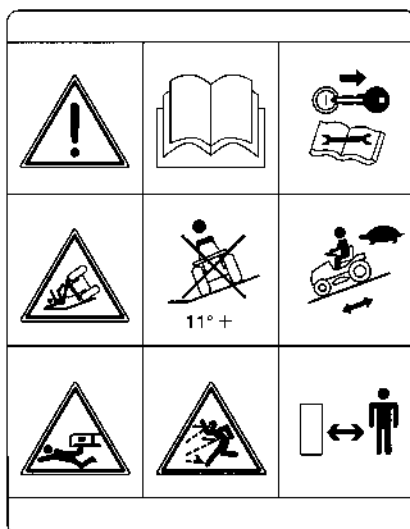
PREPARE FOR EMERGENCIES

- Keep a first aid kit and fire extinguisher ready at all times.
- Keep the emergency contact telephone numbers near your telephone at all times.

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2. PICTORIAL SAFETY LABELS

(1) Part No. K1213-6581-1



1BDAHAAAP0260

TO AVOID INJURY OR DETATH:

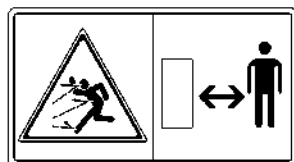
- Read and understand Operator's Manual.
- Stop the engine and remove key before servicing.
- DO NOT operate where machine could slip or tip.
- DO NOT operate on slopes of more than 11°.
- Mow up and down slopes, not across.
- DO NOT allow any bystanders or children around or near machine at any time when the engine is running.

(2) Part No. K2110-6585-1



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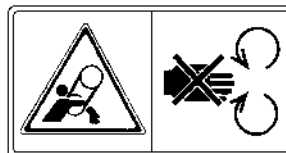
(3) Part No. K5125-7312-1



1BDADAIAAP0230

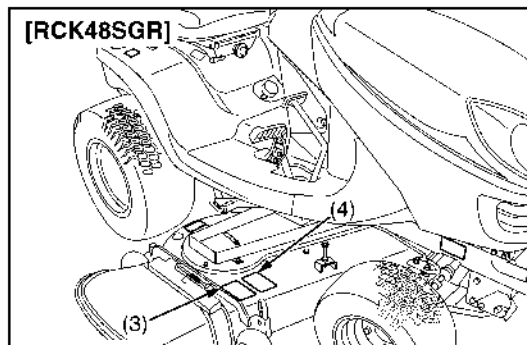
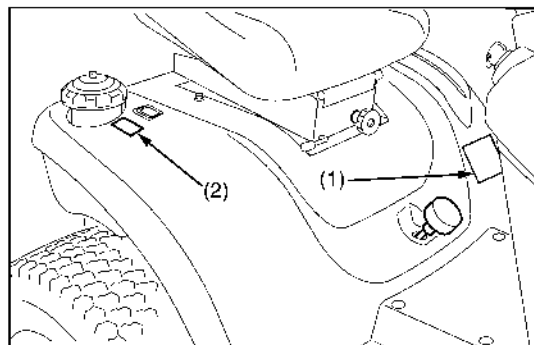
- DO NOT allow any bystanders or children around or near machine at any time when the engine is running.

(4) Part No. K5652-4180-2



1BDACAGAP003A

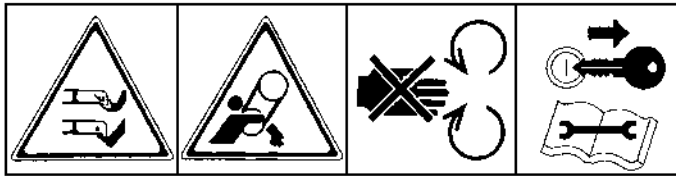
- Keep all shields and guards in place.



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(1) Part No. K5254-7311-1



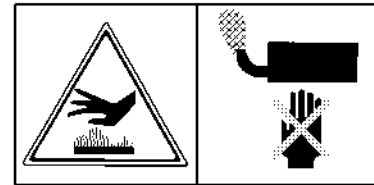
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ROTATING BLADES HAZARDOUS:

- DO NOT put hands or feet into mower when engine is running.
- Keep all shields and guards in place.
- Stay clear of rotating parts.
- Stop the engine and remove key before servicing.

(2) Part No. K1252-6542-1

Do not touch hot surface like muffler, etc.

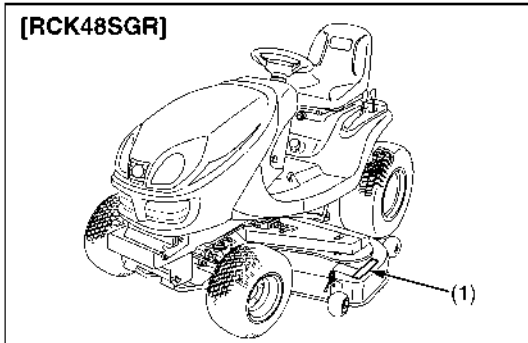
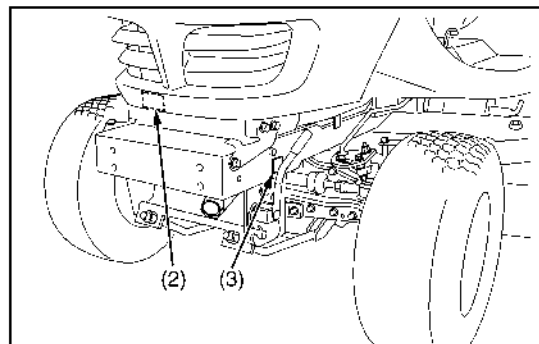
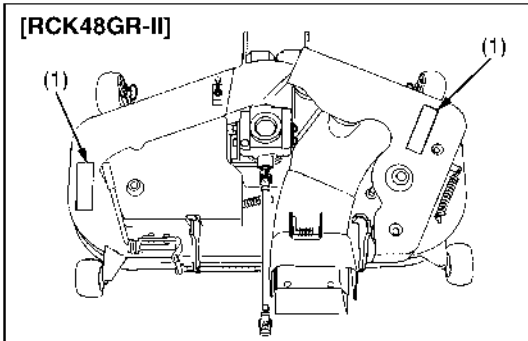


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(3) Part No. K2110-6573-1

HOT SURFACE
DO NOT TOUCH

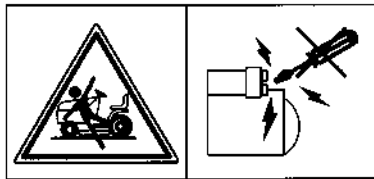
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[RCK48SGR]**[RCK48GR-II]**

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9Y1210598|NI0002US0

(1) Part No. K1213-6583-1



1BDAHAAAP0310

TO AVOID MACHINE RUNAWAY:

- DO NOT start engine by shorting across starter terminals or bypassing the safety start switch.

(3) Part No. K1272-6558-1

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



1BDABARAP113A

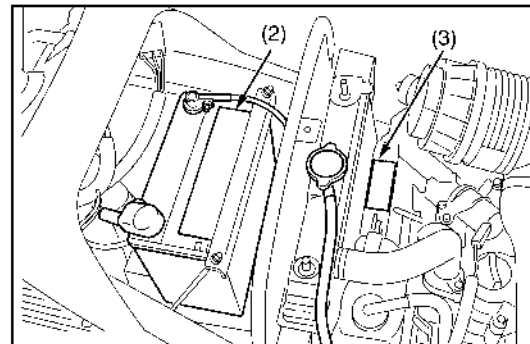
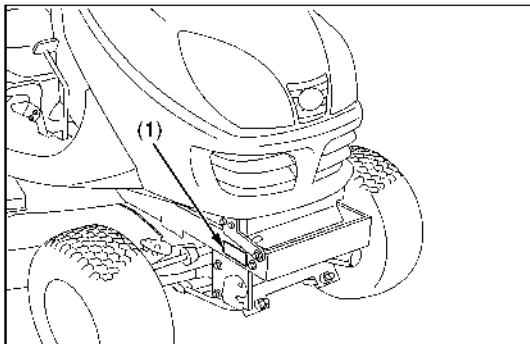
(2) Part No. K3181-6115-2



1BDABCQAP1630

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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CARE OF PICTORIAL SAFETY LABELS

1. Keep pictorial safety labels clean and free from obstructing material.
2. Clean pictorial safety labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing pictorial safety labels with new labels from your local KUBOTA Dealer.
4. If a component with pictorial safety label(s) affixed is replaced with new part, make sure new label(s) is (are) attached in the same location(s) as the replaced component.
5. Put new pictorial safety labels by applying on a clean dry surface and pressing any bubbles to outside edge.

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3. SPECIFICATIONS

Model			GR2120SEU	GR2120EU/GR2120F
Engine	Model		D782-E3-GX	
	Type		Liquid-cooled Diesel	
	Total displacement		778 cm ³ (47.5 cu.in.)	
	Gross power		15.6 kW (21 HP)*	
	Rated revolution		3000 min ⁻¹ (rpm)	
	Low idling revolution		1200 to 1350 min ⁻¹ (rpm)	
	No. of cylinders		3	
	Starter		Electric starter with battery	
	Battery		51R (12 V, 450CCA)	
	Fuel		Diesel fuel No.1 (below -10 °C) Diesel fuel No.2 (above -10 °C)	
	Preheating system		Super glow	
	Engine stop		Key stop	
Capacity	Fuel tank		18 L (4.8 U.S.gals, 4.0 Imp.gals)	
	Engine oil		2.8 L (3.0 U.S.qts, 2.5 Imp.qts)	
	Radiator coolant		2.1 L (2.2 U.S.qts, 1.8 Imp.qts)	
	Hydrostatic transmission oil		3.3 L (3.5 U.S.qts, 2.9 Imp.qts)	
Machine	PTO		Shaft drive	
	PTO clutch		Hydraulic Wet Multi Discs	
	PTO brake		Wet Multi Discs	
	Tires	Front	Size	16 × 7.50 - 8
			Type	Turf
		Rear	Size	23 × 10.50 - 12
			Type	Turf
	Steering type		Full hydraulic power steering (Glide Steer)	
	Brake		Internal expanding brake	
	Travel speed control		Foot pedal	
	Transmission		Hydrostatic	
Dimen- sions	Traveling speeds	Forward	0 to 10 km/h (0 to 6.2 mph)	
		Reverse	0 to 5 km/h (0 to 3.1 mph)	
	Overall length		2000 mm (78.7 in.)	2880 mm (113 in.) w GCK450
	Overall width (with mower deck)		1550 mm (61.0 in.)	1280 mm (50.4 in.)
	Overall height		1205 mm (47.4 in.)	
	Wheel base		1280 mm (50.4 in.)	
	Tread	Front	825 mm (32.5 in.)	
		Rear	820 mm (32.5 in.)	
	Weight (without mower deck and grass catcher)		445 kg (980 lbs)	515 kg (1140 lbs)

■ **NOTE**

- *Manufacture's estimate

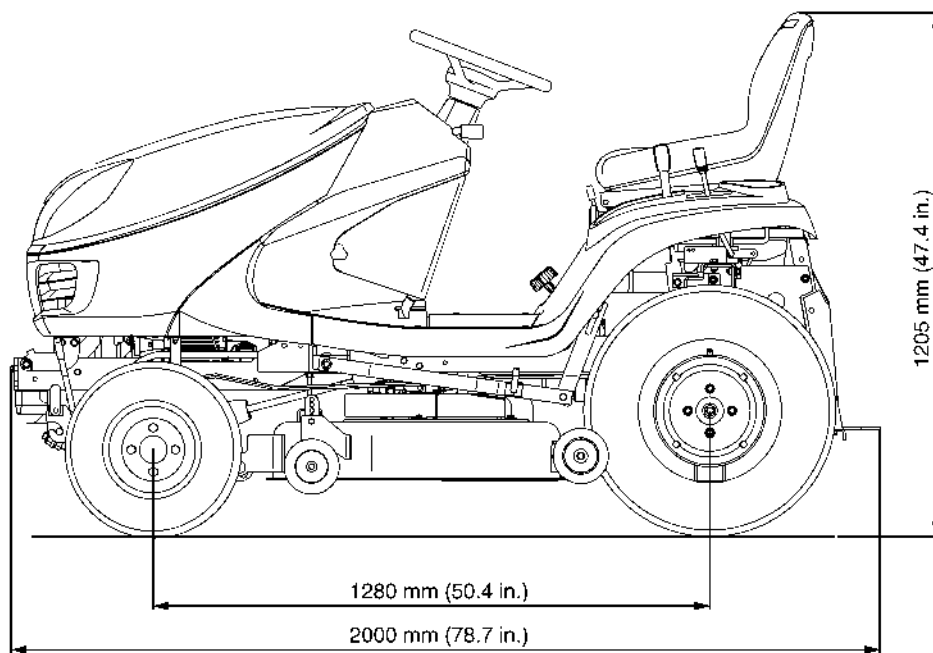
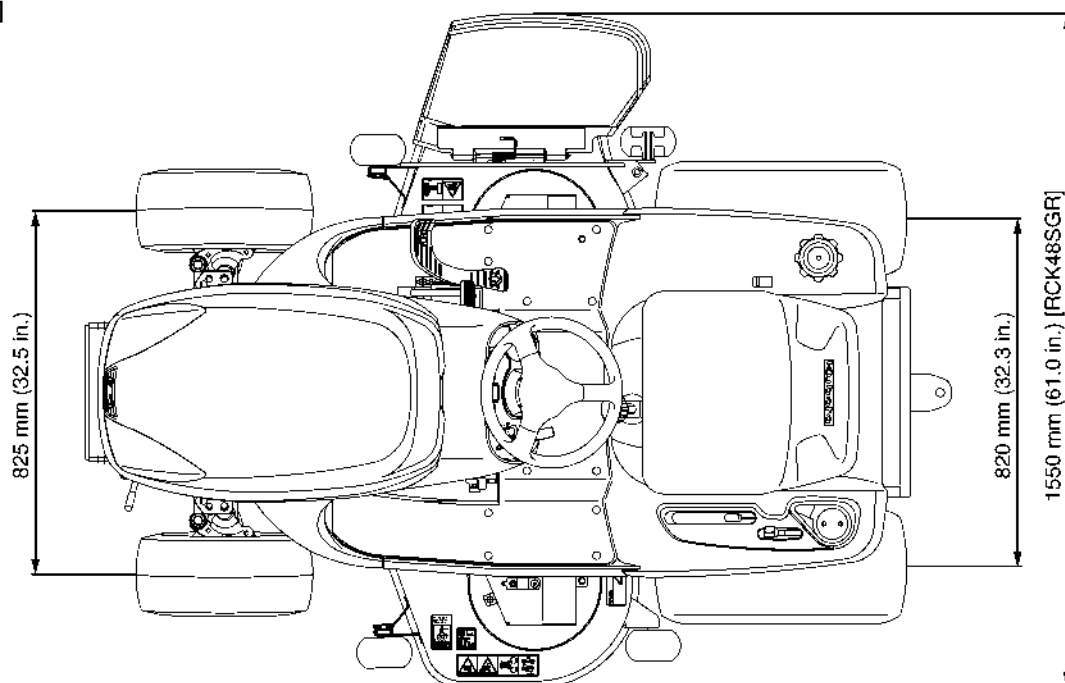
The company reserves the right to change the specifications without notice.

Model		RCK48SGR	RCK48GR-II
Mower	Cutting width	1219 mm (48.0 in.)	1219 mm (48.0 in.)
	Cutting height	25 to 102 mm (1.0 to 4.0 in.)	
	Adjustment of cutting height	Dial gauge	
	Mounting method	Quick joint, Parallel linkage	
	Weight (Approx.)	80 kg (180 lbs)	95 kg (210 lbs)
	Dimensions	Total length	900 mm (35.4 in.)
		Total width	1550 mm (61.0 in.)
		Total height	1270 mm (50.0 in.)
	Discharge direction	Right	Rear
	Gear box oil	0.15 L (0.16 U.S.qts, 0.13 Imp.qts)	0.4 L (0.4 U.S.qts, 0.4 Imp.qts)
Model		–	GCK450GR-II
Grass catcher	Container capacity	–	450 L (119 U.S.gals, 99.0 Imp.gals)
	Weight (Detachable grass catcher bag.)	–	15 kg (33 lbs)

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4. DIMENSIONS

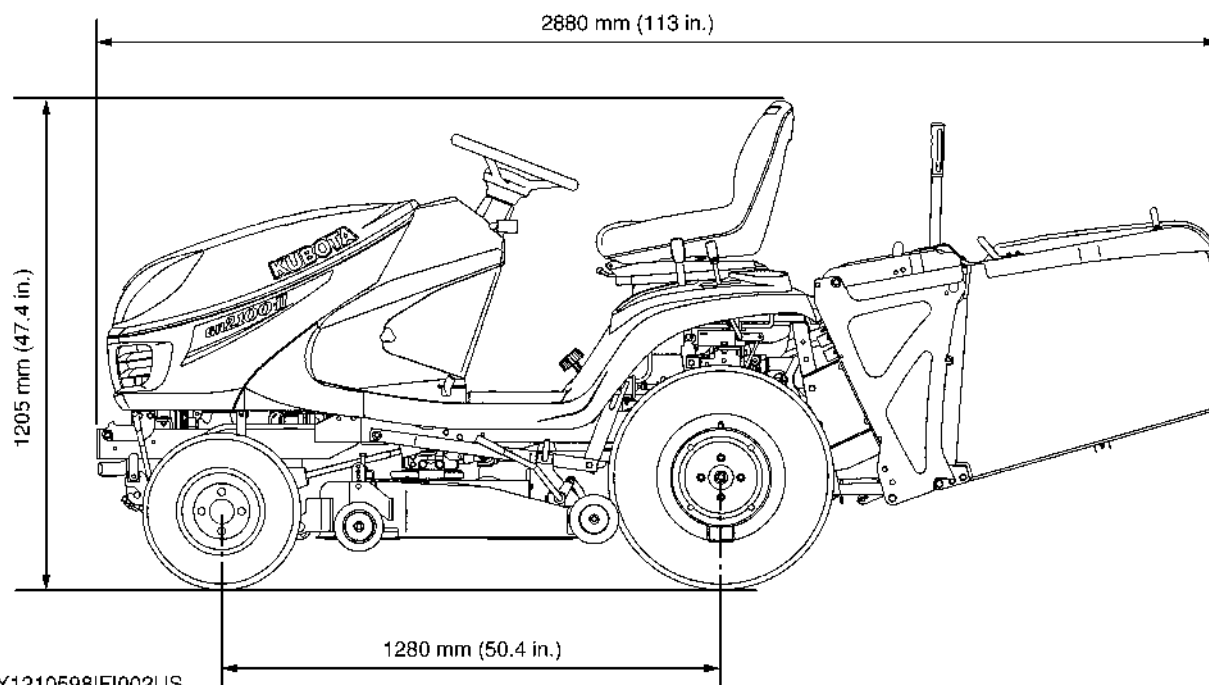
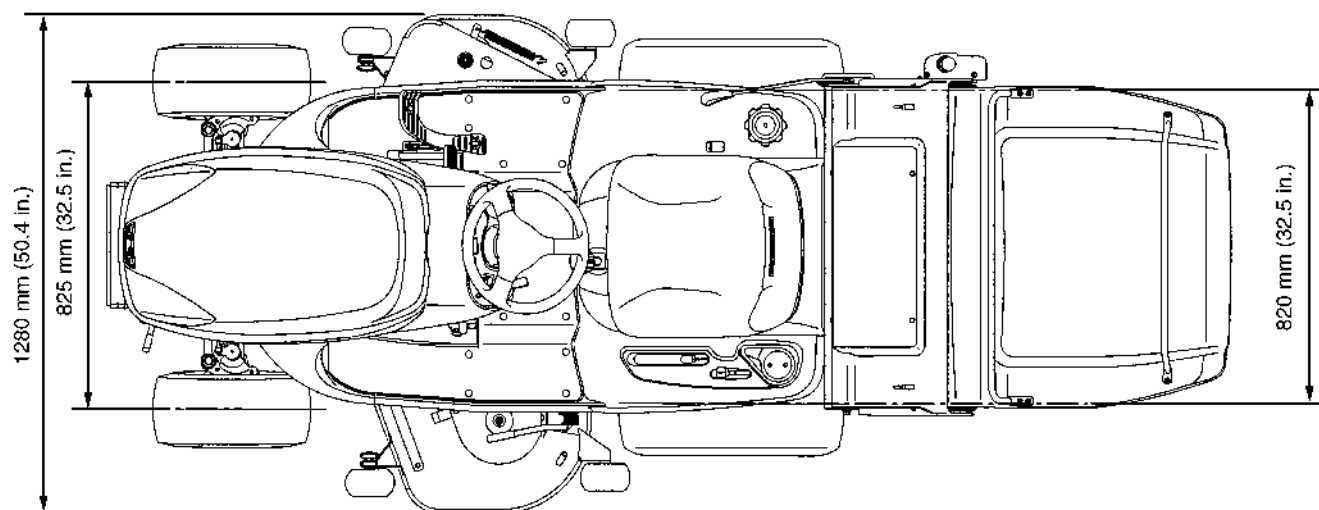
[GR2120SEU]



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[GR2120EU, GR2120F]



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G GENERAL

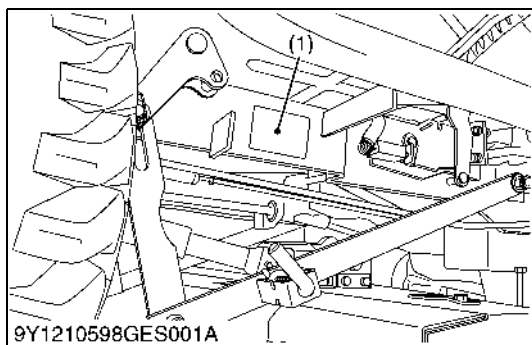
GENERAL

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1. IDENTIFICATION

[1] MODEL NAME AND SERIAL NUMBERS

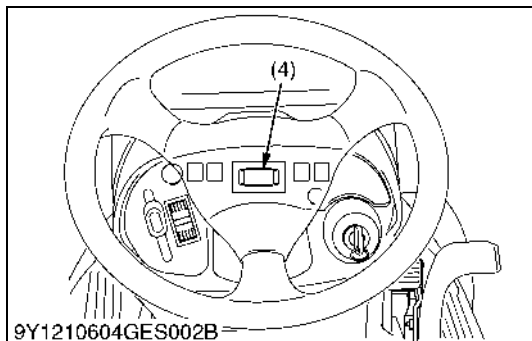
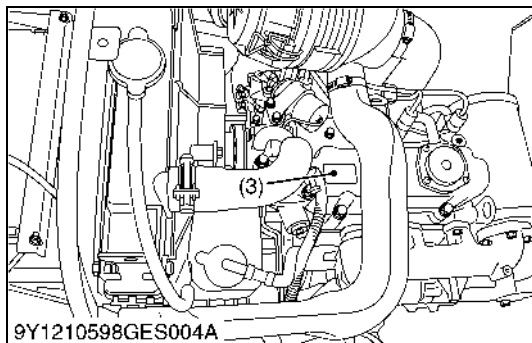
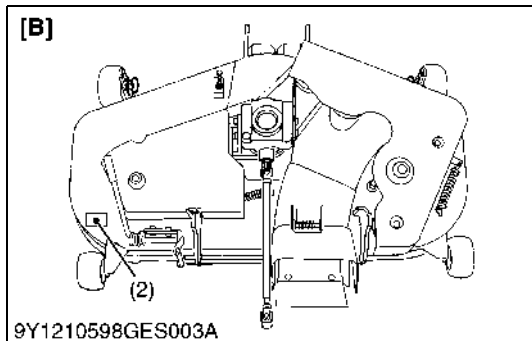
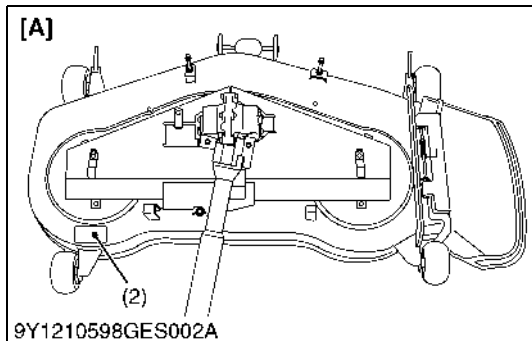


When you get contact to your local KUBOTA distributor, always specify engine serial number (3), machine serial number (1), mower serial number (2) and hour meter reading.

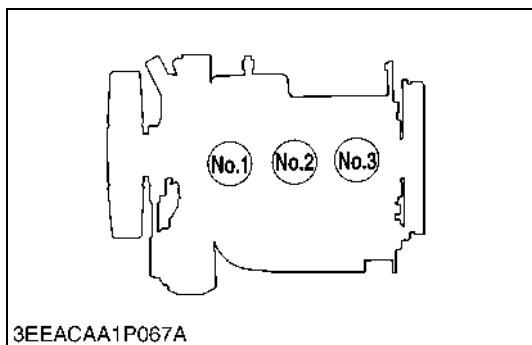
- (1) Machine Serial Number
- (2) Mower Serial Number
- (3) Engine Serial Number

- (4) Hour Meter
- [A] RCK48SGR
- [B] RCK48GR-II

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[2] CYLINDER NUMBER

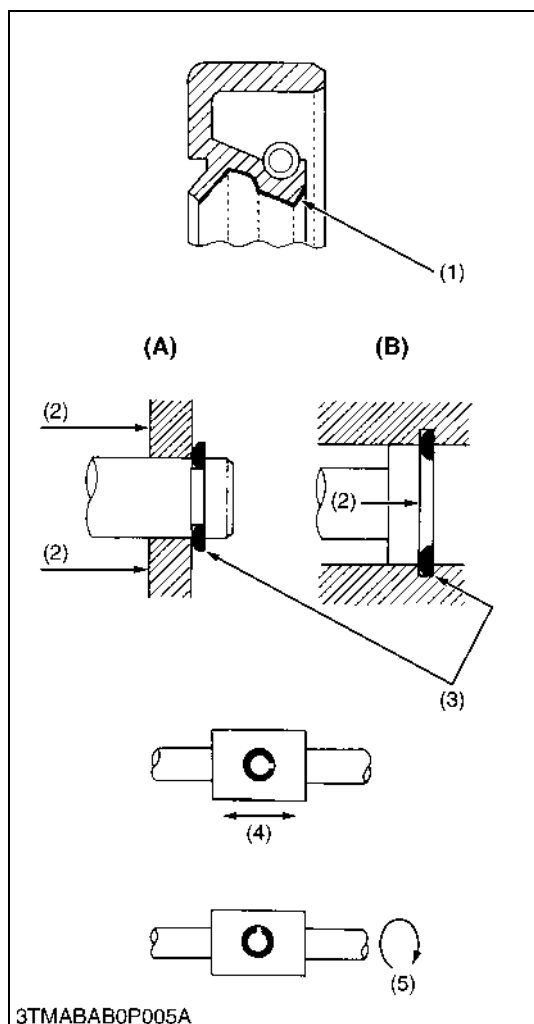


The cylinder numbers of KUBOTA diesel engine are designated as shown in the figure.

The sequence of cylinder number is given as No. 1, No. 2 and No. 3 starting from the front cover side.

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2. GENERAL PRECAUTIONS



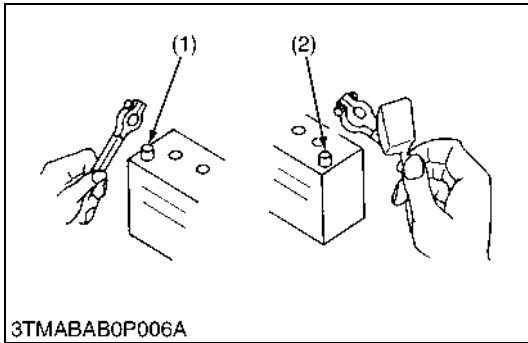
- When you disassemble, carefully put the parts in a clean area to make it easy to find the parts. You must install the screws, bolts and nuts in their initial position to prevent the reassembly errors.
- When it is necessary to use special tools, use KUBOTA special tools. Refer to the drawings when you make special tools that you do not use frequently.
- Before you disassemble or repair machine, make sure that you always disconnect the ground cable from the battery first.
- Remove oil and dirt from parts before you measure.
- Use only KUBOTA genuine parts for replacement to keep the machine performance and to make sure of safety.
- You must replace the gaskets and O-rings when you assemble again. Apply grease (1) to new O-rings or oil seals before you assemble.
- When you assemble the external or internal snap rings, make sure that the sharp edge (3) faces against the direction from which force (2) is applied.
- When inserting spring pins, their splits must face the direction from which a force is applied. See the figure left side.
- To prevent damage to the hydraulic system, use only specified fluid or equivalent.
- Clean the parts before you measure them.
- Tighten the nipples to the specified torque. Too much torque can cause damage to the hydraulic units or the nipples. Not sufficient torque can cause oil leakage.
- When you use a new hose or pipe, tighten the nuts to the specified torque. Then loosen (approx. by 45 °) and let them be stable before you tighten to the specified torque (This is not applied to the parts with seal tape).
- When you remove the two ends of a pipe, remove the lower end first.
- Use two pliers in removal and installation. One to hold the stable side, and the other to turn the side you remove to prevent twists.
- Make sure that the sleeves of flared connectors and taper s of hoses are free of dust and scratches.
- After you tighten the nipples, clean the joint and apply the maximum operation pressure 2 to 3 times to examine oil leakage.

- (1) Grease
- (2) Force
- (3) Sharp Edge
- (4) Axial Force
- (5) Rotating Movement

- (A) External Snap Ring
- (B) Internal Snap Ring

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3. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



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

■ IMPORTANT

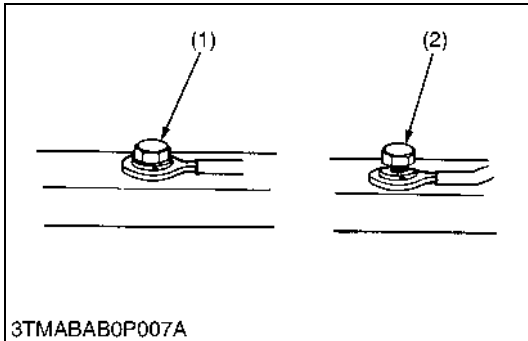
- Check electrical wiring for damage and loosened connection every year. To this end, educate the customer to do his or her own check and at the same time recommend the dealer to perform periodic check for a fee.
- Do not attempt to modify or remodel any electrical parts and wiring.
- When removing the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

(1) Negative Terminal

(2) Positive Terminal

WSM000001GEG0062US1

[1] WIRING

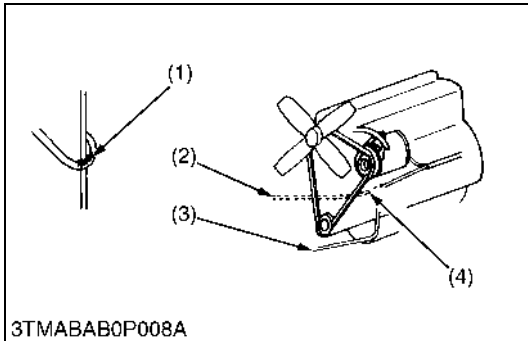


- Securely tighten wiring terminals.

(1) Correct
(Securely Tighten)

(2) Incorrect
(Loosening Leads to Faulty Contact)

WSM000001GEG0063US1

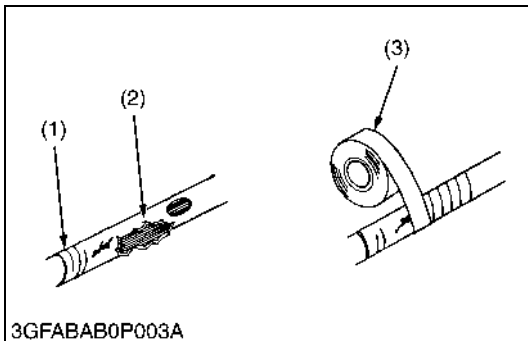


- Do not let wiring contact dangerous part.

(1) Dangerous Part (Sharp Edge)
(2) Wiring (Incorrect)

(3) Wiring (Correct)
(4) Dangerous Part

WSM000001GEG0064US1

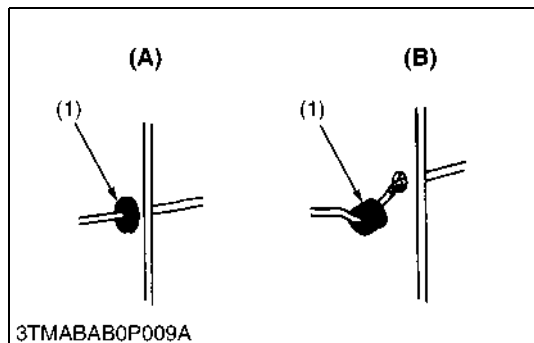


- Repair or change torn or aged wiring immediately.

(1) Aged
(2) Torn

(3) Insulating Vinyl Tape

WSM000001GEG0065US1

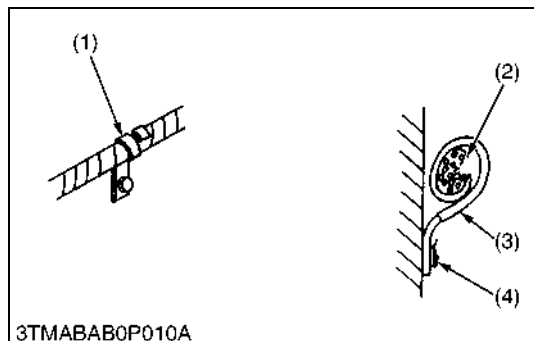


- Securely insert grommet.

(1) Grommet

(A) Correct
(B) Incorrect

WSM000001GEG0066US1

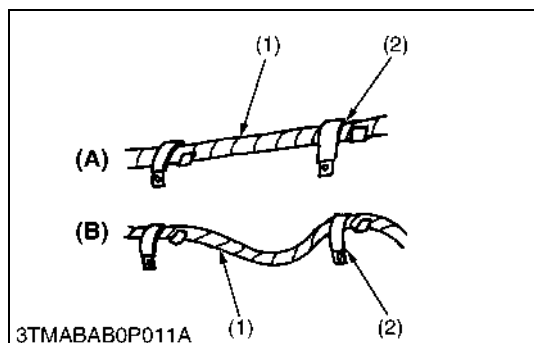


- Securely clamp, being careful not to damage wiring.

(1) Clamp
(Wind Clamp Spirally)
(2) Wire Harness

(3) Clamp
(4) Welding Dent

WSM000001GEG0067US1

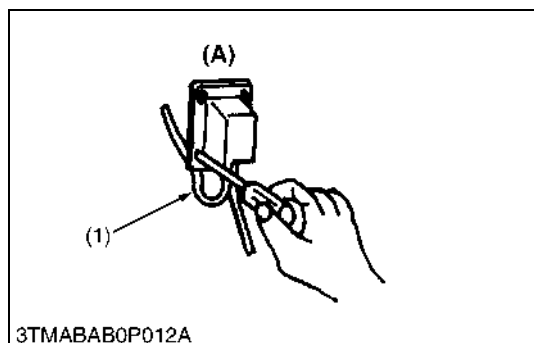


- Clamp wiring so that there is no twist, unnecessary sag, or excessive tension, except for movable part, where sag be required.

(1) Wiring
(2) Clamp

(A) Correct
(B) Incorrect

WSM000001GEG0068US1

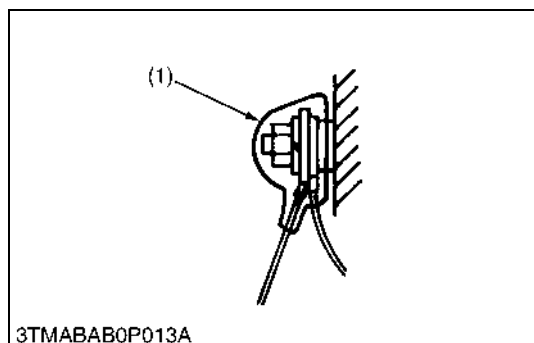


- In installing a part, take care not to get wiring caught by it.

(1) Wiring

(A) Incorrect

WSM000001GEG0069US1

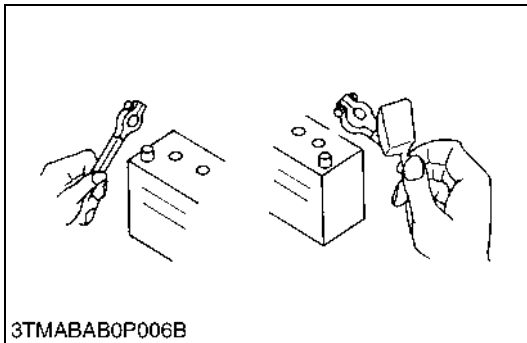


- After installing wiring, check protection of terminals and clamped condition of wiring, only connect battery.

(1) Cover
(Securely Install Cover)

WSM000001GEG0070US1

[2] BATTERY



- Take care not to confuse positive and negative terminal posts.
- When removing battery cables, disconnect negative cable first. When installing battery cables, check for polarity and connect positive cable first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting cables to battery terminal posts, apply high temperature grease to them and securely install terminal covers on them.
- Do not allow dirt and dust to collect on battery.

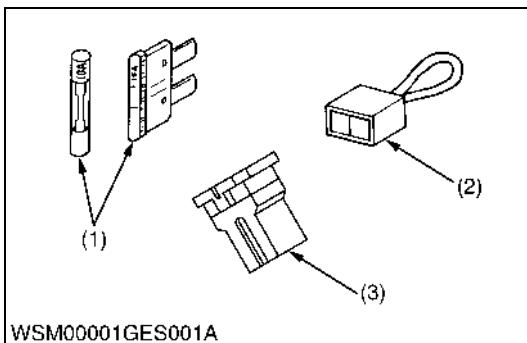


CAUTION

- Take care not to let battery liquid spill on your skin and clothes. If contaminated, wash it off with water immediately.
- Before recharging the battery, remove it from the machine.
- Before recharging, remove cell caps.
- Do recharging in a well-ventilated place where there is no open flame nearby, as hydrogen gas and oxygen are formed.

WSM000001GEG0071US1

[3] FUSE



- Use fuses with specified capacity. Neither too large or small capacity fuse is acceptable.
- Never use steel or copper wire in place of fuse.
- Do not install working light, radio set, etc. on machine which is not provided with reserve power supply.
- Do not install accessories if fuse capacity of reserve power supply is exceeded.

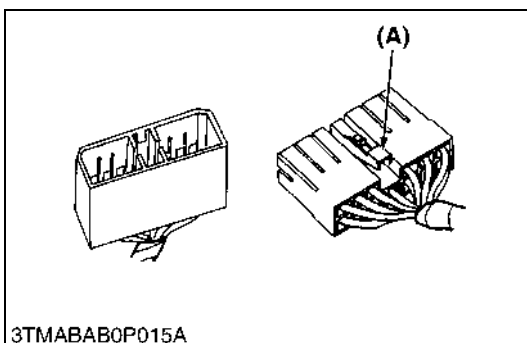
(1) Fuse

(2) Fusible Link

(3) Slow Blow Fuse

WSM000001GEG0072US1

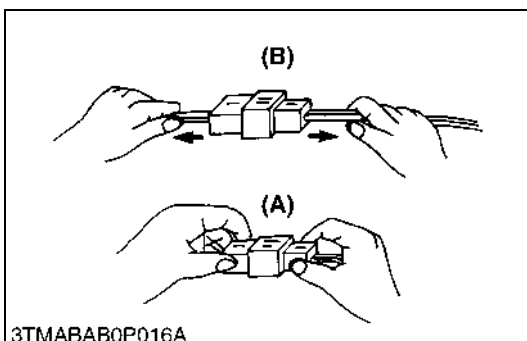
[4] CONNECTOR



- For connector with lock, push lock to separate.

(A) Push

WSM000001GEG0073US1

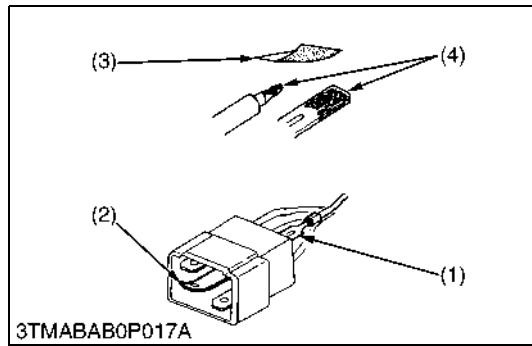


- In separating connectors, do not pull wire harnesses.
- Hold connector bodies to separate.

(A) Correct

(B) Incorrect

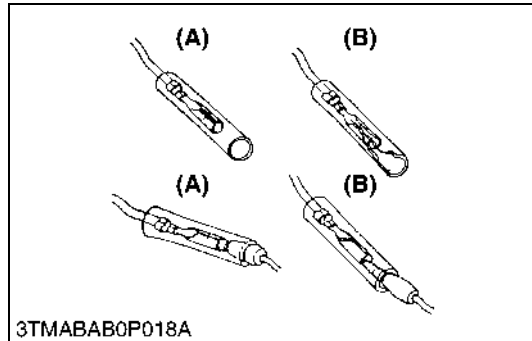
WSM000001GEG0074US1



- Use sandpaper to remove rust from terminals.
- Repair deformed terminal. Make certain there is no terminal being exposed or displaced.

(1) Exposed Terminal (3) Sandpaper
(2) Deformed Terminal (4) Rust

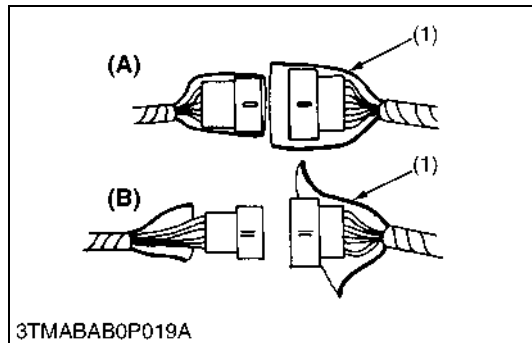
WSM000001GEG0075US1



- Make certain that there is no female connector being too open.

(A) Correct (B) Incorrect

WSM000001GEG0076US1

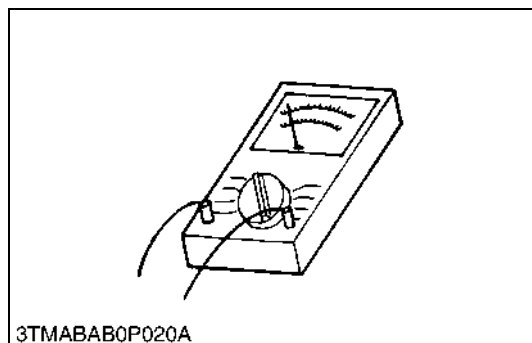


- Make certain plastic cover is large enough to cover whole connector.

(1) Cover (A) Correct
(B) Incorrect

WSM000001GEG0077US1

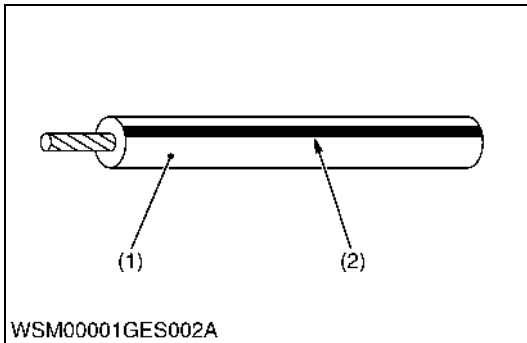
[5] HANDLING OF CIRCUIT TESTER



- Use tester correctly following manual provided with tester.
- Check for polarity and range.

WSM000001GEG0078US1

[6] COLOR OF WIRING



- Colors of wire are specified to the color codes.
- This symbol of "/" shows color with stripe(s).

(An example)

Red stripe on white color: W/R

Color of wiring	Color code
Black	B
Brown	Br
Green	G
Gray	Gy or Gr
Blue	L
Light Green	Lg
Orange	Or
Pink	P
Purple	Pu or V
Red	R
Sky Blue	Sb
White	W
Yellow	Y

(1) Wire Color

(2) Stripe

WSM000001GEG0079US0

4. LUBRICANTS, FUEL AND COOLANT

No.	Place	Capacity		Lubricants, fuel and coolant
		GR2120SEU	GR2120EU/ GR2120F	
1	Fuel tank	18 L 4.8 U.S.gals 4.0 Imp.gals		- No. 2-D diesel fuel - No. 1-D diesel fuel if temperature is below −10 °C (14 °F)
2	Coolant	2.1 L 2.2 U.S.qts 1.8 Imp.qts		Fresh clean water with anti-freeze
	Recovery tank	0.25 L 0.26 U.S.qts 0.22 Imp.qts		
3	Engine crankcase	2.8 L 3.0 U.S.qts 2.5 Imp.qts		Engine oil API Service CD, CE or CF - Below 0 °C (32 °F): SAE10W, 10W-30 or 15W-40 0 to 25 °C (32 to 77 °F) SAE20, SAE10W-30 or 15W-40 - Above 25 °C (77 °F) SAE30, SAE10W-30 or 15W-40
4	Transmission case	3.3 L 3.5 U.S.qts 2.9 Imp.qts		KUBOTA UDT or SUPER UDT fluid*
5	Front axle case	1.9 L 2.0 U.S.qts 1.7 Imp.qts		
6	Mower gear box	RCK48SGR	RCK48GR-II	
		0.15 L 0.16 U.S.qts 0.13 Imp.qts	0.4 L 0.4 U.S.qts 0.4 Imp.qts	

■ NOTE

- * KUBOTA original transmission hydraulic fluid.

Greasing				
No.	Place	No. of greasing point	Capacity	Type of grease
7	Engine transmission universal joint	2	Until grease overflows	Multipurpose EP2 Grease (NLGI Grade No.2)
8	Glide Steer link bolt	2		
9	Front axel (Center pin)	2		
10	Glide Steer rear arm	2		
11	Glide Steer arm	2		
12	Speed control pedal shaft	4	Moderate amount	Engine oil
13	PTO lever	1		
14	Hydraulic lift lever	1		
15	Seat adjuster	6		
16	Around the hole of the mower link	2		
17	Around the pin of the mower link	2		
18	Pivot of mower link	2		
19	Pivot of limit arm	2		
20	Front link	2		
21	Link fulcrum	2		
22	Throttle cable	2		
	[Mower]		Until grease overflows	Multipurpose EP2 Grease (NLGI Grade No.2)
23	Mower universal joint	1		
24	Spindle shafts	3		
25	Belt tension pivot	1		

9Y1210598GEG0002US0

■ NOTE

Engine Oil

- Oil used in the engine should have an American Petroleum Institute (API) service classification and Proper SAE Engine Oil according to the ambient temperatures as shown above:
- With the emission control now in effect, the CF-4 and CG-4 lubricating oils have been developed for use of a low-sulfur fuel on on-road vehicle engines. When an off-road vehicle engine runs on a high-sulfur fuel, it is advisable to employ the "CF or better" lubricating oil with a high Total Base Number (TBN of 10 minimum).
- Refer to the following table for the suitable API classification engine oil according to the engine type (with internal EGR, external EGR or non-EGR) and the fuel (low-sulfur or high-sulfur fuel).

Fuel used	Engine oil classification (API classification)	
	Oil class of engines except external EGR	Oil class of engines with external EGR
High Sulfur Fuel [≥ 0.05 % (500 ppm)]	CF (If the "CF-4, CG-4, CH-4, or CI-4" lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals. (approximately half))	—
Low Sulfur Fuel [< 0.05 % (500 ppm)] or Ultra Low Sulfur Fuel [< 0.0015 % (15 ppm)]	CF, CF-4, CG-4, CH-4 or CI-4	CF or CI-4 (Class CF-4, CG-4 and CH-4 engine oils cannot be used on EGR type engines)

EGR: Exhaust Gas Re-circulation

- The **CJ-4** engine oil is intended for DPF (Diesel Particulate Filter) type engines, and cannot be used on this machine.

	except external EGR	with external EGR
Model	GR2120	—

Fuel

- Cetane number of 45 minimum. Cetane number greater than 50 is preferred, especially for temperatures below -20 °C (-4 °F) or elevations above 1500 m (5000 ft).
- If diesel fuel with sulfur content greater than 0.5 % (5000 ppm) sulfur content in used, reduce the service interval for engine oil and filter by 50 %.
- NEVER use diesel fuel with sulfur content greater than 0.05 % (500 ppm) for EXTERNAL EGR type engine.
- DO NOT use diesel fuel with sulfur content greater than 1.0 % (10000 ppm).
- Diesel fuels specified to EN 590 or ASTM D975 are recommended.
- No.2-D is a distillate fuel of lower volatility for engines in industrial and heavy mobile service. (SAE J313 JUN87)

Transmission oil

- The oil used to lubricate the transmission is also used as hydraulic fluid. To insure proper operation of the hydraulic system and to complete lubrication of the transmission, it is important that a multi-grade transmission fluid is used in this system. We recommend the use of KUBOTA UDT or SUPER UDT fluid for optimum protection and performance. (Consult your local KUBOTA Dealer for further detail.) Do not mix different brands together.
- Indicated capacities of water and oil are manufacturer's estimate.

9Y1210598GEG0003US0

5. TIGHTENING TORQUES

[1] GENERAL USE SCREWS, BOLTS AND NUTS

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

Indication on top of bolt	 4 No-grade or 4T						 7 7T						 9 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

WSM000001GEG0001US1

[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	—	—	—

WSM000001GEG0002US1

[3] HYDRAULIC FITTINGS

(1) Hydraulic Hose Fittings

Hose size	Thread side	Tightening torque		
		N·m	kgf·m	lbf·ft
02	1/8	13.8 to 15.6	1.40 to 1.60	10.2 to 11.5
03	1/4	22.6 to 27.4	2.30 to 2.80	16.7 to 20.2
04				
05	3/8	45.2 to 52.9	4.60 to 5.40	33.3 to 39.0
06				

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(2) Hydraulic Pipe Cap Nuts

Pipe size	Tightening torque		
	N·m	kgf·m	lbf·ft
φ4 × t1.0	19.7 to 29.4	2.00 to 3.00	14.5 to 21.6
φ6 × t1.0	24.6 to 34.3	2.50 to 3.50	18.1 to 25.3
φ8 × t1.0	29.5 to 39.2	3.00 to 4.00	21.7 to 28.9
φ10 × t1.0	39.3 to 49.0	4.00 to 5.00	29.0 to 36.1
φ12 × t1.5	49.1 to 68.6	5.00 to 7.00	36.2 to 50.6
φ15 × t1.6	108 to 117	11.0 to 12.0	79.6 to 86.7
φ18 × t1.6	108 to 117	11.0 to 12.0	79.6 to 86.7

WSM000001GEG0098US0

(3) Adaptors, Elbows and Others

Item	Thread side	Tightening torque		
		N·m	kgf·m	lbf·ft
POA-PF (Nipple with O-ring)	PF 1/8	45 to 53	4.5 to 5.5	33 to 39
	PF 1/4	74 to 83	7.5 to 8.5	55 to 61
	PF 3/8	93.2 to 102	9.50 to 10.5	68.8 to 75.9
	PF 1/2	113 to 122	11.5 to 12.5	83.2 to 90.4
POB-PF (Elbow with O-ring and no nut)	PF 1/8	23 to 26	2.3 to 2.7	17 to 19
	PF 1/4	36 to 43	3.6 to 4.4	26 to 31
	PF 3/8	54 to 63	5.5 to 6.5	40 to 47
	PF 1/2	73 to 83	7.4 to 8.5	54 to 61
Adaptor (NPT)	PF 1/8	9.8 to 14	1.0 to 1.5	7.3 to 10
	PF 1/4	30 to 34	3.0 to 3.5	22 to 25
	PF 3/8	49 to 68	5.0 to 7.0	37 to 50
	PF 1/2	69 to 88	7.0 to 9.0	51 to 65

WSM000001GEG0099US0

[4] METRIC SCREWS, BOLTS AND NUTS

Grade	 Property class 8.8			 Property class 10.9		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M8	24 to 27	2.4 to 2.8	18 to 20	30 to 34	3.0 to 3.5	22 to 25
M10	48 to 55	4.9 to 5.7	36 to 41	61 to 70	6.2 to 7.2	45 to 52
M12	78 to 90	7.9 to 9.2	58 to 66	103 to 117	10.5 to 12.0	76.0 to 86.7
M14	124 to 147	12.6 to 15.0	91.2 to 108	167 to 196	17.0 to 20.0	123 to 144
M16	197 to 225	20.0 to 23.0	145 to 166	260 to 304	26.5 to 31.0	192 to 224

WSM000001GEG0003US1

[5] AMERICAN STANDARD SCREWS, BOLTS AND NUTS WITH UNC OR UNF THREADS

Grade	 SAE GR.5			 SAE GR.8		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
1/4	11.7 to 15.7	1.20 to 1.60	8.63 to 11.5	16.3 to 19.7	1.67 to 2.00	12.0 to 14.6
5/16	23.1 to 27.7	2.36 to 2.82	17.0 to 20.5	33 to 39	3.4 to 3.9	25 to 28
3/8	48 to 56	4.9 to 5.7	36 to 41	61 to 73	6.3 to 7.4	45 to 53
1/2	110 to 130	11.3 to 13.2	81.2 to 95.8	150 to 178	15.3 to 18.1	111 to 131
9/16	150 to 178	15.3 to 18.1	111 to 131	217 to 260	22.2 to 26.5	160 to 191
5/8	204 to 244	20.8 to 24.8	151 to 179	299 to 357	30.5 to 36.4	221 to 263

WSM000001GEG0008US1

[6] PLUGS

Shape	Size	Material of opponent part					
		Ordinariness			Aluminum		
		N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
Tapered screw 	R1/8	13 to 21	1.3 to 2.2	9.4 to 15	13 to 19	1.3 to 2.0	9.4 to 14
	R1/4	25 to 44	2.5 to 4.5	18 to 32	25 to 34	2.5 to 3.5	18 to 25
	R3/8	49 to 88	5.0 to 9.0	37 to 65	49 to 58	5.0 to 6.0	37 to 43
	R1/2	58.9 to 107	6.00 to 11.0	43.4 to 79.5	59 to 78	6.0 to 8.0	44 to 57
Straight screw 	G1/4	25 to 34	2.5 to 3.5	18 to 25	—	—	—
	G3/8	62 to 82	6.3 to 8.4	46 to 60	—	—	—
	G1/2	49 to 88	5.0 to 9.0	37 to 65	—	—	—

WSM000001GEG0005US1

6. MAINTENANCE CHECK LIST

Do the following servicing tasks on the machine at the stated running-time intervals.

No.	Item		Indication on hour meter												Interval	Reference page	Important	
			50	100	150	200	250	300	350	400	450	500	550	600				
1	Engine oil	Change	★	☆		☆		☆		☆		☆		☆	every 100 Hr	G-32		
2	Engine oil filter	Replace	★			☆				☆				☆	every 200 Hr	G-36		
3	Transmission fluid	Change				☆				☆				☆	every 200 Hr	G-38		
4	Front axle cases fluid	Change				☆				☆				☆	every 200 Hr	G-39		
5	Transmission oil filter	Replace	★			☆				☆				☆	every 200 Hr	G-37		
6	Transmission strainer	Clean				☆				☆				☆	every 200 Hr	G-37		
7	Front axle pivot	Adjust		★		☆				☆				☆	every 200 Hr	G-39	*2	
8	Safety device	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-23		
9	Oiling	—	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-24		
10	Greasing (Machine)	—	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-26		
11	Mower gear box oil	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-27		
		Change	★		☆			☆			☆			☆	every 150 Hr	G-36		
12	Air cleaner element	Clean	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-28	*1	@
		Replace													every 1 year	G-28		
13	Battery condition	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-29		
14	Brake	Adjust		☆		☆		☆		☆		☆		☆	every 100 Hr	G-33		
15	Fan drive belt	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-34		
16	Fuel filter element	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-35		@
		Replace								☆					every 400 Hr	G-41	*2	
17	Fuel line	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-35		@
		Replace													every 2 years	G-35	*2	
18	Hydraulic hose	Check				☆				☆				☆	every 200 Hr	G-40		
		Replace													every 2 years	G-40	*2	
19	Radiator hose and clamp	Check				☆				☆				☆	every 200 Hr	G-40		
		Replace													every 2 years	G-40	*2	
20	Intake air line	Check				☆				☆				☆	every 200 Hr	G-41		@
		Replace													every 2 years	G-41	*4	
21	Fuel injection nozzle injection pressure	Check													every 1500 Hr	1-S18	*3	@
22	Injection pump	Check													every 3000 Hr	1-S17	*3	@

No.	Item		Indication on hour meter												Interval	Reference page	Important	
			50	100	150	200	250	300	350	400	450	500	550	600				
23	Radiator	Clean													every 1 year	G-42		
24	Coolant	Change													every 1 year	G-42		
25	Mower gear box oil seal	Replace													every 2 years	8-S12, 8-S16	*2	
26	Engine breather hose	Replace													every 2 years	G-45	*3	
27	Fuel system	Bleed													Service as Required	G-45		
28	Fuse	Replace														G-46		
29	Blade	Replace														G-47		
30	Mower belt	Replace														G-49		

■ IMPORTANT

- The jobs indicated by ★ must be done initially.
- *1: This maintenance should be done daily more often in dusty conditions than in normal conditions.
Suggested cleaning interval is every 100 hours in normal conditions.
- *2: These items should be serviced by an authorized KUBOTA Dealer, unless the owner has the proper tools and is mechanically proficient.
- *3: Consult your local KUBOTA Dealer for this service.
- *4: Replace only if necessary.
- 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 for complete details.

9Y1210598GEG0004US0

7. CHECK AND MAINTENANCE



CAUTION

- Be sure to check and service the machine on a flat place with engine shut off, the parking brake on and chock the wheels.

9Y1210598GEG0005US0

[1] DAILY CHECK

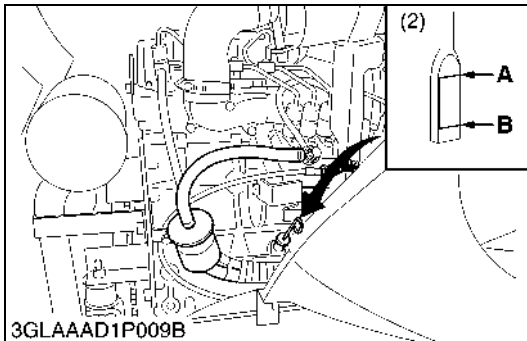
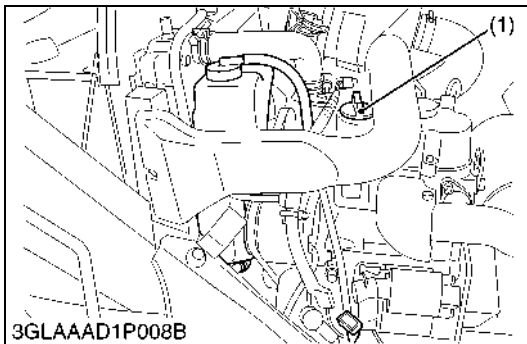
To prevent trouble from occurring, it is important to know the condition of the machine. Check the following items before starting.

9Y1210598GEG0006US0

Checking

- Check areas where previous trouble was experienced.
- Walk around the machine.
- 1. Tire pressure, wear and damage
- 2. Oil leak
- 3. Engine oil level
- 4. Coolant level in the recovery tank
- 5. Transmission fluid level
- 6. Damage of machine body, tightness of all bolts and nuts
- 7. Radiator screen
- 8. Panel screen
- 9. Brake free travel
- 10. Fuel level
- 11. Check air cleaner element
- Mower
- 1. Oil leak
- 2. Make sure blade cap screws are tight.
- 3. Blades for wear or damage.
- 4. Check all hardware.
- 5. Make sure all pins are in place.
- 6. Mower deck cleaning
- 7. Greasing
- While sitting in the operator's seat
- 1. Speed control pedal and brake pedal
- 2. Brake lock
- 3. Other movable parts
- Turning the key switch **"ON"**
- 1. Performance of the Easy Checker™ light.
- Starting the engine
- 1. Color of the exhaust fumes
- 2. Safety start switch, seat safety control and another safety devices.
- 3. Check for abnormal noise and vibration.
- Others
- 1. Check the areas where previous troubles were experienced.

9Y1210598GEG0007US0



Checking Engine Oil Level

⚠ CAUTION

- Always stop the engine and remove the key before checking oil.
1. Check engine oil before starting and 5 minutes or more after the engine has stopped.
 2. Wipe dipstick (2) area clean.
 3. To check the oil level, remove the dipstick (2), wipe it clean, reinsert it, and draw it out again. Check to see that the oil level is between the two notches.
 4. Add new oil to the prescribed level at the oil inlet (1) if necessary.

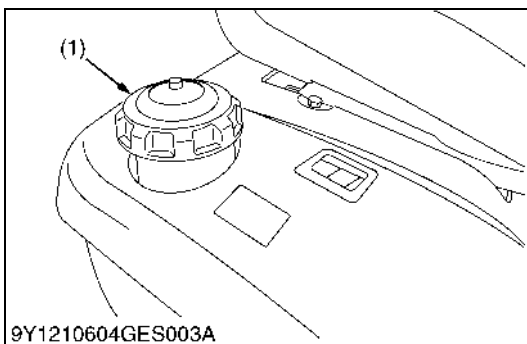
■ IMPORTANT

- When using a different brand or viscosity oil from the previous one, remove all of the old oil and oil filter. Never mix two different types of oil.
- Use the proper Engine Oil SAE according to the ambient temperatures. (See page "4. LUBRICANTS, FUEL AND COOLANT" on page G-9.)

- (1) Engine Oil Inlet
(2) Oil Level Dipstick

- A: Upper Level
B: Lower Level

9Y1210598GEG0008US0



Checking Amount of Fuel and Refueling

⚠ CAUTION

- Handle fuel carefully. If the engine is running, do not fill the fuel tank. If engine is hot, let engine cool several minutes before adding fuel.
- Do not smoke while filling the fuel tank or servicing the fuel system. Fill fuel tank only to bottom of filler neck.**

Check the fuel level. Be careful that the fuel tank does not become empty.

Fuel tank	Capacity	18 L 4.8 U.S.gals 4.0 Imp.gals
-----------	----------	--------------------------------------

■ IMPORTANT

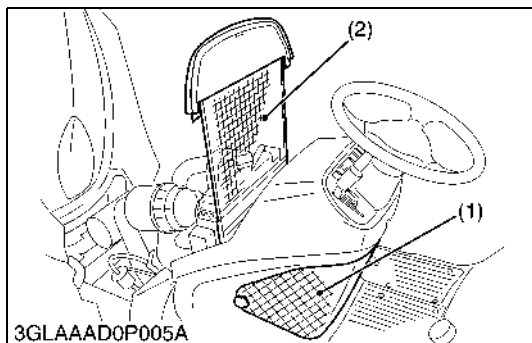
- Use Diesel Fuel Only.
1. Use No.2-D diesel fuel.
 2. Use No.1-D diesel fuel if the temperature is below -10°C (14°F).
 3. Always use a strainer when refueling to prevent fuel injection pump contamination.

■ IMPORTANT

- Do not permit dirt or trash or water to get into the fuel system.
- Be careful not to let the fuel tank become empty, otherwise air will enter the fuel system, necessitating bleeding before next engine start.
- Be careful not to spill fuel during refueling. If a spill should occur, wipe it off at once, or it may cause a fire.
- To prevent condensation (water accumulation) in the fuel tank, fill the tank before parking overnight.

- (1) Fuel Cap

9Y1210598GEG0009US0



Checking and Cleaning Radiator to Prevent Overheating



WARNING

To avoid serious injury or death:

- 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.



CAUTION

- 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.

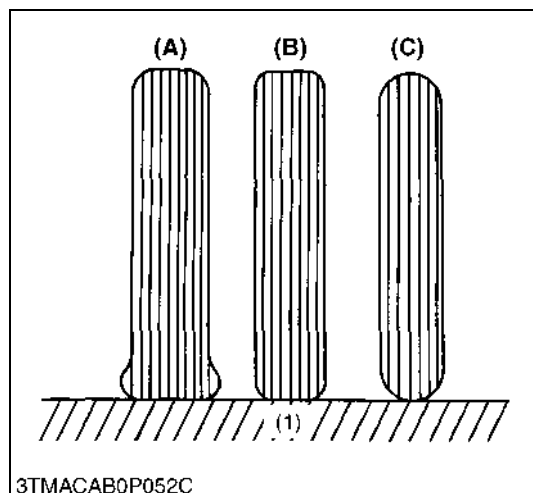
Daily or after every 5 hours of operation, check to be sure the radiator screen (2) and radiator core are clean. Dirt or chaff on the radiator screen (2) or radiator core decrease cooling performance.

1. Remove the radiator screen (2) and panel screen (1) 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, see page G-34.
4. If scale forms in the tube, clean with the scale inhibitor or its equivalent.
5. Each time the panel screen (1) is covered with grass during operation, rub it off the screen with hand. Check the radiator screen (2) from time to time if grass accumulates.
6. If the dust or chaff has accumulated inside of the panel, remove the radiator screen (2) and clean inside completely. After cleaning, reinstall the radiator screen (2) properly.

(1) Panel Screen

(2) Radiator Screen

9Y1210598GEG0010US0



Checking Tire Pressure

⚠ WARNING

- Do not try to install a tire on a rim. This is approved to a qualified person with the proper equipment.
- Always keep the correct tire pressure.
Do not inflate tires more than the recommended pressure.
- Inflation pressure in front tires increases quickly when using compressed air.

⚠ CAUTION

- Never operate machine with a loose rim, wheel or axle.
- Whenever bolts are loosened, retighten to specified torque.
- Check all bolts frequently and keep them tightened.

■ Inflation Pressure

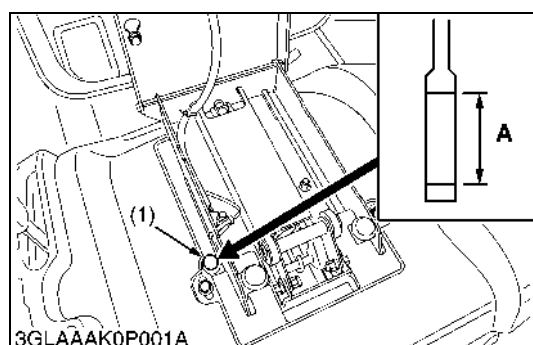
Though the inflation pressure is factory-set to the prescribed level, it naturally drops slowly in the course of time. Thus, check it every day and inflate as necessary.

	Tire Sizes	Recommended Inflation MAX. Pressure
Front	16 × 7.50-8, 4PR	200 kPa (2.0 kgf/cm ² , 29 psi)
Rear	23 × 10.50-12, 4PR	140 kPa (1.4 kgf/cm ² , 20 psi)

(1) Ground

(A) Insufficient
(B) Normal
(C) Excessive

9Y1210598GEG0011US0



Checking Transmission Fluid Level

1. Park the machine on a flat surface, lower the implement to the ground and shut off engine and remove the key.
2. Raise the operator's seat.
3. To check the oil level, pull out the dipstick (1), wipe it clean, reinsert it, and draw it out again. Check to see that the oil level lies between the two notches. If the level is too low, add new oil to the prescribed level at the oil inlet. (See page G-38.)

■ NOTE

- Check the oil level of the transmission case with mower lifted up.

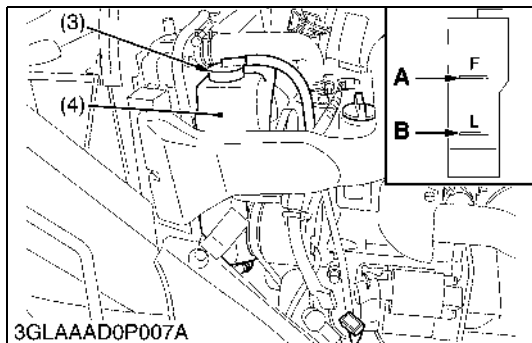
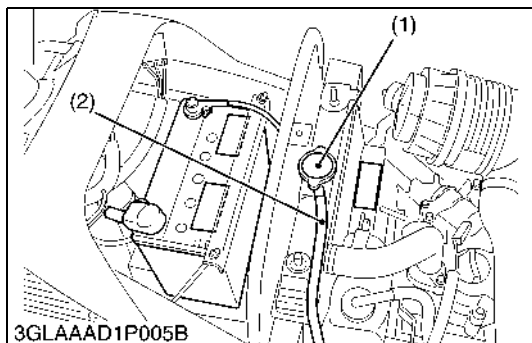
■ IMPORTANT

- If oil level is low, do not run engine.

(1) Oil Level Dipstick

A: Oil level is acceptable within this range.

9Y1210598GEG0012US0



Checking Coolant Level

⚠ CAUTION

- Be sure to stop the engine and remove the key before checking coolant level.
- Do not remove the radiator cap when the engine is hot. Loosen cap slightly, to the stop, to relieve any excess pressure before removing cap completely.

Check the coolant level daily both the radiator and the recovery tank (4) before starting engine.

1. Remove the radiator cap (1) and check to see that the coolant level is just below the fill port.
2. Check to see that the coolant level is between the "FULL" and "LOW" marks of recovery tank (4).
3. When the coolant level drops due to evaporation, add water only up to just below the fill port of the radiator and the full level of the recovery tank (4).

In case of leakage, add coolant and water in the specified mixing ratio up to the full level. (See page G-42.)

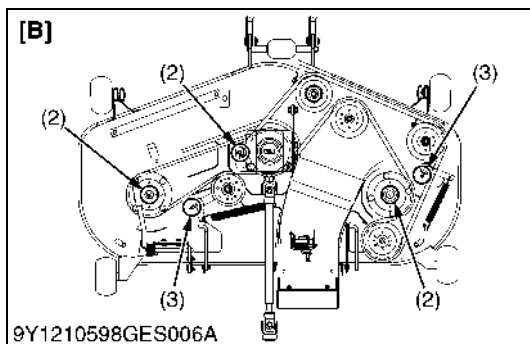
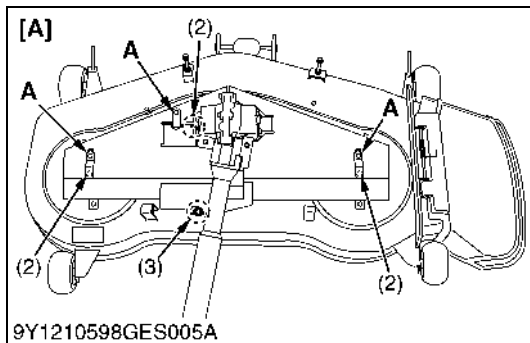
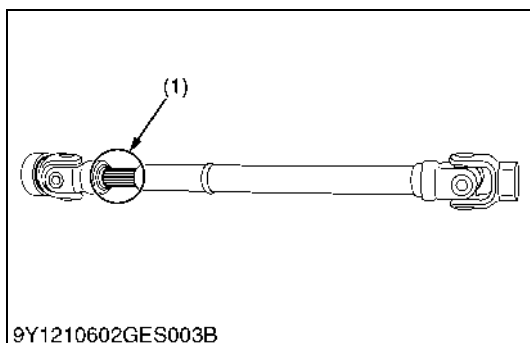
■ IMPORTANT

- If the radiator cap has to be removed, follow the caution above and securely retighten the cap.
- Use clean, distilled coolant and water to fill the radiator and recovery tank.

- (1) Radiator Cap
 (2) Overflow Pipe
 (3) Recovery Tank Cap
 (4) Recovery Tank

A: FULL
 B: LOW

9Y1210598GEG0013US0



Lubricating all Grease Fittings for Mower

⚠ CAUTION

To avoid personal injury:

- Be sure to stop the engine and remove the key before greasing.

1. Remove the universal joint covers and apply grease to the universal joint.
2. Apply grease to the spindle shafts, belt tension pivot and belt tension pulley.

■ NOTE

- For spindle shafts, remove the grease up plates and apply grease.
- For the belt tension pivot, apply grease without removing the plate and cover.

■ IMPORTANT

- After removing the grease up plates, be sure to fit the plates back in place.
- After checking above items, replace any worn, damaged or missing parts.
- Dry the deck completely before storage, or pulleys become rusty and damage can result.

- (1) Mower Universal Joint
(Apply grease on the spline shaft.)
- (2) Grease Fitting (Spindle Shaft)
- (3) Grease Fitting (Belt Tension Pivot)

A: Grease Up Plate

[A] RCK48SGR

[B] RCK48GR-II

9Y1210598GEG0066US0

Checking Movable Parts

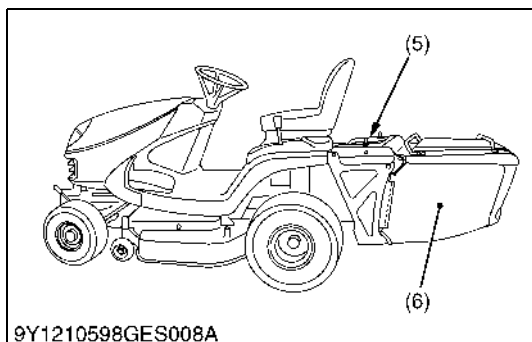
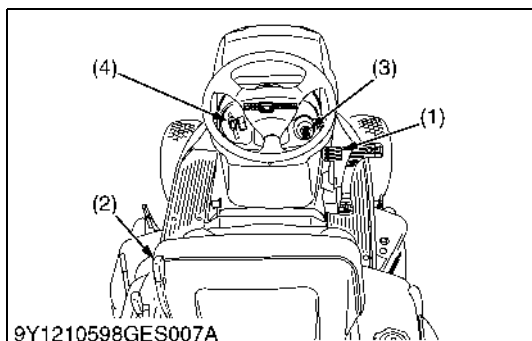
If any of the movable parts, such as levers and pedals, is not smoothly moved because of rust or anything sticky, do not attempt to force it into motion.

In the above case, remove the rust or the sticky thing, and apply oil or grease on the relevant spot.

Otherwise, the machine may get damaged.

9Y1210598GEG0067US0

[2] CHECK POINTS OF EVERY 50 HOURS



Checking Safety Device

The Safety Devices in your machine are designed to protect you while operating. Please check these Safety Devices periodically - daily is best - to test function of the Safety Devices before operation.



CAUTION

To avoid personal injury:

- Do not allow anyone near the machine while testing.
- If the machine does not get one of the following tests, do not operate the machine.
- See your local KUBOTA Dealer.
- Stay on operator's seat for all tests except for Test 3 and Test 4. (Seat safety control)

■ IMPORTANT

- Check the following tests before operating the machine.

Check the safety switches

■ Safety Start Control 1

1. Depress the brake pedal (1) fully.
2. Engage the PTO lever (2).
3. Turn the key switch (3) to the "START" position.
4. The engine should not crank.

■ Safety Start Control 2

1. Disengage the PTO lever (2).
2. Release the brake pedal (1).
3. Turn the key to the "START" position.
4. The engine should not crank.

■ Seat Safety Control 1

1. Operate the engine at half throttle.
2. Engage the PTO lever (2).
3. Stand up. (Do not get off the machine.)
4. Engine must stop.

■ Seat Safety Control 2

1. Operate the engine at half throttle.
2. Disengage the PTO lever (2).
3. Release the brake pedal (1).
4. Stand up. (Do not get off the machine.)
5. Engine must stop.

■ PTO Safety Control 1 [GR2120EU, GR2120F]

1. Remove the container (6) from the platform.
2. Operate the engine at half throttle.
3. Engage the PTO lever.
4. Engine must stop.

■ PTO Safety Control 2 [GR2120EU, GR2120F]

1. Operate the engine at half throttle.
2. Engage the PTO lever (2).
3. Dump the grass catcher.
4. Engine must stop.

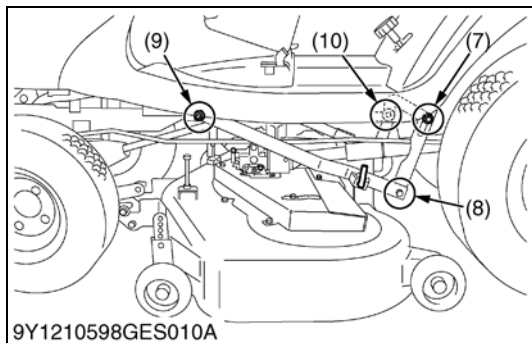
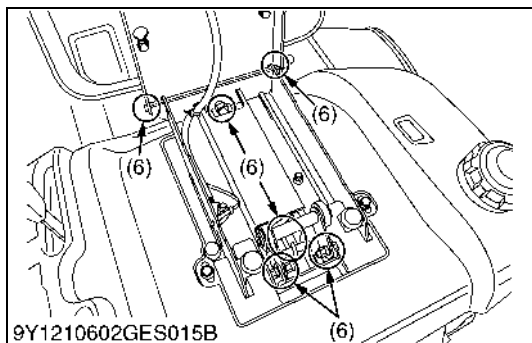
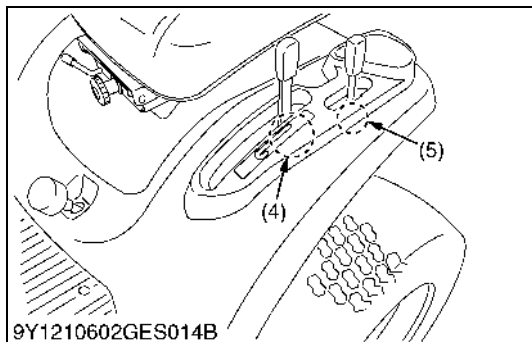
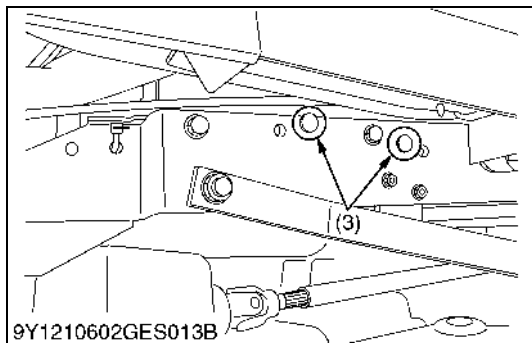
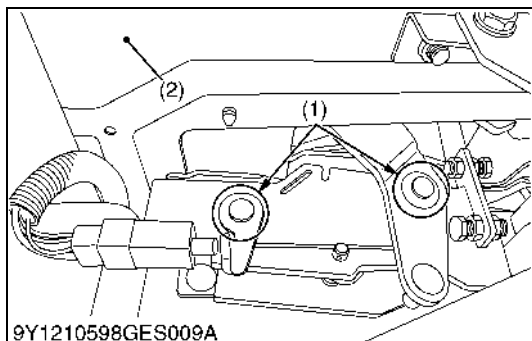
■ PTO Safety Control 3 [GR2120EU, GR2120F]

1. Open the top cover (5).
2. Operate the engine at half throttle.
3. Engage the PTO lever (2).
4. Engine must stop.

- (1) Brake Pedal
(2) PTO Lever
(3) Key Switch

- (4) Throttle Lever
(5) Top Cover
(6) Container

9Y1210598GEG0014US0



Oiling

1. Apply oil to the following location as figures.



CAUTION

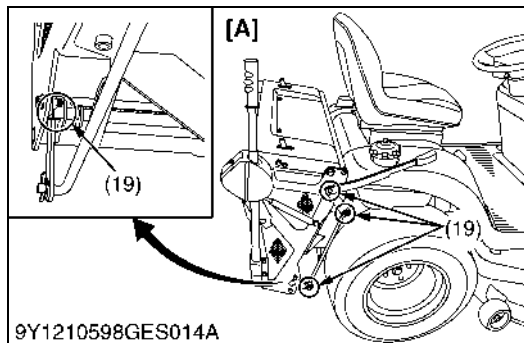
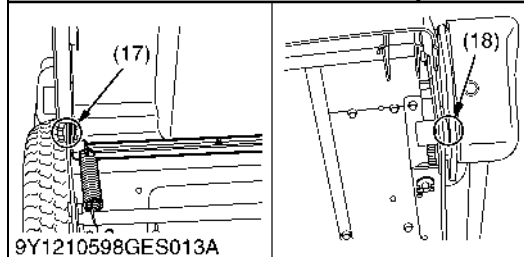
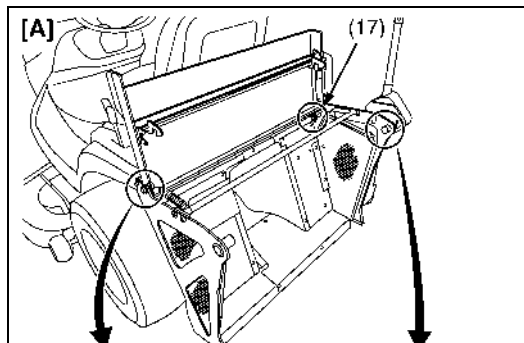
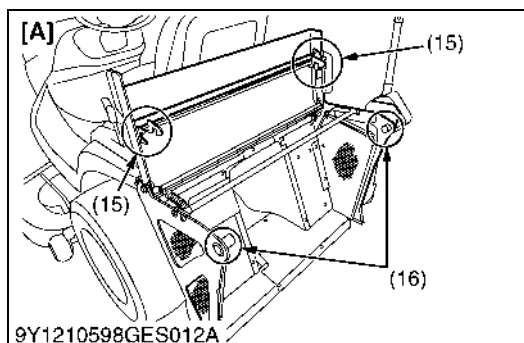
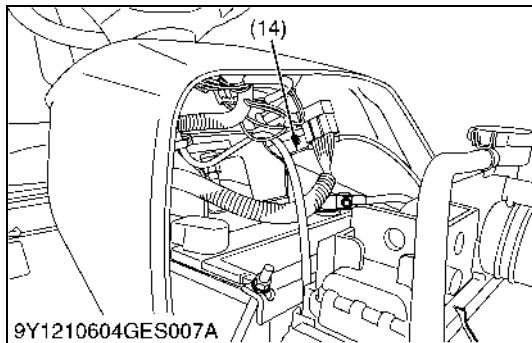
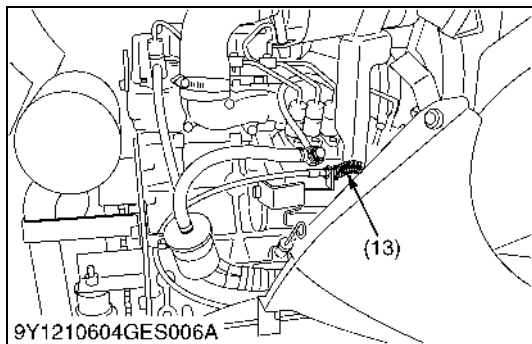
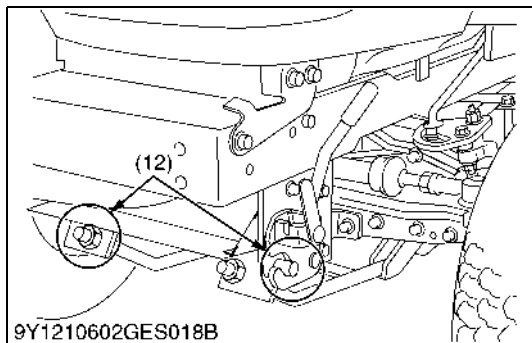
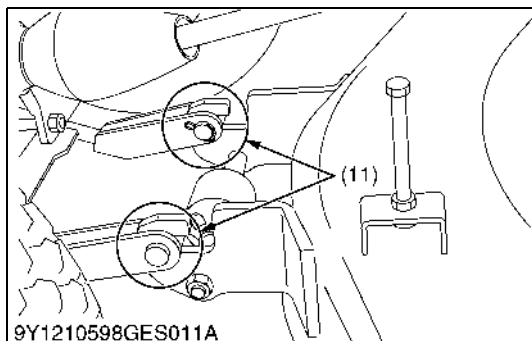
To avoid personal injury:

- Be sure to stop the engine and remove the key before greasing.

- | | |
|------------------------------------|--|
| (1) Speed Control Pedal Shaft (RH) | (7) Around the Hole of the Mower Link (LH, RH) |
| (2) Fender | (8) Around the Pin of the Mower Link (LH, RH) |
| (3) Speed Control Pedal Shaft (LH) | (9) Pivot of Mower Link (LH, RH) |
| (4) PTO Lever (Fulcrum) | (10) Pivot of Lift Arm (LH, RH) |
| (5) Hydraulic Lift Lever (Fulcrum) | |
| (6) Seat Adjuster | |

(To be continued)

(Continued)



- (11) Front Link
- (12) Link Fulcrum
- (13) Throttle Cable
- (14) Throttle Cable
- (15) Top Cover Lock Lever
- (16) Frame Shaft

- (17) Top Cover
- (18) Arm Bracket
- (19) Rear Quick Clean Lever

[A] GR2120EU, GR2120F

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Greasing for Machine

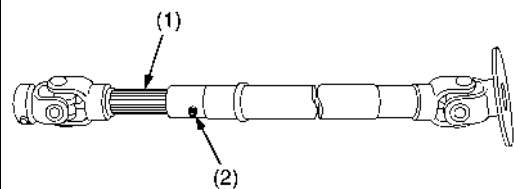


CAUTION

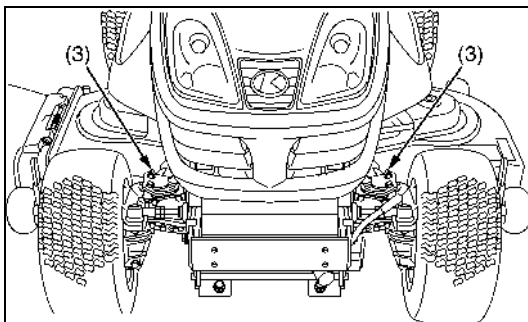
To avoid personal injury:

- Be sure to stop the engine and remove the key before greasing.

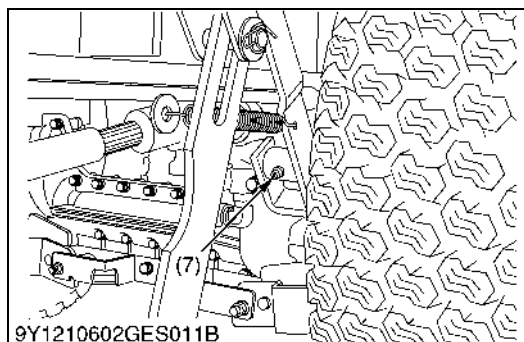
Grease the following locations.



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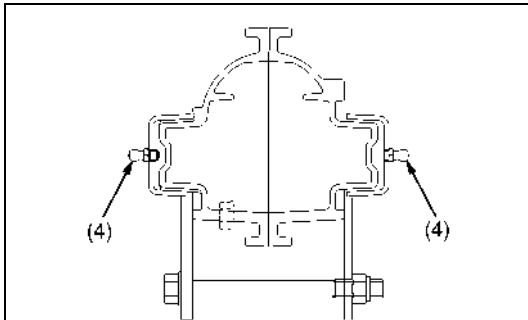
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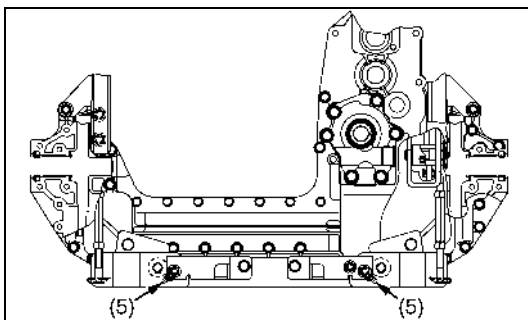
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- | | |
|---|------------------------------------|
| (1) Engine Transmission Universal Joint (Apply grease on the spline shaft.) | (3) Glide Steer Link Bolt (LH, RH) |
| (2) Engine Transmission Universal Joint (Fitting) | (4) Front Axle (Center Pin) |
| | (5) Glide Steer Rear Arm |
| | (6) Glide Steer Arm (RH) |
| | (7) Glide Steer Arm (LH) |

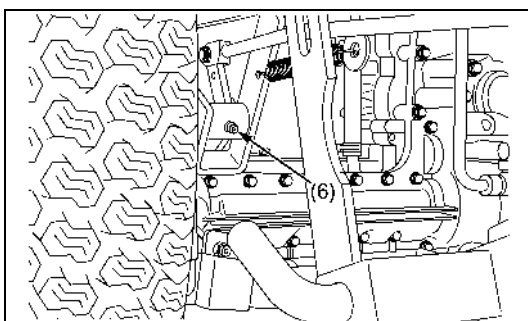
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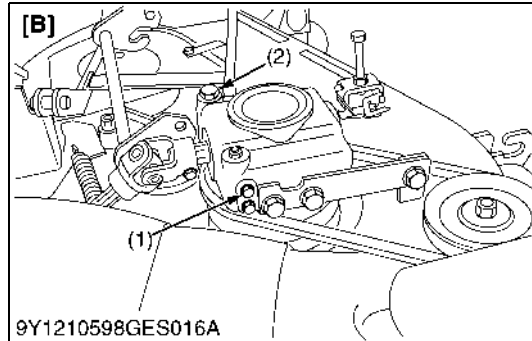
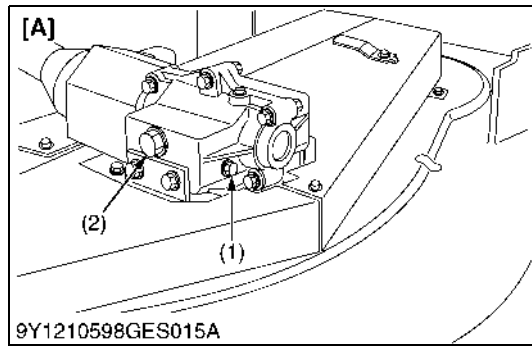
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9Y1210602GES010B



Checking Mower Gear Box Oil Level

CAUTION

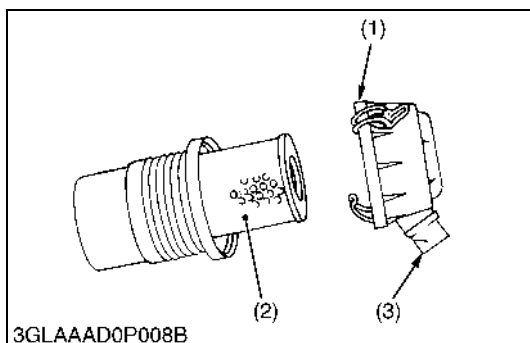
To avoid personal injury:

- Always stop the engine and remove the key before checking oil.
1. Park the machine on a flat surface and lower the mower to the ground.
 2. To check the oil level, loosen check plug (1) bolt and check to see that the oil level is just below the oil check plug (1) port.
 3. If the level is too low, add new oil to the prescribed level at the oil filling plug (2). (See page G-36.)

- (1) Check Plug
(2) Oil Filling Plug

- [A] RCK48SGR
[B] RCK48GR-II

9Y1210598GEG0017US0



Cleaning Air Cleaner Element

⚠ CAUTION

To avoid personal injury:

- **Be sure to stop engine and remove the key before cleaning air cleaner element.**

1. Remove the air cleaner cover and element.
 - (1) Undo the hook.
 - (2) Turn the cover clockwise and detach it.
2. Clean the element:
 - (1) When dry dust adheres to the element, blow compressed air from the inside, turning the element. Pressure of compressed air must be under 205 kPa (2.1 kgf/cm², 30 psi).
 - (2) When carbon or oil adheres to the element, soak the element in detergent for 15 minutes, and then wash it several times in water, rinse with clean water and dry it naturally. After element is fully dried, inspect the inside of the element with a light and check if it is damaged or not. (referring to the instructions on the label attached to the case.)
3. Replace the air cleaner element if:

Once yearly or after every sixth cleaning, whichever comes first.

■ NOTE

- **Check to see if the evacuator valve is blocked with dust.**
- **Operating in dusty conditions requires more frequent maintenance.**

■ IMPORTANT

- **The air cleaner uses a dry element, never apply oil.**
- **Do not operate the engine with the filter element removed.**
- **Align the arrow marks when reinstalling the cover. If the cover is improperly fitted, dust passes by the baffle and directly adheres to the element.**

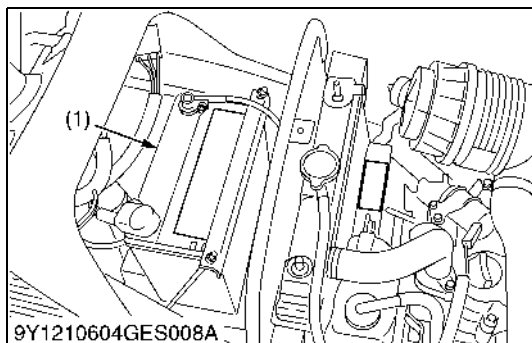
■ Evacuator valve

Open the evacuator valve one a week under ordinary conditions - or daily when used in a dusty place - to get rid of large particles of dust and dirt.

- (1) Air Cleaner Cover
(2) Air Cleaner Element

- (3) Evacuator Valve

9Y1210598GEG0018US0



Checking Battery Condition



DANGER

To avoid the possibility of battery explosion:

For the refillable type battery, follow the instructions below.

- Do not use or charge the refillable type battery if the fluid level is below the LOWER (lower limit level) mark. Otherwise, the battery component parts may prematurely deteriorate, which may shorten the battery's service life or cause an explosion. Check the fluid level regularly and add distilled water as required so that the fluid level is between the UPPER and LOWER levels.



CAUTION

To avoid person injury:

- Never remove the vent caps while the engine is running.
- Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water immediately and get medical attention.
- Wear eye protection and rubber gloves when working around the battery.

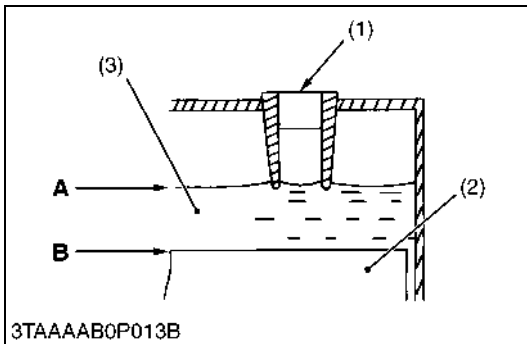
Mishandling the battery shortens the service life and adds to maintenance costs.

The original battery is maintenance free, but needs some servicing.

If the battery is weak, the engine will be difficult to start and the lights will be dim. It is important to check the battery periodically.

(1) Battery

9Y1210598GEG0019US0



Battery Charging



DANGER

To avoid serious injury or death:

- When the battery is active, hydrogen and oxygen gases in the battery are extremely explosive. Keep open sparks and flames away from the battery at all times, especially when charging the battery.



CAUTION

- When charging battery, ensure that the vent caps are securely in place (if equipped).
- When disconnecting the cables from the battery, start with the negative terminal first.
When connecting the cables to the battery, start with the positive terminal first.
- Never check battery charge by placing a metal object across the posts.

Use a voltmeter or hydrometer.

(For accessible maintainable type batteries with removable vent caps.)

1. Make sure each electrolyte level is at the bottom of vent wells, if necessary add distilled water in a well-ventilated area.
2. The water in the electrolyte evaporates during recharging. Liquid shortage damages the battery. Excessive liquid spills over and damages the machine body.
3. To slow charge the battery, connect the battery positive terminal to the charger positive terminal and the negative to the negative, then recharge in the standard fashion.
4. A boost charge is only for emergencies. It will partially charge the battery at a higher rate and in a short time.
When using a boost-charged battery, it is necessary to recharge the battery as soon as possible.
Failure to do this will shorten the battery's service life.
5. When the specific gravity of electrolyte reaches 1.27 to 1.29, charge has completed.
6. When exchanging an old battery with new one, use a battery of equal specification shown in "SPECIFICATIONS".

- (1) Vent well
(2) Separator
(3) Electrolyte

A: Highest Level
B: Lowest Level

(To be continued)

(Continued)

(For non-accessible maintenance-free type batteries.)

Maintenance-free, non-accessible batteries are designed to eliminate the need to add water. Yet the volume of electrolyte above plates may eventually become depleted due to abnormal conditions such as high heat or improper regulator setting. Use a voltmeter to check the state of charge. (See reference chart to determine if charging is necessary.)

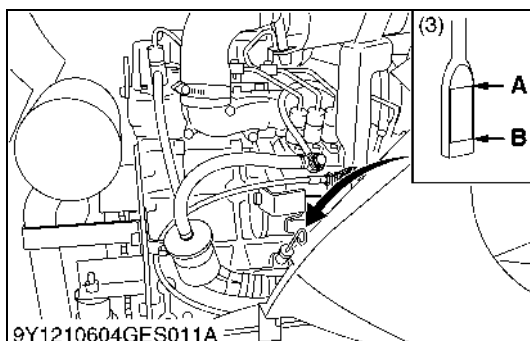
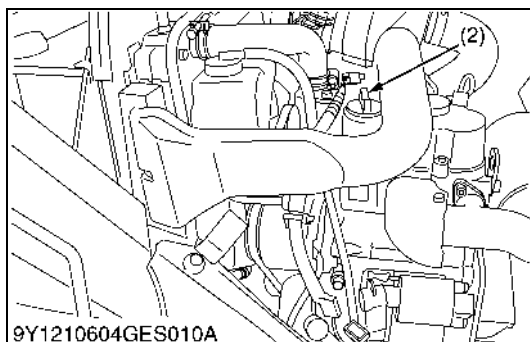
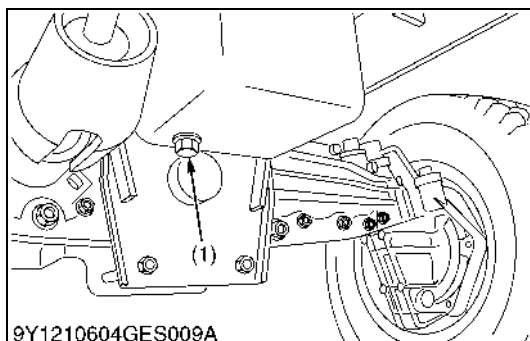
Battery voltage	Reference state of charge
12.6	100 % (Full charge)
12.4	75 %
12.2	50 %
12.0	25 %
11.8	0 %

■ **Direction for Storage**

1. When storing the machine for a long period, remove the battery from the machine, adjust the electrolyte to the proper level and store in a dry place out of direct sunlight.
2. The battery self-discharges while it is stored.
Recharge it once every three months in hot seasons and once every six months in cold seasons.

9Y1210598GEG0068US0

[3] CHECK POINTS OF EVERY 100 HOURS



Changing Engine Oil

Change the oil after the first 50 hours of operation.



CAUTION

To avoid personal injury:

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

1. To keep dirt, debris, etc., out of the engine, clean the area around the oil fill cap/dipstick before removing it.
2. Remove the oil drain plug (1), the oil fill cap, and the dipstick. Be sure to allow ample time for complete drainage.
3. The used oil can be drained out more easily if the engine is warm.
4. Reinstall the drain plug (1). Make sure it is tightened to **13.6 N·m (10 lbf·ft)** torque.
5. Fill the crankcase, with new oil of the proper type, to the "F" mark on the dipstick. Always check the level with the dipstick before adding more oil.
6. To check the oil level. Remove the dipstick, wipe it clean, insert it and draw it out again. Check to see that the oil level is between the two marks.
7. Reinstall the oil fill cap and tighten it securely. Reinstall the dipstick.

NOTE

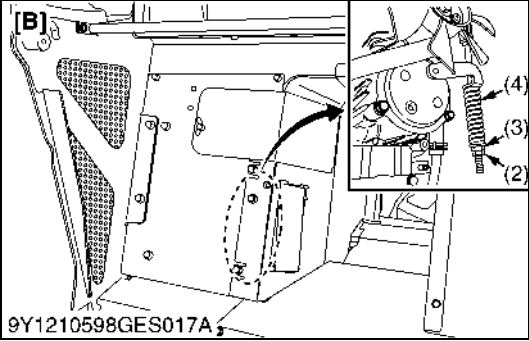
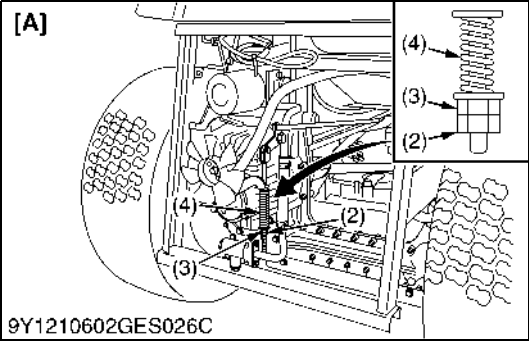
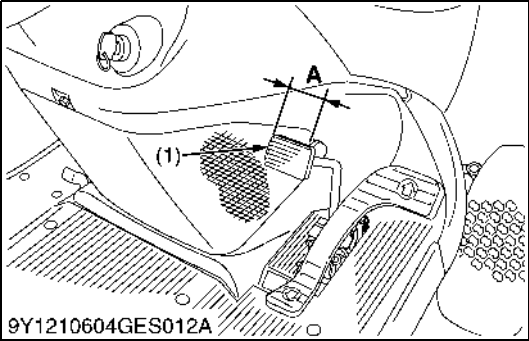
- To prevent extensive engine wear or damage, always maintain the proper oil level in the crankcase. Never operate the engine with the oil level below the "L" mark or over the "F" mark on the dipstick.

Engine oil	Capacity	2.8 L 3.0 U.S.qts 2.5 Imp.qts
------------	----------	-------------------------------------

- (1) Drain Plug
(2) Engine Oil Port
(3) Oil Level Dipstick

A: Upper Level
B: Lower Level

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Adjusting Brake

CAUTION

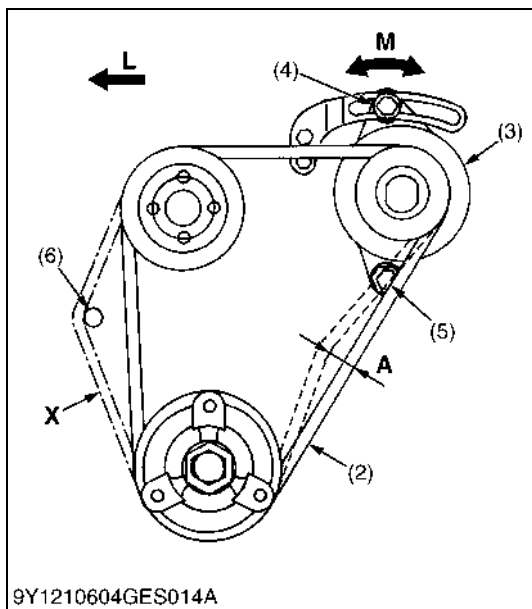
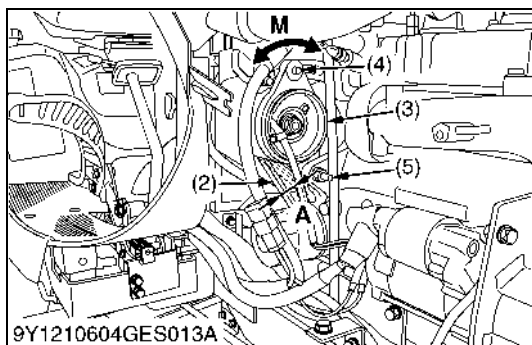
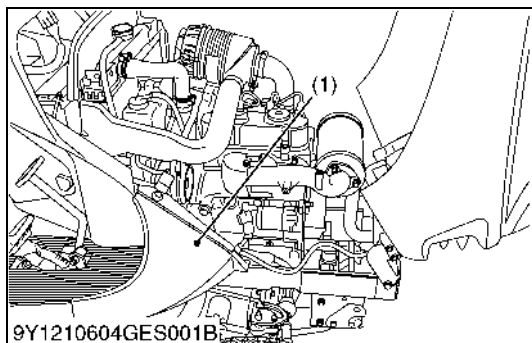
- When making adjustments, park the machine on a flat area, block wheels, stop the engine and remove the key.
1. The correct free travel ranges from 15 to 25 mm (0.59 to 0.98 in.). If it is not correct, loosen the lock nut (2) and turn the nut (3) in the desired direction until you get the proper free travel. After adjustment, retighten lock nut securely.

Play "A"	Factory specification	15 to 25 mm 0.59 to 0.98 in.
----------	-----------------------	---------------------------------

- (1) Brake Pedal
(2) Lock Nut
(3) Nut
(4) Spring

- A: Play
[A] GR2120SEU
[B] GR2120EU, GR2120F

9Y1210598GEG0021US0



Checking Fan Drive Belt Tension



CAUTION

To avoid personal injury:

- Be sure to stop the engine and remove the key before checking belt tension.

If the fan drive belt becomes loose, the engine may overheat.

1. To adjust, remove the right cover.
2. Then loosen the tension bolt and adjusting bolt and move the dynamo outward to tighten the belt.
3. After adjustment, securely tighten the bolts.

Moderate belt tension:

The belt should deflect approx. 10 mm (0.39 in.) when the center of the belt is depressed with finger pressure of 98 N (10 kgf).

■ IMPORTANT

- When replacing the fan drive belt, be careful not to catch it on the cap under the water pump.

- (1) Right Cover
- (2) Fan Drive Belt
- (3) Dynamo
- (4) Tension Bolt
- (5) Adjusting Bolt
- (6) Cap

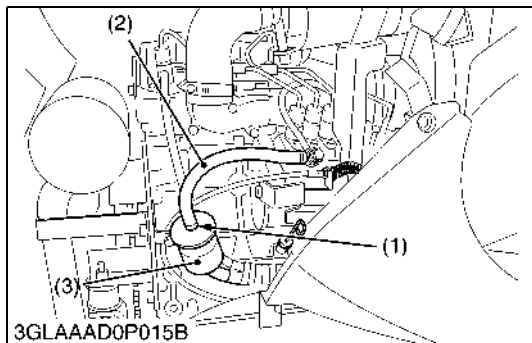
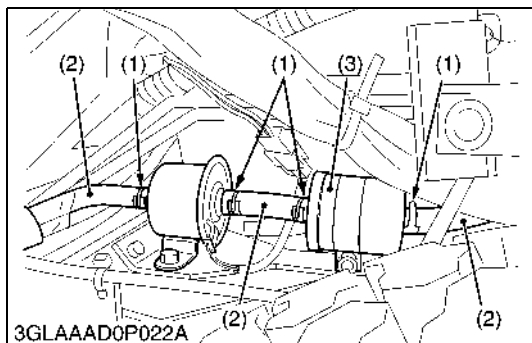
A: Approx. 10 mm (0.39 in.)

M: "MOVE"

L: "LEFT"

X: Incorrect Belt Pass

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Checking Fuel Line and Fuel Filter

⚠ CAUTION

- Be sure to stop the engine and remove the key when attempting to make the following checks and changes.
- Never fail to check the fuel lines periodically. The fuel lines are subject to wear and aging. Fuel may leak out onto the running engine, causing a fire.

The fuel line connections should be checked annually or every 100 service hours, whichever comes first.

1. The fuel line (2) is made of rubber and ages regardless of service period.
2. If the fuel line (2) and clamps (1) are found to be damaged or deteriorated, replace them.
3. Check fuel filter (3), if it is clogged by debris or contaminated with water, replace it.

■ IMPORTANT

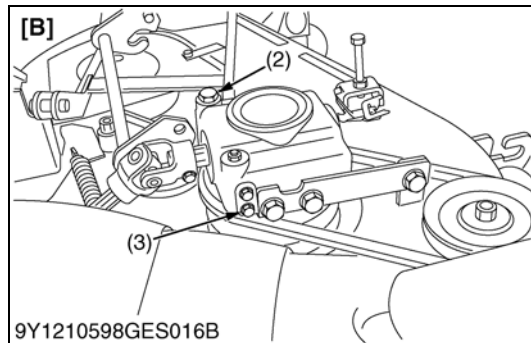
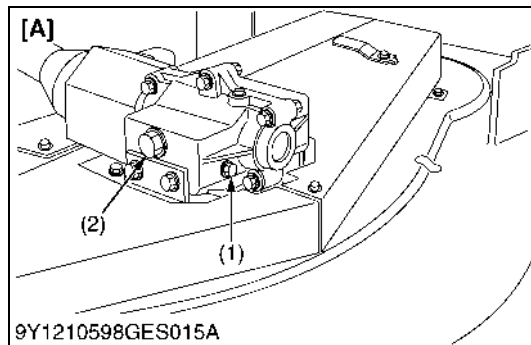
- When the fuel line is disconnected for maintenance or repair, close both ends of the fuel line with a piece of clean cloth or paper to prevent dust and dirt from entering. In addition, particular care must be taken not to admit dust and dirt into the fuel pump. Entrance of even a small amount of dust or dirt cause premature wear and malfunction of the fuel pump and injector components.

(1) Pipe Clamp
(2) Fuel Line

(3) Fuel Filter

9Y1210598GEG0023US0

[4] CHECK POINT OF EVERY 150 HOURS



Changing Mower Gear Box Oil

Change the oil after the first 50 hours of operation.

CAUTION

- Be sure to stop the engine and remove the key before changing the oil.
- Remove the right and left hand shields from the mower deck.

[RCK48SGR]

1. To drain the used oil, remove the check plug (1) at the mower gear box, tilt the mower deck and drain the oil completely into the oil pan.
2. Fill with the new oil, up to the check plug (1) port.
(See page G-27.)
3. After filling, reinstall the oil filler plug (2) and check plug (1).

Mower gear box oil	Capacity	0.15 L 0.16 U.S.qts 0.13 Imp.qts
--------------------	----------	--

[RCK48GR-II]

1. To drain the used oil, remove the oil filler plug (2) and the drain plug at the gear box, tilt the mower deck and drain the oil completely into the oil pan.
2. Fill with the new oil.
(See page G-27.)
3. After filling reinstall the oil filler plug (2).

Mower gear box oil	Capacity	0.4 L 0.4 U.S.qts 0.4 Imp.qts
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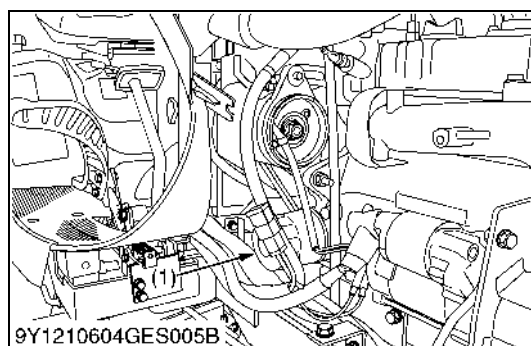
- (1) Check Plug
(2) Oil Filler Plug
(3) Drain Plug

[A] RCK48SGR

[B] RCK48GR-II

9Y1210598GEG0024US0

[5] CHECK POINTS OF EVERY 200 HOURS



Replacing Engine Oil Filter Cartridge

Replace the filter cartridge after the first 50 hours of operation.

