# WSM

## WORKSHOP MANUAL

# GR1600EC2

Kubota

KiSC issued 07, 2006 A

# TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanism, service and maintenance of KUBOTA GR1600EC2. It is divided into three parts, “General”, “Mechanism” and “Servicing”.

■ **General**

Information on the tractor identification, the general precautions, maintenance check list, check and maintenance and special tools are described.

■ **Mechanism**

Information on the construction and function are included. This part should be understood before proceeding with troubleshooting, disassembling and servicing.

■ **Servicing**

Information on the troubleshooting, servicing specification lists, tightening torque, checking and adjusting, disassembling and assembling, and servicing which cover procedures, precautions, factory specifications and allowable limits.

All information illustrations and specifications contained in this manual are based on the latest product information available at the time of publication.

The right is reserved to make changes in all information at any time without notice.

Due to covering many models of this manual, information or picture being used, have not been specified as one model.

**July 2006**



KiSC issued 07, 2006 A

# 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.**

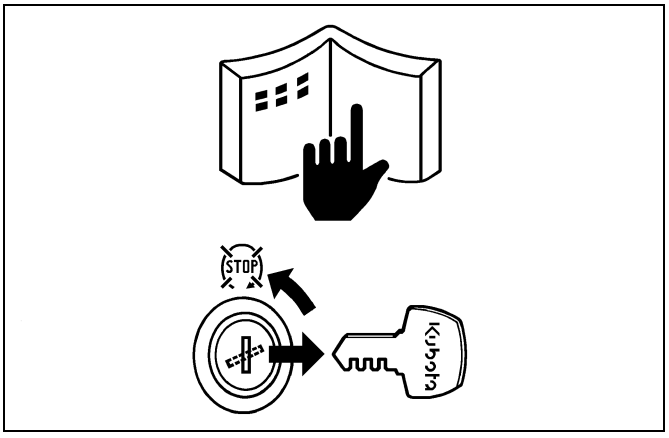
**DANGER : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

**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.**

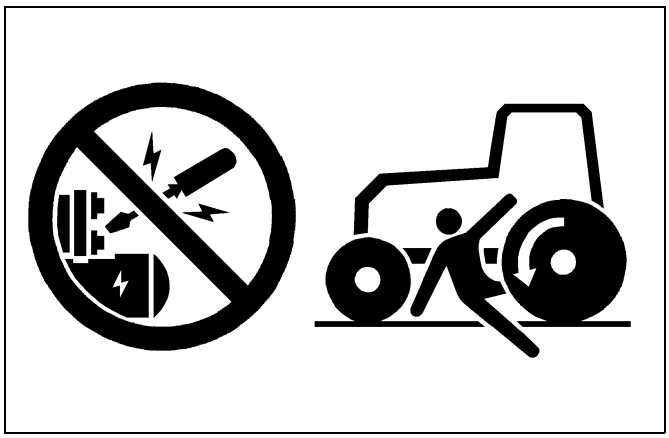
**■ IMPORTANT : Indicates that equipment or property damage could result if instructions are not followed.**

**■ NOTE : Gives helpful information.**



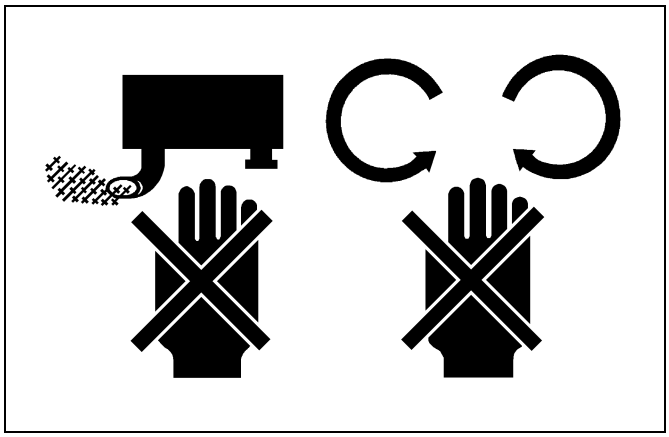

## BEFORE SERVICING AND REPAIRING

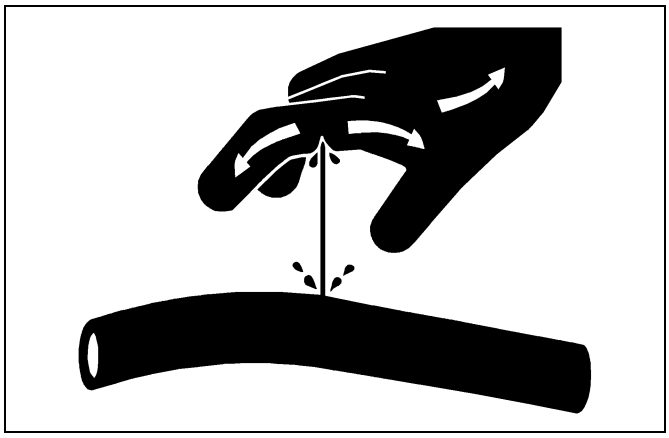
- Read all instructions and safety instructions in this manual and on your machine safety decals.
- Clean the work area and machine.
- Park the machine on a firm and level ground, and set the parking brake.
- Lower the implement to the ground.
- Stop the engine, and remove the key.
- Disconnect the battery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



## SAFETY STARTING

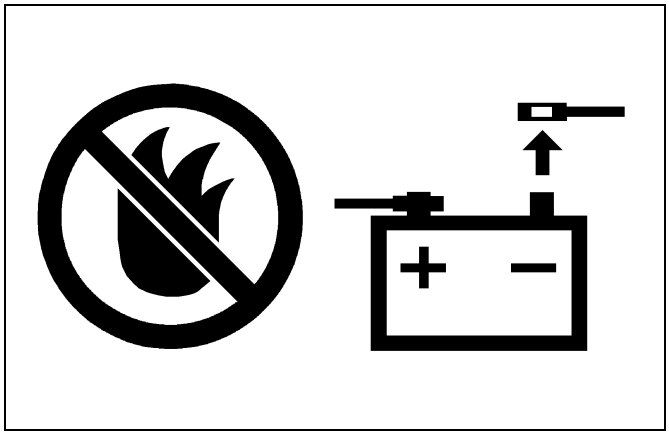
- Do not start the engine by shorting across starter terminals or bypassing the safety start switch.
- Do not alter or remove any part of machine safety system.
- Before starting the engine, make sure that all shift levers are in neutral positions or in disengaged positions.
- Never start the engine while standing on ground. Start the engine only from operator's seat.





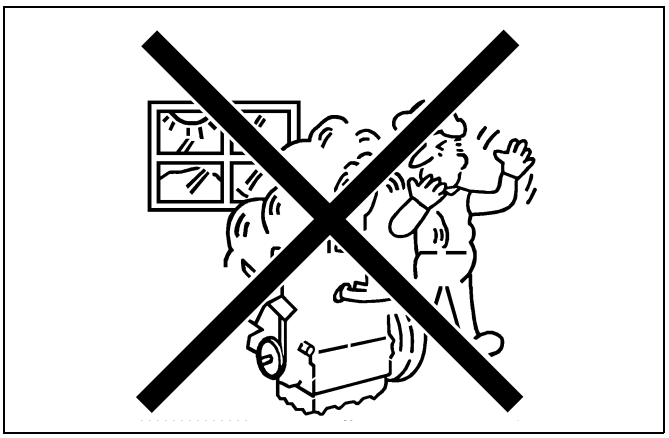
## SAFETY WORKING

- Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- Wear close fitting clothing and safety equipment appropriate to the job.
- Use tools appropriate to the work. Makeshift tools, parts, and procedures are not recommended.
- When servicing is performed together by two or more persons, take care to perform all work safely.
- Do not work under the machine that is supported solely by a jack. Always support the machine by safety stands.
- Do not touch the rotating or hot parts while the engine is running.
- Never remove the radiator cap while the engine is running, or immediately after stopping. Otherwise, hot water will spout out from radiator. Only remove radiator cap when cool enough to touch with bare hands. Slowly loosen the cap to first stop to relieve pressure before removing completely.
- Escaping fluid (fuel or hydraulic oil) under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or fuel lines. Tighten all connections before applying pressure.



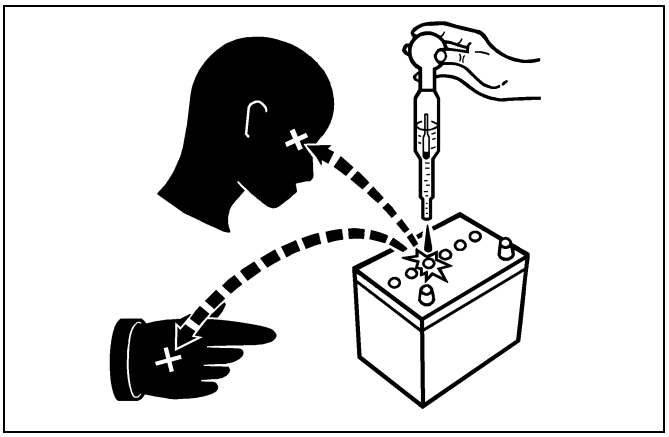
## AVOID FIRES

- Fuel is extremely flammable and explosive under certain conditions. Do not smoke or allow flames or sparks in your working area.
- To avoid sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- Battery gas can explode. Keep sparks and open flame away from the top of battery, especially when charging the battery.
- Make sure that no fuel has been spilled on the engine.



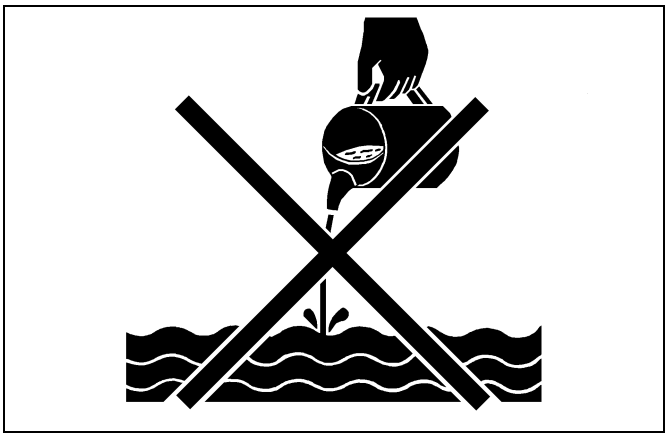
## VENTILATE WORK AREA

- If the engine must be running to do some work, make sure the area is well ventilated. Never run the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.



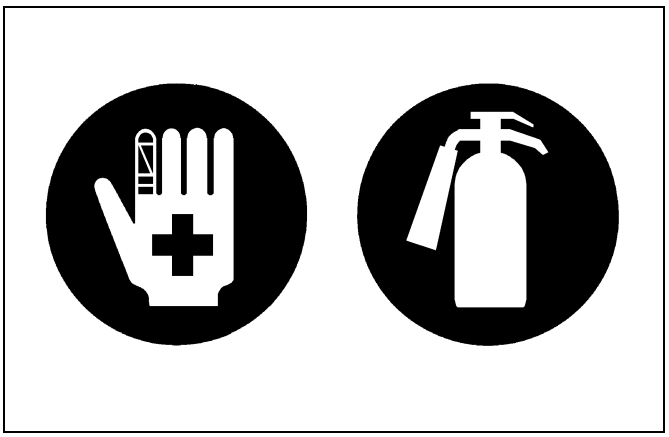
## PREVENT ACID BURNS

- Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, clothing and cause blindness if splashed into eyes. Keep electrolyte away from eyes, hands and clothing. If you spill electrolyte on yourself, flush with water, and get medical attention immediately.



## DISPOSE OF FLUIDS PROPERLY

- Do not pour fluids into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, electrolyte and other harmful waste.

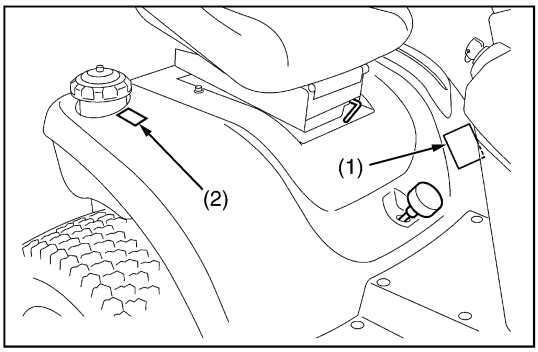


## PREPARE FOR EMERGENCIES

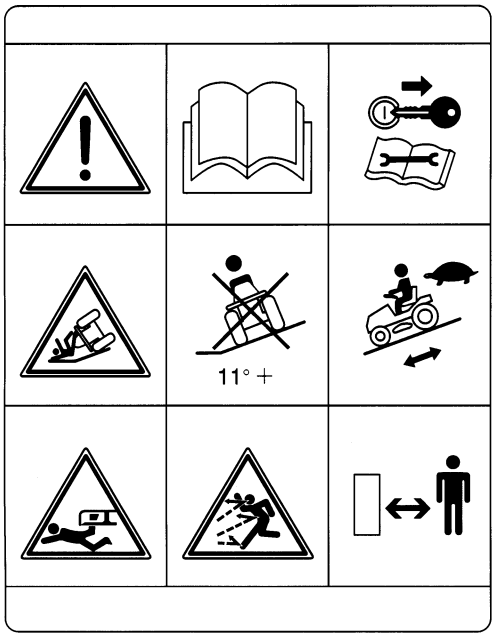
- Keep a first aid kit and fire extinguisher handy at all times.
- Keep emergency numbers for doctors, ambulance service, hospital and fire department near your telephone.

# SAFETY DECALS

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




(1) Part No. K1213-6581-1




1BDAHAAAP0260

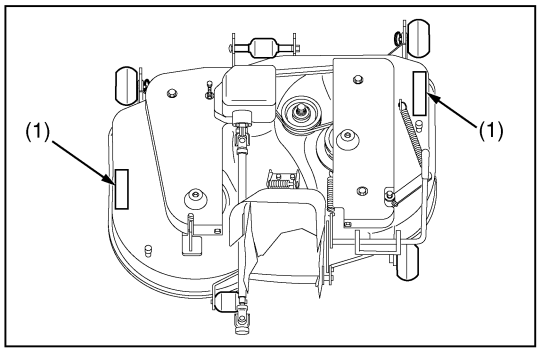
TO AVOID INJURY OR DEATH:
- Read and understand Operator's Manual.
- Stop the engine and remove key before servicing.
- DO NOT operate where machine could slip or tip.
- Mow up and down slops, not across.
- DO NOT allow any bystanders or children around or near machine at any time when the engine is running.

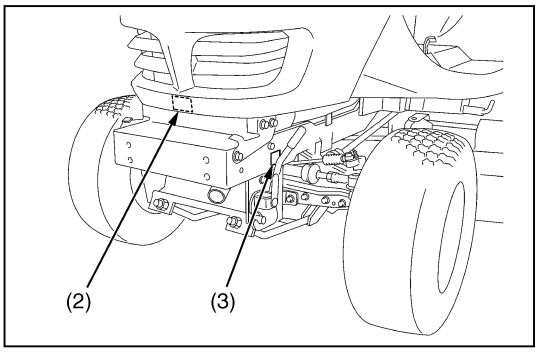
(2) Part No. K2110-6585-1

Diesel fuel only No fire


1BDAHADAP0300

3GLAAADCP001A

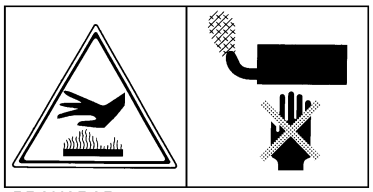



(1) Part No. K5410-7311-1

ROTATING BLADES HAZARDOUS:
- DO NOT put hands or feet into mower when engine is running.
- Keep all shields and guards in place.

(2) Part No. K2561-6542-1
Do not touch hot surface like muffler, etc.



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(3) Part No. K2110-6573-1
HOT SURFACE
DO NOT TOUCH

1BDAHAAAP0320

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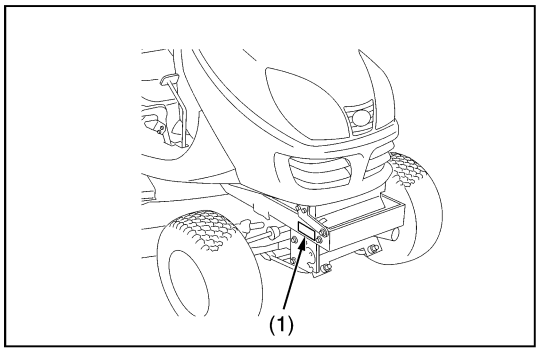
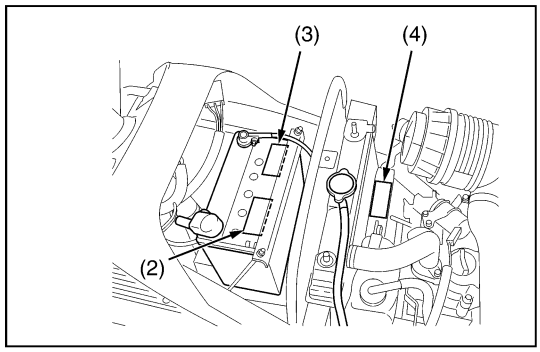
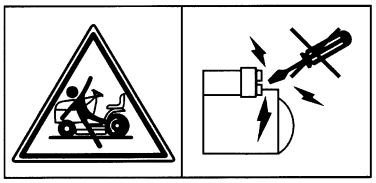



(1) Part No. K1213-6583-1



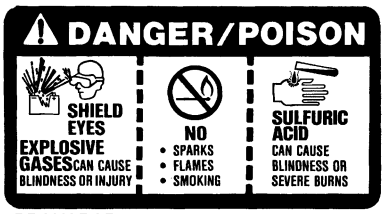
1BDAHAAAP0310

TO AVOID MACHINE RUNAWAY:
- DO NOT start engine by shorting across starter terminals or bypassing the safety start switch.

(4) Part No. 6C090-4958-2
Stay clear of engine fan and fan belt.

1BDABARAP113A

(2) Part No. K1211-6115-1




1BDAHADAP0240

(3) Part No. K1211-6116-1


1BDAHADAP0250

**CARE OF DANGER, WARNING AND CAUTION LABELS**

1. Keep danger, warning and caution labels clean and free from obstructing material.
2. Clean danger, warning and caution labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing danger, warning and caution labels with new labels.
4. If a component with danger, warning or caution 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 danger, warning and caution labels by applying on a clean dry surface and pressing any bubbles to outside edge.

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# SPECIFICATIONS

| Model | | | GR1600EC2 |
|---|---|---|---|
| Engine | Maker | | KUBOTA |
| | Model | | Z482-E2-GX |
| | Type | | Indirect injection. Vertical, water-cooled, 4-cycle diesel |
| | Number of cylinders | | 2 |
| | Bore and stroke | | 67 x 68 mm (2.64 x 2.68 in.) |
| | Total displacement | | 479 $cm^3$ (29.9 cu.in.) |
| | Engine gross power (DIN) | | 10.0 kW (13.4 HP) |
| | Rated revolution | | 53.3 r/s [3200 $min^{-1}$ (rpm)] |
| | Battery | | 51R (12 V, 450CCA) |
| | Starting system | | Cell starter (with glow plug) |
| | Lubrication system | | Forced lubrication by trochoidal pump |
| | Cooling system | | Pressurized radiator, forced circulation with water pump |
| | Fuel | | Diesel fuel No.2-D [above -10 °C (14 °F)],<br>Diesel fuel No.1-D [below -10 °C (14 °F)] |
| Capacities | Fuel tank | | 18 L (4.8 U.S.gals, 4.0 lmp.gals) |
| | Engine crankcase (with filter) | | 1.2 L (1.27 U.S.qts., 1.06 lmp.qts.) |
| | Engine coolant (with recovery tank) | | 2.15 L (2.27 U.S.qts., 1.89 lmp.qts.) |
| | Transmission case | | 2.7 L (0.71 U.S.gals., 0.59 lmp.gals.) |
| Dimensions | Overall length (with grass catcher) | | 2710 mm (107 in.) |
| | Overall width | | 1110 mm (43.7 in.) |
| | Overall height | | 1190 mm (46.9 in.) |
| | Wheel base | | 1280 mm (50.4 in.) |
| | Tread | Front | 750 mm (29.5 in.) |
| | | Rear | 800 mm (31.5 in.) |
| Weight (without mower and grass catcher) | | | 310 kg (684 lbs) |
| Traveling system | Tires | Front | 15 x 6.00 - 6, 4PR |
| | | Rear | 20 x 10.00 - 8, 4PR |
| | Steering | | Manual (Sector gear type) |
| | Transmission | | Hydrostatic transmission |
| | Brake | | Internal expanding brake |
| | Differential | | Bevel gear |
| | Traveling speed | Forward | 0.0 to 10.0 km/h (0.0 to 6.2 mph) |
| | | Reverse | 0.0 to 5.0 km/h (0.0 to 3.1 mph) |
| PTO system | Clutch | | Mechanical wet multi discs |
| | PTO brake | | Wet multi discs |

NOTE: *Manufacture's estimate
The company reserves the right to change the specifications without notice.

W1028280

| Model | | | RCK42GREC2 |
|---|---|---|---|
| Mower | Cutting width | | 1067 mm (42.0 in.) |
| | Cutting height | | 25 to 102 mm (1 to 4 in.) |
| | Adjustment of cutting height | | Dual gauge |
| | Mounting method | | Quick joint, Parallel linkage |
| | Weight (Approx.) | | 75 kg (165 lbs) |
| | Dimensions | Total length | 965 mm (38.0 in.) |
| | | Total width | 1110 mm (43.7 in.) |
| | | Total height | 295 mm (11.6 in.) |
| | Discharge direction | | Rear |
| | Gear box oil | | 0.33 L (0.35 U.S.qts, 0.29 Imp.qts) |

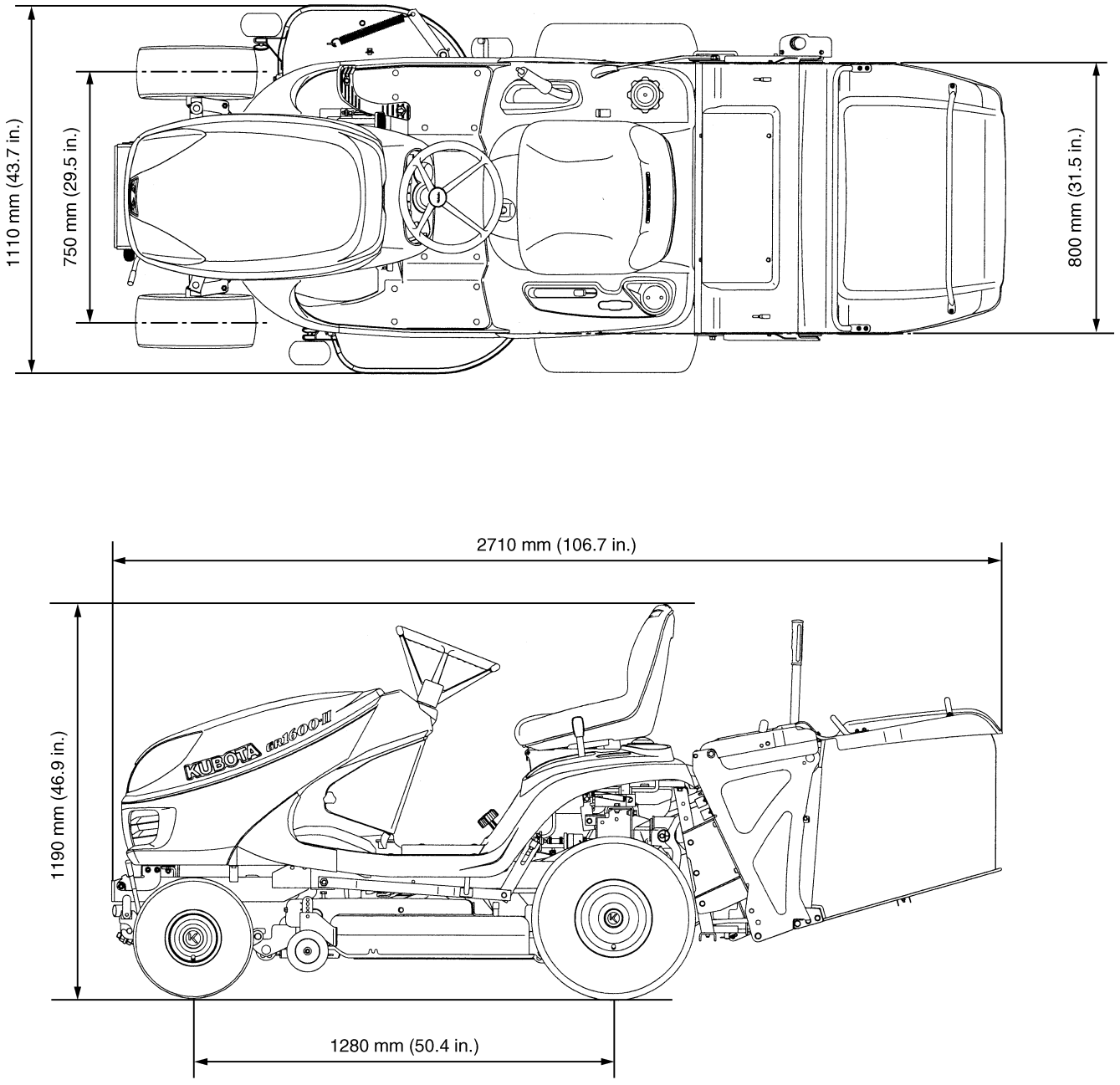
W1030594

| Model | | GCK370GREC2 |
|---|---|---|
| Grass catcher | Container capacity | 370 L (97.7 U.S.gals, 81.4 Imp.gals) |
| | Weight (Approx.) | 40 kg (88.2 lbs) |

NOTE: *Manufacture's estimate
The company reserves the right to change the specifications without notice.

W1031306

# DIMENSIONS

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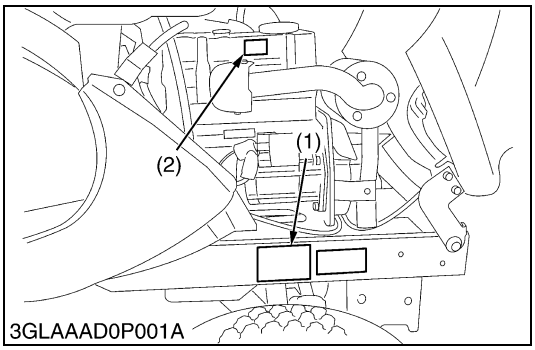
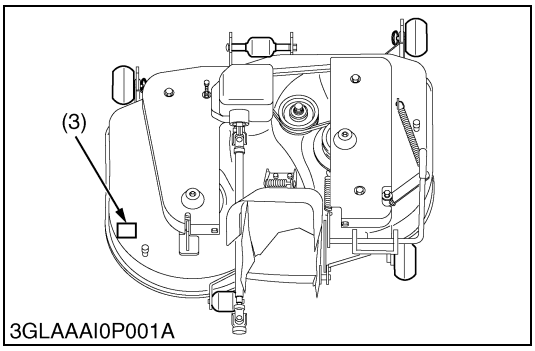
# G GENERAL

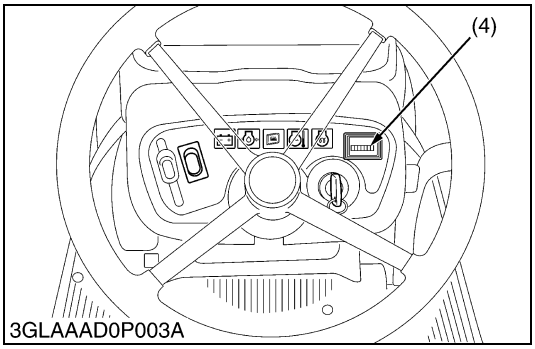
# GENERAL

## CONTENTS

# 1. IDENTIFICATION



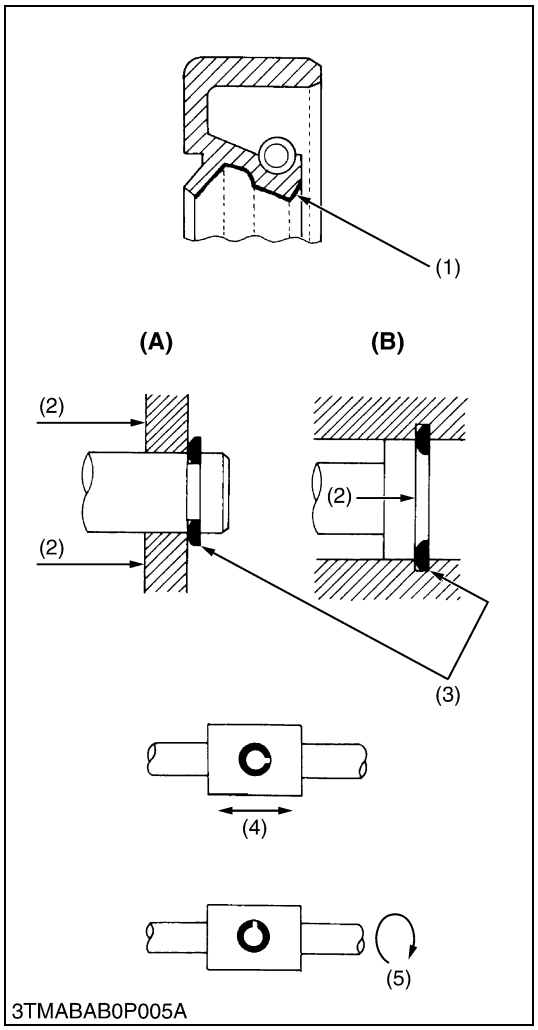




When contacting your local KUBOTA distributor, always specify engine serial number (2), machine serial number (1), mower serial number (3) and hour meter reading.

(1) Machine Serial Number
(2) Engine Serial Number
(3) Mower Serial Number
(4) Hour Meter

W1010594

# 2. GENERAL PRECAUTIONS



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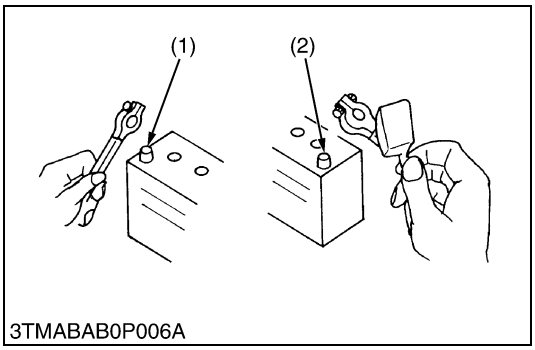
- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Screws, bolts and nuts should be installed in their original position to prevent reassembly errors.
- When special tools are required, use KUBOTA genuine special tools. Special tools which are not frequently 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 **(A)** or internal snap rings **(B)**, 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**

W10109040

# 3. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



3TMABAB0P006A

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

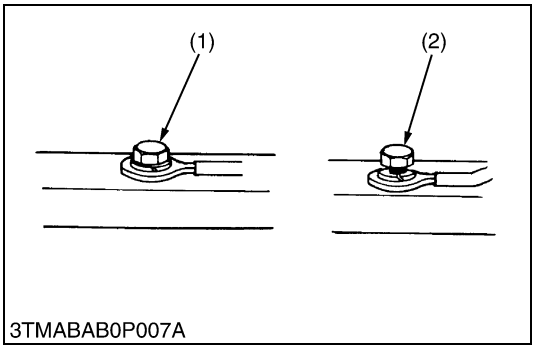
■ **IMPORTANT**

- **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

W10111140

## [1] WIRING

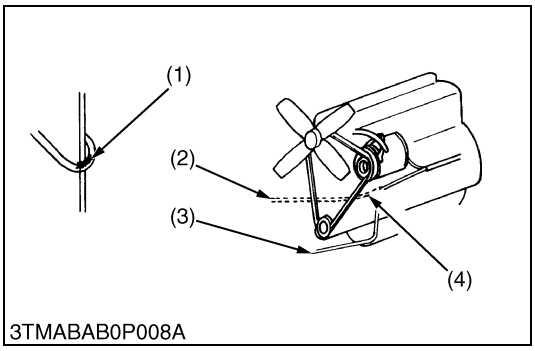


3TMABAB0P007A

- Securely tighten wiring terminals.

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

W10112160

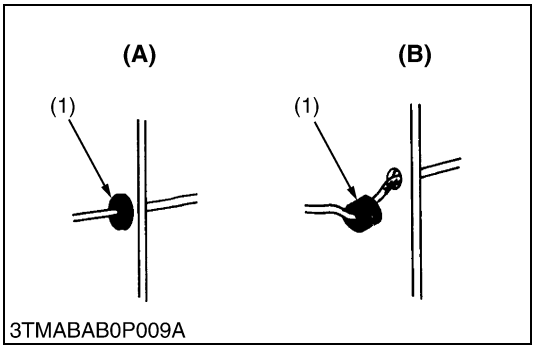


3TMABAB0P008A

- Do not let wiring contact dangerous part.

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

W10113130

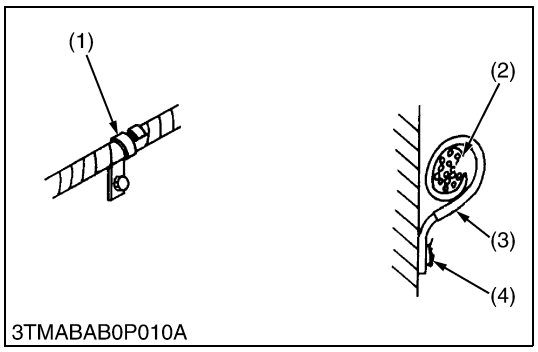


3TMABAB0P009A

- Securely insert grommet.

(1) Grommet **(A) Correct** **(B) Incorrect**

W10113880

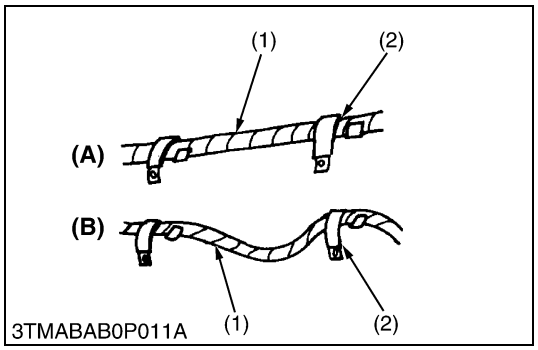


3TMABAB0P010A

- Securely clamp, being careful not to damage wiring.

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

W10114580

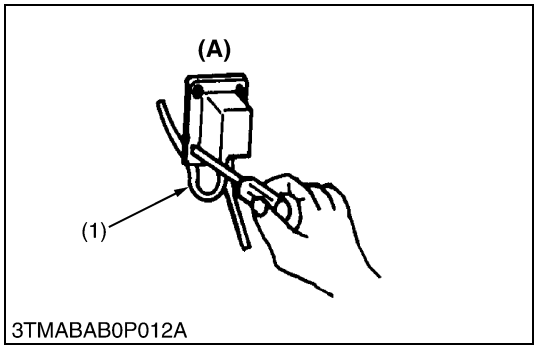


3TMABAB0P011A

- 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**

W10115870

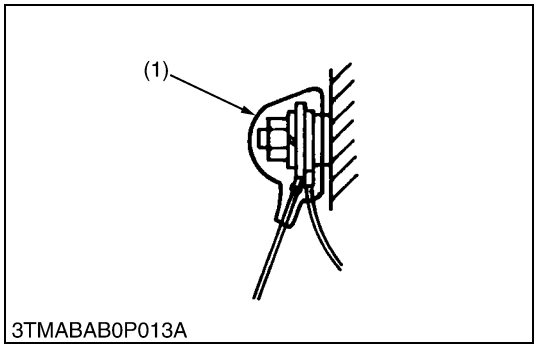


3TMABAB0P012A

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

(1) Wiring
**(A) Incorrect**

W10116700



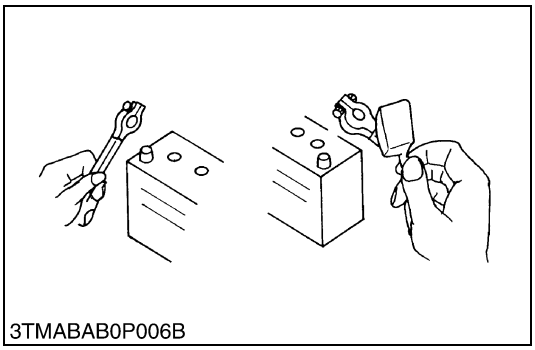
3TMABAB0P013A

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

(1) Cover
 • Securely Install Cover

W10117350

## [2] BATTERY


3TMABAB0P006B

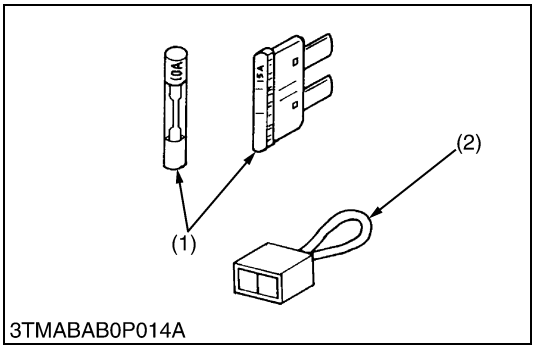
- Take care not to confuse positive and negative terminal posts.
- When removing battery cables, disconnect negative cable first. When installing battery cables, check for polarity and connect positive cable first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting 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.**

W10118160

## [3] FUSE



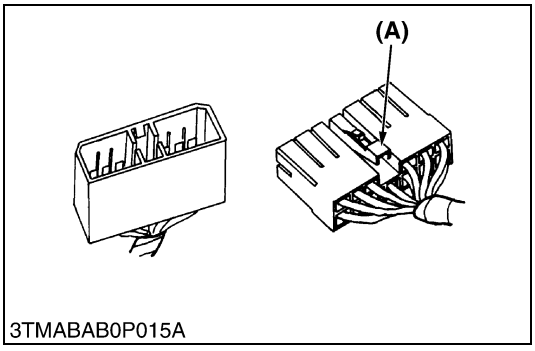
3TMABAB0P014A

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

(1) Fuse (2) Fusible Link

W10120920

## [4] CONNECTOR

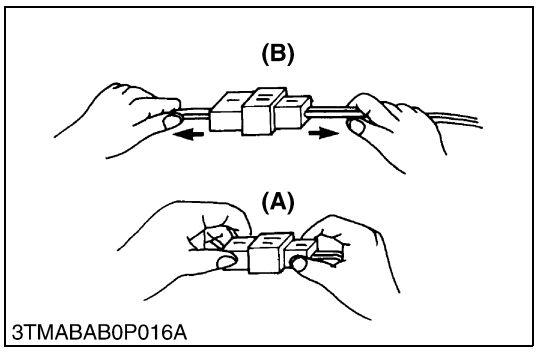


3TMABAB0P015A

- For connector with lock, push lock to separate.

**(A) Push**

W10122110

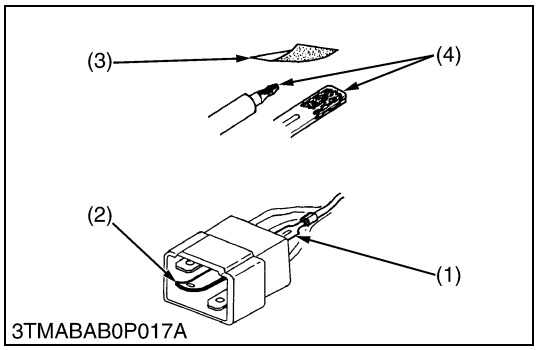


3TMABAB0P016A

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

**(A) Correct** **(B) Incorrect**

W10122720

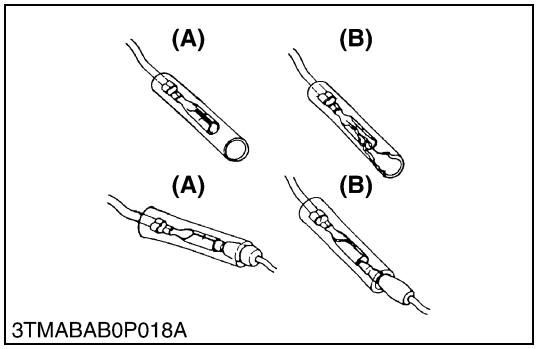


3TMABAB0P017A

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

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

W10123460

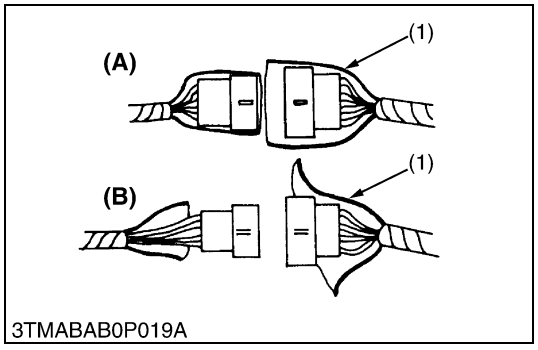


3TMABAB0P018A

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

**(A) Correct** **(B) Incorrect**

W10124300



3TMABAB0P019A

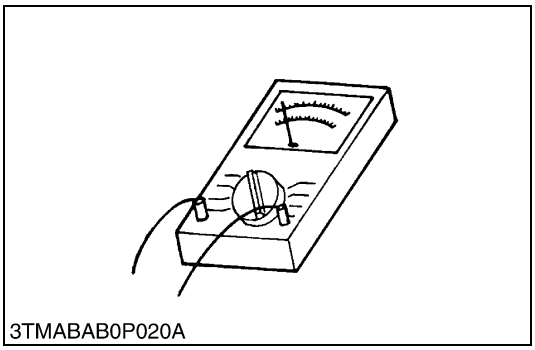
- Make certain plastic cover is large enough to cover whole connector.

(1) Cover

**(A) Correct**
**(B) Incorrect**

W10125190

# [5] HANDLING OF CIRCUIT TESTER


3TMABAB0P020A

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

W10126840

# 4. LUBRICANTS, FUEL AND COOLANT

| No. | Place | Capacity | Lubricants, fuel and coolant |
|---|---|---|---|
| 1 | Fuel tank | 18 L<br>4.8 U.S.gals.<br>4.0 lmp.gals. | No. 2-D diesel fuel<br>No. 1-D diesel fuel if temperature is below –10 °C (14 °F) |
| 2 | Cooling system with recovery tank | 2.15 L<br>2.27 U.S.qts.<br>1.89 lmp.qts. | Fresh clean water with anti-freeze |
| 3 | Engine crankcase | 1.2 L<br>1.27 U.S.qts.<br>1.06 lmp.qts. | Engine oil : API service CD, CE or CF<br>Below 0 °C (32 °F) : SAE10W, 10W-30 or 10W-40<br>0 to 25 °C (32 to 77 °F) : SAE20, 10W-30 or 10W-40<br>Above 25 °C (77 °F) : SAE30, 10W-30 or 10W-40 |
| 4 | Transmission case | 2.7 L<br>0.71 U.S.gals.<br>0.59 lmp.gals. | KUBOTA UDT or SUPER UDT fluid* |
| 5 | Mower gear box | 0.33 L<br>0.35 U.S.qts.<br>0.29 lmp.qts. | SAE90 gear oil<br>(API service classification : more than GL-3) |

**Greasing**

| No. | Place | No. of greasing points | Capacity | Type of grease |
|---|---|---|---|---|
| 6 | Engine transmission universal joint | 1 | Until grease overflows | SAE multi-purpose type grease |
| 7 | King pin | 2 | | |
| 8 | Center pin | – | | |
| 9 | Speed control pedal shaft | – | Moderate amount | Engine oil |
| 10 | Mower link | – | | |
| 11 | Seat adjuster | – | | |
| 12 | Cable | – | | |
| 13 | PTO lever | – | | |
| 14 | Hydraulic lift lever | – | | |
| 15 | Grass catcher hinge | – | | |
| | [Mower] | | | |
| 16 | Spindle shafts | 2 | Until grease overflows | SAE multi-purpose type grease |
| 17 | Tension arm | 1 | | |
| 18 | Mower universal joint | 1 | Moderate amount | Engine oil |

* KUBOTA original transmission hydraulic fluid.

# 5. TIGHTENING TORQUES

## [1] GENERAL USE SCREWS, BOLTS AND NUTS

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

| Indication on top of bolt | ⬡ 4 No-grade or 4T | | | | | | ⬡ 7 7T | | | | | | ⬡ 9 9T | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Material of bolt | SS400, S20C | | | | | | S43C, S48C | | | | | | SCr435, SCM435 | | |
| Material of opponent part | Ordinariness | | | Aluminum | | | Ordinariness | | | Aluminum | | | Ordinariness | | |
| Unit / Diameter | N·m | kgf·m | ft-lbs | N·m | kgf·m | ft-lbs | N·m | kgf·m | ft-lbs | N·m | kgf·m | ft-lbs | N·m | kgf·m | ft-lbs |
| **M6** (6 mm, 0.24 in.) | 7.85 to 9.31 | 0.80 to 0.95 | 5.79 to 6.87 | 7.85 to 8.82 | 0.80 to 0.90 | 5.79 to 6.50 | 9.81 to 11.2 | 1.00 to 1.15 | 7.24 to 8.31 | 7.85 to 8.82 | 0.80 to 0.90 | 5.79 to 6.50 | 12.3 to 14.2 | 1.25 to 1.45 | 9.05 to 10.4 |
| **M8** (8 mm, 0.31 in.) | 17.7 to 20.5 | 1.8 to 2.1 | 13.1 to 15.1 | 16.7 to 19.6 | 1.7 to 2.0 | 12.3 to 14.4 | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 | 17.7 to 20.5 | 1.8 to 2.1 | 13.1 to 15.1 | 29.5 to 34.3 | 3.0 to 3.5 | 21.7 to 25.3 |
| **M10** (10 mm, 0.39 in.) | 39.3 to 45.1 | 4.0 to 4.6 | 29.0 to 33.2 | 31.4 to 34.3 | 3.2 to 3.5 | 23.2 to 25.3 | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 | 39.3 to 44.1 | 4.0 to 4.5 | 29.0 to 32.5 | 60.9 to 70.6 | 6.2 to 7.2 | 44.9 to 52.0 |
| **M12** (12 mm, 0.47 in.) | 62.8 to 72.5 | 6.4 to 7.4 | 46.3 to 53.5 | – | – | – | 77.5 to 90.2 | 7.9 to 9.2 | 57.2 to 66.5 | 62.8 to 72.5 | 6.4 to 7.4 | 46.3 to 53.5 | 103 to 117 | 10.5 to 12.0 | 76.0 to 86.7 |
| **M14** (14 mm, 0.55 in.) | 108 to 125 | 11.0 to 12.8 | 79.6 to 92.5 | – | – | – | 124 to 147 | 12.6 to 15.0 | 91.2 to 108 | – | – | – | 167 to 196 | 17.0 to 20.0 | 123 to 144 |
| **M16** (16 mm, 0.63 in.) | 167 to 191 | 17.0 to 19.5 | 123 to 141 | – | – | – | 197 to 225 | 20.0 to 23.0 | 145 to 166 | – | – | – | 260 to 304 | 26.5 to 31.0 | 192 to 224 |
| **M18** (18 mm, 0.71 in.) | 246 to 284 | 25.0 to 29.0 | 181 to 209 | – | – | – | 275 to 318 | 28.0 to 32.5 | 203 to 235 | – | – | – | 344 to 402 | 35.0 to 41.0 | 254 to 296 |
| **M20** (20 mm, 0.79 in.) | 334 to 392 | 34.0 to 40.0 | 246 to 289 | – | – | – | 368 to 431 | 37.5 to 44.0 | 272 to 318 | – | – | – | 491 to 568 | 50.0 to 58.0 | 362 to 419 |

W1034542

## [2] METRIC SCREWS, BOLTS AND NUTS

| Grade | Property class 8.8 ⬡ 8.8 | | | Property class 10.9 ⬡ 10.9 | | |
|---|---|---|---|---|---|---|
| Unit / Nominal Diameter | N·m | kgf·m | ft-lbs | N·m | kgf·m | ft-lbs |
| **M 8** | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 | 29.4 to 34.3 | 3.0 to 3.5 | 21.7 to 25.3 |
| **M 10** | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 | 60.8 to 70.5 | 6.2 to 7.2 | 44.9 to 52.1 |
| **M 12** | 77.5 to 90.1 | 7.9 to 9.2 | 57.2 to 66.5 | 103.0 to 117.0 | 10.5 to 12.0 | 76.0 to 86.8 |
| **M 14** | 124.0 to 147.0 | 12.6 to 15.0 | 91.2 to 108.0 | 167.0 to 196.0 | 17.0 to 20.0 | 123.0 to 144.0 |
| **M 16** | 196.0 to 225.0 | 20.0 to 23.0 | 145.0 to 166.0 | 260.0 to 303.0 | 26.5 to 31.0 | 192.0 to 224.0 |

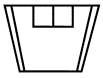
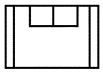
W1016172

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

| Grade | SAE GR.5  | | | SAE GR.8  | | |
|---|---|---|---|---|---|---|
| Unit / Nominal Diameter | N·m | kgf·m | ft-lbs | N·m | kgf·m | ft-lbs |
| **5/16** | 23.1 to 27.8 | 2.35 to 2.84 | 17.0 to 20.5 | 32.5 to 39.3 | 3.31 to 4.01 | 24.0 to 29.0 |
| **3/8** | 47.5 to 57.0 | 4.84 to 5.82 | 35.0 to 42.0 | 61.0 to 73.2 | 6.22 to 7.47 | 45.0 to 54.0 |
| **1/2** | 108.5 to 130.2 | 11.07 to 13.29 | 80.0 to 96.0 | 149.2 to 179.0 | 15.22 to 18.27 | 110.0 to 132.0 |
| **9/16** | 149.2 to 179.0 | 15.22 to 18.27 | 110.0 to 132.0 | 217.0 to 260.4 | 22.14 to 26.57 | 160.0 to 192.0 |
| **5/8** | 203.4 to 244.1 | 20.75 to 24.91 | 150.0 to 180.0 | 298.3 to 358.0 | 30.44 to 36.53 | 220.0 to 264.0 |

W1022485

## [4] PLUGS

| Shape | Size | Material of opponent part | | | | | |
|---|---|---|---|---|---|---|---|
| | | Ordinariness | | | Aluminum | | |
| | | N·m | kgf·m | ft-lbs | N·m | kgf·m | ft-lbs |
| **Tapered screw**  | **R1/8** | 12.7 to 21.6 | 1.3 to 2.2 | 9.4 to 15.9 | 12.7 to 19.6 | 1.3 to 2.0 | 9.4 to 15.4 |
| | **R1/4** | 24.5 to 44.1 | 2.5 to 4.5 | 18.1 to 32.5 | 24.5 to 34.3 | 2.5 to 3.5 | 18.1 to 25.4 |
| | **R3/8** | 49.0 to 88.3 | 5.0 to 9.0 | 36.2 to 65.1 | 49.0 to 58.8 | 5.0 to 6.0 | 36.2 to 43.4 |
| | **R1/2** | 58.8 to 107.9 | 6.0 to 11.0 | 43.4 to 79.6 | 58.8 to 78.5 | 6.0 to 8.0 | 43.4 to 57.9 |
| **Straight screw**  | **G1/4** | 24.5 to 34.3 | 2.5 to 3.5 | 18.1 to 25.3 | – | – | – |
| | **G3/8** | 61.8 to 82.4 | 6.3 to 8.4 | 45.6 to 60.8 | – | – | – |
| | **G1/2** | 49.0 to 88.3 | 5.0 to 9.0 | 36.2 to 65.1 | – | – | – |

0000001666E

# 6. MAINTENANCE CHECK LIST

■ **IMPORTANT**

- **The jobs indicated by ★ must be done initially.**
- ***1 : This maintenance should be done daily more often in dusty conditions than in normal conditions. Suggested cleaning interval is every 100 hours in normal conditions.**

| No. | Item \ Period | | Indication on hour meter (Hr) | | | | | | | | | | | | After since | Important | Reference page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | | | |
| 1 | Engine oil | Change | ★ | ☆ | | ☆ | | ☆ | | ☆ | | ☆ | | ☆ | every 100 hr | | G-26 |
| 2 | Engine oil filter | Replace | ★ | | | ☆ | | | | ☆ | | | | ☆ | every 200 hr | | G-28 |
| 3 | Transmission fluid | Change | | | | ★ | | | | ☆ | | | | ☆ | every 200 hr | | G-29 |
| 4 | Transmission oil filter | Replace | ★ | | | ☆ | | | | ☆ | | | | ☆ | every 200 hr | | G-30 |
| 5 | Transmission strainer | Clean | | | | ★ | | | | ☆ | | | | ☆ | every 200 hr | | G-30 |
| 6 | Front axle pivot | Adjust | | ★ | | ☆ | | | | ☆ | | | | ☆ | every 200 hr | | G-31 |
| 7 | Safety device | Check | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | every 50 hr | | G-19 |
| 8 | Oiling | – | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | every 50 hr | | G-21 |
| 9 | Greasing | – | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | every 50 hr | | G-20 |
| 10 | Mower gear box oil | Check | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | every 50 hr | | G-20 |
| | | Change | ☆ | | ☆ | | | ☆ | | | ☆ | | | ☆ | every 150 hr | | G-28 |
| 11 | Air cleaner element | Clean | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | every 50 hr | *1 | G-20 |
| | | Replace | | | | | | | | | | | | | every 1 year | | G-32 |
| 12 | Battery condition | Check | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | every 50 hr | | G-24 |
| 13 | Brake | Adjust | | ☆ | | ☆ | | ☆ | | ☆ | | ☆ | | ☆ | every 100 hr | | G-27 |
| 14 | Fan drive belt tension | Adjust | | ☆ | | ☆ | | ☆ | | ☆ | | ☆ | | ☆ | every 100 hr | | G-28 |
| 15 | Fuel filter element | Check | | ☆ | | ☆ | | ☆ | | ☆ | | ☆ | | ☆ | every 100 hr | | G-27 |
| | | Replace | | | | | | | | ☆ | | | | | every 400 hr | | G-31 |

W1035769

| No. | Item \ Period | | Indication on hour meter (Hr) 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | After since | Important | Reference page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | Fuel line | Check | | ☆ | | ☆ | | ☆ | | ☆ | | ☆ | | ☆ | every 100 hr | | G-27 |
| | | Replace | | | | | | | | | | | | | every 2 year | | G-34 |
| 17 | Radiator hose and clamp | Check | | | | ☆ | | | | ☆ | | | | ☆ | every 200 hr | | G-30 |
| | | Replace | | | | | | | | | | | | | every 2 year | | G-34 |
| 18 | Intake air line | Check | | | | ☆ | | | | ☆ | | | | ☆ | every 200 hr | | G-31 |
| | | Replace | | | | | | | | | | | | | every 2 year | | G-34 |
| 19 | Fuel injection nozzle (Injection pressure) | Check | | | | | | | | | | | | | every 1500 hr | | G-32 |
| 20 | Radiator | Clean | | | | | | | | | | | | | every 1 year | | G-32 |
| 21 | Coolant | Change | | | | | | | | | | | | | every 1 year | | G-32 |
| 22 | Mower gear box oil seal | Replace | | | | | | | | | | | | | every 2 year | | G-34 |
| 23 | Fuse | Replace | | | | | | | | | | | | | Service as required | | G-35 |
| 24 | Blade | Replace | | | | | | | | | | | | | | | G-36 |
| 25 | Mower belt | Replace | | | | | | | | | | | | | | | G-37 |
| 26 | Fuel system | Bleed | | | | | | | | | | | | | | | G-37 |

W1045250

# 7. CHECK AND MAINTENANCE

**CAUTION**

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

## [1] DAILY CHECK

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

**Checking**

- 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 recovery tank
6. Damage of machine body, tightness of all bolts and nuts
7. Radiator screen
8. Panel screen
9. Brake play
10. Fuel level
11. Check air cleaner element

- Mower

1. Oil leak
2. Make sure blade cap screws are tight.
3. Blades for wear or damage.
4. Check all hardware.
5. Make sure all pins are in place.
6. Mower deck cleaning
7. Greasing

- While sitting in the operator's seat,

1. Speed control pedal and brake pedal
2. Brake

- Turning the key switch **"ON"**

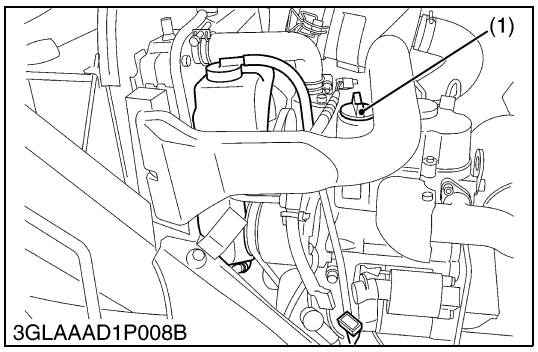
1. Performance of the easy checker light.

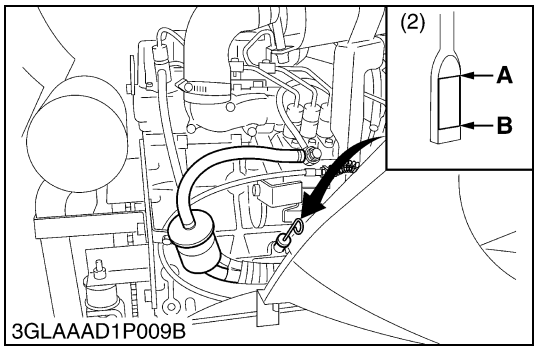
- Starting the engine

1. Color of the exhaust fumes
2. Safety start switch, seat safety control and another safety devices.
3. Check for abnormal noise and vibration.

- Others

1. Check the areas where previous troubles were experienced.




## Checking Engine Oil Level

**CAUTION**

- **Always stop the engine and remove the key before checking oil.**

1. Check engine oil before starting and 5 minutes or more after the engine has stopped.
2. Wipe dipstick (2) area clean.
3. To check the oil level, remove the dipstick (2), wipe it clean, reinsert it, and draw it out again. Check to see that the oil level is between the two notches.
4. Add new oil to the prescribed level at the oil inlet (1) if necessary.
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-8.)

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

**A : Upper Level**
**B : Lower Level**

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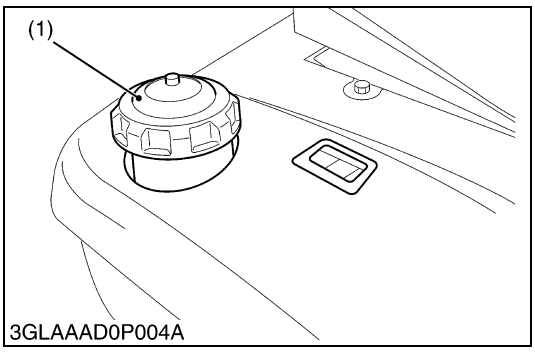




## Checking Amount of Fuel and Refueling

**CAUTION**

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

Check the fuel level. Take care that the fuel tank does not become empty.

| | |
|---|---|
| Fuel tank capacity | 18 L<br>4.8 U.S.gals<br>4.0 Imp.gals |

■ **IMPORTANT**

- **Use Diesel fuel only**

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

■ **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**

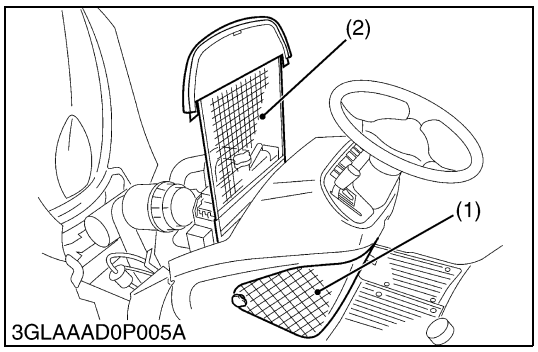
| Flash Point °C | Water and Sediment, volume % | Carbon Residue on, 10 percent Residuum % | Ash, weight % |
|---|---|---|---|
| Min | Max | Max | Max |
| 52 | 0.05 | 0.35 | 0.01 |

| Distillation Temperatures °C 90 % Point | | Kinematic Viscosity cSt or $mm^2/s$ at 40 °C | | Saybolt Viscosity, SUS at 100 °F | |
|---|---|---|---|---|---|
| Min | Max | Min | Max | Min | Max |
| 282 | 338 | 1.9 | 4.1 | 32.6 | 40.1 |

| Sulfur, weight | Copper strip Corrsion | Catane Number |
|---|---|---|
| Max | Max | Min |
| 0.50 | No.3 | 40 |

(1) Fuel Cap

W1021324




## Checking Cleaning Radiator to Prevent Overheating

**CAUTION**

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

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

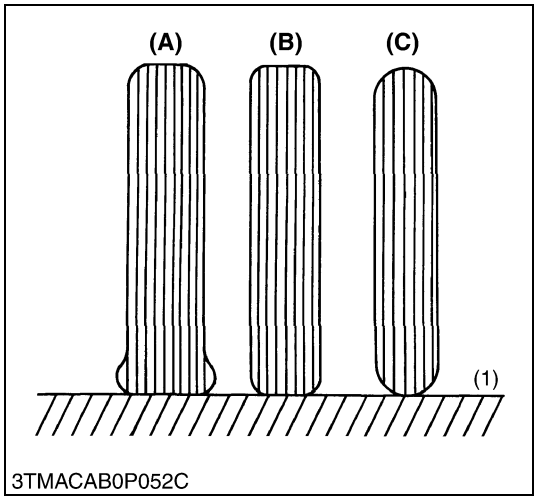
1. Remove the radiator screen (2) and panel screen (1) and remove all foreign material.
2. Remove the dust from between the fins and the tube.
3. Tighten the fan drive belt as necessary. For this, refer to "CHECK POINT EVERY 100 HOURS".
4. If scale forms in the tube, clean with the scale inhibitor or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

■ **NOTE**

- **When assembling the panel screen (1), be sure to fit it to panel with no clearance at the bottom.**

(1) Panel Screen (2) Radiator Screen

W1049374




## Checking Tire Pressure

**WARNING**

- **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.**
  **Do not inflate tires above the recommended pressure.**
- **Inflation pressure in front tires rises quickly when using compressed air.**

**CAUTION**

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

■ **Inflation Pressure**

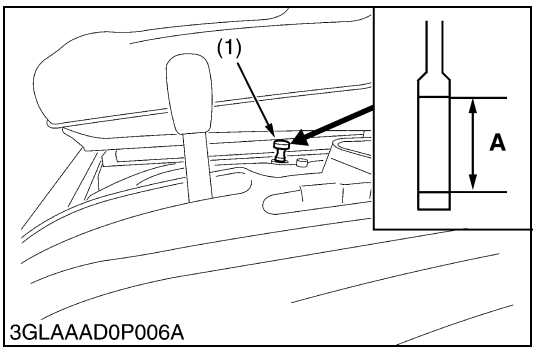
Though the inflation pressure is factory-set to the prescribed level, it naturally drops slowly in the course of time. Thus, check it every day and inflate as necessary.

| | Tire sizes | Recommended Inflation Pressure |
|---|---|---|
| Front | 15 x 6.0-6, 4PR | 200 kPa (2.0 kgf/cm$^2$, 29 psi) |
| Rear | 20 x 10.00-8, 4PR | 140 kPa (1.4 kgf/cm$^2$, 20 psi) |

(1) Ground

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

W1068933




## Checking Transmission Fluid Level

1. Park the machine on a flat surface, lower the implement to the ground and shut off engine and remove the key.
2. Raise the operator's seat.
3. To check the oil level, draw out the dipstick (1), wipe it clean, reinsert it, and draw it out again. Check to see that the oil level lies between the two notches. If the level is too low, add new oil to the prescribed level at the oil inlet. (See page G-8.)

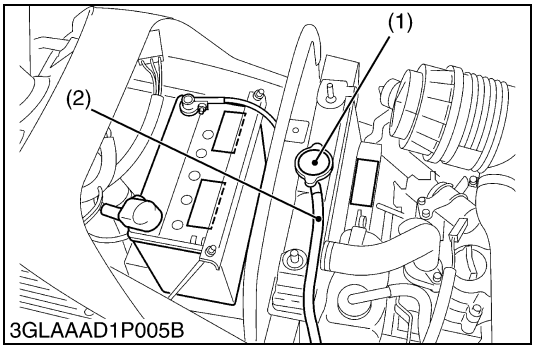
■ **IMPORTANT**

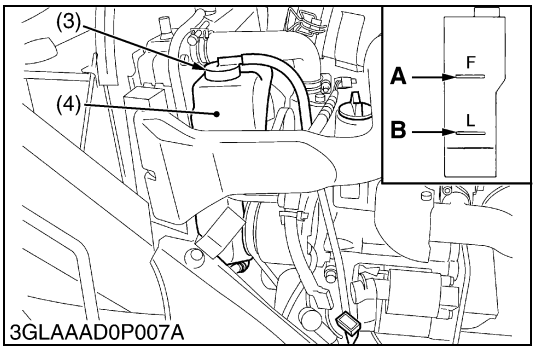
- **If oil level is low, do not run engine.**

(1) Oil Level Dipstick

**A : Oil level is acceptable within this range.**

W1050686




## Checking Coolant Level

**CAUTION**

- **Do not remove the radiator cap when the engine is hot. Loosen cap slightly, to the stop, to relieve any excess pressure before removing cap completely.**

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

1. Remove the radiator cap (1) and check to see that the coolant level is just below the fill port.
2. Check to see that the coolant level is between the **"FULL"** and **"LOW"** marks of recovery tank (4).
3. When the coolant level drops due to evaporation, add water only up to just below the fill port of the radiator and the full level of the recovery tank (4).
   In case of leakage, add coolant and water in the specified mixing ratio up to the full level. (See page G-32.)

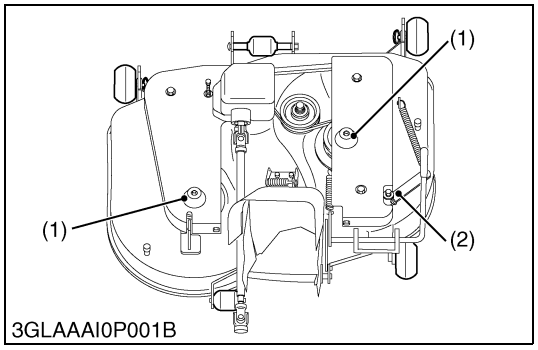
■ **IMPORTANT**

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

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

**A : FULL**
**B : LOW**

W1051701



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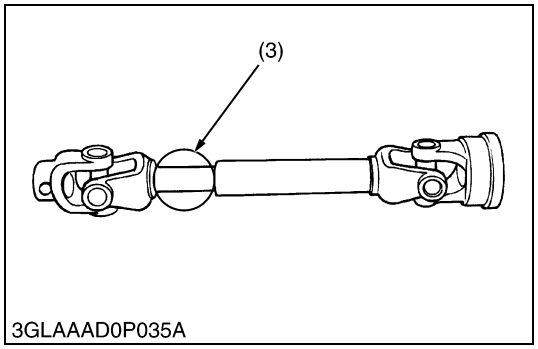


3GLAAAD0P035A

## Greasing

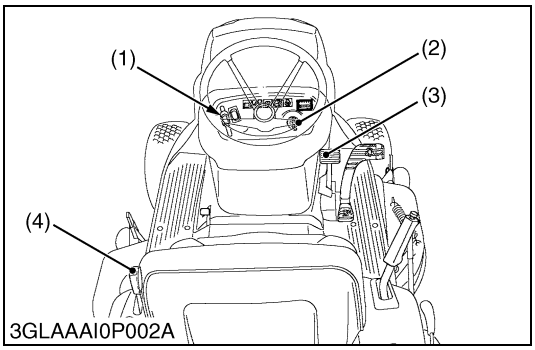
**CAUTION**

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

(1) Spindle Shaft
(2) Tension Arm
(3) Mower Universal Joint (Apply grease on the spline shaft)

W1052201

# [2] CHECK POINTS OF EVERY 50 HOURS



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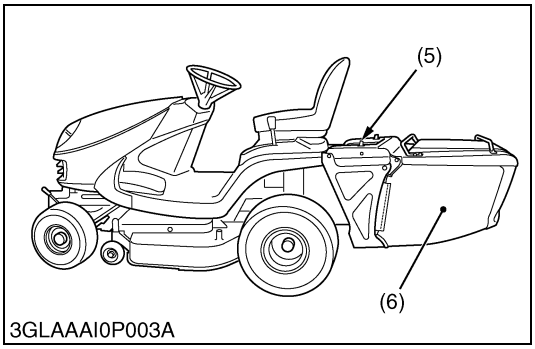

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**Checking Safety Device**

**CAUTION**

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

1. Check the following tests before operating the mower. Sit on the operator's seat for all tests.

■ **Safety Start Control 1**

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

■ **Safety Start Control 2**

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

■ **Seat Safety Control 1**

1. Run the engine at half throttle.
2. Engage the PTO lever (4).
3. Stand up. (Do not get off the machine.)
4. Engine should shut off.

■ **Seat Safety Control 2**

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

■ **PTO Safety Control 1**

1. Dismount the grass container (6) from the platform.
2. Run the engine at half throttle.
3. Engage the PTO lever (4).
4. Engine should shut off.

■ **PTO Safety Control 2**

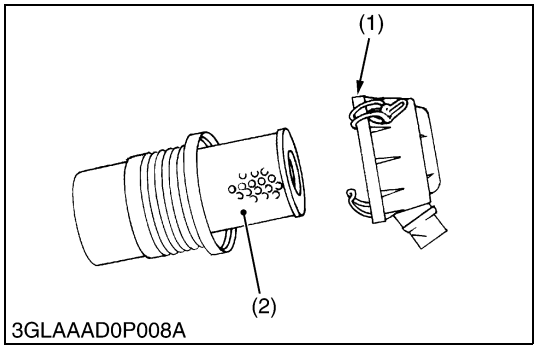
1. Run the engine at half throttle.
2. Engage the PTO lever (4).
3. Dump the grass from grass container (6).
4. Engine should shut off.

■ **PTO Safety Control 3**

1. Open the top cover (5).
2. Run the engine at half throttle.
3. Engage the PTO lever (4).
4. Engine should shut off.

(1) Throttle Lever
(2) Key Switch
(3) Brake Pedal
(4) PTO Lever
(5) Top Cover
(6) Grass Container

W1014904




## Cleaning Air Cleaner Element

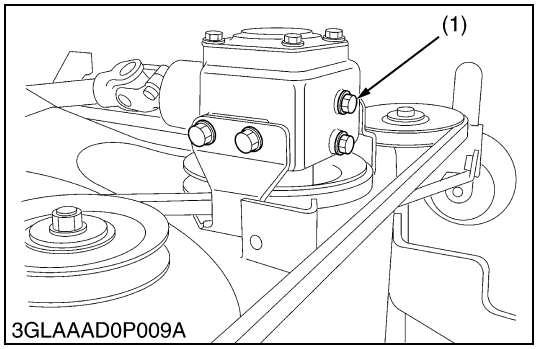
1. The air cleaner uses a dry element, never apply oil.
2. Do not touch the filter element except where cleaning is required. To clean the element, use clean and dry compressed air on the inside of the element. Air pressure should not exceed 205 kPa (2.1 kgf/cm$^2$, 30 psi).

■ **NOTE**

- **Operating in dusty conditions requires more frequent maintenance.**
- **Align the arrow marks when reinstalling the air cleaner cover.**

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

W1015242




## Checking Mower Gear Box Oil Level

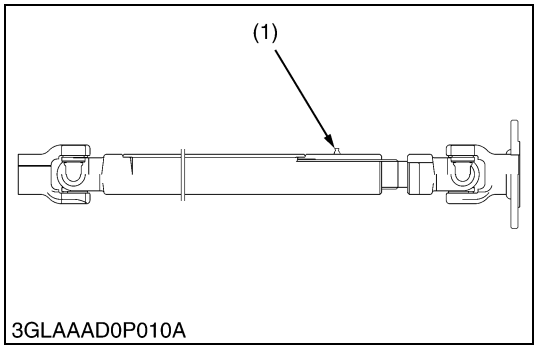
**CAUTION**

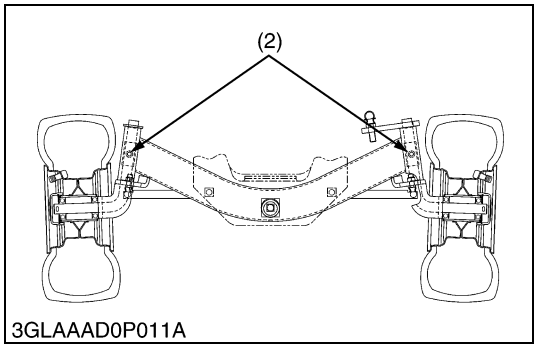
- **Always stop the engine and remove the key before checking oil.**

1. Park the machine on a flat surface and lower the mower to the ground.
   To check the oil level, loosen filler plug (1) bolt and check to see that the oil level is just below the oil filler plug (1) port.
   If the level is too low, add new oil to the prescribed level at the oil inlet. (See page G-8.)

(1) Oil Filler Plug

W1015311




## Lubricating All Grease Nipple

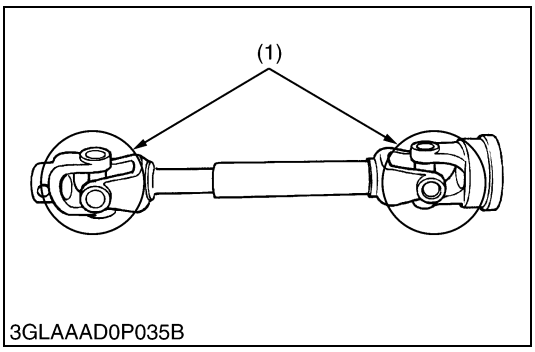
1. Apply grease to the following locations as shown in the figures.

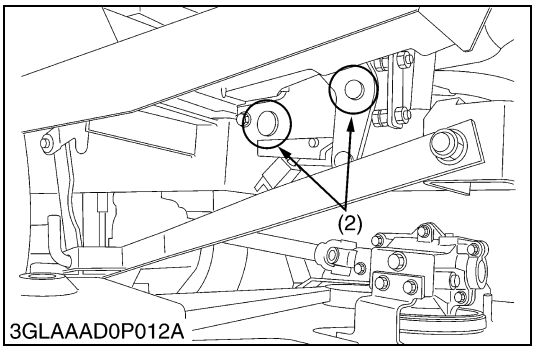
**CAUTION**

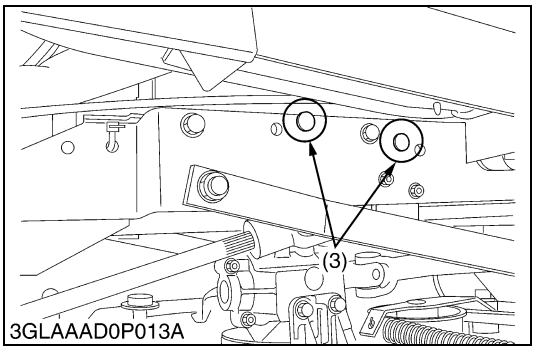
- **Be sure to stop the engine and remove the key before greasing.**

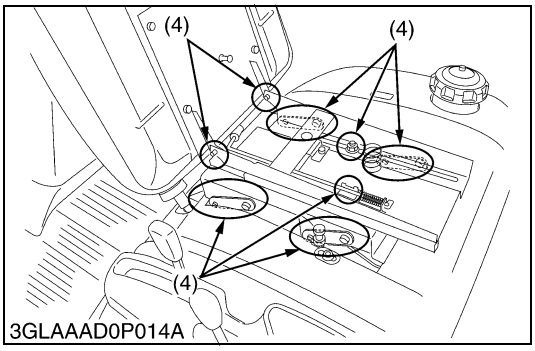
(1) Engine Transmission Universal Joint (2) King Pin (LH, RH)

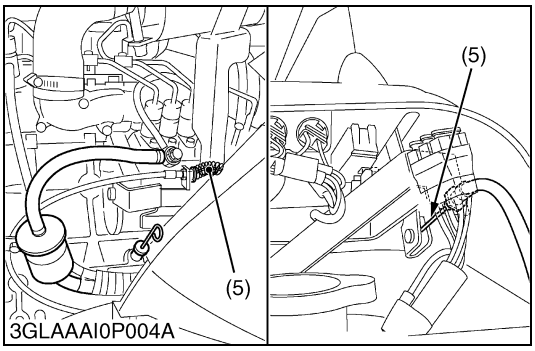
W1053820




## Oiling

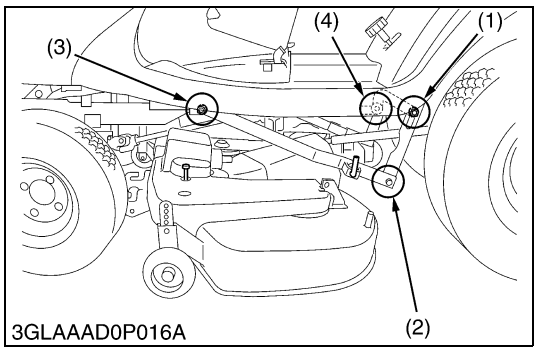
1. Apply oil to the following location as shown in the figures.

