

WSM

WORKSHOP MANUAL

ZD326-EU

Kubota

TO THE READER

This Workshop Manual tells the servicing personnel about the mechanism, servicing and maintenance of the ZD326-EU. It contains 4 parts: "**Information**", "**General**", "**Mechanism**" and "**Servicing**".

■ Information

This section contains information below.

- Safety First
- Safety Label
- Specification
- Dimension

■ General

This section 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 / 9Y021-18200) for the diesel engine / tractor mechanism that this workshop manual does not include.

■ Servicing

This section 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.

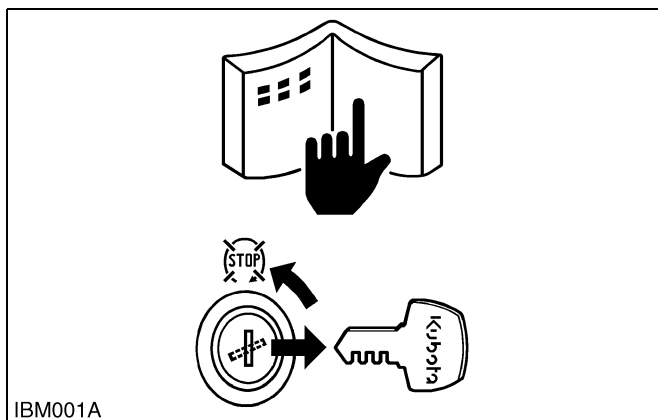
■ IMPORTANT

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

■ NOTE

- Gives helpful information.

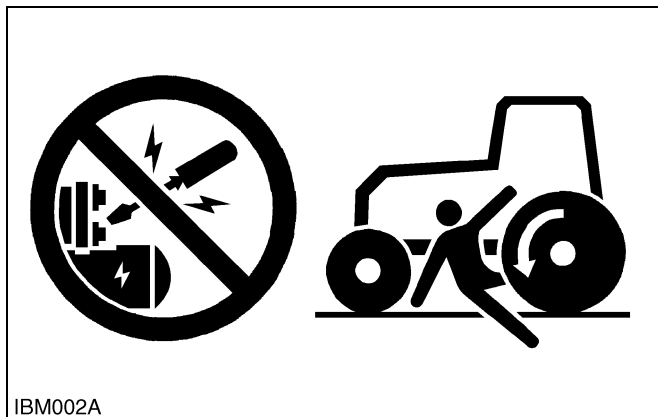
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BEFORE YOU START SERVICE

- 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.

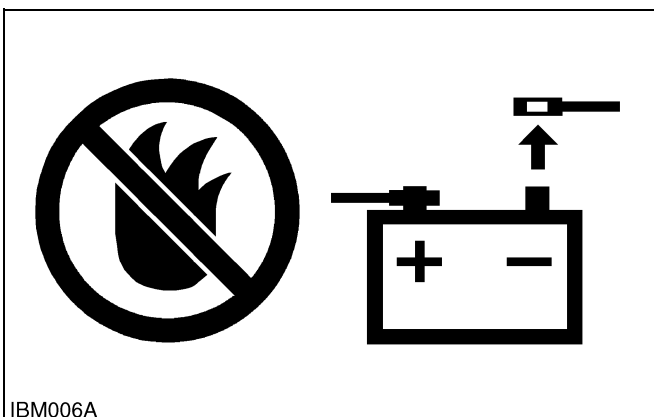
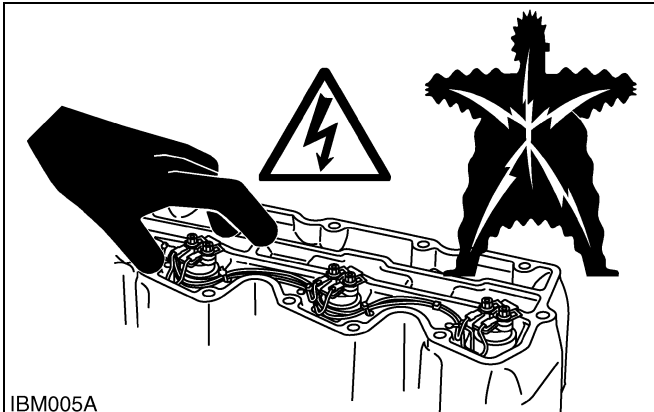
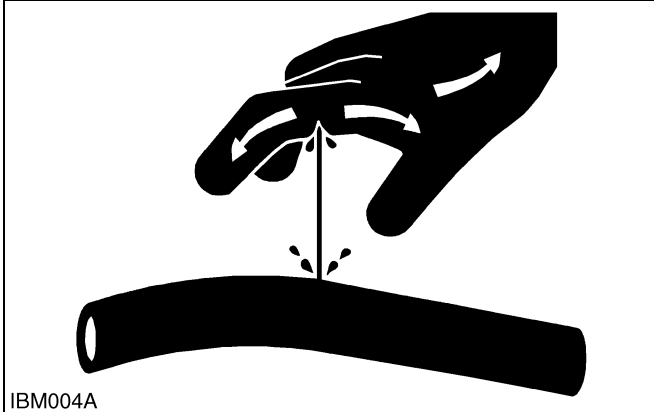
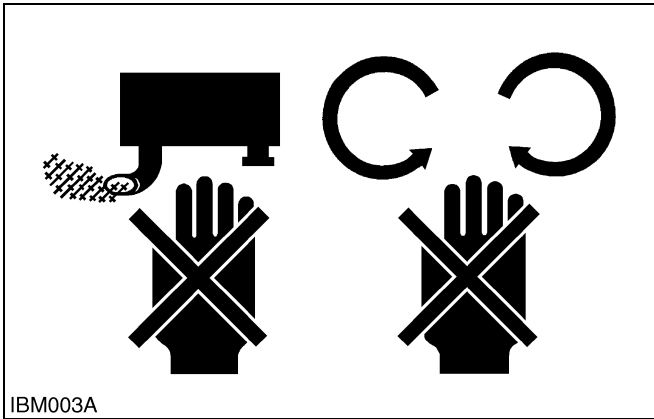
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START SAFELY

- 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

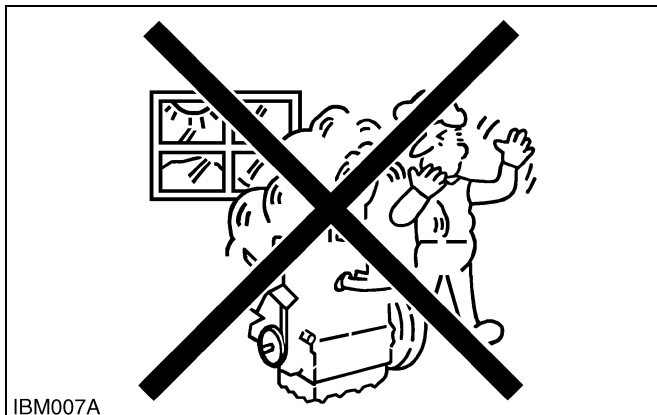
- Do not use the machine after you consume alcohol or medication or when you are tired.
- Put on applicable clothing and safety equipment.
- Use applicable tools only. Do not use alternative tools or parts.
- When 2 or more persons do servicing, make sure that you do it safely.
- Do not operate below 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.

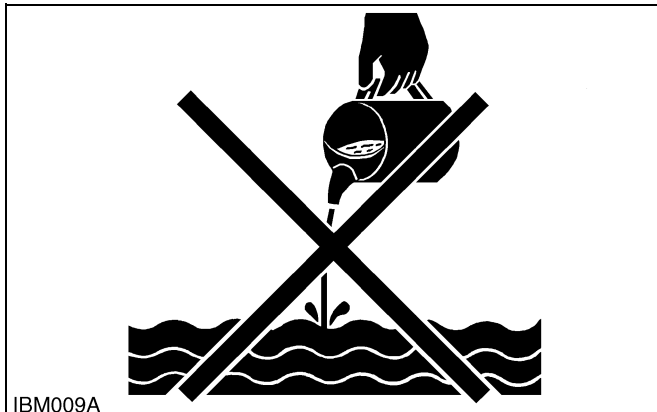
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KEEP A GOOD AIRFLOW IN THE WORK AREA

- 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.

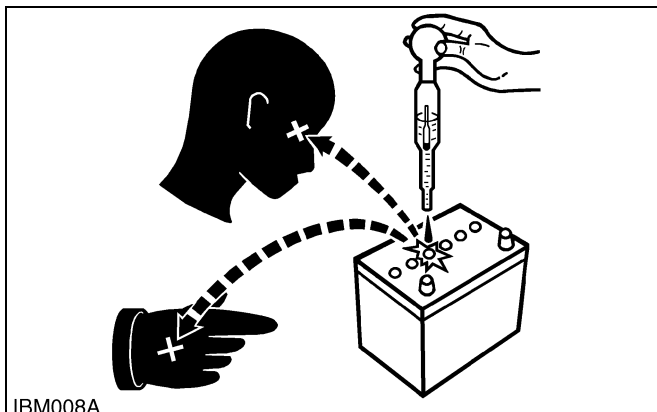
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DISCARD FLUIDS CORRECTLY

- 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.

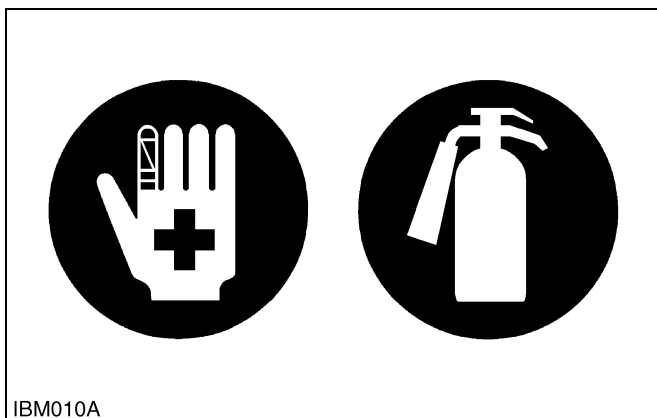
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PREVENT ACID BURNS

- 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

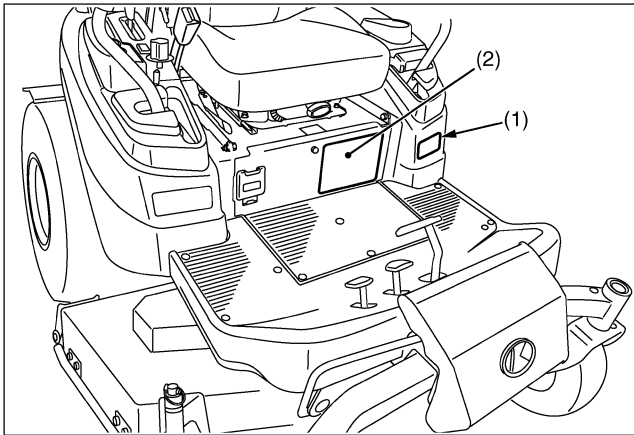
- Keep a first aid kit and fire extinguisher ready at all times.
- Keep the emergency contact telephone numbers near your telephone at all times.

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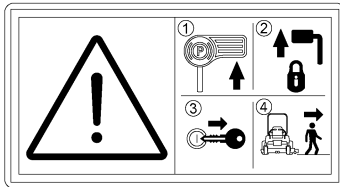
2. SAFETY DECALS

The following safety decals (pictorial safety labels) are installed on the machine. If a decal becomes damaged, illegible or is not on the machine, replace it. The decal part number is listed in the parts list.

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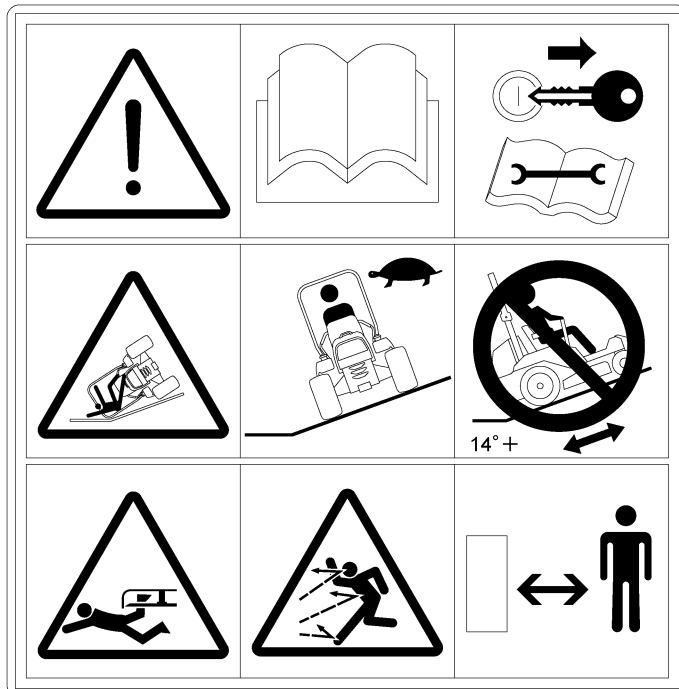
(1) Part No. K3173-6585-2



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- Park the machine on level ground.
- If necessary to park on an incline,
 - (1) Stop the machine,
 - (2) Apply the parking brake, then
 - (3) Stop the engine.
- If you stop the engine on an incline without applying the parking brake, the machine could move and run away.

(2) Part No. K3173-6581-2

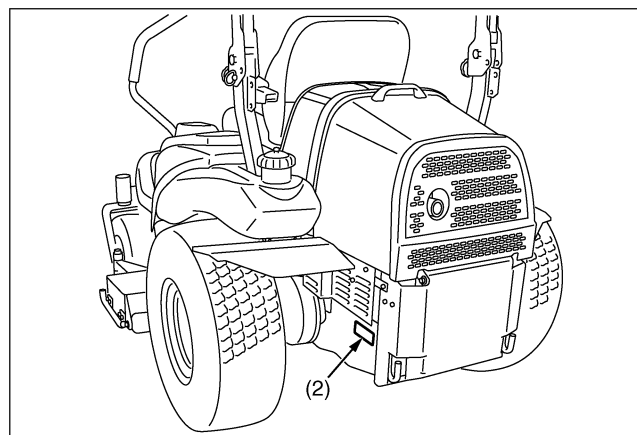
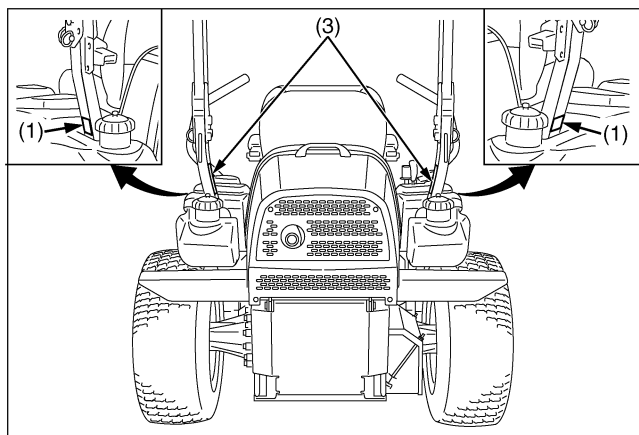


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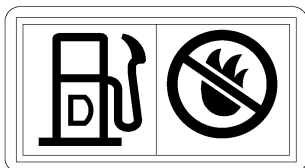
TO AVOID INJURY OR DEATH:

- Read and understand operator's manual.
- Stop the engine and remove key before servicing.
- DO NOT operate where machine could slip or tip.
- Mow across slopes, not up and down.
Use slow speed on slopes.
- DO NOT operate on slopes of more than 14°.
- DO NOT allow any bystanders or children around or near machine at any time when the engine is running.



(1) Part No. K3173-6587-1

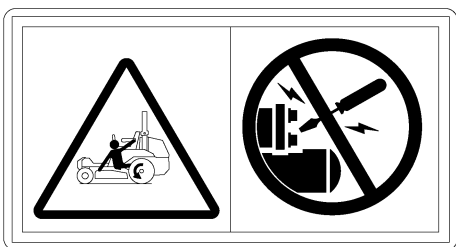
- Diesel fuel only
- No fire



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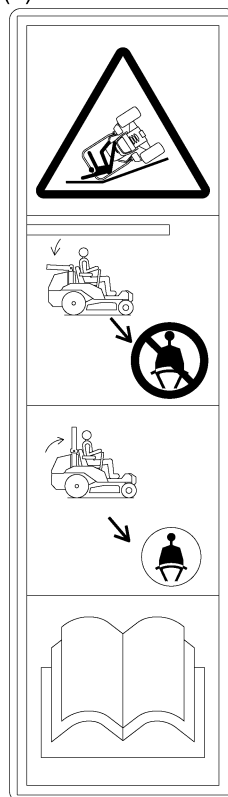
(2) Part No. K3173-6583-2

- Machine may start in gear and move
- Start engine only from operator's seat with motion control levers in neutral lock position and PTO OFF. Never start engine while standing on the ground.
- Do not start engine by shorting across starter terminals or bypassing the safety start switch.



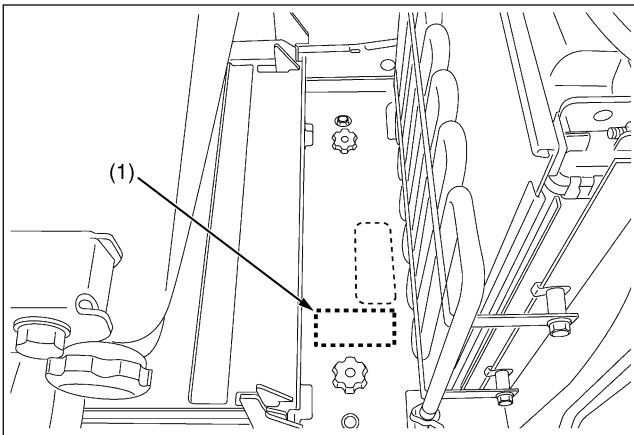
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(3) Part No. K3173-6590-2



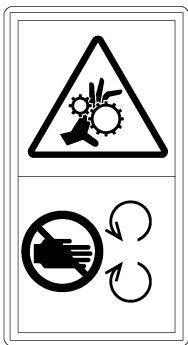
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- Machine rollover - Crush
- Do not use the seat belt if the ROPS is folded. Fold the ROPS down only when absolutely necessary and fold it up and lock it again as soon as vertical clearance allows.
- Always use the seat belt when the ROPS is in the upright position. Keep the ROPS in the upright and locked position.
- Never modify or repair the ROPS because welding, bending, drilling, grinding, or cutting any portion may weaken the structure.

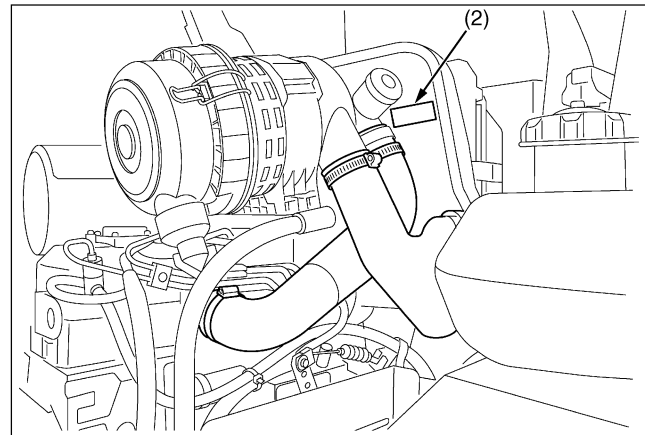


(1) Part No. K3173-6591-2

- Do not get your hands close to fan belt.

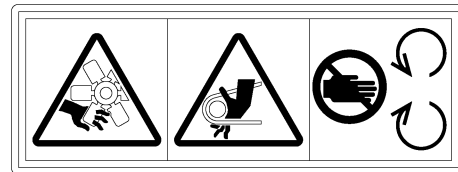


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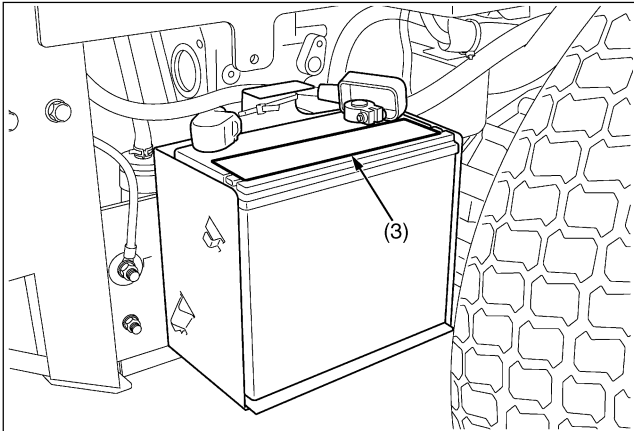


(2) Part No. K3173-6586-2

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



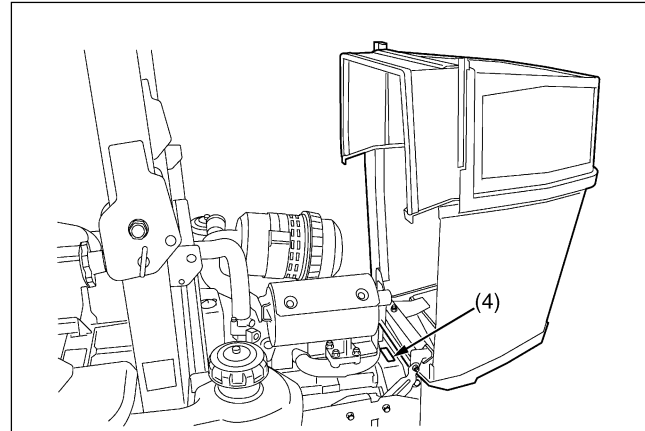
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(3) Part No. K3181-6115-1

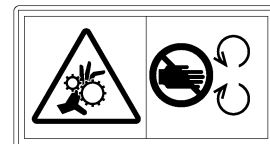


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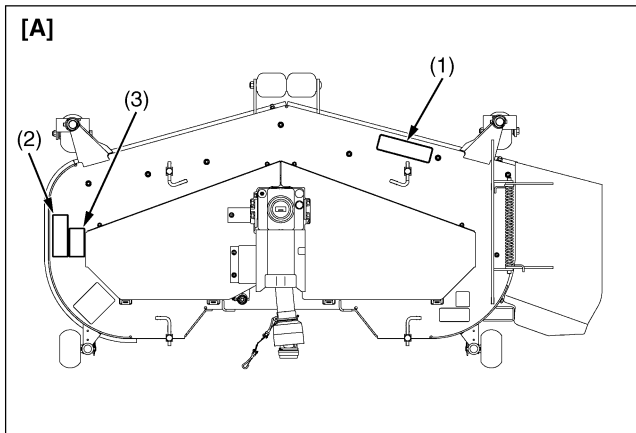
(4) Part No. K3173-6594-2

- Do not get your hands close to flywheel.

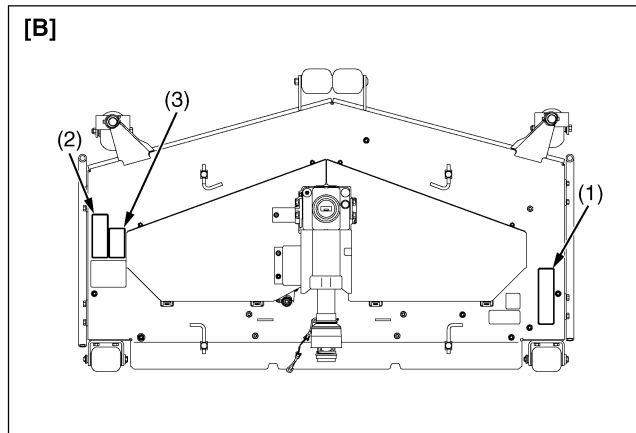


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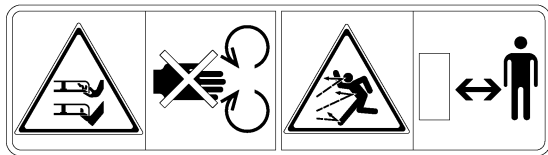
[A] RCK60P- 326Z-EU



[B] RCK60R- 326Z-EU

(1) Part No. K5652-4178-2

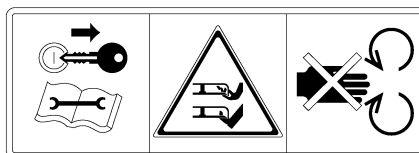
- Severing of hands or feet - blade
- Do not put hands or feet into mower when engine is running.
- Thrown or flying objects - Full body exposure
- Stay clear of discharge opening at all times.
- Do not operate mower without discharge deflector.



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(2) Part No. K5652-4179-3

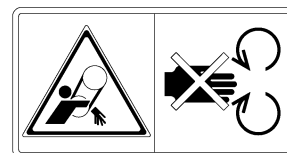
- Severing of hands or feet - blade
- Shut off engine and remove key before performing maintenance or repair work
- Do not put hands or feet into mower when engine is running.



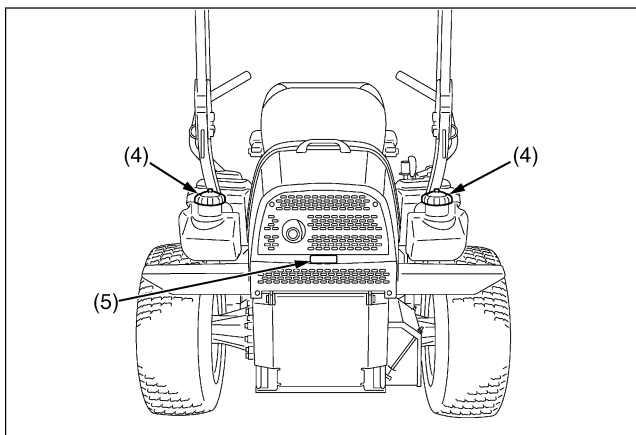
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(3) Part No. K5652-4180-2

- Hand and arm entanglement - Belt drive
- Do not get your hands close to driving belt.

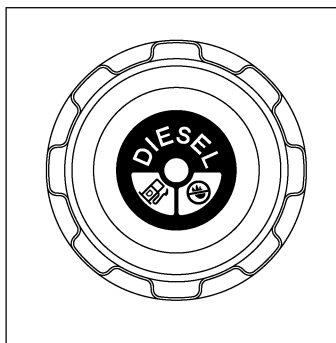


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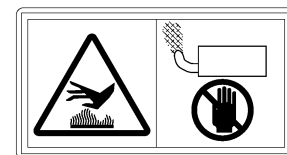
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(4) Part No. K3181-2481-1



(5) Part No. K3173-6532-2

- Hot surface
- Burn to finger or hand
- Do not touch muffler.



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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.
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. Mount new pictorial safety labels by applying on a clean dry surface and pressure any bubbles to outside edge.

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3. SPECIFICATIONS

Model			ZD326-60-EU	ZD326-60R-EU
Engine	Model		D1005-E3-ZD-2	
	Max. engine power (Gross)		19.4 kW (26 HP)* ¹	
	Type		Liquid-cooled	
	Number of cylinders		3	
	Bore and stroke		76.0 x 73.6 mm (2.99 x 2.90 in.)	
	Total displacement		1001 cm ³ (61.1 cu.in.)	
	Rated revolution		3200 min ⁻¹ (rpm)	
	Low idling revolution		1250 to 1350 min ⁻¹ (rpm)	
	Fuel		Diesel fuel No. 1 [below -10°C (14°F)] Diesel fuel No. 2 [above -10°C (14°F)]	
	Starter		Electric starter with battery, glow plug, 12 V, 1.1kW	
	Lubrication		Forced lubrication by gear pump	
	Cooling		Liquid with pressurized radiator	
	Battery		51 R (12 V, RC: 70 min, CCA: 475 A)	
	Capacities	Fuel tank		49 L (13 U.S.gals, 11 Imp.gals)
Engine crankcase (with filter)		3.9 L (4.1 U.S.qts, 3.4 Imp.qts)		
Engine coolant		3.5 L (3.7 U.S.qts, 3.1 Imp.qts)		
Recovery tank		0.25 L (0.26 U.S.qts, 0.22 Imp.qts)		
Transmission including rear axle gear case		12.1 L (12.8 U.S.qts, 10.6 Imp.qts)* ²		
Dimensions	Overall length		2220 mm (87.4 in.)	
	Overall width without mower deck		1460 mm (57.5 in.)	
	Overall height	With ROPS upright	1915 mm (75.4 in.)	
		With ROPS folded	1555 mm (61.2 in.)	
	Wheel base		1410 mm (55.5 in.)	
	Minimum ground clearance		130 mm (5.12 in.) w/RCK60P, w/RCK60R	
	Tread	Front	975 mm (38.4 in.)	
		Rear	1150 mm (45.3 in.)	
Weight (w/o fuel, w/ mower deck)			808 kg (1782 lbs) with RCK60P, RCK60R	
Traveling system	Tires	Front	15 x 6.0 - 6 (4PR) Rib	
		Rear	26 x 12.0 - 12 (4PR) Turf	
	Traveling speeds	Forward	0 to 9.3 mph (0 to 15.0 km/h)* ³	
		Reverse	0 to 5.2 mph (0 to 8.3 km/h)* ³	
	Steering		2 - Hand levers	
	Transmission		2 - HST w / Gear	
	Parking brake		Wet multi disk / Foot applied, released	
	Min. turning radius		0 mm (0 in.)	
PTO	Revolution		1 speed (2530 min ⁻¹ (rpm) at 3200 engine min ⁻¹ (rpm))	
	Drive system		Shaft drive, KUBOTA 10 tooth involute spline	
	Clutch type		Wet multi disks	
	PTO brake		Wet single disk	

(Specifications and design are subject to change without notice)

■ NOTE

- *1: Manufacturer's estimate
- *2: Oil amount when the oil level is at the upper level.
- *3: At 3200 engine min⁻¹ (rpm)

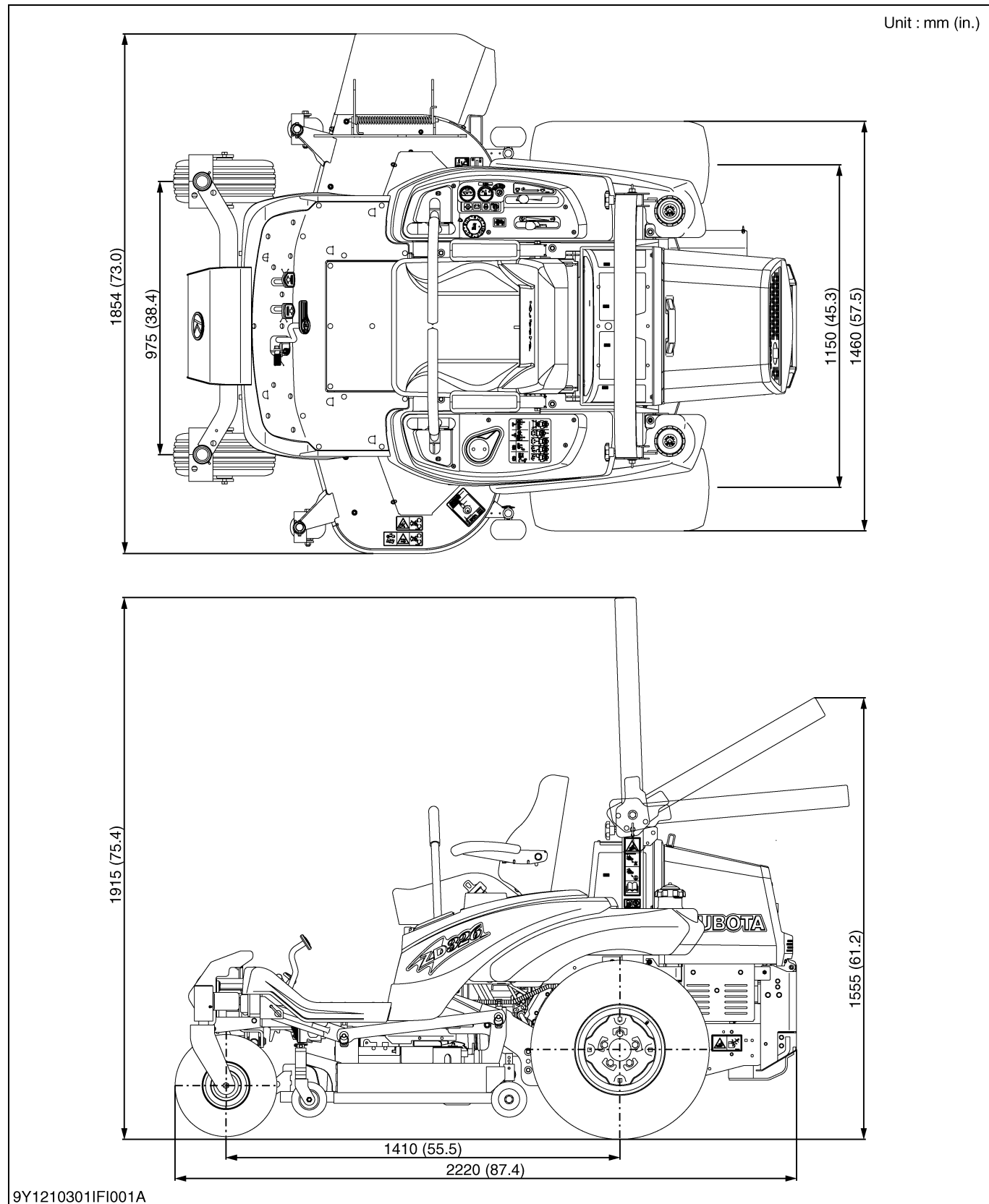
Mower Model			RCK60P-326Z-EU		RCK60R-326Z-EU		
PRO Commercial Deck (Fabricated deck)	Suitable machine		ZD326-EU				
	Mounting method		Quick joint, Parallel linkage				
	Adjustment of cutting height		Dial gauge				
	Cutting width		1524 mm (60.0 in.)				
	Cutting height		25 to 127mm (1.0 to 5.0 in.)				
	Weight (Apptox.)		146 kg (322 lbs.)				
	Blade spindle speed		56.0 r/s (3360 min ⁻¹ (rpm))* ¹				
	Blade tip velocity		76.6 m/s (15100 fpm.)* ¹				
	Blade length		523 mm (20.6 in.)				
	Number of blades		3				
	Dimensions	Total length		980 mm (38.6 in.)			
		Total width		1854 mm (73.0 in.)		1604 mm (63.1 in.)	
Total height		383 mm (15.1 in.)		380 mm (15.0 in.)			

*1: Engine Max min⁻¹ (rpm)

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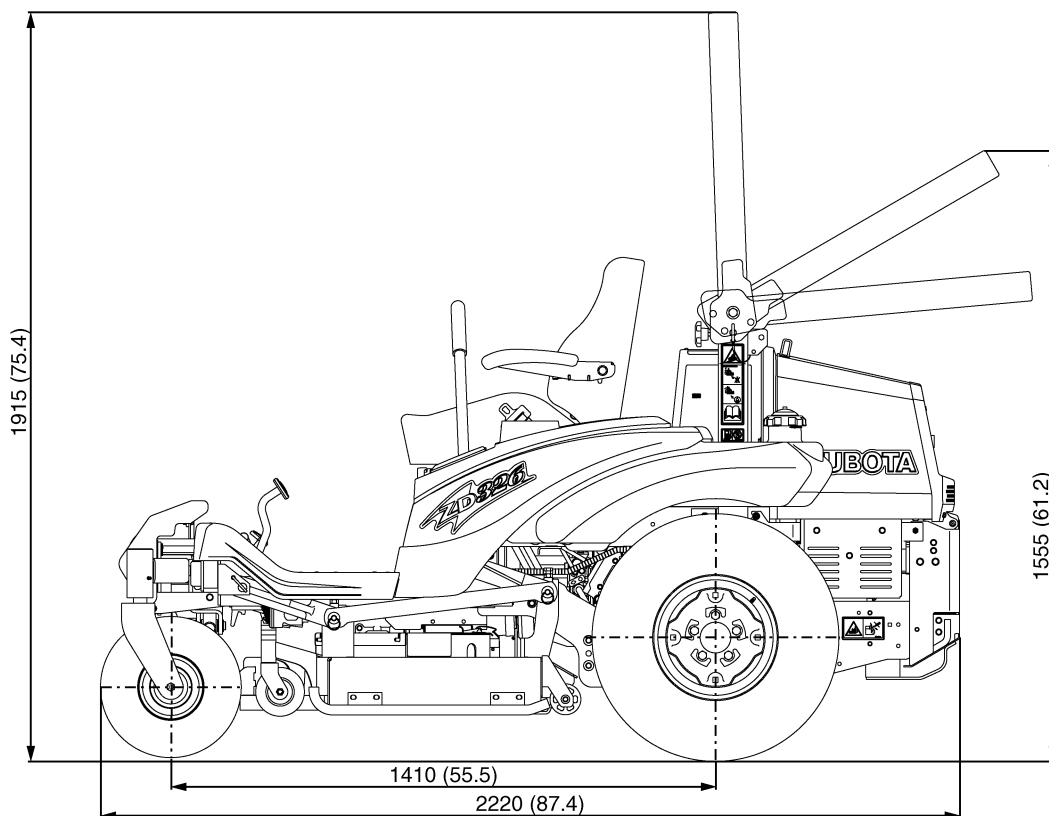
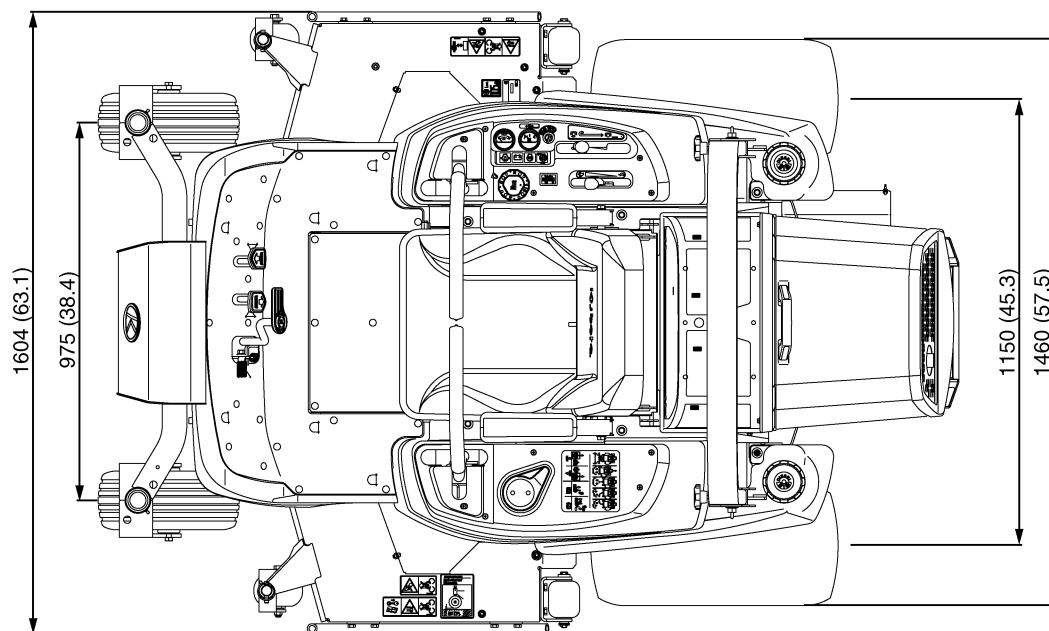
4. DIMENSIONS

ZD326-60P-EU with RCK60P-326Z-EU



ZD326-60R-EU with RCK60R-326Z-EU

Unit : mm (in.)



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G GENERAL

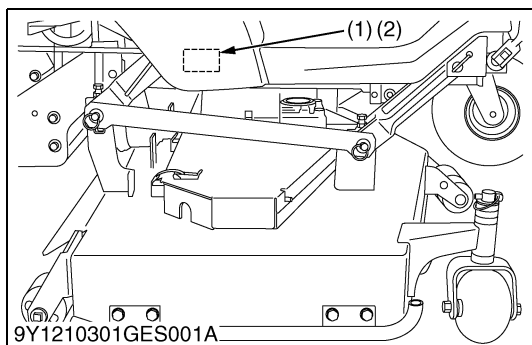
GENERAL

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1. IDENTIFICATION

[1] MODEL NAME AND SERIAL NUMBER



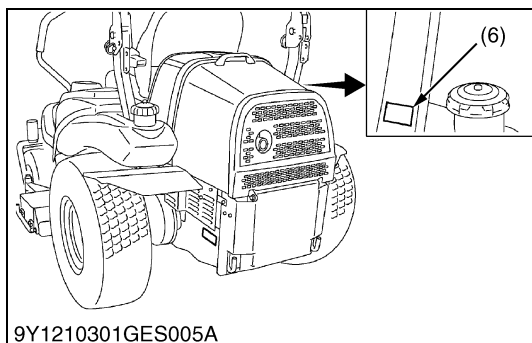
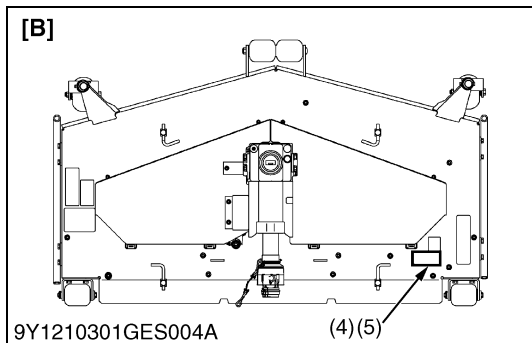
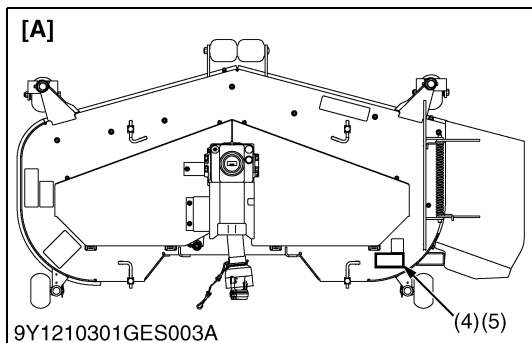
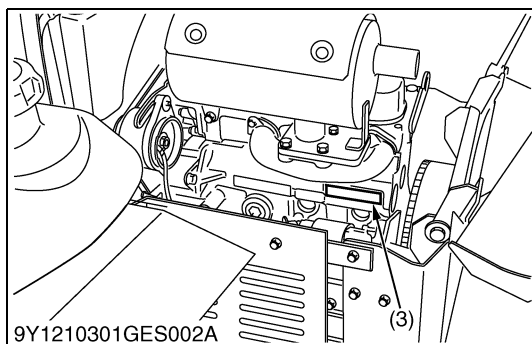
When contacting your local KUBOTA distributor, always specify engine serial number (3), machine serial number (2), mower serial number (4) and hour meter reading.