CAUTION

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

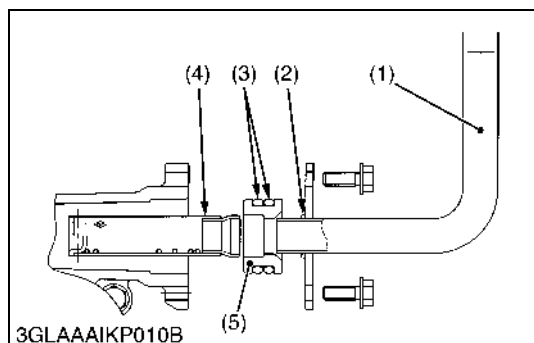
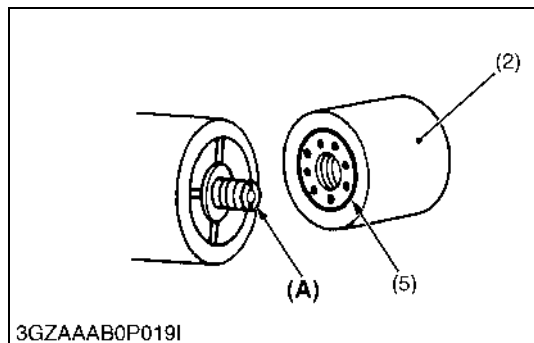
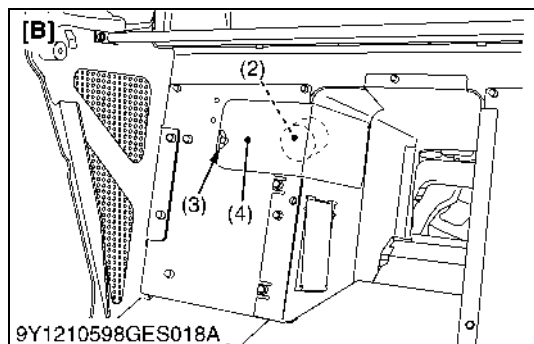
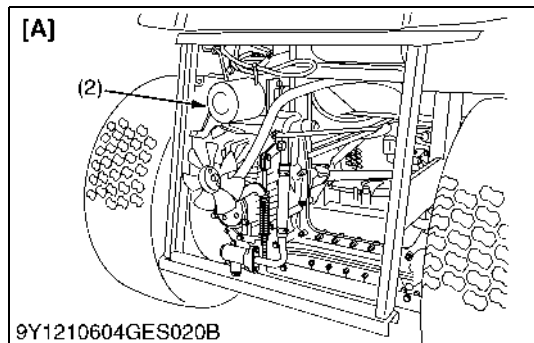
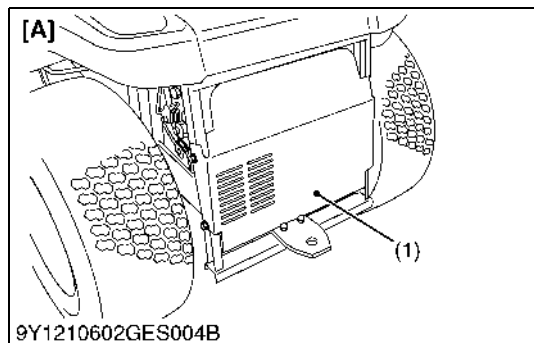
1. The oil filter cartridge (1) must be changed every 200 service hours.
2. Apply a slight coat of oil onto the rubber gasket of new cartridge.
3. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hand an additional 1/2 turn only.
4. After the cartridge has been replaced, the engine oil level normally lowers a little. Add engine oil to proper level. Check for oil leaks around filter gasket.

■ IMPORTANT

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

- (1) Engine Oil Filter Cartridge

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Replacing Transmission Oil Filter Cartridge

Replace the filter cartridge after the first 50 hours of operation.

CAUTION

- Be sure to stop the engine before changing the oil filter cartridge.
 - Allow transmission case to cool down sufficiently; oil can be hot and may cause burns.
1. The transmission oil filter cartridge must be changed every 200 service hours.
 2. Remove the rear cover (1). [GR2120SEU]
Remove the grass container and clean the area indicated. [GR2120EU, GR2120F]
Loosen the wing bolt (3) and remove the filter cover (4).
 3. Remove the oil filter cartridge (2) with the filter wrench.
 4. Lightly tighten the screw (A) by using a screwdriver.
 5. Apply a slight coat of oil onto the cartridge gasket (5).
 6. Tighten the filter quickly until it contacts the mounting surface.
Tighten filter by hand an additional 1/2 turn only.
 7. Assemble the cover and mount the grass container.
 8. After the new cartridge has been replaced, the transmission fluid level normally lowers a little. Add fluid to proper level.
Check for oil leaks around filter gasket.

IMPORTANT

- To prevent serious damage to hydraulic system, the replacement filter must be a highly efficient, 10 μ m filter. Use only a genuine KUBOTA filter or its equivalent.

- | | |
|---------------------------------------|-----------------------|
| (1) Rear Cover | (A) Screw |
| (2) Transmission Oil Filter Cartridge | [A] GR2120SEU |
| (3) Wing Bolt | [B] GR2120EU, GR2120F |
| (4) Filter Cover | |
| (5) Gasket | |

9Y1210598GEG0026US0

Cleaning Transmission Strainer

When changing the transmission fluid, disassemble and rinse the strainer with nonflammable solvent to completely clean off filings.

Check O-rings (2), (3), replace if damaged, cracked or hardened.

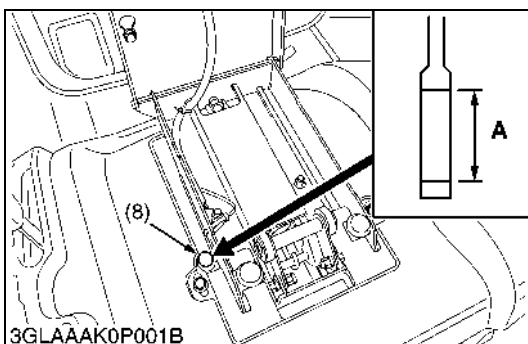
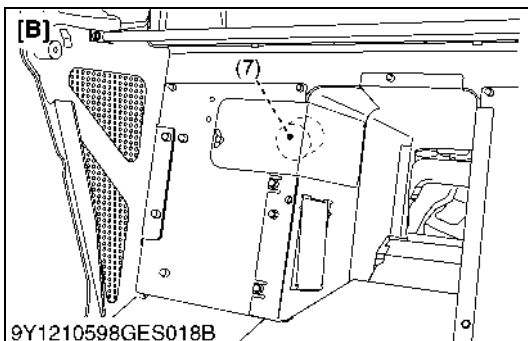
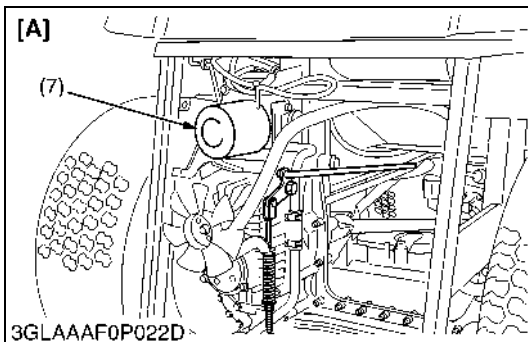
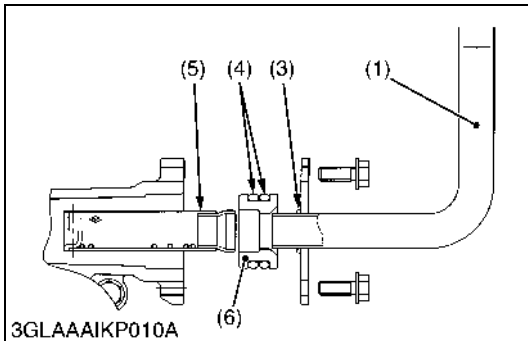
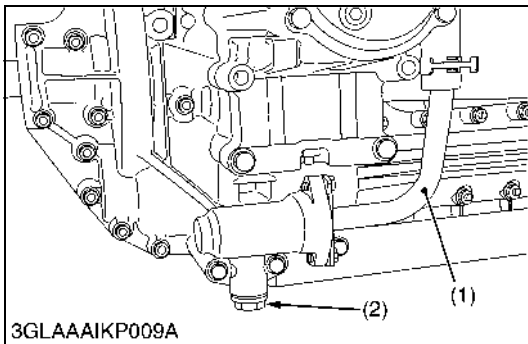
When reassembling be careful not to damage the parts.

NOTE

- Since the fine filings in the oil can damage the precision component parts of the hydraulic system, the end of the suction line is provided with an oil strainer.

- | | |
|--------------------|--------------|
| (1) Suction Pipe | (4) Strainer |
| (2) O-ring (Small) | (5) Boss |
| (3) O-ring (Large) | |

9Y1210598GEG0027US0



Changing Transmission Fluid

⚠ CAUTION

- 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 remove the drain plug (2) at the bottom of the transmission case.
2. After draining, disassemble and clean the strainer (5) and change the oil filter cartridge (7). After reassembling, fill with UDT or SUPER UDT hydrostatic transmission fluid, or its equivalent.
3. Remove the oil plug and fill with the new oil.
4. After running the engine for a few minutes, stop it and check the oil level again; add oil to the prescribed level.

■ NOTE

- Check the oil level of the transmission case with the mower lifted up.

■ IMPORTANT

- Operate only at low rpm immediately after changing the transmission fluid and filter cartridge.
- Keep the engine at medium speed for a few minutes to insure proper lubrication of all parts so that there is no damage to transmission.
- Do not engage PTO before checking the oil level.

Transmission fluid	Capacity	3.3 L 3.5 U.S.qts 2.9 Imp.qts
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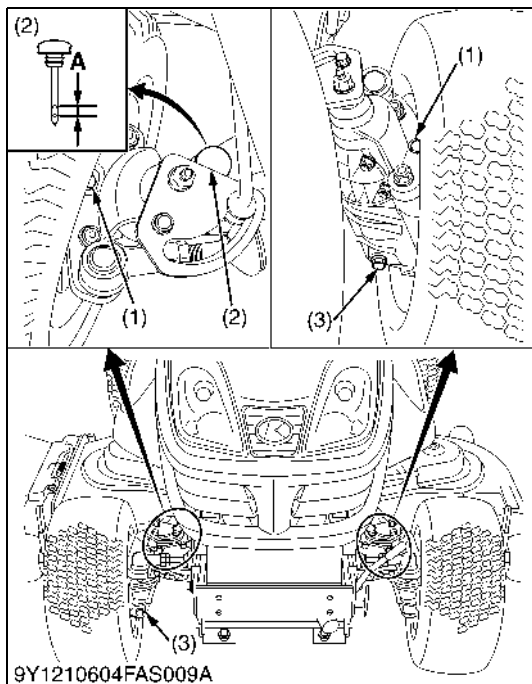
- (1) Suction Pipe
- (2) Drain Plug
- (3) O-ring (Small)
- (4) O-ring (Large)
- (5) Strainer
- (6) Boss
- (7) Transmission Oil Filter Cartridge
- (8) Dipstick

A: Oil level is acceptable within this range

[A] GR2120SEU

[B] GR2120EU, GR2120F

9Y1210598GEG0028US0



Changing Front Axle Case Oil

1. Park the machine on a firm, flat and level surface.
2. To drain the used oil, remove the right and left drain plugs (3) and filling plug (2) at the front axle case and drain the oil completely into the oil pan.
3. After draining, reinstall the drain plugs (3).
4. Remove the right or left breather plugs (1).
5. Fill with the new oil up to the upper notch on the dipstick (2).

■ IMPORTANT

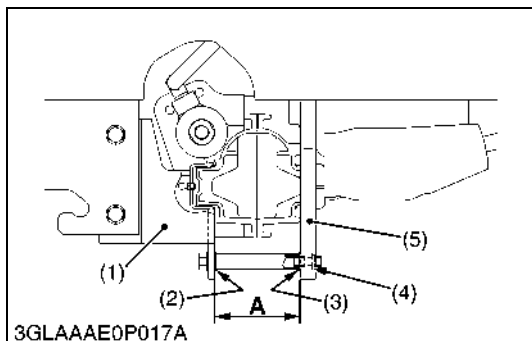
- After ten minutes, check the oil level again: add oil to prescribed level.
6. After filling reinstall the filling plug (2) and breather plugs (1).

Front axle case fluid	Capacity	1.9 L 2.0 U.S.qts 1.7 Imp.qts
-----------------------	----------	-------------------------------------

- (1) Breather Plug
(2) Filling Plug with Dipstick
(3) Drain Plug

A: Oil level is acceptable within this range

9Y1210598GEG0029US0



Adjusting Front Axle Pivot

Adjust the front axle pivot after the first 100 hours of operation.

1. Jack up the front of machine.
2. Measurement the clearance between the front axle bracket (1) and frame (5).
3. If the measurement is more than the factory specification, adjust the front axle bracket mounting screw and nut (4).
4. If the vibration in the front wheel does not stop after adjustment, remove one shim (2), (3) and tighten the front axle bracket mounting screw and nut (4) with a specified torque.

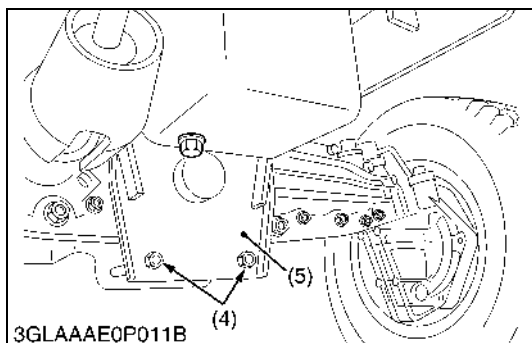
Clearance between front axle bracket and frame "A"	Factory specification	81.0 to 83.0 mm 3.19 to 3.26 in.
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Tightening torque	Front axle bracket mounting screw and nut	48.1 to 55.9 N·m 4.91 to 5.70 kgf·m 35.5 to 41.2 lbf·ft
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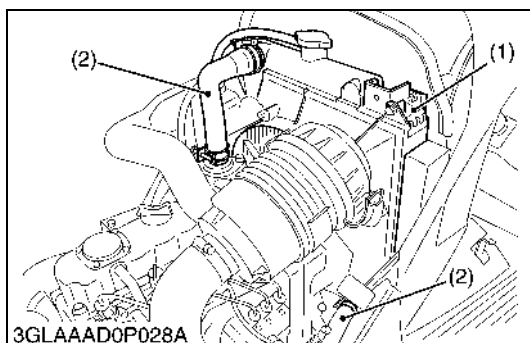
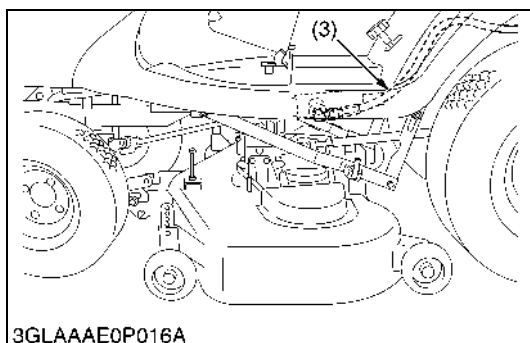
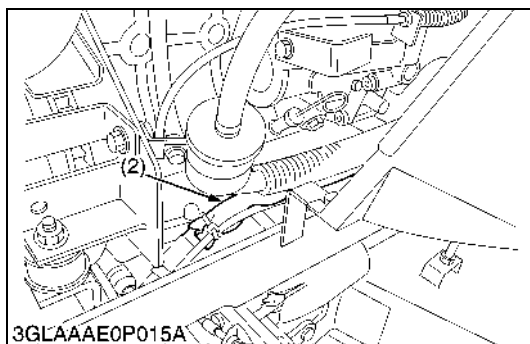
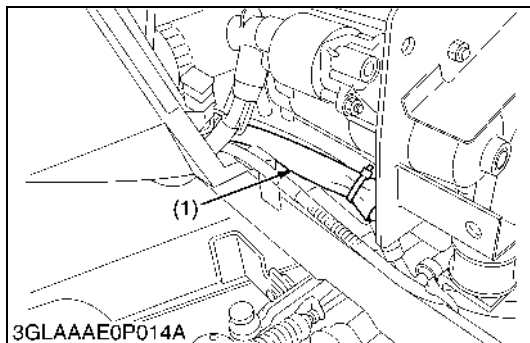
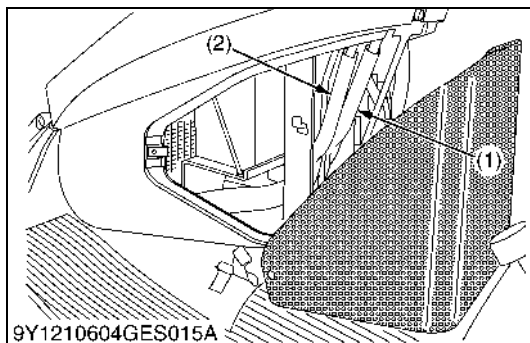
- (1) Front Axle Bracket
(2) Shim
(3) Shim
(4) Front Axle Bracket Mounting Nut

(5) Frame

A: Clearance



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Checking Hydraulic Hose

⚠ CAUTION

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

Check to see if hydraulic hoses are properly fixed every 200 hours of operation.

1. Check to see that all lines and hose clamps are tight and not damaged.
2. If hoses and clamps are found worn or damaged, replace or repair them at once.

(1) Power Steering Hose RH

(3) Mower Lift Cylinder Hose

(2) Power Steering Hose LH

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Checking Radiator Hose and Hose Clamp

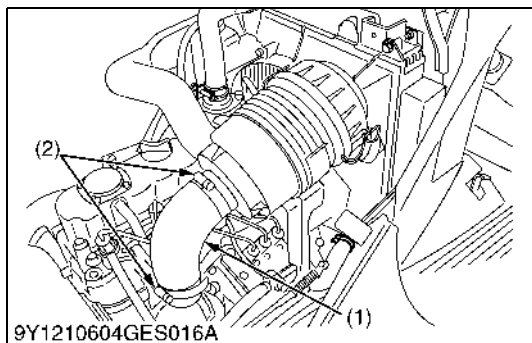
Check to see if radiator hoses are properly fixed every 200 hours of operation or six months, whichever comes first.

1. If hose clamps are loose or water leaks, tighten bands securely.
2. Replace hoses (2) and tighten hose clamps securely, if radiator hoses (2) are swollen, hardened or cracked.

(1) Radiator Core

(2) Radiator Hose

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Checking Intake Air Line

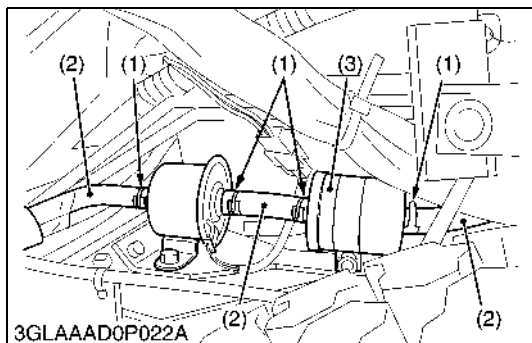
1. Check to see that hoses (1) and hose clamps (2) are tight and not damaged.
2. If hoses (1) and clamps (2) are found worn or damaged, replace or repair them at once.

(1) Hose

(2) Clamp

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[6] CHECK POINT OF EVERY 400 HOURS



Replacing Fuel Filter

1. Disconnect the fuel hoses and loosen the filter band to replace the fuel filter (3).

■ NOTE

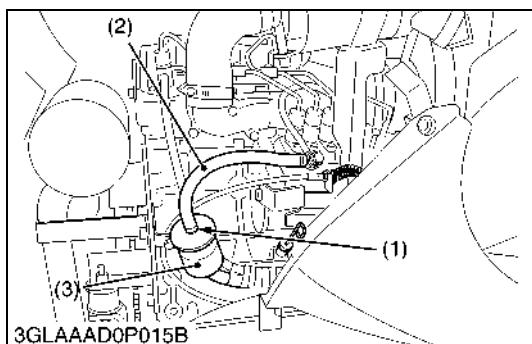
- If the fuel line is removed, be sure to properly bleed the fuel system. (See page G-45.)

(1) Pipe Clamps

(3) Fuel Filter

(2) Fuel Line

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[7] CHECK POINT OF EVERY 1500 HOURS

Checking Fuel Injection Nozzle (Injection Pressure)

See page 1-S18.

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[8] CHECK POINT OF EVERY 3000 HOURS

Checking Injection Pump

See page 1-S17.

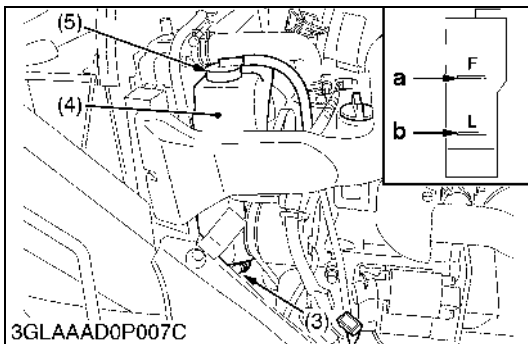
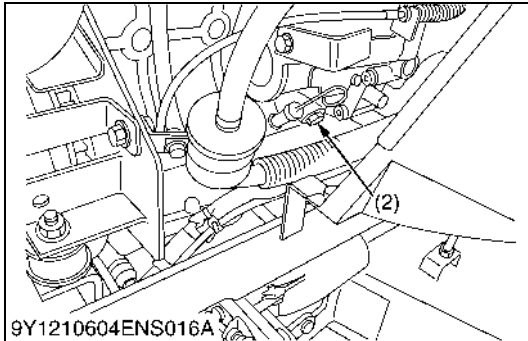
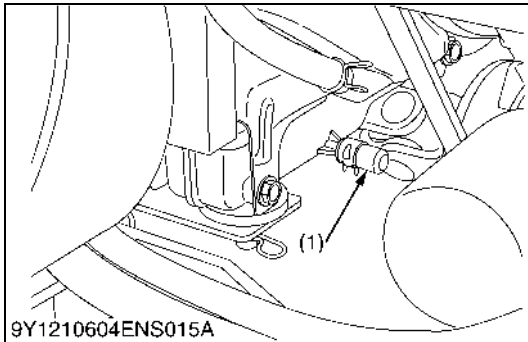
9Y1210598GEG0036US0

[9] CHECK POINTS OF EVERY 1 YEAR

Replacing Air Cleaner Element

1. Change the element once a year. (See page G-28.)

9Y1210598GEG0037US0



Flushing Cooling System and Changing Coolant

⚠ CAUTION

- **Do not remove the radiator cap when the engine is hot. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.**
1. Stop the engine and let cool down.
 2. To drain the coolant, remove the radiator drain plug and the engine drain plug, and remove the radiator cap. The radiator cap must be removed to completely drain the coolant.
 3. After all coolant is drained, install the drain plugs.
 4. Fill with clean water and cooling system cleaner.
 5. Follow directions of the cleaner instruction.
 6. After flushing, fill with clean water and anti-freeze until the coolant level is just below the fill port on the radiator. Install the radiator cap securely.
 7. Fill with coolant up to "**FULL**" mark on the recovery tank.
 8. Start and operate the engine for a few minutes.
 9. Stop the engine and let cool. Check coolant level of recovery tank (4) and add coolant if necessary.

■ IMPORTANT

- **Do not start engine without coolant.**
- **Use clean, fresh water and anti-freeze to fill the radiator and recovery tank.**
- **When the anti-freeze is mixed with water, the anti-freeze mixing ratio must be less than 50 %.**
- **Securely tighten radiator cap. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**
- **See page "4. LUBRICANTS, FUEL AND COOLANT" on page G-9.**

Coolant with recovery tank	Capacity	2.35 L 2.48 U.S.qts 2.07 Imp.qts
----------------------------	----------	--

- (1) Radiator Drain Plug
 - (2) Engine Drain Plug
 - (3) Clamp
 - (4) Recovery Tank
 - (5) Recovery Tank Cap
- a: **FULL**
b: **LOW**

(To be continued)

(Continued)**■ Anti-Freeze****CAUTION****To avoid personal injury:**

- When using anti-freeze, put on some protection such as rubber gloves. (Anti-freeze contains poison.)
- If you drink anti-freeze, throw up at once and get medical attention.
- When anti-freeze comes in contact with the skin or clothing, wash it off immediately.
- Do not mix different types of anti-freeze. The mixture can produce chemical reaction causing harmful substances.
- Anti-freeze is extremely flammable and explosive under certain conditions. Keep fire and children away from anti-freeze.
- When draining fluids from the engine, place some container underneath the engine body.
- Do not pour waste onto the grounds, down a drain, or into any water source.
- Also, observe the relevant environmental protection regulations when disposing of anti-freeze.

If it freezes, coolant can damage the cylinders and radiator. If the ambient temperature falls below 0 °C (32 °F) or before a long-term storage, let out cooling water completely, or mix fresh water with long-life coolant and fill the radiator and reserve tank with the mixture.

1. Long-life coolant (hereafter LLC) comes in several types. Use ethylene glycol (EG) type for this engine.
2. Before employing LLC-mixed cooling water, fill the radiator with fresh water and empty it again. Repeat this procedure 2 or 3 times to clean up the inside.
3. Mixing the LLC
Put the LLC in coolant in the percentage (%) for a target temperature. When mixing, stir it up well, and then fill into the radiator.
4. The procedure for the mixing of water and anti-freeze differs according to the make of the anti-freeze and the ambient temperature. Refer to SAE J1034 standard, more specifically also to SAE J814c.

(To be continued)

(Continued)

■ **IMPORTANT**

- When the anti-freeze is mixed with water, the anti-freeze mixing ratio must be less than 50 %.

Vol % Anti-freeze	Freezing Point	Boiling Point*
	°C (°F)	°C (°F)
40	-24 (-12)	106 (222)
50	-37 (-34)	108 (115)

*At 1.013×10^5 Pa (760 mmHg) pressure (atmospheric).

A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

1. Adding the LLC

(1) Add only water if the mixture reduces in amount by evaporation.

(2) If there is a mixture leak, add the LLC of the same manufacture and type in the same mixture percentage.

*Never add any long-life coolant of different manufacturer. (Different brands may have different additive components, and the engine may fail to do as specified.)

2. When the LLC is mixed, do not employ any radiator cleaning agent. The LLC contains anti-corrosive agent. If mixed with the cleaning agent, sludge may build up, adversely affecting the engine parts.

3. Kubota's genuine long-life coolant has a service life of 2 years. Be sure to change the coolant every 2 years.

■ **NOTE**

- The above data represent industry standards that necessitate a minimum glycol content in the concentrated anti-freeze.
- When the coolant level drops due to evaporation, add water only to keep the anti-freeze mixing ratio less than 50 %. In case of leakage, add anti-freeze and water in the specified mixing ratio before filling in to the radiator.

9Y1210598GEG0038US0

[10] CHECK POINTS OF EVERY 2 YEARS

Replacing Fuel Lines

1. Replace the fuel line. (See page G-35.)

9Y1210598GEG0039US0

Replacing Hydraulic Hose

1. Replace the hydraulic hose. (See page G-40.)

9Y1210598GEG0040US0

Replacing Radiator Hose

1. Replace hoses and clamp bands every 2 years or earlier if checked and found that hoses are swollen, hardened or cracked. (See page G-40.)

9Y1210598GEG0041US0

Replacing Intake Air Line

1. Replace the intake air line. (See page G-41.)

9Y1210598GEG0042US0

Replacing Mower Gear Box Oil Seals

1. Replace the mower gear box oil seals. (See page 8-S12, 8-S16.)

9Y1210598GEG0043US0

Replacing Engine Breather Hose

1. Replace the engine breather hose (1).

(1) Engine Breather Hose

9Y1210598GEG0044US0



[11] OTHERS

Bleeding Fuel System

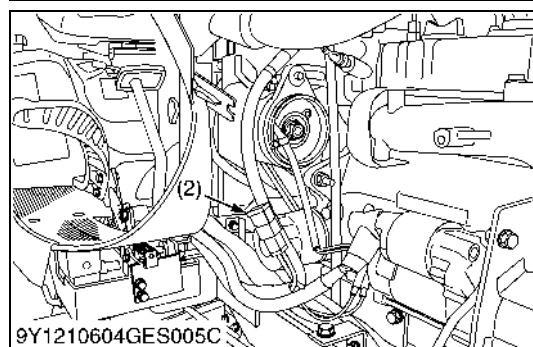
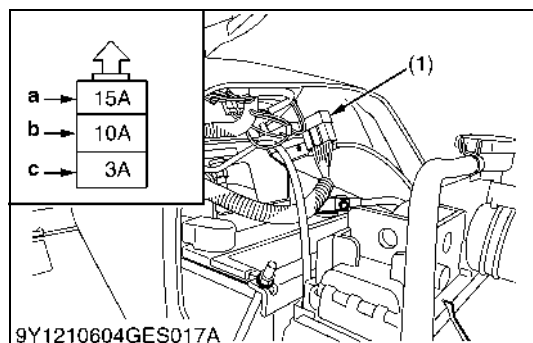
Air must be removed:

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

Bleeding procedure is as follows:

1. Fill the fuel tank with fuel.
2. Turn the key switch to the "ON" position and hold it for about 10 seconds.
3. Start the engine and run for about 30 seconds, and then stop the engine.

9Y1210598GEG0045US0



Replacing Fuses

1. Open the hood.
2. Remove the blown fuse.
3. Place a new 3 A, 10 A, 15 A, 30 A or 40 A fuse in position.

■ IMPORTANT

- If the new fuse blows out within a short time, contact your dealer for inspection and repair. Never "jump" the fuse with wire or foil, or install a larger capacity fuse than is recommended.

a: Stamp or stick label "E/G STOP"

b: Stamp or stick label "IG/M"

c: Stamp or stick label "OPC"

■ Protected circuit

Fuse No. (ID Label)		Capacity (A)	Protected circuit
(1)	E/G STOP "a"	15	Engine stop timer relay
	IG/M "b"	10	Fuel pump, head light, etc.
	OPC "c"	3	Engine running circuit
(2)	—	Slow blow fuse 40	Check circuit against wrong battery connection

(1) Fuse Location

(2) Slow Blow Fuse

9Y1210598GEG0046US0

Replacing Bulbs

(A) Replacement of the head light bulb

1. Open the hood.
2. Turn bulb socket to remove socket from head light housing.
3. Push bulb down and turn one quarter turn to remove bulb from the socket.
4. Install new bulb to the socket.
5. Install the socket in housing.
6. Close the hood.

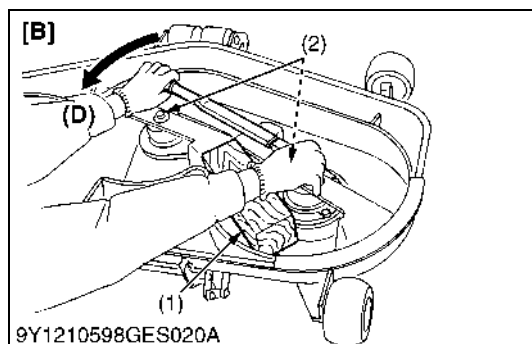
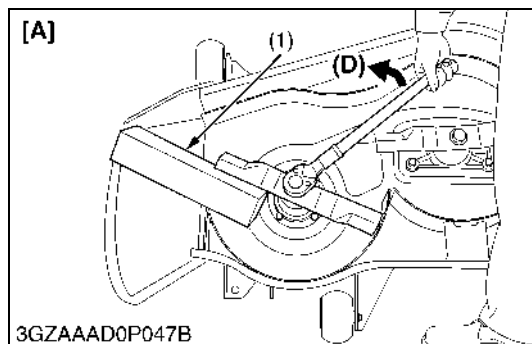
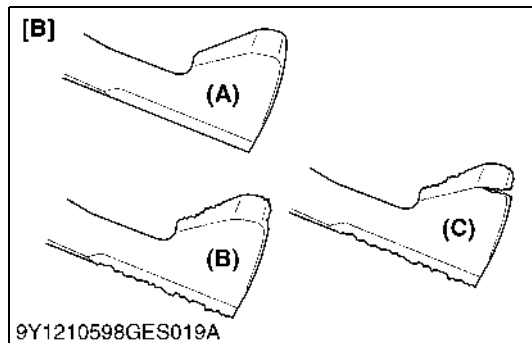
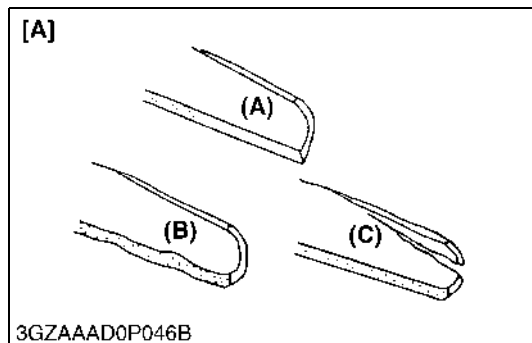
Head light bulb	24 W
-----------------	------

(B) Replacement of the indicator light bulb

1. Open the hood.
2. Turn bad bulb socket to the left. And remove it.
3. Pull bulb from the socket.
4. Push new bulb into the socket.
5. Install the socket.
6. Close the hood.

Indicator light bulb	14.0 rated voltage / 0.27 AMP/2 MSCP
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9Y1210598GEG0047US0



Checking and Replacing Blade

⚠ CAUTION

- Be sure to stop the engine and remove the key.
- Blades may be sharp. When you handle blades, wear heavy gloves or wrap end of blade with a rag.

■ Checking

The blade cutting edges should be kept sharp at all times. Sharpen the cutting edges, if they resemble blade (B).

Replace the blades if they appear similar to blade (C).

■ Replacing

1. Remove the mower deck from the machine and turn it over to expose the blades.
2. Put a block of wood between the blade and mower housing or use a box wrench over the pulley nut to prevent the spindle from rotating while removing the blade bolts; loosen the blade bolt as illustrated. [RCK48SGR]

■ IMPORTANT

- Use the proper metric size box or socket wrench to tighten or loosen the blade mounting bolt.
2. Put a block of wood between the blade and mower housing as illustrated. [RCK48GR-II]

The blade bolts (2) have right hand threads, turn counterclockwise to loosen.

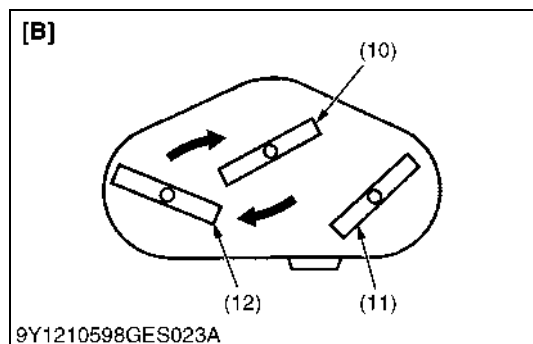
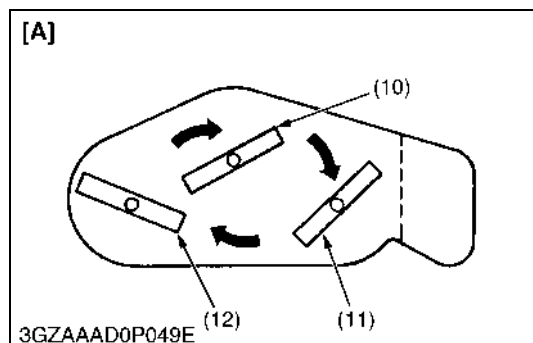
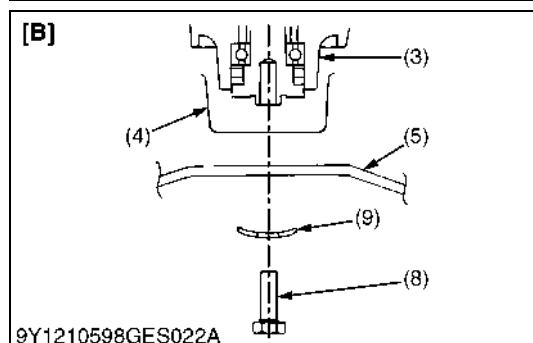
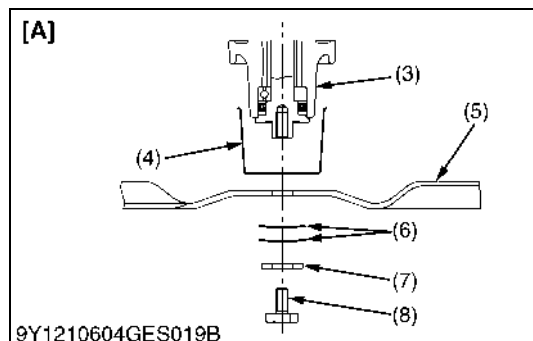
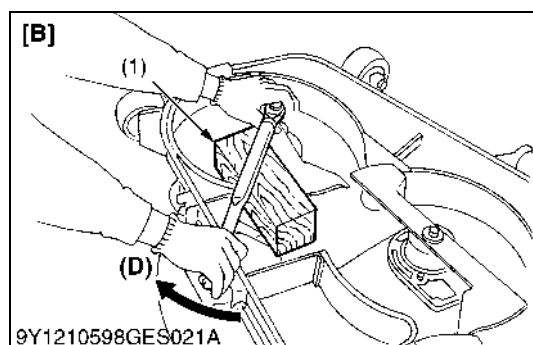
The blade bolt (2) has left hand threads, turn clockwise to loosen.

- (1) Wooden Block
(2) Blade Bolt

- (A) New Blade
(B) Worn Blade
(C) Cracked Blade
(D) Loosen
(E) Tighten
[A] RCK48SGR
[B] RCK48GR-II

(To be continued)

(Continued)



3. To sharpen blades yourself, clamp the blade securely in a vise. Use a large mill file and file along the original bevel until it becomes sharp.
4. To check the blade for balance, place a small rod through the center hole. If the blade is not balanced, file the heavy side of the blade until balance is achieved.
5. To attach blades, be sure to install the cup washer between the blade and the bolt head. [RCK48SGR]
To attach the blades, be sure to install a spindle plate between the blade and bolt head. [RCK48GR-II]

■ **NOTE**

- **Make sure that the cup washer is not flattened out or worn; this may cause blade to slip excessively. Replace the 2 cup washers if either is damaged.**
6. Before checking or replacing the blade, wipe grass and mud off the top and the inside of the mower.
Especially clean up the inside of the belt cover, because otherwise the belt life will be reduced.

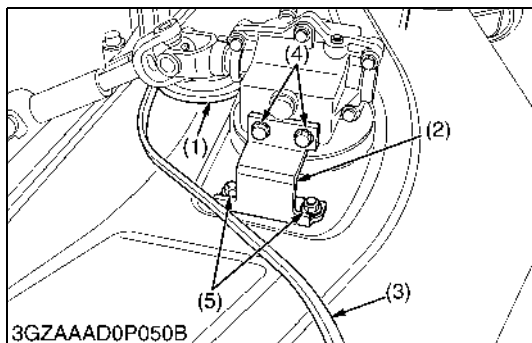
Tightening torque	Mower blade screw	103 to 118 N·m 10.5 to 12.0 kgf·m 76 to 87 lbf·ft
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- To keep the service life of the blade, replace each other as shown.

- (1) Wooden Block
- (3) Spindle Holder
- (4) Cover
- (5) Blade
- (6) Cup Washer
- (7) Lock Washer
- (8) Bolt
- (9) Spring Plate
- (10) Center Blade
- (11) RH Blade
- (12) LH Blade

- (D) Loosen
- [A] RCK48SGR
- [B] RCK48GR-II

9Y1210598GEG0069US0



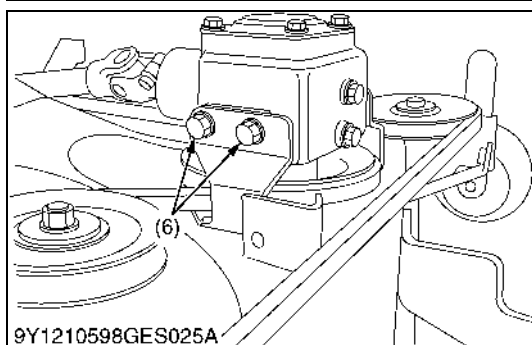
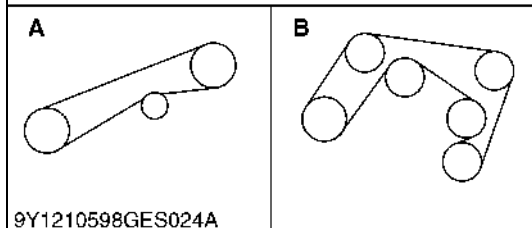
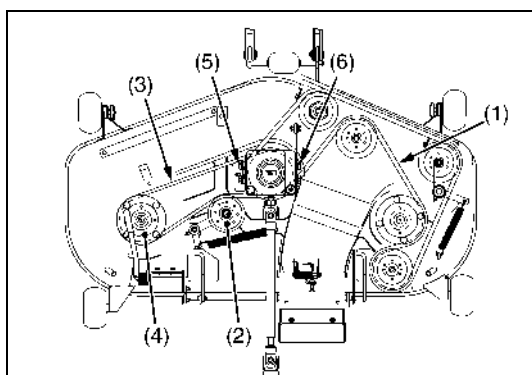
Replacing Mower Belt [RCK48GR]

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 bolt (for aluminum gear case)	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 lbf·ft
	Bracket mounting bolt and nut	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft

- (1) Tension Pulley (4) Bolt
(2) Bracket (RH) (5) Bolt and Nut
(3) Belt

9Y1210598GEG0048US0



Mower Belt Replacement [RCK48GR-II]

1. Remove the mower deck from the machine according to the procedure "DISMOUNTING THE MOWER DECK".
2. Remove the all shields from the mower deck.
3. Clean around the pulleys to remove the belt from the pulleys. Slip the belt over the top of the pulley.
4. Remove both brackets which mount the gear box to the mower deck.

■ NOTE

Tighten each bolt with following torque.

- Reamer bolt M12 and Bolt M12
77.6 to 90.2 N·m (8.0 to 9.2 kgf·m, 58 to 66 lbf·ft)
- 5. To install a new belt, reverse the above procedure.

■ IMPORTANT

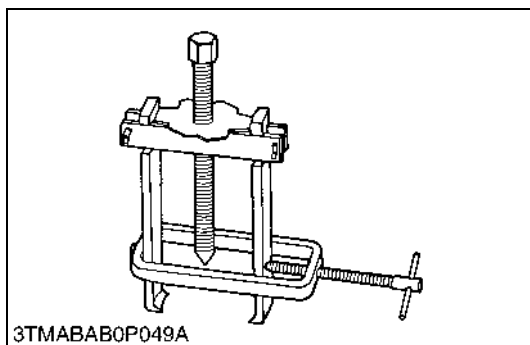
- To attach the bracket, tighten the reamer bolt first.

- (1) RH-Belt (4) Left Side Pulley
(2) Tension Pulley (5) Reamer Bolt
(3) LH-Belt (6) Bolt
- A: Belt Layout LH
B: Belt Layout RH

9Y1210598GEG0070US0

8. SPECIAL TOOLS

[1] SPECIAL TOOLS FOR ENGINE



Special Use Puller Set

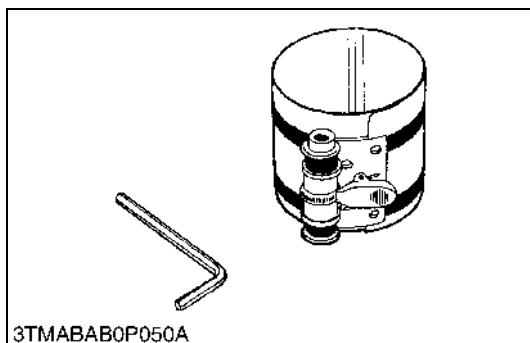
Code No.

- 07916-09032

Application

- Use exclusively for pulling out bearing, gears and other parts with ease.

WSM000001GEG0011US0



Piston Ring Compressor

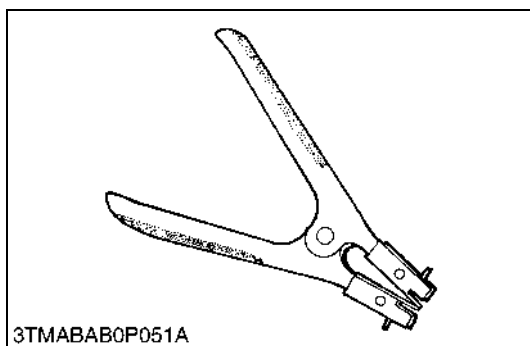
Code No.

- 07909-32111

Application

- Use exclusively for pushing in the piston with piston rings into the cylinder.

WSM000001GEG0012US0



Piston Ring Tool

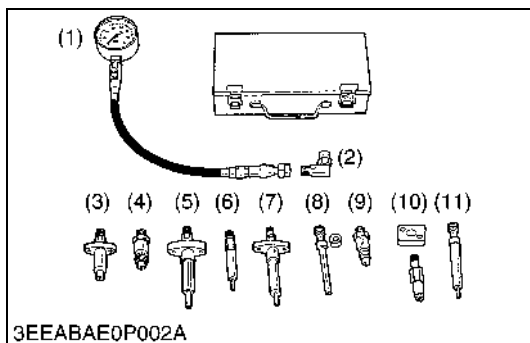
Code No.

- 07909-32121

Application

- Use exclusively for removing or installing the piston ring with ease.

WSM000001GEG0013US0



Diesel Engine Compression Tester (for Injection Nozzle)

Code No.

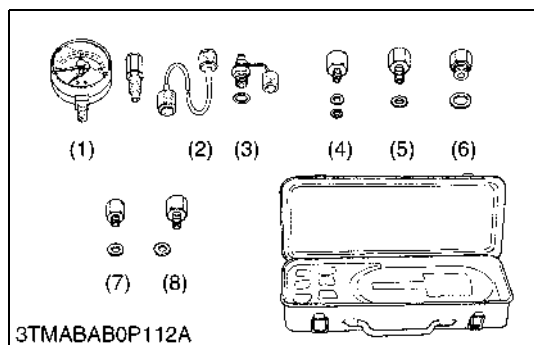
- 07909-30208 (Assembly)
- 07909-30934 (A to F)
- 07909-31211 (E and F)
- 07909-31231 (H)
- 07909-31251 (G)
- 07909-31271 (I)
- 07909-31281 (J)

Application

- Use to measure diesel engine compression and diagnostics of need for major overhaul.

- | | |
|---------------|----------------|
| (1) Gauge | (7) Adaptor F |
| (2) L Joint | (8) Adaptor G |
| (3) Adaptor A | (9) Adaptor H |
| (4) Adaptor B | (10) Adaptor I |
| (5) Adaptor C | (11) Adaptor J |
| (6) Adaptor E | |

WSM000001GEG0014US0



Oil Pressure Tester

Code No.

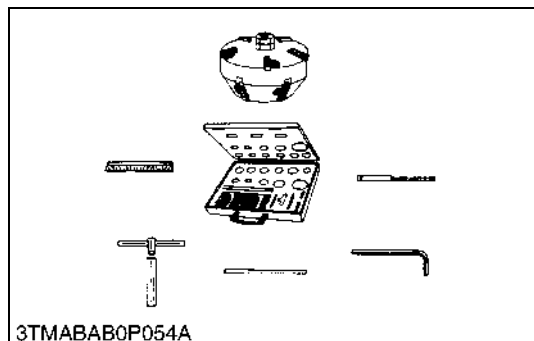
- 07916-32032

Application

- Use to measure lubricating oil pressure.

- | | |
|--------------------|---------------|
| (1) Gauge | (5) Adaptor 2 |
| (2) Cable | (6) Adaptor 3 |
| (3) Threaded Joint | (7) Adaptor 4 |
| (4) Adaptor 1 | (8) Adaptor 5 |

WSM000001GEG0015US0



Valve Seat Cutter

Code No.

- 07909-33102

Application

- Use to reseal valves.

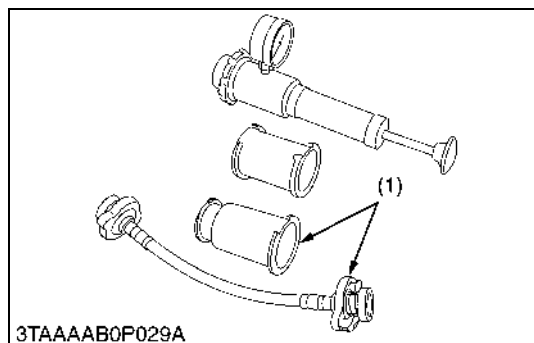
Angle

- 0.79 rad (45 °)
- 0.26 rad (15 °)

Diameter

- 28.6 mm (1.13 in.)
- 31.6 mm (1.24 in.)
- 35.0 mm (1.38 in.)
- 38.0 mm (1.50 in.)
- 41.3 mm (1.63 in.)
- 50.8 mm (2.00 in.)

WSM000001GEG0016US0



Radiator Tester

Code No.

- 07909-31551

Application

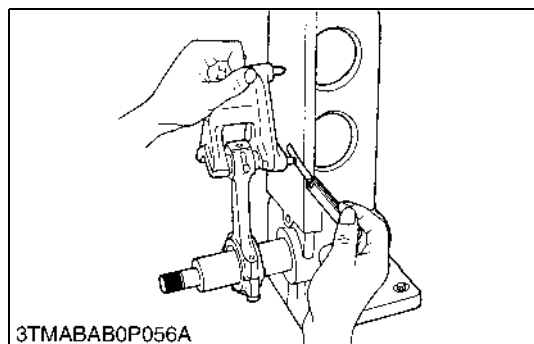
- Use to check of radiator cap pressure, and leaks from cooling system.

Remarks

- Adaptor (1) BANZAI Code No. RCT-2A-30S.

- (1) Adaptor

WSM000001GEG0017US0



Connecting Rod Alignment Tool

Code No.

- 07909-31661

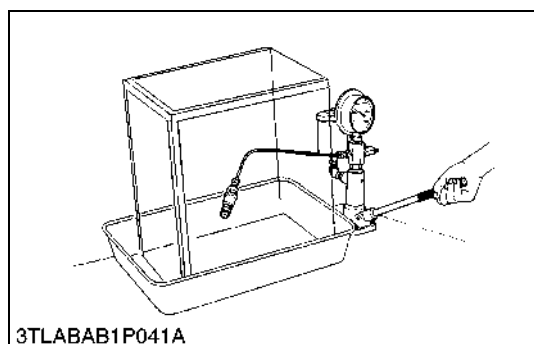
Application

- Use to check the connecting rod alignment.

Applicable range

- Connecting rod big end I.D.
30 to 75 mm dia. (1.2 to 2.9 in. dia.)
- Connecting rod length
65.0 to 300 mm (2.56 to 11.8 in.)

WSM000001GEG0020US0



Nozzle Tester

Code No.

- 07909-31361

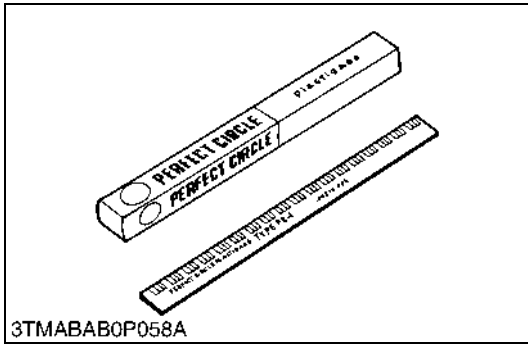
Application

- Use to check the fuel injection pressure and spray pattern of nozzle.

Measuring range

- 0 to 50 MPa (0 to 500 kgf/cm², 0 to 7200 psi)

WSM000001GEG0021US0



Plastigauge

Code No.

- 07909-30241

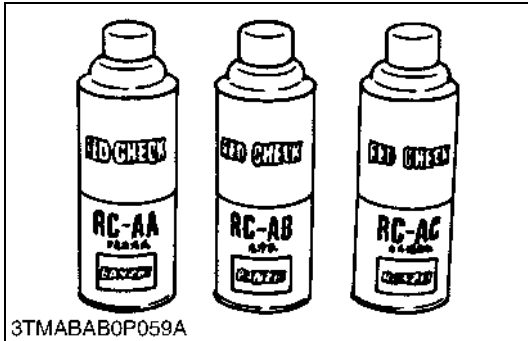
Application

- Use to check the oil clearance between crankshaft and bearing, etc..

Measuring range

- Green: 0.03 to 0.07 mm (0.001 to 0.003 in.)
- Red: 0.05 to 0.1 mm (0.002 to 0.006 in.)
- Blue: 0.1 to 0.2 mm (0.004 to 0.009 in.)

WSM000001GEG0022US0



Red Check

Code No.

- 07909-31371

Application

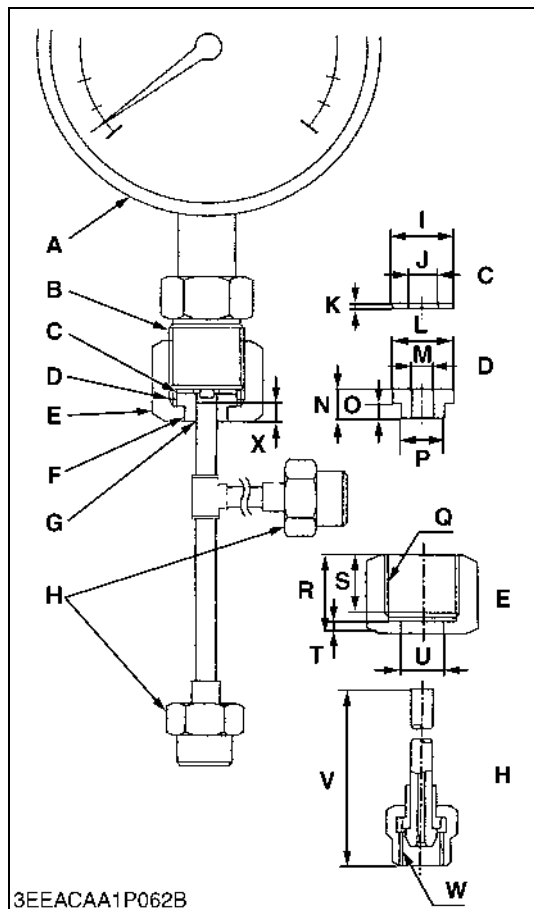
- Use to check cracks on cylinder head, cylinder block, etc..

WSM000001GEG0023US0

NOTE

- The following special tools are not provided, so make them referring to the figure.

9Y1210598GEG0049US0



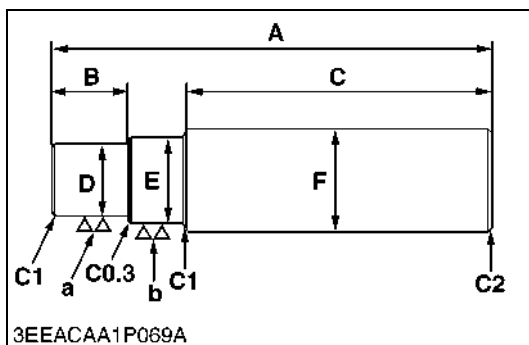
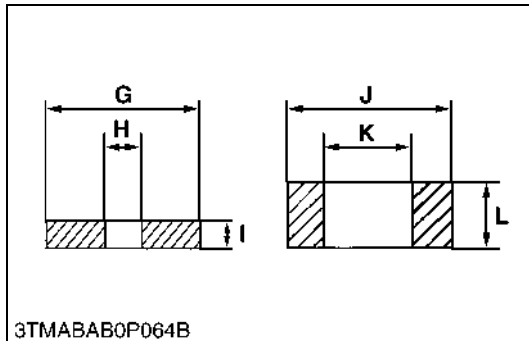
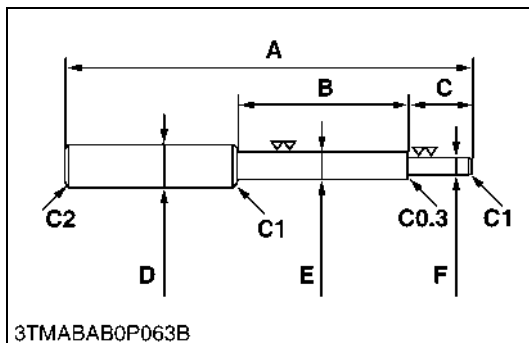
Injection Pump Pressure Tester

Application

- Use to check fuel tightness of injection pumps.

A	Pressure gauge full scale: More than 29.4 MPa (300 kgf/cm ² , 4270psi)
B	PF 1/2
C	Copper gasket
D	Flange (Material Steel)
E	Hex. nut 27 mm (1.1 in.) across the plat
F	Adhesive application
G	Fillet welding on the enter circumference
H	Retaining nut
I	17 mm dia. (0.67 in. dia.)
J	8.0 mm dia. (0.31 in. dia.)
K	1.0 mm (0.039 in.)
L	17 mm dia. (0.67 in. dia.)
M	6.10 to 6.20 mm dia. (0.241 to 0.244 in. dia.)
N	8.0 mm (0.31 in.)
O	4.0 mm (0.16 in.)
P	11.97 to 11.99 mm dia. (0.4713 to 0.4720 in. dia.)
Q	PF 1/2
R	23 mm (0.91 in.)
S	17 mm (0.67 in.)
T	4.0 mm (0.16 in.)
U	12.00 to 12.02 mm dia. (0.4725 to 0.4732 in. dia.)
V	100 mm (3.94 in.)
W	M12 × P1.5
X	5.0 mm (0.20 in.)

9Y1210598GEG0050US0



Valve Guide Replacing Tool

Application

- Use to press out and press fit the valve guide.

A	220 mm (8.66 in.)
B	80 mm (3.1 in.)
C	40 mm (1.6 in.)
D	20 mm dia. (0.79 in. dia.)
E	9.960 to 9.980 mm dia. (0.3922 to 0.3929 in. dia.)
F	5.50 to 5.70 mm dia. (0.217 to 0.224 in. dia.)
G	25 mm dia. (0.98 in. dia.)
H	6.00 to 6.10 mm dia. (0.237 to 0.240 in. dia.)
I	5.0 mm (0.20 in.)
J	18 mm dia. (0.71 in. dia.)
K	10.6 to 10.7 mm dia. (0.418 to 0.421 in. dia.)
L	6.90 to 7.10 mm dia. (0.272 to 0.279 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.3 mm (0.01 in.)

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Bushing Replacing Tools

Application

- Use to press out and to press fit the bushing.

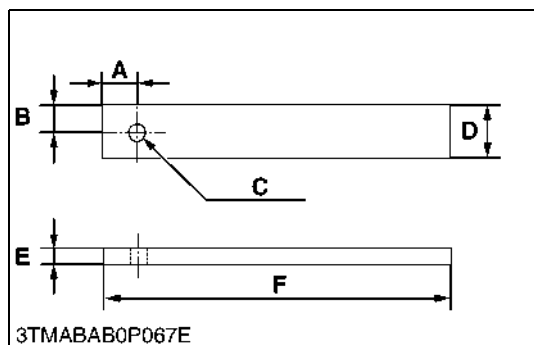
1. For small end bushing

A	145 mm (5.71 in.)
B	20 mm (0.79 in.)
C	100 mm (3.94 in.)
D	19.90 to 19.95 mm dia. (0.7835 to 0.7854 in. dia.)
E	21.90 to 21.95 mm dia. (0.8622 to 0.8641 in. dia.)
F	25 mm dia. (0.98 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.3 mm (0.012 in.)
a	6.3 µm (250 µin.)
b	6.3 µm (250 µin.)

2. For idle gear bushing

A	150 mm (5.91 in.)
B	23 mm (0.91 in.)
C	100 mm (3.94 in.)
D	19.90 to 19.95 mm dia. (0.7835 to 0.7854 in. dia.)
E	21.90 to 21.95 mm dia. (0.8622 to 0.8641 in. dia.)
F	25 mm dia. (0.98 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.3 mm (0.01 in.)
a	6.3 µm (250 µin.)
b	6.3 µm (250 µin.)

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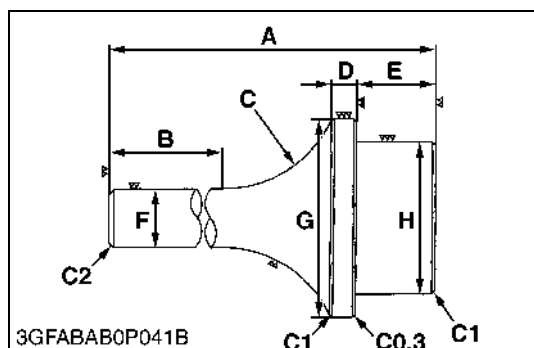
Flywheel Stopper

Application

- Use to loosen and tighten the flywheel screw.

A	20 mm (0.79 in.)
B	15 mm (0.59 in.)
C	10 mm dia. (0.39 in. dia.)
D	30 mm (1.2 in.)
E	8.0 mm (0.31 in.)
F	200 mm (7.87 in.)

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Crankshaft Bearing 1 Replacing Tool

Application

- Use to press out and press fit the crankshaft bearing 1.

[Press Out]

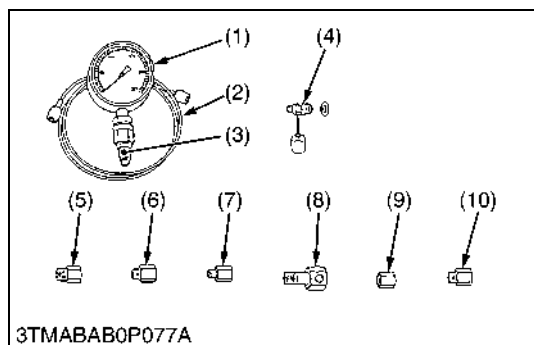
A	135 mm (5.31 in.)
B	72 mm (2.8 in.)
C	40 mm radius (1.6 in. radius)
D	10 mm (0.39 in.)
E	22 mm (0.87 in.)
F	20 mm dia. (0.79 in. dia.)
G	47.90 to 47.95 mm dia. (1.886 to 1.887 in. dia.)
H	43.90 to 43.95 mm dia. (1.729 to 1.730 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.3 mm (0.01 in.)

[Press Fit]

A	130 mm (5.12 in.)
B	72 mm (2.8 in.)
C	40 mm radius (1.6 in. radius)
D	9.0 mm (0.35 in.)
E	24 mm (0.94 in.)
F	20 mm dia. (0.79 in. dia.)
G	68 mm dia. (2.7 in. dia.)
H	39.90 to 39.95 mm dia. (1.571 to 1.572 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.3 mm (0.01 in.)

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[2] SPECIAL TOOLS FOR MACHINE



Relief Valve Pressure Tester

Code No.

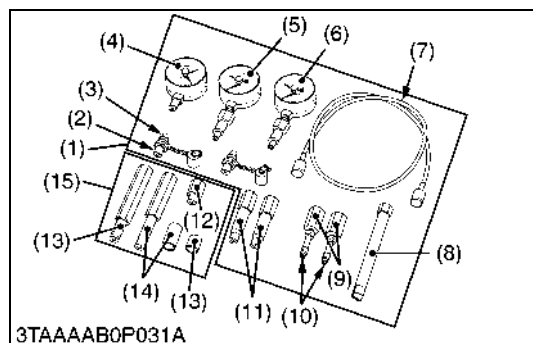
- 07916-50045

Application

- This allows easy measurement of relief valve setting pressure.

(1) Gauge (07916-50322)	(6) Adaptor C (PS3/8) (07916-50371)
(2) Cable (07916-50331)	(7) Adaptor D (PT1/8) (07916-50381)
(3) Threaded Joint (07916-50401)	(8) Adaptor E (PS3/8) (07916-50392)
(4) Threaded Joint (07916-50341)	(9) Adaptor F (PF1/2) (07916-62601)
(5) Adaptor B (M18 × P1.5) (07916-50361)	(10) Adaptor 58 (PT1/4) (07916-52391)

9Y1210598GEG0055US0



Hydrostatic Transmission Tester and HST Adaptor Set

Code No.

- 07916-52040 (Hydrostatic Transmission Tester)
- 07916-53072 (HST Adaptor Set)

Application

- This allows easy measurement of hydrostatic transmission hydraulic pressure.

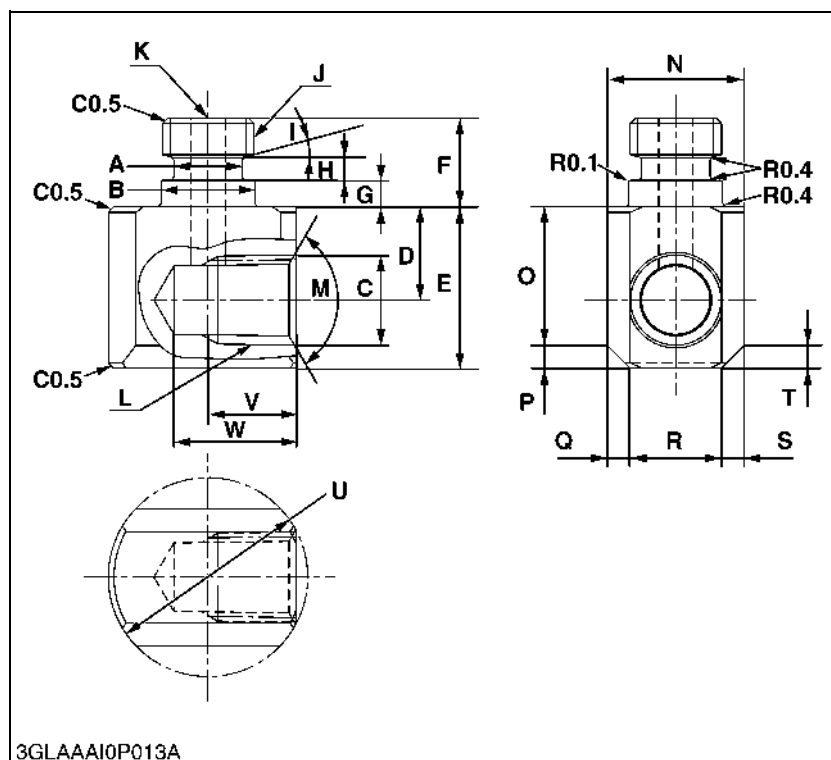
- | | |
|--|--|
| (1) Hydrostatic Transmission Tester (07916-52040) | (8) Valve Seat Driver (07916-60841) |
| (2) Gasket (04714-00200) | (9) Connector 1 (07916-60811) |
| (3) Connector 3 (07916-51331) | (10) Connector 2 (07916-60821) |
| (4) Vacuum Gauge (07916-51331) | (11) Long Connector (07916-60831) |
| (5) Pressure Gauge (Low Pressure) (07916-51301) | (12) Adaptor 1 (07916-52621) |
| (6) Pressure Gauge (High Pressure) (in Relief Valve Set Pressure Tester) (07916-50321) | (13) Adaptor 2 with Collar (07916-52632) |
| (7) HN Tube (in Relief Valve Set Pressure Tester) (07916-50331) | (14) Adaptor 3 with Collar (07916-52642) |
| | (15) HST Adaptor Set (07916-53072) |

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HST Relief Pressure Gauge Adaptors (Adaptor 1)

Application

- This allows easy measurement of hydrostatic transmission hydraulic pressure.



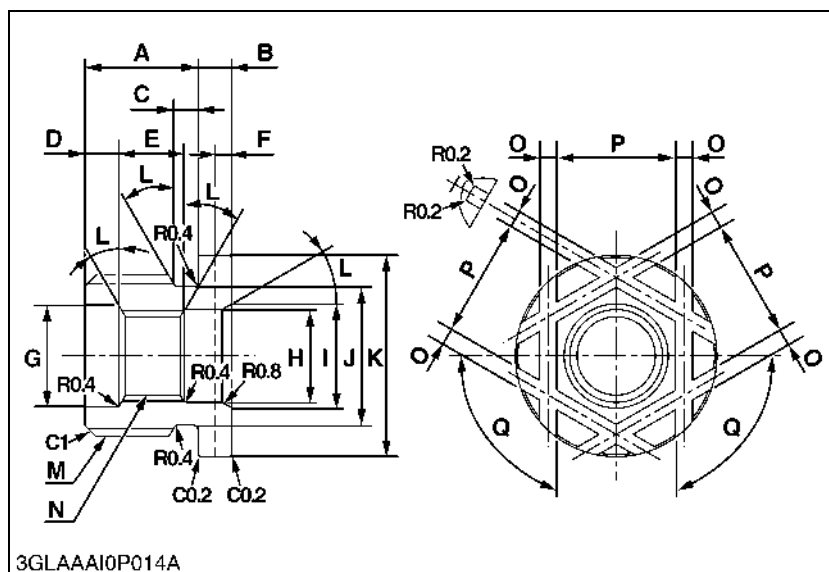
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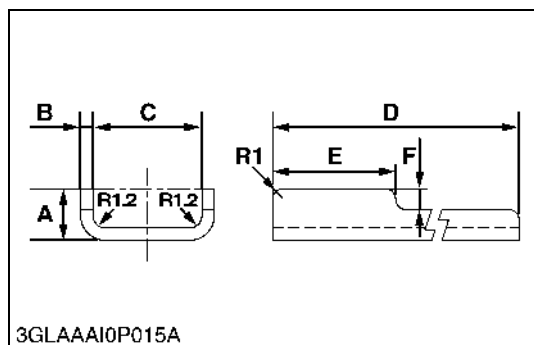
A	5.94 to 6.00 mm dia. (0.234 to 0.236 in. dia.)
B	8.165 to 8.187 mm dia. (0.3215 to 0.3223 in. dia.)
C	8.4 mm dia. (0.3307 in. dia.)
D	8.2 mm (0.32 in.)
E	14.2 mm (0.55905 in.)
F	7.6 to 8.0 mm (0.30 to 0.31 in.)
G	2.3 mm (0.09055 in.)
H	2.0 to 2.2 mm (0.079 to 0.087 in.)
I	0.26 rad (15 °)
J	M8
K	3 mm dia. drill (0.12 in. dia. drill)
L	Rc1/8
M	2.09 rad (120 °)
N	11.8 to 11.9 mm (0.465 to 0.469 in.)
O	12.2 mm (0.480 in.)
P	2 mm (0.079 in.)
Q	3 mm (0.118 in.)
R	8 mm (0.31496 in.)
S	2 mm (0.079 in.)
T	2 mm (0.079 in.)
U	17.4625 mm dia. (0.6875 in. dia.)
V	7.7 mm (0.303 in.)
W	10.7 mm (0.421 in.)
C0.5	Chamfer 0.5 mm (0.020 in.)
R0.4	Radius 0.4 mm (0.016 in.)
R0.1	Radius 0.1 mm (0.004 in.)

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HST Relief Pressure Gauge Adaptors (Adaptor 2)

A	10 mm (0.394 in.)
B	3 mm (0.1181 in.)
C	2.0 to 2.4 mm (0.079 to 0.094 in.)
D	3 mm (0.12 in.)
E	5.8 mm (0.23 in.)
F	1.5 mm (0.06 in.)
G	9 mm dia. (0.35 in. dia.)
H	8.200 to 8.215 mm dia. (0.3228 to 0.3234 in. dia.)
I	9.2 mm dia. (0.16 in. dia.)
J	12.16 to 12.29 mm dia. (0.4787 to 0.4839 in. dia.)
K	17.6 to 17.8 mm dia. (0.693 to 0.701 in. dia.)
L	0.52 rad (30 °)
M	9/16-18UNF
N	M8
O	1.5 mm (0.059 in.)
P	10.3 to 10.5 mm (0.4055 to 0.4134 in.)
Q	2.09 rad (120 °)
C1	Chamfer 1 mm (0.039 in.)
C0.2	Chamfer 0.2 mm (0.008 in.)
R0.4	Radius 0.4 mm (0.016 in.)
R0.2	Radius 0.2 mm (0.008 in.)

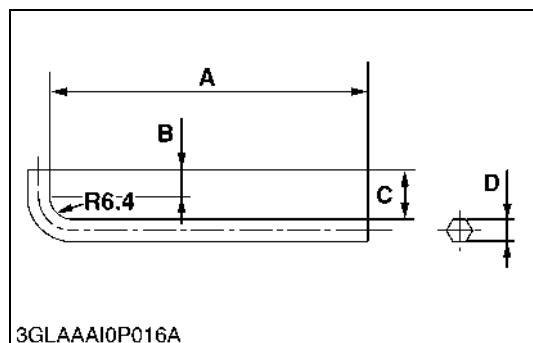
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**HST Relief Pressure Gauge Adaptors (Adaptor Lever)****Application**

- This allows easy installation and removal of the adaptor 2 from HST center section.

A	9.7 to 10.3 mm (0.382 to 0.406 in.)
B	1 mm (0.0472 in.)
C	10.6 to 10.9 mm (0.417 to 0.429 in.)
D	100 mm (3.94 in.)
E	12 mm (0.47 in.)
F	2 mm (0.08 in.)
R1.2	Radius 1.2 mm (0.047 in.)
R1	Radius 1 mm (0.039 in.)

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Short Neck Wrench

Application

- This allows easy removal and installation of the hexagon socket head plug from the HST center section.

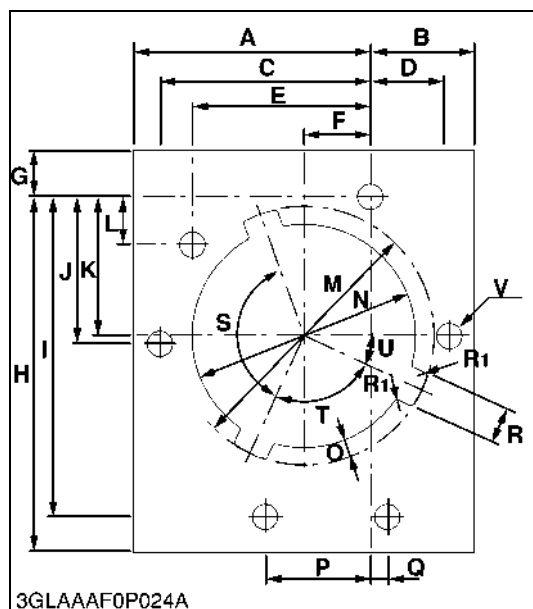
A	90 mm (3.543 in.)
B	7 to 8 mm (0.28 to 0.31 in.)
C	11 mm (0.433 in.)
D	6.35 mm (0.25 in.)
R6.4	Radius 6.4 mm (0.252 in.)

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PTO Brake Assembling Template

NOTE

- The thickness of this is 1.0 mm (0.039 in.)



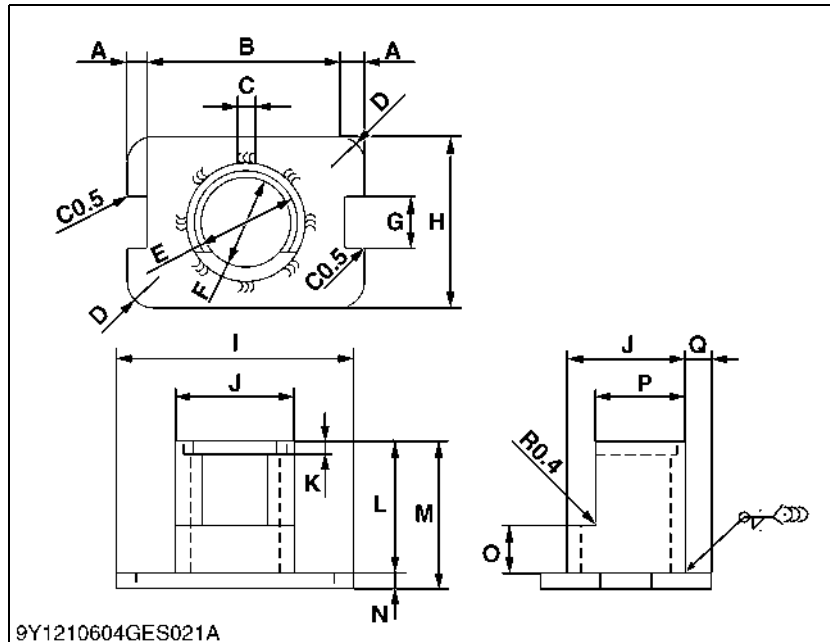
A	76.5 mm (3.01 in.)
B	33.5 mm (1.32 in.)
C	67.9 to 68.1 mm (2.67 to 2.68 in.)
D	25.4 to 25.6 mm (1.00 to 1.01 in.)
E	57.4 to 57.6 mm (2.26 to 2.27 in.)
F	21.4 to 21.6 mm (0.843 to 0.850 in.)
G	15 mm (0.59 in.)
H	115 mm (4.53 in.)
I	103.4 to 103.6 mm (4.071 to 4.078 in.)
J	47.4 to 47.6 mm (1.866 to 1.874 in.)
K	44.9 to 45.1 mm (1.77 to 1.78 in.)
L	15.4 to 15.6 mm (0.607 to 0.614 in.)
M	83.6 to 84.1 mm dia. (3.30 to 3.31 in. dia.)
N	72.15 to 72.45 mm dia. (2.841 to 2.852 in. dia.)
O	4.9 mm (0.19 in.)
P	33.9 to 34.1 mm (1.33 to 1.34 in.)
Q	5.3 to 5.7 mm (0.21 to 0.22 in.)
R	11.7 to 11.9 mm (0.461 to 0.468 in.)
S	2.3536 to 2.3588 rad (134.85 to 135.15 °)
T	1.569 to 1.573 rad (89.85 to 90.15 °)
U	0.4338 to 0.4389 rad (24.85 to 25.15 °)
V	6 × 8.2 mm dia. (6 × 0.32 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)

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Hydraulic PTO Clutch Spring Compression Tool

Application

- This allows easy installation and removal of the PTO clutch spring.



A	7.5 mm (0.30 in.)
B	75.0 mm (2.95 in.)
C	6.0 mm (0.24 in.)
D	Radius 10.0 mm (0.394 in.)
E	39.0 mm dia. (1.54 in. dia.)
F	34.0 mm dia. (1.34 in. dia.)
G	19.5 mm (0.768 in.)
H	65.0 mm (2.56 in.)
I	90.0 mm (3.54 in.)
J	45.0 mm dia. (1.8 in. dia.)
K	5.0 mm (0.20 in.)
L	50.0 mm (1.97 in.)
M	56.0 mm (2.20 in.)
N	6.0 mm (0.24 in.)
O	18.0 mm (0.709 in.)
P	34.0 mm (1.34 in.)
Q	10.0 mm (0.394 in.)
C0.5	Chamfer 0.50 mm (0.02 in.)
R0.4	Radius 0.40 mm (0.016 in.)

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9. TIRES

[1] TIRE PRESSURE



WARNING

To avoid personal injury:

- Do not try to install a tire. This should be done by a qualified person with the proper equipment.
- Always maintain the correct tire pressure.
Do not inflate tires above the recommended pressure shown in the Operator's Manual.
- Inflation pressure in front tires increases quickly when using compressed air.



CAUTION

Never operate machine with a loose rim, wheel, or axle.

- Whenever bolts are loosened, retighten to specified torque.
- Check all bolts frequently and keep them tightened.

	Tire sizes	Inflation pressure
Front	16 × 7.50-8, 4PR	200 kPa (2.0 kgf/cm ² , 29 psi)
Rear	23 × 10.50-12, 4PR	140 kPa (1.4 kgf/cm ² , 20 psi)

Though the tire pressure is factory-set to the prescribed level, it naturally drops slowly in the course of time.
Thus, check it everyday and inflate as necessary.

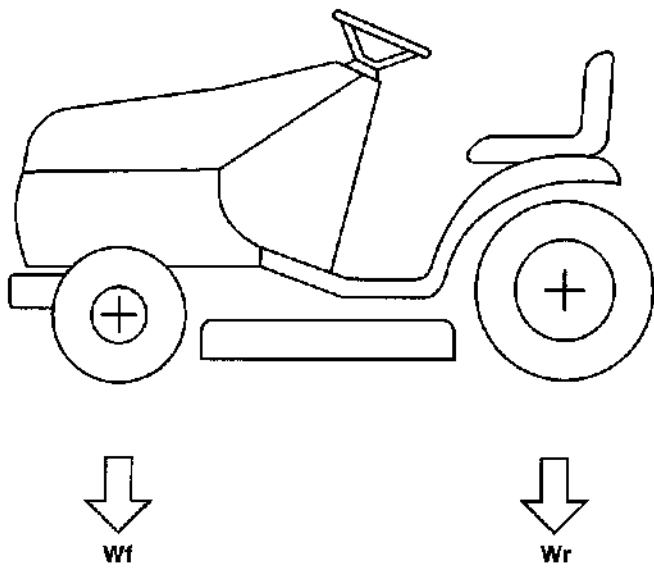
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10. IMPLIMENT LIMITATIONS

The KUBOTA Machine has been thoroughly tested for proper performance with implements sold or approved by KUBOTA. Use of implements which are not sold or approved by KUBOTA and which exceed the maximum specifications listed below, or which are otherwise unfit for use with the KUBOTA Machine may result in malfunctions or failures of the machine, damage to other property and injury to the operator or others. [Any malfunctions or failures of the machine resulting from use with improper implements are not covered by the warranty.]

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Maximum axle loading weight			
Model	Front axle Wf	Rear axle Wr	Total gross weight
GR2120SEU GR2120EU GR2120F	300 kg (661 lbf)	500 kg (1102 lbf)	700 kg (1543 lbf)



The diagram shows a side profile of a KUBOTA machine. Below the front wheel, there is a downward-pointing arrow labeled **Wf**. Below the rear wheel, there is a downward-pointing arrow labeled **Wr**. The machine has a steering wheel and a seat.

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1 ENGINE

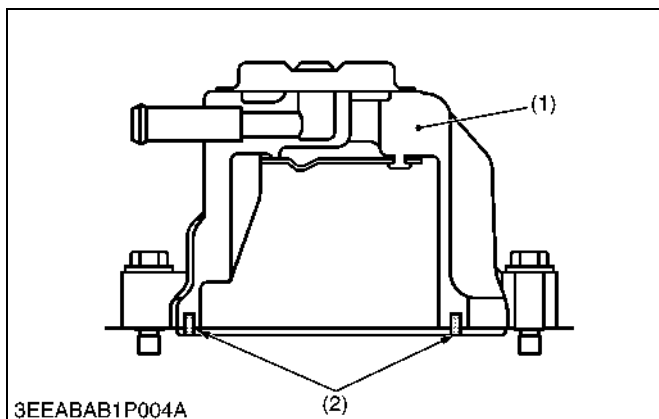
MECHANISM

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[2] CLOSED BREATHER	1-M1
2. LUBRICATING SYSTEM	1-M2
3. COOLING SYSTEM	1-M3
4. FUEL SYSTEM	1-M4
[1] FUEL LINE	1-M4

1. ENGINE BODY

[1] HALF-FLOATING HEAD COVER



The rubber packing keeps the head cover 0.5 mm (0.02 in.) or so off the cylinder head. This arrangement helps reduce noise coming from the cylinder head.

- (1) Cylinder Head Cover (2) Rubber Packing

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[2] CLOSED BREATHER

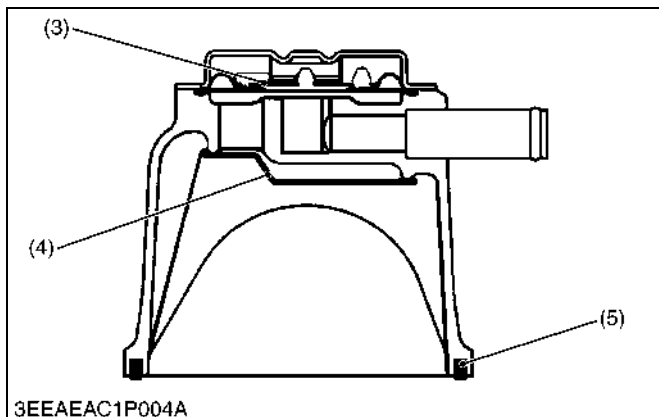


Closed breather system has been adopted to prevent the release of blowby gas into the atmosphere.

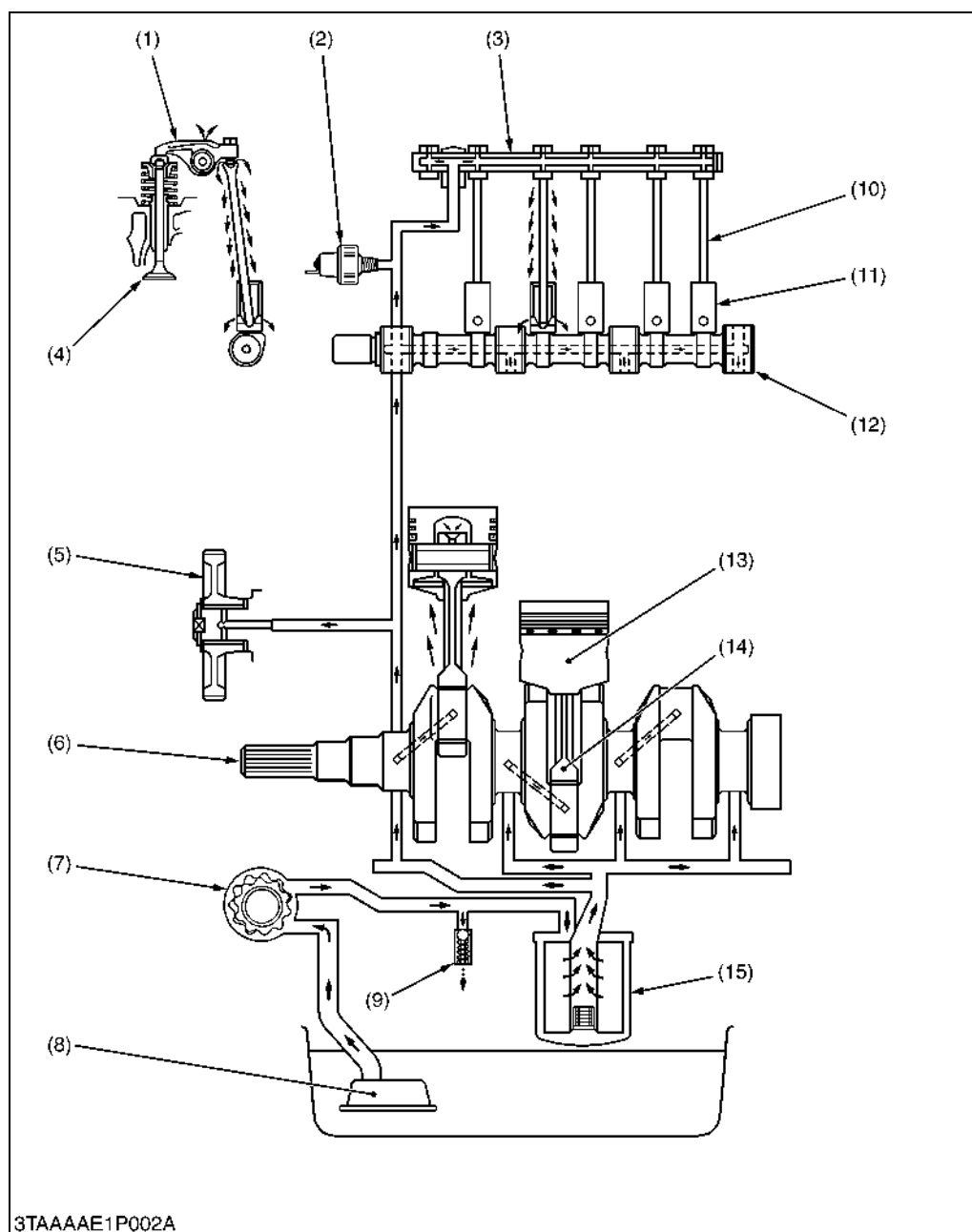
After its oil content is filtered by oil shield (4), the blowby gas is fed back to the intake manifold through breather valve (3) to be used for re-combustion.

- (1) Breather Tube (4) Oil Shield
(2) Cylinder Head Cover (5) Rubber Packing
(3) Breather Valve

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2. LUBRICATING SYSTEM



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

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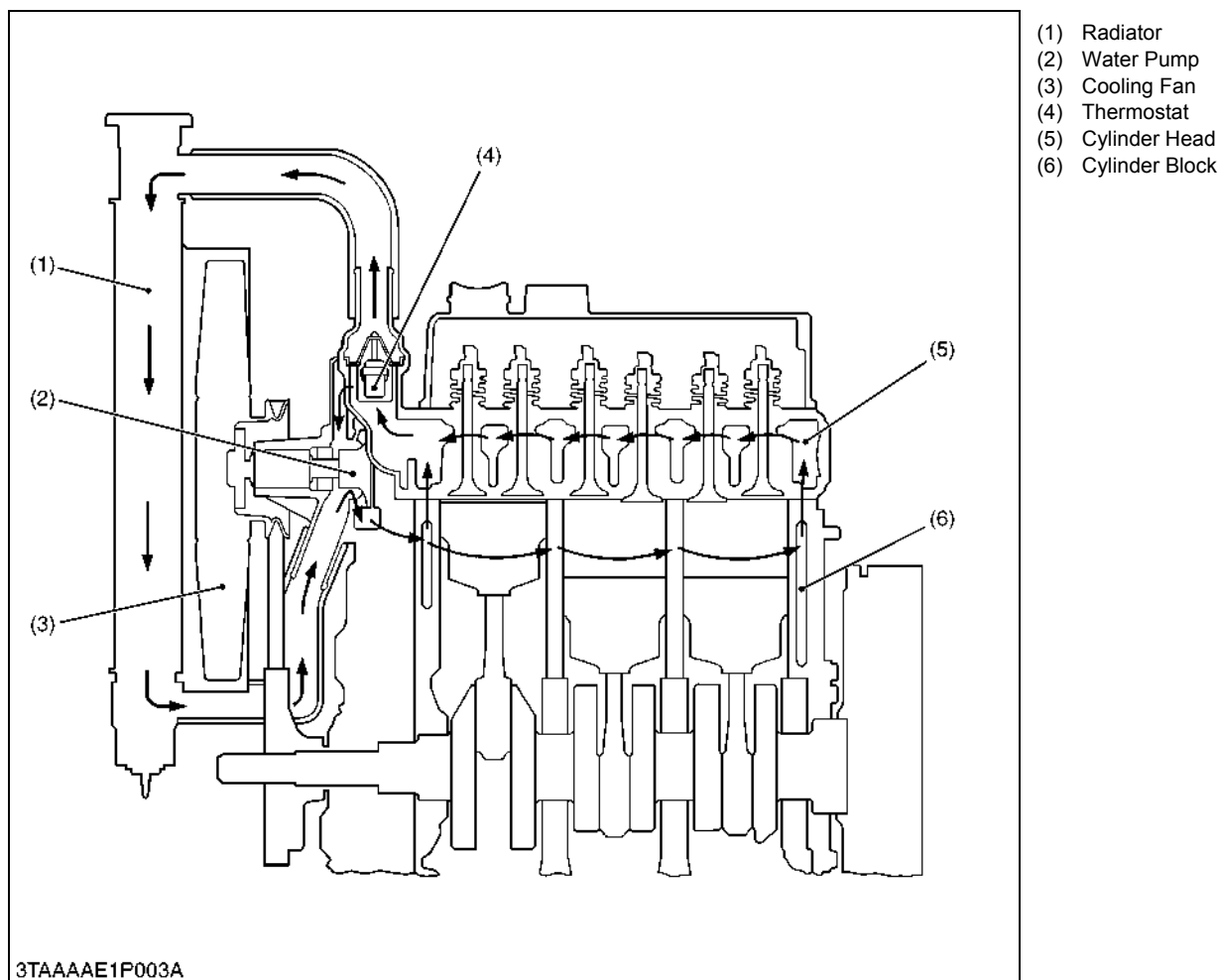
This engine's lubricating system consists of oil strainer (8), oil pump (7), relief valve (9), oil filter cartridge (15) and oil pressure switch (2).

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

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

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3. COOLING SYSTEM



The cooling system consists of a radiator (1), a centrifugal water pump (2), a cooling fan (3) and a thermostat (4). The coolant is cooled through the radiator core, and the cooling fan (3) set behind the radiator (1) pushes cooling air through the radiator core to improve cooling.

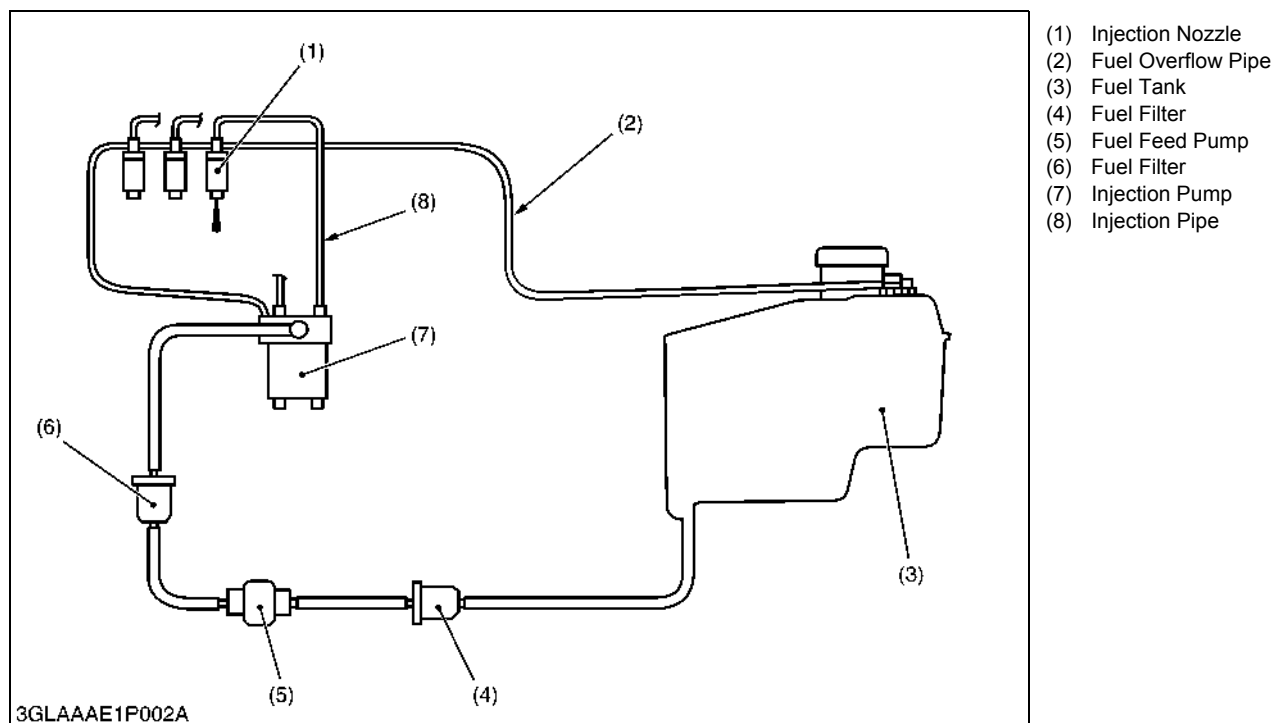
The water pump receives water from the radiator or from the cylinder head and force it into the cylinder block.

The thermostat opens or closes according to the water temperature. When the water temperature is high, the thermostat opens to allow the water to flow from the cylinder head to the radiator. When the water temperature is low, the thermostat close to flow the water only to the water pump.

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4. FUEL SYSTEM

[1] FUEL LINE



Fuel from the fuel tank (3) passes through the fuel filter (4), and then enters the injection pump (7) after impurities such as dirt, water, etc. are removed.

The fuel pressurized by the injection pump to the opening pressure (13.73 to 14.71 MPa, 140 to 150 kgf/cm², 1990 to 2133 psi), of the injection nozzle (1) is injected into the combustion chamber.

Part of the fuel fed to the injection nozzle (1) lubricates the moving parts of the needle valve inside the nozzle, then returns to the fuel tank through the fuel overflow pipe (2) from the upper part of the nozzle holder.

9Y1210598ENM0005US0

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	No fuel	Fill fuel	G-9
	Air in the fuel system	Bleed	G-45
	Water in the fuel system	Change fuel and repair or replace fuel system	G-9
	Fuel pipe clogged	Clean	G-35
	Fuel filter clogged	Change	G-35
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	G-9
	Fuel with low cetane number	Use specified fuel	G-9
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S23
	Incorrect injection timing	Adjust	1-S16
	Fuel camshaft worn	Replace	1-S30
	Injection nozzle clogged	Repair or replace	1-S18, 1-S24
	Injection pump malfunctioning	Replace	1-S28
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	1-S30
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S10, 1-S24, 1-S25
	Improper valve timing	Correct or replace timing gear	1-S29
	Piston ring and cylinder worn	Replace	1-S45
	Excessive valve clearance	Adjust	1-S12
Starter Does Not Run	Battery discharged	Charge	G-29
	Starter malfunctioning	Repair or replace	7-S8, 7-S19
	Main switch malfunctioning	Replace	7-S7
	PTO switch damaged	Replace	7-S9
	Brake switch damaged	Replace	7-S10
	Seat switch damaged	Replace	7-S11
	Slow blow fuse blown	Replace	G-46
	Wiring disconnected	Connect	–
Engine Revolution Is Not Smooth	Fuel filter clogged or dirty	Replace	G-35
	Air cleaner clogged	Clean or replace	G-28
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S23
	Injection pump malfunctioning	Replace	1-S28
	Incorrect nozzle opening pressure	Adjust	1-S18
	Injection nozzle stuck or clogged	Repair or replace	1-S18, 1-S24
	Governor malfunctioning	Repair	1-S28

Symptom	Probable Cause	Solution	Reference Page
Either White or Blue Exhaust Gas Is Observed	Excessive engine oil	Reduce to specified level	G-9
	Piston ring and cylinder worn or stuck	Repair or replace	1-S45, 1-S46
	Incorrect injection timing	Adjust	1-S16
	Damaged compression	Adjust top clearance	1-S11
Either Black or Dark Gray Exhaust Gas Is Observed	Overload	Decrease the load	–
	Low grade fuel used	Use specified fuel	G-9
	Fuel filter clogged	Replace	G-35
	Air cleaner clogged	Clean or replace	G-28
	Deficient nozzle injection	Repair or replace nozzle	1-S18, 1-S24
Deficient Output	Incorrect injection timing	Adjust	1-S16
	Engine's moving parts seem to be seizing	Repair or replace	–
	Uneven fuel injection	Replace injection pump	1-S28
	Deficient nozzle injection	Repair or replace nozzle	1-S18, 1-S24
	Compression leak	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S10, 1-S24, 1-S25
Excessive Lubricant Oil Consumption	Piston ring's gap facing the same direction	Shift ring gap direction	1-S31
	Oil ring worn or stuck	Replace	1-S32
	Piston ring groove worn	Replace piston	1-S32
	Valve stem and valve guide worn	Replace	1-S26, 1-S38
	Crankshaft bearing and crank pin bearing worn	Replace	1-S35, 1-S47
	Oil leaking due to damaged seals or packing	Replace	–
Fuel Mixed into Lubricant Oil	Injection pump's plunger worn	Replace injection pump	1-S28
	Deficient nozzle injection	Repair or replace nozzle	1-S18, 1-S24
	Injection pump broken	Replace	1-S28
Water Mixed into Lubricant Oil	Head gasket damaged	Replace	1-S25
	Cylinder block or cylinder head flawed	Repair or replace	1-S36

Symptom	Probable Cause	Solution	Reference Page
Low Oil Pressure	Engine oil insufficient	Fill	G-9
	Oil strainer clogged	Clean	1-S27
	Oil filter clogged	Replace	G-36
	Relief valve stuck with dirt	Clean	–
	Relief valve spring weaken or broken	Replace	–
	Excessive oil clearance of crankshaft bearing	Replace	1-S48, 1-S49
	Excessive oil clearance of crankpin bearing	Replace	1-S47
	Excessive oil clearance of rocker arm	Replace	1-S40
	Oil passage clogged	Clean	–
	Different type of oil	Use specified type of oil	G-9
	Oil pump damaged	Repair or replace	1-S30
High Oil Pressure	Different type of oil	Use specified type of oil	G-9
	Relief valve damaged	Replace	–
Engine Overheated	Engine oil insufficient	Fill	G-9
	Fan belt broken or tensioned improperly	Replace or adjust	G-34
	Coolant insufficient	Fill	G-42
	Radiator net and radiator fin clogged with dust	Clean	–
	Inside of radiator corroded	Clean or replace	G-42
	Coolant flow route corroded	Clean or replace	G-42
	Radiator cap damaged	Replace	1-S15
	Radiator hose damaged	Replace	G-40
	Overload running	Reduce the load	–
	Head gasket damaged	Replace	1-S25
	Incorrect injection timing	Adjust	1-S16
	Unsuitable fuel used	Use specified fuel	G-9

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2. SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Compression Pressure		2.85 to 3.23 MPa 29.0 to 33.0 kgf/cm ² 413 to 469 psi	2.26 MPa 23.0 kgf/cm ² 327 psi
Variance Among Cylinder			10 % or less
Top Clearance		0.50 to 0.70 mm 0.020 to 0.027 in.	—
Valve Clearance (Cold)		0.145 to 0.185 mm 0.00571 to 0.00728 in.	—
Cylinder Head Surface	Flatness	—	0.05 mm 0.002 in.
Valve Recessing	Intake and Exhaust	−0.10 to 0.10 mm −0.0039 to 0.0039 in.	0.30 mm 0.012 in.
Valve Stem to Valve Guide	Clearance	0.030 to 0.057 mm 0.0012 to 0.0022 in.	0.10 mm 0.0039 in.
	O.D.	5.968 to 5.980 mm 0.2350 to 0.2354 in.	—
	I.D.	6.010 to 6.025 mm 0.2367 to 0.2372 in.	—
Valve Seat	Width	2.12 mm 0.0835 in.	—
	Angle	0.79 rad 45 °	—
Valve Face	Angle	0.79 rad 45 °	—
Valve Spring	Free Length	31.3 to 31.8 mm 1.24 to 1.25 in.	28.4 mm 1.118 in.
	Tilt	—	1.2 mm 0.047 in.
	Setting Load	65 N 6.6 kgf 15 lbf	55 N 5.6 kgf 12 lbf
	Setting Length	27.0 mm 1.06 in.	—
Rocker Arm Shaft to Rocker Arm Shaft	Clearance	0.016 to 0.045 mm 0.00063 to 0.0017 in.	0.15 mm 0.0059 in.
	O.D.	10.473 to 10.484 mm 0.41233 to 0.41275 in.	—
	I.D.	10.500 to 10.518 mm 0.41339 to 0.41409 in.	—
Push Rod	Alignment	—	0.25 mm 0.0098 in.

Item		Factory Specification	Allowable Limit
Tappet to Tappet Guide	Clearance	0.016 to 0.052 mm 0.00063 to 0.0020 in.	0.10 mm 0.0039 in.
	• Tappet	O.D. 17.966 to 17.984 mm 0.70733 to 0.70803 in.	–
	• Tappet Guide Bore	I.D. 18.000 to 18.018 mm 0.70867 to 0.70937 in.	–
Timing Gear	• Idle Gear to Crank Gear	Backlash 0.0430 to 0.124 mm 0.00170 to 0.00488 in.	0.15 mm 0.0059 in.
	• Idle Gear to Cam Gear	Backlash 0.0470 to 0.123 mm 0.00185 to 0.00484 in.	0.15 mm 0.0059 in.
	• Idle Gear to Injection Pump Gear	Backlash 0.0460 to 0.124 mm 0.00182 to 0.00488 in.	0.15 mm 0.0059 in.
	• Oil Pump Drive Gear to Crank Gear	Backlash 0.0410 to 0.123 mm 0.00162 to 0.00484 in.	0.15 mm 0.0059 in.
Idle Gear	Side Clearance	0.20 to 0.51 mm 0.0079 to 0.20 in.	0.80 mm 0.031 in.
Camshaft	Side Clearance	0.15 to 0.31 mm 0.0059 to 0.012 in.	0.50 mm 0.0120 in.
	Alignment	–	0.01 mm 0.0004 in.
Cam Height	Intake and Exhaust	26.88 mm 1.058 in.	26.83 mm 1.056 in.
Camshaft Journal to Cylinder Block Bore	Oil Clearance	0.050 to 0.091 mm 0.0020 to 0.0035 in.	0.15 mm 0.0059 in.
	• Camshaft Journal	O.D. 32.934 to 32.950 mm 1.2967 to 1.2972 in.	–
	• Cylinder Block Bore	I.D. 33.000 to 33.025 mm 1.2993 to 1.3001 in.	–
Idle Gear Shaft to Idle Gear Bushing	Oil Clearance	0.020 to 0.084 mm 0.00079 to 0.0033 in.	0.10 mm 0.0039 in.
	• Idle Gear Shaft	O.D. 19.967 to 19.980 mm 0.78611 to 0.78661 in.	–
	• Idle Gear Bushing	I.D. 20.000 to 20.051 mm 0.78741 to 0.78940 in.	–
Piston Pin Bore	I.D.	20.000 to 20.013 mm 0.78741 to 0.78791 in.	20.05 mm 0.7894 in.
Piston Pin to Small End Bushing	Oil Clearance	0.014 to 0.038 mm 0.00056 to 0.0014 in.	0.10 mm 0.0039 in.
	• Piston Pin	O.D. 20.002 to 20.011 mm 0.78748 to 0.78783 in.	–
	• Small End Bushing	I.D. 20.025 to 20.040 mm 0.78839 to 0.78897 in.	–

Item		Factory Specification	Allowable Limit
Piston Pin to Small End Bushing (Spare Parts)	Oil Clearance	0.015 to 0.075 mm 0.00059 to 0.0029 in.	0.15 mm 0.0059 in.
	I.D.	20.026 to 20.077 mm 0.78843 to 0.79043 in.	—
Connecting Rod	Alignment	—	0.05 mm 0.0020 in.
Piston Ring Gap	Top Ring	0.15 to 0.30 mm 0.0059 to 0.011 in.	1.20 mm 0.0472 in.
	Second Ring	0.30 to 0.45 mm 0.012 to 0.017 in.	1.20 mm 0.0472 in.
	Oil Ring	0.15 to 0.30 mm 0.0059 to 0.011 in.	1.20 mm 0.0472 in.
Piston Ring to Piston Ring Groove	• Second Ring	Clearance 0.0900 to 0.120 mm 0.00355 to 0.00472 in.	0.15 mm 0.0059 in.
	• Oil Ring	Clearance 0.040 to 0.080 mm 0.0016 to 0.0031 in.	0.15 mm 0.0059 in.
Crankshaft	Side Clearance	0.15 to 0.31 mm 0.0059 to 0.012 in.	0.50 mm 0.020 in.
	Alignment	—	0.02 mm 0.0008 in.
Crankpin to Crankpin Bearing	Oil Clearance	0.020 to 0.051 mm 0.00079 to 0.0020 in.	0.15 mm 0.0059 in.
	• Crankpin	O.D. 33.959 to 33.975 mm 1.33670 to 1.3375 in.	—
	• Crankpin Bearing	I.D. 33.995 to 34.010 mm 1.33894 to 1.33899 in.	—
Crankshaft Journal to Crankshaft Bearing 1	Oil Clearance	0.0340 to 0.106 mm 0.00134 to 0.00417 in.	0.20 mm 0.0079 in.
	• Crankshaft Journal	O.D. 39.934 to 39.950 mm 1.5722 to 1.5728 in.	—
	• Crankshaft Bearing 1	I.D. 39.984 to 40.040 mm 1.5742 to 1.5763 in.	—
Crankshaft Journal to Crankshaft Bearing 2 (Flywheel Side)	Oil Clearance	0.028 to 0.059 mm 0.0011 to 0.0023 in.	0.20 mm 0.0079 in.
	• Crankshaft Journal	O.D. 43.934 to 43.950 mm 1.7297 to 1.7303 in.	—
	• Crankshaft Bearing 2	I.D. 43.978 to 43.993 mm 1.7315 to 1.7320 in.	—

Item		Factory Specification	Allowable Limit
Crankshaft Journal to Crankshaft Bearing 3 (Intermediate) • Crankshaft Journal • Crankshaft Bearing 3	Oil Clearance	0.028 to 0.059 mm 0.0011 to 0.0023 in.	0.20 mm 0.0079 in.
	O.D.	39.934 to 39.950 mm 1.5722 to 1.5728 in.	—
	I.D.	39.978 to 39.993 mm 1.57340 to 1.5745 in.	—
Cylinder Liner	I.D.	67.000 to 67.019 mm 2.6378 to 2.6385 in.	67.150 mm 2.6437 in.
Cylinder Liner (Oversize)	I.D.	67.250 to 67.269 mm 2.6477 to 2.6483 in.	67.400 mm 2.65435 in.

LUBRICATING SYSTEM

Item		Factory Specification	Allowable Limit
Engine Oil Pressure	At Idle Speed	More than 49 MPa 0.50 kgf/cm ² 7.1 psi	—
	At Rated Speed	197 to 441 MPa 2.00 to 4.50 kgf/cm ² 28.5 to 64.0 psi	147 MPa 1.50 kgf/cm ² 21.3 psi
Oil Pump • Inter Rotor to Outer Rotor • Outer Rotor to Pump Body • Inter Rotor to Cover	Clearance	0.030 to 0.14 mm 0.0012 to 0.0055 in.	—
	O.D.	0.070 to 0.15 mm 0.0028 to 0.0059 in.	—
	I.D.	0.0750 to 0.135 mm 0.0029 to 0.00531 in.	—

COOLING SYSTEM

Item		Factory Specification	Allowable Limit
Fan Belt	Tension	Approx. 10 mm / N 0.39 in. / 98 N (10 kgf, 22 lbf)	—
Thermostat	Valve Opening Temperature (At Beginning)	69.5 to 72.5 °C 157.1 to 162.5 °F	—
	Valve Opening Temperature (Opened Completely)	85 °C 185 °F	—
Radiator Cap	Pressure Falling Time	10 seconds or more 88 → 59 kPa 0.90 to 0.60 kgf/cm ² 13 → 8.5 psi	—
Radiator	Water Leakage Test Pressure	No leak at specified pressure 157 kPa 1.60 kgf/cm ² 22.8 psi	—

FUEL SYSTEM

Item		Factory Specification	Allowable Limit
Injection Pump	Injection Timing	0.2837 to 0.3097 rad (16.25 to 17.75 °) before T.D.C.	—
Pump Element	Fuel Tightness	—	13.7 MPa 140.0 kgf/cm ² 1991 psi
Delivery Valve	Fuel Tightness	10 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm ² 1991 → 1849 psi	5 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm ² 1991 → 1849 psi
Fuel Injection Nozzle	Injection Pressure	13.73 to 14.71 MPa 140.0 to 150.0 kgf/cm ² 1992 to 2133 psi	—
	Valve Seat Tightness	When the pressure is 12.75 MPa (130.0 kgf/cm ² , 1849 psi), the valve seat must be fuel tightness.	—

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3. TIGHTENING TORQUES

Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts: See page "5. TIGHTENING TORQUES" on page G-12.)