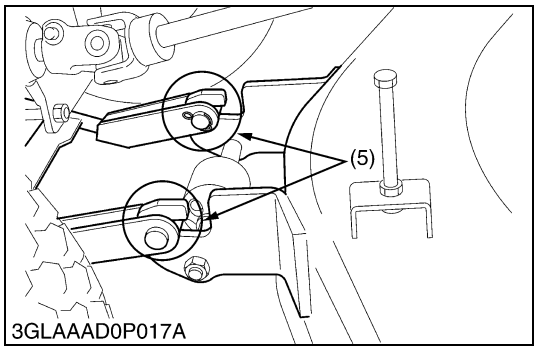
**CAUTION**

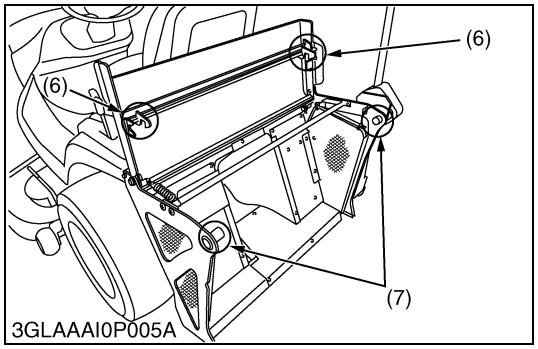
- **Be sure to stop the engine and remove the key before oiling.**

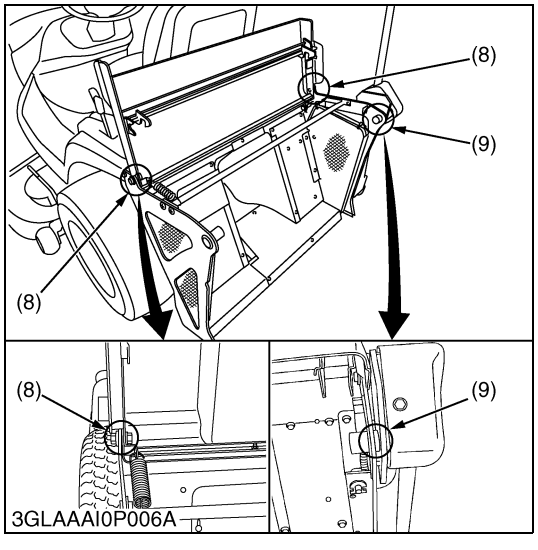
(1) Mower Universal Joint
(2) Speed Control Shaft (RH)
(3) Speed Control Shaft (LH)
(4) Seat Adjuster
(5) Throttle Cable

W1053979




**Oiling (Continued)**

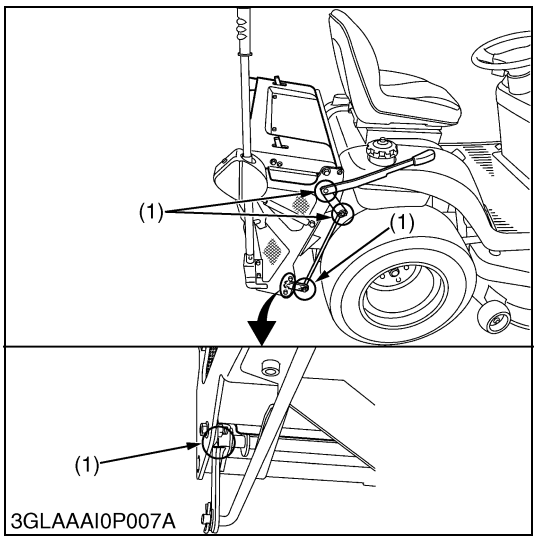
1. Apply oil to the following location as shown in the figures.

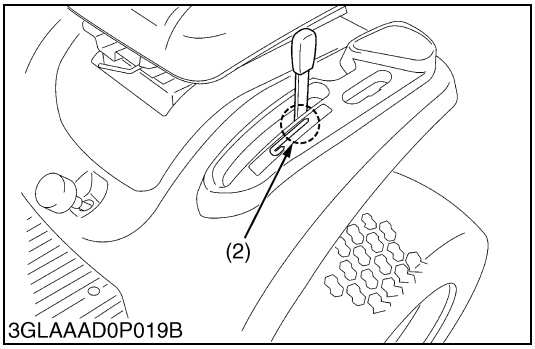
**CAUTION**

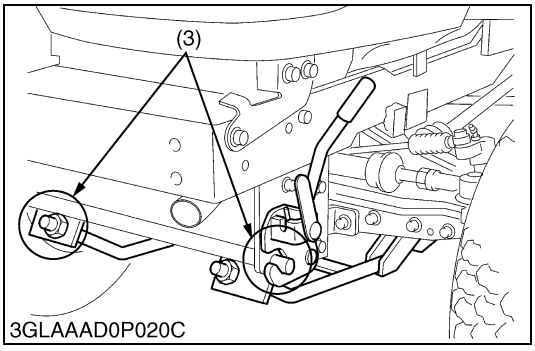
- **Be sure to stop the engine and remove the key before oiling.**

(1) Around Hole of Mower Link
(2) Around Pin
(3) Pivot of Mower Link
(4) Pivot of Lift Arm
(5) Front Link
(6) Top Cover Lock Lever
(7) Frame Shaft
(8) Top Cover Hinge
(9) Arm Bracket

W1055120




**Oiling (Continued)**

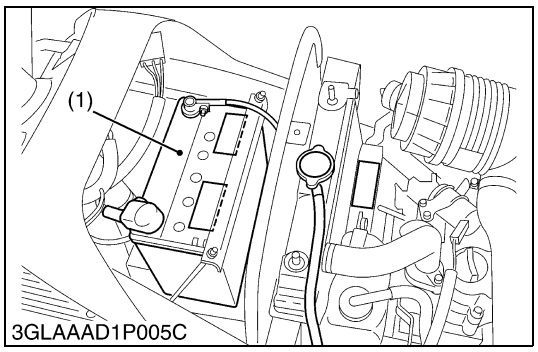
1. Apply oil to the following location as shown in the figures.

**CAUTION**

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

(1) Quick Clean Lever
(2) PTO Lever (Fulcrum)
(3) Link Fulcrum

W1043771




## Checking Battery Condition

**DANGER**

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

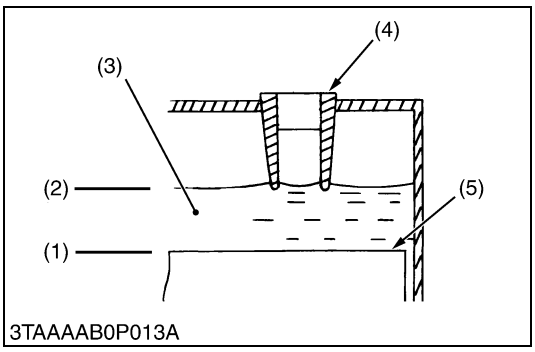
**CAUTION**

- **Never remove the vent plugs 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.**

1. Mishandling the battery shortens the service life and adds to maintenance costs.
2. The original battery is maintenance free type battery, but need some servicing. If the battery is weak, the engine is difficult to start and the lights become dim. It is important to check the battery periodically.

(1) Battery

W1055690



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## ■ Battery Charging

**DANGER**

- **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**

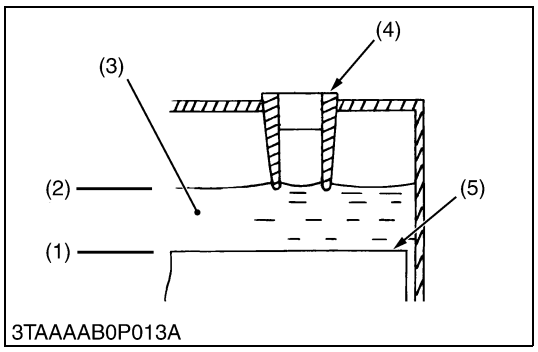
- **When charging the battery, ensure the vent caps are securely in place (if equipped).**
- **When disconnecting the cable from the battery, start with the negative terminal first.**
  **When connecting the cable to the battery, start with the positive terminal first.**
- **Never check battery charge 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 (3) level is to the bottom of vent wells (4), if necessary add distilled water in a well-ventilated area.
2. The water in the electrolyte (3) evaporates during recharging. Liquid shortage damages the battery. Excessive liquid spills over and damages the machine.
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 charges the battery at a high rate and in a short time.
   When using a boost-charged battery, it is necessary to recharge the battery as early as possible.
   Failure to do this will shorten the battery's service life.
5. When the specific gravity of electrolyte (3) become between 1.27 and 1.29 charge has completed.
6. When exchanging an old battery into new one, use battery of equal specification shown in "SPECIFICATIONS".

(1) Lowest Level
(2) Highest Level
(3) Electrolyte
(4) Vent Well
(5) Separator

W1056292



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■ **Battery Charging (Continued)**

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

Maintenance-free, non-accessible batteries are designed to eliminate the need to add water. Yet the volume of electrolyte (3) 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 below to determine if charging is necessary.)

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

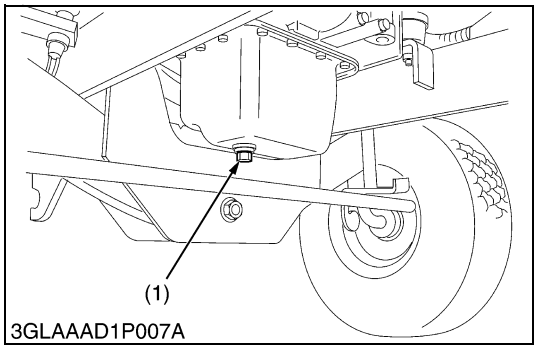
■ **Direction for Storage**

1. When storing the machine for long periods of time, remove the battery from machine, adjust the electrolyte (3) to the proper level and store in a dry place out of direct sunlight.
2. The battery self-discharges while it is stored.
   Recharge it once every three months in hot seasons and once every six months in cold seasons.

(1) Lowest Level
(2) Highest Level
(3) Electrolyte
(4) Vent Well
(5) Separator

W1056798

# [3] CHECK POINTS OF EVERY 100 HOURS



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**Changing Engine Oil**

**CAUTION**

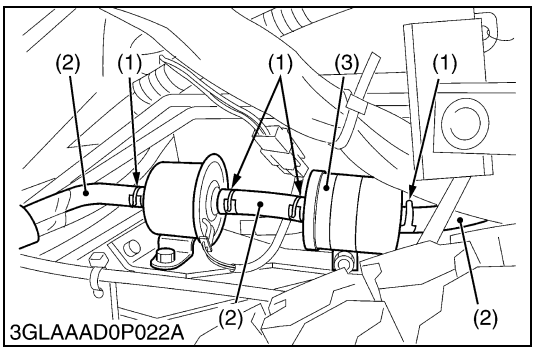
- **Be sure to stop the engine and remove the key before changing the oil.**
- **Allow engine to cool down sufficiently; oil can be hot and may cause burns.**

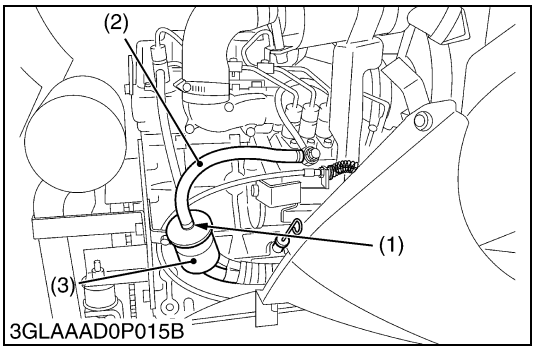
1. To change the used oil, remove the drain plug (1) at the bottom of the engine and drain the oil completely. The used oil can be drained out more easily if the engine is warm.
2. Fill with the new oil up to the upper notch on the dipstick.
3. To check the oil level. Remove the dipstick, wipe it clean, insert it and draw it out again. Check to see the oil level is between the two marks.

| | |
|---|---|
| Engine oil capacity | 1.2 L<br>1.27 U.S.qts<br>1.06 Imp.qts |

(1) Drain Plug

W1015501




## Checking Fuel Line and Fuel Filter

**CAUTION**

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

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

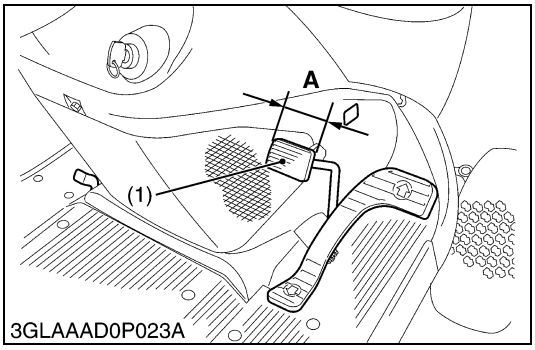
1. The fuel line (2) is made of rubber and ages regardless of service period.
2. If the fuel line (2) and clamps (1) are found to be damaged or deteriorated, replace them.
3. Check fuel filter (3), if it is clogged by debris or contaminated with water, replace it.

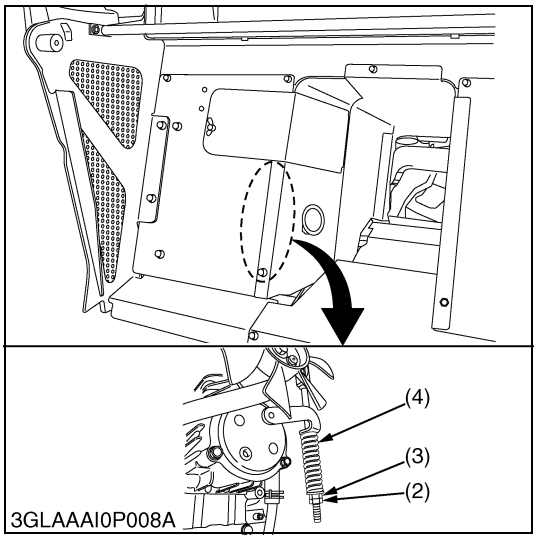
**IMPORTANT**

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

(1) Pipe Clamp
(2) Fuel Line
(3) Fuel Filter

W1015551




## Checking Brake

**CAUTION**

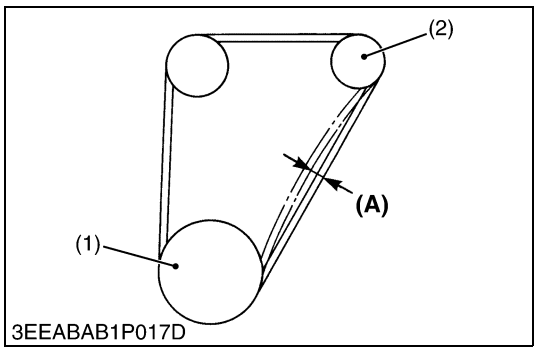
- **When making adjustments, park the machine on a flat area, block wheels, stop the engine and remove the key.**

1. Correct play ranges from 15 to 25 mm (0.59 to 0.98 in.). If it is not correct, loosen the lock nut (2) and turn the nut (3) in the desired direction until the proper play is achieved. After adjustment, retighten lock nut securely.

| | | |
|---|---|---|
| Play (**A**) | Factory spec. | 15 to 25 mm<br>0.59 to 0.98 in. |

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

W1017708




**Checking Fan Drive Belt Tension**

**CAUTION**

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

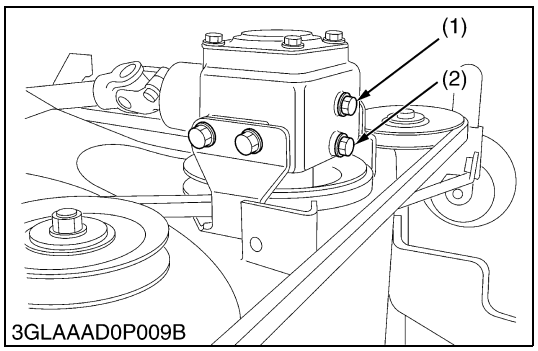
1. Measure the deflection **(A)**, depressing the belt halfway between the fan drive pulley (1) and dynamo pulley (2) at specified force (98 N, 10 kgf, 22 lbs).
2. If the measurement is not within the factory specifications, loosen the dynamo mounting screws and relocate the dynamo to adjust.

| | | |
|---|---|---|
| Deflection **(A)** | Factory spec. | 7 to 9 mm<br>0.28 to 0.35 in. |

(1) Fan Drive Pulley (2) Dynamo Pulley

W1060896

# [4] CHECK POINT OF EVERY 150 HOURS




**Changing Mower Gear Box Oil**

**CAUTION**

- **Be sure to stop the engine and remove the key before changing the oil.**

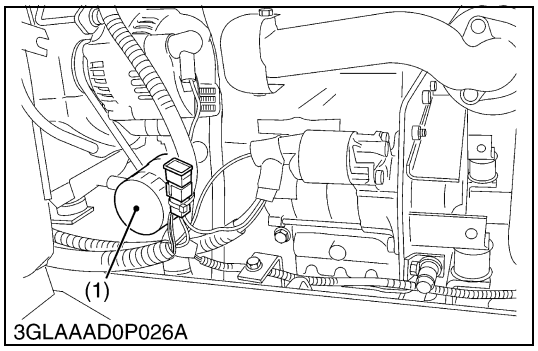
1. To drain the used oil, remove the oil filler plug (1) at the mower gear box, tilt the mower deck and drain the oil completely into the oil pan.
2. Fill with the new oil. (See page G-8.)
3. After filling, reinstall the oil filler plug (1).

| | |
|---|---|
| Mower gear box oil capacity | 0.33 L<br>0.35 U.S.qts<br>0.29 Imp.qts |

(1) Oil Filler Plug (2) Drain Plug

W1018562

# [5] CHECK POINTS OF EVERY 200 HOURS




**Replacing Engine Oil Filter Cartridge**

**CAUTION**

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

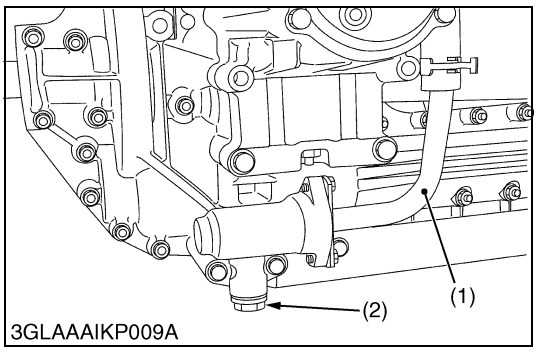
1. The oil filter cartridge (1) must be changed every 200 service hours.
2. Apply a slight coat of oil onto the rubber gasket of new cartridge.
3. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hand an additional 1/2 turn only.
4. After the cartridge has been replaced,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

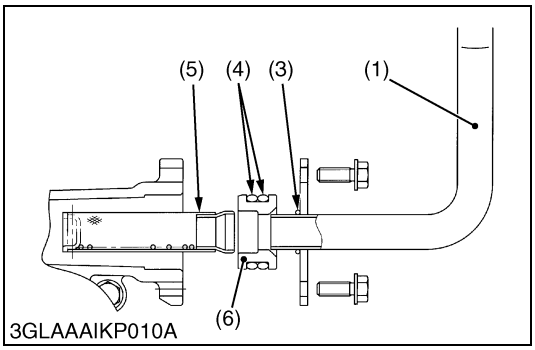
■ **IMPORTANT**

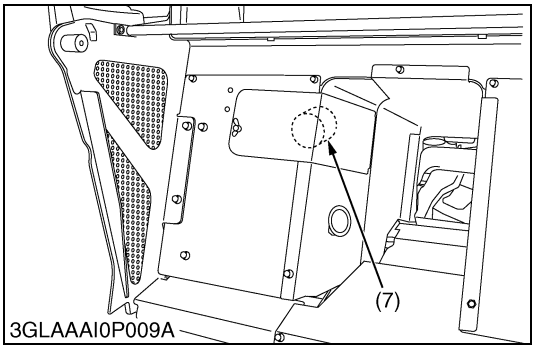
- **To prevent serious damage to the engine, element of recommended type must be used. Use only a genuine KUBOTA filter or its equivalent**

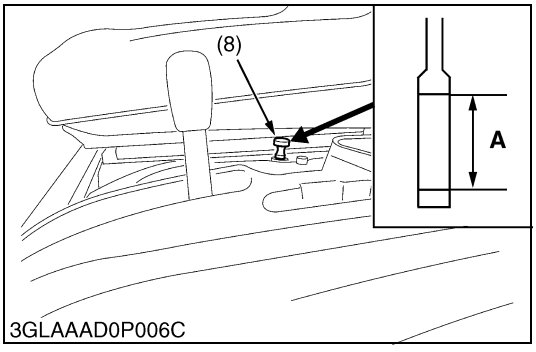
(1) Engine Oil Filter Cartridge

W1019390




## Changing Transmission Fluid

**CAUTION**

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

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

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

**■ IMPORTANT**

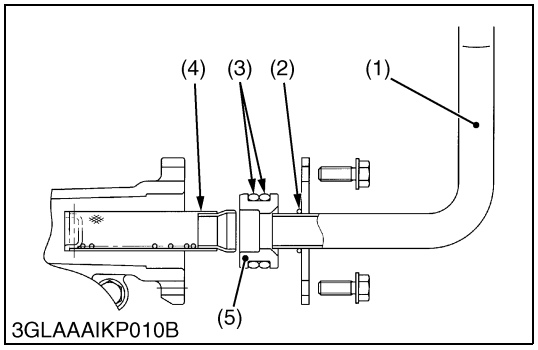
- **Operate only at low rpm immediately after changing the transmission fluid and filter cartridge.**
  **Keep the engine at medium speed for a few minutes to insure proper lubrication of all parts so that there is no damage to transmission.**
- **Do not engage PTO before checking the oil level.**

| | |
|---|---|
| Transmission fluid capacity | 2.7 L<br>0.71 U.S.gals<br>0.59 Imp.gals |

(1) Suction Pipe
(2) Drain Plug
(3) O-ring (Small)
(4) O-ring (Large)
(5) Strainer
(6) Boss
(7) Transmission Oil Filter Cartridge
(8) Dipstick

**A : Oil level is acceptable within this range**

W1019508




## Cleaning Transmission Strainer

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

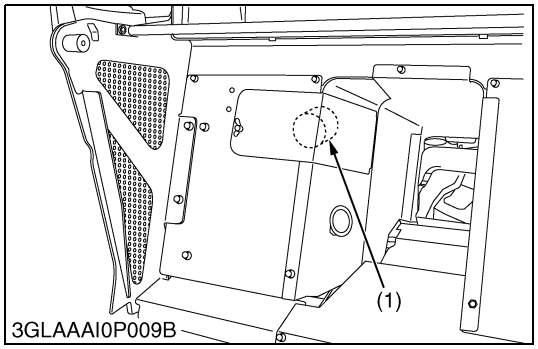
Check O-rings (2), (3), replace if damaged, cracked or hardened. When reassembling be careful not to damage the parts.

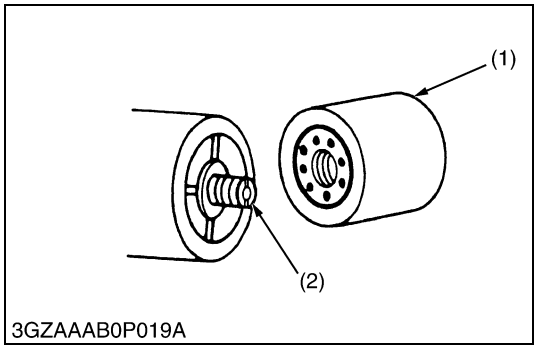
■ **NOTE**

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

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

W1062512




## Replacing Transmission Oil Filter cartridge

**CAUTION**

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

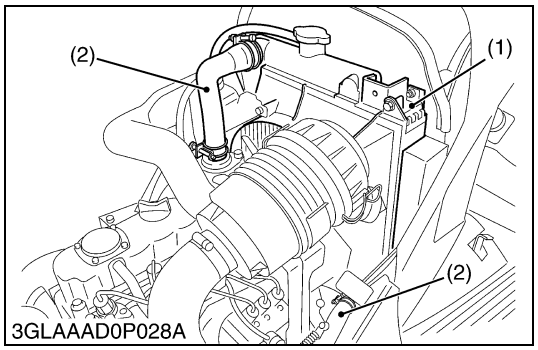
1. The transmission oil filter cartridge (1) must be changed every 300 service hours.
2. Remove the grass container and clean the area indicated.
3. Remove the oil filter cartridge (1) with the filter wrench.
4. Lightly tighten the screw (2) by using a screwdriver.
5. Apply a slight coat of oil onto 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. Assemble the cover and mount the grass container.
8. After the new cartridge has been replaced, the transmission fluid level normally lowers a little. Add fluid to proper level. Check for oil leaks around filter gasket.

■ **IMPORTANT**

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

(1) Transmission Oil Filter Cartridge
(2) Screw

W1063614



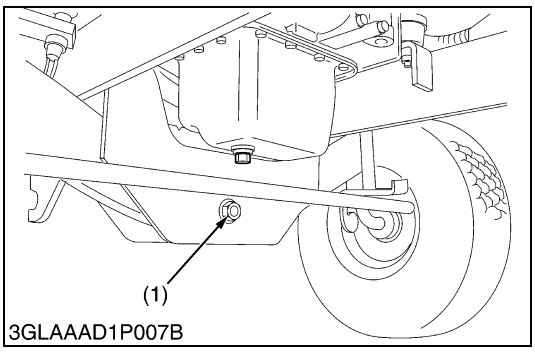

## Checking Radiator Hose and Hose Clamp

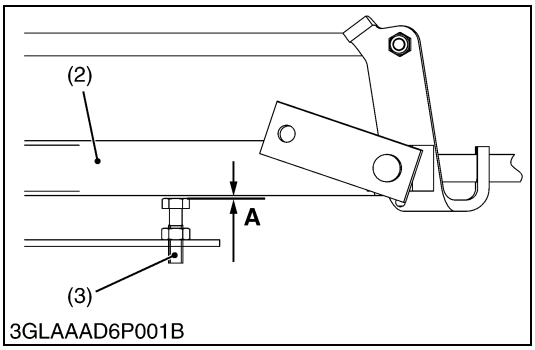
Check to see if radiator hoses are properly fixed every 200 hours of operation or six months, whichever comes first.

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

(1) Radiator Core
(2) Radiator Hose

W1064445




### Adjusting Front Axle Pivot

1. Jack up the front of machine.
2. Tighten the center pin locking nut (1) with specified torque.
3. Measure the clearance between the front axle frame (2) and anti-vibration bolt (3).
4. If the measurement exceeds the factory specification, adjust the anti-vibration bolt.

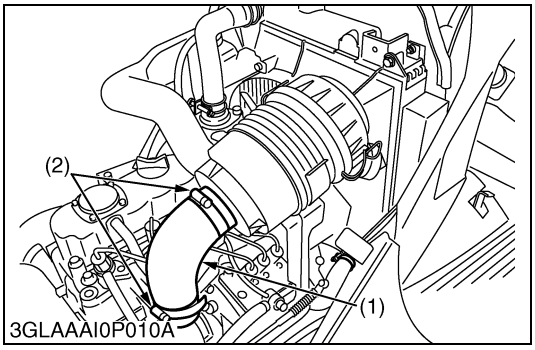
| | | |
|---|---|---|
| Tightening torque | Center pin locking nut | 77.4 to 90.2 N·m<br>7.89 to 9.20 kgf·m<br>57.1 to 66.5 ft-lbs |

| | | |
|---|---|---|
| Clearance between front axle frame and anti-vibration bolt (**A**) | Factory spec. | 0.3 to 0.5 mm<br>0.012 to 0.020 in. |

(1) Center Pin Locking Nut
(2) Front Axle Frame
(3) Anti-vibration Bolt

**A : Clearance**

W1065691



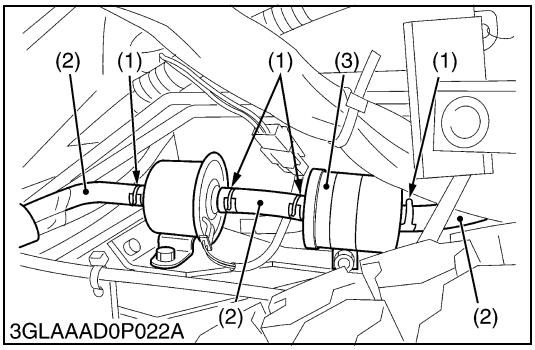

### Checking Intake Air Line

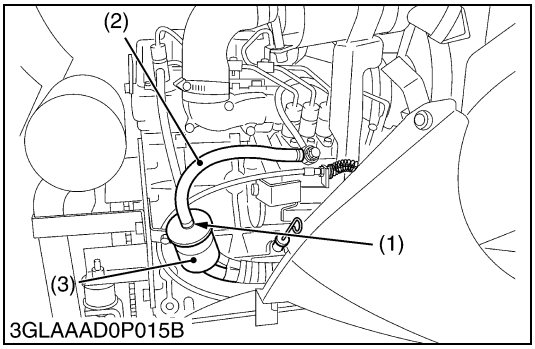
1. Check to see that hose (1) and clamps (2) are tight and not damaged.
2. If hose (1)and clamps (2) are found worn or damaged, replace or repair them at once.

(1) Hose
(2) Clamp

W1049152

## [6] CHECK POINT OF EVERY 400 HOURS




### Replacing Fuel Filter

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

■ **NOTE**

- **If the fuel line is removed, be sure to properly bleed the fuel system. (See page G-37.)**

(1) Pipe Clamps
(2) Fuel Line
(3) Fuel Filter

W1019713

# [7] CHECK POINT OF 1500 HOURS

**Checking Fuel Injection Nozzle (Injection Pressure)**

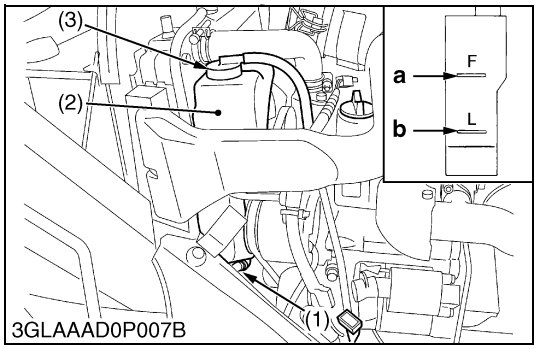
1. Check the fuel injection nozzle.
   Refer to “Fuel Injection Pressure”. (See page 1-S17.)

# [8] CHECK POINTS OF EVERY 1 YEAR

**Replacing Air Cleaner Element**

1. Change the element once a year.

W1066471




**Flushing Cooling System and Changing Coolant**

**CAUTION**

- **Do not remove the radiator cap when the engine is hot. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.**

1. Stop the engine and let cool down.
2. To drain the coolant, remove the clamp and the hose, and remove the radiator cap. The radiator cap must be removed to completely drain the coolant.
3. After all coolant is drained, install the hose with the clamp.
4. Fill with clean water and cooling system cleaner.
5. Follow directions of the cleaner instruction.
6. After flushing, fill with clean water and anti-freeze until the coolant level is just below the fill port on the radiator. Install the radiator cap securely.
7. Fill with coolant up to **"FULL"** mark on the recovery tank.
8. Start and operate the engine for a few minutes.
9. Stop the engine and let cool. Check coolant level of recovery tank (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-8.).**

| | |
|---|---|
| Coolant capacity (with recovery tank) | 1.9 L<br>2.0 U.S.qts.<br>1.7 Imp.qts. |

(1) Clamp
(2) Recovery Tank
(3) Recovery Tank Cap

**a : FULL**
**b : LOW**

W1019858

**Flushing Cooling System and Changing Coolant (Continued)**

■ **Anti-Freeze**

**CAUTION**

- **When using anti-freeze, put on some protection such as rubber gloves (Anti-freeze contains poison.).**
- **If should drink anti-freeze, 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 anti-freeze. The mixture can produce chemical reaction causing harmful substances.**
- **Anti-freeze is extremely flammable and explosive under certain conditions. Keep fire and children away from anti-freeze.**
- **When draining fluids from the engine, place some container underneath the engine body.**
- **Do not pour waste onto the grounds, down a drain, or into any water source.**
- **Also, observe the relevant environmental protection regulations when disposing of anti-freeze.**

If it freezes, coolant can damage the cylinders and radiator. If the ambient temperature falls below 0 °C or before a long-term storage, let out coolant 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 coolant, fill the radiator with fresh water and empty it again. Repeat this procedure 2 or 3 times to clean up the inside.
3. Mixing the LLC
   Put the LLC in coolant in the percentage (%) for a target temperature. When mixing, stir it up well, and then fill into the radiator.
4. The procedure for the mixing of water and anti-freeze differs according to the make of the anti-freeze and the ambient temperature. Refer to SAE J1034 standard, more specifically also to SAE J814c.

W1067182

**Flushing Cooling System and Changing Coolant (Continued)**

■ **IMPORTANT**

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

| Vol % Anti-freeze | Freezing Point | Boiling Point* |
|---|---|---|
| | °C (°F) | °C (°F) |
| 40 | -24 (-12) | 106 (222) |
| 50 | -37 (-34) | 108 (226) |

*At 0.1013 MPa (760 mmHg) pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

1. Adding the LLC
   (1) Add only water if the mixture reduces in amount by evaporation.
   (2) If there is a mixture leak, add the LLC the same manufacture and type in the same mixture percentage.
   *Never add any long-life coolant of different manufacture. (Different brands may have different additive components, and the engine may fail to perform as specified.)
2. When the LLC is mixed, do not employ any radiator cleaning agent. The LLC contains anti-corrosive agent. If mixed with the cleaning agent, sludge may build up, adversely affecting the engine parts.
3. Kubota's genuine long-life coolant has a service life of 2 years. Be sure to change the coolant every 2 years.

■ **NOTE**

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

W1068193

# [9] CHECK POINTS OF EVERY 2 YEARS

**Replacing Fuel Lines**

1. Replace the fuel line.
   Refer to "Checking Fuel Lines and Fuel Filter". (See page G-27.)

W1019995

**Replacing Radiator Hose**

1. Replace hoses and clap bands every 2 years or earlier if checked and found that hoses are swollen, hardened or cracked.

W1070217

**Replacing Intake Air Line**

1. Replace the intake air line.
   Refer to "Checking Intake Air Line". (See page G-31.)

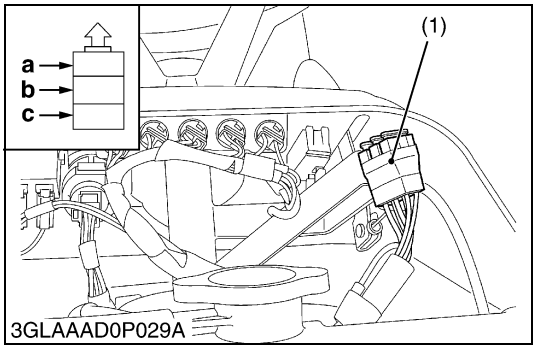
W1056499

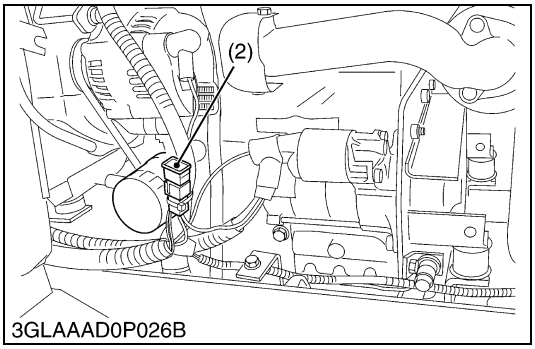
**Replacing Mower Gear Box Oil Seals**

1. Replace the mower gear box oil seals.
   Refer to "Disassembling Gear Box". (See page 7-S9.).

W1070302

# [10] OTHERS




## Replacing Fuses

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

■ **IMPORTANT**

- **Never "jump" the fuse with wire or foil, or install a larger capacity fuse than is recommended.**

■ **Protected Circuit**

| Fuse No. (ID Label) | | Capacity (A) | Protected circuit |
|---|---|---|---|
| (1) | Engine Stop (**a**) | 15 | Engine stop timer relay |
| | IG/M (**b**) | 10 | Fuel pump, head light, power steering control unit, etc. |
| | OPC (**c**) | 3 | OPC |
| (2) | – | Slow blow fuse 40 | Check circuit against wrong battery connection |

(1) Fuse Location (2) Slow Blow Fuse

W1023430

## Replacing Bulbs

### (A)Replacement of the head light bulb

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

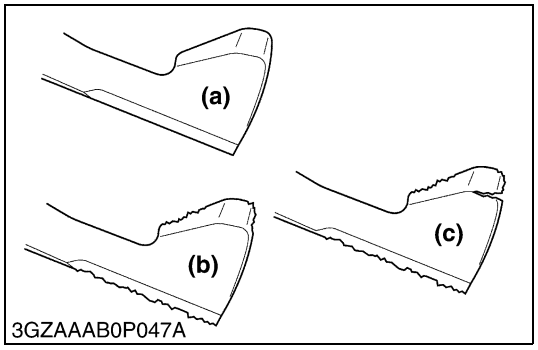
| | |
|---|---|
| Head light bulb | 24W |

### (B)Replacement of the indicator light bulb

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

| | |
|---|---|
| Indicator light bulb | 14.0 rated voltage / 0.27 AMP/2 MSCP |

W1023802



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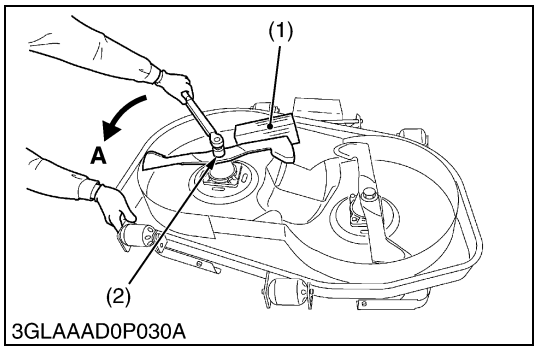

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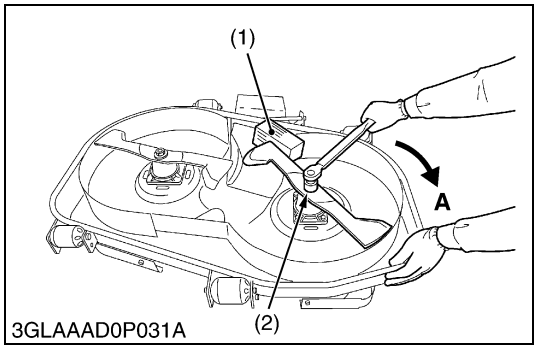

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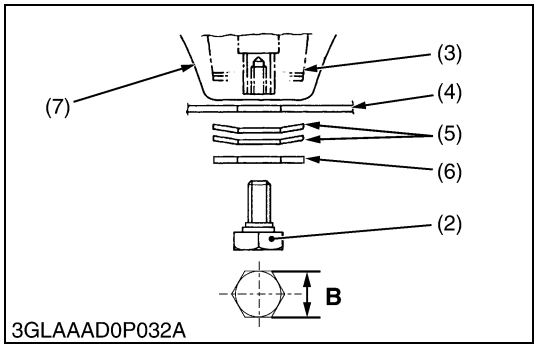

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## Checking and Replacing Mower Blade

**CAUTION**

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

### ■ Checking Blade

1. The blade cutting edges should be kept sharp at all times. Sharpen the cutting edges, if they resemble blade **(b)**. Replace the blades if they appear similar to blade **(c)**.

### ■ Replacing Blade

1. Remove the mower deck from the machine and turn it over to expose the blades (4).
2. Wedge a block of wood (1) between the blade (4) and mower housing as illustrated.
3. The blade bolt (2) has right hand threads, turn counterclockwise to loosen.
   The blade bolt (2) has left hand threads, turn clockwise to loosen.

### ■ NOTE

- **Use the proper 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.
   Use a large mill file and file along the original bevel until sharp.
5. To check the blade for balance, place a small rod though the centre hole. If the blade is not balanced, file the heavy side of the blade until balance is achieved.
6. To attach blades (4), be sure to install the 2 cup washers (5) between the blade (4) and bolt (2) head.

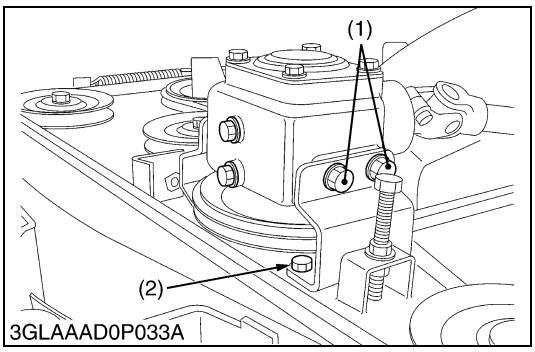
| | | |
|---|---|---|
| Tightening torque | Blade mounting bolt | 98.0 to 117.6 N·m<br>10.0 to 12.0 kgf·m<br>72.3 to 86.8 ft-lbs |

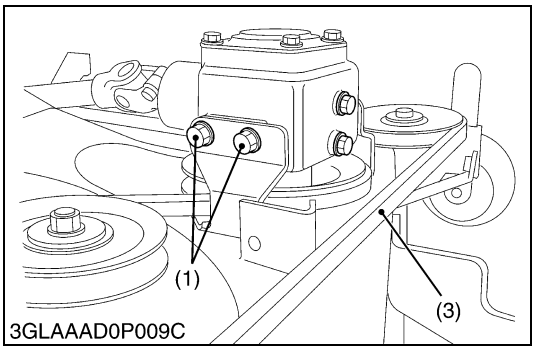
(1) Block
(2) Blade Bolt
(3) Spindle Holder
(4) Blade
(5) 2-cup Washer
(6) Shim
(7) Spindle Guard

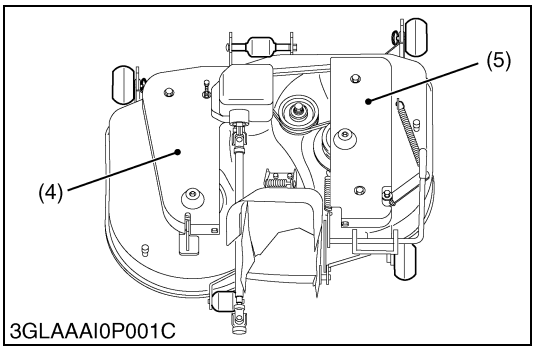
**(a) New Blade**
**(b) Worn Blade**
**(c) Cracked Blade**

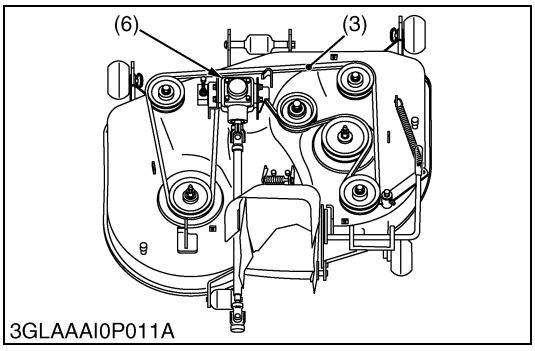
**A : Loosen**
**B : 30 mm (1.18 in.)**

W1072450




## Replacing Mower Belt

1. Remove the mower deck from the machine.
2. Remove the left and right hand shield (4), (6) from the mower deck.
3. Clean around the pulleys to remove the belt (3) from the pulleys. Slip the belt (3) over the top of the left side pulley.
4. Remove the both brackets which mounts the gear box to the mower deck.
5. To install a new belt, reverse the above procedure.

| | | |
|---|---|---|
| Tightening torque | Bracket mounting screw | 39.2 to 44.1 N·m<br>4.0 to 4.5 kgf·m<br>8.8 to 9.9 ft-lbs |

(1) Bolt
(2) Bolt, Nut
(3) Belt
(4) Left Hand Shield
(5) Right Hand Shield
(6) Mower Gear Box

W1073387

## Bleeding Fuel System

**Air must be removed :**

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

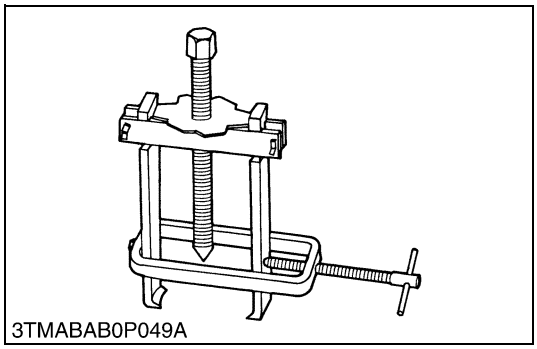
**Bleeding procedure is as follows :**

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

W1074213

# 8. SPECIAL TOOLS

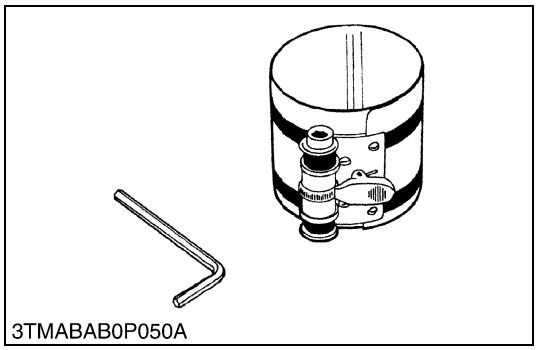
## [1] SPECIAL TOOLS FOR ENGINE


3TMABAB0P049A

**Special Use Puller Set**

Code No.: 07916-09032
Application: Use exclusively for pulling out bearing, gears and other parts with ease.

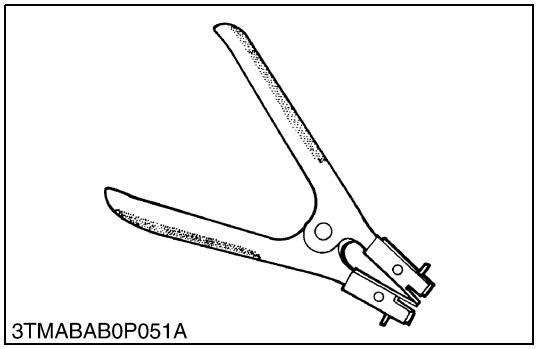
W1024050


3TMABAB0P050A

**Piston Ring Compressor**

Code No.: 07909-32111
Application: Use exclusively for pushing in the piston with piston rings into the cylinder.

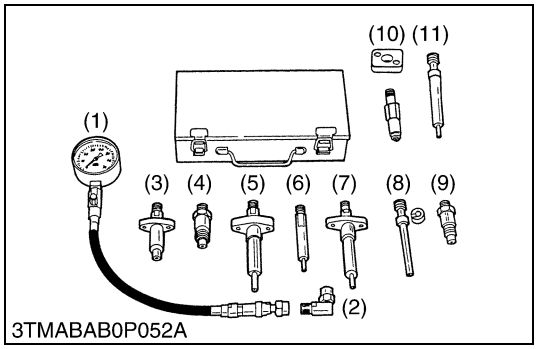
W1024100


3TMABAB0P051A

**Piston Ring Tool**

Code No.: 07909-32121
Application: Use exclusively for removing or installing the piston ring with ease.

W1024150



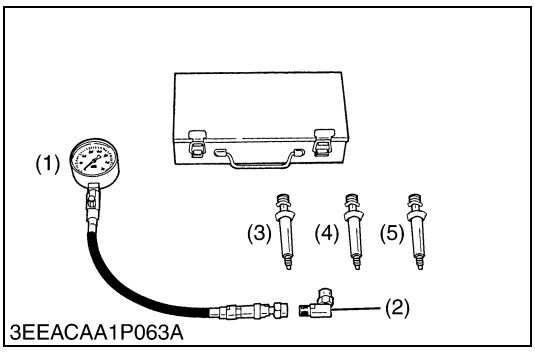
3TMABAB0P052A

**Diesel Engine Compression Tester**

Code No.: 07909-30208 (Assembly) 07909-31251 (G)
07909-30934 (A to F) 07909-31271 (I)
07909-31211 (E and F) 07909-31281 (J)
07909-31231 (H)
Application: Use to measure diesel engine compression and diagnostics of need for major overhaul.

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

W1024200



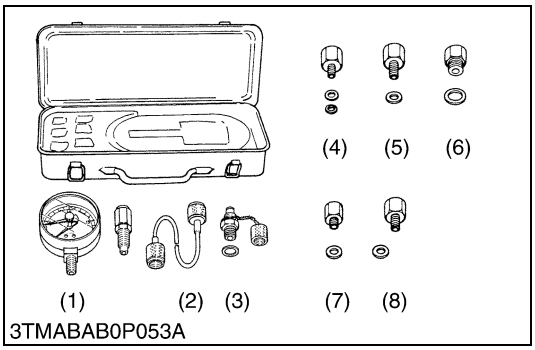

**Diesel Engine Compression Tester (for Glow Plug)**

Code No.: 07909-39081 (Assembly) 07909-31301 (L)
07909-31291 (K) 07909-31311 (M)

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

(1) Gauge
(2) L Joint
(3) Adaptor **K**
(4) Adaptor **L**
(5) Adaptor **M**

0000001398E



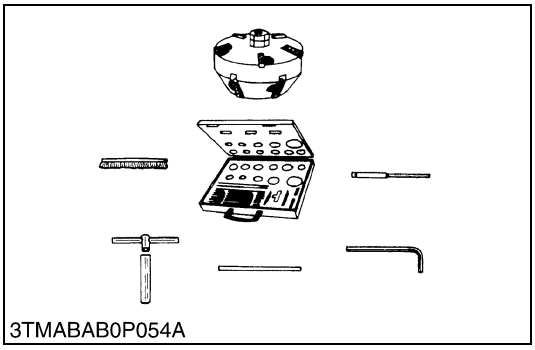

**Oil Pressure Tester**

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**

W1024318




**Valve Seat Cutter**

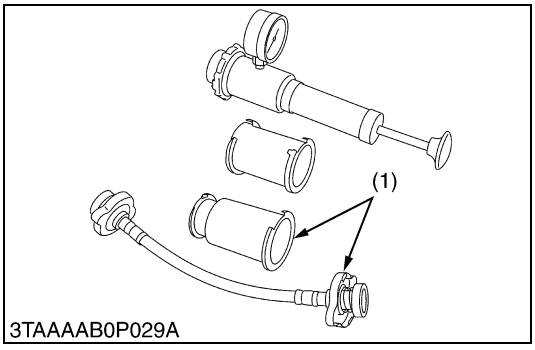
Code No.: 07909-33102

Application: Use to reseat valves.

Angle: 0.785 rad. (45°)
0.262 rad. (15°)

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

W1024458



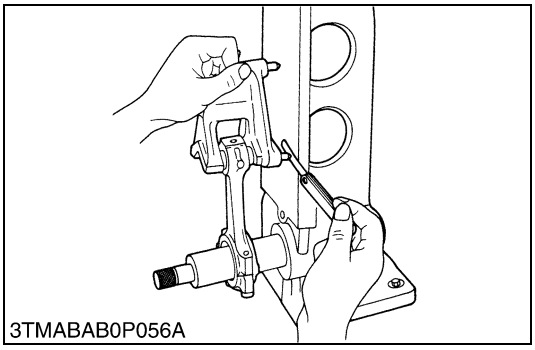

**Radiator Tester**

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

W1024532



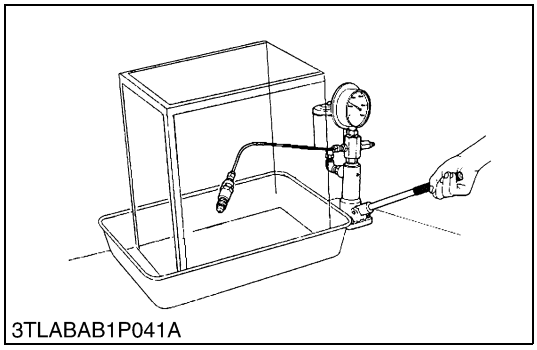

**Connecting Rod Alignment Tool**

Code No.: 07909-31661

Application: Use to check the connecting rod alignment.

Applicable: Connecting rod big end I.D.
range 30 to 75 mm (1.18 to 2.95 in.) dia.
Connecting rod length
65 to 300 mm (2.56 to 11.81 in.)

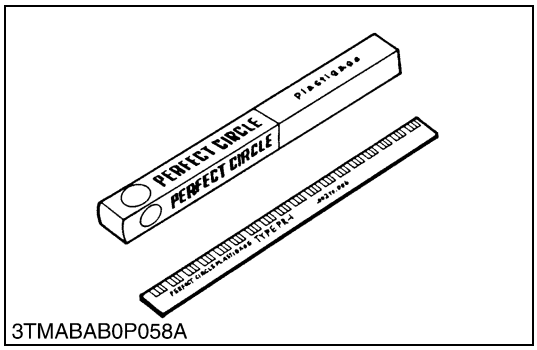
W1024583


3TLABAB1P041A

**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/cm$^2$, 0 to 7000 psi)

W1024653

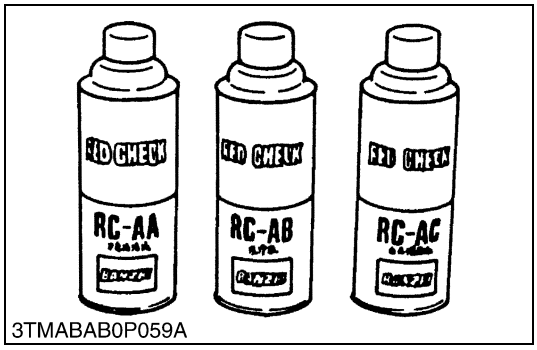


3TMABAB0P058A

**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.)

W1024719

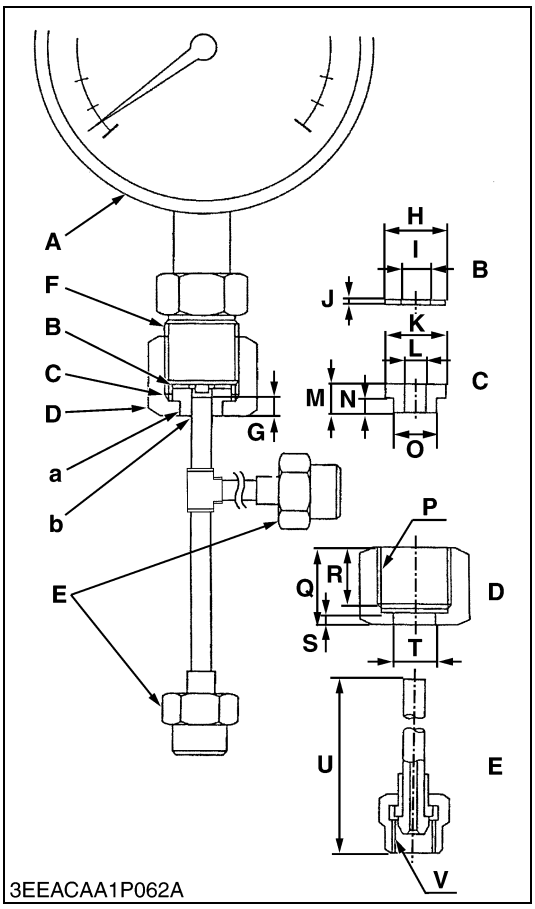


3TMABAB0P059A

**Red Check**

Code No.: 07909-31371
Application: Use to check cracks on cylinder head, cylinder block, etc..

W1024909



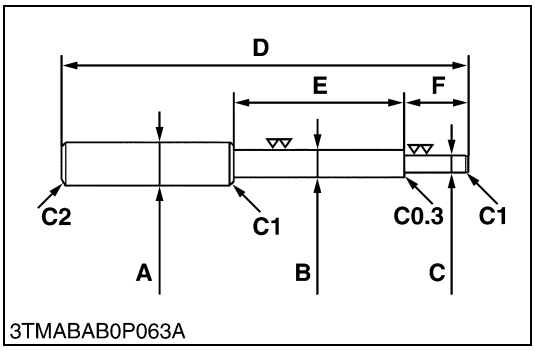
3EEACAA1P062A

## 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** | Copper gasket |
| **C** | Flange (Material : Steel) |
| **D** | Hex. nut 27 mm (1.06 in.) across the plat |
| **E** | Retaining nut |
| **F** | PF1/2 |
| **G** | 5 mm (0.20 in.) |
| **H** | 17 mm dia. (0.67 in. dia.) |
| **I** | 8 mm dia. (0.31 in. dia.) |
| **J** | 1.0 mm (0.039 in.) |
| **K** | 17 mm dia. (0.67 in. dia.) |
| **L** | 6.10 to 6.20 mm dia. (0.2402 to 0.2441 in. dia.) |
| **M** | 8 mm (0.31 in.) |
| **N** | 4 mm (0.16 in.) |
| **O** | 11.97 to 11.99 mm dia. (0.4713 to 0.4721 in. dia.) |
| **P** | PF1/2 |
| **Q** | 23 mm (0.91 in.) |
| **R** | 17 mm (0.67 in.) |
| **S** | 4 mm (0.16 in.) |
| **T** | 12.00 to 12.02 mm dia. (0.4724 to 0.4732 in. dia.) |
| **U** | 100 mm (3.94 in.) |
| **V** | M12 × P1.5 |
| **a** | Adhesive application |
| **b** | Fillet welding on the enter circumference |

W1050289



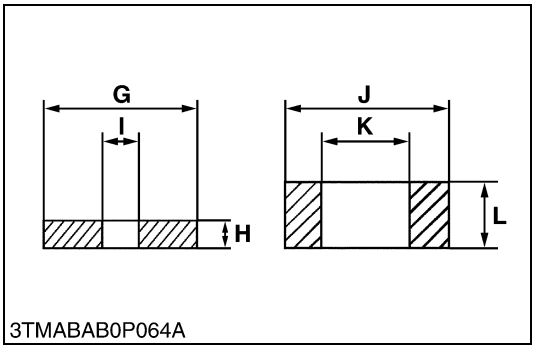
3TMABAB0P063A

## Valve Guide Replacing Tool

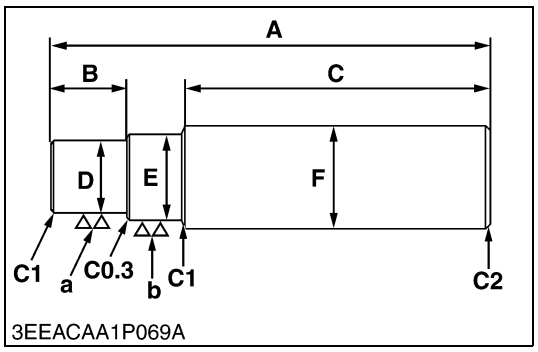
Application: Use to press out and press fit the valve guide.

| | |
|---|---|
| **A** | 20 mm dia. (0.79 in. dia.) |
| **B** | 9.96 to 9.98 mm dia. (0.3921 to 0.3929 in. dia.) |
| **C** | 5.5 to 5.7 mm dia. (0.2165 to 0.2244 in. dia.) |
| **D** | 220 mm (8.66 in.) |
| **E** | 80 mm (3.15 in.) |
| **F** | 40 mm (1.58 in.) |
| **G** | 25 mm (0.98 in. dia.) |
| **H** | 5 mm (0.197 in.) |
| **I** | 6.0 to 6.1 mm dia. (0.236 to 0.240 in. dia.) |
| **J** | 18 mm dia. (0.71 in. dia.) |
| **K** | 10.6 to 10.7 mm dia. (0.417 to 0.421 in. dia.) |
| **L** | 6.9 to 7.1 mm dia. (0.272 to 0.280 in. dia.) |
| **C1** | Chamfer 1.0 mm (0.039 in.) |
| **C2** | Chamfer 2.0 mm (0.079 in.) |
| **C0.3** | Chamfer 0.3 mm (0.012 in.) |

W1025017



3TMABAB0P064A



3EEACAA1P069A

## Bushing Replacing Tool

Application: Use to press out and press fit the bushing.

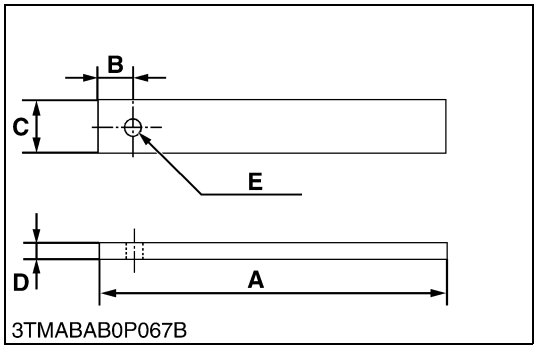
1. For small end bushing

| | |
|---|---|
| **A** | 145 mm (5.71 in.) |
| **B** | 20 mm (0.79 in.) |
| **C** | 100 mm (3.94 in.) |
| **D** | 19.90 to 19.95 mm dia. (0.7835 to 0.7854 in. dia.) |
| **E** | 21.90 to 21.95 mm dia. (0.8622 to 0.8642 in. dia.) |
| **F** | 25 mm dia. (0.98 in. dia.) |
| **C1** | Chamfer 1.0 mm (0.039 in.) |
| **C2** | Chamfer 2.0 mm (0.079 in.) |
| **C0.3** | Chamfer 0.3 mm (0.012 in.) |
| **a** | 6.3 µm (250 µin.) |
| **b** | 6.3 µm (250 µin.) |

2. For idle gear bushing

| | |
|---|---|
| **A** | 150 mm (5.91 in.) |
| **B** | 20 mm (0.79 in.) |
| **C** | 100 mm (3.94 in.) |
| **D** | 19.90 to 19.95 mm dia. (0.7835 to 0.7854 in. dia.) |
| **E** | 21.90 to 21.95 mm dia. (0.8622 to 0.8642 in. dia.) |
| **F** | 25 mm dia. (0.98 in. dia.) |
| **C1** | Chamfer 1.0 mm (0.039 in.) |
| **C2** | Chamfer 2.0 mm (0.079 in.) |
| **C0.3** | Chamfer 0.3 mm (0.012 in.) |
| **a** | 6.3 µm (250 µin.) |
| **b** | 6.3 µm (250 µin.) |

W12358870



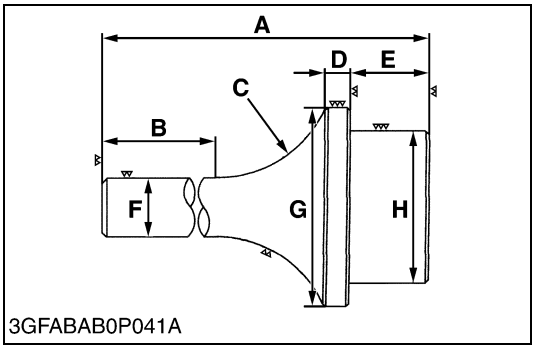
3TMABAB0P067B

## Flywheel Stopper

Application: Use to loosen and tighten the flywheel screw.

| | |
|---|---|
| **A** | 200 mm (7.87 in.) |
| **B** | 20 mm (0.79 in.) |
| **C** | 30 mm (1.18 in.) |
| **D** | 8 mm (0.31 in.) |
| **E** | 10 mm dia. (0.39 in. dia.) |

W12365478



3GFABAB0P041A

**Crankshaft Bearing 1 Replacing Tool**

Application: Use to press out and press fit the crankshaft bearing 1.

**[Press Out]**

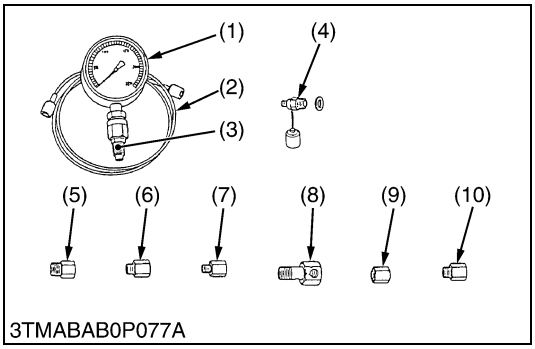
| | |
|---|---|
| **A** | 135 mm (5.31 in.) |
| **B** | 72 mm (2.83 in.) |
| **C** | 40 mm radius (1.57 in. radius) |
| **D** | 10 mm (0.39 in.) |
| **E** | 22 mm (0.87 in.) |
| **F** | 20 mm dia. (0.79 in. dia.) |
| **G** | 47.90 to 47.95 mm dia. (1.8858 to 1.8878 in. dia.) |
| **H** | 43.90 to 43.95 mm dia. (1.7283 to 1.7303 in. dia.) |

**[Press Fit]**

| | |
|---|---|
| **A** | 130 mm (5.12 in.) |
| **B** | 72 mm (2.83 in.) |
| **C** | 40 mm radius (1.57 in. radius) |
| **D** | 9 mm (0.35 in.) |
| **E** | 24 mm (0.95 in.) |
| **F** | 20 mm dia. (0.79 in. dia.) |
| **G** | 68 mm dia. (2.68 in. dia.) |
| **H** | 39.90 to 39.95 mm dia. (1.5709 to 1.5728 in. dia.) |

W78965412

# [2] SPECIAL TOOLS FOR MACHINE



3TMABAB0P077A

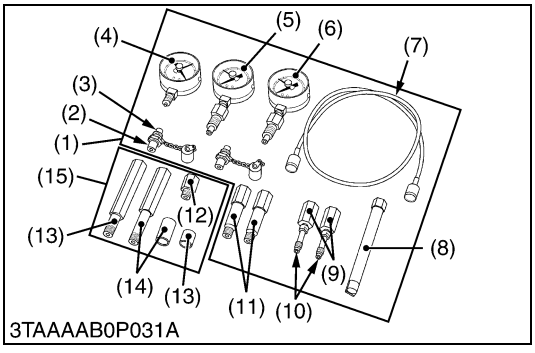
**Relief Valve Pressure Tester**

Code No.: 07916-50045

Application: This allows easy measurement of relief set pressure.

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

W1026741



3TAAAAB0P031A

**Hydrostatic Transmission Tester and HST Adaptor Set**

Code No.: 07916-52040 (Hydrostatic Transmission Tester)
07916-53072 (HST Adaptor Set)

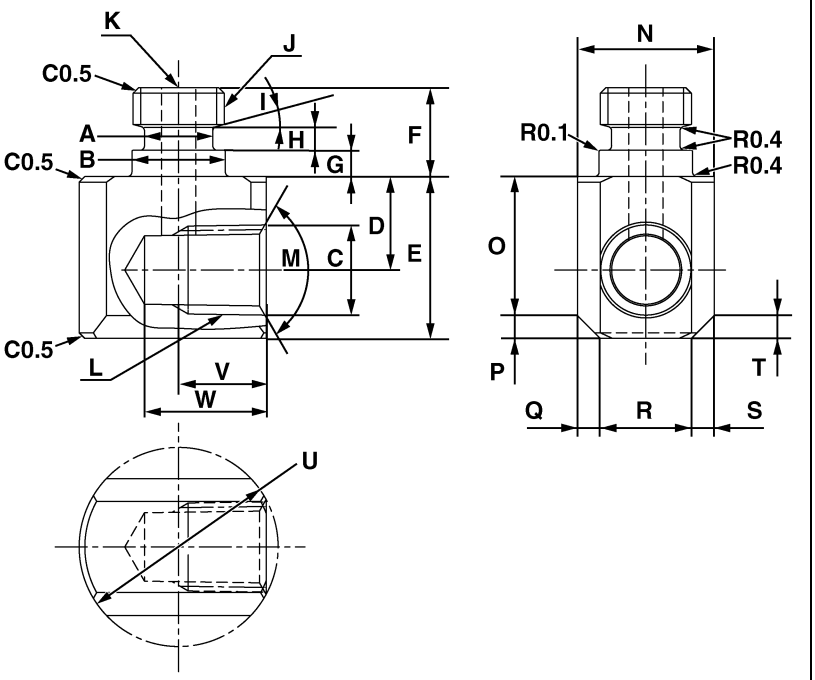
Application: This allows easy measurement of hydrostatic transmission pressure.

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

W1023682

## HST Relief Pressure Gauge Adaptors

1. Adaptor 1

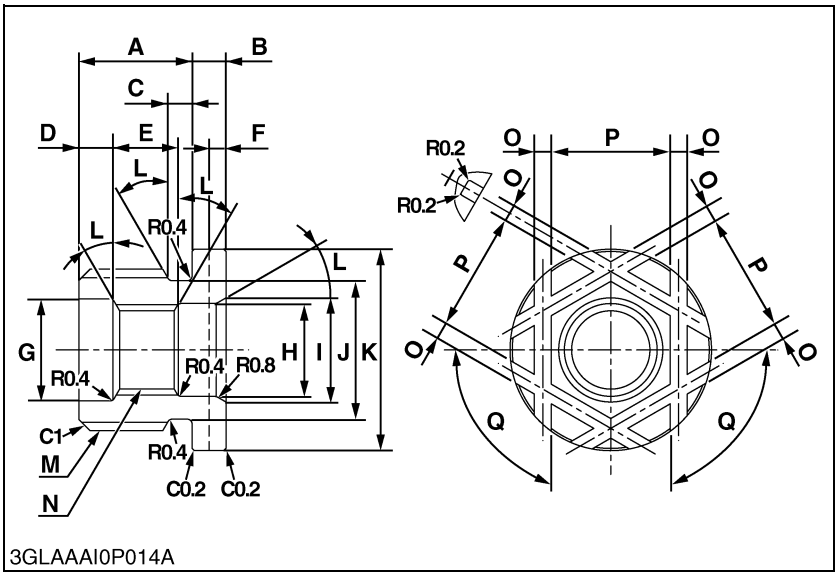



3GLAAAI0P013A

| | |
|---|---|
| **A** | 5.94 to 6.00 mm dia. (0.234 to 0.236 in. dia.) |
| **B** | 8.165 to 8.187 mm dia. (0.3215 to 0.3223 in. dia.) |
| **C** | 8.4 mm dia. (0.3307 in. dia.) |
| **D** | 8.2 mm (0.32 in.) |
| **E** | 14.2 mm (0.55905 in.) |
| **F** | 7.6 to 8.0 mm (0.30 to 0.31 in.) |
| **G** | 2.3 mm (0.09055 in.) |
| **H** | 2.0 to 2.2 mm (0.079 to 0.087 in.) |
| **I** | 15° (0.26 rad.) |
| **J** | M8 |
| **K** | 3 mm dia. drill (0.12 in. dia. drill) |
| **L** | Rc1/16 |
| **M** | 120° (2.09 rad.) |
| **N** | 11.8 to 11.9 mm (0.465 to 0.469 in.) |
| **O** | 12.2 mm (0.480 in.) |
| **P** | 2 mm (0.079 in.) |
| **Q** | 3 mm (0.118 in.) |
| **R** | 8 mm (0.31496 in.) |
| **S** | 2 mm (0.079 in.) |
| **T** | 2 mm (0.079 in.) |
| **U** | 17.4625 mm dia. (0.6875 in. dia.) |
| **V** | 7.7 mm (0.303 in.) |
| **W** | 10.7 mm (0.421 in.) |
| **C0.5** | Chamfer 0.5 mm (0.020 in.) |
| **R0.4** | Radius 0.4 mm (0.016 in.) |
| **R0.1** | Radius 0.1 mm (0.004 in.) |

W1014589

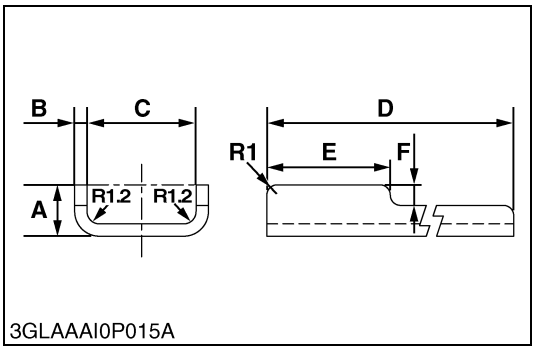
2. Adaptor 2



3GLAAAI0P014A

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

W1067375

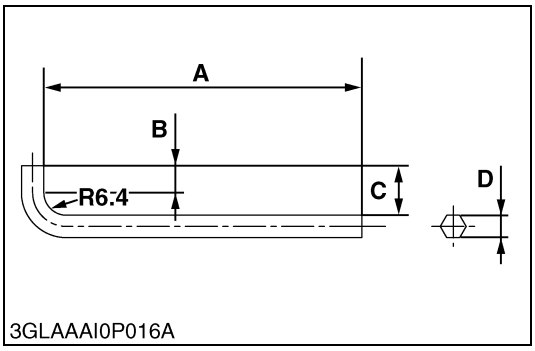


3GLAAAI0P015A

3. Adaptor Lever

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

W1015898



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**Short Neck Wrench**

| | |
|---|---|
| **A** | 90 mm (3.543 in.) |
| **B** | 7 to 8 mm (0.28 to 0.31 in.) |
| **C** | 14 mm (0.551 in.) |
| **D** | 6.35 mm (0.25 in.) |
| **R6.4** | Radius 6.4 mm (0.252 in.) |

W1068021

# 9. TIRES

## [1] TIRE PRESSURE

**CAUTION**

- **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.**
  **Do not inflate tires above the recommended pressure as shown below.**

■ **IMPORTANT**

- **Do not use tires larger than specified.**

| | Tire sizes | Inflation pressure |
|---|---|---|
| Front | 15 x 6.00-6, 4PR | 200 kPa (2.0 kgf/cm$^2$, 29 psi) |
| Rear | 20 x 10.00-8, 4PR | 140 kPa (1.4 kgf/cm$^2$, 20 psi) |

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

## [2] TREAD

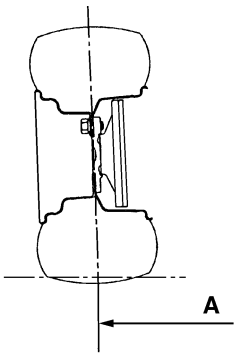
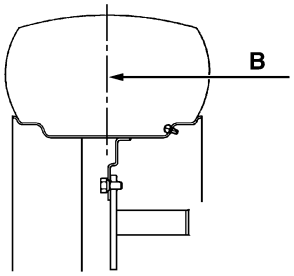
The tread can not be adjusted.

■ **IMPORTANT**

- **Do not turn discs to obtain wider tread.**
- **Always attach tires as shown in the drawing.**
- **If not attached as illustrated, transmission parts may be damaged.**

■ **NOTE**

- **Use the tapered bolts for wheels with beveled or tapered holes.**

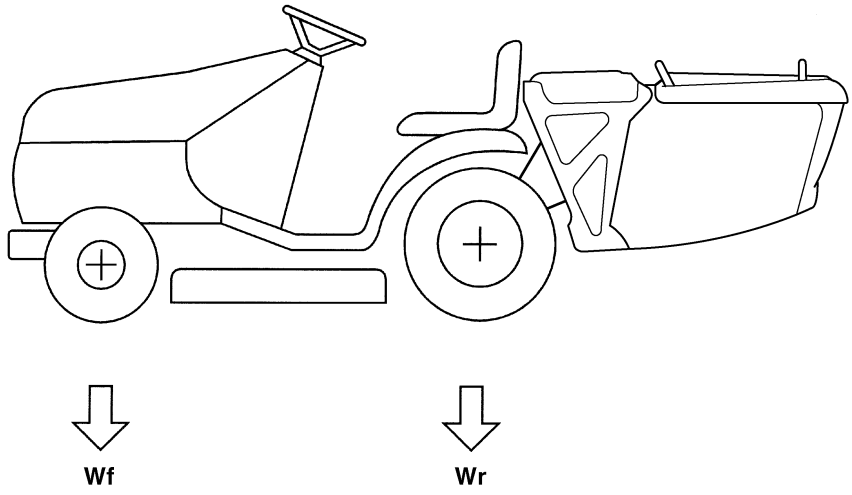
| Front | Rear |
|---|---|
| 15 × 6.00 - 6, 4PR | 20 × 10.00 - 8, 4PR |
|  3TAAAAB0P032A |  3TAAAAB0P033A |

**A : 750 mm (29.5 in.)** **B : 800 mm (31.5 in.)**

# 10. IMPLEMENT LIMITATIONS

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

| Maximum axle loading weight | | |
|---|---|---|
| Front axle Wf | Rear axle Wr | Total gross weight |
| 250 kg (551 lbs) | 450 kg (992 lbs) | 600 kg (1323 lbs) |

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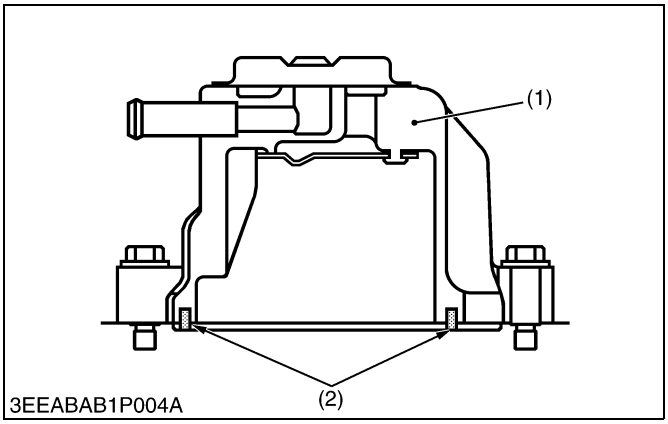
# 1 ENGINE

# MECHANISM

## CONTENTS

# 1. ENGINE BODY

## [1] HALF-FLOATING HEAD COVER

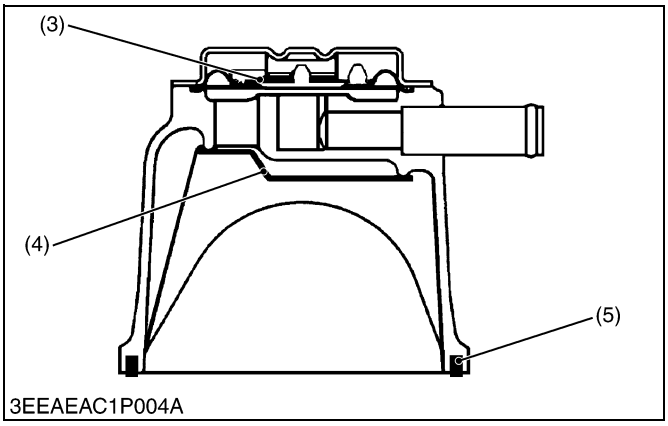



The rubber packing is fitting in to maintain the head cover 0.5 mm (0.02 in.) or so off the cylinder head. This arrangement helps reduce noise coming from the cylinder head.