- (1) Machine Identification Plate
- (2) Machine Serial Number
- (3) Engine Serial Number
- (4) Mower Serial Number
- (5) Mower Identification Plate
- (6) ROPS Serial Number

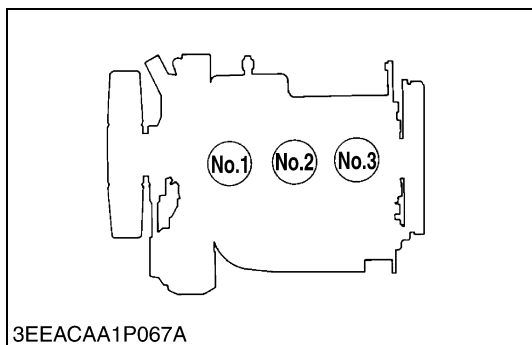
[A] RCK60P-326Z-EU

[B] RCK60R-326Z-EU

9Y1210301GEG0016US0



[2] CYLINDER NUMBER

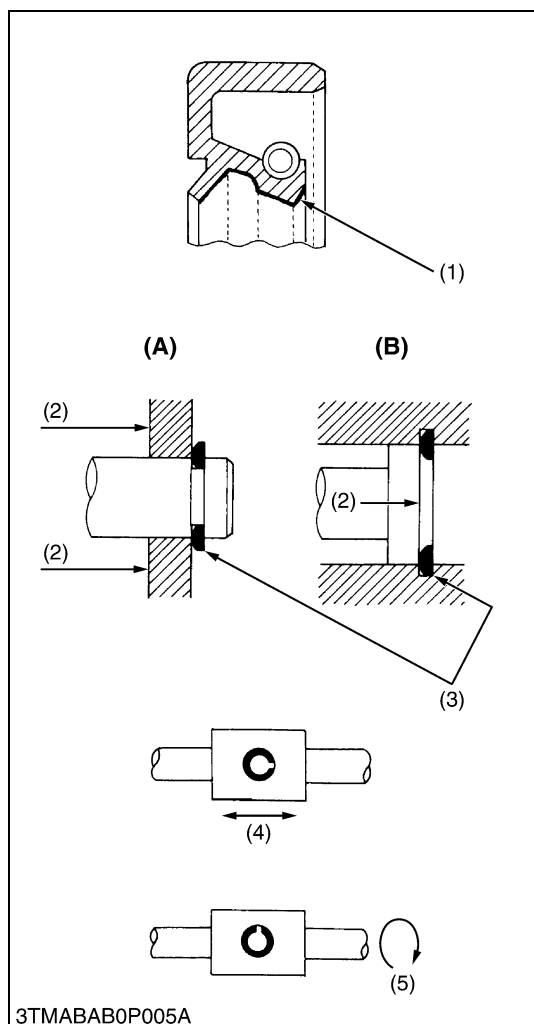


The cylinder numbers of KUBOTA diesel engine are designated as shown in the figure.

The sequence of cylinder numbers is given as No.1, No.2 and No.3 starting from the gear case side.

9Y1210301GEG0017US0

2. GENERAL PRECAUTIONS



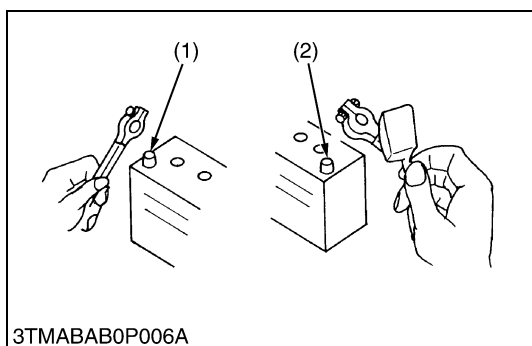
- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Screws, bolts and nuts should be installed in their original position to prevent reassembly errors.
- When special tools are required, use KUBOTA genuine special tools. Special tools which are not frequently used should be made according to the drawings provided.
- Before disassembling or servicing electrical wires, always disconnect the ground cable from the battery first.
- Remove oil and dirt from parts before measuring.
- Use only KUBOTA genuine parts for parts replacement to maintain machine performance and to assure safety.
- Gaskets and O-rings must be replaced during reassembly. Apply grease to new O-rings or oil seals before assembling. See the figure left side.
- When reassembling external snap rings or internal snap rings, they must be positioned so that sharp edge faces against the direction from which a force is applied. See the figure left side.
- 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.

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

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

9Y1210301GEG0018US0

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

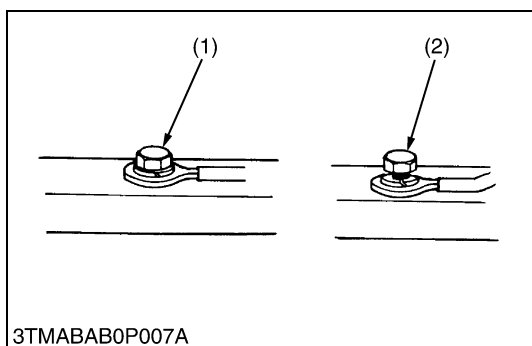
- Check electrical wiring for damage and loosened connection every year. To this end, educate the customer to do his or her own check and at the same time recommend the dealer to perform periodic check for a fee.
- Do not attempt to modify or remodel any electrical parts and wiring.
- When removing the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

(1) Negative Terminal

(2) Positive Terminal

9Y1210301GEG0019US0

[1] WIRING

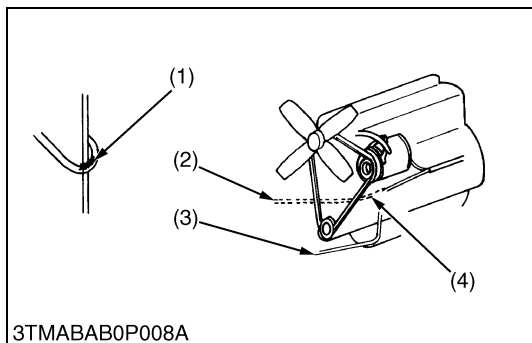


- Securely tighten wiring terminals.

(1) Correct
(Securely tighten)

(2) Incorrect
(Loosening leads to faulty contact)

9Y1210301GEG0020US0

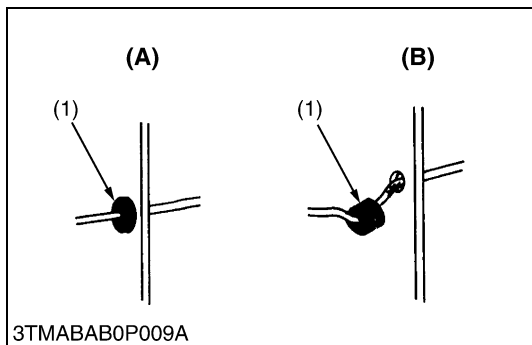


- Do not let wiring contact dangerous part.

(1) Wiring (Correct)
(2) Wiring (Incorrect)

(3) Dangerous Part
(4) Dangerous Part

9Y1210301GEG0021US0

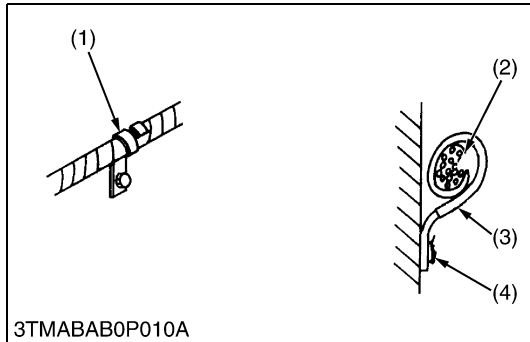


- Securely insert grommet.

(1) Grommet

(A) Correct
(B) Incorrect

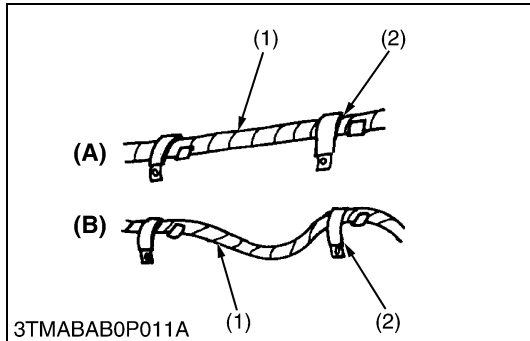
9Y1210301GEG0022US0



- Securely clamp, being careful not to damage wiring.

- (1) Clamp
(Wind Clamp Spirally)
(2) Wire Harness
(3) Clamp
(4) Welding Dent

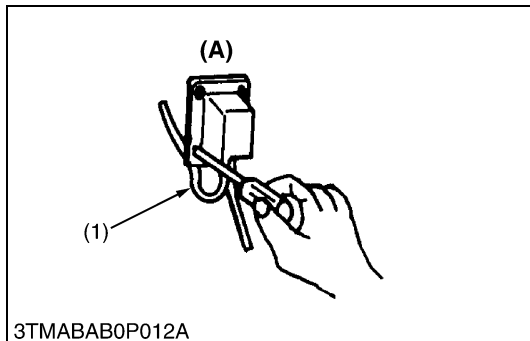
9Y1210301GEG0023US0



- 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

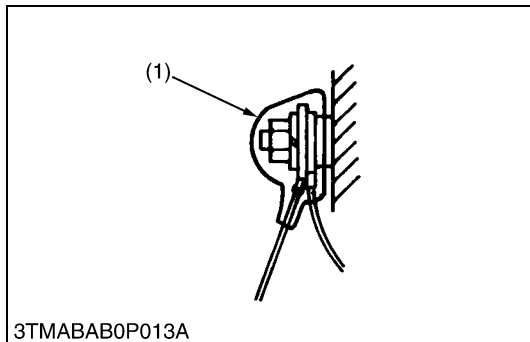
9Y1210301GEG0024US0



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

- (1) Wiring
(A) Incorrect

9Y1210301GEG0025US0

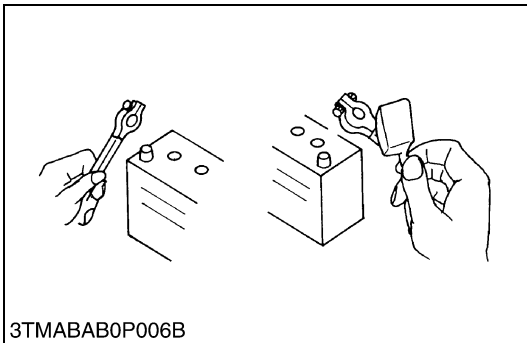


- After installing wiring, check protection of terminals and clamped condition of wiring, only connect battery.

- (1) Cover
(Securely Install Cover)

9Y1210301GEG0026US0

[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.

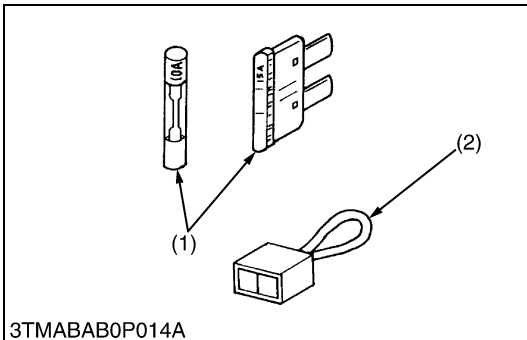


CAUTION

- 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.

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[3] FUSE



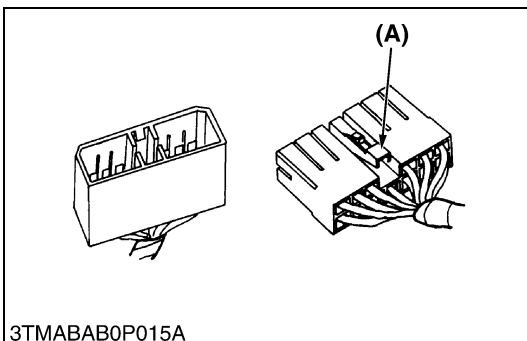
- Use fuses with specified capacity. Neither too large or small capacity fuse is acceptable.
- Never use steel or copper wire in place of fuse.
- Do not install working light, radio set, etc. on machine which is not provided with reserve power supply.
- Do not install accessories if fuse capacity of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

(1) Fuse

(2) Slow Blow Fuse

9Y1210301GEG0028US0

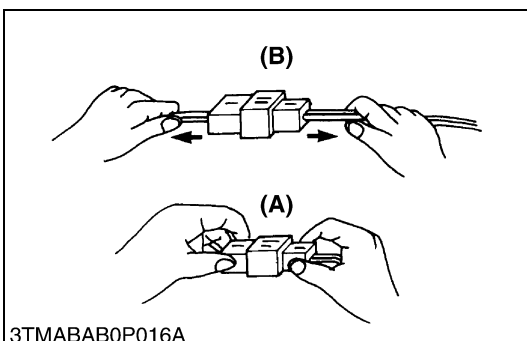
[4] CONNECTOR



- For connector with lock, push lock to separate.

(A) Push

9Y1210301GEG0029US0

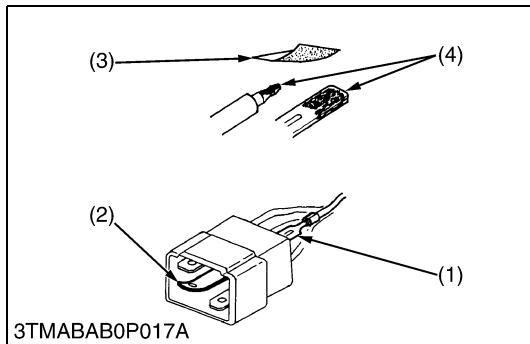


- In separating connectors, do not pull wire harnesses.
- Hold connector bodies to separate.

(A) Correct

(B) Incorrect

9Y1210301GEG0030US0

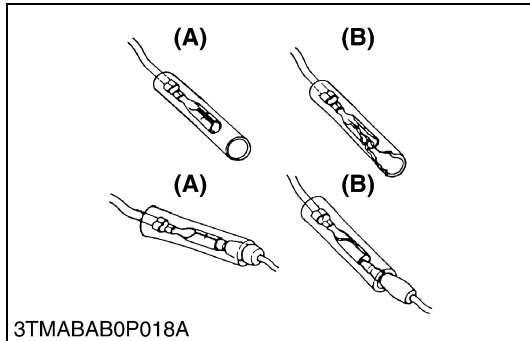


- Use sandpaper to remove rust from terminals.
- Repair deformed terminal. Make certain there is no terminal being exposed or displaced.

(1) Exposed Terminal
(2) Bend Terminal

(3) Sandpaper
(4) Rust

9Y1210301GEG0031US0



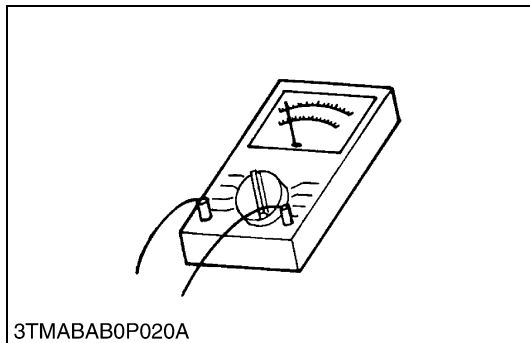
- Make certain that there is no female connector being too open.

(A) Correct

(B) Incorrect

9Y1210301GEG0032US0

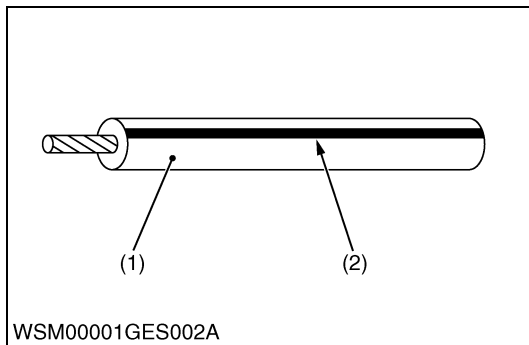
[5] HANDLING OF CIRCUIT TESTER



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

9Y1210301GEG0033US0

[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

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4. LUBRICANT, FUEL AND COOLANT

Place	Capacities		Grade	
	ZD326-60-EU	ZD326-60R-EU		
Fuel	49 L 13 U.S.gals 11 Imp.gals		- No. 2-D diesel fuel - No. 1-D diesel fuel if temperature is below −10 °C (14 °F)	
Coolant	3.5 L 3.7 U.S.qts 3.1 Imp.qts		Fresh clean water (soft water) with anti-freeze	
Recovery tank	0.25 L 0.26 U.S.qts 0.22 Imp.qts			
Engine crankcase	3.9 L* 4.1 U.S.qts 3.4 Imp.qts		Engine oil: API Service Classification CF or better - Below 0 °C (32 °F) SAE10, SAE10W-30 or 15W-40 0 to 25 °C (32 to 77 °F) SAE20, SAE10W-30 or 15W-40 - Above 25 °C (77 °F) SAE30W, SAE10W-30 or 15W-40	
Transmission case with filter & hose and rear axle gear case (RH and LH)	12.1 L 12.8 U.S.qts 10.6 Imp.qts		KUBOTA UDT or SUPER UDT fluid*1	
Mower gear box	0.4 L 0.4 U.S.qts 0.4 Imp.qts		SAE 90 gear oil (API service classification: more than GL-3)	
Greasing	No. of greasing points		Capacity	Type of grease
Motion control lever pivot bushing, and contact position	6		Until grease overflows	Multipurpose EP2 Grease (NLGI Grade No. 2)
King pin	2			
Center pin	1			
Front wheel	2			
Front lift arm	2			
Universal joint	3			
Seat adjuster	2			
Cable (throttle)	2		Moderate amount	Oil
[MOWER]				
Universal joint	3		Until grease overflows	Multipurpose EP2 Grease (NLGI Grade No. 2)
Three spindle shafts	3			
Belt tension pulley	1			
Belt tension pivot	1			
Front anti-scalp roller	2			
Front anti-scalp roller pivot boss	2			

■ NOTE

- * Oil amount when the oil level is the upper of the oil level gauge.
- * 1: KUBOTA original transmission hydraulic fluid.

■ IMPORTANT

- To prevent serious damage to hydraulic system, use only KUBOTA genuine fluid or its equivalent.

9Y1210301GEG0034US0

■ NOTE

Fuel

- Cetane number of 45 minimum. Cetane number greater than 50 is preferred, especially for temperatures below -20°C or elevations above 1500 m.
- If diesel fuel with sulfur content greater than 0.5% sulfur content is used, reduce the service interval for engine oil and filter by 50%.
- DO NOT use diesel fuel with sulfur content greater than 1.0%.
- Diesel fuels specified to EN 590 or ASTM D975 are recommended.
- No.2-D is a distillate fuel of lower volatility for engine in industrial and heavy mobile service. (SAE J313JUB87)
- Since this engine adopts EPA Tier 4 and Interim Tier 4 standards, the use of low sulfur fuel or ultra low sulfur fuel is mandatory in EPA regulated area (North America). Therefore, please use No.2-D S500 or S15 diesel fuel as an alternative to No.2-D, or use No.1-D S500 or S15 diesel fuel as an alternative to No.1-D if outside air temperature is below -10°C .

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). 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)
- Lubricating oil recommended when a low-sulfur or high-sulfur fuel is employed.

Lubricants class	Fuel		Remarks
	Low sulfur (0.5 % $\geq$)	High sulfur	
CF	○	○	TBN $\geq$ 10
CF-4	○☆	X	
CG-4	○☆	X	
CH-4	○☆	X	
CI-4	○	X	

○: Recommendable X: Not recommendable

☆: Class CF-4, CG-4 and CH-4 engine oils cannot be used on EGR (Exhaust Gas Re-circulation) type engines.

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

Transmission oil

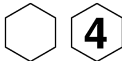
- The oil used to lubricate the transmission is also used as hydraulic fluid. To insure proper operation of the hydraulic system and to complete lubrication of the transmission, it is important that a multi-grade transmission fluid is used in this system. We recommend the use of KUBOTA UDT or SUPER UDT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

9Y1210301GEG0035US0

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	 No-grade or 4T						 7T						 9T		
Indication on top of nut	  No-grade or 4T												   6T		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8	18 to 20	1.8 to 2.1	13 to 15	17 to 19	1.7 to 2.0	13 to 14	24 to 27	2.4 to 2.8	18 to 20	18 to 20	1.8 to 2.1	13 to 15	30 to 34	3.0 to 3.5	22 to 25
M10	40 to 45	4.0 to 4.6	29 to 33	32 to 34	3.2 to 3.5	24 to 25	48 to 55	4.9 to 5.7	36 to 41	40 to 44	4.0 to 4.5	29 to 32	61 to 70	6.2 to 7.2	45 to 52
M12	63 to 72	6.4 to 7.4	47 to 53	—	—	—	78 to 90	7.9 to 9.2	58 to 66	63 to 72	6.4 to 7.4	47 to 53	103 to 117	10.5 to 12.0	76.0 to 86.7
M14	108 to 125	11.0 to 12.8	79.6 to 92.5	—	—	—	124 to 147	12.6 to 15.0	91.2 to 108	—	—	—	167 to 196	17.0 to 20.0	123 to 144
M16	167 to 191	17.0 to 19.5	123 to 141	—	—	—	197 to 225	20.0 to 23.0	145 to 166	—	—	—	260 to 304	26.5 to 31.0	192 to 224
M18	246 to 284	25.0 to 29.0	181 to 209	—	—	—	275 to 318	28.0 to 32.5	203 to 235	—	—	—	344 to 402	35.0 to 41.0	254 to 296
M20	334 to 392	34.0 to 40.0	246 to 289	—	—	—	368 to 431	37.5 to 44.0	272 to 318	—	—	—	491 to 568	50.0 to 58.0	362 to 419

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[2] STUD BOLTS

Material of opponent part	Ordinariness			Aluminum		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M8	12 to 15	1.2 to 1.6	8.7 to 11	8.9 to 11	0.90 to 1.2	6.5 to 8.6
M10	25 to 31	2.5 to 3.2	18 to 23	20 to 25	2.0 to 2.6	15 to 18
M12	30 to 49	3.0 to 5.0	22 to 36	31	3.2	23
M14	62 to 73	6.3 to 7.5	46 to 54	–	–	–
M16	98.1 to 112	10.0 to 11.5	72.4 to 83.1	–	–	–
M18	172 to 201	17.5 to 20.5	127 to 148	–	–	–

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[3] 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

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[4] 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	1.19 to 1.61	8.61 to 11.6	16.3 to 19.7	1.66 to 2.01	12.0 to 14.6
5/16	23.1 to 27.7	2.35 to 2.83	17.0 to 20.5	33 to 39	3.4 to 4.0	24 to 29
3/8	48 to 56	4.9 to 5.8	35.0 to 42.0	61 to 73	6.3 to 7.4	45 to 54
1/2	110 to 130	11 to 13	80 to 96	150 to 178	15.2 to 18.2	110 to 132
9/16	150 to 178	15.2 to 18.2	110 to 132	217 to 260	22.2 to 26.5	160 to 192
5/8	204 to 244	20.8 to 24.8	150 to 180	299 to 357	30.5 to 36.4	220 to 264

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[5] 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	–	–	–

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6. MAINTENANCE CHECK LIST

No.	Item		Service Interval													Reference page	
			50	100	150	200	250	300	350	400	450	500	550	600	After since		
1	Engine oil	Change	★			☆				☆				☆	every 200 Hr	G-21	
2	Engine oil filter	Replace	★			☆				☆				☆	every 200 Hr	G-21	
3	Transmission oil filter [HST]	Replace	★			☆				☆				☆	every 200 Hr	G-22	
4	Front axle pivot	Adjust		★		☆				☆				☆	every 200 Hr	G-22	
5	Safety device	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-23	
6	King pin, Center pin etc.	Greasing	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-25	
	Throttle cable	Oil	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-26	
7	Mower gear box oil	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-26	
		Change			☆			☆			☆			☆	every 150 Hr	G-26	
8	Air cleaner	Primary element	Clean	☆		☆		☆		☆		☆		☆	every 100 Hr	G-27	*1
		Replace													every 1 years	G-27	
		Secondary element	Replace												every 1 years	G-35	
9	Battery condition	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-27	
10	Fuel line	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-29	
		Replace													every 2 years	G-29	*2
11	Fuel filter element	Check		☆		☆		☆		☆		☆		☆	every 100 Hr	G-29	
		Replace								☆					every 400 Hr	G-29	*2
12	Fan belt	Adjust		☆		☆		☆		☆		☆		☆	every 100 Hr	G-29	
13	Parking brake	Adjust		☆		☆		☆		☆		☆		☆	every 100 Hr	G-30	*2
14	Radiator hose and clamp	Check				☆				☆				☆	every 200 Hr	G-31	
		Replace													every 2 years	G-31	*2
15	Hydraulic hose	Check				☆				☆				☆	every 200 Hr	G-32	
		Replace													every 2 years	G-32	*2
16	Motion control lever pivot	Adjust				☆				☆				☆	every 200 Hr	G-32	
17	Intake air line	Check				☆				☆				☆	every 200 Hr	G-32	
		Replace													every 2 years	G-32	*4
18	Transmission fluid and rear axle gear case (RH & LH) fluid	Change								☆					every 400 Hr	G-34	
19	Hydraulic oil filter	Replace								☆					every 400 Hr	G-33	
20	Fuel injection nozzle injection pressure	Check													every 1500Hr	1-S17	*3
21	Injection pump	Check													every 3000Hr	1-S16	*3

No.	Item		Service Interval												After since	Refer- ence page	
			50	100	150	200	250	300	350	400	450	500	550	600			
22	Radiator	Clean													every 1 years	G-36	
23	Flushing and coolant	Change													every 1 years	G-36	
24	Mower gear box oil seal	Replace													every 2 years	G-38	*2
25	Fuel system	Bleed													Service as required	G-41	
26	Fuse	Replace														G-39	
27	Blade	Replace														G-40	
28	Mower belt	Replace														G-41	

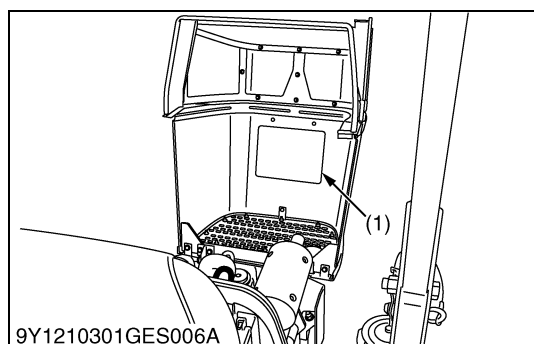
■ IMPORTANT

- The jobs indicated by ★ must be done initially.
 - *1 This maintenance should be done daily more often in dusty condition 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.

9Y1210301GEG0036US0

7. PERIODIC SERVICE CHART LABEL

9Y1210301GEG0038US0



(1) Part No. K3191-6552-2 (ENGLISH)

PERIODIC SERVICE CHART

INTERVAL		RECOMMENDED SERVICE ※		INTERVAL		RECOMMENDED SERVICE ※	
DAILY	CHECK	1. Tire pressure, wear, or damage. 2. Oil and water leakage from machine and mower. 3. Engine and transmission oil, radiator and recovery tank coolant and fuel level. 4. Damage to machine body, tightness of all bolts, nuts and pins, etc. 5. Mower blades and belt for wear or damage. 6. Parking brake, speed control levers, all safety switches and easy checker functions. 7. Color of the exhaust fumes, abnormal noise and vibrations.		E	50 Hr.	CHECK	• Mower gear box oil / Safety device
		OIL	• Throttle cable(2 places) / Motion control lever pivot bushing and contact position(2 places each)				
		GREASE	• Front axle and wheel(5 places) / Universal joint(3 places) / Seat adjuster(2 places)				
	CLEAN	• Radiator screen and core, panel screen, air cleaner primary element and mower deck.		V	100 Hr.	CHECK	• Fuel filter element / Fuel line / Battery condition
GREASE		• Mower U-joint(3 places)/Spindle shaft(3 places)/Belt tension pulley(1 place)/ Belt tension pivot(1 place)				CLEAN	• Air cleaner primary element ★
				ADJUST	• Fan belt / Parking brake ☆		
FIRST 50 Hr. 【BREAK-IN】(MUST BE DONE.)		REPLACE	• Engine & HST Transmission oil filters (2 places)	E	200 Hr.	CHANGE	• Mower gear box oil
		CHANGE	• Engine oil			CHECK	• Radiator hose and clamp / Hydraulic hose / Intake Air Line
						REPLACE	• Engine oil filter / HST transmission oil filter
FIRST 100 Hr. (MUST BE DONE.)		ADJUST	• Front axle pivot	R	400 Hr.	CHANGE	• Engine oil
						ADJUST	• Front axle pivot / Motion control lever pivot
						REPLACE	• Fuel filter element / Hydraulic oil filter
FIRST 400 Hr. (MUST BE DONE.)		REPLACE	• Hydraulic oil filter	Y	1500 Hr.☆ 3000 Hr.☆	CHANGE	• Transmission & Rear axle gear case(RH & LH) fluid
		CHANGE	• Transmission & Rear axle gear case(RH & LH) fluid			CHECK	• Fuel Injection Nozzle Injection Pressure
						CHECK	• Injection Pump
				Y	1 year	CLEAN	• Radiator
						REPLACE	• Air cleaner both elements
						CHANGE	• Coolant
				Y	2 year	REPLACE ☆	• Radiator hose and clamp / Hydraulic hose / Fuel line / Mower gear box oil seal / Intake Air Line (if necessary)
※ : See Operator's Manual in details. ☆ : Should be serviced by KUBOTA Dealer. ★ : Required more often in dusty conditions.							

Approximate fluid capacities. unit:L(qts.)

	ZD321(D782)	ZD323(D902)	ZD326(D1005)	ZD331(D1305)
Engine	3.5(3.70)		3.9(4.1)	5.7(6.0)
Radiator	2.7(2.85)		3.5(3.70)	
Transmission		12.1(12.8)		
Reserve tank		0.25(0.26)		
Mower gear box		0.4(0.42)		

Tire pressure and tightening torque recommendation.

Front	15x 6.0- 6	160 KPa (23 psi)	Ensure smooth rotation of wheel.<Do not over tighten.>
	15x 6.0- 6(NO FLAT)	NO NEED	
Rear	26x10.5-12	120 KPa (17 psi)	108.5-130.2 Nm(80.0-96.0 ft • lbs)
	26x12.0-12		

9Y1210301GES025B

9Y1210301GEG0039US0

8. 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.

9Y1210301GEG0040US0

[1] DAILY CHECK

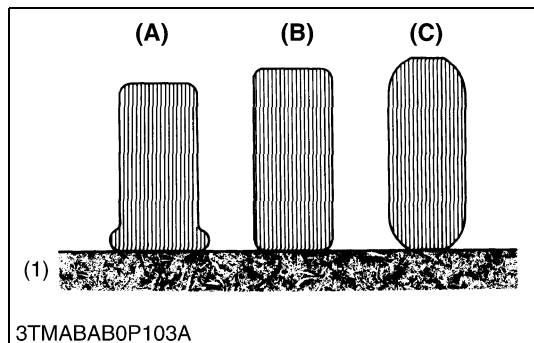
To prevent trouble from occurring, it is important to know the condition of the machine. Check the following items before starting.

9Y1210301GEG0041US0

Checking

- Check areas where previous trouble was experienced.
- Walk around the machine.
 1. Tire pressure, wear and damage
 2. Oil and water leak
 3. Engine oil level
 4. Transmission fluid level
 5. Coolant level in the radiator and the recovery tank
 6. Damage of machine body, tightness of all bolts and nuts
 7. Radiator screen
 8. Bonnet screen
 9. Brake play
 10. Air cleaner primary element
 11. Fuel level
 12. Oiling
- Mower
 1. Oil leak
 2. Make sure blade cap screws are tight.
 3. Check blades for wear or damage.
 4. Check all hardware.
 5. Make sure all pins are in place.
 6. Mower deck cleaning
 7. Greasing (Universal joint, three spindle shafts, belt tension pulley, belt tension pivot, front anti-scalp roller, front anti-scalp roller bracket boss)
- While sitting in the operator's seat,
 1. Motion control lever
 2. Parking brake
- Turning the key switch **"ON"**
 1. Performance of the Easy Checker TM light
- Starting the engine,
 1. Color of the exhaust fumes
 2. Safety start switch, seat safety control and other safety devices.
 3. Check for abnormal noise and vibration.
- Others
 1. Check the areas where previous trouble was experienced.

9Y1210301GEG0042US0



Checking Tire Pressure



WARNING

To avoid personal injury:

- Do not attempt to mount a tire on a rim. This should be done by a qualified person with the proper equipment.
- Always maintain the correct tire pressure.

Inflation pressure in front tires rises quickly when using compressed air.

Do not inflate tires above the recommended pressure shown in the Operator's Manual.

■ IMPORTANT

- Do not use tires larger than specified.

■ 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 and inflate as necessary.

	Tire Sizes	Recommended Inflation Pressure
Front	15 × 6.0-6, 4PR Rib	160 kPa (1.6 kgf/cm ² , 23 psi)
Rear	26 × 12.0-12, 4PR Turf	120 kPa (1.2 kgf/cm ² , 17 psi)

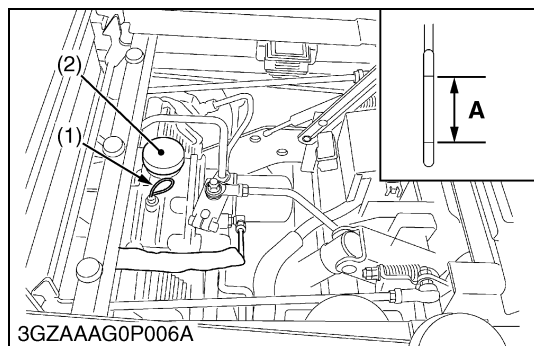
(1) Ground

(A) Insufficient

(B) Normal

(C) Excessive

9Y1210301GEG0043US0



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 and lock the operator's seat.
3. To check the oil level, draw out the dipstick, wipe it clean, replace 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-9.)

■ IMPORTANT

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

(1) Oil Level Dipstick

(2) Oil Plug and Breather Cup

A: Oil level is acceptable within this range.

9Y1210301GEG0044US0



Checking Amount of Fuel and Refueling

⚠ CAUTION

To avoid personal injury:

- 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. Take care that the fuel tank does not become empty.

Fuel tank capacity	46 L (13 U.S.gals 11 Imp.gals)
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■ IMPORTANT

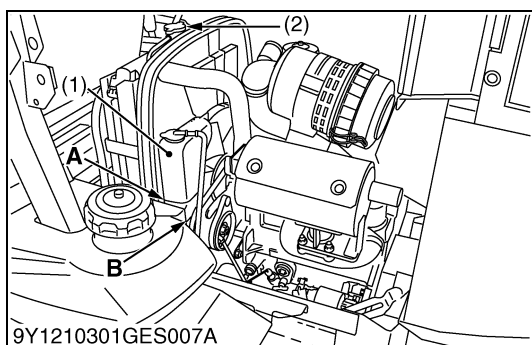
- **Use Diesel Fuel Only**

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

■ NOTE

- **No.2-D is a distillate fuel of lower volatility for engines in industrial and heavy mobile service. (SAE J313 JUN87) Grade of Diesel Fuel Oil according to ASTM D975.**

9Y1210301GEG0045US0



Checking Coolant Level

⚠ 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.

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

1. Remove the radiator cap 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.
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.

In case of leakage, add anti-freeze and water in the specified mixing ratio up to the full level.

(See page G-9.)

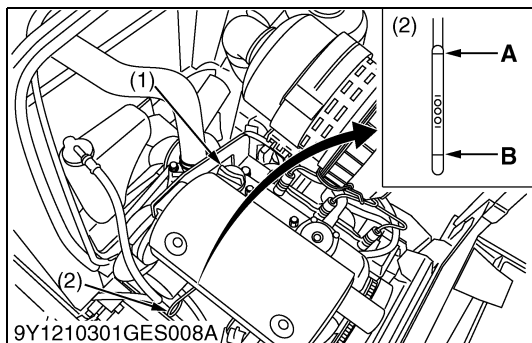
■ IMPORTANT

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

- (1) Recovery Tank
(2) Radiator Cap

A: FULL
B: LOW

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Checking Engine Oil Level



CAUTION

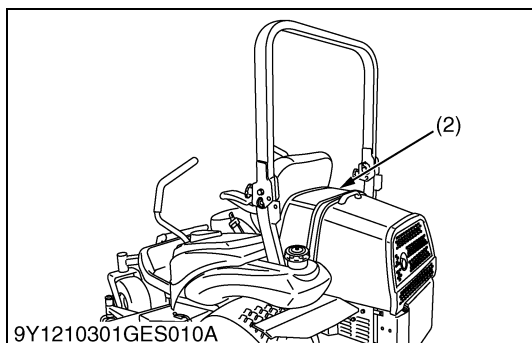
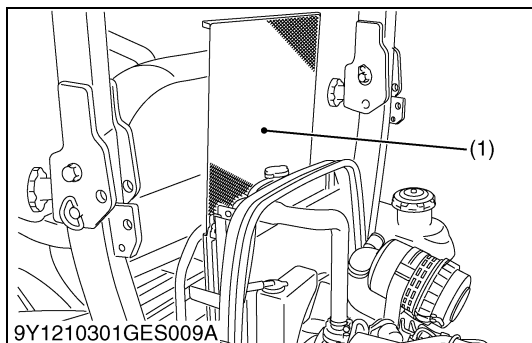
To avoid personal injury:

- 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 area clean.
 3. To check the oil level, remove the dipstick, wipe it clean, replace it, and draw it out again. Check to see that the oil level is between the two lines.
 4. Add new oil to the prescribed level at the oil port if necessary.
 5. 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.
 6. Use the proper Engine Oil SAE according to the ambient temperatures. (See page G-9.)

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

- A: Upper Level
B: Lower Level

9Y1210301GEG0047US0



Checking and Cleaning Radiator to Prevent Overheating



CAUTION

To avoid personal injury:

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

■ IMPORTANT

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

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

1. Remove the radiator screen and bonnet screen, and remove all foreign material.
2. Remove the dust from between the fins and the tube.
3. Tighten the fan drive belt as necessary. For this, refer to "EVERY 100 HOURS" in Maintenance section.
4. If scale forms in the tube, clean with the scale inhibitor or its equivalent.
5. Each time the panel screen is covered with grass during operation, rub it off the screen with hand. Check the radiator screen from time to time if grass accumulates.
6. If the dust or chaff has accumulated inside of the bonnet, remove the radiator screen and clean inside completely. After cleaning, replace the radiator screens properly.

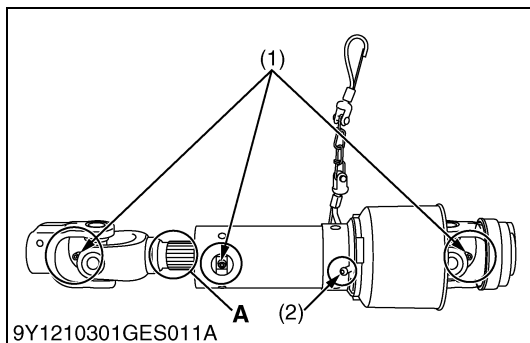
■ NOTE

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

- (1) Radiator Screen

- (2) Bonnet Screen

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Greasing Universal Joint



CAUTION

To avoid personal injury:

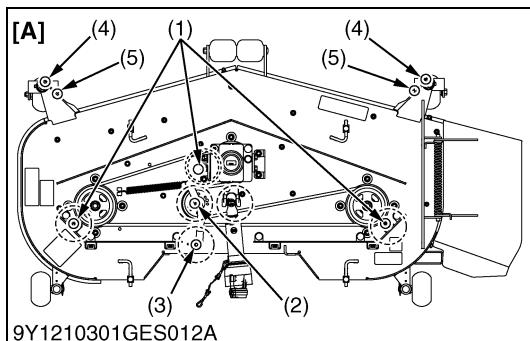
- Be sure to stop the engine and remove the key before greasing.

1. Apply grease to the following position as figures.

- (1) Mower Universal Joint
(2) Grease Nipple

A: Apply grease to the Spline with the brush.

9Y1210301GEG0049US0



Greasing Mower

- Apply grease to the following positions.

NOTE

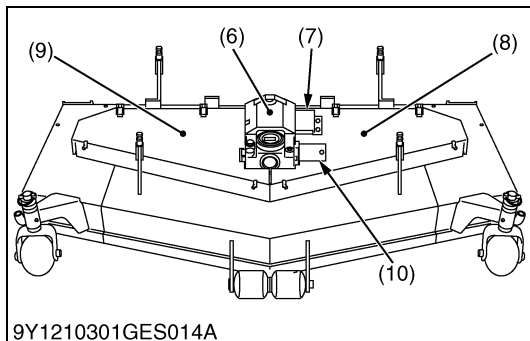
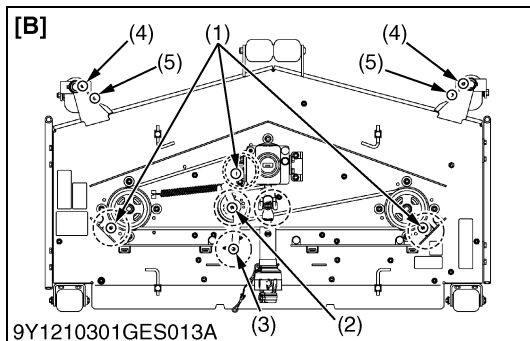
- For areas marked with double dotted line, remove the bolt and grease up plate (10).
- For areas marked with dotted line, remove the bolt, center cover (6) and grease up cover (7).
- For areas marked with chain line, no removing the cover.
- For areas in the belt cover, remove the belt cover (8),(9).

- (1) Spindle shaft
(2) Belt tension pulley
(3) Belt tension pivot
(4) Front side anti-scalp roller bracket
(5) Front side anti-scalp roller
(6) Center cover
(7) Grease up cover
(8) Left belt cover
(9) Right belt cover
(10) Grease up plate

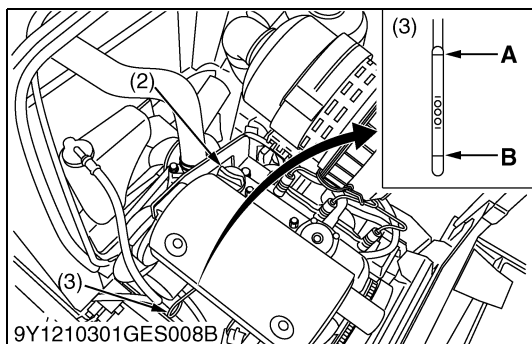
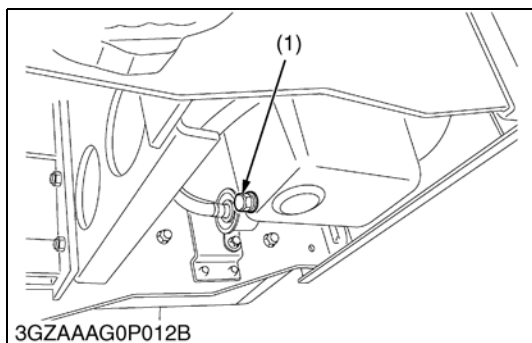
[A] RCK 60P-326Z-EU

[B] RCK 60R-326Z-EU

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[2] CHECK POINTS OF INITIAL 50 HOURS



Changing Engine Oil



CAUTION

To avoid personal injury:

- **Be sure to stop the engine before changing oil.**
- 1. Start and warm up the engine for approx. 5 minutes.
- 2. Place an oil pan underneath the engine.
- 3. To change the used oil, remove the drain plug (1) at the bottom of the engine and drain the oil completely.
- 4. Screw in the drain plug (1).
- 5. Fill with the new oil up to upper line on the dipstick (3).

■ IMPORTANT

- **When using oil of different manufacture or viscosity from the previous one, remove all of the old oil.**
- **Never mix two different type of oil.**
- **Use the proper SAE engine oil according to ambient temperatures.**

Refer to "LUBRICANTS, FUEL AND COOLANT".

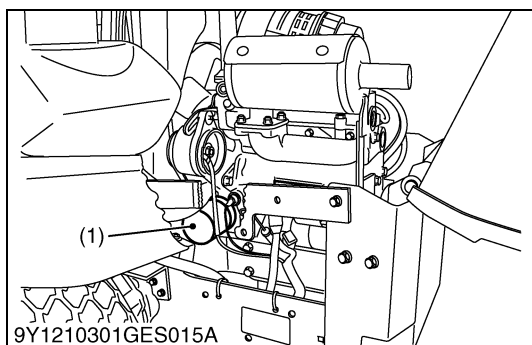
(See page G-9.)