Item	Dimension × Pitch	N·m	kgf·m	lbf·ft
*Cylinder head screw	M8 × 1.25	38 to 42	3.8 to 4.3	28 to 31
Oil pressure switch	PT1/8	15 to 19	1.5 to 2.0	11 to 14
Front coupling mounting screw	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
Engine mounting nut	M8 × 1.25	24	2.4	17
Engine support screw	M10 × 1.25	48 to 55	4.9 to 5.7	36 to 41
Air cleaner stay screw	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
*Cylinder head cover screw	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Injection pipe retaining nut	M12 × 1.5	25 to 34	2.5 to 3.5	18 to 25
Overflow pipe retaining nut	M12 × 1.5	20 to 24	2.0 to 2.5	15 to 18
Nozzle holder assembly	M20 × 1.5	49 to 68	5.0 to 7.0	37 to 50
Glow plug	M8 × 1.0	7.9 to 14	0.80 to 1.5	5.8 to 10
*Rocker arm bracket screw	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
*Fan drive pulley screw	M12 × 1.5	118 to 127	12.0 to 13.0	86.8 to 94.0
*Idle gear shaft mounting screw	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Oil pump mounting screw	M6 × 1.0	18 to 21	1.8 to 2.2	13 to 15
*Connecting rod screw	M7 × 0.75	27 to 30	2.7 to 3.1	20 to 22
*Flywheel screw	M10 × 1.25	54 to 58	5.5 to 6.0	40 to 43
Bearing case cover mounting screw	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
*Main bearing case screw 2	M7 × 1.0	27 to 30	2.7 to 3.1	20 to 22
*Main bearing case screw 1	M6 × 1.0	13 to 15	1.3 to 1.6	9.4 to 11

■ NOTE

- In removing and applying the screws and nuts marked with "*", a pneumatic wrench or similar pneumatic tool, if employed, must be used with enough care not to get them seized.
- For "*" marked screws and nuts on the table, apply engine oil to their threads and seats before tightening.
- The letter "M" in Size x Pitch means that the screw or nut dimension stands for metric. The size is the nominal outside diameter in mm of the threads. The pitch is the nominal distance in mm between two threads.

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4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING, AND ADJUSTING

(1) Engine Body



Compression Pressure

1. Operate the engine until it is warmed up.
2. Stop the engine.
3. Disconnect the **2P** connector (1) from the fuel pump.
4. Remove the air cleaner, the muffler and all injection nozzles.
5. Disconnect the accelerator wire.
6. Engage the parking brake.
7. Set a compression tester (Code No.: 07909-30208) with the adaptor (Adaptor H, Code No.: 07909-31231) to the nozzle hole.
8. While cranking the engine with the starter, measure the compression pressure.
9. Repeat steps 7 and 8 for each cylinder.
10. If the measurement is below the allowable limit, apply a small amount of oil to the cylinder wall through the nozzle hole and measure the compression pressure again.
11. If the compression pressure is still less than the allowable limit, check the top clearance, valve clearance and cylinder head.
12. If the compression pressure increases after applying oil, check the cylinder wall and piston rings.

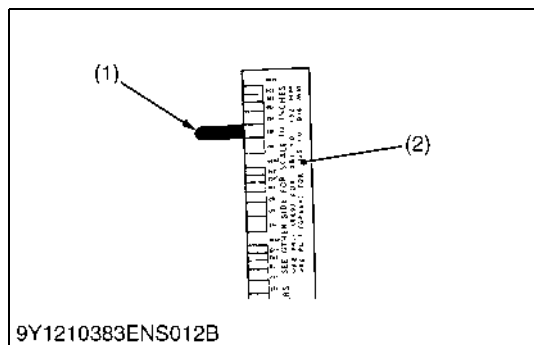
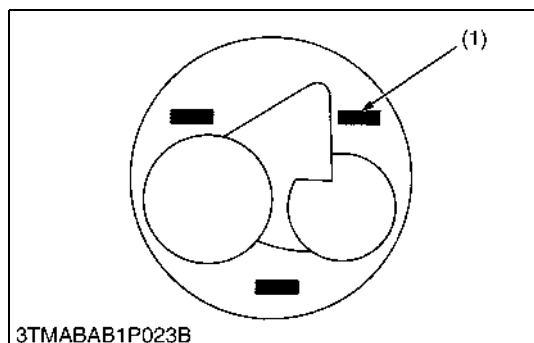
■ NOTE

- Check the compression pressure with the specified valve clearance.
- Always use a fully charged battery for this test.
- Variances in cylinder compression values should be under 10 %.

Compression pressure	Factory specification	2.85 to 3.23 MPa 29.0 to 33.0 kgf/cm ² 413 to 469 psi
	Allowable limit	2.26 MPa 23.0 kgf/cm ² 327 psi

(1) **2P** Connector

9Y1210598ENS0004US0



Top Clearance

1. Remove the cylinder head. (Do not attempt to remove the cylinder head gasket.)
2. Move the piston up, and stick a strip of plastigauge (1) on the piston head at three positions with grease so as to avoid the intake and exhaust valves and the combustion chamber ports.
3. Lower the piston, and install the cylinder head and tighten the cylinder head screws to the specified torque.
4. Turn the flywheel until the piston exceeds its top dead center.
5. Remove the cylinder head, and measure the plastigauge (1).
6. If the measurement is not within the factory specifications, check the oil clearance between the crankpin and crankpin bearing and between the piston pin and small end bushing.

NOTE

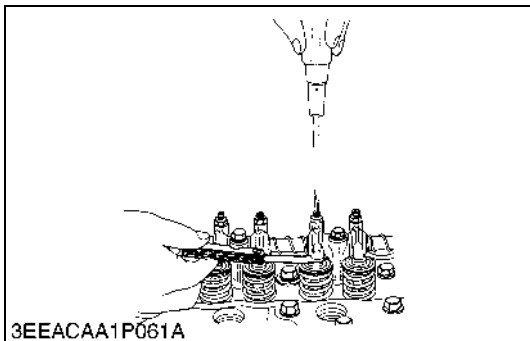
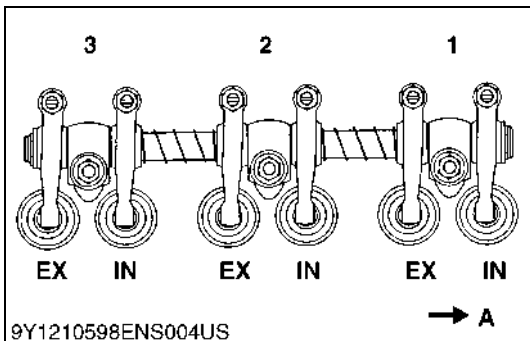
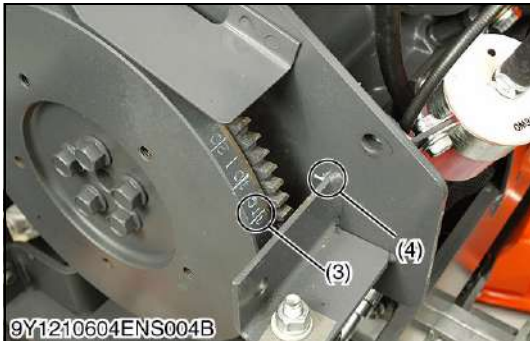
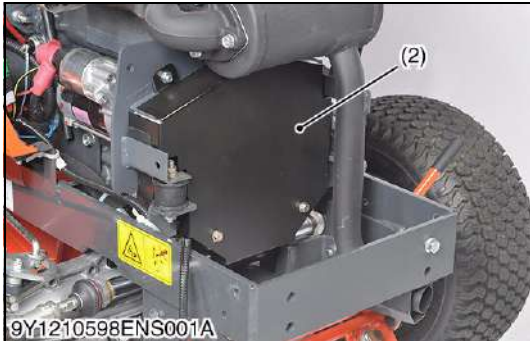
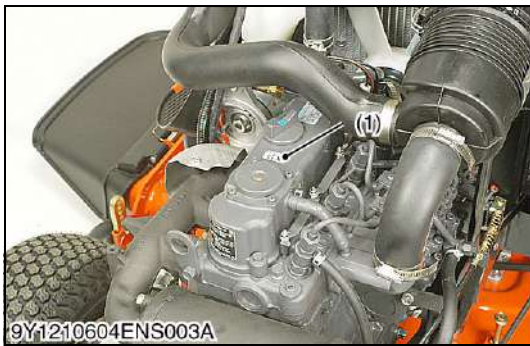
- After checking the top clearance, be sure to assemble the cylinder head with a new cylinder head gasket.

Top clearance	Factory specification	0.50 to 0.70 mm 0.020 to 0.027 in.
Tightening torque	Cylinder head screw	38 to 42 N·m 3.8 to 4.3 kgf·m 28 to 31 lbf·ft

(1) Plastigauge

(2) Scale

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Checking Valve Clearance

■ IMPORTANT

- The valve clearance must be checked and adjusted when engine is cold.
1. Remove the cylinder head cover (1) and the glow plugs. Remove the flywheel cover (2). [GR2120SEU, GR2120F only]
 2. Align the "1TC" mark (3) on the flywheel and alignment mark (4) on the rear end plate so that the No. 1 piston comes to the compression top dead center.
 3. Check the following valve clearance marked with "★" using a thickness gauge.
 4. If the clearance is not within the factory specifications, adjust with the adjusting screw.
 5. Then turn the flywheel 6.28 rad (360 °), and align the "1TC" mark (3) on the flywheel and alignment mark (4) on the rear end plate so that the No.1 piston comes to the overlap position.
 6. Check the following valve clearance marked with "☆" using a thickness gauge.

Cylinder No.	No.1	No.2	No.3
Intake valve	★	☆	★
Exhaust valve	★	★	☆

★: When No.1 piston is at the compression top dead center position.

☆: When No.1 piston is at the overlap position.

7. If the clearance is not within the factory specifications, adjust with the adjusting screw.

Intake and exhaust valve clearance (Cold)	Factory specification	0.145 to 0.185 mm 0.00571 to 0.00728 in.
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■ NOTE

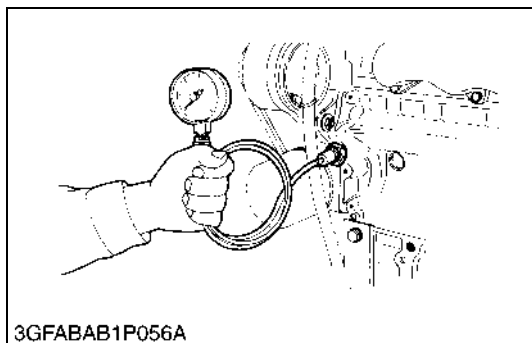
- The sequence of cylinder numbers is given as No.1, No.2 and No.3 starting from the gear case side.
- After adjusting the valve clearance, secure the adjusting screw with the lock nut.

- (1) Cylinder Head Cover
- (2) Flywheel Cover
- (3) "1TC" Mark
- (4) Alignment Mark

A: Gear Case Side

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(2) Lubricating System



Engine Oil Pressure

1. Remove the engine oil pressure switch, and set an oil pressure tester (Code No.: 07916-32032).
2. Start the engine. After warming up, measure the oil pressure of both idling and rated speeds.
3. If the oil pressure is less than the allowable limit, check the following.
 - Engine oil insufficient.
 - Oil pump damaged
 - Oil strainer clogged
 - Oil filter cartridge clogged
 - Oil gallery clogged
 - Excessive oil clearance
 - Foreign matter in the relief valve

Engine oil pressure	At idle speed	Factory specification	More than 49 kPa 0.50 kgf/cm ² 7.1 psi
	At rated speed	Factory specification	197 to 441 kPa 2.00 to 4.50 kgf/cm ² 28.5 to 64.0 psi
		Allowable limit	147 kPa 1.50 kgf/cm ² 21.3 psi

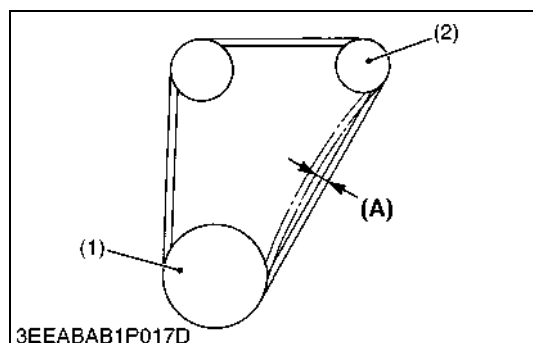
(When reassembling)

- After checking the engine oil pressure, tighten the engine oil pressure switch to the specified torque.

Tightening torque	Oil pressure switch	15 to 19 N·m 1.5 to 1.9 kgf·m 11 to 14 lbf·ft
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(3) Cooling System



Checking Fan Drive Belt Tension



CAUTION

- Be sure to stop the engine and remove the key before checking belt tension.

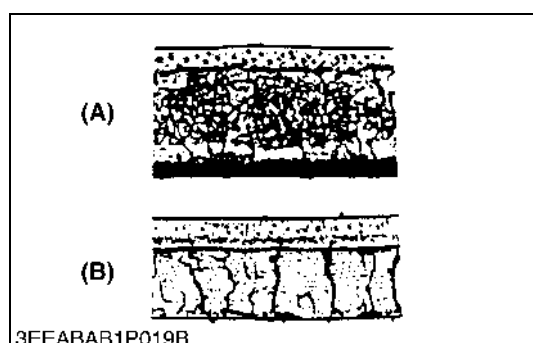
- Measure the deflection (A), depressing the belt halfway between the fan drive pulley (1) and dynamo pulley (2) at specified force (98 N, 10 kgf, 22 lbs).
- If the measurement is not within the factory specifications, loosen the dynamo mounting screws and relocate the dynamo to adjust.

Deflection (A)	Factory specification	approx. 10 mm 0.39 in.
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(1) Fan Drive Pulley

(2) Dynamo Pulley

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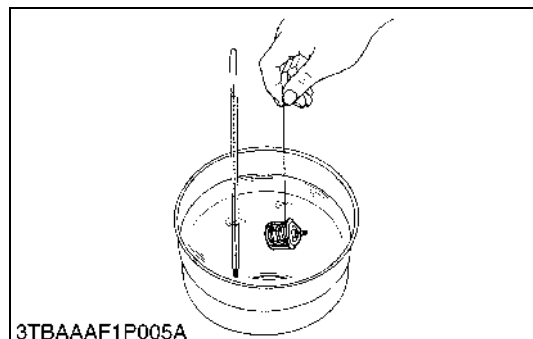
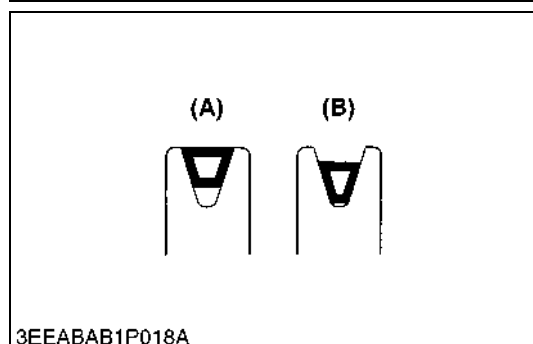
Fan Belt Damage and Wear

- Check the fan belt for damage.
- If the fan belt is damaged, replace it.
- Check if the fan belt is worn and sunk in the pulley groove.
- If the fan belt is nearly worn out and deeply sunk in the pulley groove, replace it.

(A) Good

(B) Bad

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Thermostat Valve Opening Temperature

- Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
- Heating the water gradually, read the temperature when the valve opens and leaves the string.
- Continue heating and read the temperature when the valve opens approx. 8 mm (0.31 in.).
- If the measurement is not within the factory specifications, replace the thermostat.

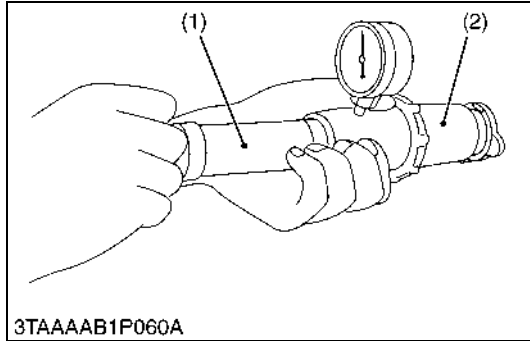
Thermostat's valve opening temperature	Factory specification	69.5 to 72.5 °C 157.1 to 162.5 °F
Temperature at which thermostat completely opens	Factory specification	85 °C 185 °F

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**CAUTION**

When removing the radiator cap, wait at least ten minutes after the engine has stopped and cooled down. Otherwise, hot water may gush out, scalding nearby people.

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**Radiator Cap Air Leakage**

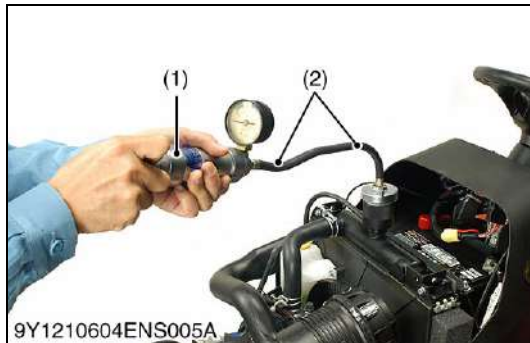
1. Set a radiator tester (1) and adaptor (2) (BANZAI Code No.: RCT-2A-30S) on the radiator cap.
2. Apply the specified pressure (88 kPa, 0.90 kgf/cm², 13 psi), and measure the time for the pressure to fall to 59 kPa (0.60 kgf/cm², 8.5 psi).
3. If the measurement is less than the factory specification, replace the radiator cap.

Pressure falling time	Factory specification	More than 10 seconds for pressure fall from 88 to 59 kPa (from 0.90 to 0.60 kgf/cm ² from 13 to 8.5 psi)
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(1) Radiator Tester

(2) Adaptor

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**Radiator Water Leakage**

1. Pour a specified amount of water into the radiator.
2. Set a radiator tester (1) (Code No.: 07909-31551) and an adaptor (2) (BANZAI Code No.: RCT-2A-30S) and raise the water pressure to the specified pressure.
3. Check the radiator for water leaks.
4. For water leak from the pinhole, repair with the radiator cement. When water leak is excessive, replace the radiator.

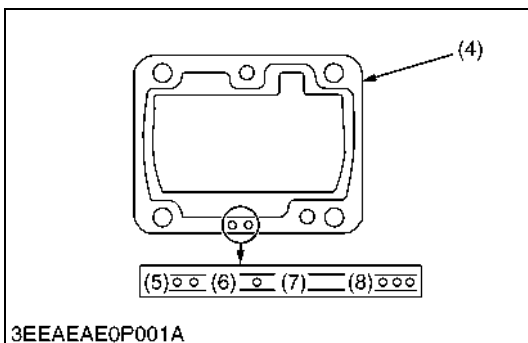
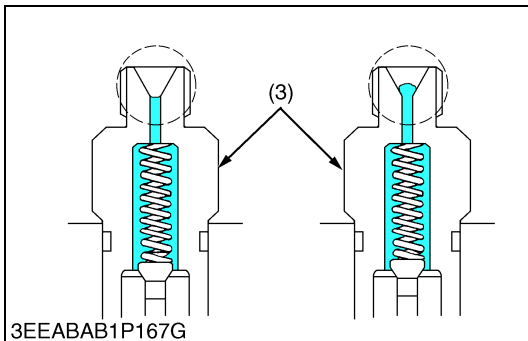
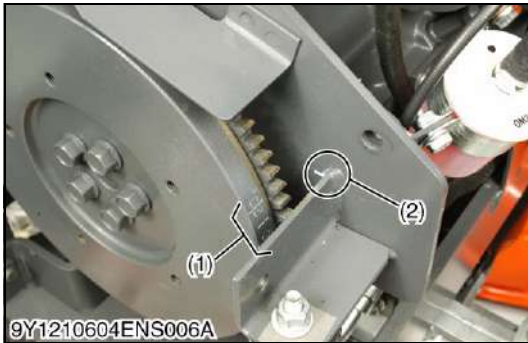
Radiator water leakage test pressure	Factory specification	157 kPa 1.60 kgf/cm ² 22.8 psi
--------------------------------------	-----------------------	---

(1) Radiator Tester

(2) Adaptor

9Y1210598ENS0013US0

(4) Fuel System



Injection Timing

1. Remove the injection pipes.
2. Remove the engine stop solenoid.
3. Turn the flywheel counterclockwise (viewed from flywheel side) until the fuel fills up to the hole of the delivery valve holder (3) for No.1 cylinder.
4. After the fuel fills up to the hole of the delivery valve holder for No.1 cylinder, turn back (clockwise) the flywheel around 1.6 rad (90 °).
5. Turn the flywheel counterclockwise to set around 0.44 rad (25 °) before T.D.C..
6. Slowly turn the flywheel counterclockwise and stop turning when the fuel begins to come up, to get the present injection timing.
7. Check to see the degree on flywheel.
The flywheel has mark "1TC" , "10" and "20" for the crank angle before the top dead center of No.1 cylinder.
8. Check to see if the timing angle on the flywheel is aligned with the alignment mark (2).
9. If injection timing is out of adjustment, readjust the timing with shims.

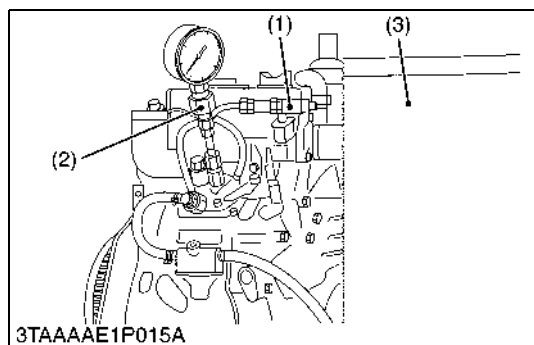
Injection timing	Factory specification	0.2837 to 0.3097 rad (16.25 to 17.75 °) before T.D.C.
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■ NOTE

- The liquid gasket is not required for assembling.
- Shims are available in thickness of 0.20 mm (0.0079 in.), 0.25 mm (0.0098 in.), 0.30 mm (0.012 in.), 0.35 mm (0.014 in.) and 0.175 mm (0.00689 in.). Combine these shims for adjustments.
- Refer to figure of the shim to check the thickness of the shims.
- Addition or reduction of shim (0.025 mm, 0.00098 in.) delays or advances the injection timing by approx. 0.0044 rad (0.25 °)
- In disassembling and replacing the injection pump, be sure to use the same number of new shims with the same thickness.
- The 0.175 mm (0.00689 in.) thick shim is coated only on the lower face. Therefore, do not use the 0.175 mm (0.00689 in.) thick shim as the top shim of the combination (injection pump side), because this can cause oil leakage.

- | | |
|-----------------------------------|--|
| (1) Timing Line | (5) Two-holes: 0.20 mm (0.0079 in.) |
| (2) Alignment Mark | Two-holes: 0.175 mm (0.00689 in.) |
| (3) Delivery Valve Holder | (6) One-holes: 0.25 mm (0.0098 in.) |
| (4) Shim (Soft Metal Gasket Shim) | (7) Without hole: 0.30 mm (0.0118 in.) |
| | (8) Three-hole: 0.35 mm (0.014 in.) |

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Fuel Tightness of Pump Element

1. Remove the engine stop solenoid.
2. Remove the injection pipes and glow plugs.
3. Install the injection pump pressure tester to the injection pump.
4. Install the injection nozzle (1) jetted with the proper injection pressure to the injection pump pressure tester (2). (Refer to the figure.)
5. Set the speed control lever to the maximum speed position.
6. Run the starter to increase the pressure.
7. If the pressure can not reach the allowable limit, replace the pump with new one or repair with a Kubota-authorized pump service shop.

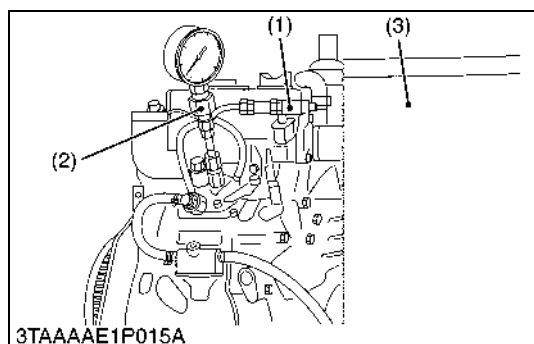
Fuel tightness of pump element	Allowable limit	13.73 MPa 140.0 kgf/cm ² 1991 psi
--------------------------------	-----------------	--

NOTE

- **Never try to disassemble the injection pump assembly. For repairs, you are strongly requested to contact a Kubota-authorized pump service shop.**

- (1) Injection Nozzle (3) Protection Cover for Jetted Fuel
(2) Injection Pump Pressure Tester

9Y1210598ENS0015US0



Fuel Tightness of Delivery Valve

1. Remove the engine stop solenoid.
2. Remove the injection pipes and glow plugs.
3. Set a pressure tester to the fuel injection pump.
4. Install the injection nozzle (1) jetted with the proper injection pressure to the injection pump pressure tester (2).
5. Run the starter to increase the pressure.
6. Stop the starter when the fuel jets from the injection nozzle. After that, turn the flywheel by the hand and raise the pressure to approx. 13.73 MPa (140 kgf/cm², 1991 psi).
7. Now turn the flywheel back about half a turn (to keep the plunger free). Maintain the flywheel at this position and clock the time taken for the pressure to drop from 13.73 to 12.75 MPa (from 140 to 130 kgf/cm², from 1991 to 1849 psi).
8. Measure the time needed to decrease the pressure from 13.73 to 12.75 MPa (from 140 to 130 kgf/cm², from 1991 to 1849 psi).
9. If the measurement is less than allowable limit, replace the pump with new one or repair with a Kubota-authorized pump service shop.

Fuel tightness of delivery valve	Factory specification	10 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm ² 1991 → 1849 psi
	Allowable limit	5 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm ² 1991 → 1849 psi

NOTE

- **Never try to disassemble the injection pump assembly. For repairs, you are strongly requested to contact a Kubota-authorized pump service shop.**

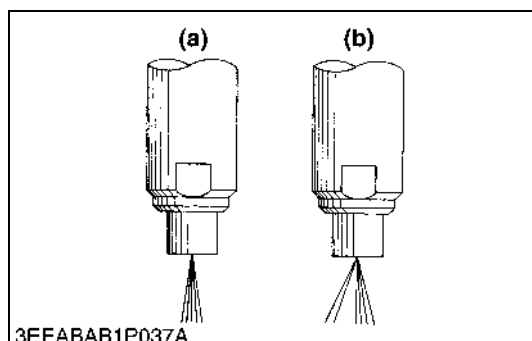
- (1) Injection Nozzle (3) Protection Cover for Jetted Fuel
(2) Injection Pump Pressure Tester

9Y1210598ENS0016US0

CAUTION

- Check the injection pressure and condition after confirming that there is nobody standing in the direction the fume goes.
- If the fume from the nozzle directly contacts the human body, cells may be destroyed and blood poisoning may be caused.

9Y1210598ENS0017US0



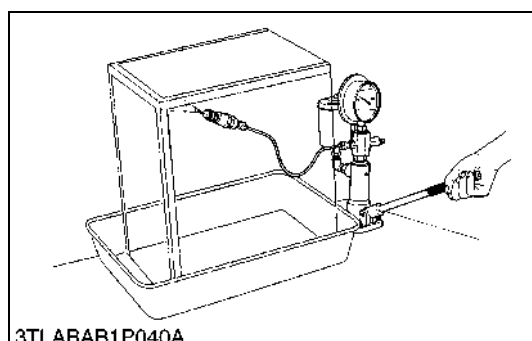
Nozzle Spraying Condition

1. Set the injection nozzle to a nozzle tester (Code No.: 07909-31361), and check the nozzle spraying condition.
2. If the spraying condition is damaged, replace the nozzle piece.

(a) Good

(b) Bad

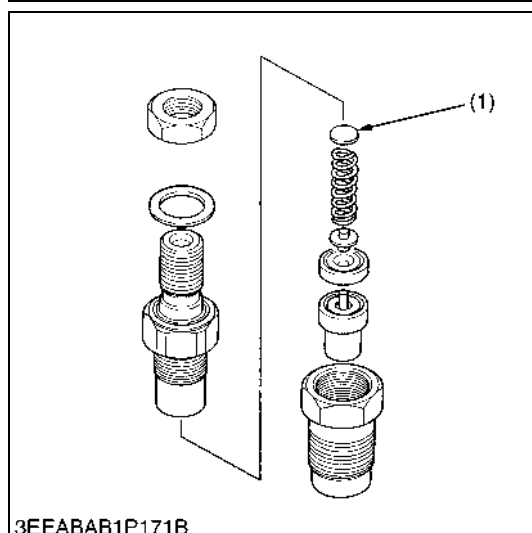
9Y1210598ENS0018US0



Fuel Injection Pressure

1. Set the injection nozzle to a nozzle tester (Code No.: 07909-31361).
2. Slowly move the tester handle to measure the pressure at which fuel begins jetting out from the nozzle.
3. If the measurement is not within the factory specifications, replace the adjusting washer (1) in the nozzle holder to adjust it.

Fuel injection pressure	Factory specification	13.73 to 14.71 MPa 140.0 to 150.0 kgf/cm ² 1992 to 2133 psi
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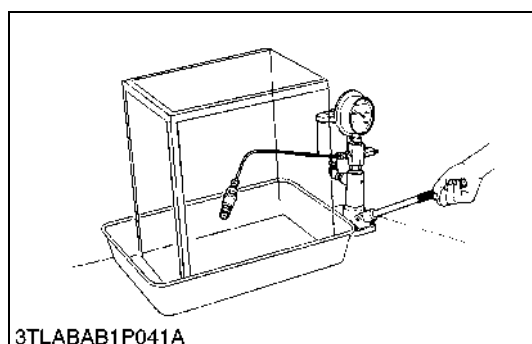


(Reference)

- Pressure variation with 0.025 mm (0.00098 in.) difference of adjusting washer thickness.
Approx. 590 kPa (6.0 kgf/cm², 85 psi)

(1) Adjusting Washer

9Y1210598ENS0019US0



Valve Seat Tightness

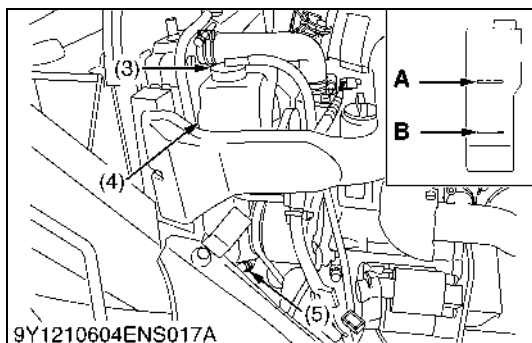
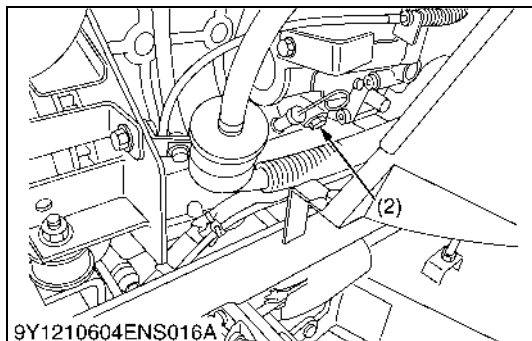
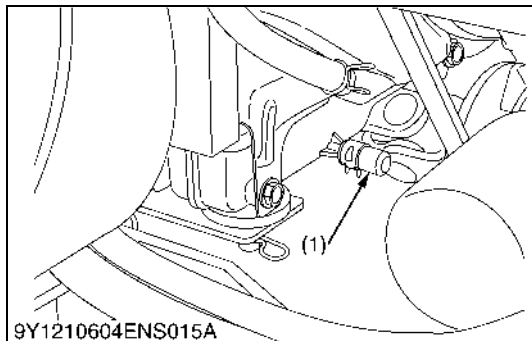
1. Set the injection nozzle to a nozzle tester (Code No.: 07909-31361).
2. Increase the fuel pressure, and keep at 12.75 MPa (130.0 kgf/cm², 1849 psi) for 10 seconds.
3. If any fuel leak is found, replace the nozzle piece.

Valve seat tightness	Factory specification	No fuel leak at 12.75 MPa 130.0 kgf/cm ² 1849 psi
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9Y1210598ENS0020US0

[2] PREPARATION

(1) Separating Engine



Draining Coolant



CAUTION

To avoid personal injury:

- Do not remove the radiator cap when the engine is hot. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.
1. Stop the engine and let cool down.
 2. To drain the coolant, remove the radiator drain plug (1) and the engine drain plug (2), and remove the radiator cap. The radiator cap must be removed to completely drain the coolant.
 3. After all coolant is drained, install the drain plugs.

IMPORTANT

- Do not start engine without coolant.
- Use clean, distilled water and anti-freeze to fill the radiator and recovery tank.
- When the anti-freeze is mixed with water, the anti-freeze mixing ratio must be less than 50 %.
- Securely tighten radiator cap. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.

(When reassembling)

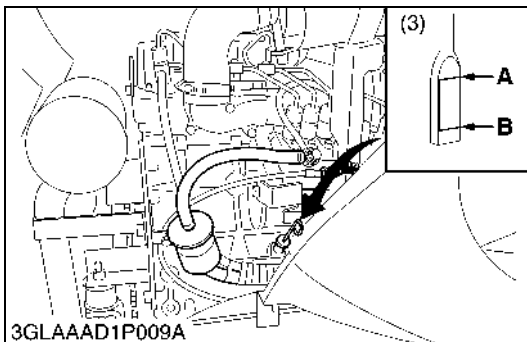
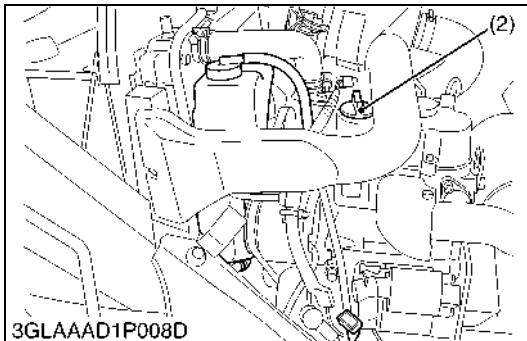
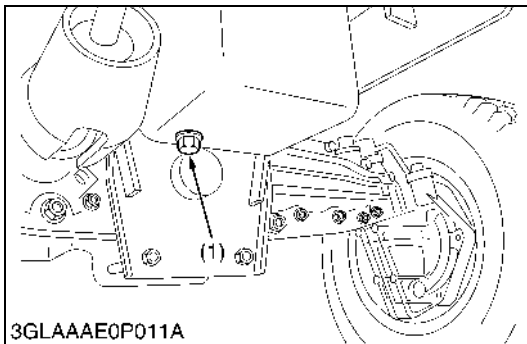
- Fill with clean water and cooling system cleaner.
 - Follow directions of the cleaner instruction.
 - After flushing, fill with clean water and anti-freeze until the radiator.
- Install the radiator cap securely.
- Fill with coolant up to the "FULL", mark on the recovery tank.
 - Start and operate the engine for a few minutes.
 - Stop the engine and let cool.
 - Check coolant level of recovery tank and add coolant if necessary.

Coolant	Capacity	2.1 L 2.2 U.S.qts 1.8 Imp.qts
Recovery tank	Capacity	0.25 L 0.26 U.S.qts 0.22 Imp.qts

- (1) Radiator Drain Plug
- (2) Engine Drain Plug
- (3) Recovery Tank Cap
- (4) Recovery Tank
- (5) Clamp

A: FULL
B: LOW

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Draining Engine Oil

⚠ CAUTION

To avoid personal injury:

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

1. To keep dirt, debris, etc., out of the engine, clean the area around the oil fill cap/dipstick before removing it.
2. Remove the oil drain plug, the oil fill cap, and the dipstick. Be sure to allow ample time for complete drainage.
3. The used oil can be drained out more easily if the engine is warm.
4. Reinstall the drain plug. Make sure it is tightened to **13.6 N·m (10 lbf·ft)** torque.

(When refilling)

- Fill the engine oil up to the upper line on the dipstick (3).

■ IMPORTANT

- Never mix two different type of oil.
- Use the proper SAE Engine Oil according to ambient temperature.

Refer to See "4. LUBRICANTS, FUEL AND COOLANT" on page G-9.

Engine oil	Capacity	2.8 L 2.96 U.S.qts 2.46 Imp.qts
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- (1) Drain Plug
- (2) Oil Inlet
- (3) Dipstick

A: Upper Level

B: Lower Level

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Battery

⚠ CAUTION

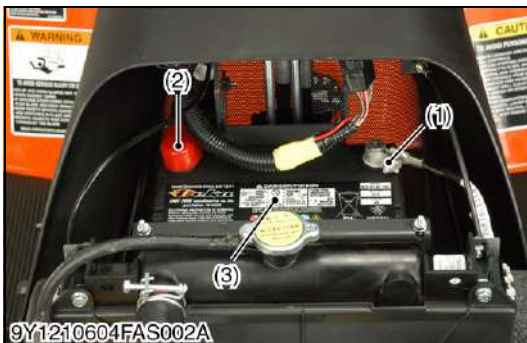
- When disconnecting the battery cables, disconnect the negative cable from the battery first. When connecting, connect the positive cable to the battery first.

1. Open the bonnet.
2. Disconnect the negative cable (1) from the battery.
3. Disconnect the positive cable (2) from the battery and remove the battery (3).

- (1) Negative Cable
- (2) Positive Cable

(3) Battery

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Bonnet and Side Bonnet

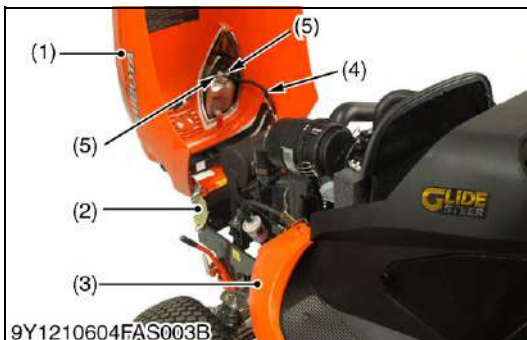
1. Disconnect the connectors (4) from the head light.
2. Remove the wire harness (5) from the bonnet.
3. Remove the bonnet (1) with bonnet bracket (2).
4. Remove the side bonnet (3).

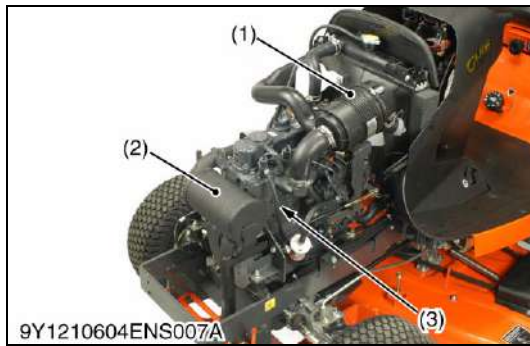
- (1) Bonnet
- (2) Bonnet Bracket
- (3) Side Bonnet

(4) Connector

(5) Wire Harness

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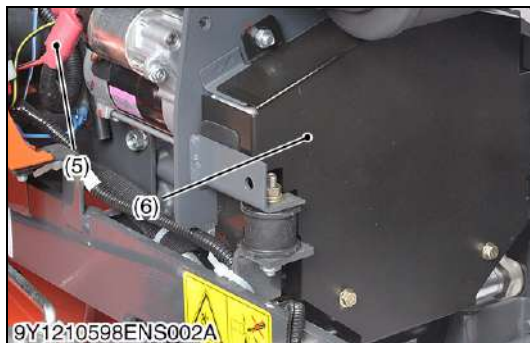
Air Cleaner, Muffler, Fuel Hose and Wire Harness

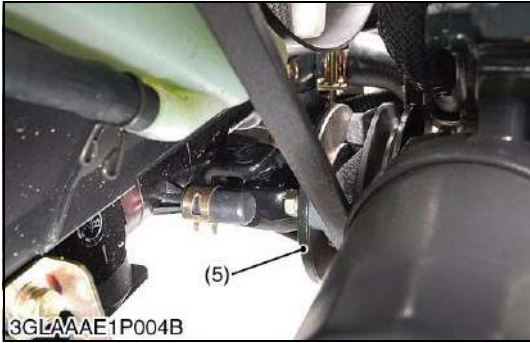
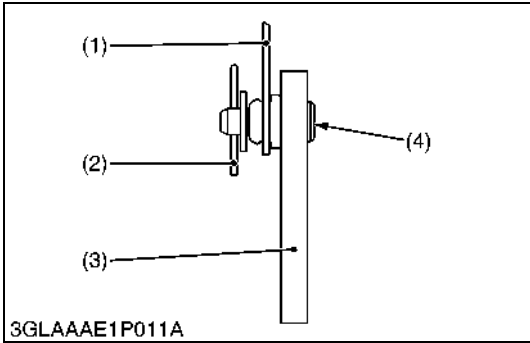
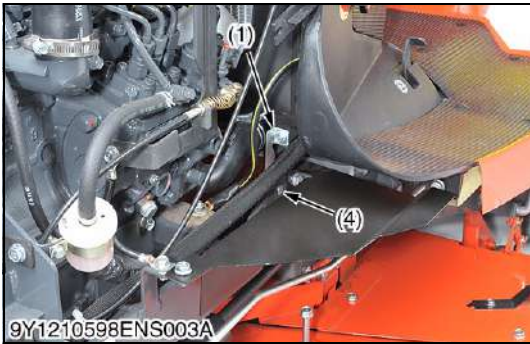
1. Remove the air cleaner (1) and muffler (2).
2. Disconnect the fuel hoses (3).
3. Disconnect the accelerator wire (4).
4. Disconnect the wire harness (5) from engine side.
5. Remove the flywheel cover (6). [GR2120SEU, GR2120F only]

- (1) Air Cleaner
(2) Muffler
(3) Fuel Hose

- (4) Accelerator Wire
(5) Wire Harness
(6) Flywheel Cover

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Engine Assembly

- 1. Remove the radiator stopper snap pins (2).
- 2. Disconnect the front coupling (5).
- 3. Separate the engine assembly (6) with radiator from the frame (3).
- 4. Remove the engine support (7).

(When reassembling)

Tightening torque	Front coupling mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Engine mounting nut	24 N·m 2.4 kgf·m 17 lbf·ft
	Engine support screw	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft

- (1) Radiator Stopper

(2) Radiator Stopper Snap Pin

(3) Frame

(4) Joint Pin
- (5) Front Coupling

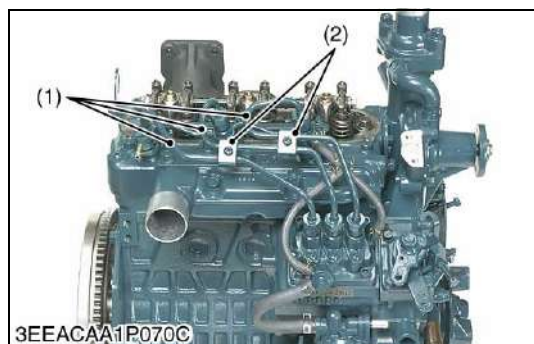
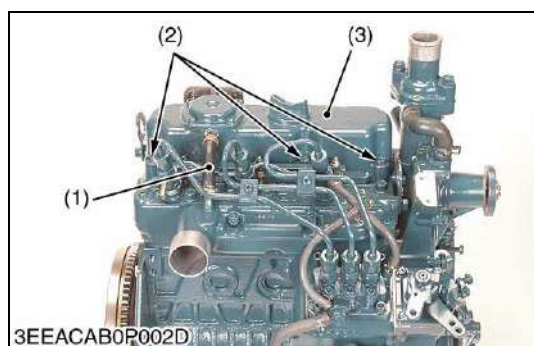
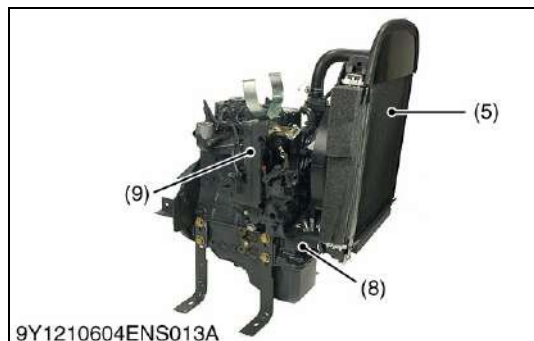
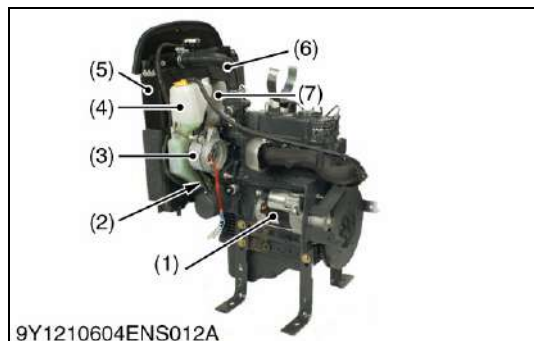
(6) Engine Assembly

(7) Engine Support

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[3] DISASSEMBLING AND ASSEMBLING

(1) Cylinder Head and Valves



Dynamo, Fan Belt and Radiator

1. Disconnect the radiator hoses (6), (8) and separate the radiator (5) with recovery tank (4) from engine assembly.
2. Remove the cooling fan (7) and fan pulley.
3. Remove the dynamo (3) and fan belt (2).
4. Remove the starter (1).
5. Disconnect the air cleaner stay (9) and engine stop solenoid.
6. Remove the wire bracket.

(When reassembling)

- Check to see that there are no cracks on the belt surface.

■ IMPORTANT

- After reassembling the fan belt, be sure to adjust the fan belt tension.

Tightening torque	Air cleaner stay screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
-------------------	------------------------	---

- | | |
|-------------------|-------------------------|
| (1) Starter | (6) Radiator Upper Hose |
| (2) Fan Belt | (7) Cooling Fan |
| (3) Dynamo | (8) Radiator Lower Hose |
| (4) Recovery Tank | (9) Air Cleaner Stay |
| (5) Radiator | |

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Cylinder Head Cover

1. Disconnect the breather hose (1).
2. Remove the cylinder head cover screws (2).
3. Remove the cylinder head cover (3).

(When reassembling)

- Check to see if the cylinder head cover gasket is not damaged.

Tightening torque	Cylinder head cover screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
-------------------	---------------------------	---

- | | |
|--------------------------------|-------------------------|
| (1) Breather Hose | (3) Cylinder Head Cover |
| (2) Cylinder Head Cover Screws | |

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Injection Pipes

1. Loosen the screws to the pipe clamps (2).
2. Detach the injection pipes (1).

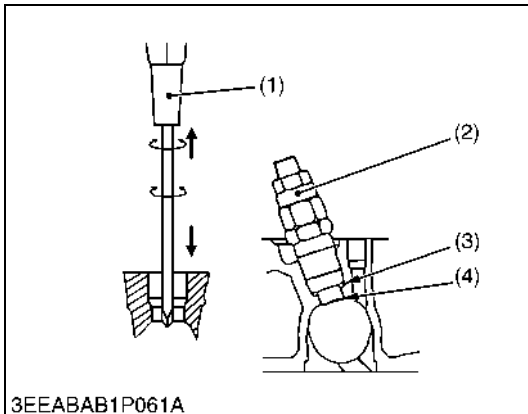
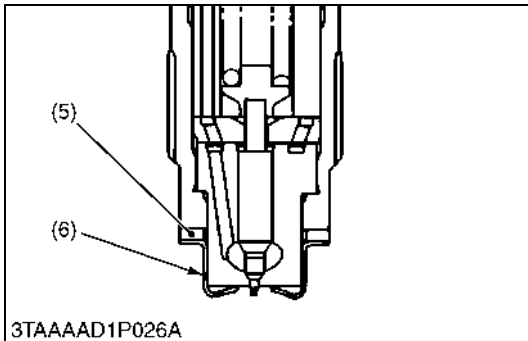
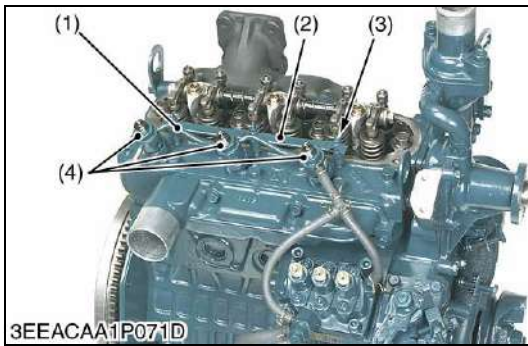
(When reassembling)

- Send compressed air into the pipes to blow out dust. Then, reassemble the pipes in the reverse order.

Tightening torque	Injection pipe retaining nut	25 to 34 N·m 2.5 to 3.5 kgf·m 18 to 25 lbf·ft
-------------------	------------------------------	---

- | | |
|--------------------|----------------|
| (1) Injection Pipe | (2) Pipe Clamp |
|--------------------|----------------|

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Nozzle Holder Assembly and Glow Plug

1. Remove the overflow pipe (1).
2. Remove the nozzle holder assemblies (4).
3. Remove the copper gasket (5) and heat seal (6).
4. Remove the lead (2) from the glow plugs (3).
5. Remove the glow plugs (3).

(When reassembling)

- Replace the copper gasket and heat seal with new one.

Tightening torque	Overflow pipe retaining nut	20 to 24 N·m 2.0 to 2.5 kgf·m 15 to 18 lbf·ft
	Nozzle holder assembly	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft
	Glow plug	7.9 to 14 N·m 0.80 to 1.5 kgf·m 5.8 to 10 lbf·ft

- | | |
|-------------------|----------------------------|
| (1) Overflow Pipe | (4) Nozzle Holder Assembly |
| (2) Lead | (5) Copper Gasket |
| (3) Glow Plug | (6) Heat Seal |

9Y1210598ENS0030US0

Nozzle Heat Seal Service Removal Procedure

■ IMPORTANT

- Use a plus (phillips head) screw driver (1) whose diameter is bigger than the heat seal hole (Approx. 6.0 mm (0.24 in.)).

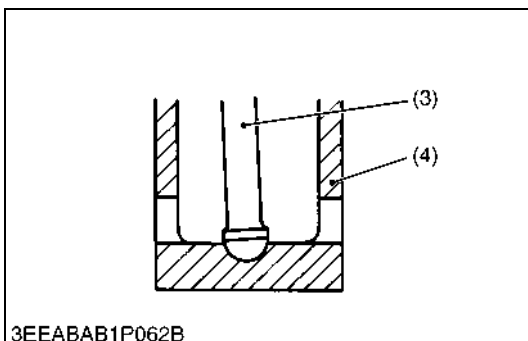
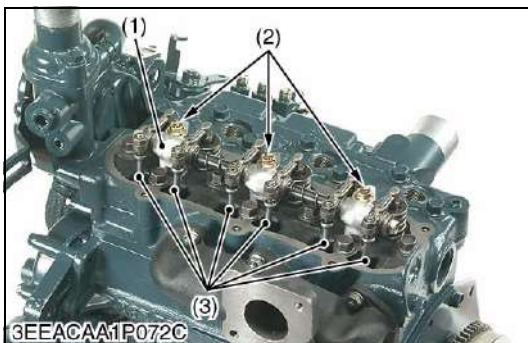
1. Drive screw driver (1) lightly into the heat seal hole.
2. Turn screw driver three or four times each way.
3. While turning the screw driver, slowly pull the heat seal (4) out together with the injection nozzle gasket (3).
4. If the heat seal drops, repeat the above procedure

(When reassembling)

- Heat seal and injection nozzle gasket must be changed when the injection nozzle is removed for cleaning or for service.

- | | |
|-----------------------|-----------------------------|
| (1) Plus Screw Driver | (3) Injection Nozzle Gasket |
| (2) Injection Nozzle | (4) Heat Seal |

9Y1210598ENS0031US0



Rocker Arm and Push Rod

1. Remove the rocker arm bracket screws (2).
2. Detach the rocker arm assembly (1).
3. Remove the push rods (3).

(When reassembling)

- When putting the push rods (3) onto the tappets (4), check to see if their ends are properly engaged with the dimples.

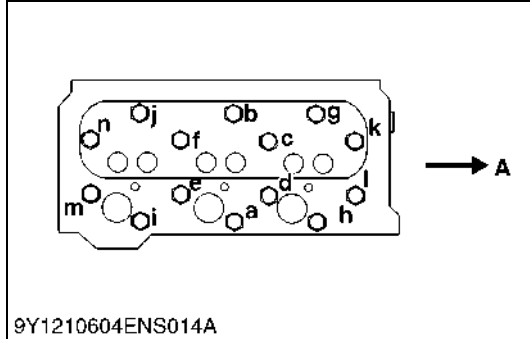
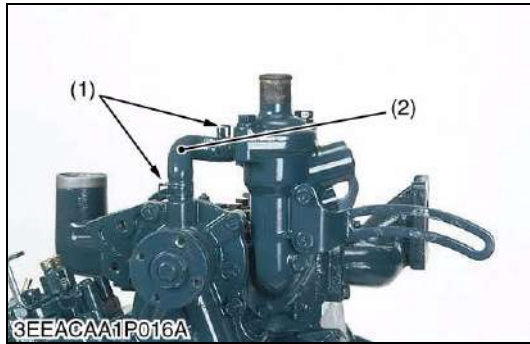
■ IMPORTANT

- After installing the rocker arm, be sure to adjust the valve clearance.

Tightening torque	Rocker arm bracket screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
-------------------	--------------------------	---

- | | |
|-------------------------------|--------------|
| (1) Rocker Arm Assembly | (3) Push Rod |
| (2) Rocker Arm Bracket Screws | (4) Tappet |

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Cylinder Head and Cylinder Head Gasket

1. Loosen the pipe clamps (1), and remove the water return pipe (2).
2. Remove the cylinder head screw in the order of "n to a".
3. Remove the cylinder head gasket.

(When reassembling)

- Replace the cylinder head gasket with a new one.
- To install the gasket, set it to the pin pipe holes. Be careful not to install it reversely.
- The cylinder head should be free of scratches and dust.
- Install the cylinder head, using care not to damage the gasket.
- After applying engine oil to the thread of screws, tighten them in several steps and specified sequence "a to n".

■ NOTE

- Do not use O-ring on the pin pipe.
- It is not necessary to retighten the cylinder head screw and to readjust valve clearance after engine warmed up.

Tightening torque	Cylinder head screw	38 to 42 N·m 3.8 to 4.3 kgf·m 28 to 31 lbf·ft
-------------------	---------------------	---

- (1) Pipe Clamp
- (2) Water Return Pipe
- (3) Pin Pipe

A: Gear Case Side
n to a: To Loosen
a to n: To Tighten

9Y1210598ENS0033US0

Tappets

1. Remove the tappets (1) from the crankcase.

(When reassembling)

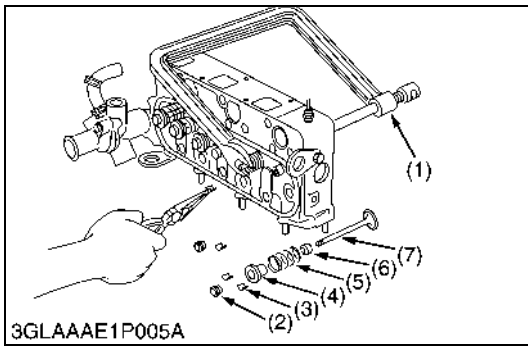
- Visually check the contact between tappets and cams for proper rotation. If defect is found, replace tappets.
- Before installing the tappets, apply engine oil thinly around them.

■ IMPORTANT

- Do not change the combination of tappet and tappet guide.

- (1) Tappet

9Y1210598ENS0034US0



Valves

1. Remove the valve caps (2).
2. Remove the valve spring collet (3), pushing the valve spring retainer (4) by valve spring replacer (1).
3. Remove the valve spring retainer (4), valve spring (5) and valve stem seal (6).
4. Remove the valve (7).

(When reassembling)

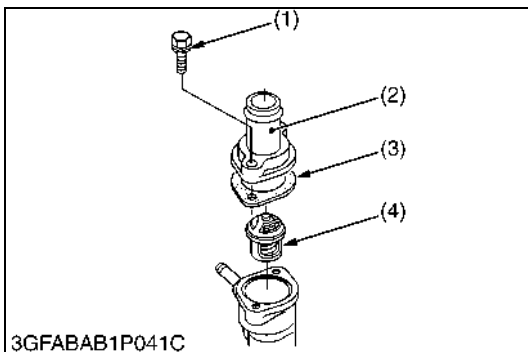
- Wash the valve stem seal and valve guide hole, and apply engine oil sufficiently.
- After installing the valve spring collets, lightly tap the stem to assure proper fit with a plastic hammer.

■ IMPORTANT

- **Do not change the combination of valve and valve guide.**

- | | |
|---------------------------|---------------------|
| (1) Valve Spring Replacer | (5) Valve Spring |
| (2) Valve Cap | (6) Valve Stem Seal |
| (3) Valve Spring Collet | (7) Valve |
| (4) Valve Spring Retainer | |

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Thermostat Assembly

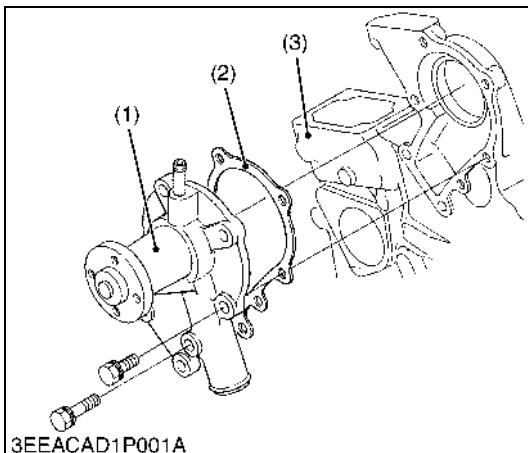
1. Remove the thermostat cover mounting screws (1), and remove the thermostat cover (2).
2. Remove the thermostat assembly (4).

(When reassembling)

- Replace the gasket (3) with a new one.

- | | |
|-------------------------------------|-----------------------------|
| (1) Thermostat Cover Mounting Screw | (3) Thermostat Cover Gasket |
| (2) Thermostat Cover | (4) Thermostat Assembly |

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Water Pump Assembly

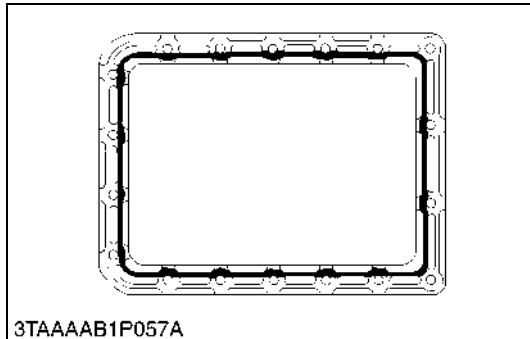
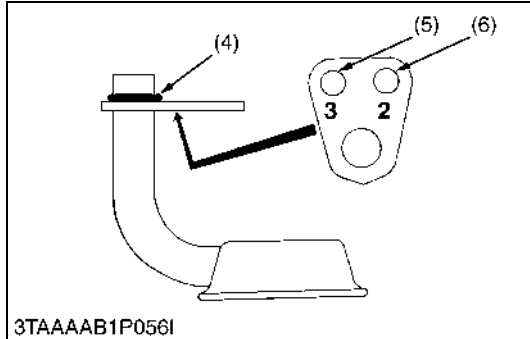
1. Loosen the alternator mounting screws, and remove the fan belt.
2. Remove the fan and fan pulley.
3. Remove the water pump assembly (1) from the gear case cover (3).

(When reassembling)

- Replace the gasket (2) with a new one.

- | | |
|-------------------------|---------------------|
| (1) Water Pump Assembly | (3) Gear Case Cover |
| (2) Water Pump Gasket | |

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Oil Pan and Oil Strainer

1. Remove the oil pan mounting screws (2).
2. Remove the oil pan (1) by lightly tapping the rim of the pan with a wooden hammer.
3. Remove the oil strainer (3).

(When reassembling)

- After cleaning the oil strainer, check to see that the filter mesh is clean, and install it.
- Visually check the O-ring (4), apply engine oil, and install it.
- Securely fit the O-ring to the oil strainer.
- To avoid uneven tightening, tighten oil pan mounting screws in diagonal order from the center.
- Using the hole (5) numbered "3", install the oil strainer by mounting screw.

■ IMPORTANT

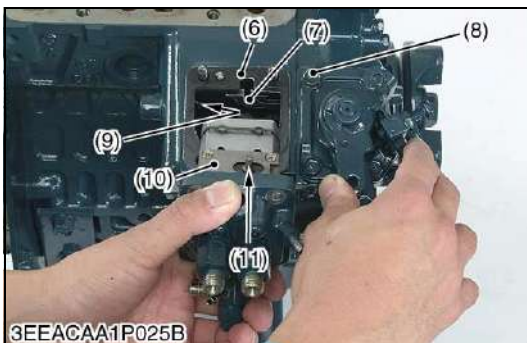
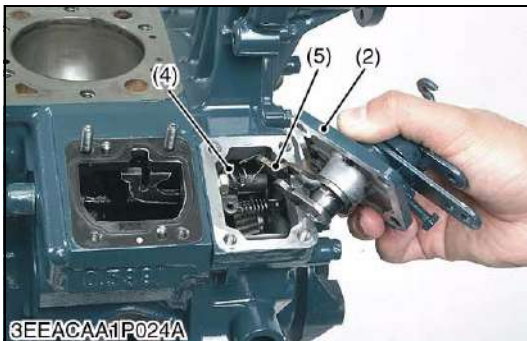
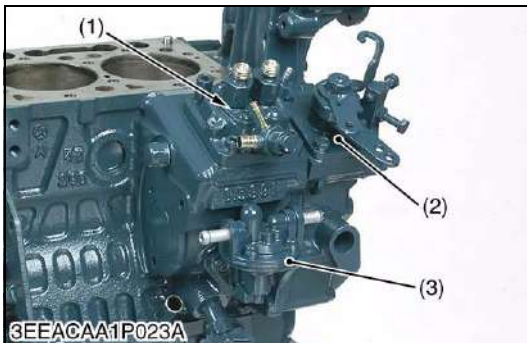
- **Scrape off the old adhesive completely. Wipe the sealing surface clean using waste cloth soaked with gasoline. Now apply new adhesive 3.0 to 5.0 mm (0.12 to 0.19 in.) thick all over the contact surface. Apply the adhesive also on the center of the flange as well as on the inner wall of each bolt hole.**
- **Cut the nozzle of the "liquid gasket" (Three Bond 1207D or equivalent) container at its second notch. Apply "liquid gasket" about 3.0 to 5.0 mm (0.12 to 0.19 in.) thick. Within 20 minutes after the application of fluid sealant, reassemble the components. Wait then for about 30 minutes, and pour oil in the crankcase.**

- (1) Oil Pan
(2) Oil Pan Mounting Screw
(3) Oil Strainer

- (4) O-ring
(5) Hole Numbered "3"
(6) Hole Numbered "2"

9Y1210598ENS0038US0

(2) Gear Case and Timing Gears



Injection Pump, Fuel Feed Pump and Speed Control Plate

1. Remove the socket head screws and nuts, and remove the injection pump (1).
2. Remove the screws and separate the speed control plate (2), taking care not to damage the governor spring (4).
3. Disconnect the governor spring (4) and remove the speed control plate (2).
4. Remove the fuel feed pump (3).

(When reassembling)

- Hook the governor spring (4) to the governor lever (5) first and install the speed control plate (2).
- Be sure to place the copper washers underneath two screws (8). (Two screws (8) in the upper of the speed control plate (2).)
- Position the slot (7) on the fork lever just under the slot (6) on the crankcase.
- Insert the injection pump (1) so that the control rod (10) should be pushed by the idling adjusting spring (9) at its end and the pin (11) on the rod engages with the slot (7) on the fork lever (as shown in the photo).

■ NOTE

- The sealant is applied to both sides of the soft metal gasket shim. The liquid gasket is not required for assembling.
- Addition or reduction of shim (0.05 mm, 0.002 in.) delays or advances the injection timing by approx. 0.009 rad (0.5 °).
- In disassembling and replacing, be sure to use the same number of new gasket shims with the same thickness.

- | | |
|---------------------------|-----------------------------|
| (1) Injection Pump | (7) Slot (Fork Lever Side) |
| (2) Speed Control Plate | (8) Screw and Copper Washer |
| (3) Fuel Feed Pump | (9) Idling Adjusting Spring |
| (4) Governor Spring | (10) Control Rod |
| (5) Governor Lever | (11) Pin |
| (6) Slot (Crankcase Side) | |

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Fan Drive Pulley

1. Secure the flywheel to keep it from turning.
2. Remove the fan drive pulley screw.
3. Pull out the fan drive pulley with a puller.

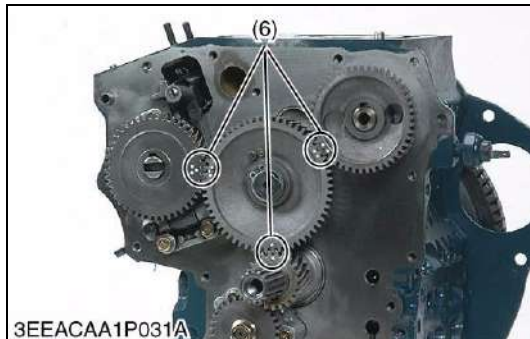
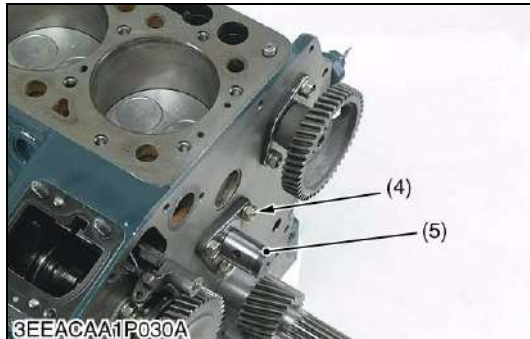
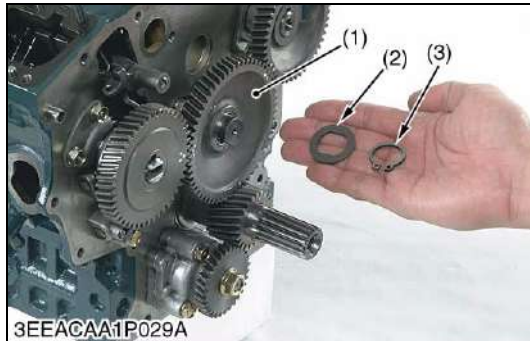
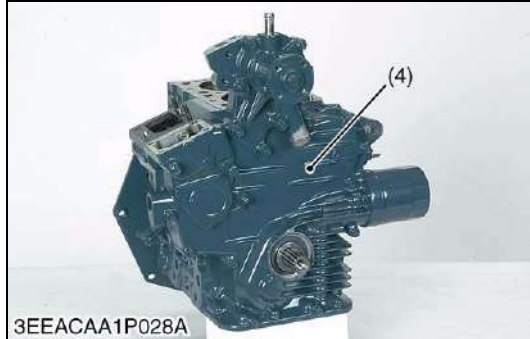
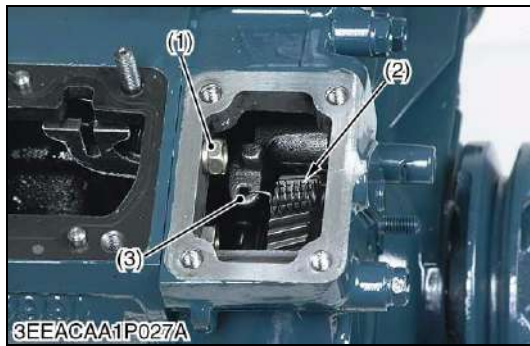
(When reassembling)

- Install the pulley to crankshaft, aligning the mark (1) on them.
- Apply engine oil to the fan drive pulley retaining screw. And tighten it.

Tightening torque	Fan drive pulley screw	118 to 127 N·m 12.0 to 13.0 kgf·m 86.8 to 94.0 lbf·ft
-------------------	------------------------	---

- (1) Alignment Mark

9Y1210598ENS0040US0



Gear Case

1. Disconnect the start spring (2) from the fork lever 1 (3).
2. Remove the screw (1) of inside the gear case and outside screws.
3. Remove the gear case (4).

(When reassembling)

- Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the gear case gasket.
- Be sure to set three O-rings inside the gear case.

(1) Screw (Inside)
(2) Start Spring

(3) Fork Lever 1
(4) Gear Case

9Y1210598ENS0041US0

Idle Gear

1. Remove the external snap ring (3), the collar (2) and the idle gear (1).
2. Remove the idle gear shaft mounting screws (4).
3. Remove the idle gear shaft (5) (if necessary).

(When reassembling)

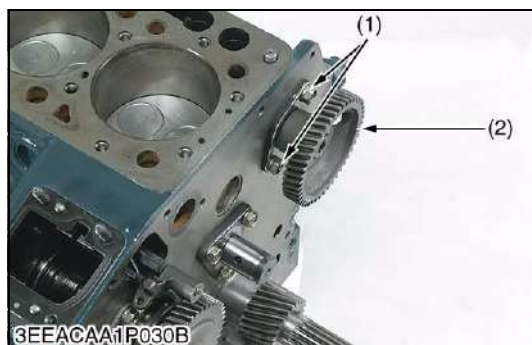
- Apply engine oil to the idle gear shaft mounting screw (4). And tighten them.
- Install the idle gear, aligning the mark (6) on the gears referring to the photo.

Tightening torque	Idle gear shaft mounting screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
-------------------	--------------------------------	---

(1) Idle Gear Assembly
(2) Idle Gear Collar
(3) External Snap Ring

(4) Idle Gear Shaft Mounting Screw
(5) Idle Gear Shaft
(6) Alignment Mark

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Camshaft

1. Remove the camshaft mounting screws (1) and pull out the camshaft with gear (2) on it.

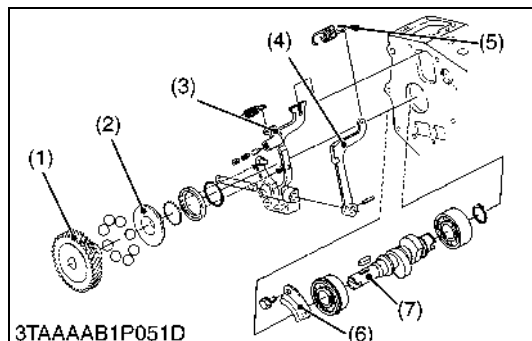
(When reassembling)

- To install the camshaft, apply engine oil to the camshaft journals.
- Apply engine oil to the camshaft mounting screws. And tighten them.

(1) Camshaft Mounting Screw

(2) Camshaft Gear

9Y1210598ENS0043US0



Fuel Camshaft

1. Remove the retaining plate (6).
2. Remove the fork lever holder mounting screws (8), then pull out the injection pump gear (1) and fuel camshaft (7) with the governor fork assembly.

(When reassembling)

- Hook the governor spring (5) to the fork lever 2 (4) before installing the fork lever assembly to the crankcase.

(1) Injection Pump Gear

(5) Governor Spring

(2) Governor Sleeve

(6) Retaining Plate

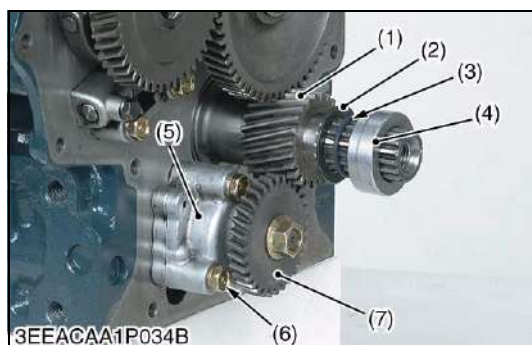
(3) Fork Lever 1

(7) Fuel Camshaft

(4) Fork Lever 2

(8) Fork Lever Holder Mounting Screw

9Y1210598ENS0044US0



Oil Pump and Crankshaft Gear

1. Remove the oil pump gear (7).
2. Remove the oil pump mounting screw (6) and the oil pump (5).
3. Remove the collar (4), O-ring (3) and crankshaft oil slinger (2).
4. Remove the crankshaft gear (1) with a puller

(When reassembling)

- Install the collar (4) after aligning the marks on the gears. (See the photo at "Idle Gear".)

Tightening torque	Oil pump mounting screw	18 to 21 N·m
		1.8 to 2.2 kgf·m
		13 to 15 lbf·ft

(1) Crankshaft Gear

(5) Oil Pump

(2) Crankshaft Oil Slinger

(6) Oil Pump Mounting Screw

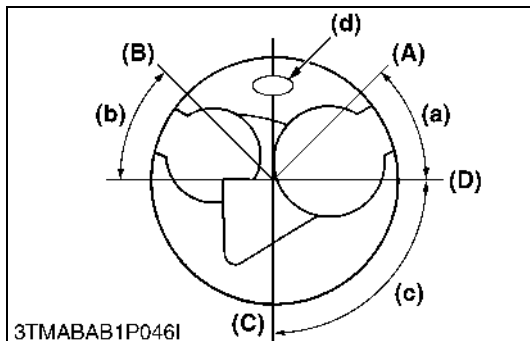
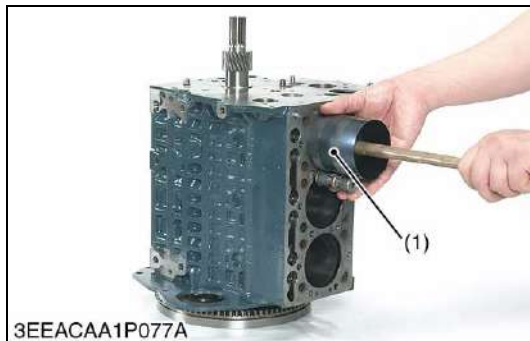
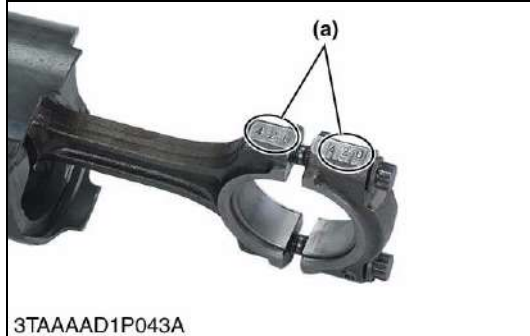
(3) O-ring

(7) Oil Pump Gear

(4) Crankshaft Collar

9Y1210598ENS0045US0

(3) Piston and Connecting Rod



Connecting Rod Cap

1. Remove the connecting rod caps (1) using a bihexagonal 8 mm socket.

(When reassembling)

- Align the marks (a) with each other. (Face the marks toward the injection pump.)
 - Apply engine oil to the connecting rod screws and lightly screw it in by hand, then tighten it to the specified torque.
- If the connecting rod screw won't be screwed in smoothly, clean the threads.
- If the connecting rod screw is still hard to screw in, replace it.

Tightening torque	Connecting rod screw	27 to 30 N·m 2.7 to 3.1 kgf·m 20 to 22 lbf·ft
-------------------	----------------------	---

(1) Connecting Rod Cap

(a) Mark

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Piston

1. Turn the flywheel and bring the piston to top dead center.
2. Pull out the piston upward by lightly tapping it from the bottom of the crankcase with the grip of a hammer.
3. Pull out the other pistons after the same method as above.

(When reassembling)

- Before inserting the piston into the cylinder, apply enough engine oil to the cylinder.
- When inserting the piston into the cylinder, face the mark on the connecting rod to the injection pump.

NOTE

- Do not change the combination of cylinder and piston. Make sure of the position of each piston by marking. For example, mark "1" on the No. 1 piston.
- When installing the piston into the cylinder, place the gaps of all of the piston rings as shown in the figure.
- Carefully insert the piston using a piston ring compressor (1). Otherwise, their chrome-plated section may be scratched, causing trouble inside the cylinder.

Models	Mark
D782	B

(1) Piston Ring Compressor

(a) 0.79 rad (45°)

(b) 0.79 rad (45°)

(c) 1.6 rad (90°)

(d) Mark

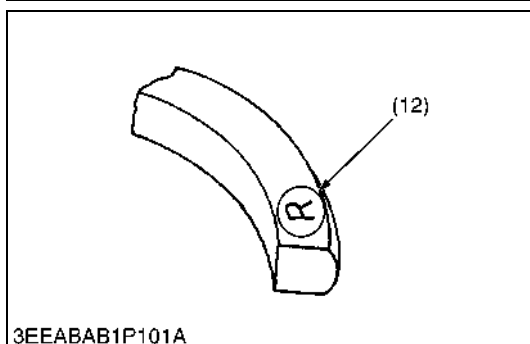
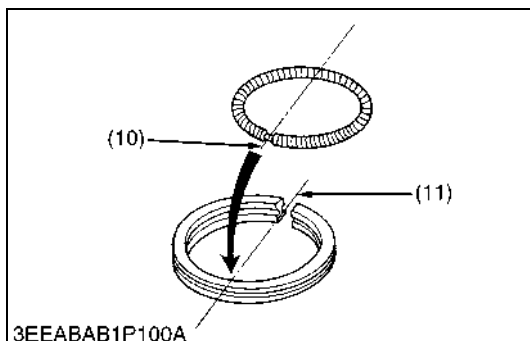
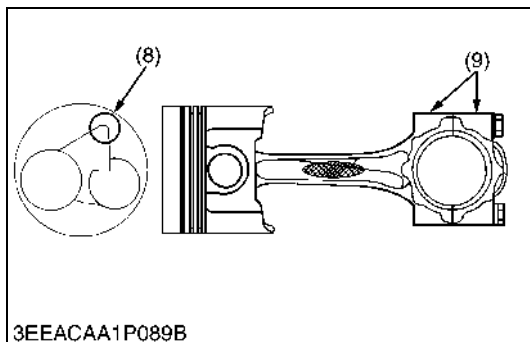
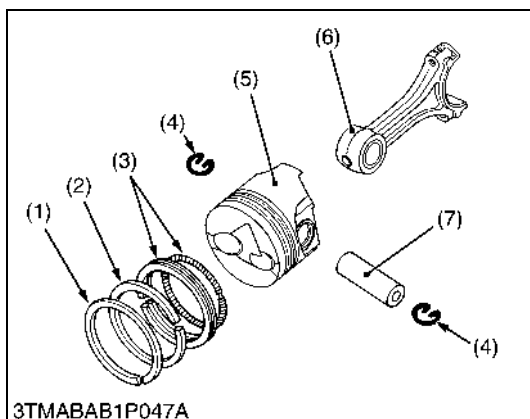
(A) Top Ring Gap

(B) Second Ring Gap

(C) Oil Ring Gap

(D) Piston Pin Hole

9Y1210598ENS0047US0



Piston Ring and Connecting Rod

1. Remove the piston rings using a piston ring tool.
2. Remove the piston pin (7), and separate the connecting rod (6) from the piston (5).

(When reassembling)

- When installing the ring, assemble the rings so that the manufacturer's mark (12) near the gap faces the top of the piston.
- When installing the oil ring onto the piston, place the expander joint (10) on the opposite side of the oil ring gap (11).
- Apply engine oil to the piston pin.
- When installing the connecting rod to the piston, immerse the piston in 80 °C (176 °F) oil for 10 to 15 minutes and insert the piston pin to the piston.
- When installing the connecting rod to the piston, align the mark (9) on the connecting rod to the fan-shaped concave (8).

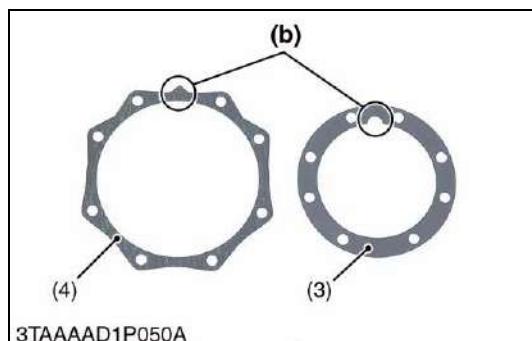
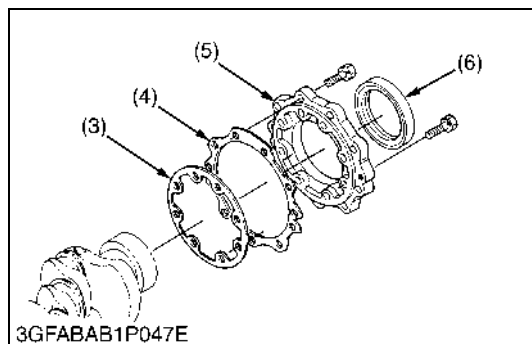
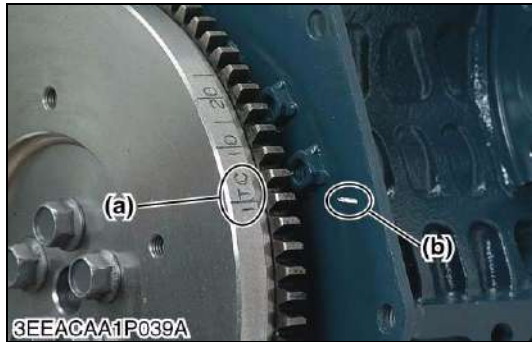
■ IMPORTANT

- **Mark the same number on the connecting rod and the piston so as not to change the combination.**

- | | |
|--------------------------|-------------------------|
| (1) Top Ring | (7) Piston Pin |
| (2) Second Ring | (8) Fan-Shaped Concave |
| (3) Oil Ring | (9) Mark |
| (4) Piston Pin Snap Ring | (10) Expander Joint |
| (5) Piston | (11) Oil Ring Gap |
| (6) Connecting Rod | (12) Manufacture's Mark |

9Y1210598ENS0048US0

(4) Flywheel and Crankshaft



Flywheel

1. Secure the flywheel to keep it from turning using a flywheel stopper. (See page G-55.)
2. Remove all flywheel screws (1) and then remove the flywheel (2).

(When reassembling)

- Set the No. 1 crankpin at the top dead center (T.D.C.).
- Align the "1TC" mark (a) on the outer surface of the flywheel horizontally with the alignment mark (b) on the rear end plate.
- Apply engine oil to the threads and the undercut surface of the flywheel screw and fit the screw.

Tightening torque	Flywheel screw	54 to 58 N·m 5.5 to 6.0 kgf·m 40 to 43 lbf·ft
-------------------	----------------	---

- (1) Flywheel Screw
(2) Flywheel

- (a) 1TC Mark
(b) Alignment Mark

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Bearing Case Cover

1. Remove the bearing case cover mounting screws. First, remove inside screws (1) and then outside screws (2).
2. Remove the bearing case cover (5).

(When reassembling)

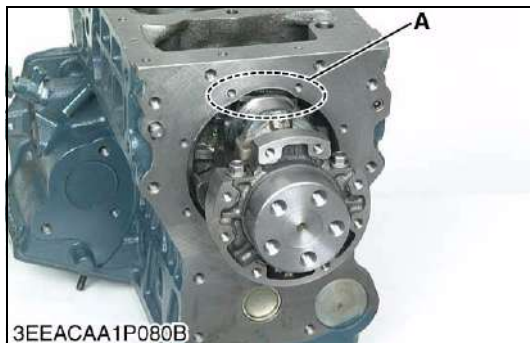
- Fit the bearing case gasket (3) and the bearing case cover gasket (4) with correct directions.
- Install the bearing case cover (5) to position the casting mark "UP" (a) on it upward.
- Apply engine oil to the oil seal (6) lip and be careful that it is not rolled when installing.
- Tighten the bearing case cover mounting screws with even force on the diagonal line.

Tightening torque	Bearing case cover mounting screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
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- (1) Bearing Case Cover Mounting Screw (Inside)
(2) Bearing Case Cover Mounting Screw (Outside)
(3) Bearing Case Gasket
(4) Bearing Case Cover Gasket
(5) Bearing Case Cover
(6) Oil Seal

- (a) Top Mark "UP"
(b) Upside

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Crankshaft Assembly

1. Remove the main bearing case screw 2 (1).
2. Turn the crankshaft to set the crankpin of the third cylinder to the bottom dead center. Then pull out the crankshaft until the crankpin of the second cylinder comes to the center of the third cylinder.
3. Turn the crankshaft by 2.09 rad (120 °) counterclockwise to set the crankpin of the second cylinder to the bottom dead center. Pull out the crankshaft until the crankpin of the first cylinder comes to the center of the third cylinder.
4. Repeat the above steps to pull out all the crankshaft.

(When reassembling)

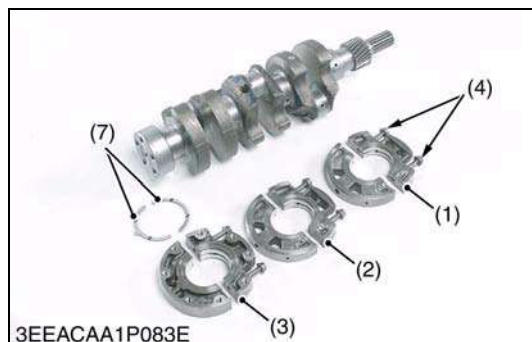
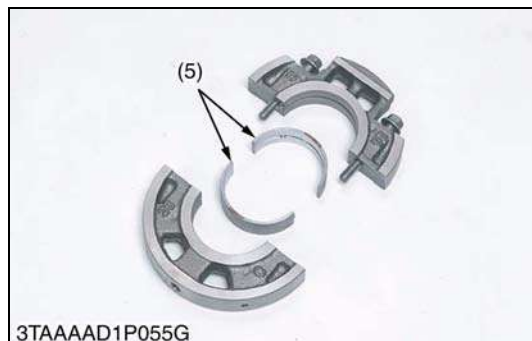
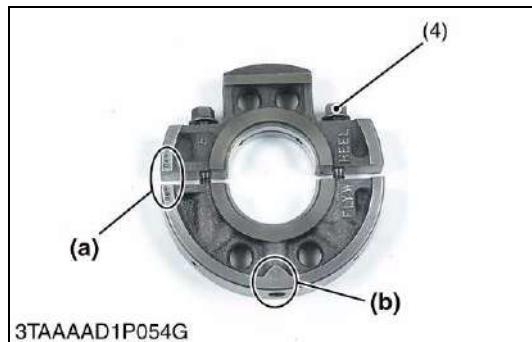
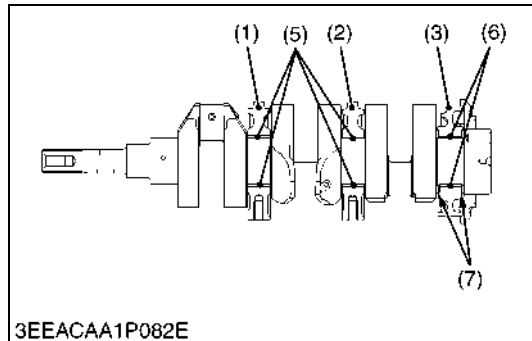
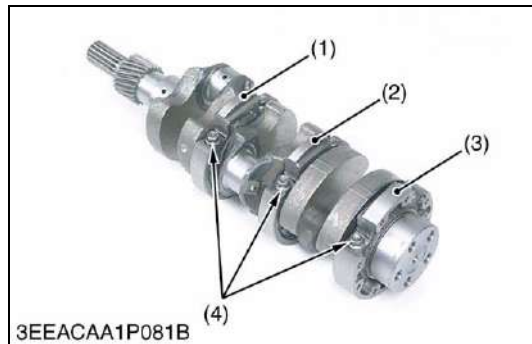
- Clean the oil passage of the crankshaft with compressed air.
- Install the crankshaft assembly, aligning the screw hole of main bearing case screw 2 with the screw hole of crankcase.
- When tightening the main bearing case 2, apply oil to the main bearing case screw 2 (1) and screw by hand before tightening the specific torque. If not smooth to screw by hand, align the screw holes between the crankcase and the main bearing case.

Tightening torque	Main bearing case screw 2	27 to 30 N·m 2.7 to 3.1 kgf·m 20 to 22 lbf·ft
-------------------	---------------------------	---

(1) Main Bearing Case Screw 2

A: Cut place for removing and installing the crankshaft

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Main Bearing Case Assembly

1. Remove the two main bearing case screws 1 (4), and remove the main bearing case assembly 1 (1), being careful with crankshaft bearing 3 (5).
2. Remove the main bearing case assembly 2 (2) and the main bearing case assembly (3) as above. Keep in mind, however, that the thrust bearing (7) is installed in the main bearing case assembly (3).

(When reassembling)

- Clean the oil passage in the main bearing cases.
- Apply clean engine oil to the bearings.
- Install the main bearing case assemblies in original positions. Since diameters of main bearing cases vary, install them in order of marking **(b)** from the gear case side. (Refer to the figure.)
- Match the alignment numbers **(a)** on the main bearing case assembly 1 (1).
- Do the same for the main bearing case assembly 2 (2) and the main bearing case assembly (3) too.
- When installing the main bearing case 1 and 2, face the mark **"FLYWHEEL"** to the flywheel.
- Install the thrust bearing (7) with its oil groove facing outward.
- Confirm that the main bearing case moves smoothly after tightening the main bearing case screw 1 to the specified torque.

Tightening torque	Main bearing case screw 1	13 to 15 N·m 1.3 to 1.6 kgf·m 9.4 to 11 lbf·ft
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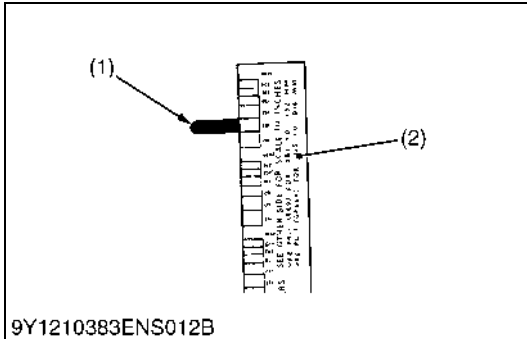
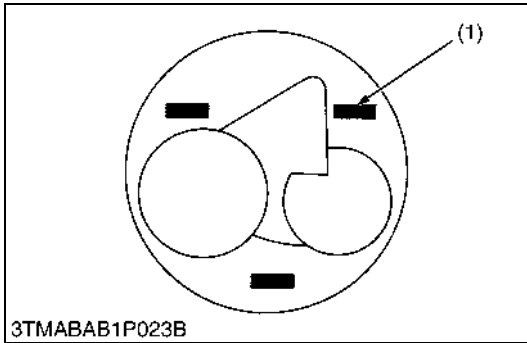
- (1) Main Bearing Case Assembly 1
- (2) Main Bearing Case Assembly 2
- (3) Main Bearing Case Assembly
- (4) Main Bearing Case Screw 1
- (5) Crankshaft Bearing 3
- (6) Crankshaft Bearing 2
- (7) Thrust Bearing

- (a) Alignment Number**
- (b) Marking (1 or 2)**

9Y1210598ENS0052US0

[4] SERVICING

(1) Cylinder Head and Valve



Top Clearance

1. Remove the cylinder head. (Do not attempt to remove the cylinder head gasket.)
2. Move the piston up, and stick a strip of plastigauge (1) on the piston head at three positions with grease so as to avoid the intake and exhaust valves and the combustion chamber ports.
3. Lower the piston, and install the cylinder head and tighten the cylinder head screws to the specified torque.
4. Turn the flywheel until the piston exceeds its top dead center.
5. Remove the cylinder head, and measure the plastigauge (1).
6. If the measurement is not within the factory specifications, check the oil clearance between the crankpin and crankpin bearing and between the piston pin and small end bushing.

NOTE

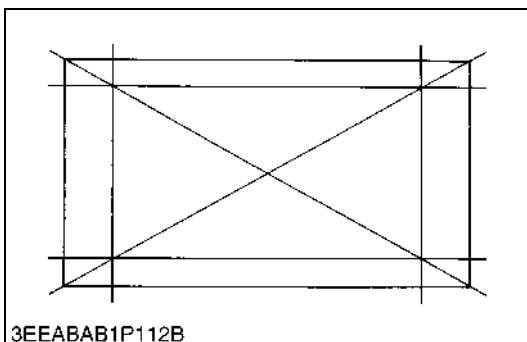
- After checking the top clearance, be sure to assemble the cylinder head with a new cylinder head gasket.

Top clearance	Factory specification	0.50 to 0.70 mm 0.020 to 0.027 in.
Tightening torque	Cylinder head screw	38 to 42 N·m 3.8 to 4.3 kgf·m 28 to 31 lbf·ft

(1) Plastigauge

(2) Scale

9Y1210598ENS0005US0



Cylinder Head Surface Flatness

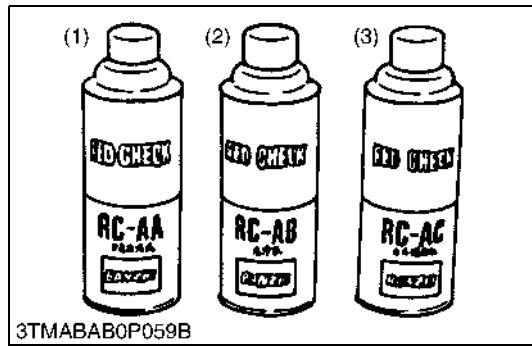
1. Clean the cylinder head surface.
2. Place a straightedge on the cylinder head's four sides and two diagonal as shown in the figure.
3. Measure the clearance with a thickness gauge.
4. If the measurement is more than the allowable limit, correct it with a surface grinder.

IMPORTANT

- Do not place the straightedge on the combustion chamber.
- Be sure to check the valve recessing after correcting.

Cylinder head surface flatness	Factory specification	0.05 mm 0.002 in.
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9Y1210598ENS0053US0



Cylinder Head Flaw

1. Prepare an air spray red check.
2. Clean the surface of the cylinder head with detergent (2).
3. Spray the cylinder head surface with the red permeative liquid (1). Leave it five to ten minutes after spraying.
4. Wash away the red permeative liquid on the cylinder head surface with the detergent (2).
5. Spray the cylinder head surface with white developer (3).
6. If flawed, it can be identified as red marks.

(1) Red Permeative Liquid
(2) Detergent

(3) White Developer

9Y1210598ENS0054US0



Valve Recessing

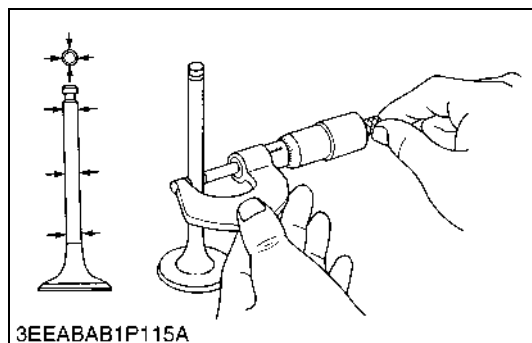
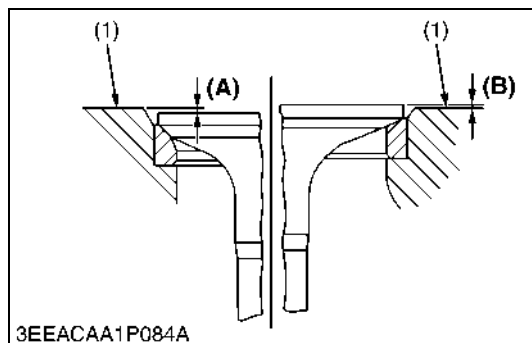
1. Clean the cylinder head surface, valve face and valve seat.
2. Insert the valve into the valve guide.
3. Measure the valve recessing with a depth gauge.
4. If the measurement is more than the allowable limit, replace the valve.
5. If it still is more than the allowable limit after replacing the valve, replace the cylinder head.

Valve recessing (Intake and exhaust)	Factory specification	-0.10 (protrusion) to 0.10 (recessing) mm -0.0039 (protrusion) to 0.0039 (recessing) in.
	Allowable limit	0.30 (recessing) mm 0.012 (recessing) in.

(1) Cylinder Head Surface

(A) Recessin
(B) Protrusion

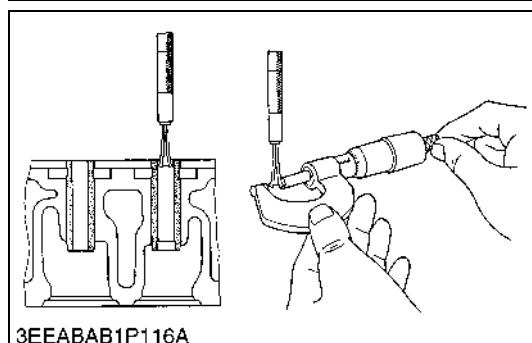
9Y1210598ENS0055US0



Clearance between Valve Stem and Valve Guide

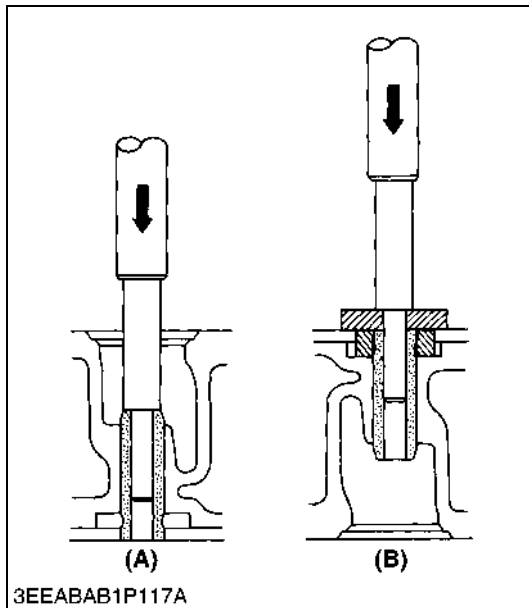
1. Remove carbon from the valve guide section.
2. Measure the valve stem O.D. with an outside micrometer.
3. Measure the valve guide I.D. with a small hole gauge, and calculate the clearance.
4. If the clearance is more than the allowable limit, replace the valves. If it still is more than the allowable limit, replace the valve guide.

Clearance between valve stem and valve guide	Factory specification	0.030 to 0.057 mm 0.0012 to 0.0022 in.
	Allowable limit	0.10 mm 0.0039 in.



Valve stem O.D.	Factory specification	5.968 to 5.980 mm 0.2350 to 0.2354 in.
Valve guide I.D.	Factory specification	6.010 to 6.025 mm 0.2367 to 0.2372 in.

9Y1210598ENS0056US0



Replacing Valve Guide

(When removing)

1. Press out the used valve guide using a valve guide replacing tool. (See page G-54.)

(When installing)

1. Clean a new valve guide and valve guide bore, and apply engine oil to them.
2. Press in a new valve guide using a valve guide replacing tool.
3. Ream precisely the I.D. of the valve guide to the specified dimension.

Valve guide I.D. (intake and exhaust)	Factory specification	6.010 to 6.025 mm 0.2367 to 0.2372 in.
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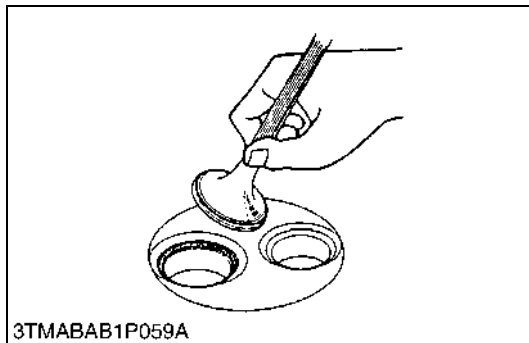
■ IMPORTANT

- Do not hit the valve guide with a hammer during replacement.

(A) When Removing

(B) When Installing

9Y1210598ENS0057US0



Valve Seating

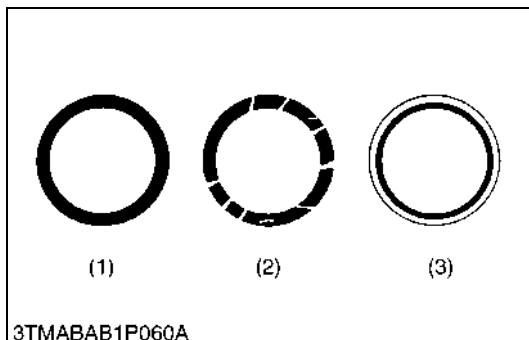
1. Coat the valve face lightly with prussian blue and put the valve on its seat to check the contact.
2. If the valve does not seat all the way around the valve seat or the valve contact is less than 70 %, correct the valve seating as follows.
3. If the valve contact does not comply with the reference value, replace the valve or correct the contact of valve seating.

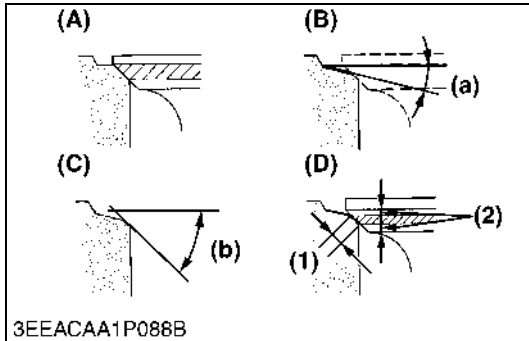
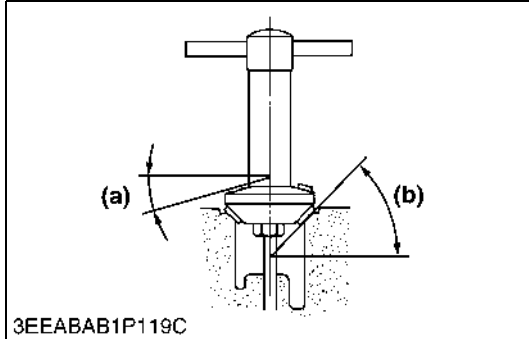
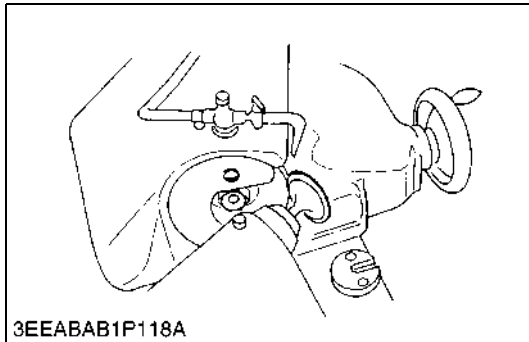
Valve seat width	Factory specification	2.12 mm 0.0835 in.
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- (1) Correct
(2) Incorrect

(3) Incorrect

9Y1210598ENS0058US0





Correcting Valve and Valve Seat

NOTE

- Before correcting the valve and seat, check the valve stem and the I.D. of valve guide section, and repair them if necessary.
- After correcting the valve seat, be sure to check the valve recessing.

(1) Correcting Valve

1. Correct the valve with a valve refacer.

Valve face angle	Factory specification	0.79 rad 45 °
------------------	-----------------------	------------------

(2) Correcting Valve Seat

1. Slightly correct the seat surface with a 0.79 rad (45 °) valve seat cutter.
2. Fitting the valve, check the contact position of the valve face and seat surface with prussian blue. (Visual check) [If the valve has been used for a long period, the seat tends to come in contact with the upper side of the valve face.]
3. Grind the upper surface of the seat with a 0.26 rad (15 °) valve seat cutter until the valve seat touches to the center of the valve face (so that (1) equals (2) as shown in the figure.)
4. Grind the seat with a 0.79 rad (45 °) valve seat cutter again, and visually recheck the contact between the valve and seat
5. Repeat steps 3 and 4 until the correct contact is achieved.
6. Continue lapping until the seated rate becomes more than 70 % of the total contact area.

Valve seat angle	Factory specification	0.79 rad 45 °
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- (1) Valve Seat Width
(2) Identical Dimensions

- (A) Check Contact
(B) Correct Seat Width
(C) Check Seat Surface
(D) Check Contact
(a) 0.26 rad (15 °)
(b) 0.79 rad (45 °)

9Y1210598ENS0059US0

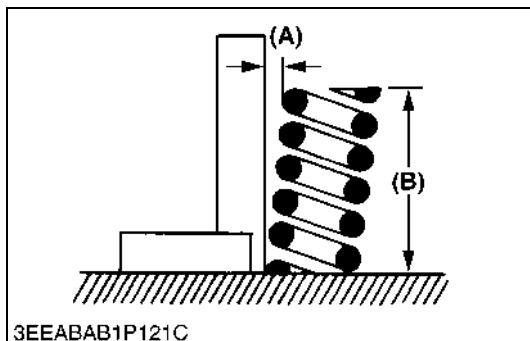
Valve Lapping

1. Apply compound evenly to the valve lapping surface.
2. Insert the valve into the valve guide. Lap the valve onto its seat with a valve flapper or screwdriver.
3. After lapping the valve, wash the compound away and apply oil, then repeat valve lapping with oil.
4. Apply prussian blue to the contact surface to check the seated rate. If it is less than 70 %, repeat valve lapping again.

IMPORTANT

- When valve lapping is performed, be sure to check the valve recessing and adjust the valve clearance after assembling the valve.

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Free Length and Tilt of Valve Spring

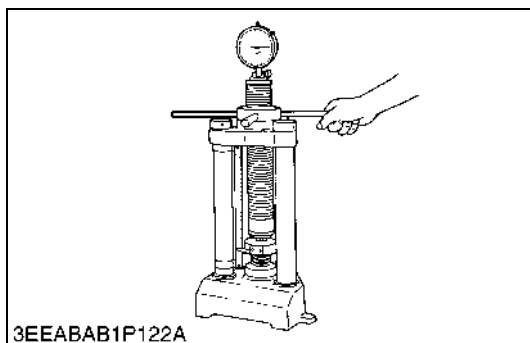
1. Measure the free length **(B)** of valve spring with vernier calipers. If the measurement is less than the allowable limit, replace it.
2. Put the valve spring on a surface plate, place a square on the side of the valve spring.
3. Check to see if the entire side is in contact with the square. Rotate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

Tilt (A)	Allowable limit	1.2 mm 0.047 in.
Free length (B)	Factory specification	31.3 to 31.8 mm 1.24 to 1.25 in.
	Allowable limit	28.4 mm 1.12 in.

(A) Tilt

(B) Free Length

9Y1210598ENS0061US0



Valve Spring Setting Load

1. Place the valve spring on a tester and compress it to the same length it is actually compressed 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	65 N / 27.0 mm 6.6 kgf / 27.0 mm 15 lbf / 1.06 in.
	Allowable limit	55 N / 27.0 mm 5.6 kgf / 27.0 mm 12 lbf / 1.06 in.

9Y1210598ENS0062US0



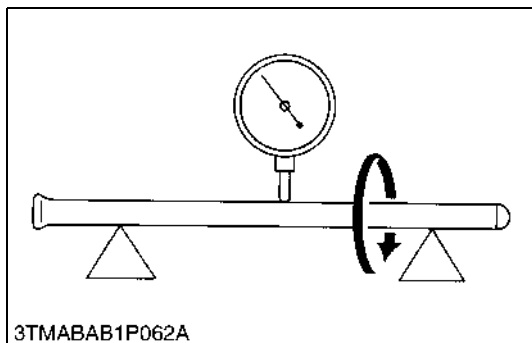
Oil Clearance between Rocker Arm and Rocker Arm Shaft

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 is more than the allowable limit, replace the rocker arm and measure the oil clearance again. If it still is more than 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	0.15 mm 0.0059 in.

Rocker arm shaft O.D.	Factory specification	10.473 to 10.484 mm 0.41233 to 0.41275 in.
Rocker arm I.D.	Factory specification	10.500 to 10.518 mm 0.41339 to 0.41409 in.

9Y1210598ENS0063US0



Push Rod Alignment

1. Place the push rod on V blocks.
2. Measure the push rod alignment.
3. If the measurement is more than the allowable limit, replace the push rod.

Push rod alignment	Allowable limit	0.25 mm 0.0098 in.
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9Y1210598ENS0064US0



Oil Clearance between Tappet and Tappet Guide Bore

1. Measure the tappet O.D. with an outside micrometer.
2. Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance is more than the allowable limit or the tappet is damaged, replace the tappet.

Oil clearance between tappet and tappet guide bore	Factory specification	0.016 to 0.052 mm 0.00063 to 0.0020 in.
	Allowable limit	0.10 mm 0.0039 in.



Tappet O.D.	Factory specification	17.966 to 17.984 mm 0.70733 to 0.70803 in.
Tappet guide bore I.D.	Factory specification	18.000 to 18.018 mm 0.70867 to 0.70937 in.

9Y1210598ENS0065US0

(2) Timing Gear



Timing Gear Backlash

1. Set a dial indicator (lever type) with its tip on the gear tooth.
2. Move the gear to measure the backlash, holding its mating gear.
3. If the backlash is more than the allowable limit, check the oil clearance of the shaft and the gear.
4. If the oil clearance is proper, replace the gear.

Backlash between idle gear and crank gear	Factory specification	0.0430 to 0.124 mm 0.00170 to 0.00488 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between idle gear and cam gear	Factory specification	0.0470 to 0.123 mm 0.00185 to 0.00484 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between idle gear and injection pump gear	Factory specification	0.0460 to 0.124 mm 0.00182 to 0.00488 in.
	Allowable limit	0.15 mm 0.0059 in.

Injection pump gear to governor gear	Factory specification	0.0410 to 0.123 mm 0.00162 to 0.00484 in.
	Allowable limit	0.15 mm 0.0059 in.

9Y1210598ENS0066US0



Idle Gear Side Clearance

1. Set a dial indicator with its tip on the idle gear.
2. Measure the side clearance by moving the idle gear to the front and rear.
3. If the measurement is more than the allowable limit, replace the idle gear collar.

Idle gear side clearance	Factory specification	0.20 to 0.51 mm 0.0079 to 0.020 in.
	Allowable limit	0.80 mm 0.031 in.

9Y1210598ENS0067US0



Camshaft Side Clearance

1. Set a dial indicator with its tip on the camshaft.
2. Measure the side clearance by moving the cam gear to the front and rear.
3. If the measurement is more than the allowable limit, replace the camshaft stopper.

Camshaft side clearance	Factory specification	0.15 to 0.31 mm 0.0059 to 0.012 in.
	Allowable limit	0.50 mm 0.020 in.

9Y1210598ENS0068US0



Camshaft Alignment

1. Support the camshaft with V blocks on the surface plate at both end journals.
2. Set a dial indicator with its tip on the intermediate journal.
3. Measure the camshaft alignment.
4. If the measurement is more than the allowable limit, replace the camshaft.

Camshaft alignment	Allowable limit	0.01 mm 0.0004 in.
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9Y1210598ENS0069US0

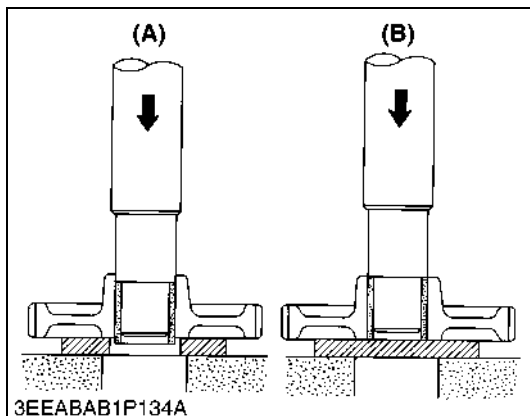


Cam Height

1. Measure the height of the cam at its highest point with an outside micrometer.
2. If the measurement is less than the allowable limit, replace the camshaft.

Cam height of intake and exhaust	Factory specification	26.88 mm 1.058 in.
	Allowable limit	26.83 mm 1.056 in.