(1) Cylinder Head Cover (2) Rubber Packing

W1013433

## [2] CLOSED BREATHER

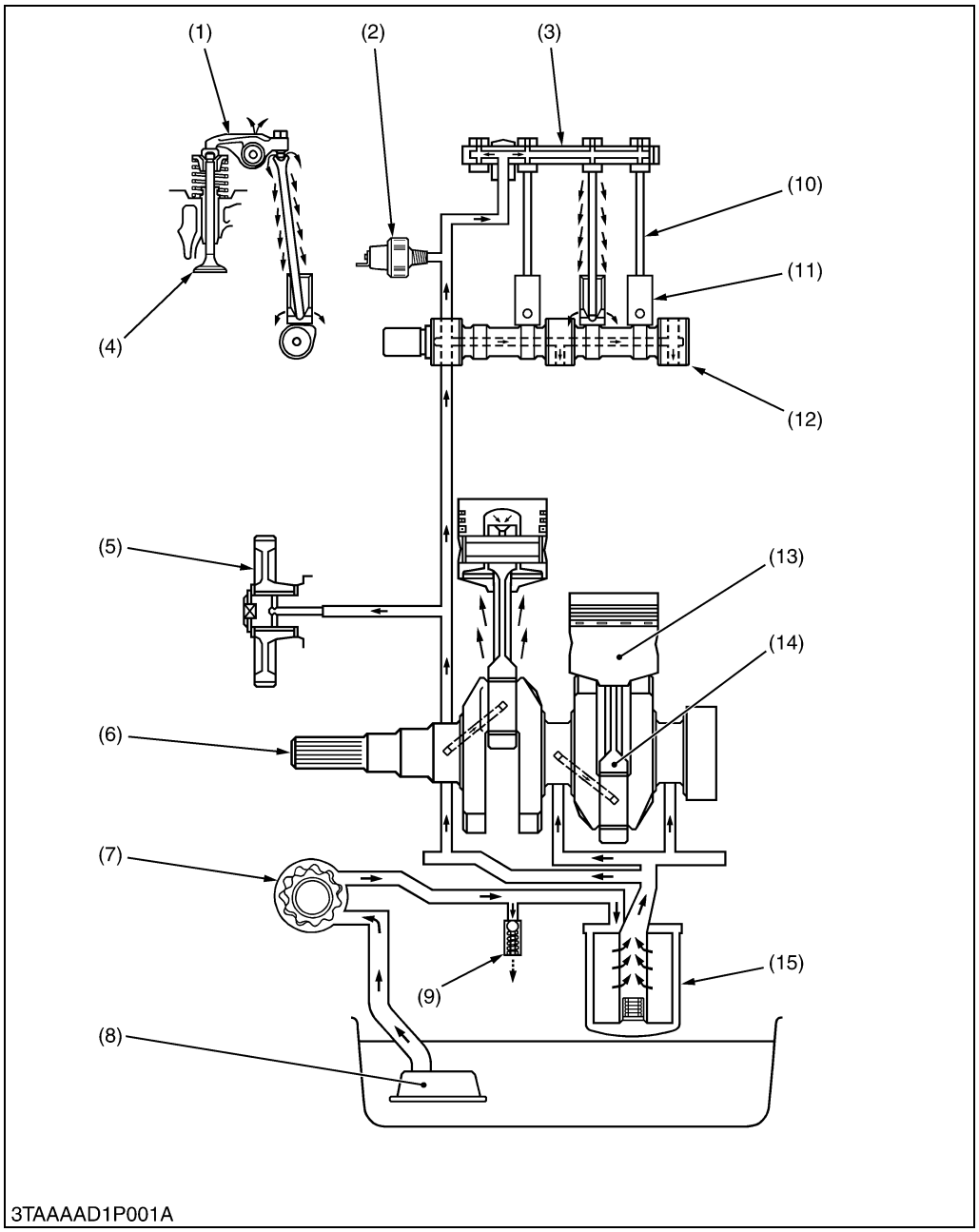

Closed breather system has been adopted to prevent the release of blowby gas into the atmosphere.

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

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

W1012956

# 2. LUBRICATING SYSTEM




3TAAAAD1P001A

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

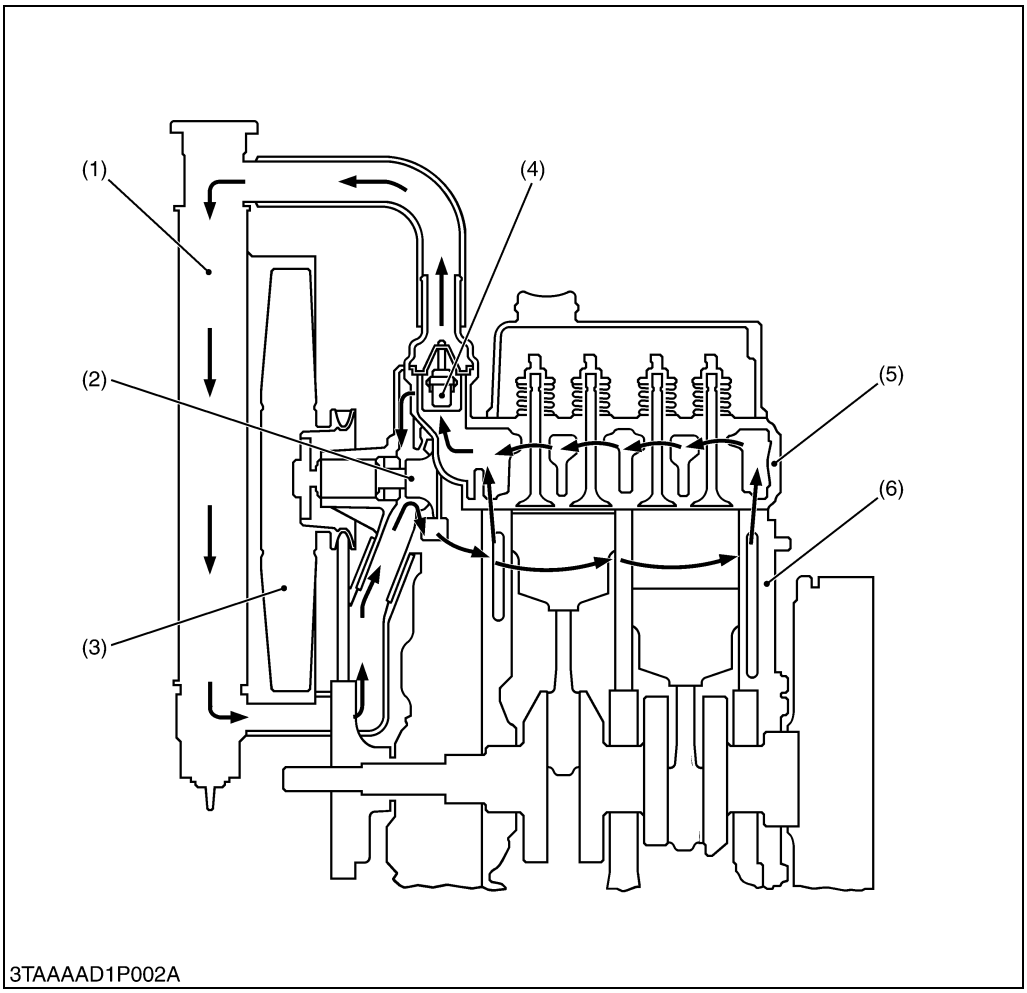
W1014160

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

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

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

# 3. COOLING SYSTEM




3TAAAAD1P002A

(1) Radiator
(2) Water Pump
(3) Cooling Fan
(4) Thermostat
(5) Cylinder Head
(6) Cylinder Block

The cooling system consists of a radiator (1), a centrifugal water pump (2), a cooling fan (3) and a thermostat (4).

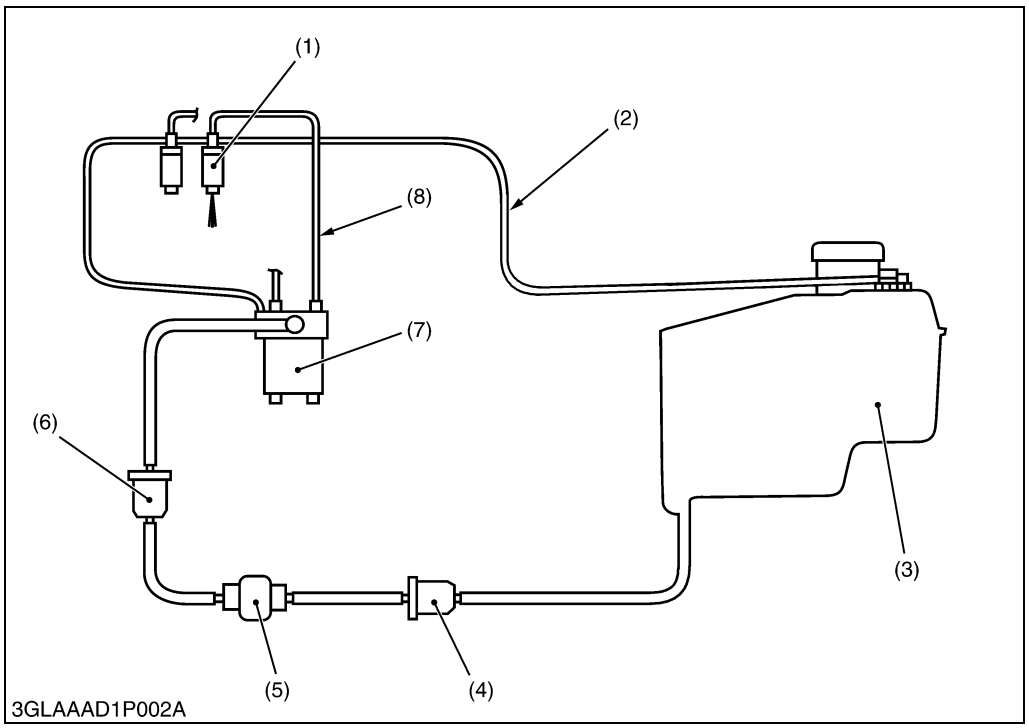
The coolant is cooled through the radiator core, and the cooling fan (3) set behind the radiator (1) pushes cooling air through the radiator core to improve cooling.

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

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

# 4. FUEL SYSTEM

## [1] FUEL LINE




(1) Injection Nozzle
(2) Fuel Overflow Pipe
(3) Fuel Tank
(4) Fuel Filter
(5) Fuel Feed Pump
(6) Fuel Filter
(7) Injection Pump
(8) Injection Pipe

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

The fuel pressurized by the injection pump to the opening pressure (13.73 to 14.71 MPa, 140 to 150 kgf/cm$^2$, 1990 to 2133 psi), of the injection nozzle (1) is injected into the combustion chamber.

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

# SERVICING

## CONTENTS

# 1. TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Engine Does Not Start** | No fuel | Replenish fuel | G-8 |
| | Air in the fuel system | Bleed | G-37 |
| | Water in the fuel system | Change fuel and repair or replace fuel system | G-27, 34 |
| | Fuel pipe clogged | Clean | G-27 |
| | Fuel filter clogged | Change | G-27, 31 |
| | Excessively high viscosity of fuel or engine oil at low temperature | Use specified fuel or engine oil | G-8 |
| | Fuel with low cetane number | Use specified fuel | G-8 |
| | Fuel leak due to loose injection pipe retaining nut | Tighten retaining nut | 1-S21 |
| | Incorrect injection timing | Adjust | 1-S15 |
| | Fuel camshaft worn | Replace | – |
| | Injection nozzle clogged | Repair or replace | 1-S34 |
| | Injection pump malfunctioning | Replace | 1-S24 |
| | Seizure of crankshaft, camshaft, piston, cylinder or bearing | Repair or replace | – |
| | Compression leak from cylinder | Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder | 1-S22, 23 |
| | Improper valve timing | Correct or replace timing gear | 1-S26 |
| | Piston ring and cylinder worn | Replace | 1-S44, 50 |
| | Excessive valve clearance | Adjust | 1-S12 |
| (**Starter Does Not Run**) | Battery discharged | Charge | G-24 |
| | Starter malfunctioning | Repair or replace | 6-S20 |
| | Main switch malfunctioning | Replace | 6-S8, 9 |
| | Safety switches malfunctioning | Replace | 6-S12 |
| | Wiring disconnected | Connect | – |

W1014322

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Engine Revolution Is Not Smooth** | Fuel filter clogged or dirty | Replace | G-27, 31 |
| | Air cleaner clogged | Clean or replace | G-20 |
| | Fuel leak due to loose injection pipe retaining nut | Tighten retaining nut | 1-S21 |
| | Injection pump malfunctioning | Replace | 1-S27 |
| | Incorrect nozzle injection pressure | Adjust | 1-S17 |
| | Injection nozzle stuck or clogged | Repair or replace | 1-S34 |
| | Governor malfunctioning | Repair | – |
| **Either White or Blue Exhaust Gas Is Observed** | Excessive engine oil | Reduce to specified level | G-8, 14 |
| | Piston ring and cylinder worn or stuck | Repair or replace | 1-S44, 50 |
| | Incorrect injection timing | Adjust | 1-S15 |
| | Deficient compression | Adjust top clearance | 1-S11 |
| **Either Black or Dark Gray Exhaust Gas Is Observed** | Overload | Reduce the load | – |
| | Low grade fuel used | Use specified fuel | G-8 |
| | Fuel filter clogged | Replace | G-31 |
| | Air cleaner clogged | Clean or replace | G-20 |
| | Deficient nozzle injection | Repair or replace nozzle | 1-S34 |
| **Deficient Output** | Incorrect injection timing | Adjust | 1-S15 |
| | Engine’s moving parts seem to be seizing | Repair or replace | – |
| | Uneven fuel injection | Replace injection pump | 1-S24 |
| | Deficient nozzle injection | Repair or replace nozzle | 1-S34 |
| | Compression leak | Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder | 1-S22, 23 |
| **Excessive Lubricant Oil Consumption** | Piston ring’s gap facing the same direction | Shift ring gap direction | 1-S29 |
| | Oil ring worn or stuck | Replace | 1-S30, 44 |
| | Piston ring groove worn | Replace piston | 1-S30, 44 |
| | Valve stem and valve guide worn | Replace | 1-S23, 36 |
| | Oil leaking due to defective seals or packing | Replace | – |
| **Fuel Mixed into Lubricant Oil** | Injection pump’s plunger worn | Replace injection pump | 1-S24 |
| | Deficient nozzle injection | Repair or replace nozzle | 1-S34 |
| | Injection pump broken | Replace | 1-S24 |

W1014322

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Water Mixed into Lubricant Oil** | Head gasket defective | Replace | 1-S23 |
| | Cylinder block or cylinder head flawed | Replace | – |
| **Low Oil Pressure** | Engine oil insufficient | Replenish | G-8, 14 |
| | Oil strainer clogged | Clean | – |
| | Oil filter clogged | Replace | G-28 |
| | 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-S46 |
| | Excessive oil clearance of rocker arm | Replace | 1-S39 |
| | Oil passage clogged | Clean | – |
| | Different type of oil | Use specified type of oil | G-8 |
| | Oil pump defective | Repair or replace | 1-S27 |
| **High Oil Pressure** | Different type of oil | Use specified type of oil | G-8 |
| | Relief valve defective | Replace | – |
| **Engine Overheated** | Engine oil insufficient | Replenish | G-8 |
| | Fan belt broken or tensioned improperly | Replace or adjust | G-28, 1-S13 |
| | Coolant insufficient | Replenish | G-8 |
| | Radiator net and radiator fin clogged with dust | Clean | – |
| | Inside of radiator corroded | Clean or replace | G-32, 1-S21 |
| | Coolant flow route corroded | Clean or replace | G-32 |
| | Radiator cap defective | Replace | 1-S14 |
| | Radiator hose damaged | Replace | G-30 |
| | Overload running | Reduce the load | – |
| | Head gasket defective | Replace | 1-S23 |
| | Incorrect injection timing | Adjust | 1-S15 |
| | Unsuitable fuel used | Use specified fuel | G-8 |

W1014322

# 2. SERVICING SPECIFICATIONS

**ENGINE BODY**

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Compression Pressure | – | 2.84 to 3.24 MPa<br>29.0 to 33.0 kgf/cm$^2$<br>412 to 469 psi | 2.26 MPa<br>23.0 kgf/cm$^2$<br>327 psi |
| | Variance Among Cylinder | – | 10 % or less |
| Top Clearance | | 0.50 to 0.70 mm<br>0.0197 to 0.0276 in. | – |
| Valve Clearance (Cold) | | 0.145 to 0.185 mm<br>0.00571 to 0.00728 in. | – |
| Cylinder Head Surface | Flatness | – | 0.05 mm<br>0.0020 in. |
| Valve Recessing (Intake and Exhaust) | | –0.10 to 0.10 mm<br>–0.0039 to 0.0039 in. | 0.30 mm<br>0.0118 in. |
| Valve Stem to Valve Guide | Clearance | 0.030 to 0.057 mm<br>0.00118 to 0.00224 in. | 0.10 mm<br>0.0039 in. |
| | Valve Stem (O.D.) | 5.968 to 5.980 mm<br>0.23496 to 0.23543 in. | – |
| | Valve Guide (I.D.) | 6.010 to 6.025 mm<br>0.23661 to 0.23720 in. | – |
| Valve Seat | Width | 2.12 mm<br>0.0835 in. | – |
| | Angle | 0.785 rad<br>45 ° | – |
| Valve Face | Angle | 0.785 rad<br>45 ° | – |
| Valve Spring | Free Length | 31.3 to 31.8 mm<br>1.232 to 1.252 in. | 28.4 mm<br>1.118 in. |
| | Tilt | – | 1.2 mm<br>0.047 in. |
| | Setting Load | 64.7 N<br>6.6 kgf<br>14.6 lbs | 54.9 N<br>5.6 kgf<br>12.3 lbs |
| | Setting Length | 27.0 mm<br>1.063 in. | – |
| Rocker Arm to Rocker Arm Shaft | Oil Clearance | 0.016 to 0.045 mm<br>0.00063 to 0.00177 in. | 0.15 mm<br>0.0059 in. |
| | Rocker Arm Shaft (O.D.) | 10.473 to 10.484 mm<br>0.41232 to 0.41276 in. | – |
| | Rocker Arm (I.D.) | 10.500 to 10.518 mm<br>0.41339 to 0.41410 in. | – |
| Push Rod | Alignment | – | 0.25 mm<br>0.0098 in. |

W10138740

**ENGINE BODY (Continued)**

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Tappet to Tappet Guide | Oil Clearance | 0.016 to 0.052 mm<br>0.00063 to 0.00205 in. | 0.10 mm<br>0.0039 in. |
| | Tappet (O.D.) | 17.966 to 17.984 mm<br>0.70732 to 0.70803 in. | – |
| | Tappet Guide Bore (I.D.) | 18.000 to 18.018 mm<br>0.70866 to 0.70937 in. | – |
| Timing Gear | Idle Gear to Crank Gear (Backlash) | 0.043 to 0.124 mm<br>0.00169 to 0.00488 in. | 0.15 mm<br>0.0059 in. |
| | Idle Gear to Cam Gear (Backlash) | 0.047 to 0.123 mm<br>0.00185 to 0.00484 in. | 0.15 mm<br>0.0059 in. |
| | Idle Gear to Injection Pump Gear (Backlash) | 0.046 to 0.124 mm<br>0.00181 to 0.00488 in. | 0.15 mm<br>0.0059 in. |
| | Oil Pump Drive Gear to Crank Gear (Backlash) | 0.041 to 0.123 mm<br>0.00161 to 0.00484 in. | 0.15 mm<br>0.0059 in. |
| Idle Gear | Side Clearance | 0.20 to 0.51 mm<br>0.0079 to 0.0201 in. | 0.80 mm<br>0.0315 in. |
| Camshaft | Side Clearance | 0.15 to 0.31 mm<br>0.0059 to 0.0122 in. | 0.50 mm<br>0.0197 in. |
| | Alignment | – | 0.01 mm<br>0.0004 in. |
| | Cam Height (Intake and Exhaust) | 26.88 mm<br>1.0583 in. | 26.83 mm<br>1.0563 in. |
| Camshaft Journal to Cylinder Block Bore | Oil Clearance | 0.050 to 0.091 mm<br>0.00197 to 0.00358 in. | 0.15 mm<br>0.0059 in. |
| | Camshaft Journal (O.D.) | 32.934 to 32.950 mm<br>1.29661 to 1.29724 in. | – |
| | Cylinder Block Bore (I.D.) | 33.000 to 33.025 mm<br>1.29921 to 1.30020 in. | – |
| Idle Gear Shaft to Idle Gear Bushing | Oil Clearance | 0.020 to 0.084 mm<br>0.00079 to 0.00331 in. | 0.10 mm<br>0.0039 in. |
| | Idle Gear Shaft (O.D.) | 19.967 to 19.980 mm<br>0.78610 to 0.78661 in. | – |
| | Idle Gear Bushing (I.D.) | 20.000 to 20.051 mm<br>0.78740 to 0.78941 in. | – |
| Piston Pin Bore | I.D. | 20.000 to 20.013 mm<br>0.78740 to 0.78791 in. | 20.05 mm<br>0.7894 in. |

W1013874

**ENGINE BODY (Continued)**

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Piston Pin to Small End Bushing | Oil Clearance | 0.014 to 0.038 mm<br>0.00055 to 0.00150 in. | 0.10 mm<br>0.0039 in. |
| | Piston Pin (O.D.) | 20.002 to 20.011 mm<br>0.78748 to 0.78783 in. | – |
| | Small End Bushing (I.D.) | 20.025 to 20.040 mm<br>0.78839 to 0.78897 in. | – |
| Piston Pin to Small End Bushing (Spare Parts) | Oil Clearance | 0.015 to 0.075 mm<br>0.00059 to 0.00295 in. | 0.15 mm<br>0.0059 in. |
| | Small End Bushing (I.D.) | 20.026 to 20.077 mm<br>0.78845 to 0.79043 in. | – |
| Piston Ring Gap | Top Ring | 0.15 to 0.30 mm<br>0.0059 to 0.0118 in. | 1.20 mm<br>0.0472 in. |
| | Second Ring | 0.25 to 0.40 mm<br>0.0118 to 0.0157 in. | 1.20 mm<br>0.0472 in. |
| | Oil Ring | 0.15 to 0.30 mm<br>0.0059 to 0.0118 in. | 1.20 mm<br>0.0472 in. |
| Piston Ring to Piston Ring Groove | Second Ring (Clearance) | 0.085 to 0.115 mm<br>0.00335 to 0.00453 in. | 0.15 mm<br>0.0059 in. |
| | Oil Ring (Clearance) | 0.02 to 0.06 mm<br>0.0008 to 0.0024 in. | 0.15 mm<br>0.0059 in. |
| Connecting Rod | Alignment | – | 0.05 mm<br>0.0020 in. |
| Crankshaft | Side Clearance | 0.15 to 0.31 mm<br>0.0059 to 0.0122 in. | 0.50 mm<br>0.0197 in. |
| | Alignment | – | 0.02 mm<br>0.0008 in. |
| Crankpin to Crankpin Bearing | Oil Clearance | 0.020 to 0.051 mm<br>0.00079 to 0.00201 in. | 0.15 mm<br>0.0059 in. |
| | Crankpin (O.D.) | 33.959 to 33.975 mm<br>1.33697 to 1.33760 in. | – |
| | Crankpin Bearing (I.D.) | 33.995 to 34.010 mm<br>1.33839 to 1.33898 in. | – |
| Crankshaft Journal to Crankshaft Bearing 1 | Oil Clearance | 0.034 to 0.106 mm<br>0.00134 to 0.00417 in. | 0.20 mm<br>0.0079 in. |
| | Crankshaft Journal (O.D.) | 39.934 to 39.950 mm<br>1.57221 to 1.57284 in. | – |
| | Crankshaft Bearing 1 (I.D.) | 39.984 to 40.040 mm<br>1.57417 to 1.57638 in. | – |
| Crankshaft Journal to Crankshaft Bearing 2 (Flywheel Side) | Oil Clearance | 0.028 to 0.051 mm<br>0.00110 to 0.00201 in. | 0.20 mm<br>0.0079 in. |
| | Crankshaft Journal (O.D.) | 43.934 to 43.950 mm<br>1.72968 to 1.73031 in. | – |
| | Crankshaft Bearing 2 (I.D.) | 43.984 to 44.026 mm<br>1.73165 to 1.73331 in. | – |

W10138740

**ENGINE BODY (Continued)**

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Crankshaft Journal to Crankshaft Bearing 3 (Intermediate) | Oil Clearance | 0.028 to 0.051 mm<br>0.00110 to 0.00201 in. | 0.20 mm<br>0.0079 in. |
| | Crankshaft Journal (O.D.) | 39.934 to 39.950 mm<br>1.57221 to 1.57284 in. | – |
| | Crankshaft Bearing 3 (I.D.) | 39.984 to 40.026 mm<br>1.57417 to 1.57583 in. | – |
| Cylinder Liner | I.D. | 67.000 to 67.019 mm<br>2.63779 to 2.63854 in. | 67.169 mm<br>2.6445 in. |
| Cylinder Liner (Oversize) | I.D. | 67.250 to 67.269 mm<br>2.64764 to 2.64839 in. | 67.419 mm<br>2.65429 in. |

W10138740

**LUBRICATING SYSTEM**

| | | | |
|---|---|---|---|
| Engine Oil Pressure | At Idle Speed | More than 49 kPa<br>0.5 kgf/cm$^2$<br>7 psi | – |
| | At Rated Speed | 196 to 441 kPa<br>2.0 to 4.5 kgf/cm$^2$<br>28 to 64 psi | 147 kPa<br>1.5 kgf/cm$^2$<br>21 psi |
| Oil Pump | Inter Rotor to Outer Rotor (Clearance) | 0.03 to 0.14 mm<br>0.0012 to 0.0055 in. | – |
| | Outer Rotor to Pump Body (O.D.) | 0.07 to 0.15 mm<br>0.0028 to 0.0059 in. | – |
| | Inter Rotor to Cover (I.D.) | 0.075 to 0.135 mm<br>0.00295 to 0.00531 in. | – |

W10139730

**COOLING SYSTEM**

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Fan Belt | Tension | 7 to 9 mm / 98 N<br>0.28 to 0.35 in. / 98 N<br>(10 kgf, 22 lbs) | – |
| Thermostat | Valve Opening Temperature (At Beginning) | 80.5 to 83.5 °C<br>176.9 to 182.3 °F | – |
| | Valve Opening Temperature (Opened Completely) | 95 °C<br>203 °F | – |
| Radiator Cap | Pressure Falling Time | 10 seconds or more<br>88 → 59 kPa<br>0.9 → 0.6 kgf/cm$^2$<br>13 → 9 psi | – |
| Radiator | Water Leakage Test Pressure | No leak at specified pressure<br>157 kPa<br>1.6 kgf/cm$^2$<br>23 psi | – |

W10135990

**FUEL SYSTEM**

| | | | |
|---|---|---|---|
| Injection Pump | Injection Timing | 0.31 to 0.33 rad<br>(18 to 20 °)<br>before T.D.C. | – |
| Pump Element | Fuel Tightness | – | 13.7 MPa<br>140 kgf/cm$^2$<br>1991 psi |
| Delivery Valve | Fuel Tightness | 10 seconds<br>13.73 → 12.75 MPa<br>140 → 130 kgf/cm$^2$<br>1991 → 1849 psi | 5 seconds<br>13.73 → 12.75 MPa<br>140 → 130 kgf/cm$^2$<br>1991 → 1849 psi |
| Fuel Injection Nozzle | Injection Pressure | 13.73 to 14.71 MPa<br>140 to 150 kgf/cm$^2$<br>1991 to 2134 psi | – |
| | Valve Seat Tightness | When the pressure is 12.75 MPa (130 kgf/cm$^2$, 1849 psi), the valve seat must be fuel tightness. | – |

W10139730

# 3. TIGHTENING TORQUES

Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts : See page G-9.)

| Item | Size x Pitch | N·m | kgf·m | ft-lbs |
|---|---|---|---|---|
| Front coupling mounting screw | M8 x 1.25 | 23.5 to 27.4 | 2.4 to 2.8 | 17.4 to 20.3 |
| Engine mounting nut | M8 x 1.25 | 23.5 | 2.4 | 17.4 |
| Air cleaner stay screw | M8 x 1.25 | 23.5 to 27.4 | 2.4 to 2.8 | 17.4 to 20.3 |
| Engine support screw | M10 x 1.25 | 48.1 to 55.9 | 4.9 to 5.7 | 35.4 to 41.2 |
| *Cylinder head cover screw | M6 x 1.0 | 6.86 to 11.3 | 0.7 to 1.15 | 5.1 to 8.3 |
| Injection pipe retaining nut | M12 x 1.5 | 24.5 to 34.3 | 2.5 to 3.5 | 18.1 to 25.3 |
| Overflow pipe retaining nut | M12 x 1.5 | 19.6 to 24.5 | 2.0 to 2.5 | 14.5 to 18.1 |
| Nozzle holder assembly | M20 x 1.5 | 49.0 to 68.6 | 5.0 to 7.0 | 36.2 to 50.6 |
| Glow plug | M8 x 1.0 | 7.85 to 14.7 | 0.8 to 1.5 | 5.8 to 10.8 |
| *Rocker arm bracket screw | M6 x 1.0 | 9.8 to 11.3 | 1.00 to 1.15 | 7.2 to 8.3 |
| *Cylinder head screw | M8 x 1.25 | 37.3 to 42.2 | 3.8 to 4.3 | 27.5 to 31.1 |
| *Fan drive pulley screw | M12 x 1.5 | 98.0 to 107.8 | 10.0 to 11.0 | 72.3 to 79.5 |
| *Idle gear shaft mounting screw | M6 x 1.0 | 9.8 to 11.3 | 1.00 to 1.15 | 7.2 to 8.3 |
| *Connecting rod screw | M7 x 0.75 | 26.5 to 30.4 | 2.7 to 3.1 | 19.5 to 22.4 |
| *Flywheel screw | M10 x 1.25 | 53.9 to 58.8 | 5.5 to 6.0 | 39.8 to 43.4 |
| Bearing case cover mounting screw | M6 x 1.0 | 9.8 to 11.3 | 1.00 to 1.15 | 7.2 to 8.3 |
| *Main bearing case screw 2 | M7 x 1.0 | 26.5 to 30.4 | 2.7 to 3.1 | 19.5 to 22.4 |
| *Main bearing case screw 1 | M6 x 1.0 | 12.7 to 15.7 | 1.3 to 1.6 | 9.4 to 11.6 |
| Nozzle holder | | 34.3 to 39.2 | 3.5 to 4.0 | 25.3 to 28.9 |
| Oil pressure switch | PT1/8 | 14.7 to 19.6 | 1.5 to 2.0 | 10.8 to 14.5 |

■ **NOTE**

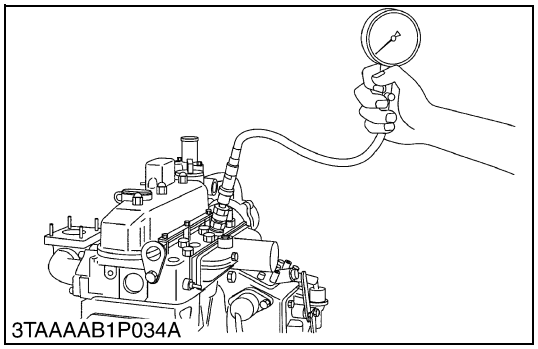
- **In removing and applying the screws and nuts marked with "*", a pneumatic wrench or similar pneumatic tool, if employed, must be used with enough care not to get them seized.**
- **For "*" marked screws and nuts on the table, apply engine oil to their threads and seats before tightening.**
- **The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

W1013236

# 4. CHECKING, DISASSEMBLING AND SERVICING

## [1] CHECKING AND ADJUSTING

### (1) Engine Body




**Compression Pressure**

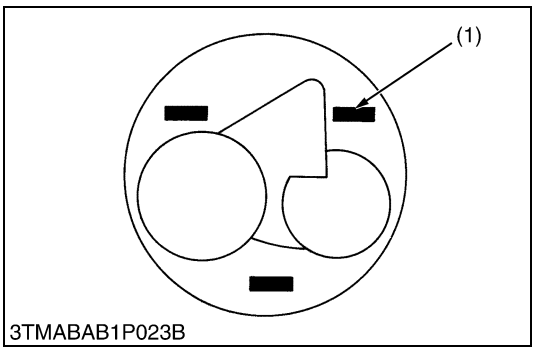
1. Run the engine until it is warmed up.
2. Stop the engine.
3. Disconnect the **2P** connector from the fuel pump.
4. Remove the air cleaner, the muffler and all injection nozzles.
5. Disconnect the accelerator wire.
6. Engage the parking brake.
7. Set a compression tester (Code No. 07909-30208) with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

■ **NOTE**

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

| | | |
|---|---|---|
| Compression pressure | Factory spec. | 2.84 to 3.24 MPa<br>29.0 to 33.0 kgf/cm$^2$<br>412 to 469 psi |
| | Allowable limit | 2.26 MPa<br>23.0 kgf/cm$^2$<br>327 psi |

W1014028



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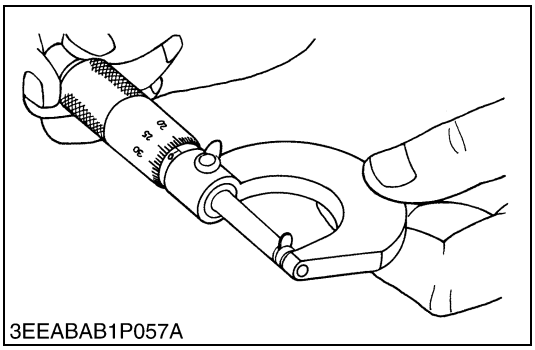
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**Top Clearance**

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 its 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**

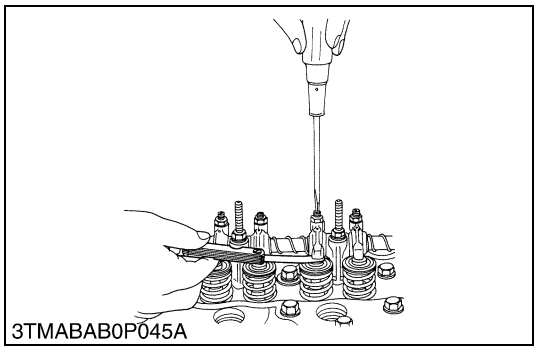
- **After checking the top clearance, be sure to assemble the cylinder head with a new cylinder head gasket.**

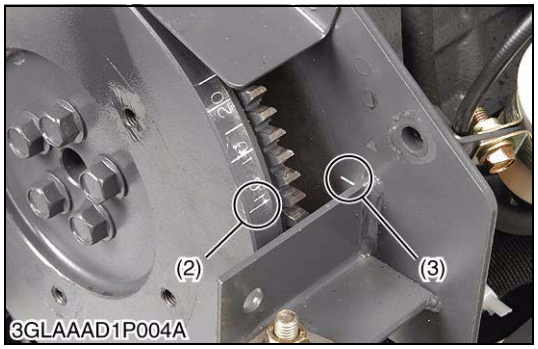
| | | |
|---|---|---|
| Top clearance | Factory spec. | 0.50 to 0.70 mm<br>0.0197 to 0.0276 in. |

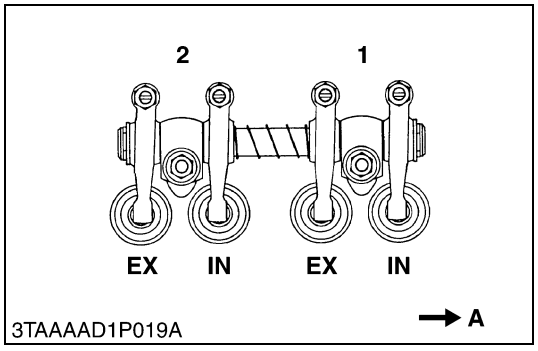
| | | |
|---|---|---|
| Tightening torque | Cylinder head screw | 37.3 to 42.2 N·m<br>3.8 to 4.3 kgf·m<br>27.5 to 31.1 ft-lbs |

(1) Fuse

W1017814


## Valve Clearance

■ **IMPORTANT**

- **The valve clearance must be checked and adjusted when engine is cold.**

1. Remove the cylinder head cover (1) and the glow plugs.
2. Align the **"1TC"** mark (2) on the flywheel and alignment mark (3) on the rear end plate so that the No. 1 piston comes to the compression top dead center.
3. Check the following valve clearance marked with "★" using a thickness gauge.

**[When No.1 piston is at the compression top dead center position]**

| Cylinder No. | No.1 | No.2 |
|---|---|---|
| Intake valve | ★ | |
| Exhaust valve | ★ | ★ |

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 (2) on the flywheel and alignment mark (3) on the rear end plate so that the No. 1 piston comes to the overlap position.
6. Check the following valve clearance marked with "☆" using a thickness gauge.

**[When No.1 piston is at the overlap position]**

| Cylinder No. | No.1 | No.2 |
|---|---|---|
| Intake valve | | ☆ |
| Exhaust valve | | |

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

| | | |
|---|---|---|
| Intake and exhaust valve clearance (Cold) | Factory spec. | 0.145 to 0.185 mm<br>0.00571 to 0.00728 in. |

■ **NOTE**

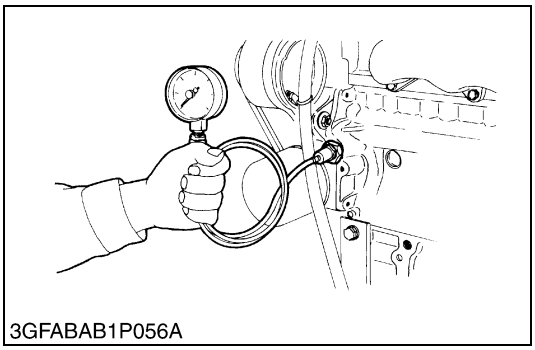
- **The sequence of cylinder numbers is given as No. 1 and No. 2 starting from the gear case side.**
- **After adjusting the valve clearance, secure the adjusting screw with the lock nut.**

(1) Cylinder Head Cover
(2) **"1TC"** Mark
(3) Alignment Mark

**A : Gear Case Side**

W10172470

## (2) Lubricating System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**Engine Oil Pressure**

1. Remove the engine oil pressure switch, and set an oil pressure tester (Code No.: 07916-32032).
2. Start the engine. After warming up, measure the oil pressure of both idling and rated speeds.
3. If the oil pressure is less than the allowable limit, check the following.

- Engine oil insufficient
- Oil pump defective
- Oil strainer clogged
- Oil filter cartridge clogged
- Oil gallery clogged
- Excessive oil clearance
- Foreign matter in the relief valve

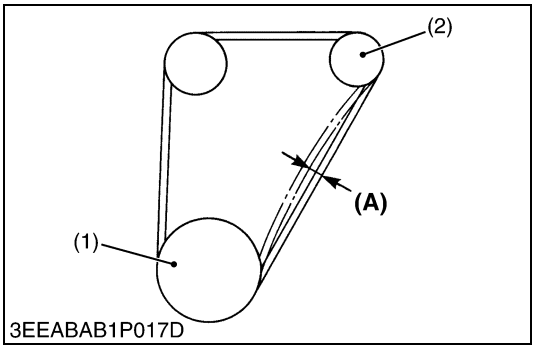
| | | | |
|---|---|---|---|
| Engine oil pressure | At idle speed | Factory spec. | More than 49 kPa<br>0.5 kgf/cm$^2$<br>7 psi |
| | At rated speed | Factory spec. | 196 to 441 kPa<br>2.0 to 4.5 kgf/cm$^2$<br>28 to 64 psi |
| | | Allowable limit | 147 kPa<br>1.5 kgf/cm$^2$<br>21 psi |

**(When reassembling)**

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

W10349520

## (3) Cooling System



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**Checking Fan Drive Belt Tension**

**CAUTION**

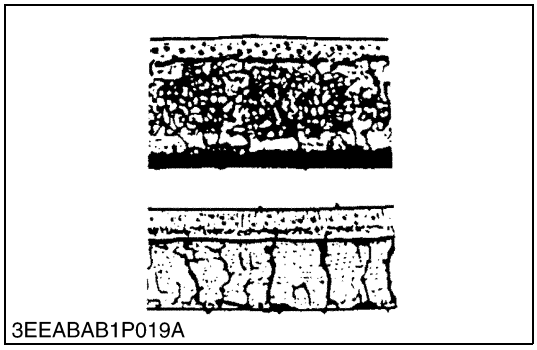
- **Be sure to stop the engine and remove the key before checking belt tension.**

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

| | | |
|---|---|---|
| Deflection **(A)** | Factory spec. | 7.0 to 9.0 mm<br>0.28 to 0.35 in. |

(1) Fan Drive Pulley (2) Dynamo pulley

W10356670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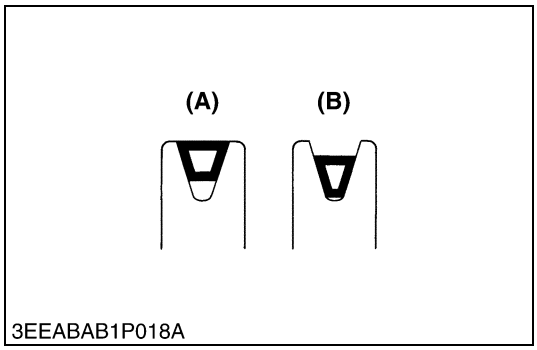
**Fan Belt Damage and Wear**

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**

W1016443



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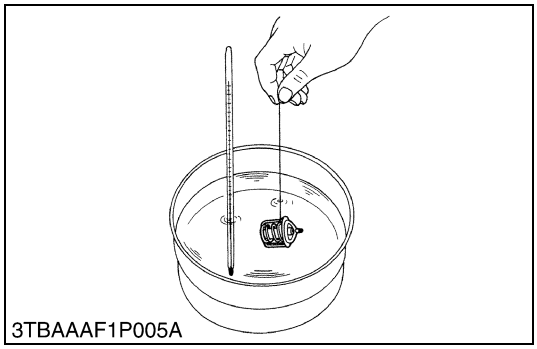
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**Thermostat Valve Opening Temperature**

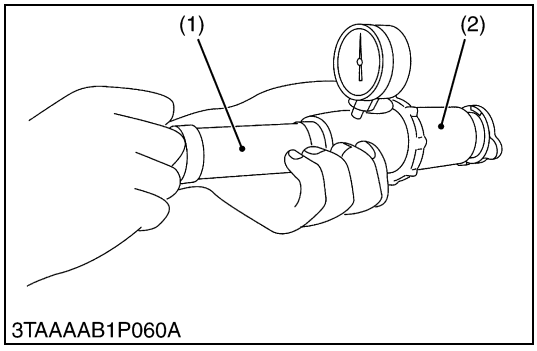
1. Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
2. Heating the water gradually, read the temperature when the valve opens and leaves the string.
3. Continue heating and read the temperature when the valve opens approx. 6 mm (0.236 in.).
4. If the measurement is not within the factory specifications, replace the thermostat.

| | | |
|---|---|---|
| Thermostat's valve opening temperature | Factory spec. | 80.5 to 83.5 °C<br>176.9 to 182.3 °F |
| Temperature at which thermostat completely opens | Factory spec. | 95 °C<br>203 °F |

W1034560

**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.**



3TAAAAB1P060A

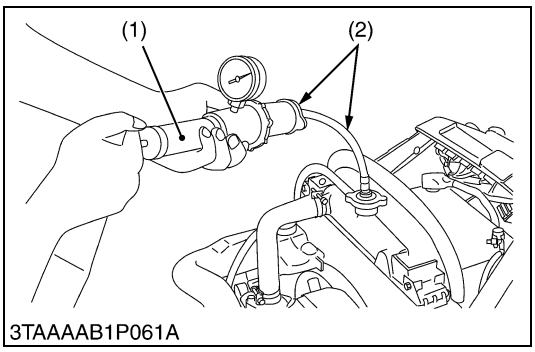
**Radiator Cap Air Leakage**

1. Set a radiator tester (1) and an adaptor (2) (BANZAI Code No.:RCT-2A-30S) on the radiator cap.
2. Apply the specified pressure (88 kPa, 0.9 kgf/cm$^2$, 13 psi), and measure the time for the pressure to fall to 59 kPa (0.6 kgf/cm$^2$, 9 psi).
3. If the measurement is less than the factory specification, replace the radiator cap.

| | | |
|---|---|---|
| Pressure falling time | Factory spec. | More than 10 seconds for pressure fall from 88 to 59 kPa (from 0.9 to 0.6 kgf/cm$^2$, from 13 to 9 psi) |

(1) Radiator Tester (2) Adaptor

W1054156




**Radiator Water Leakage**

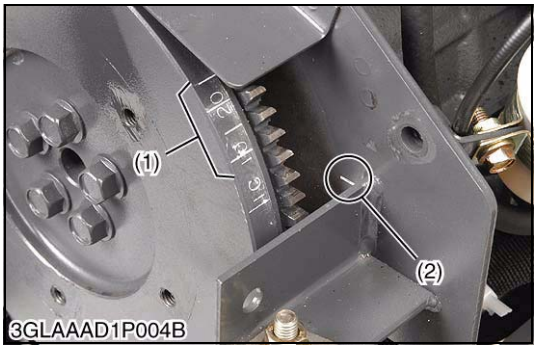
1. Pour a specified amount of water into the radiator.
2. Set a radiator tester (1) (Code No. 07909-31551) and an adapter (2) (BANZAI Code No.:RCT-2A-30S) and raise the water pressure to the specified pressure.
3. Check the radiator for water leaks.
4. For water leak from the pinhole, repair with the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

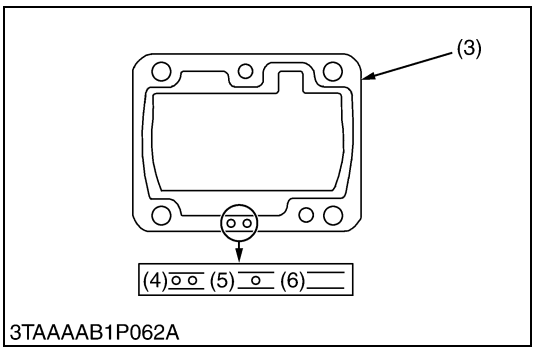
| | | |
|---|---|---|
| Radiator water leakage test pressure | Factory spec. | 157 kPa<br>1.6 kgf/cm$^2$<br>23 psi |

(1) Radiator Tester (2) Adaptor

W1016903

## (4) Fuel System




**Injection Timing**

1. Remove the injection pipes.
2. Remove the engine stop solenoid.
3. Turn the flywheel counterclockwise (facing the flywheel) until fuel flows from the delivery valve holder.
4. Continue to turn the flywheel slowly, and stop it as soon as the fuel level at the tip of the delivery valve holder begins to increase.
5. Check to see if the timing angle lines on the flywheel is aligned with the alignment mark (2).
6. If the injection timing is out of adjustment, readjust the timing with shims.

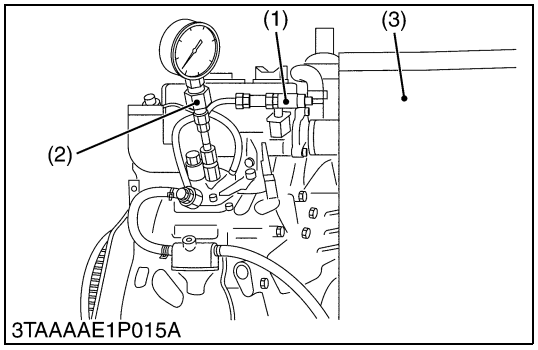
| | | |
|---|---|---|
| Injection timing | Factory spec. | 0.31 to 0.33 rad (18 to 20 °) before T.D.C. |

■ **NOTE**

- **The sealant is applied to both sides of the shims (soft metal gasket shim). 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.) and 0.30 mm (0.0118 in.). Combine these shims for adjustments.**
- **Addition or reduction of shim (0.05 mm, 0.0020 in.) delays or advances the injection timing by approx. 0.0087 rad. (0.5 °).**
- **In disassembling and replacing the injection pump, be sure to use the same number of new shims with the same thickness.**
- **Refer to figure below to check the thickness of the shims.**

(1) Timing Line
(2) Alignment Mark
(3) Shim (Soft Metal Gasket Shim)
(4) Two-holes : 0.20 mm (0.0079 in.)
(5) One-hole : 0.25 mm (0.0098 in.)
(6) Without hole : 0.30 mm (0.0118 in.)

W1018724




## Fuel Tightness of Pump Element

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

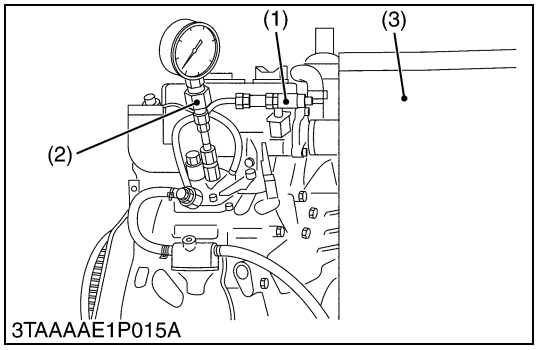
| | | |
|---|---|---|
| Fuel tightness of pump element | Allowable limit | 13.7 MPa<br>140 kgf/cm$^2$<br>1991 psi |

■ **NOTE**

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

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

W1017430




## Fuel Tightness of Delivery Valve

1. Remove the engine stop solenoid.
2. Remove the injection pipes and glow plugs.
3. Set a pressure tester to the fuel injection pump.
4. Install the injection nozzle (1) jetted with the proper injection pressure to the injection pump pressure tester (2).
5. Run the starter to increase the pressure.
6. Stop the starter when the fuel jets from the injection nozzle. After that, turn the flywheel by hand and raise the pressure to approx. 13.73 MPa (140 kgf/cm$^2$, 1991 psi).
7. Now turn the flywheel back about half a turn (to keep the plunger free). Maintain the flywheel at this position and clock the time taken for the pressure to drop from 13.73 to 12.75 MPa (from 140 to 130 kgf/cm$^2$, from 1991 to 1849 psi).
8. Measure the time needed to decrease the pressure from 13.73 to 12.75 MPa (from 140 to 130 kgf/cm$^2$, 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 spec. | 10 seconds<br>13.73 → 12.75 MPa<br>140 → 130 kgf/cm$^2$<br>1991 → 1849 psi |
| | Allowable limit | 5 seconds<br>13.73 → 12.75 MPa<br>140 → 130 kgf/cm$^2$<br>1991 → 1849 psi |

■ **NOTE**

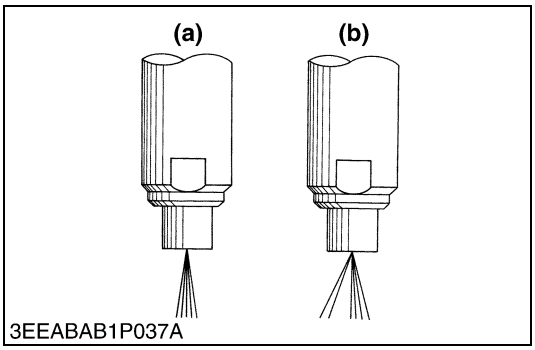
- **Never try to disassemble the injection pump assembly. For repairs, you are strongly requested to contact a Kubota-authorized pump service shop.**

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

W1017786

**CAUTION**

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



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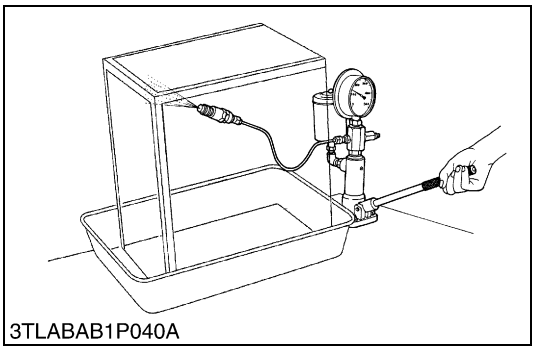
## Nozzle Spraying Condition

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

**(a) Good** **(b) Bad**

W10181310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## Fuel Injection Pressure

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

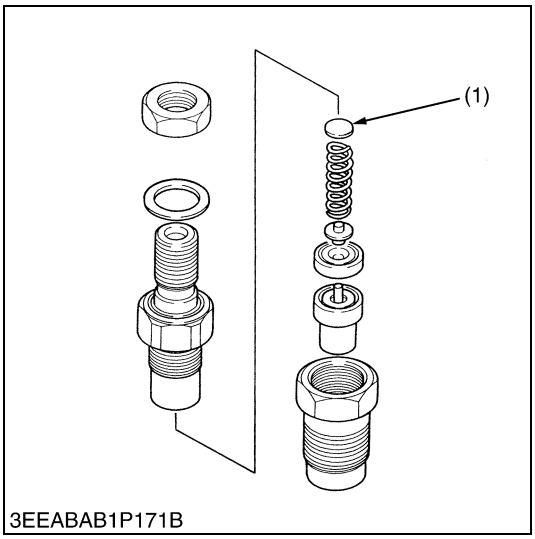
| | | |
|---|---|---|
| Fuel injection pressure | Factory spec. | 13.73 to 14.71 MPa<br>140 to 150 kgf/cm$^2$<br>1991 to 2134 psi |

**(Reference)**

- Pressure variation with 0.01 mm (0.0004 in.) difference of adjusting washer thickness.
  Approx. 235 kPa (2.4 kgf/cm$^2$, 34 psi)

(1) Adjusting Washer

W10182100



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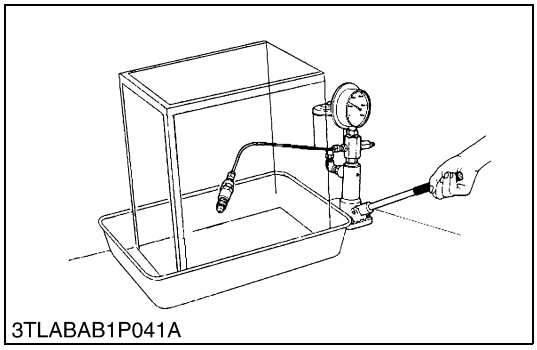
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**Valve Seat Tightness**

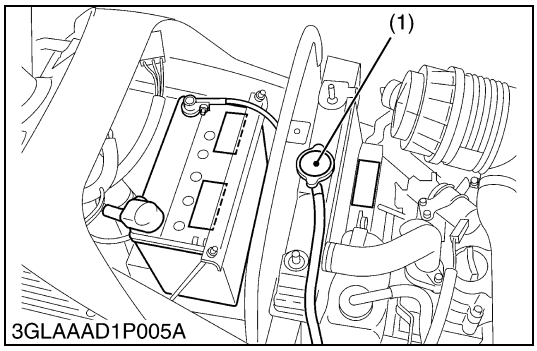
1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361).
2. Raise the fuel pressure, and keep at 12.75 MPa (130 kgf/cm$^2$, 1849 psi) for 10 seconds.
3. If any fuel leak is found, replace the nozzle piece.

| | | |
|---|---|---|
| Valve seat tightness | Factory spec. | No fuel leak at<br>12.75 MPa<br>130 kgf/cm$^2$<br>1849 psi |

W10183690

# [2] PREPARATION

## (1) Separation Engine



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**Draining Coolant**

**CAUTION**

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

1. Open the radiator drain plug (2), and remove radiator cap (1) to completely drain the coolant.
2. After all coolant is drained, close the drain plug (2).

| | | |
|---|---|---|
| Coolant | Capacity (with recovery tank) | 2.15 L<br>2.27 U.S.qts<br>1.89 Imp.qts |

(1) Radiator Cap (2) Drain Plug

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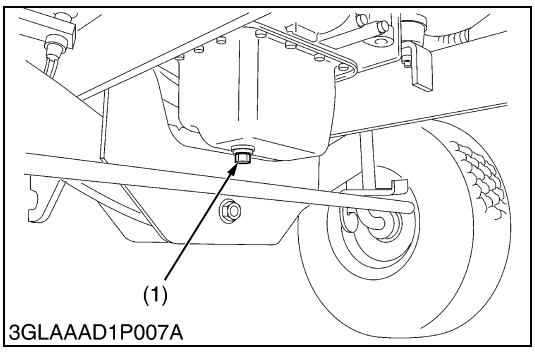
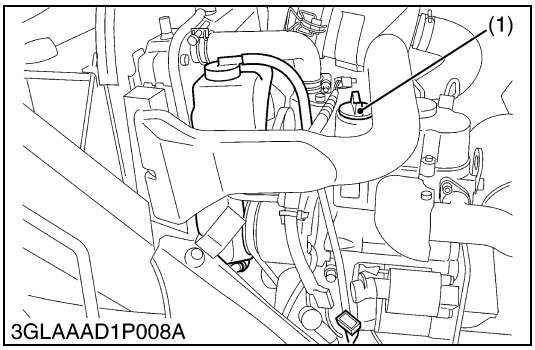
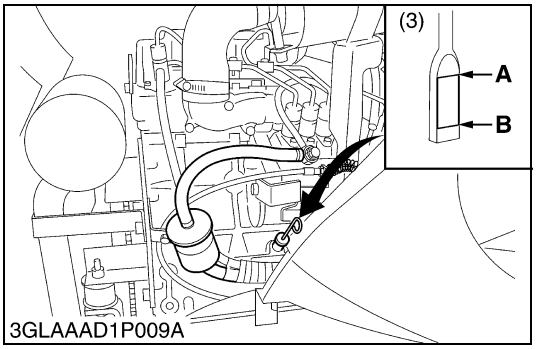
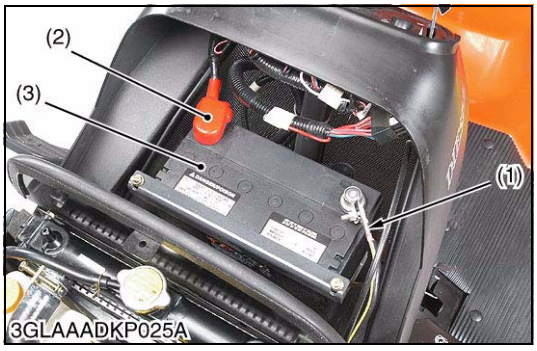
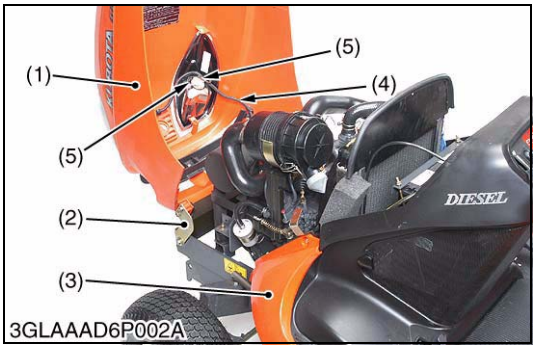



## Draining Engine Oil

1. Start and warm up the engine for approx. 5 minutes.
2. Place an oil pan underneath the engine.
3. Remove the drain plug (1) to drain oil.
4. After draining, screw in the drain plug (1).

**(When refilling)**

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

■ **IMPORTANT**

- **Never mix two different type of oil.**
- **Use the proper SAE Engine Oil according to ambient temperature.**
  **Refer to "LUBRICANT, FUEL AND COOLANT" (See page G-8.)**

| | | |
|---|---|---|
| Engine Oil | Capacity | 1.2 L<br>1.27 U.S.qts<br>1.06 lmp.qts |

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

**A : Upper Level**
**B : Lower Level**

W1042238

## Battery

**CAUTION**

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

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

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

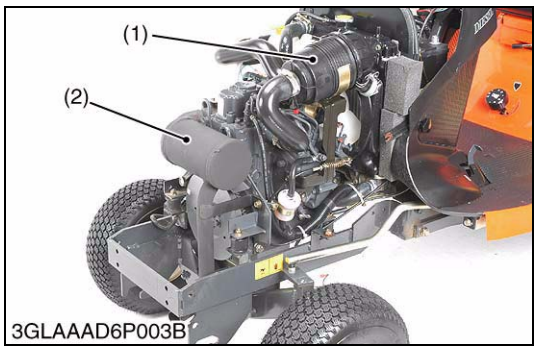
W1042837

## Bonnet and Side Bonnet

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

(1) Bonnet
(2) Bonnet Bracket
(3) Side Bonnet
(4) Wire Harness
(5) Connector

W1043145

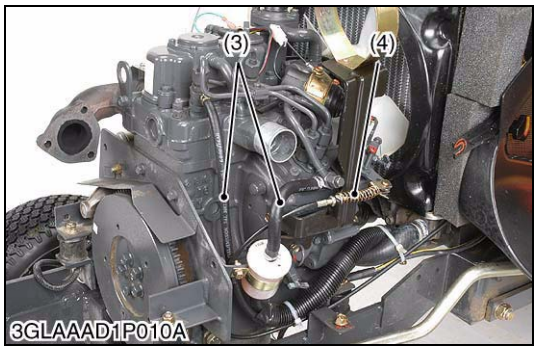


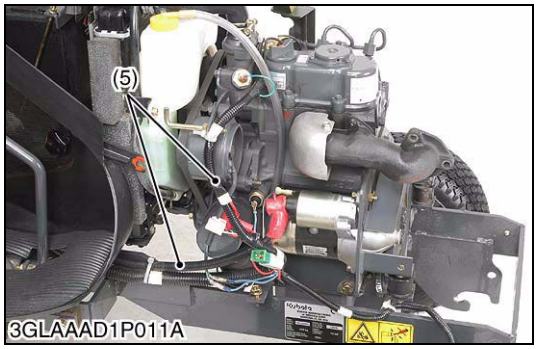

## Air Cleaner, Muffler, Fuel Hose and Wire Harness

1. Remove the air cleaner (1) and muffler (2).
2. Disconnect the fuel hoses (3).
3. Disconnect the accelerator wire (4).
4. Disconnect the wire harness (5).

(1) Air Cleaner
(2) Muffler
(3) Fuel Hose
(4) Accelerator Wire
(5) Wire Harness

W1043365



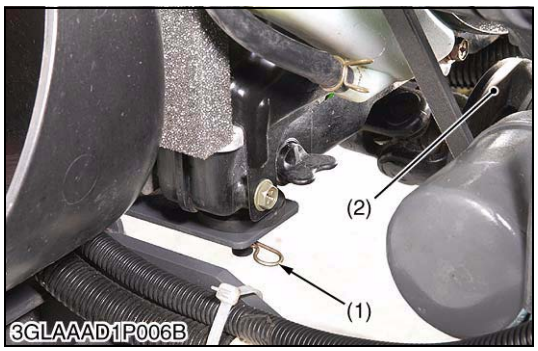




## Engine Assembly

1. Remove the radiator retaining snap pins (1).
2. Disconnect the front coupling (2).
3. Separate the engine assembly (3) with radiator from the frame (4).

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Front coupling mounting screw | 23.5 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.3 ft-lbs |
| | Engine mounting nut | 23.5 N·m<br>2.4 kgf·m<br>17.4 ft-lbs |



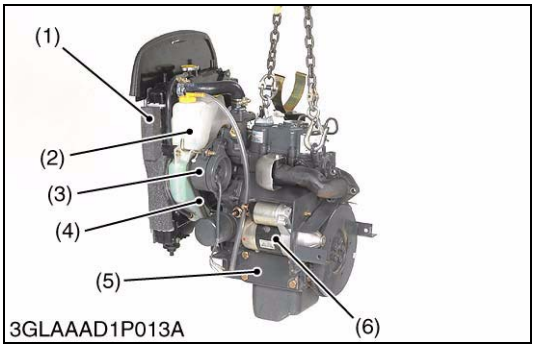


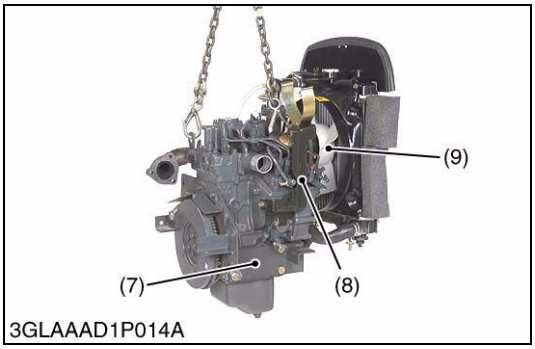
(1) Radiator Retaining Snap Pin
(2) Front Coupling
(3) Engine Assembly
(4) Frame

W1043585

# [3] DISASSEMBLING AND ASSEMBLING

## (1) Cylinder Head and Valves




### Dynamo, Fan Belt and Radiator

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

**(When reassembling)**

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

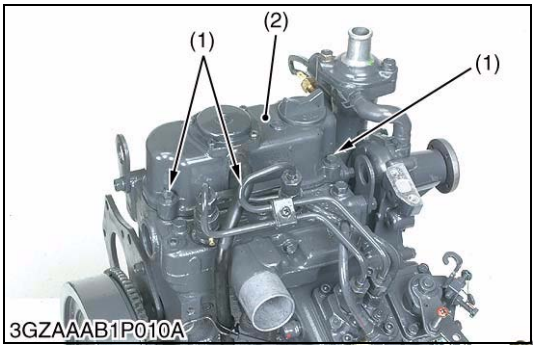
■ **IMPORTANT**

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

| | | |
|---|---|---|
| Tightening torque | Air cleaner stay screw | 23.5 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.3 ft-lbs |
| | Engine support screw | 48.1 to 55.9 N·m<br>4.9 to 5.7 kgf·m<br>35.4 to 41.2 ft-lbs |

(1) Radiator
(2) Recovery Tank
(3) Dynamo
(4) Fan Belt
(5) Engine Support RH
(6) Starter
(7) Engine Support LH
(8) Air cleaner Stay
(9) Cooling Fan

W1044063




### Cylinder Head Cover

1. Remove the head cover screws (1).
2. Remove the cylinder head cover (2).

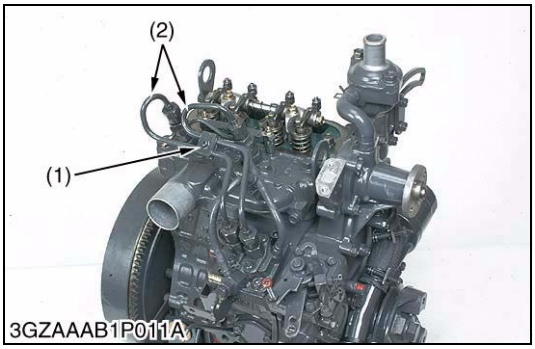
**(When reassembling)**

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

| | | |
|---|---|---|
| Tightening torque | Cylinder head cover screw | 6.86 to 11.3 N·m<br>0.7 to 1.15 kgf·m<br>5.1 to 8.3 ft-lbs |

(1) Head Cover Screws
(2) Cylinder Head Cover

W1044581




### Injection Pipes

1. Loosen the screw on the pipe clamp (1).
2. Detach the injection pipes (2).

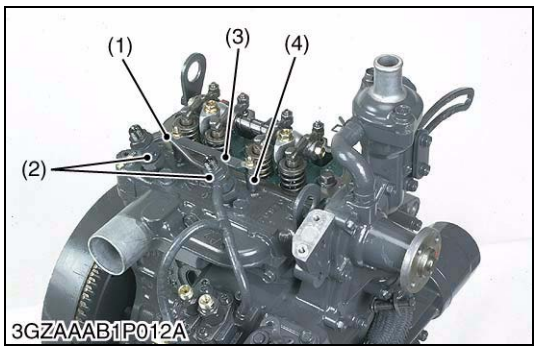
**(When reassembling)**

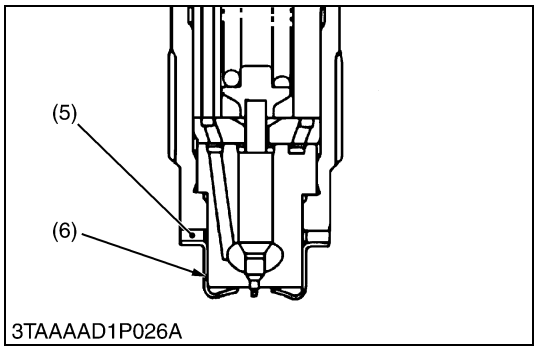
- Sent compressed air into pipes to blow out dust. Then, reassemble the pipes in the reverse order.

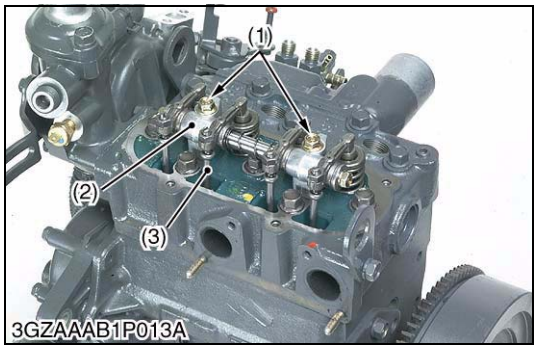
| | | |
|---|---|---|
| Tightening torque | Injection pipe retaining nut | 24.5 to 34.3 N·m<br>2.5 to 3.5 kgf·m<br>18.1 to 25.3 ft-lbs |

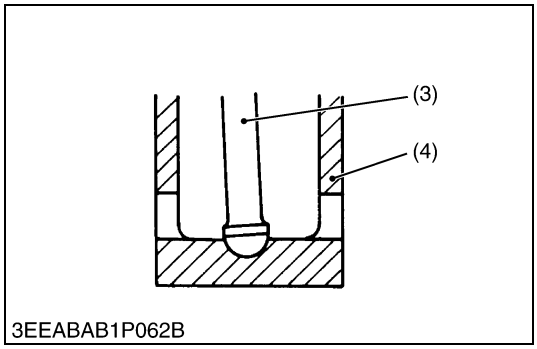
(1) Pipe Clamp
(2) Injection Pipe

W1045004




## Nozzle Holder Assembly and Glow Plug

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

**(When reassembling)**

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

| | | |
|---|---|---|
| Tightening torque | Overflow pipe retaining nut | 19.6 to 24.5 N·m<br>2.0 to 2.5 kgf·m<br>14.5 to 18.1 ft-lbs |
| | Nozzle holder assembly | 49.0 to 68.6 N·m<br>5.0 to 7.0 kgf·m<br>36.2 to 50.6 ft-lbs |
| | Glow plug | 7.85 to 14.7 N·m<br>0.8 to 1.5 kgf·m<br>5.8 to 10.8 ft-lbs |

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

W1045210

## Rocker Arm and Push Rod

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

**(When reassembling)**

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

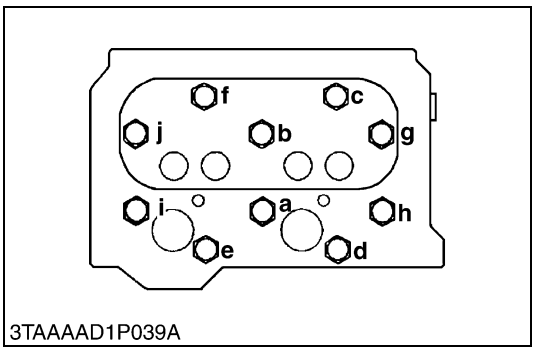
■ **IMPORTANT**

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

| | | |
|---|---|---|
| Tightening torque | Rocker arm bracket screw | 9.8 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.2 to 8.3 ft-lbs |

(1) Rocker Arm Bracket screws
(2) Rocker Arm Assembly
(3) Push Rod
(4) Tappet

W1045710



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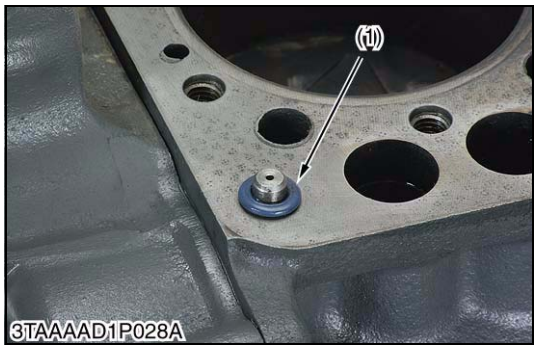

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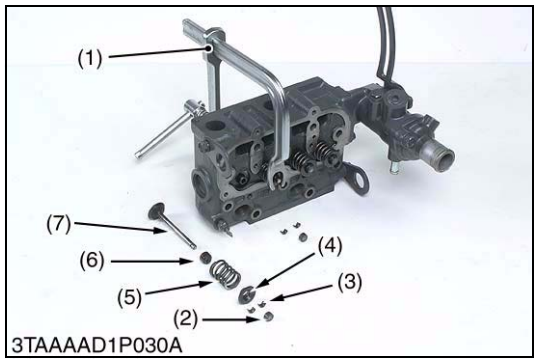

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## Cylinder Head

1. Loosen the pipe clamp, and remove the water return pipe.
2. Remove the cylinder head screw in the order of (**j**) to (**a**).
3. Lift up the cylinder head to detach.
4. Remove the cylinder head gasket and O-ring (1).

**(When reassembling)**

- Replace the cylinder head gasket with a new one.
- Securely fit the O-ring (1) to the pipe pin.
- Tighten the cylinder head screws after applying sufficient oil.
- Tighten the cylinder head screws diagonal sequence starting from the centre.
- Tighten them uniformly, or the head may deform in the long run.
- Retighten the cylinder head screws after running the engine for 30 minutes.

| | | |
|---|---|---|
| Tightening torque | Cylinder head screw | 37.3 to 42.2 N·m<br>3.8 to 4.3 kgf·m<br>27.5 to 31.1 ft-lbs |

**(j) to (a) : To Loosen**
**(a) to (j) : To Tighten**

(1) O-ring

W1045977

## 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

W10209700

## Valves

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

**(When reassembling)**

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

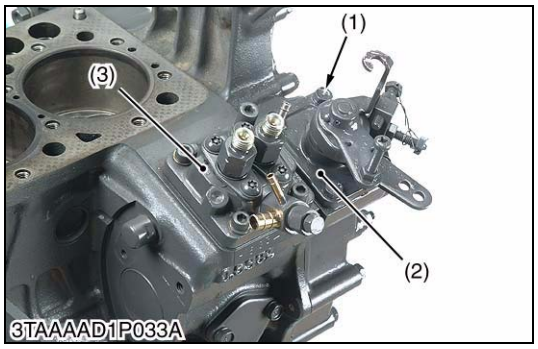
■ **IMPORTANT**

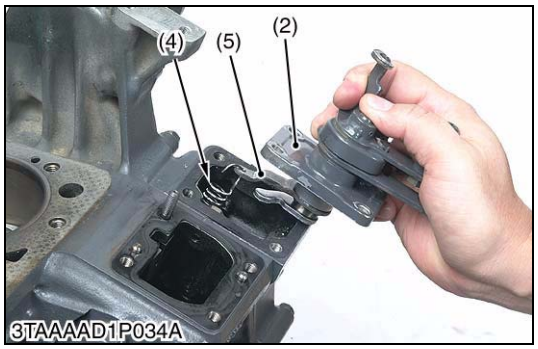
- **Do not change the combination of valve and valve guide.**

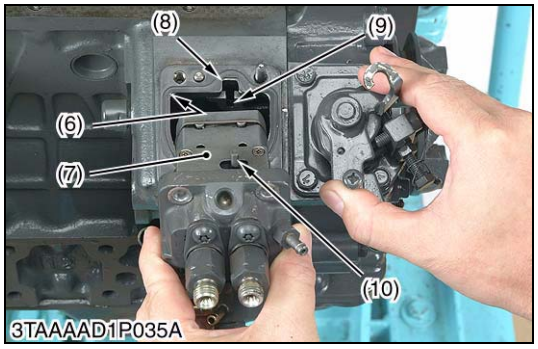
(1) Valve Spring Replacer
(2) Valve Cap
(3) Valve Spring Collet
(4) Valve Spring Retainer
(5) Valve Spring
(6) Valve Stem Seal
(7) Valve

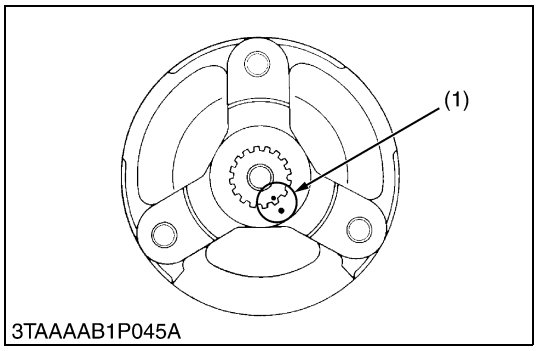
W10211070

## (2) Timing Gear, Camshaft and Fuel Camshaft




**Injection Pump and Speed Control Plate**

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

**(When reassembling)**

- Hook the governor spring (4) to the governor lever (5) first and install the speed control plate (2).
- Be sure to place the copper washers underneath two screws (1). (Two screws (1) in the upper of the speed control plate (2).)
- Position the slot (9) on the fork lever just under the slot (8) on the crankcase.
- Insert the injection pump (3) so that the control rod (7) should be pushed by the idling adjusting spring (6) at its end and the pin (10) on the rod engages with the slot (9) on the fork lever (as shown in the figure).