Engine oil capacity	3.9 L
	4.1 U.S.qts
	3.4 Imp.qts

- (1) Drain Plug
(2) Oil Inlet Plug
(3) Dipstick

A: Upper Level
B: Lower Level

9Y1210301GEG0051US0



Replacing Engine Oil Filter Cartridge



CAUTION

To avoid personal injury:

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

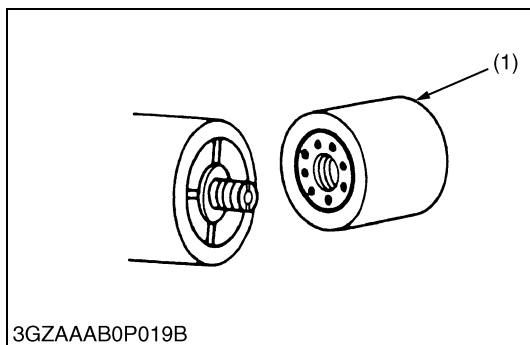
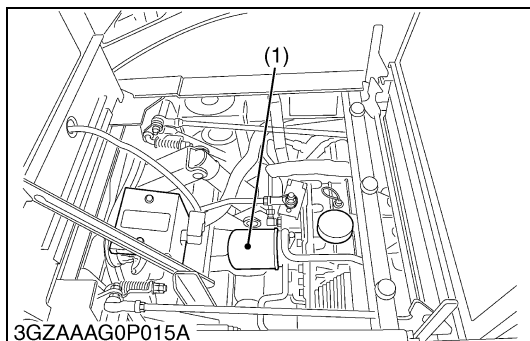
1. Remove the engine oil filter cartridge (1) with the filter wrench.
2. Apply a slight coat of oil onto the rubber gasket of new cartridge.
3. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
4. After the cartridge has been replaced, the engine 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

9Y1210301GEG0052US0



Replacing HST Transmission Oil Filter Cartridge



CAUTION

To avoid personal injury:

- 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 HST transmission oil filter cartridge (1) must be changed every 200 service hours.
2. Place an oil pan underneath the oil filter cartridge. (Do not drain oil.)
3. Remove the oil filter cartridge by using the filter wrench.
4. Apply a slight coat of oil onto the cartridge gasket.
5. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hand an additional 1/2 turn only.
6. 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.

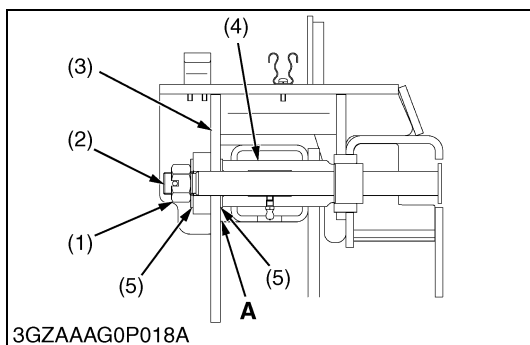
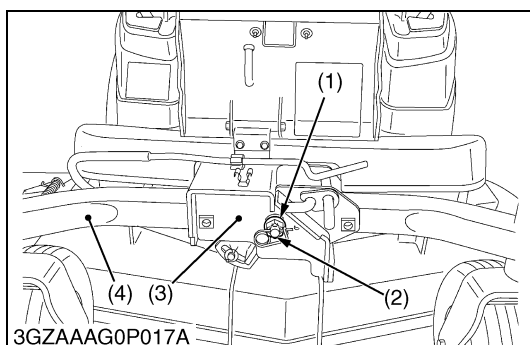
IMPORTANT

- To prevent serious damage or premature failure to the hydraulic system, use only a KUBOTA genuine filter.

(1) HST Transmission Oil Filter Cartridge

9Y1210301GEG0053US0

[3] CHECK POINT OF INITIAL 100 HOURS



Adjusting Front Axle Pivot

1. Lift up and securely block the front of the machine.
2. Measure the clearance "A" between the front axle (4) and front axle support (3).
3. If the measurement exceeds the allowable limit, remove the set spring and adjust the end play by slotted nut (1).

NOTE

- When fastening the center pin (2), tighten the nut (1) so that the front axle maybe oscillated smoothly by hand.

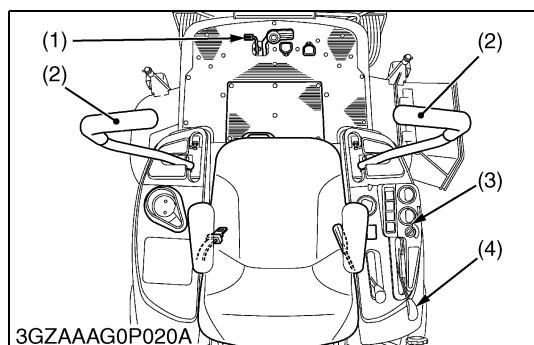
Front axle end play "A"	Factory specification	0 to 0.2 mm 0 to 0.008 in.
	Allowable limit	0.5 mm 0.02 in.

- (1) Slotted Nut
(2) Center Pin
(3) Front Axle Support
(4) Front Axle
(5) Plain Washer

A: Front Axle End Play

9Y1210301GEG0054US0

[4] CHECK POINTS OF EVERY 50 HOURS



Checking Safety Device



CAUTION

To avoid personal injury:

- Do not allow anyone near the machine while testing.
- If the machine does not pass one of the following tests, do not operate the machine.
- Sit on operator's seat for all tests except for Test 1.

■ IMPORTANT

- Check the following tests before operating the machine.

■ Test 1 (OPERATOR NOT ON THE SEAT)

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

■ Test 2 (OPERATOR ON THE SEAT)

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

■ Test 3 (OPERATOR ON THE SEAT)

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

■ Test 4 (OPERATOR ON THE SEAT)

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

■ Test 5 (OPERATOR ON THE SEAT)

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

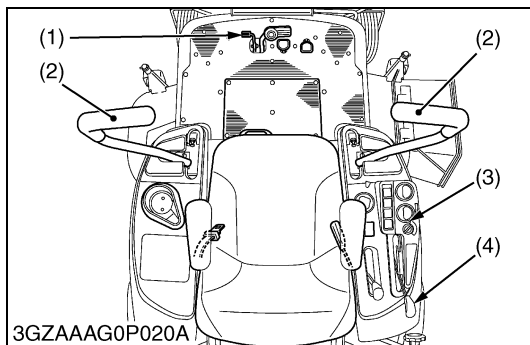
■ IMPORTANT

- For this test only, the engine will shut off in a few seconds.

- (1) Parking Brake Lock Pedal
(2) Motion Control Lever

- (3) Key Switch
(4) PTO Lever

(To be continued)

(Continued)**■ Test 6 (OPERATOR ON THE SEAT)**

1. Start the engine.
2. Do not set the parking brake.
3. Shift the PTO lever (4) to **"DISENGAGE" (OFF)** position.
4. Grasp the motion control levers (2) and move then inward from **"NEUTRAL LOCK"** position to **"NEUTRAL"** position and then release the levers.
5. Stand up. (Do not get off the machine.)
6. The engine must shut off.

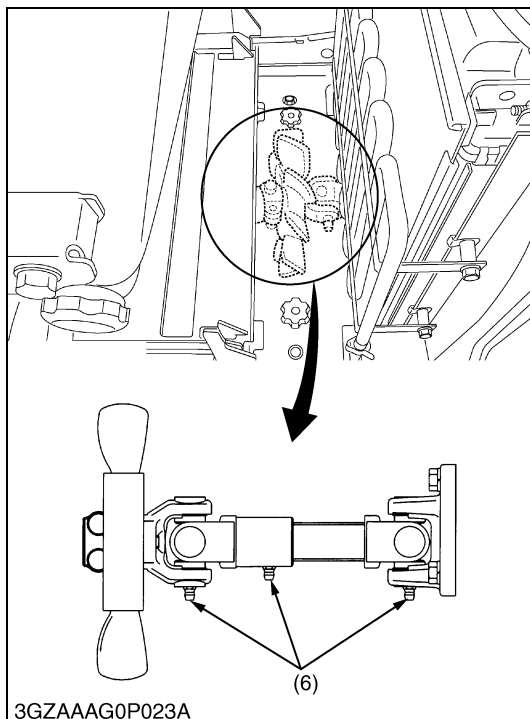
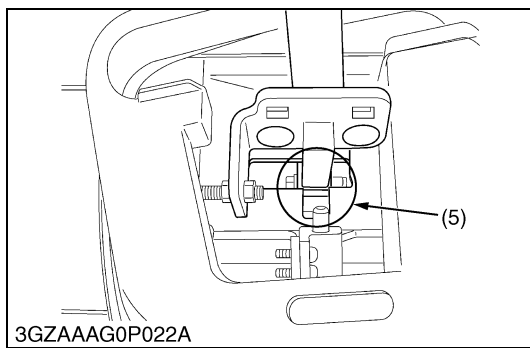
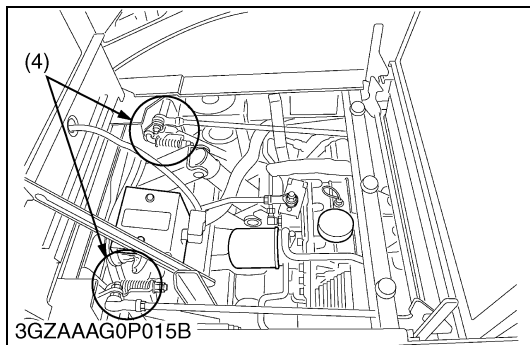
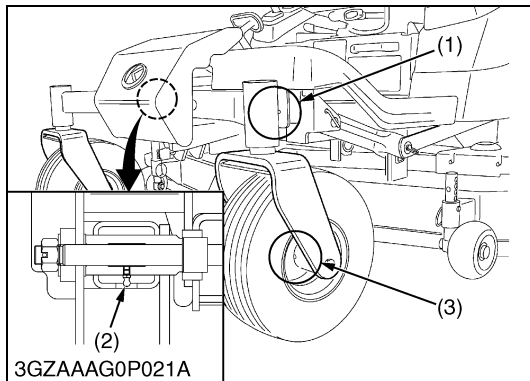
■ Test 7 (OPERATOR ON THE SEAT)

1. Start the engine.
2. Do not set the parking brake.
3. Shift the PTO lever (4) to **"ENGAGE" (ON)** position.
4. Stand up. (Do not get off the machine.)
5. The engine must shut off.

- (1) Parking Brake Lock Pedal
(2) Motion Control Lever

- (3) Key Switch
(4) PTO Lever

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Greasing

1. Apply a grease to the following position as figures.



CAUTION

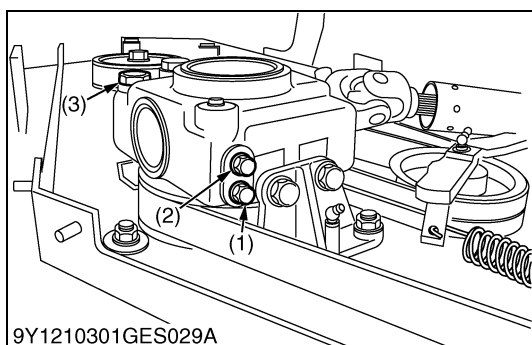
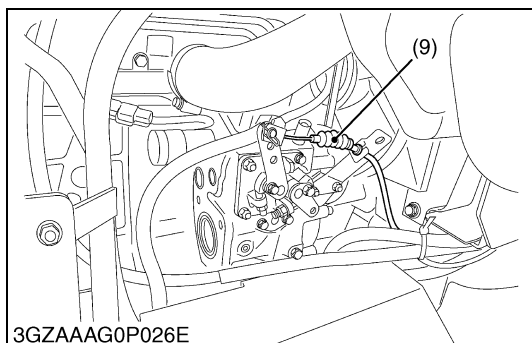
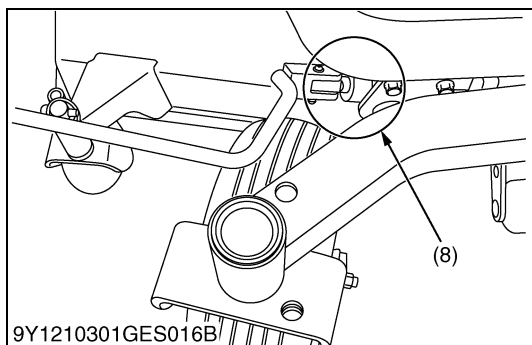
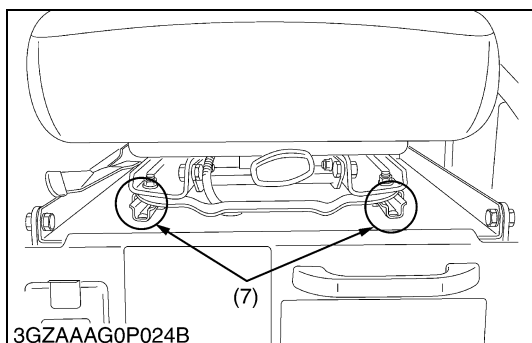
To avoid personal injury:

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

- | | |
|---|------------------------------------|
| (1) King Pin (LH, RH) | (5) Motion Control Levers (LH, RH) |
| (2) Center Pin | (6) Machine Universal Joint |
| (3) Front Wheel (LH, RH) | |
| (4) Motion Control Lever Pivot Bushing (LH, RH) | |

(To be continued)

(Continued)



1. Apply a grease to the following position as figures.

**CAUTION****To avoid personal injury:**

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

- (7) Seat Adjuster
(8) Front Lift -Arm

- (9) Throttle Cable (Oil)

9Y1210301GEG0056US0

Checking 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, remove the belt cover, loosen check plug bolt (2) and check to see that the oil level is just below the check plug port.
3. If the level is too low, add new oil to the prescribed level at the oil inlet.
(See page G-9.)

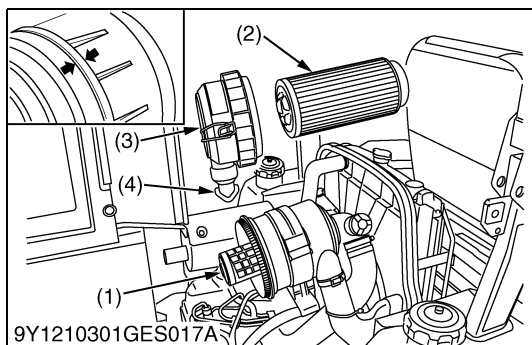
Gear box oil capacity	0.4 L 0.4 U.S.qts 0.4 Imp.qts
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- (1) Drain Plug (Bolt)
(2) Check Plug (Bolt)

- (3) Oil Filler Plug

9Y1210301GEG0057US0

[5] CHECK POINTS OF EVERY 100 HOURS



Cleaning Air Cleaner Primary Element

1. Remove the air cleaner cover and primary element (2).
2. Clean the primary element:
 - 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).
3. Replace air cleaner primary element:
Once yearly or after every sixth cleaning, whichever comes first.

■ NOTE

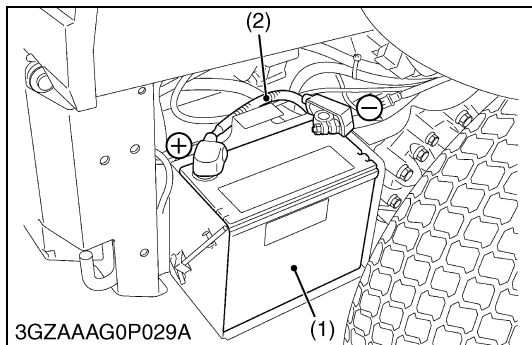
- Check to see if the evacuator valve is blocked with dust.
- The air cleaner uses a dry element, never apply oil.
- Do not run the engine with filter element removed.
- Operating in dusty conditions requires more frequent maintenance.
- Align the arrow marks when reinstalling the air cleaner cover.
- Do not touch the secondary element except in cases where replacing is required.
(See "Replacing Air Cleaner Secondary Element" in "EVERY 1 YEAR" in "PERIODIC SERVICE" section.)

[Evacuator Valve]

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

- | | |
|-----------------------|---------------------|
| (1) Secondary Element | (3) Cover |
| (2) Primary Element | (4) Evacuator Valve |

9Y1210301GEG0058US0



Checking Battery Condition



CAUTION

- Never remove the vent cap 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 battery.

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

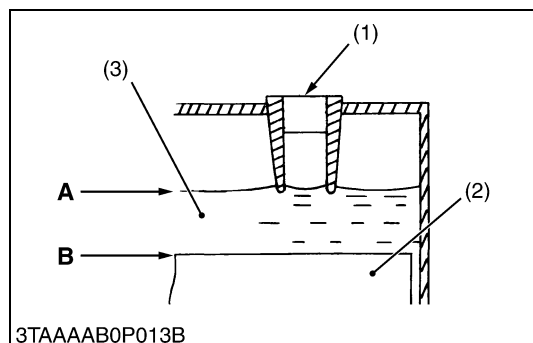
■ NOTE

- The original battery is a maintenance-free, non accessible type battery.

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

- | | |
|-------------|------------------|
| (1) Battery | (2) Ground Cable |
|-------------|------------------|

9Y1210301GEG0059US0



Battery Charging

! DANGER

To avoid serious injury or death:

- When the battery is being activated, 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 the table.

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

This is 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.)

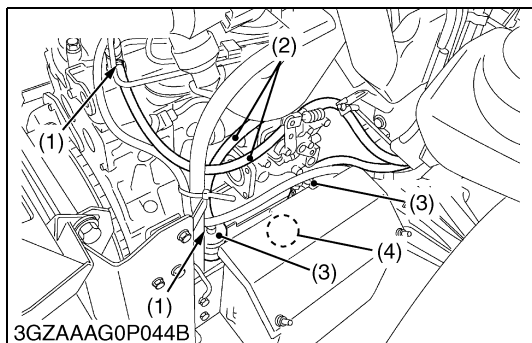
Battery type	Volts (V)	Reserve capacity (min)	Cold cranking Amps
U1L-9	12	30	285

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

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

A: Highest Level
B: Lowest Level

9Y1210301GEG0060US0



Checking Fuel Lines 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 age. 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 lines is made of rubber and ages regardless of service period.
2. If the fuel line and clamps are found damages or deteriorated, replace them.
3. Check fuel filter, if it is clogged by debris, and replace it.

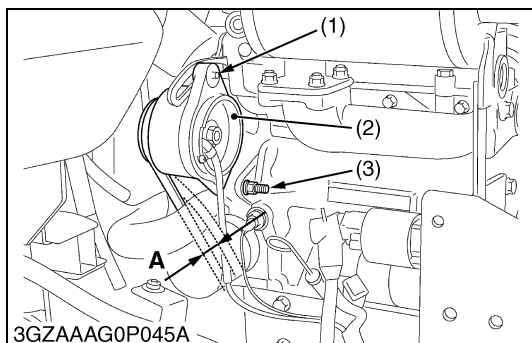
IMPORTANT

- 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 dust and dirt causes malfunction of the fuel pump and injector components.

- (1) Pipe Clamps
(2) Fuel Line

- (3) Fuel Filter
(4) Fuel Pump

9Y1210301GEG0061US0



Adjusting Fan Belt Tension

CAUTION

- Be sure to stop the engine and remove the key before checking belt tension.
1. If the fan drive belt becomes loose, the engine may overheat.
 2. To adjust, loosen bolts and turn the alternator to tighten the belt.
 3. After adjustment, securely tighten the bolts.

Moderate belt tension:

The belt deflect approx. 10 mm (0.4 in.) when the center of the belt is depressed with finger pressure of 98 N (10 kgf, 22 lbf).

Fan belt tension "A"	Factory specification	Approx. 10 mm 0.4 in.
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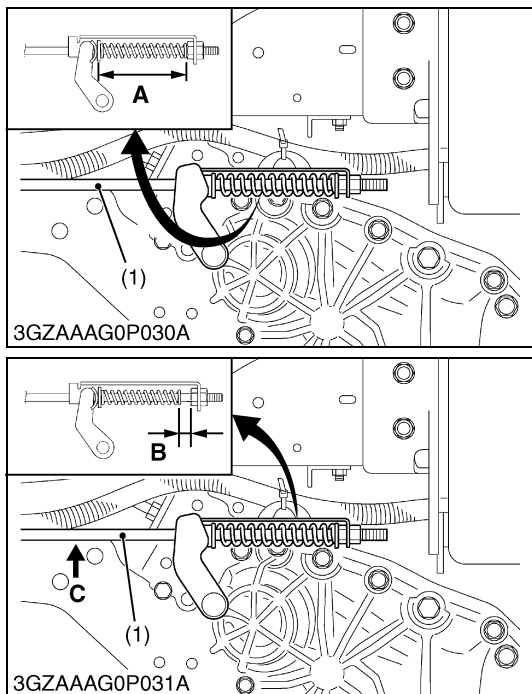
IMPORTANT

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

- (1) Tension bolt
(2) Alternator
(3) Adjustment bolt

A: Fan belt tension

9Y1210301GEG0062US0



Checking and Adjusting Parking Brake

⚠ CAUTION

To avoid personal injury:

- Park the machine on a hard and level surface.
- Stop the engine and chock the wheels before checking or adjusting.

■ IMPORTANT

- Wrong adjustment may cause machine damage.

■ Check brake spring

1. Place the motion control levers to "NEUTRAL LOCK" position.
2. Be sure to chock the rear wheels.
3. Apply the parking brake to the lock position.
4. Check the length of the brake springs on both sides.
5. Release the parking brake completely.
6. Hold the brake rod (1) lightly.
7. Check the brake spring play.
8. If these dimensions are not correct, adjust them.

Proper brake spring length "A" with the brake applied to the lock position	Factory specification	115 to 117 mm 4.53 to 4.61 in.
Proper brake spring play "B"	Factory specification	The spring must have play Reference: 0.5 to 1.0 mm 0.02 to 0.04 in.

■ Adjustment of brake spring play

1. Place the motion control lever to the "NEUTRAL LOCK" position
2. Be sure to chock the rear wheels.
3. Release the parking brake completely.
4. Loosen the lock nuts.
5. Hold the brake rod (1) by hand.
6. Tighten the nut to the correct space between the end of the spring and the nut.
7. Lock the nuts.
8. Adjust the other side spring to the same dimension.

■ Adjustment of brake spring length

1. Place the motion control lever to the "NEUTRAL LOCK" position
2. Apply the parking brake to the lock position.
3. Loosen the lock nuts.
4. Adjust the spring length to the recommendation.
5. Lock the nuts.
6. Check the brake spring play to the recommendation. If there is no play, adjust the brake spring play again.
7. Adjust the other side spring to the same dimension.

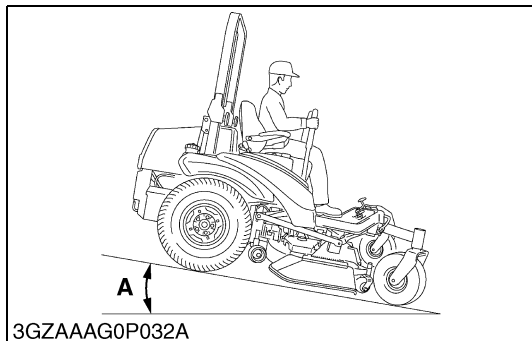
(1) Brake Rod

A: Parking Brake Spring Length

B: Parking Brake Spring Play

C: Hold the Brake Rod

9Y1210301GEG0015US0



Checking Parking Brake on the Slope

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

■ NOTE

- For parking brake test purposes, only use 17 ° ramp "A".

A: 17 ° Ramp

9Y1210301TXS0036US0

[6] CHECK POINTS OF EVERY 150 HOURS

Changing Mower Gear Box Oil

- See page G-26.

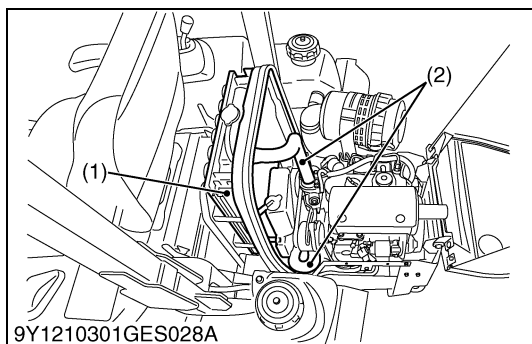
9Y1210301GEG0064US0

[7] CHECK POINTS OF EVERY 200 HOURS

Adjusting Front Axle Pivot

- See page G-22.

9Y1210301GEG0065US0



Checking Radiator Hose and Clamp

■ NOTE

- Check to see if the radiator hoses are properly fixed every 200 hours of operation or 6 months, whichever comes first.

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

■ NOTE

- Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called "Overheating".
- Park the machine in a safe place and keep the engine unloaded idling.
- Do not stop the engine suddenly, but stop it after about 5 minutes of unloaded idling.
- Keep yourself well away from the machine for further 10 minutes or while the steam is blown out.
- Checking that there gets no danger such as burning, get rid of the causes of overheating and then start the engine again.

(1) Radiator Core

(2) Radiator Hose

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Changing Engine Oil

- See page G-21.

9Y1210301GEG0067US0

Changing Engine Oil Filter Cartridge

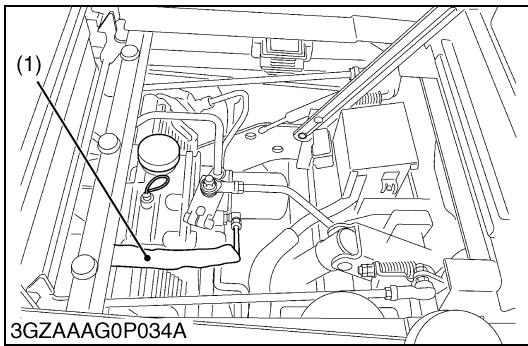
- See page G-21.

9Y1210301GEG0068US0

Changing HST Transmission Oil Filter Cartridge

- See page G-22.

9Y1210301GEG0069US0



Checking Hydraulic Hose

⚠ CAUTION

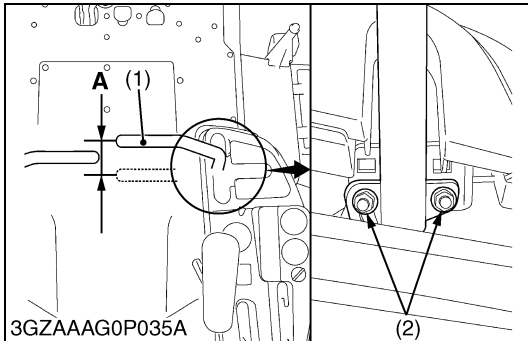
To avoid personal injury:

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

1. Check to see the hose is tight and not damaged.
2. If the worn or damaged of the hose is found, replace it.

(1) Mower Lift Cylinder Hose

9Y1210301GEG0070US0



Adjusting the Motion Control Lever Pivot

⚠ CAUTION

To avoid personal injury:

- Be sure to stop the engine and set the parking brake to "ON" before checking.

Lever free travel "A"	Factory specification	2 to 15 mm 0.08 to 0.59 in.
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1. Set the motion control lever (1) in the "NEUTRAL" position.
2. Slightly move the lever back and forth and measure the free travel at the top of lever stroke.
3. If the free travel limits are exceeded, remove the fender and retighten the nut to specified torque.

■ NOTE

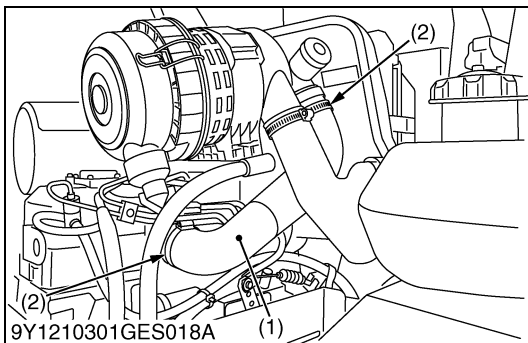
- If the motion control lever pivot bolt (2) is maladjusted, speed control may be difficult.

Tightening torque	Pivot bolt	18.6 to 20.6 N·m 1.9 to 2.1 kgf·m 13.7 to 15.2 lbf·ft
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(1) Motion Control Lever
(2) Bolt

A: Free Travel

9Y1210301GEG0071US0



Checking Intake Air Line

1. Check to see that hoses 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) Hose

(2) Clamp

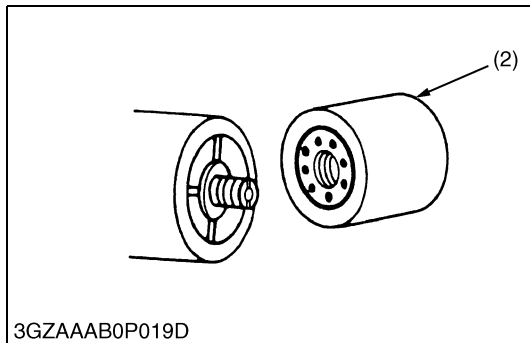
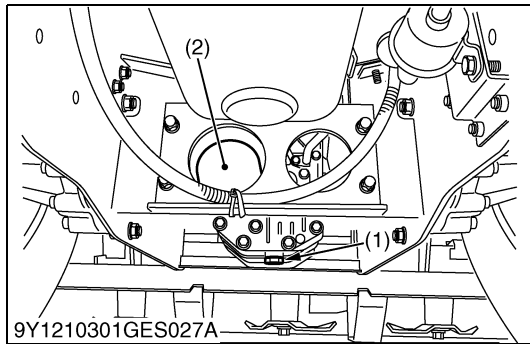
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[8] CHECK POINT OF EVERY 400 HOURS

Replacing Fuel Filter

- See page G-29.

9Y1210301GEG0073US0



Replacing Hydraulic Oil Filter Cartridge

CAUTION

To avoid personal injury:

- 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 oil filter cartridge must be changed every 400 service hours.
 2. To drain the transmission oil, place oil pan underneath the transmission case and the rear axle gear case (RH and LH) and remove the drain plug at the bottom of the transmission case and the rear axle gear case (RH and LH).
 3. After draining, reinstall the drain plugs.
 4. Remove the oil filter cartridge by using the filter wrench.
 5. Apply a slight coat of oil onto the cartridge gasket.
 6. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hand an additional 1/2 turn only.
 7. 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.

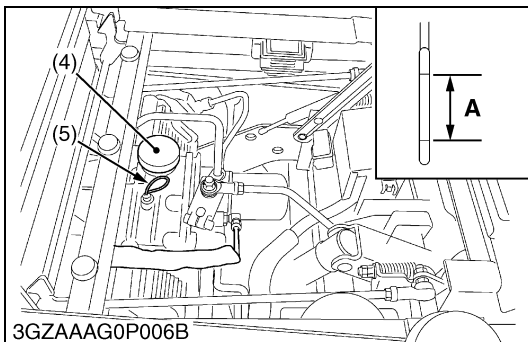
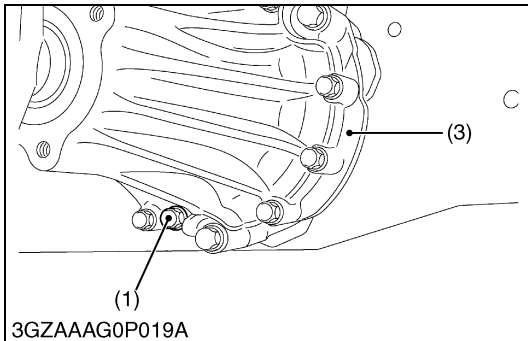
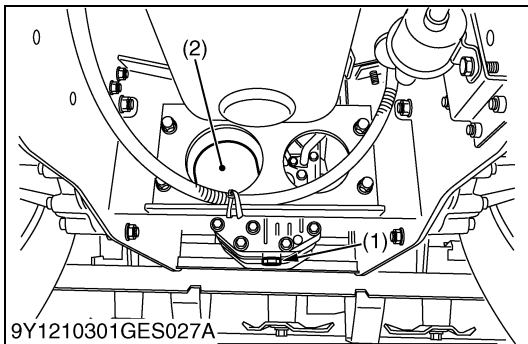
IMPORTANT

- To prevent serious damage or premature failure to the hydraulic system, use only a KUBOTA genuine filter.

(1) Drain Plug

(2) Hydraulic Oil Filter Cartridge

9Y1210301GEG0074US0



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

⚠ CAUTION

To avoid personal injury:

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

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

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

■ IMPORTANT

- If it takes time to pour the oil from the transmission case to reach the rear axle case (RH and LH) pour the regulated amount of oil slowly.
- 4. After running the engine for a few minutes, stop it and check the oil level again; add oil to the prescribed level.

■ IMPORTANT

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

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

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

A: Oil level acceptable within this range.

9Y1210301GEG0075US0

[9] CHECK POINTS OF EVERY 1500 HOURS

Checking Fuel Injection Nozzle (Injection Pressure)

- See page 1-S17.

9Y1210301GEG0076US0

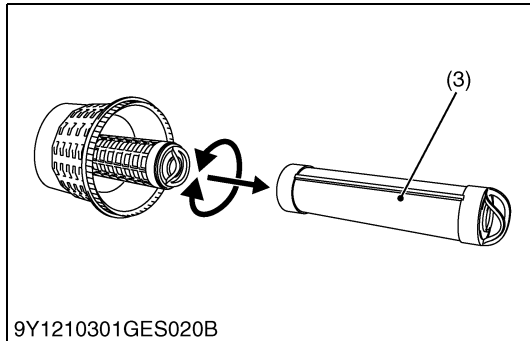
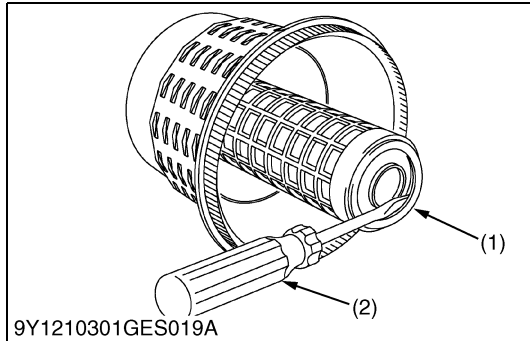
[10] CHECK POINTS OF EVERY 3000 HOURS

Checking Injection Pump

- See page 1-S16.

9Y1210301GEG0077US0

[11] CHECK POINTS OF EVERY 1 YEAR



Replacing Air Cleaner Secondary Element

1. Pull out the two tabs (1) of the secondary element (3) using a suitable tool (e.g. Flat-blade screwdriver) as shown in the figure.
2. While turning slightly, pull out the secondary element (3).

■ IMPORTANT

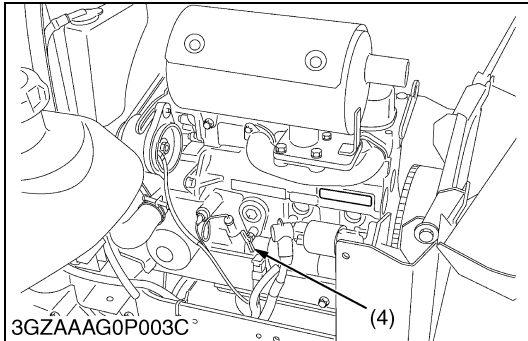
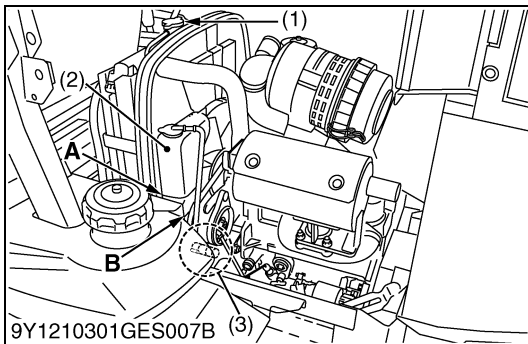
- To prevent serious damage to the engine, use only a KUBOTA genuine filter.
- Pull out the tabs (1) only when replacing the secondary element (3).
- The air cleaner uses a dry element, never apply oil.
- Do not run the engine with filter element removed.
- Be sure to refit the air cleaner cover. If the air cleaner cover is improperly fitted, evacuator valve will not function and dust will adhere to the element.
- If it is loose, dust and dirt may be sucked in, wearing down the cylinder and piston rings earlier and thereby resulting in poor power output.

(1) Tab

(2) Flat-blade Screwdriver

(3) Secondary Element

9Y1210301GEG0078US0



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, open the radiator drain cock (4) and remove the radiator drain plug (3) and remove the radiator cap (1). The radiator cap (1) must be removed to completely drain the coolant.
 3. After all coolant is drained, close the drain cock (4) and install the drain plug (3).
 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 (1) securely.
 7. Fill with coolant up to the "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 (2) 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.
- Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)

Coolant capacity	Cooling system	2.6 L 2.7 U.S.qts 2.3 Imp.qts
	Recovery tank	0.25 L 0.26 U.S.qts 0.22 Imp.qts

- (1) Radiator Cap
- (2) Recovery Tank
- (3) Drain Plug
- (4) Drain Cock

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 should drink antifreeze, throw up at once and take medical attention.
- When anti-freeze comes in contact with the skin or clothing, wash it off immediately.
- Do not mix different types of Antifreeze. 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. If swallowed anti-freeze is harmful.
- 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 cooling water 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.

■ **IMPORTANT**

- When the antifreeze 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	226

* At 1.013 x 10⁵Pa (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.

5. 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 manufacturer and type in the same mixture percentage. (Different brands may have different additive components, and the engine may fail to perform as specified.)
6. 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.
7. 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 concentrates 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.

9Y1210301GEG0079US0

[12] CHECK POINT OF EVERY 2 YEARS

Replacing Hydraulic Hose

1. Replace the hose.
Refer to "Checking Hydraulic Hose". (See page G-32.)

9Y1210301GEG0080US0

Replacing Radiator Hose

1. Replace the hoses and clamps.
Refer to "Checking Radiator Hose and Hose Clamp". (See page G-31.)

9Y1210301GEG0081US0

Replacing Fuel Lines

1. Replace the fuel line.
Refer to "Checking Fuel Lines and Fuel Filter". (See page G-29.)

9Y1210301GEG0082US0

Replacing Intake Air Line

1. Replace the intake air line.
Refer to "Checking Intake Air Line". (See page G-32.)

9Y1210301GEG0083US0

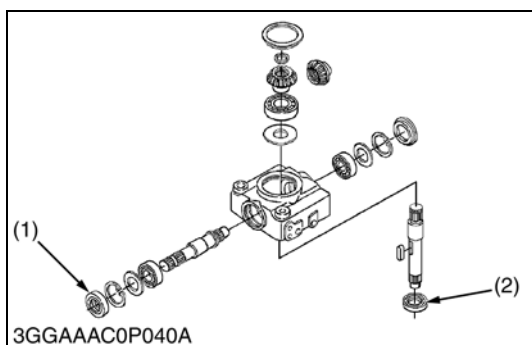
Replacing Mower Gear Box Seals

1. Replace the mower gear box oil seals (1), (2).
Refer to "Disassembling Gear Box Assembly". (See page 6-S12.)

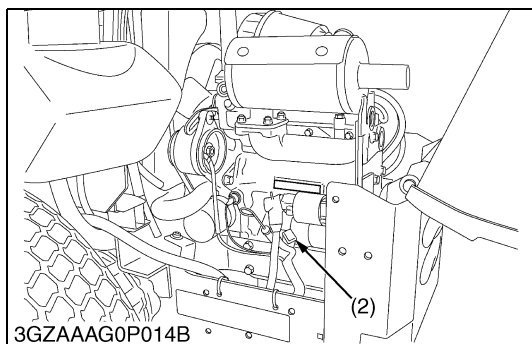
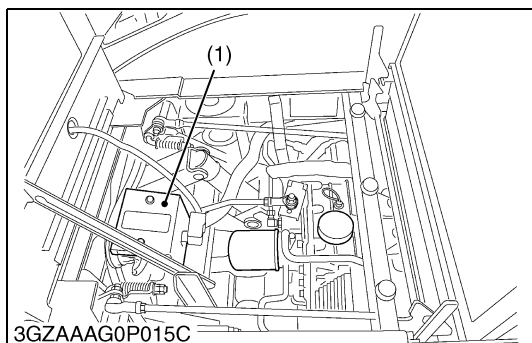
(1) Oil Seal

(2) Oil Seal

9Y1210301GEG0084US0



[13] SERVICE AS REQUIRED



Replacing Fuses

1. The electrical system is protected from potential damage by fuses.
A blown fuse indicates that there is an overload or short somewhere in the electrical system.
2. If any of the fuses should blow, replace with a new one of the same capacity.

■ IMPORTANT

- Before replacing a blown fuse, determine why the fuse blew and make any necessary repairs. Failure to follow this procedure may result in serious damage to the electrical system.

■ Protected Circuit

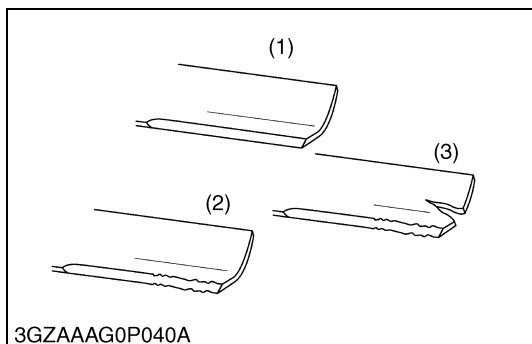
Fuse No. (ID LABEL)	Capacity (A)	Protected circuit
1	20 A	Engine stop
	15 A	Charge system
	15 A	Main system
	15 A	Aux. outlet
	10 A	Control system
	(20 A)	*(Work light)
2	Slow blow fuse 40 A	Check circuit against wrong battery connection

*Option: The fuse should be in only when the work light is attached.

(1) Fuse Location

(2) Slow Blow Fuse

9Y1210301GEG0085US0



Checking Mower Blade

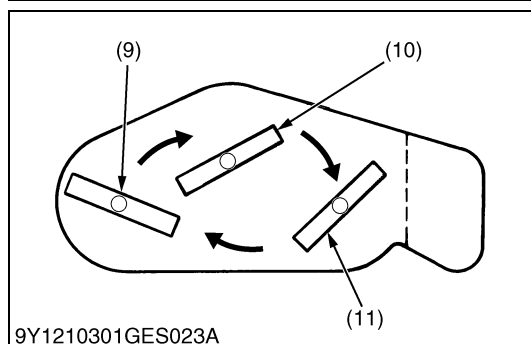
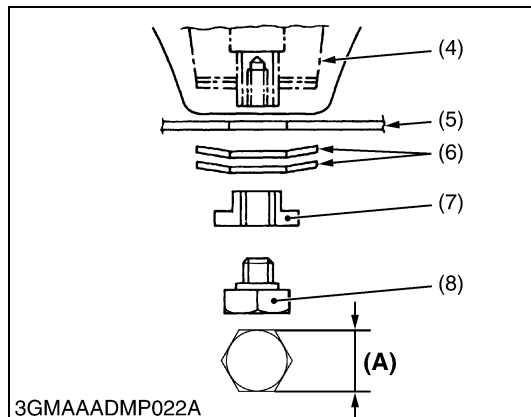
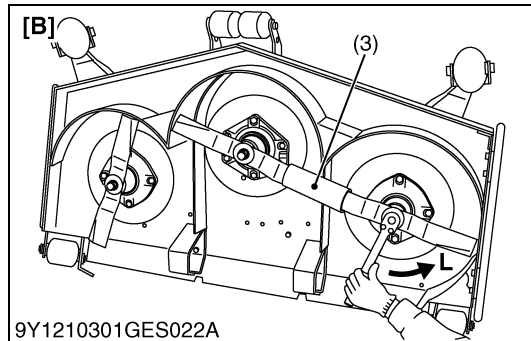
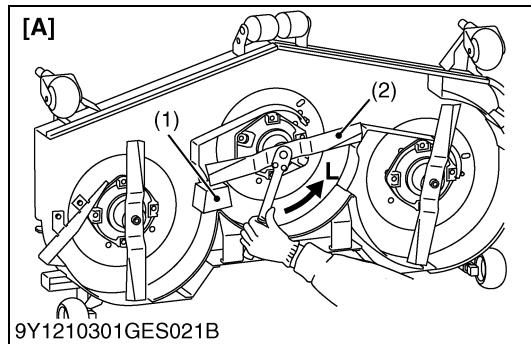
1. Check the cutting edge of mower blade.
2. Sharpen the cutting edges, if the mower blades are as shown in figure (2).
3. Replace the mower blades, if they are as shown in figure (3).

(1) New Blade

(2) Worn Blade

(3) Cracked Blade

9Y1210301GEG0086US0



Replacing and Sharpening Mower Blades

1. Tilt up the mower deck.
(See "HOW TO TILT UP THE MACHINE" at page 6-S9.)

[RCK60P]

Wedge a block of wood (1) between the blade (2) and mower housing or use a box wrench over the pulley nut to prevent the spindle from rotating while removing the blade bolts.

[RCK60R]

Set a pipe (3) between the blade and the next blade or use a box wrench over the pulley nut to prevent the spindle from rotating while removing the blade bolts.

3. Loosen the blade bolt as illustrated.

■ IMPORTANT

- Use the proper metric size box or socket wrench to tighten or loosen the blade mounting bolt.