9Y1210598ENS0070US0



Oil Clearance of Camshaft Journal

1. Measure the camshaft journal O.D. with an outside micrometer.
2. Measure the cylinder block bore I.D. for camshaft with a inside micrometer, and calculate the oil clearance.
3. If the oil clearance is more than the allowable limit, replace the camshaft.

Oil clearance of camshaft journal	Factory specification	0.050 to 0.091 mm 0.0020 to 0.0035 in.
	Allowable limit	0.15 mm 0.0059 in.

Camshaft journal O.D.	Factory specification	32.934 to 32.950 mm 1.2967 to 1.2972 in.
Camshaft bearing I.D. (Cylinder block bore I.D.)	Factory specification	33.000 to 33.025 mm 1.2993 to 1.3001 in.

9Y1210598ENS0071US0

Oil Clearance between Idle Gear Shaft and Idle Gear Bushing

1. Measure the idle gear shaft O.D. with an outside micrometer.
2. Measure the idle gear bushing I.D. with an inside micrometer, and calculate the oil clearance.
3. If the oil clearance is more than the allowable limit, replace the bushing.
4. If it still is more than the allowable limit, replace the idle gear shaft.

Oil clearance between idle gear shaft and idle gear bushing	Factory specification	0.020 to 0.084 mm 0.00079 to 0.0033 in.
	Allowable limit	0.10 mm 0.0039 in.

Idle gear shaft O.D.	Factory specification	19.967 to 19.980 mm 0.78611 to 0.78661 in.
Idle gear bushing I.D.	Factory specification	20.000 to 20.051 mm 0.78741 to 0.78940 in.

9Y1210598ENS0072US0

Replacing Idle Gear Bushing

(A) When removing

1. Press out the used idle gear bushing using an idle gear bushing replacing tool. (See page G-54.)

(B) When installing

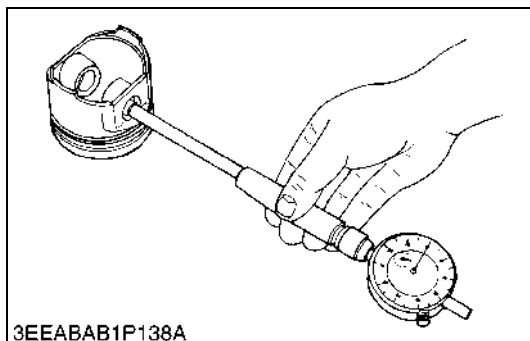
1. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
2. Press in a new bushing using an idle gear bushing replacing tool, until it is flush with the end of the idle gear.

(A) When Removing

(B) When Installing

9Y1210598ENS0073US0

(3) Piston and Connecting Rod

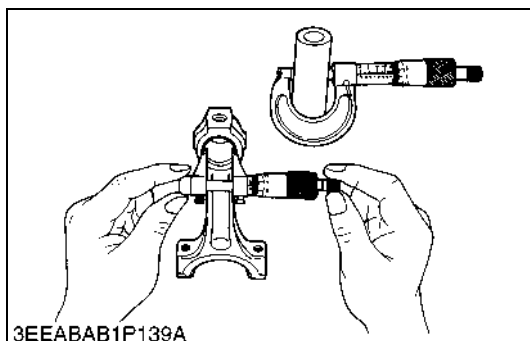


Piston Pin Bore Internal Diameter

1. Measure the piston pin bore I.D. in both the horizontal and vertical directions with a cylinder gauge.
2. If the measurement is more than the allowable limit, replace the piston.

Piston pin bore I.D.	Factory specification	20.000 to 20.013 mm 0.78741 to 0.78791 in.
	Allowable limit	20.05 mm 0.7894 in.

9Y1210598ENS0074US0



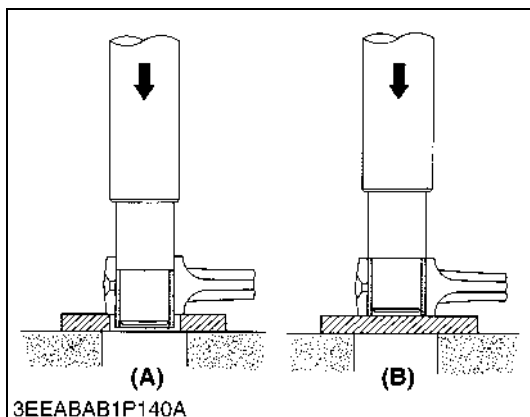
Oil Clearance between Piston Pin and Small End Bushing

1. Measure the piston pin O.D. where it contacts the bushing with an outside micrometer.
2. Measure the small end bushing I.D. with an inside micrometer, and calculate the oil clearance.
3. If the oil clearance is more than the allowable limit, replace the bushing. If it still is more than the allowable limit, replace the piston pin.

Oil clearance between piston pin and small end bushing	Factory specification	0.014 to 0.038 mm 0.00056 to 0.0014 in.
	Allowable limit	0.10 mm 0.0039 in.

Piston pin O.D.	Factory specification	20.002 to 20.011 mm 0.78748 to 0.78783 in.
Small end bushing I.D.	Factory specification	20.025 to 20.040 mm 0.78839 to 0.78897 in.

9Y1210598ENS0075US0



Replace Small End Bushing

(A) When removing

1. Press out the used bushing using a small end bushing replacing tool. (See page G-54.)

(B) When installing

1. Clean a new small end bushing and small end hole, and apply engine oil to them.
2. Using a small end bushing replacing tool, press in a new bushing (service parts) taking due care to see that the position of the connecting rod oil hole matches the bushing hole.

[Servicing parts dimension]

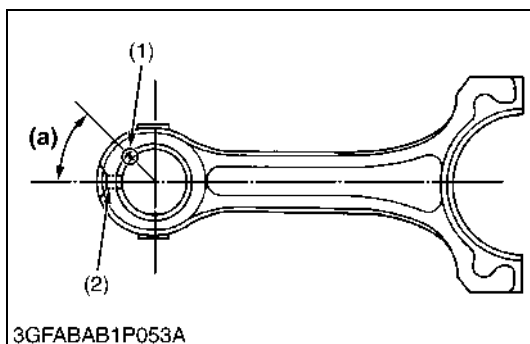
Oil clearance between piston pin and small end bushing (Spare parts)	Factory specification	0.015 to 0.075 mm 0.00059 to 0.0029 in.
	Allowable limit	0.15 mm 0.0059 in.

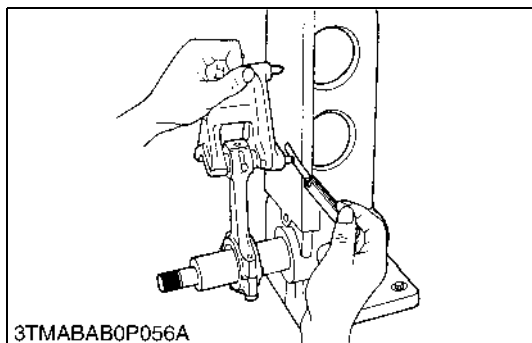
Small end bushing I.D. (Spare parts)	Factory specification	20.026 to 20.077 mm 0.78843 to 0.79043 in.
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- Seam
- Oil Hole

- (A) When Removing
(B) When Installing
(a) 0.79 rad (45 °)

9Y1210598ENS0076US0





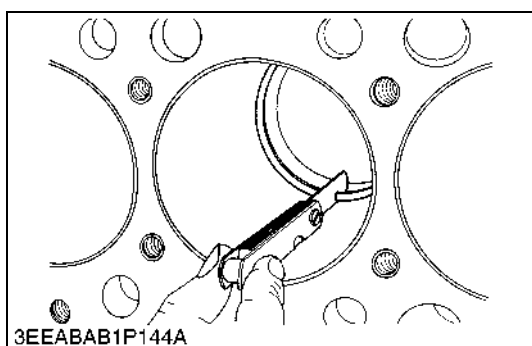
Connecting Rod Alignment

■ NOTE

- Since the I.D. of the connecting rod small end bushing is the basis of this check, check bushing for wear beforehand.
1. Install the piston pin into the connecting rod.
 2. Install the connecting rod on the connecting rod alignment tool.
 3. Put a gauge over the piston pin, and move it against the face plate.
 4. If the gauge does not fit squarely against the face plate, measure the space between the pin of the gauge and the face plate.
 5. If the measurement is more than the allowable limit, replace the connecting rod.

Connecting rod alignment	Allowable limit	0.05 mm 0.002 in.
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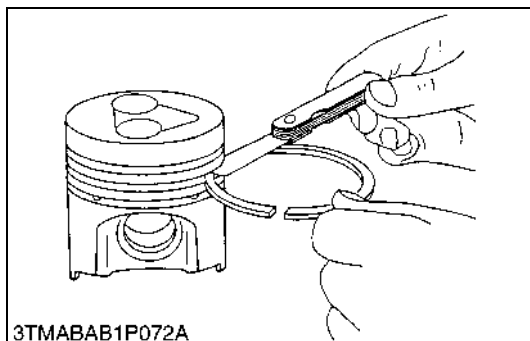


Piston Ring Gap

1. Insert the piston ring into the lower part of the cylinder (the least worn out part) with a piston ring compressor and piston.
2. Measure the ring gap with a feeler gauge.
3. If the measurement is more than the allowable limit, replace the piston ring.

Piston ring gap	Top ring	Factory specification	0.15 to 0.30 mm 0.0059 to 0.011 in.
		Allowable limit	1.20 mm 0.0472 in.
	Second ring	Factory specification	0.30 to 0.45 mm 0.012 to 0.017 in.
		Allowable limit	1.20 mm 0.0472 in.
	Oil ring	Factory specification	0.15 to 0.30 mm 0.0059 to 0.011 in.
		Allowable limit	1.20 mm 0.0472 in.

9Y1210598ENS0078US0



Clearance between Piston Ring and Piston Ring Groove

1. Clean the rings and the ring grooves, and install each ring in its groove.
2. Measure the clearance between the ring and the groove with a feeler gauge.
3. If the clearance is more than the allowable limit, replace the piston ring.
4. If the clearance still is more than the allowable limit after replacing the ring, replace the piston.

Clearance between piston ring and piston ring groove	Second ring	Factory specification	0.0900 to 0.120 mm 0.00355 to 0.00472 in.
		Allowable limit	0.15 mm 0.0059 in.
	Oil ring	Factory specification	0.040 to 0.080 mm 0.0016 to 0.0031 in.
		Allowable limit	0.15 mm 0.0059 in.

9Y1210598ENS0079US0

(4) Crankshaft



Crankshaft Side Clearance

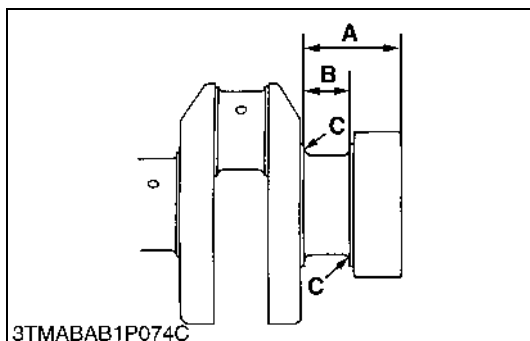
1. Set a dial indicator with its tip on the end of the crankshaft.
2. Measure the side clearance by moving the crankshaft to the front and rear.
3. If the measurement is more than the allowable limit, replace the thrust bearings.
4. If the same size bearing is useless because of the crankshaft journal wear, replace it with an oversize one referring to the table and figure.

Crankshaft side clearance	Factory specification	0.15 to 0.31 mm 0.0059 to 0.012 in.
	Allowable limit	0.50 mm 0.020 in.

(Reference)

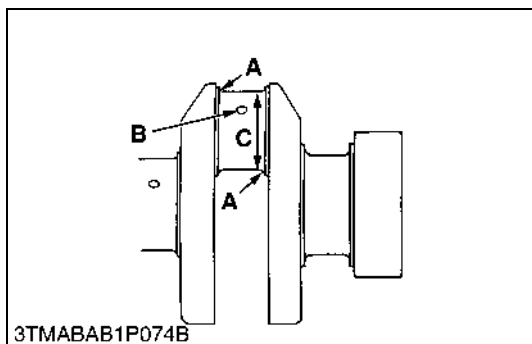
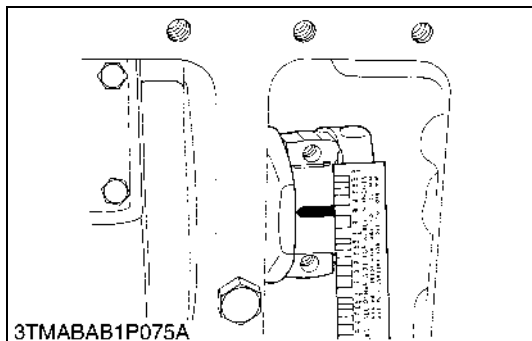
- Oversize thrust bearing

Oversize	Bearing	Code Number	Marking
0.20 mm 0.0079 in.	Thrust bearing 1 02	15261-23950	020 OS
	Thrust bearing 2 02	15261-23970	020 OS
0.40 mm 0.016 in.	Thrust bearing 1 04	15261-23960	040 OS
	Thrust bearing 2 04	15261-23980	040 OS



Oversize	0.20 mm 0.0079 in.	0.40 mm 0.0016 in.
Dimension A	54.50 to 54.70 mm 2.146 to 2.153 in.	54.60 to 54.80 mm 2.150 to 2.157 in.
Dimension B	26.20 to 26.25 mm 1.032 to 1.033 in.	26.40 to 26.45 mm 1.040 to 1.041 in.
Dimension C	2.80 to 3.20 mm radius 0.111 to 0.125 in. radius	2.80 to 3.20 mm radius 0.111 to 0.125 in. radius
The crankshaft journal must be fine-finished to higher than Rmax=0.8S		

9Y1210598ENS0080US0



Crankshaft Alignment

1. Support the crankshaft with V blocks on the surface plate at both end journals.
2. Set a dial indicator with its tip on the intermediate journal.
3. Measure the crankshaft alignment.
4. If the measurement is more than the allowable limit, replace the crankshaft.

Crankshaft alignment	Allowable limit	0.02 mm 0.0008 in.
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9Y1210598ENS0081US0

Oil Clearance between Crankpin and Crankpin Bearing

1. Clean the crankpin and crankpin bearing.
2. Put a strip of plastigauge on the center of the crankpin.
3. Install the connecting rod cap and tighten the connecting rod screws to the specified torque, and remove the cap again.
4. Measure the amount of the flattening with the scale, and get the oil clearance.
5. If the oil clearance is more than the allowable limit, replace the crankpin bearing.
6. If the same size bearing is useless because of the crankpin wear, replace it with an undersize one referring to the table and figure.

NOTE

- **Never insert the plastigauge into the crankpin oil hole.**
- **Be sure not to move the crankshaft while the connecting rod screws are tightened.**

Oil clearance between crankpin and crankpin bearing	Factory specification	0.020 to 0.051 mm 0.00079 to 0.0020 in.
	Allowable limit	0.15 mm 0.0059 in.

Crankpin O.D.	Factory specification	33.959 to 33.975 mm 1.3370 to 1.3375 in.
Crankpin bearing I.D.	Factory specification	33.995 to 34.010 mm 1.3384 to 1.3389 in.

(Reference)

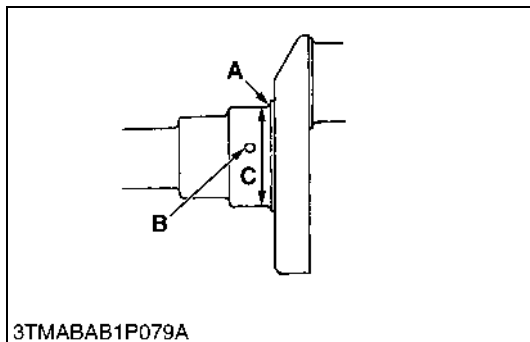
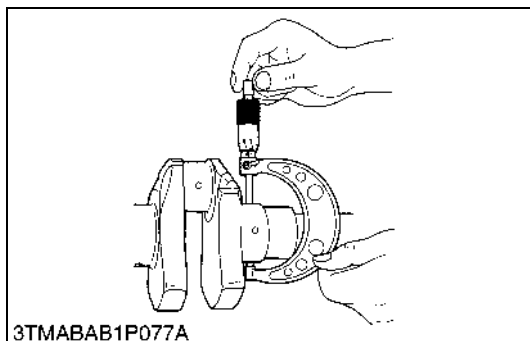
- Undersize crankpin bearing

Undersize	Bearing	Code Number	Marking
0.20 mm 0.0079 in.	Crankpin bearing 02	15861-22970	020 US
0.40 mm 0.016 in.	Crankpin bearing 04	15861-22980	040 US

Undersize	0.20 mm 0.0079 in.	0.40 mm 0.016 in.
Dimension A	2.3 to 2.7 mm radius 0.091 to 0.10 in. radius	2.3 to 2.7 mm radius 0.091 to 0.10 in. radius
*Dimension B	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief
Dimension C	33.759 to 33.775 mm dia. 1.3291 to 1.3297 in. dia.	33.559 to 33.575 mm dia. 1.3213 to 1.3218 in. dia.

The crankpin journal must be fine-finished to higher than Rmax=0.8S
 *Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.040 to 0.059 in.) relief.

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Oil Clearance between Crankshaft Journal and Crankshaft Bearing 1

1. Measure the O.D. of the crankshaft front journal with an outside micrometer.
2. Measure the I.D. of the crankshaft bearing 1 with an inside micrometer, and calculate the oil clearance.
3. If the oil clearance is more than the allowable limit, replace the crankshaft bearing 1.
4. If the same size bearing is useless because of the crankshaft journal wear, replace it with an undersize one referring to the table and the figure.

Oil Clearance between crankshaft journal and crankshaft bearing 1	Factory specification	0.0340 to 0.106 mm 0.00134 to 0.00417 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D.	Factory specification	39.934 to 39.950 mm 1.5722 to 1.5728 in.
Crankshaft bearing 1 I.D.	Factory specification	39.984 to 40.040 mm 1.5742 to 1.5763 in.

(Reference)

- Undersize crankshaft bearing 1

Undersize	Bearing	Code Number	Marking
0.20 mm 0.0079 in.	Crankshaft bearing 1 02	15861-23910	020 US
0.40 mm 0.016 in.	Crankshaft bearing 1 04	15861-23920	040 US

- Undersize dimensions of crankshaft journal

Undersize	Models	0.20 mm 0.0079 in.	0.40 mm 0.016 in.
Dimension A	All models	1.8 to 2.2 mm radius 0.071 to 0.086 in. radius	1.8 to 2.2 mm radius 0.071 to 0.086 in. radius
*Dimension B	All models	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief
Dimension C		39.734 to 39.750 mm dia. 1.5644 to 1.5649 in. dia.	39.534 to 39.550 mm dia. 1.5565 to 1.5570 in. dia.

The crankshaft journal must be fine-finished to higher than Rmax=0.8S
 *Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.040 to 0.059 in.) relief.

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Crankshaft Bearing 1

(When removing)

1. Press out the used crankshaft bearing 1 using a crankshaft bearing 1 replacing tool. (See page G-55.)

(When installing)

1. Clean a new crankshaft bearing 1 and crankshaft journal bore, and apply engine oil to them.
2. Using a crankshaft bearing 1 replacing tool, press in a new bearing 1 (2) so that its seam (1) directs toward the exhaust manifold side. (See figure.)

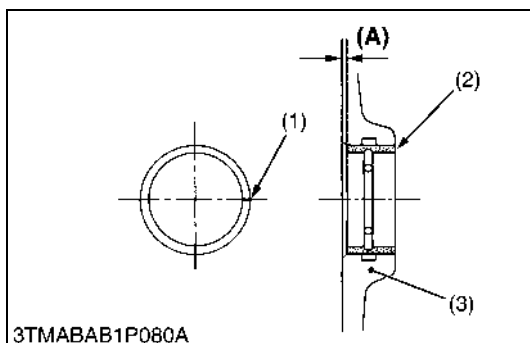
Dimension (A)	Factory specification	0 to 0.3 mm 0 to 0.01 in.
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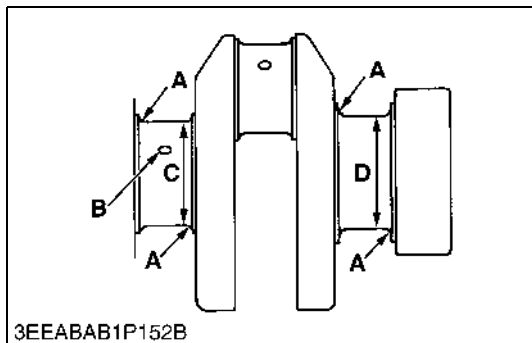
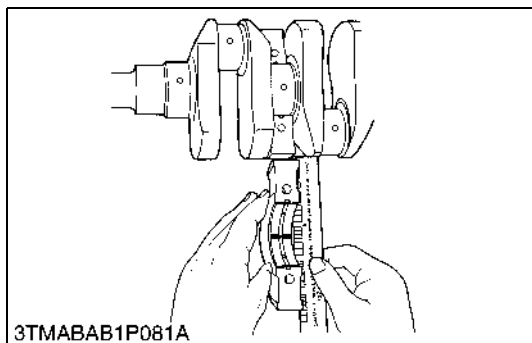
(1) Seam

(3) Cylinder Block

(2) Crankshaft Bearing 1

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Oil Clearance between Crankshaft Journal and Crankshaft Bearing 2 and Crankshaft Bearing 3

1. Put a strip of plastigauge on the center of the journal.
2. Install the bearing case and tighten the bearing case screws 1 to the specified torque, and remove the bearing case again.
3. Measure the amount of the flattening with the scale, and get the oil clearance.
4. If the oil clearance is more than the allowable limit, replace the crankshaft bearing 2 (crankshaft bearing 3).
5. If the same size bearing is useless because of the crankshaft journal wear, replace it with an undersize one referring to the table and figure.

NOTE

- Be sure not to move the crankshaft while the bearing case screws are tightened.

Oil clearance between crankshaft journal and crankshaft bearing 2 (crankshaft bearing 3)	Factory specification	0.028 to 0.059 mm 0.0011 to 0.0023 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D. (Flywheel side)	Factory specification	43.934 to 43.950 mm 1.7297 to 1.7303 in.
Crankshaft bearing 2 I.D.	Factory specification	43.978 to 43.993 mm 1.7315 to 1.7320 in.

Crankshaft journal O.D. (Intermediate)	Factory specification	39.934 to 39.950 mm 1.5722 to 1.5728 in.
Crankshaft bearing 3 I.D.	Factory specification	39.978 to 39.993 mm 1.5740 to 1.5745 in.

(Reference)

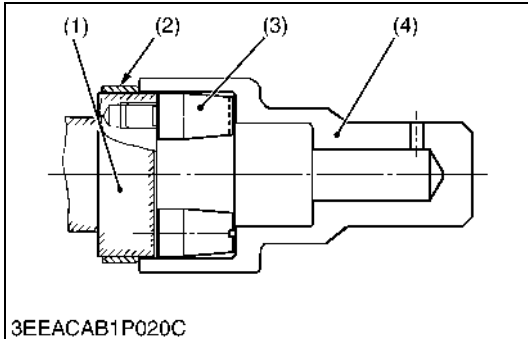
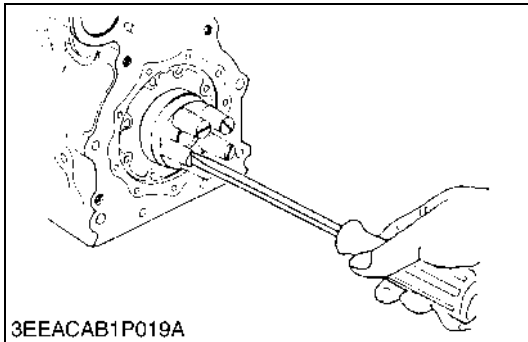
- Undersize crankshaft bearing 2 and 3

Undersize	Bearing	Code Number	Marking
0.20 mm 0.0079 in.	Crankshaft bearing 2 02	15694-23930	020 US
	Crankshaft bearing 3 02	15861-23860	020 US
0.40 mm 0.016 in.	Crankshaft bearing 2 04	15694-23940	040 US
	Crankshaft bearing 3 04	15861-23870	040 US

- Undersize dimensions of crankshaft journal

Undersize	0.20 mm 0.0079 in.	0.40 mm 0.0016 in.
Dimension A	1.8 to 2.2 mm radius 0.071 to 0.086 in. radius	1.8 to 2.2 mm radius 0.071 to 0.086 in. radius
*Dimension B	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief
Dimension C	39.734 to 39.750 mm dia. 1.5644 to 1.5649 in. dia.	39.534 to 39.550 mm dia. 1.5565 to 1.5570 in. dia.
Dimension D	43.734 to 43.750 mm dia. 1.7219 to 1.7224 in. dia.	43.534 to 43.550 mm dia. 1.7140 to 1.7145 in. dia.
The crankshaft journal must be fine-finished to higher than Rmax=0.8S *Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.040 to 0.059 in.) relief.		

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Replacing Crankshaft Sleeve

1. Remove the used crankshaft sleeve (2).
2. Set the sleeve guide (3) to the crankshaft (1).
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 (4). (Refer to "SPECIAL TOOLS".)

NOTE

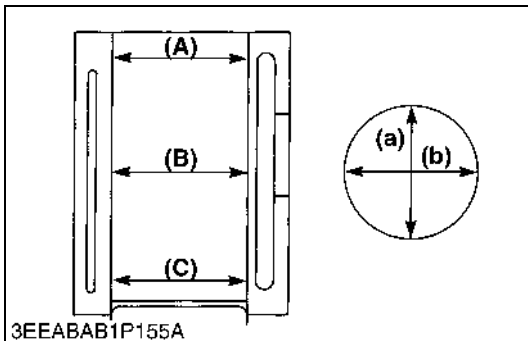
- Mount the sleeve with its largely chamfered surface facing outward.
- If heating is not enough, a sleeve can stop halfway, so be careful.

- (1) Crankshaft
(2) Crankshaft Sleeve

- (3) Sleeve Guide
(4) Auxiliary Socket for Pushing

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(5) Cylinder



Cylinder Wear

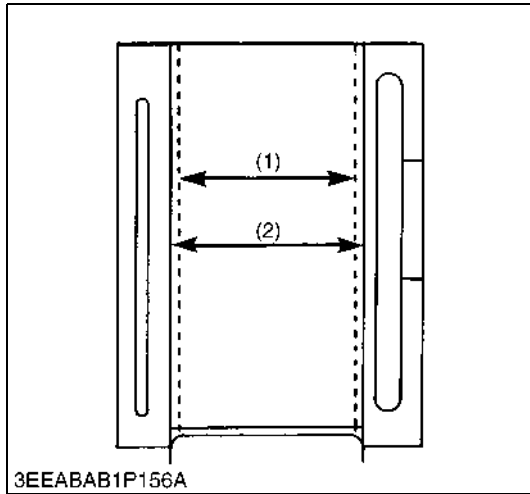
1. Measure the cylinder liner I.D. at the six positions (see figure) with a cylinder gauge to find the maximum and minimum I.D.'s.
2. Get the difference (Maximum wear) between the maximum and the minimum I.D.'s.
3. If the wear is more than the allowable limit, bore and hone to the oversize dimension. (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 liner I.D.	Factory specification	67.000 to 67.019 mm 2.6378 to 2.6385 in.
	Allowable limit	67.150 mm 2.6437 in.

- (A) Top
(B) Middle
(C) Bottom (Skirt)

- (a) Right-angled to Piston Pin
(b) Piston Pin Direction

9Y1210598ENS0087US0



Correct Cylinder (Oversize)

- When the cylinder is worn beyond the allowable limit, bore and hone it to the specified dimension.

Cylinder liner I.D.	Factory specification	67.250 to 67.269 mm 2.6477 to 2.6483 in.
	Allowable limit	67.400 mm 2.6535 in.
Finishing	Hone to 2.2 to 3.0 μmRz (87 to 110 $\mu\text{in.Rz}$)	

- Replace the piston and piston rings with oversize ones.
Oversize: 0.25 mm (0.0098 in.)
Marking: 025

NOTE

- When the oversize cylinder is worn beyond the allowable limit, replace the cylinder block with a new one.

(1) Cylinder I.D. (Before Correction) (2) Cylinder I.D. [Oversize]

9Y1210598ENS0088US0

(6) Oil Pump

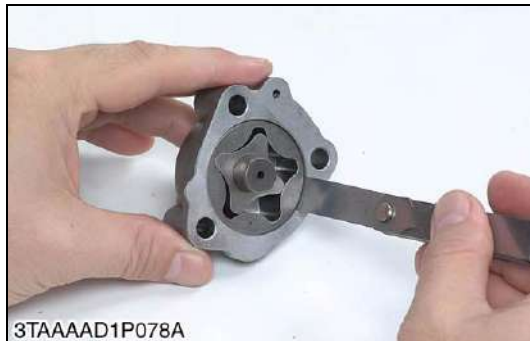


Rotor Lobe Clearance

- Measure the clearance between lobes of the inner rotor and the outer rotor with a thickness gauge.
- If the clearance is more than the factory specifications, replace the oil pump rotor assembly.

Rotor lobe clearance	Factory specification	0.030 to 0.14 mm 0.0012 to 0.0055 in.
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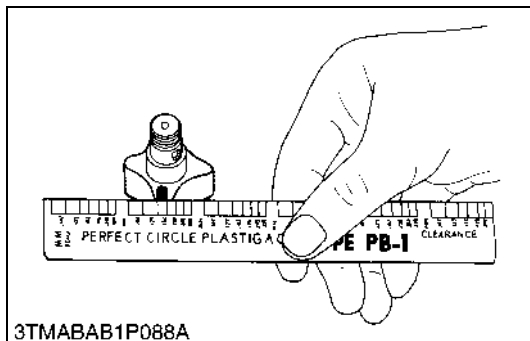


Clearance between Outer Rotor and Pump Body

- Measure the clearance between the outer rotor and the pump body with a thickness gauge.
- If the clearance is more than the factory specifications, replace the oil pump rotor assembly.

Clearance between outer rotor and pump body	Factory specification	0.070 to 0.15 mm 0.0028 to 0.0059 in.
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Clearance between Rotor and Cover

- Put a strip of plastigauge onto the rotor face with grease.
- Install the cover and tighten the screws.
- Remove the cover carefully, and measure the amount of the flattening with the scale and get the clearance.
- If the clearance is more than the factory specifications, replace oil pump rotor assembly.

Clearance between rotor and cover	Factory specification	0.0750 to 0.135 mm 0.00296 to 0.00531 in.
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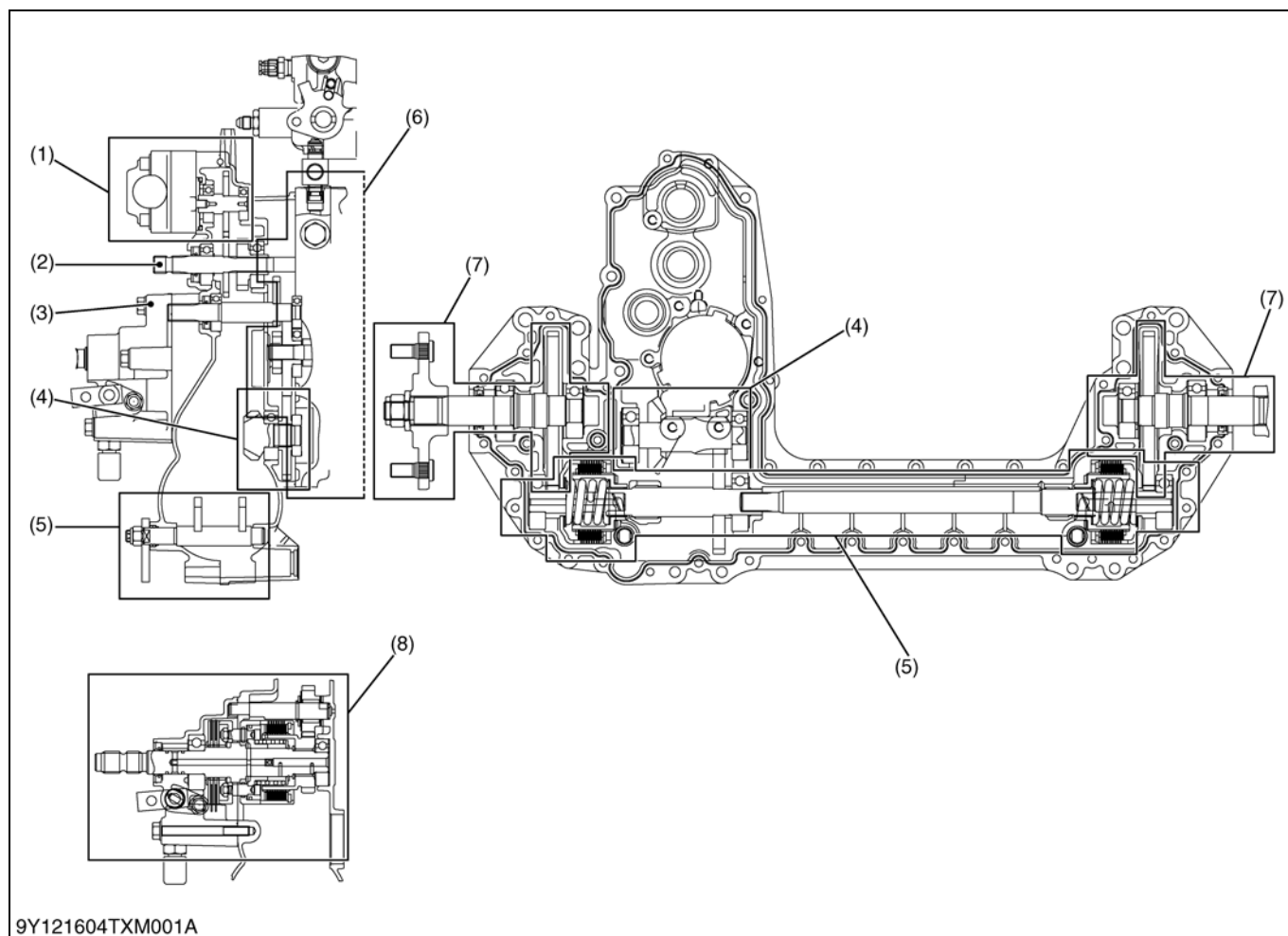
2 TRANSAXLE

MECHANISM

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1. STRUCTURE



(1) Hydraulic Pump Section

(2) Input Shaft

(3) Front Wheel Drive Section

(4) Bevel Gear Section

(5) Glide Steer Section

(6) Hydrostatic Transmission

(7) Rear Axle Section

(8) Mower PTO Section

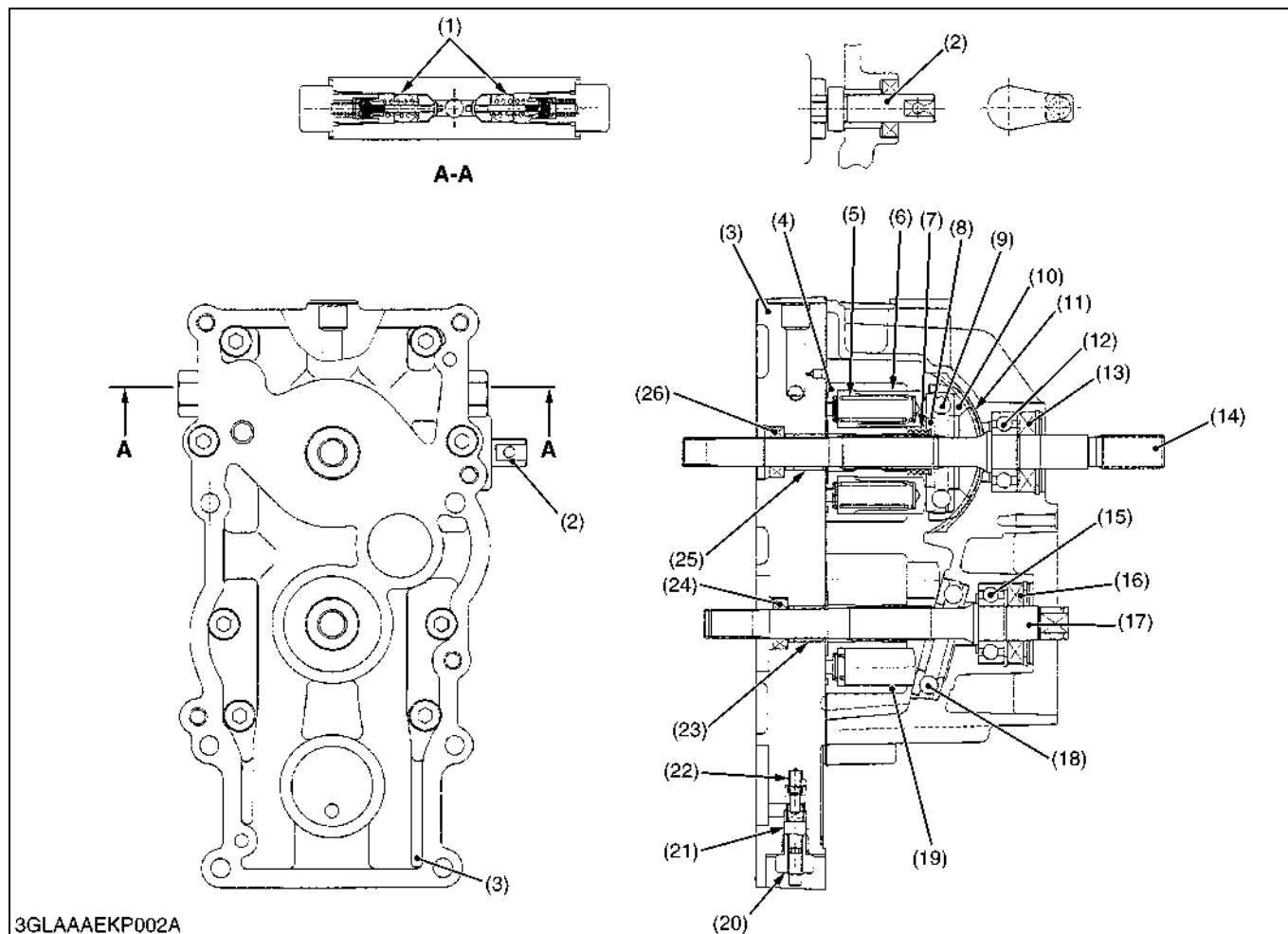
The transaxle of this machine is constructed as shown above. This machine is equipped with left and right clutches in transaxle.

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2. TRAVELLING SYSTEM

[1] HYDRAULIC TRANSMISSION

(1) Structure



3GLAAAEKP002A

- | | | | |
|--|-----------------------------|-----------------------------|----------------------|
| (1) Check and High Pressure Relief Valve | (7) Spring (Cylinder Block) | (14) Pump Shaft | (21) By-pass Spool |
| (2) Trunnion Arm | (8) Washer | (15) Ball Bearing | (22) By-pass Spring |
| (3) Center Section | (9) Thrust Ball Bearing | (16) Oil Seal | (23) Journal Bearing |
| (4) Cylinder Block (Pump) | (10) Swashplate | (17) Motor Shaft | (24) Oil Seal |
| (5) Piston Spring | (11) Cradle Bearing | (18) Thrust Ball Bearing | (25) Journal Bearing |
| (6) Piston | (12) Ball Bearing | (19) Cylinder Block (Motor) | (26) Oil Seal |
| | (13) Oil Seal | (20) By-pass Plug | |

Hydrostatic Transmission (HST) consists of a variable displacement piston pump, a fixed displacement piston motor, two check and high pressure relief valves (1) and a by-pass valve.

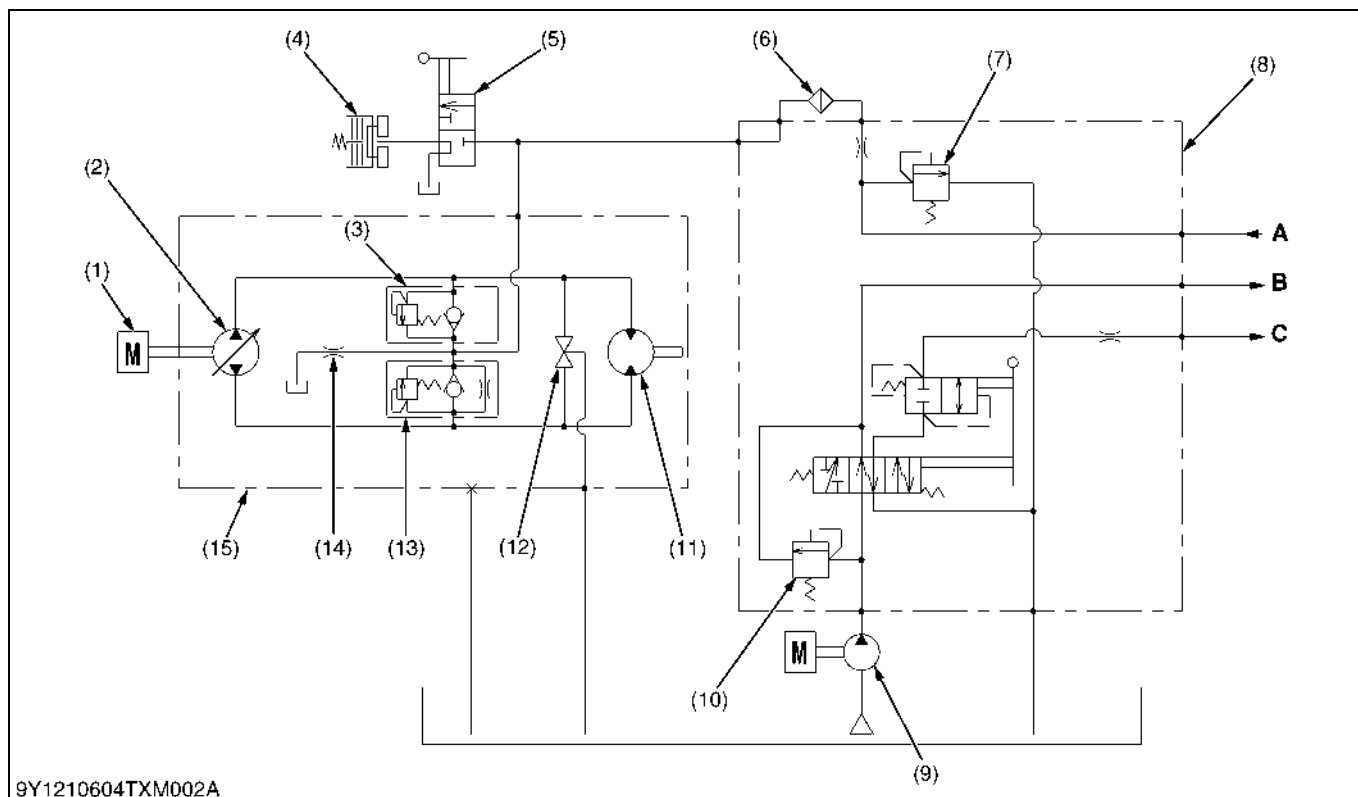
The pump and motor have five pistons (6) in their own cylinder block (4), (19).

The discharge rate of the HST is 10 cm³/rev. (0.61 cu.in./rev.).

With the speed change pedal connecting to the trunnion arm (2) in HST via a link mechanism, the speed change pedal permits simple operation of the machine, starting, stopping and increasing or decreasing speed.

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(2) Oil Flow



- | | | | |
|--|--------------------------------------|---|--|
| (1) Engine | (6) Filter Cartridge | (11) Motor | A: From Power Steering Controller |
| (2) Pump | (7) HST Relief Valve | (12) By-pass Valve | B: To Power Steering Controller |
| (3) Check and High Pressure Relief Valve (Forward) | (8) Hydraulic Control Valve Assembly | (13) Check and High Pressure Relief Valve (Reverse) | C: To Mower Lift Cylinder |
| (4) PTO Clutch | (9) Hydraulic Pump | (14) Lubricating Orifice | |
| (5) PTO Clutch Valve | (10) Main Relief Valve | (15) Hydrostatic Transmission | |

The closed oil-hydraulic loop connects the pump (2) and the motor (11) in HST.

Oil from the hydraulic pump (2) flows through the hydraulic control valve assembly (8) to the power steering controller. Then the oil flows back from the power steering controller to the hydraulic control valve assembly (8).

After that, the oil flows through the filter cartridge (6) and be supplied to HST and PTO clutch both.

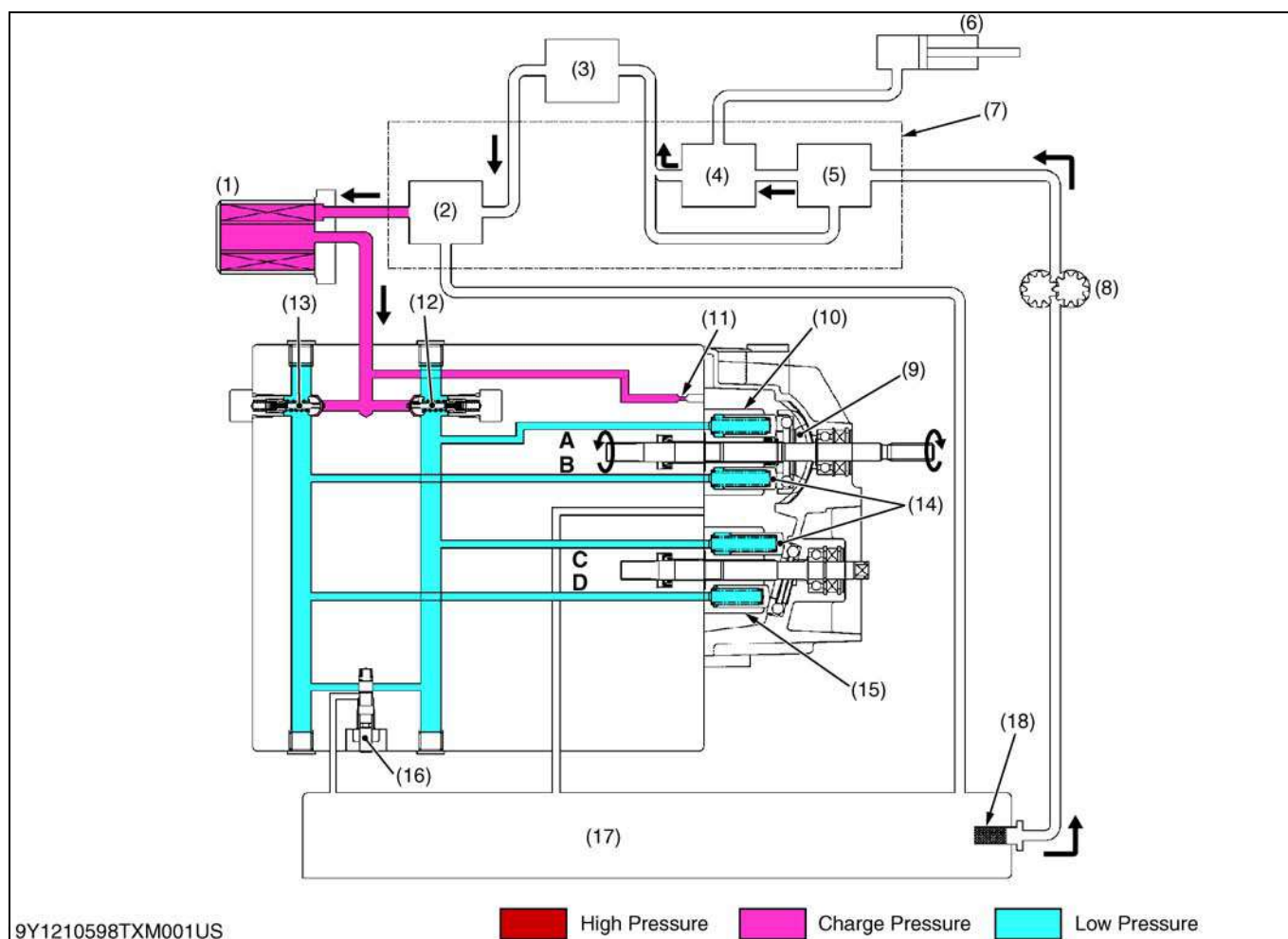
The HST relief valve (7) provides the functionality of a charge relief valve. Therefore, the oil passed through the filter cartridge is routed to HST as charge oil.

Overflow oil from the HST housing flows back to the transaxle.

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(3) Operation

Neutral



- | | | | |
|-------------------------------|-----------------------------|------------------------------|---------------------|
| (1) Filter Cartridge | (7) Hydraulic Control Valve | (12) Check and High Pressure | (16) By-pass Valve |
| (2) HST Relief Valve | (8) Hydraulic Pump | Relief Valve (Reverse) | (17) Transaxle Case |
| (3) Power Steering Controller | (9) Swashplate | (13) Check and High Pressure | (18) Oil Strainer |
| (4) Control Valve | (10) Cylinder Block (Pump) | Relief Valve (Forward) | |
| (5) Main Relief Valve | (11) Lubricating Orifice | (14) Piston | |
| (6) Mower Lift Cylinder | | (15) Cylinder Block (Motor) | |

Engine revolution rotates the pump shaft via the universal joint.

Being engaged with each other, the pump shaft and the cylinder block (10) in the pump rotate together.

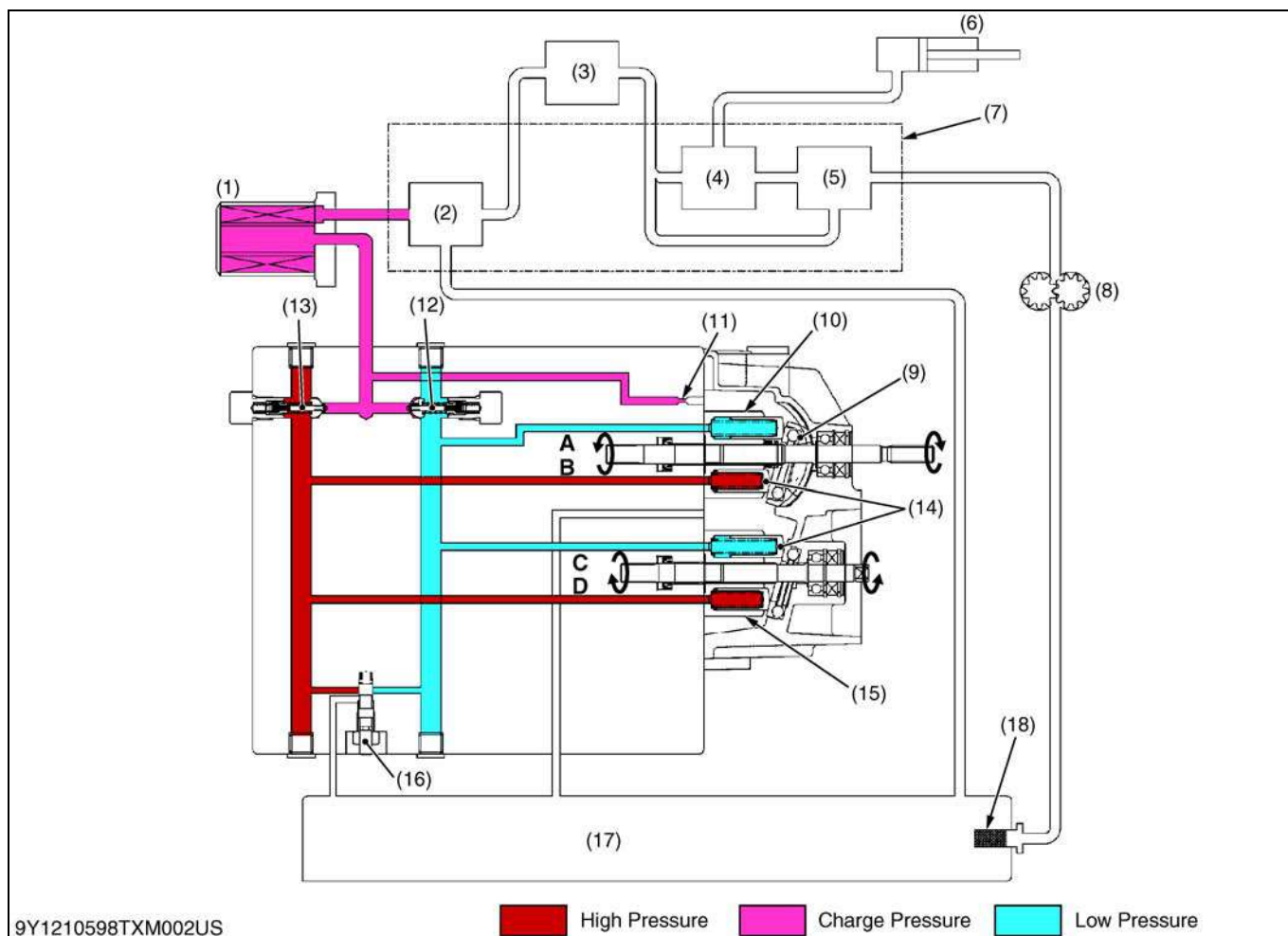
With the speed change pedal in the neutral position, the swashplate (9) in the pump is at right angles to the pump pistons.

The pump pistons rotate with the pump cylinder block (10) without reciprocating motion.

At this time, since the pump pistons do not generate pressure, no pressure is transmitted to the motor pistons, thus causing neither rotation of the motor cylinder block (15) nor that of the motor shaft engaged with it.

Thus the machine is stationary.

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Forward

- | | | | |
|-------------------------------|--------------------------------------|---|---------------------|
| (1) Filter Cartridge | (7) Hydraulic Control Valve Assembly | (12) Check and High Pressure Relief Valve (Reverse) | (16) By-pass Valve |
| (2) HST Relief Valve | (8) Hydraulic Pump | (13) Check and High Pressure Relief Valve (Forward) | (17) Transaxle Case |
| (3) Power Steering Controller | (9) Swashplate | (14) Piston | (18) Oil Strainer |
| (4) Control Valve | (10) Cylinder Block (Pump) | (15) Cylinder Block (Mower) | |
| (5) Main Relief Valve | (11) Lubricating Orifice | | |
| (6) Mower Lift Cylinder | | | |

Stepping on the speed change pedal to the forward position inclines the HST trunnion arm, causing the pump swashplate (9) to incline as shown in the figure.

The pump pistons rotate with the pump cylinder block (10) while reciprocating.

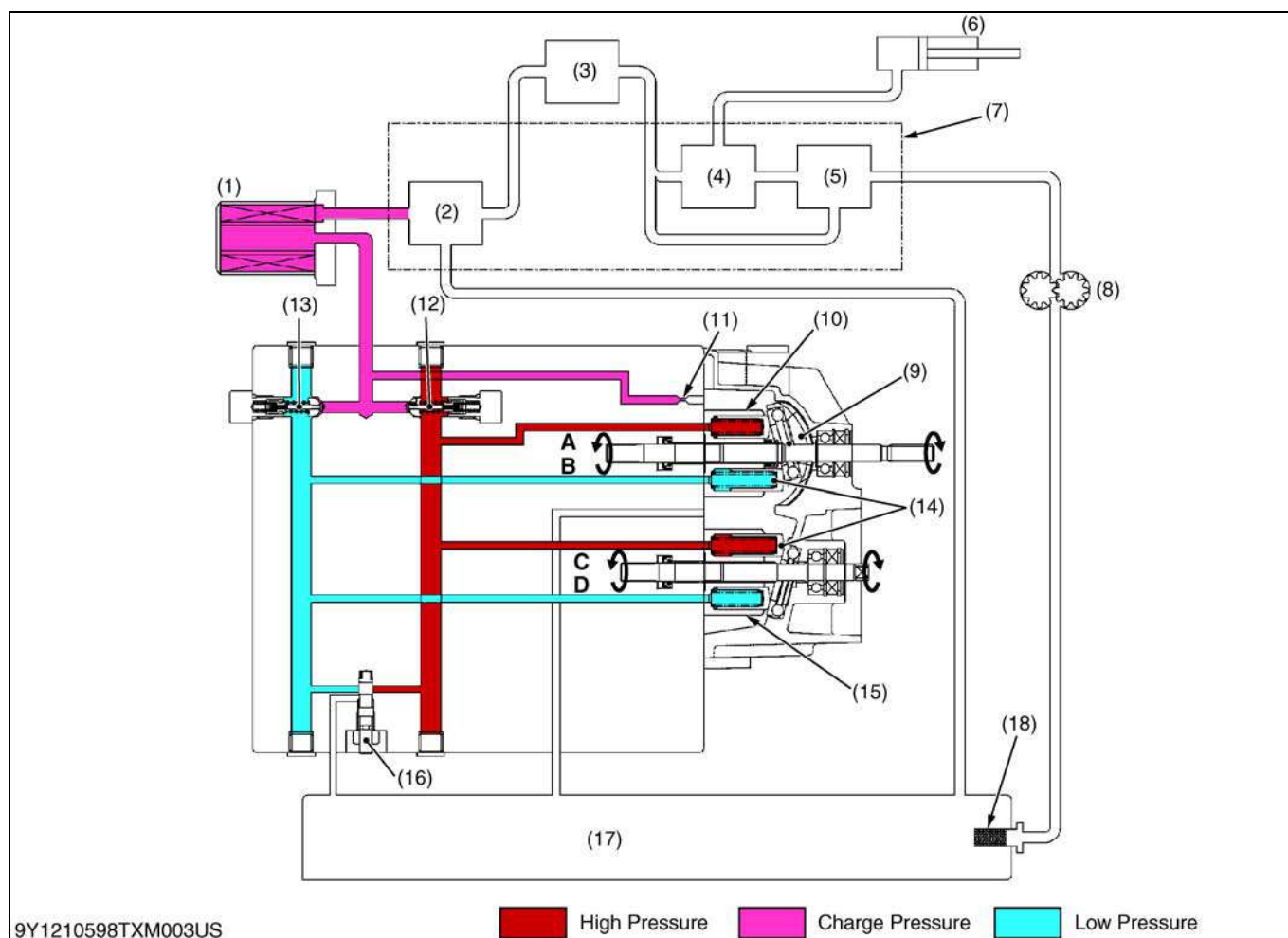
At this time, the pump pistons generate pressure by reciprocating motion. The pressure generated is transmitted to the motor pistons (Port **B** - Port **D**).

Pressure from the port **D** thrusts the motor pistons to the surface of the inclined thrust ball bearing, causing them to slide on the inclined surface.

This causes the motor cylinder block (15) and the motor shaft engaged with it to rotate.

This causes the machine to move forward. The inclination of the pump swashplate (9) determines the motor shaft speed.

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Reverse

- | | | | |
|-------------------------------|-----------------------------|------------------------------|---------------------|
| (1) Filter Cartridge | (7) Hydraulic Control Valve | (12) Check and High Pressure | (16) By-pass Valve |
| (2) HST Relief Valve | Assembly | Relief Valve (Reverse) | (17) Transaxle Case |
| (3) Power Steering Controller | (8) Hydraulic Pump | (13) Check and High Pressure | (18) Oil Strainer |
| (4) Control Valve | (9) Swashplate | Relief Valve (Forward) | |
| (5) Main Relief Valve | (10) Cylinder Block (Pump) | (14) Piston | |
| (6) Mower Lift Cylinder | (11) Lubricating Orifice | (15) Cylinder Block (Mower) | |

Stepping on the speed change pedal to the reverse position inclines the HST trunnion arm in the direction opposite to that at moving forward, causing the pump swashplate (9) to incline as shown in the figure.

The pump pistons rotate with the pump cylinder block (10) while reciprocating.

At this time, the pump pistons generate pressure by reciprocating motion. The pressure generated is transmitted to the motor pistons (Port **A** - Port **C**).

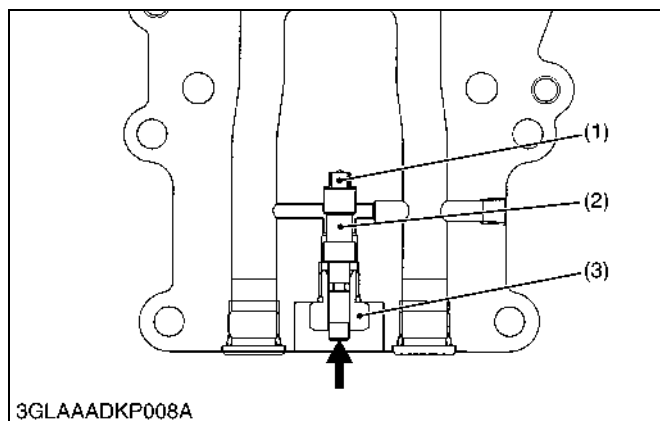
Pressure from the port **C** thrusts the motor pistons to the surface of the inclined thrust ball bearing, causing them to slide on the inclined surface.

This causes the motor cylinder block (15) and the motor shaft engaged with it to rotate.

This causes the machine to move reverse. The inclination of the pump swashplate (9) determines the motor shaft speed.

9Y1210598TXM0006US0

(4) By-pass Valve



Normally, when the engine is stopped, the pump shaft and pump cylinder block engaged with it do not rotate. Thus, the motor shaft does not rotate.

However, pressing the by-pass valve in the center section permits moving the machine with human power while the engine is stopped. The following paragraphs describe this mechanism:

Pressing the by-pass valve connects the forward and reverse loops in the center section. This allows oil to flow between the forward and reverse loops through the by-pass valve to rotate only the motor cylinder block.

This means that pressing the by-pass valve while the engine is stopped, that is, while the pump shaft is not rotating, permits rotating the motor shaft engaged with the motor cylinder block.

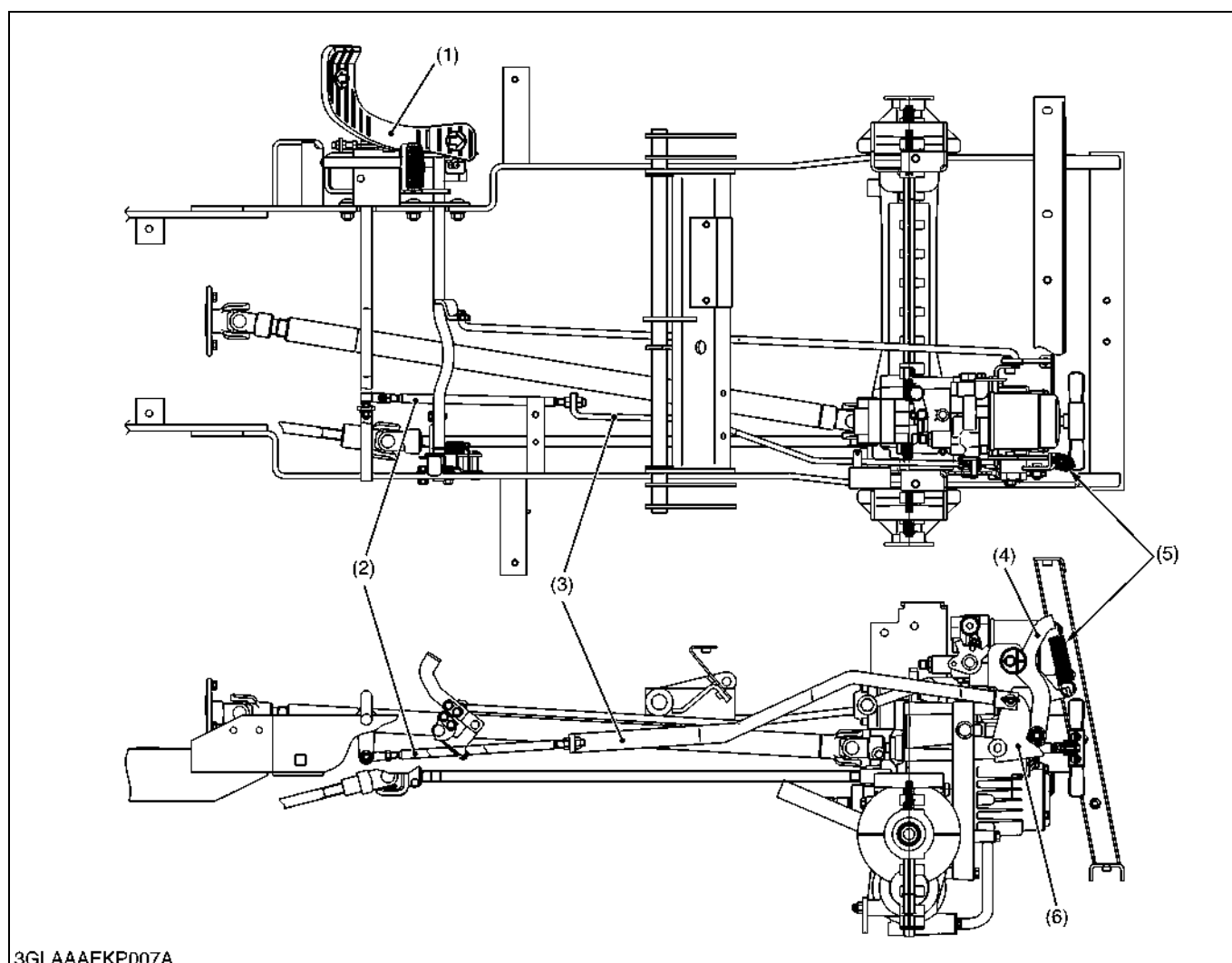
(1) By-pass Spring

(2) By-pass Spool

(3) By-pass Plug

9Y1210598TXM0007US0

(5) Control Linkage



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- | | | | |
|------------------------|------------------------|--------------------|-----------------------|
| (1) Speed Change Pedal | (3) Speed Change Plate | (5) Neutral Spring | (6) Speed Control Arm |
| (2) Speed Change Rod | (4) Neutral Arm | | |

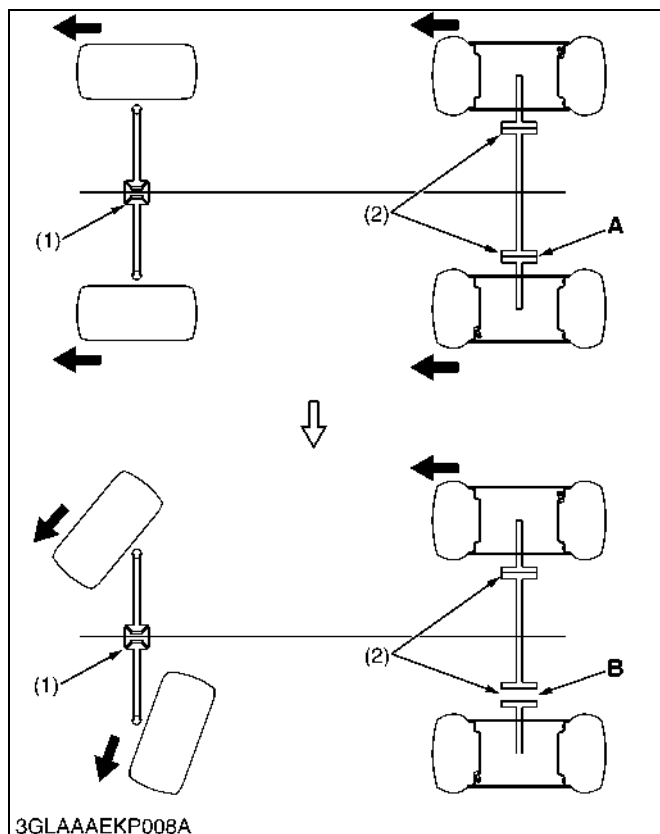
The speed change pedal (1) and the trunnion arm of variable swashplate are linked with the speed change rod (2), speed change plate (3) and the speed control arm (6). As the front of the pedal is depressed, the swashplate rotates and forward travelling speed increases. Depressing the rear end increases reverse speed.

The speed control arm (6) is returned to neutral position by the neutral arm (4) and the tension of neutral spring (5). At the same time, the swashplate is returned to neutral, when the pedal is released.

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[2] GLIDE STEER SECTION

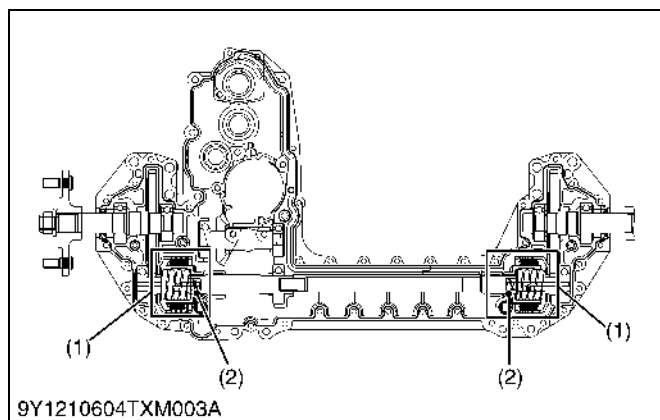
(1) General



This machine is equipped with the Glide Steer system.

On turning, the Glide Steer system provides a mechanism that allows a turf-friendly minimum turn by driving the front wheels and the rear wheel on the outside of the turn at the same time.

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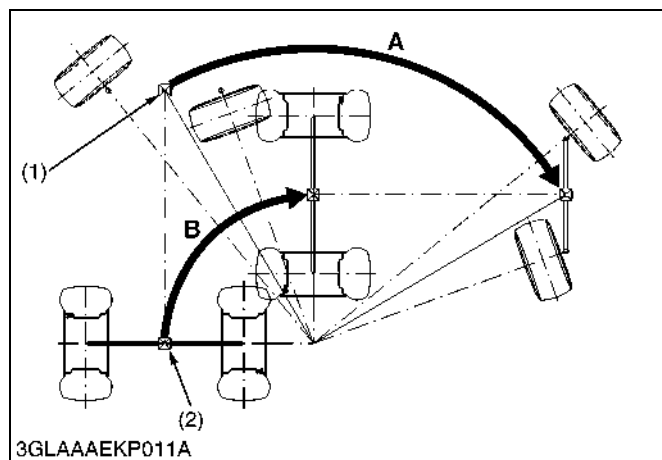
This machine has left and right steering clutches (1) in the rear transaxle.

The clutch lever (2) is connected to the king pin support on the front axle with the rod (3). When turning left or right, the rod connecting to the king pin support on the front axle disengages only the steering clutch of the turn side. This shuts off driving power to the rear wheel on the inside of the turn.

On the other hand, the rear wheel on the outside of the turn has driving power.

9Y1210598TXM0010US0





For Normal 4WD

The machine with four wheels has a wheel base.

Because of this, turning the machine creates a difference in the length of tracks made by the differential gears in the front axle and in the rear axle.

Assuming that the average speeds of the right and left front wheels and of the right and left rear wheels are equal to those of the differential gears in the front axle and in the rear axle, respectively.

Also assuming that the speeds of the differential gears in the front axle and in the rear axle are the same, the right and left rear wheels will free-spin by the difference in the length of tracks, causing damage to turf.

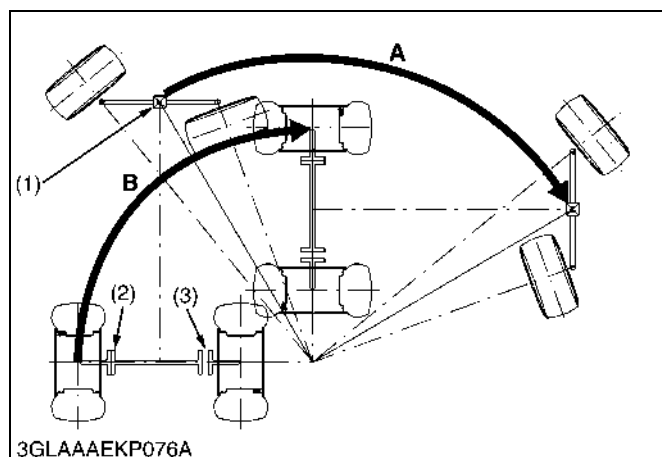
A large steering angle of the front axle results in a shorter turning radius of the machine. But a larger steering angle makes an even larger difference in the length of tracks made by differential gears in the front axle and in the rear axle.

Therefore, on a minimum turn, the right and left rear wheels will have more free-spins, causing greater damage to turf.

- (1) Differential Gear (Front)
- (2) Differential Gear (Rear)

A: Track made by Differential Gear (Front)
B: Track made by Differential Gear (Rear)

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For Glide Steer System

In the Glide Steer system, driving power is transmitted only to the right and left front wheels and the rear wheel on the outside of the turn. The rear wheel on the inside of the turn does not receive driving power.

Assuming that the speeds of the differential gear in the front axle and of the rear wheel on the outside of the turn are the same.

At this time, even with a larger steering angle of the front axle, the difference in the length of tracks made by the differential gear in the front axle and the rear wheel on the outside of the turn is smaller than 4WD.

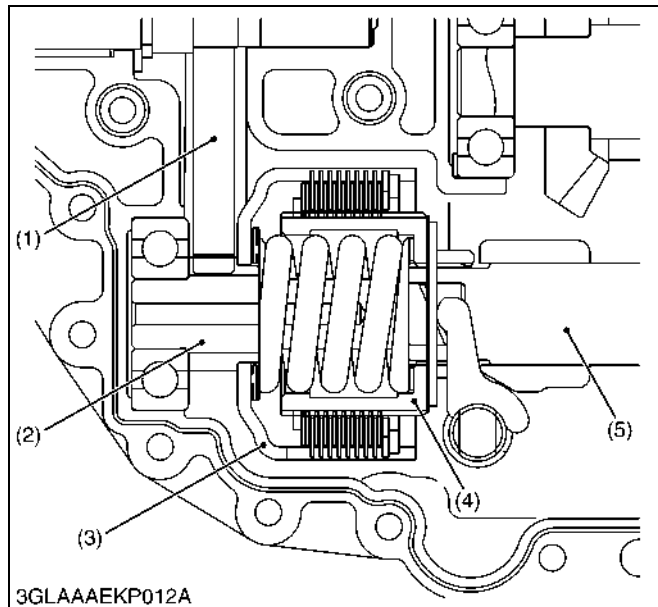
Therefore, on a minimum turn, the right and left rear wheels will have fewer free-spins, thus providing a turn-friendly mechanism.

- (1) Differential Gear (Front)
- (2) Steering Clutch (Engaged)
- (3) Steering Clutch (Disengaged)

A: Track made by Differential Gear (Front)
B: Track made by Rear Wheel on Outside of Turn

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(2) Operation



On Going Straight

On going straight, the right and left steering clutches in transaxle are engaged to transmit driving power to the right and left rear wheels. At this time, all four wheels drive the machine.

Spring tension pushes the spline boss (4) in the steering clutch toward the inside of the machine, which eliminates the clearance between clutch disc and friction plate, causing friction necessary to transmit driving power.

The spline boss (4) is engaged with 42T gear shaft (5) (for right wheels, with right drive shaft). The clutch case (3) is engaged with the 11T gear shaft (2).

Driving power is transmitted to the 42T gear shaft (5). Then the driving power is transmitted to the right and left rear wheels as follows.

- **Rear wheel (LH)**

42T gear shaft (5) → Spline boss (4) → Clutch case (3) → 11T gear shaft (2) → 65T gear shaft (1) → Rear wheel (LH)

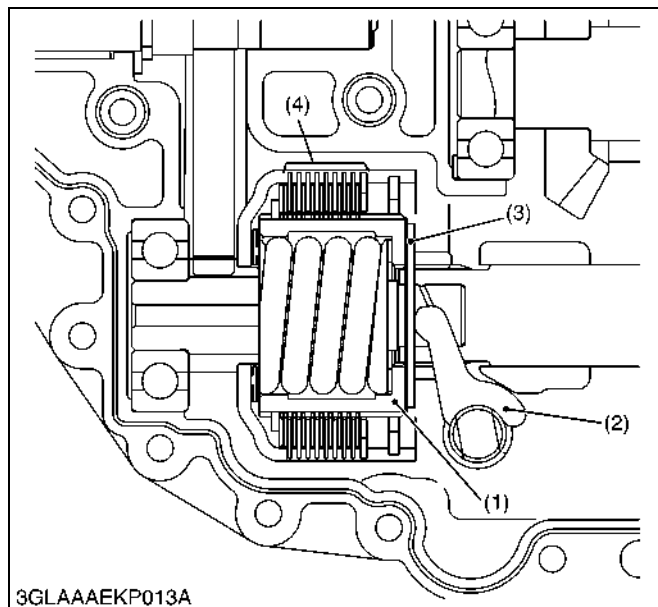
- **Rear wheel (RH)**

42T gear shaft (5) → Right drive shaft → Spline boss → Clutch case → 11T gear shaft → 65T gear shaft → Rear wheel (RH)

- (1) 65T Gear Shaft
- (2) 11T Gear Shaft
- (3) Clutch Case

- (4) Spline Boss
- (5) 42T Gear Shaft

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On Turning Right or Left

On turning right or left, the steering clutch on the inner side of the turn is disengaged. No driving power is transmitted to the rear wheels on the inside of the turn. At this time, right and left front wheels and the rear wheel on the outside of the turn drive the machine.

When the front wheels are turned by steering wheel rotation, the king pin support in the direction of turn pulls the wire, and then the wire rotates the clutch lever (2). The clutch lever (2) pushed the spline boss (1) via the clutch collar (3). This creates clearance between clutch disc and friction plate (4), causing no friction, thus shutting off driving power.

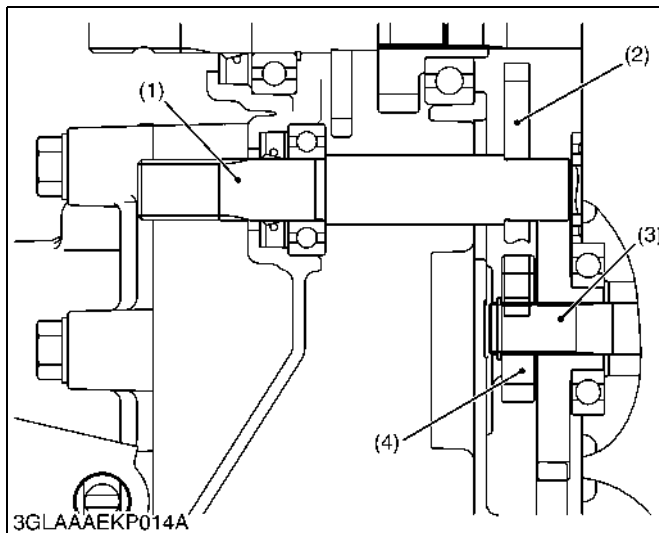
The steering clutch becomes disengaged when the steering wheel rotates to reach a front axle steering angle from 0.17 to 0.44 rad (10 to 25 degree).

- (1) Spline Boss
- (2) Clutch Lever

- (3) Clutch Collar
- (4) Clutch Disc and Friction Plate

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[3] FRONT WHEEL DRIVE SECTION



This machine is equipped with four wheel drive.
Driving power is transmitted to the front axle as follows:

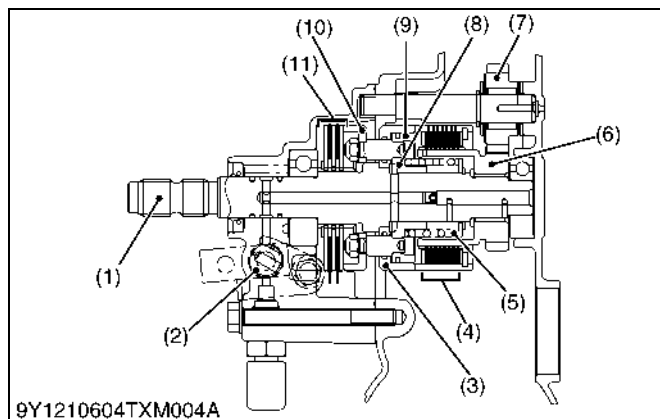
Motor shaft (3) → 15T gear (4) → 29T gear (2) →
Front wheel drive shaft (1)

- | | |
|-----------------------------|-----------------|
| (1) Front Wheel Drive Shaft | (3) Motor Shaft |
| (2) 29T Gear | (4) 15T Gear |

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3. MOWER PTO SYSTEM

[1] HYDRAULIC PTO CLUTCH



The hydraulic PTO clutch is equipped with hydraulic clutches of wet multi-plates type.

The PTO shaft (1) is engaged with the spline boss (8).

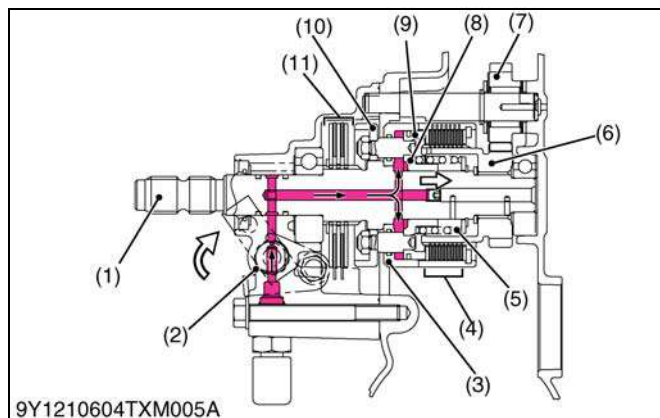
The clutch case (3) is engaged with the 24T gear (6).

Normally, spring (5) tension pushes the spline boss (8) in the PTO clutch toward the front side of the machine, which creates clearance between clutch disc and friction plate (4), causing no friction.

Thus, no driving power is transmitted between spline boss (8) and clutch case (3), that is, no driving power is transmitted to the PTO shaft (1).

- | | |
|------------------------------------|------------------------------------|
| (1) PTO Shaft | (6) 24T Gear |
| (2) PTO Clutch Valve | (7) 19T-2 Gear |
| (3) Clutch Case | (8) Spline Boss |
| (4) Clutch Disc and Friction Plate | (9) Piston |
| (5) Spring | (10) Brake Piston |
| | (11) Brake Disc and Friction Plate |

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PTO "Engaged"

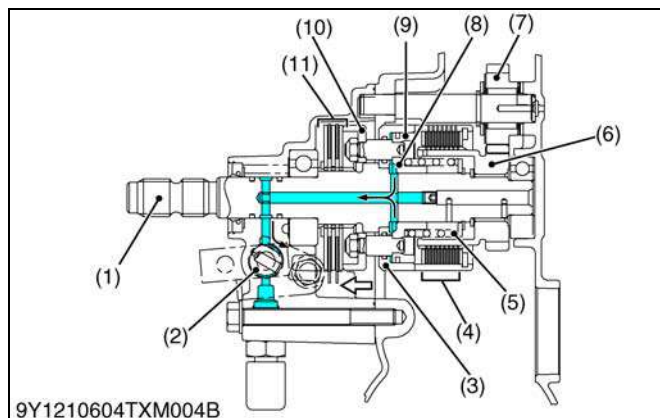
When the PTO lever is set at the **"Engaged"** position, the oil from hydraulic pump flows to PTO clutch valve (2). Oil entering the clutch pack pushes the piston (9) to engage the clutch pack.

This allows driving power to be transmitted as follows:

19T-2 Gear (7) → 24T Gear (6) → Clutch Disc and Friction Plate (4) → Clutch Case (3) → PTO Shaft (1)

- | | |
|------------------------------------|------------------------------------|
| (1) PTO Shaft | (6) 24T Gear |
| (2) PTO Clutch Valve | (7) 19T-2 Gear |
| (3) Clutch Case | (8) Spline Boss |
| (4) Clutch Disc and Friction Plate | (9) Piston |
| (5) Spring | (10) Brake Piston |
| | (11) Brake Disc and Friction Plate |

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PTO "Disengaged"

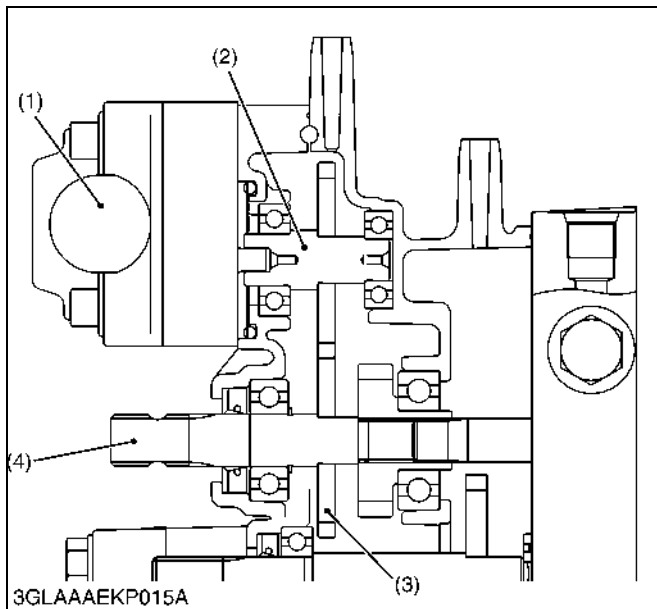
When the PTO lever is set at the **"Disengaged"** position, the oil from hydraulic pump is blocked and the oil in the clutch pack is drained into the transaxle case. Thus the piston is pushed back by the spring. When the piston is pushed back, the brake piston is also moved to contact the brake disc so as to stop the rotation and drag of the PTO shaft.

- | | |
|------------------------------------|------------------------------------|
| (1) PTO Shaft | (6) 24T Gear |
| (2) PTO Clutch Valve | (7) 19T-2 Gear |
| (3) Clutch Case | (8) Spline Boss |
| (4) Clutch Disc and Friction Plate | (9) Piston |
| (5) Spring | (10) Brake Piston |
| | (11) Brake Disc and Friction Plate |

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4. OTHERS

[1] HYDRAULIC PUMP SECTION



The hydraulic pump (1) is on the transaxle case.

The power to drive the hydraulic pump (1) is transmitted as follows:

Input shaft (4) → 25T gear (3) on input shaft → Hydraulic pump gear shaft (2)

- | | |
|---|----------------------------|
| (1) Hydraulic Pump | (3) 25T Gear (Drive Shaft) |
| (2) Hydraulic Pump Gear Shaft (Drive Shaft) | (4) Input Shaft |

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SERVICING

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1. TROUBLESHOOTING

Symptom	Probable Cause		Solution	Reference Page
System Will Not Operate in Either Direction	Oil level is low		Fill oil to proper level	2-S16
	Control linkage damaged (Speed change pedal to speed control arm)		Repair control linkage	2-S6, 2-S19
	Charge pressure is too low	Oil filter cartridge clogged	Replace oil filter cartridge	G-37
		HST relief valve damaged	Replace HST relief valve	6-S14
		Hydraulic pump damaged	Replace hydraulic pump	6-S15
	Check and high pressure relief valve damaged		Replace check and high pressure relief valve	2-S8, 2-S28
	By-pass valve damaged		Replace by-pass valve	2-S27
Vibration and Noise Loss Power	Oil level is low		Fill oil to proper level	2-S16
	Control linkage damaged (Speed change pedal to speed control arm)		Repair control linkage	2-S6, 2-S19
	Charge pressure is too low	Oil filter cartridge clogged	Replace oil filter cartridge	G-37
		HST relief valve damaged	Replace HST relief valve	6-S14
		Hydraulic pump damaged	Replace hydraulic pump	6-S15
	Check and high pressure relief valve damaged		Replace check and high pressure relief valve	2-S8, 2-S28
	By-pass valve damaged		Replace by-pass valve	2-S27
Oil Heat Over	Oil level is low		Fill oil to proper level	2-S16
	Excessive machine load		Decrease the load	—
	Charge pressure is too low	Oil filter cartridge clogged	Replace oil filter cartridge	G-37
		HST relief valve damaged	Replace HST relief valve	6-S14
		Hydraulic pump damaged	Replace hydraulic pump	6-S15
	Check and high pressure relief valve damaged		Replace check and high pressure relief valve	2-S8, 2-S28
	By-pass valve damaged		Replace by-pass valve	2-S27
Machine Will Not Stop in Neutral Position	Control linkage damaged (Speed change pedal to speed control arm)		Repair control linkage	2-S6, 2-S19
	Improper adjustment of neutral arm holder shaft		Adjust	2-S5

Symptom	Probable Cause	Solution	Reference Page
System Operates in One Direction Only	Control linkage damaged (Speed change pedal to speed control arm)	Repair control linkage	2-S6, 2-S19
	Check and high pressure relief valve damaged	Replace check and high pressure relief valve	2-S8, 2-S28

BEVEL GEAR SECTION

Symptom	Probable Cause	Solution	Reference Page
Excessive or Unusual Noise at All Time	Improper backlash between 11T bevel gear and 17T-13T gear shaft	Adjust	2-S43
	Bearing worn	Replace	–
	Insufficient or improper type of transmission fluid used	Fill or change	G-9, 2-S16
Noise while Turning	Bearing worn	Replace	–

GLIDE STEER SECTION

Symptom	Probable Cause	Solution	Reference Page
The Driving Power is not Transmitted to Rear Wheel at the Time of Going Straight	Glide Steer clutch disc worn	Replace	2-S37
	Glide Steer clutch plate worn	Replace	2-S37
	Clutch spring weaken or broken	Replace	2-S40
	Improper adjustment of rod	Adjust	2-S13
The Driving Power to Rear Wheel on inside of Turn is not Shut Off at the Time of Turning	Glide Steer clutch disc and friction plate are attached	Replace	2-S37
	Improper adjustment of rod	Adjust	2-S13
	Rod bent	Replace	–

MOWER PTO SECTION

Symptom	Probable Cause	Solution	Reference Page
PTO Clutch Slip	Operating pressure is low PTO clutch valve malfunctioning	Replace	2-S12, 2-S30
	Clutch disc or friction plate excessively worn	Replace	2-S31, 2-S43
PTO Shaft Does Not Rotate	PTO clutch malfunctioning	Repair or replace	2-S29
	Bearing broken	Replace	–
PTO Clutch Drags	Brake plate excessive worn	Replace	2-S32
	Clutch spring weaken or broken	Replace	2-S33
	Deformation of plate	Replace	2-S32

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2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
HST Charge Relief Valve (Oil temperature at 50 °C (122 °F))	Setting Pressure	0.900 to 1.10 MPa 9.18 to 11.2 kgf/cm ² 131 to 159 psi	—
High Relief Pressure Relief Valve	Setting Pressure	18.5 to 22.5 MPa 189 to 229 kgf/cm ² 2690 to 3260 psi	—
PTO Operating Pressure	Setting Pressure	0.900 to 1.10 Mpa 9.18 to 11.2 kgf/cm ² 131 to 159 psi.	—
11T Bevel Gear Shaft to 17T-13T Gear Shaft	Backlash	0.10 to 0.30 mm 0.0039 to 0.0012 in.	—
PTO Clutch Disc	Thickness	1.3 to 1.5 mm 0.052 to 0.059 in.	1.2 mm 0.047 in.
PTO Clutch Plate	Thickness	0.75 to 0.85 mm 0.030 to 0.033 in.	060 mm 0.024 in.
Clutch Spring	Free Length	45.0mm 1.77 in.	40.0 mm 1.57 in.
PTO Brake Disc (Center)	Thickness	2.60 to 2.80 mm 0.103 to 0.110 in.	2.50 mm 0.0984 in.
PTO Brake Disc (Side)	Thickness	2.15 to 2.35 mm 0.0847 to 0.0925 in.	2.05 mm 0.0807 in.
PTO Brake Plate	Thickness	0.950 to 1.05 mm 0.0374 to 0.0413 in.	0.80 mm 0.031 in.
Glide Steer Clutch Disc	Thickness	1.30 to 1.50 mm 0.0512 to 0.0590 in.	1.20 mm 0.0472 in.
Glide Steer Clutch Plate	Thickness	0.75 to 0.85 mm 0.030 to 0.033 in.	0.60 mm 0.024 in.

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3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: See page "5. TIGHTENING TORQUES" on page G-12.)

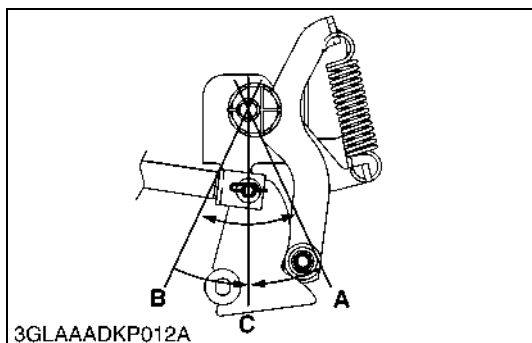
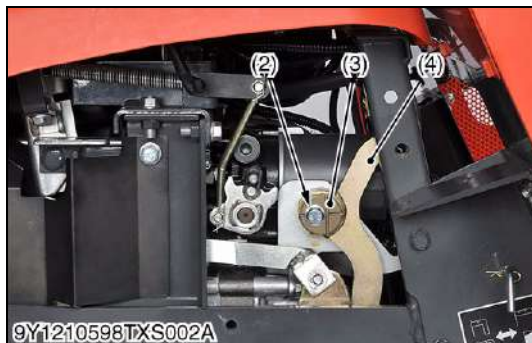
Item	N·m	kgf·m	lbf·ft
Brake plate mounting screw	35 to 40	3.6 to 4.0	26 to 29
Universal joint mounting screw	9.80 to 11.3	1.00 to 1.15	7.23 to 8.33
Power steering pipe retaining nut	20.0 to 25.0	2.04 to 2.54	14.8 to 18.4
Cylinder hose retaining nut	24.0 to 28.0	2.45 to 2.85	17.7 to 20.6
Rear wheel mounting nut	77.6 to 90.2	7.92 to 9.19	57.2 to 66.5
Transaxle mounting screw	48.1 to 55.9	4.91 to 5.70	35.5 to 41.2
Set screw for speed control arm	17.7 to 20.6	1.81 to 2.10	13.1 to 15.1
Suction pipe 2 mounting screw	7.8 to 8.8	0.80 to 0.89	5.8 to 6.4
Suction filter case mounting screw	7.8 to 8.8	0.80 to 0.89	5.8 to 6.4
Control valve pipe retaining nut	24 to 28	2.5 to 2.8	18 to 20
Hydraulic pipe joint bolt	32 to 36	3.3 to 3.6	24 to 26
Hose clamp for drain hose	1.0 to 1.2	0.11 to 0.12	0.74 to 0.88
Brake assembly mounting bolt	7.8 to 8.8	0.80 to 0.89	5.8 to 6.4
Hydrostatic transmission mounting screw	24 to 27	2.4 to 2.8	18 to 20
Hydrostatic transmission mounting screw 2	18 to 20	1.8 to 2.1	13 to 15
Center section mounting hex. socket head screw	18 to 20	1.8 to 2.1	13 to 15
By-pass valve plug	15.0	1.53	11.1
Check and high pressure relief valve plug	30.0	3.06	22.1
Joint (PTO clutch)	29 to 39	3.0 to 3.9	22 to 28
Hydraulic PTO clutch assembly mounting bolt	18 to 20	1.8 to 2.1	13 to 15
PTO clutch piston lock nut	9.8 to 11	1.1 to 1.2	7.2 to 8.6
Hydraulic pump mounting screw	18 to 20	1.8 to 2.1	13 to 15
Transaxle case bolt (M6)	9.81 to 11.3	1.00 to 1.15	7.24 to 8.31
Rear axle shaft lock nut	100 to 120	10.2 to 12.2	73.8 to 88.5

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4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING, AND ADJUSTING

(1) HST Speed Change System



Adjustment of HST Neutral Position

1. Lift up the front and rear of the machine, and support it with disassembling jacks.
2. Remove the left rear wheel.
Remove the cover (1). [GR2120SEU, GR2120F only]
3. Start the engine, and set at approx. 1500 to 3000 min⁻¹ (rpm).
4. Loosen the holder shaft mounting screw (2).
5. Rotate the holder shaft (3) counterclockwise so that the rear wheels turn forward.
6. Then rotate it clockwise until the rear wheels stop completely.
7. Put a mark on the neutral arm (4). (Position **B**)
8. Rotate the holder shaft (3) clockwise so that the rear wheels turn in reverse.
9. Then rotate it counterclockwise until the rear wheels stop completely.
10. Put a mark on the neutral arm (4). (Position **A**)
11. Set the holder shaft (3) where it is right in the center between position **A** and **B** and tighten the holder shaft mounting screw (2) firmly.
This means the hydrostatic transaxle is fully in neutral. (Position **C**)



WARNING

- Use buddy system to adjust the neutral position.
- One of you, stay on the operator's seat, adjust the engine rpm and step on the speed change pedal. The other, adjust the neutral position.

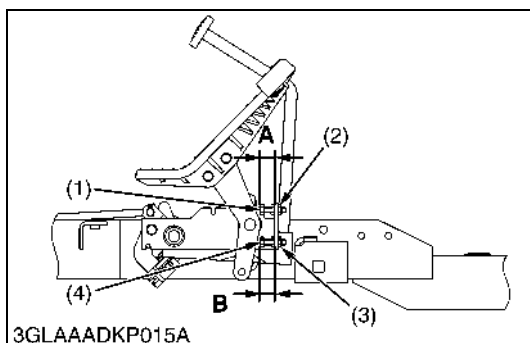
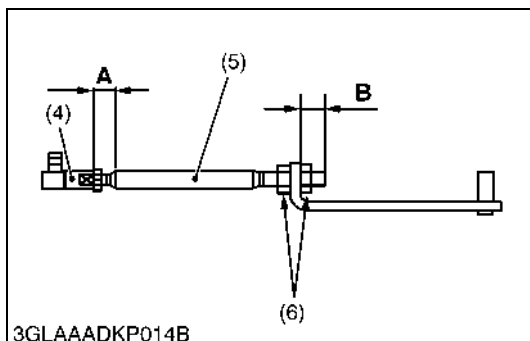
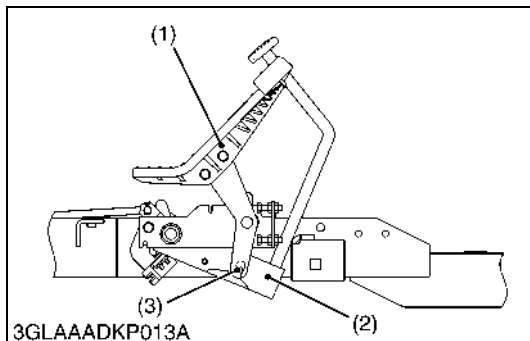
(1) Cover

(2) Holder Shaft Mounting Screw

(3) Holder Shaft

(4) Neutral Arm

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Speed Change Pedal Restriction

■ NOTE

- **Adjust this after the adjustment of neutral.**

1. Set the speed change pedal (1) to **"NEUTRAL"** position, and apply the parking brake.
2. Check that the pin (3) of speed change pedal lock with the brake pedal arm (2).
3. If it is improper, adjust the length **"A"** with the rod end (4) on speed change rod.
4. Then adjust the length **"B"** with adjusting nut (6) on speed change rod (5).

(Reference)

- Length **"A"**
20 mm (0.79 in.)
- Length **"B"**
16 to 20 mm (0.63 to 0.78 in.)

- | | |
|------------------------|----------------------|
| (1) Speed Change Pedal | (4) Rod End |
| (2) Brake Pedal Arm | (5) Speed Change Rod |
| (3) Pin | (6) Adjusting Nut |

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Adjusting Maximum Speed

■ NOTE

- **Adjust this after the adjustment of neutral.**

[Forward]

1. Loose the lock nut (2) of adjusting screw.
2. Adjust the length **"A"** with the adjusting screw (1).

(Reference)

- Length **"A"**
12 to 15 mm (0.48 to 0.59 in.)
- Traveling speed
9.0 to 10.0 km/h (5.6 to 6.2 mph)

[Reverse]

1. Loose the lock nut (3) of adjusting screw.
2. Adjust the length **"B"** with the adjusting screw (4).

(Reference)

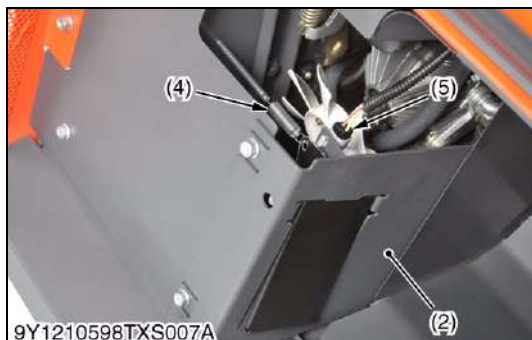
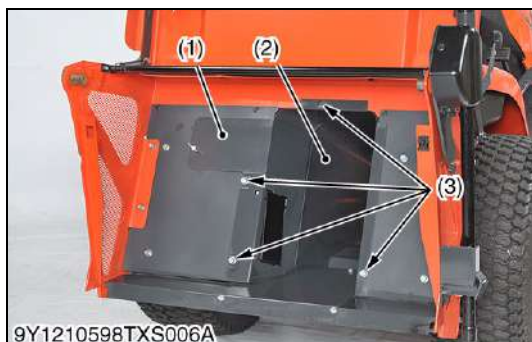
- Length **"B"**
12 to 13 mm (0.48 to 0.51 in.)
- Traveling speed
4.0 to 5.0 km/h (2.5 to 3.1 mph)

- | | |
|---------------------|---------------------|
| (1) Adjusting Screw | (3) Lock Nut |
| (2) Lock Nut | (4) Adjusting Screw |

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(2) HST Charge Pressure

[A] Preparation



Removing Container [GR2120EU, GR2120F Only]

1. Pull the top cover lock lever (2) to open the top cover (1).
2. Set the grass container lift lever (4) in "**LEVER LOCK**" position.
3. Lift up the rear of the grass container (3).
4. Lift up the whole grass container and remove.

(When attaching)

- Open the top cover (1).
- Set the grass container lift lever (4) in "**LEVER LOCK**" position.
- Lift the rear end of the grass container (3), set the grass container (3) onto the frame shaft so that a clearance "**L**" is about 0 to 50 mm (0 to 2.0 in.).
- Lock the grass container (3) with the grass container lift lever (4) in "**CONTAINER LOCK**" position.
- Close the top cover (1).

(Reference)

- Clearance "**L**": 0 to 50 mm (0 to 2.0 in.)

- (1) Top Cover
(2) Top Cover Lock Lever

- (3) Grass Container
(4) Grass Container Lift Lever

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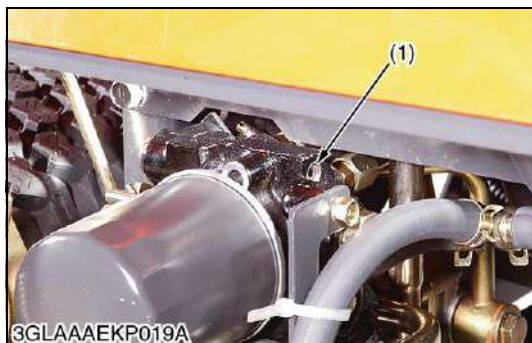
Discharge Duct [GR2120EU, GR2120F]

1. Remove the filter cover (1).
2. Remove the screws (3) for the discharge duct (2).
3. Disconnect the spring (4) and the coupler (5).
4. Remove the discharge duct (2).

- (1) Filter Cover
(2) Discharge Duct
(3) Screw

- (4) Spring
(5) Coupler

9Y1210598TXS0073US0



(3) HST Relief Pressure



Checking HST Charge Pressure



CAUTION

- Park the machine on level ground, and apply the parking brake.
 - Adjust HST neutral first.
1. Remove the plug (1) from the hydraulic control valve assembly.
 2. Install the gauge hose adaptor, gauge hose and pressure gauge. Refer to G-56.
 3. Start the engine and run engine speed at maximum speed.
 4. Read the pressure gauge to measure the HST charge pressure.
 5. If the measurement is not within the factory specification, check the hydraulic control valve and the related hydraulic components.

HST charge pressure	Factory specification	0.900 to 1.10 MPa 9.18 to 11.2 kgf/cm ² 131 to 159 psi
---------------------	-----------------------	---

Condition

- Engine speed
Maximum
- Oil temperature
50 °C (122 °F)

- (1) Plug
(2) Gauge Hose Adaptor
(3) Gauge Hose

[A] GR2120SEU

[B] GR2120EU, GR2120F

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Removing Grass Container [GR2120EU, GR2120F Only]

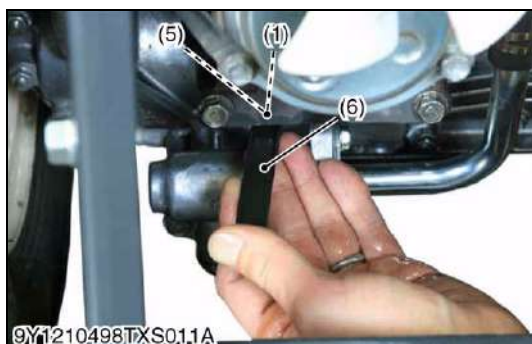
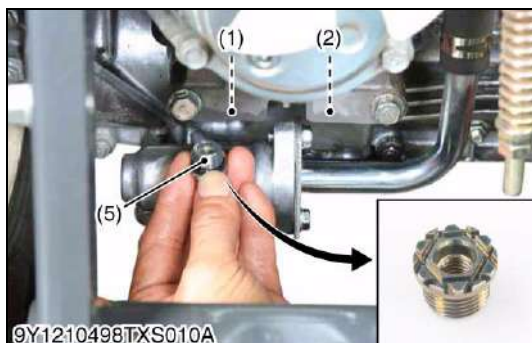
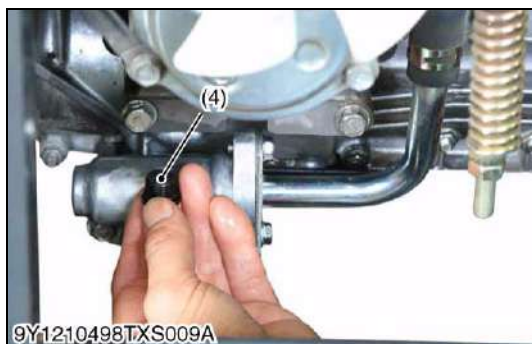
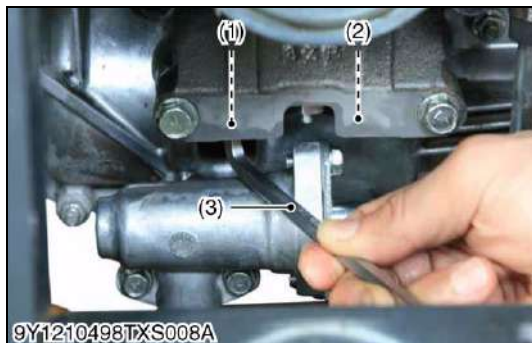
- Refer to 2-S7.

9Y1210598TXS0074US0

Removing Rear Wheel [GR2120EU GR2120F Only]

1. Set a jacky at the rear frame.
2. Remove the left rear wheel.

9Y1210598TXS0075US0



Installing HST Relief Pressure Gauge Adaptor 2 to HST Center Section



CAUTION

- **Park the machine on the asphalt level ground and apply the parking brake.**

1. Remove the hexagon socket head plug (4) from **P1** (1) or **P2** (2), from the HST center case, using the short neck hexagon wrench. (See page G-58.)
2. Install the adaptor **2** to the HST center section. (See page G-57.)
3. Tighten the adaptor 2, using the adaptor lever. (See page G-57.)

(1) **P1** Port (Reverse)

(2) **P2** Port (Forward)

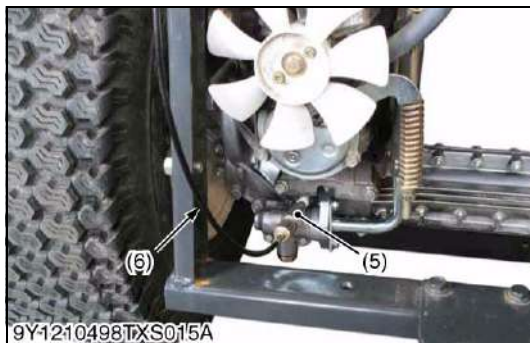
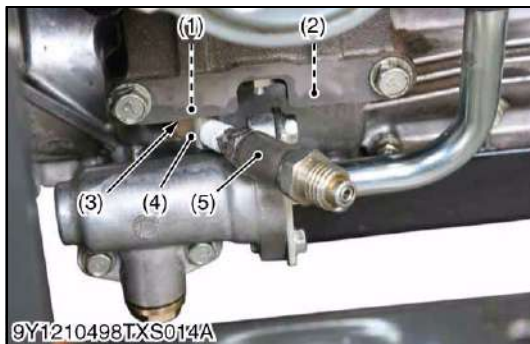
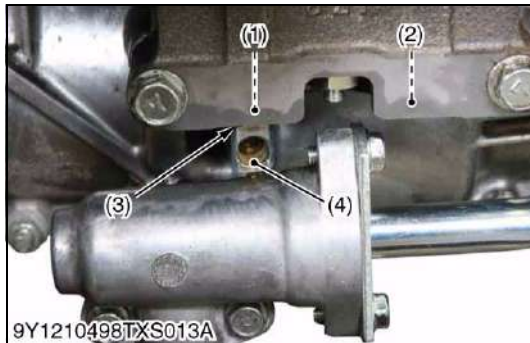
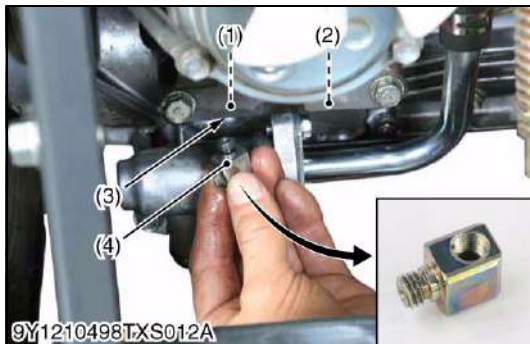
(3) Short Neck Wrench

(4) Hexagon Socket Head Plug

(5) Adaptor **2**

(6) Adaptor Lever

9Y1210598TXS0008US0



Installing HST Relief Pressure Gauge Adaptor 1 to Adaptor 2

⚠ CAUTION

- When checking, park the machine on the asphalt level ground and apply the parking brake.

1. Install the adaptor 1 (4) to the adaptor 2 (3).
2. Install the gauge hose adaptor (5) to the adaptor 1 (4).
3. Connect the gauge hose (6) to the gauge hose adaptor (5).
4. Install the left rear wheel

- (1) P1 Port (Reverse)
(2) P2 Port (Forward)
(3) Adaptor 2

- (4) Adaptor 1
(5) Gauge Hose Adaptor
(6) Gauge Hose

9Y1210598TXS0009US0



Checking the Check and High Pressure Relief Valve Operating Pressure (Forward)

1. Stop the machine on the asphalt surface.
2. Attach a wooden piece to the machine bumper and touch the front of the machine to the wall.
3. Start the engine and run it at the maximum speed.
4. Depress the speed change pedal forward, and read the pressure gauge to measure the check and high pressure relief valve operating pressure.
5. If the measurement is not same as factory specification, check the check and high pressure relief valve and the related hydraulic components.