■ **NOTE**

- **The sealant is applied to both sides of the soft metal gasket shim. The liquid gasket is not required for assembling.**
- **Addition or reduction of shim (0.05 mm, 0.0020 in.) delays or advances the injection timing by approx. 0.0087 rad. (0.5 °).**
- **In disassembling and replacing, be sure to use the same number of new gasket shims with the same thickness.**

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

W1028534

**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.

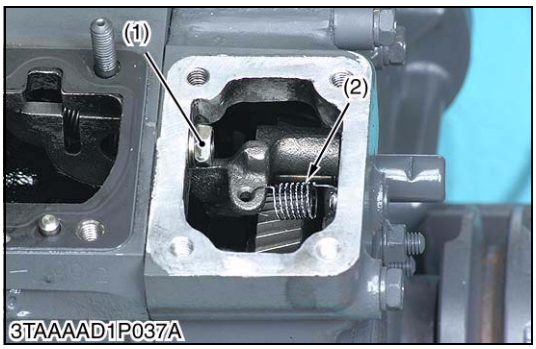
**(When reassembling)**

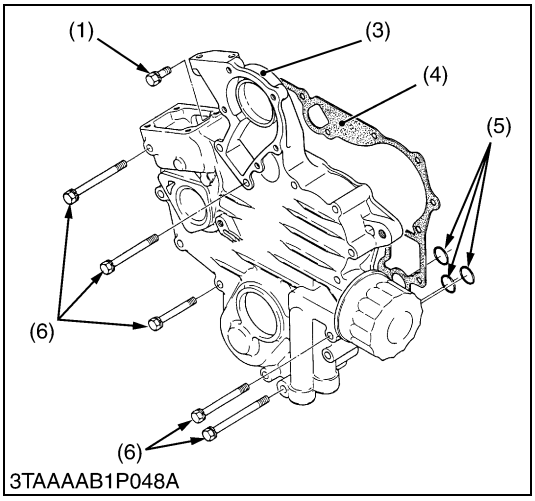
- Install the pulley to crankshaft, aligning the mark (1) on them.
- Apply engine oil to the fan drive pulley retaining screws. And tighten them.

| | | |
|---|---|---|
| Tightening torque | Fan drive pulley screw | 98.0 to 107.8N·m<br>10.0 to 11.0 kgf·m<br>72.3 to 79.5 ft-lbs |

(1) Alignment Mark

W10181950




## Gear Case

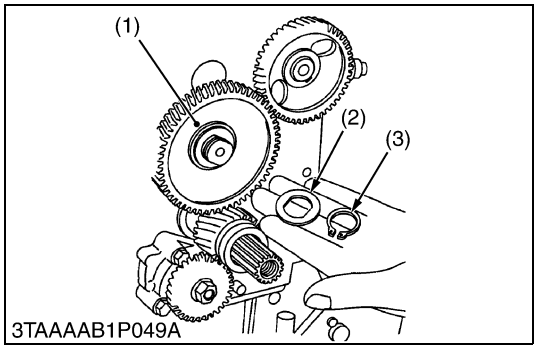
1. Remove the screw (1) of inside the gear case and outside screws (6).
2. Disconnect the start spring (2) from the fork lever 1.
3. Remove the gear case (3).

**(When reassembling)**

- Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the gear case gasket (4).
- Be sure to set three O-rings (5) inside the gear case.

(1) Screw (Inside)
(2) Start Spring
(3) Gear Case
(4) Gear Case Gasket
(5) O-rings
(6) Screw

W1029858



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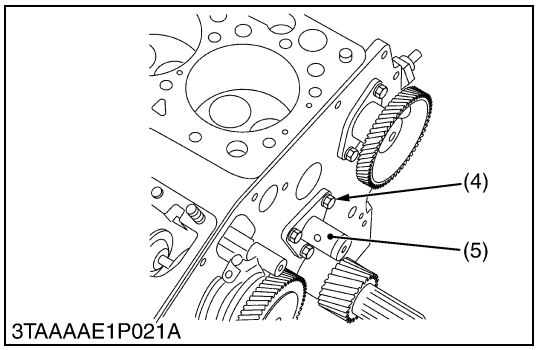

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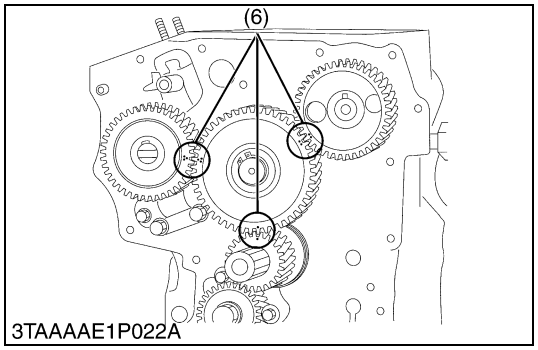

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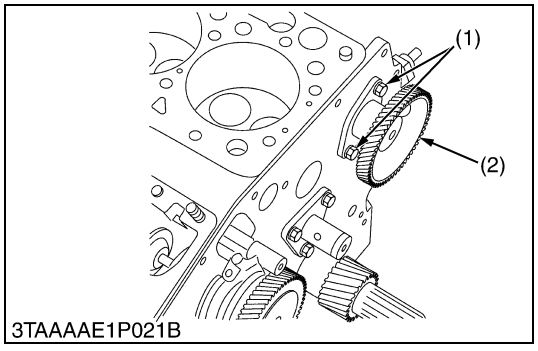

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**Idle Gear**

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

**(When reassembling)**

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

| | | |
|---|---|---|
| Tightening torque | Idle gear shaft mounting screw | 9.8 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.2 to 8.3 ft-lbs |

(1) Idle Gear
(2) Idle Gear Collar
(3) External Snap Ring
(4) Idle Gear Shaft Mounting Screw
(5) Idle Gear Shaft
(6) Alignment Mark

W1030437

**Camshaft**

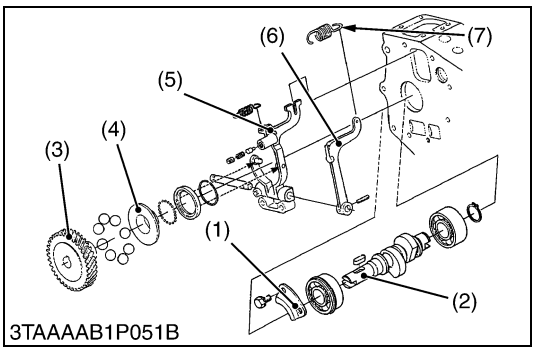
1. Remove the camshaft mounting screws (1) and draw out the camshaft with gear (2) on it.

**(When reassembling)**

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

(1) Camshaft Mounting Screw
(2) Camshaft Gear

W1030808



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## Fuel Camshaft

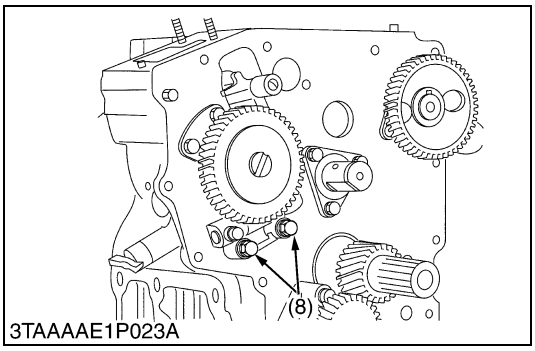
1. Remove the retaining plate (1).
2. Remove the fork lever holder mounting screws (8), then draw out the injection pump gear (3) and fuel camshaft (2) with the governor fork assembly.

**(When reassembling)**

- Hook the governor spring (7) to the fork lever 2 (6) as shown in the figure before installing the fork lever assembly to the crankcase.

(1) Retaining Plate
(2) Fuel Camshaft
(3) Injection Pump Gear
(4) Governor Sleeve
(5) Fork Lever 1
(6) Fork Lever 2
(7) Governor Spring
(8) Fork Lever Holder Mounting Screw

W10178820



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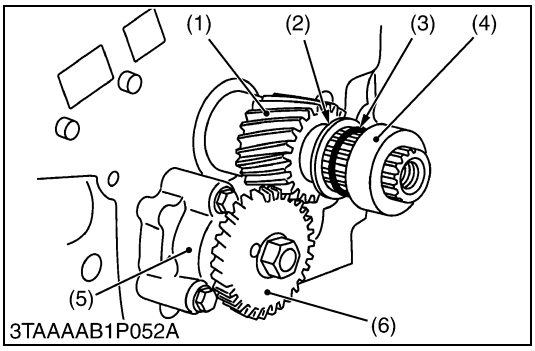

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## Oil Pump and Crankshaft Gear

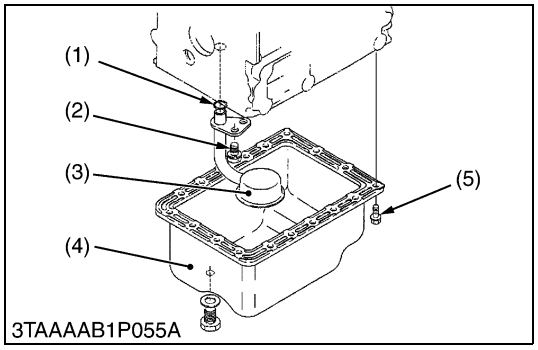
1. Remove the oil pump gear (6).
2. Remove the oil pump (5).
3. Remove the collar (4), O-ring (3) and crankshaft oil slinger (2).
4. Remove the crankshaft gear (1).

**(When reassembling)**

- Install the collar (4) after aligning the marks on the gears. (See the figure at “Idle Gear”.)

(1) Crankshaft Gear
(2) Crankshaft Oil Slinger
(3) O-ring
(4) Crankshaft Collar
(5) Oil Pump
(6) Oil Pump Gear

W10180290



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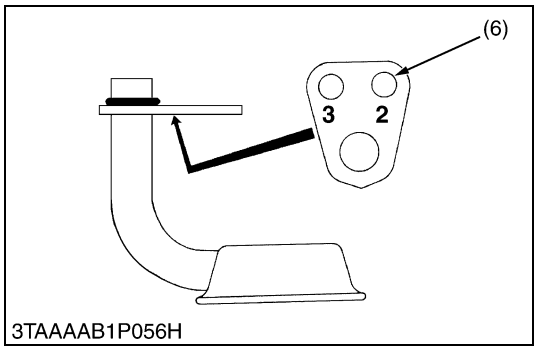

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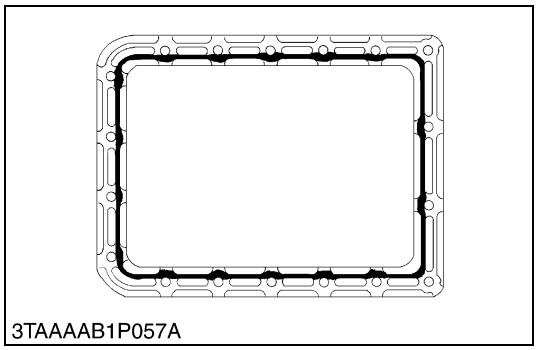
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**Oil Pan and Oil Strainer**

1. Remove the oil pan mounting screws (5).
2. Remove the oil pan (4) by lightly tapping the rim of the pan with a wooden hammer.
3. Remove the oil strainer (3).

**(When reassembling)**

- After cleaning the oil strainer, check to see that the filter mesh in 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 form the center.
- Using the hole (6) numbered "**2**", install the oil strainer by mounting screw.

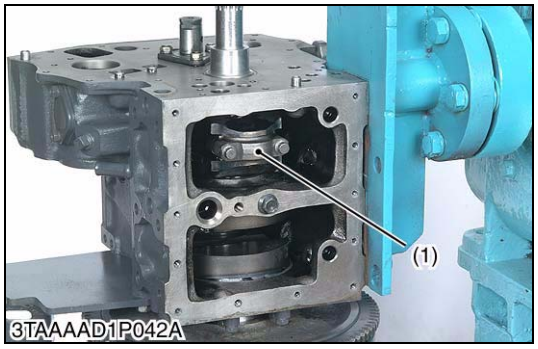
■ **IMPORTANT**

- **Scrape off the old adhesive completely. Wipe the sealing surface clean using waste cloth soaked with gasoline. Now apply new adhesive 3 to 5 mm (0.12 to 0.20 in.) thick all over the contact surface. Apply the adhesive also on the center of the flange as well as on the inner wall of each bolt hole.**
- **Cut the nozzle of the "liquid gasket" (Three Bond 1207D or equivalent) container at its second notch. Apply "liquid gasket" about 5 mm (0.20 in.) thick.**
  **Within 20 minutes after the application of fluid sealant, reassemble the components. Wait then for about 30 minutes, and pour oil in the crankcase.**

(1) O-ring
(2) Screw
(3) Oil Strainer
(4) Oil Pan
(5) Oil Pan Mounting Screws
(6) Hole

W10236610

## (3) Piston and Connecting Rod



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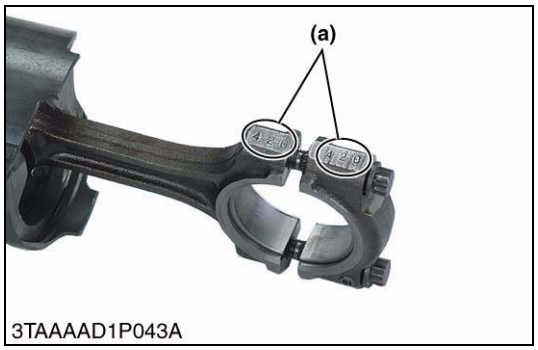

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**Connecting Rods**

1. Remove the connecting rod caps (1).

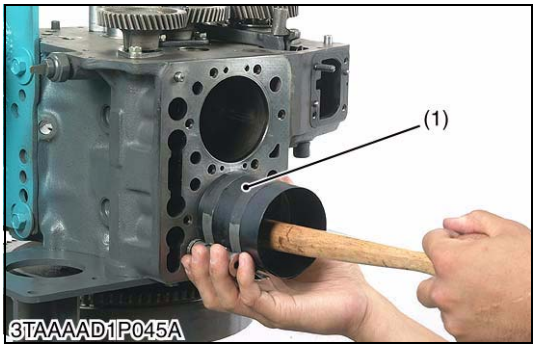
**(When reassembling)**

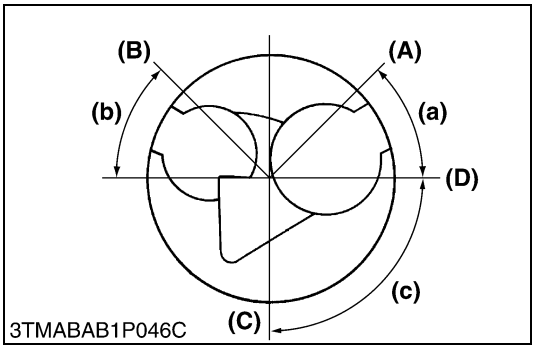
- Align the marks **(a)** with each other. (Face the marks toward the injection pump.).
- Apply engine oil to the connecting rod screws and lightly screw it in by hand, then tighten it to the specified torque.
  If the connecting rod screw won't be screwed in smoothly, clean the threads.
  If the connecting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

| | | |
|---|---|---|
| Tightening torque | Connecting rod screw | 26.5 to 30.4 N·m<br>2.7 to 3.1 kgf·m<br>19.5 to 22.4 ft-lbs |

(1) Connecting Rod Cap
**(a) Mark**

W10275480


## 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)**

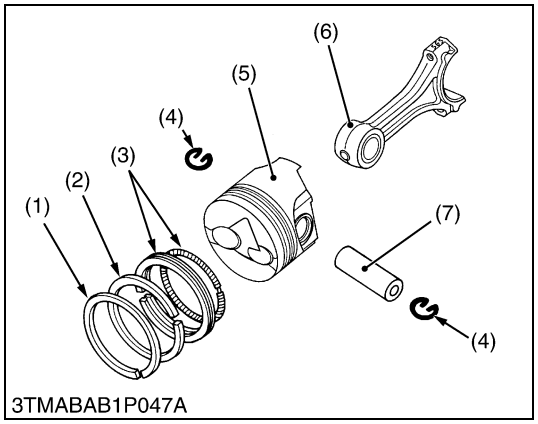
- Before inserting the piston into the cylinder, apply enough engine oil to the piston.
- When inserting the piston into the cylinder, face the mark on the connecting rod to the injection pump.

■ **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 of 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) 0.785 rad. (45 °)**
**(b) 0.785 rad. (45 °)**
**(c) 1.57 rad. (90 °)**

W10277450



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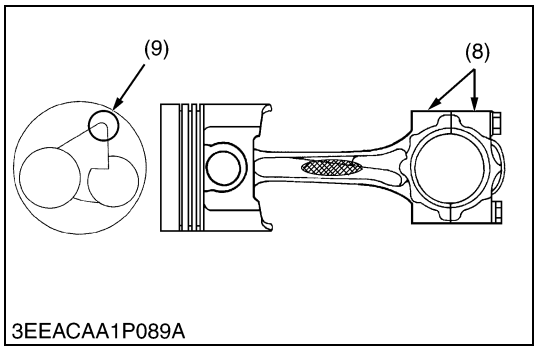

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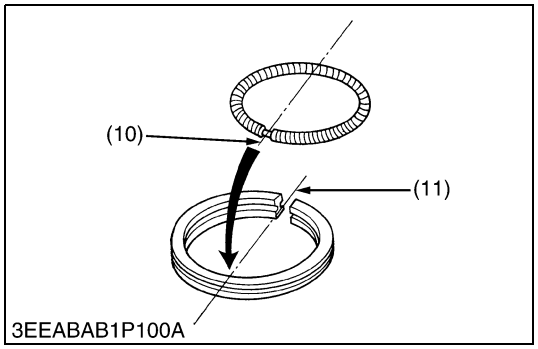

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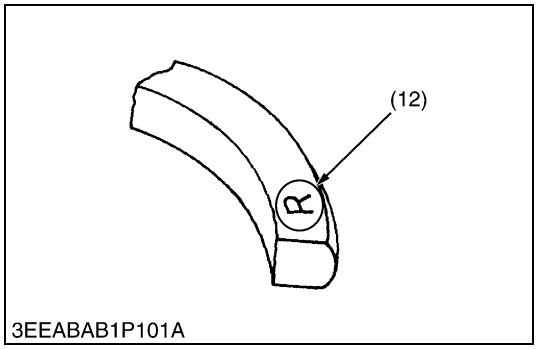

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## Piston Ring and Connecting Rod

1. Remove the piston rings using a piston ring tool (Code No. 07909-32121).
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).

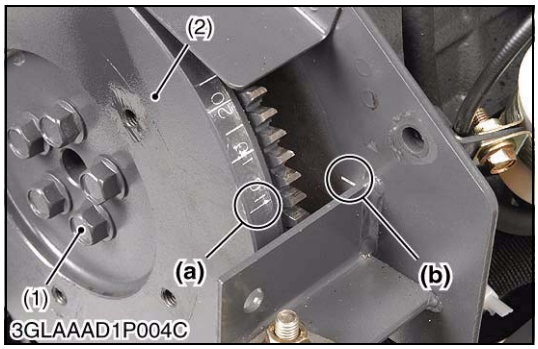
■ **NOTE**

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

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

W10281670

## (4) Crankshaft




### Flywheel

1. Secure the flywheel to keep it from turning using a flywheel stopper. (Refer to “SPECIAL TOOLS”.)
2. Remove all flywheel screws (1) and then remove the flywheel (2).

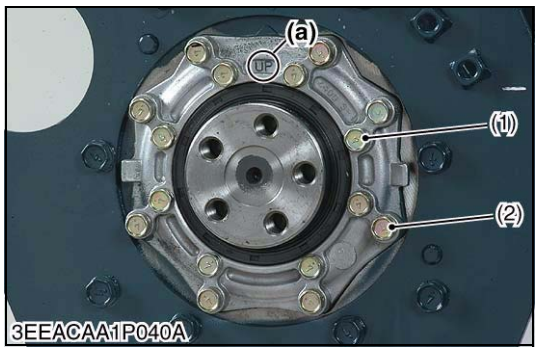
**(When reassembling)**

- Align the **“1TC”** mark **(a)** on the outer surface of the flywheel horizontally with the alignment mark **(b)** on the rear end plate. 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 | 53.9 to 58.8 N·m<br>5.5 to 6.0 kgf·m<br>39.8 to 43.4 ft-lbs |

(1) Flywheel Screw
(2) Flywheel
**(a) 1TC Mark**
**(b) Alignment Mark**

W1030810



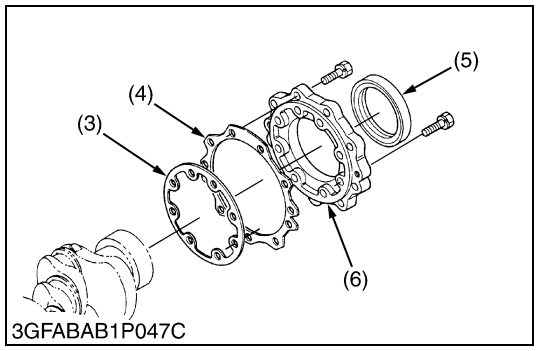

### Bearing Case Cover

1. Remove the bearing case cover mounting screws. First, remove inside screws (1) and then outside screws (2).
2. Remove the bearing case cover (6).

**(When reassembling)**

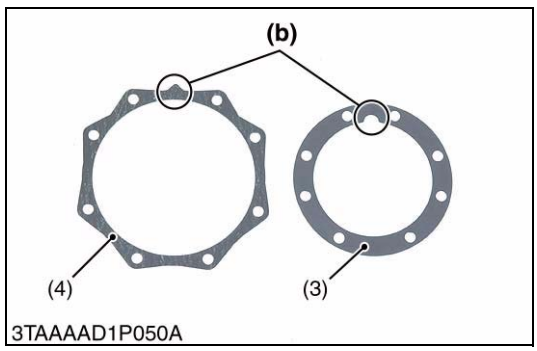
- Fit the bearing case gasket (3) and the bearing case cover gasket (4) with correct directions.
- Install the bearing case cover (6) to position the casting mark “UP” **(a)** on it upward.
- Apply engine oil to the oil seal (5) lip and take care that it is not rolled when installing.
- Tighten the bearing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

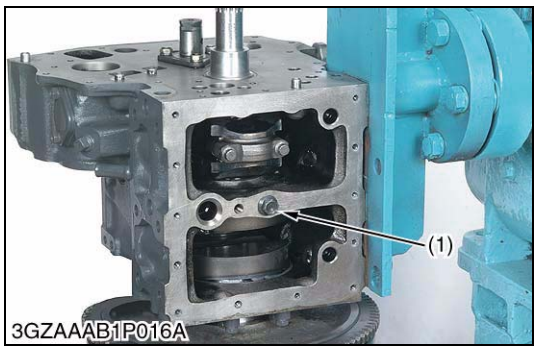
| | | |
|---|---|---|
| Tightening torque | Bearing case cover mounting screw | 9.8 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.2 to 8.3 ft-lbs |




(1) Bearing Case Cover Mounting Screw (Inside)
(2) Bearing Case Cover Mounting Screw (Outside)
(3) Bearing Case Gasket
(4) Bearing Case Cover Gasket
(5) Oil Seal
(6) Bearing Case Cover
**(a) Top Mark “UP”**
**(b) Upside**

W1031168






## Crankshaft Assembly

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

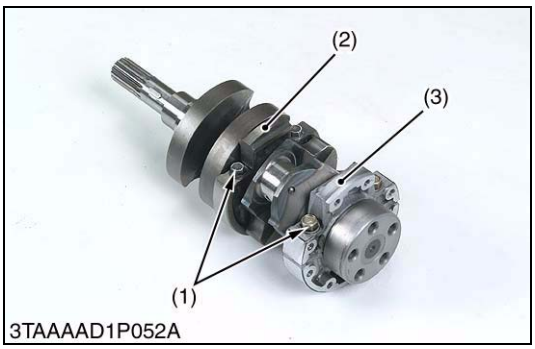
**(When reassembling)**

- 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.

| | | |
|---|---|---|
| Tightening torque | Main bearing case screw 2 | 26.5 to 30.4 N·m<br>2.7 to 3.1 kgf·m<br>19.5 to 22.4 ft-lbs |

(1) Main Bearing Case Screw 2

W1031360



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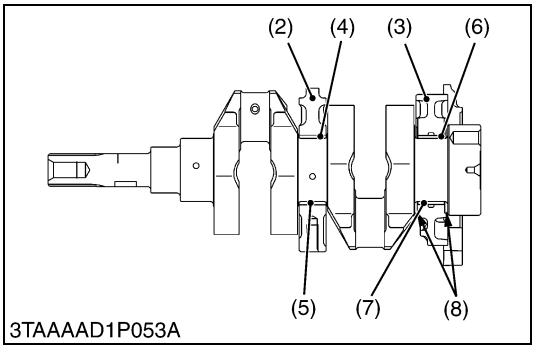

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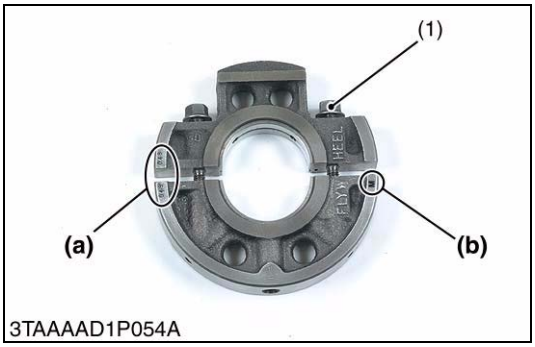

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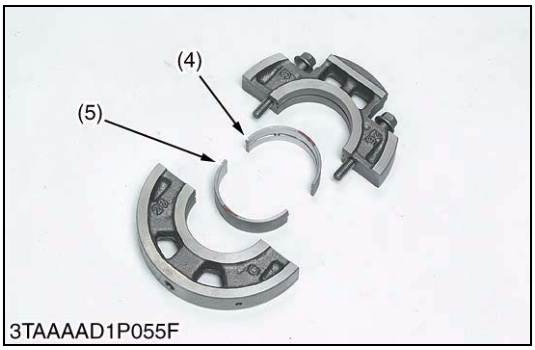

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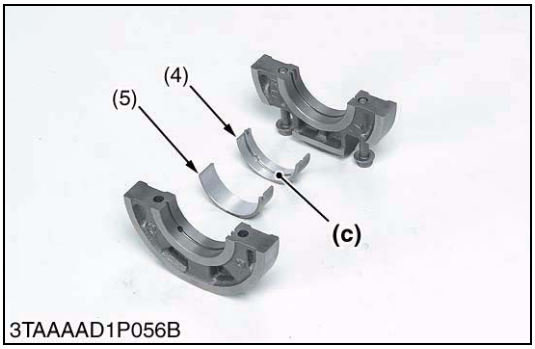

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## Main Bearing Case Assembly

1. Remove the two main bearing case screws 1 (1), and remove the main bearing case assembly 1 (2), being careful with crankshaft bearing 3 (4), (5).
2. Remove the main bearing case assembly (3) as above. Keep in mind, however, that the thrust bearing (8) is installed in the main bearing case assembly (3).

**(When reassembling)**

- Clean the oil passage in the main bearing cases.
- Apply clean engine oil on the bearings.
- Install the main bearing case assemblies in original positions. Since diameters of main bearing cases vary, install them in order to marking **(b)** from the gear case side. (Refer to the figure.).
- Match the alignment numbers **(a)** on the main bearing case assembly 1.
- Do the same for the main bearing case assembly (3) too.
- When installing the main bearing case 1, face the mark **"FLYWHEEL"** to the flywheel.
- Install the thrust bearing (8) 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.

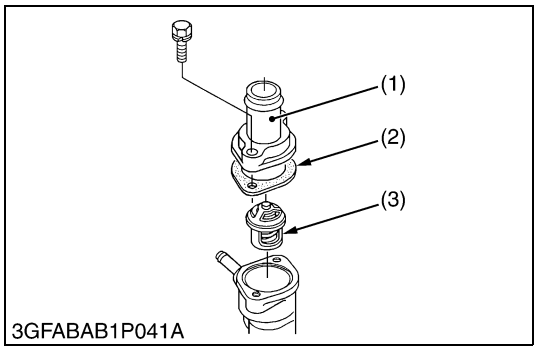
| | | |
|---|---|---|
| Tightening torque | Main bearing case screw 1 | 12.7 to 15.7 N·m<br>1.3 to 1.6 kgf·m<br>9.4 to 11.6 ft-lbs |

(1) Main Bearing Case Screw 1
(2) Main Bearing Case Assembly 1
(3) Main Bearing Case Assembly
(4) Crankshaft Bearing 3 (Upper, with oil groove)
(5) Crankshaft Bearing 3 (Lower)
(6) Crankshaft Bearing 2 (Upper, with oil groove)
(7) Crankshaft Bearing 2 (Lower)
(8) Thrust Bearing

**(a) Alignment Number**
**(b) Marking**
**(c) Oil Groove**

W1034602

## (5) Water Pump



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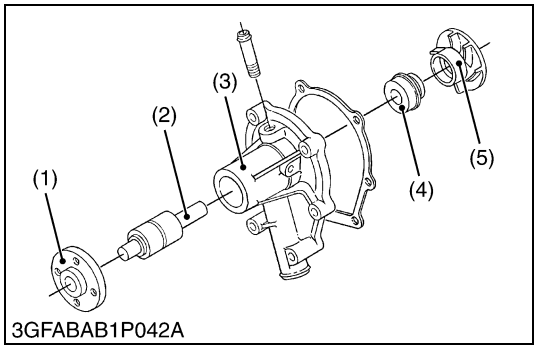

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**Thermostat Assembly**

1. Remove the thermostat cover mounting screws, and remove the thermostat cover (1).
2. Remove the thermostat assembly (3).

**(When reassembling)**

- Apply a liquid gasket (Three Bond 1215 or equivalent) only at the thermostat cover side of the gasket (2).

(1) Thermostat Cover
(2) Thermostat Cover Gasket
(3) Thermostat Assembly

W10363950

**Water pump Assembly**

1. Loosen the dynamo mounting screws, and remove the fan belt.
2. Remove the fan and fan pulley.
3. Remove the water pump assembly from the gear case cover.
4. Remove the water pump flange (1).
5. Press out the water pump shaft (2) with the impeller (5) on it.
6. Remove the impeller from the water pump shaft.
7. Remove the mechanical seal (4).

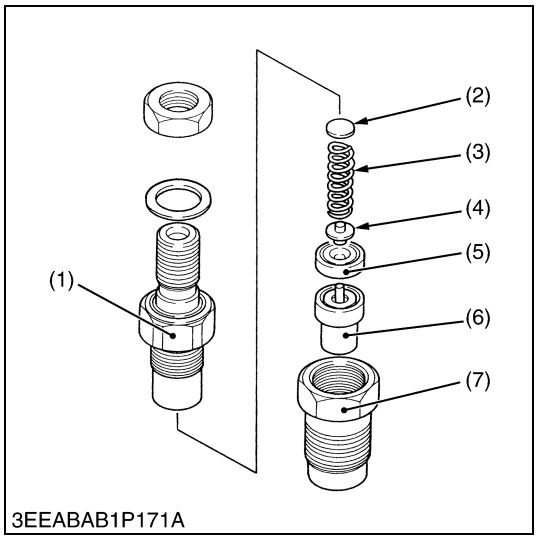
**(when reassembling)**

- Apply a liquid gasket (Three Bond 1215 or equivalent) to the both sides of gasket.
- Replace the mechanical seal with new one.

(1) Water Pump Flange
(2) Water pump Shaft
(3) Water Pump Body
(4) Mechanical Seal
(5) Impeller

W1058081

## (6) Injection Nozzle



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**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)**

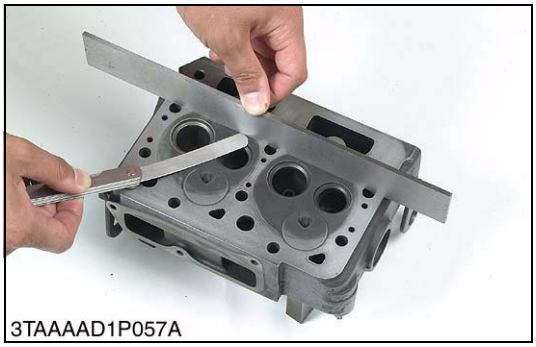
- Assemble the nozzle in clean fuel oil.
- Install the push rod (4), noting its direction.
- After assembling the nozzle, be sure to adjust the fuel injection pressure.

| | | |
|---|---|---|
| Tightening torque | Nozzle holder | 34.3 to 39.2 N·m<br>3.5 to 4.0 kgf·m<br>25.3 to 28.9 ft-lbs |
| | Overflow pipe nut | 19.6 to 24.5 N·m<br>2.0 to 2.5 kgf·m<br>14.5 to 18.1 ft-lbs |
| | Nozzle holder assembly | 49.0 to 68.6 N·m<br>5.0 to 7.0 kgf·m<br>36.2 to 50.6 ft-lbs |

(1) Nozzle Holder
(2) Adjusting Washer
(3) Nozzle Spring
(4) Push Rod
(5) Distance Piece
(6) Nozzle Piece
(7) Nozzle Retaining Nut

# [4] SERVICING

## (1) Cylinder Head and Valves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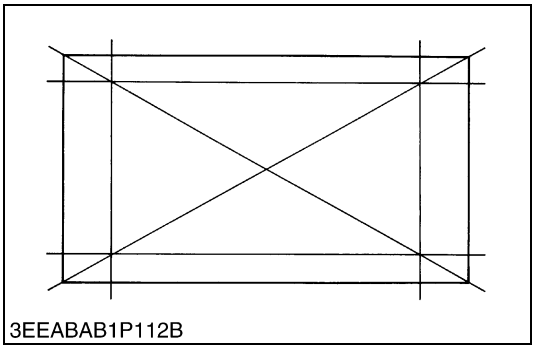
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### Cylinder Head Surface Flatness

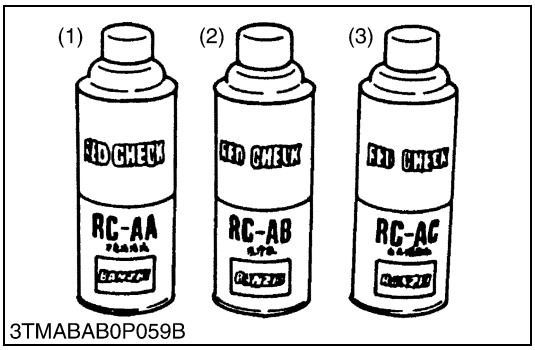
1. Clean the cylinder head surface.
2. Place a straightedge on the cylinder head's four sides and two diagonal as shown in the figure.
3. Measure the clearance with a thickness gauge.
4. If the measurement exceeds the allowable limit, correct it with a surface grinder.

■ **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<br>0.0020 in. |

W1027737



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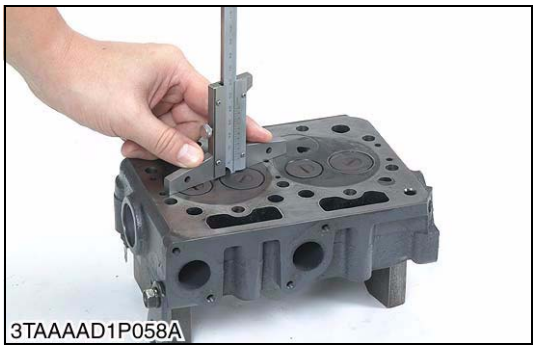
### Cylinder Head Flaw

1. Prepare an air spray red check (Code No. 07909-31371).
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 read 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

W1076542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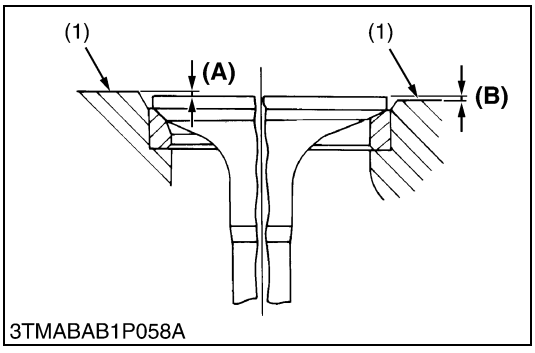
### Valve Recessing

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 (Intake and Exhaust) | Factory spec. | 0.10 (protrusion) to 0.10 (recessing) mm<br>0.0039 (protrusion) to 0.0039 (recessing) in. |
| | Allowable limit | 0.30 (recessing) mm<br>0.0118 (recessing) in. |



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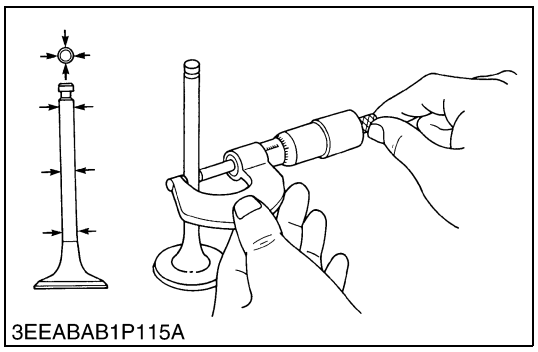
(1) Cylinder Head Surface
**(A) Recessing**
**(B) Protrusion**

W10768800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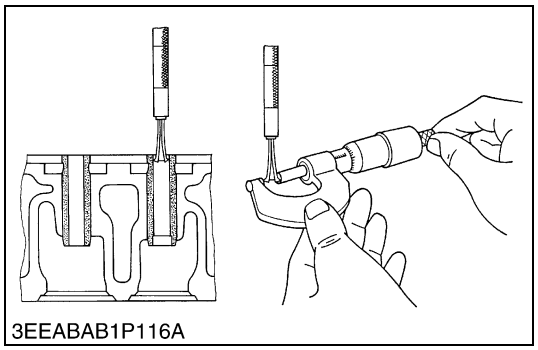
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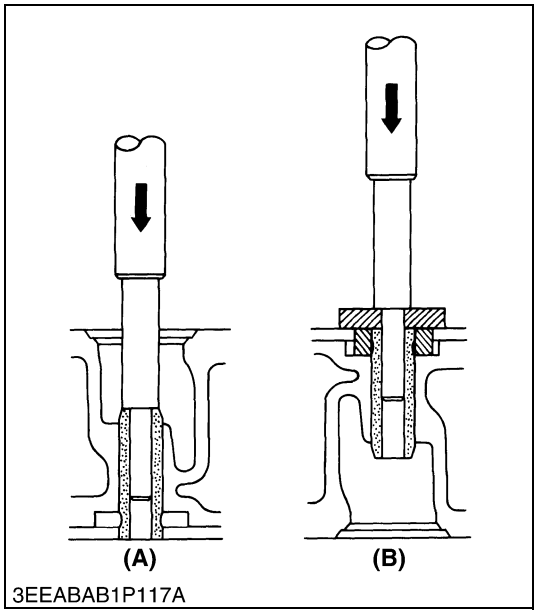

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## Clearance between Valve Stem and Valve Guide

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 spec. | 0.030 to 0.057 mm<br>0.00118 to 0.00224 in. |
| | Allowable limit | 0.10 mm<br>0.0039 in. |

| | | |
|---|---|---|
| Valve stem O.D. | Factory spec. | 5.968 to 5.980 mm<br>0.23496 to 0.23543 in. |
| Valve guide I.D. | Factory spec. | 6.010 to 6.025 mm<br>0.23661 to 0.23720 in. |

W10311740

## Replacing Valve Guide

**(When removing)**

1. Press out the used valve guide using a valve guide replacing tool.

**(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.

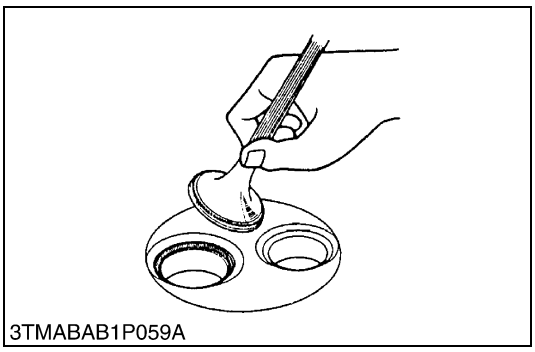
| | | |
|---|---|---|
| Valve guide I.D.<br>(Intake and Exhaust) | Factory spec. | 6.010 to 6.025 mm<br>0.23661 to 0.23720 in. |

■ **IMPORTANT**

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

**(A) When removing** **(B) When installing**

W10314690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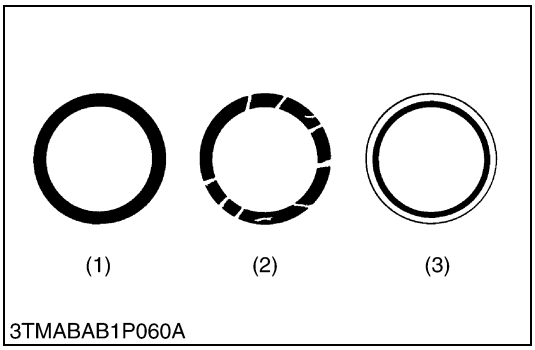

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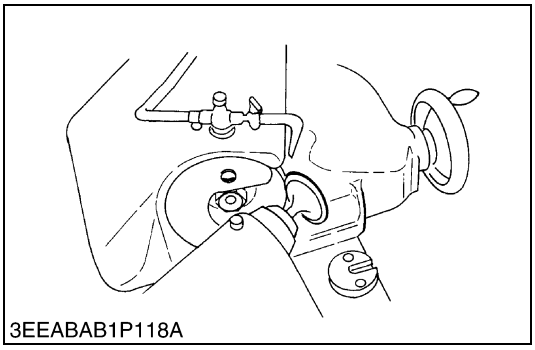
## Valve Seating

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 spec. | 2.12 mm<br>0.0835 in. |

(1) Correct
(2) Incorrect
(3) Incorrect

W10282190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## Correcting Valve and Valve Seat

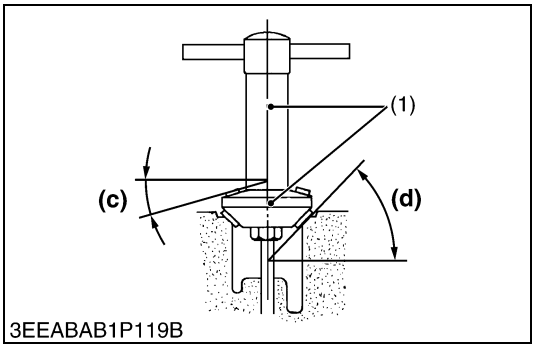
■ **NOTE**

- **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 spec. | 0.785 rad<br>45 ° |



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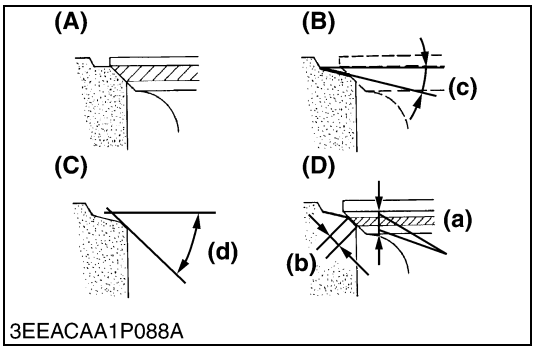
**2) Correcting Valve Seat**

1. Slightly correct the seat surface with a 0.785 rad (45 °) valve seat cutter (Code No. 07909-33102).
2. Fitting the valve, check the contact position of the valve face and seat surface with prussian blue. (Visual check) [If the valve has been used for a long period, the seat tends to come in contact with the upper side of the valve face.]
3. Grind the upper surface of the seat with a 0.262 rad (15 °) valve seat cutter until the valve seat touches to the center of the valve face (so that **(a)** equals **(b)** as shown in the figure)
4. Grind the seat with a 0.785 rad (45 °) valve seat cutter again, and visually recheck the contact between the valve and seat.
5. Repeat steps 3 and 4 until the correct contact is achieved.
6. Continue lapping until the seated rate becomes more than 70 % of the total contact area.

| | | |
|---|---|---|
| Valve seat angle | Factory spec. | 0.785 rad<br>45 ° |



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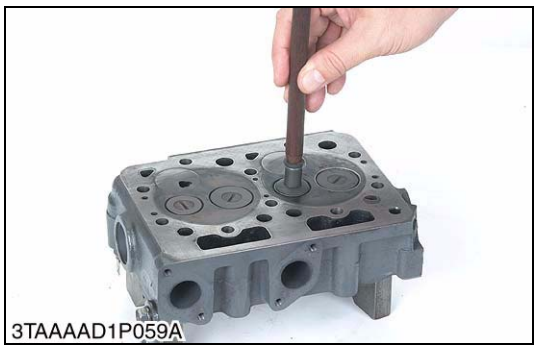
(1) Valve Seat Cutter
**(A) Check Contact**
**(B) Correct Seat Width**
**(C) Check Seat Surface**
**(D) Check Contact**
**(a) Identical Dimensions**
**(b) Valve Seat Width**
**(c) 0.262 rad (15 °)**
**(d) 0.785 rad (45 °)**

W10283500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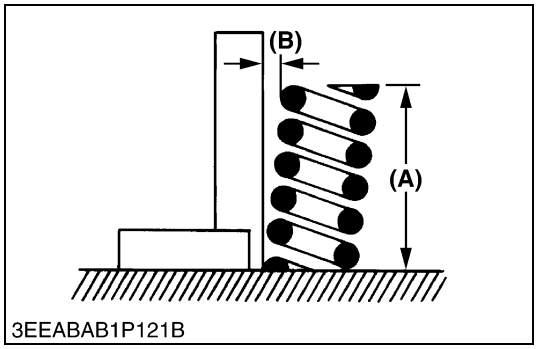
## Valve Lapping

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.**

W10288140



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## Free Length and Tilt of Valve Spring

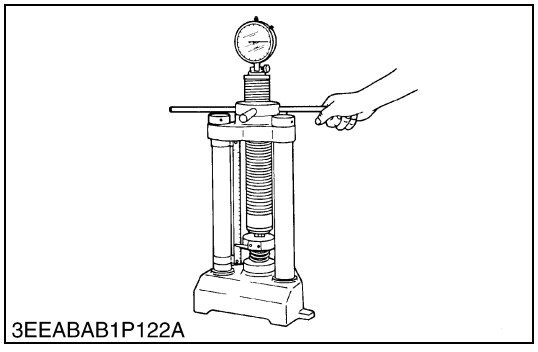
1. Measure the free length **(A)** of valve spring with vernier calipers. If the measurement is less than the allowable limit, replace it.
2. Put the valve spring on a surface plate, place a square on the side of the valve spring.
3. Check to see if the entire side is in contact with the square. Rotate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

| | | |
|---|---|---|
| Free length **(A)** | Factory spec. | 31.3 to 31.8 mm<br>1.232 to 1.252 in. |
| | Allowable limit | 28.4 mm<br>1.118 in. |

| | | |
|---|---|---|
| Tilt **(B)** | Allowable limit | 1.2 mm<br>0.047 in. |

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

W11157830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## Valve Spring Setting Load

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

| | | |
|---|---|---|
| Setting load /<br>Setting length | Factory spec. | 64.7 N / 27.0 mm<br>6.6 kgf / 27.0 mm<br>14.6 lbs / 1.063 in. |
| | Allowable limit | 54.9 N / 27.0 mm<br>5.6 kgf / 27.0 mm<br>12.3 lbs / 1.063 in. |

W11177330


3TAAAAD1P060A

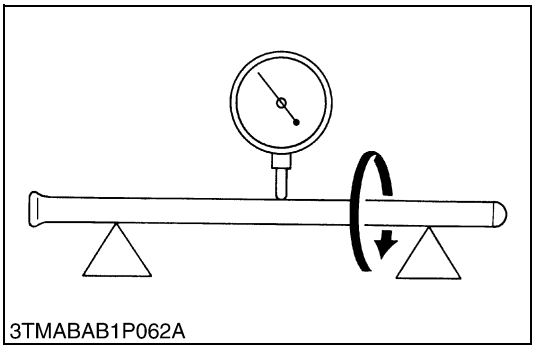
## Oil Clearance between Rocker Arm and Rocker Arm Shaft

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 spec. | 0.016 to 0.045 mm<br>0.00063 to 0.00177 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |

| | | |
|---|---|---|
| Rocker arm shaft O.D. | Factory spec. | 10.473 to 10.484 mm<br>0.41232 to 0.41276 in. |
| Rocker arm I.D. | Factory spec. | 10.500 to 10.518 mm<br>0.41339 to 0.41410 in. |

W11199710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## 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<br>0.0098 in. |

W11220210


3TAAAAD1P061A

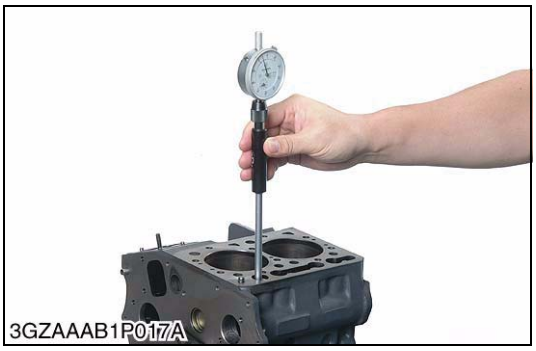
## Oil Clearance between Tappet and Tappet Guide Bore

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 spec. | 0.016 to 0.052 mm<br>0.00063 to 0.00205 in. |
| | Allowable limit | 0.10 mm<br>0.0039 in. |

| | | |
|---|---|---|
| Tappet O.D. | Factory spec. | 17.966 to 17.984 mm<br>0.70732 to 0.70803 in. |
| Tappet guide bore I.D. | Factory spec. | 18.000 to 18.018 mm<br>0.70866 to 0.70937 in. |

W11231410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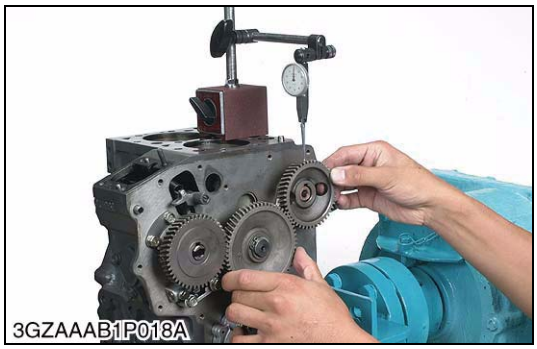
## (2) Timing Gear, Camshaft and Fuel Camshaft

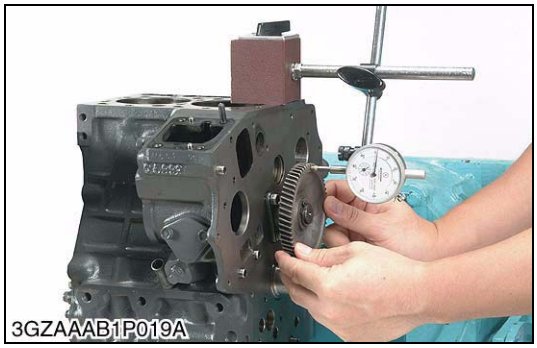



### Timing Gear Backlash

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 and crank gear | Factory spec. | 0.043 to 0.124 mm<br>0.00169 to 0.00488 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |
| Backlash between idle gear and cam gear | Factory spec. | 0.047 to 0.123 mm<br>0.00185 to 0.00484 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |
| Backlash between idle gear and injection pump gear | Factory spec. | 0.046 to 0.124 mm<br>0.00185 to 0.00488 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |
| Backlash between oil pump drive gear and crank gear | Factory spec. | 0.041 to 0.123 mm<br>0.00161 to 0.00484 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |

W11264830

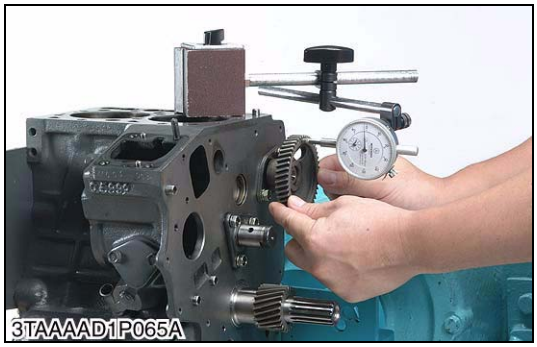



### Idle Gear Side Clearance

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

| | | |
|---|---|---|
| Idle gear side clearance | Factory spec. | 0.20 to 0.51 mm<br>0.0079 to 0.0201 in. |
| | Allowable limit | 0.80 mm<br>0.0315 in. |

W11286770




### 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 font and rear.
3. If the measurement exceeds the allowable limit, replace the camshaft stopper.

| | | |
|---|---|---|
| Camshaft side clearance | Factory spec. | 0.15 to 0.31 mm<br>0.0059 to 0.0122 in. |
| | Allowable limit | 0.50 mm<br>0.0197 in. |

W11299720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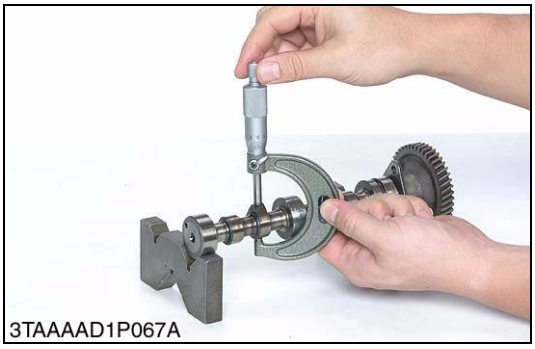
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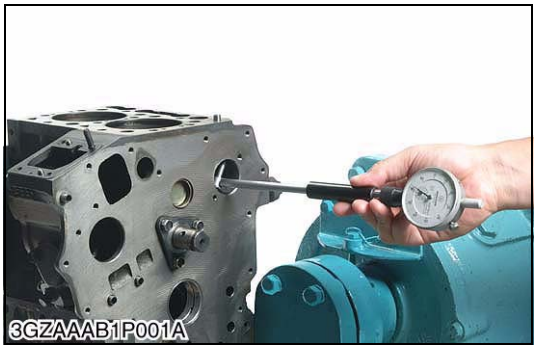
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3TAAAAD1P069A

## 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<br>0.0004 in. |

W11312720

## Cam Height

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

| | | |
|---|---|---|
| Cam height of intake and exhaust | Factory spec. | 26.88 mm<br>1.0583 in. |
| | Allowable limit | 26.83 mm<br>1.0563 in. |

W11324040

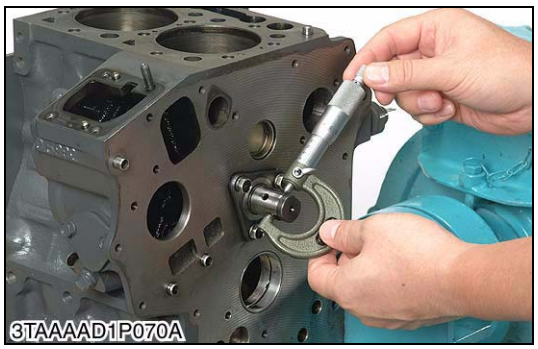
## Oil Clearance of Camshaft Journal

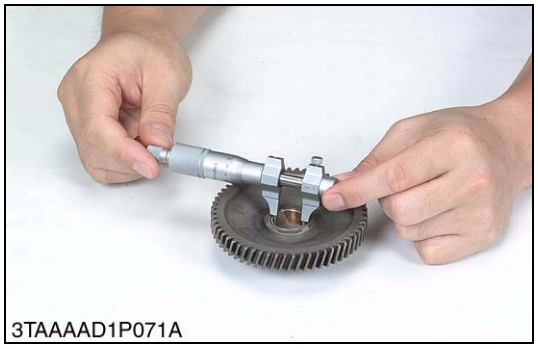
1. Measure the camshaft journal O.D. with an outside micrometer.
2. Measure the cylinder block bore I.D. for camshaft with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the camshaft.

| | | |
|---|---|---|
| Oil clearance of camshaft journal | Factory spec. | 0.050 to 0.091 mm<br>0.00197 to 0.00358 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |

| | | |
|---|---|---|
| Camshaft journal O.D. | Factory spec. | 32.934 to 32.950 mm<br>1.29661 to 1.29724 in. |
| Camshaft bearing I.D. (Cylinder block bore I.D.) | Factory spec. | 33.000 to 33.025 mm<br>1.29921 to 1.30020 in. |

W11335580



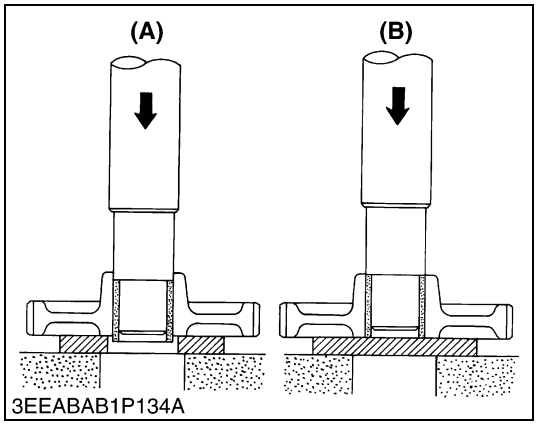

**Oil Clearance between Idle Gear Shaft and Idle Gear Bushing**

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

| | | |
|---|---|---|
| Oil clearance between idle gear shaft and idle gear bushing | Factory spec. | 0.020 to 0.084 mm<br>0.00079 to 0.00331 in. |
| | Allowable limit | 0.10 mm<br>0.0039 in. |

| | | |
|---|---|---|
| Idle gear shaft O.D. | Factory spec. | 19.967 to 19.980 mm<br>0.78610 to 0.78661 in. |
| Idle gear bushing I.D. | Factory spec. | 20.000 to 20.051 mm<br>0.78740 to 0.78941 in. |

W11356150




**Replacing Idle Gear Bushing**

**(When removing)**

1. Press out the used idle gear bushing using an idle gear bushing replacing tool.

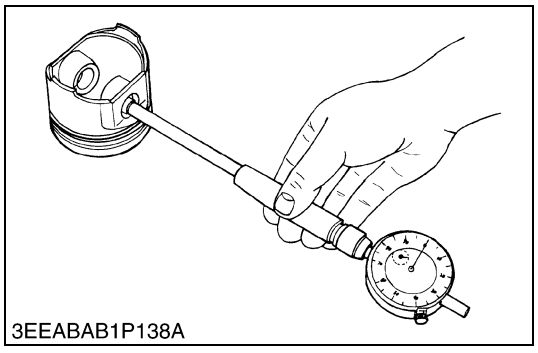
**(When installing)**

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

**(A) When removing** **(B) When installing**

W11373220

## (3) Piston and Connecting Rod

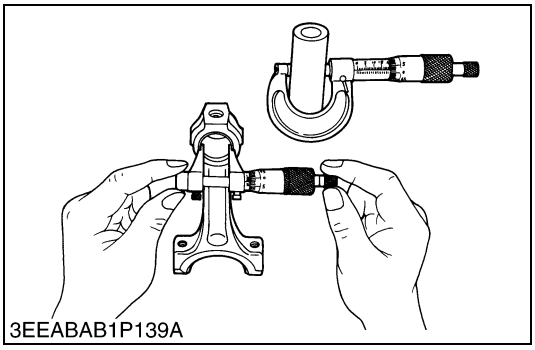



**Piston Pin Bore I.D.**

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 spec. | 20.000 to 20.013 mm<br>0.78740 to 0.78791 in. |
| | Allowable limit | 20.05 mm<br>0.7894 in. |

W11406200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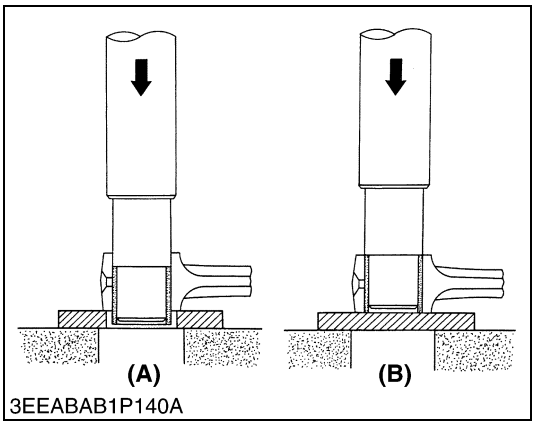
**Oil Clearance between Piton Pin and Small End Bushing**

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 spec. | 0.014 to 0.038 mm<br>0.00055 to 0.00150 in. |
| | Allowable limit | 0.10 mm<br>0.0039 in. |

| | | |
|---|---|---|
| Piston pin O.D. | Factory spec. | 20.002 to 20.011 mm<br>0.78748 to 0.78783 in. |
| Small end bushing I.D. | Factory spec. | 20.025 to 20.040 mm<br>0.78839 to 0.78897 in. |

W11420110



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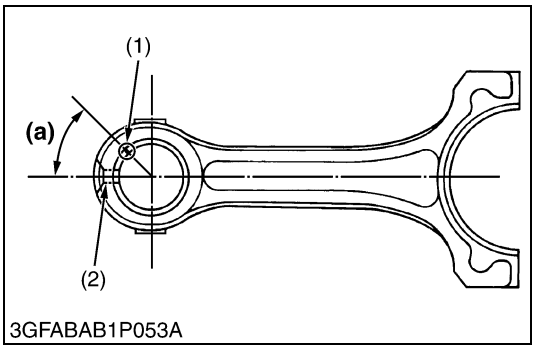

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**Replacing Small End Bushing**

**(When removing)**

1. Press out the used bushing using a small end bushing replacing tool.

**(When installing)**

1. Clean a new small end bushing and bore, and apply engine oil to them.
2. Insert a new bushing onto the tool and press-fit it with a press so that the seam (1) of bushing positions as shown in the figure, until it is flush with the connecting rod.
3. Drill a hole to the bushing with aligning the oil hole (2) of connecting rod. (Refer to the figure.)

■ **NOTE**

- **Be sure to chamfer the oil hole circumference with an oil stone.**

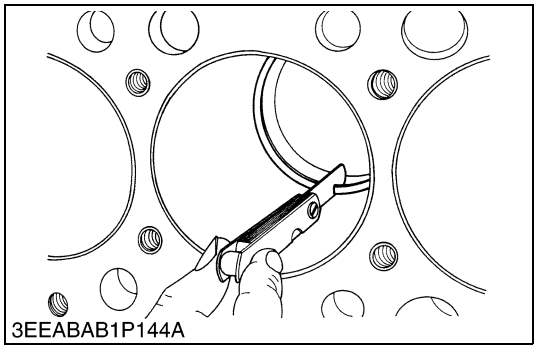
| | | |
|---|---|---|
| Oil clearance between piston pin and small end bushing (Spare parts) | Factory spec. | 0.015 to 0.075 mm<br>0.00059 to 0.00295 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |

| | | |
|---|---|---|
| Small end bushing I.D. (Spare parts) | Factory spec. | 20.026 to 20.077 mm<br>0.78845 to 0.79043 in. |

(1) Seam
(2) Oil Hole

**(A) When removing**
**(B) When installing**
**(a) 0.785 rad. (45°)**

W11437590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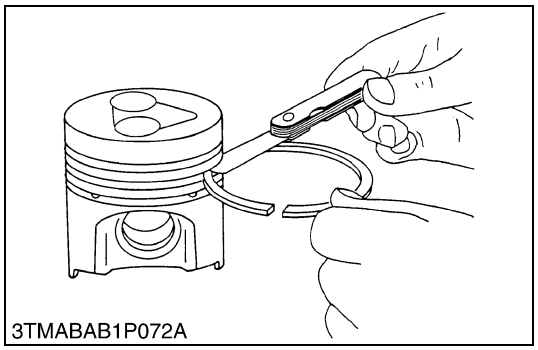
## Piston Ring Gap

1. Insert the piston ring into the lower part of the cylinder (the least worn out part) with 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 spec. | 0.15 to 0.30 mm<br>0.0059 to 0.0118 in. |
| | | Allowable limit | 1.20 mm<br>0.0472 in. |
| | Second ring | Factory spec. | 0.30 to 0.40 mm<br>0.0118 to 0.0157 in. |
| | | Allowable limit | 1.20 mm<br>0.0472 in. |
| | Oil ring | Factory spec. | 0.15 to 0.30 mm<br>0.0059 to 0.0118 in. |
| | | Allowable limit | 1.20 mm<br>0.0472 in. |

W11466710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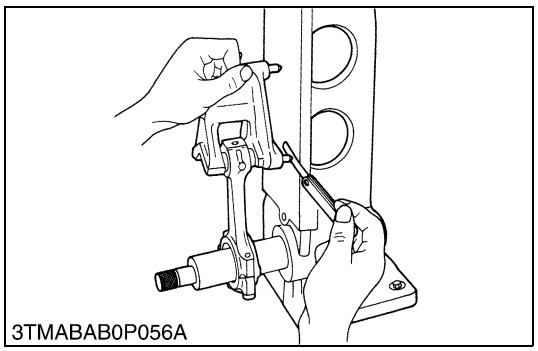
## Clearance between Piston Ring and Piston Ring Groove

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 thickness 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 spec. | 0.085 to 0.115 mm<br>0.00335 to 0.00453 in. |
| | | Allowable limit | 0.15 mm<br>0.0059 in. |
| | Oil ring | Factory spec. | 0.02 to 0.06 mm<br>0.0008 to 0.0024 in. |
| | | Allowable limit | 0.15 mm<br>0.0059 in. |

W11485500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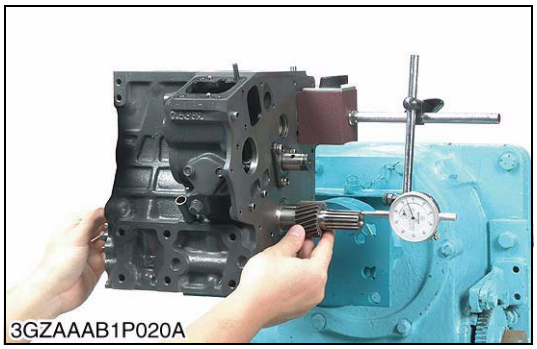
## Connecting Rod Alignment

1. Remove the crankpin bearing, and install the connecting rod cap.
2. Install the piston pin in the connecting rod.
3. Install the connecting rod on the connecting rod alignment tool (Code No. 07909-31661).
4. Put a gauge over the piston pin, and move it against the face plate.
5. If the gauge does not fit squarely against the face plate, measure the space between the pin of the gauge and the face plate.
6. If the measurement exceeds the allowable limit, replace the connecting rod.

| | | |
|---|---|---|
| Space between gauge pin face plate | Allowable limit | 0.05 mm<br>0.0020 in. |

W10314620

## (4) Crankshaft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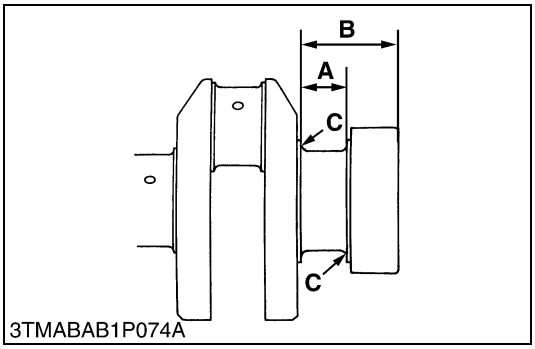
### Crankshaft Side Clearance

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 spec. | 0.15 to 0.31 mm<br>0.0059 to 0.0122 in. |
| | Allowable limit | 0.50 mm<br>0.0197 in. |



3TMABAB1P074A

**(Reference)**

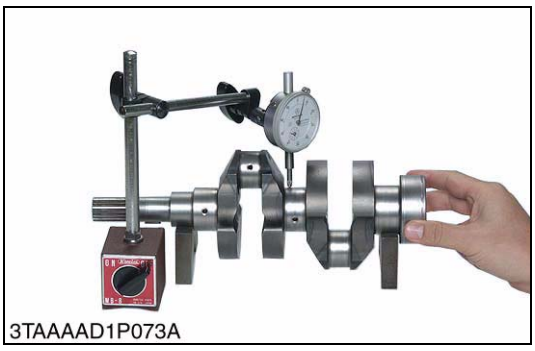
- Oversize thrust bearing

| Oversize | Bearing | Code Number | Marking |
|---|---|---|---|
| 0.2 mm<br>0.008 in. | Thrust bearing 1 02 | 15261-23950 | 020 OS |
| | Thrust bearing 2 02 | 15261-23970 | 020 OS |
| 0.4 mm<br>0.016 in. | Thrust bearing 1 04 | 15261-23960 | 040 OS |
| | Thrust bearing 2 04 | 15261-23980 | 040 OS |

- Oversize dimensions of crankshaft journal

| Oversize | 0.2 mm<br>0.008 in. | 0.4 mm<br>0.016 in. |
|---|---|---|
| Dimension **A** | 23.40 to 23.45 mm<br>0.9213 to 0.9232 in. | 23.80 to 23.85 mm<br>0.9370 to 0.9390 in. |
| Dimension **B** | 46.1 to 46.3 mm<br>1.815 to 1.823 in. | 46.3 to 46.5 mm<br>1.823 to 1.831 in. |
| Dimension **C** | 1.8 to 2.2 mm radius<br>0.071 to 0.087 in. radius | 1.8 to 2.2 mm radius<br>0.071 to 0.087 in. radius |
| The crankshaft journal must be fine-finished to higher than ∇∇∇. | | (0.8-S) |

W11586190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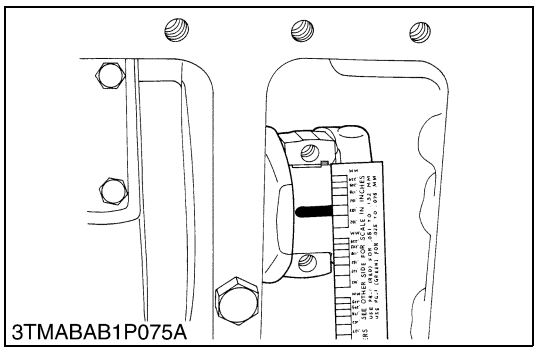
### Crankshaft Alignment

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<br>0.0008 in. |

W11613530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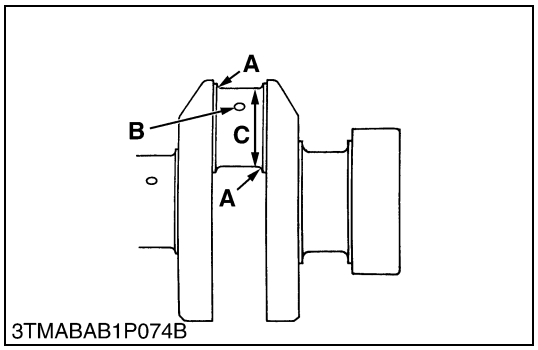


3TMABAB1P074B

**Oil Clearance between Crankpin and Crankpin Bearing**

1. Clean the crankpin and crankpin bearing.
2. Put a strip of plastigage (Code No.: 07909-30241) 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 spec. | 0.020 to 0.051mm<br>0.00079 to 0.00201 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |

| | | |
|---|---|---|
| Crankpin O.D. | Factory spec. | 33.959 to 33.975 mm<br>1.33697 to 1.33760 in. |
| Crankpin bearing I.D. | Factory spec. | 33.995 to 34.010 mm<br>1.33839 to 1.33898 in. |

**(Reference)**

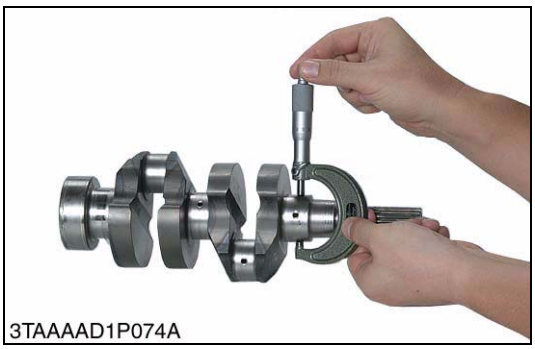
- Undersize crankpin bearing

| Undersize | Bearing | Code Number | Marking |
|---|---|---|---|
| 0.2 mm<br>0.008 in. | Crankpin bearing 02 | 15861-22970 | 020 US |
| 0.4 mm<br>0.016 in. | Crankpin bearing 04 | 15861-22980 | 040 US |

- Undersize dimensions of crankpin

| Undersize | 0.2 mm<br>0.008 in. | 0.4 mm<br>0.016 in. |
|---|---|---|
| Dimension **A** | 2.3 to 2.7 mm radius<br>0.091 to 0.106 in. radius | 2.3 to 2.7 mm radius<br>0.091 to 0.106 in. radius |
| *Dimension **B** | 1.0 to 1.5 mm relief<br>0.0394 to 0.0591 in. relief | 1.0 to 1.5 mm relief<br>0.0394 to 0.0591 in. relief |
| Dimension **C** | 33.759 to 33.775 mm dia.<br>1.32910 to 1.32973 in. dia. | 33.559 to 33.575 mm dia.<br>1.32122 to 1.32185 in. dia. |
| (0.8S)<br>The crankpin must be fine-finished to higher than ∇∇∇∇.<br>*Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.0394 to 0.0591 in.) relief. | | |

W11625390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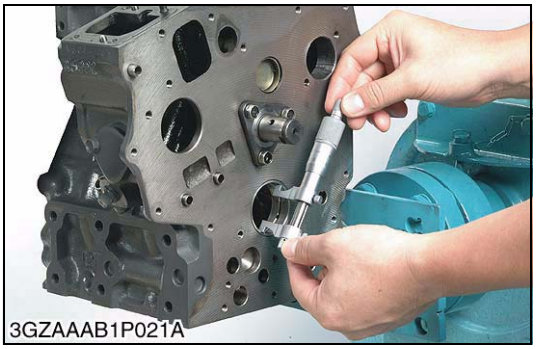
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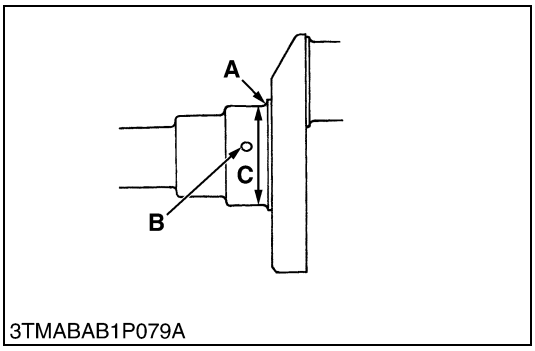


3TMABAB1P079A

## Oil Clearance between Crankshaft Journal and Crankshaft Bearing 1

1. Measure the O.D. of the crankshaft front journal with an outside micrometer.
2. Measure the I.D. of the crankshaft bearing 1 with an inside micrometer, and calculate the oil clearance.
3. If the oil clearance 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 the figure.

| | | |
|---|---|---|
| Oil Clearance between crankshaft journal and crankshaft bearing 1 | Factory spec. | 0.034 to 0.106 mm<br>0.00134 to 0.00417 in. |
| | Allowable limit | 0.20 mm<br>0.0079 in. |

| | | |
|---|---|---|
| Crankshaft journal O.D. | Factory spec. | 39.934 to 39.950 mm<br>1.57221 to 1.57284 in. |
| Crankshaft bearing 1 I.D. | Factory spec. | 39.984 to 40.040 mm<br>1.57417 to 1.57638 in. |

**(Reference)**

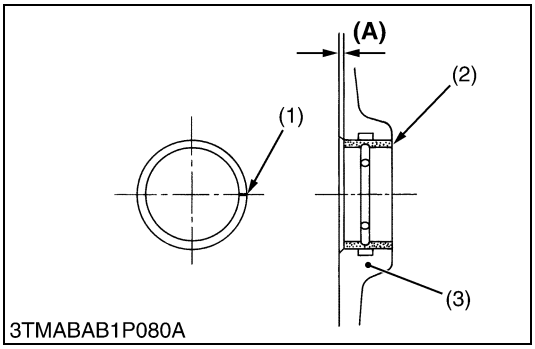
- Undersize crankshaft bearing 1

| Undersize | Bearing | Code Number | Marking |
|---|---|---|---|
| 0.2 mm<br>0.008 in. | Crankshaft bearing 1 02 | 15861-23910 | 020 US |
| 0.4 mm<br>0.016 in. | Crankshaft bearing 1 04 | 15861-23920 | 040 US |

- Undersize dimensions of crankshaft journal

| Undersize | 0.2 mm<br>0.008 in. | 0.4 mm<br>0.016 in. |
|---|---|---|
| Dimension **A** | 1.8 to 2.2 mm radius<br>0.071 to 0.087 in. radius | 1.8 to 2.2 mm radius<br>0.071 to 0.087 in. radius |
| Dimension **B** | 5 mm dia.<br>0.20 in. dia. | 5 mm dia.<br>0.20 in. dia. |
| Dimension **C** | 39.734 to 39.750 mm dia.<br>1.56433 to 1.56496 in. dia. | 39.534 to 39.550 mm dia.<br>1.55646 to 1.55709 in. dia. |
| The crankshaft journal must be fine-finished to higher than ∇∇∇∇ (0.8-S) | | |

W10323470



3TMABAB1P080A

## Replacing Crankshaft Bearing 1

**(When removing)**

1. Press out the used crankshaft bearing 1 using a crankshaft bearing 1 replacing tool. (Refer to “SPECIAL TOOLS”.)

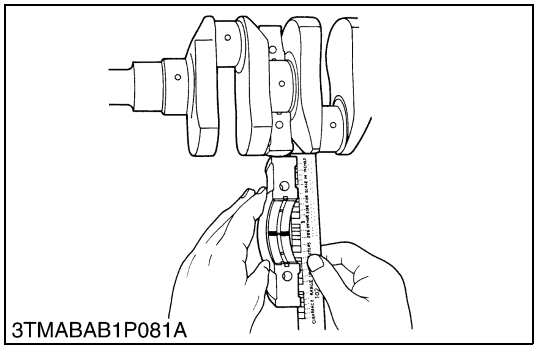
**(When installing)**

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 spec. | 0.0 to 0.3 mm<br>0.0 to 0.0118 in. |

(1) Seam
(2) Crankshaft Bearing 1
(3) Cylinder Block
**(A) Dimension**

W10342000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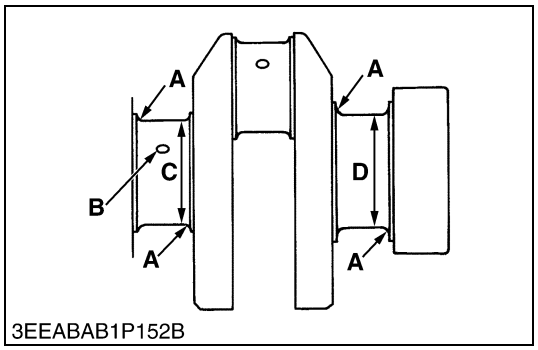


3EEABAB1P152B

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

1. Put a strip of plastigage (Code No. 07909-30241) on the center of the journal.
2. Install the bearing case and tighten the bearing case screws 1 to the specified torque, and remove the bearing case again.
3. Measure the amount of the flattening with the scale, and get the oil clearance.
4. If the oil clearance exceeds the allowable limit, replace the crankshaft bearing 2 (crankshaft bearing 3).
5. If the same size bearing is useless because of the crankshaft journal wear, replace it with an undersize one referring to the table and figure.