4. To sharpen the blades yourself, clamp the blade securely in a vise.
5. 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.
6. Pass the spline boss through the blade (5) and 2 cup washers (6), and tighten the bolt.

■ NOTE

- Make sure that the cup washer is not flattened out or worn; this cause blade to slip excessively.

Replace the 2 cup washer if either is damaged.

7. Before checking or replacing the blade, wipe grass and mud off the top and inside of the mower. Especially clean up the inside of the belt cover, because otherwise the belt life will be reduced.

■ IMPORTANT

- Tighten the three blade bolts to 98 to 117.6 N·m (10 to 12 kgf·m, 72 to 87 lbf·ft) of torque.
- The blade bolts have Right hand threads. Turn then counterclockwise to loosen.
- To prolong the service life of the blades, reposition them as shown in the figure below periodically.

- (1) Block Wood
- (2) Blade
- (3) Pipe
- (4) Spindle Holder
- (5) Blade
- (6) 2 Cup Washer
- (7) Lock Washer
- (8) Bolt
- (9) LH blade
- (10) Center Blade
- (11) RH blade

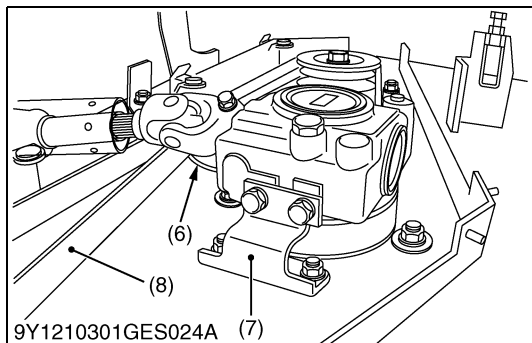
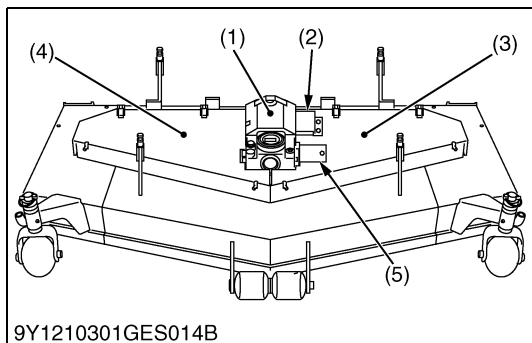
[A] RCK60P-326Z-EU

[B] RCK60R-326Z-EU

L: Loosen

(A) 30 mm (1-3/16 in)

9Y1210301GEG0087US0



Replacing Mower Belt

1. Remove the mower deck from the machine.
See "DISMOUNTING THE MOWER DECK" at page 6-S7.
2. Remove the center cover (1) and the grease up cover (2) from the mower deck.
3. Remove the left and right hand shield (3), (4) from the mower deck.
4. Clean around the gear box.
5. Remove the belt (8) from the tension pulley (6).
6. Remove the right hand bracket (7) which mounts the top of the gear box.
7. To install a new belt, reverse the above procedure.

NOTE

- **Tighten bracket bolts securely 77.6 to 90.2 N·m (8.0 to 9.2 kgf-m, 57.1 to 66.5 lbf-ft).**

- | | |
|---------------------|---------------------|
| (1) Center Cover | (5) Grease Up Plate |
| (2) Grease Up Cover | (6) Tension Pulley |
| (3) Left Shield | (7) Bracket (RH) |
| (4) Right Shield | (8) Belt |

9Y1210301GEG0088US0

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.

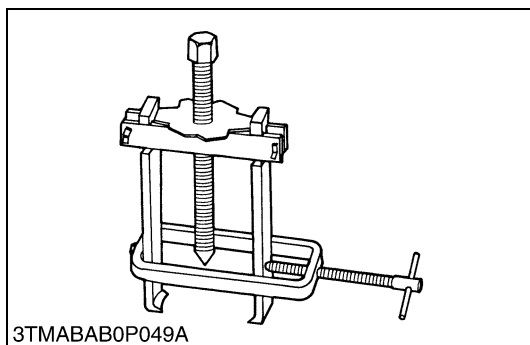
Bleeding

1. Fill the fuel tank with fuel.
2. Start the engine and run for about 30 seconds, and then stop the engine.

9Y1210301GEG0089US0

9. SPECIAL TOOLS

[1] SPECIAL TOOLS FOR ENGINE



Special Use Puller Set

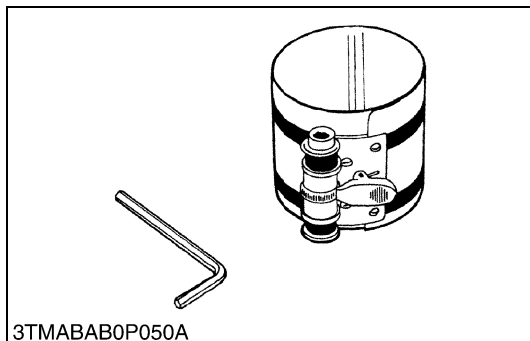
Code No.

- 07916-09032

Application

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

9Y1210301GEG0003US0



Piston Ring Compressor

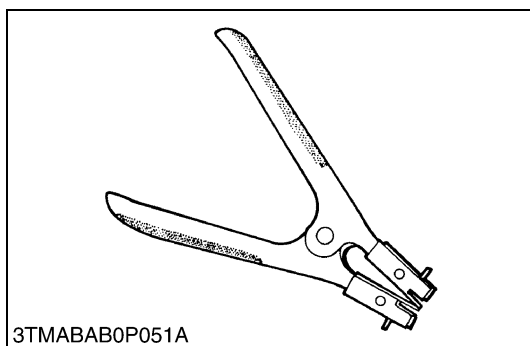
Code No.

- 07909-32111

Application

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

9Y1210301GEG0004US0



Piston Ring Tool

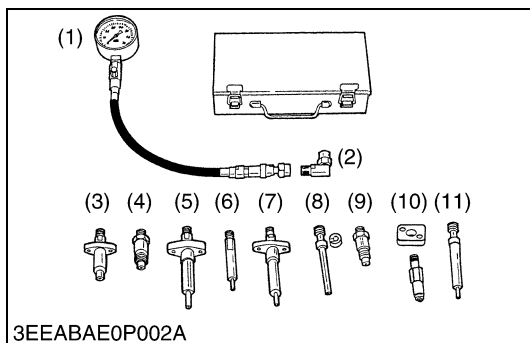
Code No.

- 07909-32121

Application

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

9Y1210301GEG0005US0



Diesel Engine Compression Tester (for Nozzle Hole)

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

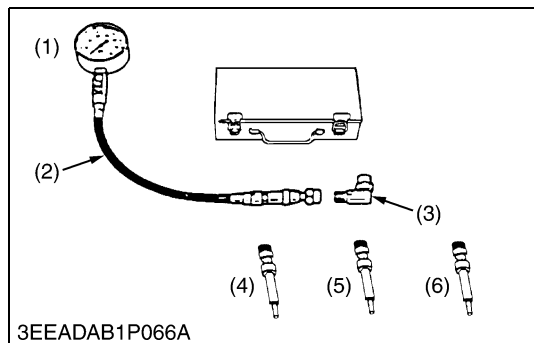
- Use to measure diesel engine compression and diagnostics of need for major overhaul.

Adaptor

- H for 05 series.

- | | |
|---------------|----------------|
| (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 | |

9Y1210301GEG0090US0



Diesel Engine Compression Tester (for Glow Plug Hole)

Code No.

- 07909-39081 (Assembly)
- 07909-31291 (**K**)
- 07909-31301 (**L**)
- 07909-31311 (**M**)

Application

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

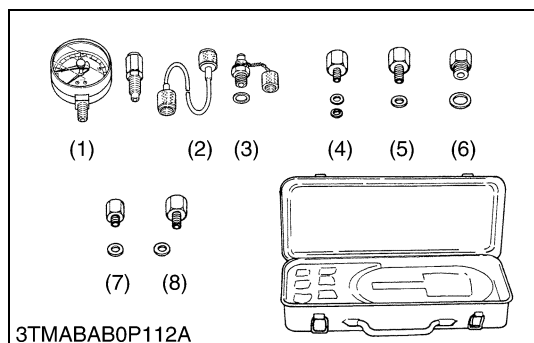
Adaptor

- **H** for 05 series.

- (1) Gauge
(2) Hose Assembly
(3) **L** Joint

- (4) Adaptor **K**
(5) Adaptor **L**
(6) Adaptor **M**

9Y1210301GEG0091US0



Oil Pressure Tester

Code No.

- 07916-32032

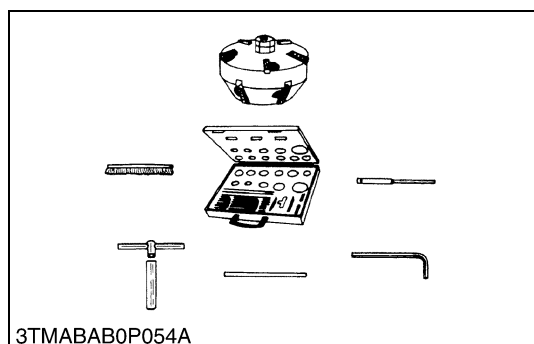
Application

- Use to measure lubricating oil pressure.

- (1) Gauge
(2) Cable
(3) Threaded Joint
(4) Adaptor **1**

- (5) Adaptor **2**
(6) Adaptor **3**
(7) Adaptor **4**
(8) Adaptor **5**

9Y1210301GEG0006US0



Valve Seat Cutter

Code No.

- 07909-33102

Application

- Use to reseal valves.

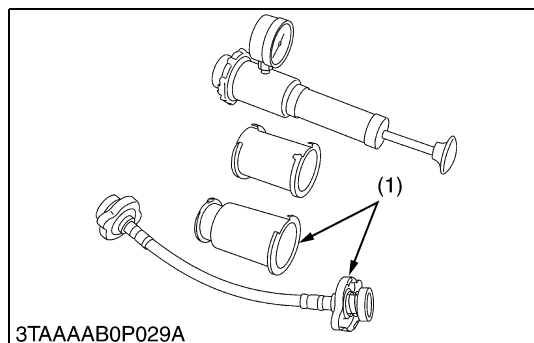
Angle

- 0.785 rad (45 °)
- 0.262 rad (15 °)

Diameter

- 28.6 mm (1.126 in.)
- 31.6 mm (1.244 in.)
- 35.0 mm (1.378 in.)
- 38.0 mm (1.496 in.)
- 41.3 mm (1.626 in.)
- 50.8 mm (2.000 in.)

9Y1210301GEG0007US0



Radiator Tester

Code No.

- 07909-31551

Application

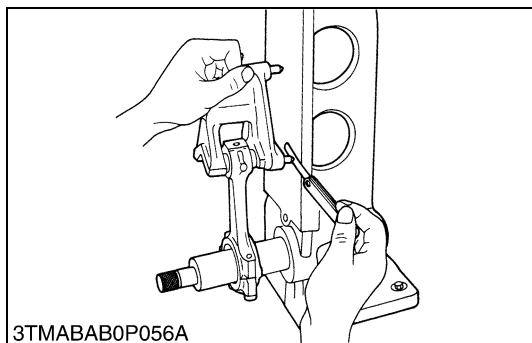
- Use to check of radiator cap pressure, and leaks from cooling system.

Remarks

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

- (1) Adaptor

WSM000001GEG0017US0



Connecting Rod Alignment Tool

Code No.

- 07909-31661

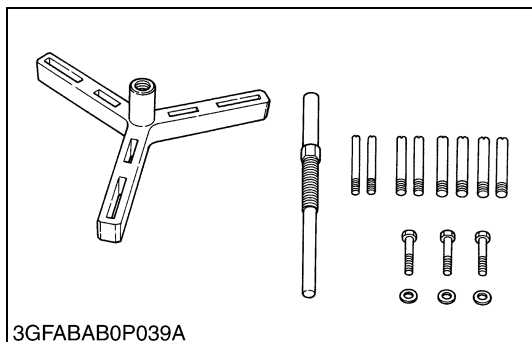
Application

- Use to check the connecting rod alignment.

Applicable range

- Connecting rod big end I.D.
30 to 75 mm dia. (1.18 to 2.95 in. dia.)
- Connecting rod length
65 to 300 mm (2.57 to 11.81 in.)

9Y1210301GEG0009US0



Flywheel Puller

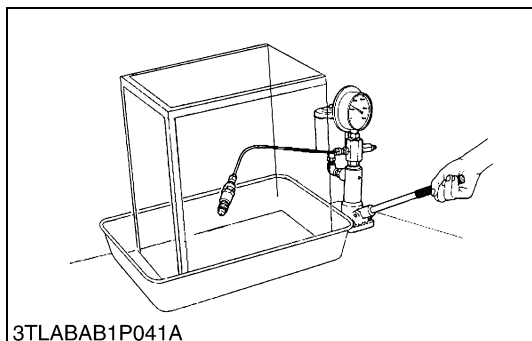
Code No.

- 07916-32011

Application

- Use exclusively for removing the flywheel with ease.

9Y1210301GEG0010US0



Nozzle Tester

Code No.

- 07909-31361

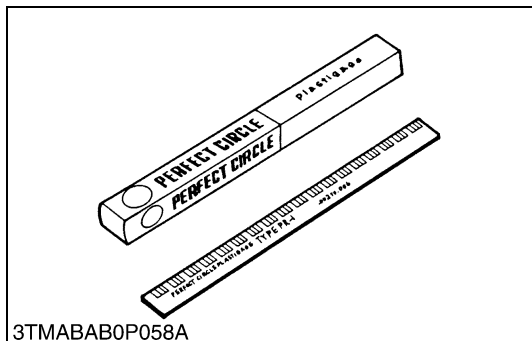
Application

- 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 7000 psi)

9Y1210301GEG0011US0



Plastigage

Code No.

- 07909-30241

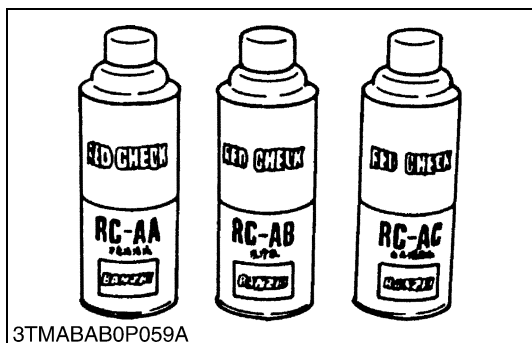
Application

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

Measuring range

- Green: 0.025 to 0.076 mm (0.001 to 0.003 in.)
- Red: 0.051 to 0.152 mm (0.002 to 0.006 in.)
- Blue: 0.102 to 0.229 mm (0.004 to 0.009 in.)

9Y1210301GEG0012US0



Red Check

Code No.

- 07909-31371

Application

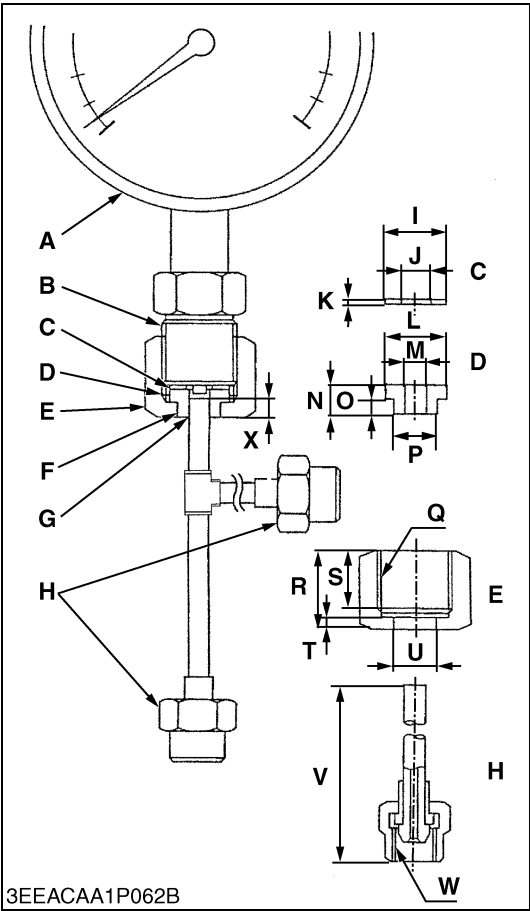
- Use to check cracks on cylinder head, cylinder block, etc..

9Y1210301GEG0013US0

■ NOTE

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

9Y1210301GEG0092US0



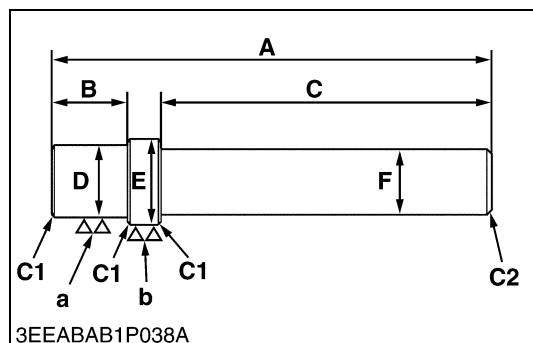
Injection Pump Pressure Tester

Application

- Use to check fuel tightness of injection pumps.

A	Pressure gauge full scale: More than 29.4 MPa (300 kgf/cm ² , 4267 psi)
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. (0.472 to 0.4732 in. dia.)
V	100 mm (3.94 in.)
W	M12 × P1.5
X	5.0 mm (0.20 in.)

9Y1210301GEG0093US0



Bushing Replacing Tool

Application

- Use to press out and press fit the bushing.

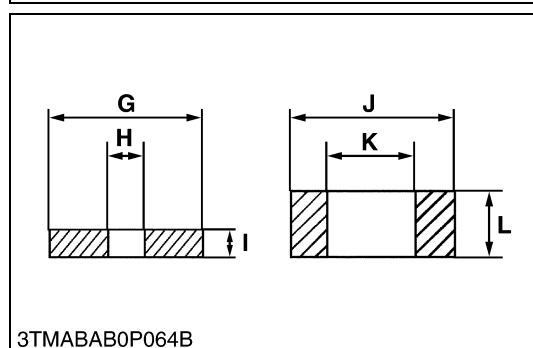
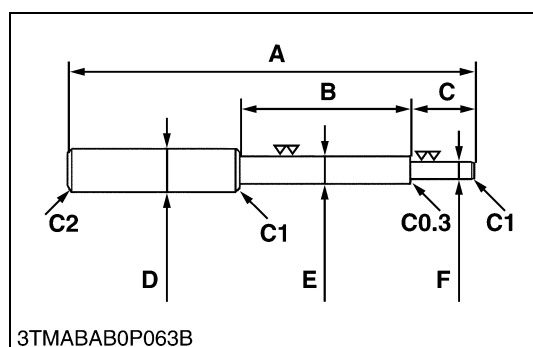
[For small end bushing]

A	157 mm (6.18 in.)
B	24 mm (0.94 in.)
C	120 mm (4.72 in.)
D	21.8 to 21.9 mm dia. (0.859 to 0.862 in. dia.)
E	24.8 to 24.9 mm dia. (0.977 to 0.980 in. dia.)
F	20 mm dia. (0.79 in. dia.)
a	6.3 μ m (250 μ in.)
b	6.3 μ m (250 μ in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

[For idle gear bushing]

A	196 mm (7.72 in.)
B	26 mm (1.0 in.)
C	150 mm (5.91 in.)
D	25.80 to 25.90 mm dia. (1.016 to 1.019 in. dia.)
E	28.80 to 28.90 mm dia. (1.134 to 1.137 in. dia.)
F	20 mm dia. (0.79 in. dia.)
a	6.3 μ m (250 μ in.)
b	6.3 μ m (250 μ in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

9Y1210301GEG0094US0



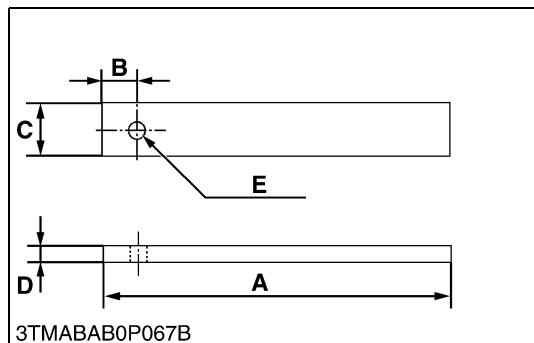
Valve Guide Replacing Tool

Application

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

A	225 mm (8.86 in.)
B	70 mm (2.8 in.)
C	45 mm (1.8 in.)
D	20 mm dia. (0.79 in. dia.)
E	11.7 to 11.9 mm dia. (0.461 to 0.468 in. dia.)
F	6.50 to 6.60 mm dia. (0.256 to 0.259 in. dia.)
G	25 mm dia. (0.98 in. dia.)
H	6.70 to 7.00 mm dia. (0.264 to 0.275 in. dia.)
I	5.0 mm (0.20 in.)
J	20 mm dia. (0.79 in. dia.)
K	12.5 to 12.8 mm dia. (0.493 to 0.503 in. dia.)
L	8.90 to 9.10 mm (0.351 to 0.358 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.30 mm (0.012 in.)

9Y1210301GEG0095US0



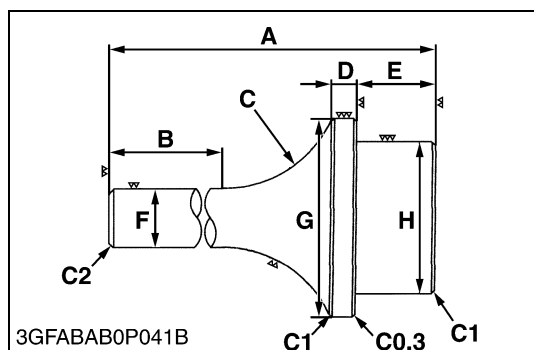
Flywheel Stopper

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.)

9Y1210301GEG0096US0



Crankshaft Bearing 1 Replacing Tool

Application

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

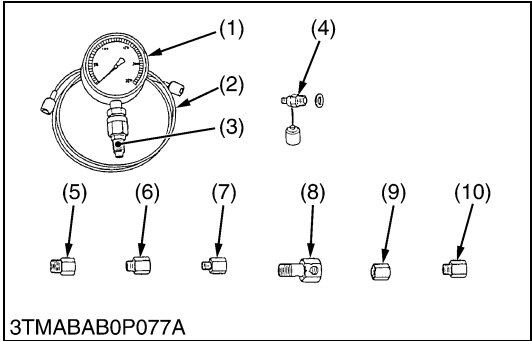
[Press Out]

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	24 mm (0.94 in.)
F	20 mm dia. (0.79 in. dia.)
G	51.20 to 51.40 mm dia. (2.016 to 2.023 in. dia.)
H	47.30 to 47.50 mm dia. (1.863 to 1.870 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.30 mm (0.012 in.)

[Press Fit]

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	24 mm (0.94 in.)
F	20 mm dia. (0.79 in. dia.)
G	68 mm dia. (2.7 in. dia.)
H	47.30 to 47.50 mm dia. (1.863 to 1.870 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.30 mm (0.012 in.)

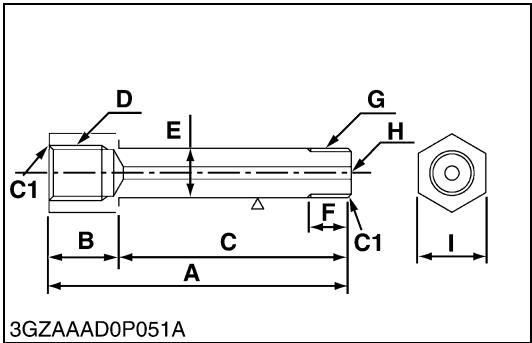
[2] SPECIAL TOOLS FOR MACHINE



Relief Valve Pressure Tester

- Code No.
- 07916-50045
- Application
- This allows easy measurement of relief set 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) |



HST Relief Valve Adaptor

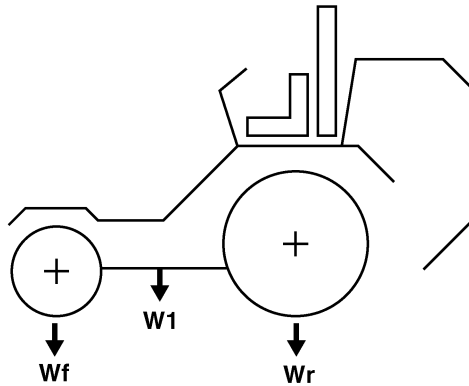
- Application
- This adaptor is used to measure the HST relief valve pressure.

A	80 mm (3.15 in.)
B	20 mm (0.79 in.)
C	60 mm (2.36 in.)
D	G 1/4 × 15 mm (0.59 in.)
E	12 mm (0.47 in.)
F	13 mm dia. (0.51 in. dia.)
G	G 1/4
H	3 mm dia. (0.118 in. dia.)
I	19 mm (0.75 in.)
C1	Chamfer 1.0 mm (0.039 in.)

10. IMPLEMENT LIMITATIONS

The KUBOTA Tractor has been thoroughly tested for proper performance with implements sold or approved by KUBOTA. Use with 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 Tractor may result in malfunctions or failures of the tractor, damage to other property and injury to the operator or others. [Any malfunctions or failures of the tractor resulting from use with improper implements are not covered by the warranty.]

	Maximum loading weight		Implement weight W_1	Maximum total weight
	Front axle W_f	Rear axle W_r		
ZD326-EU	190 kg (419 lbs)	618 kg (1363 lbs)	146 kg (322 lbs)	808 kg (1782 lbs)



3GZAAAG0P042A

9Y1210301GEG0099US0

1 ENGINE

SERVICING

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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-41
	Water in the fuel system	Change fuel and repair or replace fuel system	G-18
	Fuel pipe clogged	Clean or replace	G-29
	Fuel filter clogged	Replace	G-29
	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-10
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S23
	Incorrect injection timing	Adjust	1-S15, 1-S27, 1-S28
	Fuel camshaft worn	Replace	1-S29
	Injection nozzle clogged	Clean or replace	1-S24
	Injection pump malfunctioning	Replace	1-S28
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	1-S30 to 1-S35
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S24 to 1-S25
	Improper valve timing	Correct or replace timing gear	1-S29
	Piston ring and cylinder worn	Replace	1-S32, 1-S46, 1-S50
	Excessive valve clearance	Adjust	1-S11
	Stop solenoid malfunctioning	Replace	1-S23
Starter Does Not Run	Battery discharged	Charge	G-27
	Starter malfunctioning	Repair or replace	1-S23, 5-S9, 5-S18
	Key switch malfunctioning	Replace	5-S19
	Wiring disconnected	Connect	–
Engine Revolution Is Not Smooth	Fuel filter clogged or dirty	Replace	G-29
	Air cleaner clogged	Clean or replace	G-27, G-35
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S23, 1-S27
	Injection pump malfunctioning	Replace	1-S28
	Incorrect nozzle opening pressure	Adjust	1-S17
	Injection nozzle stuck or clogged	Replace	1-S24
	Governor malfunctioning	Repair	1-S27

Symptom	Probable Cause	Solution	Reference Page
Either White or Blue Exhaust Gas Is Observed	Excessive engine oil	Reduce to specified level	G-21, 1-S19
	Piston ring and cylinder worn or stuck	Replace	1-S32, 1-S46, 1-S50
	Incorrect injection timing	Adjust	1-S15, 1-S27, 1-S28
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-29
	Air cleaner clogged	Clean or replace	G-27, G-35
	Deficient nozzle injection	Replace nozzle	1-S24
Deficient Output	Incorrect injection timing	Adjust	1-S15, 1-S27, 1-S28
	Engine's moving parts seem to be seizing	Repair or replace	–
	Injection pump malfunctioning	Replace	1-S28
	Deficient nozzle injection	Replace nozzle	1-S24
	Compression leak	Check the compression pressure and repair	1-S10, 1-S24 to 1-S25
	Gas leak from exhaust system	Repair or replace	–
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-S46
	Valve stem and valve guide worn	Replace	1-S37, 1-S38
	Crankshaft bearing and crank pin bearing worn	Replace	1-S47 to 1-S49
	Oil leaking due to defective seals or packing	Replace	–
Fuel Mixed into Lubricant Oil	Injection pump's plunger worn	Replace	1-S28
	Deficient nozzle injection	Replace nozzle	1-S24
	Injection pump broken	Replace	1-S28
Water Mixed into Lubricant Oil	Head gasket defective	Replace	1-S25
	Cylinder block or cylinder head flawed	Replace	1-S36, 1-S37

Symptom	Probable Cause	Solution	Reference Page
Low Oil Pressure	Engine oil insufficient	Fill	G-9
	Oil strainer clogged	Clean	1-S30
	Relief valve stuck with dirt	Clean	–
	Relief valve spring weaken or broken	Replace	–
	Excessive oil clearance of crankshaft bearing	Replace	1-S48
	Excessive oil clearance of crankpin bearing	Replace	1-S47
	Excessive oil clearance of rocker arm	Replace	1-S25
	Oil passage clogged	Clean	–
	Different type of oil	Use specified type of oil	G-9
	Oil pump defective	Replace	1-S51
High Oil Pressure	Different type of oil	Use specified type of oil	G-9
	Relief valve defective	Replace	–
Engine Overheated	Engine oil insufficient	Fill	G-9
	Fan belt broken or elongated	Replace or adjust	1-S12, 1-S13
	Coolant insufficient	Fill	G-9
	Radiator net and radiator fin clogged with dust	Clean	G-36
	Inside of radiator corroded	Clean or replace	G-36
	Coolant flow route corroded	Clean or replace	G-36
	Radiator cap defective	Replace	G-36
	Overload running	Reduce the load	–
	Head gasket defective	Replace	1-S25
	Incorrect injection timing	Adjust	1-S15, 1-S27, 1-S28
	Unsuitable fuel used	Use specified fuel	G-9, G-10
Battery Quickly Discharged	Battery electrolyte insufficient	Fill distilled water and charge	G-27
	Fan belt slips	Adjust belt tension or replace	1-S12, 1-S13
	Wiring disconnected	Connect	–
	Regulator defective	Replace	5-S12
	Dynamo defective	Replace	5-S12, 5-S18
	Battery defective	Replace	G-27

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2. SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Valve Clearance (Cold)		0.145 to 0.185 mm 0.00571 to 0.00728 in.	—
Compression Pressure		3.73 to 4.11 MPa 38.0 to 42.0 kgf/cm ² 541 to 597 psi	2.26 MPa 23.0 kgf/cm ² 327 psi
• Difference among Cylinders		—	10 % or less
Top Clearance		0.55 to 0.75 mm 0.022 to 0.029 in.	—
Cylinder Head Surface	Flatness	—	0.05 mm 0.002 in.
Valve Recessing	Intake and Exhaust	−0.05 to 0.25 mm −0.0020 to 0.0098 in.	0.40 mm 0.016 in.
Valve Stem to Valve Guide	Clearance	0.035 to 0.065 mm 0.0014 to 0.0025 in.	0.10 mm 0.0039 in.
• Valve Stem	O.D.	6.960 to 6.975 mm 0.2741 to 0.2746 in.	—
• Valve Guide	I.D.	7.010 to 7.025 mm 0.2760 to 0.2765 in.	—
Valve Face	Angle (Intake)	1.0 rad 60 °	—
	Angle (Exhaust)	0.79 rad 45 °	—
Valve Seat	Angle (Intake)	1.0 rad 60 °	—
	Angle (Exhaust)	0.79 rad 45 °	—
	Width	2.12 mm 0.0835 in.	—
Valve Spring	Free Length	37.0 to 37.5 mm 1.46 to 1.47 in.	36.5 mm 1.44 in.
	Tilt	—	1.0 mm 0.039 in.
	Setting Load	117.4 N / 31.0 mm 11.97 kgf / 31.0 mm 26.39 lbf / 1.22 in.	100.0 N / 31.0 mm 10.20 kgf / 31.0 mm 22.48 lbf / 1.22 in.
Rocker Arm Shaft to Rocker Arm	Clearance	0.016 to 0.045 mm 0.00063 to 0.0017 in.	0.10 mm 0.0039 in.
• Rocker Arm Shaft	O.D.	11.973 to 11.984 mm 0.47138 to 0.47181 in.	—
• Rocker Arm	I.D.	12.000 to 12.018 mm 0.47244 to 0.47314 in.	—

Item		Factory Specification	Allowable Limit
Push Rod	Alignment	–	0.25 mm 0.0098 in.
Tappet to Tappet Guide	Clearance	0.020 to 0.062 mm 0.00079 to 0.0024 in.	0.07 mm 0.003 in.
	O.D.	19.959 to 19.980 mm 0.78579 to 0.78661 in.	–
	I.D.	20.000 to 20.021 mm 0.78740 to 0.78822 in.	–
Timing Gear	Backlash	0.0320 to 0.115 mm 0.00126 to 0.00452 in.	0.15 mm 0.0059 in.
	Backlash	0.0360 to 0.114 mm 0.00142 to 0.00448 in.	0.15 mm 0.0059 in.
	Backlash	0.0340 to 0.116 mm 0.00134 to 0.00456 in.	0.15 mm 0.0059 in.
Governor Gear	Backlash	0.0300 to 0.117 mm 0.00119 to 0.00460 in.	0.15 mm 0.0059 in.
Idle Gear Shaft to Gear Bushing	Clearance	0.020 to 0.054 mm 0.00079 to 0.0021 in.	0.10 mm 0.0039 in.
	I.D.	26.000 to 26.021 mm 1.0237 to 1.0244 in.	–
	O.D.	25.967 to 25.980 mm 1.0224 to 1.0228 in.	–
Idle Gear	Side Clearance	0.20 to 0.51 mm 0.0079 to 0.020 in.	0.80 mm 0.031 in.
Camshaft	Side Clearance	0.070 to 0.22 mm 0.0028 to 0.0086 in.	0.30 mm 0.012 in.
	Alignment	–	0.01 mm 0.0004 in.
Cam Height	Intake	28.80 mm 1.134 in.	28.75 mm 1.132 in.
	Exhaust	29.00 mm 1.142 in.	28.95 mm 1.140 in.
Camshaft Journal to Cylinder Block Bore	Clearance	0.050 to 0.091 mm 0.0020 to 0.0035 in.	0.15 mm 0.0059 in.
	O.D.	35.934 to 35.950 mm 1.4148 to 1.4153 in.	–
	I.D.	36.000 to 36.025 mm 1.4174 to 1.4183 in.	–
Piston Pin Bore	I.D.	22.000 to 22.013 mm 0.86615 to 0.86665 in.	22.03 mm 0.8673 in.

Item		Factory Specification	Allowable Limit
Piston Pin to Small End Bushing • Piston Pin • Small End Bushing	Clearance	0.014 to 0.038 mm 0.00056 to 0.0014 in.	0.15 mm 0.0059 in.
	O.D.	22.002 to 22.011 mm 0.86622 to 0.86657 in.	—
	I.D.	22.025 to 22.040 mm 0.86713 to 0.86771 in.	—
Piston Ring Gap • Top Ring • Second Ring • Oil Ring		0.30 to 0.45 mm 0.012 to 0.017 in. 0.30 to 0.45 mm 0.012 to 0.017 in. 0.25 to 0.40 mm 0.0098 to 0.015 in.	1.25 mm 0.0492 in. 1.25 mm 0.0492 in. 1.25 mm 0.0492 in.
Piston Ring to Piston Ring Groove • Second Ring • Oil Ring	Clearance	0.0850 to 0.112 mm 0.00335 to 0.00440 in.	0.2 mm 0.008 in.
	Clearance	0.020 to 0.055 mm 0.00079 to 0.0021 in.	0.15 mm 0.0059 in.
Connecting Rod	Alignment	—	0.05 mm 0.002 in.
Crankshaft	Alignment	—	0.2 mm 0.008 in.
Crankshaft to Crankshaft Bearing 1 • Crankshaft • Crankshaft Bearing 1	Oil Clearance	0.0340 to 0.114 mm 0.00134 to 0.00448 in.	0.20 mm 0.0079 in.
	O.D.	47.934 to 47.950 mm 1.8872 to 1.8877 in.	—
	I.D.	47.984 to 48.048 mm 1.8892 to 1.8916 in.	—
Crankshaft to Crankshaft Bearing 2 • Crankshaft Journal • Crankshaft Bearing 2	Oil Clearance	0.034 to 0.095 mm 0.0014 to 0.0037 in.	0.20 mm 0.0079 in.
	O.D.	47.934 to 47.950 mm 1.8872 to 1.8877 in.	—
	I.D.	47.984 to 48.029 mm 1.8892 to 1.8909 in.	—
Crankshaft to Crankshaft Bearing 3 • Crankshaft Journal • Crankshaft Bearing 3	Oil Clearance	0.0340 to 0.1030 mm 0.00134 to 0.00405 in.	0.20 mm 0.0079 in.
	O.D.	51.921 to 51.940 mm 2.0442 to 2.0448 in.	—
	I.D.	51.974 to 52.019 mm 2.0463 to 2.0481 in.	—

Item		Factory Specification	Allowable Limit
Crankpin to Crankpin Bearing	Oil Clearance	0.029 to 0.091 mm 0.0012 to 0.0035 in.	0.20 mm 0.0079 in.
	• Crankpin	O.D. 39.959 to 39.975 mm 1.5732 to 1.5738 in.	—
	• Crankshaft Bearing	I.D. 40.040 to 40.050 mm 1.5764 to 1.5767 in.	—
Crankshaft	Side Clearance	0.15 to 0.31 mm 0.0059 to 0.012 in.	0.50 mm 0.020 in.
Cylinder Liner I.D.		76.000 to 76.019 mm 2.9922 to 2.9928 in.	76.15 mm 2.998 in.
Cylinder (Oversized)		76.500 to 76.519 mm 3.0119 to 3.0125 in.	76.65 mm 3.015 in.

LUBRICATING SYSTEM

Item		Factory Specification	Allowable Limit
Engine Oil Pressure	At Idle Speed	—	49 kPa 0.50 kgf/cm ² 7.1 psi
	At Rated Speed	197 to 441 kPa 2.00 to 4.50 kgf/cm ² 28.5 to 64.0 psi	147 kPa 1.50 kgf/cm ² 21.3 psi
Inner Rotor to Outer Rotor	Clearance	0.06 to 0.18 mm 0.002 to 0.0071 in.	—
Outer Rotor to Pump Body	Clearance	0.100 to 0.180 mm 0.00394 to 0.00708 in.	—
Inner Rotor to Cover	Clearance	0.025 to 0.075 mm 0.00099 to 0.0029 in.	—

COOLING SYSTEM

Item		Factory Specification	Allowable Limit
Fan Belt	Tension	7.0 to 9.0 mm / 98 N 0.28 to 0.35 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 → 0.60 kgf/cm ² 13 → 8.5 psi	—
Radiator	Water Leakage Test Pressure	No leak at specified pressure 177 kPa 1.8 kgf/cm ² 25.7 psi	—

FUEL SYSTEM

Item		Factory Specification	Allowable Limit
Injection Pump	Injection Timing	0.3360 to 0.3621 rad (19.25 to 20.75°) before T.D.C.	—
Pump Element	Fuel Tightness	—	13.73 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
Injection Nozzle	Injection Pressure	13.73 to 14.70 MPa 140.0 to 150.0 kgf/cm ² 1991 to 2133 psi	—
Injection Nozzle Valve Seat	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, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: See page G-11.)

Item	Size x Pitch	N·m	kgf·m	lbf·ft
Cylinder head cover screw	M7 x 1.0	7 to 8	0.7 to 0.9	5 to 6
*Cylinder head screw	M10 x 1.25	64 to 68	6.5 to 7.0	47 to 50
*Main bearing case screw 1	M8 x 1.25	30 to 34	3.0 to 3.5	22 to 25
*Main bearing case screw 2	M9 x 1.25	49 to 53	5.0 to 5.5	37 to 39
*Flywheel screw	M10 x 1.25	54 to 58	5.5 to 6.0	40 to 43
*Connecting rod screw	M8 x 1.0	42 to 46	4.2 to 4.7	31 to 33
*Rocker arm bracket nuts	M7 x 1.0	22 to 26	2.2 to 2.7	16 to 19
*Idle gear shaft screws	M6 x 1.0	9.81 to 11.2	1.00 to 1.15	7.23 to 8.31
*Fan drive pulley screw	M14 x 1.5	236 to 245	24.0 to 25.0	174 to 180
*Bearing case cover mounting screw	M6 x 1.0	9.81 to 11.2	1.00 to 1.15	7.23 to 8.31
Glow plugs	M8 x 1.0	8 to 14	0.8 to 1.5	6 to 10
Nozzle holder assembly	M20 x 1.5	49 to 68	5.0 to 7.0	37 to 50
Nozzle holder	—	35 to 39	3.5 to 4.0	26 to 28
Oil pressure switch	PT 1/8	15 to 19	1.5 to 2.0	11 to 14
Injection pipe retaining nuts	M12 x 1.5	25 to 34	2.5 to 3.5	18 to 25
Overflow pipe assembly retaining nut	M12 x 1.5	20 to 24	2.0 to 2.5	15 to 18
Drain plug with copper gasket	M12 x 1.25	33 to 37	3.3 to 3.8	24 to 27
Drain plug with rubber coated gasket	M22 x 1.5	45 to 53	4.5 to 5.5	33 to 39

■ NOTE

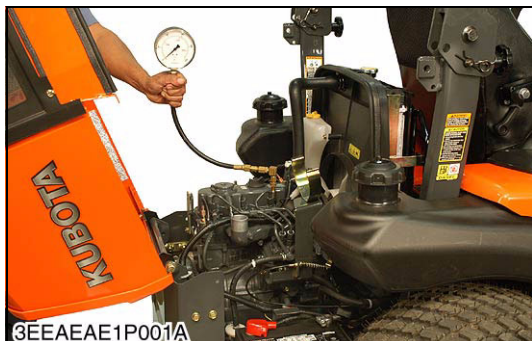
- For "*" marked screws, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.
- The letter "M" in Size x Pitch means that the screw, bolt or nut dimension stands for metric. The size is the nominal outside diameter in mm of the threads. The pitch is the nominal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

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4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

(1) Engine Body



Compression Pressure

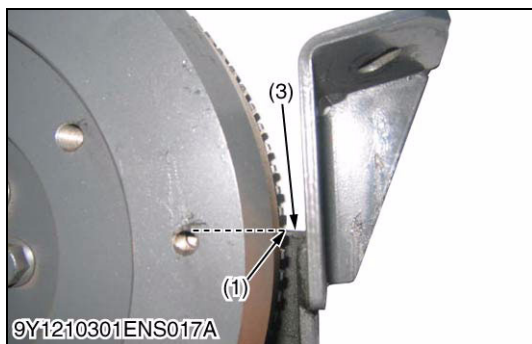
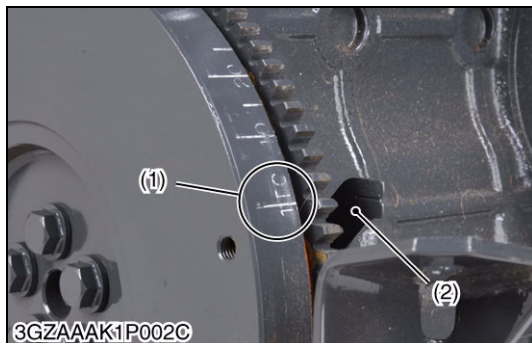
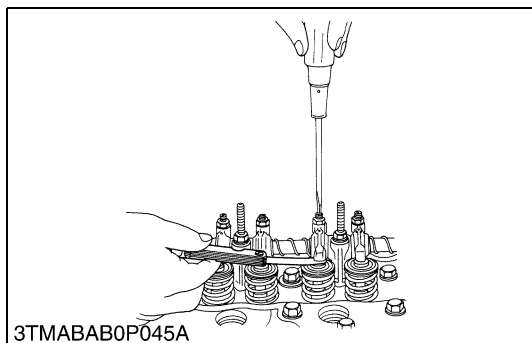
1. Run the engine until it is warmed up.
2. Stop the engine.
3. Remove the air cleaner with air cleaner support, muffler and all glow plugs (or nozzles).
4. Set a compression tester with the adaptor to the glow plug hole (or nozzle hole).
Nozzle hole: Adaptor **H** (07909-31231)
Glow plug hole: Adaptor **L** (07909-31301)
5. After making sure that the stop lever is set at the stop position (non-injection), run the engine with the starter and measure the compression pressure.
6. Repeat steps 4 and 5 for each cylinder.
7. If the measurement is less than the allowable limit, apply a small amount of oil to the cylinder wall through the glow plug hole (or nozzle hole) and measure the compression pressure again.
8. If the compression pressure is still less than the allowable limit, check the top clearance, valve clearance and cylinder head.
9. If the compression pressure increases after applying oil, check the cylinder wall and piston rings.