Check and high pressure relief valve operating pressure (Forward)	Factory specification	18.5 to 22.5 MPa 189 to 229 kgf/cm ² 2690 to 3260 psi
---	-----------------------	--

Condition

- Engine speed
Maximum speed
- Oil temperature
50 °C (122 °F)

- (1) Wooden Piece
(2) Wall
(3) Front Frame

[A] GR2120SEU

[B] GR2120EU, GR2120F

9Y1210598TXS0010US0



Checking the Check and High Pressure Relief Valve Operating Pressure (Reverse)

1. Stop the machine on the asphalt surface.
2. Connect the steel chain to the machine front frame. Connect the steel chain other end to the strong and stable object.
3. Start the engine and run it at the maximum speed.
4. Depress the speed change pedal reverse, and read the pressure gauge to measure the check and high pressure relief valve operating pressure.
5. If the measurement is not same as factory specification, check the check and high pressure relief valve and the related hydraulic components.

Check and high pressure relief valve operating pressure (Reverse)	Factory specification	18.5 to 22.5 MPa 189 to 229 kgf/cm ² 2690 to 3260 psi
---	-----------------------	--

Condition

- Engine speed
Maximum speed
- Oil temperature
50 °C (122 °F)

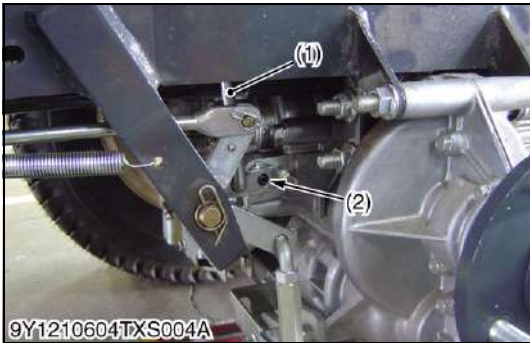
- (1) Front Frame
(2) Steel Chain

[A] GR2120SEU

[B] GR2120EU, GR2120F

9Y1210598TXS0011US0

(4) PTO Operating Pressure



Checking PTO Operating Pressure

1. Start the engine and warm up the transmission fluid, and then stop the engine.
2. Remove the plug (2) (R 1/8) from the PTO valve.
3. Set the pressure gauge.
4. Start the engine.
5. Shift the PTO lever to **ON** position and measure the pressure.
6. If the measurement is not within the factory specification, check the hydraulic control valve.

PTO operating pressure	Factory specification	PTO lever ON position	0.900 to 1.10 MPa 9.18 to 11.2 kgf/cm ² 131 to 159 psi
		PTO lever OFF position	0 MPa 0 kgf/cm ² 0 psi

Condition

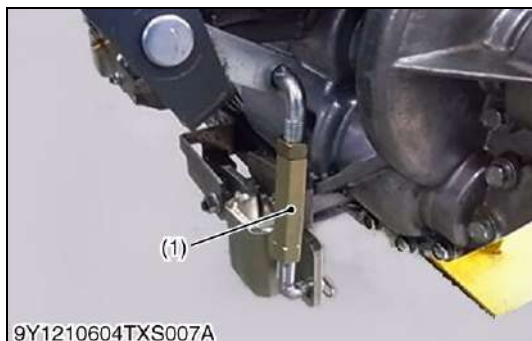
- Engine speed
Maximum speed
- Oil temperature
40 to 60 °C (104 to 140 °F)

- (1) PTO Lever
(2) Plug (R 1/8)

A: ON Position

9Y1210598TXS0012US0

(5) Glide Steer



Adjusting Glide Steer



CAUTION

- Park the machine on level ground.
- Stop the engine and remove the key.



NOTE

- **Adjust this after the adjustment of toe-in.**
1. Jack up the machine and fix it to the disassembly stand.
 2. Straighten front tire direction by steering the steering wheel.
 3. Steer the front tires to angle "A" 0.35 rad (22 °) by steering the steering wheel.
 4. Place protractor at the frame and check angle.
 5. Measure the nut of rear shaft in the tightening direction.
 6. Measure the torque and check if tires rotate at 40 N·m (4.1 kgf·m, 30 lbf·ft).
 7. When rear tires do not rotate, adjust the length of adjusting rod (1) to proper position.
 8. Handle the steering wheel so that the tires straighten.
 9. Move the Glide Steer rod back and forth and make sure there is play.
 10. Adjust both the right and the left Glide Steer rods.

(1) Adjusting Rod

A: 0.35 rad (22 °)

9Y1210598TXS0013US0

[2] PREPARATION

(1) Separating Transaxle



Dismounting Mower

1. See page "[1] PREPARATION" on page 8-S9.

9Y1210598TXS0014US0

Rear Cover [GR2120SEU]

1. Remove the rear cover (1).

(1) Rear Cover

9Y1210598TXS0015US0

Removing Container [GR2120EU, GR2120F Only]

1. Pull the top cover lock lever (2) to open the top cover (1).
2. Set the grass container lift lever (4) in "**LEVER LOCK**" position.
3. Lift up the rear of the grass container (3).
4. Lift up the whole grass container and remove.

(When attaching)

- Open the top cover (1).
- Set the grass container lift lever (4) in "**LEVER LOCK**" position.
- Lift the rear end of the grass container (3), set the grass container (3) onto the frame shaft so that a clearance "**L**" is about 0 to 50 mm (0 to 2.0 in.).
- Lock the grass container (3) with the grass container lift lever (4) in "**CONTAINER LOCK**" position.
- Close the top cover (1).

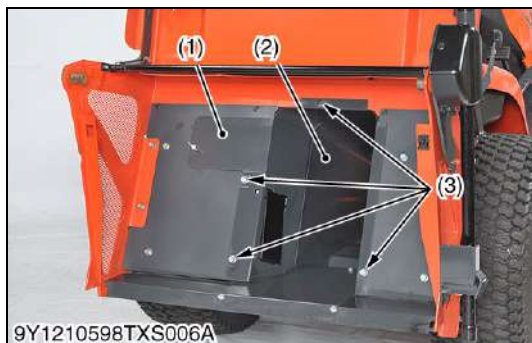
(Reference)

- Clearance "**L**": 0 to 50 mm (0 to 2.0 in.)

- (1) Top Cover
(2) Top Cover Lock Lever

- (3) Grass Container
(4) Grass Container Lift Lever

9Y1210598TXS0072US0

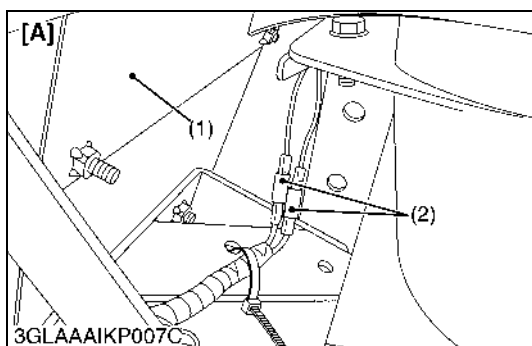
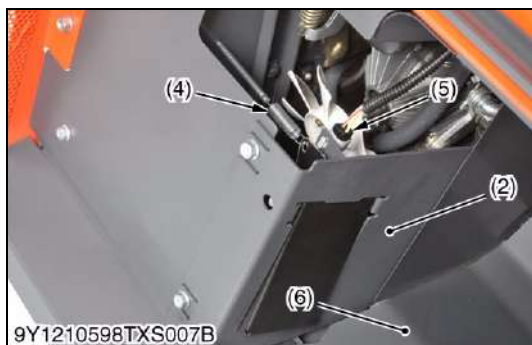


Discharge Duct [GR2120EU, GR2120F]

1. Remove the filter cover (1).
2. Remove the screws (3) for the discharge duct (2).
3. Disconnect the spring (4) and the coupler (5).
4. Remove the discharge duct (2) and duct plate (6).

- | | |
|--------------------|----------------|
| (1) Filter Cover | (4) Spring |
| (2) Discharge Duct | (5) Coupler |
| (3) Screw | (6) Duct Plate |

9Y1210598TXS0076US0



Container Base [GR2120EU, GR2120F]

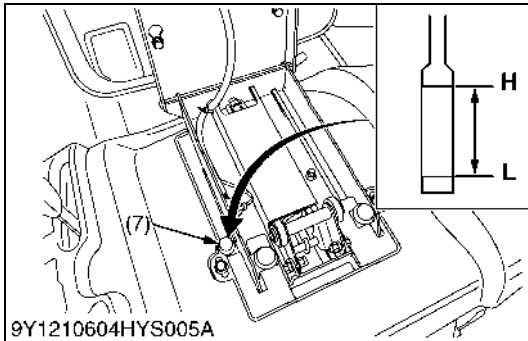
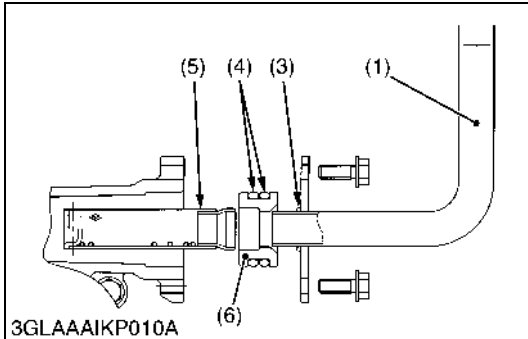
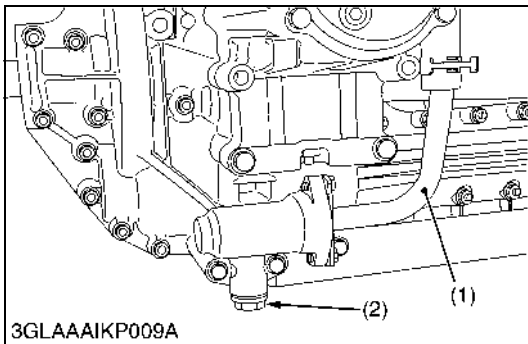
1. Disconnect the connector (2).
2. Remove the container base (1).

- | |
|--------------------|
| (1) Container Base |
| (2) Connector |

[A] Right Side

9Y1210598TXS0077US0





Draining Transmission Fluid

1. Start the engine. Push the mower lift lever and lower the mower link.
2. Place an oil pan under the transaxle.
3. Remove the drain plug (2).
4. Remove the strainer (5) to completely drain the transmission fluid.
5. After draining, clean the strainer (5) and reinstall it.

(When refilling)

- Remove the filling plug with the dipstick, and fill the new transmission fluid to "H" level on the dipstick.
- Start the engine, and do the following operations. However, absolutely avoid engaging the PTO lever during this operation.
 - 1) Depress the speed change pedal alternately to the forward side and reverse side in order to move the machine forward and backward.
 - 2) Rotate the steering wheel to the right and left to turn the front wheels right and left.
 - 3) Operate the mower lift lever in order to make the mower deck go up and down.
 - 4) During the operation described above, check to see if no oil leakage from the transaxle assembly and each hydraulic pipe is found.
- At least 5 minutes after stopping the engine, check the oil level again, using the dipstick.
- If the oil level is lower than the "H" level indicated on the dipstick, fill the oil tank with transmission fluid additionally up to the "H" level.
- Do the above-mentioned operation again. And confirm that the oil level is not low level.
- Disconnect the universal joint of mower deck from the PTO shaft. Shift the PTO lever to "**Engage**" position, and check to see if the PTO shaft rotates quickly without abnormal noise. Next, shift the PTO lever to the "**Disengage**" position, and check to see if the PTO shaft stops operation quickly without abnormal noise.

■ IMPORTANT

- **Park the machine on level ground.**
- **Use the KUBOTA UDT or SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. (See page "4. LUBRICANTS, FUEL AND COOLANT" on page G-9.)**
- **Do not mix different brand oil together.**

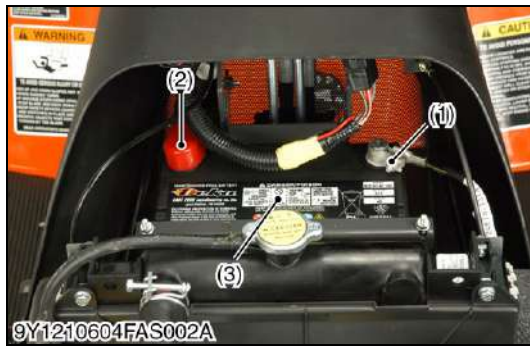
Transmission fluid	Capacity	3.3 L 3.5 U.S.qts 2.9 Imp.qts
--------------------	----------	-------------------------------------

- (1) Suction Pipe
- (2) Drain Plug
- (3) O-ring (Small)
- (4) O-ring (Large)
- (5) Strainer

- (6) Boss
- (7) Filling Plug with Dipstick

H: Highest Level
L: Lowest Level

9Y1210598TXS0016US0



Battery

⚠ CAUTION

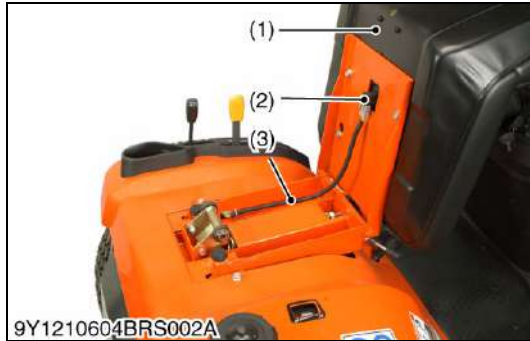
- When disconnecting the battery cables, disconnect the negative cable from the battery first. When connecting, connect the positive cable to the battery first.

- Open the bonnet.
- Disconnect the negative cable (1) from the battery.
- Disconnect the positive cable (2) from the battery and remove the battery (3).

- (1) Negative Cable
(2) Positive Cable

(3) Battery

9Y1210598ENS0023US0



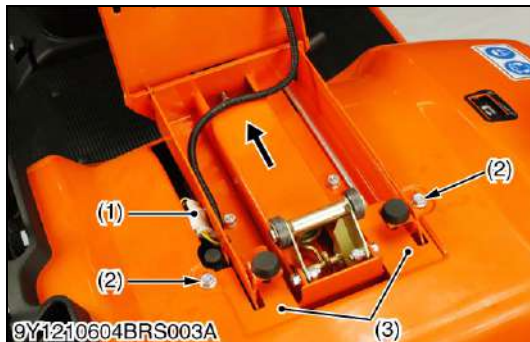
Seat

- Turn the seat (1).
- Disconnect the safety switch connector (2).
- Remove the seat (1).

- (1) Seat
(2) Safety Switch Connector

(3) Wire Harness

9Y1210598TXS0018US0



Seat Base and Fender

- Disconnect the seat connector (1).
- Remove the screws (2).
- Remove the support base (3).
- Move the seat base (4) in ahead.
- Remove the seat base (4).
- Remove the lever grips (6), fuel and the cutting height control dial (9).
- Remove the speed change pedal (10).
- Remove the fuel tank cap (7) and fender (8).

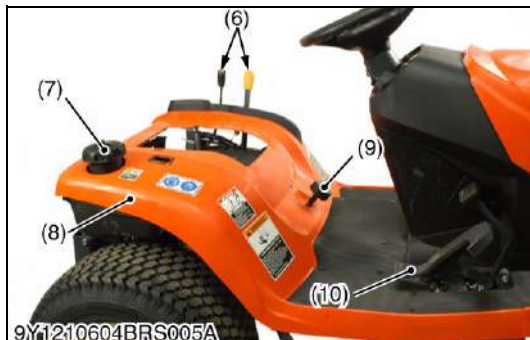
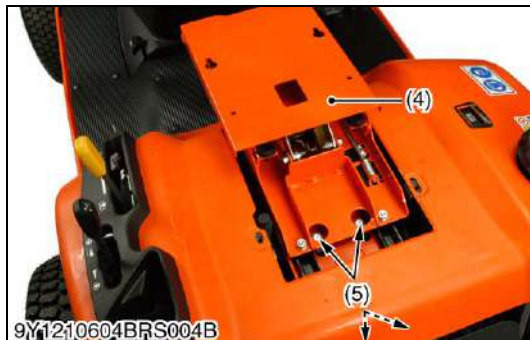
■ NOTE

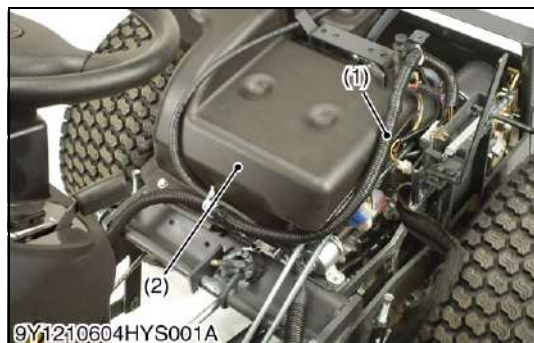
- To remove the fender, remove the hydraulic hose from guide first.

- (1) Seat Connector
(2) Screw
(3) Support Base
(4) Seat Base
(5) Seat Base Mounting screw

- (6) Lever Grip
(7) Fuel Tank Cap
(8) Fender
(9) Cutting Height Control Dial
(10) Speed Charge Pedal

9Y1210598TXS0020US0





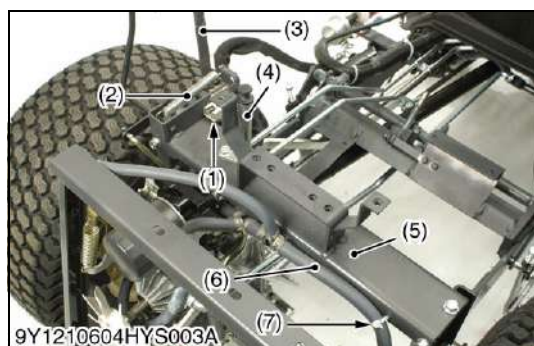
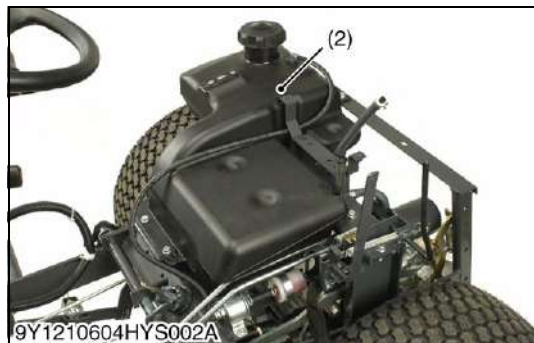
Fuel Tank

1. Drain the fuel.
2. Disconnect the wire harness (1).
3. Disconnect the fuel hoses.
4. Remove the fuel tank (2).

(1) Wire Harness

(2) Fuel Tank

9Y1210598TXS0021US0



Beam

1. Disconnect the connector from the PTO switch (1).
2. Remove the spring (2) from the PTO lever (3).
3. Remove the PTO rod.
4. Remove the filling pipe (4).
5. Remove the hose clamp (7) of breather hose (6).
6. Remove the beam (5).

(When reassembling)

- After assembling the beam, fix the breather hose (6) to the beam (5) with the hose clamp horizontally along the beam (5).

(1) PTO Switch

(5) Beam

(2) Spring

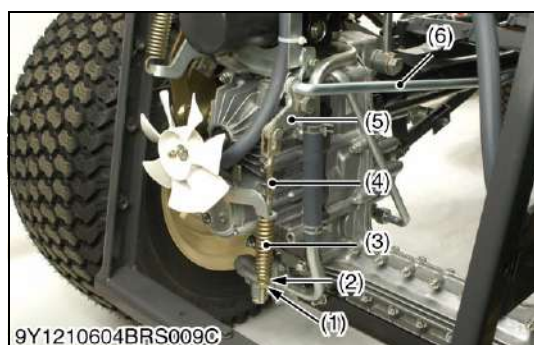
(6) Breather Hose

(3) PTO Lever

(7) Hose Clamp

(4) Filling Pipe

9Y1210598TXS0022US0



Brake Rod

1. Disconnect the brake rod 1 (6).
2. Remove the lock nut (1), plain washers (2) and brake spring (3).
3. Remove the brake plate (5).
4. Remove the brake rod 2 (4) and brake rod 1 (6).

(When reassembling)

■ IMPORTANT

- After assembling the brake rod 1, 2 (4), (6) and brake spring (3), be sure to adjust the brake pedal free travel. (See page 3-S4.)

Tightening torque	Brake plate mounting screw	35 to 40 N·m 3.6 to 4.0 kgf·m 26 to 29 lbf·ft
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(1) Lock Nut

(4) Brake Rod 2

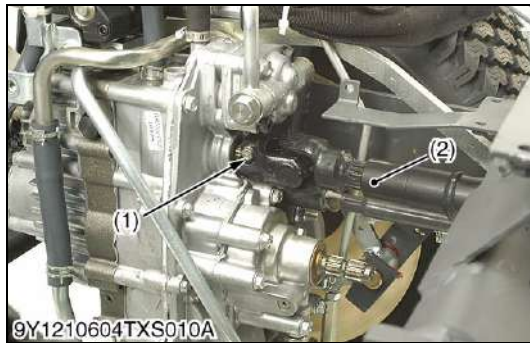
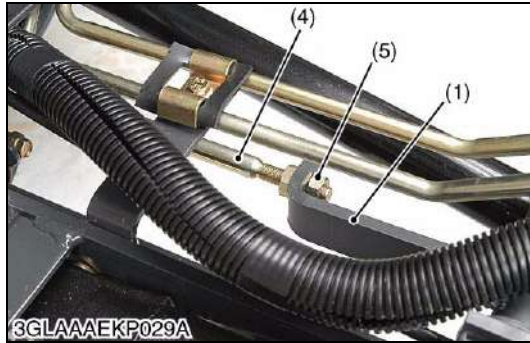
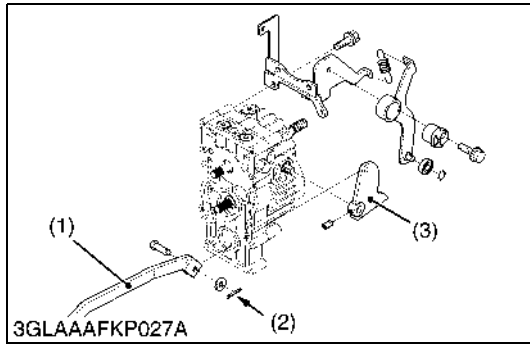
(2) Plain Washer

(5) Brake Plate

(3) Brake Spring

(6) Brake Rod 1

9Y1210598TXS0023US0



Speed Control Plate

1. Remove the split pin (2), and disconnect the speed change plate (1) and speed control arm (3).
2. Separate the speed change plate (1) and speed change rod (4).

(When reassembling)

■ **IMPORTANT**

- After assembling the speed change plate (1) and speed change rod (4), be sure to adjust the speed change pedal restriction. (See page 2-S6.)

- | | |
|------------------------|----------------------|
| (1) Speed Change Plate | (4) Speed Change Rod |
| (2) Split Pin | (5) Lock Nut |
| (3) Speed Control Arm | |

9Y1210598TXS0024US0

Universal Joint

1. Remove the universal joint mounting screw (1).
2. Disconnect the universal joint (2).

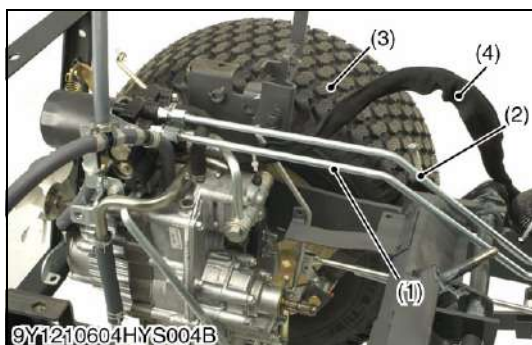
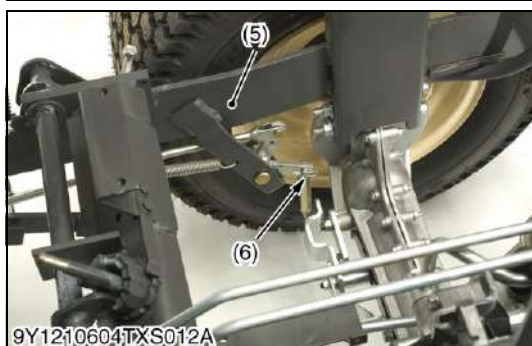
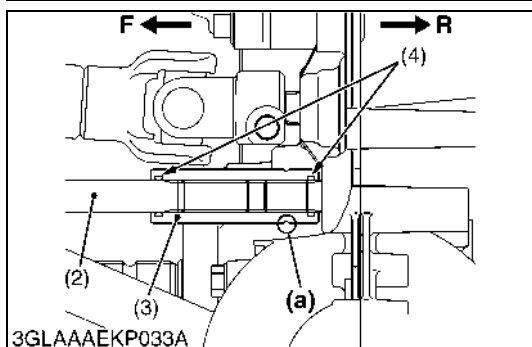
(When reassembling)

- Apply grease to the splines of the universal joint.

Tightening torque	Universal joint mounting screw	9.80 to 11.3 N·m 1.00 to 1.15 kgf·m 7.23 to 8.33 lbf·ft
-------------------	--------------------------------	---

- | | |
|------------------------------------|---------------------|
| (1) Universal Joint Mounting Screw | (2) Universal Joint |
|------------------------------------|---------------------|

9Y1210598TXS0025US0



Front Wheel Drive Shaft and Glide Steer Linkage

1. Remove the bearing holder (1).
2. Disconnect the front wheel drive shaft (2) and spline boss (3) from transaxle.
3. Remove the rue rings (6) and remove the pins.

(When reassembling)

- Install the spline boss (3) as shown in figure.

- | | |
|-----------------------------|------------|
| (1) Bearing Holder | (a) Groove |
| (2) Front Wheel Drive Shaft | F: Front |
| (3) Spline Boss | R: Rear |
| (4) O-ring | |
| (5) Glide Steer Linkage | |
| (6) Rue Ring | |

9Y1210598TXS0026US0

Power Steering Pipe, Cylinder Hose and Rear Wheel

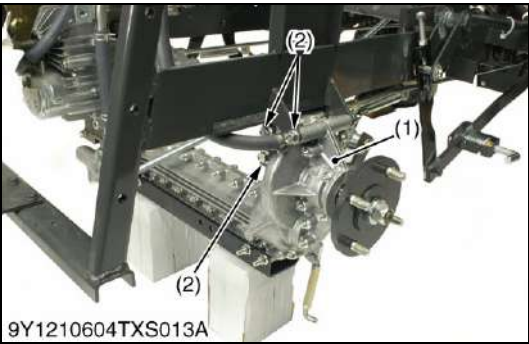
1. Disconnect the power steering pipes (1), (2).
2. Disconnect the cylinder hose (4) from the control valve.
3. Remove the rear wheel (3).

(When reassembling)

Tightening torque	Power steering pipe retaining nut	20.0 to 25.0 N·m 2.04 to 2.54 kgf·m 14.8 to 18.4 lbf·ft
	Cylinder hose retaining nut	24.0 to 28.0 N·m 2.45 to 2.85 kgf·m 17.7 to 20.6 lbf·ft
	Rear wheel mounting nut	77.6 to 90.2 N·m 7.92 to 9.19 kgf·m 57.2 to 66.5 lbf·ft

- | | |
|---|-------------------|
| (1) Power Steering Pipe
(To Power Steering Controller) | (3) Rear Wheel |
| (2) Power Steering Pipe
(From Power Steering Controller) | (4) Cylinder Hose |

9Y1210598TXS0027US0



Separating Transmission

- 1. Remove the transaxle mounting screws (2).
- 2. Separate the transaxle (1) from the frame.

(When reassembling)

Tightening torque	Transaxle mounting screw	48.1 to 55.9 N·m 4.91 to 5.70 kgf·m 35.5 to 41.2 lbf·ft
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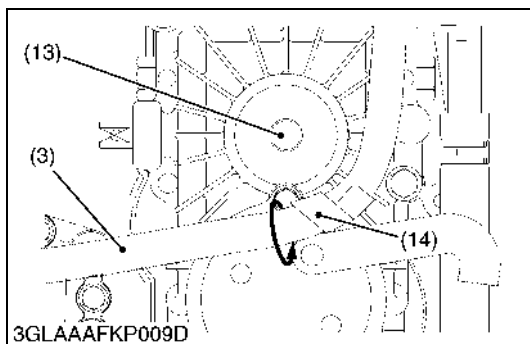
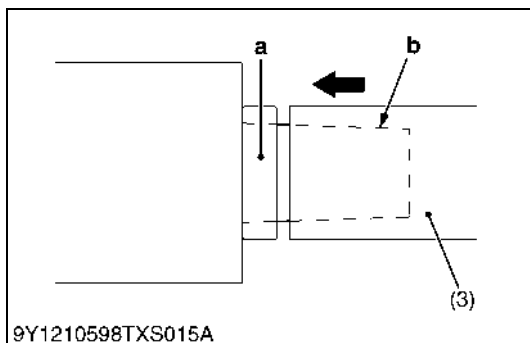
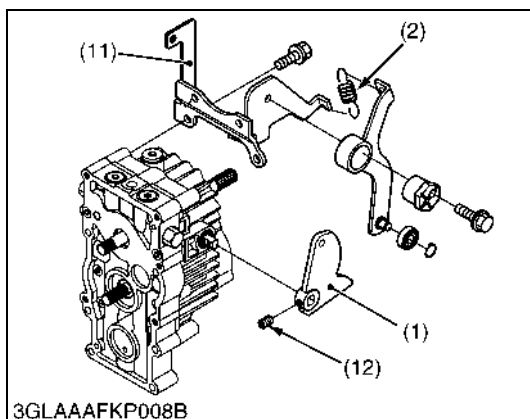
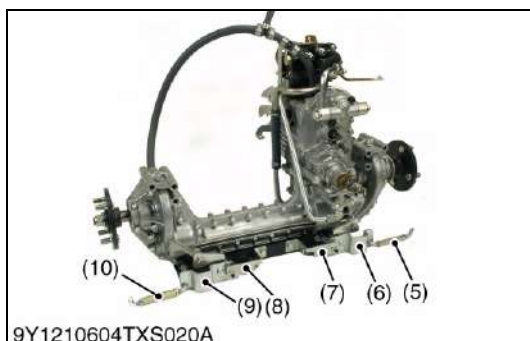
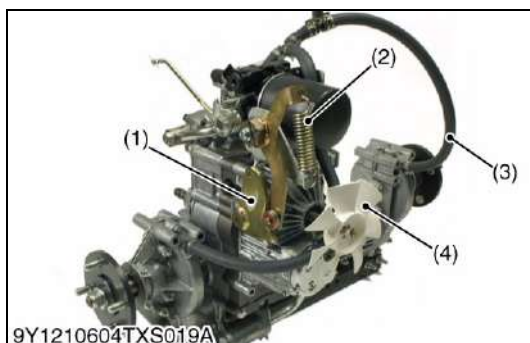
(1) Transaxle

(2) Transaxle Mounting Screw

9Y1210598TXS0028US0



(2) Separating Hydrostatic Transmission



Speed Control Arm, Neutral Spring, Cooling Fan and Others

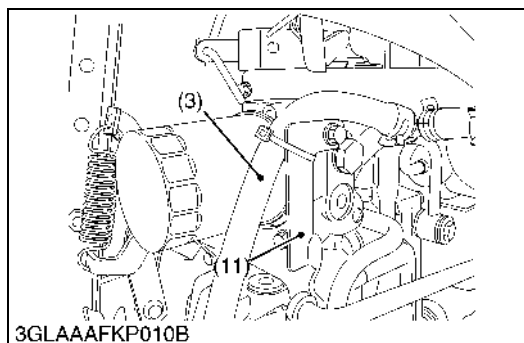
1. Remove the neutral spring (2).
2. Remove the speed control arm (1).
3. Remove the cooling fan (4).
4. Remove the breather hoses (3).
5. Remove the turnbuckles (5), (10) and the arm bracket (LH), (RH) (7), (8).
6. Remove the glide steer arms (6), (9).

(When reassembling)

■ NOTE

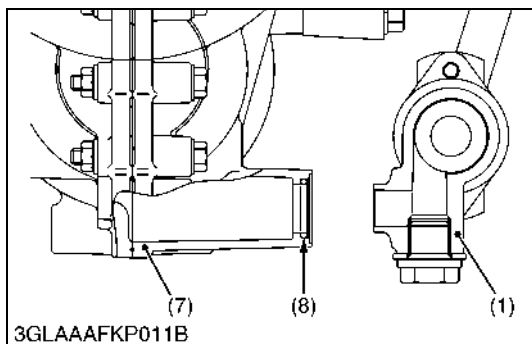
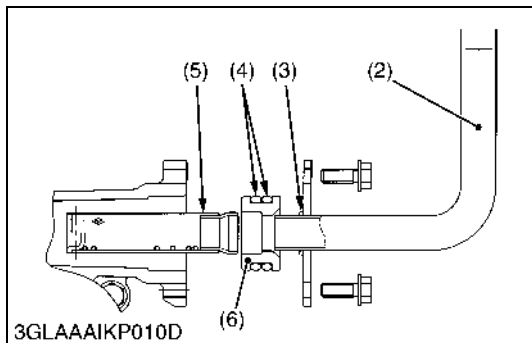
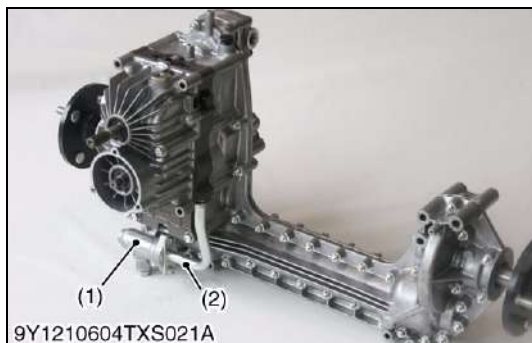
- To reinstall the set screw (12) (for the speed control arm), apply the liquid lock (Three Bond 1324 or its equivalent) to the screw.
- Before reconnecting the breather hoses to breather ports, clean the breather ports and the inside of breather hose.
- Apply liquid gasket "a" (Three Bond 1206D) to the breather ports "b" (3 places).
- Apply at the foot of breather port "b" with 4 to 5 mm (0.16 to 0.19 in.) thick around the breather port.
- When reconnecting the breather hoses to breather ports, push the breather hoses all the way and set the hose clamp at 1 to 2 mm (0.04 to 0.08 in.) from the hose end.
- Attach the breather hose (3) with a cord clamp (14) so that the breather hose (3) does not touch the cooling fan shaft (13). In this case, wind the cord clamp (14) around the breather hose (3) in the direction indicated by the arrow mark shown in the figure.
- Attach the breather hose (3) on the neutral arm holder (11) with the clamp as shown in the figure.

Tightening torque	Set screw for speed control arm	17.7 to 20.6 N·m 1.81 to 2.10 kgf·m 13.1 to 15.1 lbf·ft
-------------------	---------------------------------	---



- | | |
|--------------------------|-------------------------|
| (1) Speed Control Arm | (10) Turn Buckle (RH) |
| (2) Neutral Spring | (11) Neutral Arm Holder |
| (3) Breather Hose | (12) Set Screw |
| (4) Cooling Fan | (13) Cooling Fan Shaft |
| (5) Turn Buckle (LH) | (14) Cord Clamp |
| (6) Glide Steer Arm (LH) | |
| (7) Arm Bracket (LH) | |
| (8) Arm Bracket (RH) | |
| (9) Glide Steer Arm (RH) | |
- a: Liquid Gasket
b: Breather Port

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Suction Filter Case

1. Remove the suction filter case (1) with the suction pipe 2 (2).
2. Remove the suction pipe 2 (2) from the suction filter case (1).
3. Remove the boss (6) and strainer (5) from the suction filter case (1).

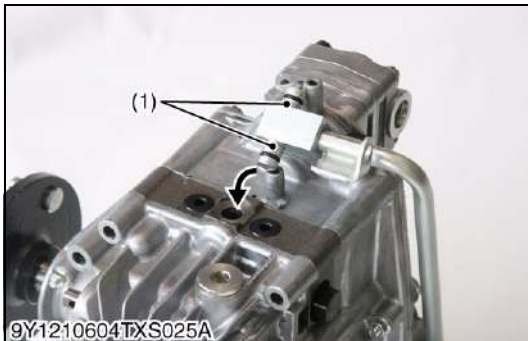
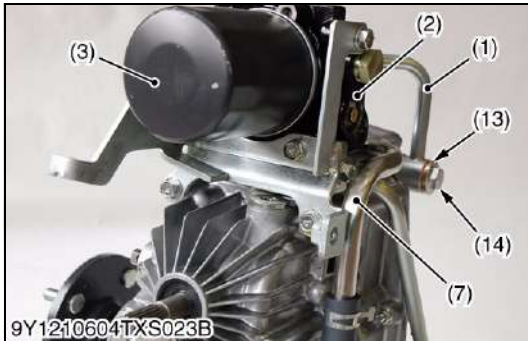
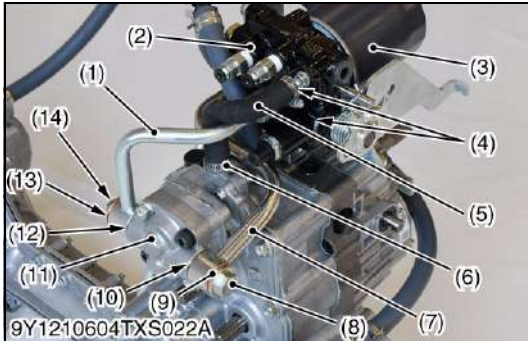
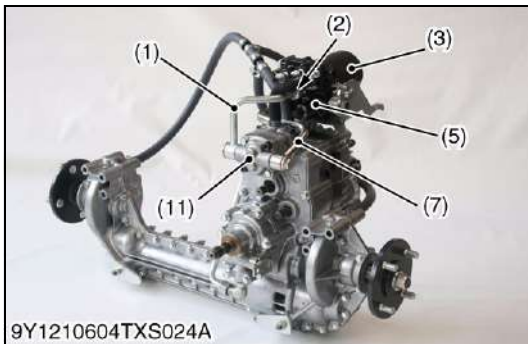
(When reassembling)

- After cleaning the strainer (5), install it in the suction filter case (1).
- Install the boss (6) that sets two O-rings (4) in the suction filter case (1).
- After setting the O-ring (3) in the suction pipe 2 (2), install the suction pipe 2 (2) in the suction filter case (1).
- After setting the O-ring (8) in the transaxle case (7), install the suction filter case (1) in the transaxle case (7).

Tightening torque	Suction pipe 2 mounting screw	7.8 to 8.8 N·m 0.80 to 0.89 kgf·m 5.8 to 6.4 lbf·ft
	Suction filter case mounting screw	7.8 to 8.8 N·m 0.80 to 0.89 kgf·m 5.8 to 6.4 lbf·ft

- | | |
|-------------------------|--------------------|
| (1) Suction Filter Case | (5) Strainer |
| (2) Suction Pipe 2 | (6) Boss |
| (3) O-ring (Small) | (7) Transaxle Case |
| (4) O-ring (Large) | (8) O-ring |

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Suction Pipe and Control Valve Pipe

1. Remove the drain hose (5).
2. Remove the hydraulic pipe joint bolts (8), (14), and disconnect the suction pipe 1 (7) and control valve pipe (1) from the hydraulic pump (11).

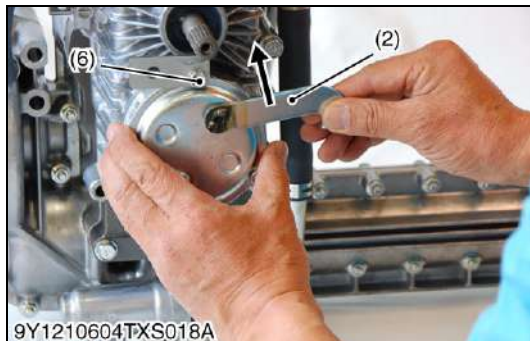
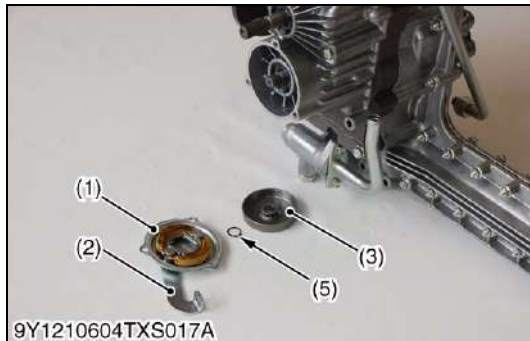
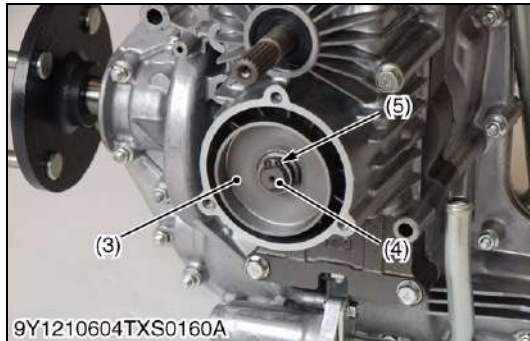
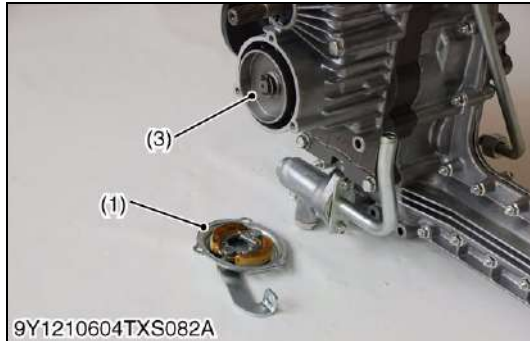
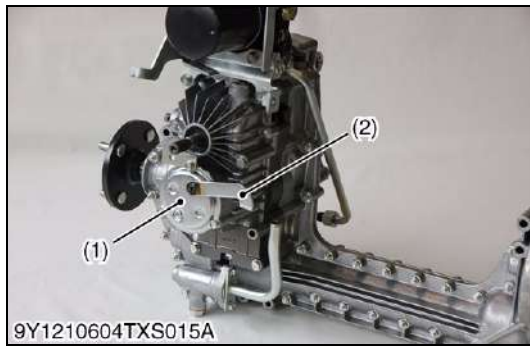
(When reassembling)

- Replace all copper gaskets (9), (10), (12), (13) with new one.
- Install all copper gaskets (9), (10), (12), (13) in original position.
- After temporarily assembling the control valve pipe (1) to the hydraulic control valve (2) first, reconnect the control valve pipe (1) to the hydraulic pump (11) with the joint bolt (14).
- Reconnect the suction pipe 1 (7) so that it is straight with the hose and suction pipe 2.
- When reconnecting the drain hose (5) to the transaxle and the hydraulic control valve (2), set the hose clamps (4), (6) at the position shown in the picture.

Tightening torque	Control valve pipe retaining nut	24 to 28 N·m 2.5 to 2.8 kgf·m 18 to 20 lbf·ft
	Hydraulic pipe joint bolt (8), (14)	32 to 36 N·m 3.3 to 3.6 kgf·m 24 to 26 lbf·ft
	Hose clamp for drain hose (4), (6)	1.0 to 1.2 N·m 0.11 to 0.12 kgf·m 0.74 to 0.88 lbf·ft

- | | |
|--|---------------------------------|
| (1) Control Valve Pipe | (8) Joint Bolt |
| (2) Hydraulic Control Valve (Filter Bracket) | (9) Copper Gasket (Thick Type) |
| (3) Oil Filter Cartridge | (10) Copper Gasket (Thin Type) |
| (4) Hose Clamp | (11) Hydraulic Pump |
| (5) Drain Hose | (12) Copper Gasket (Thin Type) |
| (6) Hose Clamp | (13) Copper Gasket (Thick Type) |
| (7) Suction Pipe 1 | (14) Hydraulic Pipe Joint Bolt |

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Brake Assembly

1. Remove the brake assembly mounting bolts.
2. Remove the brake assembly (1).
3. Remove the external cir-clip (5).

(When reassembling)

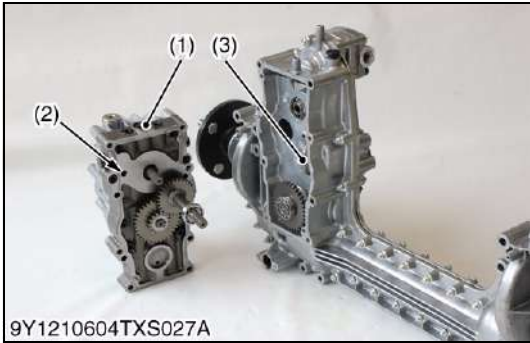
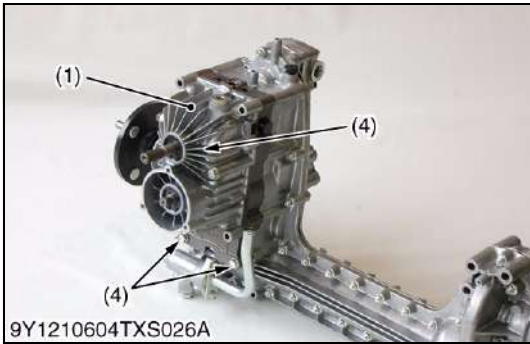
- Apply liquid gasket (Three Bond 1206D or equivalent) to the joint face of the brake assembly and the hydrostatic transmission case thinly.
- Tighten the brake assembly mounting bolts while pushing up the brake arm lever by hand.

Tightening torque	Brake assembly mounting bolt	7.8 to 8.8 N·m 0.80 to 0.89 kgf·m 5.8 to 6.4 lbf·ft
-------------------	------------------------------	---

- (1) Brake Assembly
(2) Brake Arm Lever
(3) Brake Drum

- (4) Brake Shaft
(5) External Cir-clip
(6) Bolt

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Hydrostatic Transmission Assembly

1. Remove the hydrostatic transmission assembly (1).

(When reassembling)

- Apply the liquid gasket (Three Bond 1206D or equivalent) to joint face of the hydrostatic transmission assembly (1).
- Cover the splines of front drive shaft with thin tape to protect the sealing lip of the oil seal.

■ **NOTE**

- **When reassembling the hydrostatic transmission assembly, insert the drain pipe (3) in the hole (2) surely so as not to drop out it.**

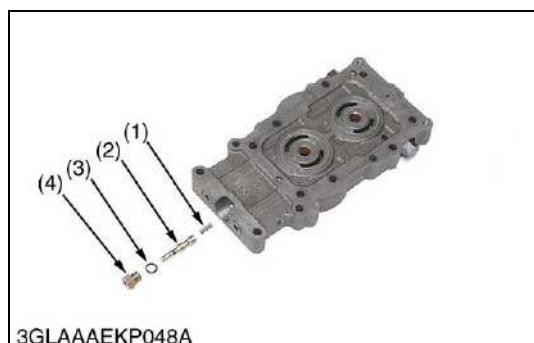
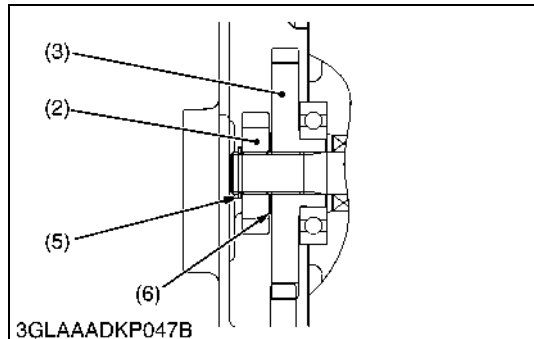
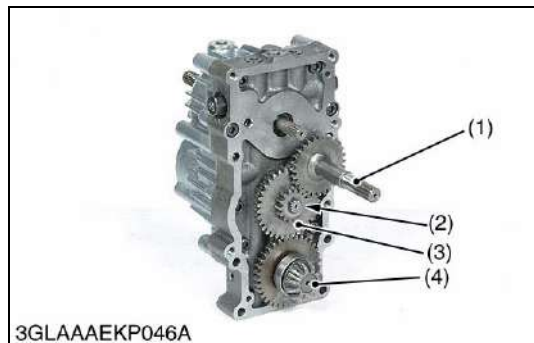
Tightening torque	Hydrostatic transmission mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Hydrostatic transmission mounting screw 2	18 to 20 N·m 1.8 to 2.1 kgf·m 13 to 15 lbf·ft

- (1) Hydrostatic Transmission Assembly (4) Hydrostatic Transmission Mounting Screw 2
(2) Hole
(3) Drain Pipe

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[3] DISASSEMBLING AND ASSEMBLING

(1) Hydrostatic Transmission



15T Gear, 34T Gear and Bevel Gear Shaft

1. Remove the external snap ring (5). And pull out the 15T gear (2).
2. Remove the 34T gear (3) with the front drive shaft (1).
3. Remove the bevel gear shaft (4).

- | | |
|-----------------------|------------------------|
| (1) Front Drive Shaft | (4) Bevel Gear Shaft |
| (2) 15T Gear | (5) External Snap Ring |
| (3) 34T Gear | (6) Shim |

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Center Section

1. Remove the center section mounting hex. socket head screws.
2. Tap the center section (1) with a soft hammer and separate the center section (1) from the HST housing (2).

(When reassembling)

- Cover the splines of each shaft with thin tape to protect the sealing lip of the oil seals.
- Place a new gasket on the HST housing.

NOTE

- **Be careful not to damage the surface of cylinder blocks, pistons and center section.**

Tightening torque	Center section mounting hex. socket head screw	18 to 20 N·m 1.8 to 2.1 kgf·m 13 to 15 lbf·ft
-------------------	---	---

(1) Center Section

(2) HST Housing

9Y1210598TXS0035US0

By-pass Valve

1. Remove the plug (4) and pull out the by-pass spool (2) and spring (1).

(When reassembling)

- Be careful not to damage the O-ring (3) on the plug (4).

Tightening torque	By-pass valve plug	15.0 N·m 1.53 kgf·m 11.1 lbf·ft
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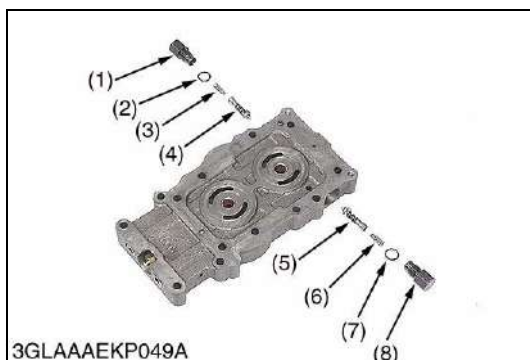
(1) Spring

(3) O-ring

(2) By-pass Spool

(4) Plug

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Check and High Pressure Relief Valve

1. Remove the plugs (1), (8).
2. Pull out the springs (3), (6).
3. Pull out the check and high pressure relief valves (4), (5).

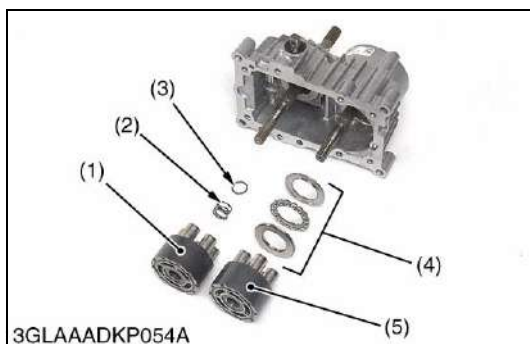
(When reassembling)

- Be careful not to damage the O-rings (2), (7) on the plugs (1), (8).

Tightening torque	Check and high pressure relief valve plug	30.0 N·m 3.06 kgf·m 22.1 lbf·ft
-------------------	---	---------------------------------------

- | | |
|--|--|
| (1) Plug | (5) Check and High Pressure Relief Valve (Forward) |
| (2) O-ring | (6) Spring |
| (3) Spring | (7) O-ring |
| (4) Check and High Pressure Relief Valve (Reverse) | (8) Plug |

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Cylinder Block Assembly and Thrust Ball Bearing

1. Remove the cylinder block assembly (pump side) (1), spring (2) and washer (3).
2. Remove the cylinder block assembly (motor side) (5).
3. Remove the thrust ball bearing (4).

(When reassembling)

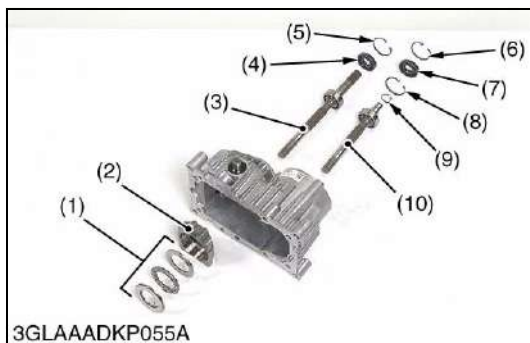
- Apply clean transmission oil to thrust ball bearing, cylinder block and piston.

■ NOTE

- Be careful not to damage the surface of cylinder blocks and pistons.

- | | |
|---|--|
| (1) Cylinder Block Assembly (Pump Side) | (4) Thrust Ball Bearing |
| (2) Spring | (5) Cylinder Block Assembly (Motor Side) |
| (3) Washer | |

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Swashplate, Pump Shaft and Motor Shaft

1. Remove the swashplate (2) and thrust ball bearing (1) from the HST housing.
2. Remove the internal snap ring (5), and tap out the pump shaft (3) and oil seal (4).
3. Remove the internal snap ring (6) and the oil seal (7).
4. Remove the internal snap ring (8), and tap out the motor shaft (10).

■ NOTE

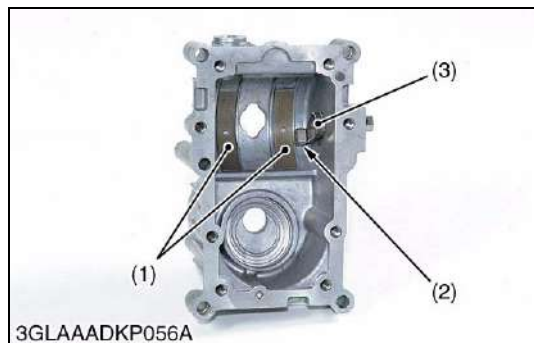
- When removing the oil seal (7), be careful not to damage the HST housing.

(When reassembling)

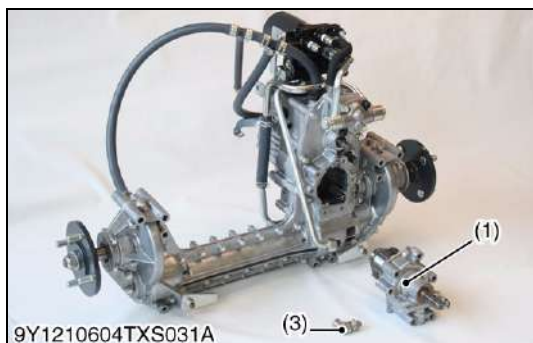
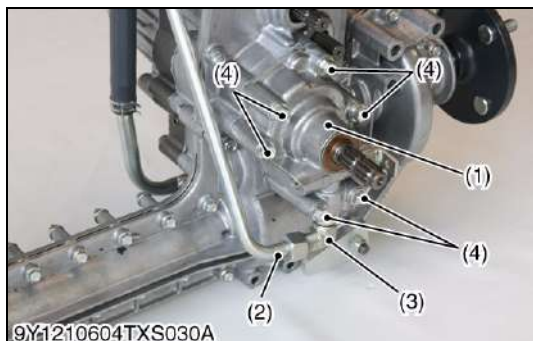
- Apply clean transmission oil to thrust ball bearing (1).

- | | |
|-------------------------|------------------------|
| (1) Thrust Ball Bearing | (6) Internal Snap Ring |
| (2) Swashplate | (7) Oil Seal |
| (3) Pump Shaft | (8) Internal Snap Ring |
| (4) Oil Seal | (9) External Snap Ring |
| (5) Internal Snap Ring | (10) Motor Shaft |

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(2) PTO Clutch



Cradle Bearing, Slot Guide and Trunnion Arm

1. Remove the slot guide (2) and trunnion arm (3).
2. Remove the cradle bearings (1) from the HST housing.

(When reassembling)

- Apply clean transmission oil to the cradle bearings (1) and trunnion arm.
- Attach the cradle bearing to the HST housing.

(1) Cradle Bearing

(3) Trunnion Arm

(2) Slot Guide

9Y1210598TXS0040US0

Removing Hydraulic PTO Clutch Assembly

1. Disconnect the delivery pipe (2) from the joint (3).
2. Remove the joint from the hydraulic PTO clutch assembly (1).
3. Remove the hydraulic PTO clutch assembly mounting bolts (4).
4. Remove the hydraulic PTO clutch assembly (1) from the transaxle case.

(When reassembling)

- Remove the liquid gasket from the transaxle case and the hydraulic PTO clutch case.
- Apply the liquid gasket (Three Bond 1206D or its equivalent) to the joint face of the transaxle case and the hydraulic PTO clutch case.
- Tighten the hydraulic PTO clutch assembly mounting bolts to the specified tightening torque.
- Tighten the joint (3) to the tightening torque below.

Tightening torque	Joint	29 to 39 N·m 3.0 to 3.9 kgf·m 22 to 28 lbf·ft
	Hydraulic PTO clutch assembly mounting bolt	18 to 20 N·m 1.8 to 2.1 kgf·m 13 to 15 lbf·ft

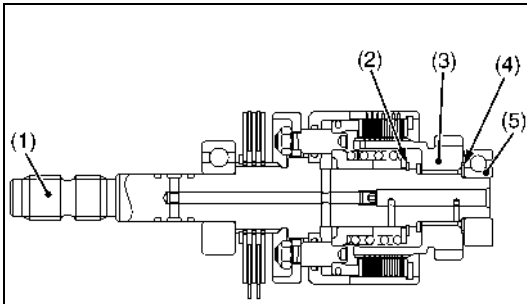
(1) Hydraulic PTO Clutch Assembly

(3) Joint

(2) Delivery Pipe

(4) Bolt

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9Y1210604TXS037A

Removing 24T Gear

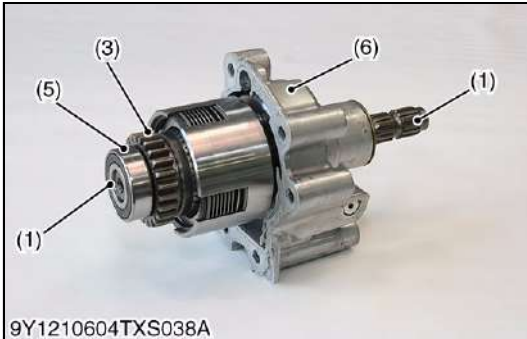
1. Remove the hydraulic PTO clutch assembly from the PTO cover (6).
2. Remove the bearing (5), the spacer (4), the 24T gear (3) and the collar (2) from the PTO shaft (1).

(When reassembling)

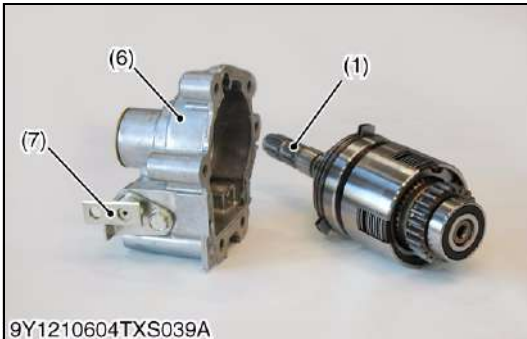
- Install the removed parts to the original position.

- | | |
|---------------|---------------------|
| (1) PTO Shaft | (5) Bearing |
| (2) Collar | (6) PTO Cover |
| (3) 24T Gear | (7) PTO Valve Lever |
| (4) Spacer | |

9Y1210598TXS0042US0



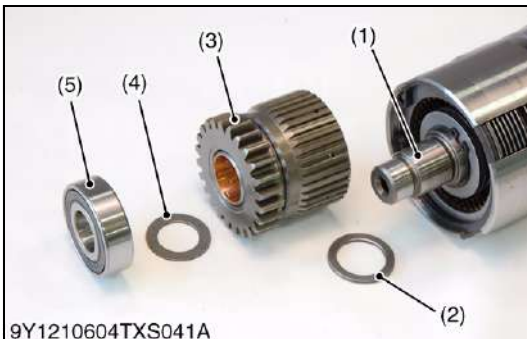
9Y1210604TXS038A



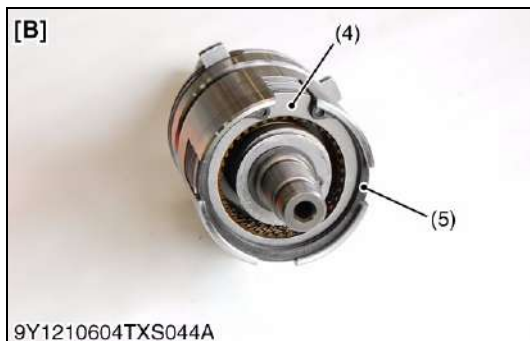
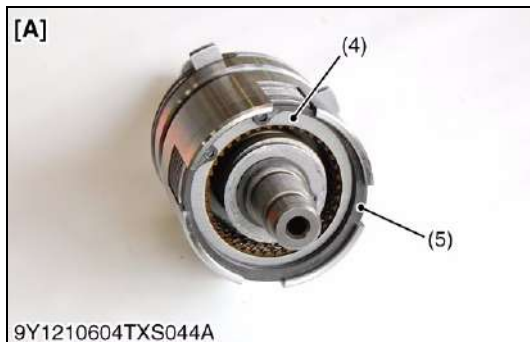
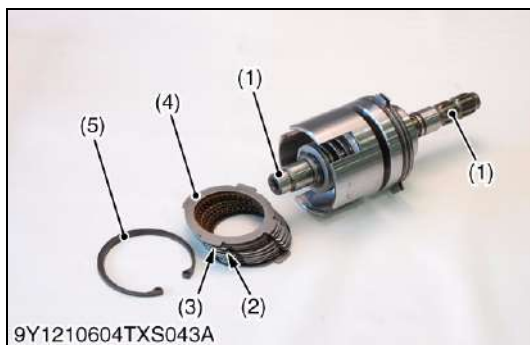
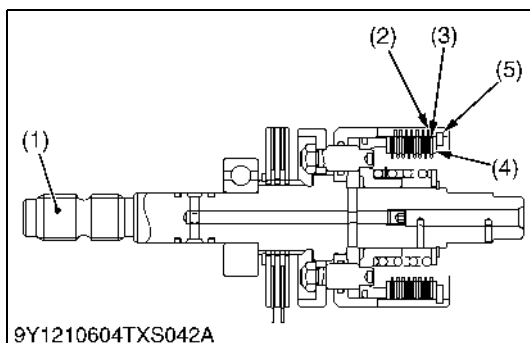
9Y1210604TXS039A



9Y1210604TXS040A



9Y1210604TXS041A



Removing Clutch Disk and Clutch Plate

1. Remove the cir-clip (5) with a snap ring plier.
2. Remove the clutch plate (1.6) (4).
3. Remove the clutch disks (3) and the clutch plates (2).

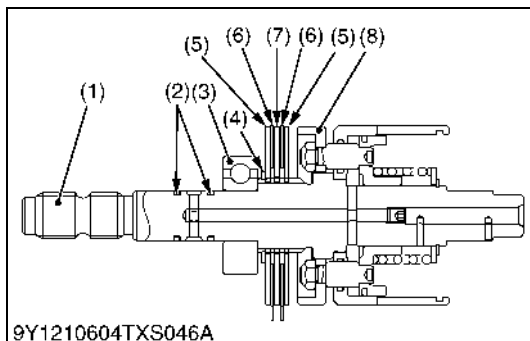
(When reassembling)

- Check the wear of the clutch disks and the clutch plates.
- Install the clutch disks and the clutch plates as shown in the figure.
- Install the cir-clip as shown in the picture "A".

- (1) PTO Shaft
- (2) Clutch Plate
- (3) Clutch Disk
- (4) Clutch Plate (1.6)
- (5) Cir-clip

- [A] Good Installation of Cir-clip
[B] Wrong Installation of Cir-clip

9Y1210598TXS0043US0



Removing PTO Clutch Brake Discs and Brake Plates

1. Remove the bearing (3) from the PTO shaft (1).
2. Remove the cir-clip (4) from the PTO shaft (1).
3. Remove the PTO brake disc 1 (5), the PTO brake plate 1 (6) and the brake disc (7).

(When reassembling)

- If the ring seal is damaged, replace it with a new one.

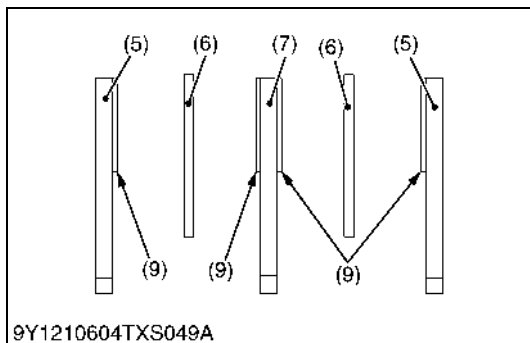
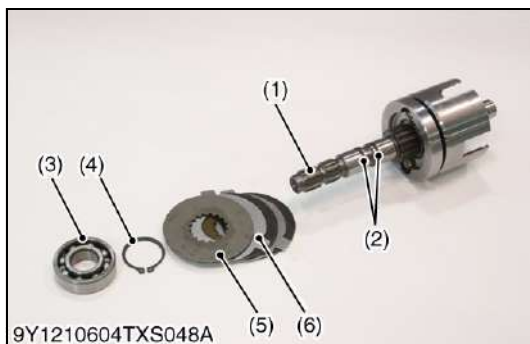
■ IMPORTANT

- Since two types of PTO brake discs are adopted, install the double facing brake disc to the center position as shown in the figure.



- | | |
|----------------------|-----------------------|
| (1) PTO Shaft | (6) PTO Brake Plate 1 |
| (2) Ring Seal | (7) Brake Disc |
| (3) Bearing | (8) PTO Brake Piston |
| (4) Cir-clip | (9) Facing |
| (5) PTO Brake Disc 1 | |

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Removing PTO Clutch Brake Spring

1. Press and the spring collar (2) the PTO brake spring (3) by using the puller and the spring compressor (5).
2. Remove the cir-clip (1) by a snap ring plier (7).
3. Remove the PTO clutch brake spring (3).

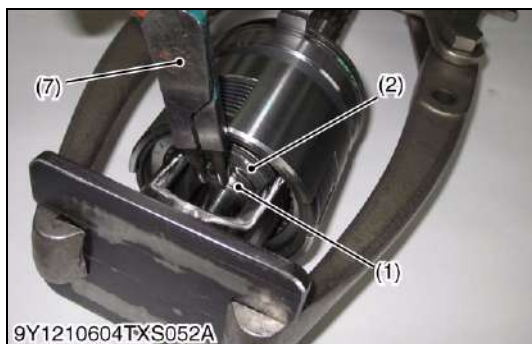
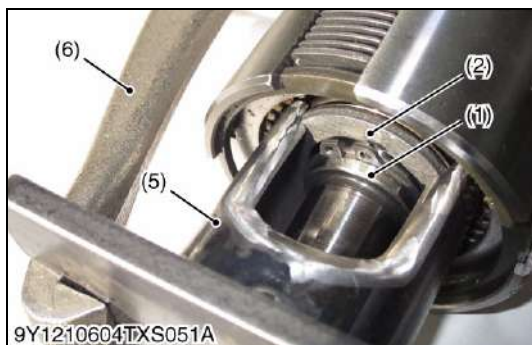
(When reassembling)

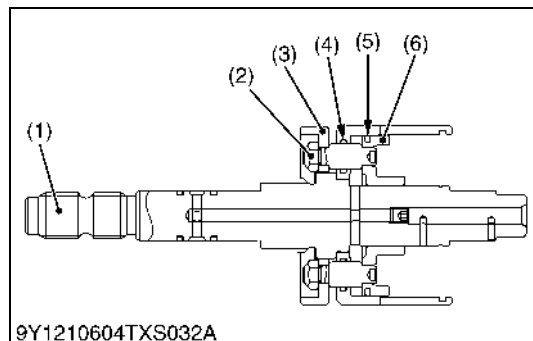
- Since it is very difficult to press the PTO brake spring and the spring collar, use the spring compressor (5) and the puller (6) as shown in the picture.

- (1) Cir-clip
- (2) Spring Collar
- (3) Brake Spring
- (4) PTO Shaft

- (5) Spring Compressor
- (6) Puller
- (7) Snap Ring Plier

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Removing PTO Brake Piston and PTO Clutch Piston

1. Loosen the lock nuts (2).
2. Remove the lock nuts (2) from the PTO clutch piston (6).

(Remarks)

- PTO clutch piston consists of piston body, stud bolts and D-ring. The stud bolts must not be removed from the piston body.

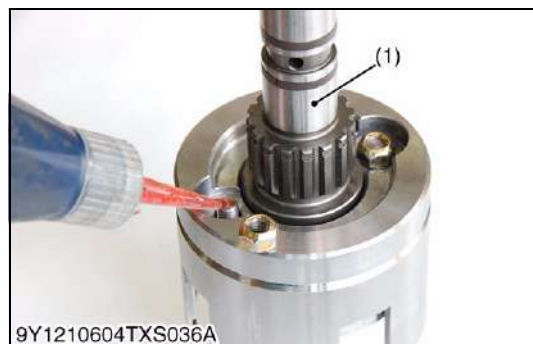
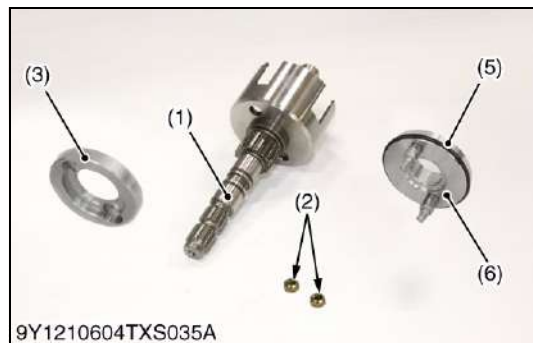
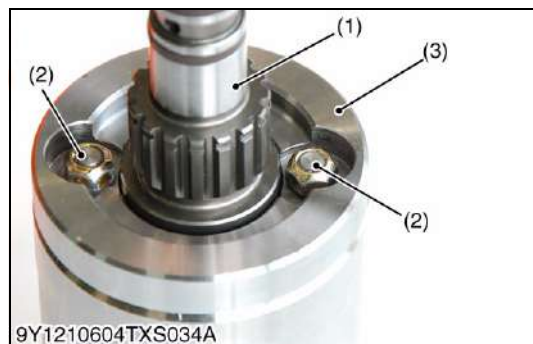
(When reassembling)

- Do not use the used lock nuts again.
- Replace the lock nuts with new ones.
- Apply LOCTITE 262 or its equivalents.
- Apply oil to the O-ring and D-ring.

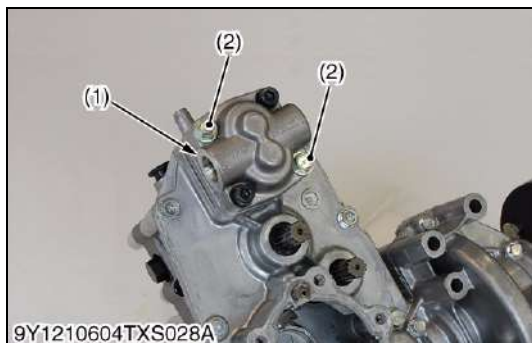
Tightening torque	PTO clutch piston lock nut	9.8 to 11 N·m 1.0 to 1.2 kgf·m 7.2 to 8.6 lbf·ft
-------------------	----------------------------	--

- | | |
|----------------------|-----------------------|
| (1) PTO Shaft | (4) O-ring |
| (2) Lock Nut | (5) D-ring |
| (3) PTO Brake Piston | (6) PTO Clutch Piston |

9Y1210598TXS0046US0



(3) Hydraulic Pump



Removing Hydraulic Pump

1. Loosen the hydraulic pump mounting screws (2).
2. Remove the hydraulic pump (1) from the transaxle case (front side).

(When reassembling)

- Do not damage the O-ring.

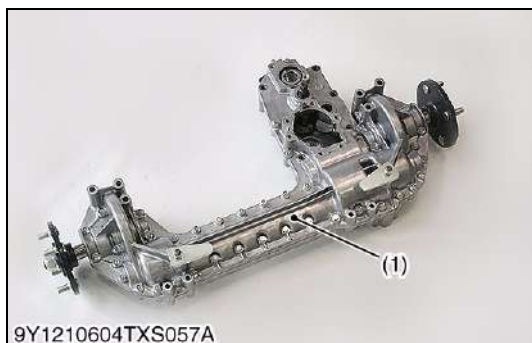
Tightening torque	Hydraulic pump mounting screw	18 to 20 N·m 1.8 to 2.1 kgf·m 13 to 15 lbf·ft
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(1) Hydraulic Pump

(2) Hydraulic Pump Mounting Screw

9Y1210598TXS0047US0

(4) Transaxle Case



Removing Glide Steer Rod Levers

1. Loosen the lock nuts (2), (5).
2. Remove the Glide Steer rod levers (3), (4).
3. Remove the O-rings (6) from the transaxle case (front side) (1).

(When reassembling)

- Do not damage the O-rings.
- Install the Glide Steer rod lever as shown in the pictures.
- Replace the lock nuts with new ones.

(1) Transaxle Case (Front Side)

(4) Glide Steer Rod Lever

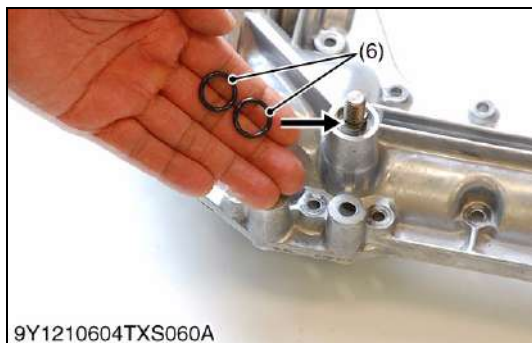
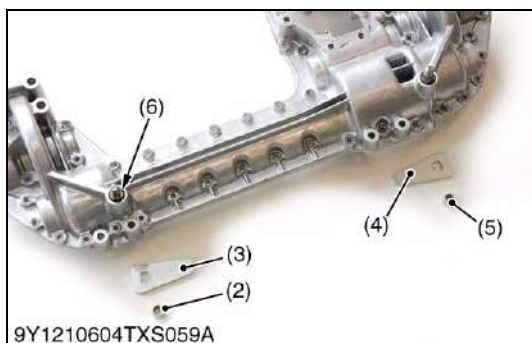
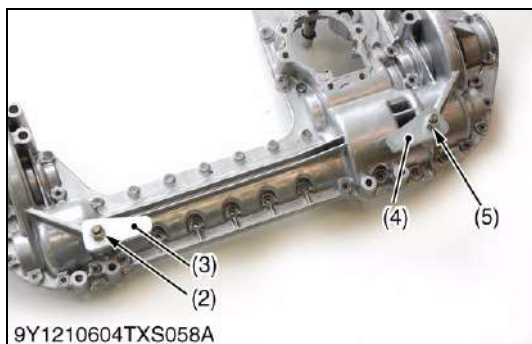
(2) Lock nut

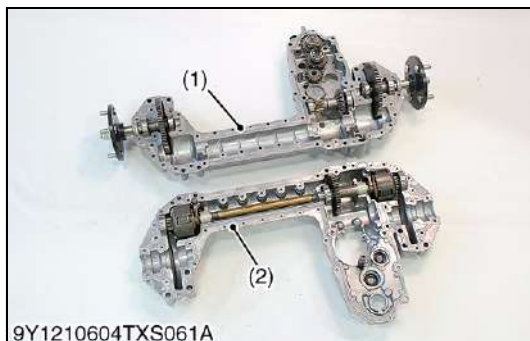
(5) Lock nut

(3) Glide Steer Rod Lever

(6) O-ring

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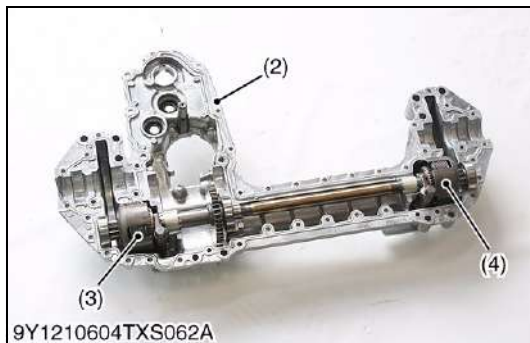
Separating Transaxle Case

1. Remove the docking bolts of the transaxle case (front side) (2) and the transaxle case (rear side) (1).

(When reassembling)

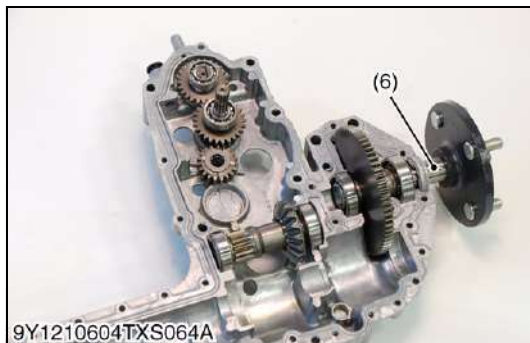
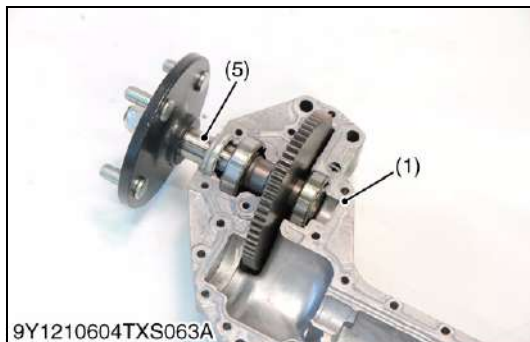
- Clean the joint surface of the transaxle case (front side) and the transaxle case (rear side).
- Apply liquid gasket. Refer to page 2-S38.

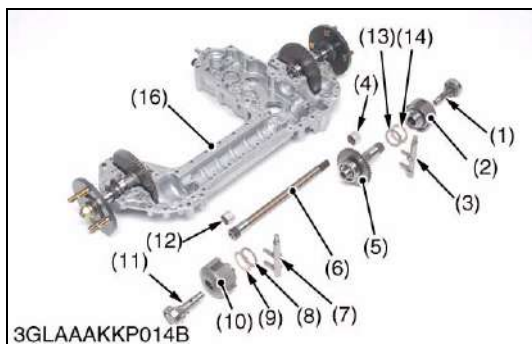
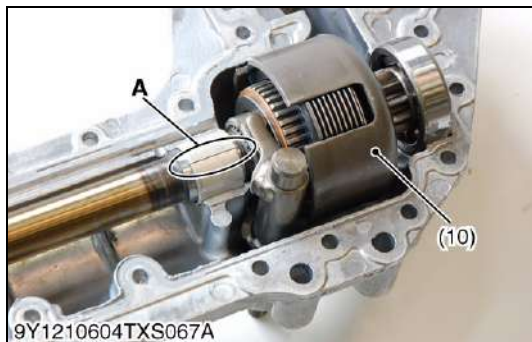
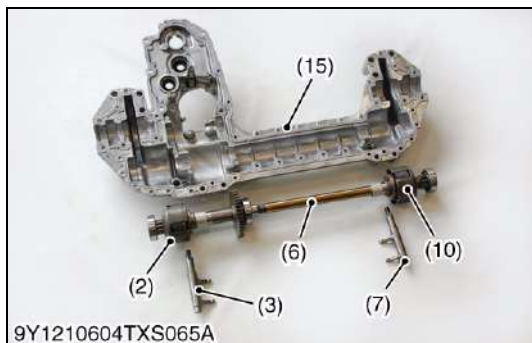
Tightening torque	Transaxle case bolt (M6)	9.81 to 11.3 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
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- | | |
|---------------------------------|-------------------------------|
| (1) Transaxle Case (Rear Side) | (4) Glide Steer Clutch (R.H.) |
| (2) Transaxle Case (Front Side) | (5) Rear Axle Assembly (R.H.) |
| (3) Glide Steer Clutch (L.H.) | (6) Rear Axle Assembly (L.H.) |

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Removing Glide Steer Clutch, Clutch Lever, 11T Gear Shaft, 42T Gear Shaft and Drive Shaft

1. Remove the glide steering clutches (2), (10), clutch levers (3), (7), 11T gear shafts (1), (11), 42T gear shaft (5) and drive shaft (6) from transaxle case.

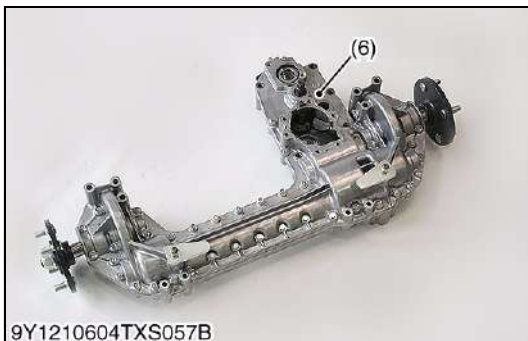
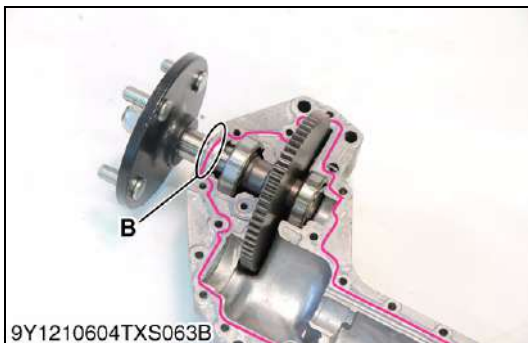
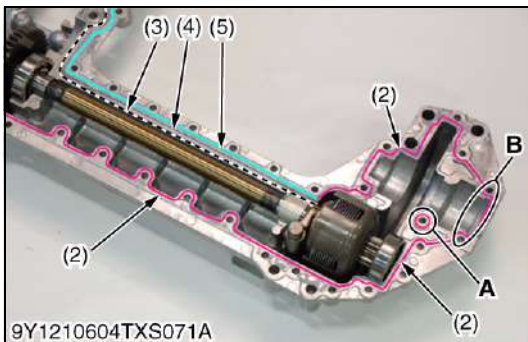
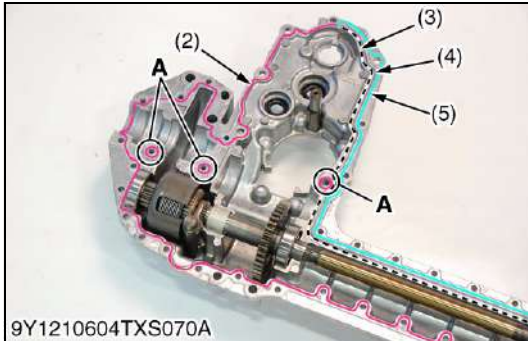
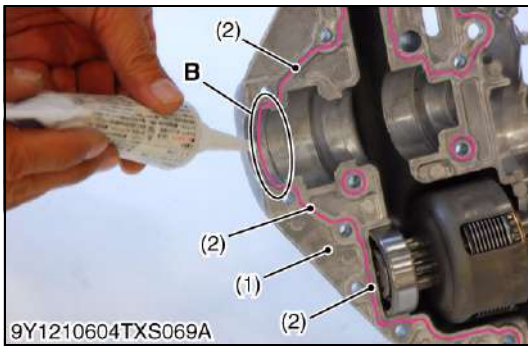
(When reassembling)

- When installing the bushes (4), (12) in the rear side of transaxle case, direct the splits of bushes "A" to the front side.

- | | |
|----------------------------------|----------------------------------|
| (1) 11T Gear Shaft (L.H.) | (10) Steering Clutch (R.H.) |
| (2) Glide Steering Clutch (L.H.) | (11) 11T Gear Shaft (R.H.) |
| (3) Clutch Lever (L.H.) | (12) Bush (R.H.) |
| (4) Bush (L.H.) | (13) Thrust Collar |
| (5) 42T Gear Shaft | (14) Spacer |
| (6) Drive Shaft | (15) Transaxle Case (Front Side) |
| (7) Glide Clutch Lever (R.H.) | (16) Transaxle Case (Rear Side) |
| (8) Thrust Collar | |
| (9) Spacer | |

A: Split of Bush

9Y1210598TXS0050US0



Applying Liquid Gasket to Transaxle Case

To Liquid Gasket Groove Portion

1. Clean the joint surface of the transaxle case (1), (6).
2. Apply the liquid gasket (Three Bond 1206D or its equivalent). The coating width and height must be 2 to 3 mm (0.08 to 0.12 in.) and 2 to 3 mm (0.08 to 0.12 in.) respectively. Also apply the liquid gasket on the grooves around holes "A" shown in the figure.

To Oil Seal and Axle Collar Portion

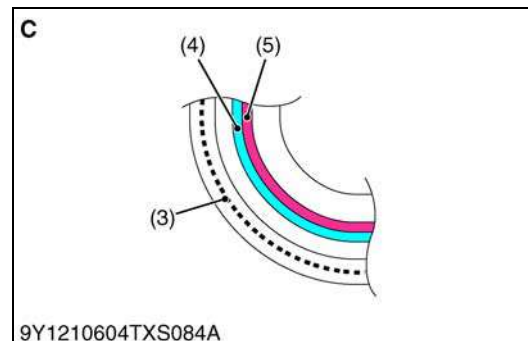
1. Apply the liquid gasket (Three Bond 1206D or it equivalent).
2. Install the oil seal and the axle collar to the transaxle case.
3. Apply the liquid gasket (Three Bond 1206D or it equivalent) around the axle collar of the portion "B" as shown in the picture.

To Oil Passage Portion

NOTE

- Do not apply the liquid gasket to the liquid gasket sealing groove portion located near by the oil passage. If you apply the liquid gasket to the liquid gasket sealing groove, the applied liquid gasket can block the oil passage to the glide steering clutch (L.H.).
1. Apply the liquid gasket (Three Bond 1206D or its equivalent) to the outside of the liquid gasket sealing groove located near by the oil passage (3) shown with the dotted line.

Tightening torque	Transaxle case bolt	9.81 to 11.3 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
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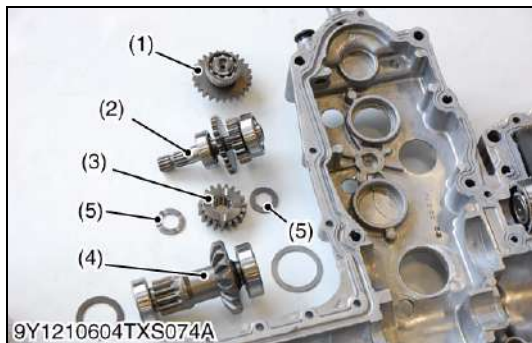
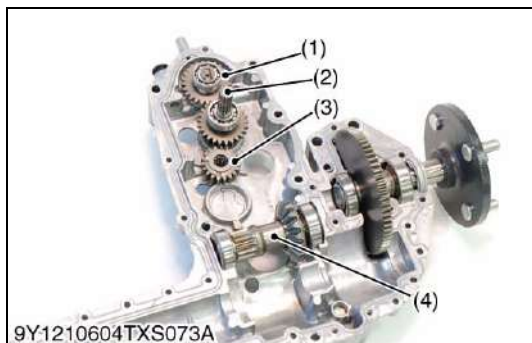
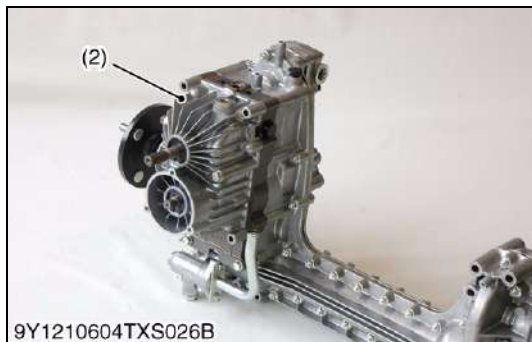
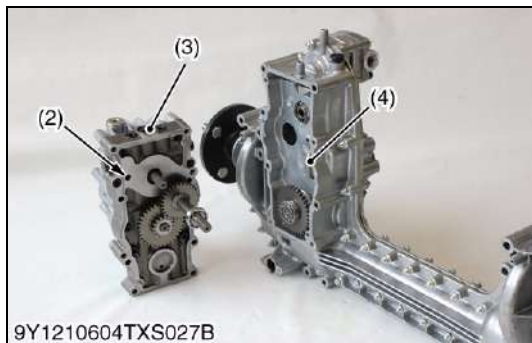
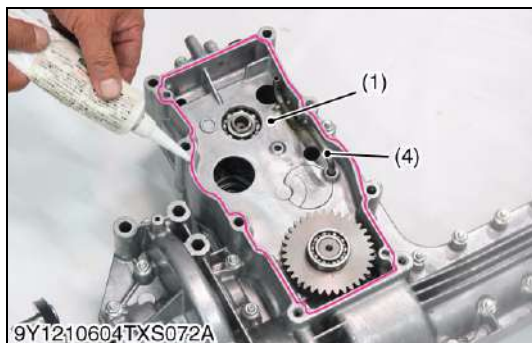
- (1) Transaxle Case (Front Side)
- (2) Liquid Gasket Sealing Groove
- (3) Oil Passage
- (4) Liquid Gasket Sealing Groove (Do not apply liquid gasket)
- (5) Liquid Gasket Portion (Apply liquid gasket)
- (6) Transaxle Case (Rear Side)

A: Liquid Gasket Application Portion

B: Oil Seal and Axle Collar Portion

C: Liquid Gasket to Oil Passage

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Applying Liquid Gasket to HST Joint Face

1. Clean the joint face of the transaxle case (rear side) (1) and HST assembly case.
2. Apply the liquid gasket (Three Bond 1206D or its equivalent) to the liquid gasket sealing groove of the transaxle case (rear side) (1).

NOTE

- When reassembling the hydrostatic transmission assembly, insert the drain pipe (4) in the hole (3) surely so as not to drop out it.
3. Install the hydrostatic transmission assembly (2) to the transaxle case (rear side) (1).

Tightening torque	Hydrostatic transmission mounting screw (5 pcs)	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Hydrostatic transmission mounting screw 2 (3 pcs)	18 to 20 N·m 1.8 to 2.1 kgf·m 13 to 15 lbf·ft

- (1) Transaxle Case (Rear Side) (3) Hole
(2) Hydrostatic Transmission Assembly (4) Drain Pipe

9Y1210598TXS0052US0

Removing Pump Drive Gear, Input Shaft, 19T-2 Gear and 17T-13T Gear Shaft

1. Remove the pump drive gear (1) and input shaft (2).
2. Remove the 19T-2 gear (3) with collars and needle bearing.
3. Remove the 17T-13T gear shaft (4).

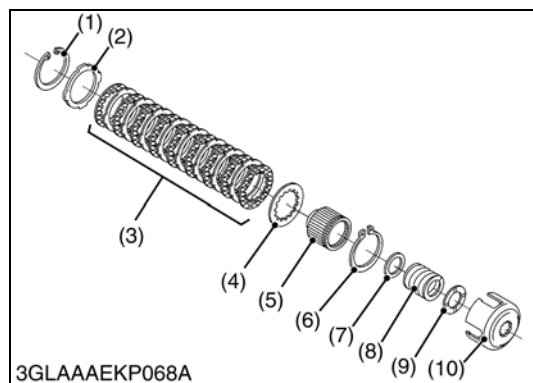
(When reassembling)

NOTE

- Install the collars (5) so that the faces with oil grooves of collars (5) are directed to the 19T-2 gear (3).

- (1) Pump Drive Gear (4) 17T-13T Gear Shaft
(2) Input Shaft (5) Collar
(3) 19T-2 Gear

9Y1210598TXS0053US0

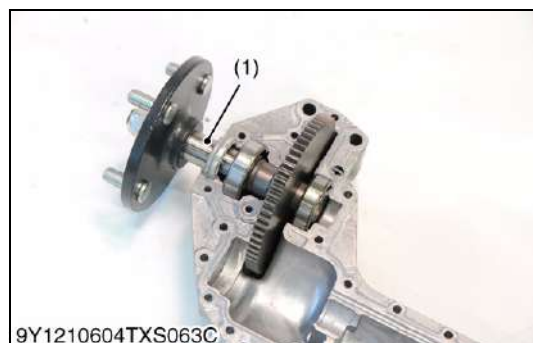


Disassembling Glide Steer Clutch

1. Remove the internal snap ring (1).
2. Remove the clutch plate (2) and spline boss (5) with clutch disc and friction plate (3) from the steering clutch case (10).
3. Remove the spacer (7), spring (8) and clutch collar (9).
4. Remove the clutch disc and the friction plate (3), clutch spline (4) and external snap ring (6) from spline boss (5).

- | | |
|------------------------------------|---------------------------|
| (1) Internal Snap Ring | (6) External Snap Ring |
| (2) Clutch Plate | (7) Spacer |
| (3) Clutch Disc and Friction Plate | (8) Spring |
| (4) Clutch Spline Plate | (9) Clutch Collar |
| (5) Spline Boss | (10) Steering Clutch Case |

9Y1210598TXS0054US0



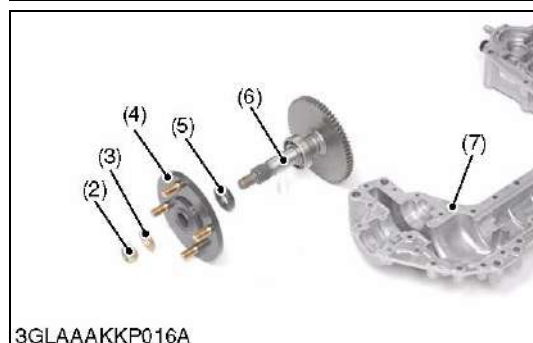
Rear Axle

1. Remove the rear axle assembly (1) from the transaxle case.
2. Remove the lock nut (2), and remove the rear wheel hub (4).
3. Remove the oil seal (5) from 65T gear shaft (6).

(When reassembling)

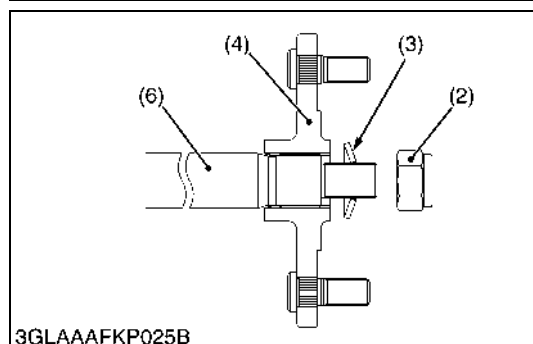
- When installing the rear wheel hub (4) to the rear axle, apply the molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of rear axle.
- Install the belleville washer (3), noting its direction as shown in the figure.

Tightening torque	Rear axle shaft lock nut	100 to 120 N·m 10.2 to 12.2 kgf·m 73.8 to 88.5 lbf·ft
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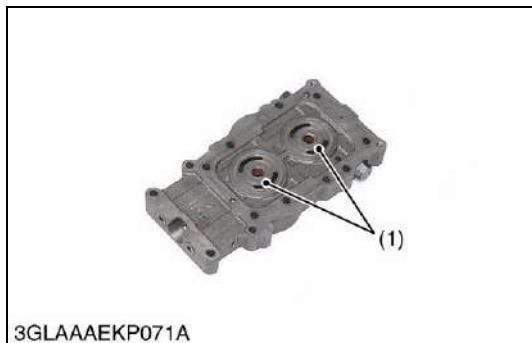
- | | |
|------------------------|--------------------------------|
| (1) Rear Axle Assembly | (5) Oil Seal |
| (2) Lock Nut | (6) 65T Gear Shaft |
| (3) Belleville Washer | (7) Transaxle Case (Rear Side) |
| (4) Rear Wheel Hub | |

9Y1210598TXS0055US0



[4] SERVICING

(1) Hydrostatic Transmission

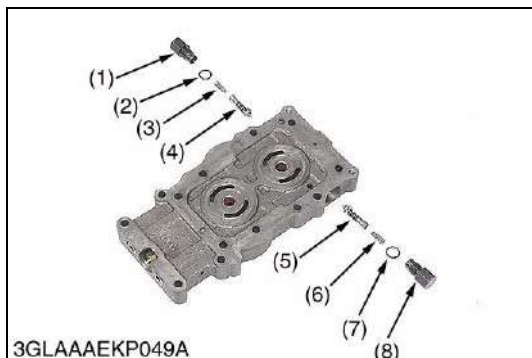


Center Section

1. Check the surfaces (1) of center section for scratches or wear.
2. If deep scratch or excessive wear is found, replace the hydrostatic transmission assembly.

(1) Surface

9Y1210598TXS0056US0

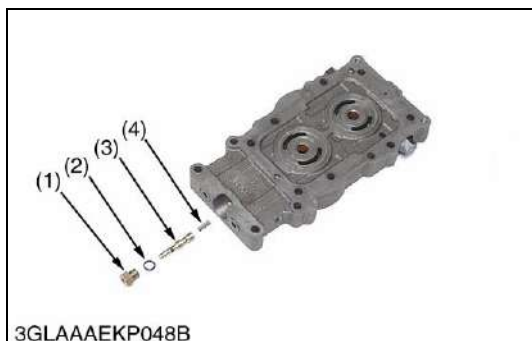


Check and High Pressure Relief Valve

1. Check the check and high pressure relief valves (4), (5) for scratches and damage.
2. Check the springs (3), (6) for breakage and wear.
3. If anything unusual, replace the check and high pressure relief valve assembly.

(1) Plug	(5) Check and High Pressure Relief Valve (Forward)
(2) O-ring	(6) Spring
(3) Spring	(7) O-ring
(4) Check and High Pressure Relief Valve (Reverse)	(8) Plug

9Y1210598TXS0057US0

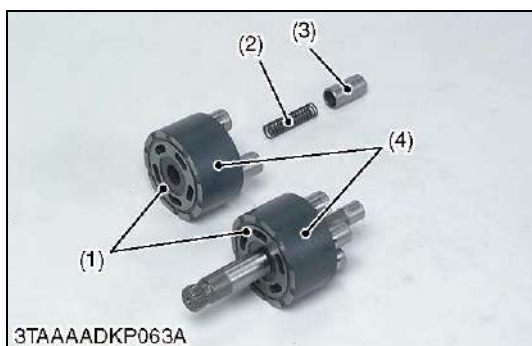


By-pass Valve

1. Check the by-pass spool (3) and spring (4).
2. If defects are found, replace them.

(1) Plug	(3) By-pass Spool
(2) O-ring	(4) Spring

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Cylinder Block Assembly

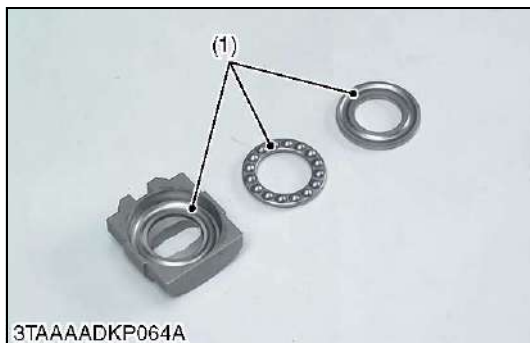
1. Check the cylinder blocks (4) and pistons (3) for scratches and wear.
2. If scratch or worn, replace the cylinder block assembly.
3. Check that the piston (3) and spring (2) are in each cylinder bore.
4. Check the pistons for their free movement in the cylinder block bores.
5. If the piston or the cylinder block is scored, replace the cylinder block assembly.
6. Check the polished face (1) of cylinder block for scoring.
7. If scored, replace the cylinder block assembly.

■ IMPORTANT

- Do not interchange pistons between pump and motor cylinder block. Pistons and cylinder blocks are matched.

(1) Polished Face	(3) Piston
(2) Spring	(4) Cylinder Block

9Y1210598TXS0059US0

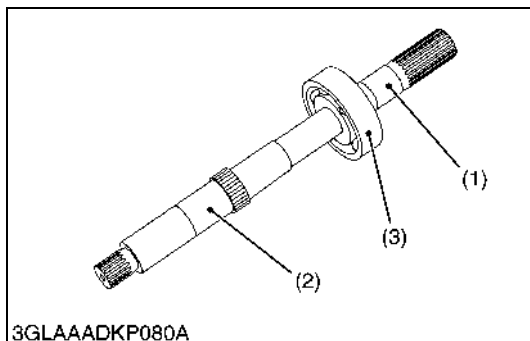


Thrust Ball Bearing

1. Check the thrust ball bearing (1) for scratches and excessive wear.
2. If the thrust ball bearing (1) is worn, replace it.

(1) Thrust Ball Bearing

9Y1210598TXS0060US0



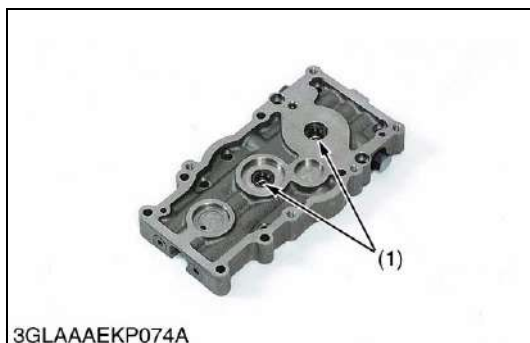
Pump Shaft

1. Check the seal surface (1), the bearing surface (2) and the ball bearing (3).
2. If the shaft is rough or grooved, replace it.
3. If the ball bearing is worn, replace it.

(1) Seal Surface
(2) Bearing Surface

(3) Ball Bearing

9Y1210598TXS0061US0



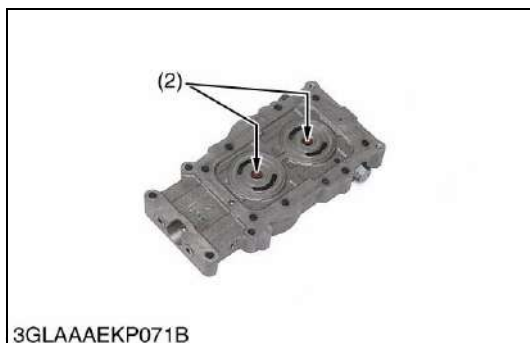
Bushing and Oil Seal

1. Check the oil seals (1) for damage.
2. Check the bushings (2) for wear.
3. If the oil seals and bushings are worn or damaged, replace them.

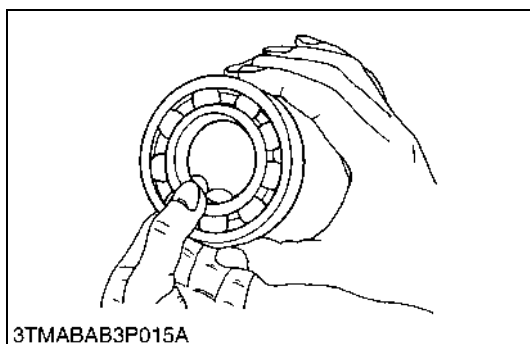
(1) Oil Seal

(2) Bushing

9Y1210598TXS0062US0



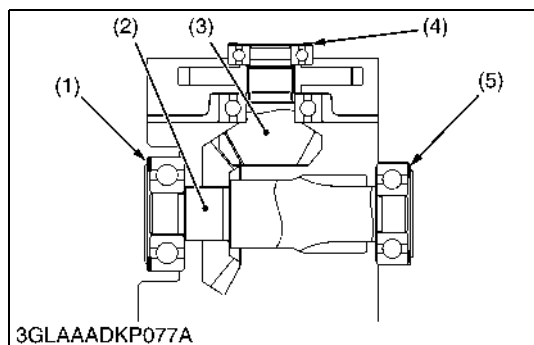
(2) Transaxle Case



Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.

9Y1210598TXS0063US0



Backlash between 11T Bevel Gear Shaft and 17T-13T Gear Shaft

1. Stick a strip of plastigauge the three spots on the 11T bevel gear shaft (3) with grease.
2. Reassemble the hydrostatic transmission and transaxle case.
3. Fix the transaxle case, and push the by-pass valve.
4. Turn the motor shaft.
5. Remove the 11T bevel gear shaft (3), and measure the plastigauge.

Backlash between 11T bevel gear shaft and 17T-13T gear shaft	Factory specification	0.10 to 0.30 mm 0.0039 to 0.012 in.
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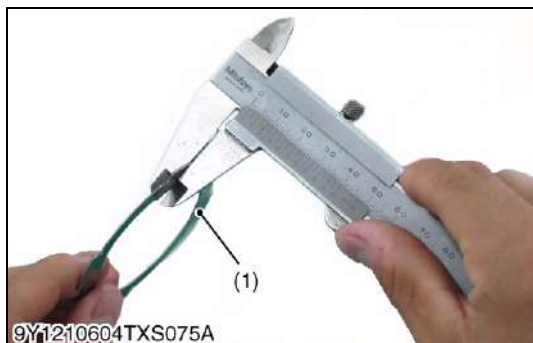
(Reference)

- Thickness of adjusting shims
 - For 11T bevel gear shaft (4)
 - 0.2 mm (0.008 in.)
 - 0.3 mm (0.012 in.)
 - 0.5 mm (0.020 in.)
 - For 17T-13T gear shaft (LH) (1)
 - 0.2 mm (0.008 in.)
 - 0.3 mm (0.012 in.)
 - 0.5 mm (0.020 in.)
 - For 17T-13T gear shaft (RH) (5)
 - 0.2 mm (0.008 in.)
 - 0.3 mm (0.012 in.)
 - 0.5 mm (0.020 in.)
- Tooth contact
 - More than 35 %

- (1) Shim (for 17T-13T Gear Shaft (LH)) (4) Shim (for 11T Bevel Gear Shaft)
 (2) 17T-13T Gear Shaft (5) Shim (for 17T-13T Gear Shaft (RH))
 (3) 11T Bevel Gear Shaft

9Y1210598TXS0064US0

(3) Hydraulic PTO Clutch



PTO Clutch Disc Wear

1. Measure the thickness of PTO clutch disc with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Thickness of PTO clutch disc	Factory specification	1.3 to 1.5 mm 0.052 to 0.059 in.
	Allowable limit	1.2 mm 0.047 in.

- (1) PTO Clutch Disk

9Y1210598TXS0065US0



PTO Clutch Plate Wear

1. Measure the thickness of PTO clutch plate with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Thickness of PTO clutch plate	Factory specification	0.75 to 0.85 mm 0.030 to 0.033 in.
	Allowable limit	0.60 mm 0.024 in.

(1) PTO Clutch Plate

9Y1210598TXS0066US0



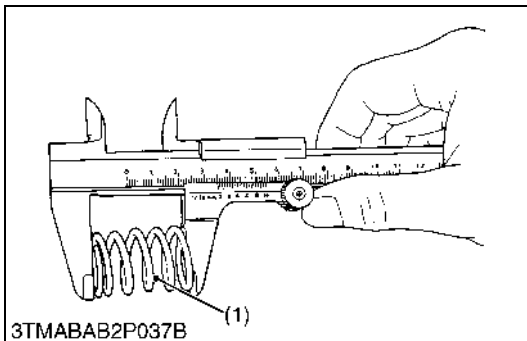
PTO Clutch Brake Spring Free Length

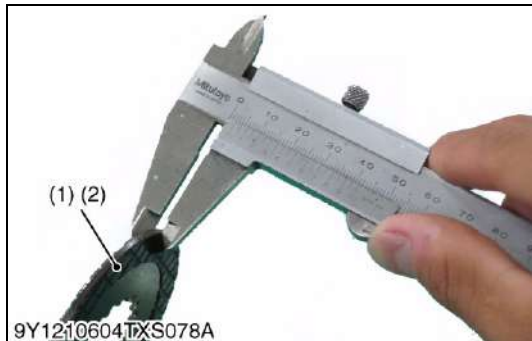
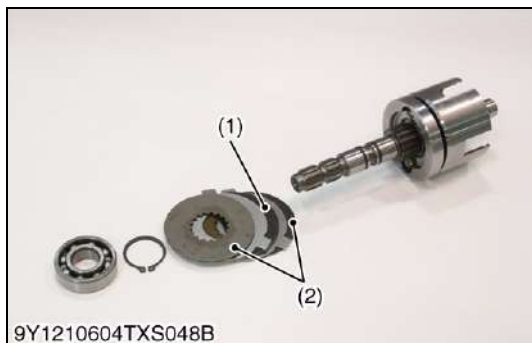
1. Measure the free length of spring (1) with vernier calipers.
2. If the measurement is less than the allowable limit, replace it.

Clutch spring free length	Factory specification	45.0 mm 1.77 in.
	Allowable limit	40.0 mm 1.57 in.

(1) Spring

9Y1210598TXS0067US0





PTO Brake Disc Wear

1. Measure the thickness of PTO brake disc with a vernier caliper.
2. If the thickness is less than the allowable limit, replace it.

PTO brake disc (Center) thickness	Factory specification	2.60 to 2.80 mm 0.103 to 0.110 in.
	Allowable limit	2.50 mm 0.0984 in.

PTO brake disc (Side) thickness	Factory specification	2.15 to 2.35 mm 0.0847 to 0.0925 in.
	Allowable limit	2.05 mm 0.0807 in.

(1) PTO Brake Disc (Center)

(2) PTO Brake Disc (Side)

9Y1210598TXS0068US0

PTO Clutch Brake Plate Wear

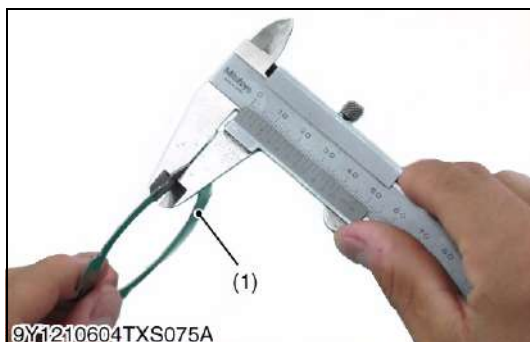
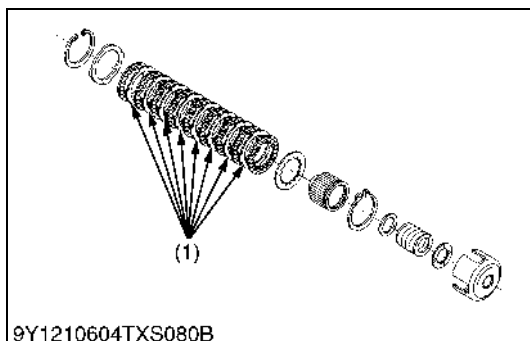
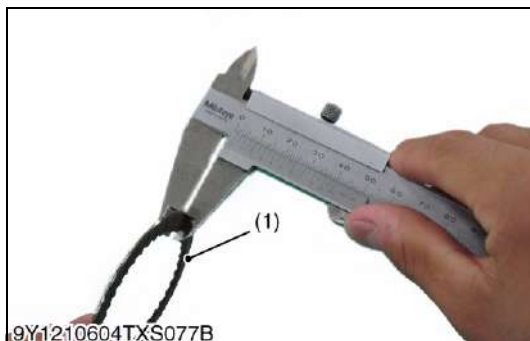
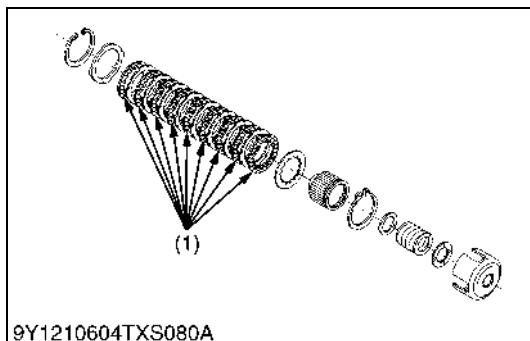
1. Measure the thickness of brake plate with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Thickness of PTO brake plate	Factory specification	0.950 to 1.05 mm 0.0374 to 0.0413 in.
	Allowable limit	0.80 mm 0.031 in.