■ **NOTE**

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

| | | |
|---|---|---|
| Oil clearance between crankshaft journal and crankshaft bearing 2 (crankshaft bearing 3) | Factory spec. | 0.028 to 0.051 mm<br>0.00110 to 0.00201 in. |
| | Allowable limit | 0.20 mm<br>0.0079 in. |

| | | |
|---|---|---|
| Crankshaft journal O.D. (Flywheel side) | Factory spec. | 43.934 to 43.950 mm<br>1.72968 to 1.73031 in. |
| Crankshaft bearing 2 I.D. | Factory spec. | 43.984 to 44.026 mm<br>1.73165 to 1.73331 in. |

| | | |
|---|---|---|
| Crankshaft journal O.D. (Intermediate) | Factory spec. | 39.934 to 39.950 mm<br>1.57221 to 1.57284 in. |
| Crankshaft bearing 3 I.D. | Factory spec. | 39.984 to 40.026 mm<br>1.57417 to 1.57583 in. |

**(Reference)**

- Undersize crankshaft bearing 2 and 3

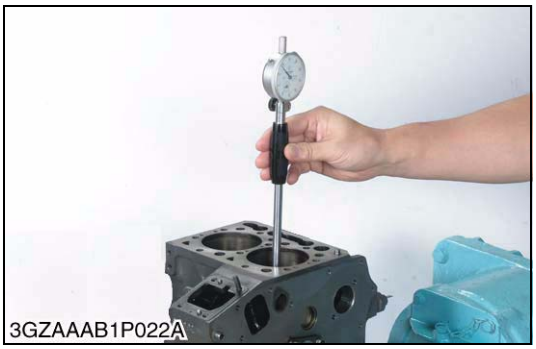
| Undersize | Bearing | Code Number | Marking |
|---|---|---|---|
| 0.2 mm<br>0.008 in. | Crankshaft bearing 2 02 | 15694-23930 | 020 US |
| | Crankshaft bearing 3 02 | 15861-23860 | 020 US |
| 0.4 mm<br>0.016 in. | Crankshaft bearing 2 04 | 15694-23940 | 040 US |
| | Crankshaft bearing 3 04 | 15861-23871 | 040 US |

- Undersize dimensions of crankshaft journal

| Undersize | 0.2 mm<br>0.008 in. | 0.4 mm<br>0.016 in. |
|---|---|---|
| Dimension **A** | 1.8 to 2.2 mm radius<br>0.071 to 0.087 in. radius | 1.8 to 2.2 mm radius<br>0.071 to 0.087 in. radius |
| *Dimension **B** | 1.0 to 1.5 mm relief<br>0.0394 to 0.0591 in. relief | 1.0 to 1.5 mm relief<br>0.0394 to 0.0591 in. relief |
| Dimension **C** | 39.734 to 39.750 mm dia.<br>1.56433 to 1.56496 in. dia. | 39.534 to 39.550 mm dia.<br>1.55646 to 1.55709 in. dia. |
| Dimension **D** | 43.734 to 43.750 mm dia.<br>1.72181 to 1.72244 in. dia. | 43.534 to 43.550 mm dia.<br>1.71394 to 1.71457 in. dia. |
| (0.8S)<br>The crankshaft journal must be fine-finished to higher than ∇∇∇∇.<br>*Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.0394 to 0.0591 in.) relief. | | |

W10344030

## (5) Cylinder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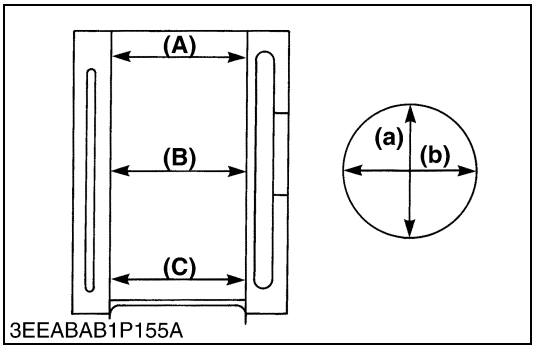

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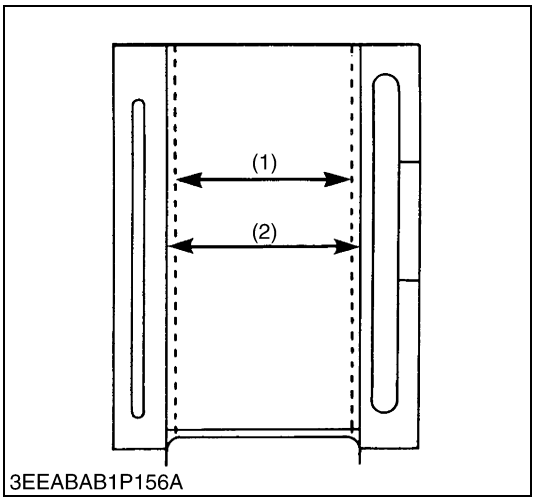

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### Cylinder Wear

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

| | | |
|---|---|---|
| Cylinder I.D. | Factory spec. | 67.000 to 67.019 mm<br>2.63779 to 2.63854 in. |
| | Allowable limit | 67.169 mm<br>2.6445 in. |

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

W10360060

### Correcting Cylinder

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

| | | |
|---|---|---|
| Cylinder I.D.<br>[Oversize] | Factory spec. | 67.250 to 67.269 mm<br>2.64764 to 2.64839 in. |
| | Allowable limit | 67.419 mm<br>2.65429 in. |
| Finishing | Hone to 1.2 to 2.0 µm Rmax.<br>∇∇∇∇<br>(0.000047 to 0.000079 in. Rmax.) | |

2. Replace the piston and piston rings with oversize ones.

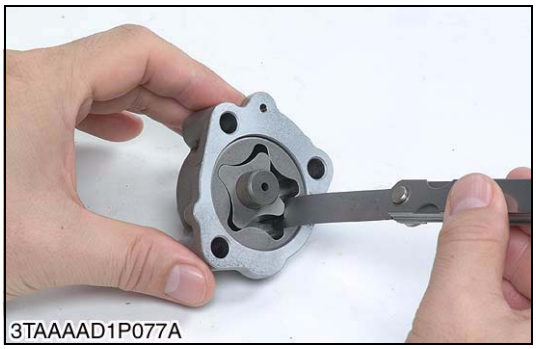
| Oversize | Part Name | Code Number | Marking |
|---|---|---|---|
| 0.25 mm<br>0.0098 in. | Piston | 16851-21900 | 025 |
| | Piston ring assembly | 16851-21090 | 025 |

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

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

W10367470

## (6) Oil Pump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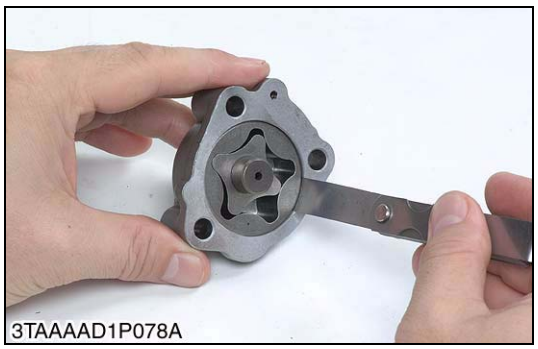
### Rotor Lobe Clearance

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

| | | |
|---|---|---|
| Rotor lobe clearance | Factory spec. | 0.03 to 0.14 mm<br>0.0012 to 0.0055 in. |

W10378950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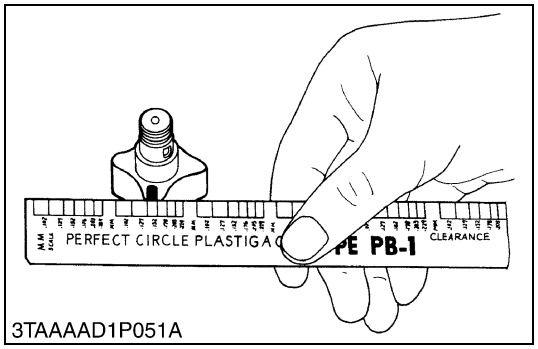
## Clearance between Outer Rotor and Pump Body

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

| | | |
|---|---|---|
| Clearance between outer rotor and pump body | Factory spec. | 0.07 to 0.15 mm<br>0.0028 to 0.0059 in. |

W10381420



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## Clearance between Rotor and Cover

1. Put a strip of plastigage (Code No. 07909-30241) 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 spec. | 0.075 to 0.135 mm<br>0.00295 to 0.00531 in. |

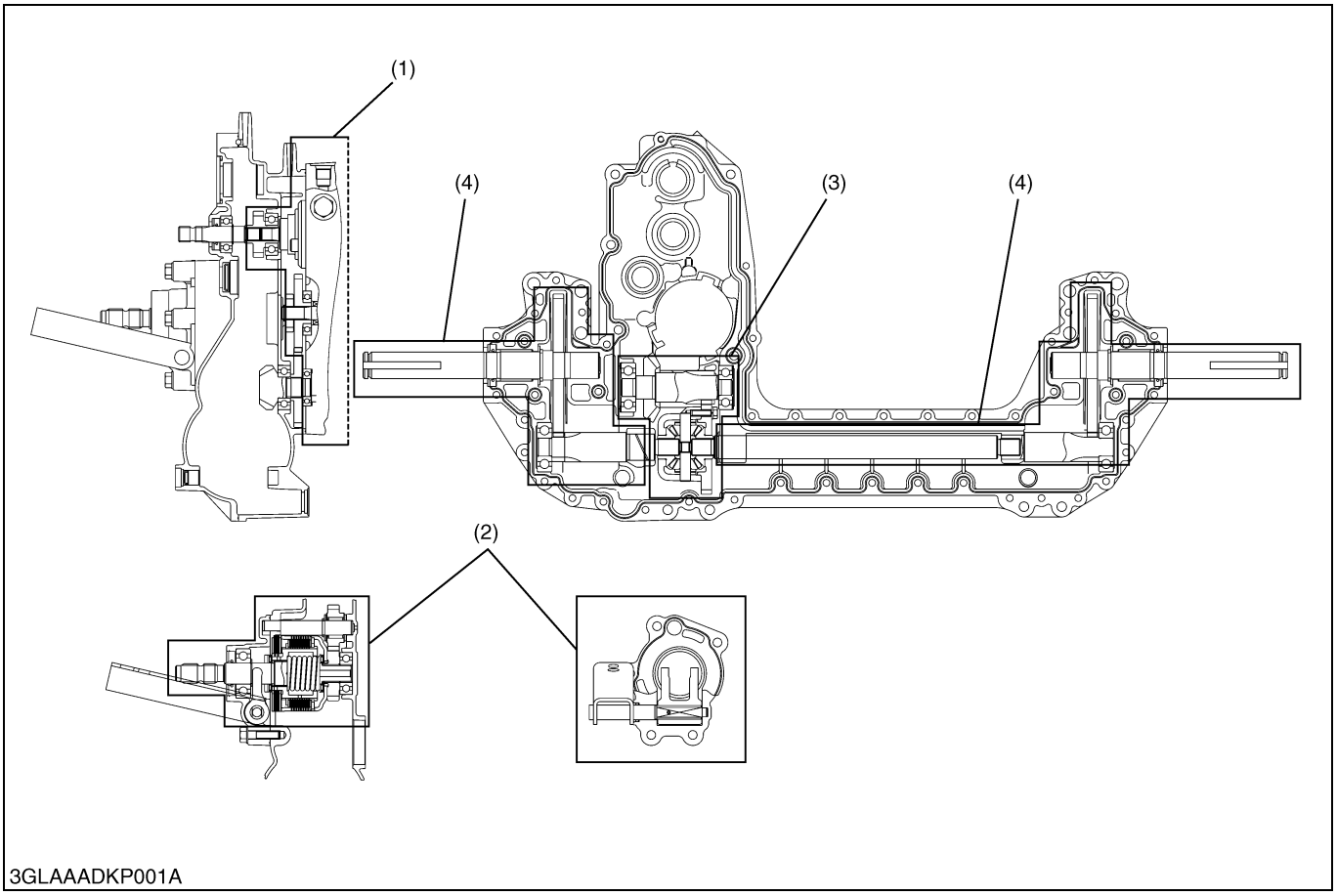
W10382660

# 2 TRANSAXLE

# MECHANISM

## CONTENTS

# 1. STRUCTURE

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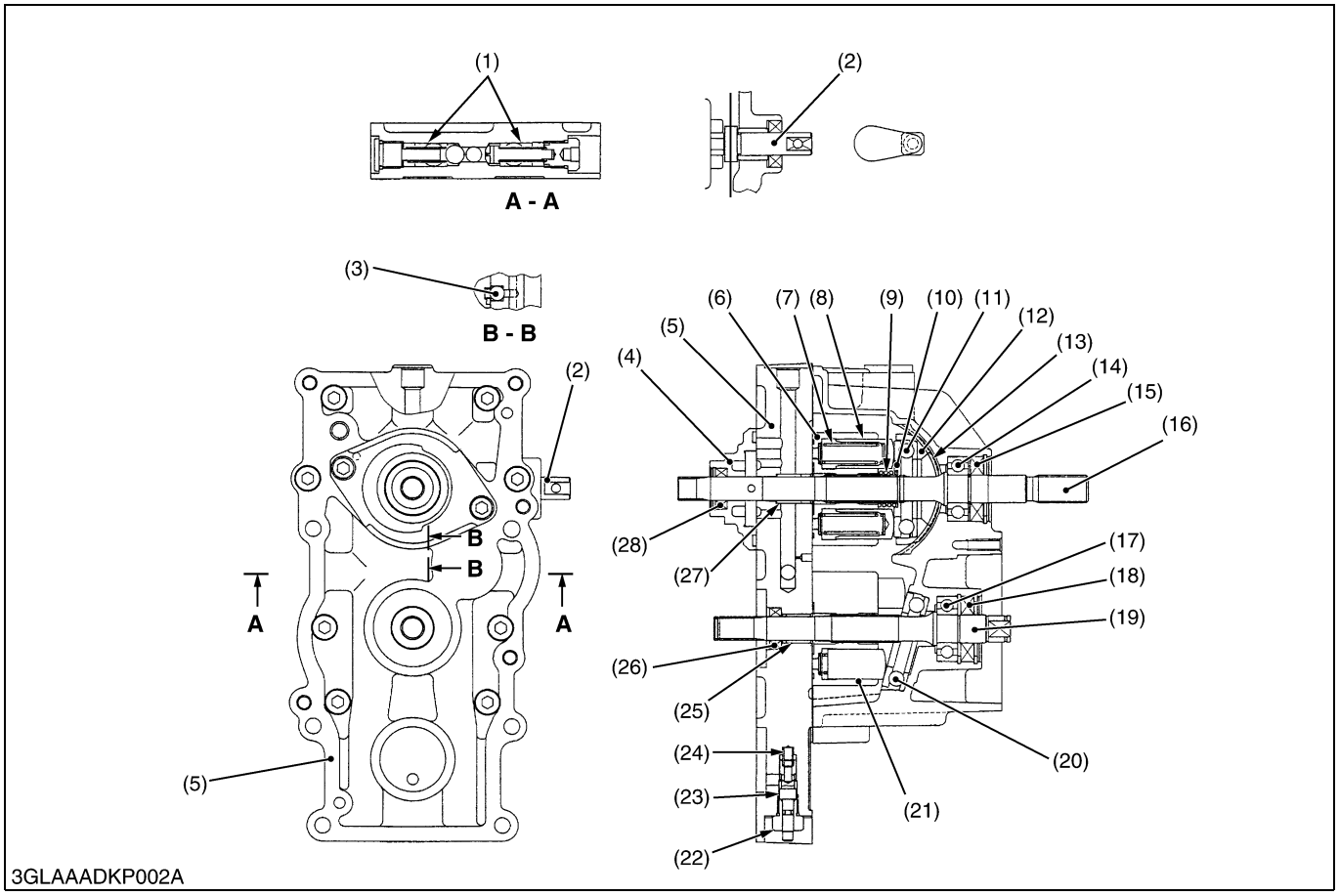
(1) Hydraulic Transmission Section
(2) Mower PTO Section
(3) Differential Gear Section
(4) Rear Axle Section

# 2. TRAVELLING SYSTEM

## [1] HYDRAULIC TRANSMISSION

### (1) Structure




| | | | |
|---|---|---|---|
| (1) Check Valve | (8) Piston | (15) Oil Seal | (22) By-pass Plug |
| (2) Trunnion Arm | (9) Spring (Cylinder Block) | (16) Pump Shaft | (23) By-pass Spool |
| (3) Charge Relief Valve | (10) Washer | (17) Ball Bearing | (24) By-pass Spring |
| (4) Charge Pump | (11) Thrust Ball Bearing | (18) Oil Seal | (25) Journal Bearing |
| (5) Center Section | (12) Swashplate | (19) Motor Shaft | (26) Oil Seal |
| (6) Cylinder Block (Pump) | (13) Cradle Bearing | (20) Thrust Ball Bearing | (27) Journal Bearing |
| (7) Piston Spring | (14) Ball Bearing | (21) Cylinder Block (Motor) | (28) Oil Seal |

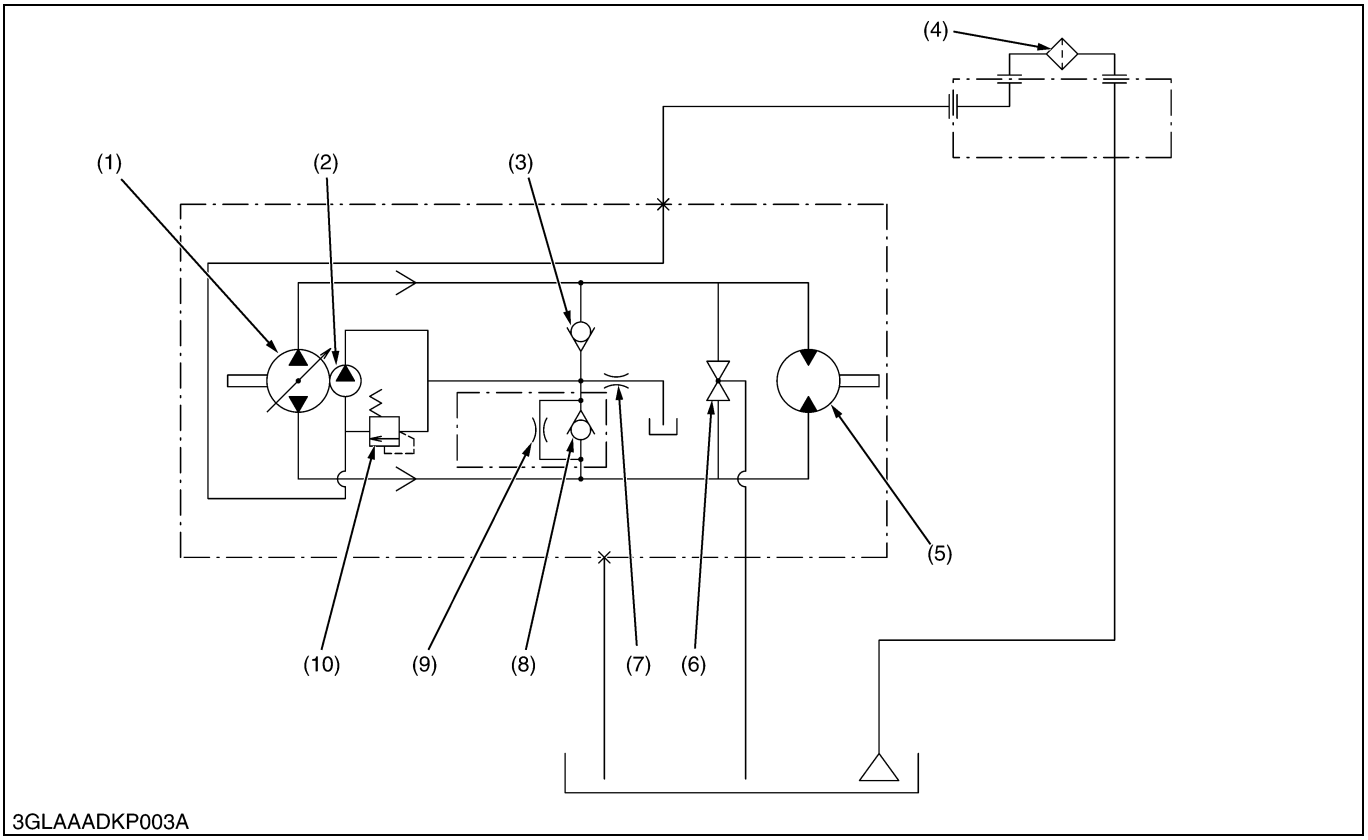
Hydrostatic Transmission (HST) consists of a variable displacement piston pump, a fixed displacement piston motor, two check valves (1) and a by-pass valve.

The pump and motor have five pistons (8) in their own cylinder block (6), (21).

The discharge rate of the HST is 10 $cm^3$/rev. (0.61 cu. in./rev.).

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

## (2) Oil Flow




(1) Pump
(2) Charge Pump
(3) Check Valve (Forward)
(4) Filter Cartridge
(5) Motor
(6) By-pass Valve
(7) Lubricating Orifice
(8) Check Valve (Reverse)
(9) Neutral Orifice
(10) Charge Relief Valve

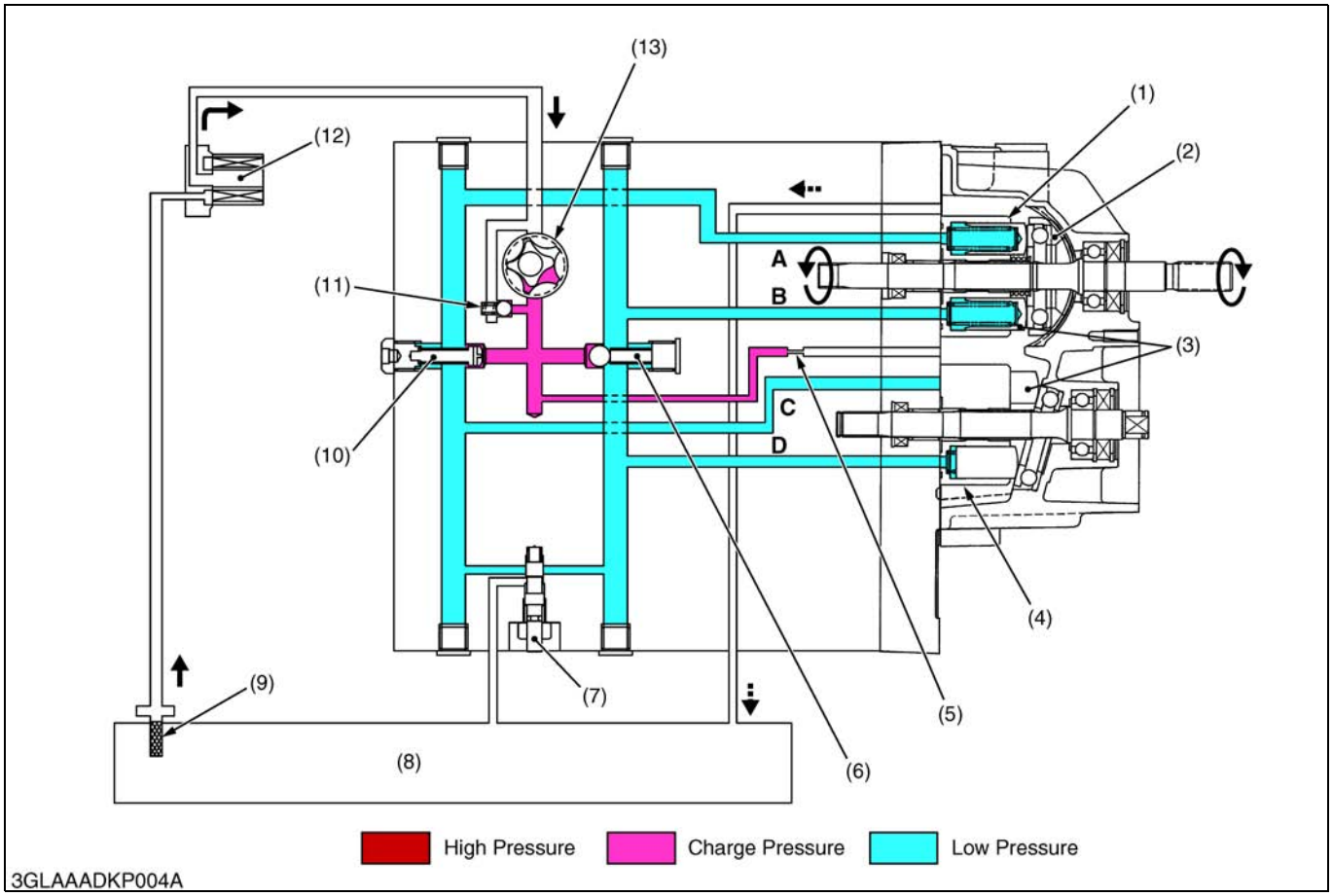
The closed oil-hydraulic loop connects between the pump (1) and the motor (5) in HST.

Oil from the transaxle flows through the filter cartridge (4). Then the oil passed through the filter cartridge (4) is routed to HST as charge oil by the charge pump (2) and charge relief valve (10).

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

## (3) Operation

### ■ Neutral




(1) Cylinder Block (Pump)
(2) Swashplate
(3) Piston
(4) Cylinder Block (Motor)
(5) Lubricating Orifice
(6) Check Valve (Forward)
(7) By-pass Valve
(8) Transaxle Case
(9) Oil Strainer
(10) Check Valve (Reverse)
(11) Charge Relief Valve
(12) Filter Cartridge
(13) Charge Pump

Engine revolution rotates the pump shaft via the universal joint.

Being engaged with each other, the pump shaft and the cylinder block (1) in the pump rotate together.

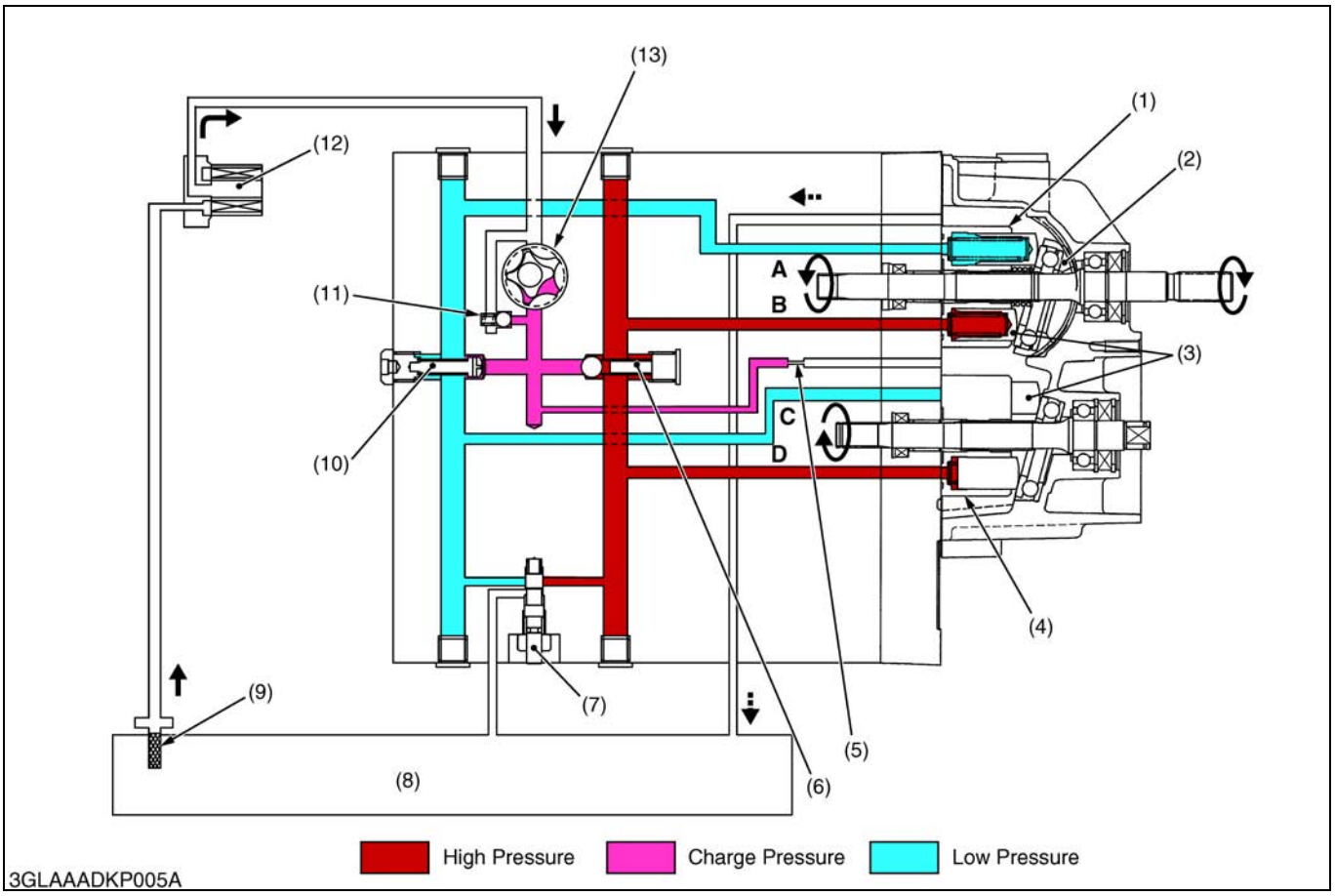
With the speed control pedal in the neutral position, the swashplate (2) in the pump is at right angles to the pump pistons.

The pump pistons rotate with the pump cylinder block (1) without reciprocating motion.

At this time, since the pump pistons do not generate pressure, no pressure is transmitted to the motor pistons, thus causing neither rotation of the motor cylinder block (4) nor that of the motor shaft engaged with it.

Thus the machine is stationary.

## ■ Forward




(1) Cylinder Block (Pump)
(2) Swashplate
(3) Piston
(4) Cylinder Block (Motor)
(5) Lubricating Orifice
(6) Check Valve (Forward)
(7) By-pass Valve
(8) Transaxle Case
(9) Oil Strainer
(10) Check Valve (Reverse)
(11) Charge Relief Valve
(12) Filter Cartridge
(13) Charge Pump

Stepping on the speed control pedal to the forward position inclines the HST trunnion arm, causing the pump swashplate (2) to incline as shown in the figure.

The pump pistons rotate with the pump cylinder block (1) while reciprocating.

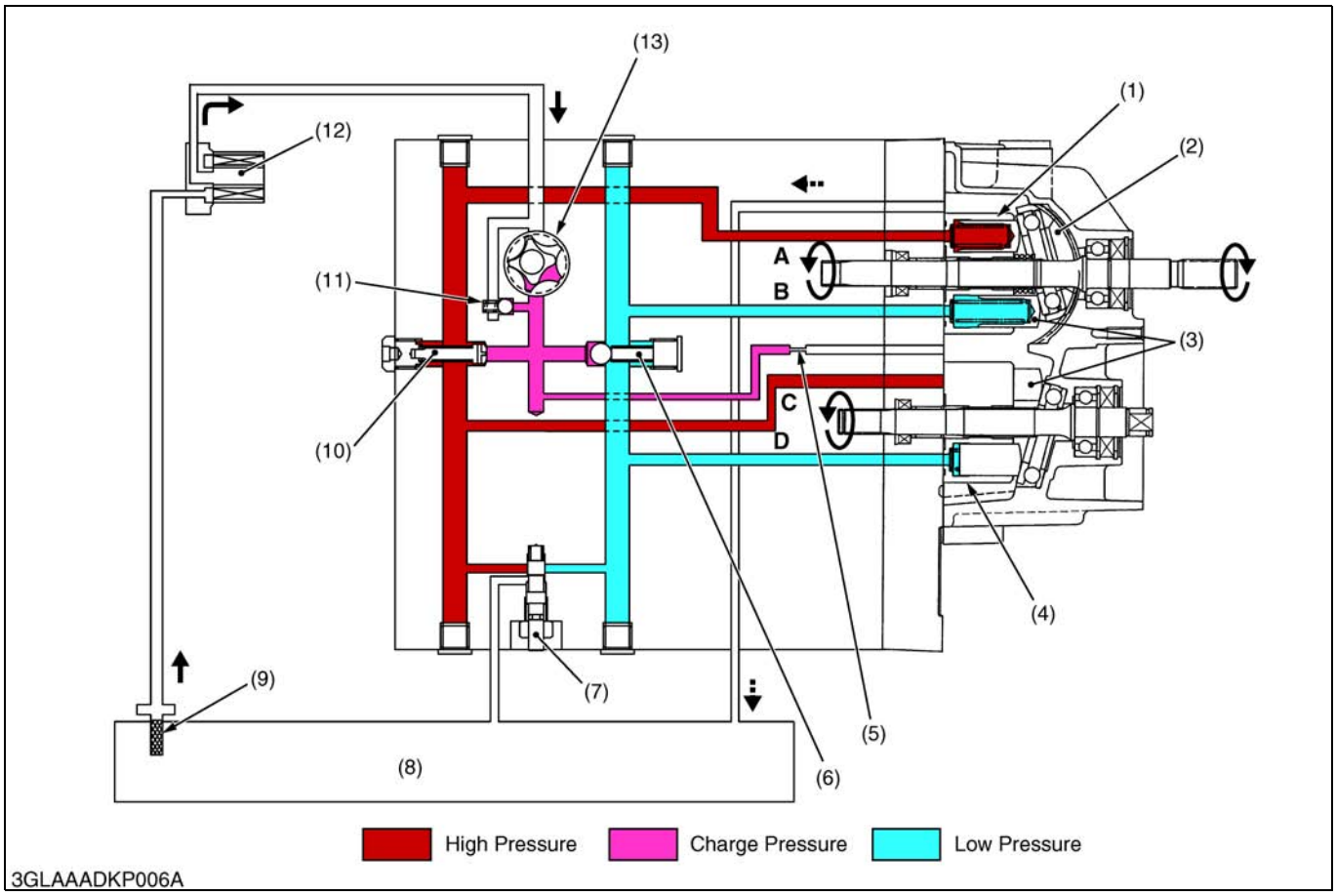
At this time, the pump pistons generate pressure by reciprocating motion. The pressure generated is transmitted to the motor pistons (Port **B** - Port **D**).

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

This causes the motor cylinder block (4) and the motor shaft engaged with it to rotate.

This causes the machine to move forward. The inclination of the pump swashplate (2) determines the motor shaft speed.

## ■ Reverse




(1) Cylinder Block (Pump)
(2) Swashplate
(3) Piston
(4) Cylinder Block (Motor)
(5) Lubricating Orifice
(6) Check Valve (Forward)
(7) By-pass Valve
(8) Transaxle Case
(9) Oil Strainer
(10) Check Valve (Reverse)
(11) Charge Relief Valve
(12) Filter Cartridge
(13) Charge Pump

Stepping on the speed control pedal to the reverse position inclines the HST trunnion arm in the direction opposite to that at moving forward, causing the pump swashplate (2) to incline as shown in the figure.

The pump pistons rotate with the pump cylinder block (1) while reciprocating.

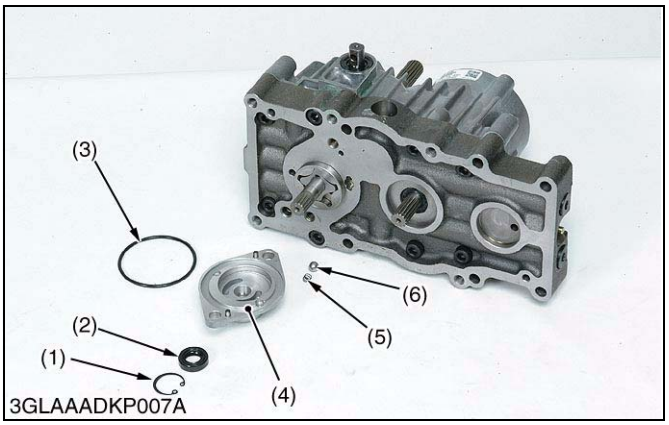
At this time, the pump pistons generate pressure by reciprocating motion. The pressure generated is transmitted to the motor pistons (Port **A** - Port **C**).

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

This causes the motor cylinder block (4) and the motor shaft engaged with it to rotate.

This causes the machine to move reverse. The inclination of the pump swashplate (2) determines the motor shaft speed.

## (4) Charge Pump




The charge pump revolves in combination with pump shaft to draw oil from the transaxle case, and feed oil to the charge circuit.

The charge pump is necessary to make up for leakage from the pump and motor, preventing system.

| | | |
|---|---|---|
| Charge relief pressure | Factory spec. | 0.3 to 0.5 MPa<br>3.1 to 5.1 kgf/cm$^2$<br>43.5 to 72.5 psi |

**Condition**

- Engine Speed : Rated speed
- Oil Temperature : 50 °C (122 °F)

(1) Internal Snap Ring
(2) Oil Seal
(3) O-ring
(4) Charge Pump Housing
(5) Spring (Charge Relief Valve)
(6) Steel Ball (Charge Relief valve)

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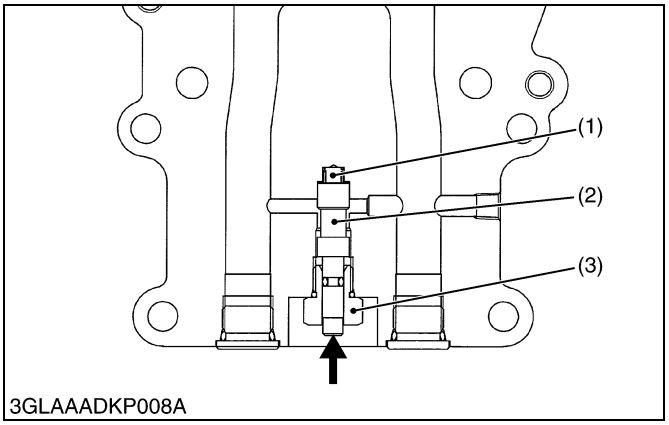
## (5) By-pass Valve




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

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

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

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

(1) By-pass Spring
(2) By-pass Spool
(3) By-pass Plug

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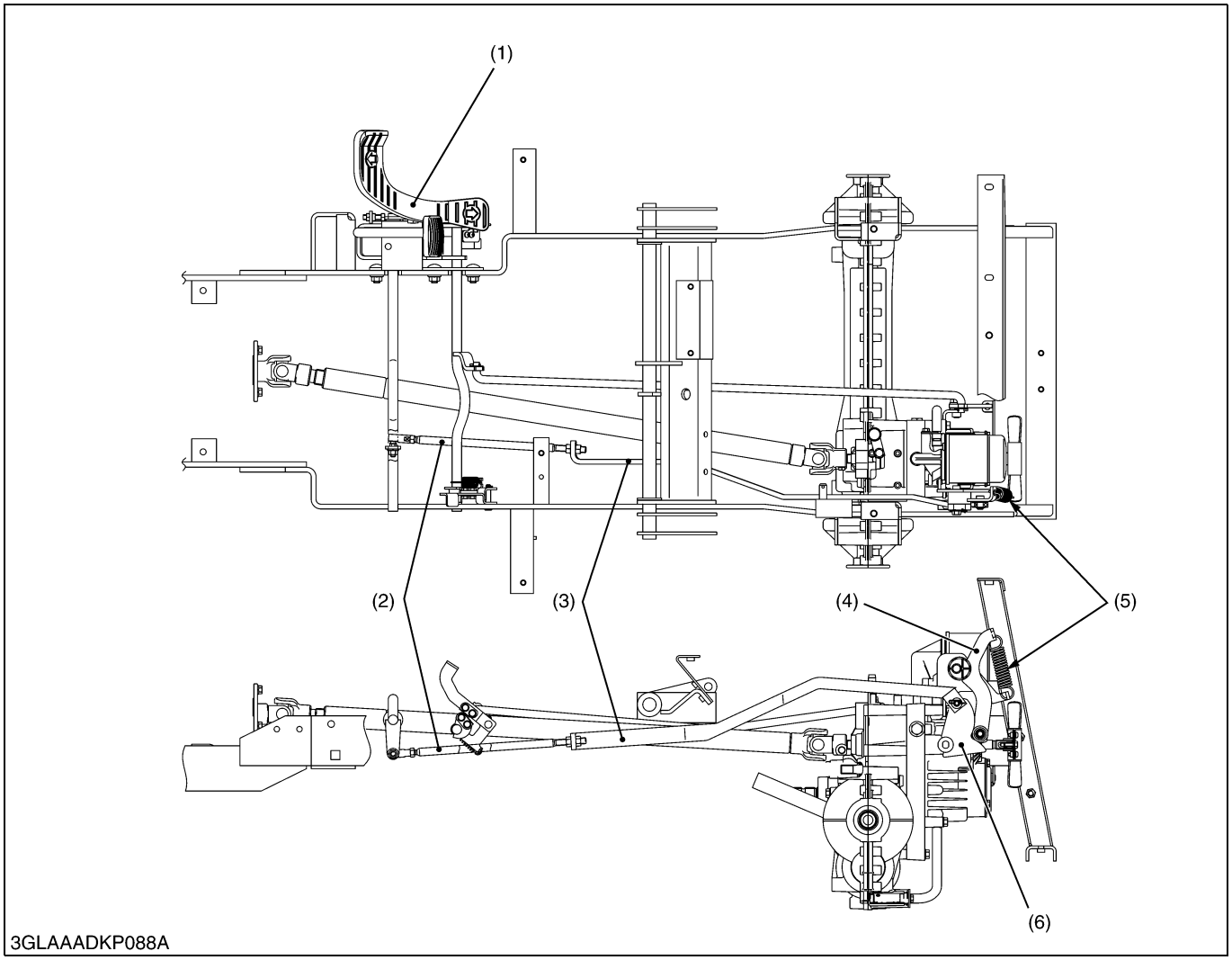
## (6) Control Linkage



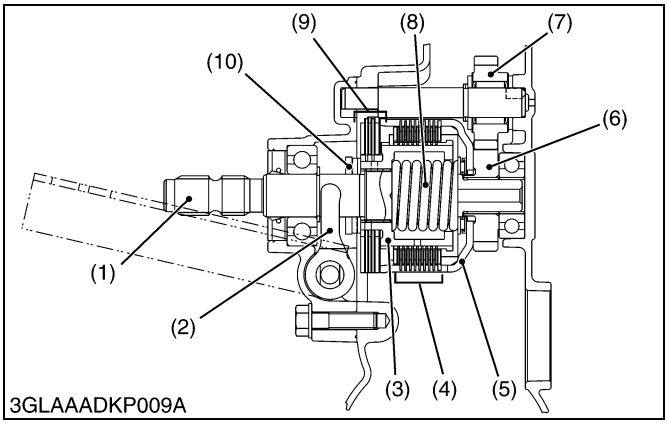

(1) Speed Change Pedal
(2) Speed Change Rod
(3) Speed Change Plate
(4) Neutral Arm
(5) Neutral Spring
(6) Speed Control Arm

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

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

# [2] MOWER PTO SYSTEM

## (1) Mower PTO Clutch




The mower PTO clutch is equipped with mechanical independent clutches of wet multi-plates type.

The PTO shaft (1) is engaged with the spline boss (3).

The clutch case (5) is engaged with the 24T gear (6).

Normally, spring (8) tension pushes the spline boss (3) in the PTO clutch toward the front side of the machine, which creates clearance between clutch disc and friction plate (4), causing no friction.

Thus, no driving power is transmitted between spline boss (3) and clutch case (5), that is, no driving power is transmitted to the PTO shaft (1).

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

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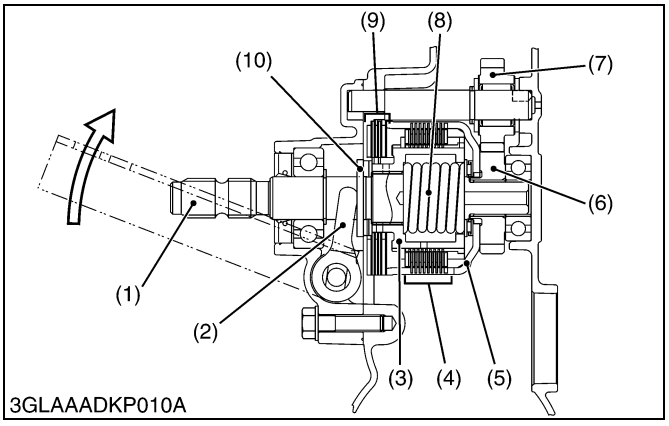


### ■ PTO “Engaged”

When the PTO lever is set at the **"Engaged"** position, the clutch lever (2) connected to the PTO lever via a link mechanism rotates to the rear side of the machine.

The clutch lever pushes the spline boss (3) toward the rear side of the machine via the thrust collar (10), which eliminates the clearance between the clutch disc and friction plate (4), causing friction necessary to transmit driving power.

This allows driving power to be transmitted as follows:

19T-2 Gear (7) → 24T Gear (6) → Clutch Case (5) → Spline Boss (3) → PTO Shaft (1).

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

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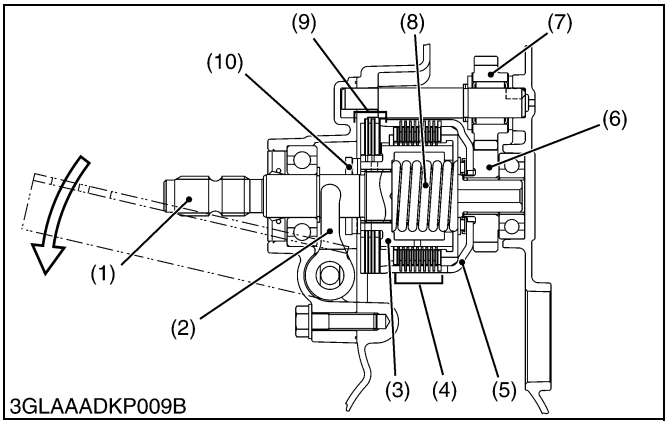


### ■ PTO “Disengaged”

When the PTO lever is set at the **"Disengaged"** position, the clutch lever (2) connected to the PTO lever via a link mechanism rotates to the front side of the machine.

Spring (8) tension pushes the spline boss (3) toward the front side of the machine, which creates clearance between the clutch disc and friction plate (4), causing no friction.

This eliminates the clearance between brake discs and friction plate (9), causing friction.

Driving power to the PTO shaft (1) is thus shut off and brake engages to prevent the PTO shaft (1) from free-spinning.

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

W12345678

# SERVICING

## CONTENTS

# 1. TROUBLESHOOTING

| Symptom | Probable Cause | | Solution | Reference Page |
|---|---|---|---|---|
| **System Will Not Operate in Either Direction** | Oil level is low | | Fill oil to proper level | G-8, 2-S11 |
| | Control linkage defective (Speed change pedal to speed control arm) | | Repair control linkage | 2-S6, 15 |
| | Charge pressure is too low | Oil filter cartridge clogged | Replace oil filter cartridge | G-30 |
| | | Charge pump defective | Replace charge pump | 2-S18 |
| | | Charge relief valve defective | Repair or replace charge relief valve | 2-S18 |
| | Check valve defective | | Replace check valve | 2-S19 |
| | By-pass valve defective | | Replace by-pass valve | 2-S19 |
| | HST component parts defective | | Replace HST assembly | 2-S17, 20 |
| **Vibration and Noise** | Oil level is low | | Fill oil to proper level | G-8, 2-S11 |
| | Control linkage defective (Speed change pedal to speed control arm) | | Repair control linkage | 2-S6, 15 |
| | Charge pressure is too low | Oil filter cartridge clogged | Replace oil filter cartridge | G-30 |
| | | Charge pump defective | Replace charge pump | 2-S18 |
| | | Charge relief valve defective | Repair or replace charge relief valve | 2-S18 |
| | Check valve defective | | Replace check valve | 2-S19 |
| | By-pass valve defective | | Replace by-pass valve | 2-S19 |
| | HST component parts defective | | Replace HST assembly | 2-S17, 20 |

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**(Continued)**

| Symptom | Probable Cause | | Solution | Reference Page |
|---|---|---|---|---|
| **Loss of Power** | Oil level is low | | Fill oil to proper level | G-8, 2-S11 |
| | Control linkage defective (Speed change pedal to speed control arm) | | Repair control linkage | 2-S6, S15 |
| | Charge pressure is too low | Oil filter cartridge clogged | Replace oil filter cartridge | G-30 |
| | | Charge pump defective | Replace charge pump | 2-S18 |
| | | Charge relief valve defective | Repair or replace charge relief valve | 2-S18 |
| | Check valve defective | | Replace check valve | 2-S19 |
| | By-pass valve defective | | Replace by-pass valve | 2-S19 |
| | HST component parts defective | | Replace HST assembly | 2-S17, 20 |
| **Oil Heat Over** | Oil level is low | | Fill oil to proper level | G-8, 2-S11 |
| | Excessive machine load | | Reduce machine load | – |
| | Charge pressure is too low | Oil filter cartridge clogged | Replace oil filter cartridge | G-30 |
| | | Charge pump defective | Replace charge pump | 2-S18 |
| | | Charge relief valve defective | Repair or replace charge relief valve | 2-S18 |
| **Machine Will Not Stop in Neutral Position** | Control linkage defective (Speed change pedal to speed control arm) | | Repair control linkage | 2-S6, S15 |
| | Improper adjustment of neutral arm holder shaft | | Adjust | 2-S6 |
| **System Operates in One Direction Only** | Control linkage defective (Speed change pedal to speed control arm) | | Repair control linkage | 2-S6, S15 |
| | Check valve defective | | Replace check valve | 2-S19 |

W1026435

**DIFFERENTIAL GEAR SECTION**

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Excessive or Unusual Noise at All Time** | Improper backlash between 11T bevel gear and 17T-13T gear shaft | Adjust | 2-S34 |
| | Improper backlash between differential pinion and differential side gear | Adjust | 2-S33 |
| | Bearing worn | Replace | – |
| | Insufficient or improper type of transmission fluid used | Replenish or change | G-8, 2-S11 |
| **Noise while Turning** | Differential pinions or differential side gears worn or damaged | Replace | 2-S28 |
| | Bearing worn | Replace | – |

W1013718

**MOWER PTO SECTION**

| | | | |
|---|---|---|---|
| **PTO Clutch Slip** | Improper length of PTO rod spring | Adjust | 2-S13 |
| | PTO rod spring weaken or broken | Replace | 2-S13 |
| | Clutch disc or friction plate excessively worn | Replace | 2-S24, 31, 32 |
| **PTO Shaft Does Not Rotate** | PTO clutch malfunctioning | Repair or replace | 2-S23, S24 |
| | Bearing broken | Replace | 2-S23 |
| **PTO Clutch Drags** | Brake plate excessive worn | Replace | 2-S24, 32 |
| | Clutch spring weaken or broken | Replace | 2-S24, 31 |
| | Deformation of plate | Replace | 2-S24 |

W1011002

# 2. SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Charge Relief Valve<br>(Oil temperature at 50 °C, 122 °F) | Setting Pressure | 0.3 to 0.5 MPa<br>3.1 to 5.1 kgf/cm$^2$<br>43.5 to 72.5 psi | – |
| PTO Clutch Disc | Thickness | 1.3 to 1.5 mm<br>0.051 to 0.059 in. | 1.2 mm<br>0.047 in. |
| Pressure Plate | Thickness | 1.55 to 1.65 mm<br>0.061 to 0.065 in. | 1.50 mm<br>0.059 in. |
| Friction Plate 1 | Thickness | 1.55 to 1.65 mm<br>0.061 to 0.065 in. | 1.50 mm<br>0.059 in. |
| Friction Plate 2 | Thickness | 0.75 to 0.85 mm<br>0.030 to 0.034 in. | 0.70 mm<br>0.028 in. |
| Clutch Spring | Free Length | 45 mm<br>1.77 in. | 42 mm<br>1.65 in. |
| PTO Brake Disc | Thickness | 3.3 to 3.5 mm<br>0.13 to 0.14 in. | 3.0 mm<br>0.118 in. |
| Brake Friction Plate 1 | Thickness | 1.75 to 1.85 mm<br>0.069 to 0.073 in. | 1.60 mm<br>0.063 in. |
| Brake Friction Plate 2 | Thickness | 0.95 to 1.05 mm<br>0.037 to 0.041 in. | 0.80 mm<br>0.031 in. |
| Differential Case to Differential Side Gear | Clearance | 0.040 to 0.082 mm<br>0.0016 to 0.0032 in. | 0.17 mm<br>0.0067 in. |
| | Differential Case Bore (I.D.) | 22.500 to 22.521 mm<br>0.8858 to 0.8867 in. | – |
| | Differential Side Gear Boss (O.D.) | 22.439 to 22.460 mm<br>0.8834 to 0.8843 in. | – |
| 42T Gear to Differential Side Gear | Clearance | 0.040 to 0.082 mm<br>0.0016 to 0.0032 in. | 0.17 mm<br>0.0067 in. |
| | 42T Gear Boss (I.D.) | 22.500 to 22.521 mm<br>0.8858 to 0.8867 in. | – |
| Differential Pinion Gear to Differential Pinion Shaft | Clearance | 0.025 to 0.055 mm<br>0.00098 to 0.00217 in. | 0.25 mm<br>0.0096 in. |
| | Differential Case Bore (I.D.) | 10.000 to 10.015 mm<br>0.39370 to 0.39429 in. | – |
| | Differential Side Gear Boss (O.D.) | 9.960 to 9.975 mm<br>0.39212 to 0.39272 in | – |
| Differential Pinion Gear to Differential Side Gear | Backlash | 0.15 to 0.30 mm<br>0.0059 to 0.0012 in. | – |
| 11T Bevel Gear Shaft to 17T-13T Gear Shaft | Backlash | 0.15 to 0.30 mm<br>0.0059 to 0.0012 in. | – |

W1013874

# 3. TIGHTENING TORQUES

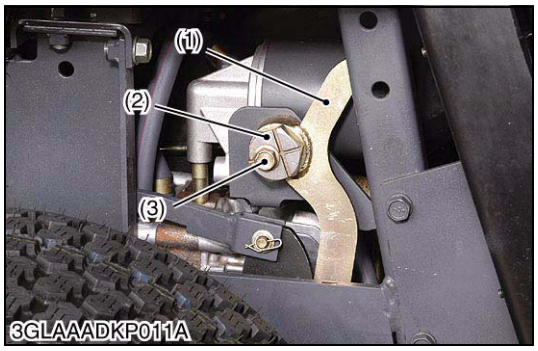
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-9.)

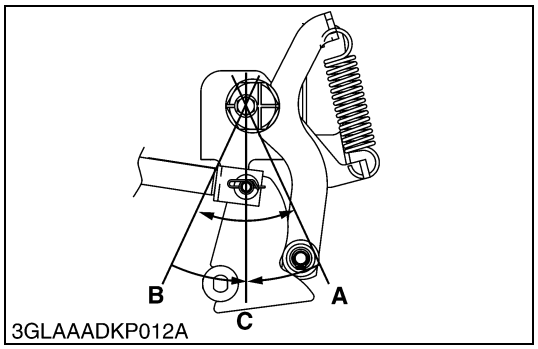
| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Brake plate mounting screw | 34 to 40 | 3.47 to 4.07 | 25.1 to 29.5 |
| Universal joint mounting screw | 9.8 to 11.3 | 1.00 to 1.15 | 7.23 to 8.33 |
| Transaxle mounting screw | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |
| Hydrostatic transmission mounting screw | 23.5 to 27.5 | 2.4 to 2.8 | 17.3 to 20.3 |
| Hydrostatic transmission mounting screw 2 | 17.7 to 20.6 | 1.8 to 2.1 | 13.1 to 15.2 |
| Center section mounting hex. socket head screw | 17.7 to 20.6 | 1.8 to 2.1 | 13.1 to 15.2 |
| By-pass valve plug | 15.0 | 1.53 | 11.1 |
| Check valve plug | 30.0 | 3.06 | 22.1 |
| PTO clutch assembly mounting screw | 17.7 to 20.6 | 1.8 to 2.1 | 13.1 to 15.2 |
| Beam mounting screw | 17.7 to 20.6 | 1.8 to 2.1 | 13.1 to 15.2 |
| Transaxle case screw | 7.8 to 8.8 | 0.8 to 0.9 | 5.8 to 6.5 |
| 42T gear mounting screw | 9.8 to 11.3 | 1.00 to 1.15 | 7.23 to 8.33 |

W1012736

# 4. CHEKING, DISASSEMBLING AND SERVICING

## [1] CHECKING AND ADJUSTING




**Adjustment of HST Neutral Position**

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

**WARNING**

- **Use buddy system in adjusting the neutral position.**
- **One of you should sit on the operator's seat, adjust the engine rpm and step on the speed change pedal. The other should adjust the neutral position.**

(1) Neutral Arm
(2) Holder Shaft
(3) Holder Shaft Mounting Screw

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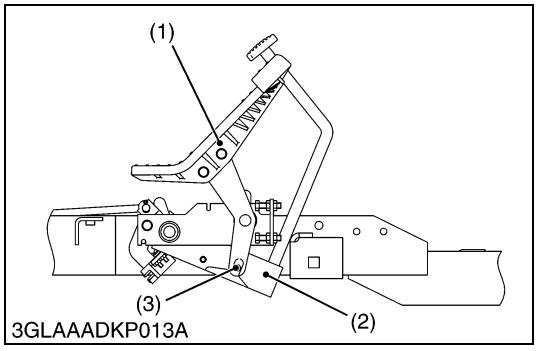


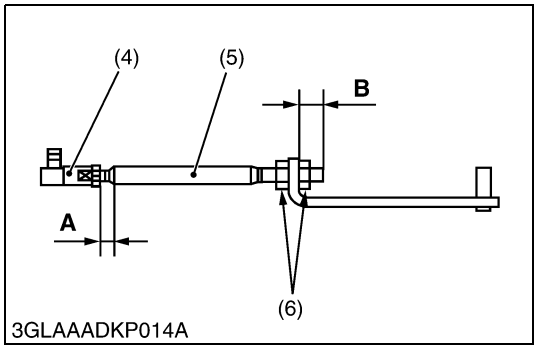


**Speed Change Pedal Restriction**

■ **NOTE**

- **This adjustment should be performed after completing the adjustment of neutral.**

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

**(Reference)**

- Length **A** : 5 mm (0.2 in.)
- Length **B** : 17 to 23 mm (0.67 to 0.91 in.)

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

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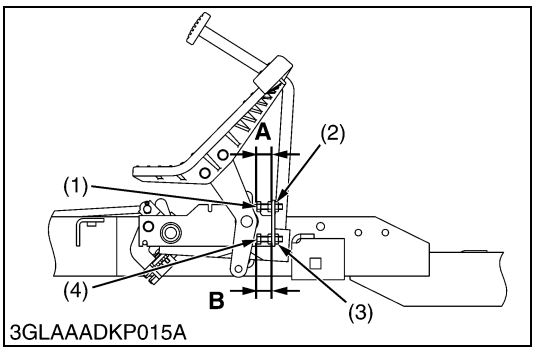

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## Adjusting Maximum Speed

■ **NOTE**
- **This adjustment should be performed after completing the adjustment of neutral.**

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

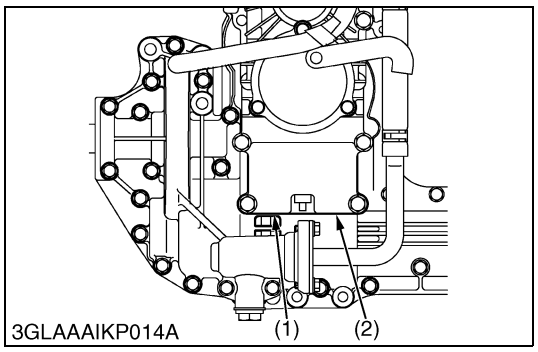
**(Reference)**
- Length (**A**) : 10 to 12 mm (0.40 to 0.47 in.)
- Traveling speed : 9.0 to 10.0 km/h (5.6 to 6.2 mph)

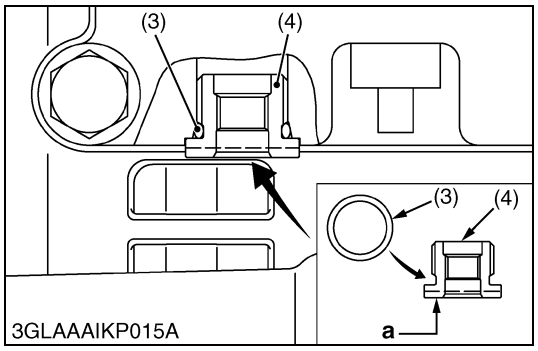
**[Reverse]**
1. Loose the lock nut (3) of adjusting screw.
2. Adjust the length (**B**) with the adjusting screw (4).

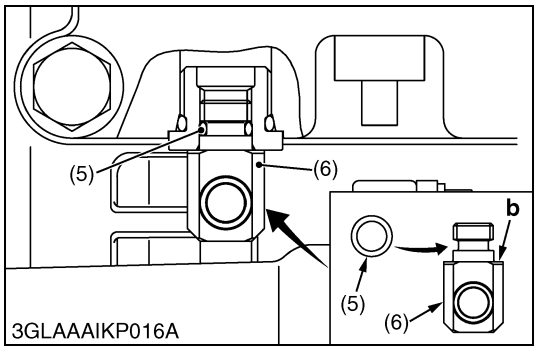
**(Reference)**
- Length (**B**) : 12 to 15 mm (0.47 to 0.59 in.)
- Traveling speed : 4.0 to 5.0 km/h (2.5 to 3.1 mph)

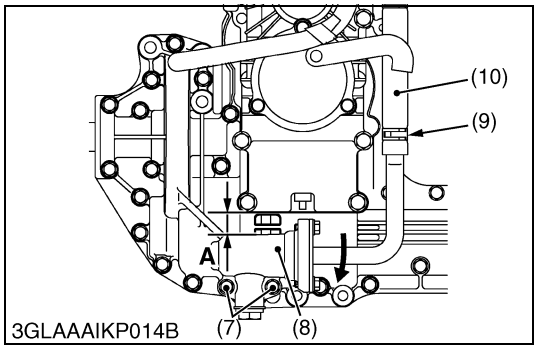
(1) Adjusting Screw
(2) Lock Nut
(3) Lock Nut
(4) Adjusting Screw

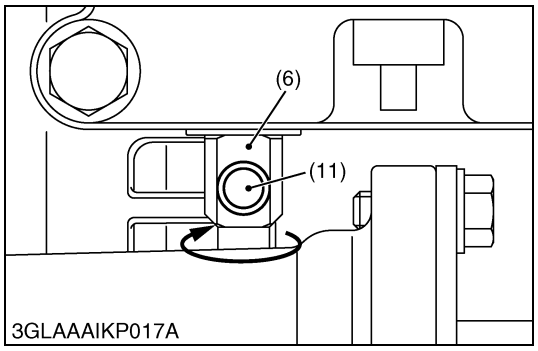
W1011202




## Charge Relief Pressure

**CAUTION**

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

1. Remove the hexagon socket head plug from **P1** (1) or **P2** (2), using the short neck hexagon wrench (see page G-45).
2. Install the O-ring (3) to the adaptor **2** (4). Then, install the adaptor **2** (4) to **P1** (1) or **P2** (2), manually first and then using an adaptor lever (see page G-45).
3. Install the O-ring (5) to the adaptor **1** (6). Then, install the adaptor **1** (6) to the adaptor **2** (4), so that the surface "**b**" of adaptor **1** (6) lightly contacts the surface "**a**" of adaptor **2** (4).

**NOTE**

- **If the adaptor 1 (6) cannot be installed to the adaptor 2 (4) due to interference with the filter case, adjust a mounting position of the filter case (8) to expand clearance "A", by loosening the filter case mounting screws (7) and the hose clamp (9) and turning the filter case (8) clockwise.**
- **After adjusting a mounting position of the filter case (8), retighten the filter case mounting screws (7) and return the hose clamp (9) to a normal position.**

4. Adjust direction of the port (11) by rotating the adaptor **1** (6) counterclockwise seen from underneath, so that the pressure gauge adaptor can be installed on the port (11). However, do not rotate the adapter **1** (6) more than one rotation.
5. Install the adaptor of pressure gauge to the port (11) of adaptor **1** with seal tape. Then install the cable and pressure gauge.
6. Start the engine and run it at rated speed.
7. Read the pressure gauge to measure the charge relief pressure.
8. If the measurement is not within factory specification, check the charge pump and charge relief valve.

| | | |
|---|---|---|
| Charge relief pressure | Factory spec. | 0.3 to 0.5 MPa<br>3.1 to 5.1 kgf/cm$^2$<br>43.5 to 72.5 psi |

**IMPORTANT**

- **To keep a good fit between the adaptor 1 (6) and the adaptor 2 (4), do not rotate the adaptor 1 (6) while measuring.**

**NOTE**

- **When installing the adaptor 1 (6), adaptor 2 (4) and hexagon socket head plug, take care not to damage the O-rings.**

**Condition**

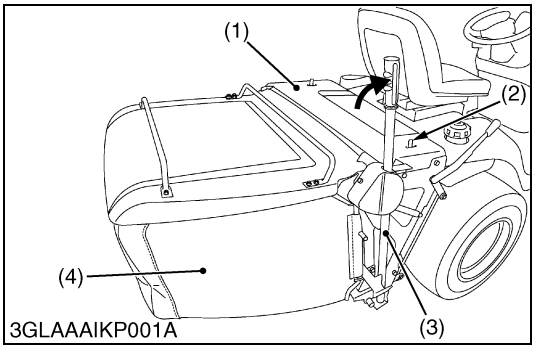
- Engine Speed : Rated Speed
- Oil Temperature : 50 °C (122 °F)

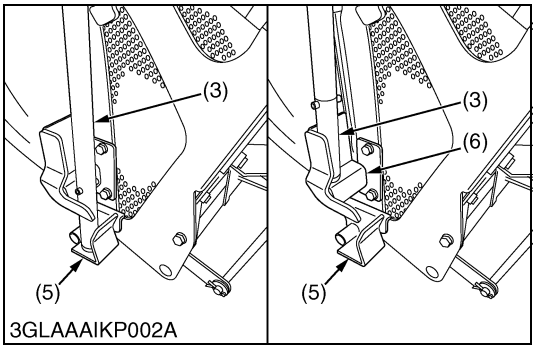
(1) **P1** Port (Reverse)
(2) **P2** Port (Forward)
(3) O-ring (SAE J515 #6 (Tube OD 3/8))
(4) Adaptor **2** (See page G-45)
(5) O-ring (P/N 04811-10060)
(6) Adaptor **1** (See page G-44)
(7) Filter Case Mounting Screw
(8) Filter Case
(9) Hose Clamp
(10) Hose
(11) Port
**A : Clearance between the filter case and the bottom of center section.**

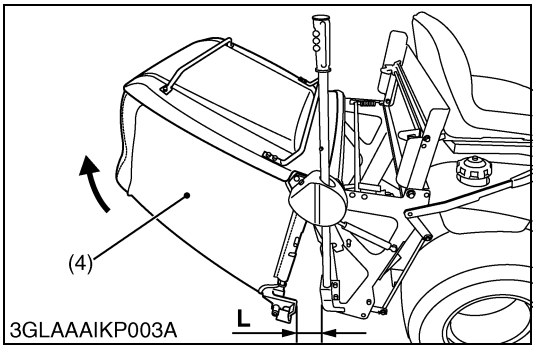
W1051999

# [2] PREPARATION

## (1) Separating Transaxle




**Dismounting Mower**

1. See Page 7-S6. (“Mower” Section)

W1012761

**Dismounting the Container**

**CAUTION**

- **Park the machine on a firm and level ground.**
- **Stop the engine, and remove the key.**

1. Open the top cover (1) with the top cover lock lever (2).
2. Place the grass container lift lever (3) on the container lock plate (5).
3. As shown in the figure, while lifting the rear end of the grass container (4), dismount the grass container (4).

**(When remounting)**

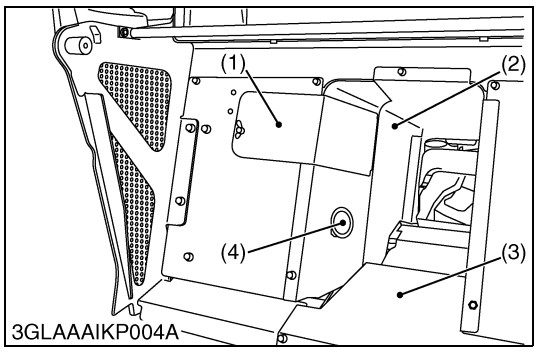
- Open the top cover (1).
- Place the grass container lift lever (3) on the frame lock plate (6).
- While lifting the rear end of the grass container (4), hook the grass container (4) onto the frame shaft so that a clearance “**L**” is about 0 to 50 mm.
- Lock the grass container (4) by inserting the grass container lift lever (3) between the container lock plate (5) and the frame lock plate (6).
- Close the top cover (1).

**(Reference)**

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

(1) Top Cover
(2) Top Cover Lock Lever
(3) Grass Container Lift Lever
(4) Grass Container
(5) Container Lock Plate
(6) Frame Lock Plate

W1012898

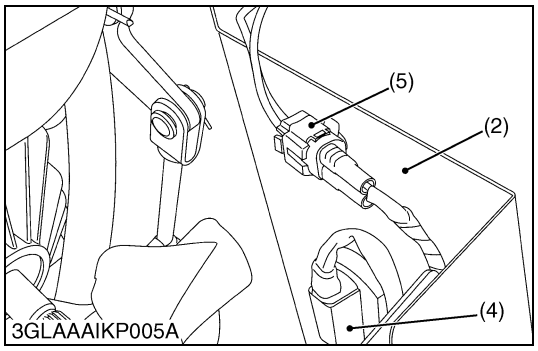


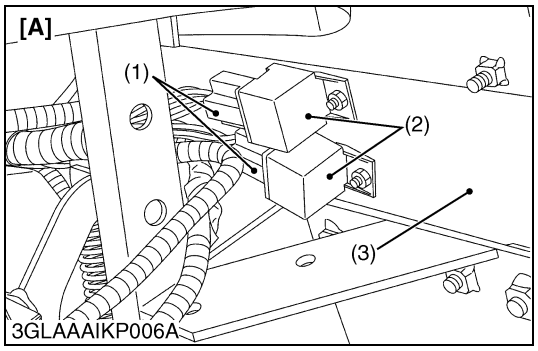

## Discharge Duct

1. Remove the filter cover (1) and the duct plate (3).
2. Disconnect the connector (5) from the grass container full switch (4).
3. Remove the discharge duct (2).

(1) Filter Cover
(2) Discharge Duct
(3) Duct Plate
(4) Grass Container Full Switch
(5) Connector

W1012965



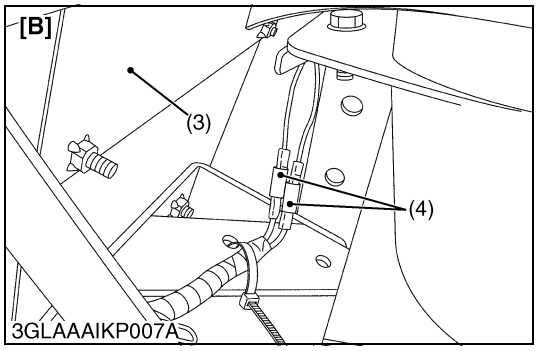



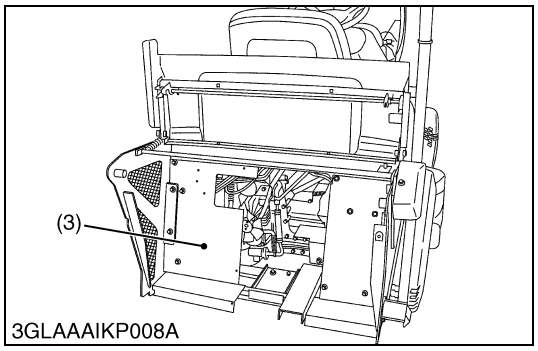

## Container Base

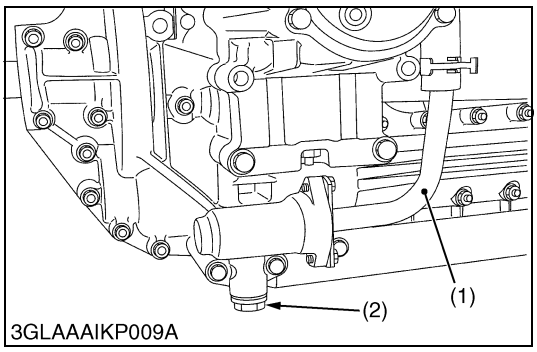
1. Disconnect the couplers (1) from the relays (2).
2. Disconnect the connector (4).
3. Remove the container base (3).

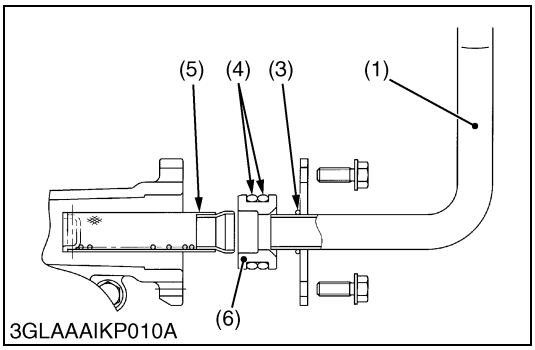
(1) Coupler
(2) Relay
(3) Container Base
(4) Connector
**[A] Left Side**
**[B] Right Side**

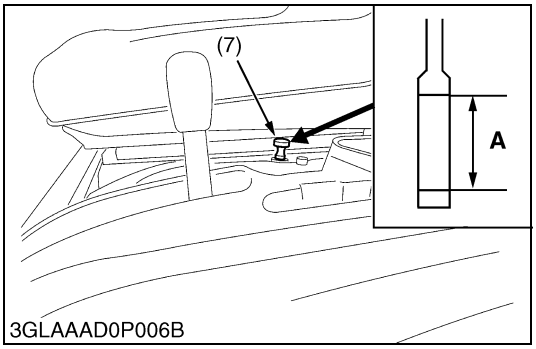
W1013019

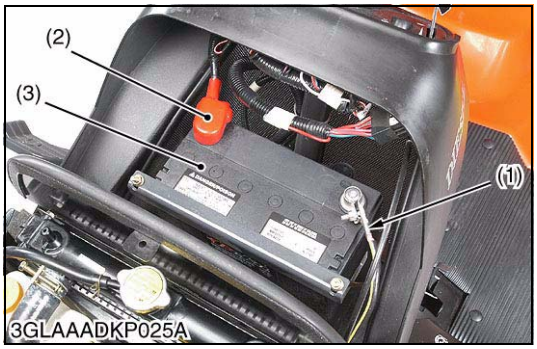


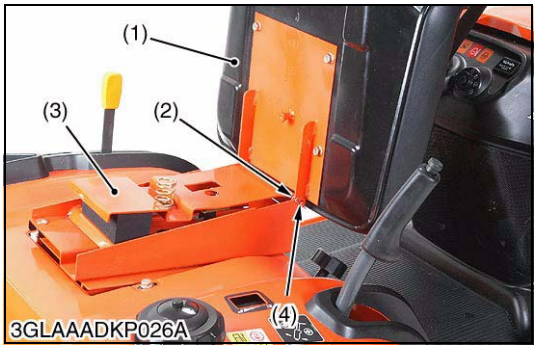






## Draining Transmission Fluid

1. Place an oil pan under the transaxle.
2. Remove the drain plug (2).
3. Remove the stainer (5) to completely drain the transmission fluid.
4. After draining, clean the strainer (5) and reinstall the strainer (5).