■ NOTE

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

Compression pressure	Factory specification	3.73 to 4.11 MPa 38.0 to 42.0 kgf/cm ² 541 to 597 psi
	Allowable limit	2.26 MPa 23.0 kgf/cm ² 327 psi

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Valve Clearance

■ IMPORTANT

- **Valve clearance must be checked and adjusted when engine is cold.**
1. Remove the cylinder head cover and the glow plugs.
 2. To get No.1 piston at the compression top dead center, **[Machine with alignment mark plate (2): Serial number from 30000]** align the "1TC" mark (1) on the flywheel to the alignment mark. **[Machine without alignment mark plate (2)]** align the "1TC" mark (1) on the flywheel to the level of the top edge of the engine support (3).
 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 (1) on the flywheel and alignment mark so that the No. 1 piston comes to the overlap position.
 6. Check the following valve clearance marked with "☆" using a feeler gauge.

Adjustable cylinder location of piston		Number of cylinders Valve arrangement	
		3 cylinder	
		IN.	EX.
When No. 1 piston is at compression top dead center	1st	☆	☆
	2nd		☆
	3rd	☆	
When No. 1 piston is at overlap position	1st		
	2nd	☆	
	3rd		☆
Valve clearance	Factory specification	0.145 to 0.185 mm 0.00571 to 0.00728 in.	

■ 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.

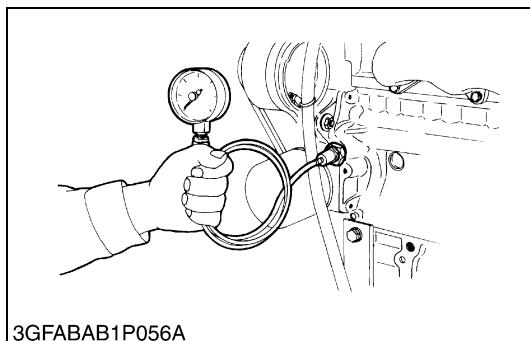
(1) "1TC" Mark

(2) Alignment Mark Plate

(3) Top Edge of Engine Support

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(2) Lubricating System



Engine Oil Pressure

1. Remove the engine oil pressure switch, and set an oil pressure tester.
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 defective
 - 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

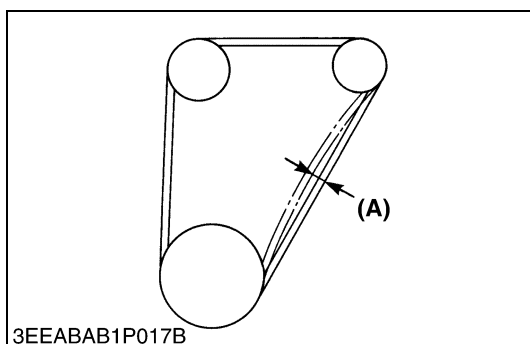
(When reassembling)

- 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 2.0 kgf·m 11 to 14 lbf·ft
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(3) Cooling System



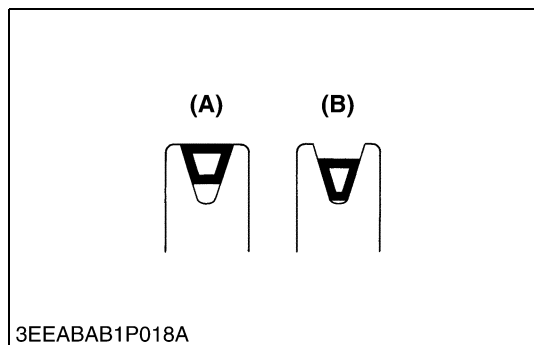
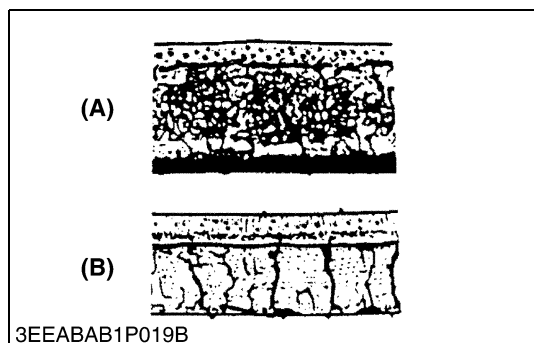
Fan Belt Tension

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

Deflection (A)	Factory specification	7.0 to 9.0 mm 0.28 to 0.35 in.
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(A) Deflection

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Fan Belt Damage and Wear

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

(A) Good

(B) Bad

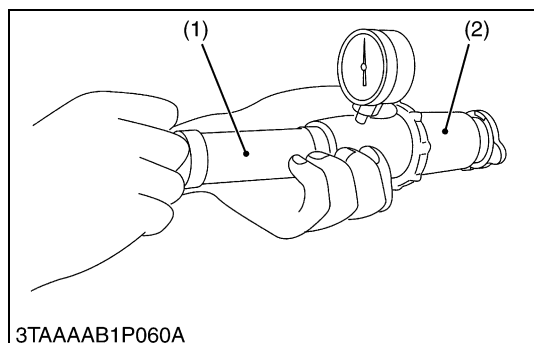
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CAUTION

- 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

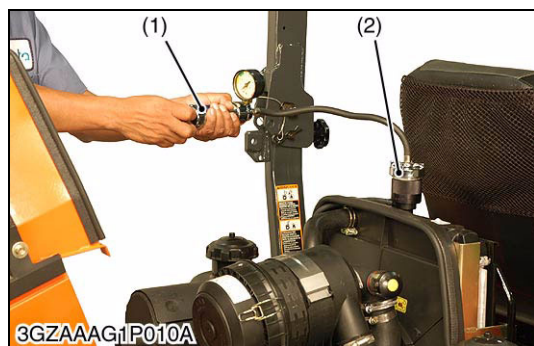
1. Set a radiator tester (1) and an adaptor (2) on the radiator cap.
2. Apply the specified pressure 88 kPa (0.9 kgf/cm², 13 psi), and measure the time for the pressure to fall to 59 kPa (0.6 kgf/cm², 9 psi).
3. If the measurement is less than the factory specification, replace the radiator cap.

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)

(1) Radiator Tester

(2) Adaptor

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Radiator Water Leakage

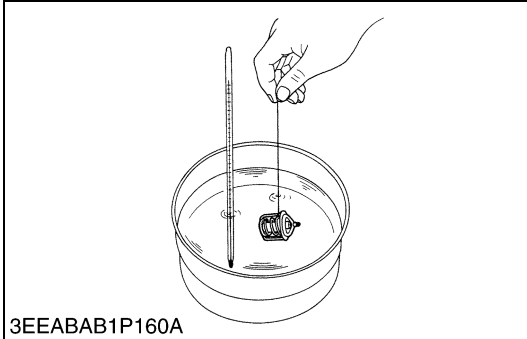
1. Pour a specified amount of water into the radiator.
2. Set a radiator tester (1) and an adaptor (2) and raise the water pressure to the specified pressure.
3. Check the radiator for water leaks.
4. For water leak from the pinhole, repair with the radiator cement. When water leak is excessive, replace the radiator.

Radiator water leakage test pressure	Factory specification	177 kPa 1.8 kgf/cm ² 25.7 psi

(1) Radiator Tester

(2) Adaptor

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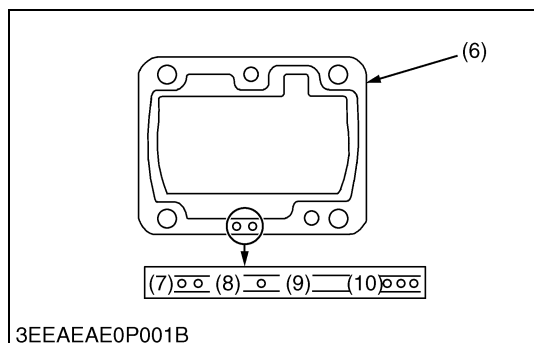
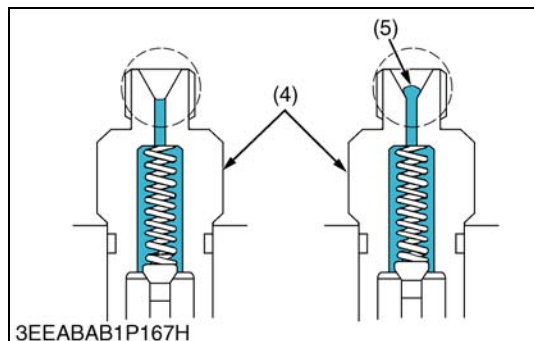
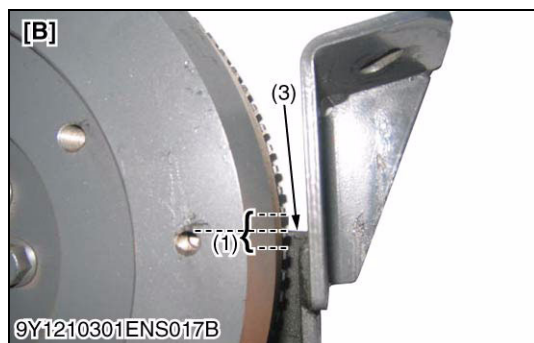
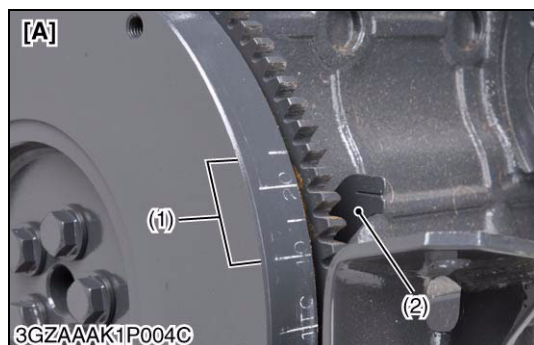
**Thermostat Valve Opening Temperature**

1. Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
2. Heating the water gradually, read the temperature when the valve opens and leaves the string.
3. Continue heating and read the temperature when the valve opens approx. 8 mm (0.3 in.).
4. 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

9Y1210301ENS0014US0

(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 (2) 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 1.57 rad (90 °).
5. Turn the flywheel counterclockwise to set at 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 gas mark "1TC", "10" and "20" for the crank angle before the top dead center of No. 1 cylinder.
8. If injection timing is out of adjustment, readjust the timing with shims.

Injection timing	Factory specification	0.3360 to 0.3621 rad (19.25 to 20.75 °) before T.D.C.
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NOTE

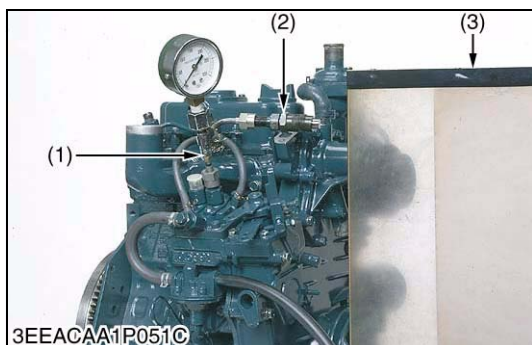
- The liquid gasket is not required for assembling.
- Shims are available in thickness of 0.20 mm (0.0079 in.), 0.25 mm (0.0098 in.), 0.30 mm (0.012 in.) and 0.35 mm (0.014 in.) and 0.175 mm (0.00689 in.). Combine these shims for adjustments.
- Addition or reduction of shim (0.025 mm, 0.00098 in.) delays 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 thick shim is coated only on the lower face. Therefore, do not use the 0.175 mm thick shim as the top shim of the combination (injection pump side), because this can cause oil leakage.

- | | |
|-----------------------------------|---------------------------------------|
| (1) Timing Line | (7) Two-holes: 0.20 mm (0.0079 in.) |
| (2) Alignment Mark Plate | Two-holes: 0.175 mm (0.00689 in.) |
| (3) Top Edge of Engine Support | (8) One-hole: 0.25 mm (0.0098 in.) |
| (4) Delivery Valve Holder | (9) Without hole: 0.30 mm (0.012 in.) |
| (5) Fuel | (10) Three-holes: 0.35 mm (0.014 in.) |
| (6) Shim (Soft Metal Gasket Shim) | |

[A] Machine with alignment mark plate (2)

[B] Machine without alignment mark plate (2)

9Y1210301ENS0015US0



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 (2) jetted with the proper injection pressure to the injection pump pressure tester (1). (Refer to the photo.)
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.

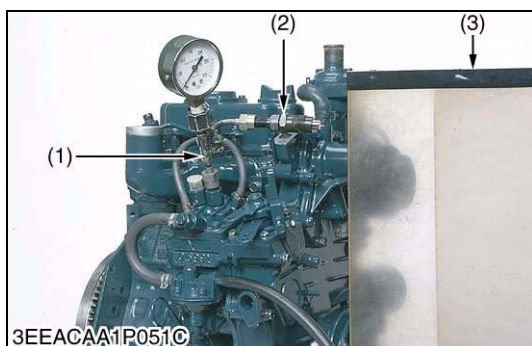
Fuel tightness of pump element	Allowable limit	13.73 MPa 140.0 kgf/cm ² 1991 psi
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NOTE

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

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

9Y1210301ENS0016US0



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 (2) jetted with the proper injection pressure to the injection pump pressure tester (1).
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 (140.0 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 140.0 to 130.0 kgf/cm², from 1991 to 1849 psi).
8. Measure the time needed to decrease the pressure from 13.73 to 12.75 MPa (140.0 to 130.0 kgf/cm², 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.**

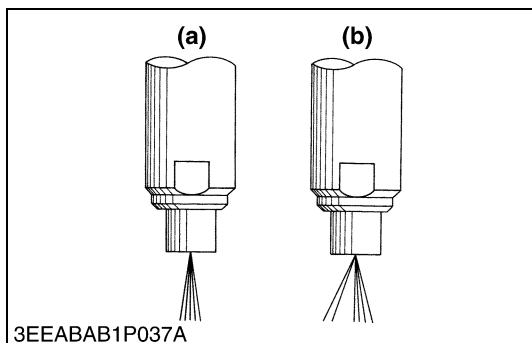
- (1) Injection Pump Pressure Tester (3) Protection Cover for Jetted Fuel
(2) Injection Nozzle

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**CAUTION**

- Check the nozzle 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.

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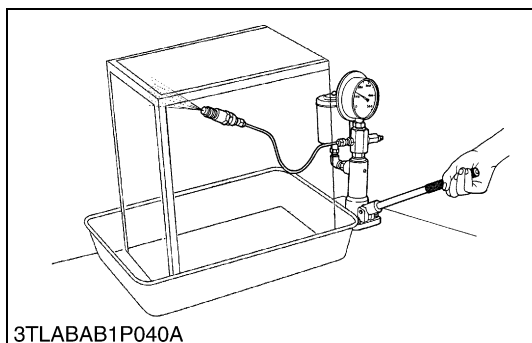
**Nozzle Spraying Condition**

- Set the injection nozzle to a nozzle tester, and check the nozzle spraying condition.
- If the spraying condition is defective, replace the nozzle piece.

(a) Good

(b) Bad

9Y1210301ENS0019US0

**Fuel Injection Pressure**

- Set the injection nozzle to a nozzle tester.
- Slowly move the tester handle to measure the pressure at which fuel begins jetting out from the nozzle.
- If the measurement is not within the factory specifications, replace the adjusting washer (1) in the nozzle holder to adjust it.

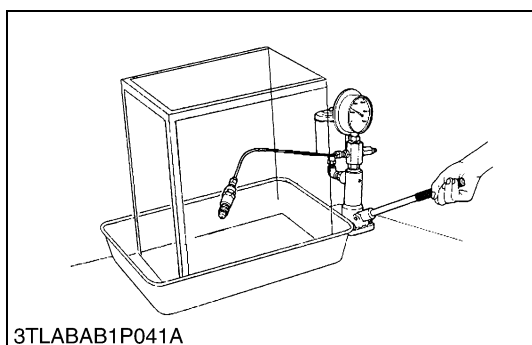
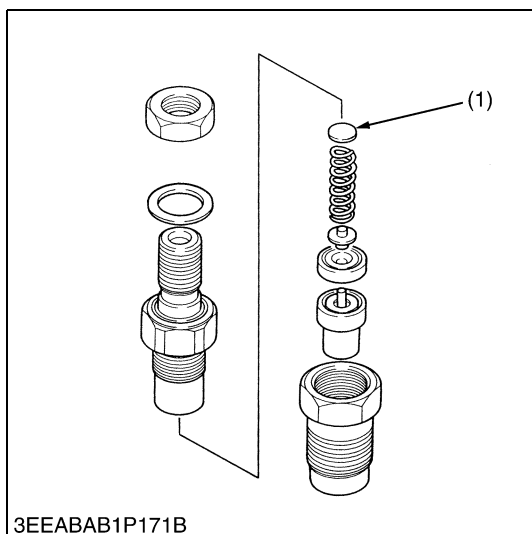
(Reference)

- Pressure variation with 0.01 mm (0.0004 in.) difference of adjusting washer thickness.
Approx. 235 kPa (2.4 kgf/cm², 34 psi)

Fuel injection pressure	Factory specification	13.73 to 14.70 MPa 140.0 to 150.0 kgf/cm ² 1992 to 2133 psi
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(1) Adjusting Washer

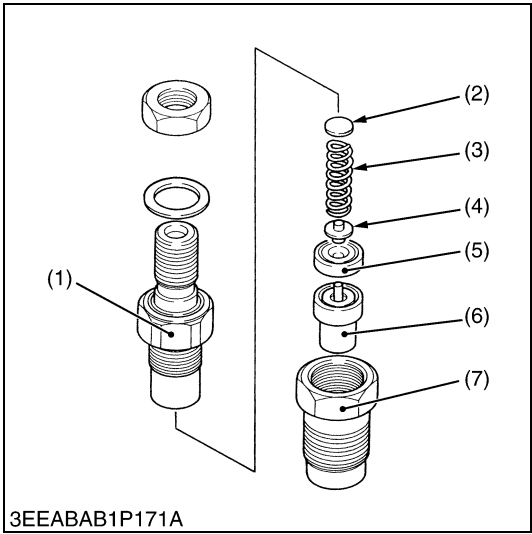
9Y1210301ENS0020US0

**Valve Seat Tightness**

- Set the injection nozzle to a nozzle tester.
- Raise the fuel pressure, and keep at 12.75 MPa (130.0 kgf/cm², 1849 psi) for 10 seconds.
- 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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9Y1210301ENS0021US0



Nozzle Holder

- 1. Secure the nozzle retaining nut (7) with a vise.
 - 2. Remove the nozzle holder (1), and take out parts inside.
- (When reassembling)**
- Assemble the nozzle in clean fuel oil.
 - Install the push rod (4), noting its direction.
 - After assembling the nozzle, be sure to adjust the fuel injection pressure.

Tightening torque	Nozzle holder	35 to 39 N·m 3.5 to 4.0 kgf·m 26 to 28 lbf·ft
	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 36 to 50 lbf·ft

- (1) Nozzle Holder

(2) Adjusting Washer

(3) Nozzle Spring

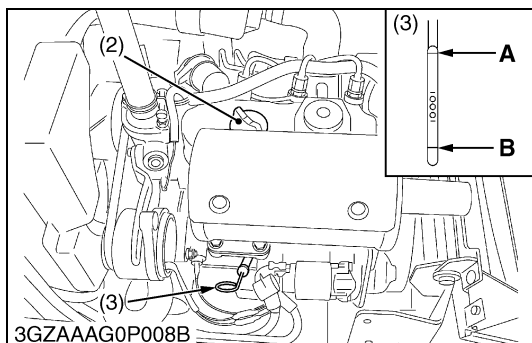
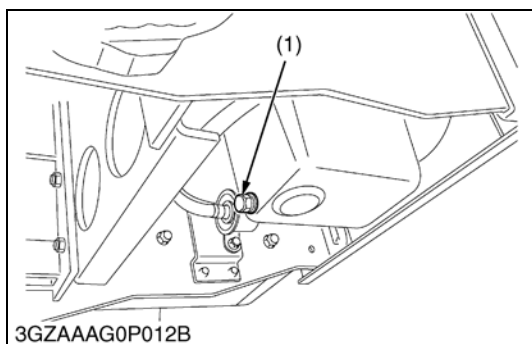
(4) Push Rod
- (5) Distance Piece

(6) Nozzle Piece

(7) Nozzle Retaining Nut

9Y1210301ENS0022US0

[2] SEPARATING ENGINE



Draining Engine Oil

1. If you do not disassemble the engine, skip this draining procedure.
2. Park the machine on level ground.
3. Start and warm up the engine for approx. 5 minutes.
4. Place an oil pan underneath the engine.
5. Remove the drain plug (1) to drain oil.
6. After draining, screw in the drain plug (1).

(When refilling)

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

Engine oil capacity	3.9 L
	4.1 U.S.qts
	3.4 Imp.qts

■ IMPORTANT

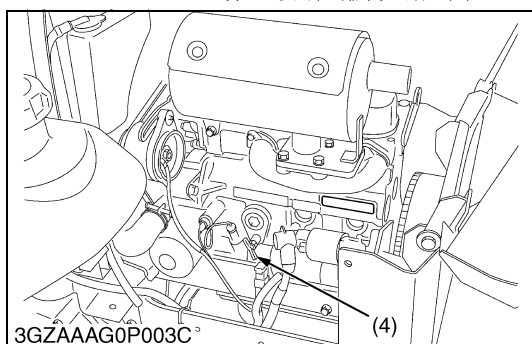
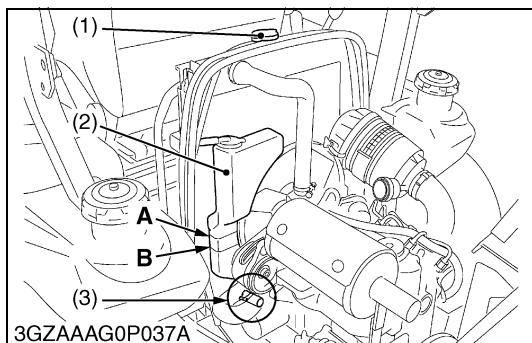
- **Never mix two different type of oil.**
- **Use the proper SAE Engine Oil according to ambient temperatures.**

Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)

- (1) Drain Plug
(2) Oil Inlet Plug
(3) Dipstick

A: Upper Level
B: Lower Level

9Y1210301ENS0023US0



Draining Coolant



CAUTION

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

1. If you do not disassemble the engine, skip this draining procedure.
2. Stop the engine and let cool down.
3. Remove the radiator coolant drain plug (3) and engine coolant drain plug (4) to drain the coolant.
4. Remove the radiator cap (1) to completely drain the coolant.
5. After all coolant is drained, close the drain plugs.

Coolant	Capacity	Radiator	2.7 L 2.85 U.S.qts 2.38 Imp.qts
		Recovery tank	0.25 L 0.26 U.S.qts 0.22 Imp.qts

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

A: Upper Level
B: Lower Level

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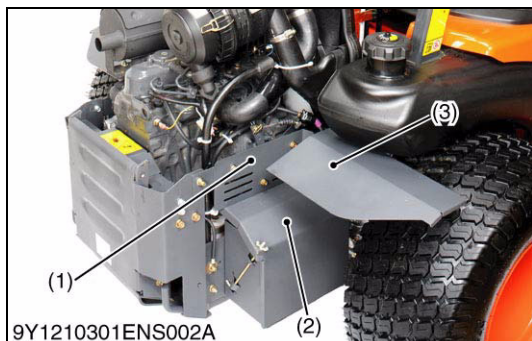


Bonnet

1. Remove the snap pin and bonnet mounting screw, then remove the bonnet (1).

(1) Bonnet

9Y1210301ENS0025US0



Battery Cover

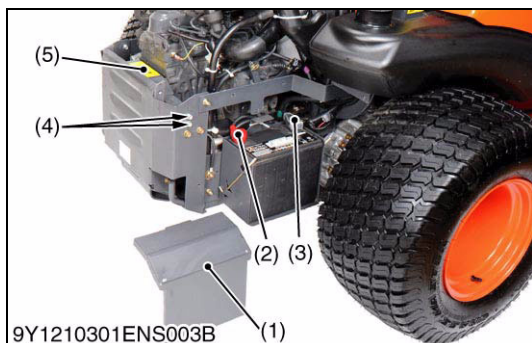
1. Remove the side covers L, R (1) and the rear fenders L, R (3).
2. Remove the battery cover (2).

(1) Side cover

(3) Rear Fender

(2) Battery cover

9Y1210301ENS0001US0



Battery and Flywheel Cover



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. Disconnect the negative cable (3) from the battery.
2. Disconnect the positive cable (2) from the battery.
3. Remove the bolts (4) and flywheel cover (5).

(1) Battery Cover

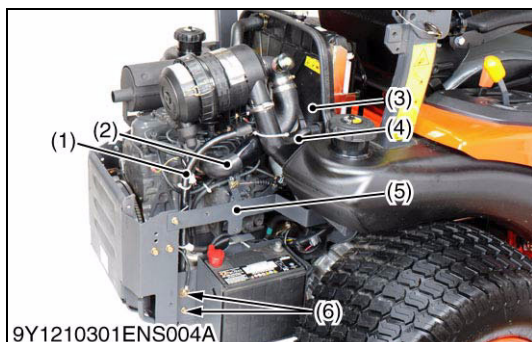
(4) Bolt

(2) Positive Cable

(5) Flywheel Cover

(3) Negative Cable

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Air Cleaner

1. Remove the side cover stays L, R (5).
2. Remove the bolts (6) for air cleaner support (1).
3. Disconnect the inlet hose (2) from engine.
4. Pull out the intake pipe (4) from the shroud (3).
5. Remove the air cleaner.

(1) Air Cleaner Support

(4) Intake Pipe

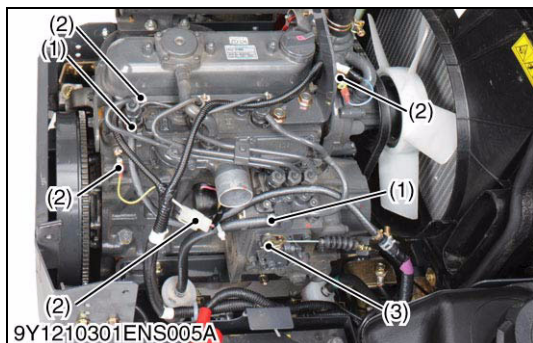
(2) Inlet Hose

(5) Side Cover Stay

(3) Shroud

(6) Bolt

9Y1210301ENS0026US0



Electric Wiring and Fuel Hoses

1. Disconnect the wiring connectors (2) for engine stop solenoid, glow plug, coolant temperature sensor, and coolant temperature switch.
2. Disconnect the accelerator wire (3).
3. Disconnect the fuel hoses (1) from engine.

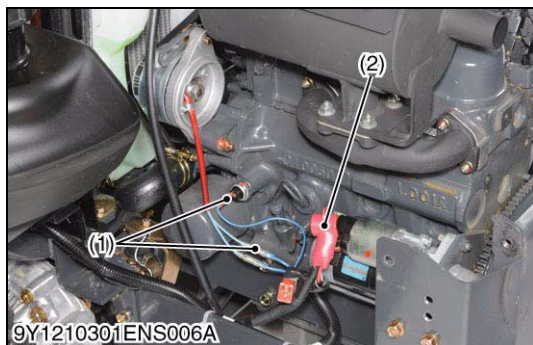
(When reassembling)

- When accelerator wire is installed, adjust the wiring length. The stop lever must hit both the idling speed adjusting bolt and the maximum speed adjusting bolt within the stroke of the accelerator lever.

(1) Fuel Hose
(2) Wiring Connectors

(3) Accelerator Wire (Throttle Cable)

9Y1210301ENS0027US0



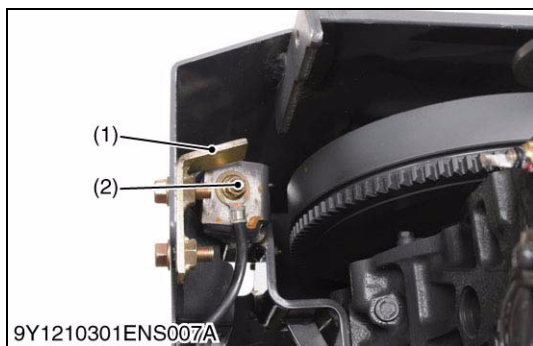
Electric Wiring

1. Disconnect the wiring connectors (1) for dynamo and engine oil pressure switch.
2. Remove the positive cable (2) from the starter motor.

(1) Wiring Connectors

(2) Positive Cable

9Y1210301ENS0028US0



Engine Stopper and Mounting Nuts

1. Remove the engine stoppers (1).
2. Remove the engine mounting nuts (2).
3. Remove the bolts (3) for shroud.

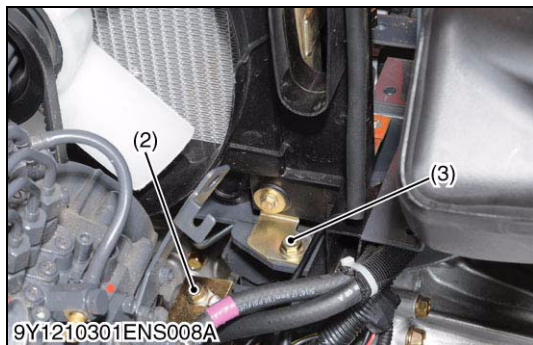
(When reassembling)

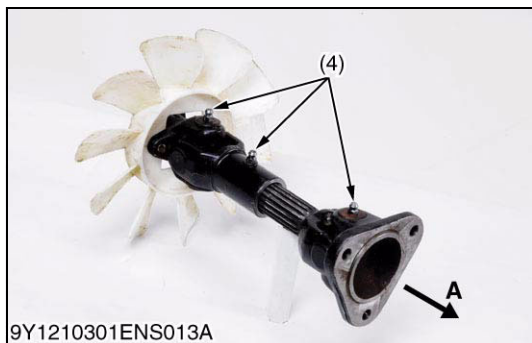
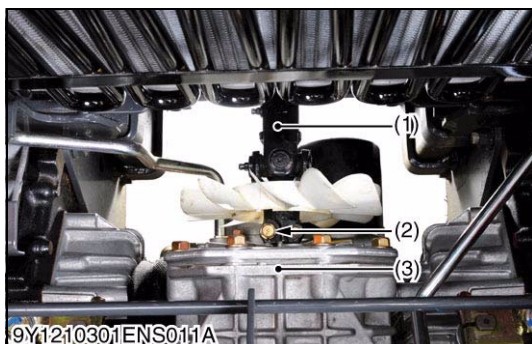
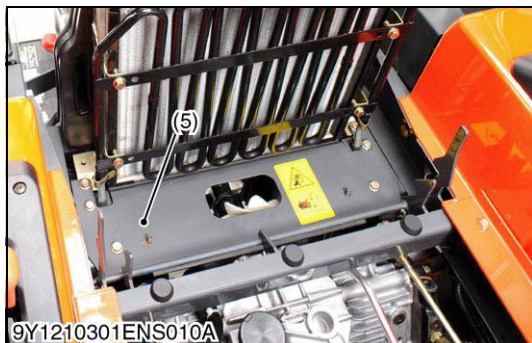
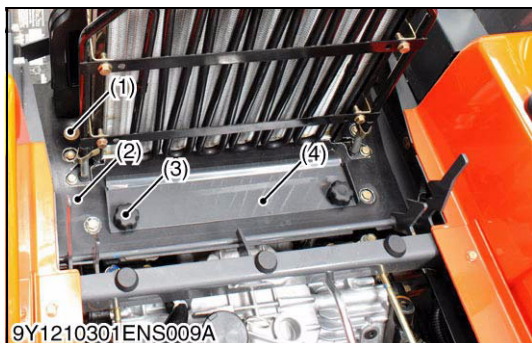
- To get a good contact of the ground, attach the ground wire (5) to the specified position (separate position from that of the battery negative cable (4)). (Right side front only)

(1) Engine Stopper
(2) Engine Mounting Nut
(3) Bolt

(4) Battery Negative Cable
(5) Ground Wire

9Y1210301ENS0029US0





Plate

1. Raise the seat.
2. Remove the knobs (3) and the plate (4).
3. Remove the 2 bolts (1) and the rubber sheet (2).
4. Remove the plate (5).

- | | |
|------------------|-----------|
| (1) Bolt | (4) Plate |
| (2) Rubber Sheet | (5) Plate |
| (3) Knob | |

9Y1210301ENS0030US0

Universal Joint

1. Remove the 2 bolts (2).
2. Lift up the engine and separate the universal joint (1) from transmission (3).

(When reassembling)

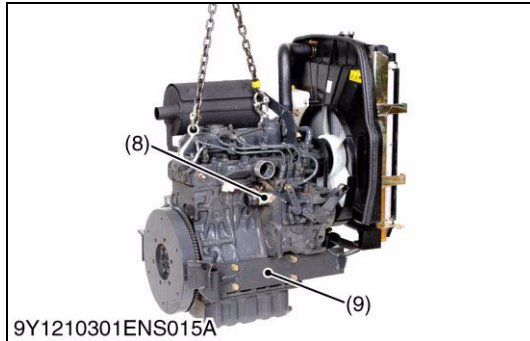
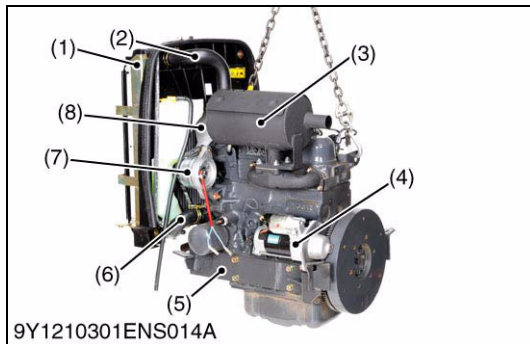
- Apply grease to the all splines on the drive shaft.
- Set the engine on the rubber cushion. Before fastening the engine mounting nuts, connect the universal joint.
- Make sure to align all the grease nipples. Only this one position meets the spline.

Tightening torque	Universal joint mounting screw	26.0 to 28.0 N·m 2.7 to 2.9 kgf·m 19.2 to 20.7 lbf·ft
	Engine mounting nut	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 lbf·ft

- (1) Universal Joint
- (2) Bolt
- (3) Transmission
- (4) Grease Nipple

A: Fixed to the fan drive pulley.

9Y1210301ENS0031US0



Dynamo, Fan Belt and Muffler

1. Remove the radiator hoses (2), (6) and radiator (1).
2. Remove the cooling fan (8) and fan pulley.
3. Remove the dynamo (7) and fan belt.
4. Remove the muffler (3).
5. Remove the starter (4).
6. Remove the engine support LH (5) and RH (9). Then remove the engine stop solenoid (8).

(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.

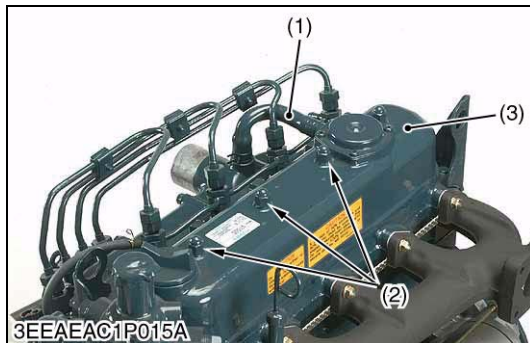
Tightening torque	Engine support mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 lbf·ft
-------------------	-------------------------------	---

- | | |
|-----------------------|--------------------------|
| (1) Radiator | (6) Radiator Hose |
| (2) Radiator Hose | (7) Dynamo |
| (3) Muffler | (8) Engine Stop Solenoid |
| (4) Starter | (9) Engine Support RH |
| (5) Engine Support LH | |

9Y1210301ENS0032US0

[3] DISASSEMBLING AND ASSEMBLING

(1) Cylinder Head and Valve



Cylinder Head Cover

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

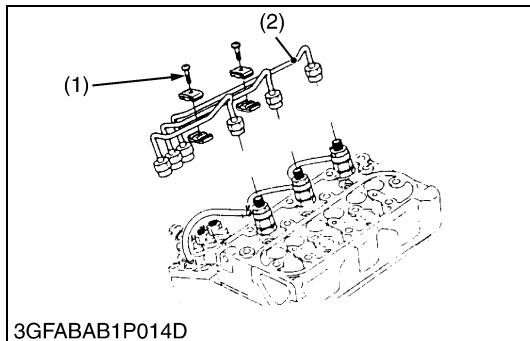
(When reassembling)

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

Tightening torque	Cylinder head cover screw	7 to 8 N·m 0.7 to 0.9 kgf·m 5 to 6 lbf·ft
-------------------	---------------------------	---

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

9Y1210301ENS0033US0



Injection Pipes

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

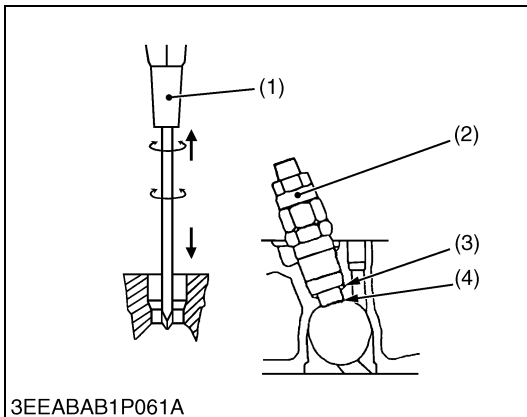
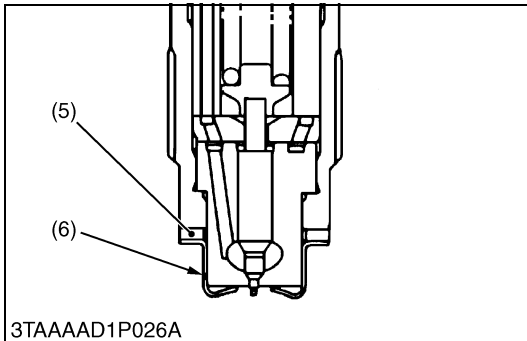
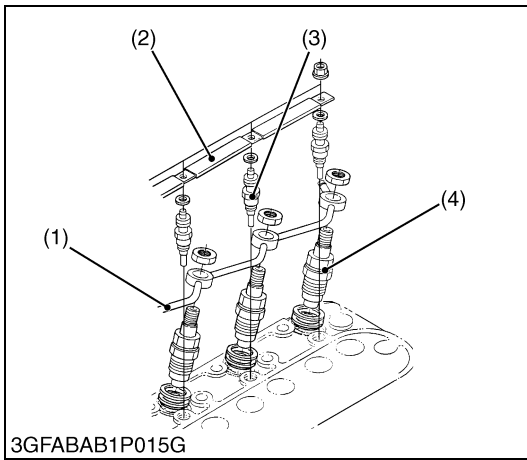
(When reassembling)

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

9Y1210301ENS0034US0



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	8 to 14 N·m 0.8 to 1.5 kgf·m 6 to 10 lbf·ft

- (1) Overflow Pipe
(2) Lead
(3) Glow Plug

- (4) Nozzle Holder Assembly
(5) Copper Gasket
(6) Heat Seal

9Y1210301ENS0035US0

Nozzle Heat Seal Service Removal Procedure

■ IMPORTANT

- Use a plus (phillips head) screw driver (1) of which diameter is bigger than the heat seal hole (Approx. 6 mm (1/4 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.

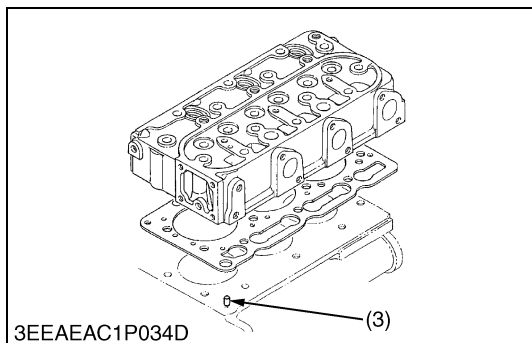
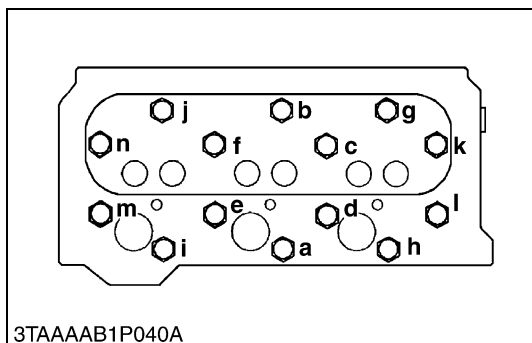
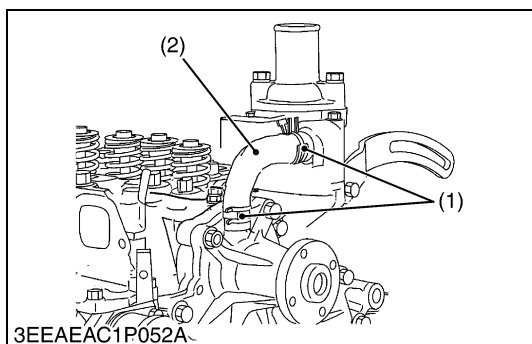
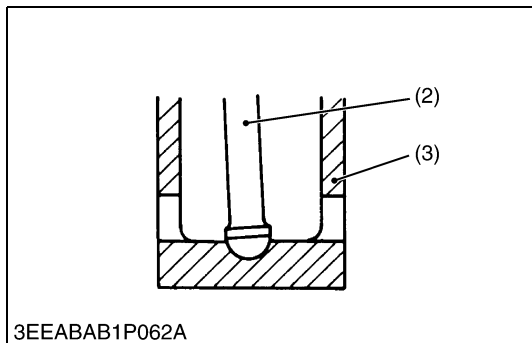
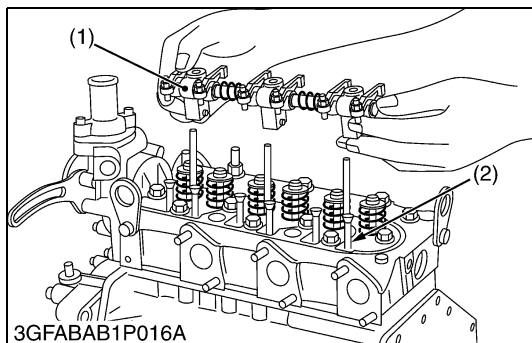
(When reassembling)

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

- (1) Plus Screw Driver
(2) Nozzle Holder

- (3) Injection Nozzle Gasket
(4) Heat Seal

9Y1210301ENS0036US0



Rocker Arm and Push Rod

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

(When reassembling)

- When putting the push rods (2) onto the tappets (3), 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 nut	22 to 26 N·m 2.2 to 2.7 kgf·m 16 to 19 lbf·ft
-------------------	------------------------	---

(1) Rocker Arm Assembly

(3) Tappet

(2) Push Rod

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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" and remove the cylinder head.
3. Remove the cylinder head gasket.