(1) PTO Clutch Brake Plate

9Y1210598TXS0069US0

(4) Glide Steer Clutch



Glide Steer Clutch Disc Wear

1. Measure the thickness of Glide Steer clutch disc with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Thickness of Glide Steer clutch disc	Factory specification	1.3 to 1.5 mm 0.0512 to 0.0590 in.
	Allowable limit	1.20 mm 0.0472 in.

(1) Glide Steer Clutch Disc

9Y1210598TXS0070US0

Glide Steer Clutch Plate

1. Measure the thickness of wear Glide Steer clutch plate with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Thickness of Glide Steer clutch plate	Factory specification	0.075 to 0.85 mm 0.030 to 0.033 in.
	Allowable limit	0.60 mm 0.024 in.

(1) Glide Steer Clutch Plate

9Y1210598TXS0071US0

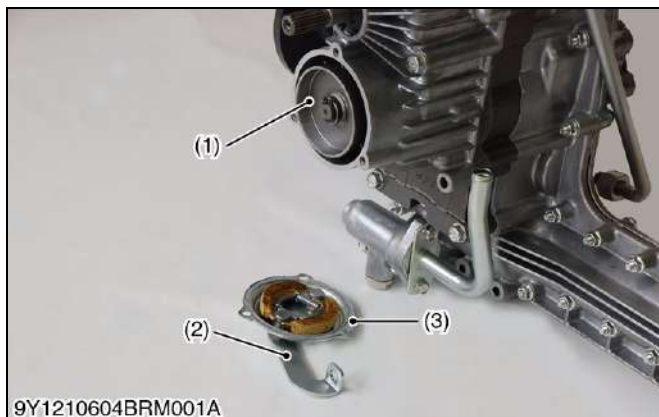
3 BRAKES

MECHANISM

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1. BRAKE MECHANISM



Internal expanding brake drum is used in braking system for GR series.

Brake drum (1) is connected to idle gear shaft.

Idle gear shaft is located between drive gear and final gear.

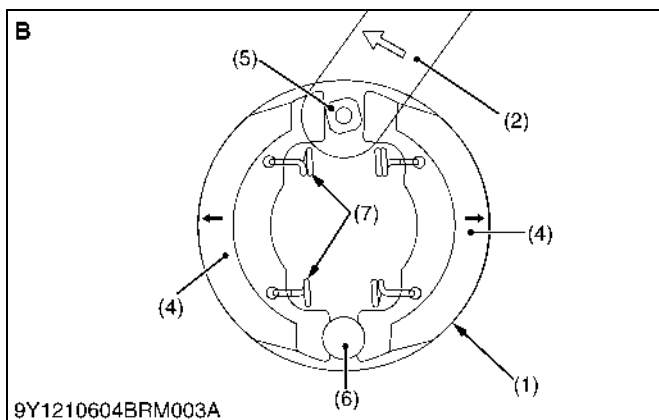
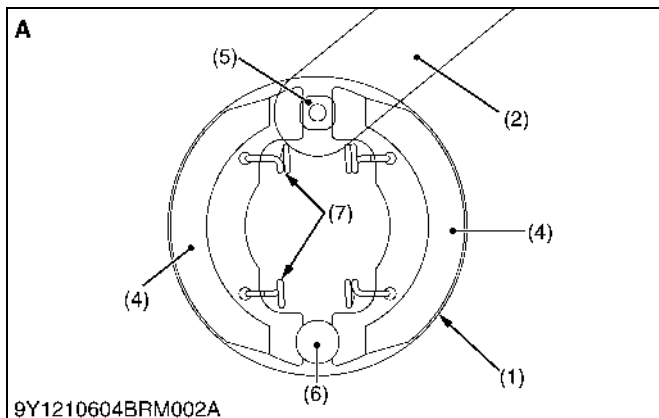
Brake shoes (4) expand via brake cam lever (2) when you press the brake pedal.

Brake shoes (4) touch inside of brake drum (1). Friction between brake shoes (4) and drum generates braking power.

- (1) Brake Drum
- (2) Brake Cam Lever
- (3) Brake Assy
- (4) Brake Shoe
- (5) Cam Pin
- (6) Brake Fulcrum
- (7) Spring

A: Free
B: Applied

9Y1210598BRM0001US0



SERVICING

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1. TROUBLESHOOTING.....	3-S1
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3. TIGHTENING TORQUES.....	3-S3
4. CHECKING, DISASSEMBLING AND SERVICING	3-S4
[1] CHECKING, AND ADJUSTING.....	3-S4
[2] DISASSEMBLING AND ASSEMBLING	3-S4
(1) Preparation	3-S4
(2) Pedal System Component.....	3-S6
(3) Brake Assembly.....	3-S10
[3] SERVICING.....	3-S11
(1) Brake Shoe.....	3-S11

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Insufficient Braking Force	Brake pedal free travel excessive	Adjust	3-S4
	Brake shoe worn	Replace	3-S10, 3-S11
	Brake drum worn	Replace	3-S10
	Grease or oil on brake shoe	Replace	3-S10
Brake Drags	Brake pedal free travel too small	Adjust	3-S4
	Brake spring weaken or broken	Replace	3-S10
Heavy Brakes	Brake pedal rusted	Repair or replace	3-S10
	Brake arm lever rusted	Replace	3-S10

9Y1210598BRS0001US0

2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Brake Pedal	Free Travel	15 to 25 mm 0.59 to 0.98 in.	—
Brake Shoe Outside Diameter L		61.20 to 61.40 mm 2.410 to 2.417 in.	60.20 mm 2.370 in.

9Y1210598BRS0002US0

3. TIGHTENING TORQUES

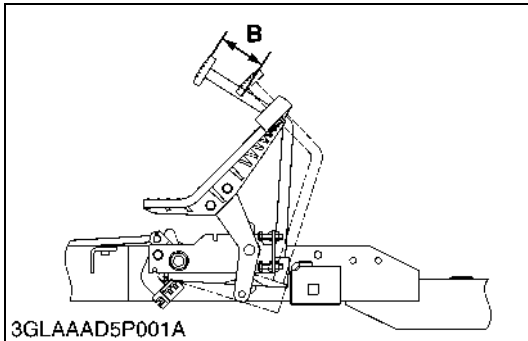
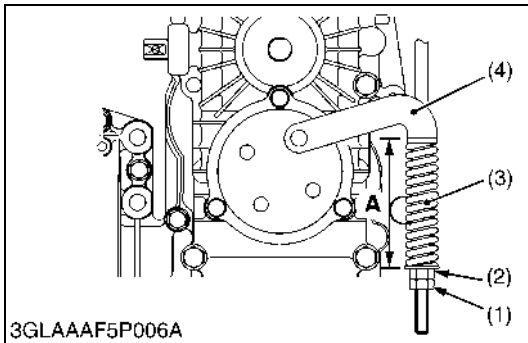
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: See page "5. TIGHTENING TORQUES" on page G-12.)

Item	N·m	kgf·m	lbf·ft
Steering wheel mounting nut	20.0 to 25.0	2.04 to 2.54	14.8 to 18.4
Power steering pipe and hose retaining nut	24.0 to 28.0	2.45 to 2.85	17.7 to 20.6
Steering support mounting screw	48 to 55	4.9 to 5.7	36 to 41
Pedal system component mounting nut	48 to 55	4.9 to 5.7	36 to 41
Brake assembly mounting screw	7.8 to 8.8	0.80 to 0.89	5.8 to 6.4

9Y1210598BRS0003US0

4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING, AND ADJUSTING



Brake Pedal Free Travel



CAUTION

- Stop the engine, remove the key before checking the brake pedal.

1. Release the parking brake.
2. Loosen the lock nut (1) and adjusting nut (2).
3. Lift up the brake arm (4) by hand.
4. Tighten the adjusting nut (2) so that the top of the brake spring (3) touches the brake arm (4). Next loosen the adjusting nut (2) by 3 turns.
5. Retighten the lock nut (1).
6. Confirm that the brake pedal free travel is 15 to 25 mm (0.59 to 0.98 in.). Then, with the brake pedal completely released, push the bypass valve of HST, and ensure that the rear wheel rotates.

Brake pedal free travel "B"	Factory specification	15 to 25 mm 0.59 to 0.98 in.
--------------------------------	-----------------------	---------------------------------

(Reference)

- Brake spring length "A"
73 to 74 mm (2.88 to 2.91 in.)

- (1) Lock Nut
(2) Adjusting Nut

- (3) Brake Spring
(4) Brake Arm

9Y1210598BRS0004US0

[2] DISASSEMBLING AND ASSEMBLING

(1) Preparation

Dismounting Mower

1. See page "[1] PREPARATION" on page 8-S9.

9Y1210598TXS0014US0

Battery



CAUTION

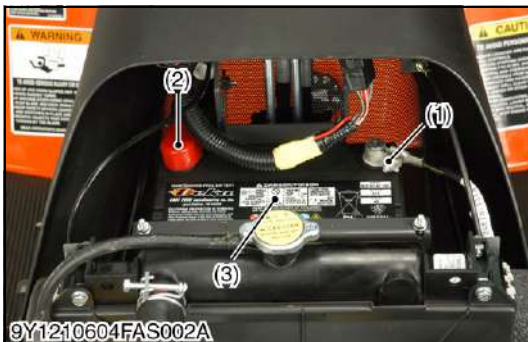
- When disconnecting the battery cables, disconnect the negative cable from the battery first. When connecting, connect the positive cable to the battery first.

1. Open the bonnet.
2. Disconnect the negative cable (1) from the battery.
3. Disconnect the positive cable (2) from the battery and remove the battery (3).

- (1) Negative Cable
(2) Positive Cable

- (3) Battery

9Y1210598ENS0023US0



Rear Cover [GR2120SEU]

1. Remove the rear cover (1).

- (1) Rear Cover

9Y1210598TXS0015US0





Removing Container [GR2120EU, GR2120F Only]

1. Pull the top cover lock lever (2) to open the top cover (1).
2. Set the grass container lift lever (4) in "**LEVER LOCK**" position.
3. Lift up the rear of the grass container (3).
4. Lift up the whole grass container and remove.

(When attaching)

- Open the top cover (1).
- Set the grass container lift lever (4) in "**LEVER LOCK**" position.
- Lift the rear end of the grass container (3), set the grass container (3) onto the frame shaft so that a clearance "**L**" is about 0 to 50 mm (0 to 2.0 in.).
- Lock the grass container (3) with the grass container lift lever (4) in "**CONTAINER LOCK**" position.
- Close the top cover (1).

(Reference)

- Clearance "**L**": 0 to 50 mm (0 to 2.0 in.)

(1) Top Cover

(2) Top Cover Lock Lever

(3) Grass Container

(4) Grass Container Lift Lever

9Y1210598TXS0072US0

Discharge Duct [GR2120EU, GR2120F]

1. Remove the filter cover (1).
2. Remove the screws (3) for the discharge duct (2).
3. Disconnect the spring (4) and the coupler (5).
4. Remove the discharge duct (2).

(1) Filter Cover

(2) Discharge Duct

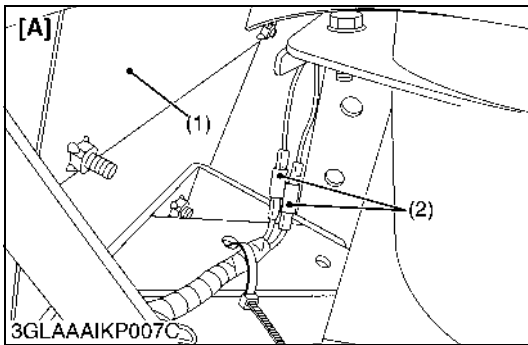
(3) Screw

(4) Spring

(5) Coupler

9Y1210598TXS0073US0

(2) Pedal System Component



Container Base [GR2120EU, GR2120F]

1. Disconnect the connector (2).
2. Remove the container base (1).

- (1) Container Base
(2) Connector

[A] Right Side

9Y1210598TXS0077US0



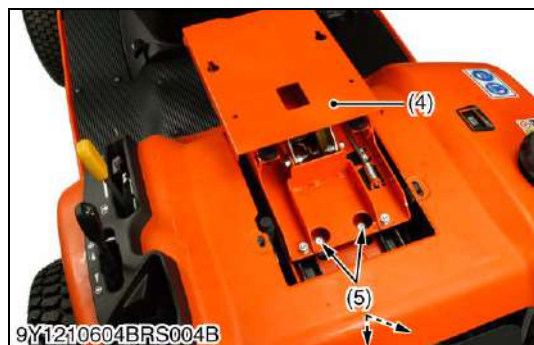
Seat

1. Turn the seat (1).
2. Disconnect the safety switch connector (2).
3. Remove the seat (1).

- (1) Seat
(2) Safety Switch Connector

(3) Wire Harness

9Y1210598TXS0018US0



Seat Base and Fender

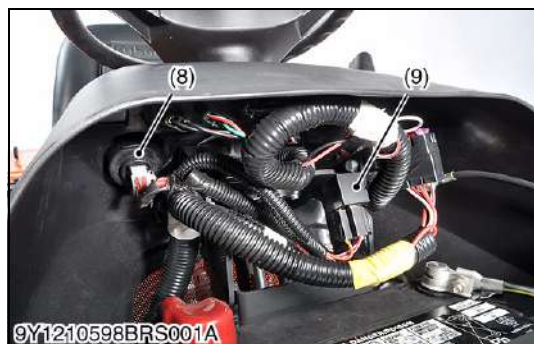
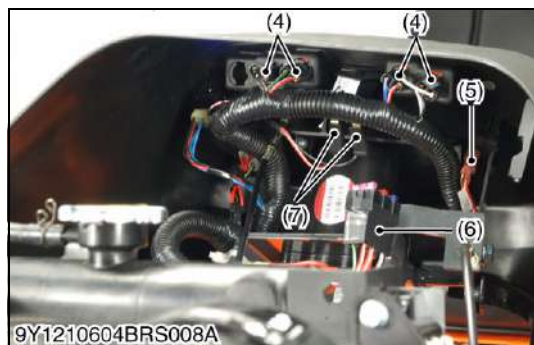
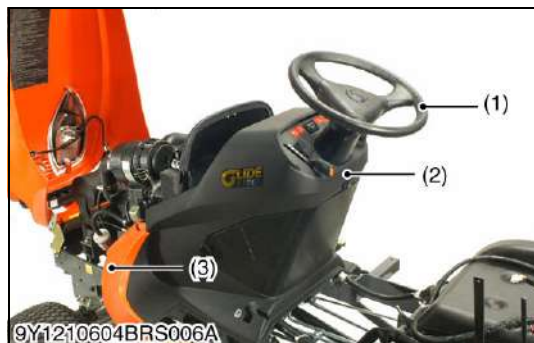
1. Disconnect the seat connector (1).
2. Remove the screws (2).
3. Remove the support base (3).
4. Move the seat base (4) in ahead.
5. Remove the seat base (4).
6. Remove the lever grips (6), fuel and the cutting height control dial (9).
7. Remove the speed change pedal (10).
8. Remove the fuel tank cap (7) and fender (8).

■ NOTE

- To remove the fender, remove the hydraulic hose from guide first.

- | | |
|------------------------------|---------------------------------|
| (1) Seat Connector | (6) Lever Grip |
| (2) Screw | (7) Fuel Tank Cap |
| (3) Support Base | (8) Fender |
| (4) Seat Base | (9) Cutting Height Control Dial |
| (5) Seat Base Mounting screw | (10) Speed Change Pedal |

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Steering Wheel, Side Bonnet and Panel

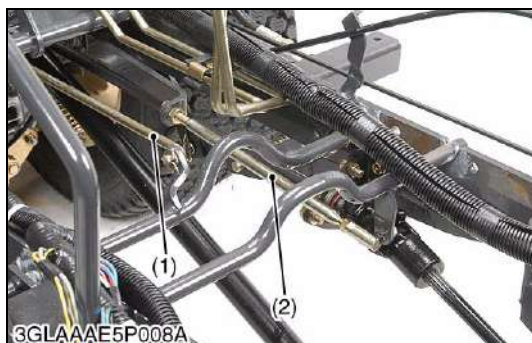
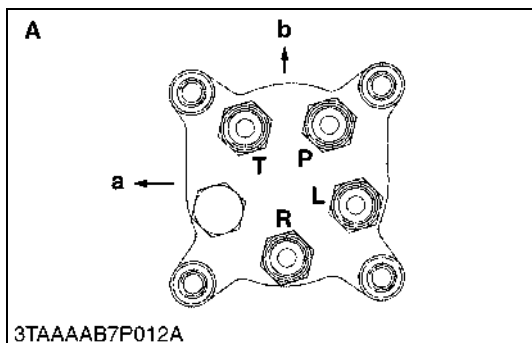
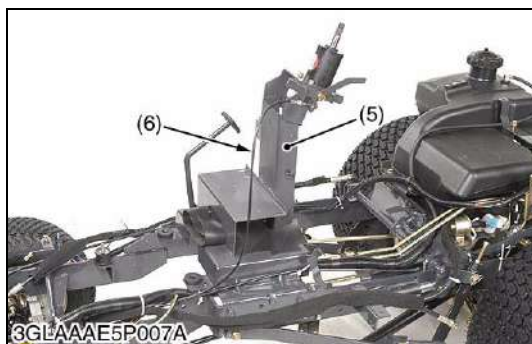
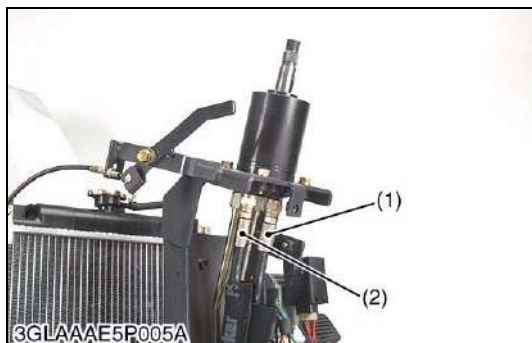
1. Remove the steering wheel (1).
2. Remove the side bonnet (3).
3. Remove the accelerator lever grip.
4. Remove the indicator lamps (4).
5. Disconnect the head light switch connectors (5).
6. Disconnect the connectors for the main switch (8), hour meter (7), overheated horn relay (9), overheated horn (10) and buzzer (11). [GR2120EU, GR2120F]
7. Remove the fuse box (6) from the steering support.
8. Remove the panel (2).

(When reassembling)

Tightening torque	Steering wheel mounting nut	20.0 to 25.0 N·m 2.04 to 2.54 kgf·m 14.8 to 18.4 lbf·ft
-------------------	-----------------------------	---

- | | |
|---------------------------------|-------------------------|
| (1) Steering Wheel | (7) Hour Meter |
| (2) Panel | (8) Main Switch |
| (3) Side Bonnet | (9) Overheat Horn Relay |
| (4) Indicator Lamp | (10) Overheat Horn |
| (5) Head Light Switch Connector | (11) Buzzer |
| (6) Fuse Box | |

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Steering Support Assembly

1. Disconnect the power steering hoses (1), (2) and pipes (3), (4).
2. Disconnect the connectors for the timer relay, regulator.
3. Disconnect the accelerator wire (6).
4. Separate the steering support assembly (5).

(When reassembling)

- Be sure to connect the power steering hoses to their original positions, and tighten them to the specified torque.

Tightening torque	Power steering pipe and hose retaining nut	24.0 to 28.0 N·m 2.45 to 2.85 kgf·m 17.7 to 20.6 lbf·ft
	Steering support mounting screw	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft

- (1) Cylinder Hose LH
- (2) Cylinder Hose RH
- (3) Return Pipe
- (4) Delivery Pipe
- (5) Steering Support Assembly
- (6) Accelerator Wire

- A:** Bottom View
P: Pump Port
 (Connected to Delivery Hose)
T: Tank Port
 (Connected to Return Hose)
L: L Port
 (Connected to Cylinder RH)
R: R Port
 (Connected to Cylinder LH)
a: Right from Operator
b: Front

9Y1210598BRS0007US0

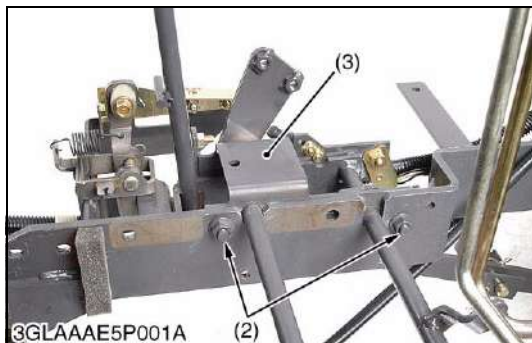
Brake Rod and Speed Change Rod

1. Disconnect the brake rod 1 (1) from the pedal system component.
2. Disconnect the speed change rod (2) from the pedal system component.

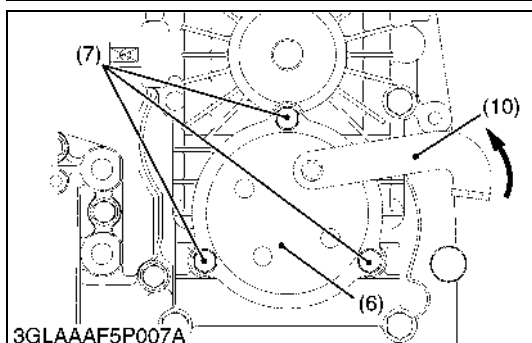
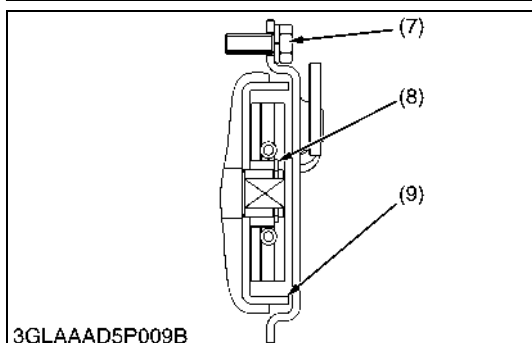
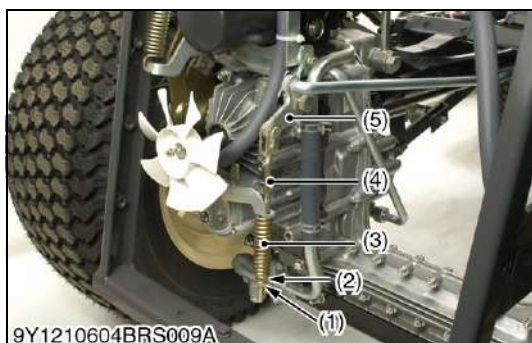
(1) Brake Rod 1

(2) Speed Change Rod

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(3) Brake Assembly



Pedal System Component

1. Remove the parking brake spring (1).
2. Remove the pedal system component mounting nuts (2).
3. Separate the pedal system component (3) from frame.

(When reassembling)

Tightening torque	Pedal system component mounting nut	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft
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- (1) Parking Brake Spring (3) Pedal System Component
(2) Pedal System Component Mounting Nut

9Y1210598BRS0009US0

Brake Assembly

1. Remove the lock nut (1), plain washers (2) and brake spring (3).
2. Remove the brake plate (5).
3. Remove the brake rod 2 (4).
4. Remove the brake assembly (6).
5. Remove the external snap ring (8).
6. Pull out the brake drum (9).

(When reassembling)

- Apply liquid gasket (Three Bond 1206D or equivalent) to joint face of the brake assembly.
- Tighten the brake assembly mounting screws (7) while pushing up the brake arm lever (10) by hand.

■ NOTE

- After assembling the brake assembly, be sure to adjust the brake pedal free travel. (See page 3-S4.)

Tightening torque	Brake assembly mounting screw	7.8 to 8.8 N·m 0.80 to 0.89 kgf·m 5.8 to 6.4 lbf·ft
-------------------	-------------------------------	---

- (1) Lock Nut (6) Brake Assembly
(2) Plain Washer (7) Brake Assembly Mounting Screw
(3) Brake Spring (8) External Snap Ring
(4) Brake Rod 2 (9) Brake Drum
(5) Brake Plate (10) Brake Arm Lever

9Y1210598BRS0010US0

[3] SERVICING

(1) Brake Shoe



Brake Shoe Wear

1. Measure the brake shoe outside diameter "L".
2. If the outside diameter is less than the allowable limit, replace it.

Brake shoe outside diameter "L"	Factory specification	61.20 to 61.40 mm 2.410 to 2.417 in
	Allowable limit	60.20 mm 2.370 in

L: Brake Shoe Outside Diameter

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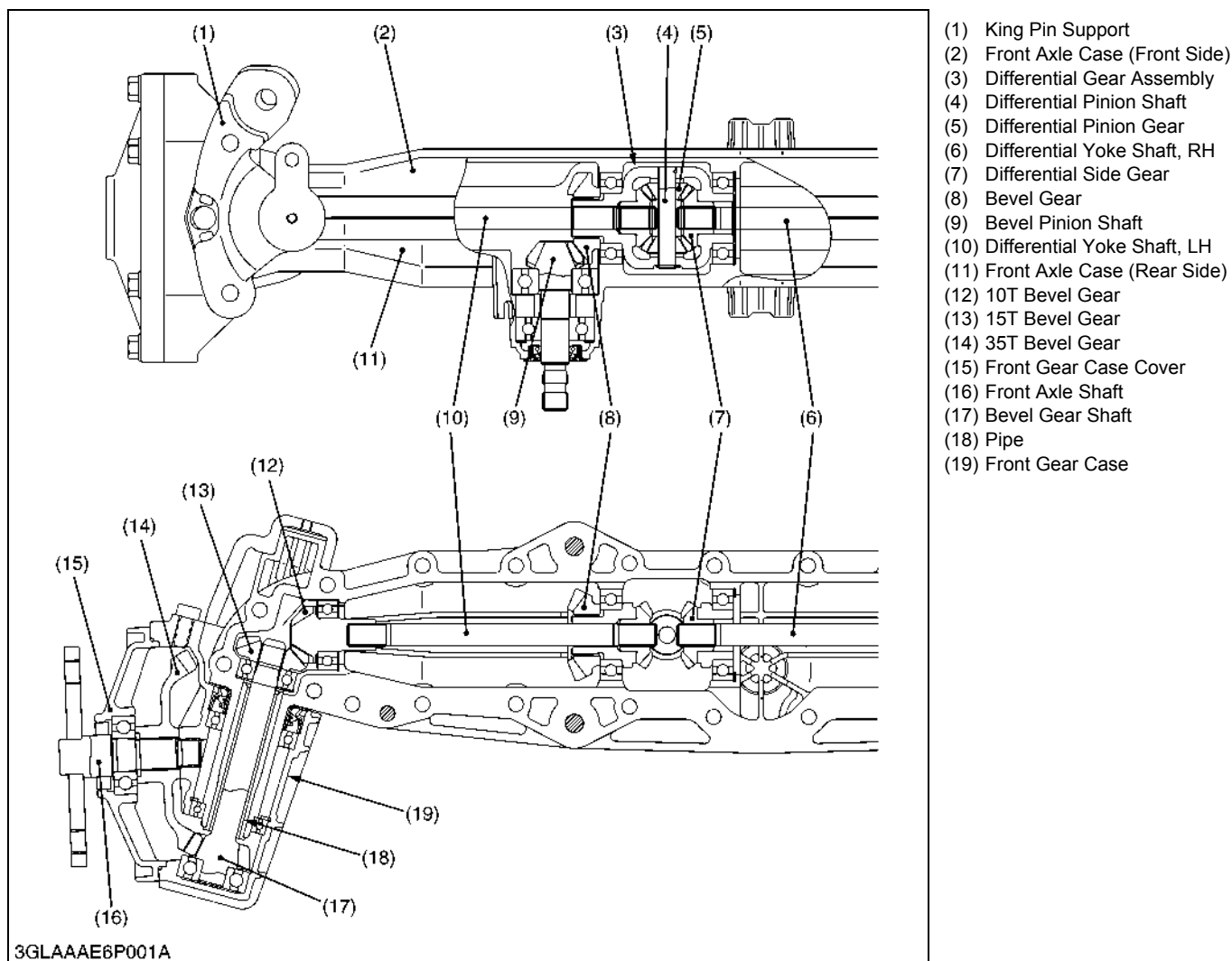
4 FRONT AXLE

MECHANISM

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1. STRUCTURE.....	4-M1
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1. STRUCTURE



The front axle of this machine is constructed as shown above. Power is transmitted from the transmission through the propeller shaft to the bevel pinion shaft (9), then to the bevel gear (8) and to the differential side gear (7).

The power through the differential side gear is transmitted to the differential yoke shaft (6), (10), and to the bevel gear shaft (17) through the 10T bevel gear (12) and 15T bevel gear (13).

The revolution is greatly reduced by the bevel gear shaft (17) and 35T bevel gear (14), then the power is transmitted to the front axle shaft (16).

The differential system allows each wheel to rotate at a different speed to make turning easier.

9Y1210598FAM0001US0

SERVICING

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1. TROUBLESHOOTING.....	4-S1
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4. CHECKING, DISASSEMBLING AND SERVICING	4-S4
[1] CHECKING AND ADJUSTING.....	4-S4
[2] PREPARATION	4-S5
(1) Separating Front Axle Assembly	4-S5
[3] DISASSEMBLING AND ASSEMBLING	4-S9
(1) Front Axle Assembly.....	4-S9
[4] SERVICING.....	4-S12

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Front Wheels Wander to Right or Left	Tire pressure uneven	Adjust	G-20
	Improper toe-in adjustment (improper alignment)	Adjust	4-S4
	Tie-rod end loose	Tighten	4-S9
	Air sucked in power steering circuit	Bleed	—
Front Wheels Can Not Be Driven	Front wheel driving gears in front axle gear case broken	Replace	4-S9
	Universal joint broken	Replace	4-S7
	Front wheel drive gears in transmission broken	Replace	2-S36
	Front differential gear broken	Replace	4-S11
Noise	Gear backlash excessive	Adjust or replace	4-S12
	Oil insufficient	Fill	4-S5
	Bearings damaged or broken	Replace	—
	Gears damaged or broken	Replace	—

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2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	0 to 10 mm 0.00 to 0.39 in.	—
Differential Gear Case to Differential Side Gear	Clearance	0.040 to 0.082 mm 0.0016 to 0.0032 in.	0.17 mm 0.0067 in.
• Differential Gear Case	I.D.	19.500 to 19.521 mm 0.76772 to 0.76854 in.	—
• Differential Side Gear	O.D.	19.439 to 19.460 mm 0.76532 to 0.76614 in.	—
Differential Pinion Shaft to Differential Pinion	Clearance	0.025 to 0.055 mm 0.00099 to 0.0021 in.	0.25 mm 0.0098 in.
• Differential Pinion Shaft	O.D.	9.960 to 9.975 mm 0.3922 to 0.3927 in.	—
• Differential Pinion	I.D.	10.000 to 10.015 mm 0.39370 to 0.39429 in.	—
Differential Pinion Gear to Differential Side Gear	Backlash	0.10 to 0.30 mm 0.0040 to 0.011 in.	—
Bevel Pinion Shaft to Bevel Gear	Backlash	0.10 to 0.30 mm 0.0040 to 0.011 in.	—
10T Bevel Gear to 15T Bevel Gear	Backlash	0.10 to 0.30 mm 0.0040 to 0.011 in.	—

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3. TIGHTENING TORQUES

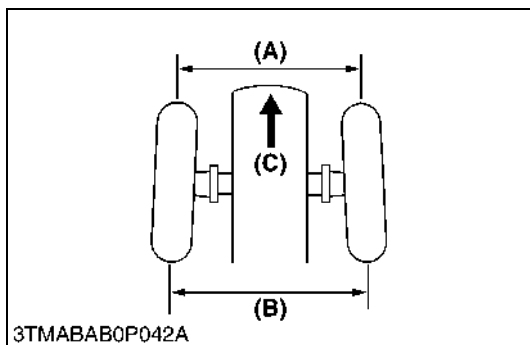
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: See page "5. TIGHTENING TORQUES" on page G-12.)

Item	N·m	kgf·m	lbf·ft
Power steering cylinder hose	24.0 to 28.0	2.45 to 2.85	17.7 to 20.6
Glide steer flange screw	17.6 to 20.6	1.80 to 2.10	13.0 to 15.1
Glide steer stay mounting screw	23.5 to 27.5	2.40 to 2.80	17.4 to 20.2
Front wheel mounting screw	108.5 to 130.2	11.07 to 13.28	80 to 96
Front axle bracket mounting screw	48 to 55	4.9 to 5.7	36 to 41
Tie-rod slotted nut	17.7 to 34.3	1.81 to 3.49	13.1 to 25.2
King pin support mounting nut	20 to 25	2.0 to 2.6	15 to 18
Front gear case cover mounting screw	18 to 20	1.8 to 2.1	13 to 15
Front axle case screw	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31

9Y1210598FAS0003US0

4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING



Toe-in

1. Inflate the tires to the specified pressure.
2. Turn the front wheels straight ahead.
3. Measure the toe-in **(B-A)**.
4. If the measurement is not within the factory specifications, adjust the tie-rod length.

Toe-in (B-A)	Factory specification	0 to 10 mm 0 to 0.39 in.
---------------------	-----------------------	-----------------------------

(A) Wheel to Wheel Distance at Front (C) Front

(B) Wheel to Wheel Distance at Rear

9Y1210598FAS0004US0



Toe-in Adjusting

1. Loosen the lock nuts (1).
2. Turn the tie-rod (2) to the factory specification.
3. Tighten the lock nuts (1).

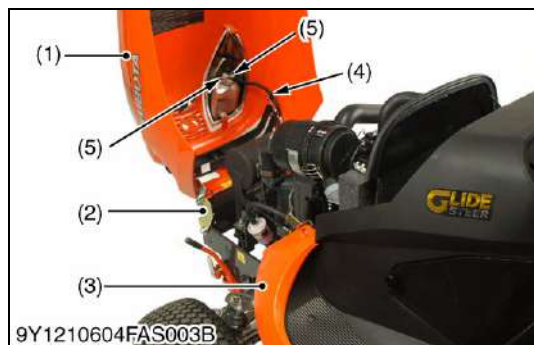
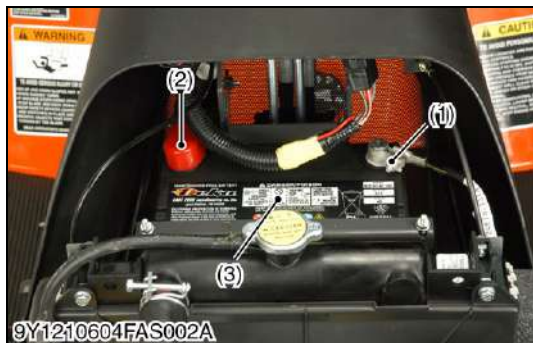
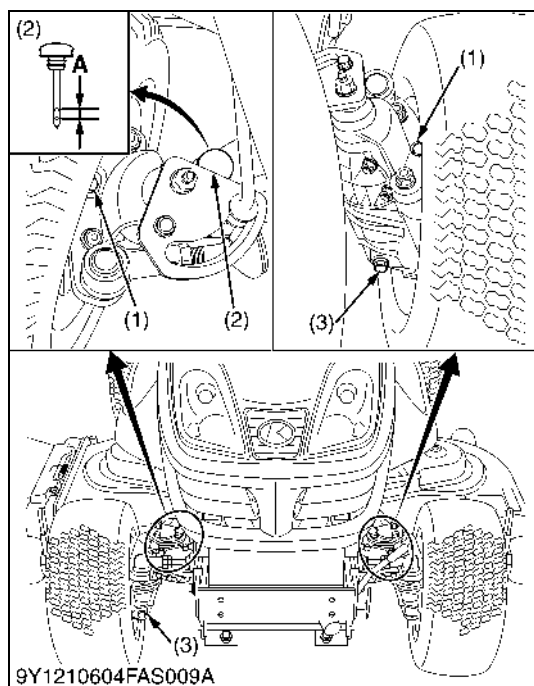
(1) Lock Nut

(2) Tie-rod

9Y1210598FAS0005US0

[2] PREPARATION

(1) Separating Front Axle Assembly



Dismounting Mower

1. See page "[1] PREPARATION" on page 8-S9.

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Draining Front Axle Case Oil

1. Place the oil pans underneath the front axle case.
2. Remove the both right and left hand side drain plugs (3) and filling plug with dipstick (2) to drain the oil.
3. After draining, reinstall the drain plugs (3).

(When re-filling)

- When re-filling, remove the right and left breather plugs (1).
- Fill the oil up to the upper line on the filling plug with dipstick (2).

■ IMPORTANT

- After ten minutes, check the oil level again, add oil to prescribed level.
- Use KUBOTA UDT or SUPER UDT fluid. (See Page "4. LUBRICANTS, FUEL AND COOLANT" on page G-9.)

Front axle case fluid	Capacity	1.9 L 2.0 U.S.qts 1.7 Imp.qts
-----------------------	----------	-------------------------------------

- (1) Breather Plug
- (2) Filling Plug with Dipstick
- (3) Drain Plug

A: Oil level is acceptable within this range

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Battery



CAUTION

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

1. Open the bonnet.
2. Disconnect the negative cable (1) from the battery.
3. Disconnect the positive cable (2) from the battery and remove the battery (3).

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

9Y1210598ENS0023US0

Bonnet and Side Bonnet

1. Disconnect the connectors (4) from the head light.
2. Remove the wire harness (5) from the bonnet.
3. Remove the bonnet (1) with bonnet bracket (2).
4. Remove the side bonnet (3).

- (1) Bonnet
- (2) Bonnet Bracket
- (3) Side Bonnet
- (4) Connector
- (5) Wire Harness

9Y1210598ENS0024US0



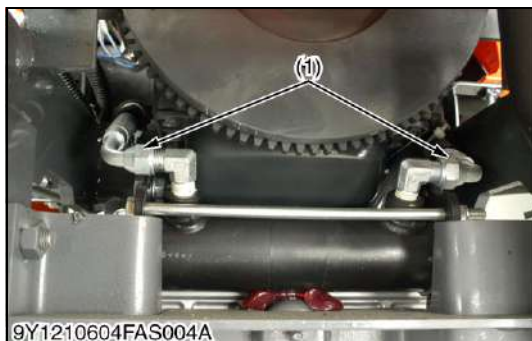
Flywheel Cover and Muffler Cover [GR2120SEU, GR2120F Only]

1. Remove the screws (2) and a nut (1) for the flywheel cover and muffler cover.

(1) Nut

(2) Screw

9Y1210598FAS0025US0



Power Steering Hose

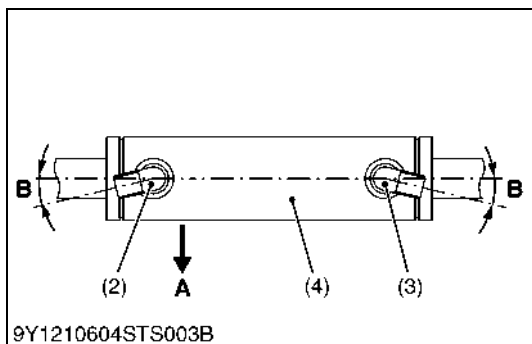
1. Disconnect the power steering cylinder hoses (1).

NOTE

- Attach the plugs to the adaptors of steering cylinder after removing the hoses so that oil should not come out.

(When reassembling)

- Be sure to install the hose adaptors (2), (3) as shown in the figure.
- Connect the power steering cylinder hoses to the power steering cylinder adaptors.
- After starting the engine, steer the steering wheel to the right turning end or the left turning end to bleed air in the power steering oil system.



Tightening torque	Power steering cylinder hose retaining nut	24.0 to 28.0 N·m 2.45 to 2.85 kgf·m 17.7 to 20.6 lbf·ft
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(1) Power Steering Cylinder Hose

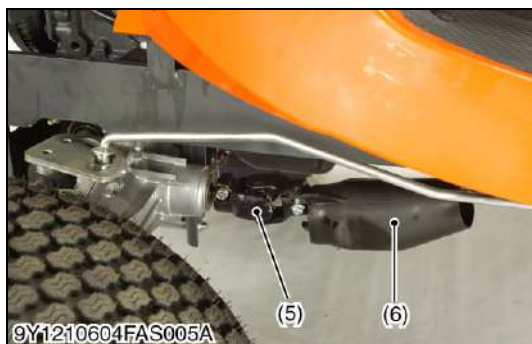
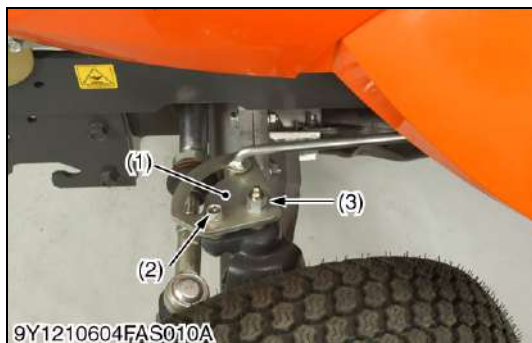
(2) Hose Adaptor (LH)

(3) Hose Adaptor (RH)

(4) Cylinder

A: Front**B: 0.09 to 0.1 rad (5 to 6 °)**

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Glide Steer Rod, Front Wheel and Joint Cover

1. Remove the Glide Steer stays (1).
2. Lift up the front side of machine and place the disassembling stand under the front axle frame.
3. Remove the front wheels (4).
4. Remove the joint cover mounting screws and slide the joint cover (6).

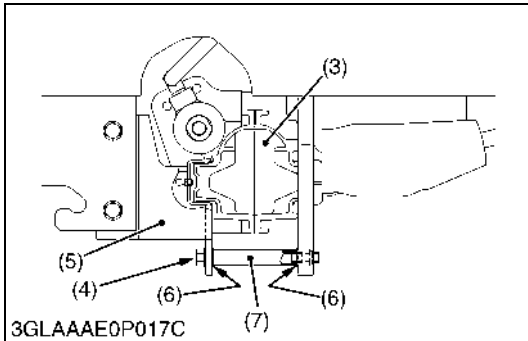
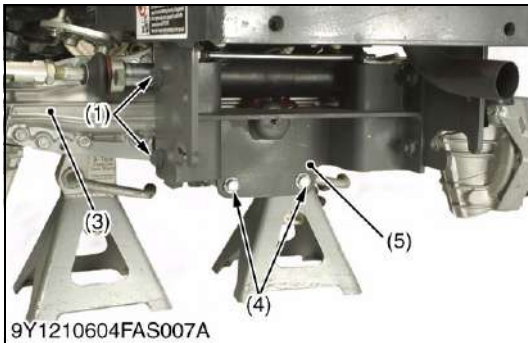
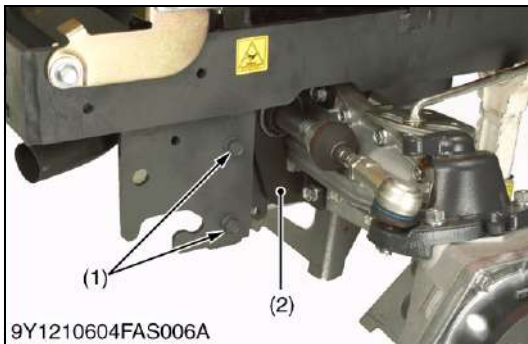
(When reassembling)

Tightening torque	Glide steer flange screw	17.6 to 20.6 N·m 1.80 to 2.10 kgf·m 13.0 to 15.1 lbf·ft
	Glide Steer stay mounting screw	23.5 to 27.5 N·m 2.40 to 2.80 kgf·m 17.4 to 20.2 lbf·ft
	Front wheel mounting screw	108.5 to 130.2 N·m 11.07 to 13.28 kgf·m 80 to 96 lbf·ft

- (1) Glide Steer Stay
(2) Glide Steer Screw
(3) Glide Steer Flange Screw

- (4) Front Wheel
(5) Universal Joint
(6) Joint Cover

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Front Axle Assembly

1. Support the front axle assembly (3) so as not to drop out.
2. Remove the power steering cylinder holder mounting screws (1).
3. Remove the front axle bracket (5).
4. Separate the front axle assembly (3) from the frame.

(When reassembling)

- Apply the grease to center pin of front axle assembly.
- Reinstall the shims (6) and collar (7) on the front axle bracket retaining screw (4) as shown in the figure.

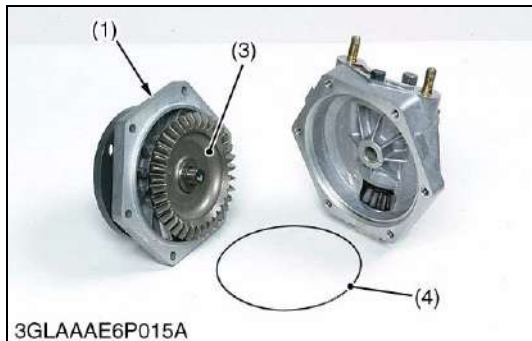
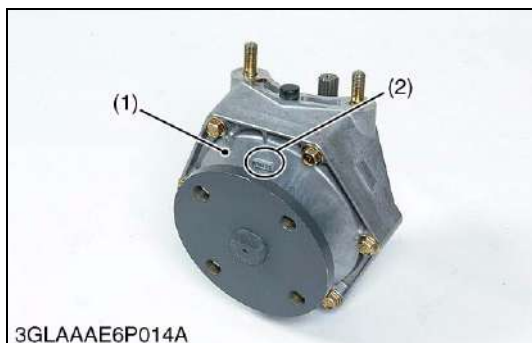
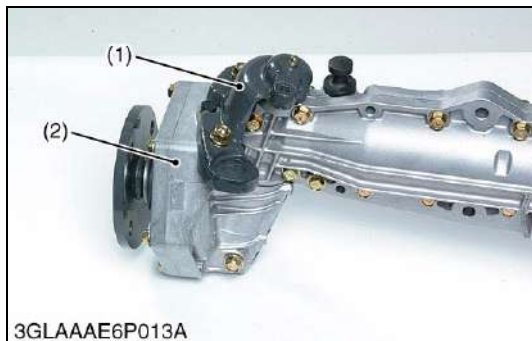
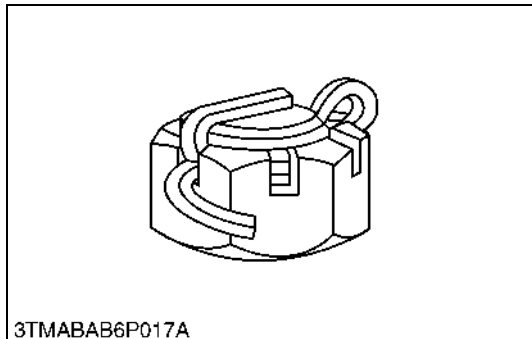
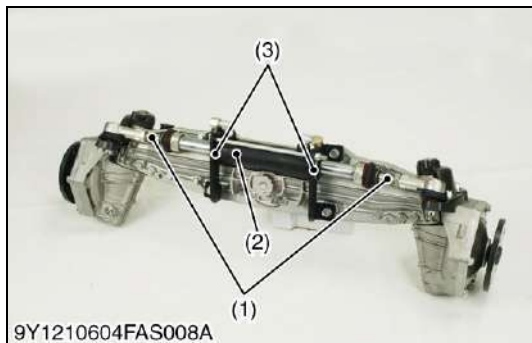
Tightening torque	Front axle bracket mounting screw	48 to 55 N·m 4.91 to 5.70 kgf·m 36 to 41 lbf·ft
-------------------	-----------------------------------	---

- | | |
|---|------------------------|
| (1) Power Steering Cylinder Holder Mounting Screw | (5) Front Axle Bracket |
| (2) Power Steering Cylinder Holder | (6) Shim |
| (3) Front Axle Assembly | (7) Collar |
| (4) Front Axle Bracket Retaining Screw | |

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[3] DISASSEMBLING AND ASSEMBLING

(1) Front Axle Assembly



Power Steering Cylinder

1. Remove the power steering cylinder holder (3).
2. Remove the cotter pin and remove the slotted nut for tie-rod (1).
3. Remove the power steering cylinder mounting screws and remove the power steering cylinder (2) with tie-rod.

(When reassembling)

■ NOTE

- Tighten the slotted nut to 17.7 N·m (1.81 kgf·m, 13.1 lbf·ft). If the slot and pin hole do not meet, tighten the nut until they do meet, and install the cotter pin.
- After tightening the tie-rod end slotted nut to the specified torque, install a cotter pin as shown in the figure.

Tightening torque	Tie-rod slotted nut	17.7 to 34.3 N·m 1.81 to 3.49 kgf·m 13.1 to 25.2 lbf·ft
-------------------	---------------------	---

(1) Tie-rod

(3) Power Steering Cylinder Holder

(2) Power Steering Cylinder

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Front Gear Case Assembly

1. Remove the king pin support (1).
2. Remove the front gear case assembly (2).

(When reassembling)

- Do not interchange left and right front gear case assemblies.

Tightening torque	King pin support mounting nut	20 to 25 N·m 2.0 to 2.6 kgf·m 15 to 18 lbf·ft
-------------------	-------------------------------	---

(1) King Pin Support

(2) Front Gear Case

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Front Gear Case Cover

1. Remove the front gear case cover (1) with bevel gear (3).

(When reassembling)

- Be careful not to damage the O-ring (4).
- Install the front gear case cover (1) to position the square mark (2) on it upward.

Tightening torque	Front gear case cover mounting screw	18 to 20 N·m 1.8 to 2.1 kgf·m 13 to 15 lbf·ft
-------------------	--------------------------------------	---

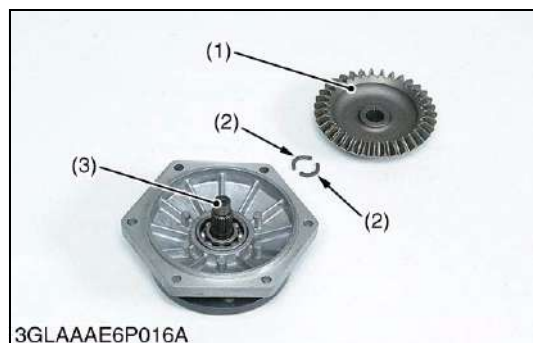
(1) Front Case Cover

(3) Bevel Gear

(2) Square Mark

(4) O-ring

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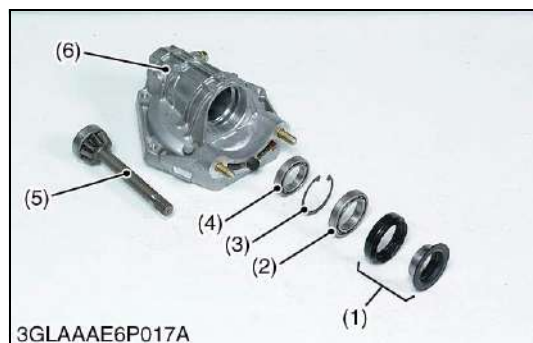


35T Bevel Gear and Front Axle

1. Remove the 35T bevel gear (1).
2. Remove the collar (2).
3. Tap out the front axle shaft (3).

- (1) 35T Bevel Gear (3) Front Axle Shaft
(2) Collar

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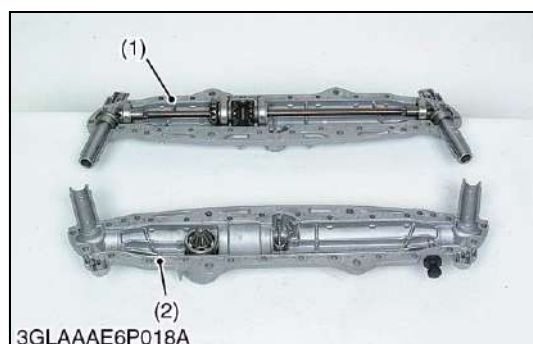


Front Gear Case

1. Remove the oil seal (1) and the ball bearing (2).
2. Remove the internal snap ring (3).
3. Remove the ball bearing (4).
4. Remove the bevel gear shaft (5) with ball bearing.

- (1) Oil Seal (4) Ball Bearing
(2) Ball Bearing (5) Bevel Gear Shaft
(3) Internal Snap Ring (6) Front Gear Case

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Front Axle Case

1. Separate the front axle case to front side (1) and rear side (2).

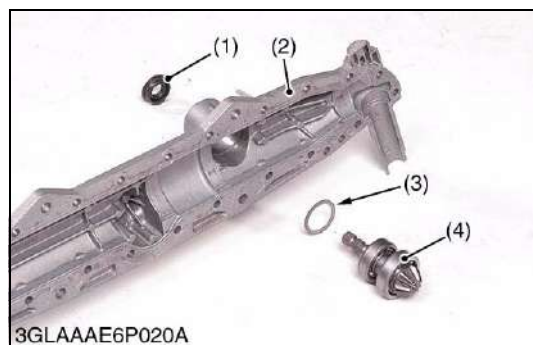
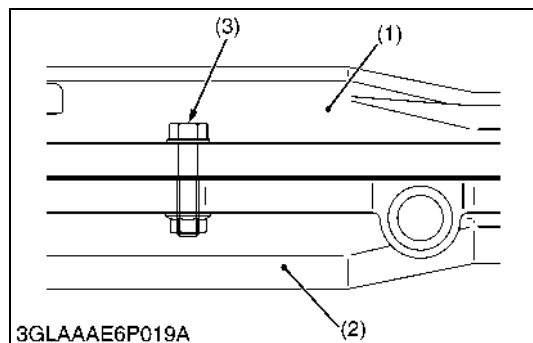
(When reassembling)

- Apply liquid gasket (Three Bond 1206D or equivalent) to joint face of the front axle case.
- Install the front axle case screw (3), noting its direction as shown in the figure.
- Tentatively tighten the front axle case screws (3) at intervals of every other one to join the front-side and rear-side front axle cases (1), (2). Then tighten all front axle case screws (3) with a specified tightening torque.

Tightening torque	Front axle case screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
-------------------	-----------------------	---

- (1) Front Axle Case (Front Side) (3) Front Axle Case Screw
(2) Front Axle Case (Rear Side)

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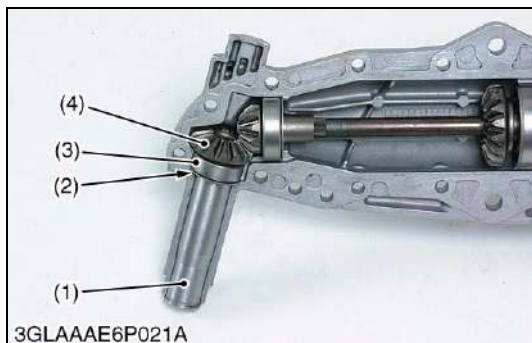


Bevel Pinion Shaft

1. Remove the bevel pinion shaft (4) from the rear side of front axle case (2).
2. Remove the oil seal (1).

- (1) Oil Seal (3) Shim
(2) Front Axle Case (Real Side) (4) Bevel Pinion Shaft

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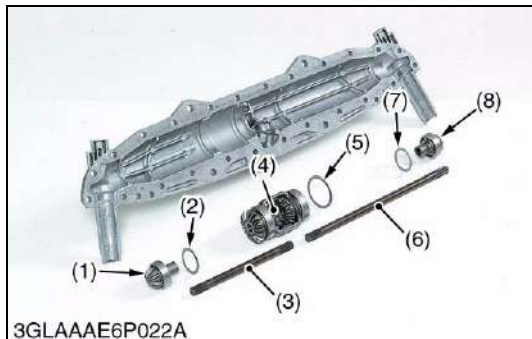


15T Bevel Gear

1. Remove the pipe (1).
2. Remove the ball bearing (3) and 15T bevel gear (4).

- | | |
|----------|--------------------|
| (1) Pipe | (3) Ball Bearing |
| (2) Shim | (4) 15T Bevel Gear |

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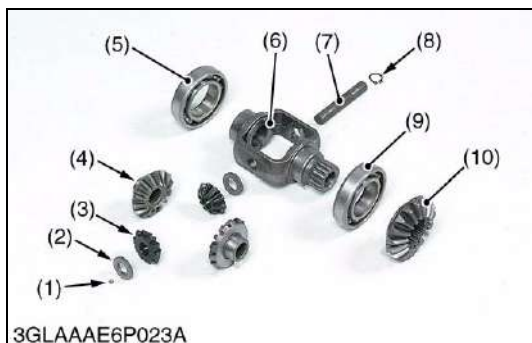


10T Bevel Gear and Differential Gear Assembly

1. Remove the 10T bevel gears (1), (8) with bearing.
2. Remove the differential yoke shafts (3), (6).
3. Remove the differential gear assembly (4).

- | | |
|----------------------------------|----------------------------------|
| (1) 10T Bevel Gear (LH) | (5) Shim |
| (2) Shim | (6) Differential Yoke Shaft (RH) |
| (3) Differential Yoke Shaft (LH) | (7) Shim |
| (4) Differential Gear Assembly | (8) 10T Bevel Gear (RH) |

9Y1210598FAS0018US0



Differential Gear Assembly

1. Remove the bevel gear (10).
2. Remove the bearings (5), (9) with the puller.
3. Remove the external snap ring (8).
4. Remove the differential pinion shaft (7).
5. Remove the differential pinion gears (3), differential side gears (4) and shims (2).

NOTE

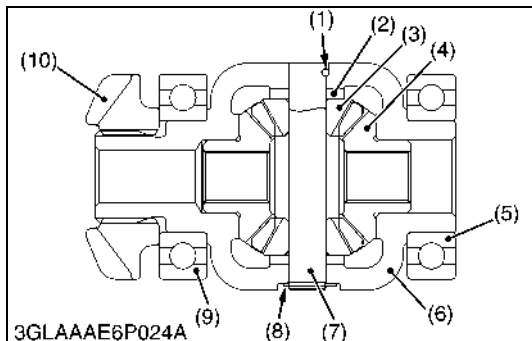
- Arrange the parts to know their original position.

(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of differential pinion gears (3), differential side gears (4) and shims (2).
- Install the steel ball (1) in a specified position of the differential gear case (6) as shown in the figure.

- | | |
|------------------------------|-------------------------------|
| (1) Steel Ball | (6) Differential Gear Case |
| (2) Shim | (7) Differential Pinion Shaft |
| (3) Differential Pinion Gear | (8) External Snap Ring |
| (4) Differential Side Gear | (9) Bearing |
| (5) Bearing | (10) Bevel Gear |

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[4] SERVICING



3GLAAAE6P025A

Clearance between Differential Gear Case and Differential Side Gear

1. Measure the differential side gear boss O.D..
2. Measure the differential case bore I.D., and calculate the clearance.
3. If the clearance is more than the allowable limit, replace damaged parts.

Clearance between differential gear case and differential side gear	Factory specification	0.040 to 0.082 mm 0.0016 to 0.0032 in.
	Allowable limit	0.17 mm 0.0067 in.

Differential gear case bore I.D.	Factory specification	19.500 to 19.521 mm 0.76772 to 0.76854 in.
Differential side gear O.D.	Allowable limit	19.439 to 19.460 mm 0.76532 to 0.76614 in.

9Y1210598FAS0020US0



3GLAAAE6P026A

Clearance between Differential Pinion Shaft and Differential Pinion Gear

1. Measure the differential pinion shaft O.D..
2. Measure the differential pinion gear I.D., and calculate the clearance.
3. If the clearance is more than the allowable limit, replace damaged parts.

Clearance between differential pinion shaft and differential pinion gear	Factory specification	0.025 to 0.055 mm 0.00099 to 0.0021 in.
	Allowable limit	0.25 mm 0.0098 in.

Differential pinion shaft O.D.	Factory specification	9.960 to 9.975 mm 0.3922 to 0.3927 in.
Differential pinion gear I.D.	Factory specification	10.000 to 10.015 mm 0.39370 to 0.39429 in.

9Y1210598FAS0021US0



3GLAAAE6P027A

Backlash between Differential Pinion Gear and Differential Side Gear

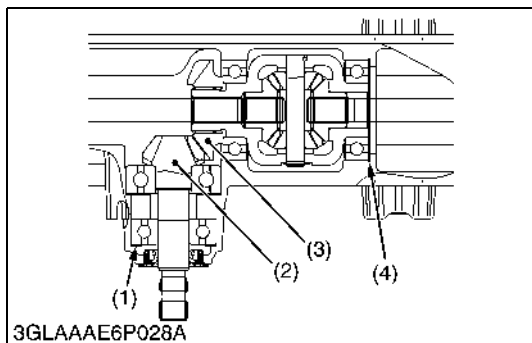
1. Set a dial gauge (lever type) on a tooth of the differential pinion gear.
2. Fix the differential side gear, and move the differential pinion gear to measure the backlash.
3. If the measurement is more than the factory specifications, adjust with the differential pinion gears shims.

Backlash between differential pinion gear and differential side gear	Factory specification	0.10 to 0.30 mm 0.0040 to 0.011 in.
--	-----------------------	--

(Reference)

- Thickness of adjusting shims:
 - For pinion gear:
 - 2.3 mm (0.091 in.)
 - 2.5 mm (0.098 in.)
 - 2.70 mm (0.106 in.)
 - 2.90 mm (0.114 in.)

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Backlash between Bevel Pinion Shaft and Bevel Gear

1. Put a strip of plastigauge to three spots on the bevel gear (3) with grease.
2. Fix the front side and rear side of front axle case.
3. Turn the bevel pinion shaft.
4. Separate the front axle case to front side and rear side.
5. Remove the bevel gear (3), and measure the plastigauge.
6. If the backlash is not within the factory specifications, adjust with shims (1), (4).

Backlash between bevel pinion shaft and bevel gear	Factory specification	0.10 to 0.30 mm 0.0040 to 0.011 in.
--	-----------------------	--

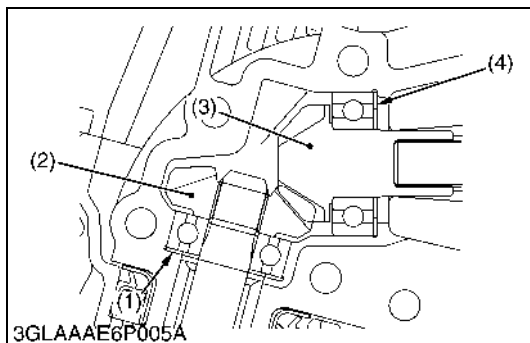
(Reference)

- Thickness of adjusting shims (1) (4):
 - For Bevel pinion shaft (2):
 - 0.50 mm (0.020 in.)
 - 0.80 mm (0.031 in.)
 - 1.0 mm (0.039 in.)
 - 1.2 mm (0.047 in.)
 - 1.4 mm (0.055 in.)
 - For Bevel gear (3):
 - 0.60 mm (0.024 in.)
 - 0.80 mm (0.031 in.)
 - 1.0 mm (0.039 in.)
 - 1.2 mm (0.047 in.)
 - 1.4 mm (0.055 in.)

(1) Shim
(2) Bevel Pinion Shaft

(3) Bevel Gear
(4) Shim

9Y1210598FAS0023US0



Backlash between 10T Bevel Gear and 15T Bevel Gear

1. Put a strip of plastigauge to three spots on the 15T bevel gear (2) with grease.
2. Fix the front side and rear side of front axle case.
3. Install the front gear case in front axle case.
4. Turn the axle.
5. Remove the front gear case, and separate the front axle case to front side and rear side.
6. Remove the 15T bevel gear (2), and measure the plastigauge.
7. If the backlash is not within the factory specifications, adjust with shims (1), (4).

Backlash between 10T bevel gear and 15T bevel gear	Factory specification	0.10 to 0.30 mm 0.0040 to 0.011 in.
--	-----------------------	--

(Reference)

- Thickness of adjusting shims (1) (4):
 - For 15T Bevel gear (2):
 - 0.60 mm (0.024 in.)
 - 0.80 mm (0.031 in.)
 - 1.0 mm (0.039 in.)
 - 1.2 mm (0.047 in.)
 - 1.4 mm (0.055 in.)
 - For 10T Bevel gear (3):
 - 0.60 mm (0.024 in.)
 - 0.80 mm (0.031 in.)
 - 1.0 mm (0.039 in.)
 - 1.2 mm (0.047 in.)
 - 1.4 mm (0.055 in.)

(1) Shim

(2) 15T Bevel Gear

(3) 10T Bevel Gear

(4) Shim

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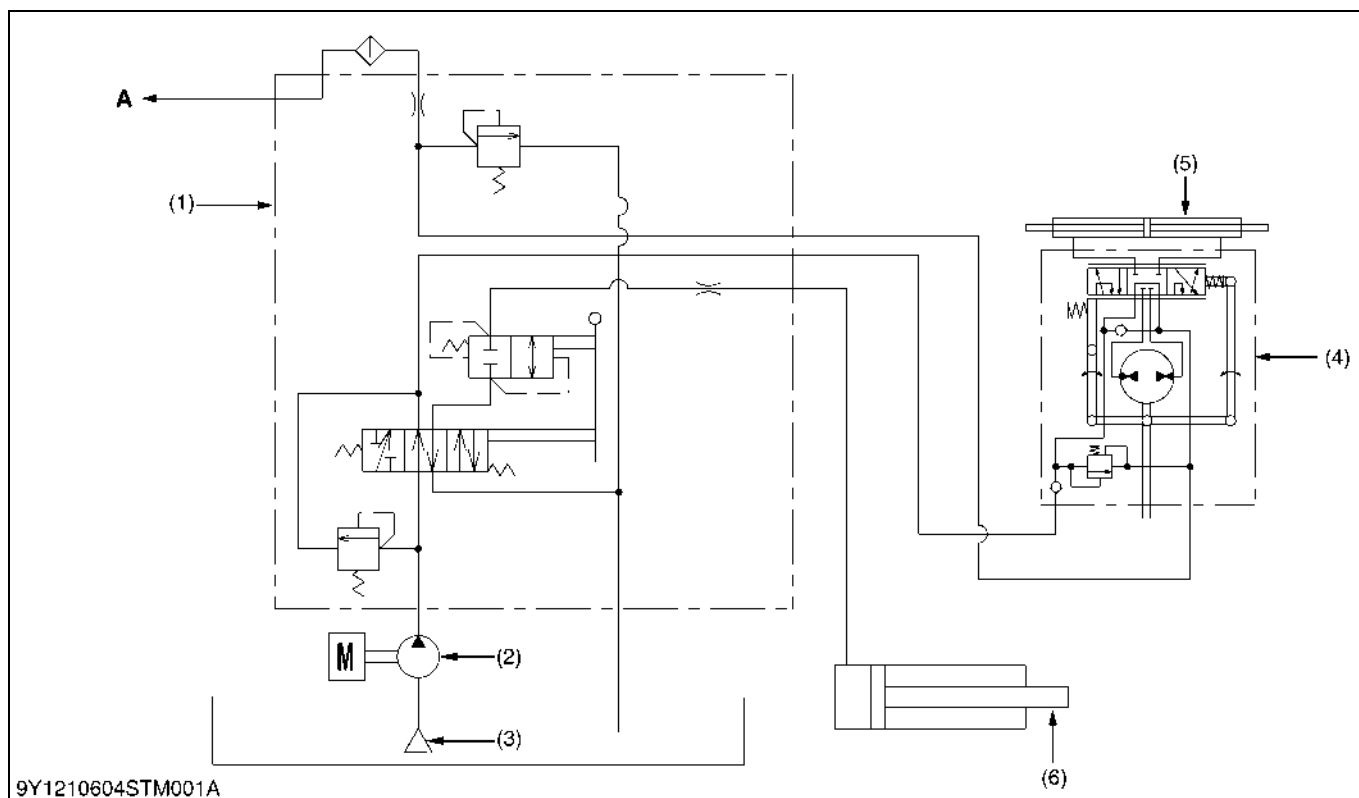
5 STEERING

MECHANISM

CONTENTS

1. HYDRAULIC CIRCUIT	5-M1
2. STEERING CONTROLLER.....	5-M2
3. STEERING CYLINDER	5-M4

1. HYDRAULIC CIRCUIT



(1) Hydraulic Control Valve Assembly

(2) Hydraulic Pump

(3) Oil Strainer

(4) Steering Controller

(5) Steering Cylinder

(6) Mower lift Cylinder

A: To HST

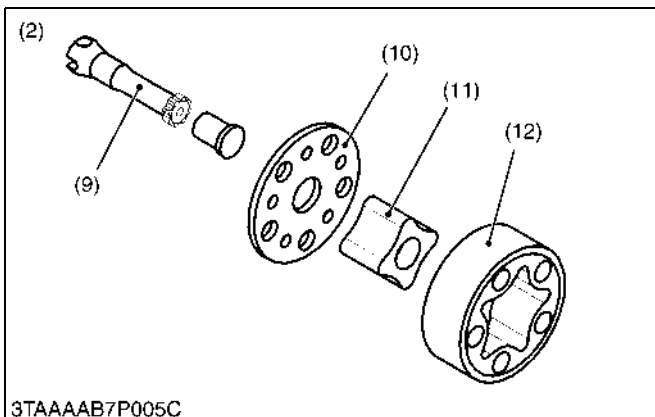
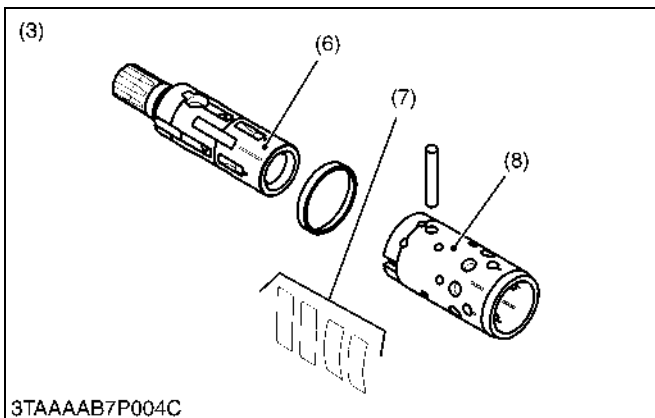
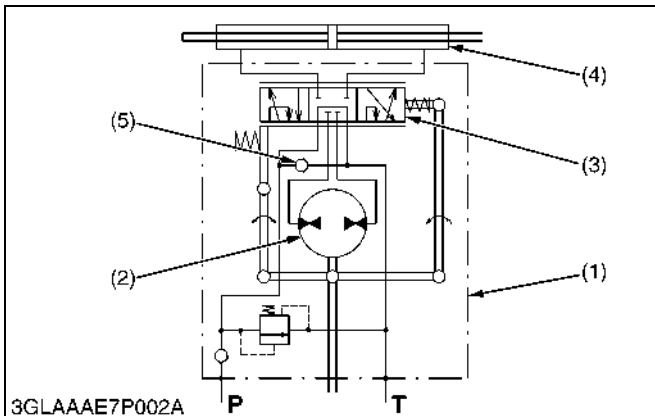
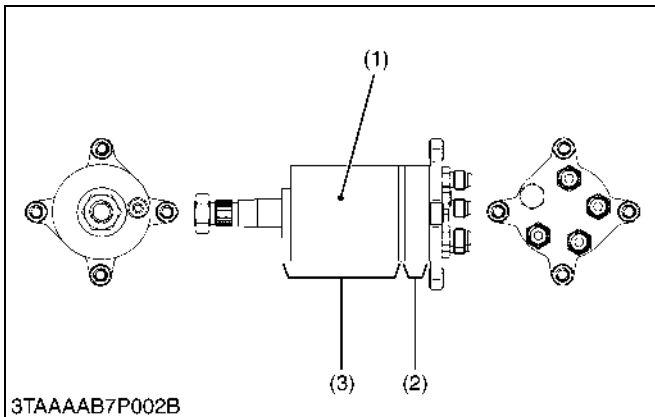
This machine has a full hydrostatic power steering.

In the full hydrostatic power steering, the steering controller (4) is connected to the steering cylinder (5) with only the hydraulic piping. Accordingly, it does not have mechanical transmitting parts such as steering gear, pitman arm, drag link, etc. Therefore, it is simple in construction. This steering system consists of the oil strainer (3), hydraulic pump (2), hydraulic control valve assembly (1), steering controller (4), steering cylinder (5), etc..

The oil is supplied to the steering controller (4) through the hydraulic control valve assembly (1) by the hydraulic pump (2). With the steering wheel at neutral, the oil returns through the steering controller (4) to the hydraulic control valve assembly (1). Turn the steering wheel, and just a required amount of oil is sent to the steering cylinder (5). The oil at the side opposite to the cylinder flows back to the hydraulic control valve assembly (1).

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2. STEERING CONTROLLER



The steering controller consists of a control valve (3) and a metering device (2).

■ Control Valve

The control valve is a rotating spool type.

When the steering wheel is not turned, the position of the spool (6) and sleeve (8) is kept neutral by the centering spring (7). This causes the forming of a "Neutral" oil circuit.

When the steering wheel is turned either clockwise or counterclockwise, the position of the spool and sleeve changes in relation to the centering spring. This allows the forming of a "Right Turning" or "Left Turning" oil circuit. At the same time, the gear pump (Metering device) rotates with the spool and sends the oil to the cylinder corresponding to the rotation of the steering wheel.

■ Metering Device

An oil, sent from the hydraulic pump to the steering cylinder, passes through the metering device (2).

Namely, when the rotor is driven, two chambers suck in oil due to volumetric change in the pup chambers formed between the rotor (11) and the stator (12), while oil is discharged from other two chambers. On the other hand, rotation of the steering wheel is directly transmitted to the rotor through the spool (6), drive shaft (9), etc.

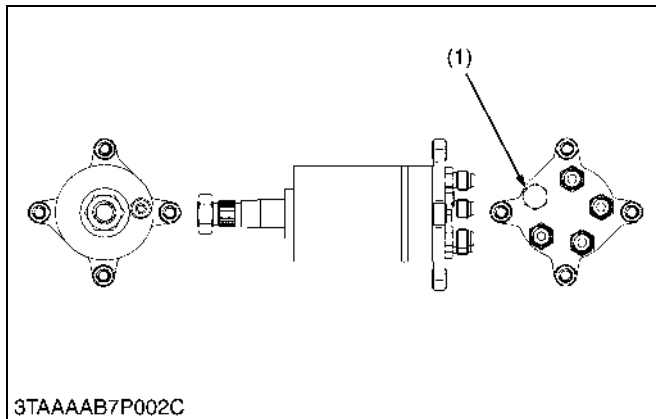
Accordingly, the metering device serves to supply the steering cylinder with oil, amount of which corresponds to the rotation of the steering wheel. The wheels are thus turned by the angle corresponding to the rotation of the steering wheel.

When the engine stops or the hydraulic pump malfunctions, the metering device functions as a manual trochoid pump, which makes manual steering possible.

- | | |
|-------------------------|------------------------|
| (1) Steering Controller | (10) Distributor Plate |
| (2) Metering Device | (11) Rotor |
| (3) Control Valve | (12) Stator |
| (4) Steering Cylinder | |
| (5) Check Valve | |
| (6) Spool | |
| (7) Centering Spring | |
| (8) Sleeve | |
| (9) Drive Shaft | |

P: P Port (From Hydraulic Control Valve Assembly)
T: T Port (To Hydraulic Control Valve Assembly)

9Y1210598STM0002US0



Relief Valve

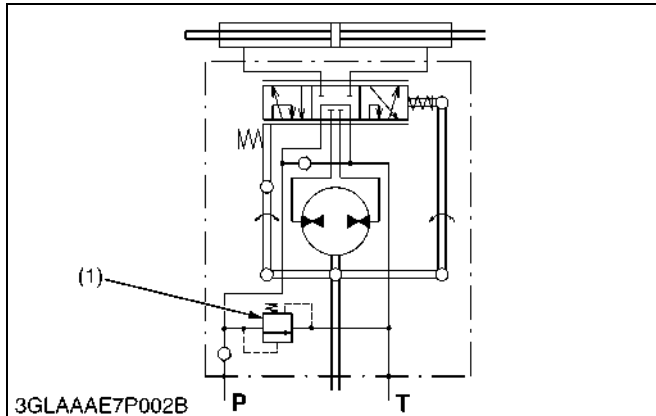
The relief valve (1) is located in the steering controller. It controls the maximum pressure of the power steering system.

- Its setting pressure is as follows.
 8.3 to 8.8 MPa
 84.6 to 89.7 kgf/cm²
 1204 to 1276 psi

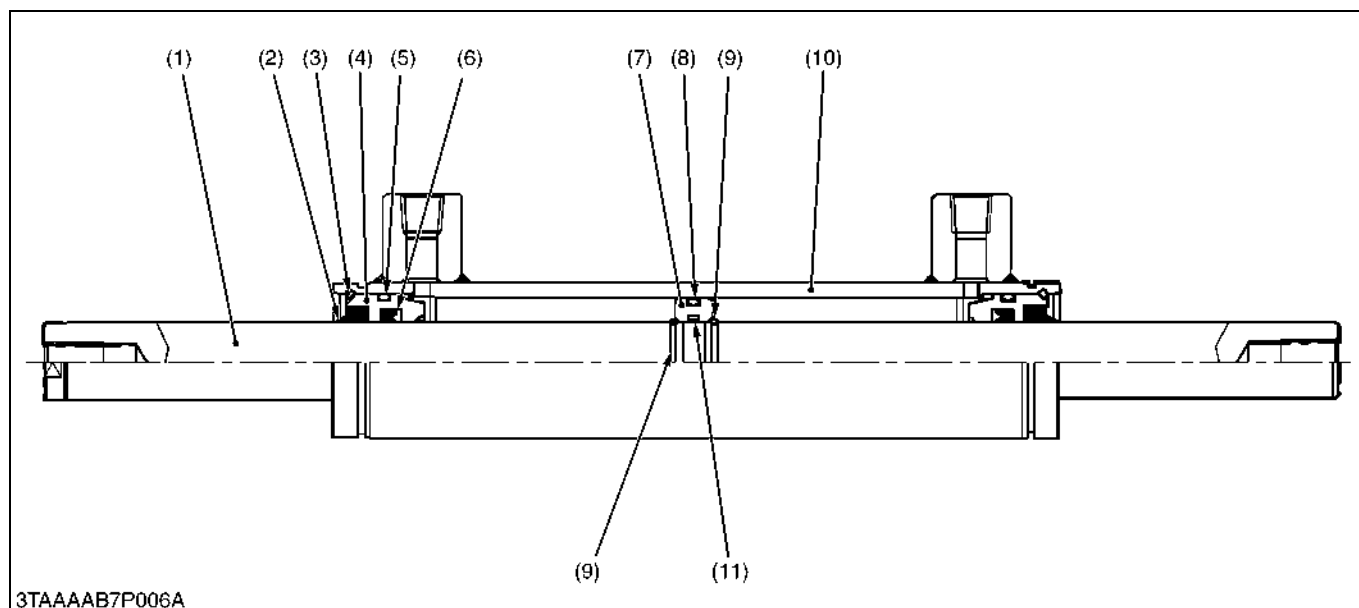
(1) Relief Valve

P: P Port (From Hydraulic Control Valve Assembly)
T: T Port (To Hydraulic Control Valve Assembly)

9Y1210598STM0003US0



3. STEERING CYLINDER



- | | | | |
|------------------------|---------------|------------------------|--------------------|
| (1) Rod | (4) Guide | (7) Center Piston | (10) Cylinder Tube |
| (2) Wiper Ring | (5) O-ring | (8) Piston O-ring | (11) Rod O-ring |
| (3) Internal Snap Ring | (6) Seal Ring | (9) External Snap Ring | |

The steering cylinder is single piston both rod double-acting type. This steering cylinder is installed parallel to the front axle and connected to tie-rods.

The tie-rods connected to both knuckle arm guarantees equal steering movement to both front wheels.

The steering cylinder provide force in both directions. Depending upon direction the steering wheel is turned pressure oil enters at one end of the cylinder to extend, or the other end to retract it, thereby turning front wheel of the tractor.

9Y1210598STM0004US0

SERVICING

CONTENTS

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4. CHECKING AND ADJUSTING	5-S4
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(2) Separating Power Steering Controller	5-S7
(3) Separating Power Steering Cylinder	5-S10
[3] DISASSEMBLING AND ASSEMBLING	5-S14
(1) Power Steering Cylinder	5-S14

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Cannot Be Steered	Steering controller malfunctioning	Replace	5-S10
	Hose broken	Replace	5-S10
Hard Steering	Power steering oil improper	Change with specified oil	G-9
	Hydraulic pump malfunctioning	Replace	6-S15
	Steering controller malfunctioning	Replace	5-S10
Steering Force Fluctuates	Steering controller malfunctioning	Replace	5-S10
	Air sucked in pump due to lack of oil	Fill	G-9
	Air sucked in pump from suction circuit	Repair	6-S13
Steering Wheel Turns Spontaneously When Released	Steering controller malfunctioning	Replace	5-S10
Front Wheels Wander to Right and Left	Steering controller malfunctioning	Replace	5-S10
	Air sucked in pump due to lack of oil	Fill	G-9
	Air sucked in pump from suction circuit	Repair	6-S13
	Insufficient bleeding	Bleed	5-S11
	Cylinder malfunctioning	Replace	5-S11
	Improper toe-in adjustment	Adjust	4-S4
	Tire pressure uneven	Inflate	G-20
Wheels Turn Opposite to Steering Direction	Cylinder hoses connected in reverse	Repair	5-S10
Steering Wheel Turns Idle in Manual Steering	Insufficient bleeding	Bleed	5-S11
	Air sucked in due to lack of oil	Fill	G-9
Noise	Air sucked in pump due to lack of oil	Fill	G-9
	Air sucked in pump from suction circuit	Repair	6-S13
Oil Temperature Increases Rapidly	Steering controller (relief valve) malfunctioning	Replace	5-S10

9Y1210598STS0001US0

2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Steering Wheel	Play	30 to 70 mm 0.79 to 1.18 in.	—

POWER STEERING BODY

Item		Factory Specification	Allowable Limit
Power Steering Relief Valve	Operating Pressure	8.30 to 8.80 MPa 84.7 to 89.7 kgf/cm ² 1210 to 1270 psi	—

9Y1210598STS0002US0

3. TIGHTENING TORQUES

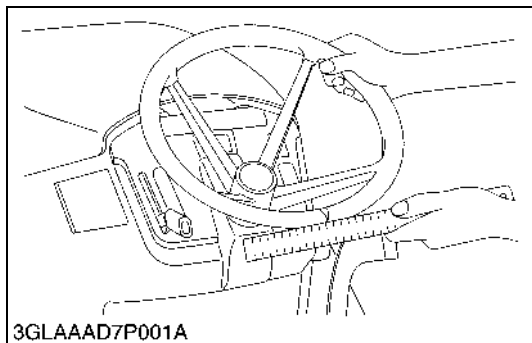
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: See page "5. TIGHTENING TORQUES" on page G-12.)

Item	N·m	kgf·m	lbf·ft
Steering wheel mounting nut	20.0 to 25.0	2.04 to 2.54	14.8 to 18.4
Power steering hose mounting nut	24.0 to 28.0	2.45 to 2.85	17.7 to 20.6
Power steering cylinder hose retaining nut	24.0 to 28.0	2.45 to 2.85	17.7 to 20.6
Glide Steer screw mounting flange screw	17.6 to 20.6	1.80 to 2.10	13.0 to 15.1
Glide Steer stay mounting screw	23.5 to 27.5	2.40 to 2.80	17.4 to 20.2
Front wheel mounting screw	108.5 to 130.2	11.07 to 13.28	80 to 96
Front axle bracket mounting screw	48.1 to 55.9	4.91 to 5.70	35.5 to 41.2
Tie-rod slotted nut	17.7 to 34.3	1.81 to 3.49	13.1 to 25.2
Tie-rod screw	74 to 84	7.6 to 8.6	55 to 61

9Y1210598STS0003US0

4. CHECKING AND ADJUSTING

[1] CHECKING AND ADJUSTING



Steering Wheel Play

1. Turn the front wheels straight ahead.
2. Rotate the steering wheel lightly by hand, and measure the play.
3. If the measurement is more than the factory specifications, replace the steering shaft and sector gear.

Steering wheel play	Factory specification	30 to 70 mm 0.79 to 1.18 in.
---------------------	-----------------------	---------------------------------

9Y1210598STS0004US0



Power Steering Relief Valve Operating Pressure

CAUTION

- When checking, park the machine on level ground, and apply the parking brake.
1. Disconnect the power steering hose L (or R) from steering controller, and set a pressure gauge.
 2. Start the engine and set at maximum speed.
 3. Fully turn the steering wheel to the left (or right) to check the feeling which the steering wheel lightly locks. Read the relief valve operating pressure when the steering wheel to the above-mentioned lock position.

NOTE

- After set a pressure gauge, be sure to bleed air.
- Note that the pressure value changes by the pump action of the power steering controller when the steering operation is continued after the steering wheel is lightly locked and accurate relief valve pressure cannot be measured.

(Reference)

- Hose and adaptor size:
9/16-18 UNF.

Power steering relief valve operating pressure	Factory specification	8.30 to 8.80 MPa 84.7 to 89.7 kgf/cm ² 1210 to 1270 psi
--	-----------------------	--

9Y1210598STS0005US0

[2] DISASSEMBLING AND ASSEMBLING

(1) Preparation

Dismounting Mower

1. See page "[1] PREPARATION" on page 8-S9.

9Y1210598TXS0014US0

Battery



CAUTION

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

1. Open the bonnet.
2. Disconnect the negative cable (1) from the battery.
3. Disconnect the positive cable (2) from the battery and remove the battery (3).

(1) Negative Cable

(3) Battery

(2) Positive Cable

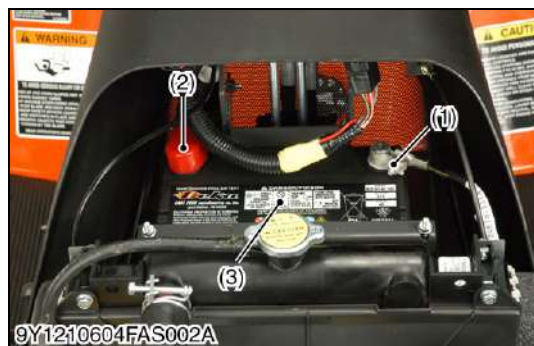
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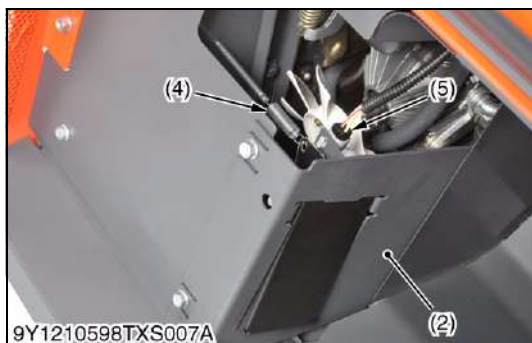
Rear Cover [GR2120SEU]

1. Remove the rear cover (1).

(1) Rear Cover

9Y1210598TXS0015US0





Removing Container [GR2120EU, GR2120F Only]

1. Pull the top cover lock lever (2) to open the top cover (1).
2. Set the grass container lift lever (4) in "**LEVER LOCK**" position.
3. Lift up the rear of the grass container (3).
4. Lift up the whole grass container and remove.

(When attaching)

- Open the top cover (1).
- Set the grass container lift lever (4) in "**LEVER LOCK**" position.
- Lift the rear end of the grass container (3), set the grass container (3) onto the frame shaft so that a clearance "**L**" is about 0 to 50 mm (0 to 2.0 in.).
- Lock the grass container (3) with the grass container lift lever (4) in "**CONTAINER LOCK**" position.
- Close the top cover (1).

(Reference)

- Clearance "**L**": 0 to 50 mm (0 to 2.0 in.)

- (1) Top Cover
(2) Top Cover Lock Lever

- (3) Grass Container
(4) Grass Container Lift Lever

9Y1210598TXS0072US0

Discharge Duct [GR2120EU, GR2120F]

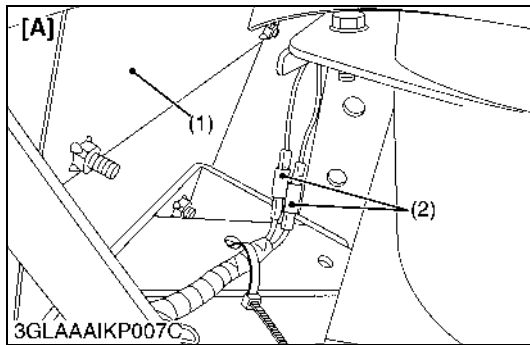
1. Remove the filter cover (1).
2. Remove the screws (3) for the discharge duct (2).
3. Disconnect the spring (4) and the coupler (5).
4. Remove the discharge duct (2).

- (1) Filter Cover
(2) Discharge Duct
(3) Screw

- (4) Spring
(5) Coupler

9Y1210598TXS0073US0

(2) Separating Power Steering Controller



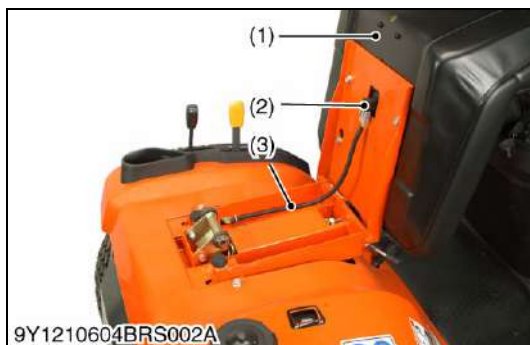
Container Base [GR2120EU, GR2120F]

1. Disconnect the connector (2).
2. Remove the container base (1).

- (1) Container Base
(2) Connector

[A] Right Side

9Y1210598TXS0077US0



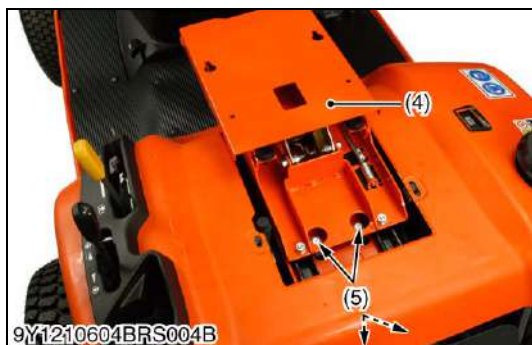
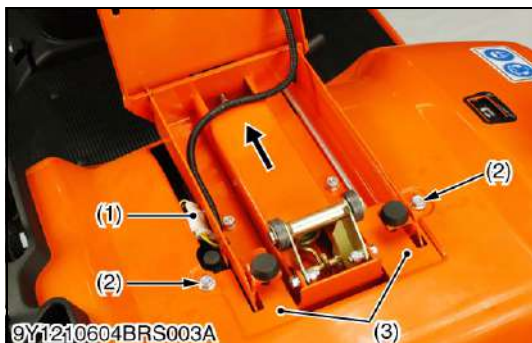
Seat

1. Turn the seat (1).
2. Disconnect the safety switch connector (2).
3. Remove the seat (1).

- (1) Seat
(2) Safety Switch Connector

(3) Wire Harness

9Y1210598TXS0018US0



Seat Base and Fender

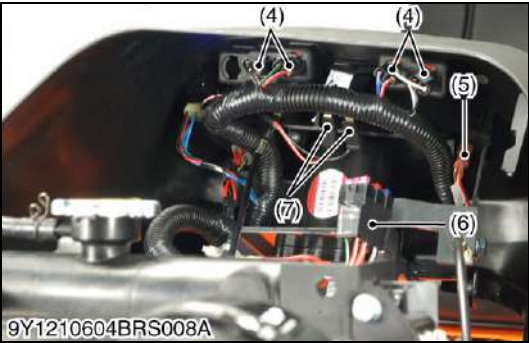
1. Disconnect the seat connector (1).
2. Remove the screws (2).
3. Remove the support base (3).
4. Move the seat base (4) in ahead.
5. Remove the seat base (4).
6. Remove the lever grips (6), fuel and the cutting height control dial (9).
7. Remove the speed change pedal (10).
8. Remove the fuel tank cap (7) and fender (8).

NOTE

- To remove the fender, remove the hydraulic hose from guide first.

- | | |
|------------------------------|---------------------------------|
| (1) Seat Connector | (6) Lever Grip |
| (2) Screw | (7) Fuel Tank Cap |
| (3) Support Base | (8) Fender |
| (4) Seat Base | (9) Cutting Height Control Dial |
| (5) Seat Base Mounting screw | (10) Speed Change Pedal |

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Steering Wheel, Side Bonnet and Panel

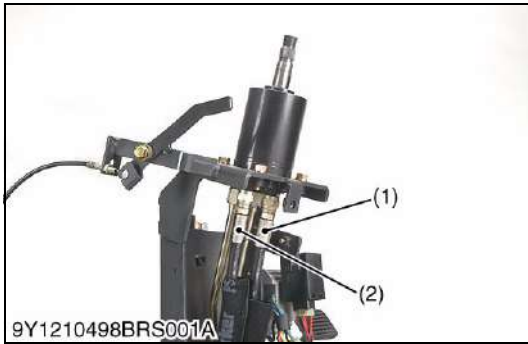
1. Remove the steering wheel (1).
2. Remove the side bonnet (3).
3. Remove the accelerator lever grip.
4. Remove the indicator lamps(4).
5. Disconnect the head light switch connectors (5).
6. Disconnect the connectors for the main switch (8), hour meter (7), overhear horn relay (9), overhear horn (10) and buzzer (11). [GR2120EU, GR2120F]
7. Remove the fuse box (6) from the steering support.
8. Remove the panel (2).

(When reassembling)

Tightening torque	Steering wheel mounting nut	20.0 to 25.0 N·m 2.04 to 2.54 kgf·m 14.8 to 18.4 lbf·ft
-------------------	-----------------------------	---

- | | |
|---------------------------------|-------------------------|
| (1) Steering Wheel | (7) Hour Meter |
| (2) Panel | (8) Main Switch |
| (3) Side Bonnet | (9) Overheat Horn Relay |
| (4) Indicator Lamp | (10) Overheat Horn |
| (5) Head Light Switch Connector | (11) Buzzer |
| (6) Fuse Box | |

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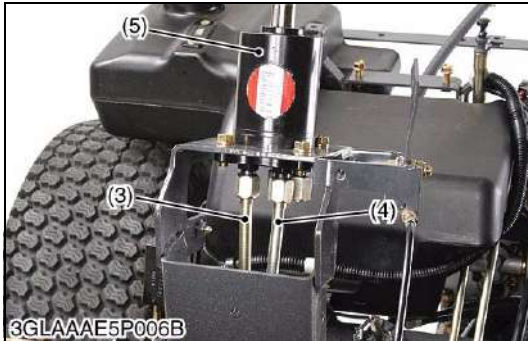
Steering Controller

1. Disconnect the power steering hoses (1), (2), and pipes (3), (4).
2. Remove the steering controller mounting screws and remove the steering controller (5).

(When reassembling)

- Be sure to connect the power steering hoses to their original position, and tighten them to the specified torque.

Tightening torque	Power steering pipe and pipe mounting nut	24.0 to 28.0 N·m 2.45 to 2.85 kgf·m 17.7 to 20.6 lbf·ft
-------------------	---	---



- (1) Power Steering Hose LH
- (2) Power Steering Hose RH
- (3) Return Pipe
- (4) Delivery Pipe
- (5) Steering Controller

A: Bottom View

P: Pump Port (Connect to Delivery Hose)

T: Tank Port (Connect to Return Hose)

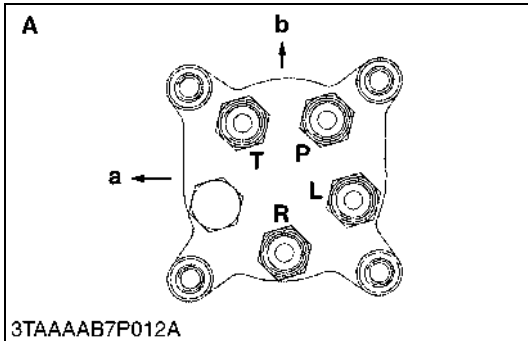
L: L Port (Connect to Cylinder RH)

R: R Port (Connect to Cylinder LH)

a: Right from Operator

b: Front

9Y1210598STS0006US0



(3) Separating Power Steering Cylinder

Dismounting Mower

1. See page "[1] PREPARATION" on page 8-S9.

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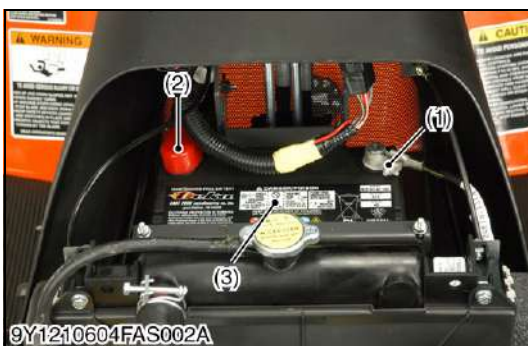
Battery



CAUTION

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

1. Open the bonnet.
2. Disconnect the negative cable (1) from the battery.
3. Disconnect the positive cable (2) from the battery and remove the battery (3).

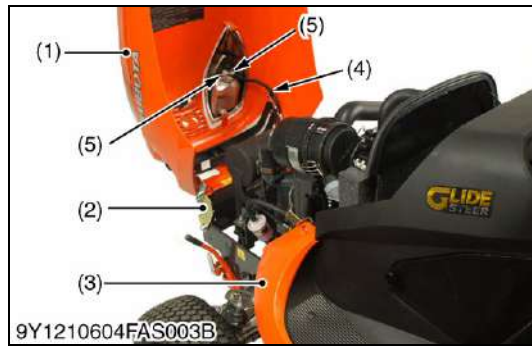


(1) Negative Cable

(3) Battery

(2) Positive Cable

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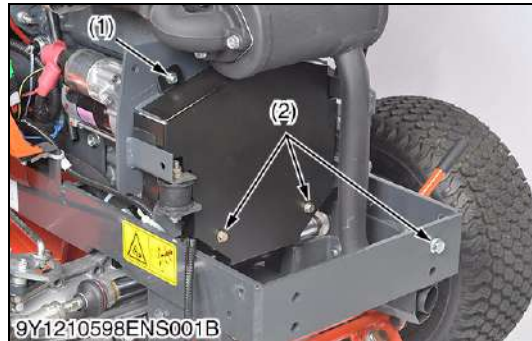


Bonnet and Side Bonnet

1. Disconnect the connectors (4) from the head light.
2. Remove the wire harness (5) from the bonnet.
3. Remove the bonnet (1) with bonnet bracket (2).
4. Remove the side bonnet (3).

- (1) Bonnet
(2) Bonnet Bracket
(3) Side Bonnet
(4) Connector
(5) Wire Harness

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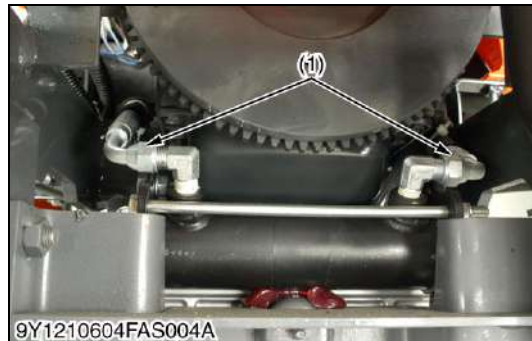


Flywheel Cover and Muffler Cover [GR2120SEU, GR2120F Only]

1. Remove the screws (2) and a nut (1) for the flywheel cover and muffler cover.

- (1) Nut
(2) Screw

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Power Steering Hose

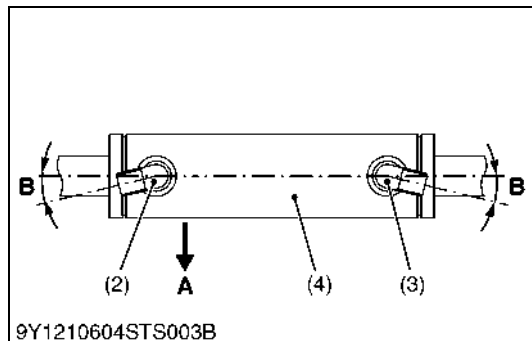
1. Disconnect the power steering cylinder hoses (1).

NOTE

- Attach the plugs to the adaptors of steering cylinder after removing the hoses so that oil should not come out.

(When reassembling)

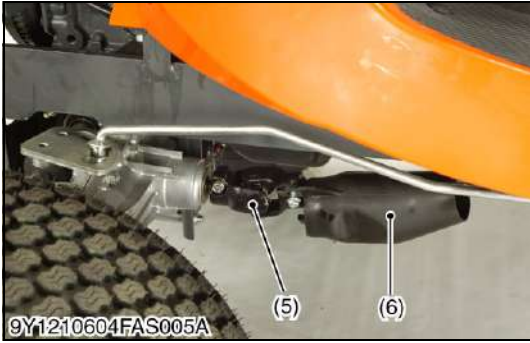
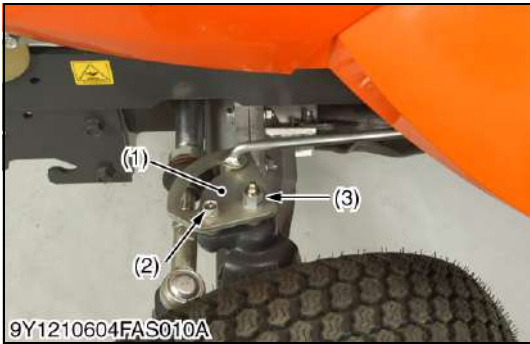
- Be sure to install the hose adaptors (2), (3) as shown in the figure.
- Connect the power steering cylinder hoses to the power steering cylinder adaptors.
- After starting the engine, steer the steering wheel to the right turning end or the left turning end to bleed air in the power steering oil system.



Tightening torque	Power steering cylinder hose retaining nut	24.0 to 28.0 N·m 2.45 to 2.85 kgf·m 17.7 to 20.6 lbf·ft
-------------------	--	---

- (1) Power Steering Cylinder Hose
(2) Hose Adaptor (LH)
(3) Hose Adaptor (RH)
(4) Cylinder
- A: Front**
B: 0.09 to 0.1 rad (5 to 6 °)

9Y1210598FAS0007US0



Glide Steer Rod, Front Wheel and Joint Cover

- 1. Remove the Glide Steer stays (1).
- 2. Lift up the front side of machine and place the disassembling stand under the front axle frame.
- 3. Remove the front wheels (4).
- 4. Remove the joint cover mounting screws and slide the joint cover (6).

(When reassembling)

Tightening torque	Glide steer flange screw	17.6 to 20.6 N·m 1.80 to 2.10 kgf·m 13.0 to 15.1 lbf·ft
	Glide Steer stay mounting screw	23.5 to 27.5 N·m 2.40 to 2.80 kgf·m 17.4 to 20.2 lbf·ft
	Front wheel mounting screw	108.5 to 130.2 N·m 11.07 to 13.28 kgf·m 80 to 96 lbf·ft

- (1) Glide Steer Stay

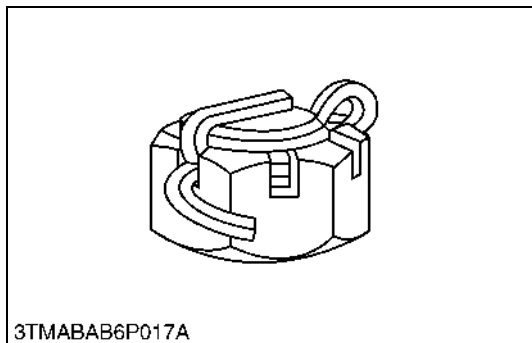
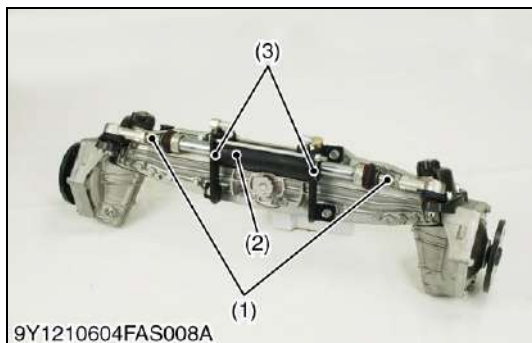
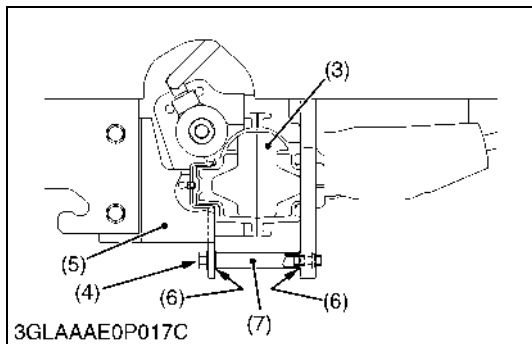
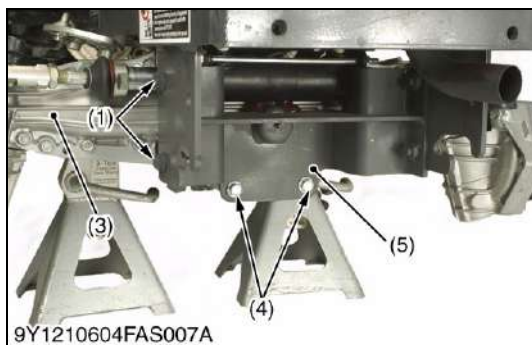
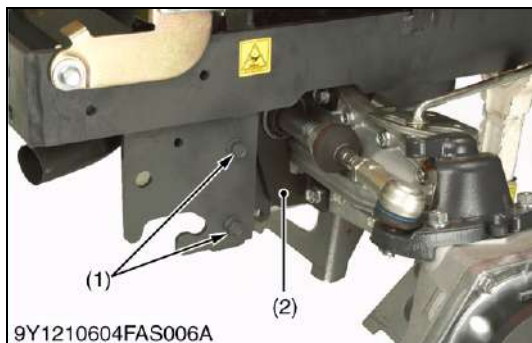
(2) Glide Steer Screw

(3) Glide Steer Flange Screw
- (4) Front Wheel

(5) Universal Joint

(6) Joint Cover

9Y1210598FAS0008US0



Front Axle Assembly

1. Support the front axle assembly (3) so as not to drop out.
2. Remove the power steering cylinder holder mounting screws (1).
3. Remove the front axle bracket (5).
4. Separate the front axle assembly (3) from the frame.

(When reassembling)

- Apply the grease to center pin of front axle assembly.
- Reinstall the shims (6) and collar (7) on the front axle bracket retaining screw (4) as shown in the figure.

Tightening torque	Front axle bracket mounting screw	48 to 55 N·m 4.91 to 5.70 kgf·m 36 to 41 lbf·ft
-------------------	-----------------------------------	---

- | | |
|---|------------------------|
| (1) Power Steering Cylinder Holder Mounting Screw | (5) Front Axle Bracket |
| (2) Power Steering Cylinder Holder | (6) Shim |
| (3) Front Axle Assembly | (7) Collar |
| (4) Front Axle Bracket Retaining Screw | |

9Y1210598FAS0009US0

Power Steering Cylinder

1. Remove the power steering cylinder holder (3).
2. Remove the cotter pin and remove the slotted nut for tie-rod (1).
3. Remove the power steering cylinder mounting screws and remove the power steering cylinder (2) with tie-rod.

(When reassembling)

■ NOTE

- Tighten the slotted nut to 17.7 N·m (1.81 kgf·m, 13.1 lbf·ft). If the slot and pin hole do not meet, tighten the nut until they do meet, and install the cotter pin.
- After tightening the tie-rod end slotted nut to the specified torque, install a cotter pin as shown in the figure.

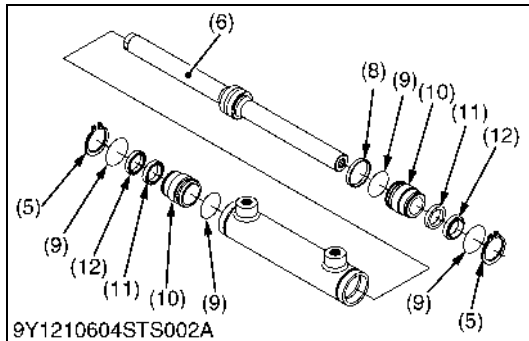
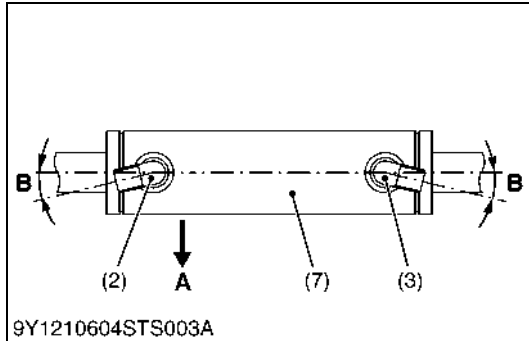
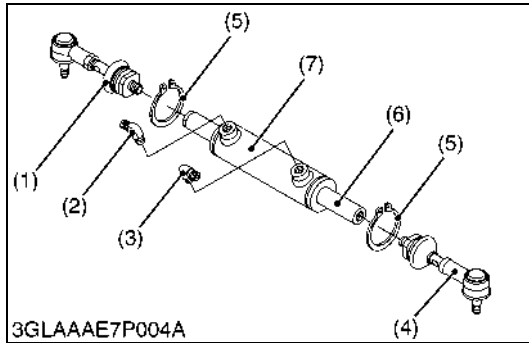
Tightening torque	Tie-rod slotted nut	17.7 to 34.3 N·m 1.81 to 3.49 kgf·m 13.1 to 25.2 lbf·ft
-------------------	---------------------	---

- | | |
|-----------------------------|------------------------------------|
| (1) Tie-rod | (3) Power Steering Cylinder Holder |
| (2) Power Steering Cylinder | |

9Y1210598FAS0010US0

[3] DISASSEMBLING AND ASSEMBLING

(1) Power Steering Cylinder



Power Steering Cylinder and Tie-rod

1. Remove the cylinder hose adaptors (2), (3).
2. Remove the tie-rods (1), (4) from piston rod (6).
3. Remove the external snap rings (5).
4. Remove the steering cylinder head cover (10) and pull out the piston rod.

(When reassembling)

- Be sure to install the hose adaptors (2), (3) as shown in the figure.
- After reassembling the tie-rod, be sure to adjust the toe-in. (See page 4-S4.)
- Apply liquid lock (Locktite 271 or equivalent) to the thread of piston rod (6).
- Apply transmission fluid to the oil seal and O-ring.