**(When refilling)**

- Remove the filling plug with the dipstick (7) and fill with the new transmission fluid.
- After running the engine for few minutes, stop the engine and check the oil level again, if low, add oil to prescribed level.

■ **IMPORTANT**

- **Use the KUBOTA UDT or SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8.)**
- **Never work the machine immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.**
- **Do not mix different bland oil together.**

| | | |
|---|---|---|
| Transmission fluid | Capacity | 2.7 L<br>0.71 U.S.gals<br>0.59 lmp.gals |

(1) Suction Pipe
(2) Drain Plug
(3) O-ring (Small)
(4) O-ring (Large)
(5) Strainer
(6) Boss
(7) Filling Plug with Dipstick
**A : Oil level is acceptable within this range**

W1043955

## Battery

**CAUTION**

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

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

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

W1013083

## Seat

1. Remove two snap pins (2), (4).
2. Remove the seat (1) and seat plate (3).

(1) Seat
(2) Snap Pin
(3) Snap Plate
(4) Snap Pin

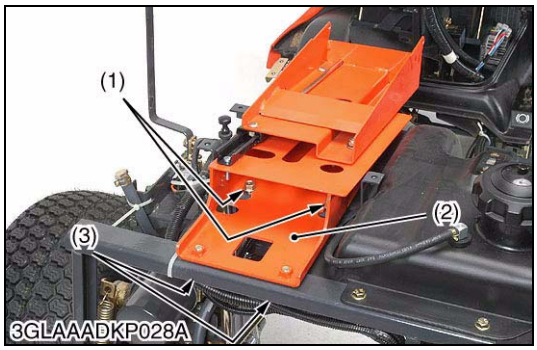
W1013324


## Fender

1. Remove the speed change pedal (5).
2. Peel the step sheet (4) halfway.
3. Remove the fuel cap (1).
4. Remove the fender (2).

(1) Fuel Cap
(2) Fender
(3) Fender Mounting Screw
(4) Step Sheet
(5) Speed Change Pedal

W1013575




## Seat Base

1. Loose the seat base mounting screw 1 (1).
2. Remove the seat base mounting screws 2 (3).
3. Slide the seat base (2) and remove it.

(1) Seat Base Mounting Screw 1
(2) Seat Base
(3) Seat Base Mounting Screw 2

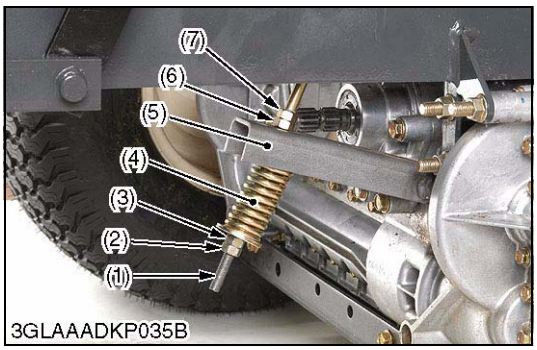
W1013823

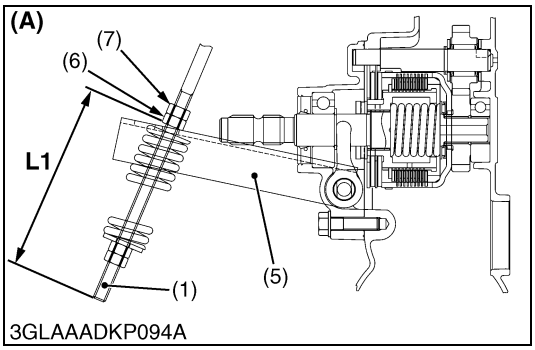

## Fuel Tank

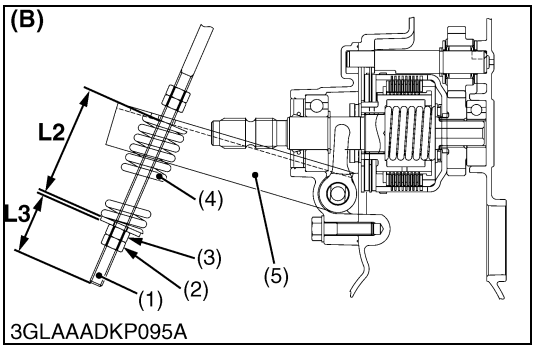
1. Drain the fuel.
2. Disconnect the fuel hoses.
3. Remove the fuel tank (1).

(1) Fuel Tank

W1013980




**PTO Rod Spring**

1. Remove the two nuts (2) (3) and spring (4).

**(When reassembling)**

1. Assemble a fuel tank, a seat base and a fender.
2. Setting the PTO lever at **"Disengaged"** position and lifting the PTO arm (5) slightly by hands directly, the upper side of PTO arm (5) and lower nut (6) on the upper side of PTO rod (1) make contact, and there is no play between them. Keeping this position, be sure to tighten the two nuts (6) (7) on the upper side of this PTO rod (1).
3. Assembly temporarily the spring (4) and two nuts (2) (3) to the PTO rod (1). After this, set the PTO lever at **"Engaged"** position, and then be sure to tighten two nuts (2) (3) on the lower side of PTO rod (1) so that the spring length (**L2**) reaches the specified value.

**(When reassembling)**

■ **IMPORTANT**

- **After completing above assembling / adjustment, repeat the motion several times to set the PTO lever at "Disengaged" and "Engaged" position. Then, finally set the PTO lever at "Engaged" position. Be sure to check that the upper side of PTO arm (5) and the lower sides of two nuts (6) (7) on the upper side of PTO rod (1) are making no contact.**

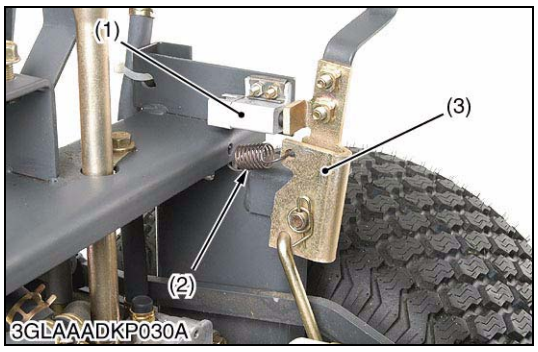
| | | |
|---|---|---|
| Spring length (**L2**) | Factory spec. | 68 mm<br>2.68 in. |

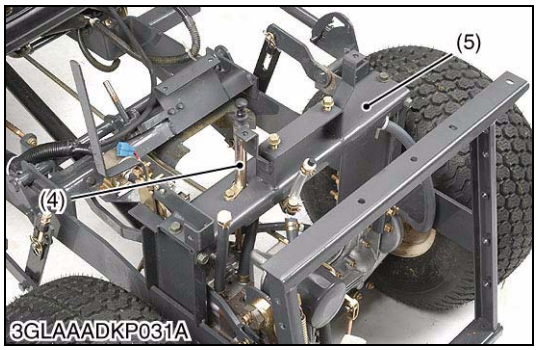
**(Reference)**

- Length (**L1**) : 115 to 118 mm (4.53 to 4.64 in.)
- Length (**L3**) : 38 to 40 mm (1.50 to 1.57 in.)

(1) PTO Rod
(2) Nut
(3) Nut
(4) Spring
(5) PTO Arm
(6) Nut
(7) Nut
**(A) "Disengaged" Position**
**(B) "Engaged" Position**

W1014341



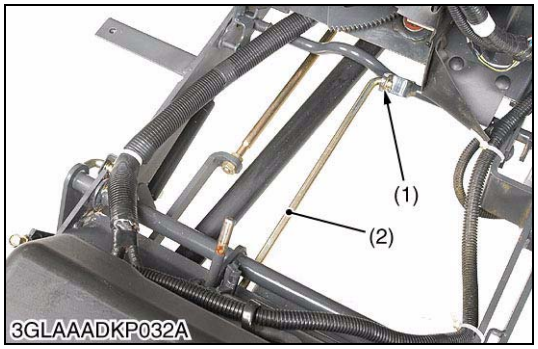




## Beam

1. Disconnect the connector from the PTO switch (1).
2. Remove the spring (2) from the PTO lever (3)
3. Remove the PTO rod.
4. Remove the filling pipe (4).
5. Remove the beam (5).

(1) PTO Switch
(2) Spring
(3) PTO Lever
(4) FIlling Pipe
(5) Beam

W1014971




## Brake Rod

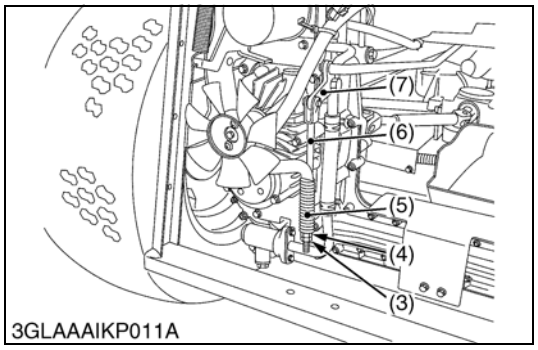
1. Remove the split pin (1), and disconnect the brake rod 1 (2) and the pedal system.
2. Remove the lock nut (3), plain washers (4) and brake spring (5).
3. Remove the brake plate (7).
4. Remove the brake rod 2 (6) and brake rod 1 (2).

**(when reassembling)**

■ **IMPORTANT**

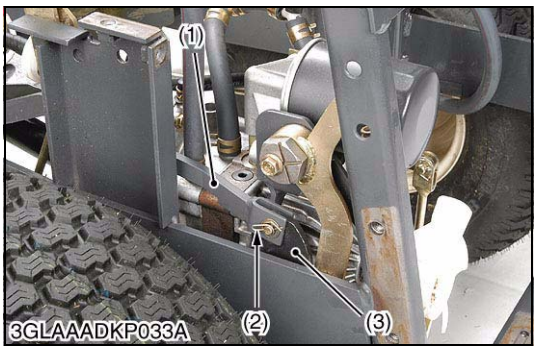
- **After assembling the brake rod 1, 2 (2), (6) and brake spring (5), be sure to adjust the brake pedal free travel. (See page G-26)**

| | | |
|---|---|---|
| Tightening torque | Brake plate mounting screw | 35 to 40 N·m<br>3.47 to 4.07 kgf·m<br>25.1 to 29.5 ft-lbs |




(1) Split Pin
(2) Brake Rod 1
(3) Lock Nut
(4) Plain Washer
(5) Brake Spring
(6) Brake Rod 2
(7) Brake Plate

W1015151




## Speed Control Plate

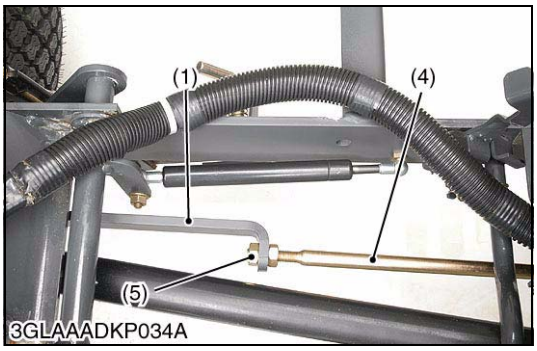
1. Remove the rue ring pin (2), and disconnect the speed change plate (1) and speed control arm (3).
2. Separate the speed change plate (1) and speed change rod (4).

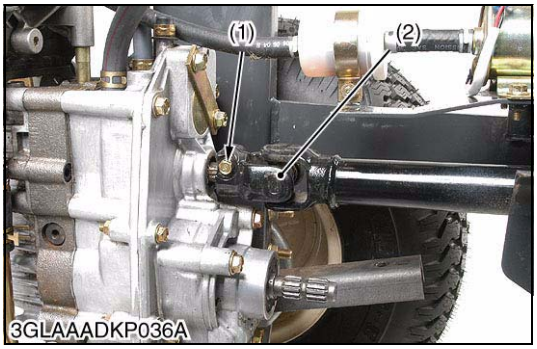
■ **IMPORTANT**

- **After assembling the speed change plate (1) and speed change rod (4), be sure to adjust the speed change pedal restriction. (See page 2-S7.)**

(1) Speed Change Plate
(2) Rue Ring Pin
(3) Speed Control Arm
(4) Speed Change Rod
(5) Lock Nut

W1015752




## Universal Joint and Rear Wheel

1. Remove the universal joint mounting screw (1).
2. Disconnect the universal joint (2).
3. Block the front wheels with stopper, and lift up the frame.
4. Remove the retaining ring (3) and remove the rear wheel (4).

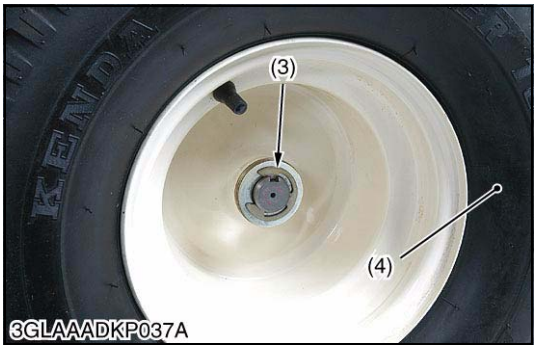
**(When reassembling)**

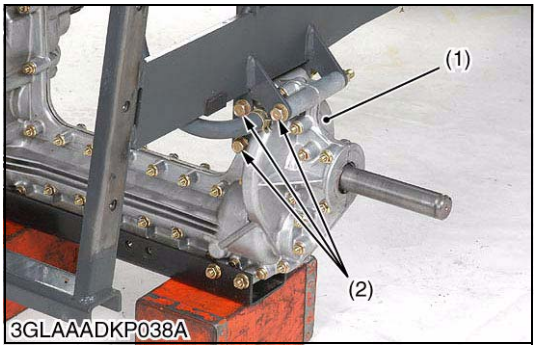
- Apply grease to the splines of the universal joint.

| | | |
|---|---|---|
| Tightening torque | Universal joint mounting screw | 9.8 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.23 to 8.33 ft-lbs |

(1) Universal Joint Mounting Screw
(2) Universal Joint
(3) Retaining Ring
(4) Rear Wheel

W1016017




## Separating Transmission

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

**(When reassembling)**

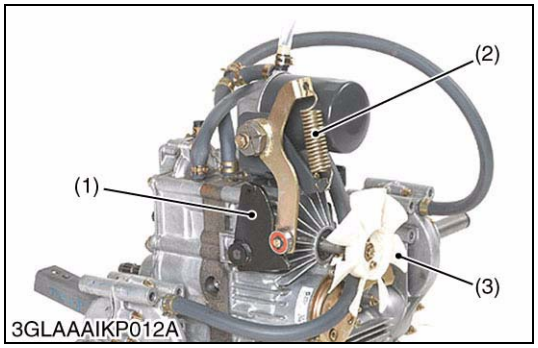
| | | |
|---|---|---|
| Tightening torque | Transaxle mounting screw | 48.1 to 55.8 N·m<br>4.9 to 5.7 kgf·m<br>35.5 to 41.2 ft-lbs |

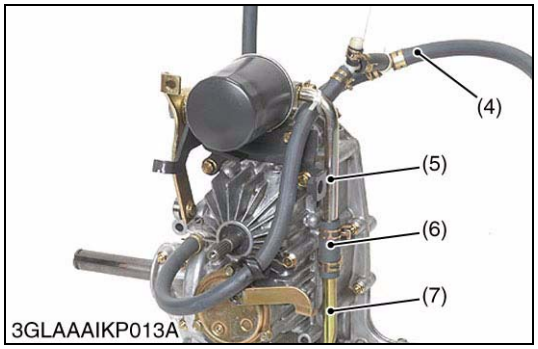
(1) Transaxle
(2) Transaxle Mounting Screw

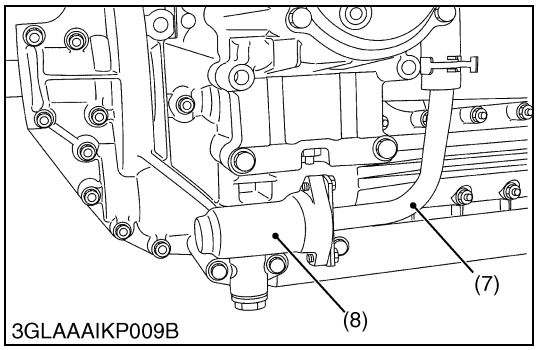
W1016596

# [3] DISASSEMBLING AND ASSEMBLING

## (1) Hydrostatic Transmission



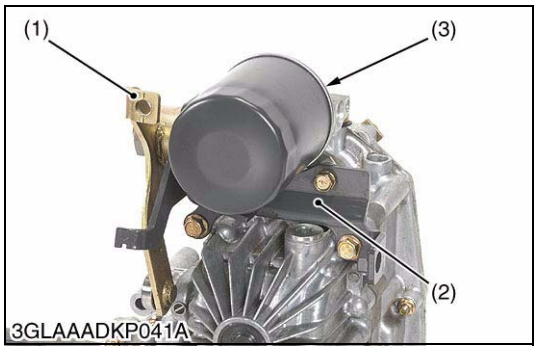




### Speed Control Arm, Neutral Spring, Cooling Fan and Others

1. Remove the neutral spring (2).
2. Remove the speed control arm (1).
3. Remove the cooling fan (3).
4. Remove the breather hoses (4).
5. Remove the suction pipe 1, 2 (5), (7) and hose (6).
6. Remove the suction filter case (8).

(1) Speed Control Arm
(2) Neutral Spring
(3) Cooling Fan
(4) Breather Hose
(5) Suction Pipe 1
(6) Hose
(7) Suction Pipe 2
(8) Suction Filter Case

W1017008

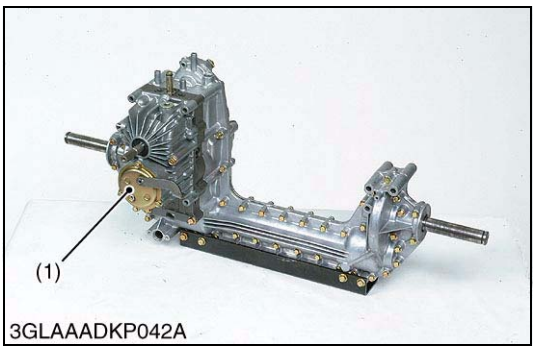


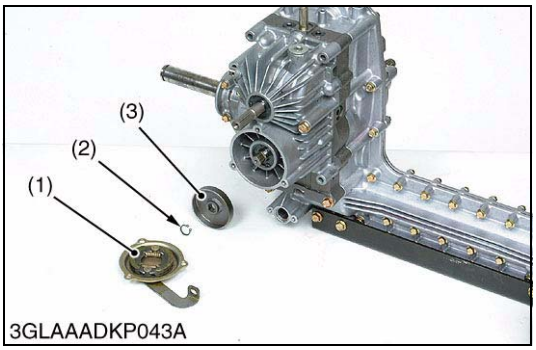

### Neutral Arm Holder and Filter Bracket

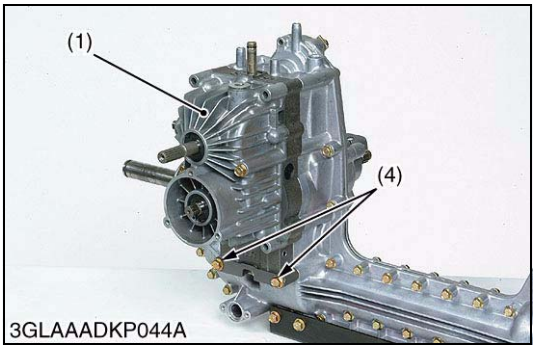
1. Remove the neutral arm holder (2) with neutral arm (1).
2. Remove the filter bracket (3).

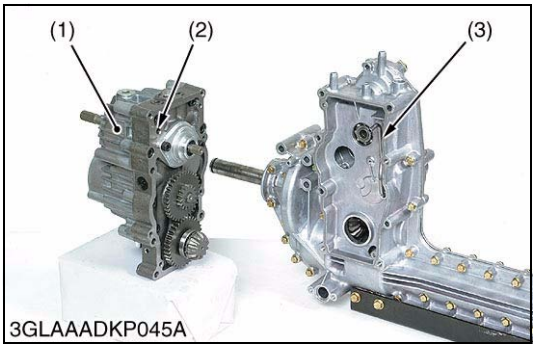
(1) Neutral Arm
(2) Neutral Arm Holder
(3) Filter Bracket

W1017280




## Brake Assembly

1. Remove the brake assembly (1).
2. Remove the external snap ring (2). And pull out the brake drum (3).

(1) Brake Assembly
(2) External Snap Ring
(3) Brake Drum

W1017501

## Hydrostatic Transmission Assembly

1. Remove the hydrostatic transmission assembly (1).

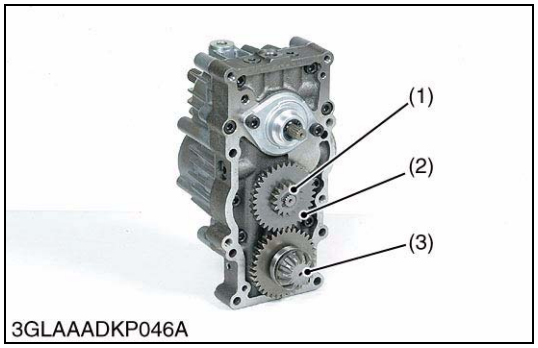
■ **NOTE**

- **When reassembling the hydrostatic transmission assembly, insert the drain pipe (3) in the hole (2) surely so as not to drop out it.**

| | | |
|---|---|---|
| Tightening torque | Hydrostatic transmission mounting screw | 23.5 to 27.5 N·m<br>2.4 to 2.8 kgf·m<br>17.3 to 20.3 ft-lbs |
| | Hydrostatic transmission mounting screw 2 | 17.7 to 20.6 N·m<br>1.8 to 2.1 kgf·m<br>13.1 to 15.2 ft-lbs |

(1) Hydrostatic Transmission Assembly
(2) Hole
(3) Drain Pipe
(4) Hydrostatic Transmission Mounting Screw 2

W1017663

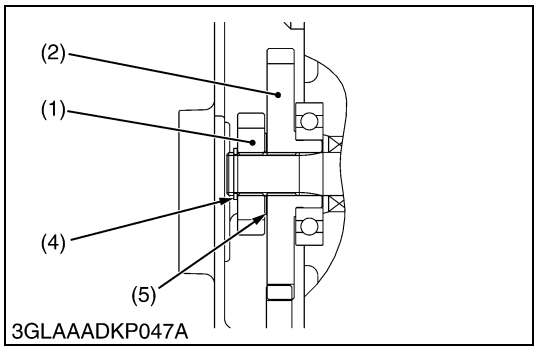



## 15T Gear, 34T Gear and Bevel Gear Shaft

1. Remove the external snap ring (4). And pull out the 15T gear (1) and 34T gear (2).
2. Remove the bevel gear shaft (3).

(1) 15T Gear
(2) 34T Gear
(3) Bevel Gear Shaft
(4) External Snap Ring
(5) Shim

W1017904




## Charge Pump Housing and Charge Relief Valve

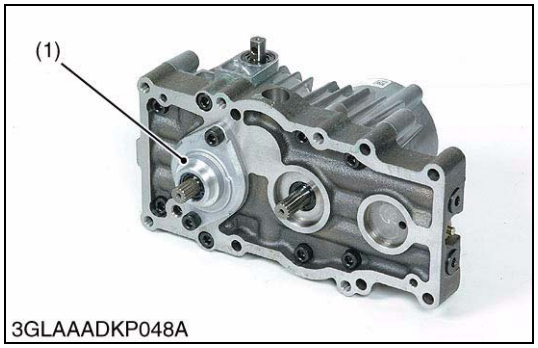
1. Remove the charge pump housing (1).
2. Remove the spring (5) and the steel ball (6).
3. Remove the O-ring (4) from the charge pump housing (1).
4. Remove the internal snap ring (2) and the oil seal (3).

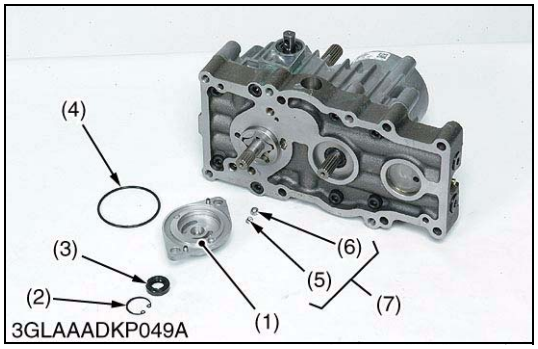
■ **NOTE**

- **When removing the oil seal (3), take care not to damage the charge pump housing (1).**
- **Take care not to damage the O-ring (4).**

(1) Charge Pump Housing
(2) Internal Snap Ring
(3) Oil Seal
(4) O-ring
(5) Spring
(6) Steel Ball
(7) Charge Relief Valve

W1018141




## Gerotor

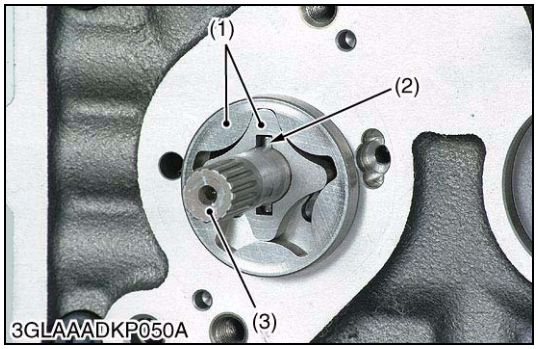
1. Remove the gerotor (1).
2. Draw out the drive pin (2) on the pump shaft (3).

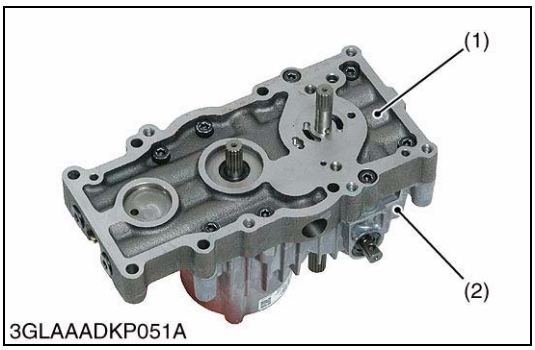
**(When reassembling)**

- Apply clean transmission oil to the both side of gerotors.

(1) Gerotor
(2) Drive Pin
(3) Pump Shaft

W1018461






## Center Section

1. Remove the center section mounting hex. socket head screws.
2. Tap the center section (1) with soft hammer and separate the center section (1) from the HST housing (2).

**(When reassembling)**

- Cover the splines of each shaft with thin tape to protect the sealing lip of the oil seals.
- Place a new gasket on the HST housing.

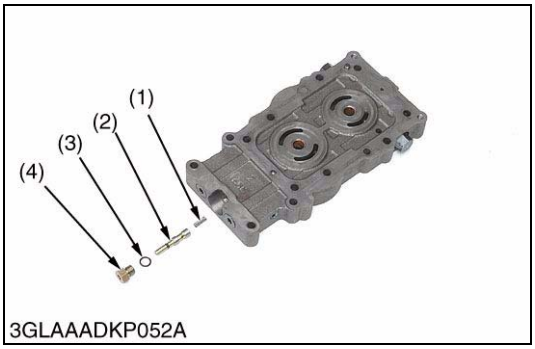
■ **NOTE**

- **Take care not to damage the surface of cylinder blocks, pistons and center section.**

| | | |
|---|---|---|
| Tightening torque | Center section mounting hex. socket head screw | 17.7 to 20.6 N·m<br>1.8 to 2.1 kgf·m<br>13.1 to 15.2 ft-lbs |

(1) Center Section (2) HST Housing

W1018657




## By-pass Valve

1. Remove the plug (4) and draw out the by-pass spool (2) and spring (1).

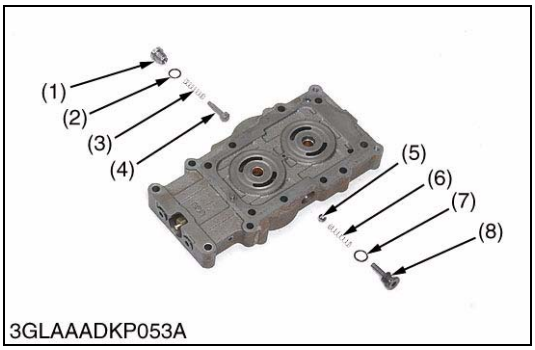
**(When reassembling)**

- Take care not to damage the O-ring (3) on the plug (4).

| | | |
|---|---|---|
| Tightening torque | By-pass valve plug | 15.0 N·m<br>1.53 kgf·m<br>11.1 ft-lbs |

(1) Spring (3) O-ring
(2) By-pass Spool (4) Plug

W1019068




## Check Valve

1. Remove the plugs (1), (8).
2. Draw out the springs (3), (6).
3. Draw out the check valve (4) and ball check (5).

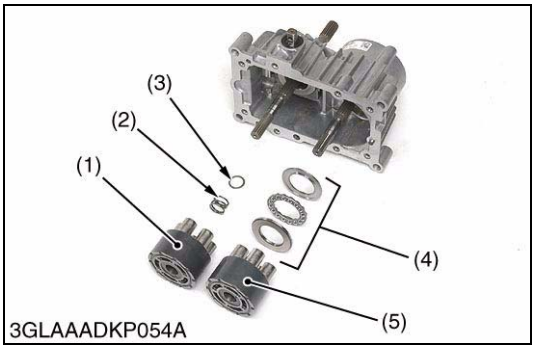
**(When reassembling)**

- Take care not to damage the O-rings (2), (7) on the plugs (1), (8).

| | | |
|---|---|---|
| Tightening torque | Check valve plug | 30.0 N·m<br>3.06 kgf·m<br>22.1 ft-lbs |

(1) Plug (5) Ball Check
(2) O-ring (6) Spring
(3) Spring (7) O-ring
(4) Check Valve (8) Plug

W1019295




## Cylinder Block Assembly and Thrust Ball Bearing

1. Remove the cylinder block assembly (pump side) (1), spring (2) and washer (3).
2. Remove the cylinder block assembly (motor side) (5).
3. Remove the thrust ball bearing (4).

**(When reassembling)**

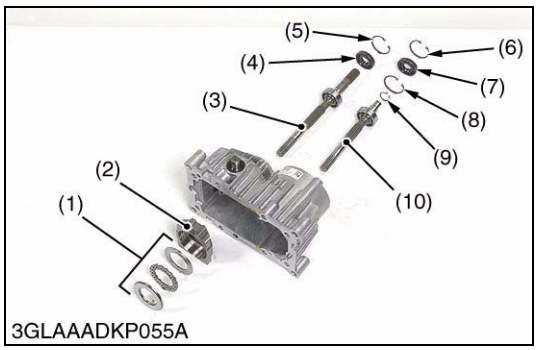
- Apply clean transmission oil to thrust ball bearing, cylinder block and piston.

■ **NOTE**

- **Take care not to damage the surface of cylinder blocks and pistons.**

(1) Cylinder Block Assembly (Pump Side) (4) Thrust Ball Bearing
(2) Spring (5) Cylinder Block Assembly (Motor Side)
(3) Washer

W1019565




## Swashplate, Pump Shaft and Motor Shaft

1. Remove the swashplate (2) and thrust ball bearing (1) from the HST housing.
2. Remove the internal snap ring (5), and tap out the pump shaft (3) and oil seal (4).
3. Remove the internal snap ring (6) and the oil seal (7).
4. Remove the internal snap ring (8) and tap out the motor shaft (10).

■ **NOTE**

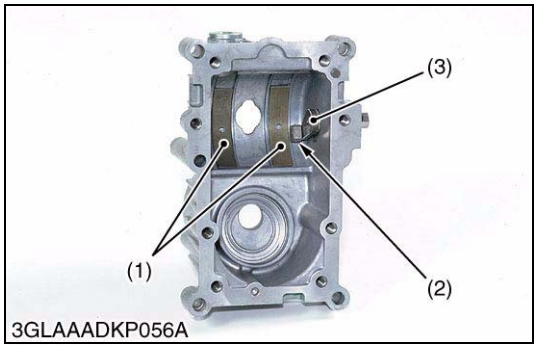
- **When removing the oil seal (7), take care not to damage the HST housing.**

**(When reassembling)**

- Apply clean transmission oil to thrust ball bearing (1).

(1) Thrust Ball Bearing
(2) Swashplate
(3) Pump Shaft
(4) Oil Seal
(5) Internal Snap Ring
(6) Internal Snap Ring
(7) Oil Seal
(8) Internal Snap Ring
(9) External Snap Ring
(10) Motor Shaft

W1019980




## Cradle Bearing, Slot Guide and Trunnion Arm

1. Remove the slot guide (2) and trunnion arm (3).
2. Remove the cradle bearings (1) from the HST housing.

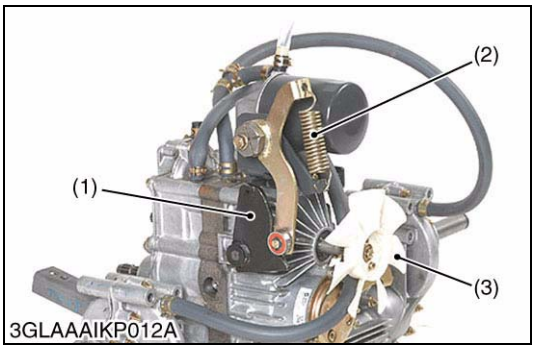
**(When reassembling)**

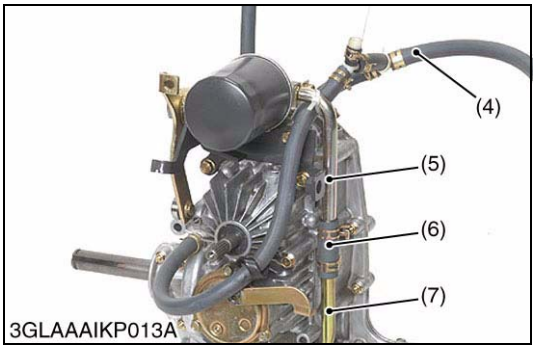
- Apply clean transmission oil to the cradle bearings (1) and trunnion arm.
- Fasten down the cradle bearing to the HST housing.

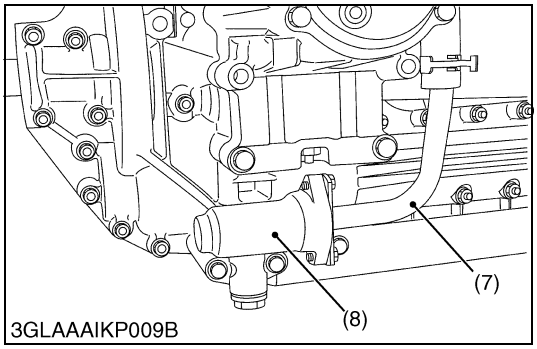
(1) Cradle Bearing
(2) Slot Guide
(3) Trunnion Arm

W1020533

## (2) Transaxle Case



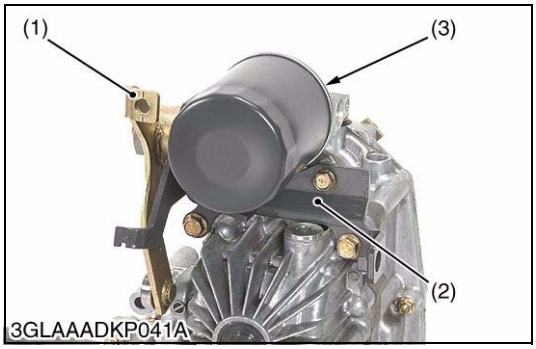




**Speed Control Arm, Neutral Spring, Cooling Fan and Others**

1. Remove the neutral spring (2).
2. Remove the speed control arm (1).
3. Remove the cooling fan (3).
4. Remove the breather hoses (4).
5. Remove the suction pipe 1, 2 (5), (7) and hose (6).
6. Remove the suction filter case (8).

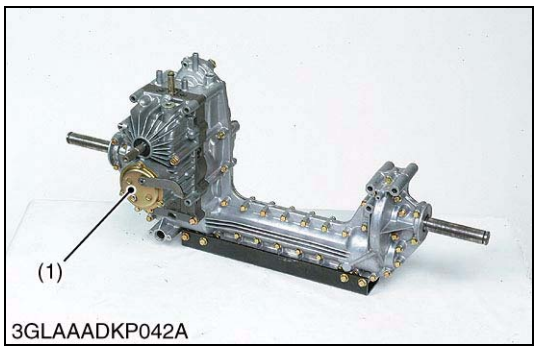
(1) Speed Control Arm
(2) Neutral Spring
(3) Cooling Fan
(4) Breather Hose
(5) Suction Pipe 1
(6) Hose
(7) Suction Pipe 2
(8) Suction Filter Case

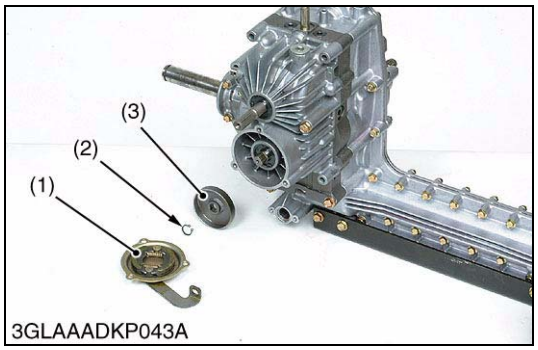


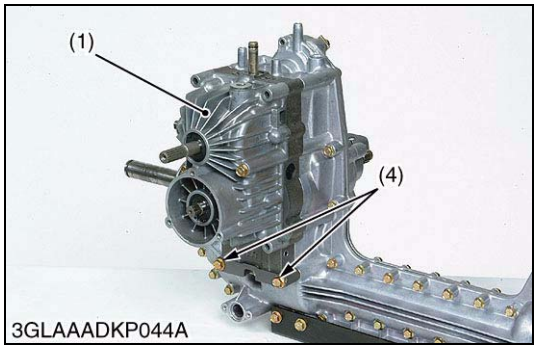

**Neutral Arm Holder and Filter Bracket**

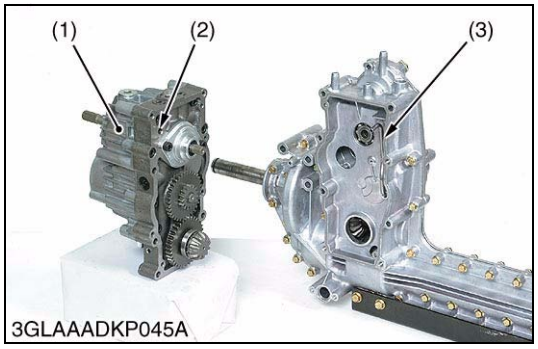
1. Remove the neutral arm holder (2) with neutral arm (1).
2. Remove the filter bracket (3).

(1) Neutral Arm
(2) Neutral Arm Holder
(3) Filter Bracket




## Brake Assembly

1. Remove the brake assembly (1).
2. Remove the external snap ring (2). And pull out the brake drum (3).

(1) Brake Assembly
(2) External Snap Ring
(3) Brake Drum

## Hydrostatic Transmission Assembly

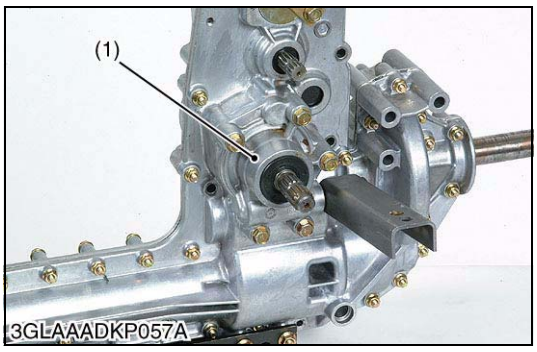
1. Remove the hydrostatic transmission assembly (1).

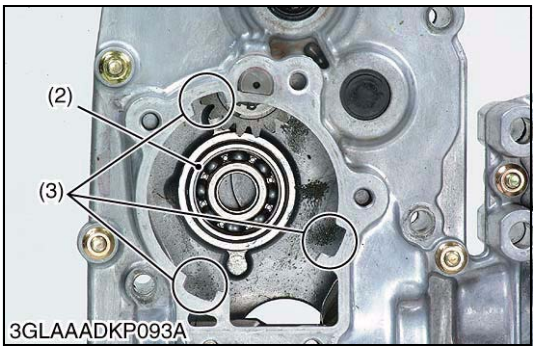
■ **NOTE**

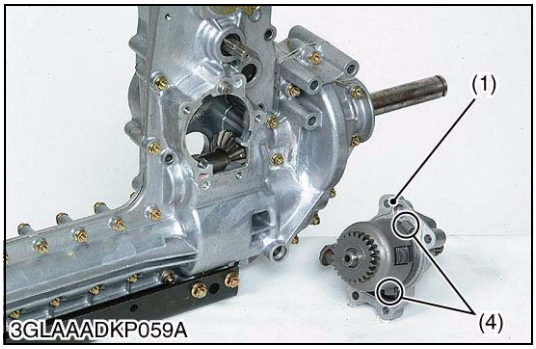
- **When reassembling the hydrostatic transmission assembly, insert the drain pipe (3) in the hole (2) surely so as not to drop out it.**

| | | |
|---|---|---|
| Tightening torque | Hydrostatic transmission mounting screw | 23.5 to 27.5 N·m<br>2.4 to 2.8 kgf·m<br>17.3 to 20.3 ft-lbs |
| | Hydrostatic transmission mounting screw 2 | 17.7 to 20.6 N·m<br>1.8 to 2.1 kgf·m<br>13.1 to 15.2 ft-lbs |

(1) Hydrostatic Transmission Assembly
(2) Hole
(3) Drain Pipe
(4) Hydrostatic Transmission Mounting Screw 2




## PTO Clutch Assembly

1. Remove the PTO clutch assembly (1) and the ball bearing (2) from the transaxle case.

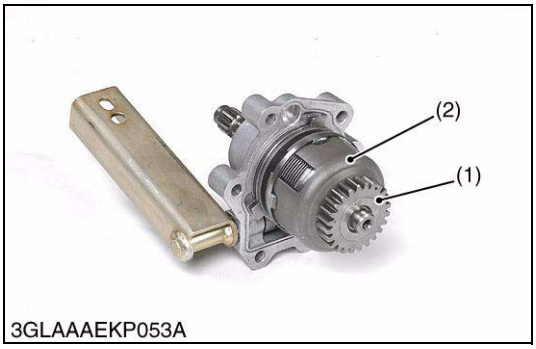
**(When reassembling)**

- Install the ball bearing (2) with the sealed face inside.
- Align the tangs (4) of PTO brake friction plate with the slots (3) of transaxle case.

| | | |
|---|---|---|
| Tightening torque | PTO clutch assembly mounting screw | 17.7 to 20.6 N·m<br>1.8 to 2.1 kgf·m<br>13.1 to 15.2 ft-lbs |

(1) PTO Clutch Assembly
(2) Ball Bearing
(3) Slot
(4) Tang

W1022814



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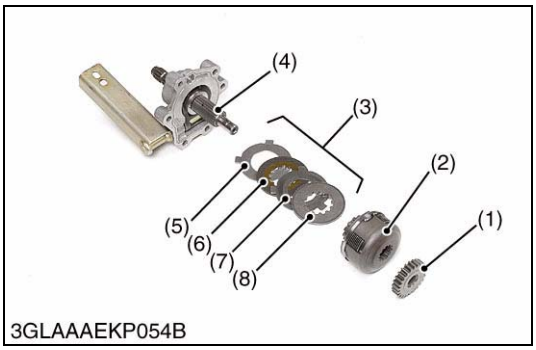

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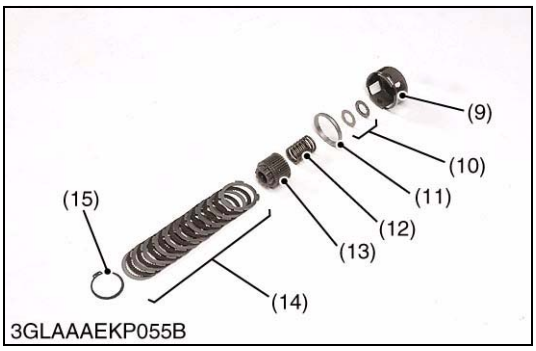

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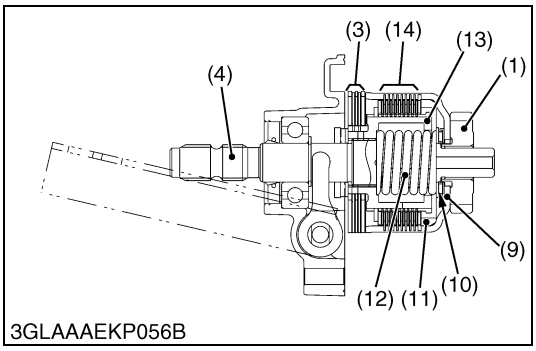

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## Disassembling PTO Clutch Assembly

1. Remove the 24T gear (1), clutch (2), brake disc and friction plate (3) from PTO shaft (4).
2. While pressing the clutch (2), turn the clutch case (9) clockwise. Then, separate the clutch case (9) and the spline boss (13) with clutch disc and friction plate (14).
3. Then remove the thrust needle bearing (10), collar (11) and spring (12).
4. Remove the external snap ring (15), clutch disc and friction plate (14) from the spline boss.

**(When reassembling)**

■ **IMPORTANT**

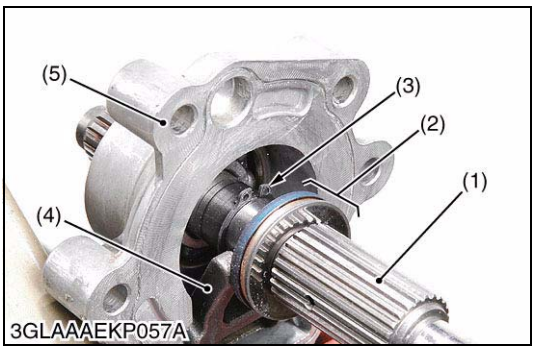
- **Do not change the arrangement of brake discs (6) (8) and brake friction plates (5) (7).**

■ **NOTE**

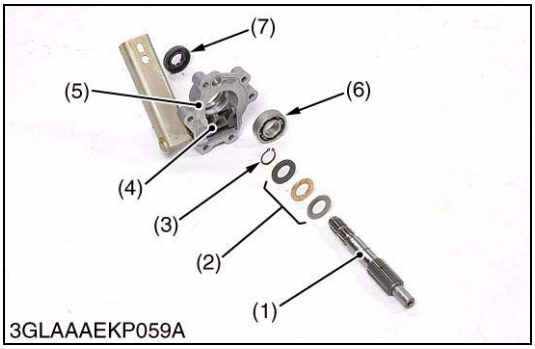
- **Thickness of the brake friction plate 1 (5) is greater than that of the brake friction 2 (7).**
- **The brake disc 1 (8) has the facing only in one side.**

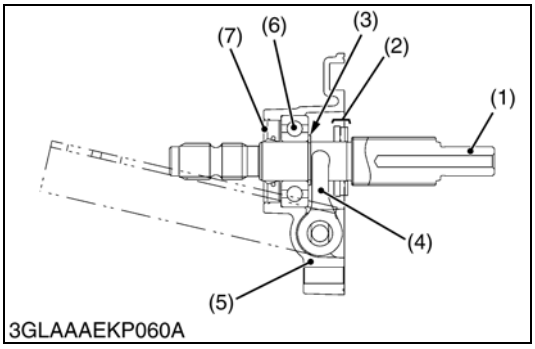
(1) 24T Gear
(2) Clutch
(3) Brake Disc and Friction Plate
(4) PTO Shaft
(5) Brake Friction Plate 1
(6) Brake Disc
(7) Brake Friction Plate 2
(8) Brake Disc 1
(9) Clutch Case
(10) Thrust Needle Bearing
(11) Collar
(12) Spring
(13) Spline Boss
(14) Clutch Disc and Friction Plate
(15) External Snap Ring

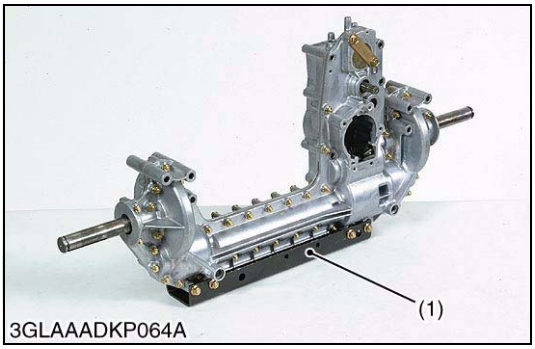
W1023309








## Disassembling PTO Clutch Assembly (Continued)

1. Pull out the PTO shaft (1) from PTO clutch cover (5) until external snap ring (3) touches clutch lever (4).
2. Tap out the PTO shaft (1) while opening the external snap ring (3) with external snap ring pliers.
3. Remove the thrust collar (2) from PTO shaft (1).
4. Remove the ball bearing (6) and oil seal (7) from the PTO clutch cover (5).

(1) PTO Shaft
(2) Thrust Collar
(3) External Snap Ring
(4) Clutch Lever
(5) PTO Clutch Cover
(6) Ball Bearing
(7) Oil Seal

W1023968

## Beam

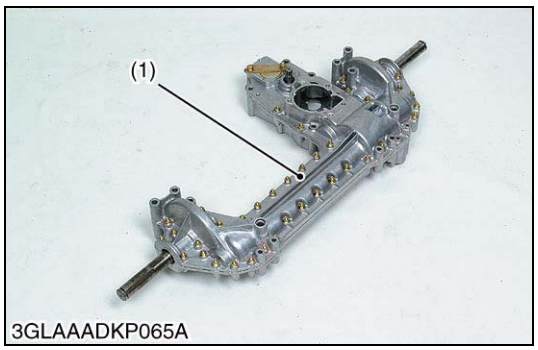
1. Remove the beam (1) from the transaxle case.

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Beam mounting screw | 17.7 to 20.6 N·m<br>1.8 to 2.1 kgf·m<br>13.1 to 15.2 ft-lbs |

(1) Beam

W1024533



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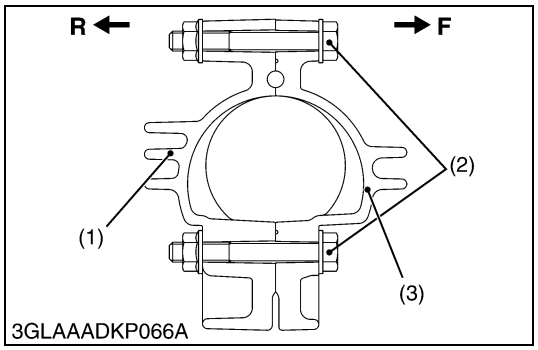

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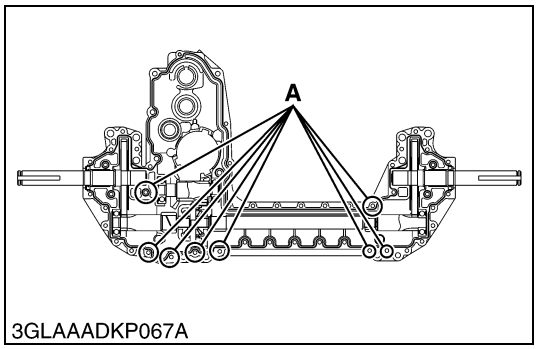

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## Transaxle Case

1. Remove the transaxle case screws (2).
2. Separate the rear side of transaxle case (1).

**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the transaxle case.

■ **NOTE**

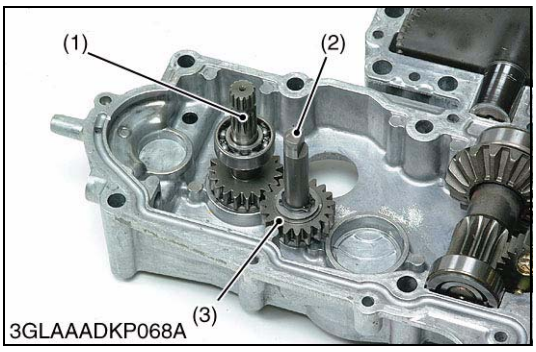
- **Install the transaxle case screws (2) in the direction shown in figure.**
- **Tighten all screws by your hand. Then, tighten the screws located at the circled positions first with tightening torques. Next, tighten the remaining screws with tightening torque.**

| | | |
|---|---|---|
| Tightening torque | Transaxle case screw | 7.8 to 8.8 N·m<br>0.8 to 0.9 kgf·m<br>5.8 to 6.5 ft-lbs |

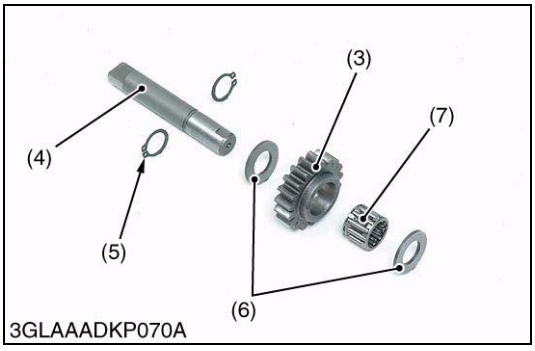
(1) Transaxle Case (Rear Side)
(2) Transaxle Case Screw
(3) Transaxle Case (Front Side)

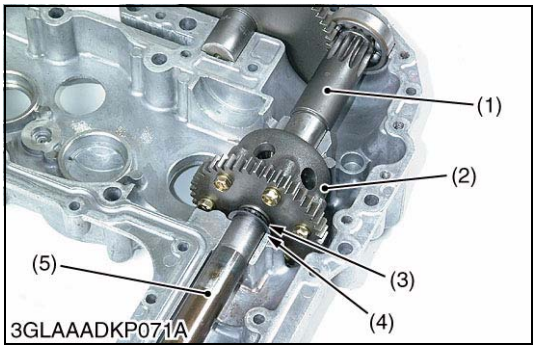
**F : Front Side**
**R : Rear Side**
**A : Screws Which Tightened First with Tightening Torque**

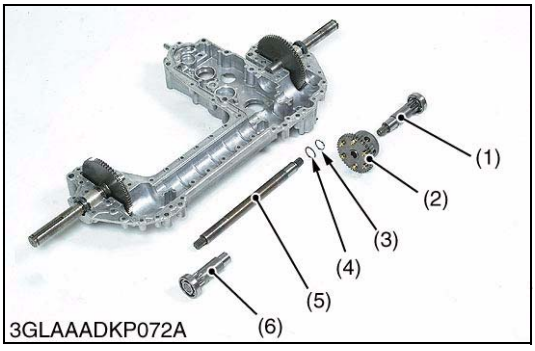
W1024743








## Input Shaft, 19T-2 Gear and 17T-13T Gear Shaft

1. Remove the input shaft (1).
2. Remove the intermediate shaft (2) and 19T-2 gear (3) with collars (6) and needle bearing (7).
3. Remove the 17T-13T gear shaft (4).

■ **NOTE**

- **Install the two external snap rings (5) on intermediate shaft (2) by shifting each mating portion by 180 degrees.**

(1) Input Shaft
(2) Intermediate Shaft
(3) 19T-2 Gear
(4) 17T-13T Gear Shaft
(5) External Snap Ring
(6) Collar
(7) Needle Bearing

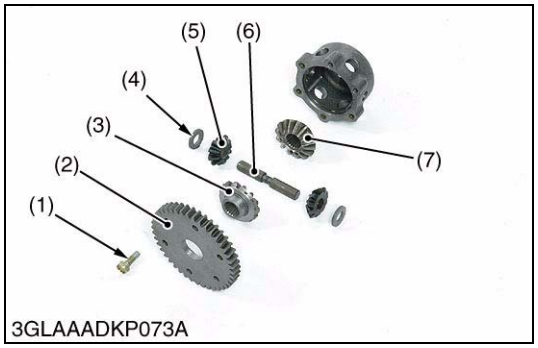
W1025227

## Rear Differential Gear, Drive Shaft and 11T Gear Shaft (RH, LH)

1. Remove the rear differential gear assembly (2), 11T gear shafts (1), (6) and drive shaft (5).
2. Remove the external snap ring (3) and washer (4) from drive shaft (5).

(1) 11TGear Shaft (LH)
(2) Rear Differential Gear Assembly
(3) External Snap Ring
(4) Washer
(5) Drive Shaft
(6) 11T Gear Shaft (RH)

W1025654




## Rear Differential Gear Assembly

1. Remove the 42T gear mounting screws (1).
2. Remove the 42T gear (2) and differential side gear (3).
3. Remove the differential pinion shaft (6).
4. Remove the differential pinion gears (5), differential side gear (7) and shims (4).

■ **NOTE**

- **Arrange the parts to know their original position.**

**(When reassembling)**

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of differential pinion gears (5), differential side gears (3), (7) and shims (4).

| | | |
|---|---|---|
| Tightening torque | 42T gear mounting screw | 9.8 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.23 to 8.33 ft-lbs |

(1) 42T Gear Mounting Screw
(2) 42T Gear
(3) Differential Side Gear
(4) Shim
(5) Differential Pinion Gear
(6) Differential Pinion Shaft
(7) Differential Side Gear

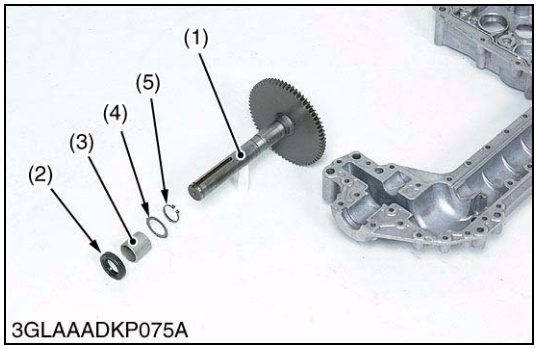
W1025887


## Rear Axle

1. Remove the rear axle (1).
2. Remove the oil seal (2), bush (3), collar (4) and external snap ring (5).

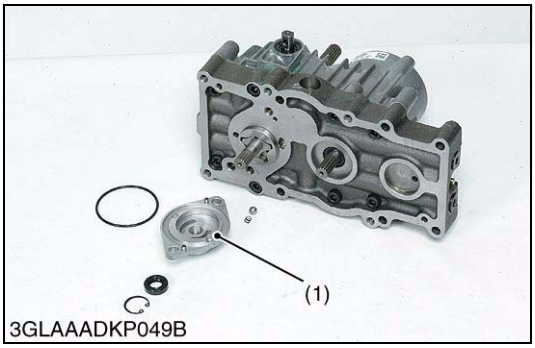
(1) Rear Axle
(2) Oil Seal
(3) Bush
(4) Collar
(5) External Snap Ring

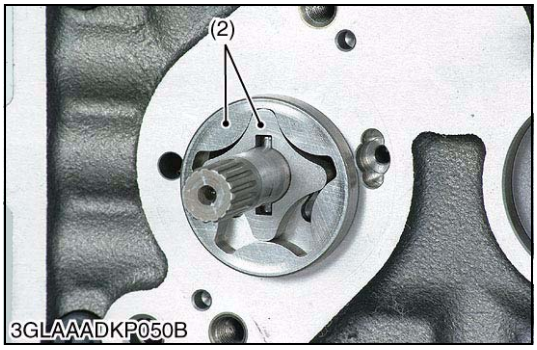
W1026571



# [4] SERVICING

## (1) Hydrostatic Transmission



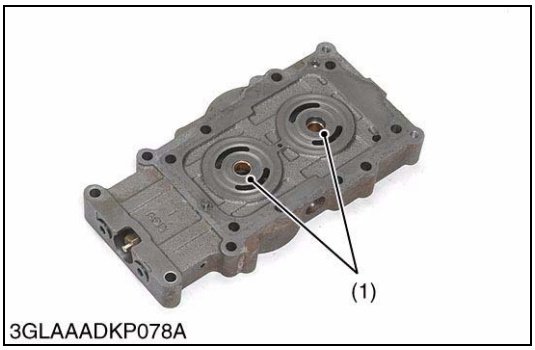




### Charge Pump

1. Check the charge pump housing (1) and gerotor assembly (2) for scratches and wear.
2. If scratch or worn, replace the charge pump assembly.

(1) Charge Pump Housing (2) Gerotor Assembly

W1026782

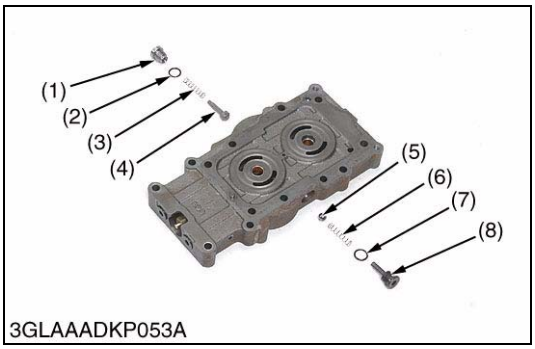



### Center Section

1. Check the surfaces (1) of center section for scratches or wear.
2. If deep scratch or excessive wear is found, replace the hydrostatic transmission assembly.

(1) Surface

W1026940

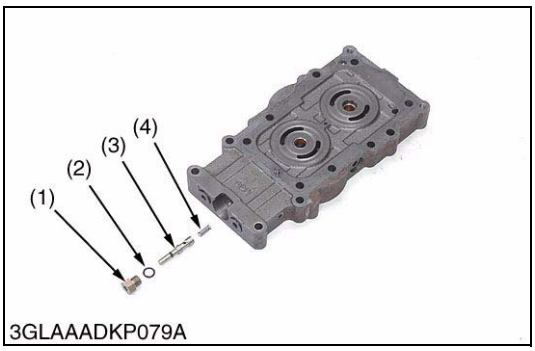



### Check Valve

1. Check the ball check (5) and check valve (4) for scratches and damage.
2. Check the springs (3), (6) for breakage and wear.
3. If anything unusual, replace the check valve assembly.

(1) Plug
(2) O-ring
(3) Spring
(4) Check Valve
(5) Ball Check
(6) Spring
(7) O-ring
(8) Plug

W1027748

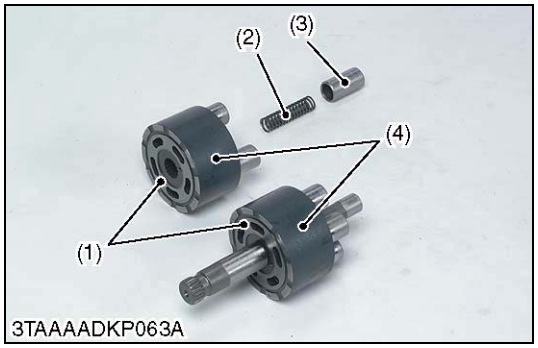



### By-pass Valve

1. Check the by-pass spool (3) and spring (4).
2. If defects are found, replace them.

(1) Plug
(2) O-ring
(3) By-pass Spool
(4) Spring

W1028011




## Cylinder Block Assembly

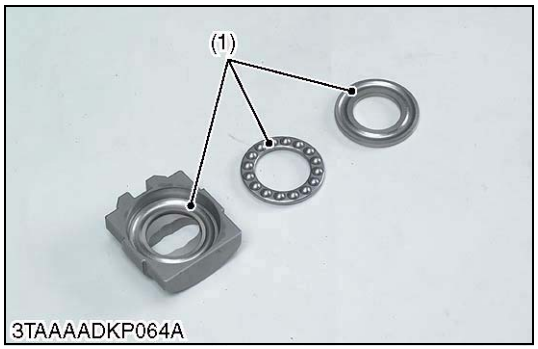
1. Check the cylinder blocks (4) and pistons (3) for scratches and wear.
2. If scratch or warn, replace the cylinder block assembly.
3. Check that the piston (3) and spring (2) are in each cylinder bore.
4. Check the pistons for their free movement in the cylinder block bores.
5. If the piston or the cylinder block is scored, replace the cylinder block assembly.
6. Check the polished face (1) of cylinder block for scoring.
7. If scored, replace the cylinder block assembly.

■ **IMPORTANT**

- **Do not interchange pistons between pump and motor cylinder block. Pistons and cylinder blocks are matched.**

(1) Polished Face
(2) Spring
(3) Piston
(4) Cylinder Block

W1028175

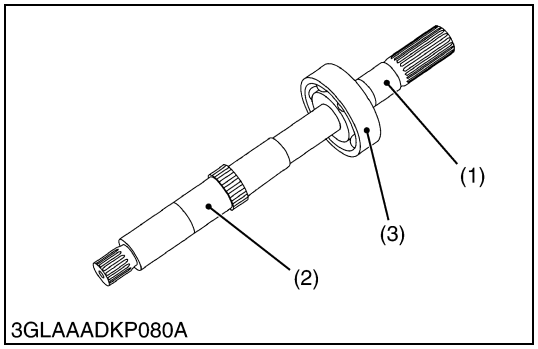



## Thrust Ball Bearing

1. Check the thrust ball bearing (1) for scratches and excessive wear.
2. If the thrust ball bearing (1) is worm, replace it.

(1) Thrust Ball Bearing

W1028631

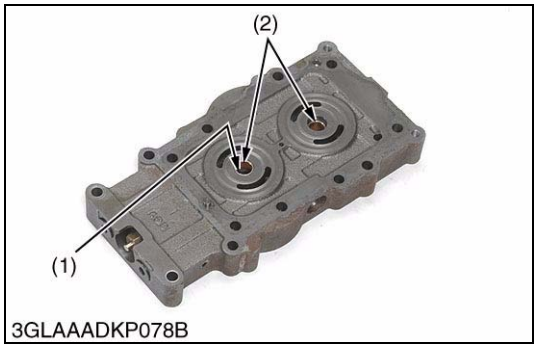



## Pump Shaft

1. Check the seal surface (1), the bearing surface (2) and the ball bearing (3).
2. If the shaft is rough or grooved, replace it.
3. If the ball bearing is worn, replace it.

(1) Seal Surface
(2) Bearing Surface
(3) Ball Bearing

W1028763



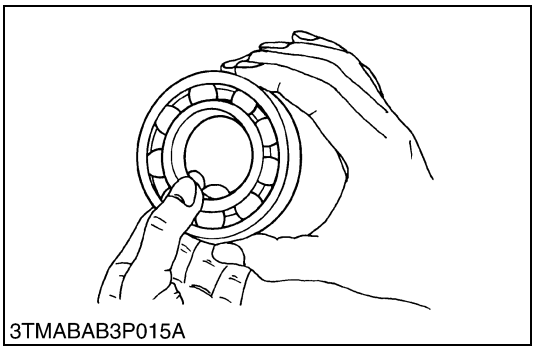

## Bushing and Oil Seal

1. Check the oil seals (1) for damage.
2. Check the bushings (2) for wear.
3. If the oil seals and bushings are worn or damaged, replace them.

(1) Oil Seal
(2) Bushing

W1028901

## (2) Transaxle Case


3TMABAB3P015A

### Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect replace it.

W1029051


3GLAAADKP081A

### PTO Clutch Disc Wear

1. Measure the thickness of PTO clutch disc with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Thickness of PTO clutch disc | Factory spec. | 1.3 to 1.5 mm<br>0.051 to 0.059 in. |
| | Allowable limit | 1.2 mm<br>0.047 in. |

W1029300


3GLAAADKP082A

### Pressure Plate and Friction Plate Wear

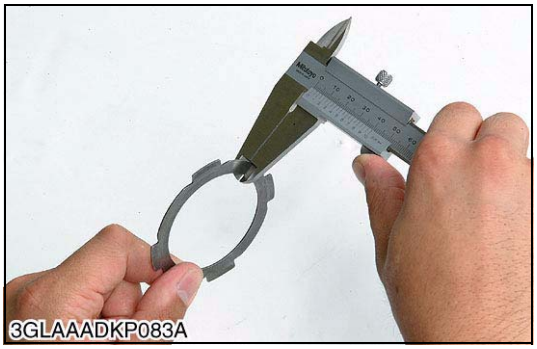
1. Measure the thickness of pressure plate and friction plate 1, 2 with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Thickness of pressure plate | Factory spec. | 1.55 to 1.65 mm<br>0.061 to 0.065 in. |
| | Allowable limit | 1.50 mm<br>0.059 in. |

| | | |
|---|---|---|
| Thickness of friction plate 1 | Factory spec. | 1.55 to 1.65 mm<br>0.061 to 0.065 in. |
| | Allowable limit | 1.50 mm<br>0.059 in. |

| | | |
|---|---|---|
| Thickness of friction plate 2 | Factory spec. | 0.75 to 0.85 mm<br>0.030 to 0.034 in. |
| | Allowable limit | 0.70 mm<br>0.028 in. |

W1029467

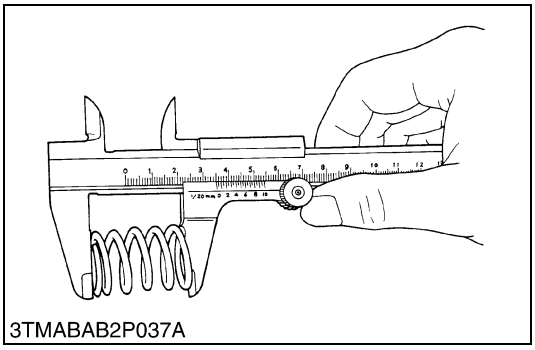

3GLAAADKP083A

### Clutch Spring Free Length

1. Measure the free length of spring with vernier calipers.
2. If the measurement is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Clutch spring free length | Factory spec. | 45 mm<br>1.77 in. |
| | Allowable limit | 42 mm<br>1.65 in. |

W1029779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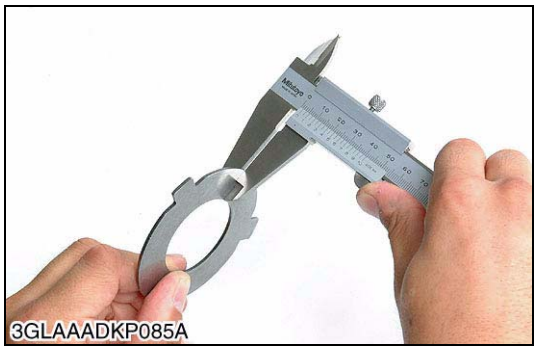
## PTO Brake Disc Wear

1. Measure the thickness of PTO brake disc with a vernier caliper.
2. If the thickness is less than the allowable limit, replace it.

| | | |
|---|---|---|
| PTO brake disc thickness | Factory spec. | 3.3 to 3.5 mm<br>0.13 to 0.14 in. |
| | Allowable limit | 3.00 mm<br>0.118 in. |

W1029677



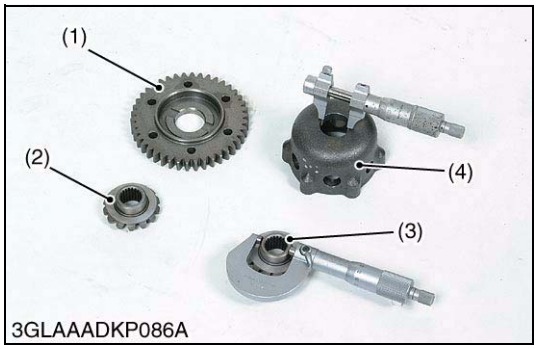

## Friction Plate Wear

1. Measure the thickness of brake friction plate 1, 2 with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Thickness of brake friction plate 1 | Factory spec. | 1.75 to 1.85 mm<br>0.069 to 0.073 in. |
| | Allowable limit | 1.60 mm<br>0.063 in. |

| | | |
|---|---|---|
| Thickness of brake friction plate 2 | Factory spec. | 0.95 to 1.05 mm<br>0.037 to 0.041 in. |
| | Allowable limit | 0.80 mm<br>0.031 in. |

W1029986




## Clearance between Differential Gear Case and Differential Side Gear

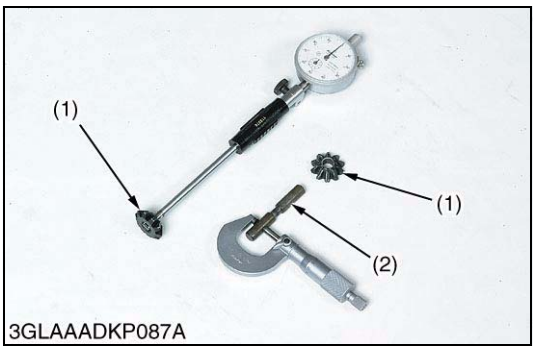
1. Measure the differential gear case (4) bore I.D..
2. Measure the differential side gear (3) boss O.D., and calculate the clearance.
3. Measure the 42T gear (1) bore I.D..
4. Measure the differential side gear (2) boss O.D., and calculate the clearance.
5. If the clearance exceeds the allowable limit, replace faulty parts.

| | | |
|---|---|---|
| Clearance between differential case and differential side gear | Factory spec. | 0.040 to 0.082 mm<br>0.0016 to 0.0032 in. |
| | Allowable limit | 0.17 mm<br>0.0067 in. |
| Clearance between 42T gear and differential side gear | Factory spec. | 0.040 to 0.082 mm<br>0.0016 to 0.0032 in. |
| | Allowable limit | 0.17 mm<br>0.0067 in. |

| | | |
|---|---|---|
| Differential case bore I.D. | Factory spec. | 22.500 to 22.521 mm<br>0.8858 to 0.8867 in. |
| Differential side gear boss O.D. | Factory spec. | 22.439 to 22.460 mm<br>0.8834 to 0.8843 in. |
| 42T gear bore I.D. | Factory spec. | 22.500 to 22.521 mm<br>0.8858 to 0.8867 in. |

(1) 42T Gear
(2) Differential Side Gear
(3) Differential Side Gear
(4) Differential Gear Case

W1030169




## Clearance between Differential Pinion Gear and Differential Pinion Shaft

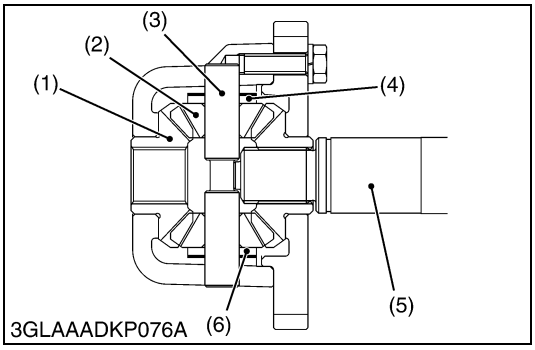
1. Measure the differential pinion gear (1) I.D..
2. Measure the differential pinion shaft (2) O.D., and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace faulty parts.

| | | |
|---|---|---|
| Clearance between differential pinion gear and differential pinion shaft | Factory spec. | 0.025 to 0.055 mm<br>0.00098 to 0.00217 in. |
| | Allowable limit | 0.25 mm<br>0.0096 in. |

| | | |
|---|---|---|
| Differential pinion gear I.D. | Factory spec. | 10.000 to 10.015 mm<br>0.39370 to 0.39429 in. |
| Differential pinion shaft O.D. | Factory spec. | 9.960 to 9.975 mm<br>0.39212 to 0.39272 in. |

(1) Differential Pinion Gear (2) Differential Pinion Shaft

W1030994




## Backlash between Differential Pinion Gear and Differential Side Gear

1. Stick a strip of fuse the three spots on the differential pinion gear (2) with grease.
2. Reassemble the differential gear assembly.
3. Fix the differential gear assembly, and install the drive shaft (5).
4. Turn the drive shaft (5).
5. Remove the differential pinion gear (2) from the differential gear assembly, and measure the thickness of the fuses with an outside micrometer.
6. If the backlash is not within the factory specifications, adjust with shims (4), (6)

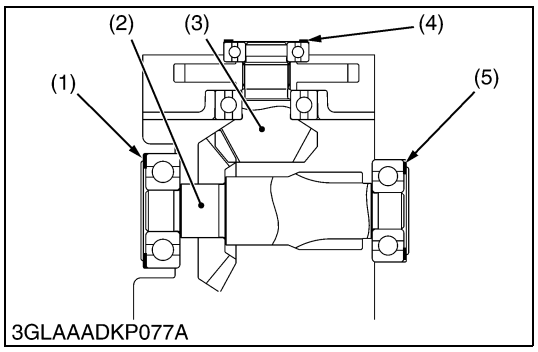
| | | |
|---|---|---|
| Backlash between differential pinion gear and differential side gear | Factory spec. | 0.15 to 0.30 mm<br>0.0059 to 0.012 in. |

**(Reference)**

- Thickness of adjusting shims
  For differential pinion gear : 2.3 mm (0.091 in.)
  2.5 mm (0.098 in.)
  2.7 mm (0.106 in.)
  2.9 mm (0.11 in.)
- Tooth contact : More than 35 %

(1) Differential Side Gear
(2) Differential Pinion Gear
(3) Differential Pinion Shaft
(4) Shim
(5) Drive Shaft
(6) Shim

W1031324




**Backlash between 11T Bevel Gear Shaft and 17T-13T Gear Shaft**

1. Stick a strip of fuse the three spots on the 11T bevel gear shaft (3) with grease.
2. Reassemble the hydrostatic transmission and transaxle case.
3. Fix the transaxle case, and push the by-pass valve.
4. Turn the motor shaft.
5. Remove the 11T bevel gear shaft (3), and measure the thickness of the fuses with an outside micrometer.

| | | |
|---|---|---|
| Backlash between 11T bevel gear shaft and 17T-13T gear shaft | Factory spec. | 0.10 to 0.30 mm<br>0.0039 to 0.012 in. |

**(Reference)**

- Thickness of adjusting shims
  For 11T bevel gear shaft (4) : 0.2 mm (0.008 in.)
  0.3 mm (0.012 in.)
  0.5 mm (0.020 in.)
  For 17T-13T gear shaft (LH) (1) : 0.2 mm (0.008 in.)
  0.3 mm (0.012 in.)
  0.5 mm (0.020 in.)
  For 17T-13T gear shaft (RH) (5) : 0.2 mm (0.008 in.)
  0.3 mm (0.012 in.)
  0.5 mm (0.020 in.)
- Tooth contact : More than 35 %

(1) Shim (for 17T-13T Gear Shaft (LH))
(2) 17T-13T Gear Shaft
(3) 11T Gear Shaft
(4) Shim (for 11T Bevel Gear Shaft )
(5) Shim (for 17T-13T Gear Shaft (RH))

W1031740

# 3 BRAKES

# SERVICING

## CONTENTS

# 1. TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Insufficient Braking Force** | Brake pedal free travel excessive | Adjust | 3-S4 |
| | Brake shoe worn | Replace | 3-S8 |
| | Brake drum worn | Replace | 3-S8 |
| | Grease or oil on brake shoe | Replace | 3-S8 |
| **Brake Drags** | Brake pedal free travel too small | Adjust | 3-S4 |
| | Brake spring weaken or broken | Replace | 3-S8 |
| **Heavy Brakes** | Brake pedal rusted | Repair or replace | 3-S7 |
| | Brake cam lever rusted | Replace | 3-S8 |

W1014322

# 2. SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Brake Pedal | Free Travel | 15 to 25 mm<br>0.59 to 0.98 in. | – |

W1013874

# 3. TIGHTENING TORQUES

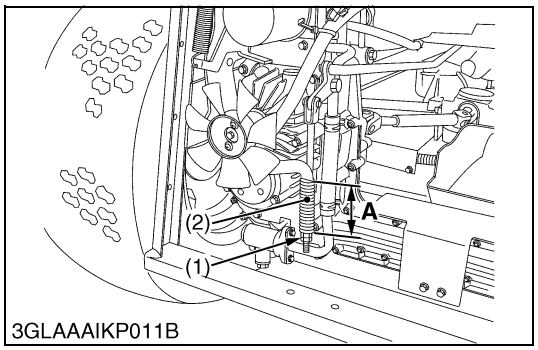
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-9.)