(When reassembling)

- Replace the cylinder head gasket with new one.
- When mounting the gasket, set it to the pin pipe holes. Take care not to mount 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	64 to 68 N·m 6.5 to 7.0 kgf·m 47 to 50 lbf·ft
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(1) Clamp

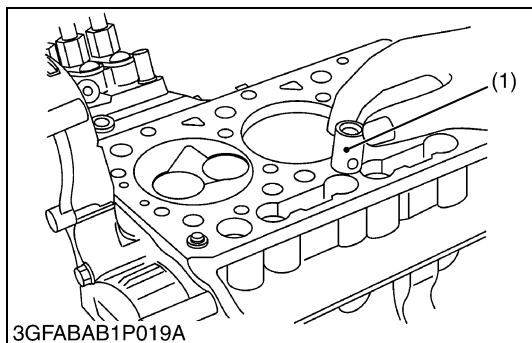
(2) Return Pipe

(3) Pin Pipe

n to a: To Loosen

a to n: To Tighten

9Y1210301ENS0038US0



Tappets

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

(When reassembling)

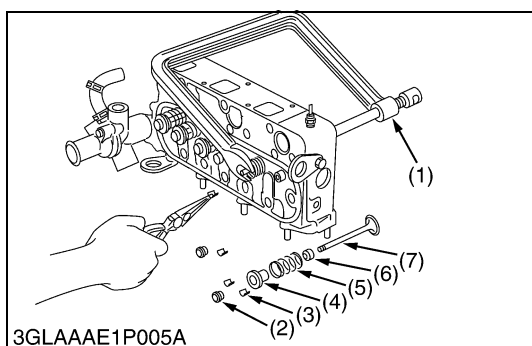
- Visually check the contact between tappets and cams for proper rotation. If defect is found, replace tappets.
- Before installing the tappets, apply engine oil thinly around them.

■ IMPORTANT

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

(1) Tappet

9Y1210301ENS0039US0



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 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

(2) Valve Cap

(3) Valve Spring Collet

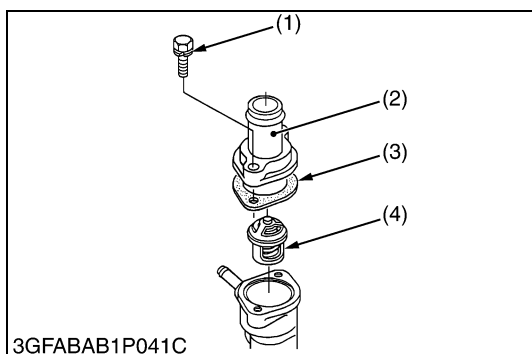
(4) Valve Spring Retainer

(5) Valve Spring

(6) Valve Stem Seal

(7) Valve

9Y1210301ENS0040US0



Thermostat Assembly

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

(When reassembling)

- Apply a liquid gasket (Three Bond 1215 or equivalent) only at the thermostat cover side of the gasket (3).

(1) Thermostat Cover Mounting Screw

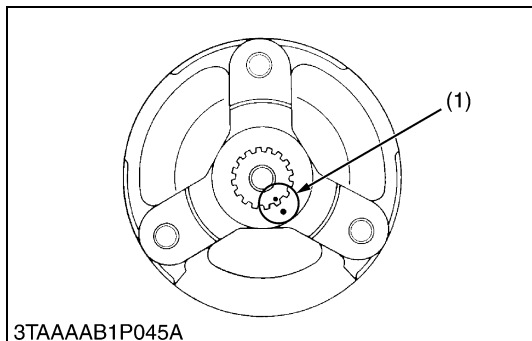
(2) Thermostat Cover

(3) Thermostat Cover Gasket

(4) Thermostat Assembly

9Y1210301ENS0041US0

(2) Gear Case and Timing Gears



3TAAAB1P045A

Fan Drive Pulley

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

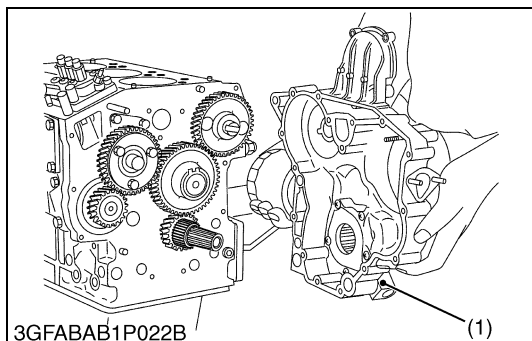
(When reassembling)

- Install the pulley to crankshaft, aligning the mark (1) on them (3-cylinder engine).
- Apply engine oil to the fan drive pulley retaining screw. And tighten it.

Tightening torque	Fan drive pulley screw	236 to 245 N·m 24.0 to 25.0 kgf·m 174 to 180 lbf·ft
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(1) Aligning Mark

9Y1210301ENS0042US0



3GFABAB1P022B

Gear Case

1. Remove the gear case.

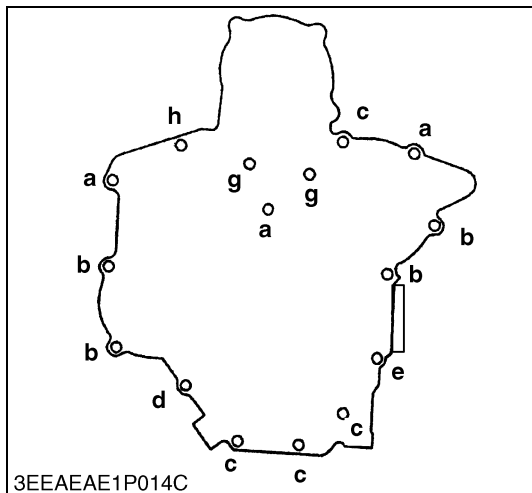
(When reassembling)

- Grease thinly to the oil seal, and install it, ensuring the lip does not come off.

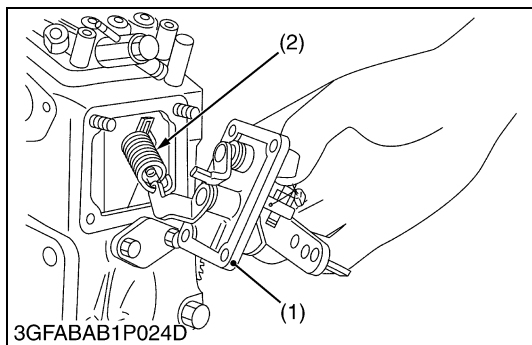
(1) Gear Case

- a: Bolt Length = 45 mm (1.8 in.)
b: Bolt Length = 50 mm (2.0 in.)
c: Bolt Length = 55 mm (2.2 in.)
d: Bolt Length = 65 mm (2.6 in.)
e: Bolt Length = 68 mm (2.7 in.)
f: Bolt Length = 70 mm (2.8 in.)
g: Bolt Length = 85 mm (3.3 in.)
h: Nut

9Y1210301ENS0043US0



3EEAEAE1P014C



3GFABAB1P024D

Speed Control Plate

1. Remove the engine stop solenoid.
2. Remove the speed control plate (1).

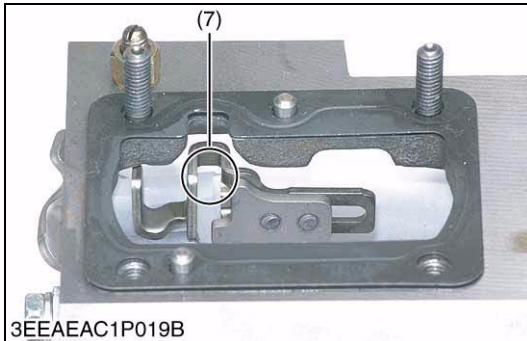
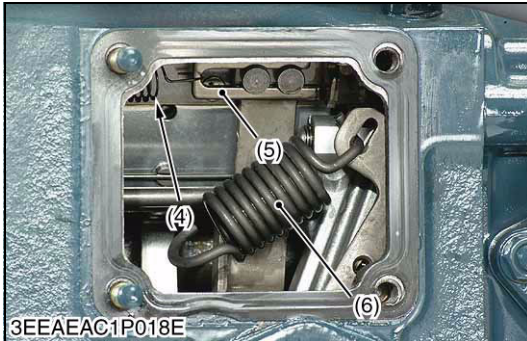
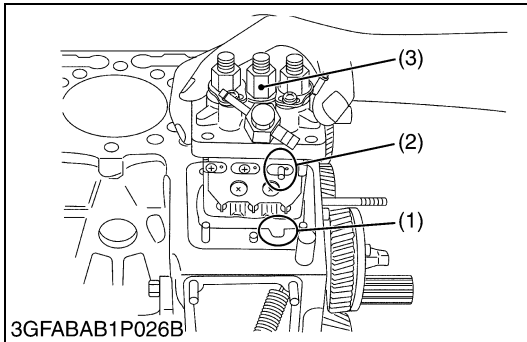
(When reassembling)

- Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the solenoid cover gasket and control plate gasket.
- Be careful not to drop the governor spring (2) into the crankcase.

(1) Speed Control Plate

(2) Governor Spring

9Y1210301ENS0044US0



Injection Pump

1. Disconnect the start spring (4) on the thrust lever side (5).
2. Align the control rack pin (2) with the notch (1) on the crankcase, and remove the injection pump (3).
3. Remove the injection pump shims.
4. In principle, the injection pump should not be disassembled.

(When reassembling)

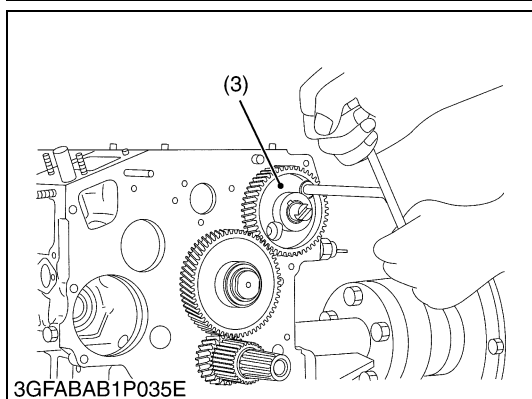
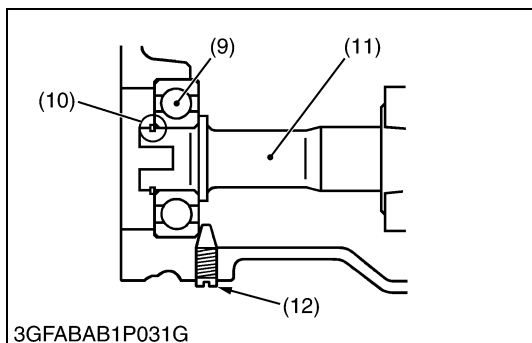
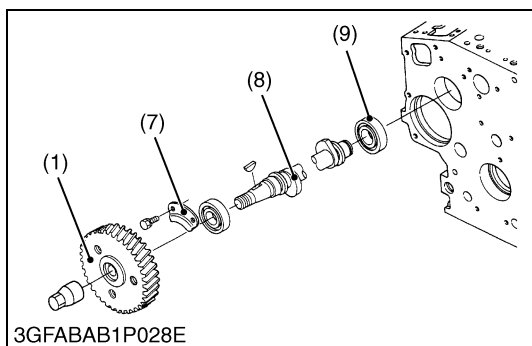
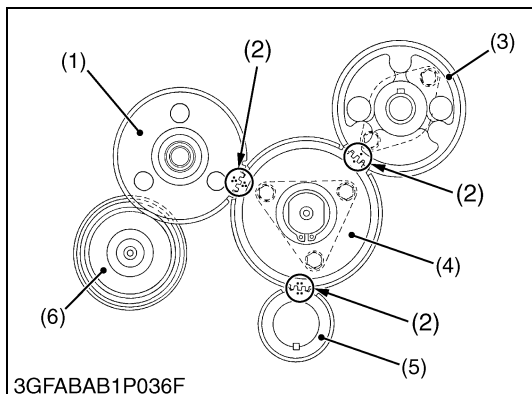
- When installing the injection pump, insert the control rack pin (2) firmly into the groove (7) of the thrust lever of fork lever.

■ NOTE

- **Addition or reduction of shim (0.05 mm, 0.002 in.) delays or advances the injection timing by approx. 0.0087 rad (0.50 °).**
- **In disassembling and replacing, be sure to use the same number or new gasket shims with the same thickness.**

- | | |
|----------------------|---------------------|
| (1) Notch | (5) Thrust Lever |
| (2) Control Rack Pin | (6) Governor Spring |
| (3) Injection Pump | (7) Groove |
| (4) Start Spring | |

9Y1210301ENS0045US0



Cam Gear, Idle Gear 1 and Governor Gear

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

NOTE

- **Three-lever type fork lever**

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

(When reassembling)

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

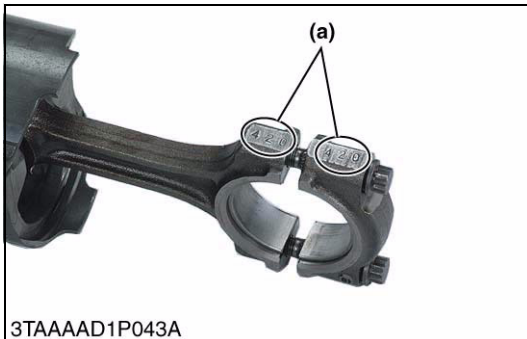
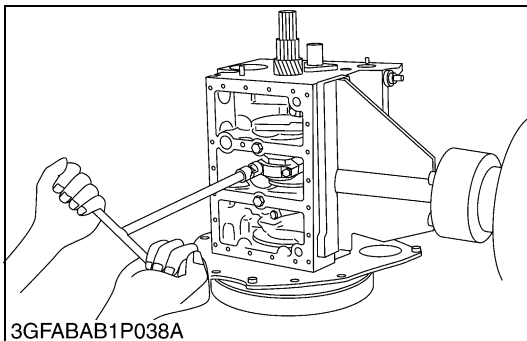
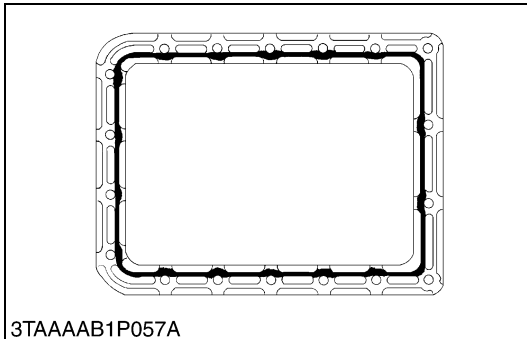
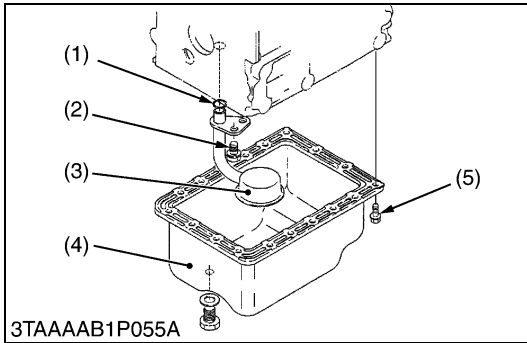
IMPORTANT

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

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

9Y1210301ENS0046US0

(3) Piston and Connecting Rod



Oil Pan and Oil Strainer

1. Remove the oil pan mounting screws (5).
2. Remove the oil pan (4).
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 (1), 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.

■ IMPORTANT

- **Scrape off the old adhesive completely. Wipe the sealing surface clean using waste cloth soaked with gasoline.**
- **Apply "liquid gasket" about 5 mm (0.20 in.) thick. Within 20 minutes after the application of fluid sealant, reassemble the components.**

- | | |
|------------------|----------------------------|
| (1) O-ring | (4) Oil Pan |
| (2) Screw | (5) Oil Pan Mounting Screw |
| (3) Oil Strainer | |

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Connecting Rod

1. Remove the connecting rod cap.

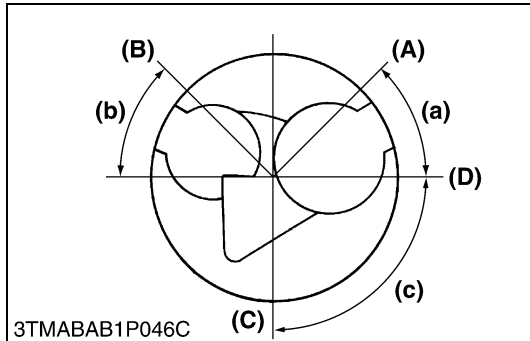
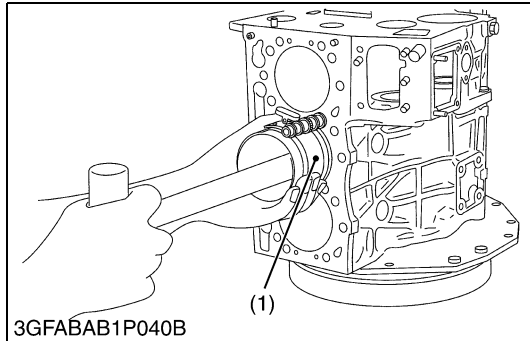
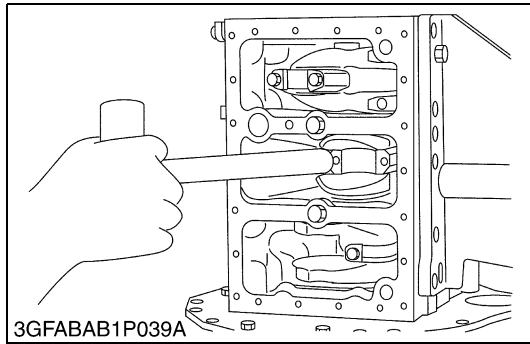
(When reassembling)

- 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	42 to 46 N·m 4.2 to 4.7 kgf·m 31 to 33 lbf·ft
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(a) Mark

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Pistons

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

(When reassembling)

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

■ IMPORTANT

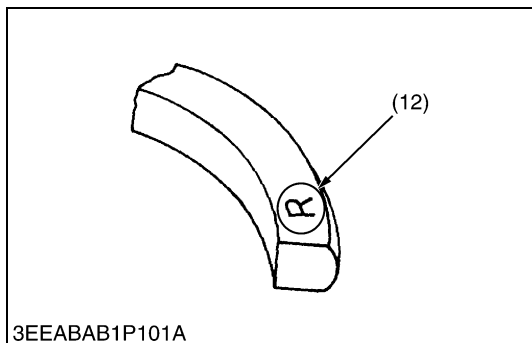
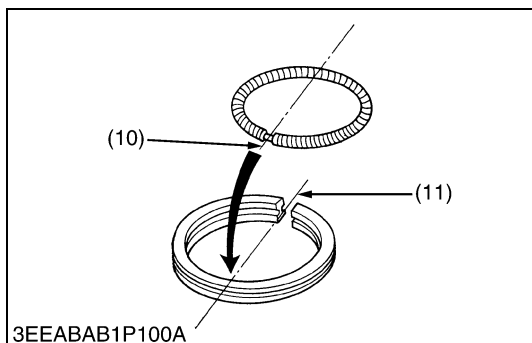
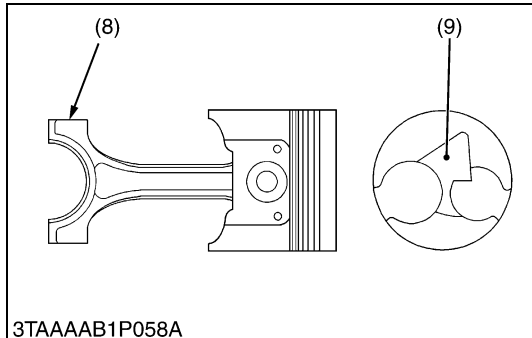
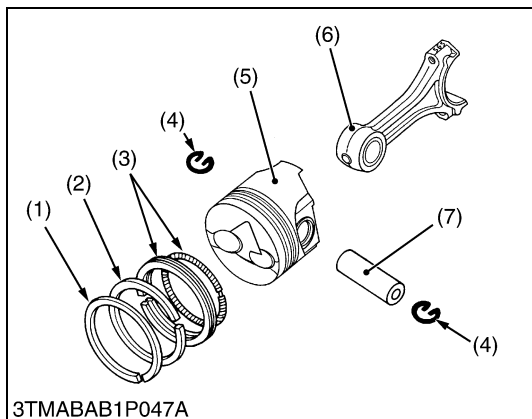
- Do not change the combination of cylinder and piston. Make sure of the position of each piston by marking. For example, mark "1" on the No.1 piston.
- When installing the piston into the cylinder, place the gaps of all the piston rings as shown in the figure.
- Carefully insert the pistons using a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

(1) Piston Ring Compressor

- (A) Top Ring Gap
(B) Second Ring Gap
(C) Oil Ring Gap
(D) Piston Pin Hole

- (a) 0.79 rad (45 °)
(b) 0.79 rad (45 °)
(c) 1.6 rad (90 °)

9Y1210301ENS0049US0



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 (8) on the connecting rod to the fan-shaped concave (9).

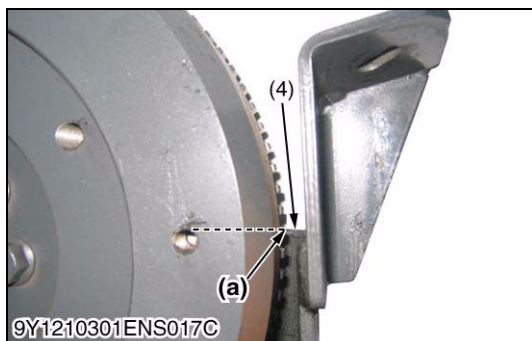
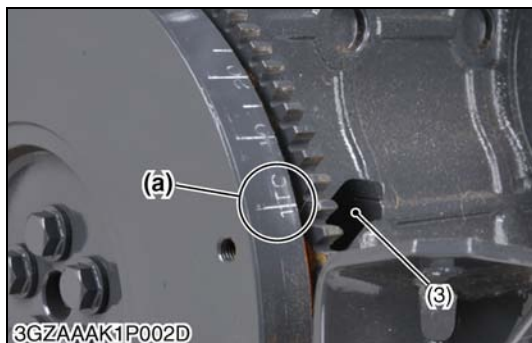
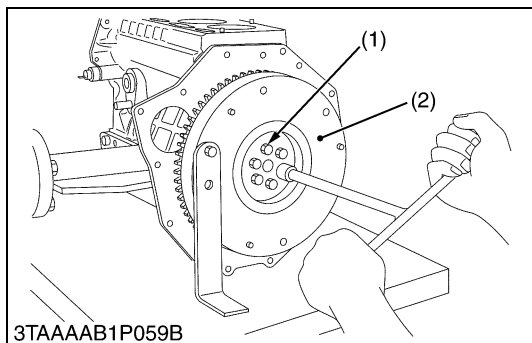
■ NOTE

- **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) Mark |
| (3) Oil Ring | (9) Fan-shaped Concave |
| (4) Piston Pin Snap Ring | (10) Expander Joint |
| (5) Piston | (11) Oil Ring Gap |
| (6) Connecting Rod | (12) Manufacturer's Mark |

9Y1210301ENS0050US0

(4) Flywheel and Crankshaft



Flywheel

1. Secure the flywheel to keep it from turning, using a flywheel stopper.
2. Remove all flywheel screws (1) and then remove the flywheel (2).

(When reassembling)

• [Machine with alignment mark plate (2)]

Align the "1TC" mark (a) on the flywheel to the alignment mark (3).

[Machine without alignment mark plate (2)]

Align the "1TC" mark (a) on the flywheel to the level of the top edge of the engine support (4).

- Now fit the flywheel in position.
- 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
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(1) Flywheel Screw

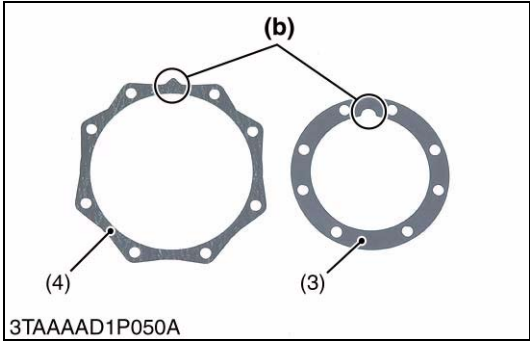
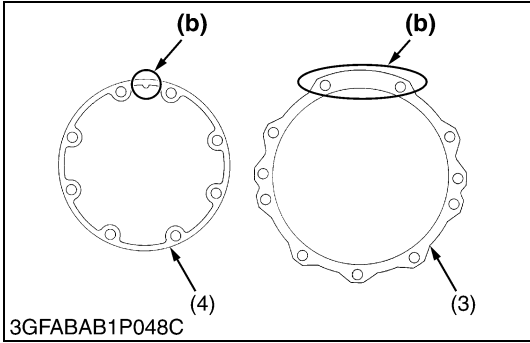
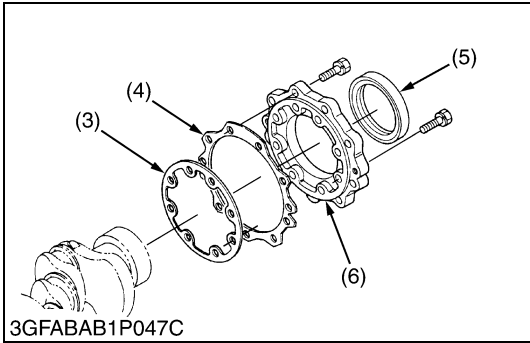
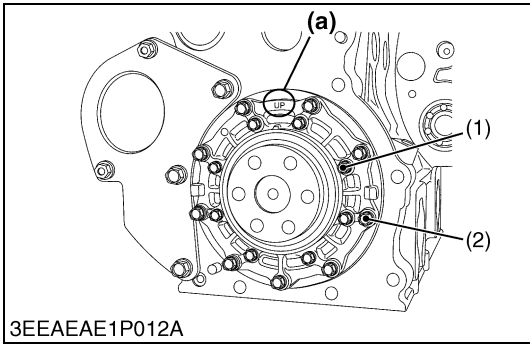
(2) Flywheel

(3) Alignment Mark Plate

(4) Top Edge of Engine Support

(a) 1TC Mark

9Y1210301ENS0051US0



Bearing Case Cover

1. Remove the bearing case cover mounting screws.
2. Remove the bearing case cover (6).

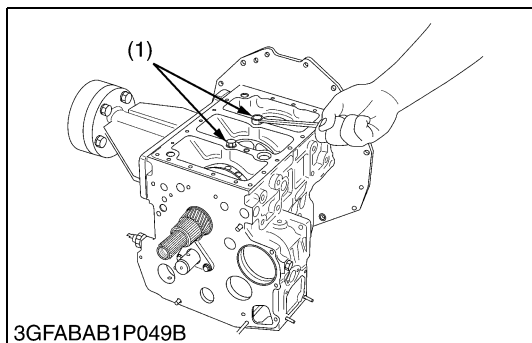
(When reassembling)

- Fit the bearing case gasket (3) and the bearing case cover gasket (4) with correct directions.
- Install the bearing case cover (6) to position the casting mark "UP" on it upward.
- Apply engine oil to the oil seal (5) lip and take care 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 7.23 to 8.31 lbf·ft
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- | | |
|---|------------------------|
| (1) Bearing Case Cover Mounting Screw (Inside) (Long) | (5) Oil Seal |
| (2) Bearing Case Cover Mounting Screw (Outside) (Short) | (6) Bearing Case Cover |
| (3) Bearing Case Gasket | (a) Top Mark "UP" |
| (4) Bearing Case Cover Gasket | (b) Upside |

9Y1210301ENS0052US0



Crankshaft Assembly

1. Remove the main bearing case screw 2 (1).
2. Pull out the crankshaft assembly.

■ IMPORTANT

- Take care to protect crankshaft bearing 1 from scratches, caused by the crank gear, etc.. (Wrap the gear in vinyl tape, etc.)

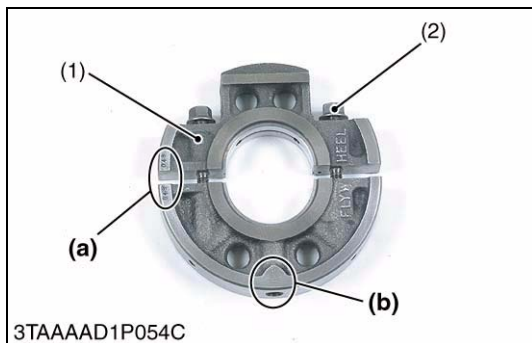
(When reassembling)

- Clean the oil passage of the crankshaft with compressed air.
- Apply oil to the main bearing case screw 2 (1).
- Install the crankshaft assembly, aligning the screw hole of main bearing case with the screw hole of crankcase.
- Clean the oil passage of the crankshaft with compressed air.

Tightening torque	Main bearing case screw 2	49.0 to 53.9 N·m 5.0 to 5.5 kgf·m 36.2 to 39.8 lbf·ft
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(1) Main Bearing Case Screw 2

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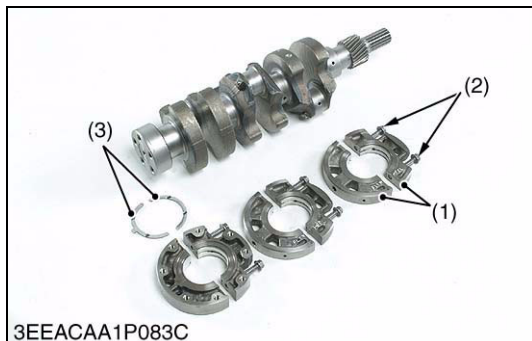
Main Bearing Case Assembly

1. Remove the two main bearing case screws 1 (2) of each main bearing case.
2. Remove the main bearing case from crankshaft.

(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 the original positions. Since diameters of main bearing cases vary, install them in order of marking (b) (A, B, C) from the gear case side.
- Match the alignment numbers (a) on the main bearing case assembly 1.
- When installing the main bearing case 1 and 2, face the mark "FLYWHEEL" to the flywheel.
- Install the thrust bearing (3) 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	30 to 34 N·m 3.0 to 3.5 kgf·m 22 to 25 lbf·ft
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(1) Main Bearing Case Assembly 1

(2) Main Bearing Case Screw 1

(3) Thrust Bearing

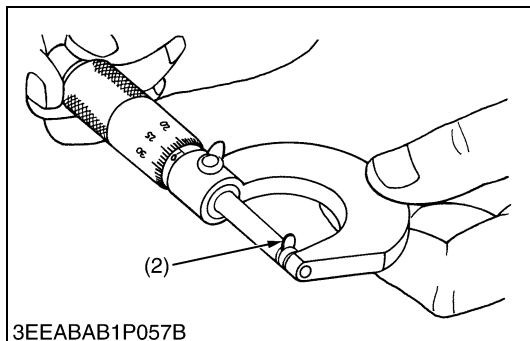
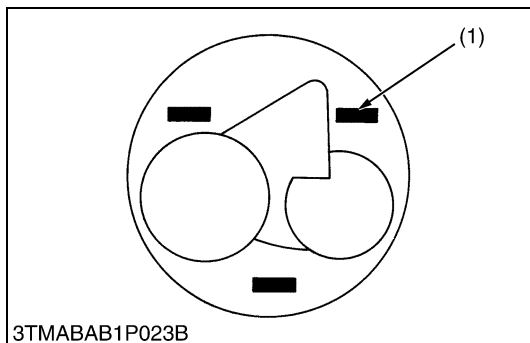
(a) Alignment Number

(b) Marking (A, B, C)

9Y1210301ENS0054US0

[4] SERVICING

(1) Cylinder Head and Valves



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 fuse [1.5 mm dia. (0.059 in. dia.), 5 to 7 mm long (0.197 to 0.276 in. long)] 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 top dead center.
5. Remove the cylinder head, and measure the thickness of the squeezed fuses.
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.

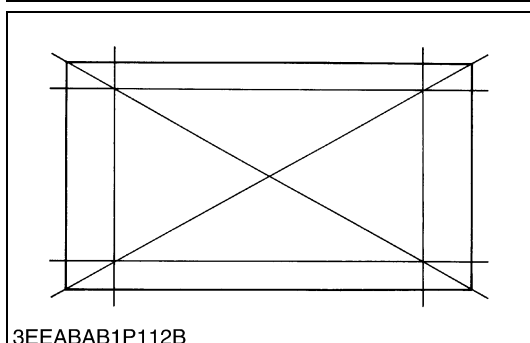
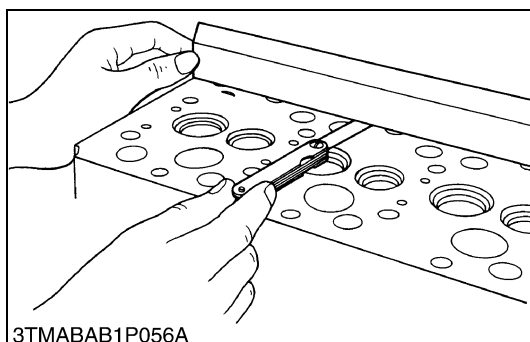
Top clearance	Factory specification	0.55 to 0.75 mm 0.022 to 0.029 in.
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Tightening torque	Cylinder head screw	64 to 68 N·m 6.5 to 7.0 kgf·m 47 to 50 lbf·ft
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(1) Fuse

(2) Fuse

9Y1210301ENS0055US0



Cylinder Head Surface Flatness

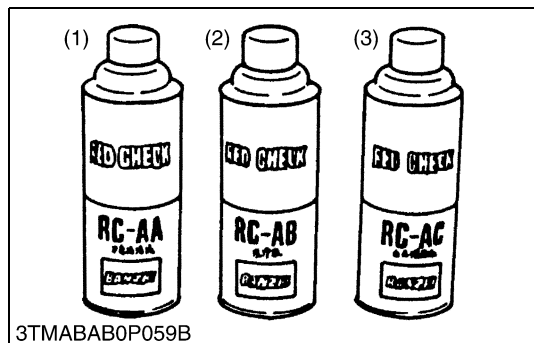
1. Clean the cylinder head surface.
2. Place a straightedge on the cylinder head's four sides and two diagonal as shown in the figure.
3. Measure the clearance with a thickness gauge.
4. If the measurement exceeds the allowable limit, correct it with a surface grinder.

■ IMPORTANT

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

Cylinder head surface flatness	Allowable limit.	0.05 mm 0.002 in.
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9Y1210301ENS0056US0



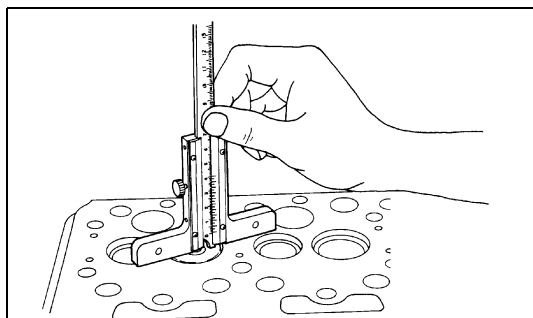
Cylinder Head Flaw

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

9Y1210301ENS0057US0



Valve Recessing

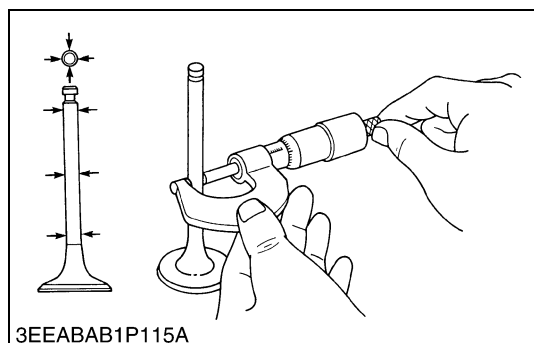
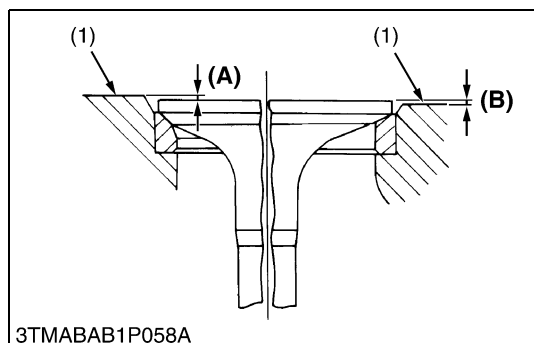
1. Clean the cylinder head surface, valve face and valve seat.
2. Insert the valve into the valve guide.
3. Measure the valve recessing with a depth gauge.
4. If the measurement exceeds the allowable limit, replace the valve.
5. If it still exceeds the allowable limit after replacing the valve, replace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

Valve recessing	Factory specification	0.050 (protrusion) to 0.25 (recessing) mm 0.0020 (protrusion) to 0.0098 (recessing) in.
	Allowable limit	0.40 (recessing) mm 0.016 (recessing) in.

(1) Cylinder Head Surface

(A) Recessing
(B) Protrusion

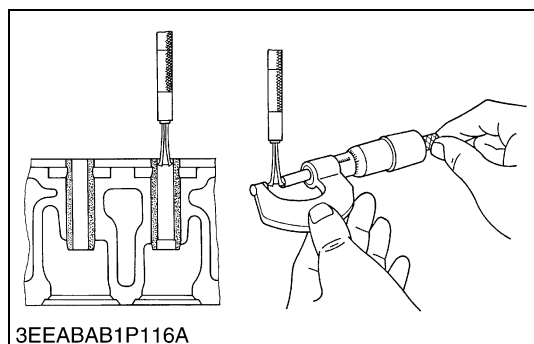
9Y1210301ENS0058US0



Clearance between Valve Stem and Valve Guide

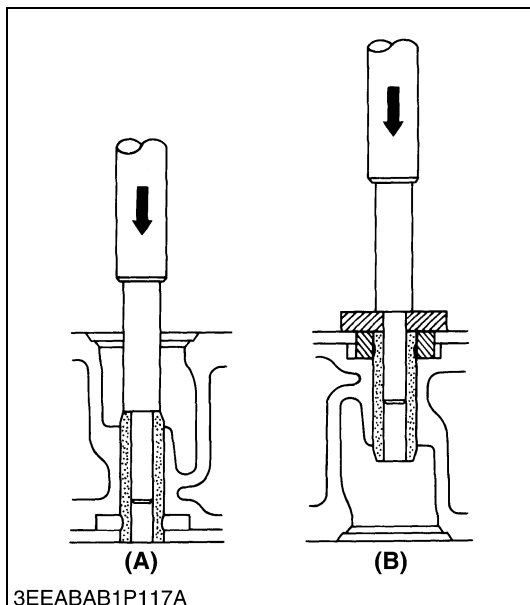
1. Remove carbon from the valve guide section.
2. Measure the valve stem O.D. with an outside micrometer.
3. Measure the valve guide I.D. with a small hole gauge, and calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the valves.
If it still exceeds the allowable limit,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

Clearance between valve stem and valve guide	Factory specification	0.035 to 0.065 mm 0.0014 to 0.0025 in.
	Allowable limit	0.10 mm 0.0039 in.



Valve stem O.D.	Factory specification	6.960 to 6.975 mm 0.2741 to 0.2746 in.
Valve guide I.D.	Factory specification	7.010 to 7.025 mm 0.2760 to 0.2765 in.

9Y1210301ENS0059US0



Replacing Valve Guide

(When removing)

1. Press out the used valve guide using a valve guide replacing tool. (See page "SPECIAL TOOLS".)

(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	7.010 to 7.025 mm 0.2760 to 0.2765 in.
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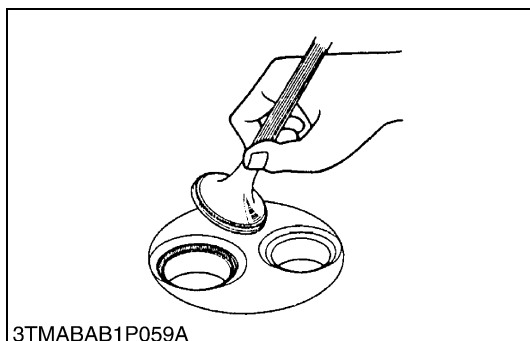
■ IMPORTANT

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

(A) When Removing

(B) When Installing

9Y1210301ENS0060US0



Valve Seating

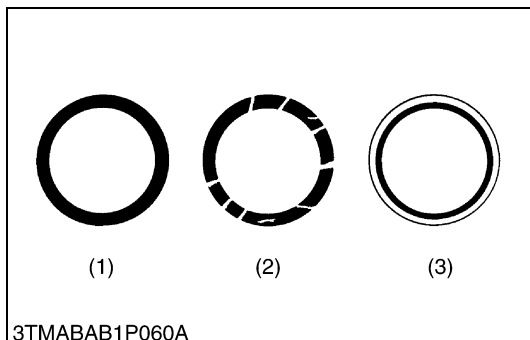
1. Coat the valve face lightly with prussian blue and put the valve on its seat to check the contact.
2. If the valve does not seat all the way around the valve seat or the valve contact is less than 70 %, correct the valve seating as follows.
3. If the valve contact does not comply with the reference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

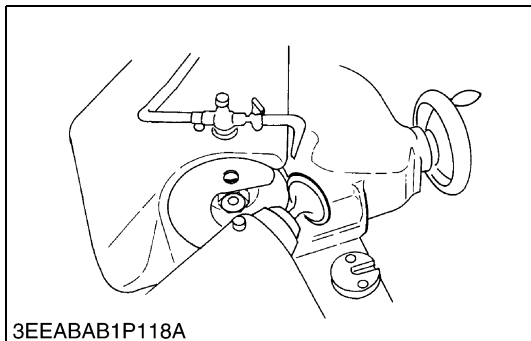
Valve seat width	Factory specification	2.12 mm 0.0835 in.
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- (1) Correct
(2) Incorrect

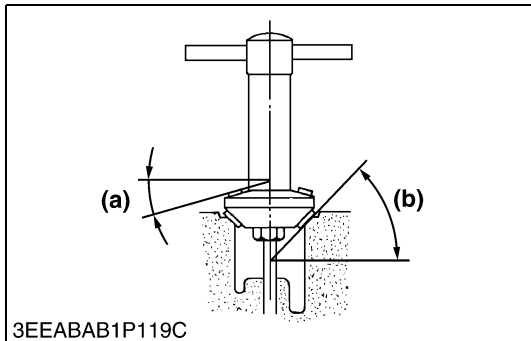
(3) Incorrect

9Y1210301ENS0061US0

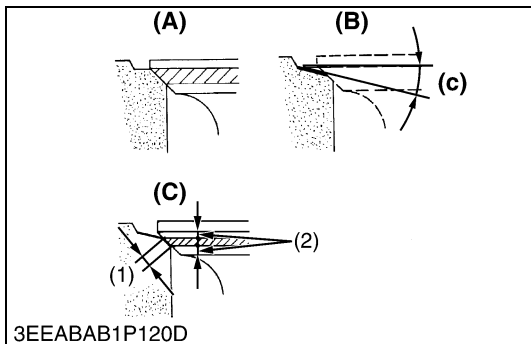




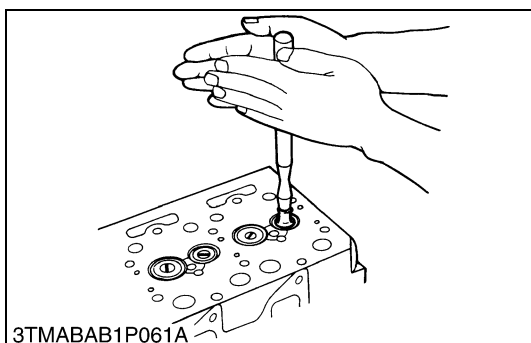
3EEABAB1P118A



3EEABAB1P119C



3EEABAB1P120D



3TMABAB1P061A

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	IN.	1.0 rad 60 °
		EX.	0.79 rad 45 °

2) Correcting Valve Seat

1. Slightly correct the seat surface with a 1.0 rad (60 °) (intake valve) or 0.79 rad (45 °) (exhaust valve) valve seat cutter.
2. Resurface the seat surface with a 0.52 rad (30 °) valve seat cutter to intake valve seat and with a 0.26 rad (15 °) valve seat cutter to exhaust valve seat so that the width is close to specified valve seat width (2.12 mm, 0.0835 in.).
3. After resurfacing the seat, inspect for even valve seating, apply a thin film of compound between the valve face and valve seat, and fit them with valve lapping tool.
4. Check the valve seating with prussian blue. The valve seating surface should show good contact all the way around.