Tightening torque	Tie-rod screw	74 to 84 N·m 7.6 to 8.5 kgf·m 55 to 61 lbf·ft
-------------------	---------------	---

- (1) Tie-rod RH
- (2) Hose Adaptor LH
- (3) Hose Adaptor RH
- (4) Tie-rod LH
- (5) External Snap Ring
- (6) Piston Rod
- (7) Cylinder
- (8) Packing

- (9) O-ring
- (10) Head Cover
- (11) U-packing
- (12) Dust seal

A: Front

B: 0.09 to 0.1 rad (5 to 6 °)

9Y1210598STS0007US0

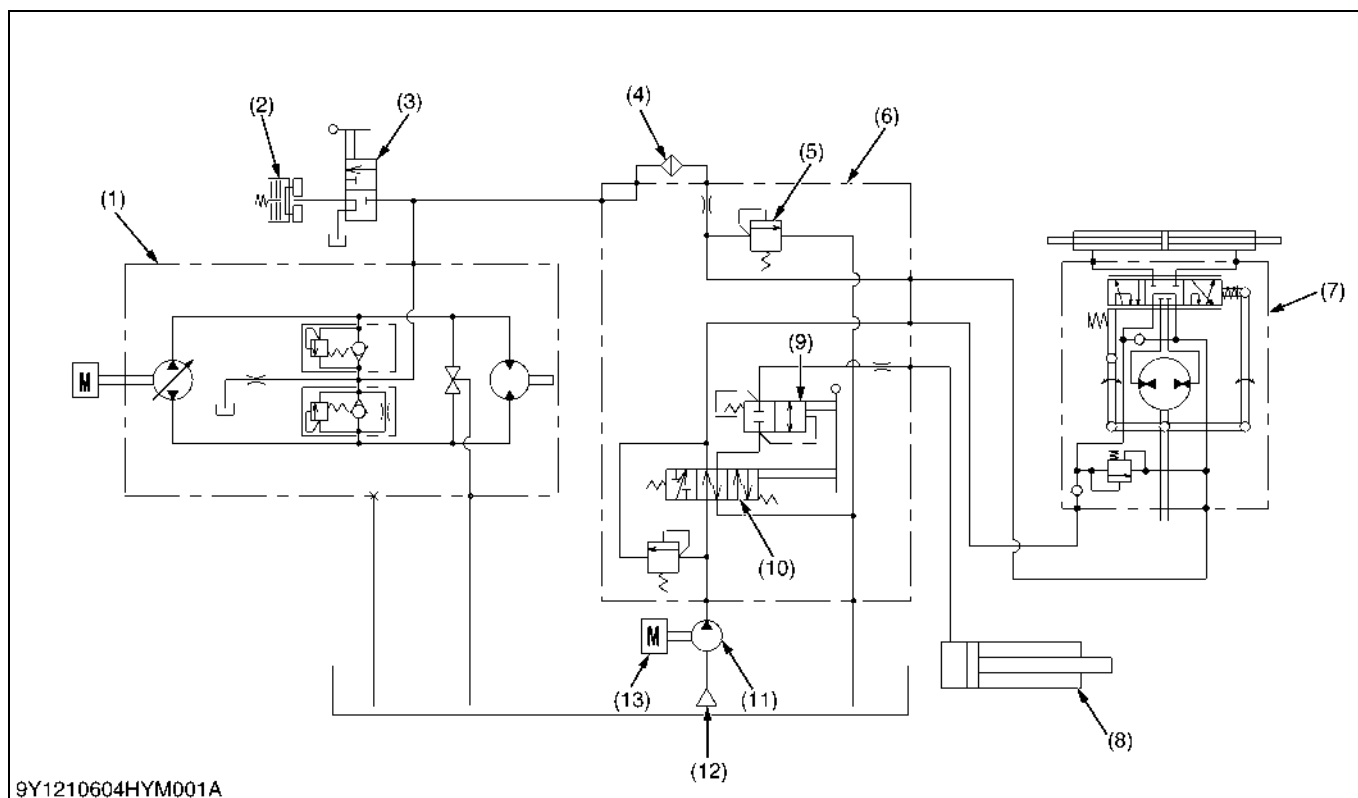
6 HYDRAULIC SYSTEM

MECHANISM

CONTENTS

1. HYDRAULIC CIRCUIT	6-M1
2. HYDRAULIC PUMP.....	6-M2
3. HYDRAULIC CONTROL VALVE.....	6-M3
[1] MOWER LIFT CIRCUIT	6-M4
[2] HST RELIEF VALVE	6-M8
4. MOWER LIFT CYLINDER	6-M9
5. MOWER LINKAGE	6-M10

1. HYDRAULIC CIRCUIT



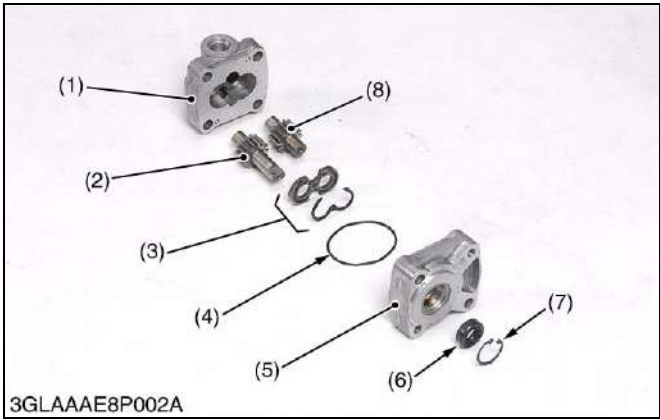
- | | | | |
|------------------------------|--------------------------------------|-------------------------|------------------------|
| (1) Hydrostatic Transmission | (5) HST Relief Valve | (8) Mower Lift Cylinder | (12) Oil Strainer |
| (2) PTO Clutch Pack | (6) Hydraulic Control Valve Assembly | (9) Check Valve | (13) Main Relief Valve |
| (3) PTO Control Valve | (7) Steering Controller | (10) Control Valve | |
| (4) Oil Filter Cartridge | | (11) Hydraulic Pump | |

The hydraulic system of this machine is composed of a hydraulic pump (11), hydraulic control valve assembly (6), mower lift cylinder (8) and other components as shown in the above hydraulic circuit.

1. The oil is supplied by the hydraulic pump (11) which is driven by pump drive shaft in the transaxle case. As the pump drive shaft is engaged with the input shaft which connected to the propeller shaft, the hydraulic pump (11) starts running when engine is started.
2. The hydraulic pump forces out the oil to the hydraulic control valve assembly (6), steering controller (7) and hydrostatic transmission (1).

9Y1210598HYM0001US0

2. HYDRAULIC PUMP



The hydraulic pump is composed of the casing (1), cover (5), side plate (3), drive gear (2) and driven gear (8).

Hydraulic pump is driven by the pump drive shaft in the transaxle case.

Maximum displacement is as follows.

Displacement	Engine speed	Condition
10.4 L/min. 2.75 U.S.gals/min. 2.29 Imp.gals/min.	At 3000 min ⁻¹ (rpm)	At no load

- (1) Casing

(2) Drive Gear

(3) Side Plate

(4) O-ring
- (5) Cover

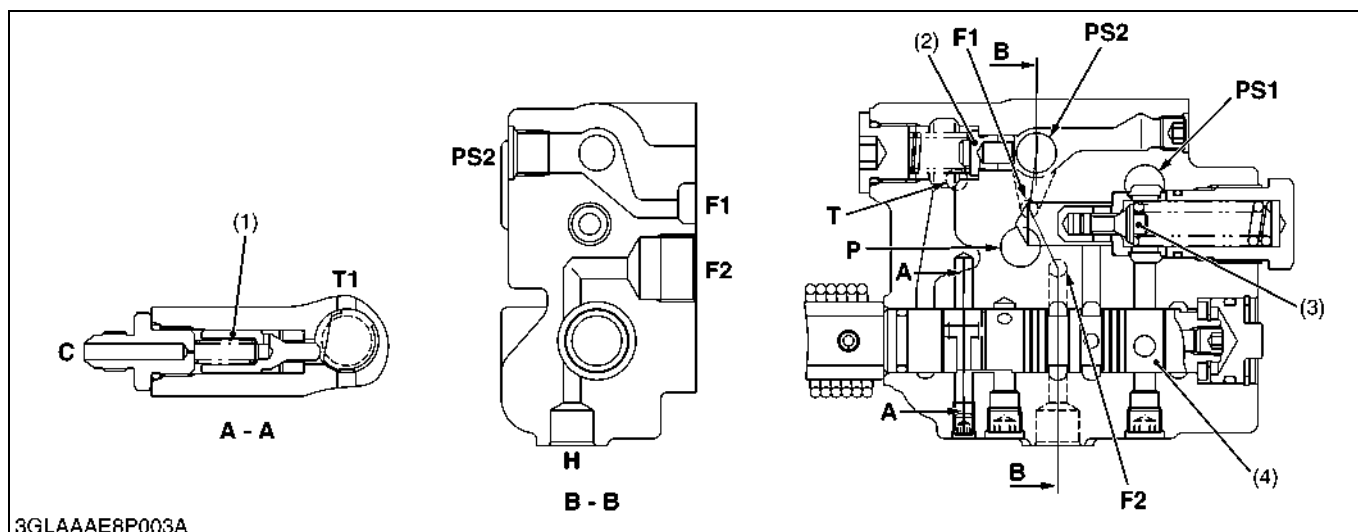
(6) Oil Seal

(7) Internal Snap Ring

(8) Driven Gear

9Y1210598HYM0002US0

3. HYDRAULIC CONTROL VALVE



- (1) Check Valve
- (2) HST Relief Valve
- (3) Main Relief Valve
- (4) Spool (for Control Valve)

P: Pump Port
T: Tank Port
T1: Tank Port (To T Port)
C: Cylinder Port

PS1: Power Steering Port
 (To Power Steering
 Controller)
PS2: Power Steering Port
 (From Power Steering
 Controller)

F1: Filter Port
 (To Filter Cartridge)
F2: Filter Port
 (From Filter Cartridge)
H: HST Port (To HST)

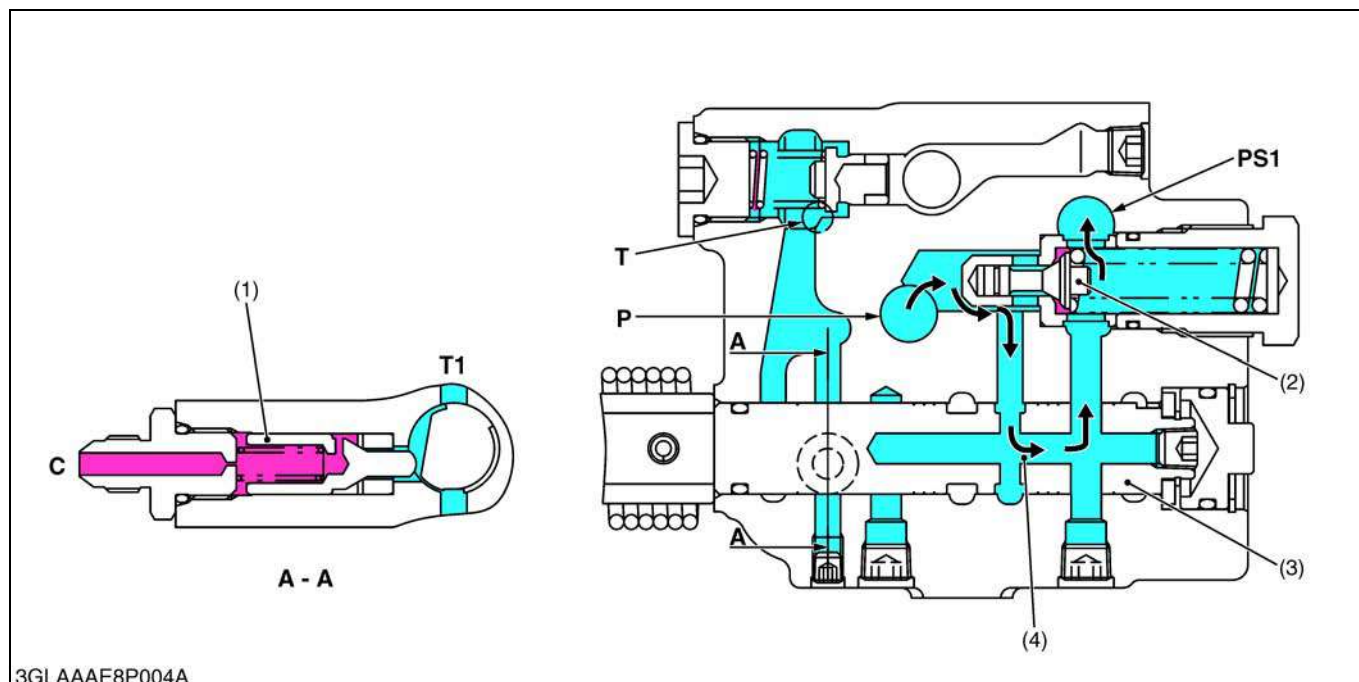
Hydraulic control valve assembly has spool (for control valve) (4), main relief valve (3), HST relief valve (2) and check valve (1).

The oil from hydraulic pump is forced into control valve. The spool (4) turns by hydraulic lift lever via a link mechanism and changes the flow direction of oil from hydraulic pump.

9Y1210598HYM0003US0

[1] MOWER LIFT CIRCUIT

Neutral



- (1) Check Valve
- (2) Main Relief Valve
- (3) Spool
- (4) Oil Passage

P: Pump Port
T: Tank Port
(To Transaxle Case)

T1: Tank Port (To T Port)
C: Cylinder Port

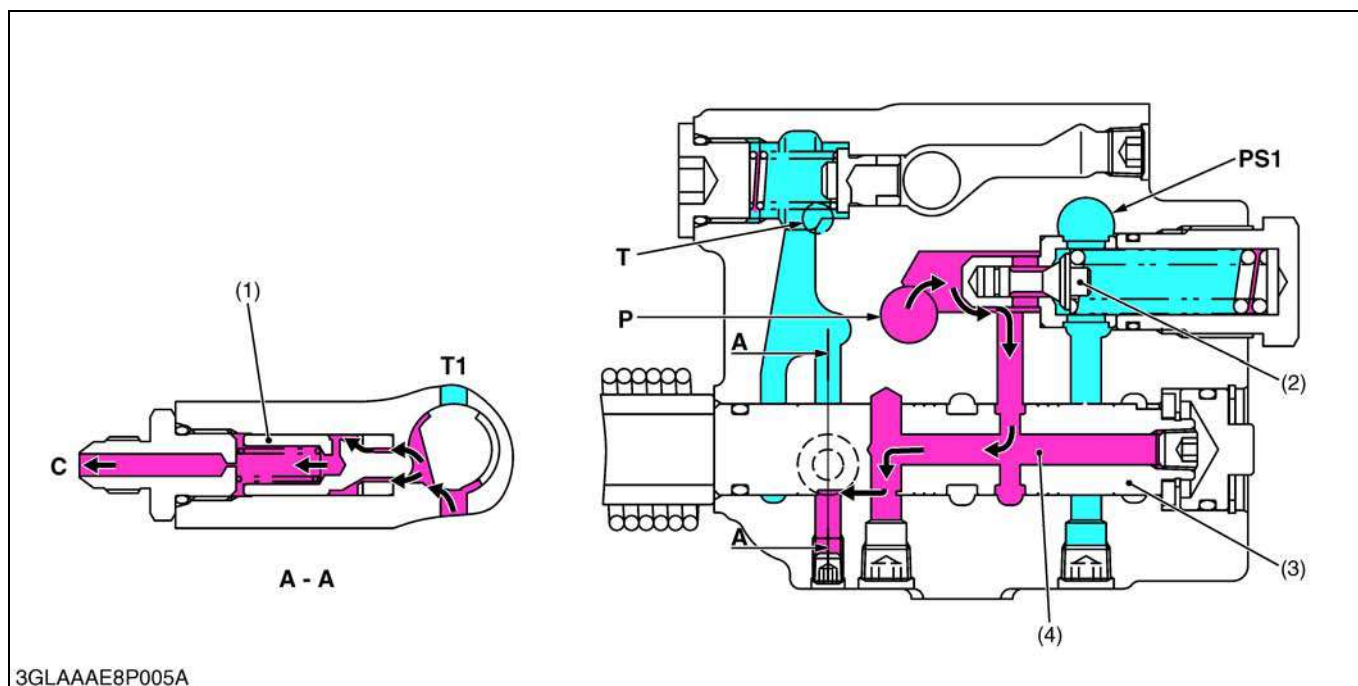
PS1: Power Steering Port
(To Power Steering Controller)

The oil is forced into the hydraulic control valve assembly through **P** port.

When the hydraulic lift lever is set to the **"NEUTRAL"** position, the spool (3) keeps its original position. The oil flows through oil passage (4) in spool to **PS1** port, then flows to power steering controller.

Since the oil does not flow through oil passage (4) in spool to check valve (1), **C** port closes by check valve (1). Therefore, the oil in mower lift cylinder does not flow out through **C** port and the mower keeps its position.

9Y1210598HYM0004US0

Lift

- (1) Check Valve
- (2) Main Relief Valve
- (3) Spool
- (4) Oil Passage

P: Pump Port
T: Tank Port
(To Transaxle Case)

T1: Tank Port (To T Port)
C: Cylinder Port

PS1: Power Steering Port
(To Power Steering Controller)

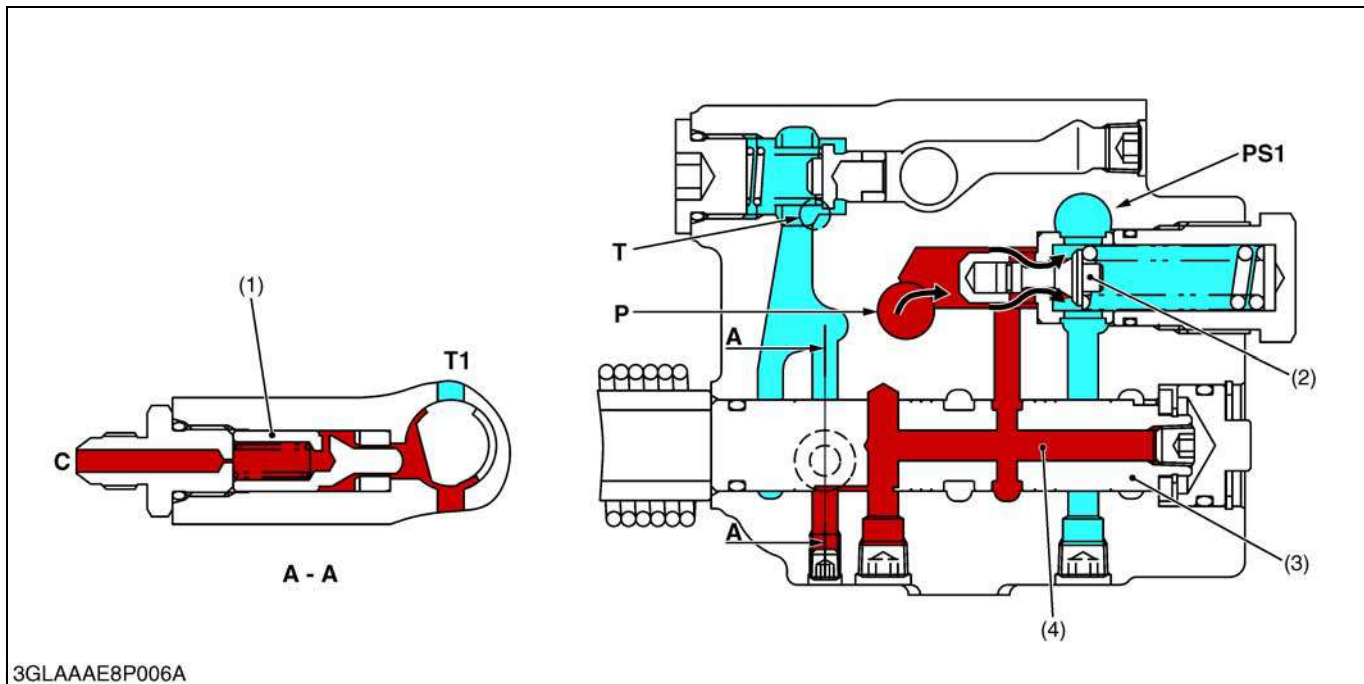
When the hydraulic lift lever is set to the **"LIFT"** position, the spool (3) is rotated counterclockwise in view of left side of the machine.

The oil flows through passage (4) in spool to check valve (1), and opens the check valve (1).

The oil flows through **C** port to mower lift cylinder. Therefore, the mower is lifted.

While the hydraulic lift lever is set to the **"LIFT"** position, the oil does not flow through oil passage (4) in spool to **PS1** port.

9Y1210598HYM0005US0

Overload

- (1) Check Valve
- (2) Main Relief Valve
- (3) Spool
- (4) Oil Passage

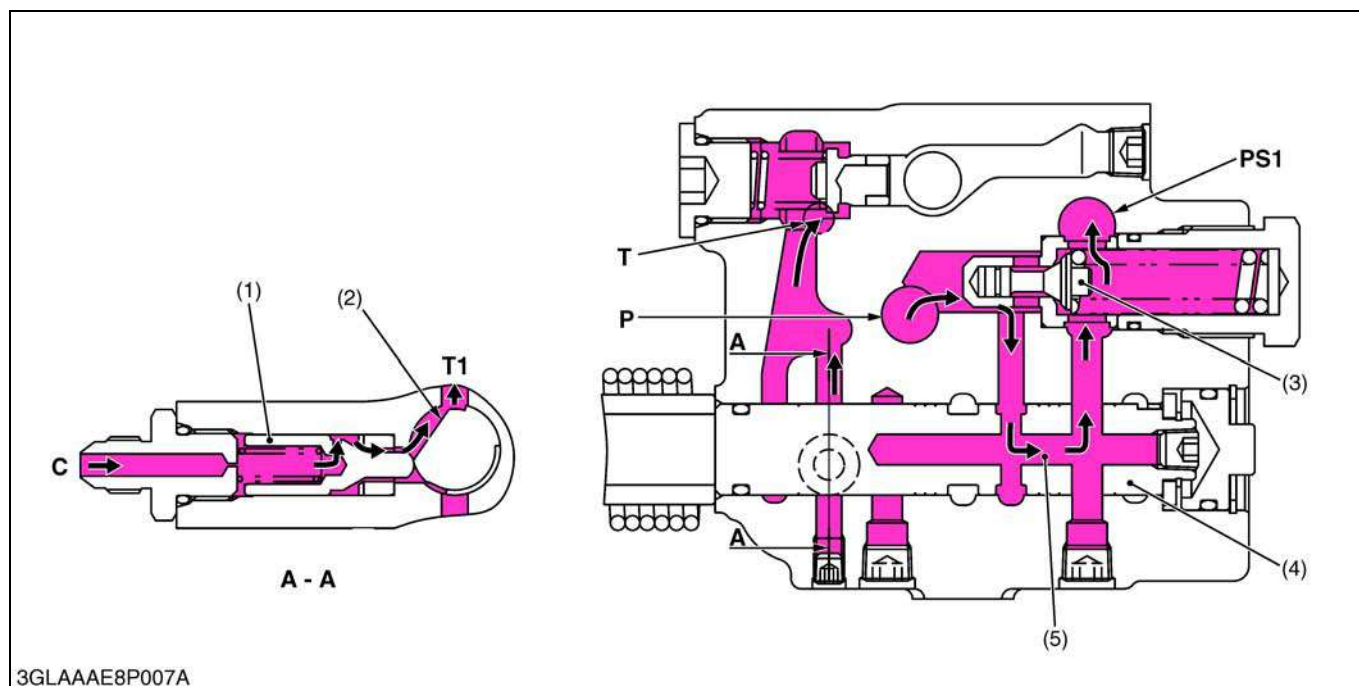
P: Pump Port
T: Tank Port
(To Transaxle Case)

T1: Tank Port (To T Port)
C: Cylinder Port

PS1: Power Steering Port
(To Power Steering Controller)

If the pressure between **P** port and **C** port is more than the main relief valve setting pressure (9.5 to 11.0 MPa, 97 to 112 kgf/cm², 1378 to 1595 psi) while the hydraulic lift lever is set to "**LIFT**" position, the main relief valve (2) opens. Then, the oil flows out through the main relief valve (2) to **PS1** port, preventing any further rise in pressure.

9Y1210598HYM0006US0

Down

- (1) Check Valve
- (2) Flat Face
- (3) Main Relief Valve
- (4) Spool
- (5) Oil Passage

P: Pump Port
T: Tank Port
 (To Transaxle Case)

T1: Tank Port (To T Port)
C: Cylinder Port

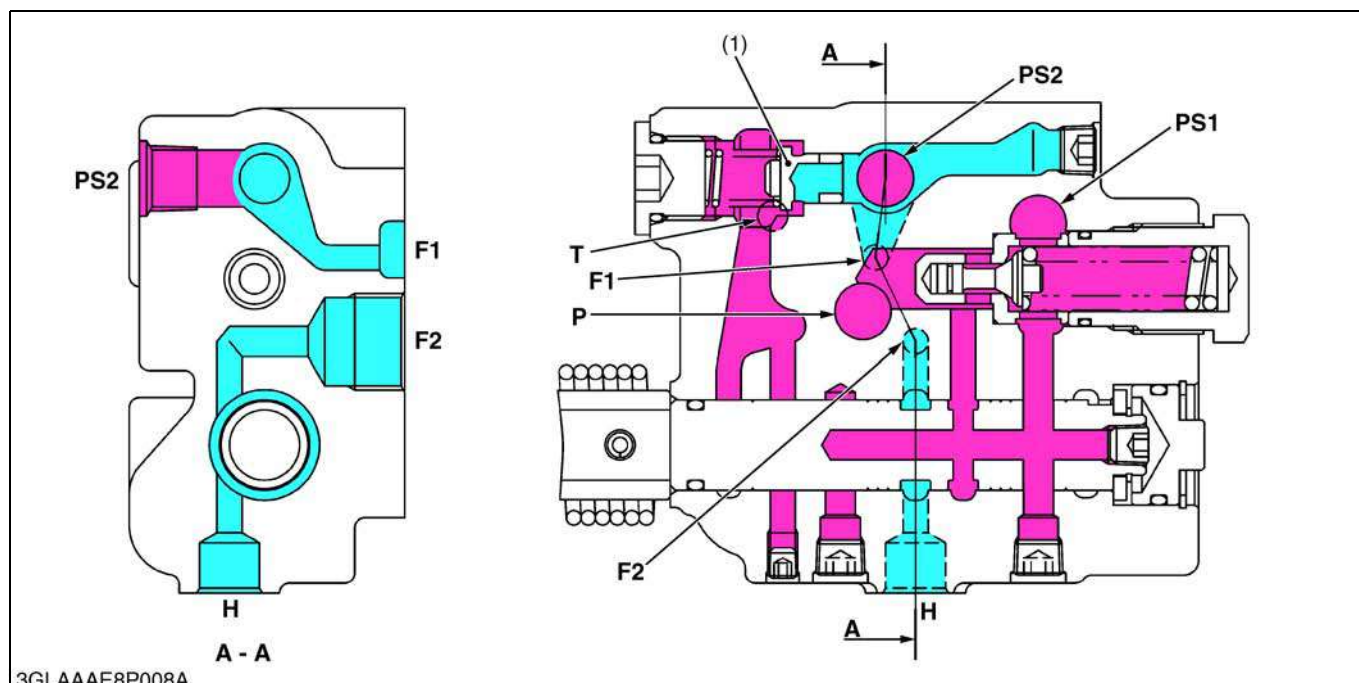
PS1: Power Steering Port
 (To Power Steering Controller)

When the hydraulic lift lever is set to **"DOWN"** position, the spool (4) is rotated clockwise in view of left side of the machine.

The oil does not flow through passage in spool (4) to check valve (1). However, the check valve (1) is pushed by flat face (2) of spool and opened. The oil in mower lift cylinder is forced out through **C** port to **T** port by the weight of the mower, causing the mower to lower. The oil forced out returns to the transaxle case.

9Y1210598HYM0007US0

[2] HST RELIEF VALVE



(1) HST Relief Valve

P: Pump Port
T: Tank Port
 (To Transaxle Case)

PS1: Power Steering Port
 (To Power Steering
 Controller)
PS2: Power Steering Port
 (From Power Steering
 Controller)

F1: Filter Port
 (To Filter Cartridge)
F2: Filter Port
 (From Filter Cartridge)
H: HST Port (To HST)

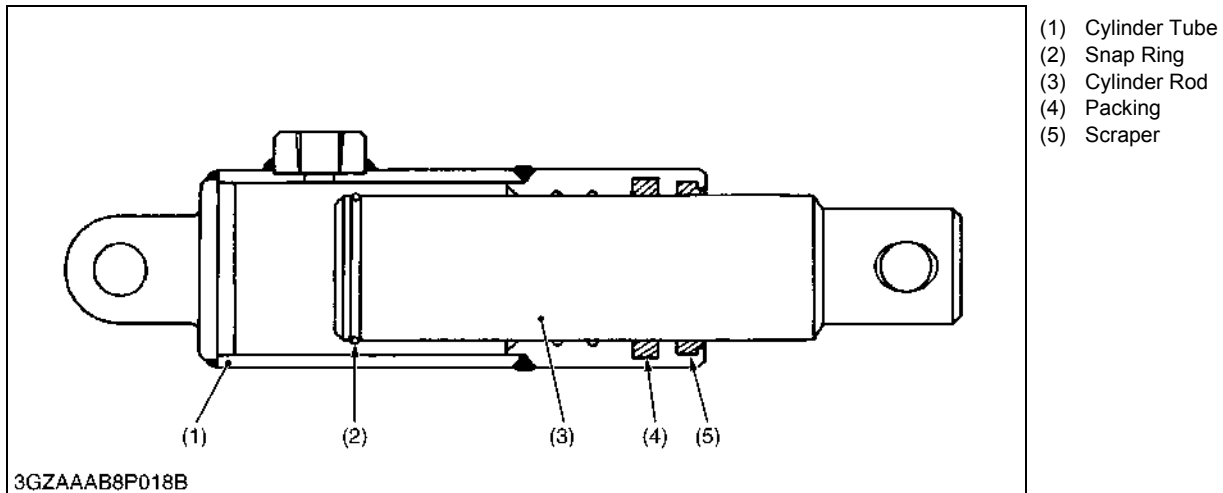
The oil flows through **PS1** port to the power steering controller, and then returns to the hydraulic control valve through **PS2** port. The oil in **PS2** port is regulated the setting pressure (0.9 to 1.1 MPa, 9.2 to 11.2 kgf/cm², 130.6 to 159.5 psi) by HST relief valve (1). Then, the oil flows through **F1** port to the filter cartridge. The oil passes through the filter cartridge, and is supplied through **H** port as the charge oil to HST.

Therefore, the HST relief valve (1) provides the functionality of a charge relief valve.

The oil that is relieved by HST relief valve (1) passes into the valve poppet, and flows through **T** port to the transaxle case.

9Y1210598HYM0008US0

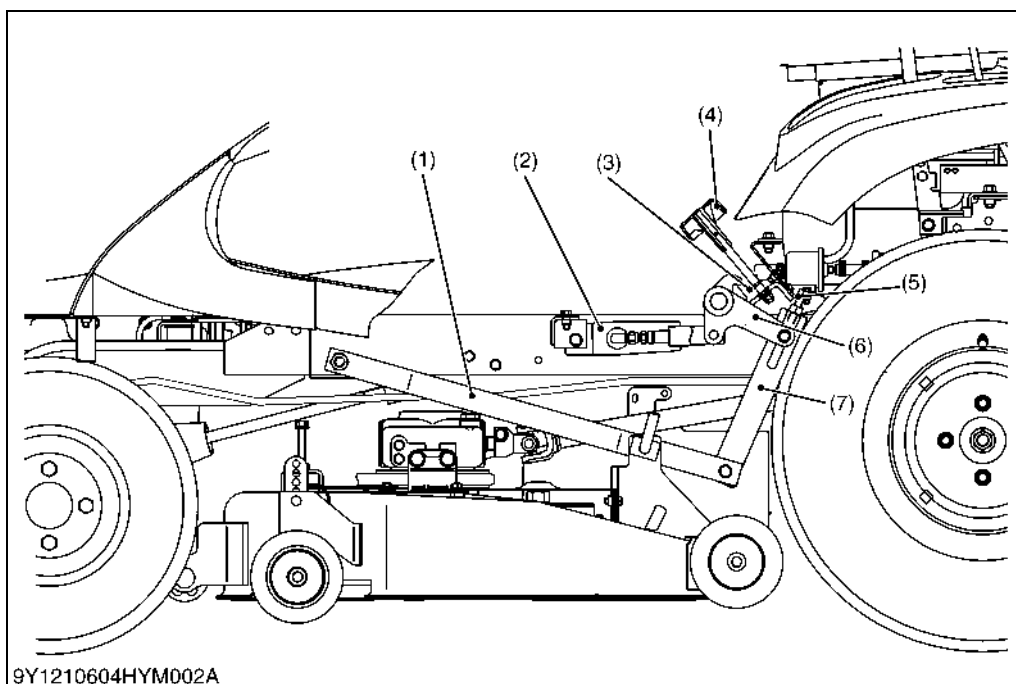
4. MOWER LIFT CYLINDER



The mower lift cylinder consists of cylinder tube (1), cylinder rod (3) and other parts as shown in the figure above. This cylinder is a single acting type.

9Y1210598HYM0009US0

5. MOWER LINKAGE



- (1) Rear Link
- (2) Mower Lift Cylinder
- (3) Adjusting Cam
- (4) Cutting Height Adjusting Dial
- (5) Cutting Height Fine Turning Bolt
- (6) Lift Link Shaft
- (7) Lift Link

9Y1210604HYM002A

The rear link (1) and lift link shaft (6) are linked with the lift link (7).

As the hydraulic lift lever is set to the **"LIFT"** position, the mower lift cylinder (2) is extended and the lift link shaft (6) is rotated to pull the lift link (7). As a result, mower is lifted up.

The cutting height adjusting dial (4) adjusts the cutting height of mower by rotating the adjusting cam (3).

The level of mower deck is adjusted by adjusting the cutting height fine tuning bolt length (5).

9Y1210598HYM0010US0

SERVICING

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[3] DISASSEMBLING AND ASSEMBLING	6-S9
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(2) Hydraulic Control Valve Assembly	6-S11
(3) Hydraulic Pump	6-S15

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Mower Does Not Lift	Control valve malfunctioning	Repair or replace	6-S13
	Lift cylinder damaged	Replace	6-S9
	Main relief valve spring damaged	Check or replace	6-S4, 6-S14
	Main relief valve setting pressure too low	Adjust	6-S4
	Hydraulic pump damaged	Replace	6-S15
	Oil strainer clogged	Clean or replace	G-37
	Insufficient transmission oil	Refill	G-9
Mower Does Not Lower	Control valve malfunctioning	Repair or replace	6-S13
Mower Lowers by Its Weight	Lift cylinder worn or damaged	Replace	6-S9
	Control valve malfunctioning	Replace	6-S13

9Y1210598HYS0001US0

2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Main Relief Valve	Setting pressure	9.50 to 11.0 MPa 96.9 to 112 kgf/cm ² 1380 to 1590 psi	—

9Y1210598HYS0002US0

3. TIGHTENING TORQUES

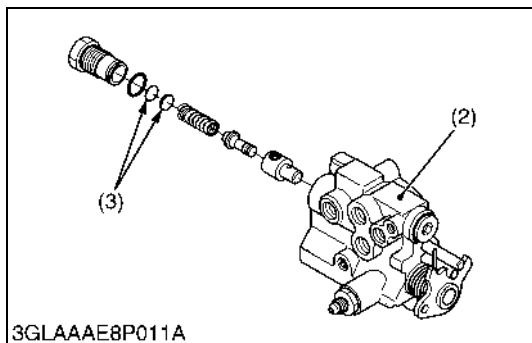
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: See page "5. TIGHTENING TORQUES" on page G-12.)

Item	N·m	kgf·m	lbf·ft
Control valve pipe retaining nut	24 to 28	2.5 to 2.8	18 to 20
Control valve joint bolt	32 to 36	3.3 to 3.6	24 to 27
Hose clamp for drain hose	1.0 to 1.2	0.11 to 0.12	0.74 to 0.88
Hydraulic pump mounting screw	17.7 to 20.6	1.81 to 2.10	13.1 to 15.1
Hydraulic pump joint bolt	40.0 to 45.0	4.08 to 4.58	29.5 to 33.1
Control valve adaptor	20.0 to 25.0	2.04 to 2.54	14.8 to 18.4
Drain pipe mounting screw	5.0 to 7.0	0.51 to 0.71	3.7 to 5.1
Control valve joint pipe	20.0 to 25.0	2.04 to 2.54	14.8 to 18.4

9Y1210598HYS0003US0

4. CHECKING AND DISASSEMBLING

[1] CHECKING AND ADJUSTING



Main Relief Valve Setting Pressure

1. Remove the cylinder hose from the mower lift cylinder (1).
2. Install the T-shaped adaptor and pressure gauge.
3. Start the engine and set at maximum speed.
4. Move the hydraulic lift lever to the "**LIFT**" position to operate the main relief valve and read the gauge.
5. If the pressure is not within the factory specifications, adjust with the adjusting shims (3).

Main relief valve setting pressure	Factory specification	9.50 to 11.0 MPa 96.9 to 112 kgf/cm ² 1380 to 1590 psi
------------------------------------	-----------------------	---

Condition

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

(Reference)

- Hose and adaptor size:
7/16-20 UNF
- Thickness of shim:
0.10 mm (0.039 in.)
0.20 mm (0.079 in.)
0.40 mm (0.016 in.)

- (1) Mower Lift Cylinder (3) Shim
(2) Hydraulic Control Valve Assembly

9Y1210598HYS0004US0

[2] PREPARATION



Dismounting Mower

1. See page "[1] PREPARATION" on page 8-S9.

9Y1210598TXS0014US0

Battery



CAUTION

- When disconnecting the battery cables, disconnect the negative cable from the battery first. When connecting, connect the positive cable to the battery first.
1. Open the bonnet.
 2. Disconnect the negative cable (1) from the battery.
 3. Disconnect the positive cable (2) from the battery and remove the battery (3).

- (1) Negative Cable
(2) Positive Cable

- (3) Battery

9Y1210598ENS0023US0



Rear Cover [GR2120SEU]

1. Remove the rear cover (1).

- (1) Rear Cover

9Y1210598TXS0015US0



9Y1210598TXS003A



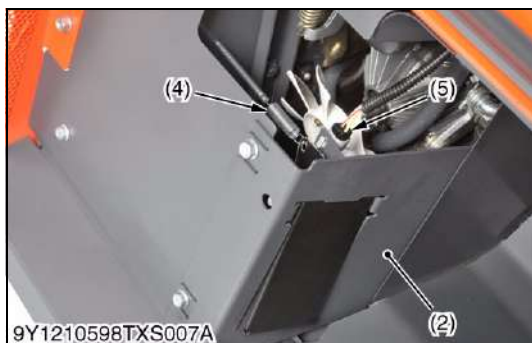
9Y1210598TXS004A



9Y1210598TXS005A



9Y1210598TXS006A



9Y1210598TXS007A

Removing Container [GR2120EU, GR2120F Only]

1. Pull the top cover lock lever (2) to open the top cover (1).
2. Set the grass container lift lever (4) in "**LEVER LOCK**" position.
3. Lift up the rear of the grass container (3).
4. Lift up the whole grass container and remove.

(When attaching)

- Open the top cover (1).
- Set the grass container lift lever (4) in "**LEVER LOCK**" position.
- Lift the rear end of the grass container (3), set the grass container (3) onto the frame shaft so that a clearance "**L**" is about 0 to 50 mm (0 to 2.0 in.).
- Lock the grass container (3) with the grass container lift lever (4) in "**CONTAINER LOCK**" position.
- Close the top cover (1).

(Reference)

- Clearance "**L**": 0 to 50 mm (0 to 2.0 in.)

- (1) Top Cover
(2) Top Cover Lock Lever

- (3) Grass Container
(4) Grass Container Lift Lever

9Y1210598TXS0072US0

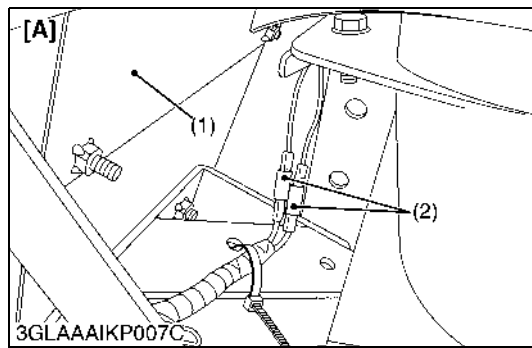
Discharge Duct [GR2120EU, GR2120F]

1. Remove the filter cover (1).
2. Remove the screws (3) for the discharge duct (2).
3. Disconnect the spring (4) and the coupler (5).
4. Remove the discharge duct (2).

- (1) Filter Cover
(2) Discharge Duct
(3) Screw

- (4) Spring
(5) Coupler

9Y1210598TXS0073US0

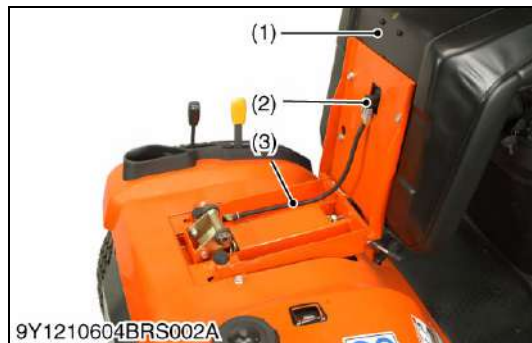
**Container Base [GR2120EU, GR2120F]**

1. Disconnect the connector (2).
2. Remove the container base (1).

- (1) Container Base
(2) Connector

[A] Right Side

9Y1210598TXS0077US0

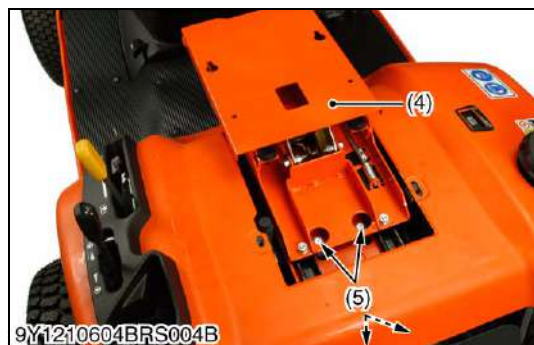
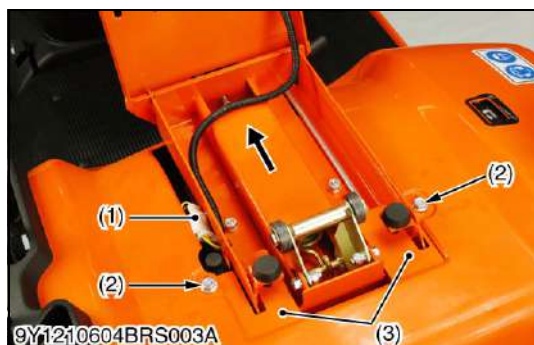
**Seat**

1. Turn the seat (1).
2. Disconnect the safety switch connector (2).
3. Remove the seat (1).

- (1) Seat
(2) Safety Switch Connector

(3) Wire Harness

9Y1210598TXS0018US0



Seat Base and Fender

1. Disconnect the seat connector (1).
2. Remove the screws (2).
3. Remove the support base (3).
4. Move the seat base (4) in ahead.
5. Remove the seat base (4).
6. Remove the lever grips (6), fuel and the cutting height control dial (9).
7. Remove the speed change pedal (10).
8. Remove the fuel tank cap (7) and fender (8).

■ NOTE

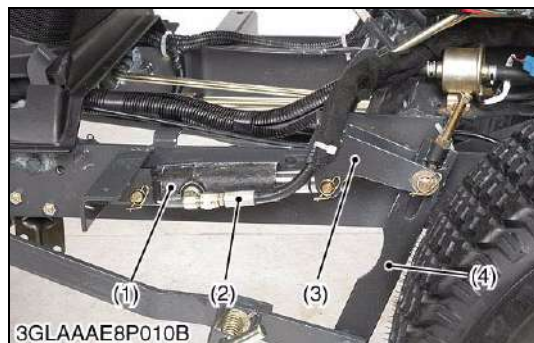
- To remove the fender, remove the hydraulic hose from guide first.

- | | |
|------------------------------|---------------------------------|
| (1) Seat Connector | (6) Lever Grip |
| (2) Screw | (7) Fuel Tank Cap |
| (3) Support Base | (8) Fender |
| (4) Seat Base | (9) Cutting Height Control Dial |
| (5) Seat Base Mounting screw | (10) Speed Charge Pedal |

9Y1210598TXS0020US0

[3] DISASSEMBLING AND ASSEMBLING

(1) Mower Lift Cylinder and Linkage

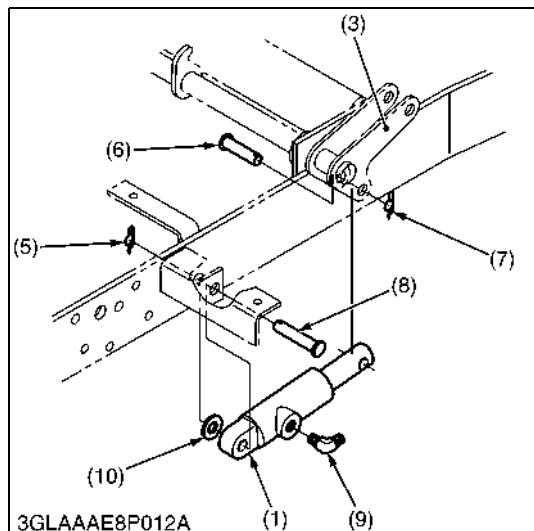


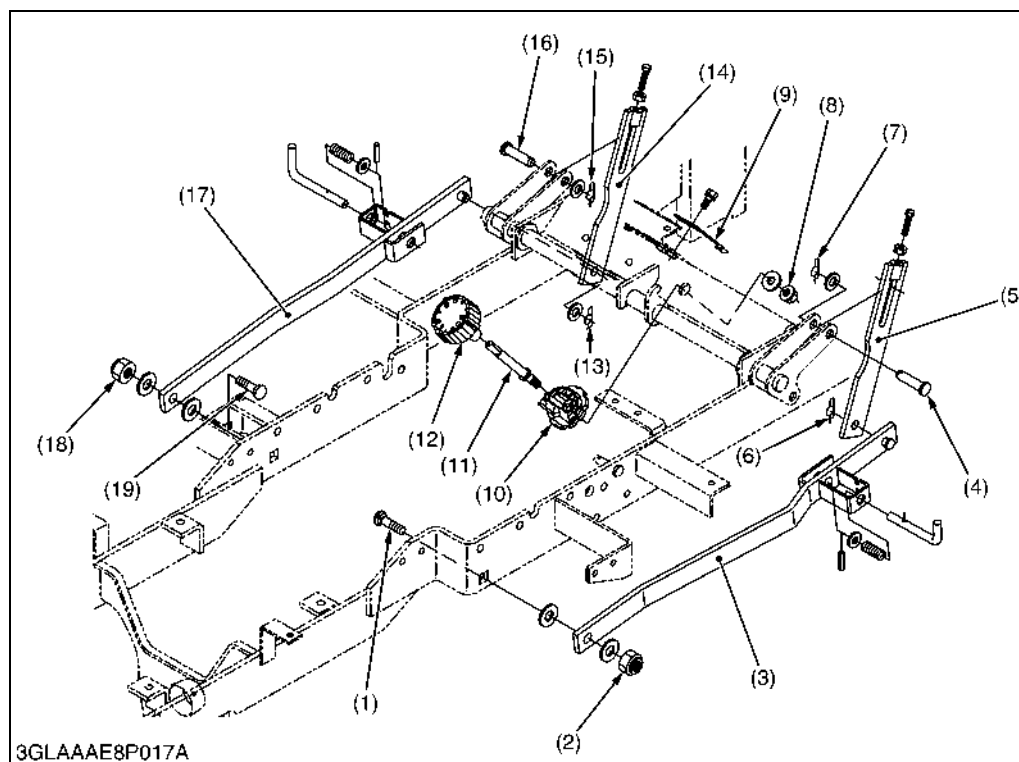
Mower Lift Cylinder

1. Disconnect the cylinder hose (2) from the mower lift cylinder (1).
2. Remove the both side of lift link (4) from the lift shaft (3).
3. Remove the clevis pins (6), (8), and remove the mower lift cylinder (1).

- | | |
|-------------------------|-------------------|
| (1) Mower Lift Cylinder | (6) Clevis Pin |
| (2) Cylinder Hose | (7) Rue Ring |
| (3) Lift Shaft | (8) Clevis Pin |
| (4) Lift Link | (9) Adaptor |
| (5) Rue Ring Pin | (10) Plain Washer |

9Y1210598HYS0007US0



Mower Lift Linkage

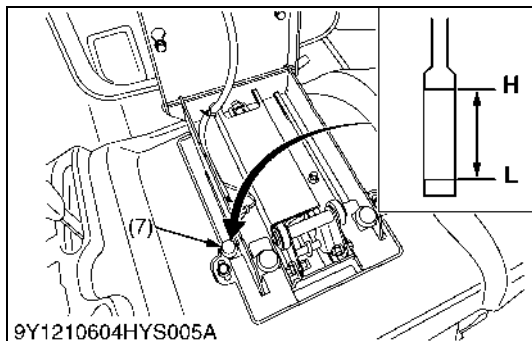
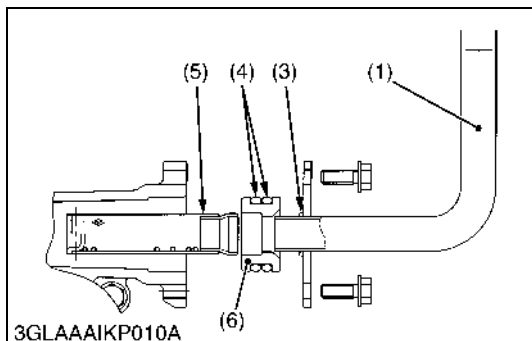
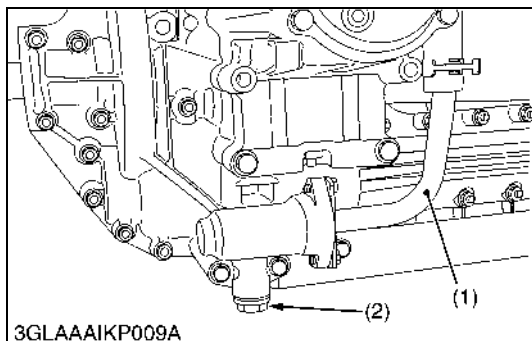
- (1) Screw
- (2) Lock Nut
- (3) Rear Link LH
- (4) Clevis Pin
- (5) Lift Link LH
- (6) Rue Ring
- (7) Rue Ring
- (8) Lock Nut
- (9) Plate Spring
- (10) Adjusting Cam
- (11) Cutting Height Adjusting Rod
- (12) Cutting Height Adjusting Dial Knob
- (13) Rue Ring
- (14) Lift Link RH
- (15) Rue Ring
- (16) Clevis Pin
- (17) Rear Link RH
- (18) Lock Nut
- (19) Screw

3GLAAAE8P017A

1. Remove the screws (1), (19) and lock nuts (2), (18), and pull out the rue rings (6), (13).
2. Remove the rear link LH (3) and RH (17).
3. Pull out the rue rings (7), (15) and remove the clevis pins (4), (16).
4. Remove the lift link LH (5) and RH (14).
5. Remove the cutting height adjusting dial knob (12).
6. Remove the plate spring (9).
7. Remove the lock nut (8), and remove the cutting height adjusting rod (11) and adjusting cam (10).

9Y1210598HYS0012US0

(2) Hydraulic Control Valve Assembly



Draining Transmission Fluid

1. Start the engine. Push the mower lift lever and lower the mower link.
2. Place an oil pan under the transaxle.
3. Remove the drain plug (2).
4. Remove the strainer (5) to completely drain the transmission fluid.
5. After draining, clean the strainer (5) and reinstall it.

(When refilling)

- Remove the filling plug with the dipstick, and fill the new transmission fluid to "H" level on the dipstick.
- Start the engine, and do the following operations. However, absolutely avoid engaging the PTO lever during this operation.
 - 1) Depress the speed change pedal alternately to the forward side and reverse side in order to move the machine forward and backward.
 - 2) Rotate the steering wheel to the right and left to turn the front wheels right and left.
 - 3) Operate the mower lift lever in order to make the mower deck go up and down.
 - 4) During the operation described above, check to see if no oil leakage from the transaxle assembly and each hydraulic pipe is found.
- At least 5 minutes after stopping the engine, check the oil level again, using the dipstick.
- If the oil level is lower than the "H" level indicated on the dipstick, fill the oil tank with transmission fluid additionally up to the "H" level.
- Do the above-mentioned operation again. And confirm that the oil level is not low level.
- Disconnect the universal joint of mower deck from the PTO shaft. Shift the PTO lever to "Engage" position, and check to see if the PTO shaft rotates quickly without abnormal noise. Next, shift the PTO lever to the "Disengage" position, and check to see if the PTO shaft stops operation quickly without abnormal noise.

■ IMPORTANT

- **Park the machine on level ground.**
- **Use the KUBOTA UDT or SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. (See page "4. LUBRICANTS, FUEL AND COOLANT" on page G-9.)**
- **Do not mix different brand oil together.**

Transmission fluid	Capacity	3.3 L 3.5 U.S.qts 2.9 Imp.qts
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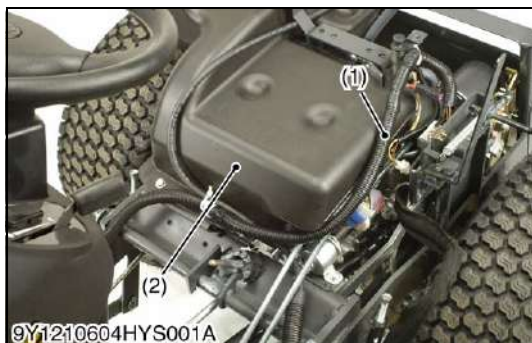
- (1) Suction Pipe
(2) Drain Plug
(3) O-ring (Small)
(4) O-ring (Large)
(5) Strainer

- (6) Boss
(7) Filling Plug with Dipstick

H: Highest Level

L: Lowest Level

9Y1210598TXS0016US0



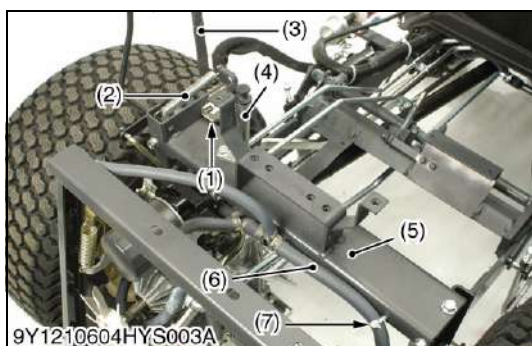
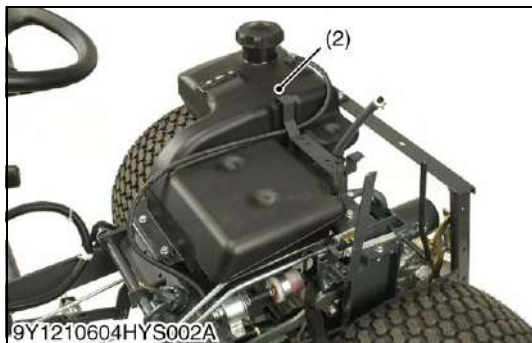
Fuel Tank

1. Drain the fuel.
2. Disconnect the wire harness (1).
3. Disconnect the fuel hoses.
4. Remove the fuel tank (2).

(1) Wire Harness

(2) Fuel Tank

9Y1210598TXS0021US0



Beam

1. Disconnect the connector from the PTO switch (1).
2. Remove the spring (2) from the PTO lever (3).
3. Remove the PTO rod.
4. Remove the filling pipe (4).
5. Remove the hose clamp (7) of breather hose (6).
6. Remove the beam (5).

(When reassembling)

- After assembling the beam, fix the breather hose (6) to the beam (5) with the hose clamp horizontally along the beam (5).

(1) PTO Switch

(5) Beam

(2) Spring

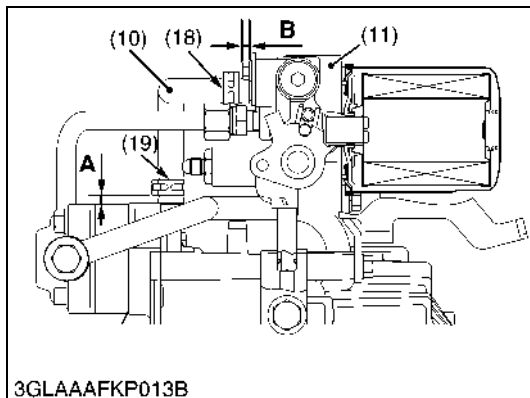
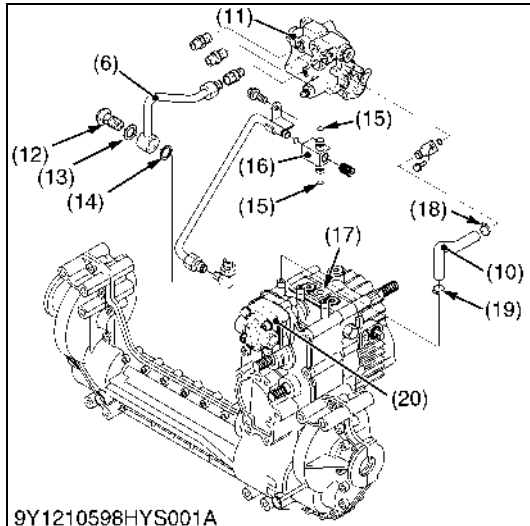
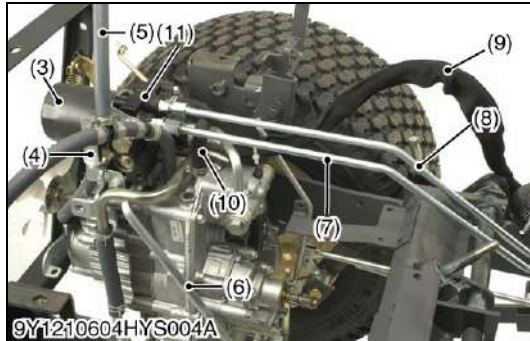
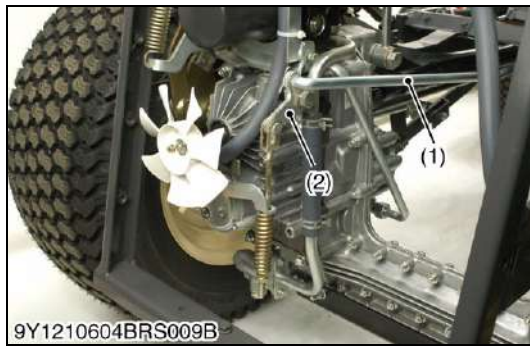
(6) Breather Hose

(3) PTO Lever

(7) Hose Clamp

(4) Filling Pipe

9Y1210598TXS0022US0



Hydraulic Control Valve Assembly

1. Disconnect the brake rod 1 (1) and brake plate (2).
2. Remove the brake plate (2) from neutral arm holder.
3. Remove the filter cartridge (3), breather hose (5) and neutral arm holder (4).
4. Disconnect the power steering pipes (7), (8) and drain hose (10).
5. Remove the control valve pipe (6).
6. Disconnect the cylinder hose (9).
7. Remove the hydraulic control valve assembly (11).

(When reassembling)

- Apply the oil to two O-rings (15) on the charge pipe (16). Insert the charge pipe (16) straight into the charge port (17) while taking care not to damage the O-ring. Next, insert the hydraulic control valve assembly (11) straight into the charge pipe (16).
- Replace the copper gaskets (13), (14) with new one.
- Install the copper gaskets (13), (14) in original position.
- After temporarily assembling the control valve pipe (6) to the hydraulic control valve assembly (11) first, reconnect the control valve pipe (6) to the hydraulic pump (20) with the joint bolt (12).
- When reconnecting the drain hose (10) to the transaxle and hydraulic control valve assembly (11), set the hose clamps (18), (19) at the position shown in figure.

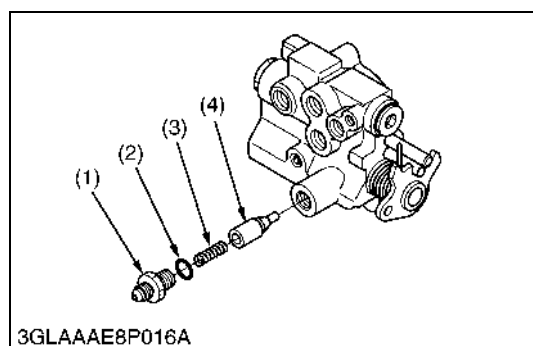
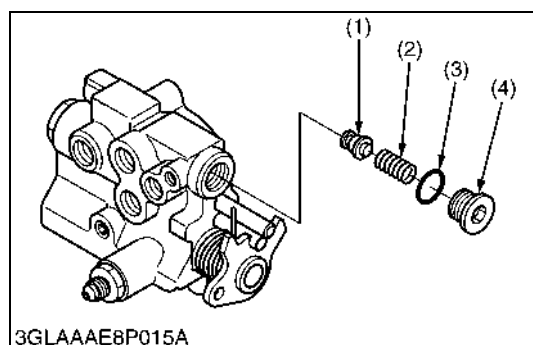
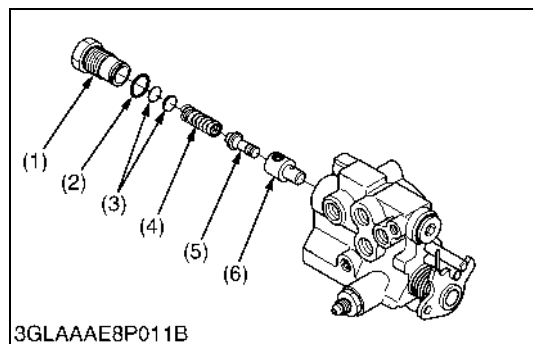
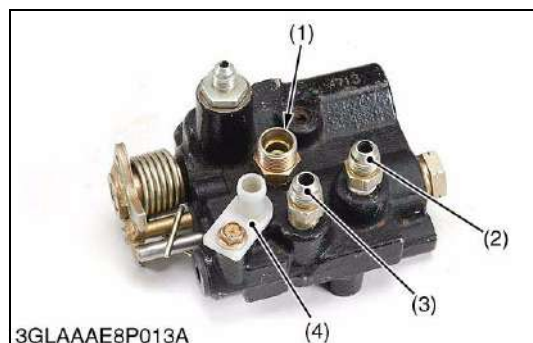
Tightening torque	Control valve pipe retaining nut	24 to 28 N·m 2.5 to 2.8 kgf·m 18 to 20 lbf·ft
	Control valve joint bolt (12)	32 to 36 N·m 3.3 to 3.6 kgf·m 24 to 27 lbf·ft
	Hose clamp for drain hose (18), (19)	1.0 to 1.2 N·m 0.11 to 0.12 kgf·m 0.74 to 0.88 lbf·ft

(Reference)

- Distance "A":
1.0 to 2.0 mm (0.040 to 0.078 in.)
- Distance "B":
5.0 mm (0.20 in.)

- | | |
|--|---------------------------------------|
| (1) Brake Rod 1 | (10) Drain Hose |
| (2) Brake Plate | (11) Hydraulic Control Valve Assembly |
| (3) Filter Cartridge | (12) Joint Bolt |
| (4) Neutral Arm Holder | (13) Copper Gasket (Thick Type) |
| (5) Breather Hose | (14) Copper Gasket (Thin Type) |
| (6) Control Valve Pipe | (15) O-ring |
| (7) Power Steering Pipe
(To Power Steering Unit Controller) | (16) Charge Pipe |
| (8) Power Steering Pipe
(From Power Steering Unit Controller) | (17) Charge Port |
| (9) Cylinder Hose | (18) Hose Clamp |
| | (19) Hose Clamp |
| | (20) Hydraulic pump |

9Y1210598HYS0005US0



Adaptor and Filter Joint

1. Remove the adaptors (2), (3).
2. Remove the drain pipe mounting screw, and remove the drain pipe (4).
3. Remove the joint pipe (1).
4. Remove the filter joint (5).

(When reassembling)

Tightening torque	Control valve adaptor	20.0 to 25.0 N·m 2.04 to 2.54 kgf·m 14.8 to 18.4 lbf·ft
	Drain pipe mounting screw	5.0 to 7.0 N·m 0.51 to 0.71 kgf·m 3.7 to 5.1 lbf·ft
	Control valve joint pipe	20.0 to 25.0 N·m 2.04 to 2.54 kgf·m 14.8 to 18.4 lbf·ft

- | | |
|----------------|------------------|
| (1) Joint Pipe | (4) Drain Pipe |
| (2) Adaptor | (5) Filter Joint |
| (3) Adaptor | |

9Y1210598HYS0008US0

Main Relief valve

1. Remove the plug (1).
2. Pull out the shims (3), spring (4), poppet (5) and valve seat (6).

(When reassembling)

- Be careful not to damage the O-ring (2).

■ IMPORTANT

- After reassembling the main relief valve, be sure to adjust the main relief valve setting pressure. (See page 6-S4.)

- | | |
|------------|----------------|
| (1) Plug | (4) Spring |
| (2) O-ring | (5) Poppet |
| (3) Shim | (6) Valve Seat |

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HST Relief Valve

1. Remove the plug (4).
2. Pull out the spring (2) and poppet (1).

(When reassembling)

- Be careful not to damage the O-ring (3).

- | | |
|------------|------------|
| (1) Poppet | (3) O-ring |
| (2) Spring | (4) Plug |

9Y1210598HYS0010US0

Check Valve

1. Remove the cylinder hose adaptor (1).
2. Pull out the spring (3) and poppet (4).

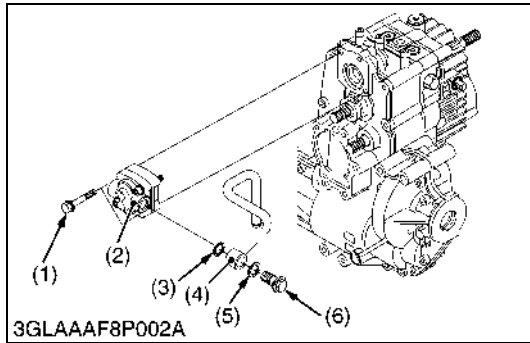
(When reassembling)

- Be careful not to damage the O-ring (2).

- | | |
|---------------------------|------------|
| (1) Cylinder Hose Adaptor | (3) Spring |
| (2) O-ring | (4) Poppet |

9Y1210598HYS0011US0

(3) Hydraulic Pump



Hydraulic Pump

1. Remove the hydraulic control valve assembly.
2. Remove the hydraulic pump (2) with the suction pipe 1 (4).
3. Remove the joint bolt (6), and remove the suction pipe 1 (4) from the hydraulic pump (2).

(When reassembling)

- Replace the copper gaskets (3), (5) with new one.
- Install the copper gaskets (3), (5) in original position.

Tightening torque	Hydraulic pump mounting screw	17.7 to 20.6 N·m 1.81 to 2.10 kgf·m 13.1 to 15.1 lbf·ft
	Hydraulic pump joint bolt	40.0 to 45.0 N·m 4.08 to 4.58 kgf·m 29.5 to 33.1 lbf·ft

- | | |
|-----------------------------------|--------------------------------|
| (1) Hydraulic Pump Mounting Screw | (4) Suction Pipe 1 |
| (2) Hydraulic Pump | (5) Copper Gasket (Thick Type) |
| (3) Copper Gasket (Thin Type) | (6) Joint Bolt |

9Y1210598HYS0006US0

7 ELECTRICAL SYSTEM

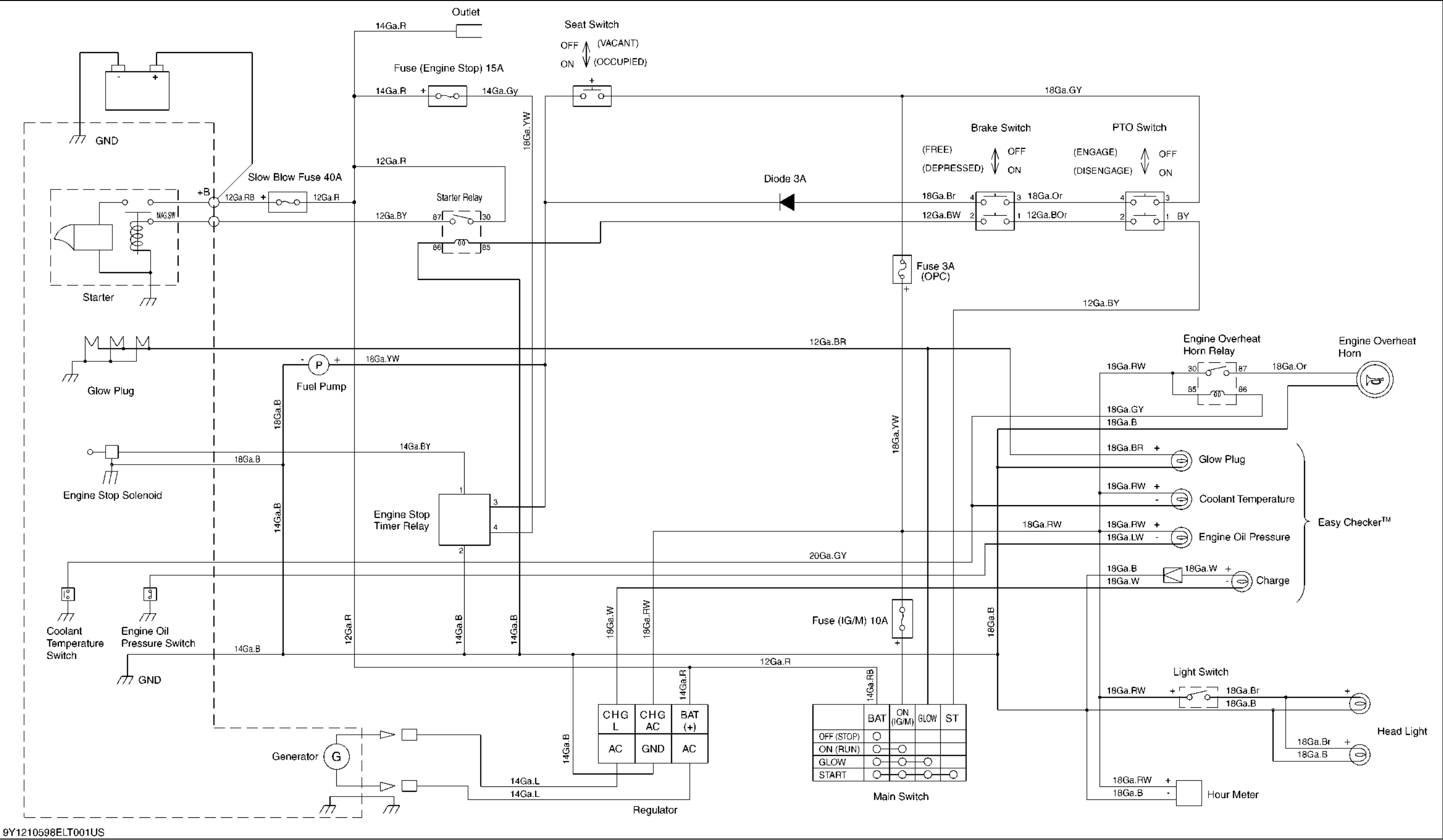
MECHANISM

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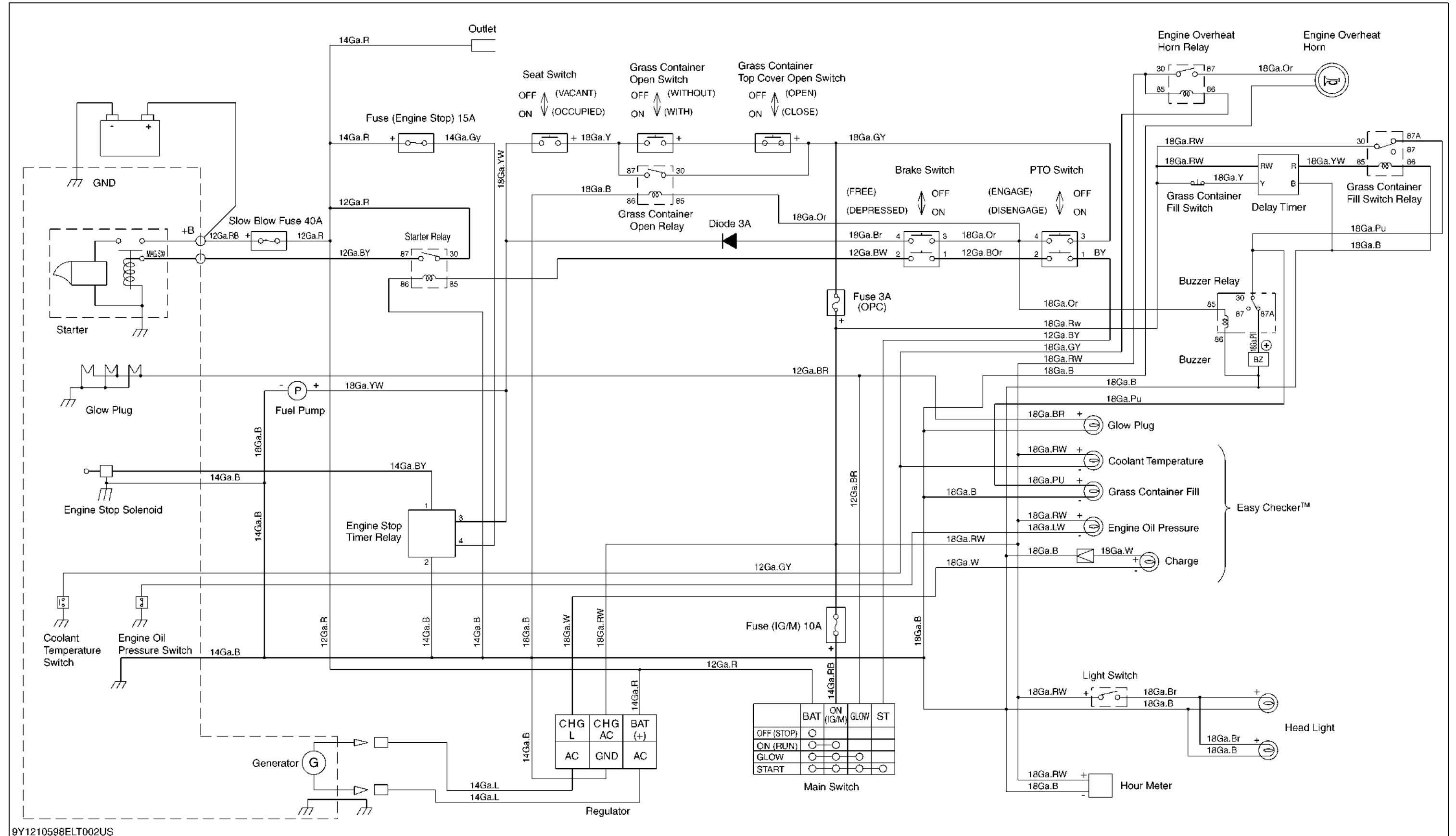
1. WIRING DIAGRAM

[1] GR2120SEU



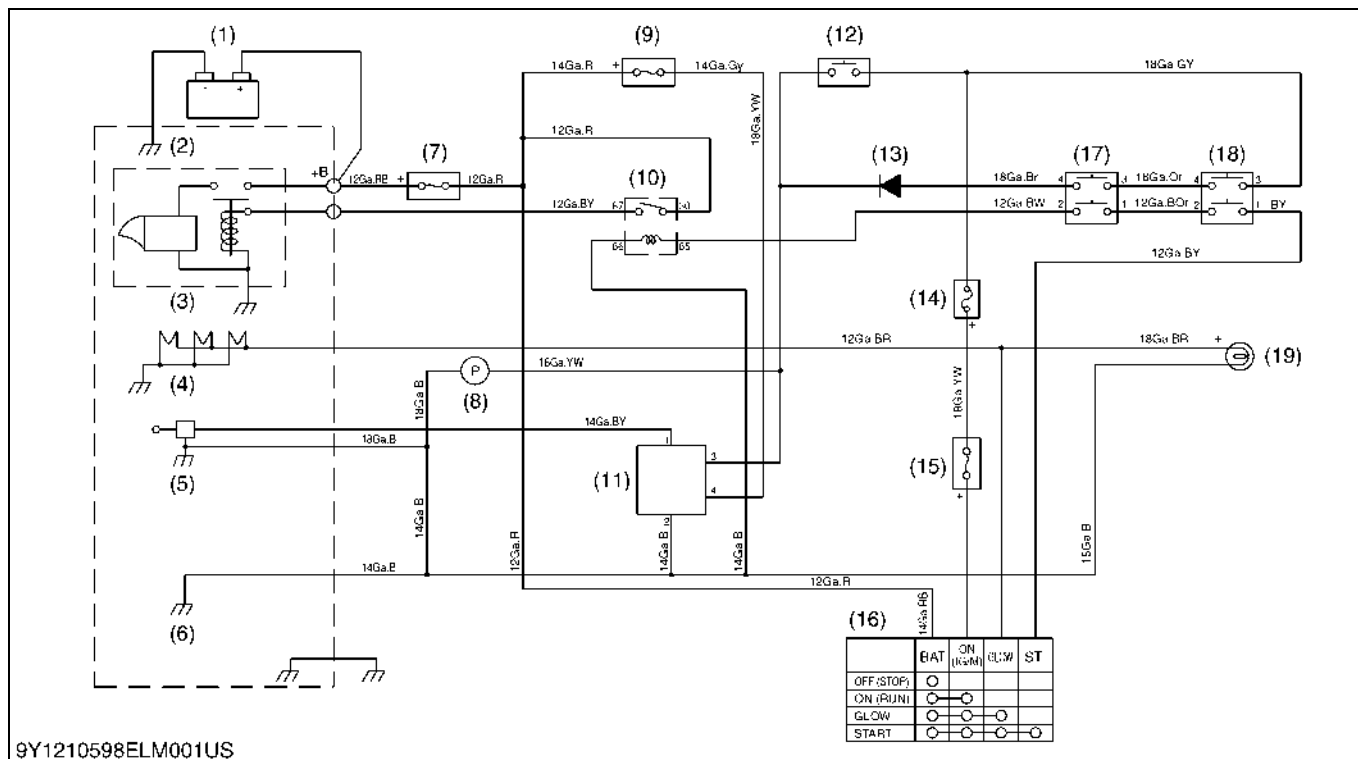
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2. STARTING SYSTEM

[1] GR2120SEU



- | | | | |
|--------------------------|-------------------------------|------------------------------|---------------------|
| (1) Battery | (6) GND | (11) Engine Stop Timer Relay | (16) Main Switch |
| (2) GND | (7) Slow Blow Fuse (40 A) | (12) Seat Switch | (17) Brake Switch |
| (3) Starter Motor | (8) Fuel Feed Pump | (13) Diode (3A) | (18) PTO Switch |
| (4) Glow Plug | (9) Fuse (Engine Stop) (15 A) | (14) Fuse (OPC) (3 A) | (19) Glow Plug Lamp |
| (5) Engine Stop Solenoid | (10) Starter Relay | (15) Fuse (IG/M) (10 A) | |

When the main switch (16) is turned to the **PREHEAT** position, the terminal **BAT** is connected to the terminals **GLOW** and **ON**. The glow plugs (4) become red-hot, and the glow plug (preheat indicator) lamp (19) also lights on while preheating.

When the main switch (16) is then turned to the **START** position with the brake switch (17) on and PTO switch (18) on, the terminal **BAT** is connected to the terminals **START** and **ON**. Consequently, battery current flows to the starter motor (3) and start the engine.

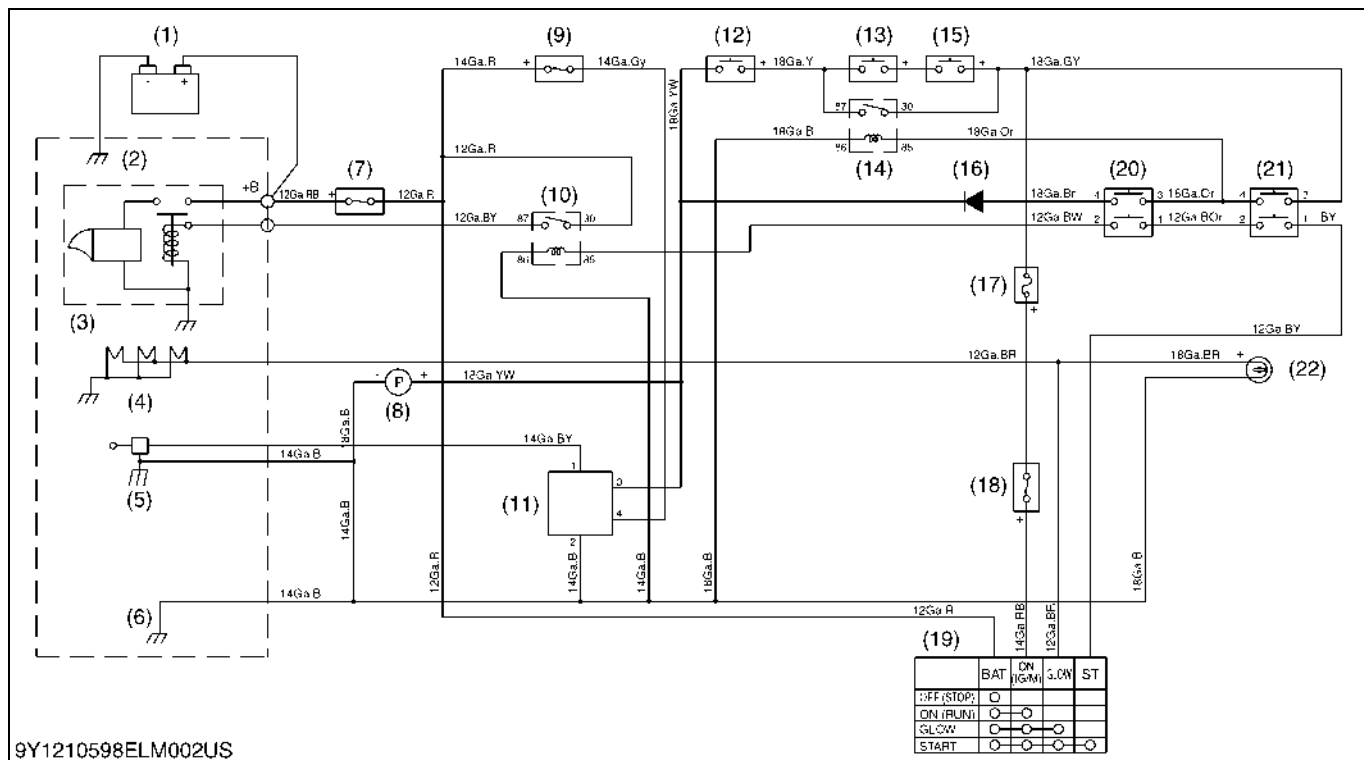
The main switch (16) automatically returns to the **ON** position, the terminal **BAT** is connected only to the terminal **ON**, thereby causing the starting circuit to be opened, stopping the starter motor (3).

When the main switch (16) turned from the **ON** position to the **OFF** position, the engine stop solenoid (5) moves the fuel injection pump control rack to the "**No Fuel Injection**" position and stop the engine.

This machine is equipped with the operator presence control (OPC) system which automatically stops the engine when operator stands from the seat while shifting the PTO lever.

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[2] GR2120EU, GR2120F



- | | | | |
|--------------------------|-------------------------------|----------------------------------|-------------------------|
| (1) Battery | (7) Slow Blow Fuse (40 A) | (13) Grass Container Open Switch | (18) Fuse (IG/M) (10 A) |
| (2) GND | (8) Fuel Feed Pump | (14) Grass Container Open Relay | (19) Main Switch |
| (3) Starter Motor | (9) Fuse (Engine Stop) (15 A) | (15) Top Cover Open Switch | (20) Brake Switch |
| (4) Glow Plug | (10) Starter Relay | (16) Diode (3A) | (21) PTO Switch |
| (5) Engine Stop Solenoid | (11) Engine Stop Time Relay | (17) Fuse (OPC) (3 A) | (22) Glow Plug Lamp |
| (6) GND | (12) Seat Switch | | |

When the main switch (19) is turned to the **PREHEAT** position, the terminal **BAT** is connected to the terminals **GLOW** and **ON**. The glow plugs (4) become red-hot, and the glow plug (preheat indicator) lamp also lights on while preheating.

When the main switch (19) is then turned to the **START** position with the brake switch (20) on and PTO switch (21) on, the terminal **BAT** is connected to the terminals **START** and **ON**. Consequently, battery current flows to the starter motor (3) and start the engine.

The main switch (19) automatically returns to the **ON** position, the terminal **BAT** is connected only to the terminal **ON**, thereby causing the starting circuit to be opened, stopping the starter motor (3).

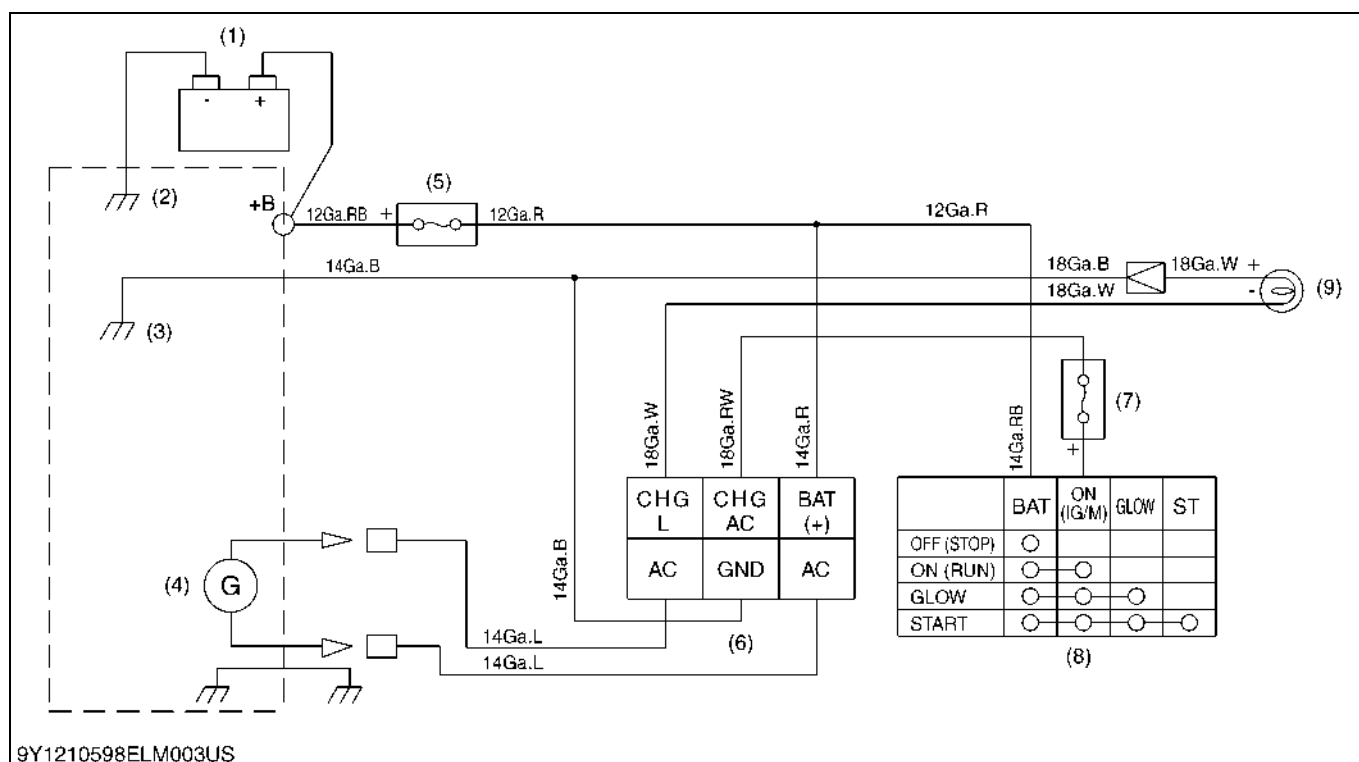
When the main switch (19) turned from the **ON** position to the **OFF** position, the engine stop solenoid (5) moves the fuel injection pump control rack to the **"No Fuel Injection"** position and stop the engine.

This machine equipped the operator presence control (OPC) system which automatically stops the engine when operator stands from the seat while shifting the PTO lever.

With the PTO lever shifted to the **"ENGAGE"** position, the engine of this machine stops automatically when the cover of the grass container opens, the grass container opens or dismantled.

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3. CHARGING SYSTEM



(1) Battery

(2) GND

(3) GND

(4) Dynamo

(5) Slow Blow Fuse (40 A)

(6) Regulator

(7) Fuse (10 A)

(8) Main Switch

(9) Charge Lamp

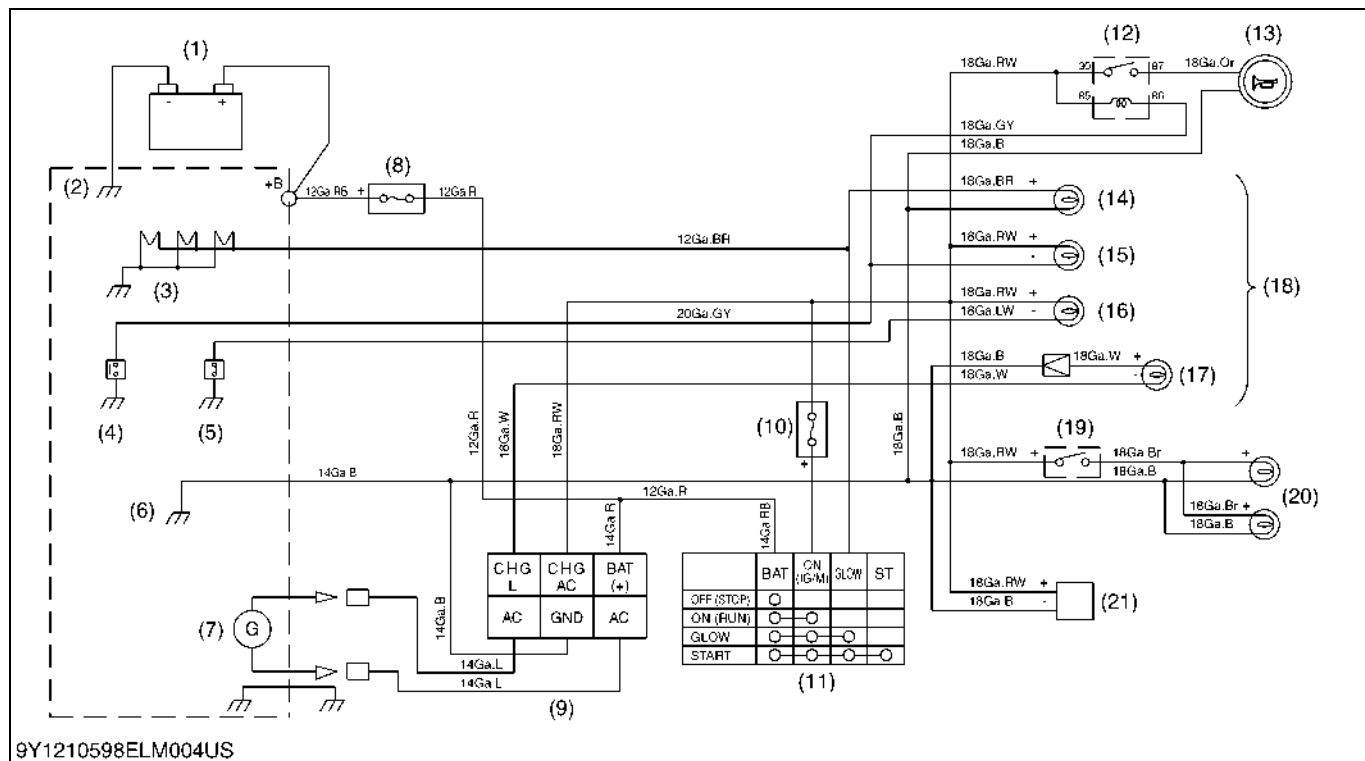
The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs.

It consists of a dynamo (4) and a regulator (6).

9Y1210598ELM0005US0

4. LIGHTING SYSTEM AND METER PANEL

[1] GR2120SEU



- | | | | |
|--------------------------------|---------------------------|---------------------------------|------------------------|
| (1) Battery | (7) Dynamo | (12) Engine Overheat Horn Relay | (17) Charge Lamp |
| (2) GND | (8) Slow Blow Fuse (40 A) | (13) Engine Overheat Horn | (18) Easy Checker™ |
| (3) Glow Plug | (9) Regulator | (14) Glow Plug Lamp | (19) Head Light Switch |
| (4) Coolant Temperature Switch | (10) Fuse (10 A) | (15) Coolant Temperature Lamp | (20) Head Light |
| (5) Oil Pressure Switch | (11) Main Switch | (16) Oil Pressure Lamp | (21) Hour Meter |
| (6) GND | | | |

The lighting system of this machine consists of the main switch (11), head light switch (19), head lights (20) etc..

The meter panel has Easy Checker™ (18) and engine overheat horn (13).

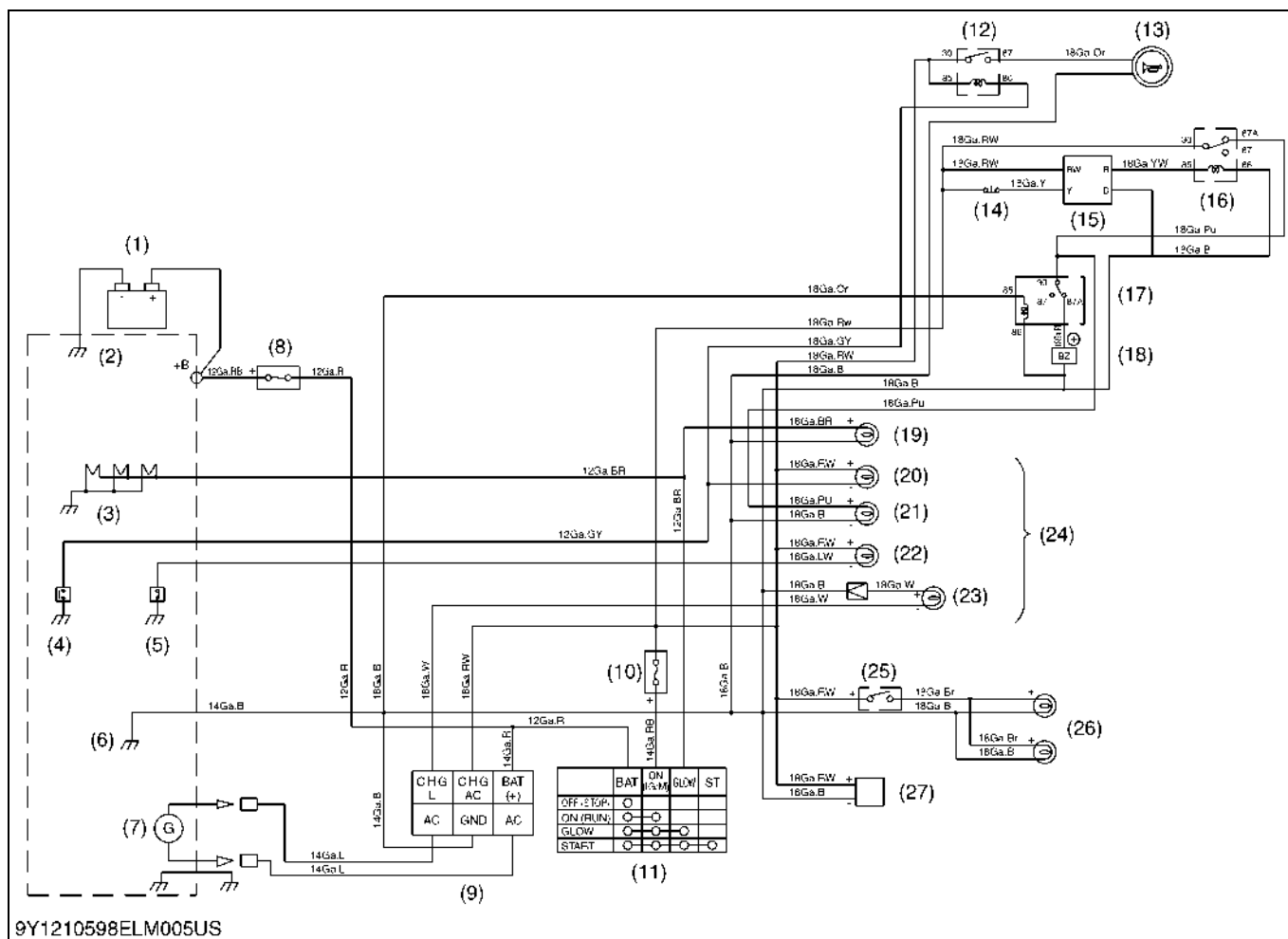
The coolant temperature lamp (15) lights and engine overheat horn (13) operates when the engine coolant temperature is more than the working temperature of the coolant temperature switch (4).

The oil pressure lamp (16) lights when the engine oil pressure drops below the prescribed level.

The charge lamp (17) lights when the dynamo (7) is not charging the battery (1) while the engine runs.

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[2] GR2120EU, GR2120F



- | | | | |
|--------------------------------|----------------------------------|----------------------------------|------------------------|
| (1) Battery | (9) Regulator | (16) Grass Container Full Switch | (22) Oil Pressure Lamp |
| (2) GND | (10) Fuse (10 A) | Relay | (23) Charge Lamp |
| (3) Glow Plug | (11) Main Switch | (17) Buzzer Relay | (24) Easy Checker™ |
| (4) Coolant Temperature Switch | (12) Engine Overheat Horn Relay | (18) Buzzer | (25) Head Light Switch |
| (5) Oil Pressure Switch | (13) Engine Overheat Horn | (19) Glow Plug Lamp | (26) Head Light |
| (6) GND | (14) Grass Container Full Switch | (20) Coolant Temperature Lamp | (27) Hour Meter |
| (7) Dynamo | (15) Delay Timer | (21) Grass Container Full Lamp | |
| (8) Slow Blow Fuse (40 A) | | | |

The lighting system consists of the main switch (11), head light switch (25), head lights (26) etc..

The grass container full lamp (21) in the easy checker™ lights and the buzzer operates when the grass container is full while shifting the PTO lever.

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SERVICING

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(2) Dynamo	7-S22

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
All Electrical Equipments Do Not Operate	Battery discharged or damaged	Recharge or replace	G-29, 7-S6
	Battery positive cable disconnected or improperly connected	Repair or replace	6-S5
	Battery negative cable disconnected or improperly connected	Repair or replace	6-S5
	Slow blow fuse blown (40 A)	Replace	G-46
Fuse Blown Frequently	Short-circuited	Repair or replace	G-46

BATTERY

Symptom	Probable Cause	Solution	Reference Page
Battery Discharges Too Quickly	Battery damaged	Replace	G-29
	Dynamo damaged	Repair or replace	7-S14, 7-S20
	Regulator damaged	Replace	7-S14
	Wiring harness disconnected or improperly connected (between battery positive terminal and regulator B terminal)	Repair or replace	—
	Cooling fan belt slipping	Adjust tension	G-34

STARTING SYSTEM

Symptom	Probable Cause	Solution	Reference Page
Starter Motor Does Not Operate	Battery discharged or damaged	Recharge or replace	G-29, 7-S6
	Slow blow fuse blown (40 A)	Replace	G-46
	Wiring harness disconnected or improperly connected (between main switch ST terminal and safety switches, between safety switches and starter motor, between battery positive terminal and starter motor)	Repair or replace	–
	Starter motor damaged	Repair or replace	7-S8
	Main switch damaged	Replace	7-S7
	Seat switch damaged	Replace	7-S11
	Brake switch damaged	Replace	7-S10
	PTO switch damaged	Replace	7-S9
	Stater relay damaged	Replace	7-S9
	Grass container open switch damaged	Replace	7-S10
	Top cover open switch damaged	Replace	7-S10
Engine Does Not Stop When Main Switch is Turned OFF	Fuse (Engine stop) blown (15 A)	Replace	G-46
	Wiring harness disconnected or improperly connected	Repair or replace	–
	Engine stop solenoid damaged	Replace	7-S13
	Engine stop timer relay damaged	Replace	7-S13

CHARGING SYSTEM

Symptom	Probable Cause	Solution	Reference Page
Charging Lamp Does Not Light when Main Switch is Turned ON	Fuse blown (15 A)	Replace	G-46
	Bulb blown	Replace	G-46
	Wiring harness disconnected or improperly connected (between main switch ACC terminal and regulator connector terminal (yellow), between regulator connector terminal (green) and charge lamp)	Repair or replace	–
	Regulator damaged	Replace	7-S14
Charging Lamp Does Not Go Off When Engine is Running	Dynamo damaged	Repair or replace	7-S14, 7-S20
	Regulator damaged	Replace	7-S14

LIGHTING SYSTEM AND METER PANEL

Symptom	Probable Cause	Solution	Reference Page
Head Light Does Not Light	Fuse blown (10 A)	Replace	G-46
	Bulb blown	Replace	G-46
	Wiring harness disconnected or improperly connected (between main switch ACC terminal and head light switch, between head light switch and head light)	Repair or replace	–
Glow Plug Lamp Does Not Light When Main Switch Is in Pre-heat Position	Battery discharged or damaged	Recharge or replace	G-29, 7-S6
	Slow blow fuse blown (40 A)	Replace	G-46
	Wiring harness disconnected or improperly connected (between main switch G terminal and glow plug lamp, between glow plug lamp and glow plugs)	Repair or replace	–
	Main switch damaged	Replace	7-S7
	Bulb blown	Replace	G-46
Oil Pressure Lamp Lights Up When Engine Is Running	Engine oil pressure too low	Repair engine	7-S15
	Engine oil insufficient	Fill	G-9
	Oil pressure switch damaged	Replace	7-S16
	Short circuit between oil pressure switch lead and chassis	Repair	–
Oil Pressure Lamp Does Not Light When Main Switch Is Turned ON and Engine Is Not Running	Fuse blown (10 A)	Replace	G-46
	Bulb blown	Replace	G-46
	Oil pressure switch damaged	Replace	7-S16
	Wiring harness disconnected or improperly connected (between main switch ACC terminal and oil pressure lamp, between oil pressure lamp and oil pressure switch)	Repair or replace	–
Coolant Temperature Lamp Does Not Light When Main Switch Is Turned ON and Engine Is Not Running	Fuse blown (10 A)	Replace	G-46
	Bulb blown	Replace	G-46
	Coolant temperature switch	Replace	7-S16
	Wiring harness disconnected or improperly connected (between main switch ACC terminal and coolant temperature lamp, between coolant temperature lamp and coolant temperature switch)	Repair or replace	–

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2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Battery	Voltage	More than 12 V	—
	Potential Difference	Less than 0.1 V	—
Glow Plug	Resistance	Approx. 0.9 Ω	—
Coolant Temperature Switch	Working temperature	120 to 126 °C 248 to 258 °F	—
Starter	Commutator (O.D.)	28.0 mm 1.10 in.	27.0 mm 1.06 in.
	Commutator (Difference of O.D.)	Less than 0.05 mm 0.002 in.	0.4 mm 0.016 in.
	Mica (Undercut)	0.50 to 0.80 mm 0.020 to 0.031 in.	0.20 mm 0.008 in.
	Brush (Length)	16.0 mm 0.630 in.	10.5 mm 0.413 in.

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3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: See page "5. TIGHTENING TORQUES" on page G-12.)

Item	N·m	kgf·m	lbf·ft
Starter C terminal nut	5.9 to 11.8	0.6 to 1.2	4.3 to 8.7
Dynamo stator nut	40 to 44	4.0 to 4.5	29 to 32

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4. CHECKING AND ADJUSTING

[1] STARTING SYSTEM



CAUTION

- To avoid accidental short circuit, be sure to attach the positive cable to the positive terminal before the negative cable is attached to the negative terminal.
- Do not remove the battery cap while the engine is in operation.
- Keep electrolyte away from eyes, hands and clothes. If you are splattered with it, clean it away completely with water immediately.
- Keep open sparks and flames away from the battery at all times. Hydrogen gas mixed with oxygen becomes very explosive.

■ IMPORTANT

- If you operate the machine for a short time without battery (using a slave battery for starting), use additional current (lights) while engine is in operation and insulate terminal of battery. If you ignore this advice, damage to dynamo and regulator can occur.

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(1) Battery



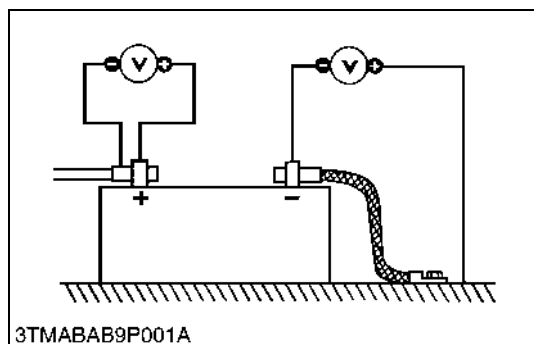
Battery Voltage

1. Stop the engine and turn the main switch off.
2. Connect the COM (-) lead of the voltmeter to the battery's negative terminal post (2) and the (+) lead to the positive terminal post (1), and measure the battery voltage.
3. If the battery voltage is less than the factory specification, check the battery specific gravity and recharge the battery.

Battery voltage	Factory specification	More than 12 V
-----------------	-----------------------	----------------

- (1) Positive Terminal Post (3) Battery
(2) Negative Terminal Post

9Y1210598ELS0005US0



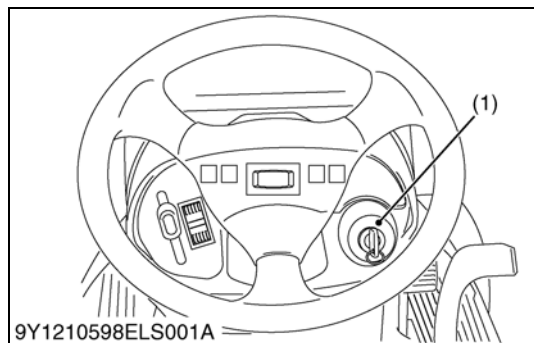
Battery Terminal Connection

1. Turn the main switch on, and turn on the head light.
2. Measure the voltage with a voltmeter across the battery's positive terminal post and the cable terminal, and the voltage across the battery's negative terminal post and the chassis.
3. If the measurement is more than the factory specification, clean the battery terminal posts and cable clamps, and tighten them firmly.

Potential difference	Factory specification	Less than 0.1 V
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9Y1210598ELS0006US0

(2) Main Switch

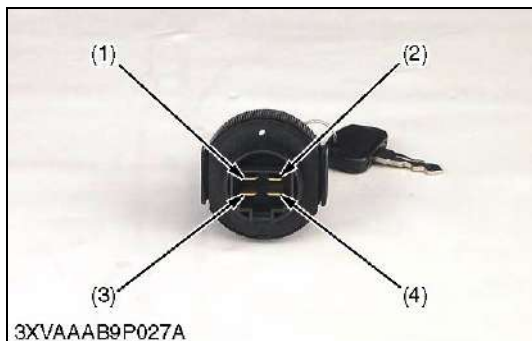


Main Switch

1. Open the bonnet.
2. Disconnect the 4P connector and remove the main switch (1).
3. Do the following checks.

- (1) Main Switch

9Y1210598ELS0007US0



Connector Voltage

1. Measure the voltage with a voltmeter across the connector **B** (red) terminal and chassis.
2. If the voltage differs from the battery voltage (11 to 14 V), the wiring harness is damaged.

Voltage	Connector B (Red) terminal – chassis	Approx. battery voltage
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(1) Connector

9Y1210598ELS0008US0

Main Switch Continuity

1) Main Switch Key at OFF Position

1. Set the main switch **OFF** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **ACC** terminal, **B** terminal and **ST** terminal, **B** terminal and **G** terminal.
3. If infinity is not indicated, the contacts of the main switch are damaged.

Resistance	B terminal – ACC terminal	Infinity
	B terminal – ST terminal	
	B terminal – G terminal	

2) Main Switch Key at ON Position

1. Set the main switch **ON** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **ACC** terminal.
3. If 0 ohm is not indicated, the **B – ACC** contact of the main switch are damaged.

Resistance	B terminal – ACC terminal	0 Ω
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3) Main Switch Key at START Position

1. Set and hold the main switch key at the **START** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **G** terminal, across the **B** terminal and the **ST** terminal, and across the **B** terminal and the **ACC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are damaged.

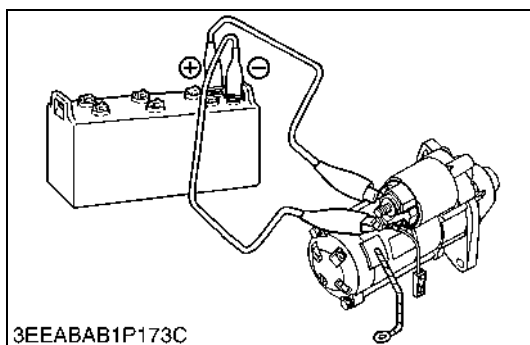
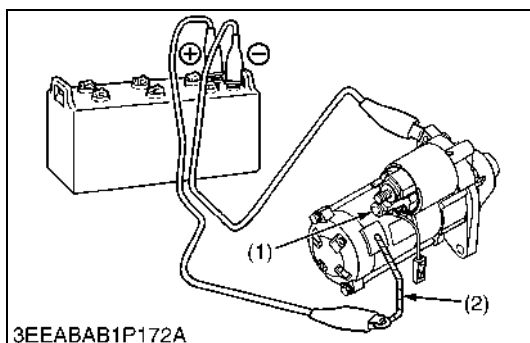
Resistance	B terminal – G terminal	0 Ω
	B terminal – ST terminal	
	B terminal – ACC terminal	

(1) **G** Terminal
(2) **ACC** Terminal

(3) **ST** Terminal
(4) **B** Terminal

9Y1210598ELS0009US0

(3) Starter



Motor Test



CAUTION

- **Attach the starter to prevent jumping up and down during the test.**

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

9Y1210598ELS0010US0

Starter Magnet Switch Test (Pull-in, Holding Coils)

NOTE

- **Prepare a 6 V battery for the test, and do each test for 3 to 5 seconds.**

1) Checking Pull-in Coil

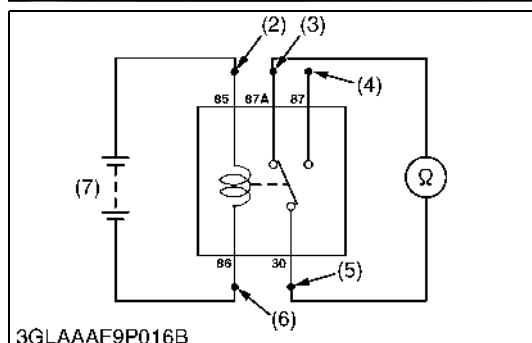
1. Connect jumper lead from the battery's negative terminal post to the **C** terminal.
2. The plunger must keep pulled strongly when a jumper lead is connected from the battery positive terminal to the **S** terminal.