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Steering wheel mounting nut | 20 to 25 | 2.0 to 2.5 | 14.8 to 18.4 |
| Drag link locking nut | 74.8 to 81.3 | 7.62 to 8.29 | 55.2 to 60.0 |
| Steering support mounting screw | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |
| Pedal system component mounting nut | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |

W1012736

# 4. CHECKING, DISASSEMBLING AND SERVICING

## [1] CHECKING AND ADJUSTING



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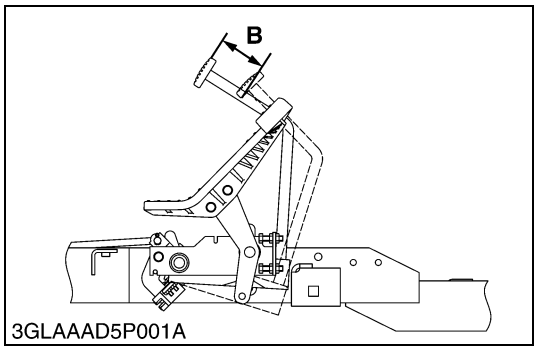

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**Brake Pedal Free Travel**

**CAUTION**

- **Stop the engine, remove the key, and chock the wheels before checking brake pedal.**

1. Release the parking brake.
2. Loosen the lock nut (1)
3. Adjust the brake spring (2) length (**A**) so that the brake pedal free travel (**B**) is from 15 to 25 mm (0.59 to 0.98 in.).
4. Retighten the lock nut (1).

| | | |
|---|---|---|
| Brake pedal free travel (**B**) | Factory spec. | 15 to 25 mm<br>0.59 to 0.98 in. |

**(Reference)**

- Brake spring length (**A**) : 73 to 74 mm (2.87 to 2.91 in.)

(1) Lock Nut (2) Brake Spring

W1010642

## [2] DISASSEMBLING AND ASSEMBLING

### (1) Pedal System Component

**Dismounting Mower**

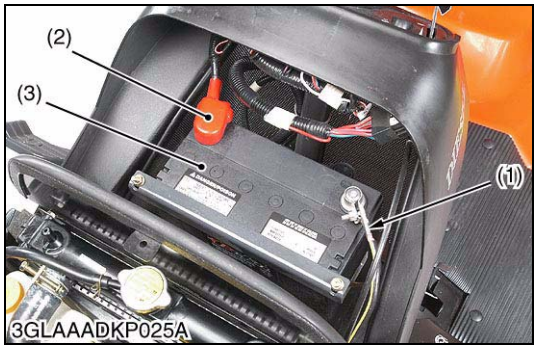
1. See Page 7-S6. (“Mower” Section)

W1011029

**Dismounting Container**

1. See Page 2-S9. (“Transaxle” Section)

W1011095



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**Battery**

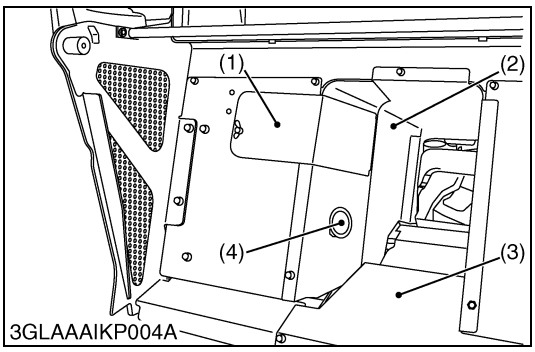
**CAUTION**

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

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

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

W1011173

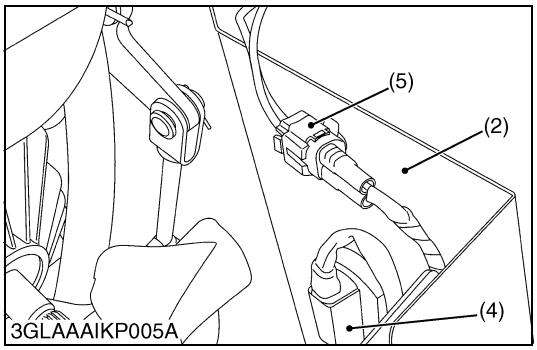


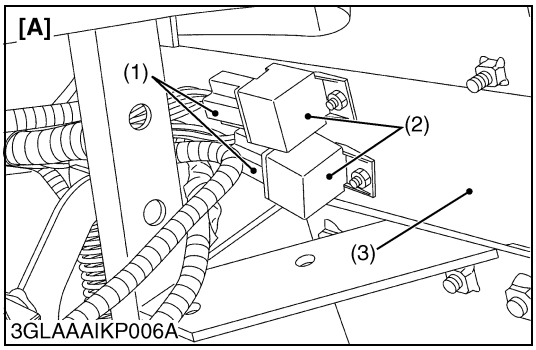

## Discharge Duct

1. Remove the filter cover (1) and the duct plate (3).
2. Disconnect the connector (5) from the grass container full switch (4).
3. Remove the discharge duct (2).

(1) Filter Cover
(2) Discharge Duct
(3) Duct Plate
(4) Grass Container Full Switch
(5) Connector

W1012965



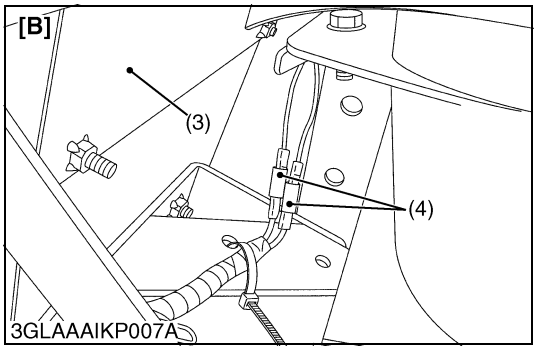



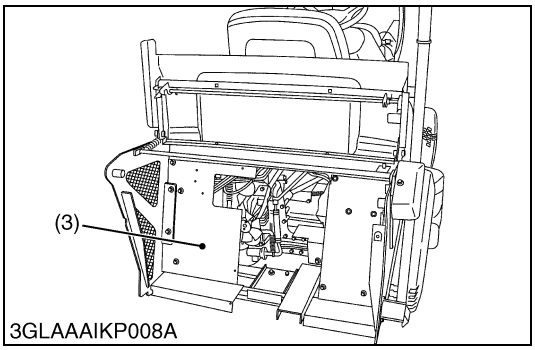

## Container Base

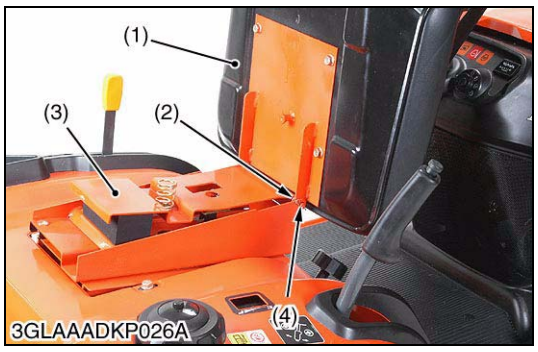
1. Disconnect the couplers (1) from the relays (2).
2. Disconnect the connector (4).
3. Remove the container base (3).

(1) Coupler
(2) Relay
(3) Container Base
(4) Connector
**[A] Left Side**
**[B] Right Side**

W1018829



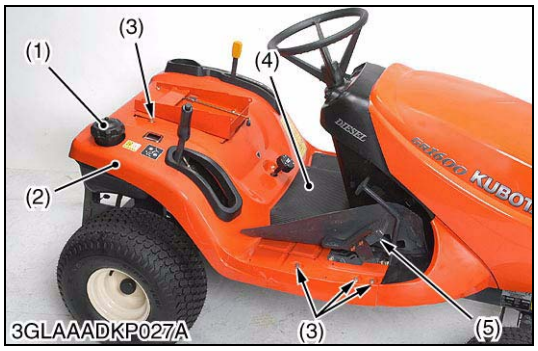



## Seat

1. Remove two snap pins (2), (4).
2. Remove the seat (1) and seat plate (3).

(1) Seat
(2) Snap pin
(3) Seat Plate
(4) Snap Pin

W1011458

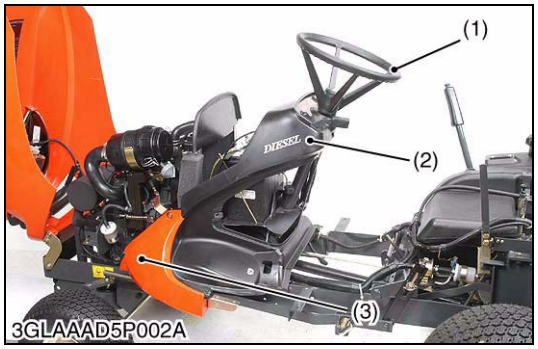



## Fender

1. Remove the speed change pedal (5).
2. Peel the step sheet (4) halfway.
3. Remove the fuel cap (1).
4. Remove the fender (2).

(1) Fuel Cap
(2) Fender
(3) Fender Mounting Screw
(4) Step Sheet
(5) Speed Change Pedal

W1011701

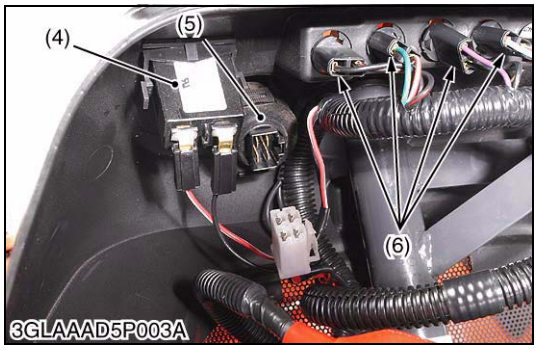



## Steering Wheel, Side Bonnet and Panel

1. Remove the steering wheel (1).
2. Remove the side bonnet (3).
3. Remove the accelerator lever grip.
4. Disconnect the connectors for hour meter (4), main switch (5) and light switch.
5. Remove the indicator lamps (6).
6. Remove the fuse box (7) from the steering support.
7. Remove the panel (2).

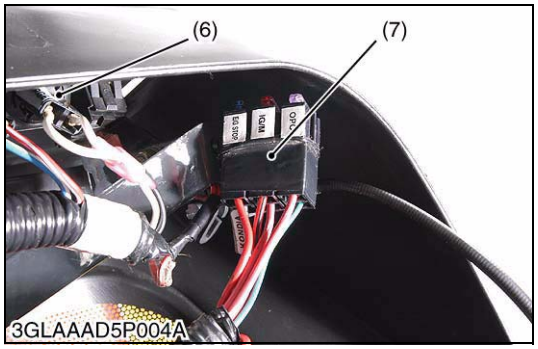
**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Steering Wheel mounting nut | 20 to 25 N·m<br>2.0 to 2.5 kgf·m<br>14.8 to 18.4 ft-lbs |




(1) Steering Wheel
(2) Panel
(3) Side Bonnet
(4) Hour Meter
(5) Main Switch
(6) Indicator Lamp
(7) Fuse Box

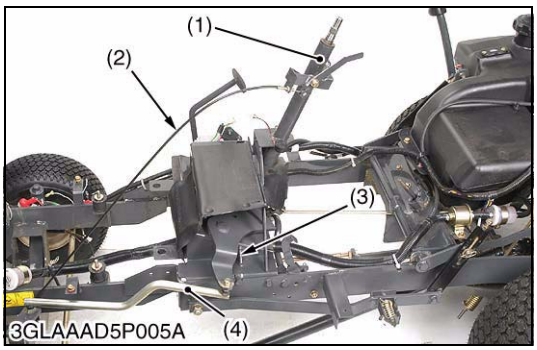
W1011932




## Separating Engine

1. See page 1-S18. (“Engine” Section)

W1012295




## Steering Support Assembly

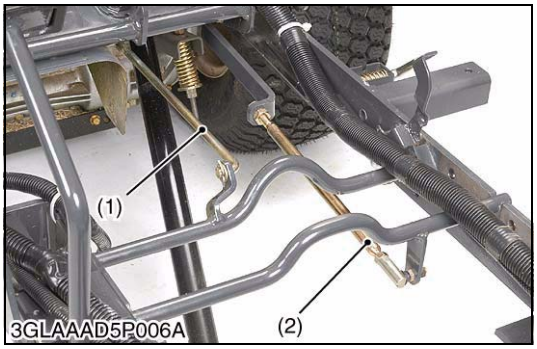
1. Disconnect the drag ling (4) from the sector gear (3).
2. Disconnect the connectors for the timer relay, regulator and buzzer unit.
3. Disconnect the accelerator wire (2).
4. Separate the steering support assembly (1).

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Drag link locking nut | 74.8 to 81.3 N·m<br>7.62 to 8.29 kgf·m<br>55.2 to 60.0 ft-lbs |
| | Steering support mounting screw | 48.1 to 55.8 N·m<br>4.9 to 5.7 kgf·m<br>35.5 to 41.2 ft-lbs |

(1) Steering Support
(2) Accelerator Wire
(3) Sector Gear
(4) Drag Link

W1012363




## Brake Rod and Speed Change Rod

1. Disconnect the brake rod 1 (1) from the pedal system component.
2. Disconnect the speed change rod (2) from the pedal system component.

(1) Brake Rod 1
(2) Speed Change Rod

W1014984


## Pedal System Component

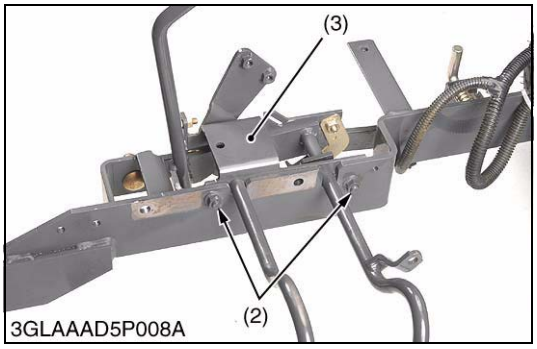
1. Remove the parking lock spring (1).
2. Remove the pedal system component mounting nuts (2).
3. Separate the pedal system component (3) from frame.

**(When reassembling)**

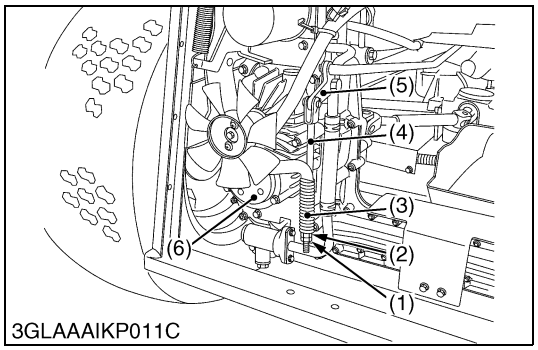
| | | |
|---|---|---|
| Tightening torque | Pedal system component mounting nut | 48.1 to 55.8 N·m<br>4.9 to 5.7 kgf·m<br>35.5 to 41.2 ft-lbs |

(1) Parking Lock Spring
(2) Pedal System Component Mounting Nut
(3) Pedal System Component

W1015153



## (2) Brake Assembly



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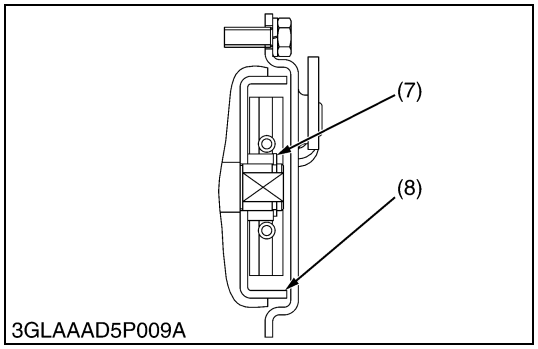

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**Brake Assembly**

1. Remove the lock nut (1), plain washers (2) and brake spring (3).
2. Remove the brake plate (5).
3. Remove the brake rod 2 (4).
4. Remove the brake assembly (6).
5. Remove the external snap ring (7).
6. Pull out the brake drum (8).

**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the brake assembly.

■ **NOTE**

- **After assembling the brake assembly, be sure to adjust the brake pedal free travel (see page G-26)**

(1) Lock Nut
(2) Plain Washer
(3) Brake Spring
(4) Brake Rod 2
(5) Brake Plate
(6) Brake Assembly
(7) External Snap Ring
(8) Brake Drum

W1015462

# 4 FRONT AXLE

# SERVICING

## CONTENTS

# 1. TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Front Wheels Wander to Right or Left** | Tire pressure uneven | Adjust | – |
| | Improper toe-in | Replace tie-rod | 4-S4, 6 |
| | Kingpin worn | Replace front axle assembly | 4-S5 |
| | Center pin collar worn | Replace | 4-S5, 6 |
| | Center pin locking nut loosen | Tighten | 4-S5 |
| **Front Wheels Shimmy** | Improper toe-in | Replace tie-rod | 4-S4, 6 |
| | Kingpin worn | Replace front axle assembly | 4-S5 |
| | Center pin collar worn | Replace | 4-S5, 6 |
| | Steering linkage loosen or worn | Tighten or replace | 4-S5 |

W1014322

# 2. SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Front Wheel Alignment | Toe-in | 1 to 10 mm<br>0.04 to 0.39 in. | – |
| Front Axle Frame to Anti-vibration Bolt | Clearance | 0.3 to 0.5 mm<br>0.012 to 0.020 in. | – |
| Center Pin to Center Pin Collar | Clearance | 0.109 to 0.200 mm<br>0.00430 to 0.00789 in. | 0.210 mm<br>0.00828 in. |
| | Center Pin Boss (I.D.) | 25.400 to 25.430 mm<br>1.00000 to 1.00118 in. | – |
| | Center Pin Collar (O.D.) | 25.230 to 25.291 mm<br>0.99329 to 0.99570 in. | – |

W1013874

# 3. TIGHTENING TORQUES

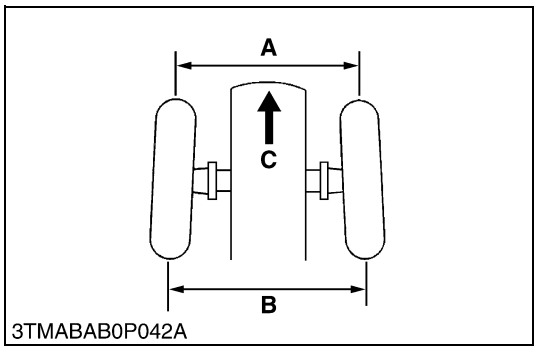
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-9.)

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Center pin locking nut | 77.4 to 90.2 | 7.9 to 9.2 | 57.2 to 66.5 |
| Tie-rod mounting locking nut | 49.9 to 54.2 | 5.09 to 5.53 | 36.8 to 40.0 |

W1012736

# 4. CHECKING, DISASSEMBLING AND SERVICING

## [1] CHECKING AND ADJUSTING



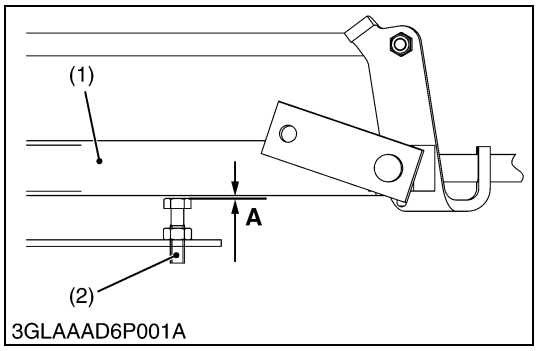

**Toe-in**

1. Inflate the tires to the specified pressure.
2. Turn the front wheels straight ahead.
3. Measure the toe-in (**B**-**A**).
4. If the measurement is not within the factory specifications, replace the tie-rod.

| | | |
|---|---|---|
| Toe-in (**B**-**A**) | Factory spec. | 1 to 10 mm<br>0.04 to 0.39 in. |

**A : Wheel to Wheel Distance at Front C ; Front**
**B : Wheel to Wheel Distance at Rear**

W1010640




**Anti-Vibration Bolt**

1. Jack up the front of machine.
2. Measure the clearance between the front axle frame (1) and anti-vibration bolt (2).
3. If the measurement exceeds the factory specification, adjust the anti-vibration bolt.

| | | |
|---|---|---|
| Clearance between front axle frame and anti-vibration bolt | Factory spec. | 0.3 to 0.5 mm<br>0.012 to 0.020 in. |

(1) Front Axle Frame **A : Clearance**
(2) Anti-Vibration Bolt

W1010902

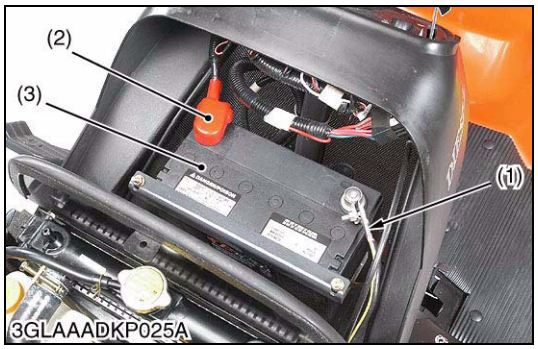
## [2] PREPARATION

### (1) Separating Front Axle Assembly

**Dismounting Mower**

1. See page 7-S6. (“Mower” Section)

W1011172




**Battery**

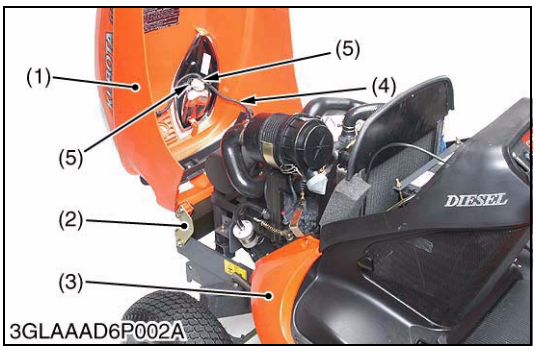
**CAUTION**

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

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

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

W1011247

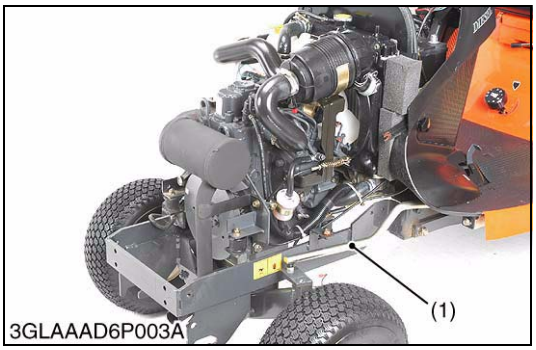



## Bonnet and Side Bonnet

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

(1) Bonnet
(2) Bonnet Bracket
(3) Side Bonnet
(4) Wire Harness
(5) Connector

W1011459



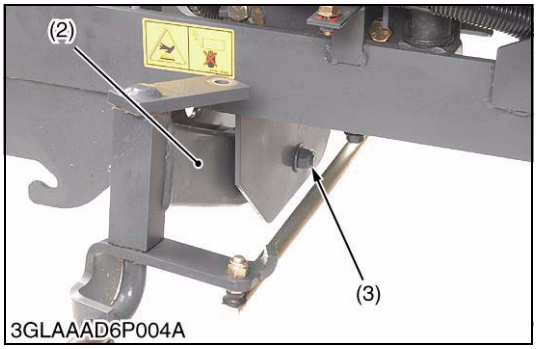

## Separating Front Axle Assembly

1. Disconnect the drag link (1) from the front axle assembly (2).
2. Support the front of frame with jacks.
3. Remove the front wheels.
4. Loose the anti-vibration bolts (5).
5. Remove the center pin locking nut (3), and draw out the center pin bolt (6).
6. Separate the front axle assembly (2).

**(When reassembling)**

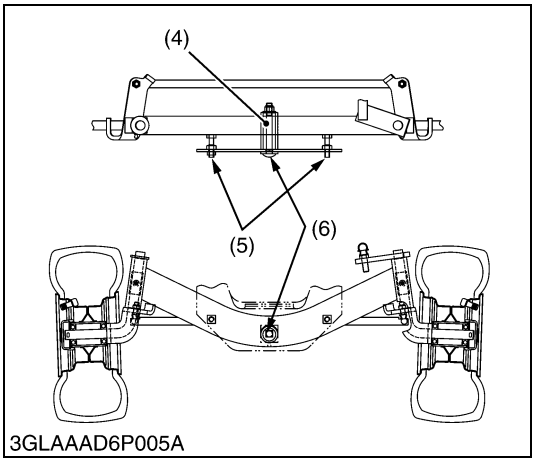
- Apply grease to the outer side of center pin collar (4).

| | | |
|---|---|---|
| Tightening torque | Center pin locking nut | 77.4 to 90.2 N·m<br>7.9 to 9.2 kgf·m<br>57.2 to 66.5 ft-lbs |



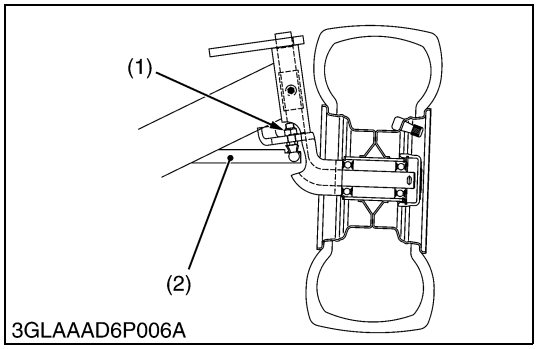

(1) Drag Link
(2) Front Axle Assembly
(3) Center Pin Locking Nut
(4) Center Pin Collar
(5) Anti-vibration Bolt
(6) Center Pin Bolt

W1011682



# [3] DISASSEMBLING AND ASSEMBLING

## (1) Front Axle Assembly




**Tie-rod**

1. Remove the tie-rod mounting locking nut (1).
2. Remove the tie-rod (2).

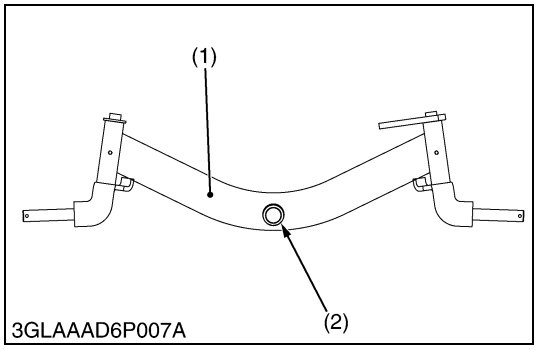
**(When reassembling)**

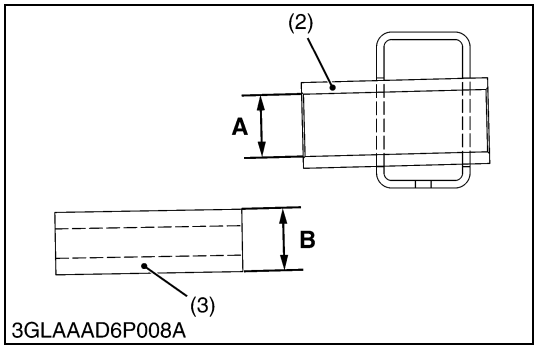
| | | |
|---|---|---|
| Tightening torque | Tie-rod mounting locking nut | 49.9 to 54.2 N·m<br>5.09 to 5.53 kgf·m<br>36.8 to 40.0 ft-lbs |

(1) Tie-rod Mounting Locking Nut (2) Tie-rod

W1012154

# [4] SERVICING




**Clearance between Center Pin Boss and Center Pin Collar**

1. Measure the center pin boss (2) I.D. with a cylinder gauge.
2. Measure the center pin collar (3) O.D. with an outside micrometer and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

| | | |
|---|---|---|
| Clearance between center pin boss and center pin collar | Factory spec. | 0.109 to 0.200 mm<br>0.00430 to 0.00789 in. |
| | Allowable limit | 0.210 mm<br>0.0828 in. |

| | | |
|---|---|---|
| Center pin boss I.D. (**A**) | Factory spec. | 25.400 to 25.430 mm<br>1.00000 to 1.00118 in. |
| Center pin collar O.D. (**B**) | Factory spec. | 25.230 to 25.291 mm<br>0.99329 to 0.99570 in. |

(1) Front Axle Frame (3) Center Pin Collar
(2) Center Pin Boss

W1012404

# 5 STEERING

# SERVICING

## CONTENTS

# 1. TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Cannot Steer** | Steering shaft and sector gear broken | Replace | 5-S8 |
| | Steering linkage broken | Replace | 5-S7 |
| **Hard Steering** | Tire pressure uneven | Adjust | – |
| | Improper alignment of front wheels | Replace tie-rod | 4-S4, 6 |
| | Bearing stuck | Replace | 5-S8 |
| | Steering shaft and sector gear stuck | Replace | 5-S8 |

W1014322

# 2. SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Steering Wheel | Play | 30 to 70 mm<br>0.79 to 1.18 in. | – |

W1013874

# 3. TIGHTENING TORQUES

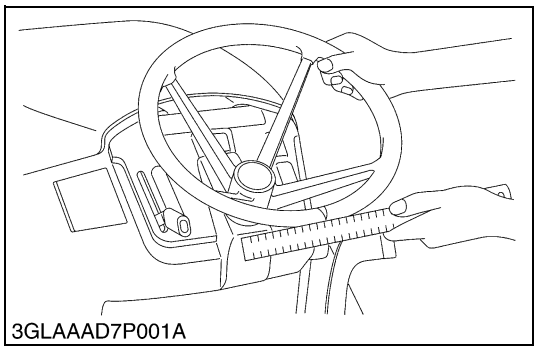
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-9.)

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Steering wheel mounting nut | 20 to 25 | 2.0 to 2.5 | 14.8 to 18.4 |
| Drag link locking nut | 74.8 to 81.3 | 7.62 to 8.29 | 55.2 to 60.0 |
| Steering support mounting screw | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |
| Sector gear mounting screw | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |

W1012736

# 4. CHECKING, DISASSEMNLING AND SERVICING

## [1] CHECKING AND ADJUSTING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**Steering Wheel Play**

1. Turn the front wheels straight ahead.
2. Rotate the steering wheel lightly by hand, and measure the play.
3. If the measurement exceeds the factory specifications, replace the steering shaft and sector gear.

| | | |
|---|---|---|
| Steering wheel play | Factory spec. | 30 to 70 mm<br>0.79 to 1.18 in. |

W1010638

## [2] PREPARATION

### (1) Separating Steering Support Assembly

**Dismounting Mower**

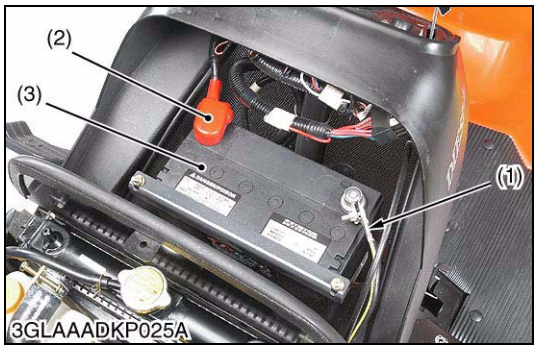
1. See page 7-S6. (“Mower” Section)

W1010809

**Dismounting Container**

1. See page 2-S9. (“Transaxle” Section)

W1010875



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**Battery**

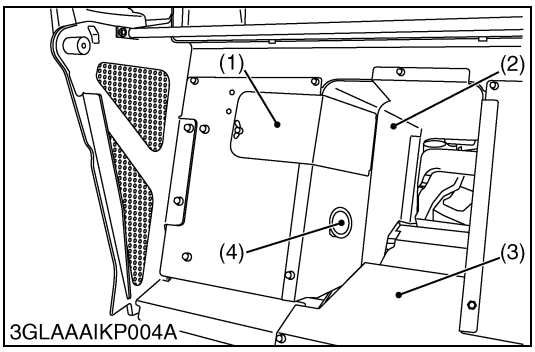
**CAUTION**

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

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

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

W1010944

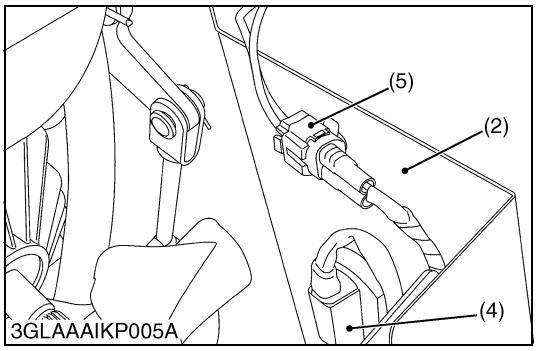


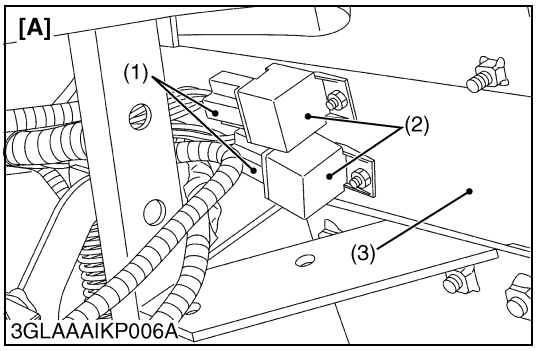

## Discharge Duct

1. Remove the filter cover (1) and the duct plate (3).
2. Disconnect the connector (5) from the grass container full switch (4).
3. Remove the discharge duct (2).

(1) Filter Cover
(2) Discharge Duct
(3) Duct Plate
(4) Grass Container Full Switch
(5) Connector

W1012965



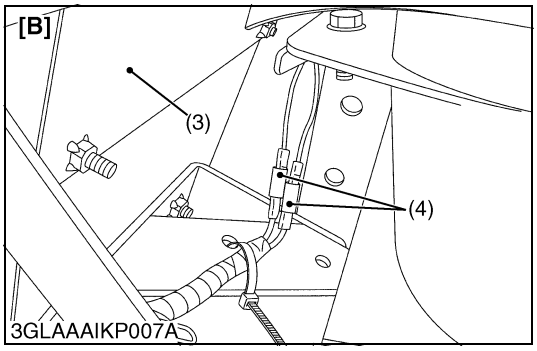



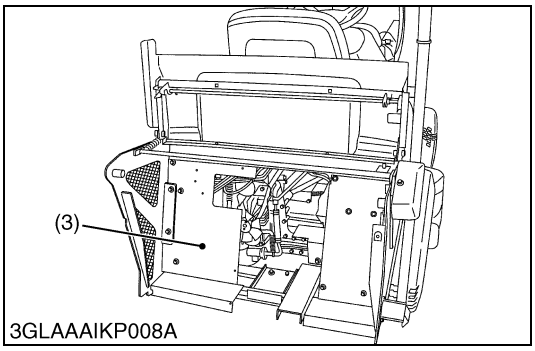

## Container Base

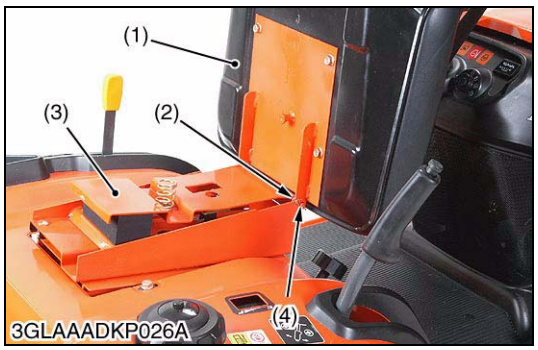
1. Disconnect the couplers (1) from the relays (2).
2. Disconnect the connector (4).
3. Remove the container base (3).

(1) Coupler
(2) Relay
(3) Container Base
(4) Connector
**[A] Left Side**
**[B] Right Side**

W1014159






## Seat

1. Remove two snap pins (2), (4).
2. Remove the seat (1) and seat plate (3).

(1) Seat
(2) Snap Pin
(3) Seat Plate
(4) Snap Pin

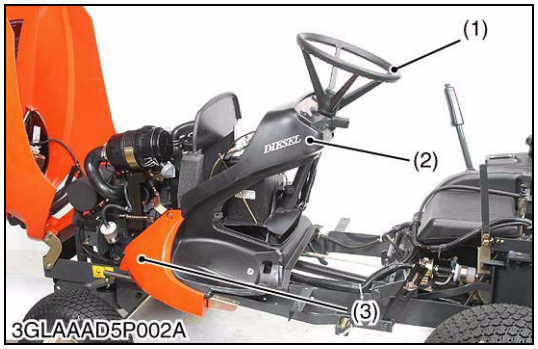
W1011217


## Fender

1. Remove the speed change pedal (5).
2. Peel the step sheet (4) halfway.
3. Remove the fuel cap (1).
4. Remove the fender (2).

(1) Fuel Cap
(2) Fender
(3) Fender Mounting Screw
(4) Step Sheet
(5) Speed Change Pedal

W1011459

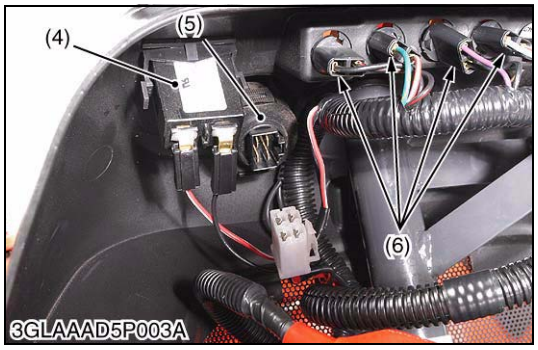



## Steering Wheel, Side Bonnet and Panel

1. Remove the steering wheel (1).
2. Remove the side bonnet (3).
3. Remove the accelerator lever grip.
4. Disconnect the connectors for hour meter (4), main switch (5) and light switch.
5. Remove the indicator lamps (6).
6. Remove the fuse box (7) from the steering support.
7. Remove the panel (2).

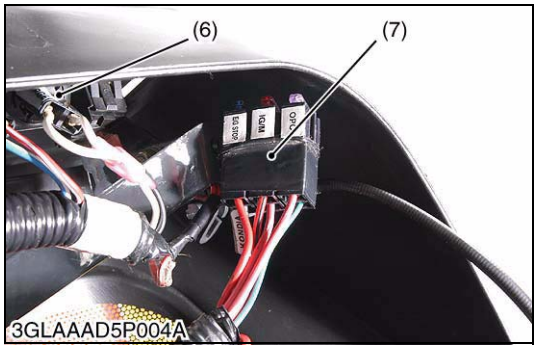
**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Steering wheel mounting nut | 20 to 25 N·m<br>2.0 to 2.5 kgf·m<br>14.8 to 18.4 ft-lbs |




(1) Steering Wheel
(2) Panel
(3) Side Bonnet
(4) Hour Meter
(5) Main Switch
(6) Indicator Lamp
(7) Fuse Box

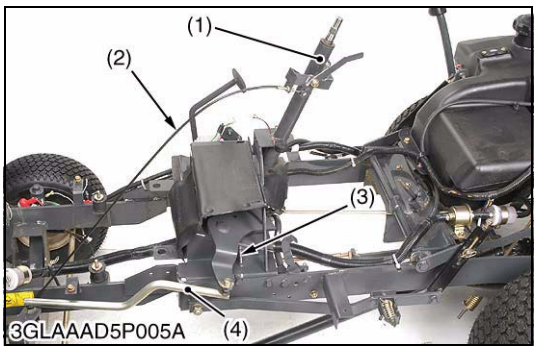
W1011711




## Separating Engine

1. See page 1-S18. (“Engine” Section)

W1012193




**Steering Support Assembly**

1. Disconnect the drag link (4) from the sector gear (3).
2. Disconnect the connectors for the timer relay, regulator and buzzer unit.
3. Disconnect the accelerator wire (2).
4. Separate the steering support assembly (1).

**(When reassembling)**

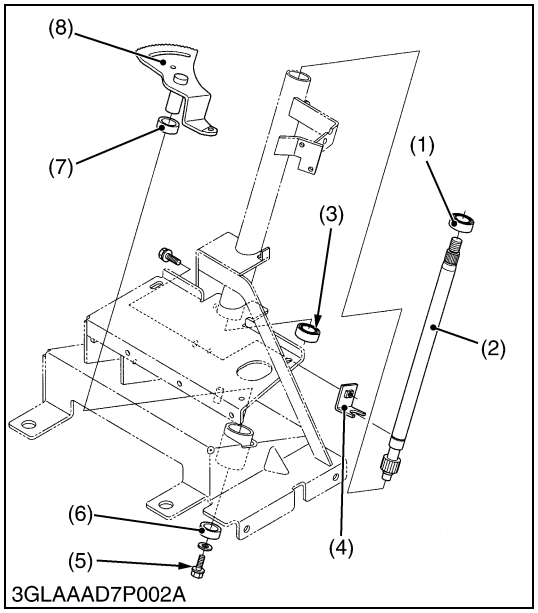
| | | |
|---|---|---|
| Tightening torque | Drag link locking nut | 74.8 to 81.3 N·m<br>7.62 to 8.29 kgf·m<br>55.2 to 60.0 ft-lbs |
| | Steering Support mounting screw | 48.1 to 55.8 N·m<br>4.9 to 5.7 kgf·m<br>35.5 to 41.2 ft-lbs |

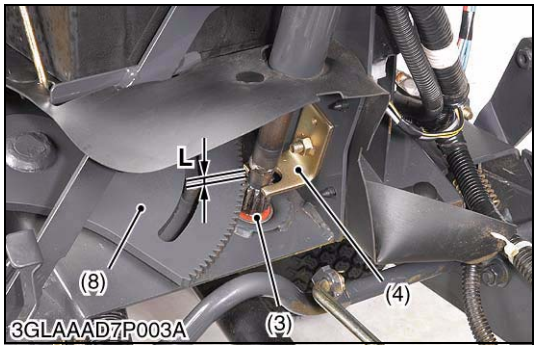
(1) Steering Support
(2) Accelerator Wire
(3) Sector Gear
(4) Drag Link

W1012258

# [3] DISASSEMBLING AND ASSEMBLING

## (1) Steering Support Assembly




**Steering Shaft and Sector Gear**

1. Remove the shaft retainer (4).
2. Remove the sector gear mounting screw (5), and remove the sector gear (8).
3. Remove the steering bearing (1) and ball bearing (3).
4. Pull out the steering shaft (2).

**(When reassembling)**

- Apply to grease to the sector gear teeth.
- Apply to grease to the pinion teeth of steering shaft.
- Apply to grease to the sector bushes (6), (7).
- Apply to grease to the steering bearing.
- Adjust the clearance between the shaft retainer and the pinion gear of steering shaft.

**(Reference)**

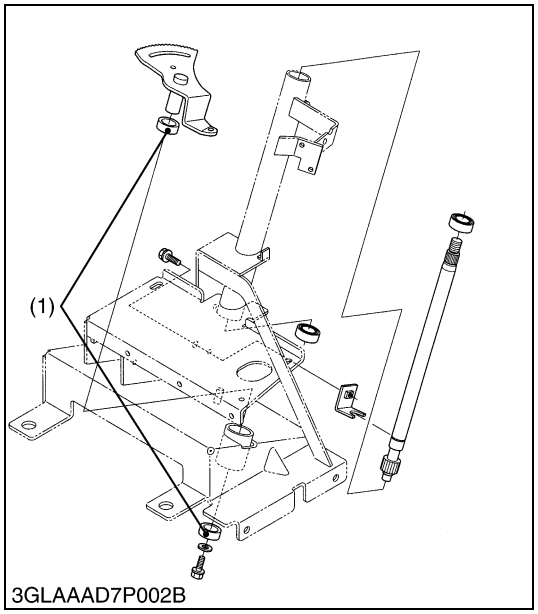
- Length (**L**) : 1 mm (0.040 in.)

| | | |
|---|---|---|
| Tightening torque | Sector gear mounting screw | 48.1 to 55.8 N·m<br>4.9 to 5.7. kgf·m<br>35.5 to 41.2 ft-lbs |

(1) Steering Bearing
(2) Steering Shaft
(3) Ball Bearing
(4) Shaft Retainer
(5) Sector Gear Mounting Screw
(6) Sector Bush
(7) Sector Bush
(8) Sector Gear

W1012713

# [4] SERVICING




**Steering Support Bushing Wear**

1. Visually inspect the sector bushes (1) for signs of wear or damage.
2. If defect are found, replace the sector bush (1).

(1) Sector Bush

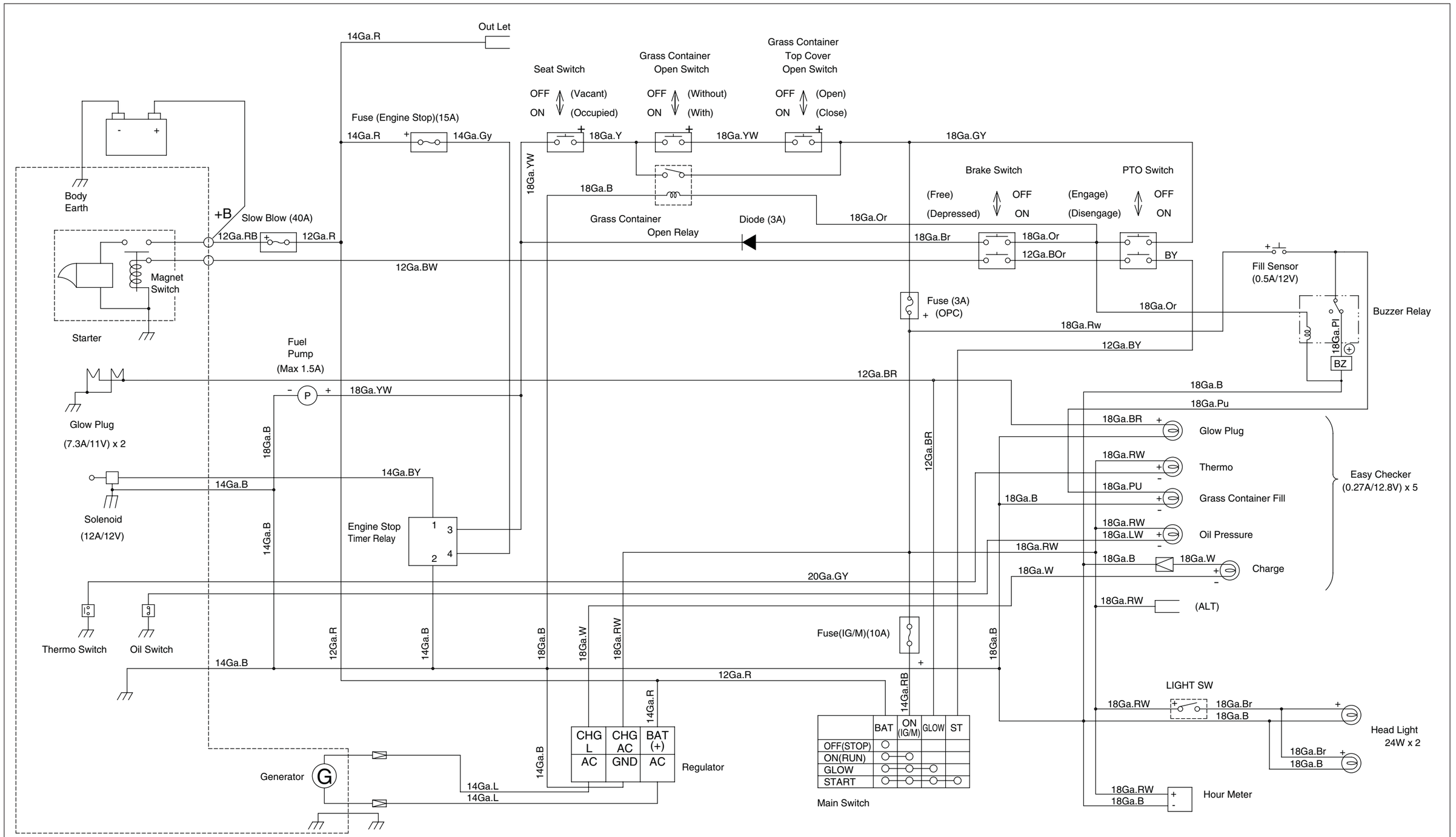
W1013149

# 6 ELECTRICAL SYSTEM

# MECHANISM

## CONTENTS

# 1. WIRING DIAGRAM

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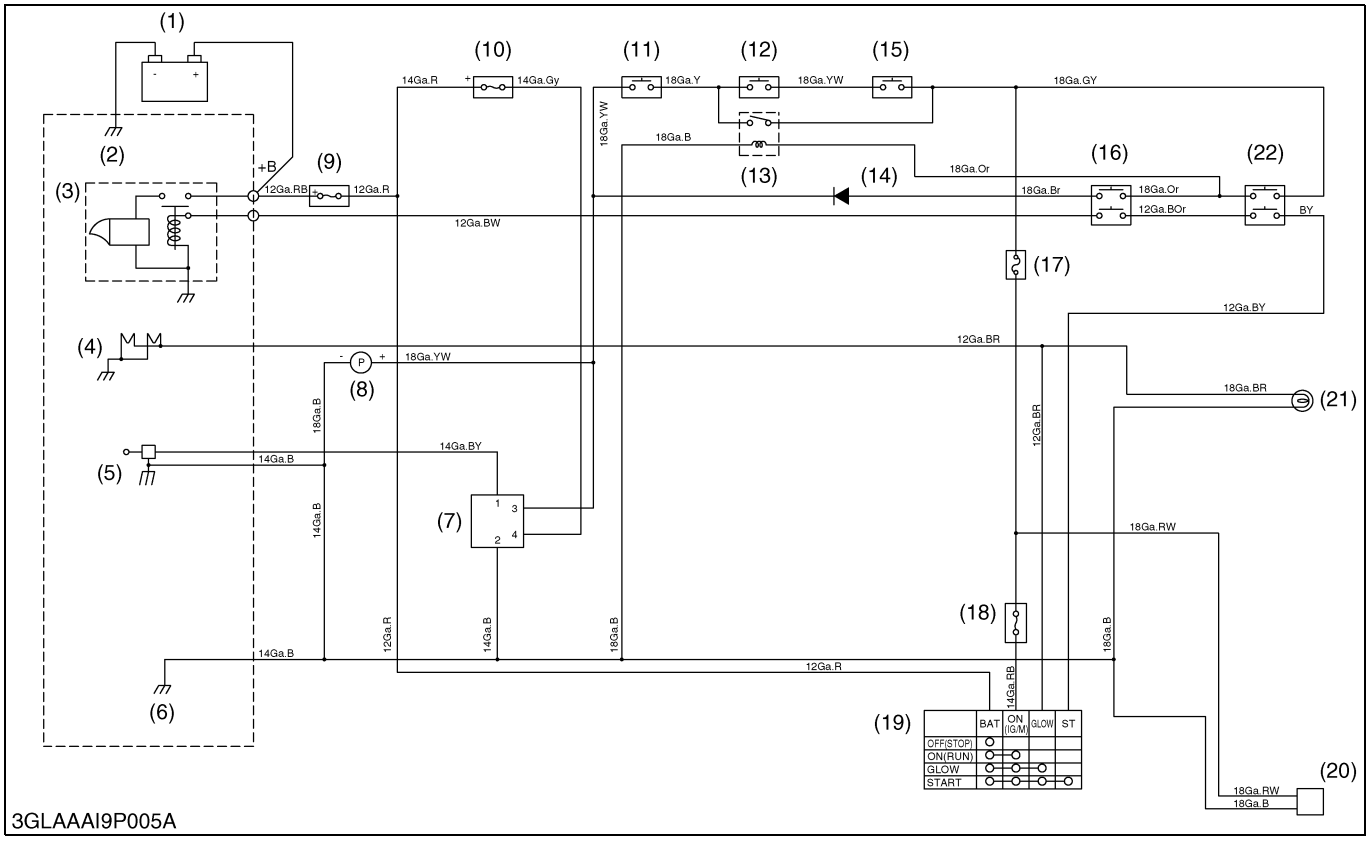
**Color of Wiring**

| | | |
|---|---|---|
| W ..... White | WR ..... White / Red | BW ..... Black / White |
| R ..... Red | WY ..... White / Yellow | BR ..... Black / Red |
| L ..... Blue | RB ..... Red / Black | GW ..... Green / White |
| P ..... Pink | RW ..... Red / White | YR ..... Yellow / Red |
| B ..... Black | RG ..... Red / Green | YL ..... Yellow / Blue |
| Br ..... Brown | RY ..... Red / Yellow | LW ..... Blue / White |
| Sb ..... Sky Blue | | |

W1019456

# 2. STARTING SYSTEM




(1) Battery
(2) Body Earth
(3) Starter Motor
(4) Glow Plug
(5) Engine Stop Solenoid
(6) Body Earth
(7) Engine Stop Time Relay
(8) Fuel Feed Pump
(9) Slow Blow Fuse (40 A)
(10) Fuse (15 A)
(11) Seat Switch
(12) Grass Container Open Switch
(13) Grass Container Open Relay
(14) Diode (3 A)
(15) Grass Container Top Cover Open Switch
(16) Brake Switch
(17) Fuse (3 A)
(18) Fuse (10 A)
(19) Main Switch
(20) Hour Meter
(21) Glow Plug Lamp
(22) PTO Switch

When the main switch is turned to the **PREHEAT** position, the terminal **BAT** is connected to the terminals **GLOW** and **ON**. The glow plugs become red-hot, and the glow plug (preheat indicator) lamp also lights on while preheating.

When the main switch is then turned to the **START** position with the brake switch on and PTO switch on, the terminal **BAT** is connected to the terminals **START** and **ON**. Consequently, battery current flows to the starter motor and start the engine.

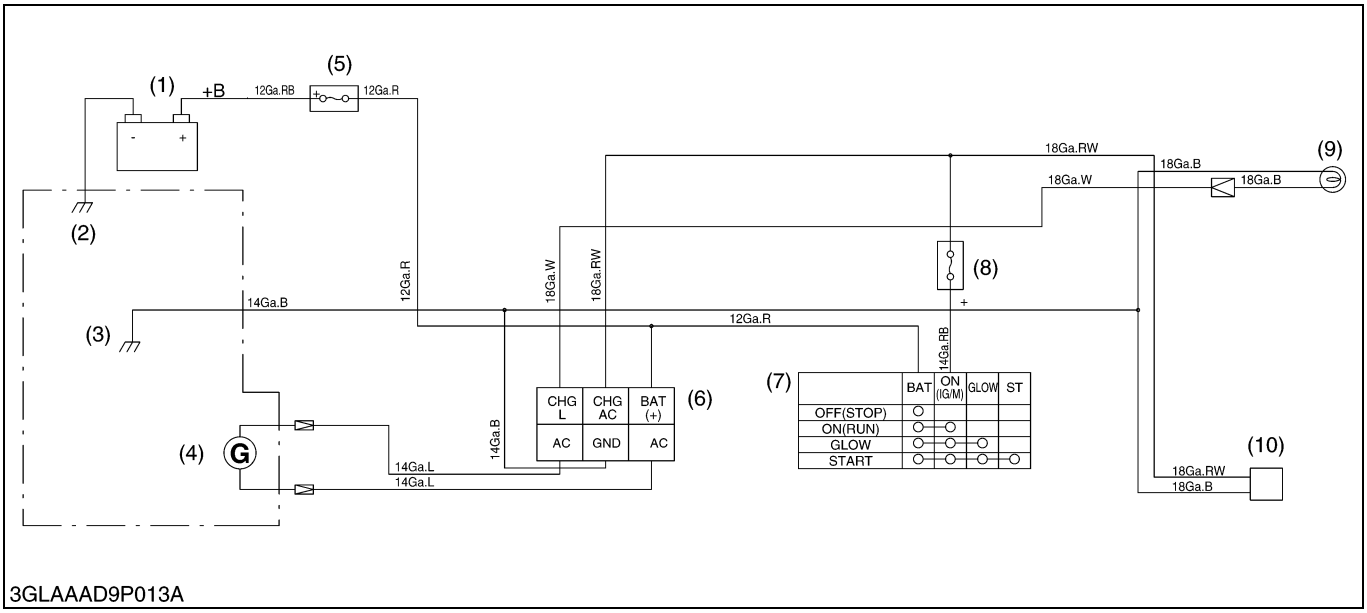
The main switch automatically returns to the **ON** position, the terminal **BAT** is connected only to the terminal **ON**, thereby causing the starting circuit to be opened, stopping the starter motor.

When the main switch turned from the **ON** position to the **OFF** position, the engine stop solenoid moves the fuel injection pump control rack to the **"No Fuel Injection"** position and stops the engine.

This machine equipped the operator presence control (OPC) system which automatically stop the engine when operator stands from the seat while shifting the PTO lever.

With the PTO lever shifted to the **"ENGAGE"** position, the engine of this machine stops automatically when the top cover of the grass container is opened, the grass container is opened or dismounted.

# 3. CHARGING SYSTEM

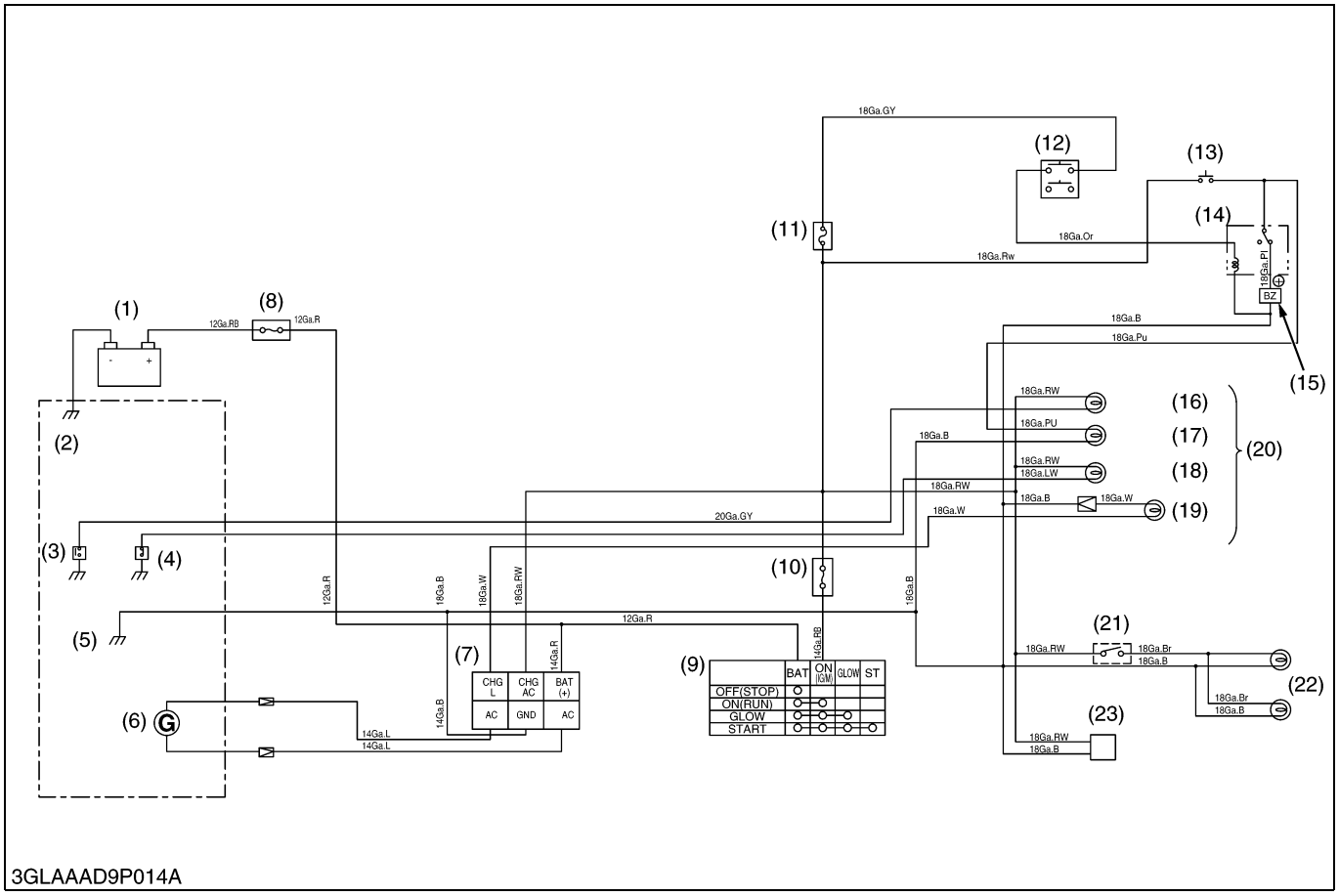



(1) Battery
(2) Body Earth
(3) Body Earth
(4) Dynamo
(5) Slow Blow Fuse (40 A)
(6) Regulator
(7) Main Switch
(8) Fuse (10 A)
(9) Charge Lamp
(10) Hour Meter

The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs.

It consists of a dynamo (4) and a regulator (6).

# 4. LIGHTING SYSTEM

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(1) Battery
(2) Body Earth
(3) Thermo Switch
(4) Oil Switch
(5) Body Earth
(6) Dynamo
(7) Regulator
(8) Slow Blow Fuse (40 A)
(9) Main Switch
(10) Fuse (10 A)
(11) Fuse (3 A)
(12) PTO Switch
(13) Grass Container Full Switch
(14) Buzzer Relay
(15) Buzzer
(16) Thermo Lamp
(17) Grass Container Full Lamp
(18) Oil Pressure Lamp
(19) Charge Lamp
(20) Easy Checker
(21) Head Light Switch
(22) Head Light
(23) Hour Meter

The lighting system consists of main switch, head light switch, head lights, etc..

The grass container full lamp in the easy checker lights when the grass container is filled while shifting the PTO lever. And the buzzer rings.

# SERVICING

## CONTENTS

# 1. TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **All Electrical Equipments Do Not Operate** | Battery discharged or defective | Recharge or replace | G-24, 1-S19 |
| | Battery positive cable disconnected or improperly connected | Repair or replace | – |
| | Battery negative cable disconnected or improperly connected | Repair or replace | – |
| | Slow blow fuse blown (40 A) | Replace | G-35 |
| **Fuse Blown Frequently** | Short-circuited | Repair or replace | – |

W1014322

**BATTERY**

| | | | |
|---|---|---|---|
| **Battery Discharges Too Quickly** | Battery defective | Replace | 1-S19 |
| | Dynamo defective | Repair or replace | 6-S21 |
| | Regulator defective | Replace | 6-S15, 16 |
| | Wiring harness disconnected or improperly connected (between battery positive terminal and regulator **B** terminal) | Repair or replace | – |
| | Cooling fan belt slipping | Adjust tension | G-28 |

W1013718

**STARTING SYSTEM**

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Starter Motor Does Not Operate** | Battery discharged or defective | Recharge or replace | G-24, 1-S19 |
| | Slow blow fuse blown (40 A) | Replace | G-35 |
| | Wiring harness disconnected or improperly connected (between main switch ST terminal and safety switches, between safety switches and starter motor, between battery positive terminal and starter motor) | Repair or replace | – |
| | Starter motor defective | Repair or replace | 6-S20 |
| | Main switch defective | Replace | 6-S8, 9 |
| | Seat switch defective | Replace | 6-S13 |
| | Brake switch defective | Replace | 6-S12 |
| | PTO switch defective | Replace | 6-S12 |
| | Top cover open switch defective | Replace | 6-S13 |
| | Grass container open switch defective | Replace | 6-S13 |
| **Engine Does Not Stop When Main Switch is Turned OFF** | Fuse blown (15 A) | Replace | G-35 |
| | Wiring harness disconnected or improperly connected (between main switch **ACC** terminal and engine stop solenoid) | Repair or replace | – |
| | Engine stop solenoid defective | Replace | 6-S14 |
| | Timer relay defective | Replace | 6-S15 |
| **Engine Does Not Start** | Engine stop solenoid defective | Replace | 6-S14 |
| | Timer relay defective | Replace | 6-S15 |

W1013580

**CHARGING SYSTEM**

| | | | |
|---|---|---|---|
| **Charging Lamp Does Not Light when Main Switch is Turned ON** | Fuse blown (15 A) | Replace | G-35 |
| | Bulb blown | Replace | G-35 |
| | Wiring harness disconnected or improperly connected (between main switch **ACC** terminal and regulator connector terminal (yellow), between regulator connector terminal (green) and charge lamp) | Repair or replace | – |
| | Regulator defective | Replace | – |
| **Charging Lamp Does Not Go Off When Engine is Running** | Dynamo defective | Repair or replace | 6-S21 |
| | Regulator defective | Replace | 6-S15, 16 |

W1019547

**LIGHTING SYSTEM**

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Head Light Does Not Light** | Fuse blown (10 A) | Replace | G-35 |
| | Bulb blown | Replace | G-35 |
| | Wiring harness disconnected or improperly connected (between main switch **ACC** terminal and head light switch, between head light switch and head light) | Repair or replace | – |
| **Glow Plug Lamp Does Not Light When Main Switch Is in Pre-heat Position** | Battery discharged or defective | Recharge or replace | G-24, 1-S19 |
| | Slow blow fuse blown (40 A) | Replace | G-35 |
| | Wiring harness disconnected or improperly connected (between main switch **G** terminal and glow plug lamp, between glow plug lamp and glow plugs) | Repair or replace | – |
| | Main switch defective | Replace | 6-S8, 9 |
| | Bulb blown | Replace | G-35 |
| **Oil Pressure Lamp Lights Up When Engine Is Running** | Engine oil pressure too low | Repair engine | – |
| | Engine oil insufficient | Replenish | G-26 |
| | Oil pressure switch defective | Replace | 6-S17 |
| | Short circuit between oil pressure switch lead and chassis | Repair | – |
| **Oil Pressure Lamp Does Not Light When Main Switch Is Turned ON and Engine Is Not Running** | Fuse blown (10 A) | Replace | G-35 |
| | Bulb blown | Replace | G-35 |
| | Oil pressure switch defective | Replace | 6-S17 |
| | Wiring harness disconnected or improperly connected (between main switch **ACC** terminal and oil pressure lamp, between oil pressure lamp and oil pressure switch) | Repair or replace | – |
| **Thermo Lamp Does Not Light When Main Switch Is Turned ON and Engine Is Not Running** | Fuse blown (10 A) | Replace | G-35 |
| | Bulb blown | Replace | – |
| | Thermo switch defective | Replace | 6-S18 |
| | Wiring harness disconnected or improperly connected (between main switch **ACC** terminal and thermo lamp, between thermo lamp and thermo switch) | Repair or replace | – |

W1019624

# 2. SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Battery | Voltage | More than 12 V | – |
| | Potential Difference | Less than 0.1 V | – |
| Glow Plug | Resistance | Approx. 0.9 Ω | – |
| Head Light Switch | Resistance OFF | Infinity | – |
| | Resistance ON | 0 Ω | – |
| Starter | Commutator (O.D.) | 28.0 mm<br>1.102 in | 27.0 mm<br>1.063 in. |
| | Commutator (Difference of O.D.) | Less than 0.05 mm<br>0.002 in | 0.4 mm<br>0.016 in. |
| | Mica (Undercut) | 0.50 to 0.80 mm<br>0.0197 to 0.0315 in. | 0.20 mm<br>0.0079 in. |
| | Brush (Length) | 16.0 mm<br>0.630 in. | 10.5 mm<br>0.413 in. |

W1013874

# 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-9.)

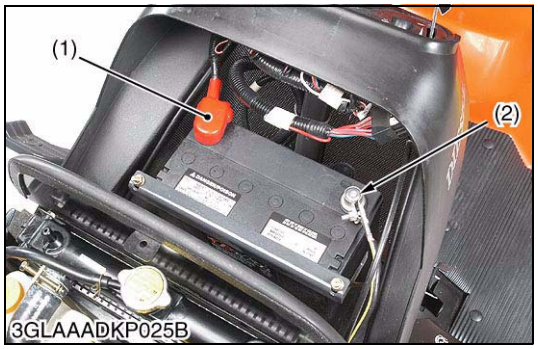
| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Starter (**C** terminal nut) | 5.9 to 11.8 | 0.6 to 1.2 | 4.3 to 8.7 |
| Dynamo (stater nut) | 39.2 to 44.1 | 4.0 to 4.5 | 28.9 to 32.5 |

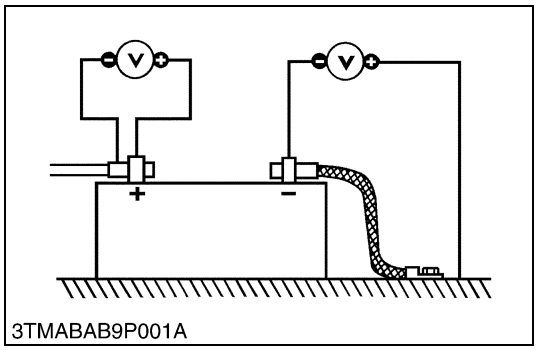
W1012736

# 4. CHEKING, DISASSEMBLING AND SERVICING

## [1] CHECKING AND ADJUSTING

### (1) Battery




**Battery Voltage**

1. Stop the engine and turn the main switch off.
2. Connect the COM (-) lead of the voltmeter to the battery's negative terminal post (2) and the (+) lead to the positive terminal post (1), and measure the battery voltage.
3. If the battery voltage is less than the factory specification, check the battery specific gravity and recharge the battery.

| | | |
|---|---|---|
| Battery Voltage | Factory spec. | More than 12 V |

(1) Positive Terminal Post (2) Negative Terminal Post

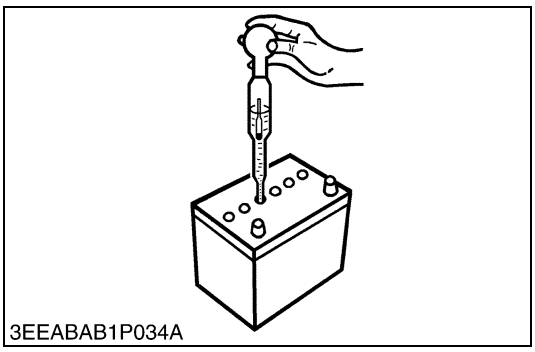
W1010650

**Battery Terminal Connection**

1. Turn the main switch on, and turn on the head light.
2. Measure the voltage with a voltmeter across the battery's positive terminal post and the cable terminal, and the voltage across the battery's negative terminal post and the chassis.
3. If the measurement exceeds the factory specification, clean the battery terminal posts and cable clamps, and tighten them firmly.

| | | |
|---|---|---|
| Potential difference | Factory spec. | Less than 0.1 V |

W1010906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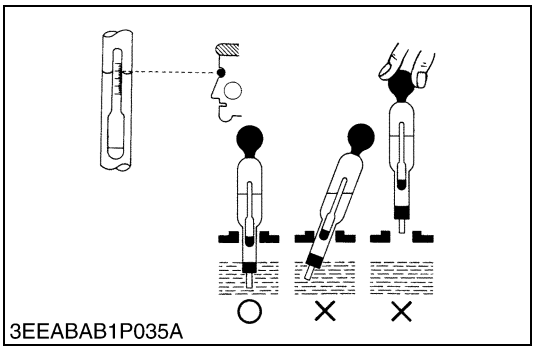
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**Battery Specific Gravity**

1. Check the specific gravity of the electrolyte in each cell with a hydrometer.
2. When the electrolyte temperature differs from that at which the hydrometer was calibrated, correct the specific gravity reading following the formula mentioned in **(Reference)**.
3. If the specific gravity is less than 1.215 (after it is corrected for temperature), charge or replace the battery.
4. If the specific gravity differs between any two cells by more than 0.05, replace the battery.

■ **NOTE**

- **Hold the hydrometer tube vertical without removing it from the electrolyte.**
- **Do not suck too much electrolyte into the tube.**
- **Allow the float to move freely and hold the hydrometer at eye level.**
- **The hydrometer reading must be taken at the highest electrolyte level.**

**(Reference)**

- Specific gravity slightly varies with temperature. To be exact, the specific gravity decreases by 0.0007 with an increase of 1 °C (0.0004 with an increase of 1 °F) in temperature, and increases by 0.0007 with an decreases of 1 °C (0.0004 with a decrease of 1 °F).