Valve seat angle	Factory specification	IN.	1.0 rad 60 °
		EX.	0.79 rad 45 °

- (1) Valve Seat Width
(2) Identical Dimensions

- (A) Check Contact
(B) Correct Seat Width
(C) Check Contact
(a) 0.26 rad (15 °) or 0.52 rad (30 °)
(b) 0.79 rad (45 °) or 1.0 rad (60 °)
(c) 0.52 rad (30 °) or 0.26 rad (15 °)

9Y1210301ENS0062US0

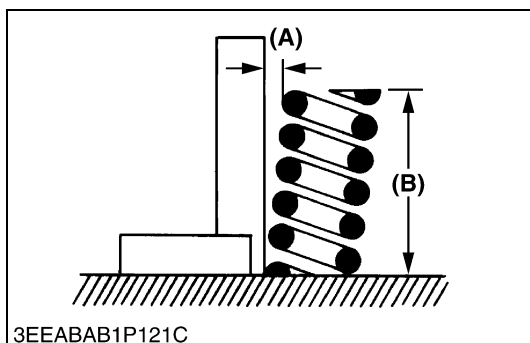
Valve Lapping

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.

9Y1210301ENS0063US0



Free Length and Tilt of Valve Spring

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

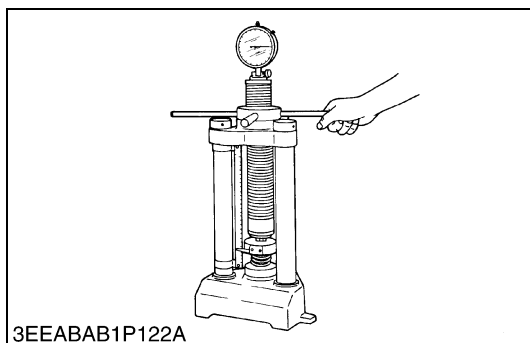
Tilt (A)	Allowable limit	1.0 mm 0.039 in.
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Free length (B)	Factory specification	37.0 to 37.5 mm 1.46 to 1.47 in.
	Allowable limit	36.5 mm 1.44 in.

(A) Tilt

(B) Free Length

9Y1210301ENS0064US0



Valve Spring Setting Load

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

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

9Y1210301ENS0065US0



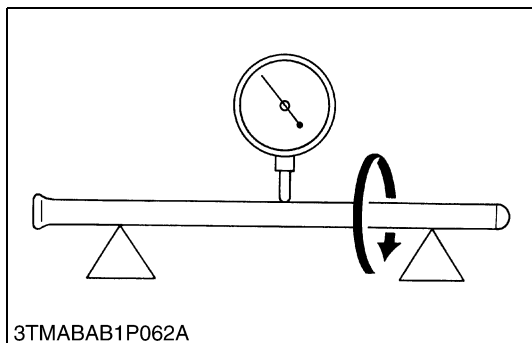
Oil Clearance between Rocker Arm and Rocker Arm Shaft

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

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

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

9Y1210301ENS0066US0

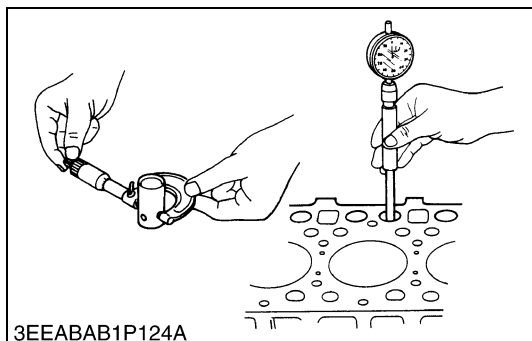


Push Rod Alignment

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

Push rod alignment	Allowable limit	0.25 mm 0.0098 in.
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Oil Clearance between Tappet and Tappet Guide Bore

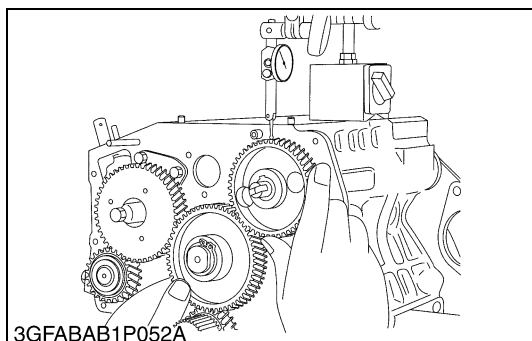
1. Measure the tappet O.D. with an outside micrometer.
2. Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

Oil clearance between tappet and tappet guide bore	Factory specification	0.020 to 0.062 mm 0.00079 to 0.0024 in.
	Allowable limit	0.07 mm 0.003 in.

Tappet O.D.	Factory specification	19.959 to 19.980 mm 0.78579 to 0.78661 in.
Tappet guide bore I.D.	Factory specification	20.000 to 20.021 mm 0.78740 to 0.78822 in.

9Y1210301ENS0068US0

(2) Timing Gears, Camshaft and Governor 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 exceeds the allowable limit, check the oil clearance of the shafts and the gear.
4. If the oil clearance is proper, replace the gear.

Backlash between idle gear 1 and crank gear	Factory specification	0.0320 to 0.115 mm 0.00126 to 0.00452 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between idle gear 1 and cam gear	Factory specification	0.0360 to 0.114 mm 0.00142 to 0.00448 in.
	Allowable limit	0.15 mm 0.0059 in.

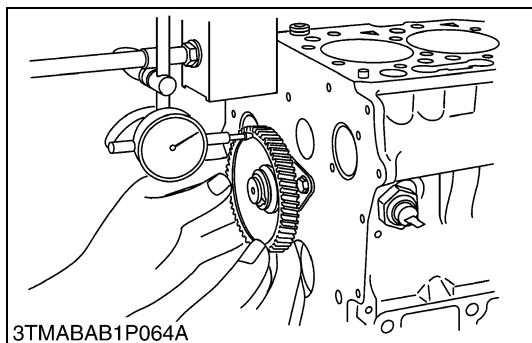
Backlash between idle gear 1 and injection pump gear	Factory specification	0.0340 to 0.116 mm 0.00134 to 0.00456 in.
	Allowable limit	0.15 mm 0.0059 in.

9Y1210301ENS0069US0

Governor Gear Backlash

Backlash between injection pump gear and governor gear	Factory specification	0.0300 to 0.117 mm 0.00119 to 0.00460 in.
	Allowable limit	0.15 mm 0.0059 in.

9Y1210301ENS0070US0

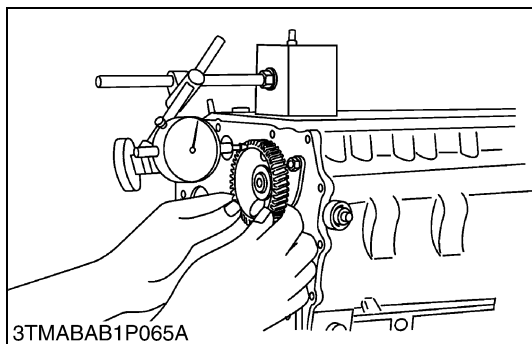


Idle Gear and Gear 1 Side Clearance

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 exceeds the allowable limit, replace the idle gear collar.

Idle gear and idle gear 1 side clearance	Factory specification	0.20 to 0.51 mm 0.0079 to 0.020 in.
	Allowable limit	0.80 mm 0.031 in.

9Y1210301ENS0071US0

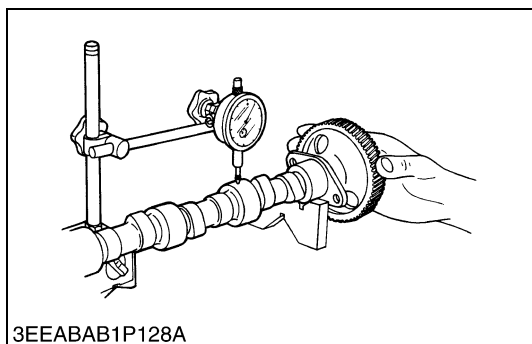


Camshaft Side Clearance

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

Camshaft side clearance	Factory specification	0.070 to 0.22 mm 0.0028 to 0.0086 in.
	Allowable limit	0.30 mm 0.012 in.

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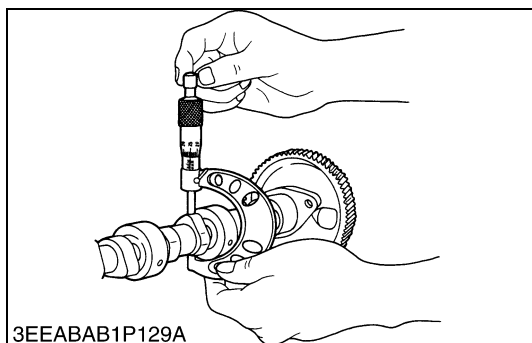


Camshaft Alignment

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 exceeds the allowable limit, replace the camshaft.

Camshaft alignment	Allowable limit	0.01 mm 0.0004 in.
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9Y1210301ENS0073US0



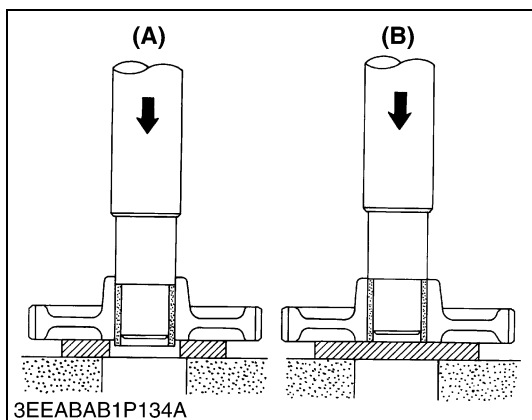
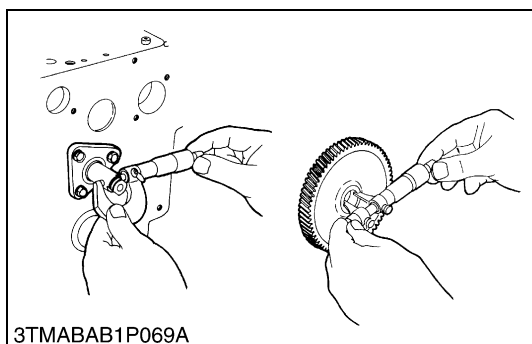
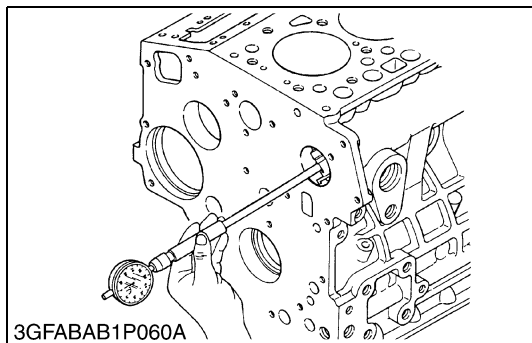
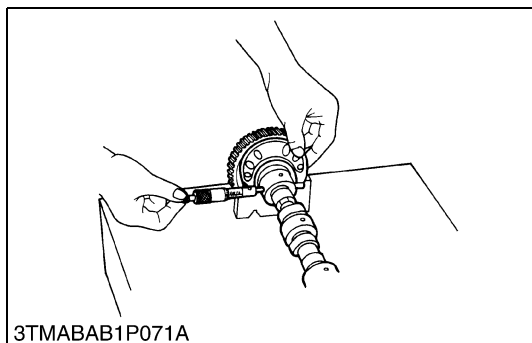
Cam Height

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	Factory specification	28.80 mm 1.134 in.
	Allowable limit	28.75 mm 1.132 in.

Cam height of exhaust	Factory specification	29.0 mm 1.142 in.
	Allowable limit	28.95 mm 1.140 in.

9Y1210301ENS0074US0



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 cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds 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	35.934 to 35.950 mm 1.4147 to 1.4153 in.
Camshaft bearing I.D. (Cylinder block bore I.D.)	Factory specification	36.000 to 36.025 mm 1.4173 to 1.4183 in.

9Y1210301ENS0075US0

Oil Clearance between Idle Gear Shaft1 and Idle Gear Bushing

1. Measure the idle gear shaft1 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 exceeds the allowable limit, replace the bushing.
If it still exceeds the allowable limit, replace the idle gear shaft1.

Oil clearance between idle gear shaft and idle gear bushing	Factory specification	0.020 to 0.054 mm 0.00079 to 0.0021 in.
	Allowable limit	0.10 mm 0.0039 in.

Idle gear shaft 1 O.D.	Factory specification	25.967 to 25.980 mm 1.0223 to 1.0228 in.
Idle gear bushing 1 I.D.	Factory specification	26.000 to 26.021 mm 1.0237 to 1.0244 in.

9Y1210301ENS0076US0

Replacing Idle Gear Bushing

(When removing)

1. Press out the used idle gear bushing using an idle gear bushing replacing tool. (See page "SPECIAL TOOLS".)

(When installing)

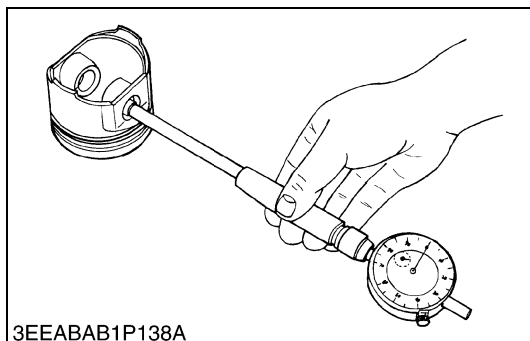
1. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
2. Press in a new bushing using an idle gear bushing replacing tool, until it is flush with the end of the idle gear.

(A) When Removing

(B) When Installing

9Y1210301ENS0077US0

(3) Piston and Connecting Rod

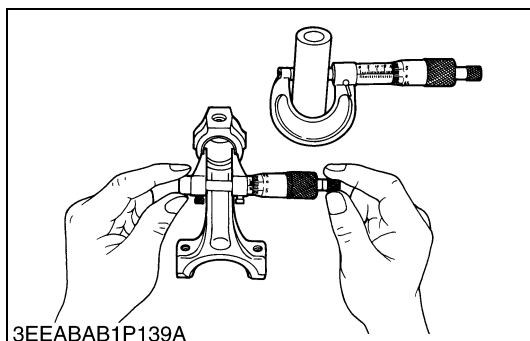


Piston Pin Bore I.D.

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

Piston pin bore I.D.	Factory specification	22.000 to 22.013 mm 0.86615 to 0.86665 in.
	Allowable limit	22.03 mm 0.8673 in.

9Y1210301ENS0078US0



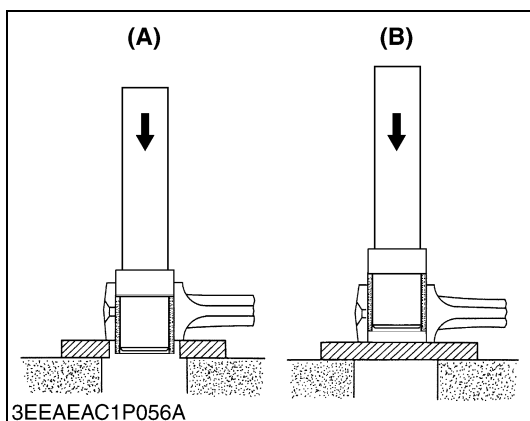
Oil Clearance between Piston Pin and Small End Bushing

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 exceeds the allowable limit, replace the bushing. If it still exceeds the allowable limit, replace the piston pin.

Oil clearance between piston pin and small end bushing	Factory specification	0.014 to 0.038 mm 0.00055 to 0.0014 in.
	Allowable limit	0.15 mm 0.0059 in.

Piston pin O.D.	Factory specification	22.002 to 22.011 mm 0.86622 to 0.86657 in.
Small end bushing I.D.	Factory specification	22.025 to 22.040 mm 0.86713 to 0.86771 in.

9Y1210301ENS0079US0



Replacing Small End Bushing

(When removing)

1. Press out the used bushing using a small end bushing replacing tool. (See page "SPECIAL TOOLS".)

(When installing)

1. Clean a new small end bushing and bore, 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 connecting rod oil hole matches the bushing hole.

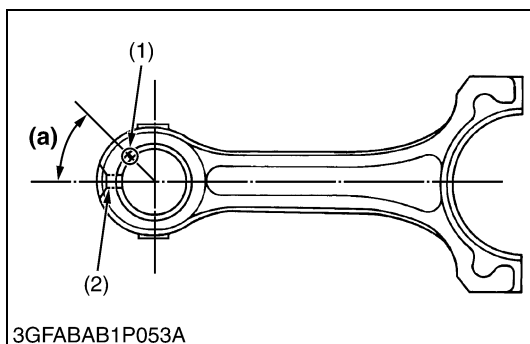
Oil clearance between piston pin and small end bushing (Spare parts)	Factory specification	0.015 to 0.038 mm 0.00056 to 0.0014 in.
	Allowable limit	0.15 mm 0.0059 in.

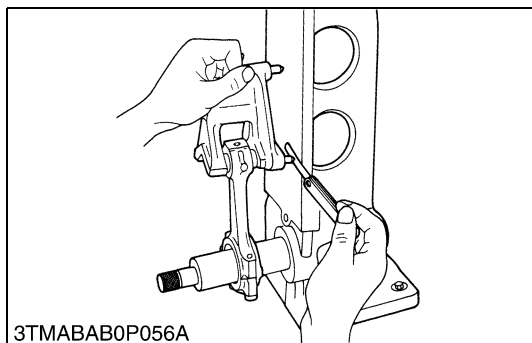
Small end bushing I.D. (Spare parts)	Factory specification	22.025 to 22.040 mm 0.86713 to 0.86771 in.
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- (1) Seam
(2) Oil Hole

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

9Y1210301ENS0080US0





Connecting Rod Alignment

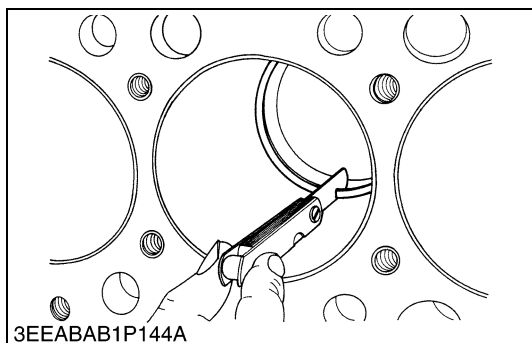
NOTE

- 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 exceeds the allowable limit, replace the connecting rod.

Connecting rod alignment	Allowable limit	0.05 mm 0.002 in.
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9Y1210301ENS0081US0

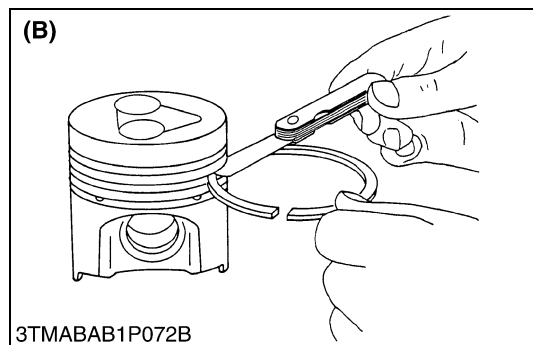
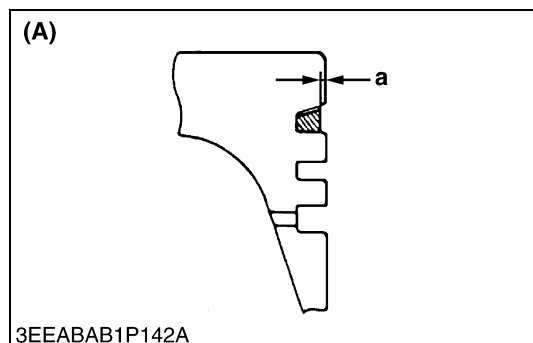


Piston Ring Gap

1. Insert the piston ring into the lower part of the cylinder (the least worn out part) with a piston.
2. Measure the ring gap with a thickness gauge.
3. If the measurement exceeds the allowable limit, replace the piston ring.

Piston ring gap	Top ring	Factory specification	0.30 to 0.45 mm 0.012 to 0.017 in.
		Allowable limit	1.25 mm 0.0492 in.
	Second ring	Factory specification	0.30 to 0.45 mm 0.012 to 0.017 in.
		Allowable limit	1.25 mm 0.0492 in.
	Oil ring	Factory specification	0.25 to 0.40 mm 0.0099 to 0.015 in.
		Allowable limit	1.25 mm 0.0492 in.

9Y1210301ENS0082US0



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 or depth gauge.
3. If the clearance exceeds the allowable limit, replace the piston ring.
4. If the clearance still exceeds the allowable limit with new ring, replace the piston.

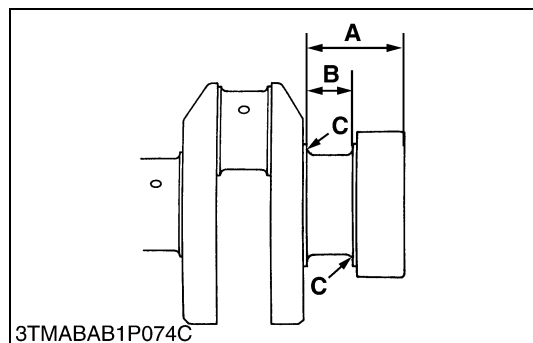
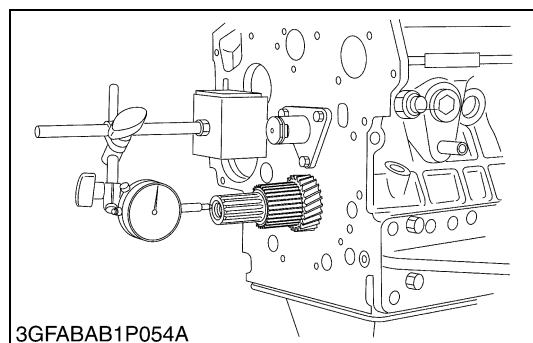
Clearance between piston ring and piston ring groove	Second ring	Factory specification	0.0850 to 0.112 mm 0.00335 to 0.00440 in.
		Allowable limit	0.2 mm 0.008 in.
	Oil ring	Factory specification	0.020 to 0.055 mm 0.00079 to 0.0021 in.
		Allowable limit	0.15 mm 0.0059 in.
Factory specification: a		More than 0.2 mm 0.008 in.	

(A) Top Ring (Key Stone Type)

(B) 2nd, Oil Ring

9Y1210301ENS0083US0

(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 exceeds 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.

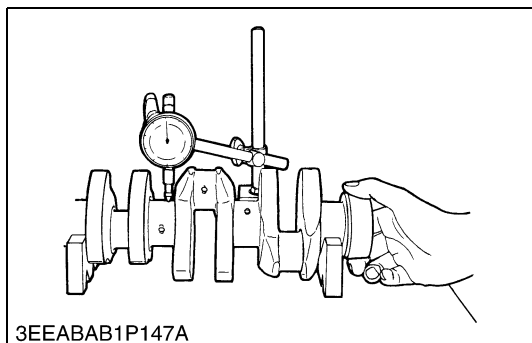
(Reference)

- Oversize dimensions of crankshaft journal

Oversize	0.20 mm 0.0079 in.	0.40 mm 0.016 in.
Dimension A	51.50 to 51.70 mm 2.028 to 2.035 in.	51.60 to 51.80 mm 2.032 to 2.039 in.
Dimension B	28.20 to 28.25 mm 1.111 to 1.112 in.	28.40 to 28.45 mm 1.119 to 1.120 in.
Dimension C	2.3 to 2.7 mm radius 0.091 to 0.10 in. radius	2.3 to 3.7 mm radius 0.091 to 0.10 in. radius

The crankshaft journal must be fine-finished to higher than Rmax=0.8S.

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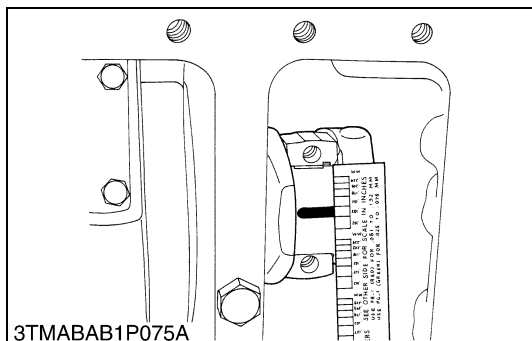


Crankshaft Alignment

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 exceeds the allowable limit, replace the crankshaft.

Crankshaft alignment	Allowable limit	0.02 mm 0.0008 in.
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Oil Clearance between Crankpin and Crankpin Bearing

1. Clean the crankpin and crankpin bearing.
2. Put a strip of plastigage 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 exceeds 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 plastigage 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	0.029 to 0.091 mm 0.0011 to 0.0036 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankpin O.D.	Factory specification	39.959 to 39.975 mm 1.5732 to 1.5738 in.
Crankpin bearing I.D.	Factory specification	40.040 to 40.050 mm 1.5764 to 1.5767 in.

(Reference)

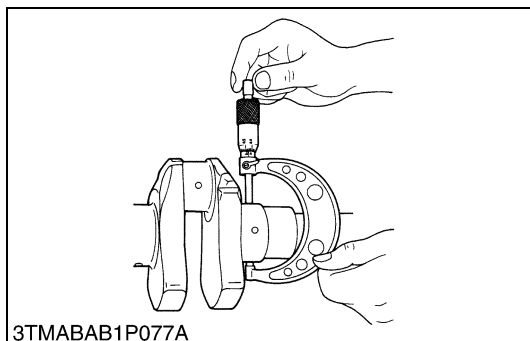
- Undersize dimensions of crankpin

Undersize	0.20 mm 0.0079 in.	0.40 mm 0.016 in.
Dimension A	2.8 to 3.2 mm radius 0.11 to 0.12 in. radius	2.8 to 3.2 mm radius 0.11 to 0.12 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	39.759 to 39.775 mm dia. 1.5654 to 1.5659 in. dia.	39.559 to 39.575 mm dia. 1.5575 to 1.5580 in. dia.

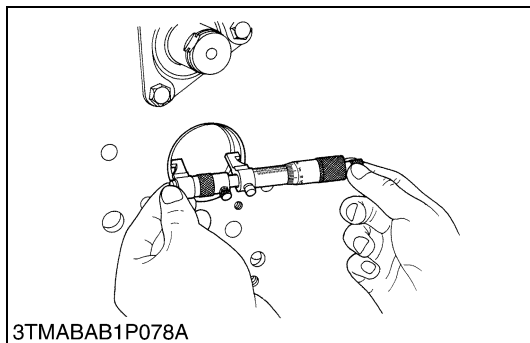
The crankpin must be fine-finished to higher than Rmax=0.8S.

*Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.0394 to 0.0591 in.) relief.

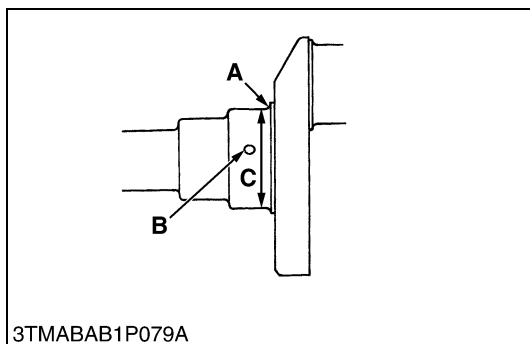
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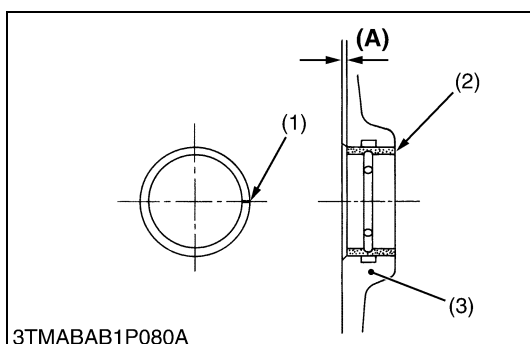
3TMABAB1P077A



3TMABAB1P078A



3TMABAB1P079A



3TMABAB1P080A

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 clearance exceeds 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 figure.

Oil Clearance between crankshaft journal and crankshaft bearing 1	Factory specification	0.0340 to 0.114 mm 0.00134 to 0.00448 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D.	Factory specification	47.934 to 47.950 mm 1.8872 to 1.8877 in.
Crankshaft bearing 1 I.D.	Factory specification	47.984 to 48.048 mm 1.8892 to 1.8916 in.

(Reference)

- Undersize dimensions of crankshaft journal

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	47.734 to 47.750 mm dia. 1.8793 to 1.8799 in. dia.	47.534 to 47.550 mm dia. 1.8715 to 1.8720 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 (0.0394 to 0.0591 in.) relief.

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Replacing Crankshaft Bearing 1

(When removing)

1. Press out the used crankshaft bearing 1 using a crankshaft bearing 1 replacing tool. (See page "SPECIAL TOOLS".)

(When installing)

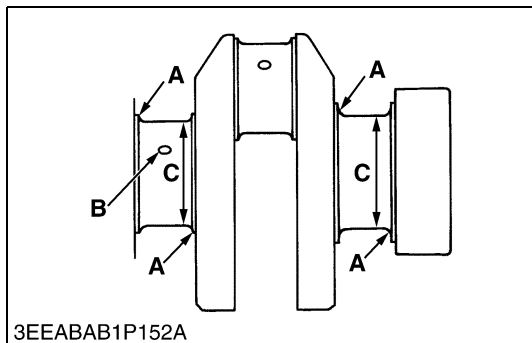
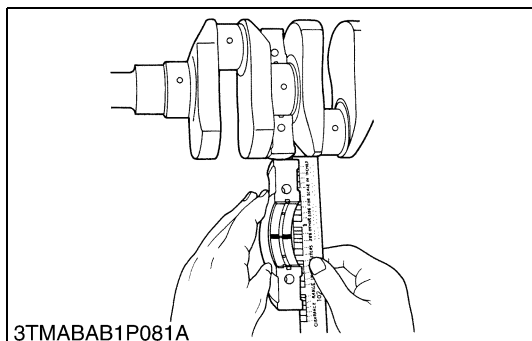
1. Clean a new crankshaft bearing 1 and crankshaft journal bore, and apply engine oil to them.
2. Using a crankshaft bearing 1 replacing tool, press in a new bearing 1 (2) so that its seam (1) directs toward the exhaust manifold side. (See figure.)

Dimension (A)	Factory specification	0 to 0.3 mm 0 to 0.01 in.
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- (1) Seam
- (2) Crankshaft Bearing 1
- (3) Cylinder Block

(A) Dimension

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

1. Put a strip of plastigage 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 clearance exceeds the allowable limit, replace the crankshaft bearing 2 (1) and 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	Factory specification	0.034 to 0.095 mm 0.0014 to 0.0037 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D. (Intermediate)	Factory specification	47.934 to 47.950 mm 1.8872 to 1.8877 in.
Crankshaft bearing 2 I.D.	Factory specification	47.984 to 48.029 mm 1.8892 to 1.8909 in.

Oil clearance between crankshaft journal and crankshaft bearing 3	Factory specification	0.0340 to 0.1030 mm 0.00134 to 0.00405 in.
	Allowable limit	0.20 mm 0.0079 in.

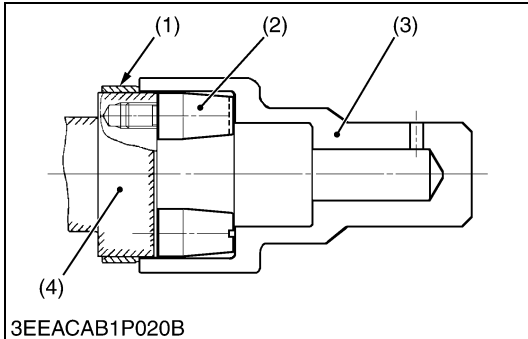
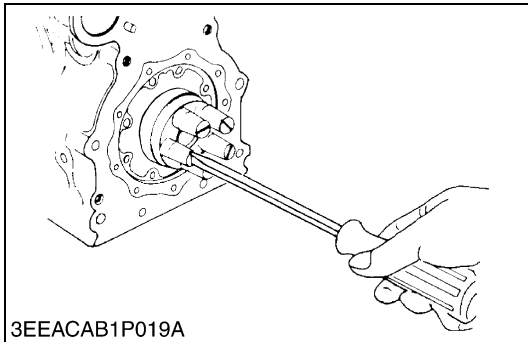
Crankshaft journal O.D. (Flywheel side)	Factory specification	51.921 to 51.940 mm 2.0442 to 2.0448 in.
Crankshaft bearing 3 I.D.	Factory specification	51.974 to 52.024 mm 2.0463 to 2.0481 in.

(Reference)

- Undersize dimensions of crankshaft journal

Undersize	0.2 mm 0.0079 in.	0.4 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	47.734 to 47.750 mm dia. 1.8793 to 1.8799 in. dia.	47.534 to 47.550 mm dia. 1.8715 to 1.8720 in. dia.
Dimension D	51.721 to 51.740 mm dia. 2.0363 to 2.0370 in. dia.	51.521 to 51.540 mm dia. 2.0284 to 2.0291 in. dia.
The crankshaft journal must be fine-finished to higher than Rmax=0.8-S. *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. Set the sleeve guide (2) to the crankshaft.
3. Heat a new sleeve to a temperature between 150 and 200 °C (302 and 392 °F), and fix the sleeve to the crankshaft as shown in figure.
4. Press fit the sleeve using the auxiliary socket for pushing (3).

NOTE

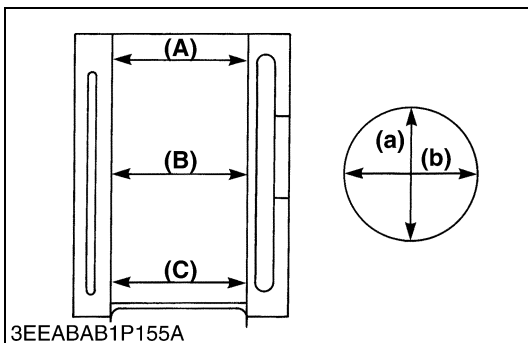
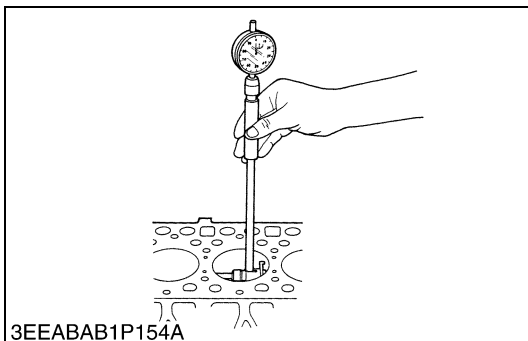
- Mount the sleeve with its largely chamfered surface facing outward.
- Should heating is not enough, a sleeve might stop halfway, so be careful.

- (1) Crankshaft Sleeve
(2) Sleeve Guide

- (3) Auxiliary Socket for Pushing
(4) Crankshaft

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(5) Cylinder



Cylinder Wear

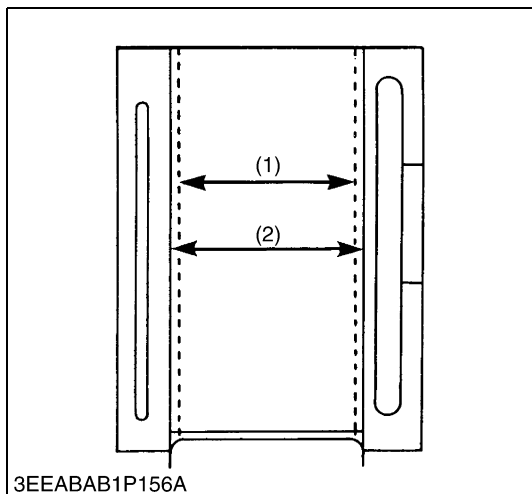
1. Measure the I.D. of the cylinder at the six positions (see figure) with a cylinder gauge to find the maximum and minimum I.D.'s.
2. Get the difference (Maximum wear) between the maximum and the minimum I.D.'s.
3. If the wear exceeds the allowable limit, bore and hone to the oversize dimension. (Refer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

Cylinder I.D.	Factory specification	76.000 to 76.019 mm 2.9922 to 2.9929 in.
	Allowable limit	76.15 mm 2.998 in.

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

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

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Correcting Cylinder

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

Oversized cylinder liner I.D.	Factory specification	76.500 to 76.519 mm 3.0119 to 3.0125 in.
	Allowable limit	76.65 mm 3.018 in.
Finishing	Hone to 1.2 to 2.0 mm μ R max. (0.000048 to 0.000078 μ in. R max.)	

2. Replace the piston and piston rings with oversize ones.
Oversize: 0.5 mm (0.02 in.)

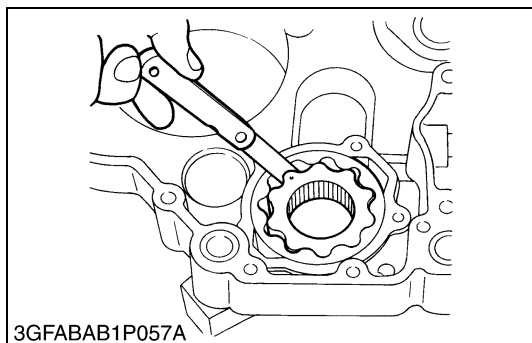
NOTE

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

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

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(6) Oil Pump

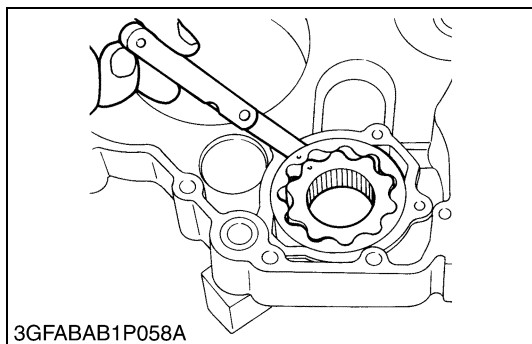


Rotor Lobe Clearance

1. Measure the clearance between lobes of the inner rotor and the outer rotor with a feeler gauge.
2. If the clearance exceeds the factory specifications, replace the oil pump rotor assembly.

Rotor lobe clearance	Factory specification	0.060 to 0.18 mm 0.0024 to 0.0071 in.
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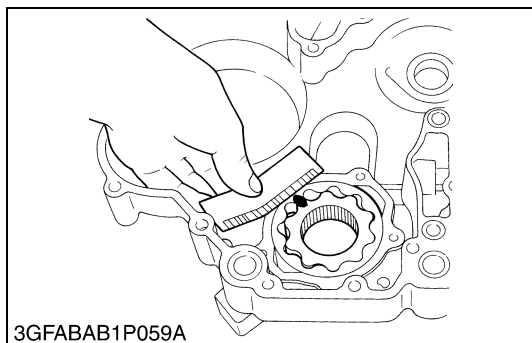


Clearance between Outer Rotor and Pump Body

1. Measure the clearance between the outer rotor and the pump body with a feeler gauge.
2. If the clearance exceeds the factory specifications, replace the oil pump rotor assembly.

Clearance between outer rotor and pump body	Factory specification	0.100 to 0.180 mm 0.00394 to 0.00708 in.
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Clearance between Rotor and Cover

1. Put a strip of plastigage onto the rotor face with grease.
2. Install the cover and tighten the screws.
3. Remove the cover carefully, and measure the amount of the flattening with the scale and get the clearance.
4. If the clearance exceeds the factory specifications, replace the oil pump rotor assembly.

Clearance between rotor and cover	Factory specification	0.025 to 0.075 mm 0.00099 to 0.0029 in.
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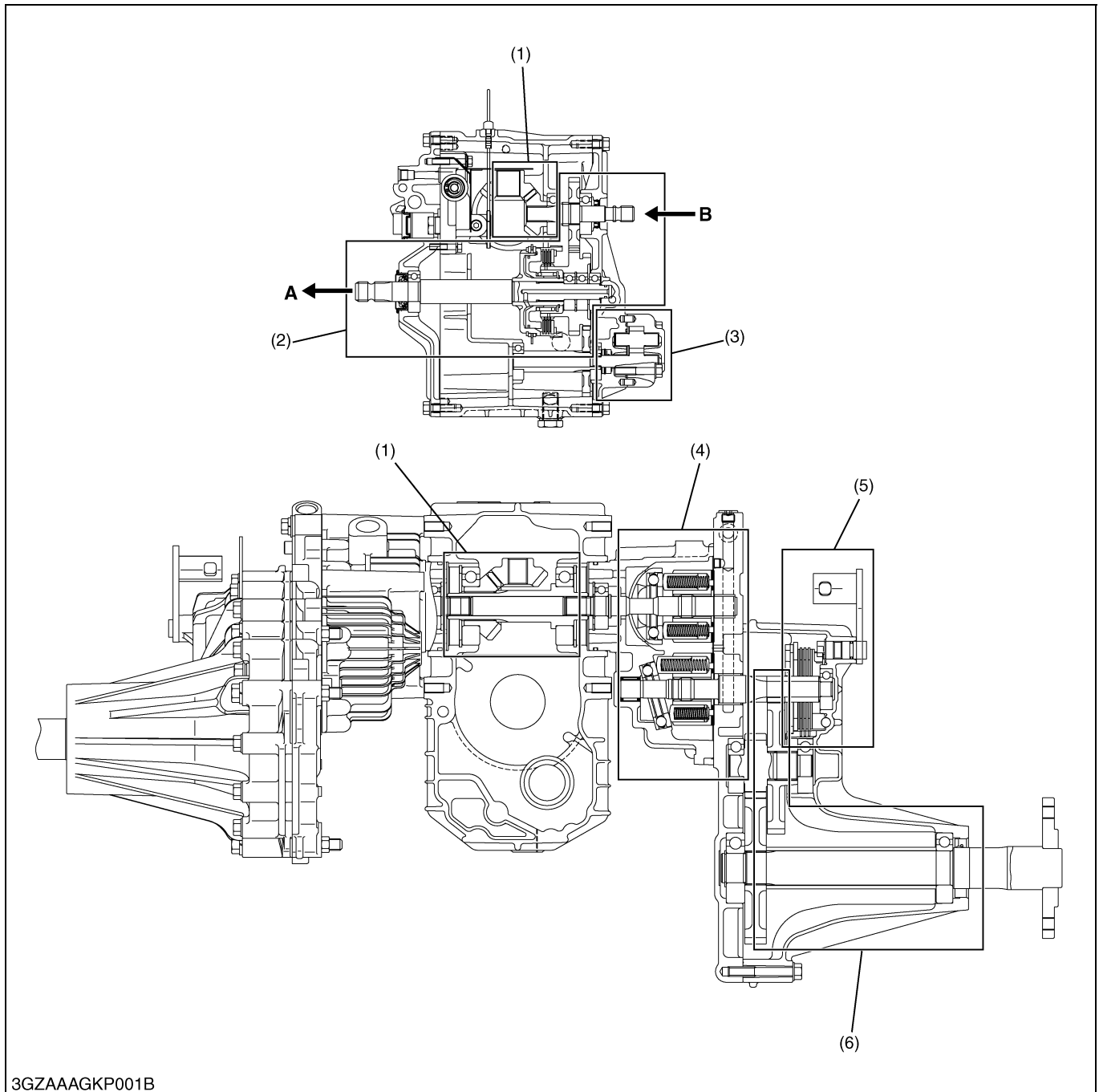
2 TRANSAXLE

MECHANISM

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1. STRUCTURE



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- | | | | |
|-----------------------------|------------------------------|----------------------------------|-----------------------|
| (1) Bevel Gear Section | (3) Hydraulic Pump | (5) Brake Section | A: To Mower |
| (2) PTO Section (Side View) | (4) Hydrostatic Transmission | (6) Final Reduction Gear Section | B: From Engine |

Transmission consists of a bevel gear section (1), hydraulic pump (3), hydrostatic transmission RH and LH (4), brake section (5), final reduction gear section (6), and PTO section (2).