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 must keep pulled.

9Y1210598ELS0011US0

(4) Starter Relay



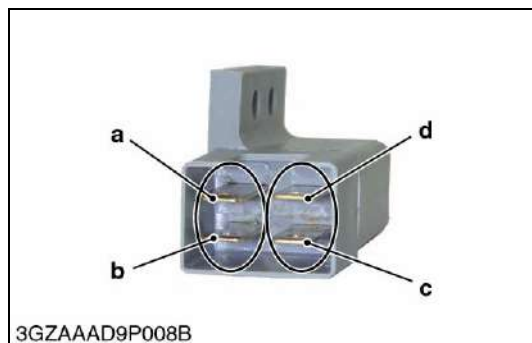
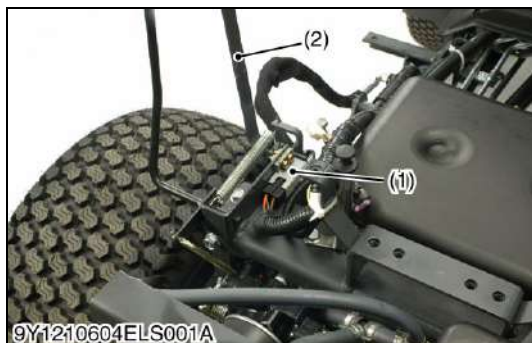
Relay

1. Remove the starter relay (1) from the machine.
2. Connect jumper leads across the battery positive terminal and **85** terminal (2), and across the battery negative terminal and **86** terminal (6).
3. Connect leads of an ohmmeter to **87a** terminal (3) and **30** terminal (5).
4. Check continuity between **87a** terminal (3) and **30** terminal (5).
5. If continuity is 0 ohms, the relay is proper.

- | | |
|-------------------------|------------------------|
| (1) Starter Relay | (5) 30 Terminal |
| (2) 85 Terminal | (6) 86 Terminal |
| (3) 87a Terminal | (7) Battery (12V) |
| (4) 87 Terminal | |

9Y1210598ELS0012US0

(5) Safety Switch



PTO Switch

1. Remove the battery.
2. Remove the fender.
3. Disconnect the connector from PTO switch (1).
4. Measure the resistance with an ohmmeter between the terminals.
5. If the PTO switch (1) is damaged, replace it.

Resistance (between terminal a and b)	When plunger is pushed	0 Ω
	When plunger is released	Infinity
Resistance (between terminal c and d)	When plunger is pushed	0 Ω
	When plunger is released	Infinity

- (1) PTO Switch
- (2) PTO Lever

a to d: Switch Terminal

9Y1210598ELS0013US0



Top Cover and Grass Container Open Switch [GR2120EU, GR2120F]

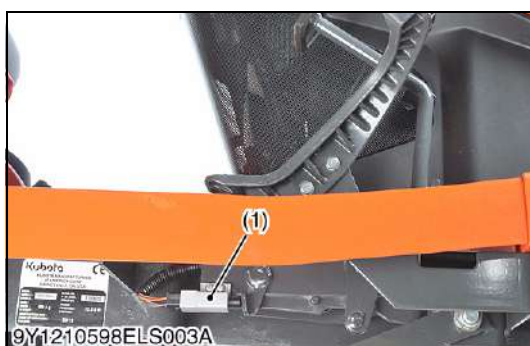
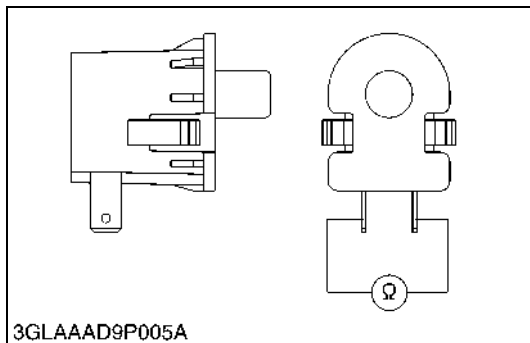
1. Remove the battery.
2. Remove the open switches (1), (2).
3. Measure the resistance with an ohmmeter between the safety switch terminals.
4. If the switches is damaged, replace it.

Resistance (between switch terminals)	When plunger is pushed	0 Ω
	When plunger is released	Infinity

(1) Top Cover Open Switch

(2) Grass Container Open Switch

9Y1210598ELS0036US0



Brake Switch

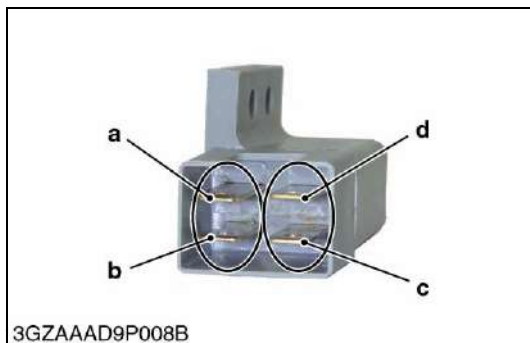
1. Remove the battery.
2. Remove the fender.
3. Disconnect the connector from brake switch (1).
4. Measure the resistance with an ohmmeter between the terminals.
5. If the brake switch (1) is damaged, replace it.

Resistance (between terminal a and b)	When plunger is pushed	0 Ω
	When plunger is released	Infinity
Resistance (between terminal c and d)	When plunger is pushed	0 Ω
	When plunger is released	Infinity

(1) Brake Switch

a to d: Switch Terminal

9Y1210598ELS0014US0



(6) Operator Presence Control (OPC) Switch



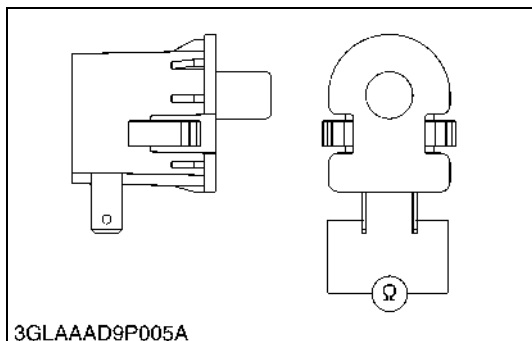
OPC Switch (Seat Switch)

1. Remove the battery.
2. Remove the OPC switch (1).
3. Measure the resistance with an ohmmeter between the OPC switch terminals.
4. If the OPC switch (1) is damaged, replace it.

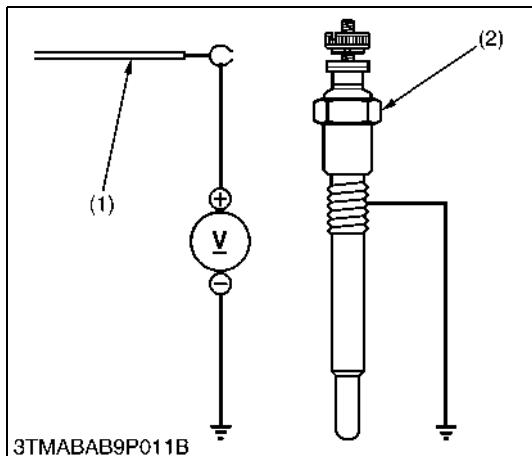
Resistance (between switch terminals)	When plunger is pushed	0 Ω
	When plunger is released	Infinity

(1) OPC Switch (Seat Switch)

9Y1210598ELS0015US0



(7) Glow Plug



Lead Terminal Voltage

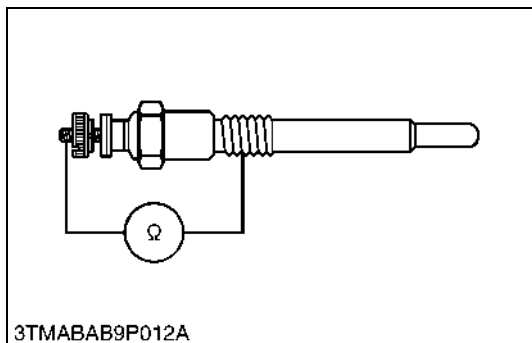
1. Disconnect the wiring lead (1) from the glow plug (2) after turning the main switch off.
2. Turn the main switch key to the **"PREHEAT"** position, and measure the voltage between the lead terminal and the chassis.
3. Turn the main switch key to the **"START"** position, and measure the voltage with 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 damaged.

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

9Y1210598ELS0016US0



Glow Plug Continuity

1. Disconnect the lead from the glow plugs.
2. Measure the resistance with an ohmmeter between the glow plug terminal and the chassis.
3. If 0 ohm is indicated, the screw at the tip of the glow plug and the housing are short-circuited.
4. If the factory specification is not indicated, the glow plug is damaged.

Glow plug resistance	Factory specification	Approx. 0.9 Ω
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9Y1210598ELS0017US0

(8) Fuel Pump



Connector Voltage

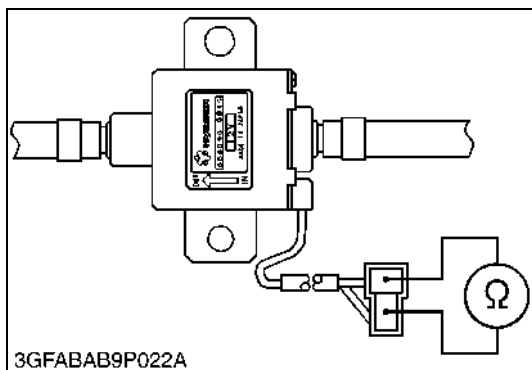
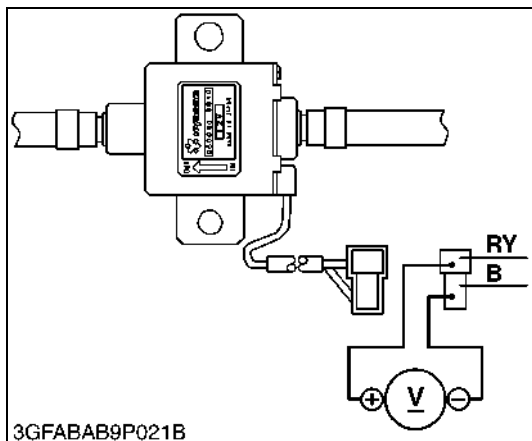
1. Disconnect the **2P** connector (2) from the fuel pump (1).
2. Turn the main switch key to the "**ON**" position, and measure the voltage with a voltmeter between the connector terminals.
3. If the voltage differs from the battery voltage, the wiring harness or main switch is damaged.

Voltage	Between connector terminals	Approx. battery voltage
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(1) Fuel Pump

(2) **2P** connector

9Y1210598ELS0018US0

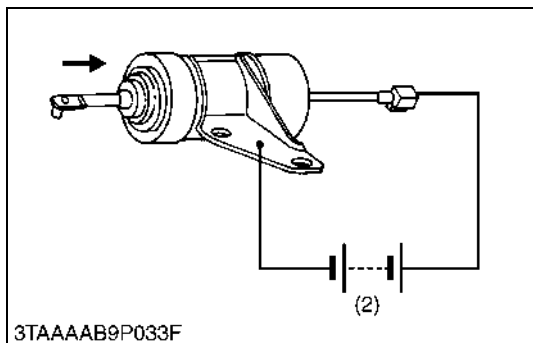


Fuel Pump Continuity

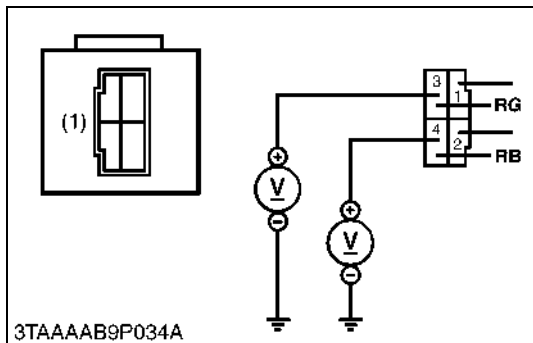
1. Disconnect the **2P** connector from the fuel pump.
2. Check the continuity between the connector terminals with an ohmmeter.
3. If it does not conduct, the fuel pump is damaged.

9Y1210598ELS0019US0

(9) Engine Stop Solenoid



(10) Engine Stop Timer Relay



Engine Stop Solenoid Test

1. Disconnect the **1P** connector from the engine stop solenoid (1).
2. Remove the engine stop solenoid (1) from the engine.
3. Connect the jumper leads from the battery positive terminal to the **1P** connector, and from the battery negative terminal to the engine stop solenoid body.
4. If the solenoid plunger does not go in, the engine stop solenoid (1) is damaged.

(1) Engine Stop Solenoid

(2) Battery (12 V)

9Y1210598ELS0020US0

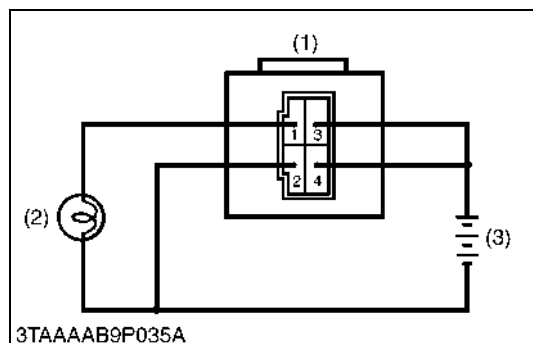
Timer Relay Connector Voltage

1. Disconnect the connector from the timer relay after turning the main switch off.
2. Measure the voltage with a voltmeter across the connector terminal **4** and chassis.
3. Turn the main switch on, and measure the voltage across the connector terminal **3** and chassis.
4. If these voltages differ from the battery voltage, the wiring harness or main switch is damaged.

Voltage	Connector terminal 4 – chassis	Approx. battery voltage
	Connector terminal 3 – chassis	Approx. battery voltage

(1) Timer Relay

9Y1210598ELS0021US0



Test of Timer Relay

1. Remove the timer relay from the machine.
2. Connect jumper leads across the battery positive terminal and the timer relay terminal **3**, and across the battery positive terminal and the timer relay terminal **4**.
3. Connect jumper leads across the battery negative terminal and the timer relay terminal **2**, and across the battery negative terminal and the bulb terminal.
4. Connect jumper lead across the timer relay terminal **1** and the bulb terminal.
5. The bulb lights up when disconnecting a jumper lead from the terminal **3** and goes off 6 to 13 seconds late, the timer relay is proper.

(1) Timer Relay
(2) Load (Lamp)

(3) Battery (12V)

9Y1210598ELS0022US0

[2] CHARGING SYSTEM

(1) Dynamo



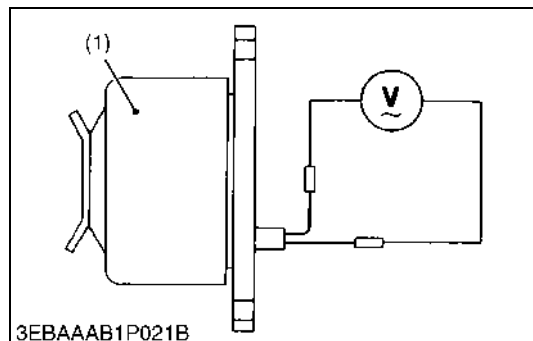
No-load Dynamo Output

1. Disconnect the lead wires from the dynamo.
2. Start the engine and operate the dynamo at the rated speed.
3. Measure the output voltage with a volt meter.
4. If the measurement is not within the specified values, replace the dynamo.

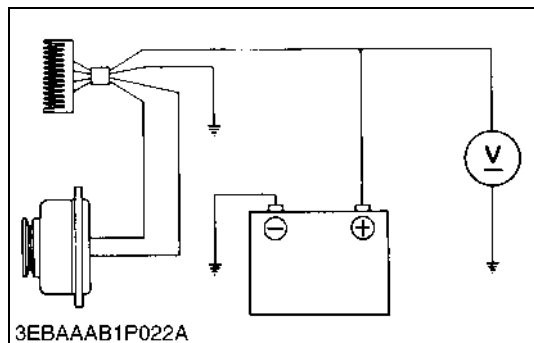
No-load output	Factory specification	AC 20 V or more
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(1) Dynamo

9Y1210598ELS0023US0



(2) Regulator



Regulation Voltage

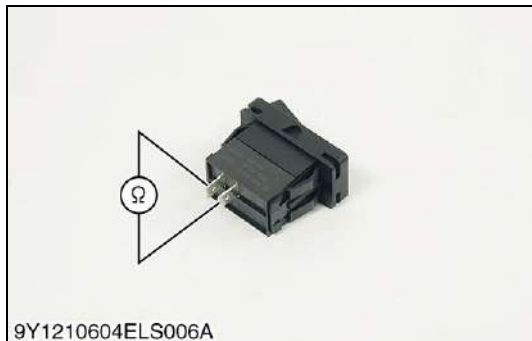
1. Complete the charging circuit with a fully charged battery and operate the engine speed at the rated speed.
2. Measure the battery voltage with a volt meter.
3. If the measurement is not within the specified values, replace the regulator.

Regulating voltage	Factory specification	14 to 15 V
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9Y1210598ELS0024US0

[3] LIGHTING SYSTEM AND METER PANEL

(1) Head Light Switch



Head Light Switch Continuity

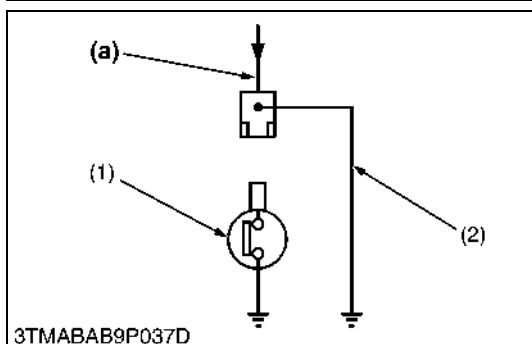
1. Disconnect the wiring leads from head light switch and remove it.
2. Measure the resistance with an ohmmeter across the head light switch terminals in each position.
3. If the resistance differs from the factory specifications, the head light switch is damaged.

Resistance	Factory specification	OFF	Infinity
		ON	0 Ω

(1) Head Light Switch

9Y1210598ELS0025US0

(2) Engine Oil Pressure



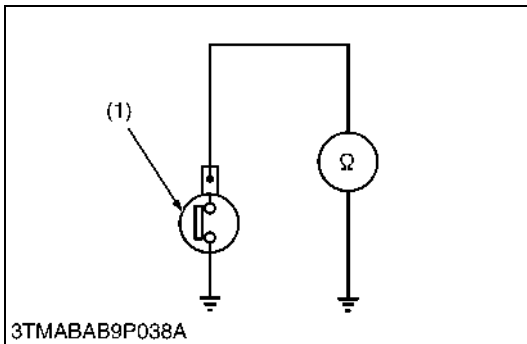
Lamp Harness

1. Disconnect the wiring harness from the engine oil pressure switch (1) with the main switch **OFF**.
2. Turn the main switch **ON** and connect a jumper lead (2) from the chassis to the wiring harness.
3. If the engine oil pressure indicator lamp does not light, the wiring harness is damaged.

(1) Engine Oil Pressure Switch
(2) Jumper Lead

(a) From Oil Pressure Lamp

9Y1210598ELS0026US0



Engine Oil Pressure Switch Continuity

1. Measure the resistance with an ohmmeter across the switch terminal and the chassis.
2. If 0 ohm is not indicated in the normal state, the switch is damaged.
3. If infinity is not indicated at pressure over 4.9 kPa (0.5 kgf/cm², 7 psi), the switch is damaged.

Resistance (Switch terminal – Chassis)	In normal state	0 Ω
	At pressure over approx. 4.9 kPa (0.5 kgf/cm ² , 7 psi)	Infinity

(1) Engine Oil Pressure Switch

9Y1210598ELS0027US0

(3) Coolant Temperature Switch



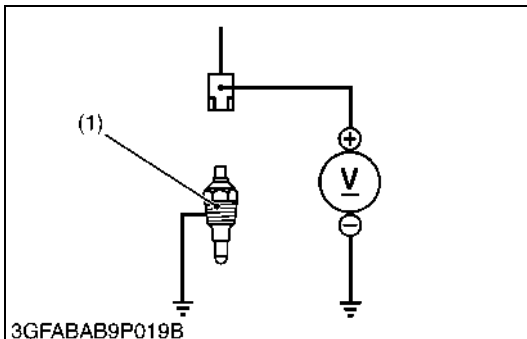
Connector Voltage

1. Disconnect the **1P** connector from the coolant temperature switch (1).
2. Turn the main switch key to the "**ON**" position, and measure the voltage with a voltmeter between the connector terminal and the chassis.
3. If a certain voltage is not indicated, the wiring harness is damaged.

Voltage (Connector terminal – Chassis)	Factory specification	A certain voltage is indicated
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(1) Coolant Temperature Switch

9Y1210598ELS0028US0



Switch Continuity

1. Disconnect the **1P** connector, and remove the coolant temperature switch.
2. Using an ohmmeter, check for continuity between the switch terminal and the chassis. The figure shows the operation hysteresis
3. If infinity is indicated at temperature over factory specifications, the switch is damaged.

Working temperature	Factory specification	120 to 126 °C 248 to 258 °F
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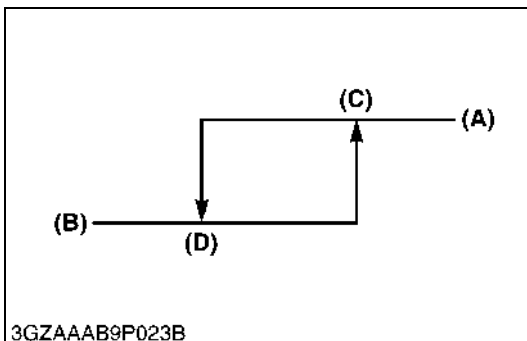
(A) ON

(C) 120 to 126 °C (248.0 to 258.8 °F)

(B) OFF

(D) 116 °C (240.8 °F) or more

9Y1210598ELS0037US0



(4) Relay (Overheat Horn, Grass Container Relay)



Removing Overheat Horn Relay

1. Remove the overheat horn relay (1) from inside the meter panel.

(1) Overheat Horn Relay

9Y1210598ELS0038US0



Removing Grass Container Relays [GR2120EU, GR2120F]

1. Remove the grass container.
2. Remove the discharge duct.
3. Remove the screws (1).
4. Push the relay stay (2).
5. Remove the relays (3), (4), (5).

(1) Screw

(4) Grass Container Relay

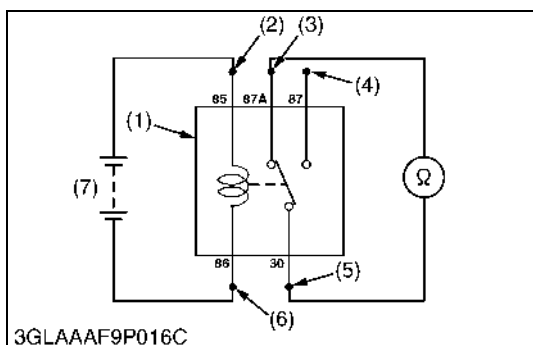
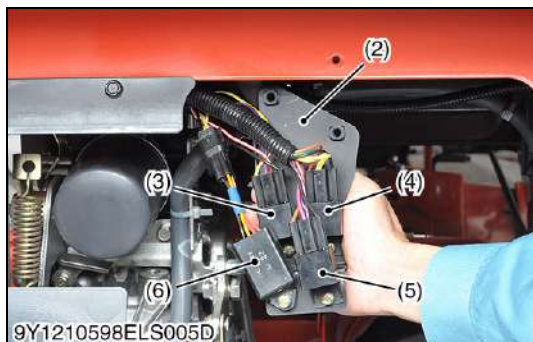
(2) Relay Stay

(5) Buzzer Relay

(3) Grass Container Full Switch Relay

(6) Delay Timer

9Y1210598ELS0039US0



Relay

1. Remove the relay (1) from the relay stay.
2. Connect jumper leads across the battery positive terminal and **85** terminal (2), and across the battery negative terminal and **86** terminal (6).
3. Connect leads of an ohmmeter to **87a** terminal (3) and **30** terminal (5).
4. Check continuity between **87a** terminal (3) and **30** terminal (5).
5. If continuity is 0 ohms, the relay is proper.

(1) Relay

(5) **30** Terminal

(2) **85** Terminal

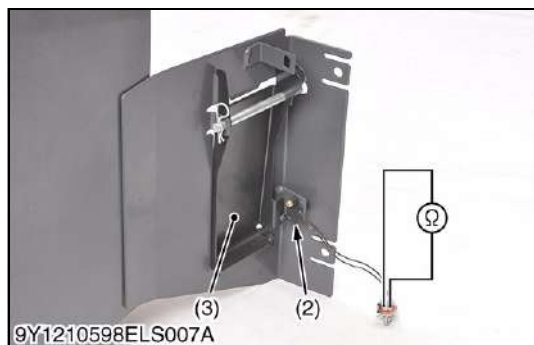
(6) **86** Terminal

(3) **87a** Terminal

(7) Battery (12V)

(4) **87** Terminal

9Y1210598ELS0029US0



Grass Container Full Switch Continuity [GR2120EU, GR2120F]

1. Remove the battery.
2. Dismount the grass container.
3. Remove the filter cover.
4. Disconnect the connector (1) from the grass container full switch (2).
5. Measure the resistance with an ohmmeter between the grass container full switch terminals.
6. If the grass container full switch is damaged, replace it.

Resistance (between switch terminals)	When the flap of switch is pushed	0 Ω
	When the flap of switch is released	Infinity

- (1) Connector (3) Flap
(2) Grass Container Full Switch

9Y1210598ELS0040US0

(5) Buzzer and Horn

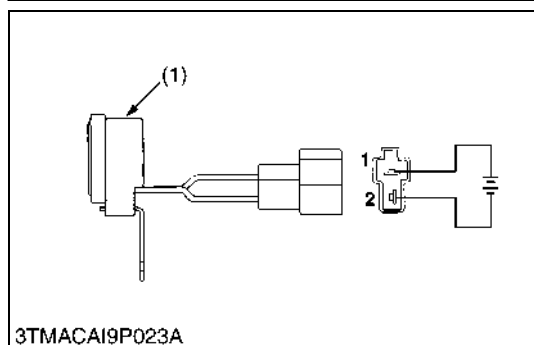


Buzzer [GR2120EU, GR2120F] and Overheat Horn

1. Remove the air intake net under the meter panel.
2. Disconnect the lead from buzzer (1), overhear horn (2).
3. Connect the jumper lead between the battery positive terminal and terminal 1 of connector.
4. Connect the jumper lead between the battery negative terminal and terminal 2 of connector.
5. If the buzzer, overhear horn does not whistle, replace it.

- (1) Buzzer 1: Terminal 1
(2) Overheat Horn 2: Terminal 2

9Y1210598ELS0041US0

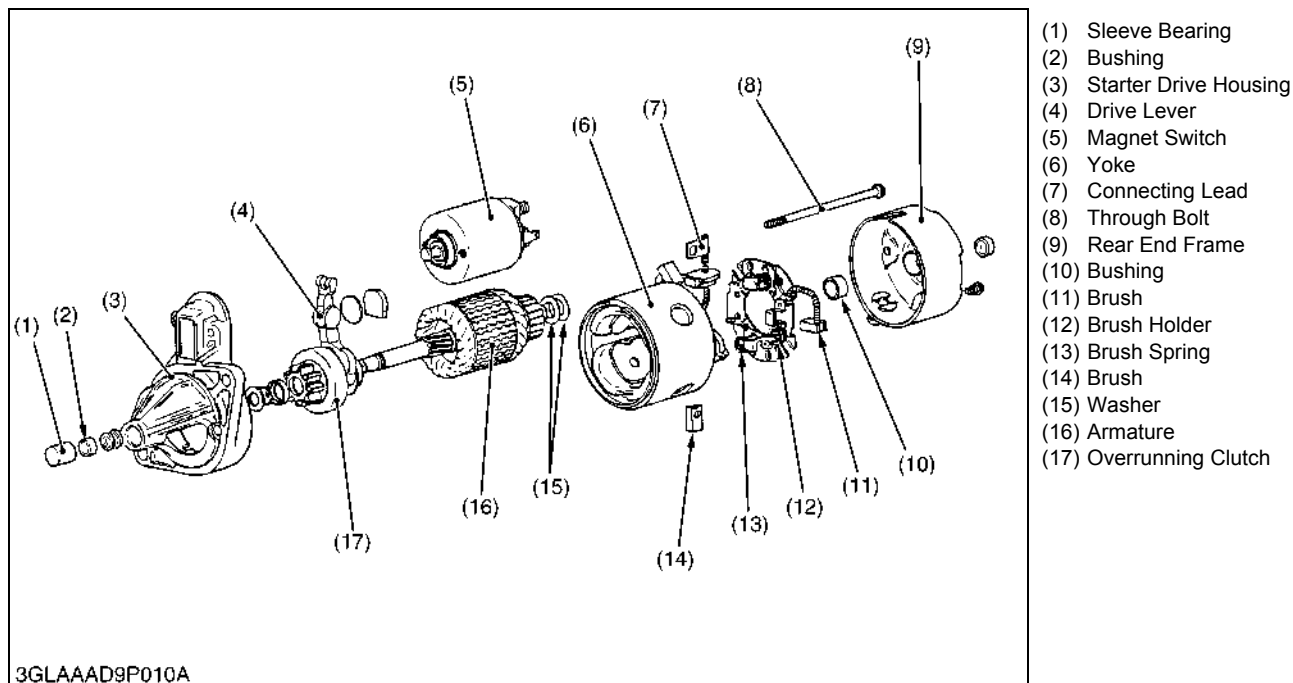


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5. DISASSEMBLING AND SERVICING

[1] DISASSEMBLING

(1) Starter



1. Disconnect the connecting lead (7).
2. Remove the magnetic switch (5).
3. Remove the rear end frame (9).
4. Remove the brush (11) from brush holder (12).
5. Remove the brush holder (12).
6. Pull out the yoke (6) from the starter drive housing (3).
7. Pull out the armature (16) with the drive lever (4).

■ NOTE

- Do not damage to the brush and commutator.

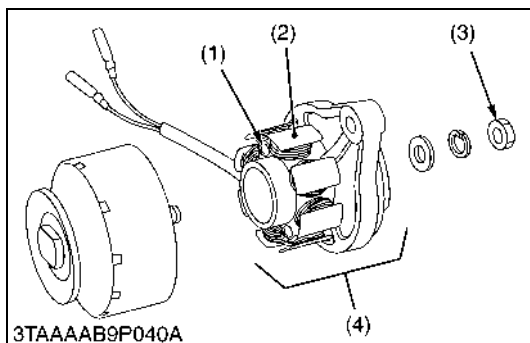
(When reassembling)

- Apply grease to spline teeth of the armature, bushing, pinion gear of the overrunning clutch and armature shaft.

Tightening torque	Starter C Terminal Nut	5.9 to 11.8 N·m 0.6 to 1.2 kgf·m 4.3 to 8.7 lbf·ft
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9Y1210598ELS0030US0

(2) Dynamo



Stator

1. Remove the nut (3) and separate the stator comp. (4).
2. Remove the screws (1) and remove the stator (2).

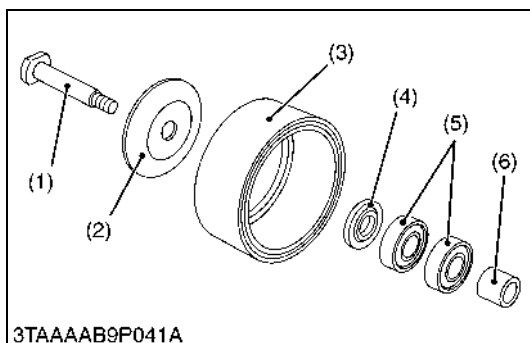
(When reassembling)

Tightening torque	Dynamo stator Nut	40 to 44 N·m 4.0 to 4.5 kgf·m 29 to 32 lbf·ft
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- (1) Screw
(2) Stator

- (3) Nut
(4) Stator Comp

9Y1210598ELS0031US0



Rotor

1. Tap out the shaft (1) from the rotor (3).

(When reassembling)

- Be careful the direction of the collar (4), the flat side should face to the pulley (2) side.

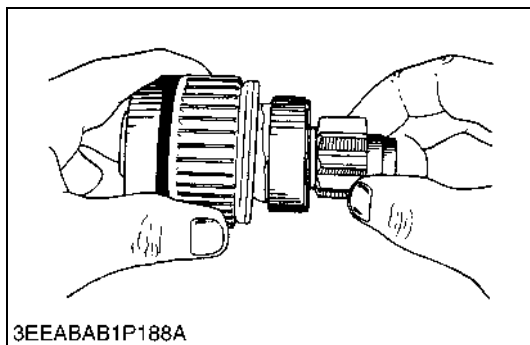
- (1) Shaft
(2) Pulley
(3) Rotor

- (4) Collar
(5) Bearings
(6) Collar

9Y1210598ELS0032US0

[2] SERVICING

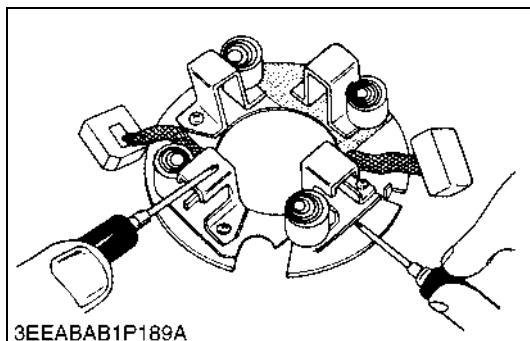
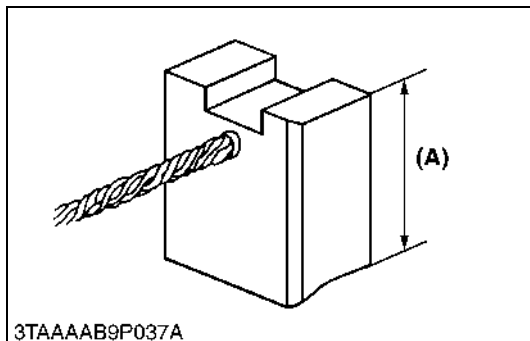
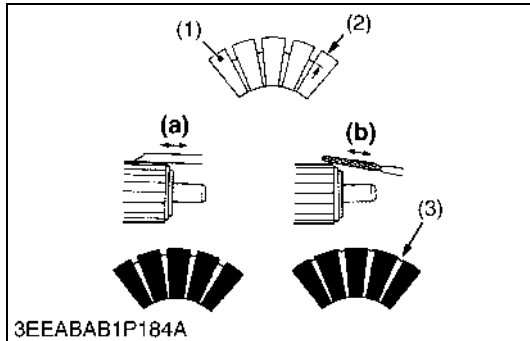
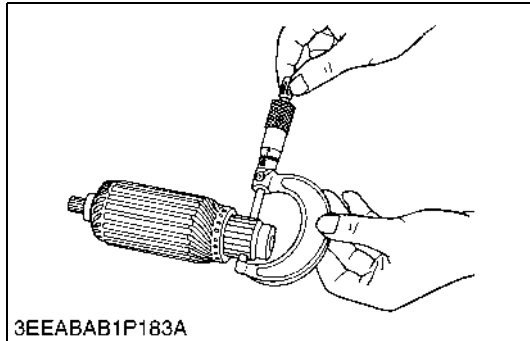
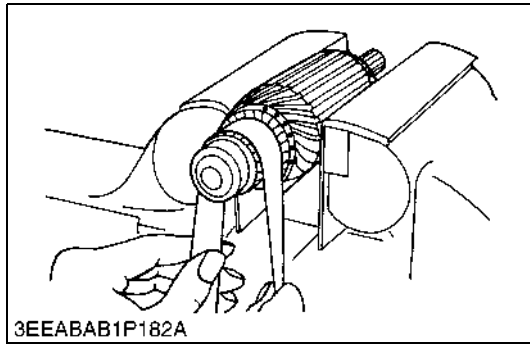
(1) Starter



Overrunning Clutch

1. Inspect the pinion for wear or damage.
2. If there is any defect, replace the overrunning clutch assembly.
3. Check that the pinion turns freely and smoothly in the overrunning direction and does not slip in the cranking direction.
4. If the pinion slips or does not rotate in the both directions, replace the overrunning clutch assembly.

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Commutator and Mica

1. Check the contact face of the commutator for wear, and grind the commutator with emery paper if it is slightly worn.
2. Measure the commutator O.D. with an outside micrometer at several points.
3. If the minimum O.D. is less than the allowable limit, replace the armature.
4. If the difference of the O.D.'s is more than the allowable limit, correct the commutator on a lathe to the factory specification.
5. Measure the mica undercut.
6. If the undercut is less than the allowable limit, correct it with a saw blade and chamfer the segment edges.

Commutator O.D.	Factory specification	28.0 mm 1.10 in.
	Allowable limit	27.0 mm 1.06 in.

Difference of O.D.'s	Factory specification	Less than 0.05 mm 0.002 in.
	Allowable limit	0.4 mm 0.016 in.

Mica undercut	Factory specification	0.50 to 0.80 mm 0.020 to 0.031 in.
	Allowable limit	0.2 mm 0.008 in.

- (1) Segment
(2) Undercut
(3) Mica

- (a) **Correct**
(b) **Incorrect**

9Y1210598ELS0033US0

Brush Wear

1. If the contact face of the brush is dirty or dusty, clean it with emery paper.
2. Measure the brush length (A) with vernier calipers.
3. If the length is less than the allowable limit, replace the yoke assembly and brush holder.

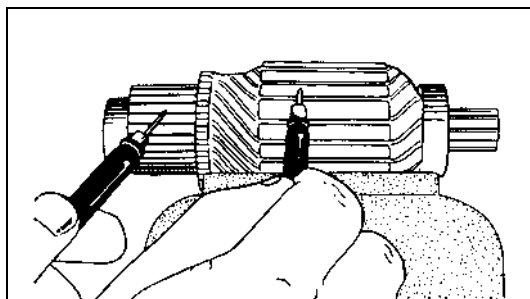
Brush length (A)	Factory specification	16.0 mm 0.630 in.
	Allowable limit	10.5 mm 0.413 in.

9Y1210598ELS0034US0

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.

9Y1210598ELS0035US0

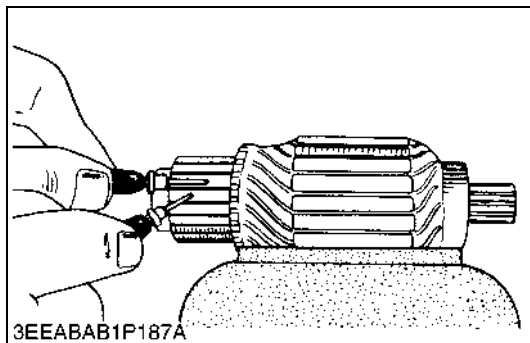


3EEABAB1P186A

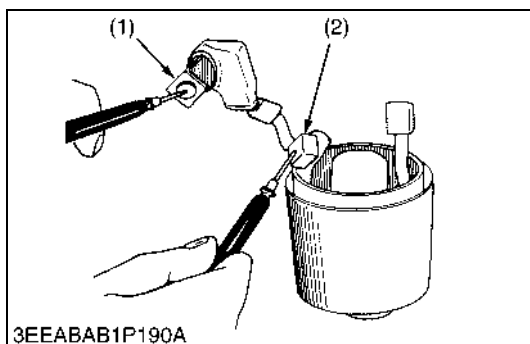
Armature Coil

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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3EEABAB1P187A



3EEABAB1P190A

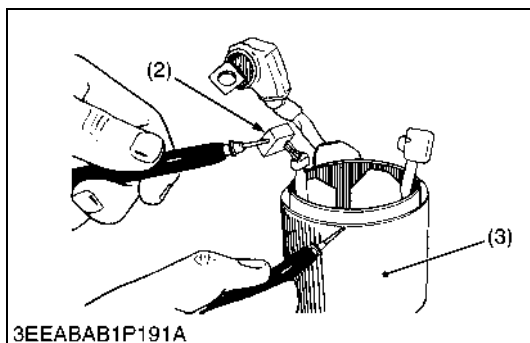
Field Coil

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.

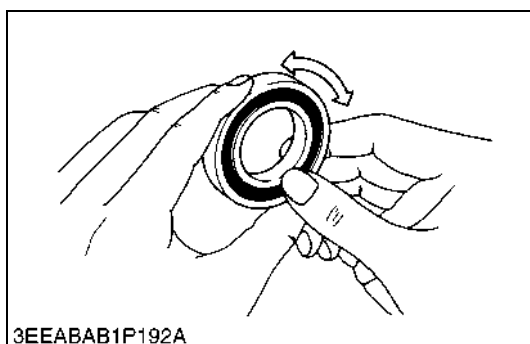
(1) Lead
(2) Brush

(3) Yoke

WSM000001ELS0038US0



3EEABAB1P191A

(2) Dynamo

3EEABAB1P192A

Bearing

1. Check the bearing for smooth rotation.
2. If it does not rotate smoothly, replace it.

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8 MOWER

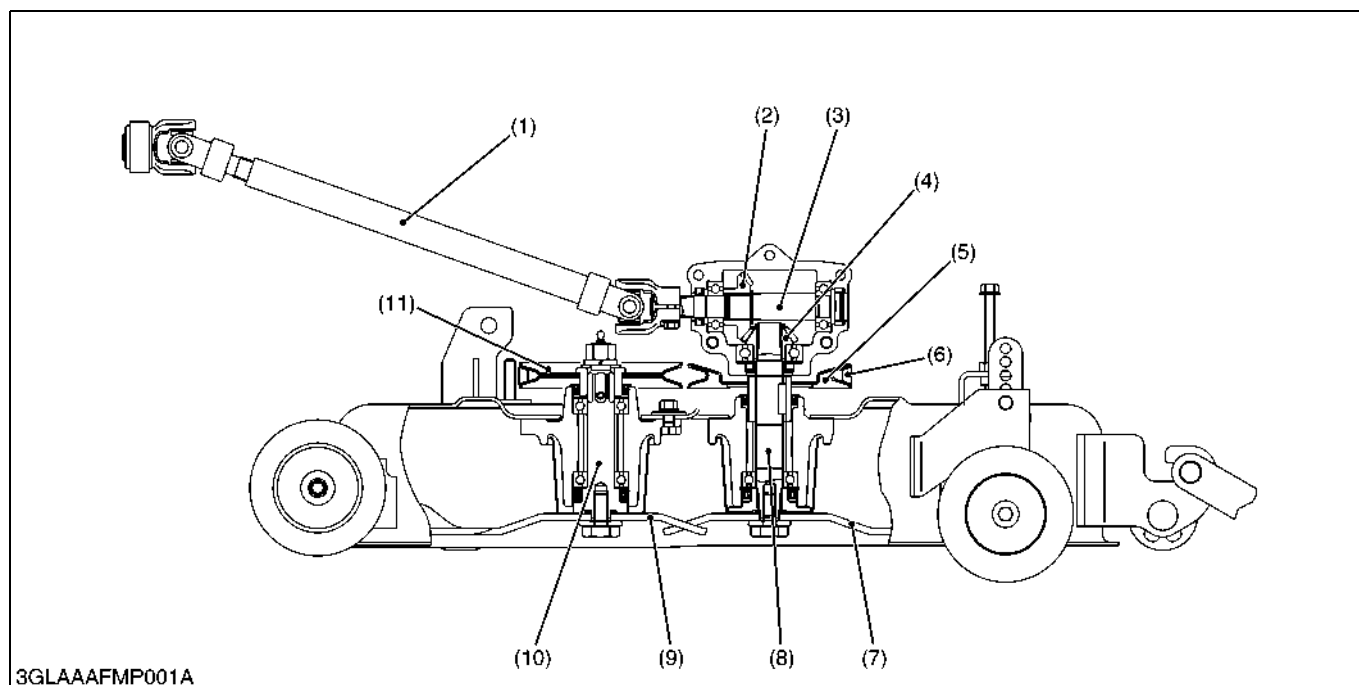
MECHANISM

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[2] RCK48GR-II	8-M2
2. LIFTING MECHANISM	8-M3

1. POWER TRANSMISSION

[1] RCK48SGR



- | | | | |
|---------------------|--------------------|------------------------|------------------------|
| (1) Universal Joint | (4) 16T Bevel Gear | (7) Center Blade | (10) Outer Blade Shaft |
| (2) 21T Bevel Gear | (5) Center Pulley | (8) Center Blade Shaft | (11) Outer Pulley |
| (3) Input Shaft | (6) Mower Belt | (9) Outer Blade | |

The power is transmitted from PTO shaft to blades as follows.

■ Center Blade

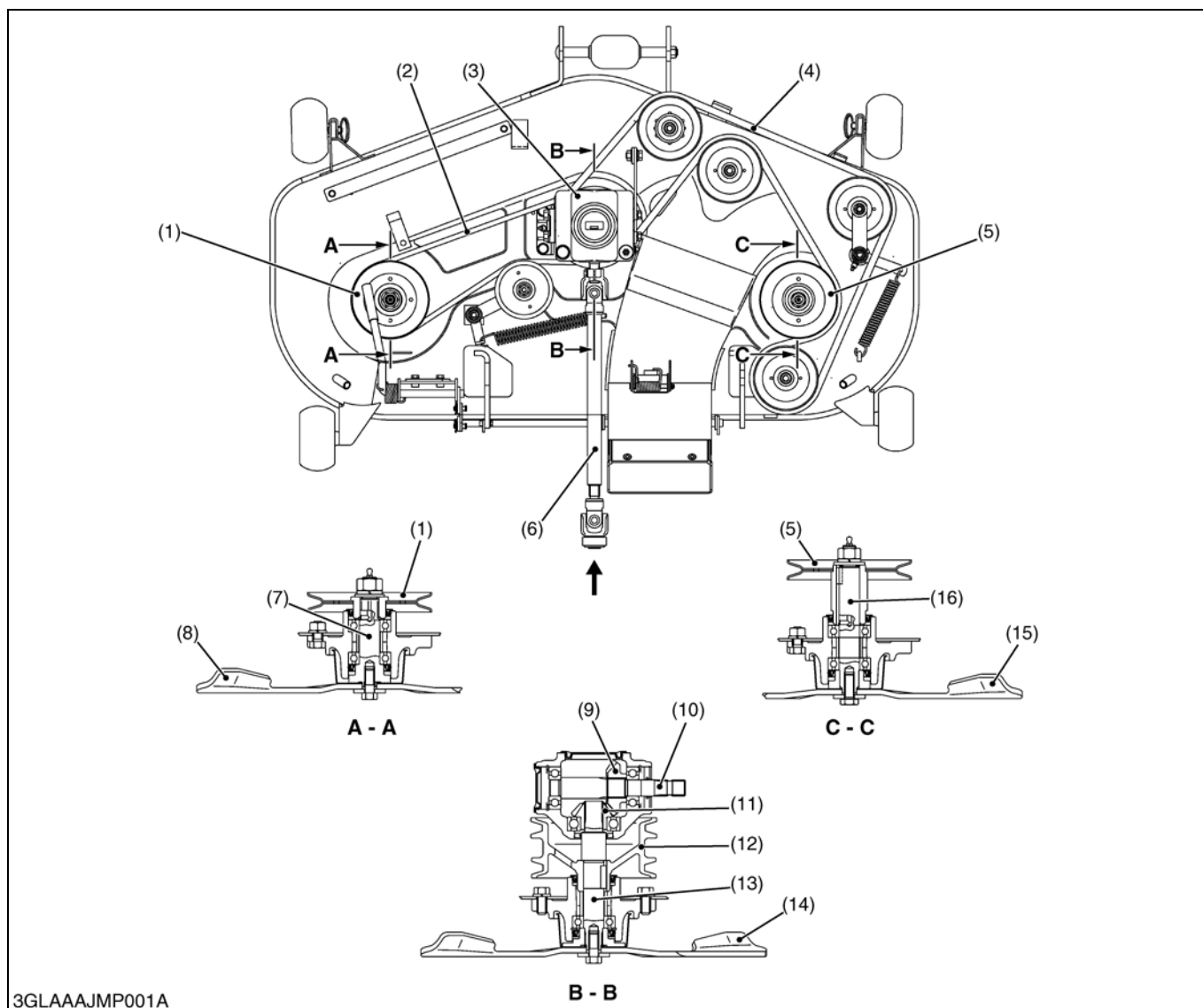
PTO Shaft → Universal Joint (1) → Input Shaft (3) → 21T Bevel Gear (2) → 16T Bevel Gear (4) → Center Blade Shaft (8) → Center Blade (7)

■ Outer Blade

PTO Shaft → Universal Joint (1) → Input Shaft (3) → 21T Bevel Gear (2) → 16T Bevel Gear (4) → Center Blade Shaft (8) → Center Pulley (5) → Mower Belt (6) → Outer Pulley (11) → Outer Blade Shaft (10) → Outer Blade (9)

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[2] RCK48GR-II



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- | | | | |
|-----------------------------|-----------------------------|--------------------------|-------------------------------|
| (1) Left Side Blade Pulley | (5) Right Side Blade Pulley | (9) 21T Spiral Gear | (13) Bevel Gear Shaft |
| (2) Mower Belt (Left Side) | (6) Universal Joint | (10) Input Shaft | (14) Center Blade |
| (3) Gear Box | (7) Blade Shaft (Left Side) | (11) 16T Spiral Gear | (15) Right Side Blade |
| (4) Mower Belt (Right Side) | (8) Left Side Blade | (12) Center Blade Pulley | (16) Blade Shaft (Right Side) |

The power is transmitted from transaxle case to blades as follows.

■ Center Blade

PTO Shaft → Universal Joint (6) → Input Shaft (10) → 21T Spiral Gear (9) → 16T Spiral Gear (11) → Bevel Gear Shaft (13) → Center Blade (14)

■ Left Side Blade

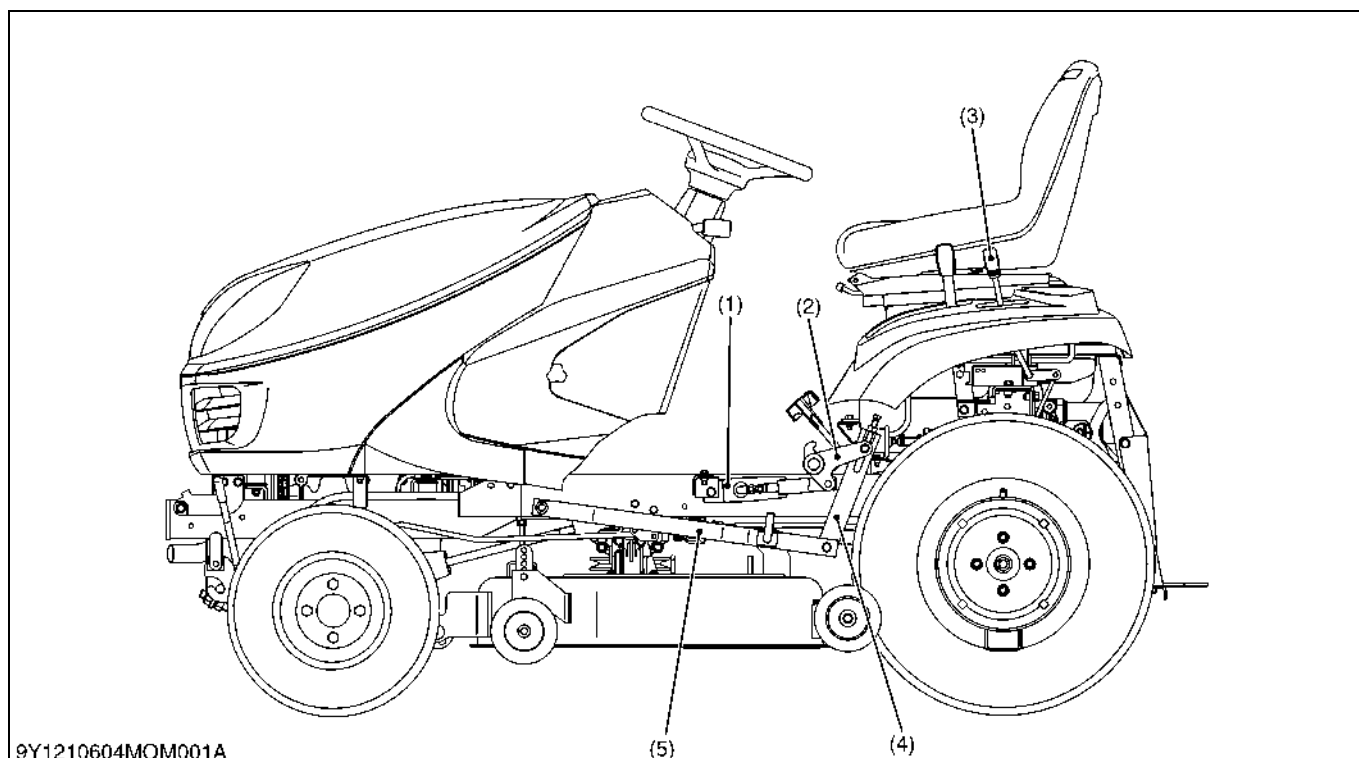
PTO Shaft → Universal Joint (6) → Input Shaft (10) → 21T Spiral Gear (9) → 16T Spiral Gear (11) → Bevel Gear Shaft (13) → Center Blade Pulley (12) → Mower Belt (Left Side) (2) → Left Side Blade Pulley (1) → Blade Shaft (Left Side) (7) → Left Side Blade (8)

■ Right Side Blade

PTO Shaft → Universal Joint (6) → Input Shaft (10) → 21T Spiral Gear (9) → 16T Spiral Gear (11) → Bevel Gear Shaft (13) → Center Blade Pulley (12) → Mower Belt (Right Side) (4) → Right Side Blade Pulley (5) → Blade Shaft (Right Side) (16) → Right Side Blade (15)

9Y1210598MOM0002US0

2. LIFTING MECHANISM



9Y1210604MOM001A

(1) Lift Cylinder
(2) Lift Link Shaft

(3) Hydraulic Lift Lever

(4) Lift Link

(5) Rear Link

The lifting of mower is by the hydraulic system on the machine.

To prevent danger, the mower must keep lifting when traveling. When the hydraulic lift lever (3) is moved to **"LIFT"** position, the lift links (4) are risen with lift link shaft (2) by the oil pressure of hydraulic system.

Therefore, rear links (5) are lifted at the same time.



CAUTION

- Never operate mower in transport position.

9Y1210598MOM0003US0

SERVICING

CONTENTS

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(1) RCK48SGR	8-S20
(2) RCK48GR-II	8-S20

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Blade Does Not Turn	PTO system malfunctioning	Check transmission	2-S12, 2-S29
	Broken mower belt	Replace mower belt	G-49
Blade Speed is Slow	Loosen mower belt	Replace mower belt or tension spring	G-49
	Clogged grass	Remove grass	–
	Flattened out or worn cup washer	Replace cup washer	8-S11, 8-S14
	Engine rpm too low	Mow at full throttle, check and reset engine rpm	–
Cutting is Poor	Worn or bent mower blade	Sharpen or replace mower blade	G-47, 8-S11
	Loosen mower blade screw	Retighten mower blade screw	8-S11
	Cutting height improper	Adjust cutting height	8-S7
	Ground speed too fast	Slow-down	–
	Low wheel inflation	Add air to correct	G-20
	Anti-scalp rollers not adjusted correctly	Adjust anti-scalp rollers	8-S5
Mower Does Not Lift	Broken linkage system	Replace linkage system	6-S9
	Trouble of hydraulic system	Check hydraulic system	6-S1
Discharge Chute Plugged	Grass too wet	–	–
	Grass too long	–	–
	Cutting too low	Adjust cutting height	8-S7
	Engine rpm too low	Mow at full throttle, check and reset engine rpm	–
	Ground speed too fast	Slow-down	–
	Restricted airflow	–	–
Streaking of Uncut Grass	Ground speed too fast	Slow-down	–
	Engine rpm too low	Mow at full throttle, check and reset engine rpm	–
	Grass too long	–	–
	Blades dull or damaged	Sharpen or replace mower blade	G-47, 8-S11
	Debris in mower deck	Remove	–
Uneven Cut	Mower deck not level	Adjust	8-S7

Symptom	Probable Cause	Solution	Reference Page
Blades Scalping Grass	Cutting height too low	Adjust	8-S7
	Blades speed too fast	Slow-down	–
	Ridges in terrain	–	–
	Rough or uneven terrain	–	–
	Bent blade(s)	Repair, replace	8-S11
	Low tire inflation	Add air	G-20

9Y1210598MOS0001US0

2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Left Tip of Blade to Right Tip of Blade	Difference	Less than 3.0 mm 0.12 in.	—
Front Tip of Blade to Rear Tip of Blade	Difference	Less than 5.0 mm 0.20 in.	—
Bevel Gear	Backlash	0.13 to 0.25 mm 0.0052 to 0.0098 in.	0.40 mm 0.16 in.

9Y1210598MOS0002US0

3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: See page "5. TIGHTENING TORQUES" on page G-12.)

RCK48SGR

Item	N·m	kgf·m	lbf·ft
Mower blade screw	103 to 117	10.5 to 12.0	76.0 to 86.7
Gear box mounting screw (for aluminum gear case)	40 to 44	4.0 to 4.5	29 to 32
Gear box bracket mounting screw and nut	48 to 55	4.9 to 5.7	36 to 41
Gear box screw	24 to 27	2.4 to 2.8	18 to 20
Outer Pulley mounting nut	103 to 117	10.5 to 12.0	76.0 to 86.7
Pulley holder mounting screw	48 to 55	4.9 to 5.7	36 to 41

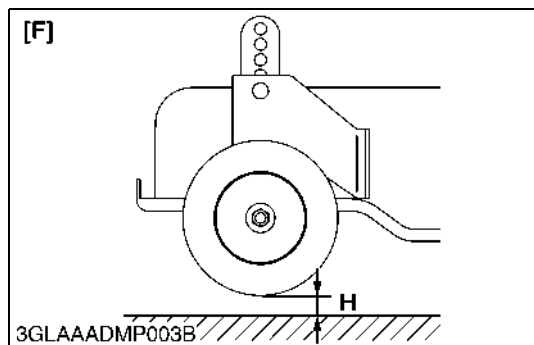
RCK48GR-II

Item	N·m	kgf·m	lbf·ft
Mower blade screw	103 to 118	10.5 to 12.0	76.0 to 86.7
Gear box mounting screw LH (Reamer)	78 to 90	7.9 to 9.2	58 to 66
Gear box mounting screw RH	78 to 90	7.9 to 9.2	58 to 66
Gear box stay mounting screw LH (Reamer)	78 to 90	7.9 to 9.2	58 to 66
Gear box stay mounting screw RH	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Center blade pulley holder mounting screw	78 to 90	7.9 to 9.2	58 to 66
Pulley mounting nut (Right side)	89 to 117	9.0 to 12.0	65 to 86.7
Pulley mounting nut (Left side)	103 to 118	10.5 to 12.0	76.0 to 87.0
Pulley holder mounting screw	78 to 90	7.9 to 9.2	58 to 66
Tension pulley mounting screw and nut (Right side)	109 to 130	11.1 to 13.3	80.3 to 96.1
Tension pulley mounting screw and nut (Left side)	47 to 56	4.8 to 5.8	35 to 41
Tension arm mounting screw (Only left side) and nut	78 to 90	7.9 to 9.2	58 to 66

9Y1210598MOS0003US0

4. CHECKING AND ADJUSTING

[1] ANTI-SCALP ROLLERS



Adjusting Anti-scalp Rollers

■ IMPORTANT

- To get the flattest cut, adjust the anti-scalp rollers off the ground.

Check anti-scalp roller adjustments each time the mower deck cutting height is changed.

We recommend that all the anti-scalp rollers keep off the ground to keep scuffing minimum.

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

	Inflation Pressure
Front wheel	200 kPa, 2.0 kgf/cm ² , 29 psi
Rear wheel	140 kPa, 1.4 kgf/cm ² , 20 psi

- Start the engine.
- Lift up the mower deck to the transport position.
(Also the top end of the lift.)
- Turn the cutting height control dial to adjust height.
- Lower the mower deck.

■ Front side anti-scalp roller

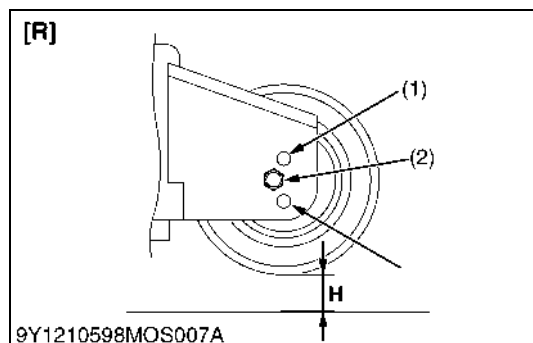
- Adjust height "H" of the front side anti-scalp roller to one of holes to approximately 6 to 13 mm (1/4 to 1/2 in.) between rollers and ground. Adjust both side rollers to the same height.
- Install the roller with attaching hardware.

[F] Front

H: Height 6 to 13 mm (1/4 to 1/2 in.)

(To be continued)

(Continued)



■ Rear side anti-scalp roller

8. Adjust height "H" of the rear side anti-scalp roller to one of holes to approximately 19 mm (0.75 in.) between rollers and ground. Adjust both side rollers to the same height.
9. Install the roller with attaching hardware.

Reference

- Set the position for a recommended ground clearance of 19 mm (3/4 in.).
(Figure shows a setting position of cutting height 50 or 55 mm (2.0" or 2.25"))

Cutting height inch (mm)	Position of bolts	(Ref.) Ground clearance between rollers and the ground
1" (25) *1	(1)	6 mm (0.2 in.)
1.25" (32) *2		12.4 mm (0.5 in.)
1.5" (38)		19.0 mm (0.7 in.)
1.75" (44)		25.4 mm (1.0 in.)
2.0" (50)	(2)	19.0 mm (0.7 in.)
2.25" (58)		25.4 mm (1.0 in.)
2.5" (64)	(3)	19.0 mm (0.7 in.)
2.75" (70)		25.4 mm (1.0 in.)
3.0" (76) *3		(31.8 mm) (1.3 in.)
3.5" (89) *3		(44.6 mm) (1.8 in.)
4.0" (102) *3		(57.4 mm) (2.3 in.)

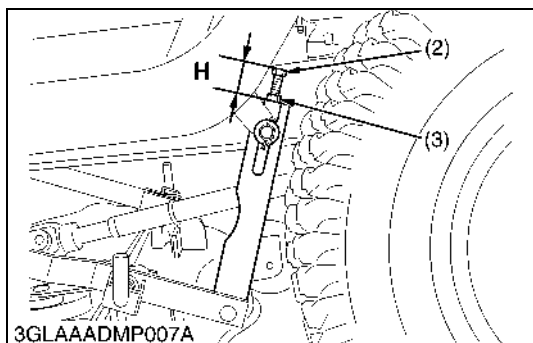
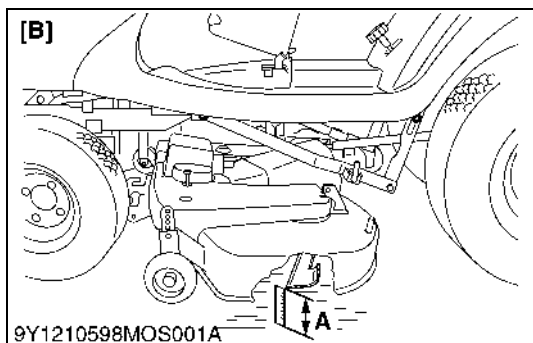
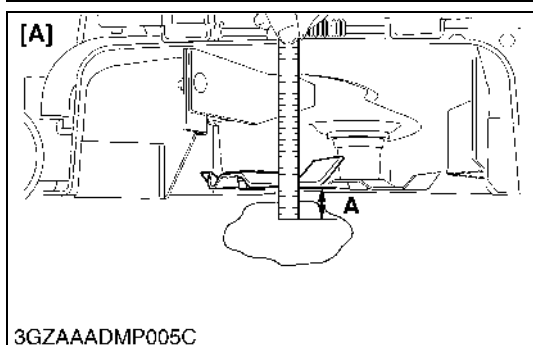
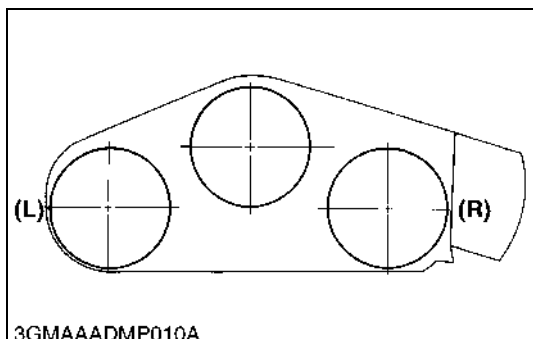
- *1: Cutting height 1" is a ground clearance of 6 mm.
- *2: Cutting height 1.25" is a ground clearance of 12.4 mm.
- *3: For cutting height above 3.0". The anti-scalp rollers will still be effective against scalping.

[R] Rear [RCK48SGR]

H: Height 19 mm (0.75 in.)

9Y1210598MOS0004US0

[2] CUTTING HEIGHT



Adjusting Left and Right Cutting Height

1. Park the machine on level surface.
2. Wheel pressure must be correct.
3. Lift up the mower deck to the transport position. (Also the top end.)
4. Turn the cutting height control dial (1) to the "3" position.
5. Place 51 mm (2 in.) height wood blocks under each side of the mower deck.
Anti-scalp rollers must not rest on the wood block.
6. Lower the mower deck.
7. Position mower blade in the Side-to-Side position.
8. Measure the heights of blade (L) and (R) from the ground surface and calculate the difference.
9. If the difference between left tip and right tip of blade is not within the factory specification, adjust the length of cutting height fine tuning bolt (2).

Difference (L) - (R) between left tip and right tip of blade	Factory specification	Less than 3.0 mm 0.12 in.
--	-----------------------	---------------------------------

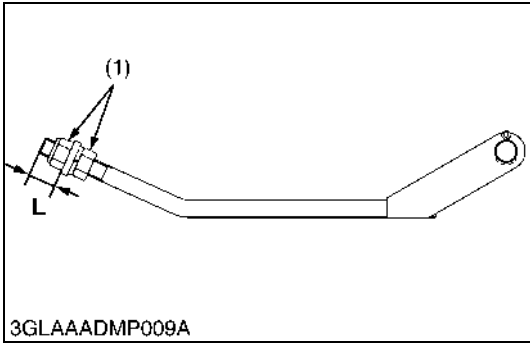
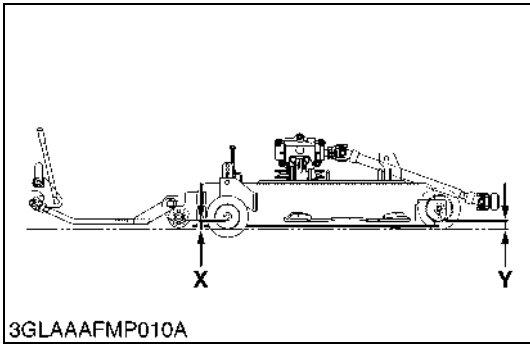
(Reference)

- Length of cutting height fine tuning bolt "H":
46.0 to 54.0 mm (1.82 to 2.12 in.)

- (1) Cutting Height Control Dial
- (2) Cutting Height Fine Tuning Bolt
- (3) Lock Nut

- (L) Left Blade Measurement Position
- (R) Right Blade Measurement Position
- A: Blade Height
- [A] RCK48SGR
- [B] RCK48GR-II

9Y1210598MOS0005US0



Adjusting Parallel Linkage [RCK48SGR, RCK48GR-II]

- 1. Park the machine on a level surface.
- 2. Wheel pressure must be correct.
- 3. Adjust the cutting height so that blade is level.
- 4. Position mower blade in the Front-to-Rear position.
- 5. Measure the height of blade **X** and **Y** from the ground surface and calculate the difference.
- 6. If the difference between front tip and rear tip of blade is not within the factory specification, adjust the length "**L**" of front link with lock nut (1).

Difference (X - Y) between front tip and rear tip of blade	Factory specification	Less than 5.0 mm 0.20 in.
--	-----------------------	---------------------------------

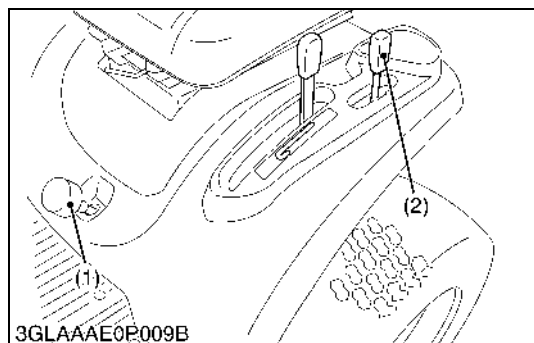
(Reference)

- "**L**": 26 to 28 mm (1.03 to 1.10 in.)
- (1) Lock Nut
- X: Height of Blade Tip (Front)**
Y: Height of Blade Tip (Rear)
- 9Y1210598MOS0006US0

5. DISASSEMBLING AND ASSEMBLING

[1] PREPARATION

(1) Dismounting Mower



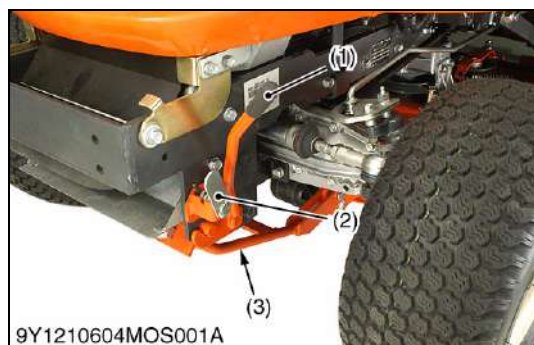
Cutting Height Adjusting Dial

1. Park the machine on level ground, and stop the engine.
2. Set the cutting height adjusting dial (1) to "1" position.
3. Set the front anti-scalp rollers at the top position.
4. Lower the mower deck on level ground by hydraulic lift lever (2).

(1) Cutting Height Adjusting Dial

(2) Hydraulic Lift Lever

9Y1210598MOS0007US0



Front Link

1. Pull the lever fulcrum fixing pin (2) and turn it counterclockwise to lock.
2. Push down the link fixing lever (1).
3. Remove the front link (3) from the mower deck.

(When reassembling)

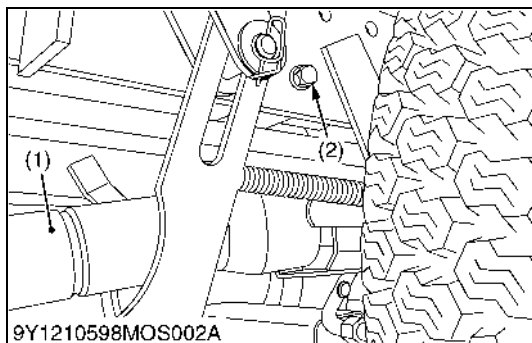
- When you attach the front link, make sure the length of the front link.

(1) Link Fixing Lever

(3) Front Link

(2) Lever Fulcrum Fixing Pin

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Universal Joint

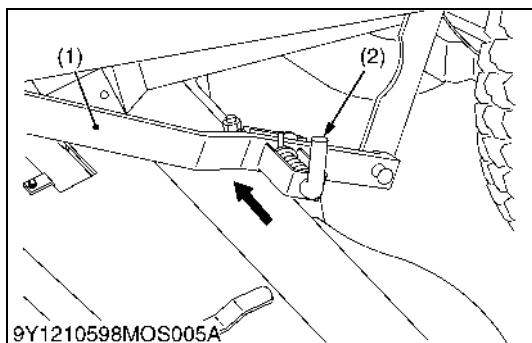
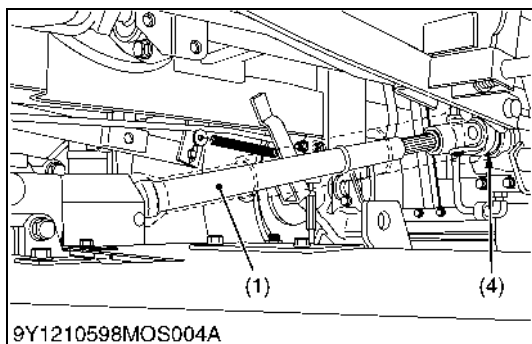
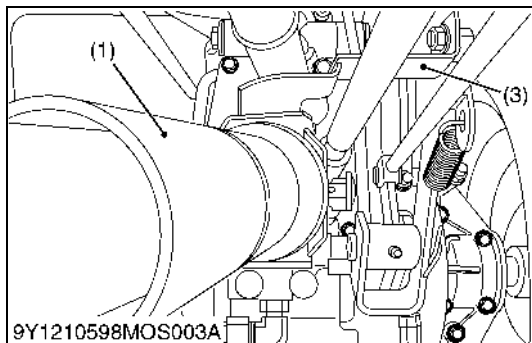
1. Remove the bolt (2) and stay (3) from the frame.
Pull down the universal joint cover (1) and show the coupler (4).
2. Unlock the coupler and disconnect the universal joint.

(When reassembling)

- Apply grease to the spline of PTO shaft.
- Slide the universal joint back and front to make sure the universal joint is locked securely.

- | | |
|---------------------------|-------------|
| (1) Universal Joint Cover | (3) Stay |
| (2) Bolt | (4) Coupler |

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Rear Link

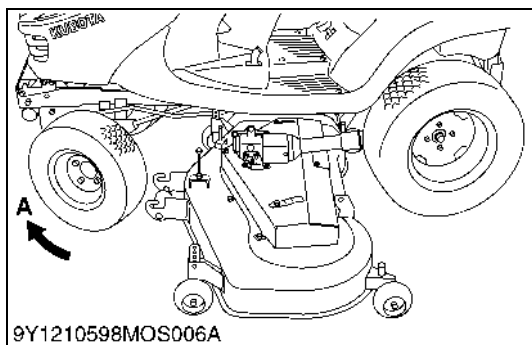
1. Disconnect the rear link (1) from the mower deck, pulling the L-pins (2).
2. Lift the mower lift lever and lock in the lift position.

(When reassembling)

- When attaching the rear links, make sure the length of the rear links.

- | | |
|---------------|-----------|
| (1) Rear Link | (2) L-pin |
|---------------|-----------|

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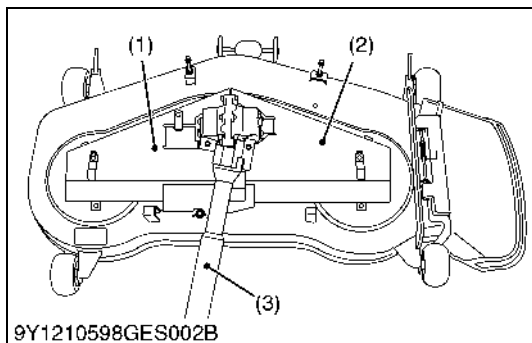
Dismounting Mower

1. Turn the front wheel to the right.
2. Pull out the mower deck to the left.

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[2] DISASSEMBLING AND ASSEMBLING

(1) RCK48SGR



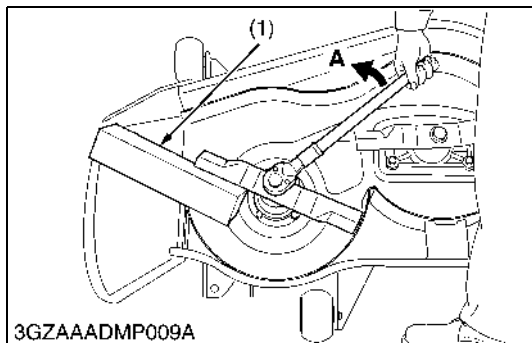
Universal Joint and Belt Covers

1. Remove the universal joint (3).
2. Remove the left and right belt covers (1), (2).

(1) Belt Cover (LH)
(2) Belt Cover (RH)

(3) Universal Joint

9Y1210598MOS0011US0



Mower Blades (Center Blade and Outer Blades)

1. Turn over the mower.
2. Remove the mower blade screw (7), and remove the lock washer (6), cup washer (5), mower blade (4) and dust cover (3).

NOTE

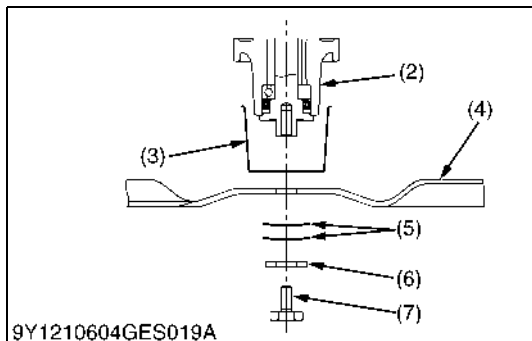
- To remove the blade securely, put a wooden block (1) between one blade and the mower deck in such position that it will hold the blade safely while loosening the blade screw.

(When reassembling)

- Be sure to assemble the cup washers (5) and lock washer (6) between the mower blade (4) and mower blade screw (7).

IMPORTANT

- Make sure the cup washers (5) is not flattened out or worn, causing blade to slip easily.
Replace plate spring if it is damaged.



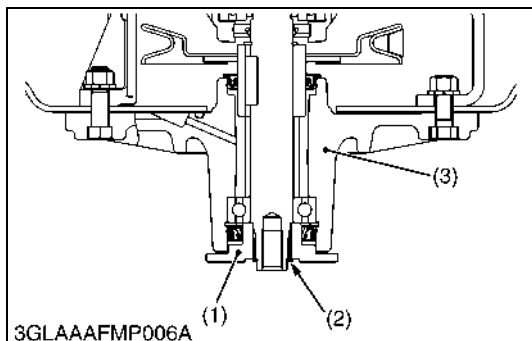
Tightening torque	Mower blade screw	103 to 117 N·m 10.5 to 12.0 kgf·m 76.0 to 86.7 lbf·ft
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(1) Wooden Block
(2) Spindle Holder
(3) Dust Cover
(4) Mower Blade
(5) Cup Washer

(6) Lock Washer
(7) Mower Blade Screw

A: Loosen

9Y1210598MOS0012US0



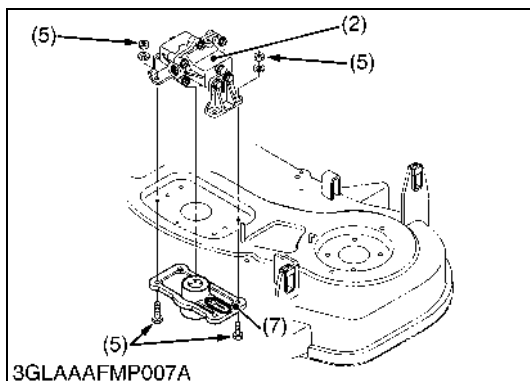
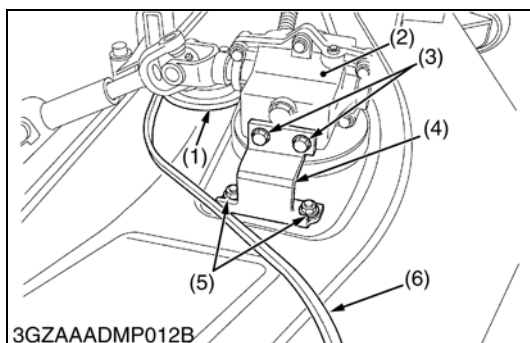
Spline Boss

1. Remove the external snap ring (2).
2. Remove the spline boss (1).

(1) Spline Boss
(2) External Snap Ring

(3) Center Pulley Holder

9Y1210598MOS0013US0



Gear Box and Mower Belt

1. Clean around the gear box.
2. Remove the belt from the tension pulley.
3. Remove the gear box bracket (RH) (4) and slip the belt (6) over the top of gear box.
4. Remove the gear box bracket (LH).
5. Remove the gear box and center pulley holder (7).

Tightening torque	Gear box mounting screw (for aluminum gear case)	40 to 44 N·m 4.0 to 4.5 kgf·m 29 to 32 lbf·ft
	Gear box bracket mounting screws and nut	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft

- | | |
|-----------------------------|---|
| (1) Tension Pulley | (5) Gear Box Bracket Mounting Screw and Nut |
| (2) Gear Box | (6) Belt |
| (3) Gear Box Mounting Screw | (7) Center Pulley Holder |
| (4) Gear Box Bracket (RH) | |

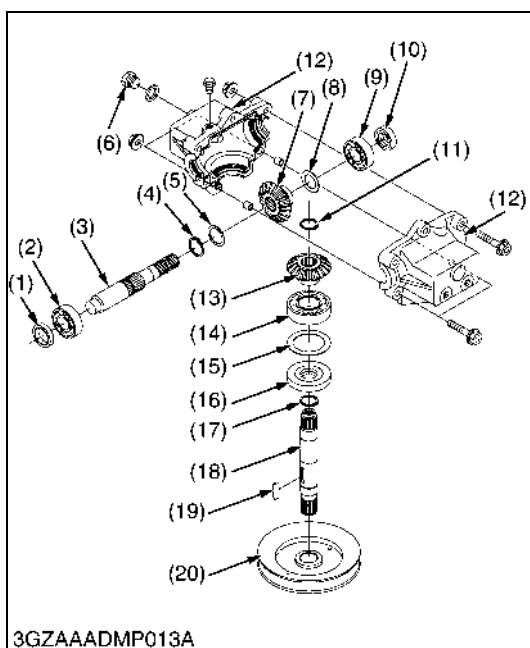
9Y1210598MOS0014US0

Disassembling Gear Box

1. Remove the drain plug (6), and drain the gear box oil.
2. Remove the center pulley (20) with a puller, and remove the feather key (19) from the blade shaft (18).
3. Open the bevel gear cases (12).
4. Remove the input shaft (3) and the blade shaft (18).
5. Remove the oil seal (10), ball bearings (2), (9), bevel gear (7), shims (5), (8) and external cir clip (4) from the input shaft (3).
6. Remove the external snap ring (11), bevel gear (13), ball bearing (14), shim (15) and oil seal (16) from the blade shaft (18).
7. Remove the external snap ring (17) from the blade shaft (18).

(When reassembling)

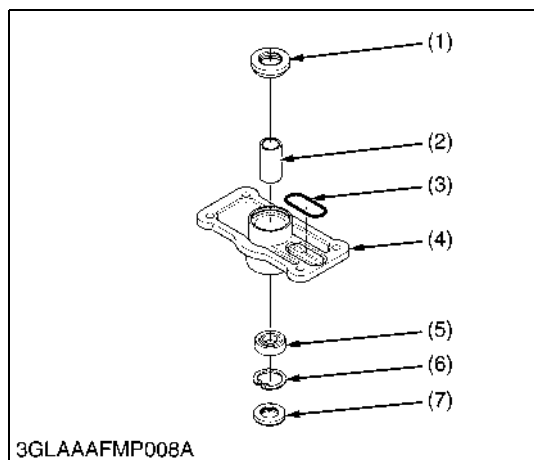
- Replace the oil seals (10), (16) and plug (1) with new ones.
- Check the backlash and turning torque.
If not proper, adjust with the shims.
- After cleaning dirty and gear box oil and the gear box surface, apply the liquid gasket.



Tightening torque	Gear box screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft

- | | |
|-----------------------|-------------------------|
| (1) Plug | (11) External Snap Ring |
| (2) Ball Bearing | (12) Bevel Gear Case |
| (3) Input Shaft | (13) Bevel Gear |
| (4) External Cir Clip | (14) Ball Bearing |
| (5) Shim | (15) Shim |
| (6) Drain Plug | (16) Oil Seal |
| (7) Bevel Gear | (17) External Snap Ring |
| (8) Shim | (18) Blade Shaft |
| (9) Ball Bearing | (19) Feather Key |
| (10) Oil Seal | (20) Center Pulley |

9Y1210598MOS0015US0



Disassembling Center Pulley Holder

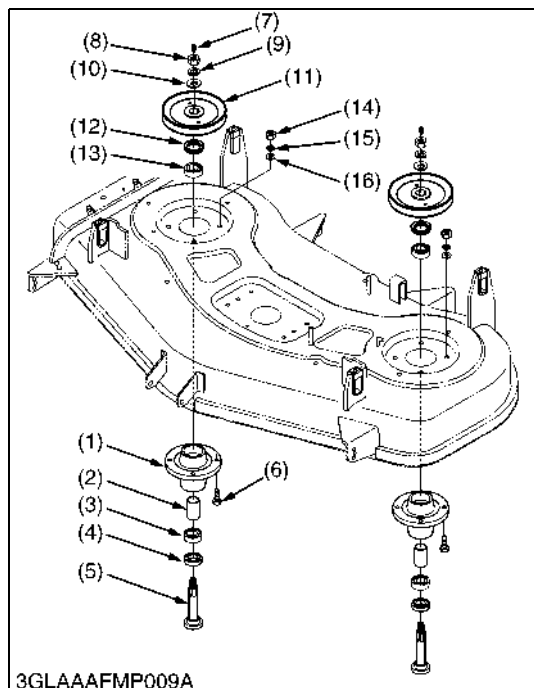
1. Remove the upper oil seal (1) and lower oil seal (7).
2. Remove the collar (2), internal cir clip (6) and ball bearing (5).

(When reassembling)

- Replace the oil seals (1), (7) with new ones.

- | | |
|--------------------------|-----------------------|
| (1) Upper Oil Seal | (5) Ball Bearing |
| (2) Collar | (6) Internal Cir Clip |
| (3) O-ring | (7) Lower Oil Seal |
| (4) Center Pulley Holder | |

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Disassembling Outer Pulley Holder

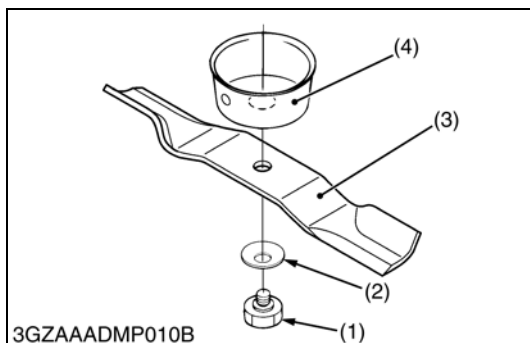
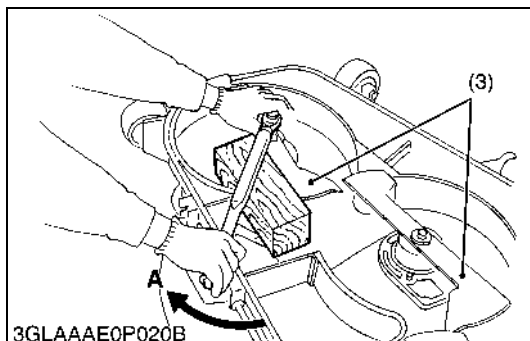
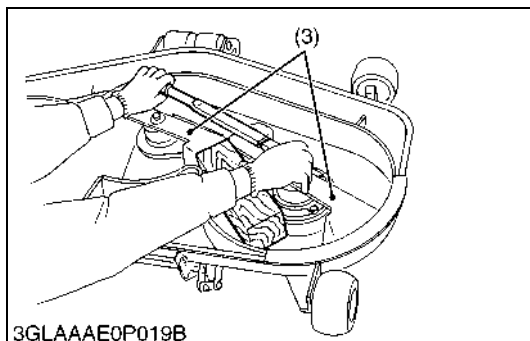
1. Remove the outer pulley mounting nut (8), and remove the outer pulley (11).
2. Remove the pulley holder mounting screws (6), and separate the right pulley holder (1) from the mower deck.
3. Tap out the blade shaft (5).
4. Remove the oil seals (4), (12).
5. Remove the ball bearings (3), (13) and collar (2) from the pulley holder (1).
6. Remove the left pulley holder and blade shaft as above.

Tightening torque	Outer pulley mounting nut	103 to 117 N·m 10.5 to 12.0 kgf·m 76.0 to 86.7 lbf·ft
	Pulley holder mounting screw	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft

- | | |
|---------------------------------|---------------------|
| (1) Pulley Holder | (9) Spring Washer |
| (2) Collar | (10) Plain Washer |
| (3) Ball Bearing | (11) Outer Pulley |
| (4) Lower Oil Seal | (12) Upper Oil Seal |
| (5) Blade Shaft | (13) Ball Bearing |
| (6) Pulley Holder Housing Screw | (14) Nut |
| (7) Grease Fitting | (15) Spring Washer |
| (8) Outer Pulley Mounting Nut | (16) Plain Washer |

9Y1210598MOS0017US0

(2) RCK48GR-II



Mower Blades

1. Turn over the mower.
2. Remove the mower blade screw (1), and remove the plate spring (2), mower blade (3) and dust cover (4).

■ NOTE

- To remove the blade securely, put a block of wood between one blade and the mower deck in such position that it will hold the blade safely while loosening the blade screw.

(When reassembling)

- Be sure to assemble the plate spring (2) between the mower blade (3) and the mower blade screw (1).

■ IMPORTANT

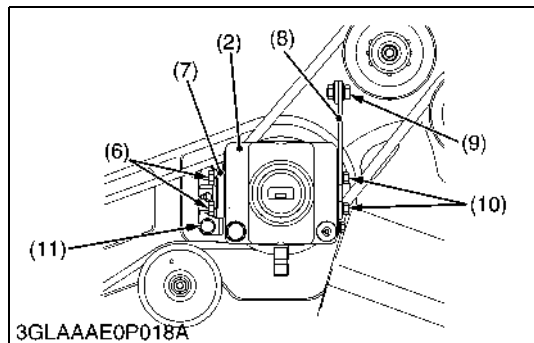
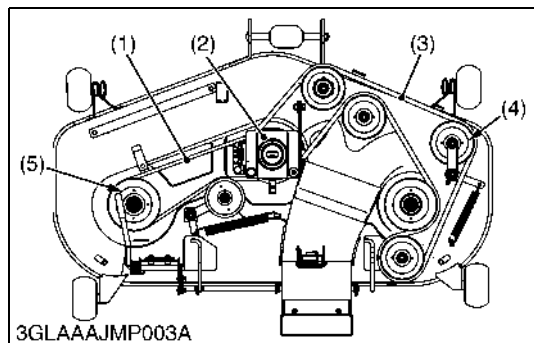
- Make sure the cup washer is not flattened out or worn, causing blade to slip easily.
Replace two cup washers if either is damaged.

Tightening torque	Mower blade screw	103 to 118 N·m 10.5 to 12.0 kgf·m 76.0 to 86.7 lbf·ft
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- (1) Mower Blade Screw
- (2) Plate Spring
- (3) Mower Blade
- (4) Dust Cover

A: Loosen

9Y1210598MOS0021US0



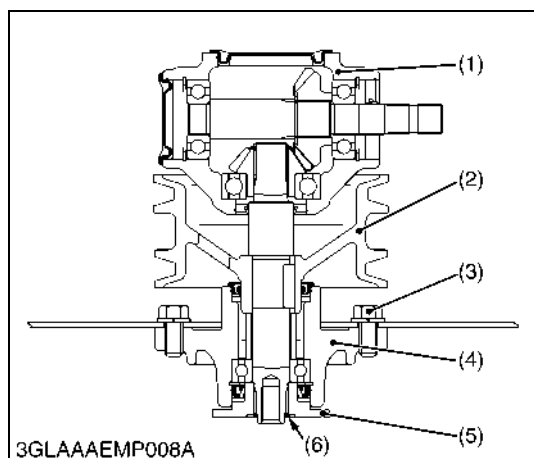
Mower Belt

1. Remove the left and right belt covers from the mower deck.
2. Disconnect the universal joint from the gear box (2).
3. Clean around the gear box (2).
4. Remove the mower belt RH (3) from the tension pulley (4).
5. Remove the mower belt LH (1) from the left side blade pulley (5).
6. Remove the gear box stays (7), (8).
7. Remove the mower belts (1), (3) from the center blade pulley.

Tightening torque	Gear box mounting screw LH (reamer)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft
	Gear box mounting screw RH	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft
	Gear box stay mounting screw LH (reamer)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft
	Gear box stay mounting screw RH	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft

- | | |
|---|---|
| (1) Mower Belt LH | (7) Gear Box Stay LH |
| (2) Gear Box | (8) Gear Box Stay RH |
| (3) Mower Belt RH | (9) Gear Box Stay Mounting Screw RH |
| (4) Tension Pulley | (10) Gear Box Mounting Screw RH |
| (5) Left Side Blade Pulley | (11) Gear Box Stay Mounting Screw LH (Reamer) |
| (6) Gear Box Mounting Screw LH (Reamer) | |

9Y1210598MOS0022US0



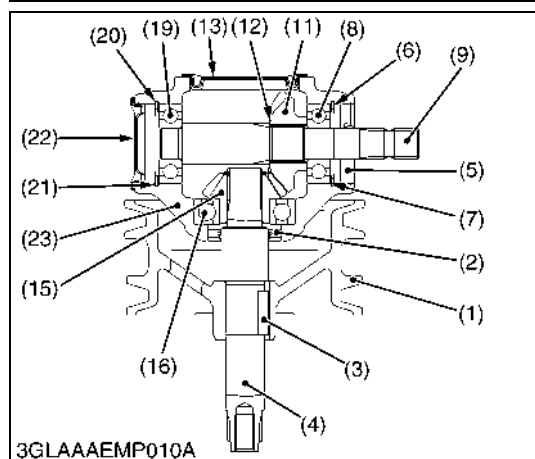
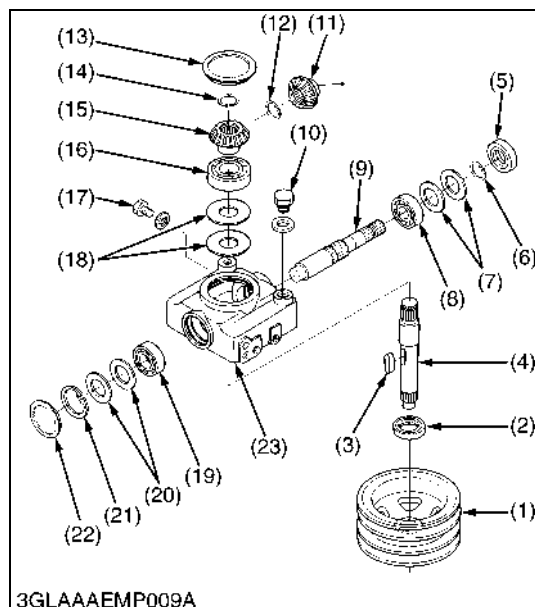
Gear Box

1. Remove the external snap ring (6).
2. Pull out the gear box (1) with the center blade pulley (2).
3. Remove the spline boss (5).
4. Remove the center blade pulley holder mounting screws (3).
5. Remove the pulley holder (4).

Tightening torque	Center blade pulley holder mounting screw	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft
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- | | |
|---|------------------------|
| (1) Gear Box | (4) Pulley Holder |
| (2) Center Blade Pulley | (5) Spline Boss |
| (3) Center Blade Pulley Holder Mounting Screw | (6) External Snap Ring |

9Y1210598MOS0023US0



Disassembling Mower Gear Box Assembly

1. Remove the drain plug (17), and drain gear case oil.
2. Remove the center blade pulley (1) with a puller, and remove the feather key (3) on the bevel gear shaft (4).
3. Remove the gear case caps (13), (22).
4. Remove the internal snap ring (21) and shims (20).
5. Tap out the input shaft (9) with the ball bearing (19), and external snap ring (12).
6. Remove the 21T spiral gear (11).
7. Remove the oil seal (5), internal snap ring (6), shims (7) and ball bearing (8).
8. Remove the external snap ring (14), and pull out the bevel gear shaft (4).
9. Remove the 16T spiral gear (15), ball bearing (16), shims (18) and oil seal (2).

(When reassembling)

- Replace the oil seals (2), (5) and gear case caps (13), (22) with new ones.
- Apply grease to the spline of input shaft and of bevel gear shaft.

■ IMPORTANT

- Use the specified gear box oil.
- Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-9.

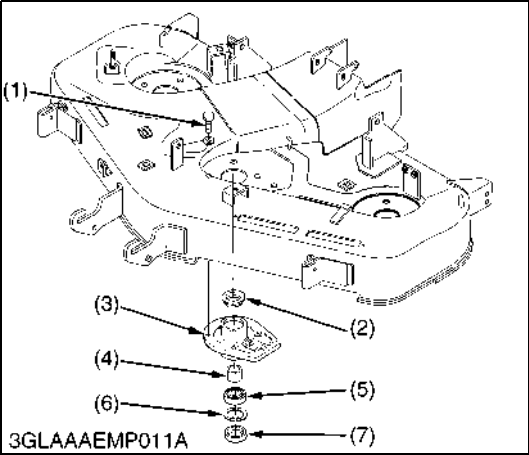
Mower gear case oil	Capacity	0.40 L 0.42 U.S.qts 0.35 Imp.qts
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■ NOTE

- While tapping out the input shaft (9) from the gear case (23), set the mating portion of external snap ring (12) on input shaft upward.

(1) Center Blade Pulley	(13) Case Cap
(2) Oil Seal	(14) External Snap Ring
(3) Feather Key	(15) 16T Spiral Gear
(4) Bevel Gear Shaft	(16) Ball Bearing
(5) Oil Seal	(17) Drain Plug
(6) Internal Snap Ring	(18) Shim
(7) Shim	(19) Ball Bearing
(8) Ball Bearing	(20) Shim
(9) Input Shaft	(21) Internal Snap Ring
(10) Plug	(22) Case Cap
(11) 21T Spiral Gear	(23) Gear Case
(12) External Snap Ring	

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Disassembling Center Blade Pulley Holder

1. Remove the center blade pulley holder mounting screws (1).
2. Separate the center blade pulley holder from the mower deck.
3. Remove the lower oil seal (7).
4. Remove the internal snap ring (6), ball bearing (5) and center collar (4).
5. Remove the upper oil seal (2).

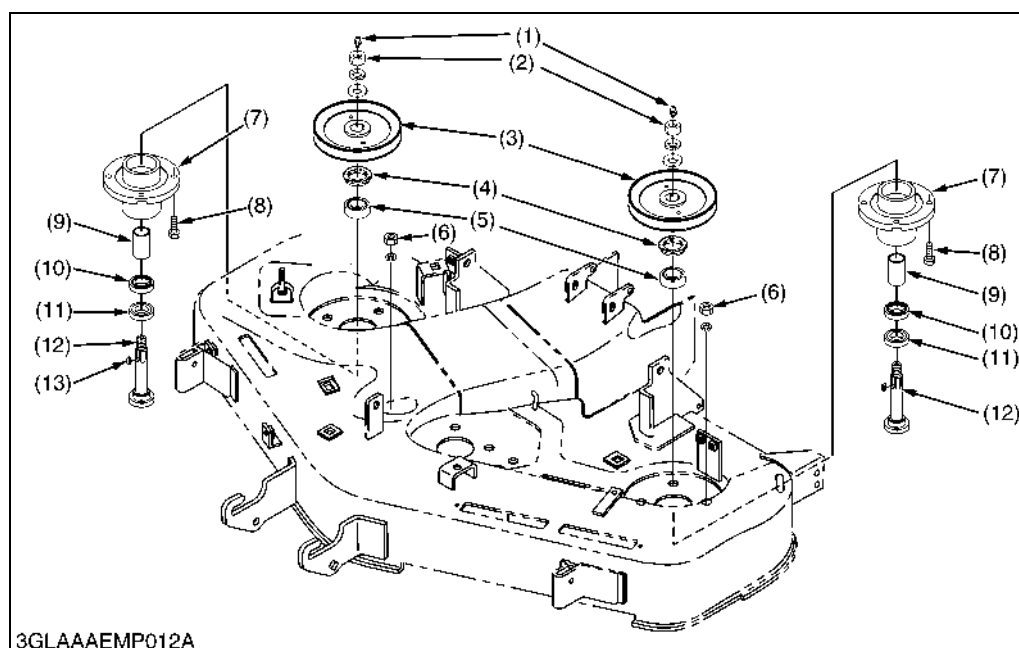
(When reassembling)

- Apply grease to the bearing and oil seal lips.
- Apply grease to the inside of center collar.
- Replace the oil seals with new ones.
- Be sure to pay attention to how to assemble lower oil seal.
- Apply liquid gasket (Three Bond 1208D or its equivalent) to the face of center pulley holder.

Tightening torque	Center blade pulley holder mounting screw	78 to 90 N·m 7.9 to 9.2 kgf·m 58 to 66 lbf·ft
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- | | |
|--|------------------------|
| (1) Center Blade Holder Mounting Screw | (4) Center Collar |
| (2) Upper Oil Seal | (5) Ball Bearing |
| (3) Center Blade Pulley Holder | (6) Internal Snap Ring |
| | (7) Lower Oil Seal |

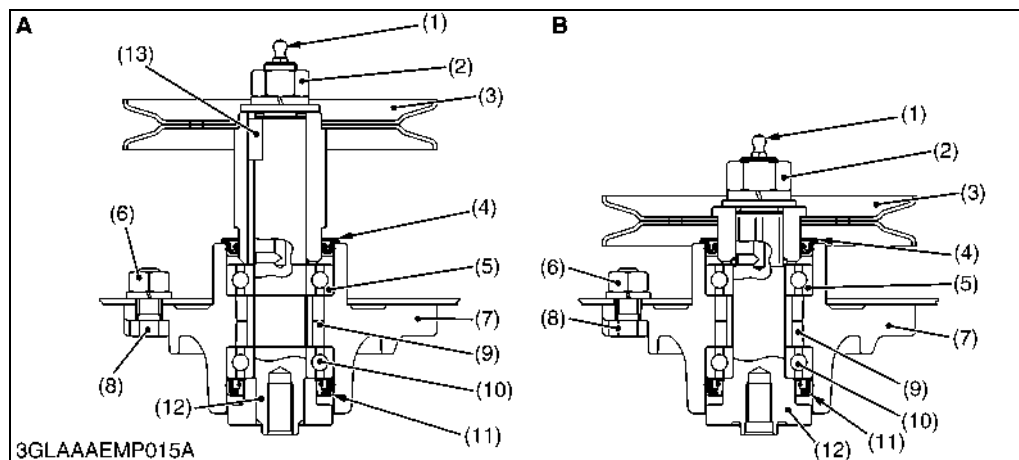
9Y1210598MOS0025US0

Disassembling Side Blade Pulley Holder

- (1) Grease Fitting
- (2) Pulley Mounting Nut
- (3) Pulley
- (4) Oil Seal
- (5) Ball Bearing
- (6) Pulley Holder Mounting Nut
- (7) Pulley Holder
- (8) Pulley Holder Mounting Screw
- (9) Collar
- (10) Ball Bearing
- (11) Oil Seal
- (12) Blade Shaft
- (13) Feather Key

A: Right Side Blade Pulley Holder

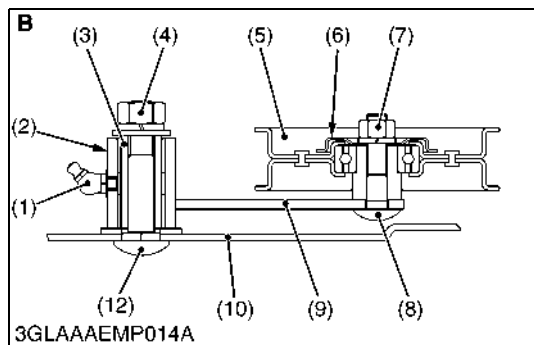
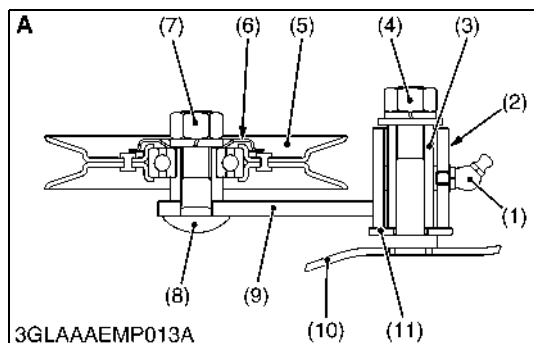
B: Left Side Blade Pulley Holder



1. Remove the grease fitting (1).
2. Remove the pulley mounting nut (2), and remove the pulley (3) and feather key (13) (only right side).
3. Tap out the blade shaft (12).
4. Remove the pulley holder (7) from the mower deck.
5. Remove the oil seal (4), (11).
6. Remove the ball bearings (5), (10) and collar (9).

Tightening torque	Pulley mounting nut (Right side)	89 to 117 N·m 9.0 to 12.0 kgf·m 65 to 86.7 lbf·ft
	Pulley mounting nut (Left side)	103 to 118 N·m 10.5 to 12.0 kgf·m 76.0 to 86.7 lbf·ft
	Pulley holder mounting screw	78 to 90 N·m 7.9 to 9.2 kgf·m 58 to 66 lbf·ft

9Y1210598MOS0026US0



Disassembling Tension Pulley

1. Remove the spring from the tension arm (9).
2. Remove the tension arm mounting nut (4) and screw (12) (only left side).
3. Remove the tension arm assembly, tension collar (3) and plate (11) (only right side).
4. Remove the tension pulley mounting screw (8) and nut (7).
5. Remove the tension pulley (5) and the tension cover (6) from the tension arm (9).

(When reassembling)

- Apply grease to the tension collar (3).

Tightening torque	Tension pulley mounting screw and nut (Right side)	109 to 130 N·m 11.1 to 13.3 kgf·m 80.3 to 96.1 lbf·ft
	Tension pulley mounting screw and nut (Left side)	47 to 56 N·m 4.8 to 5.8 kgf·m 35 to 41 lbf·ft
	Tension arm mounting screw (Only left side) and nut	78 to 90 N·m 7.9 to 9.2 kgf·m 58 to 66 lbf·ft

- | | |
|-----------------------------------|------------------------|
| (1) Grease Fitting | (9) Tension Arm |
| (2) Shim | (10) Mower Deck |
| (3) Tension Collar | (11) Plate |
| (4) Tension Arm Mounting Nut | (12) Tension Arm Screw |
| (5) Tension Pulley | |
| (6) Tension Cover | |
| (7) Tension Pulley Mounting Nut | |
| (8) Tension Pulley Mounting Screw | |

A: Right Side Tension Pulley

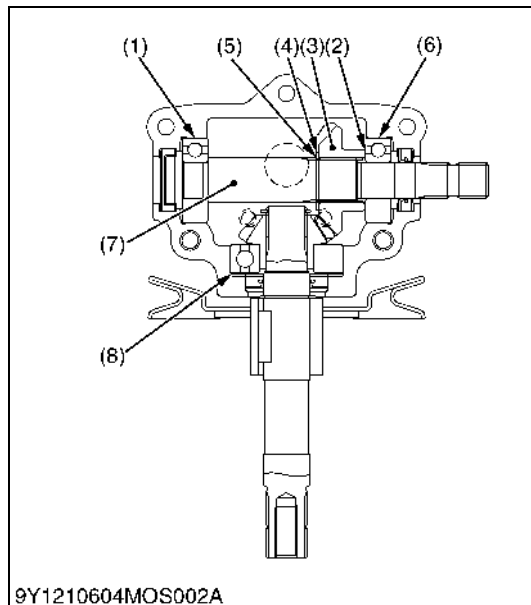
B: Left Side Tension Pulley

9Y1210598MOS0027US0

6. SERVICING

[1] GEAR BOX

(1) RCK48SGR



Backlash between Bevel Gears

1. Disassemble the gear box.
2. Put a strip of plastigauge to the bevel gear (3) on the input shaft (7).
3. Assemble the gear box.
4. Turn the input shaft (7).
5. Get the plastigauge, and measure the plastigauge. (Backlash equal thickness of plastigauge.)
6. If the backlash is more than the allowable limit, adjust with shims (2), (4), (8).

Backlash between bevel gears	Factory specification	0.13 to 0.25 mm 0.0052 to 0.0098 in.
	Allowable limit	0.40 mm 0.016 in.

(Reference)

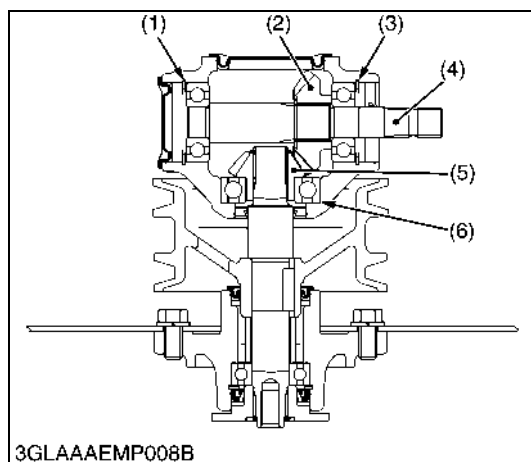
- Thickness of adjusting shims (2), (4):
0.20 mm (0.0079 in.)
0.30 mm (0.012 in.)
- Thickness of adjusting shims (8):
0.20 mm (0.0079 in.)
0.30 mm (0.012 in.)

- (1) Ball Bearing
(2) Shim
(3) Bevel Gear
(4) Shim

- (5) External Cir Clip
(6) Ball Bearing
(7) Input Shaft
(8) Shim

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(2) RCK48GR-II



Backlash between 21T Spiral Gear and 16T Spiral Gear

1. Remove the 21T spiral gear (2) from gear box.
2. Put a strip of plastigauge on the 21T spiral gear (2) with grease.
3. Assemble the gear box.
4. Turn the input shaft (4).
5. Get the plastigauge, and measure the plastigauge. (Backlash equal thickness of plastigauge.)
6. If the backlash is more than the allowable limit, adjust with shims (1), (3), (6).

Backlash between 21T spiral gear and 16T spiral gear	Factory specification	0.13 to 0.25 mm 0.0051 to 0.0098 in.
	Allowable limit	0.40 mm 0.0157 in.

(Reference)

- Thickness of adjusting shims (1), (3) for 21T spiral gear (2):
0.20 mm (0.0079 in.)
0.30 mm (0.0118 in.)
- Thickness of adjusting shims (6) for 16T spiral gear (5):
0.1 mm (0.0039 in.)
0.2 mm (0.0079 in.)

- (1) Shim
(2) 21T Spiral Gear
(3) Shim

- (4) Input Shaft
(5) 16T Spiral Gear
(6) Shim

9Y1210598MOS0019US0

EDITOR:

KUBOTA FARM & INDUSTRIAL MACHINERY SERVICE, LTD.

64, ISHIZU-KITAMACHI, SAKAI-KU, SAKAI-CITY, OSAKA, 590-0823, JAPAN

PHONE : (81)72-241-1129

FAX : (81)72-245-2484

E-mail : ksos-pub@kubota.co.jp