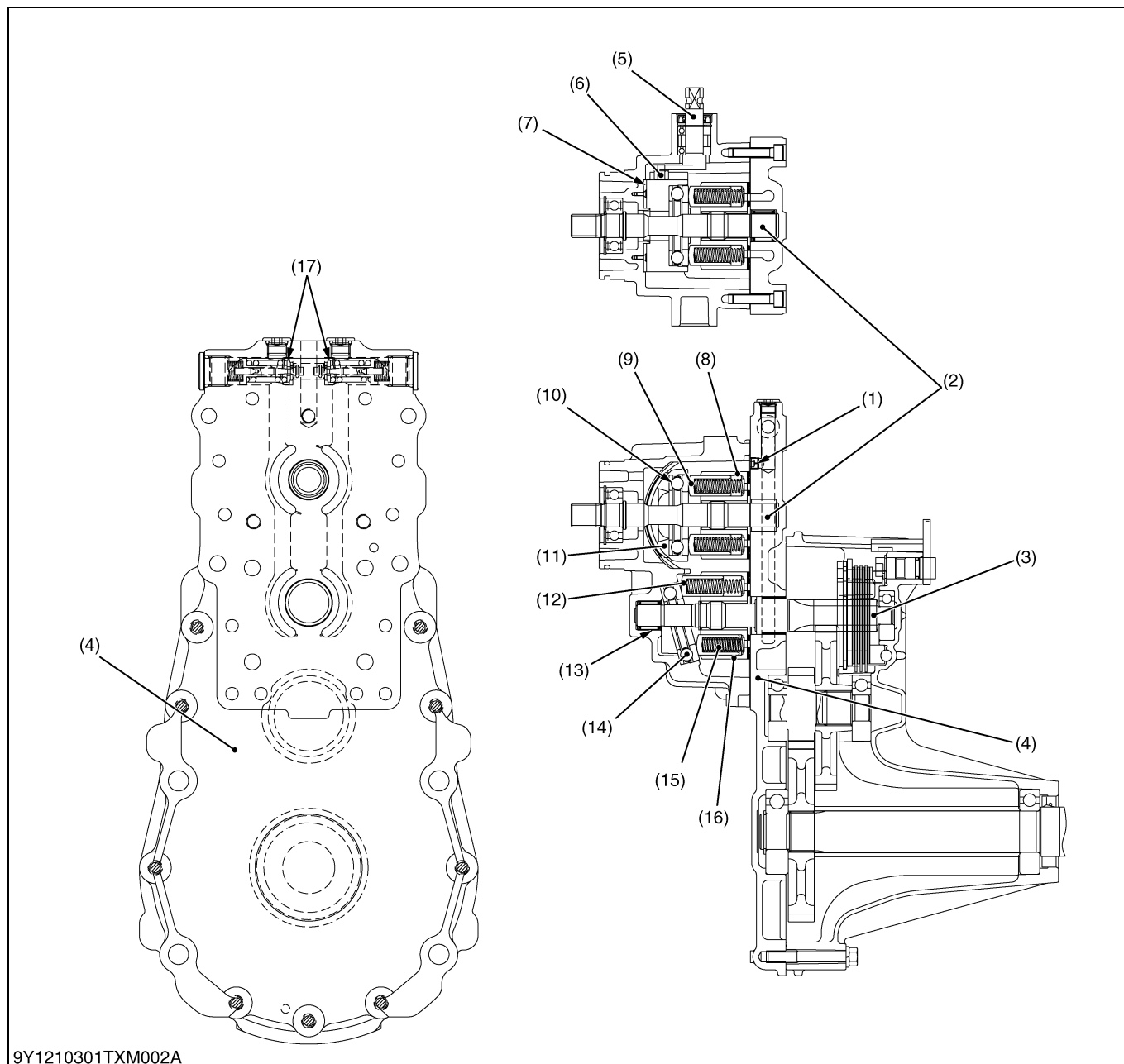
Power from engine is transmitted through transmission to mower and rear wheels.

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2. TRAVELING SYSTEM

[1] HYDROSTATIC TRANSMISSION

(1) Structure

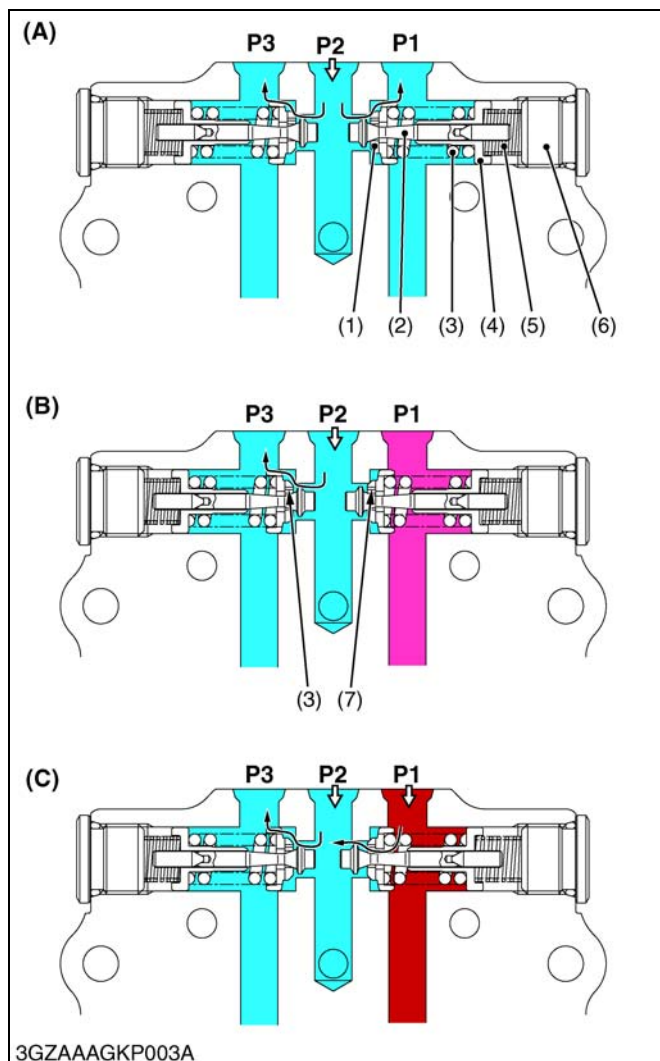


- | | | | |
|------------------------------------|---------------------------|--------------------------|---|
| (1) Lubricating Orifice | (6) Slot Guide | (11) Swashplate | (16) Cylinder Block (Motor) |
| (2) Pump Shaft | (7) Cradle Bearing | (12) Piston (Motor) | (17) Check and High Pressure Relief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

The hydrostatic transmission consists of a trunnion arm (5), variable displacement piston pump (8) - (11), fixed displacement piston motor (12) - (16) and check and high pressure relief valve (17).

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(2) Check and High Pressure Relief Valve



The check and high-pressure relief valve consists of pressure poppet (2), check valve seat (1), relief valve spring (3), spring guide (4) and check valve spring (5).

The valve is used to prevent an overload that would happen at a quick start, sudden stop or even during usual running. This valve doubles as a check valve.

The check and high-pressure relief valves are laid out facing each other as shown in the figure.

(A) In neutral, both valves are open and charging oil enters into the main oil circuit through the valves.

(B) At normal operation, the check valve in the high-pressure side is closed and it pushes and opens the another one. An excessive charge flow goes through the charge relief valve into HST housing.

(C) The check and high-pressure relief valve along the high-pressure line serves as a high-pressure relief valve. If the pressure exceeds a high-pressure limit level, the pressure poppet opens itself against the relief valve spring (3) force and opens the valve seat that is located between the check valve seat (1) and the pressure poppet (2). Now the flow goes from **P1** to **P2** and **P3**.

If the **P1** pressure drops, the relief valve spring forces the valve seat closed against the pressure. The high-pressure oil at **P1** does not flow to **P2** any longer.

As discussed above, the check and high-pressure relief valve protects engines, pumps, motors, gears and even the machine itself from overload.

Oil temperature	Valve operating pressure
50 °C (122 °F)	19.5 to 22.5 MPa 199 to 229 kgf/cm ² 2830 to 3260 psi

Condition

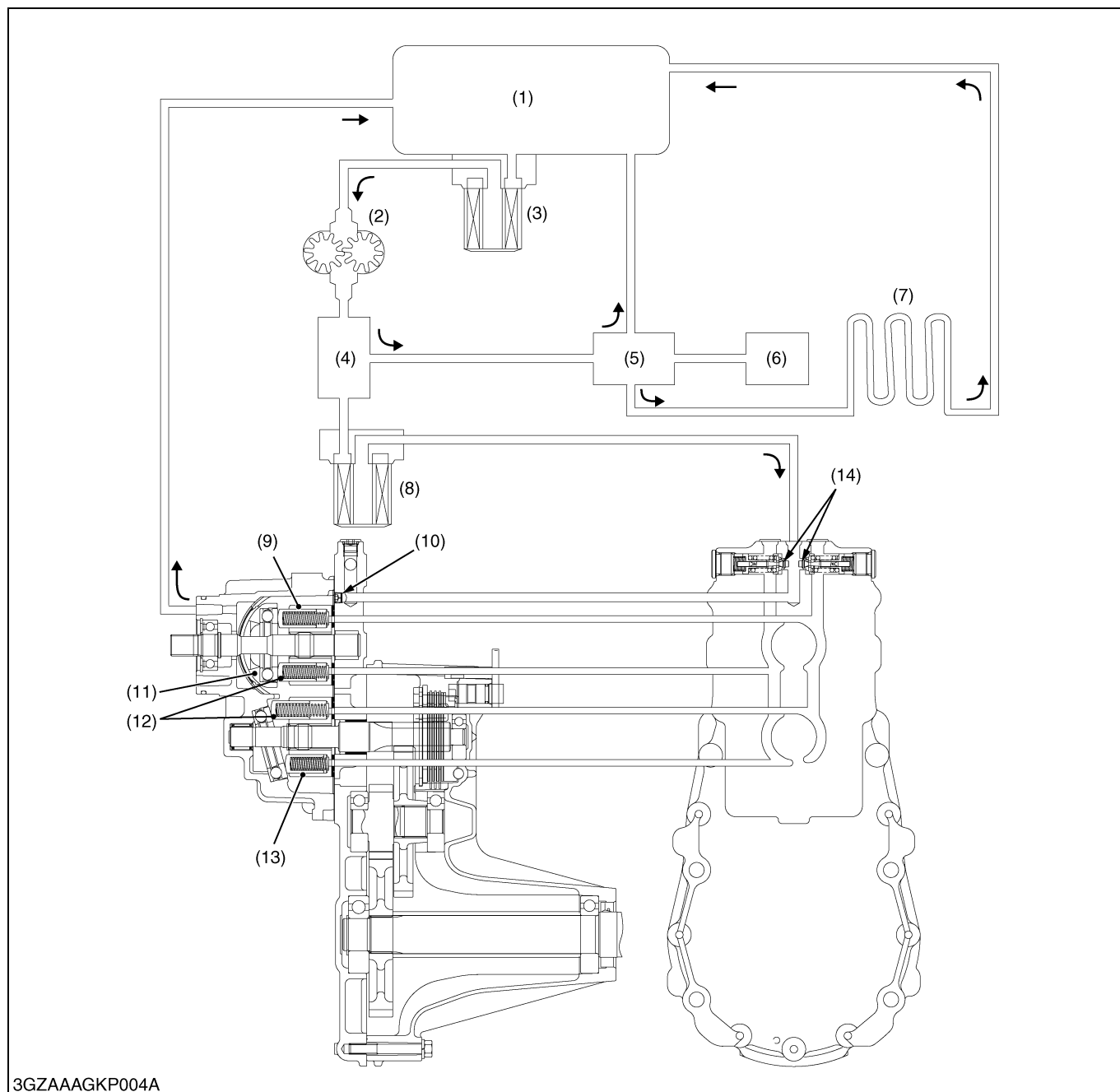
- At engine speed 1800 min⁻¹ (rpm)

- (1) Check Valve Seat
- (2) Pressure Poppet
- (3) Relief Valve Spring
- (4) Spring Guide
- (5) Check Valve Spring
- (6) Valve Plug
- (7) Neutral Orifice

- (A) In Neutral (Stop)**
(B) When Check Valve Activating (Normal Operation)
(C) When High Pressure Relief Valve Activating
P1: Forward
P2: Charge
P3: Reverse

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(3) Oil Flow



- | | | | |
|------------------------------------|-----------------------------------|---------------------------|---|
| (1) Transmission Case | (5) Regulator Valve | (9) Cylinder Block (Pump) | (13) Cylinder Block (Motor) |
| (2) Hydraulic Pump | (6) PTO Clutch | (10) Lubricating Orifice | (14) Check and High Pressure Relief Valve |
| (3) Hydraulic Oil Filter Cartridge | (7) Oil Cooler | (11) Swashplate | |
| (4) Control Valve | (8) TM Oil Filter Cartridge (HST) | (12) Piston | |

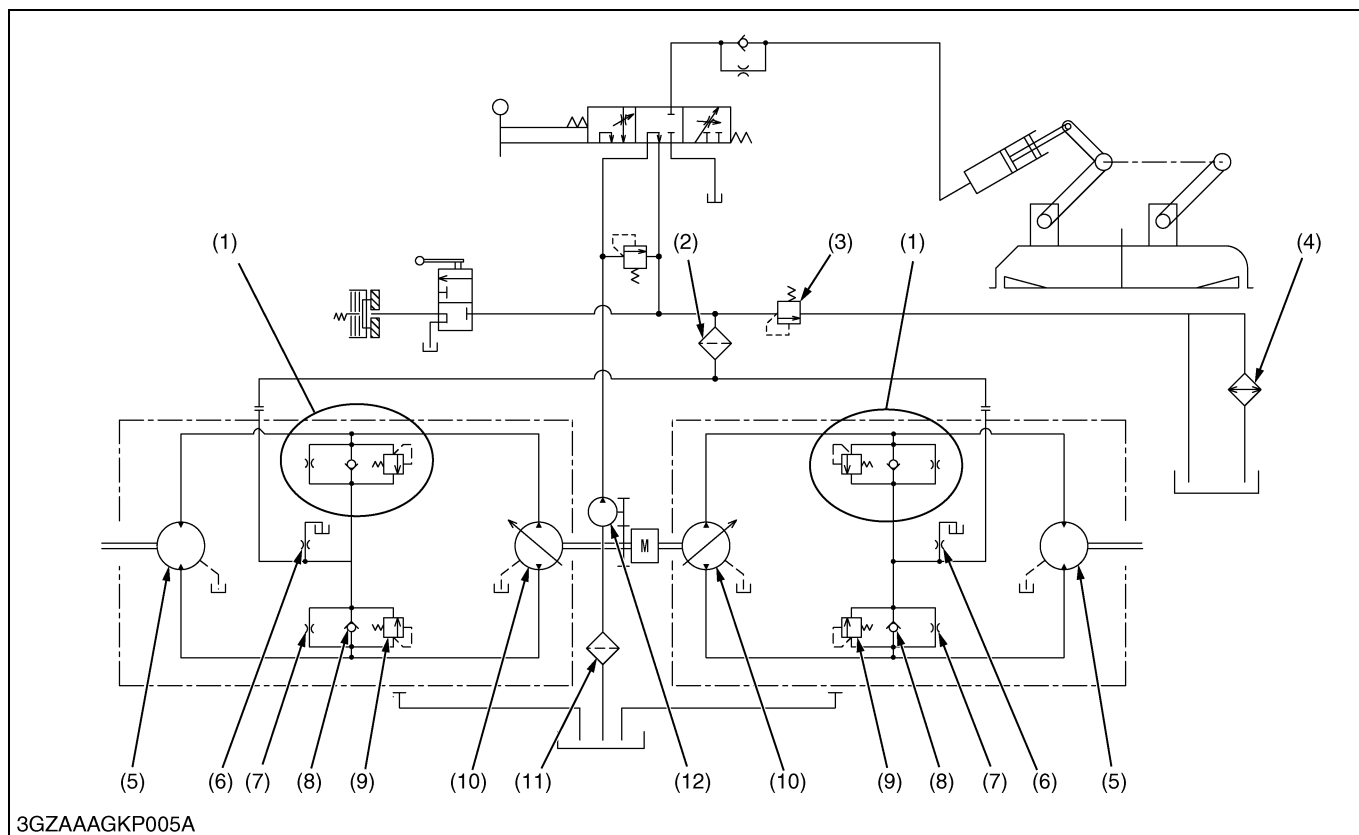
The pump and motor are joined in a closed hydraulic loop and most of oil circulates within the main oil circuit. A little oil lubricates and oozes out from the clearance between the moving parts of the case. Then oil in the main oil circuit of the HST needs to be supplied a want.

The charge oil is sent to the HST housing after the control valve (4) and TM oil filter cartridge (8) pass by the hydraulic pump (2). And, pressure is always controlled to the charge oil with the regulator valve (5).

The charge oil aids smooth operation of pistons for pump and motor. And overflow oil from HST housing return to the transmission case.

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(4) Power Trains Operation



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

■ Neutral

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

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

■ Forward

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

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

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

■ Reverse

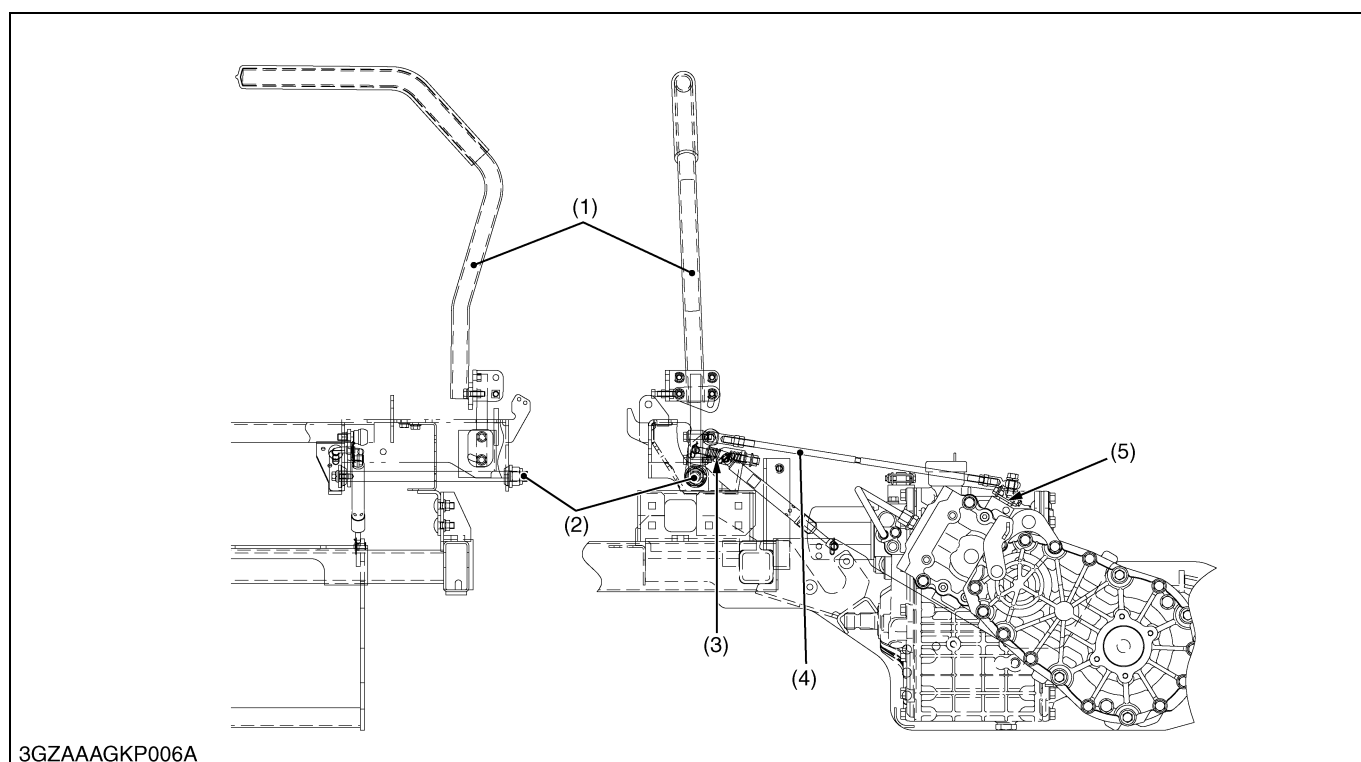
Reverse operation is controlled by reversing the angle applied to the pump swash plates, reversing the flow of high-pressure oil to the motors.

(Reference)

- Regulating valve setting pressure (PTO clutch operating pressure)
0.65 to 0.75 MPa (6.7 to 7.6 kgf/cm², 95 to 100 psi) at engine speed 1800 min⁻¹ (rpm)

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(5) Control Linkage



- (1) Motion Control Lever (3) Speed Limit Spring (4) Speed Control Rod (5) Trunnion Arm
 (2) Speed Shaft

The motion control lever (1) and the trunnion shaft of variable swashplate are linked with the speed shaft (2), speed control rod (4) and the trunnion arm (5). As the motion control lever (1) is pushed, the swashplate rotates and forward travelling speed increases. Pulling the motion control lever (1) increases reverse speed.

A neutral position can be requested by operating the motion control lever (1). Moreover, it is possible to fix to a neutral position by putting the motion control lever (1) in the neutral slot. The motion control lever (1) is pushed by the speed limit spring's (3) working when the motion control lever (1) is removed from the neutral slot. As the result, the machine synchronizes with the movement of the motion control lever (1) and begins to move slowly. (The machine is set like this.) The damper connected to the speed shaft (2) restricts the movement of the linkage to prevent abrupt operation or reversing.

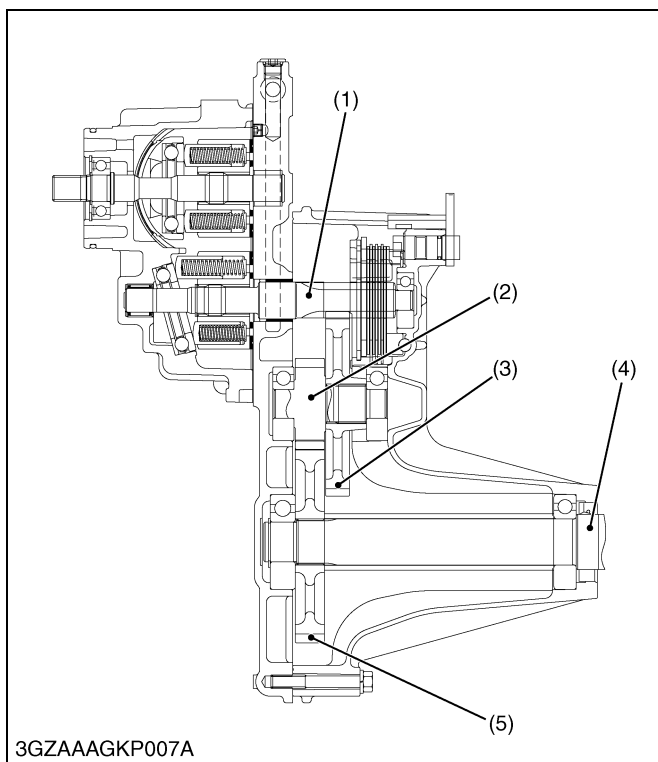
■ Steering

The Zero-Turn Mower does not have a separate steering system. Steering is controlled by varying the wheel motor speeds. This gives the machine a zero-turn capability.

As the control levers are moved to a full left turn position, the right hydraulic pump is moved to the full-speed forward position and the left pump is moved to the full-speed reverse position. This will allow the machine to pivot around its center.

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(6) Final Reduction Gear Section

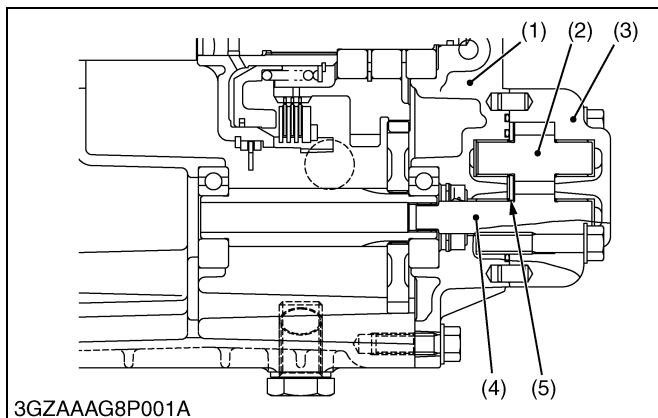


As for this machine, power is transmitted from the 8T gear on the brake shaft (1) to the rear axle (4) through 53T gear (3), 19T gear shaft (2) and 49T gear (5).

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

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(7) Hydraulic Pump



The hydraulic pump consists of the casing (1), cover (3), side plate (5), and two spur gears (drive gear (4) and driven gear (2)) that are in mesh.

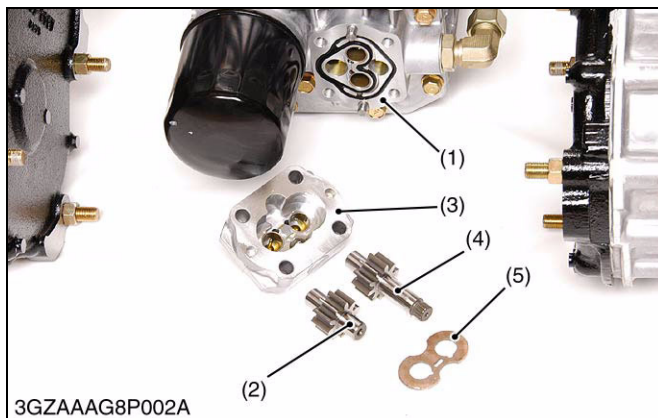
Hydraulic pump is driven by the pump drive shaft in the transmission case.

Maximum displacement is as follows.

Displacement	Engine speed	Condition
21.0 L/min. 5.5 U.S.gals/min. 4.6 Imp.gals/min.	At 3200 min ⁻¹ (rpm)	at no load

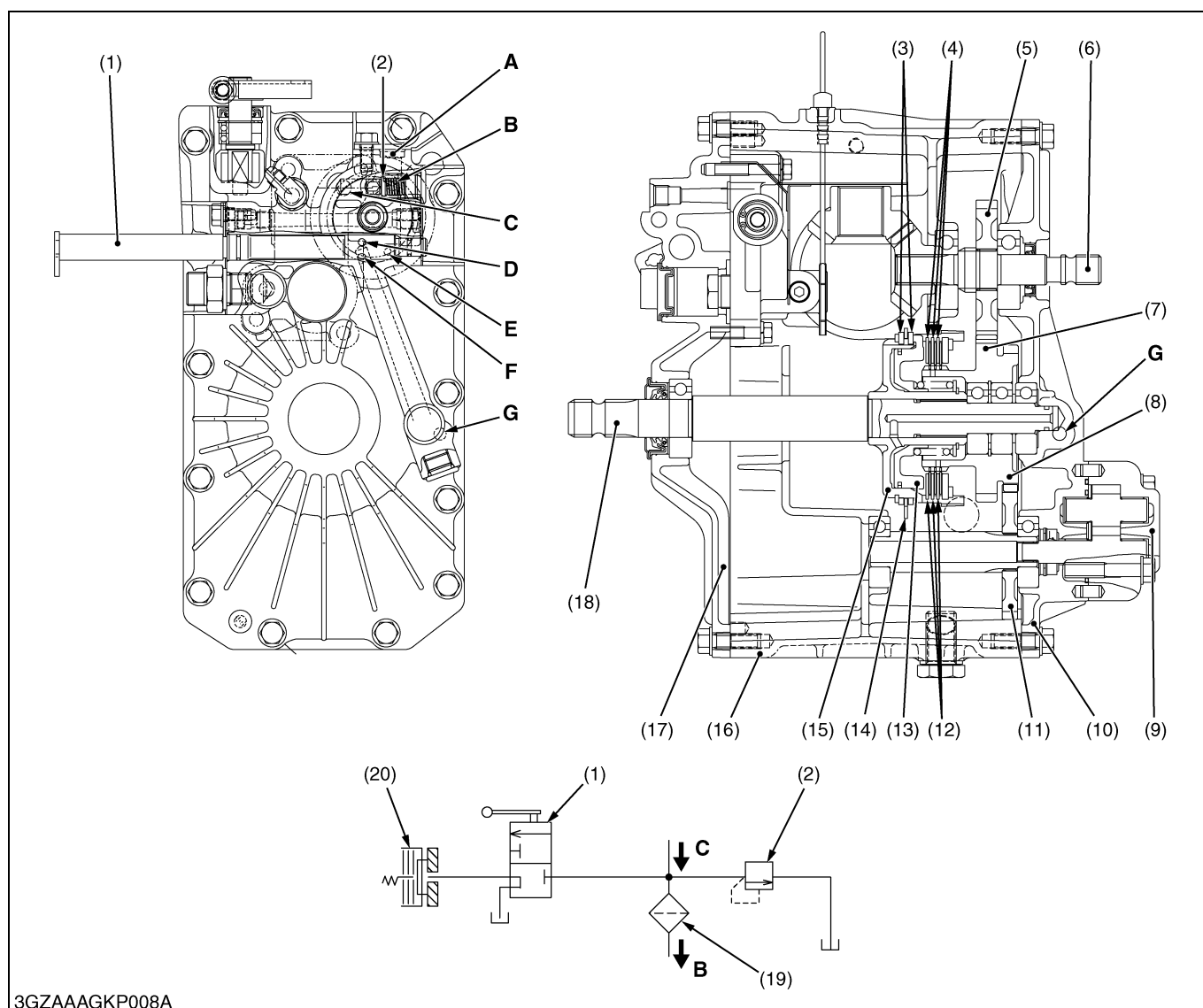
- | | |
|-----------------|----------------|
| (1) Casing | (4) Drive Gear |
| (2) Driven Gear | (5) Side Plate |
| (3) Cover | |

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(8) PTO System

PTO Clutch and Valve



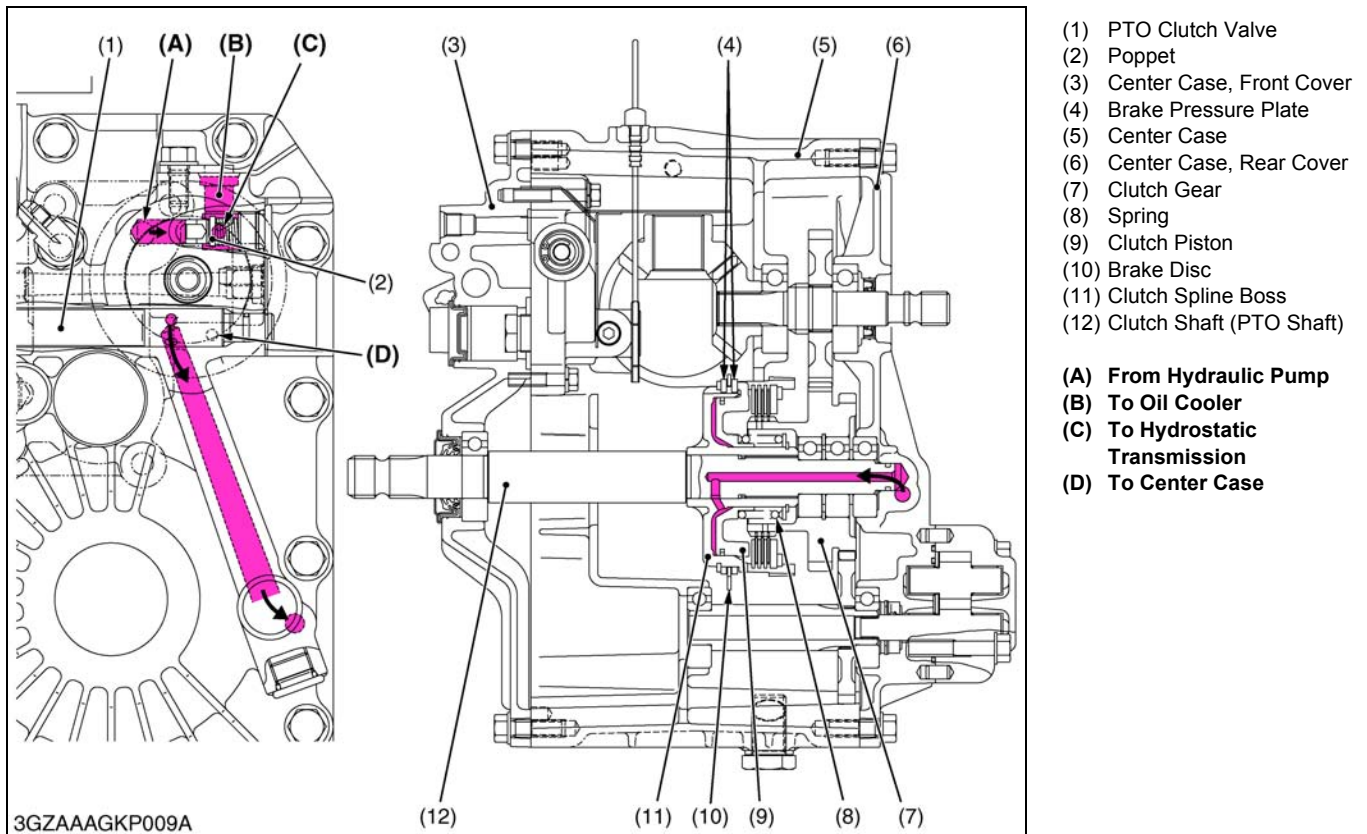
- | | | | |
|----------------------|------------------------------|-------------------------------|--|
| (1) PTO Valve Lever | (8) 35T Gear | (15) PTO Case | A: To Oil Cooler |
| (2) Regulator Valve | (9) Hydraulic Pump | (16) Center Case | B: To Hydrostatic Transmission |
| (3) PTO Brake Plate | (10) Center Case, Rear Cover | (17) Center Case, Front Cover | C: From Hydraulic Pump |
| (4) PTO Clutch Plate | (11) 32T Gear | (18) PTO Shaft | D: From Hydraulic Pump to Valve Lever |
| (5) 34T Gear | (12) PTO Clutch Disc | (19) Oil Filter Cartridge | E: From PTO Shaft to Center Case (Drain Port) |
| (6) Input Shaft | (13) Clutch Piston | (20) PTO Clutch | F: From PTO Valve Lever to PTO Shaft |
| (7) 43T Gear | (14) PTO Brake Disc | | G: To PTO Shaft |

The ZD series is equipped with hydraulic independent PTO clutch (wet multi-plates type). Therefore, the engine power could engage or disengage to the PTO shaft (18) without stopping the machine movement.

The PTO clutch (20) has three PTO clutch discs (12), three PTO clutch plates (4), clutch piston (13) and so on.

The clutch piston (13) is actuated by hydraulic oil flow the hydraulic pump through regulator valve (2).

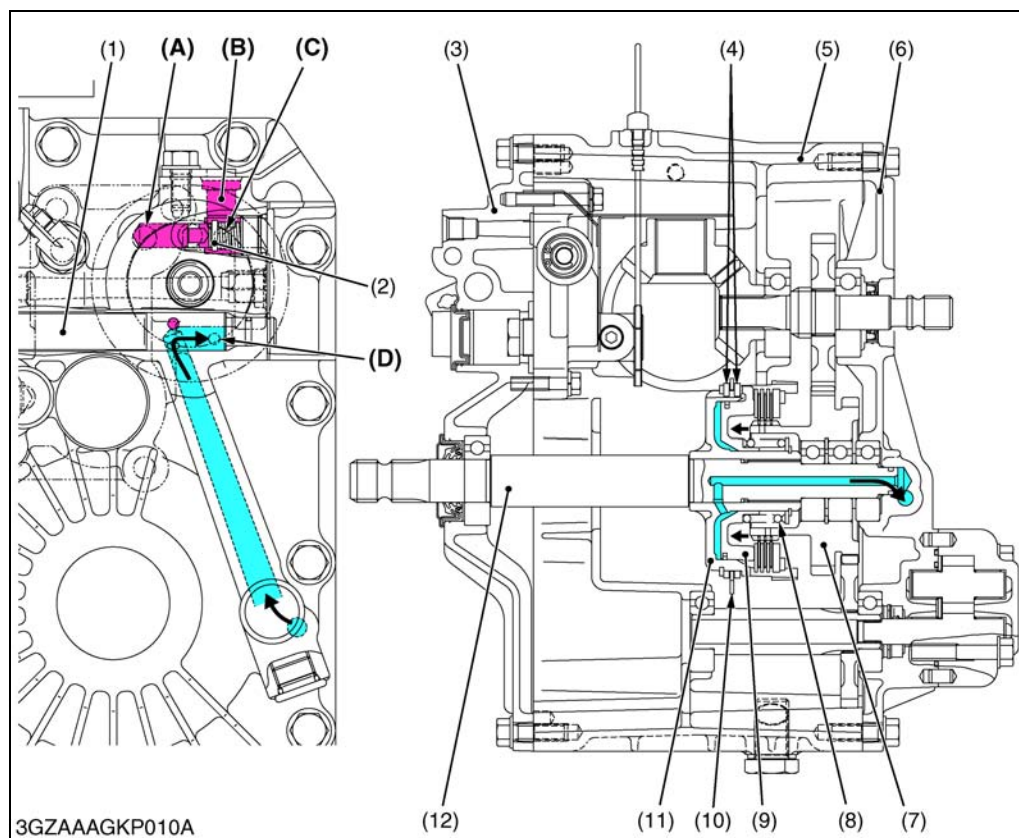
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PTO Clutch "Engaged"

When the PTO clutch lever is set at the **"Engaged"** position, the PTO clutch valve (1) rotates and form the oil line to the PTO clutch pack.

Oil entering the clutch pack pushes the clutch piston (9) to engage the clutch pack.

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PTO Clutch "Disengaged"

- (1) PTO Clutch Valve
- (2) Poppet
- (3) Center Case, Front Cover
- (4) Brake Pressure Plate
- (5) Center Case
- (6) Center Case, Rear Cover
- (7) Clutch Gear
- (8) Spring
- (9) Clutch Piston
- (10) Brake Disc
- (11) Clutch Spline Boss
- (12) Clutch Shaft (PTO Shaft)

- (A) From Hydraulic Pump
- (B) To Oil Cooler
- (C) To Hydrostatic Transmission
- (D) To Center Case

After starting the engine, when the PTO clutch lever is set at the **"Disengaged"** position, the hole of PTO valve lever dose not face to hydraulic pump port.

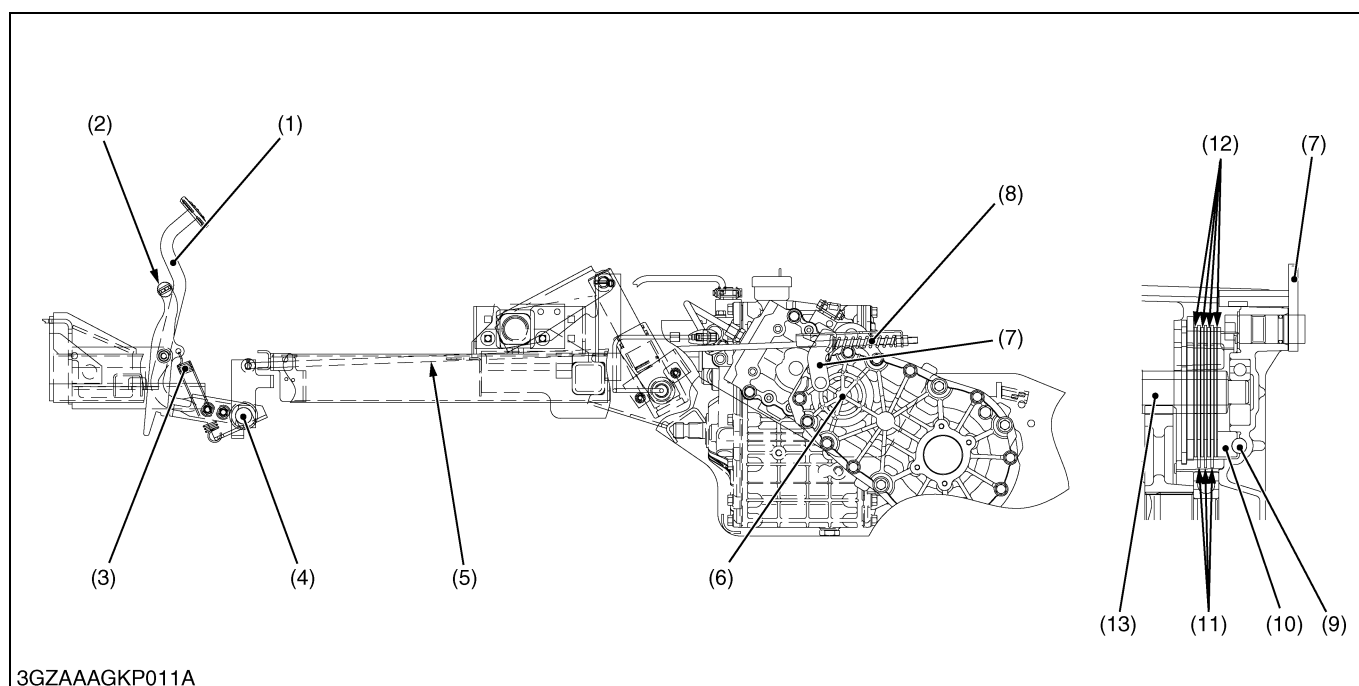
Since oil from hydraulic pump is blocked at the PTO valve lever, oil dose not flow to the PTO shaft. Blocked oil flows to the hydrostatic transmission and oil cooler to the regulator valve.

Oil in the clutch pack drained through the PTO valve lever into the center case (5).

Thus the clutch piston (9) is pushed back by the spring (8). When the piston (9) is pushed back, the piston pushed the brake plate (4) and brake disc (10), the rotation and drag of the PTO shaft (12) stop.

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(9) Parking Brake



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- | | | | |
|-------------------------------|--------------------|------------------|------------------------------|
| (1) Brake Pedal | (5) Brake Rod | (8) Brake Spring | (11) Brake Disk |
| (2) Parking Lock Pedal | (6) Brake Assembly | (9) Ball | (12) Brake Plate |
| (3) Brake Pedal Return Spring | (7) Brake Arm | (10) Actuator | (13) HST Motor Shaft (Brake) |
| (4) Brake Shaft | | | |

The parking brake consists of brake pedal (1), parking lock pedal (2), brake pedal return spring (3), brake shaft (4), brake rods (5), brake arms (7) and brake assemblies (6).

The brake is mechanical wet disks type.

When the brake pedal (1) is pressed, the brake shaft (4) is rotated forward and the brake rods (5) is pulled forward. And the brake arms (7) are rotated forward.

The brake arms (7) is connected mechanically to the grooves of the actuators (10).

The brake arms (7) rotates the actuators (10) and the actuators (10) mounting on three balls pushes the brake disks (11) and brake plates (12) to stop the brake shafts rotation.

As both the brake pedal (1) and parking lock pedal (2) are pressed, the parking brake will be applied and locked.

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SERVICING

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Vehicle Will Not Stop in Neutral Position	Improper neutral adjustment	Adjust neutral	2-S6
	Improper speed control rod adjustment	Adjust	2-S6
Vehicle Jerky and Noisy When Starting	Transmission oil insufficient	Replenish	2-S14
	Air entering from suction pipe	Retighten	–
	Transmission oil filter cartridge clogged	Replace	G-22
	Hydrostatic transmission defective	Replace	2-S30
Loss of Power	Control linkage defective	Repair or replace	2-M6
	Transmission oil insufficient	Replenish	2-S14
	Transmission oil filter cartridge clogged	Replace	G-22
	Hydraulic pump defective	Replace	2-S26
	Hydrostatic transmission defective	Replace	2-S30
System Operates in One Direction Only	Check valve defective	Replace	2-S31
	Control linkage defective	Repair	2-M6
System Operating Hot	Transmission oil insufficient	Replenish	2-S14
	Transmission oil filter cartridge clogged	Replace	G-22
	HST fan defective	Replace	2-S25
	Overload working	Decrease load	–
Noise from Transmission	Transmission oil insufficient	Replenish	2-S14
	Gear worn	Replace	–
	Improper backlash between 15T bevel gear and 21T bevel gear	Adjust	2-S39
	Bearing worn	Replace	–

TRAVELLING GEAR SHIFT SECTION

Symptom	Probable Cause	Solution	Reference Page
Noise from Transmission	Transmission oil insufficient	Refill	2-S14
	Gear worn or broken	Replace	–
	Bearings worn	Replace	–