  Therefore, using 20 °C (68 °F) as a reference, the specific gravity reading must be corrected by the following formula :
  - Specific gravity at 20 °C = Measured value + 0.0007 x (electrolyte temperature - 20 °C)
  - Specific gravity at 68 °F = Measured value + 0.0004 x (electrolyte temperature - 68 °F)

| Specific Gravity | State of Charge |
|---|---|
| 1.260 Sp. Gr. | 100 % Charged |
| 1.230 Sp. Gr. | 75 % Charged |
| 1.200 Sp. Gr. | 50 % Charged |
| 1.170 Sp. Gr. | 25 % Charged |
| 1.140 Sp. Gr. | Very Little Useful Capacity |
| 1.110 Sp. Gr. | Discharged |

At an electrolyte temperature of 20 °C (68 °F)

W1011053

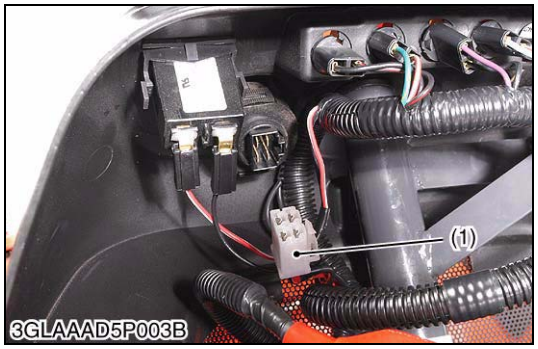
## (2) Main Switch


**Main Switch**

1. Open the bonnet.
2. Disconnect the **4P** connector and remove the main switch (1).
3. Perform the following checks.

(1) Main Switch

W1012030



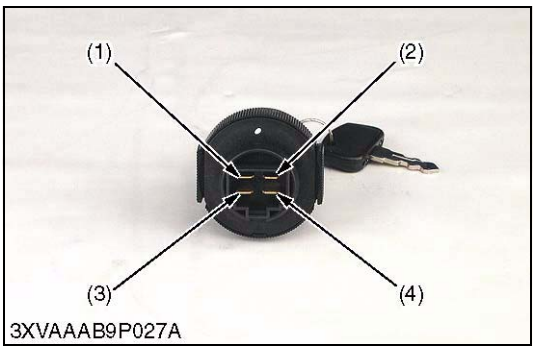

**Connector Voltage**

1. Measure the voltage with a voltmeter across the connector **B** (red) terminal and chassis.
2. If the voltage differs from the battery voltage (11 to 14 V), the wiring harness is faulty.

| | | |
|---|---|---|
| Voltage | Connector **B** (Red) terminal - chassis | Approx. battery voltage |

(1) Connector

W1012220




**Main Switch Continuity**

**1) Main Switch Key at OFF Position**

1. Set the main switch **OFF** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **ACC** terminal, **B** terminal and **ST** terminal, **B** terminal and **G** terminal.
3. If infinity is not indicated, the contacts of the main switch are faulty.

| | | |
|---|---|---|
| Resistance | **B** terminal - **ACC** terminal | Infinity |
| | **B** terminal - **ST** terminal | |
| | **B** terminal - **G** terminal | |

**2) Main Switch Key at ON Position**

1. Set the main switch **ON** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **ACC** terminal.
3. If 0 ohm is not indicated, the **B** - **ACC** contact of the main switch are faulty.

| | | |
|---|---|---|
| Resistance | **B** terminal - **ACC** terminal | 0 Ω |

**3) Main Switch Key at PREHEAT Position**

1. Set and hold the main switch key at the **PREHEAT** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **G** terminal, and measure the resistance across the **B** terminal and the **ACC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

| | | |
|---|---|---|
| Resistance | **B** terminal - **G** terminal | 0 Ω |
| | **B** terminal - **ACC** terminal | |

**4) Main Switch Key at START Position**

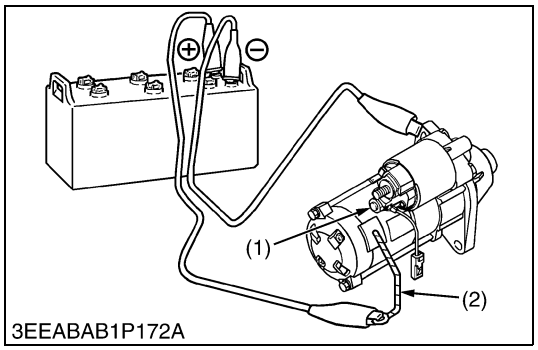
1. Set and hold the main switch key at the **START** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **G** terminal, across the **B** terminal and the **ST** terminal, and across the **B** terminal and the **ACC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

| | | |
|---|---|---|
| Resistance | **B** terminal - **G** terminal | 0 Ω |
| | **B** terminal - **ST** terminal | |
| | **B** terminal - **ACC** terminal | |

(1) **G** Terminal
(2) **ACC** Terminal
(3) **ST** Terminal
(4) **B** Terminal

W10136580

## (3) Starter




**Motor Test**

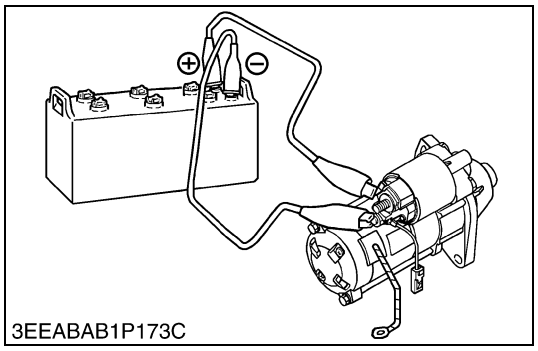
**CAUTION**

- **Secure the starter to prevent it from jumping up and down while testing the motor.**

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter.
3. Remove the starter from the engine.
4. Disconnect the connecting lead (2) from the starter **C** terminal (1).
5. Connect a jumper lead from the connecting lead (2) to the battery positive terminal post.
6. Connect a jumper lead momentarily between the starter motor housing and the battery negative terminal post.
7. If the motor does not run, check the motor.

(1) **C** Terminal (2) Connecting Lead

W10142670




**Starter Magnet Switch Test (Pull-in, Holding Coils)**

■ **NOTE**

- **Preparate a 6 V battery for the test, and each test should be carried out for 3 to 5 seconds.**

**1) Checking Pull-in Coil**

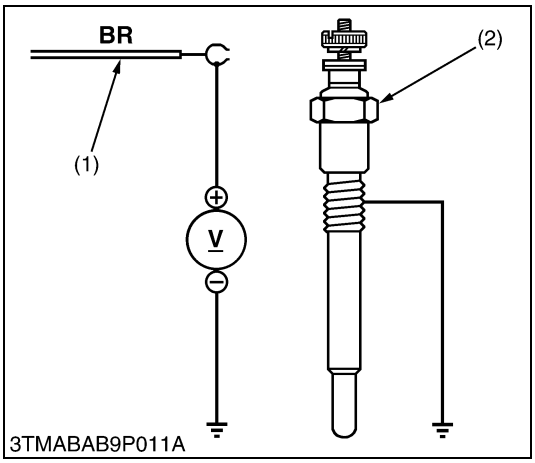
1. Connect jumper lead from the battery's negative terminal post to the **C** terminal.
2. The plunger should be attracted strongly when a jumper lead is connected from the battery positive terminal to the **S** terminal.

**2) Checking Holding Coil**

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

W1015210

## (4) Glow Plug



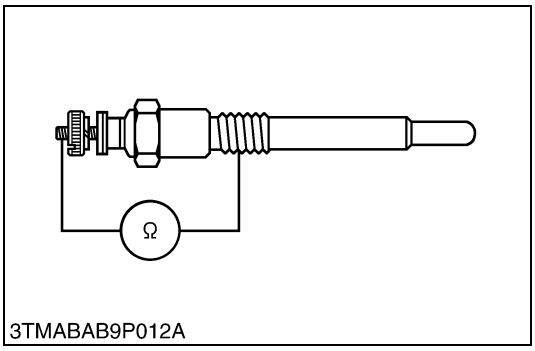

**Lead Terminal Voltage**

1. Disconnect the wiring lead (1) from the glow plug (2) after turning the main switch off.
2. Turn the main switch key to the **"PREHEAT"** position, and measure the voltage between the lead terminal and the chassis.
3. Turn the main switch key to the **"START"** position, and measure the voltage with a voltmeter between the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or main switch is faulty.

| | | |
|---|---|---|
| Voltage (Lead terminal - Chassis) | Main switch key at **"PREHEAT"** | Approx. battery voltage |
| | Main switch key at **"START"** | Approx. battery voltage |

(1) Wiring Lead (Positive) (2) Glow Plug

W10149130



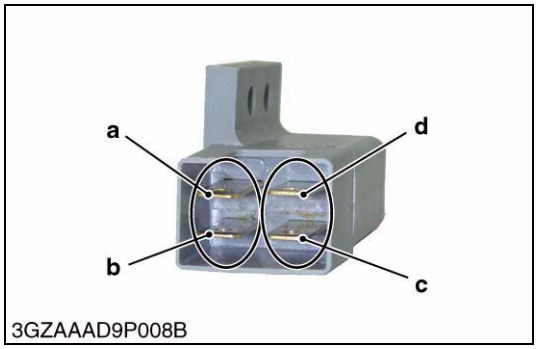

**Glow Plug Continuity**

1. Disconnect the lead from the glow plugs.
2. Measure the resistance with an ohmmeter between the glow plug terminal and the chassis.
3. If 0 ohm is indicated, the screw at the tip of the glow plug and the housing are short-circuited.
4. If the factory specification is not indicated, the glow plug is faulty.

| | | |
|---|---|---|
| Glow plug resistance | Factory spec. | Approx. 0.9 Ω |

W10151150

## (5) Safety Switch


### PTO Switch

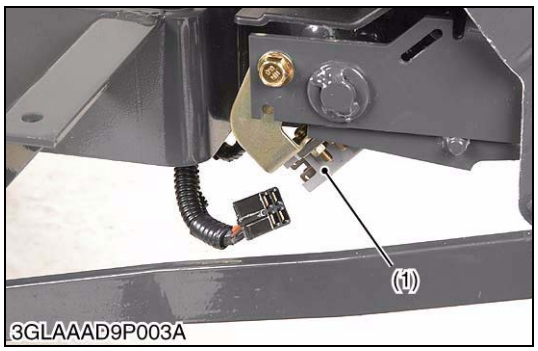
1. Remove the battery.
2. Remove the fender.
3. Disconnect the connector from the PTO switch (1).
4. Measure the resistance with an ohmmeter between the terminals.
5. If the PTO switch is defective, replace it.

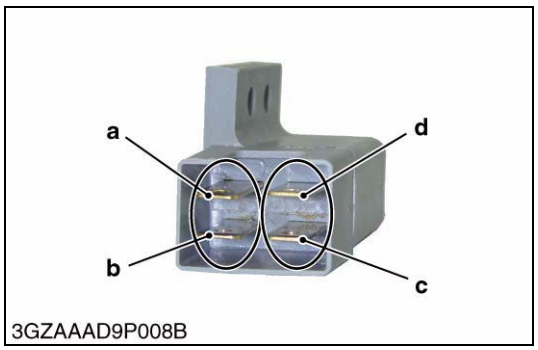
| | | |
|---|---|---|
| Resistance (between terminal **a** and **b**) | When plunger is pushed | 0 Ω |
| | When plunger is released | Infinity |
| Resistance (between terminal **c** and **d**) | When plunger is pushed | 0 Ω |
| | When plunger is released | Infinity |

(1) PTO Switch
(2) PTO Lever

**a to d :Safety Switch Terminal**

W10158610




### Brake Switch

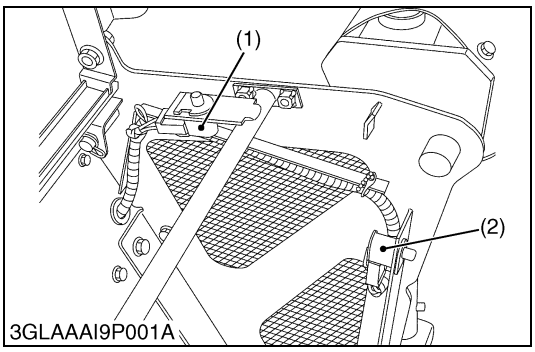
1. Remove the battery.
2. Remove the fender.
3. Disconnect the connector from the brake switch (1).
4. Measure the resistance with an ohmmeter between the terminals.
5. If the brake switch is defective, replace it.

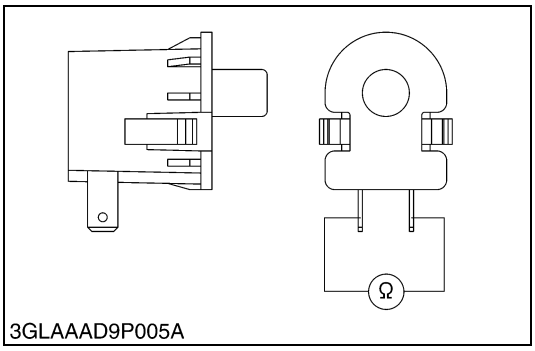
| | | |
|---|---|---|
| Resistance (between terminal **a** and **b**) | When plunger is pushed | 0 Ω |
| | When plunger is released | Infinity |
| Resistance (between terminal **c** and **d**) | When plunger is pushed | 0 Ω |
| | When plunger is released | Infinity |

(1) Brake Switch

**a to d :Safety Switch Terminal**

W10413270




**Top Cover and Grass Container Open Switch**

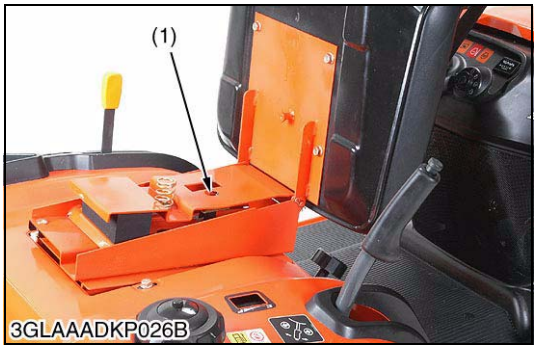
1. Remove the battery.
2. Remove the open switches (1) (2).
3. Measure the resistance with an ohmmeter between the switch terminals.
4. If the switches are defective, replace them.

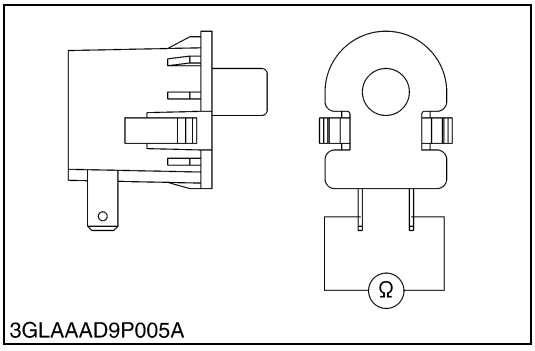
| | | |
|---|---|---|
| Resistance (between switch terminals) | When plunger is pushed | 0 Ω |
| | When plunger is released | Infinity |

(1) Top cover Open Switch (2) Grass Container Open Switch

W10438150

## (6) Operator Presence Control (OPC) Switch




**OPC Switch (Seat Switch)**

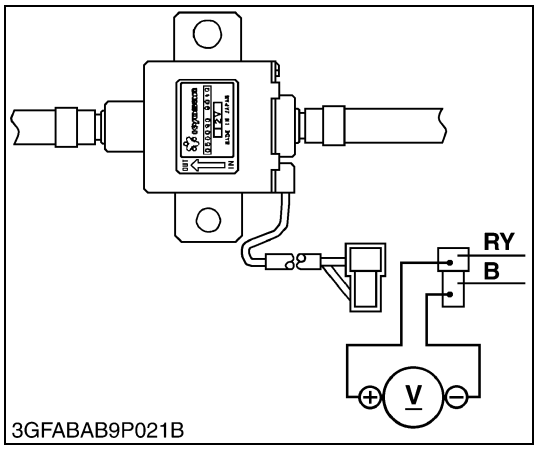
1. Remove the battery.
2. Remove the OPC switch (1).
3. Measure the resistance with an ohmmeter between the OPC switch terminals.
4. If the OPC switch is defective, replace it.

| | | |
|---|---|---|
| Resistance (between switch terminals) | When plunger is pushed | 0 Ω |
| | When plunger is released | Infinity |

(1) OPC Switch (Seat Switch)

W10440960

## (7) Fuel Pump



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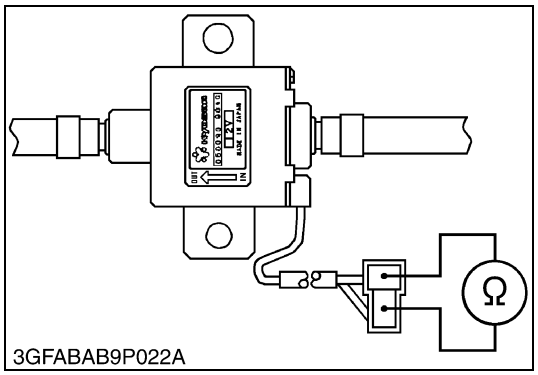
**Connector Voltage**

1. Disconnect the **2P** connector from the fuel pump.
2. Turn the main switch key to the **"ON"** position, and measure the voltage with a voltmeter between the connector terminals.
3. If the voltage differs from the battery voltage, the wiring harness or main switch is faulty.

| | | |
|---|---|---|
| Voltage | Between connector terminals | Approx. battery voltage |

W1016341



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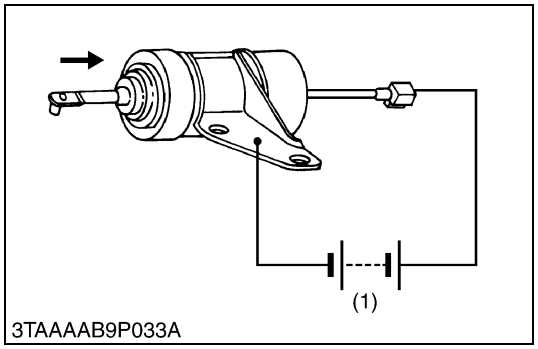
**Fuel Pump Continuity**

1. Disconnect the **2P** connector from the fuel pump.
2. Check the continuity between the connector terminals with an ohmmeter.
3. If it does not conduct, the fuel pump is faulty.

W1016134

## (8) Engine Stop Solenoid



3TAAAAB9P033A

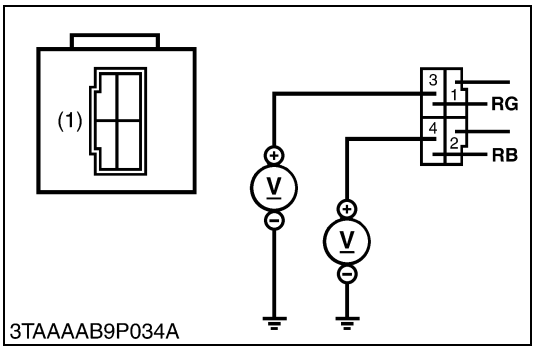
**Engine Stop Solenoid Test**

1. Disconnect the **1P** connector from the engine stop solenoid.
2. Remove the engine stop solenoid from the engine.
3. Connect the jumper leads from the battery positive terminal to the **1P** connector, and from the battery negative terminal to the engine stop solenoid body.
4. If the solenoid plunger is not attracted, the engine stop solenoid is faulty.

(1) Battery (12 V)

W1019658

## (9) Timer Relay



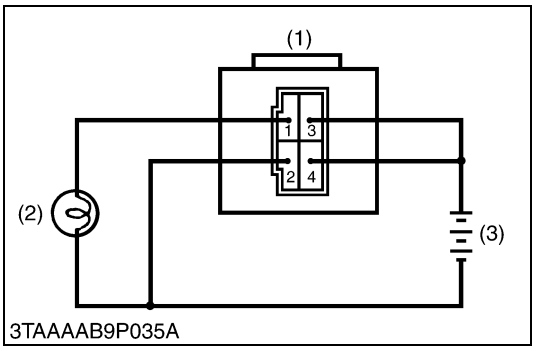

**Timer Relay Connector Voltage**

1. Disconnect the connector from the timer relay after turning the main switch off.
2. Measure the voltage with a voltmeter across the connector terminal **4** and chassis.
3. Turn the main switch on, and measure the voltage across the connector terminal **3** and chassis.
4. If these voltages differ from the battery voltage, the wiring harness or main switch is faulty.

| | | |
|---|---|---|
| Voltage | Connector terminal **4** - chassis | Approx. battery voltage |
| | Connector terminal **3** - chassis | Approx. battery voltage |

(1) Timer Relay

W1016544



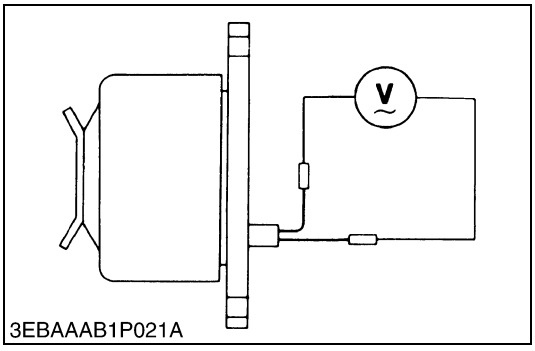

**Test of Timer Relay**

1. Remove the timer relay from the machine.
2. Connect jumper leads across the battery positive terminal and the timer relay terminal **3**, and across the battery positive terminal and the timer relay terminal **4**.
3. Connect jumper leads across the battery negative terminal and the timer relay terminal **2**, and across the battery negative terminal and the bulb terminal.
4. Connect jumper lead across the timer relay terminal 1 and the bulb terminal.
5. The bulb lights up when disconnecting a jumper lead from the terminal **3** arid goes off 6 to 13 seconds late, the timer relay is proper.

(1) Timer Relay
(2) Load (Lamp)
(3) Battery (12V)

W1016721

## (10) Charging System

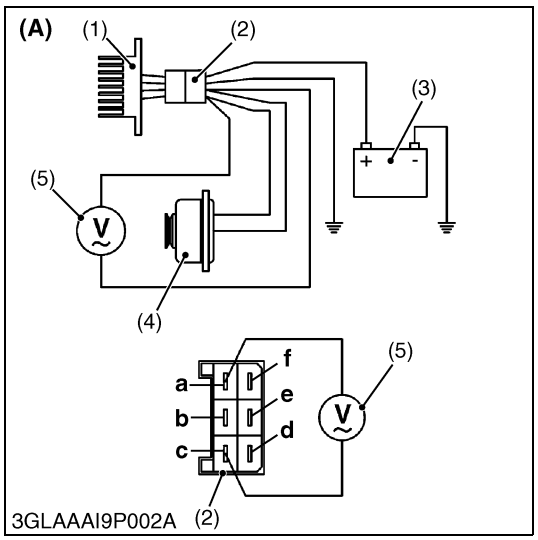


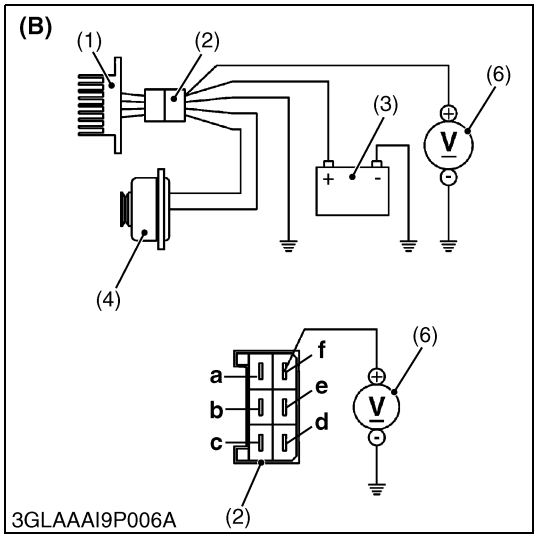

**No-load Dynamo Output**

1. Disconnect the lead wires from the dynamo.
2. Start the engine and operate the dynamo at the rated speed.
3. Measure the output voltage with a volt meter.
4. If the measurement is not within the specified values, replace the dynamo.

| | | |
|---|---|---|
| No-load output | Factory spec. | AC 20 V or more |

W1048417




## Regulation Voltage

**CAUTION**

- **To avoid personal injury, do not touch the rotating or hot parts while the engine is running.**

**NOTE**

- **Before performing this checking, make sure that the no-load dynamo output is proper.**
- **Complete the charging circuit with fully charged battery.**

1. Rum the engine at the rated speed.
2. Keeping the coupler (2) of regulator being connected, measure the voltage with a volt meter (5) across the terminal blue (**a**) and terminal blue (**c**). (Refer to figure **(A)**.)
3. If the measurement is not within the specified value, replace the wire harness between the dynamo (4) and regulator (1).
4. If the measurement is within the specified value, measure the voltage with a volt meter (6) across the terminal red (**f**) and chassis. (Refer to figure **(B)**.)
5. If the measurement is not within specified value, replace the regulator (1).

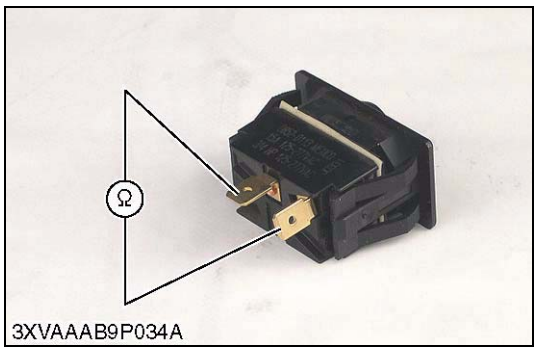
| | | |
|---|---|---|
| Voltage | Terminal blue (**a**) - Terminal blue (**c**) | AC 20 V or more |
| | Terminal blue (**f**) - Chassis | DC 14 to 15 V |

(1) Regulator
(2) Coupler
(3) Battery
(4) Dynamo
(5) Volt Meter (AC)
(6) Volt Meter (DC)

**a : Terminal Blue**
**b : Terminal Black**
**c : Terminal Blue**
**d : Terminal Green**
**e : Terminal Yellow**
**f : Terminal Red**

W1015722

# (11) Lighting System

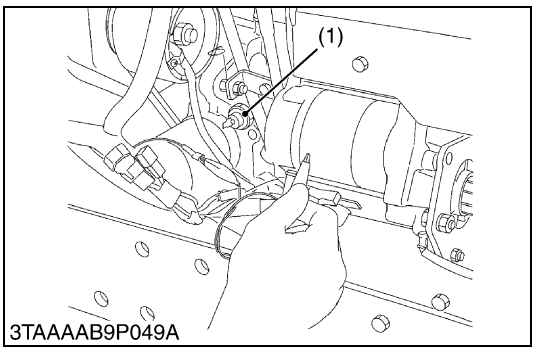

## Head Light Switch Continuity

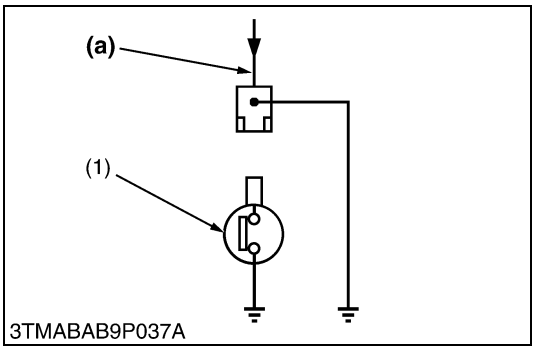
1. Disconnect the wiring leads from head light switch and remove it.
2. Measure the resistance with an ohmmeter across the head light switch terminals in each position.
3. If the resistance differs from the factory specifications, the head light switch is faulty.

| | | | |
|---|---|---|---|
| Resistance | Factory spec. | **OFF** | Infinity |
| | | **ON** | 0 Ω |

(1) Head Light Switch

W1019964



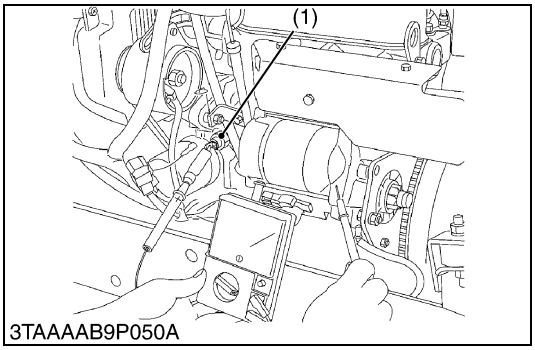



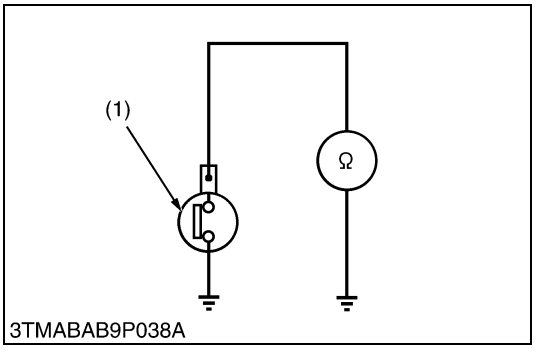

## Engine Oil Pressure Lamp

1. Disconnect the lead from the engine oil pressure switch after turning the main switch **OFF**.
2. Turn the main switch **ON** and connect a jumper lead from the lead to the chassis.
3. If the engine oil pressure indicator lamp does not light, the wiring harness is faulty.

(1) Engine Oil Pressure Switch **(a) From Oil Pressure Lamp**

W1020094



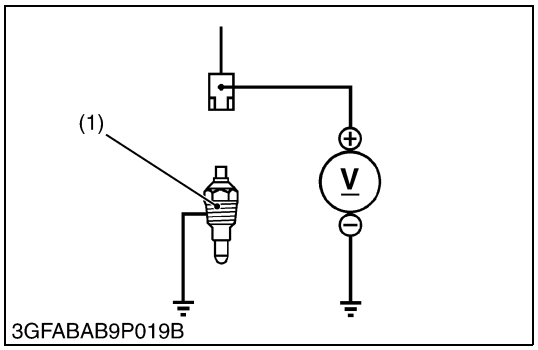

## Engine Oil Pressure Switch Continuity

1. Measure the resistance with an ohmmeter across the switch terminal and the chassis.
2. If 0 ohm is not indicated in the normal state, the switch is faulty.
3. If infinity is not indicated at pressure over 4.9 kPa (0.5 kgf/cm$^2$, 7 psi), the switch is faulty.

| | | |
|---|---|---|
| Resistance (Switch terminal - Chassis) | In normal state | 0 Ω |
| | At pressure over approx. 4.9 kPa(0.5 kgf/cm$^2$, 7 psi) | Infinity |

(1) Engine Oil Pressure Switch

## (12) Coolant Temperature Sensor



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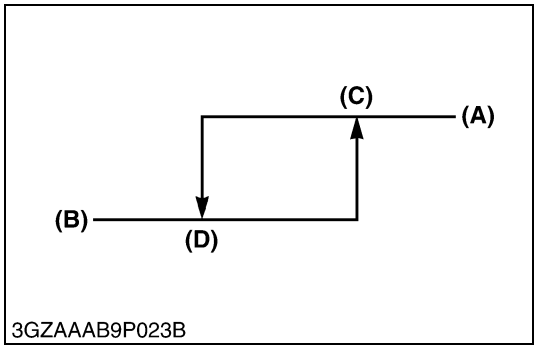

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**Coolant Temperature Sensor**

**1) Connector Voltage**

1. Disconnect the **1P** connector from the thermo switch (1).
2. Turn the main switch key to the **"ON"** position, and measure the voltage with a voltmeter between the connector terminal and the chassis.
3. If a certain voltage is not indicated, the wiring harness is faulty.

| | | |
|---|---|---|
| Voltage (Connector terminal - Chassis) | Factory spec. | A certain voltage is indicated |

**2) Thermo Switch Continuity**

1. Disconnect the **1P** connector, and remove the thermo switch.
2. Using an ohmmeter, check for continuity between the switch terminal and the chassis.
3. If infinity is indicated at temperature over factory specifications, the switch is faulty.

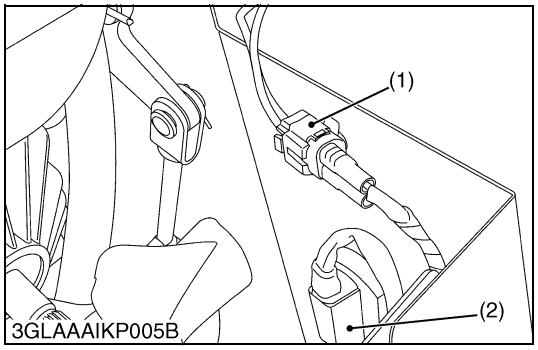
| | | |
|---|---|---|
| Working temperature | Factory spec. | 120 to 126 °C<br>248.0 to 258.8 °F |

(1) Thermo Switch

**(A) ON**
**(B) OFF**
**(C) 120 to 126 °C (248.0 to 258.8 °F)**
**(D) 116 °C (240.8 °F) or more**

W10599470

## (13) Grass Container Full Switch



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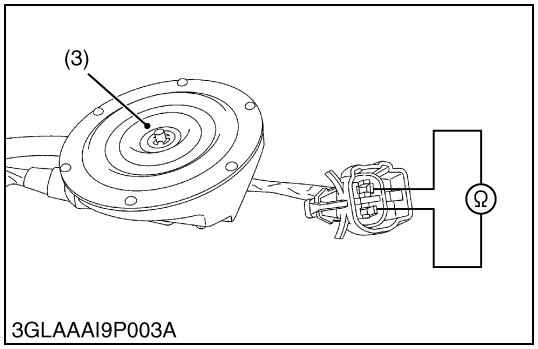

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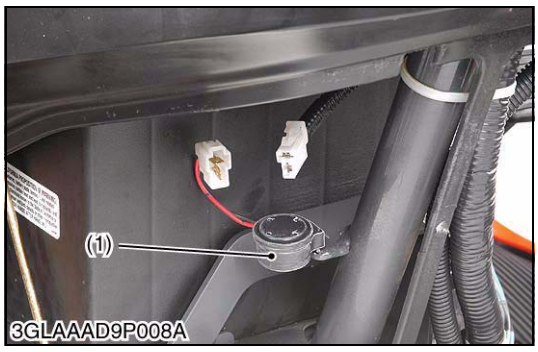
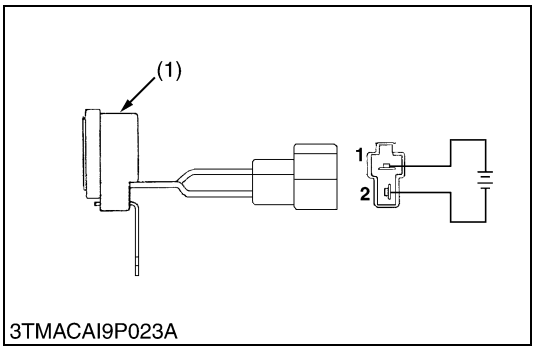
**Grass Container Full Switch Continuity**

1. Remove the battery.
2. Dismount the grass container.
3. Remove the filter cover.
4. Disconnect the connector (1) from the grass container full switch (2).
5. Measure the resistance with an ohmmeter between the grass container full switch terminals.
6. If the grass container full switch is defective, replace it.

| | | |
|---|---|---|
| Resistance (between switch terminals) | When the diaphragm of switch is pushed | 0 Ω |
| | When the diaphragm of switch is released | Infinity |

(1) Connector
(2) Grass Container Full Switch
(3) Diaphragm




**Buzzer**

1. Remove the air intake net.
2. Disconnect the lead from buzzer (1).
3. Connect the jumper lead between the battery positive terminal and terminal **1** of connector.
4. Connect the jumper lead between the battery negative terminal and terminal **2** of connector.
5. If the buzzer does not whistle, replace it.

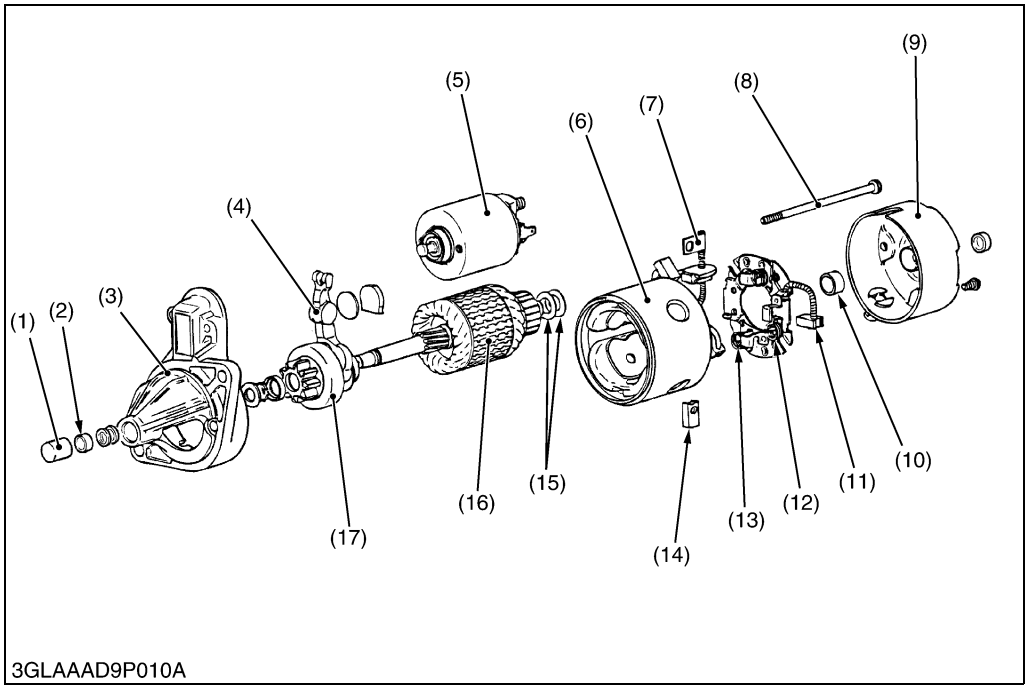
(1) Buzzer

**1 : Terminal 1**
**2 : Terminal 2**

W1057349

# [2] DISASSEMBLING AND ASSEMBLING

## (1) Starter

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(1) Sleeve Bearing
(2) Bushing
(3) Starter Drive Housing
(4) Drive Lever
(5) Magnet Switch
(6) Yoke
(7) Connecting Lead
(8) Through Bolt
(9) Rear End Frame
(10) Bushing
(11) Brush
(12) Brush Holder
(13) Brush Spring
(14) Brush
(15) Washer
(16) Armature
(17) Overrunning Clutch

W1063760

1. Disconnect the connecting lead (7).
2. Remove the magnetic switch (5).
3. Remove the rear end frame (9).
4. Remove the brush (11) from the brush holder (12).
5. Remove the brush holder (12).
6. Draw out the yoke (6) from the starter drive housing (3).
7. Draw out the armature (16) with the drive lever (4).

■ **NOTE**

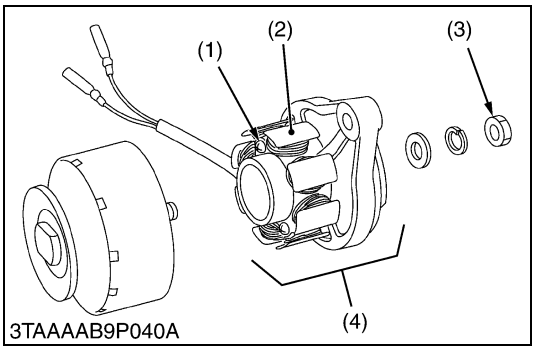
- **Do not damage to the brush and commutator.**

**(When reassembling)**

- Apply grease to spline teeth of the armature, bushing, pinion gear of the overrunning clutch and armature shaft.

| | | |
|---|---|---|
| Tightening torque | **C** terminal nut | 5.9 to 11.8 N·m<br>0.6 to 1.2 kgf·m<br>4.3 to 8.7 ft-lbs |

## (2) Dynamo



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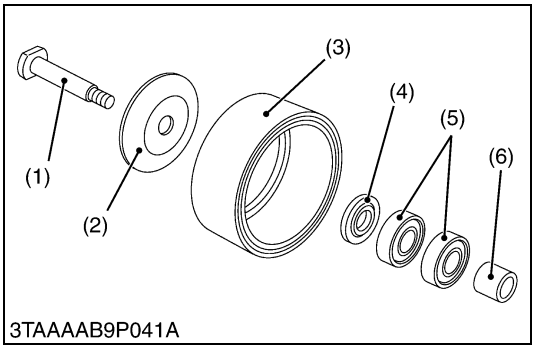

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**Stator**

1. Remove the nut (3) and separate the stator comp. (4).
2. Unscrew the screws (1) and remove the stator (2).

| | | |
|---|---|---|
| Tightening torque | Nut | 39.2 to 44.1 N·m<br>4.0 to 4.5 kgf·m<br>28.9 to 32.5 ft-lbs |

(1) Screw
(2) Stator
(3) Nut
(4) Stator Comp.

W1058597

**Rotor**

1. Tap out the shaft (1) from the rotor (3).

**(When reassembling)**

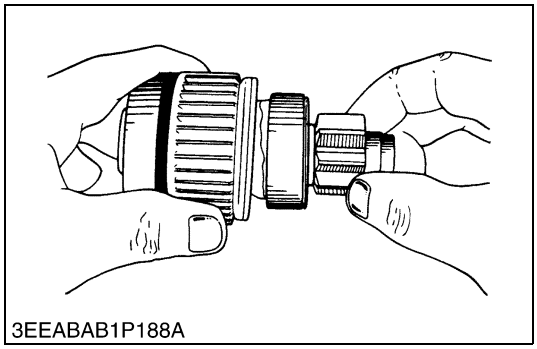
- Take care the direction of the collar (4), the flat side should face to the pulley (2) side.

(1) Shaft
(2) Pulley
(3) Rotor
(4) Collar
(5) Bearings
(6) Collar

W1064758

# [3] SERVICING

## (1) Starter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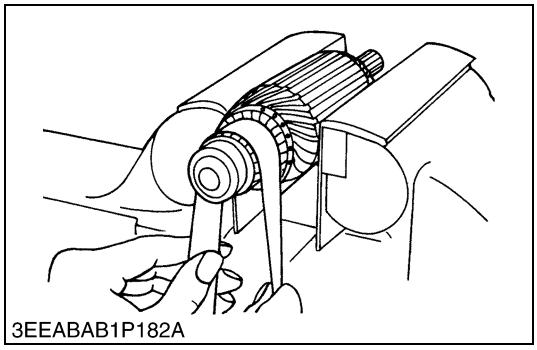
### Overrunning Clutch

1. Inspect the pinion for wear or damage.
2. If there is any defect, replace the overrunning clutch assembly.
3. Check that the pinion turns freely and smoothly in the overrunning direction and does not slip in the cranking direction.
4. If the pinion slips or does not rotate in the both directions, replace the overrunning clutch assembly.

W1016990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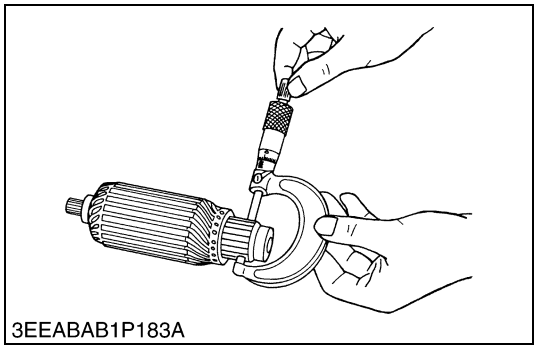
### Commutator and Mica

1. Check the contact face of the commutator for wear, and grind the commutator with emery paper if it is slightly worn.
2. Measure the commutator O.D. with an outside micrometer at several points.
3. If the minimum O.D. is less than the allowable limit, replace the armature.
4. If the difference of the O.D.'s exceeds the allowable limit, correct the commutator on a lathe to the factory specification.
5. Measure the mica undercut.
6. If the undercut is less than the allowable limit, correct it with a saw blade and chamfer the segment edges.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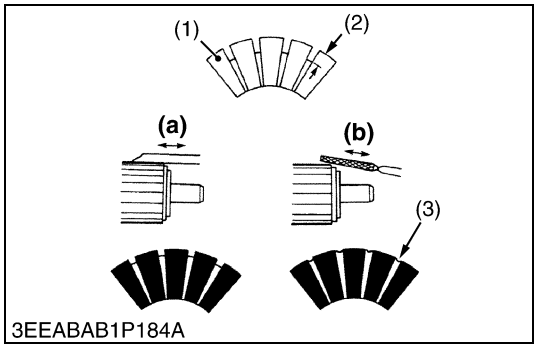
| | | |
|---|---|---|
| Commutator O.D. | Factory spec. | 28.0 mm<br>1.102 in. |
| | Allowable limit | 27.0 mm<br>1.063 in. |

| | | |
|---|---|---|
| Difference of O.D.'s | Factory spec. | Less than 0.05 mm<br>0.002 in. |
| | Allowable limit | 0.4 mm<br>0.016 in. |

| | | |
|---|---|---|
| Mica undercut | Factory spec. | 0.50 to 0.80 mm<br>0.0197 to 0.0315 in. |
| | Allowable limit | 0.20 mm<br>0.0079 in. |

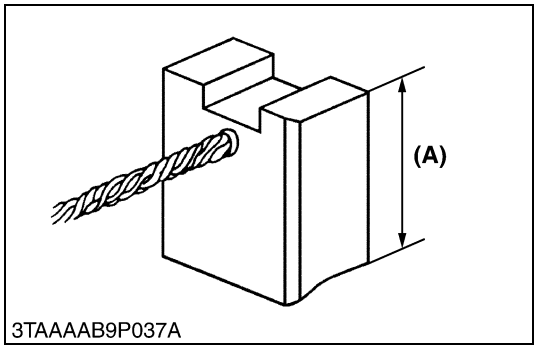


3EEABAB1P184A

(1) Segment
(2) Undercut
(3) Mica

**(a) Correct**
**(b) Incorrect**

W1017092



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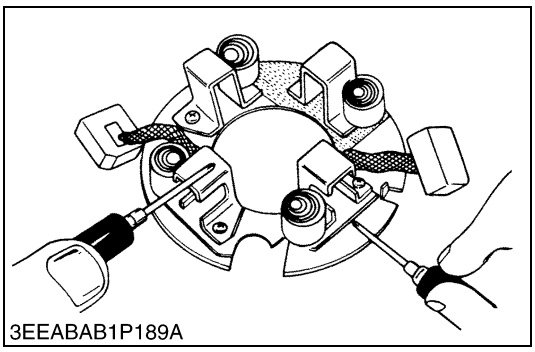
### Brush Wear

1. If the contact face of the brush is dirty or dusty, clean it with emery paper.
2. Measure the brush length **(A)** with vernier calipers.
3. If the length is less than the allowable limit, replace the yoke assembly and brush holder.

| | | |
|---|---|---|
| Brush length **(A)** | Factory spec. | 16.0 mm<br>0.630 in. |
| | Allowable limit | 10.5 mm<br>0.413 in. |

W1017544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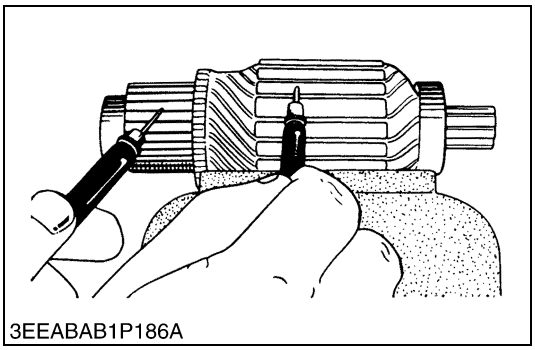
**Brush Holder**

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

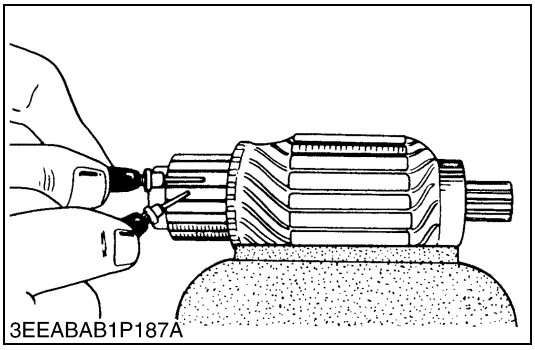
W1017672


3EEABAB1P186A

**Armature Coil**

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

W1017767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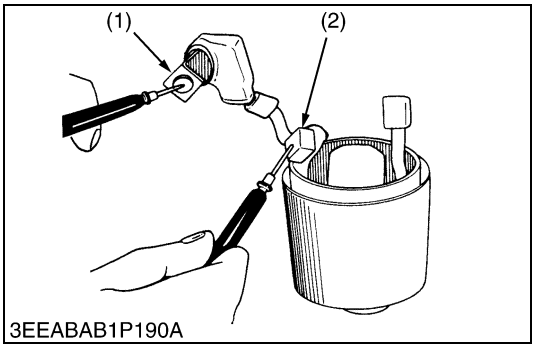

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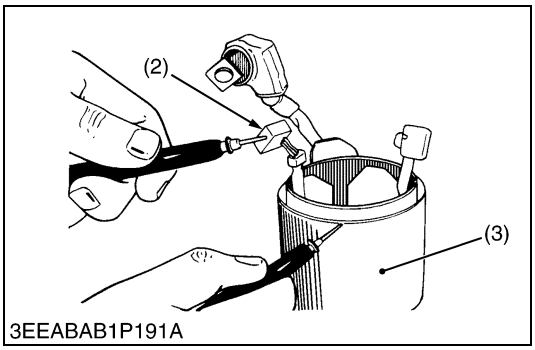
**Field Coil**

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

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

W1018015



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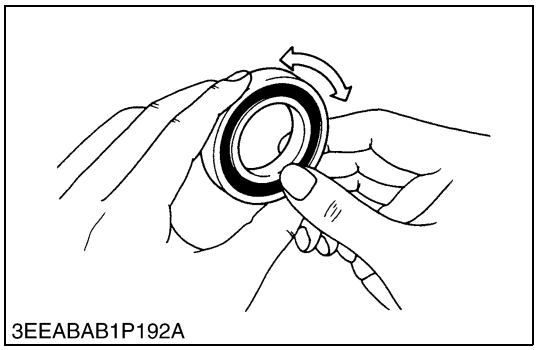
## (2) Dynamo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**Bearing**

1. Check the bearing for smooth rotation.
2. If it does not rotate smoothly, replace it.

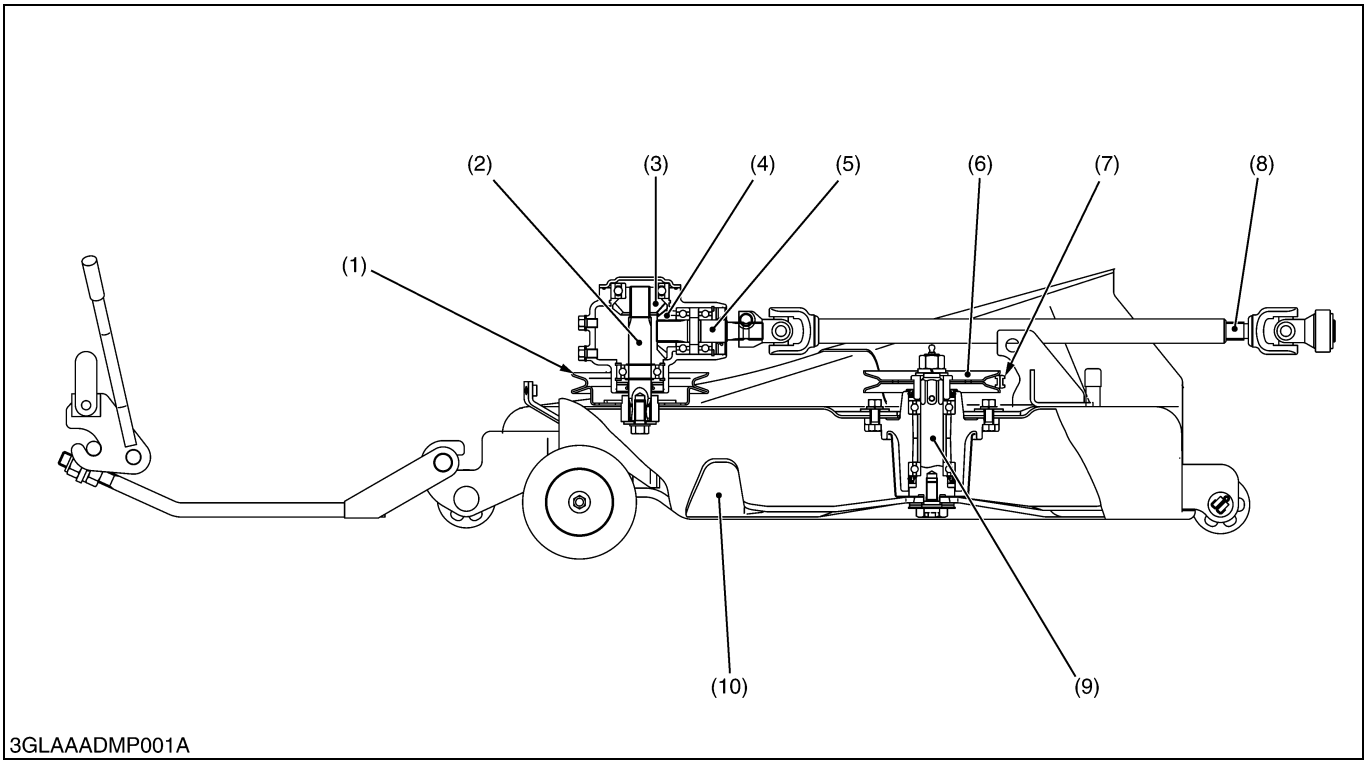
W1019790

# 7 MOWER

# MECHANISM

## CONTENTS

# 1. POWER TRANSMISSION

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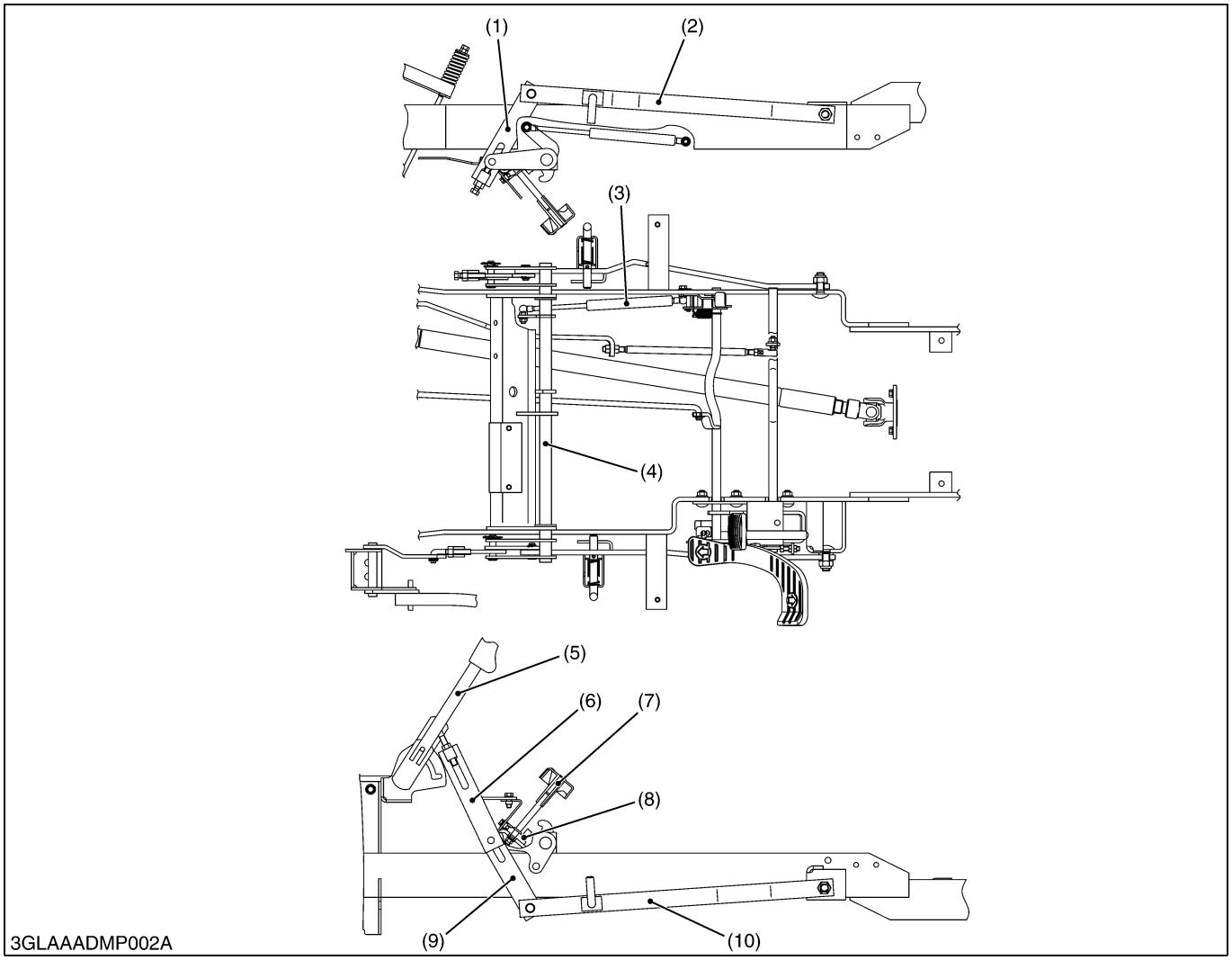
(1) Center Pulley
(2) Output Shaft
(3) 17T Spiral Gear
(4) 18T Spiral Gear
(5) Input Shaft
(6) Outer Pulley
(7) Mower Belt
(8) Universal Joint
(9) Blade Shaft
(10) Blade

The power is transmitted from transmission case to blades as follows.

PTO Shaft → Universal Joint (8) → Input Shaft (5) → 18T Spiral Gear (4) → 17T Spiral Gear (3) → Output Shaft (2) → Center Pulley (1) → Mower Belt (7) → Outer Pulley (6) → Blade Shaft (9) → Blade (10).

# 2. LIFTING MECHANISM




(1) Lift Link LH
(2) Rear Link LH
(3) Gas Spring
(4) Lift Link Shaft
(5) Mower Lift Lever
(6) Lift Link
(7) Cutting Height Adjusting Dial
(8) Adjusting Cam
(9) Lift Link RH
(10) Rear Link RH

The rear link RH (10) and mower lift lever (5) are linked with lift link RH (9) and lift link (6). The rear link LH (2) and mower lift lever (5) are linked with lift link LH (1), lift link shaft (4) and lift link (6).

As the mower lift lever (5) moves to **"LIFT"** position, the lift link (6) and lift link RH (9) are raised and the lift link shaft (4) is rotated to raise the lift link LH (1). As a result, the rear link RH (10) and LH (2) are lifted. The gas spring (3) connected with lift link shaft (4) assists lifting of mower.

The cutting height adjusting dial (7) adjusts cutting height of mower by rotating the adjusting cam. The position of rear link RH (10) and LH (2) are adjusted by cutting height fine turning bolt on lift link (6) and lift link LH (1).

# SERVICING

## CONTENTS

# 1. TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Blade Does Not Turn** | PTO system malfunctioning | Check transmission | – |
| | Mower belt broken | Replace mower belt | 7-S8 |
| **Blade Speed Is Slow** | Mower belt loosen | Replace mower belt or tension spring | 7-S8 |
| | Grass clogged | Remove grass | – |
| | Cup washer flattened out or worn | Remove cup washer | 7-S8 |
| | Engine rpm too low | Mow at full throttle, check and reset engine rpm | – |
| **Cutting Is Poor** | Mower blade worn or bent | Sharpen or replace mower blade | 7-S8 |
| | Mower blade screw loosen | Retighten mower blade screw | 7-S8 |
| | Cutting height improper | Adjust cutting height | 7-S5 |
| | Ground speed too fast | Slow-down | – |
| | Tire pressure uneven | Add air to correct | – |
| | Anti-scalp rollers not adjusted correctly | Adjust anti-scalp rollers | 7-S4 |
| **Mower Is Not Lifted** | Linkage system broken | Replace linkage system | 7-S11 |

W1014322

# 2. SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Left Tip of Blade to Right Tip of Blade | Difference | Less than 6 mm<br>0.24 in. | – |
| Front Tip of Blade to Rear Tip of Blade | Difference | Less than 5 mm<br>0.20 in. | – |
| 17T Spiral Gear to 18T Spiral Gear | Backlash | 0.13 to 0.25 mm<br>0.051 to 0.0098 in. | 0.40 mm<br>0.157 in. |

W1013874

# 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-9.)

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Mower blade screw | 98 to 118 | 10.0 to 12.0 | 72.3 to 86.8 |
| Gear box mounting screw | 77.5 to 90.2 | 7.9 to 9.2 | 57.2 to 66.5 |
| Gear box bracket mounting screw and nut | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |
| Pulley mounting screw (gear box) | 77.5 to 90.2 | 7.9 to 9.2 | 57.2 to 66.5 |
| Pulley mounting nut (pulley holder) | 103 to 118 | 10.5 to 12.0 | 76.0 to 87.0 |
| Pulley holder mounting screw | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |

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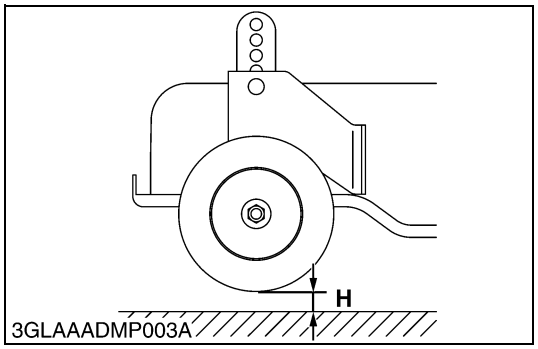
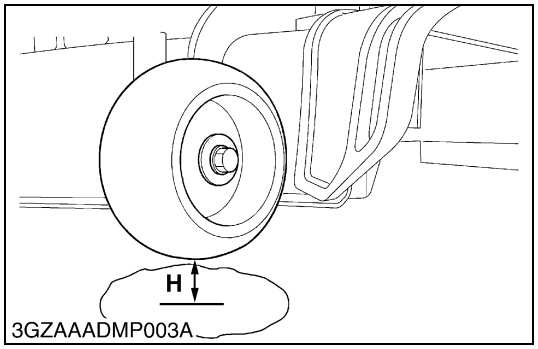
# 4. CHECKING, DISASSEMBLING AND ASSEMBLING

## [1] CHECKING AND ADJUSTING

### (1) Adjusting Anti-scalp Rollers




**Adjusting Anti-scalp Rollers**

■ **IMPORTANT**

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

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

| | Inflation Pressure |
|---|---|
| Front wheel | 200 kPa, 2.0 kgf/cm$^2$, 29 psi |
| Rear wheel | 140 kPa, 1.4 kgf/cm$^2$, 20 psi |

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

■ **Front side anti-scalp roller**

6. Adjust height **H** of the rear side anti-scalp roller to one of four positions to approximately 19 mm (0.75 in.) between rollers and ground. Adjust both side rollers to the same height.
7. Install the roller with attaching hardware.

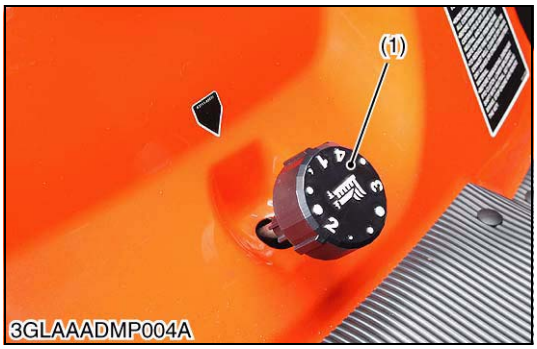
■ **Rear side anti-scalp roller**

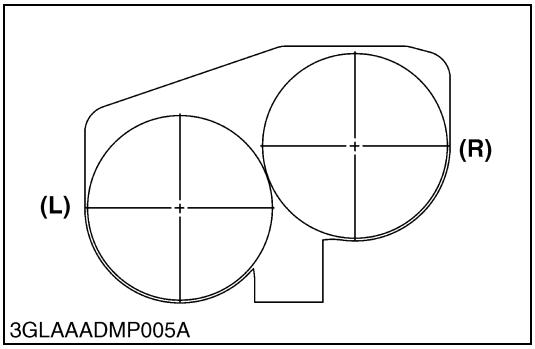
8. Adjust height **H** of the front side anti-scalp roller to one of seven positions to approximately 19 mm (0.75 in.) between rollers and ground. Adjust both side rollers to the same height.
9. Install the roller with attaching hardware.

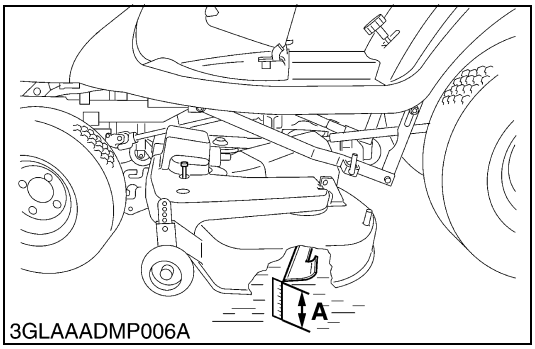
**H : Height 19 mm (0.75 in.)**

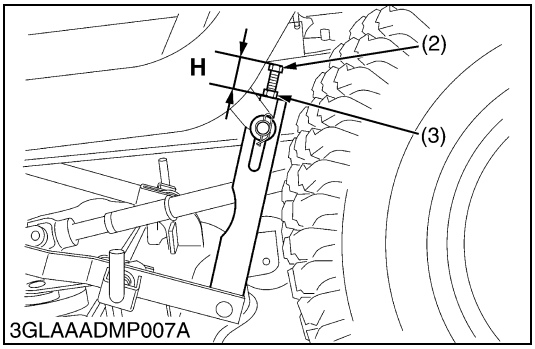
W1018550

## (2) Adjusting Left and Right Cutting Height




**Adjusting Left and Right Cutting Height**

1. Park the machine on level surface.
2. Wheel pressure must be correct.
3. Raise up the mower deck to the transport position. (Also the top end.)
4. Turn the cutting height control dial (1) to the "3" position.
5. Place 51 mm (2 in.) height wood blocks under each side of the mower deck.
   Anti-scalp rollers must not rest on the wood block.
6. Lower the mower deck.
7. Adjust the left side equally.
8. Measure the heights of blade **(L)** and **(R)** from the ground surface and calculate the difference.
9. If the difference between left tip and right tip of blade is not within the factory specification, adjust the length of cutting height fine tuning bolt (2).

| | | |
|---|---|---|
| Difference **(L)** - **(R)** between left tip and right tip of blade | Factory spec. | Less than 6 mm<br>0.24 in. |

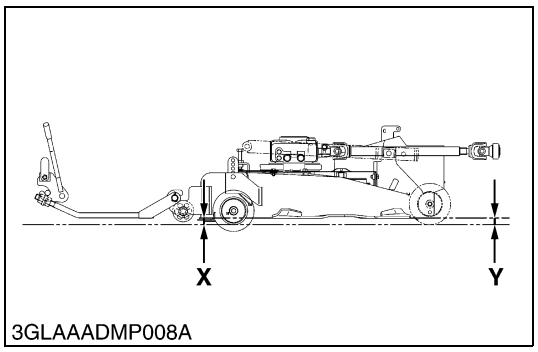
**(Reference)**

- Length of cutting height fine tuning bolt (**H**) :
  16 to 20 mm (0.63 to 0.79 in.)

(1) Cutting Height Control Dial
(2) Cutting Height Fine Tuning Bolt
(3) Lock Nut

**(L) Left Blade Measurement Position**
**(R) Right Blade Measurement Position**
**A : Blade Height**

W1019075



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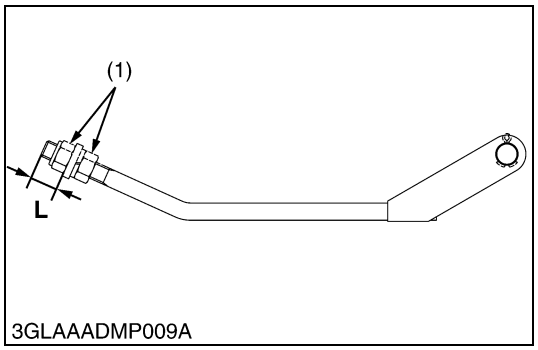


3GLAAADMP009A

**Adjusting Parallel Linkage**

1. Park the machine on a level surface.
2. Wheel pressure must be correct.
3. Adjust the cutting height so that blade is level.
4. Position mower blade in the Front-to-Rear position.
5. Measure the height of blade **X** and **Y** from the ground surface and calculate the difference.
6. If the difference between front tip and rear tip of blade is not within the factory specification, adjust the length **"L"** of front link with lock nut (1).

| | | |
|---|---|---|
| Difference (**X** - **Y**) between front tip and rear tip of blade | Factory spec. | Less than 5 mm<br>0.20 in. |

**(Reference)**

- **L** : 26 to 28 mm (1.0 to 1.1 in.)

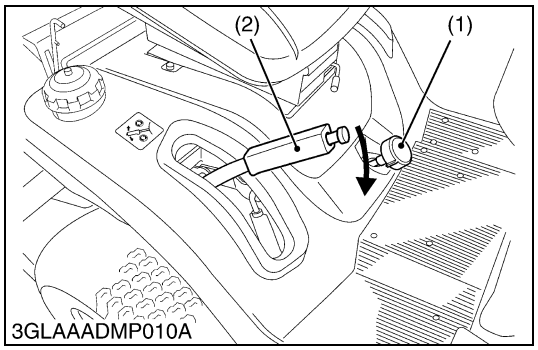
(1) Lock Nut

**X : Height of Blade Tip (Front)**
**Y : Height of Blade Tip (Rear)**

W1019694

# [2] PREPARATION

## (1) Dismounting Mower



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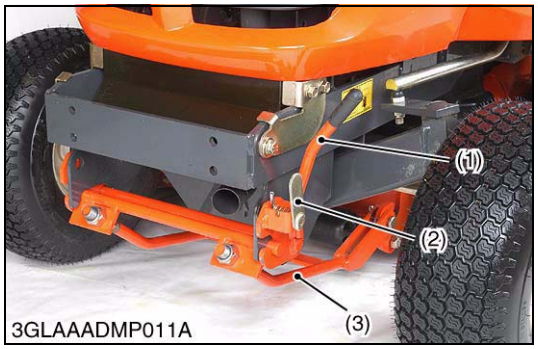
**Cutting Height Adjusting Dial**

1. Park the machine on level ground, and stop the engine.
2. Set the cutting height adjusting dial (1) to **"1"** position.
3. Set the front anti-scalp rollers at the top position.
4. Lower the mower lift lever (2) and lock in the lower position.

(1) Cutting Height Adjusting Dial
(2) Mower Link Lever

W1016339



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**Front Link**

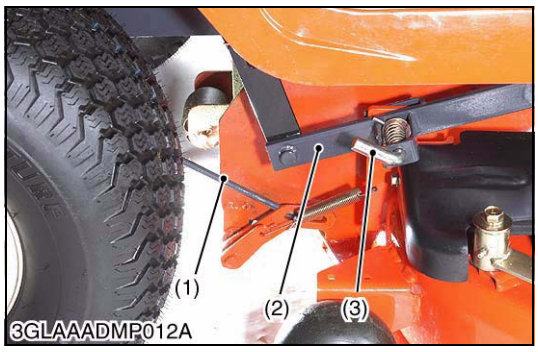
1. Pull the lever fulcrum fixing pin (2) and turn it counterclockwise to lock.
2. Push down the link fixing lever (1).
3. Remove the front link (3) from the mower deck.

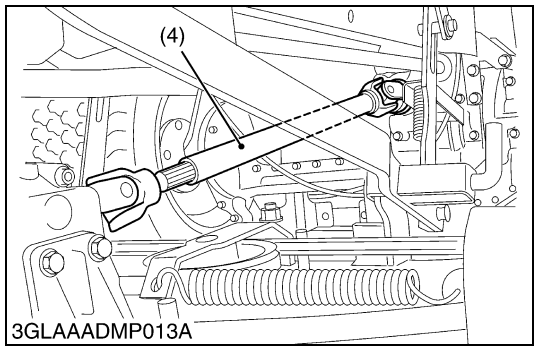
**(When reassembling)**

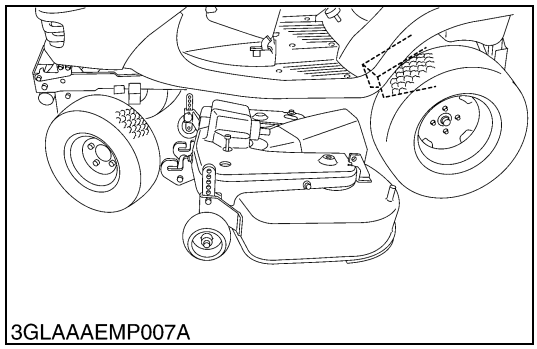
- When attach the front link, make sure the length of the front link.

(1) Link Fixing Lever
(2) Lever Fulcrum Fixing Pin
(3) Front Link

W1020679




## Rear Link and Universal Joint

1. Disconnect the rotate plate rod (1).
2. Disconnect the rear link (2) from the mower deck, pulling the L-pins (3).
3. Disconnect the universal joint (4) from the PTO shaft.
4. Raise the mower lift lever and lock in the raised position.

**(When reassembling)**

- Apply grease to the spline of PTO shaft.
- Slide the universal joint back and front to make sure the universal joint is locked securely.
- When attach the rear links, make sure the length of the rear links.

(1) Rotate Plate Rod
(2) Rear Link
(3) L-pin
(4) Universal Joint

W1020981

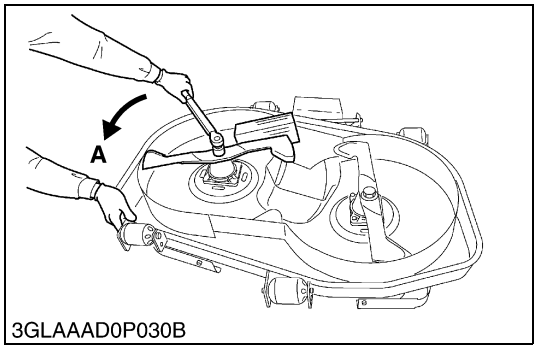
## Dismounting Mower

1. Turn the front wheel to the right.
2. Pull out the mower deck to the left.

W1021734

# [3] DISASSEMBLING AND ASSEMBLING

## (1) Mower



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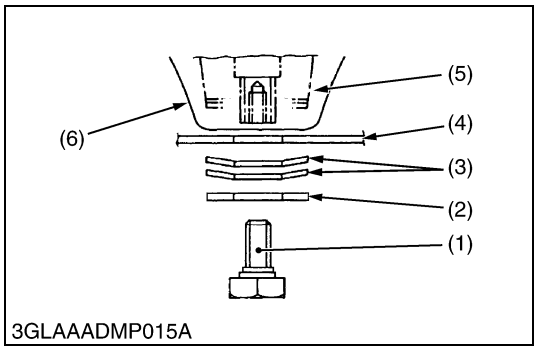

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**Mower Blades (Left Blade and Right Blades)**

1. Turn over the mower.
2. Unscrew the mower blade screw (1), and remove the shim (2), two cup washers (3), mower blade (4) and dust cover (6).

■ **NOTE**

- **To remove the blade securely, wedge a block of wood between one blade and the mower deck in such position that it will hold the blade safely while loosing or tightening the blade screw.**

**(When reassembling)**

- Be sure to assemble the two cup washers between the mower blade and the mower blade screw.

■ **IMPORTANT**

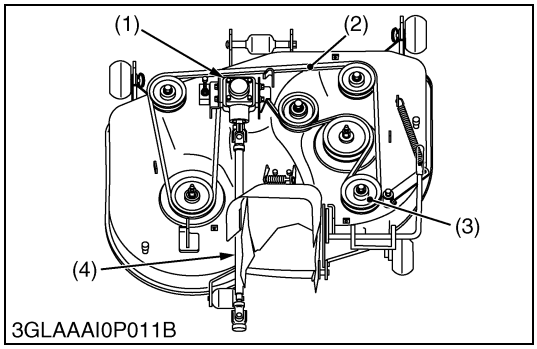
- **Make sure the cup washer is not flattened out or worn, causing blade to slip easily.**
  **Replace two cup washers if either is damaged.**

| | | |
|---|---|---|
| Tightening torque | Mower blade screw | 98 to 118 N·m<br>10.0 to 12.0 kgf·m<br>72.3 to 86.8 ft-lbs |

(1) Mower Blade Screw
(2) Shim
(3) Cap Washer
(4) Mower Blade
(5) Spindle Holder
(6) Dust Cover

**A : Loosen**

W1021356



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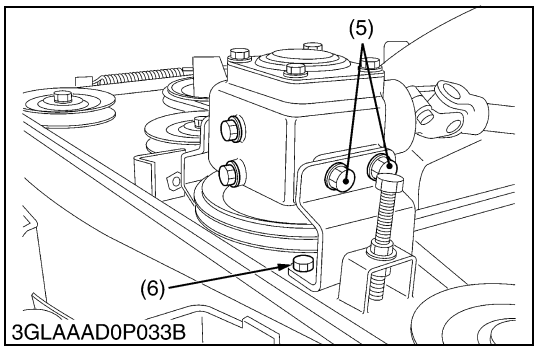

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**Gear Box and Mower Belt**

1. Remove the left and right belt covers from the mower deck.
2. Disconnect the universal joint (4) from the gear box (1).
3. Clean around the gear box (1).
4. Remove the mower belt (2) from the tension pulley (3).
5. Remove the gear box mounting screws (5) and gear box bracket mounting screws and nuts (6).
6. Remove the gear box (1) and mower belt (2).

| | | |
|---|---|---|
| Tightening torque | Gear box mounting screw | 77.5 to 90.2 N·m<br>7.9 to 9.2 kgf·m<br>57.2 to 66.5 ft-lbs |
| | Gear box bracket mounting screw and nut | 48.1 to 55.8 N·m<br>4.9 to 5.7 kgf·m<br>35.5 to 41.2 ft-lbs |

(1) Gear Box
(2) Mower Belt
(3) Tension Pulley
(4) Universal Joint
(5) Gear Box Mounting Screw
(6) Gear Box Bracket Mounting Screw and Nut

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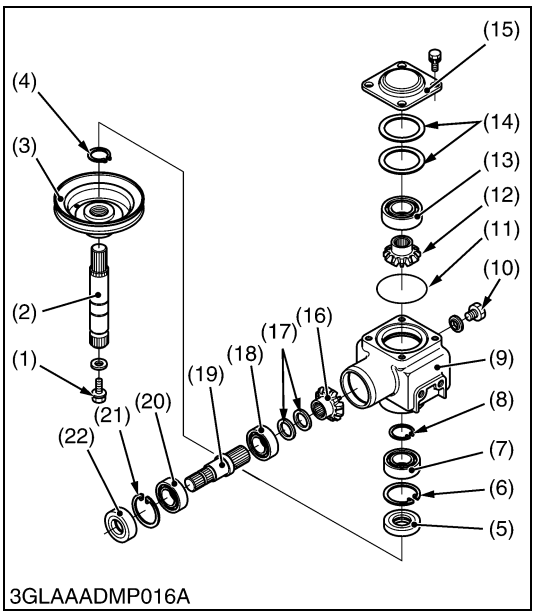

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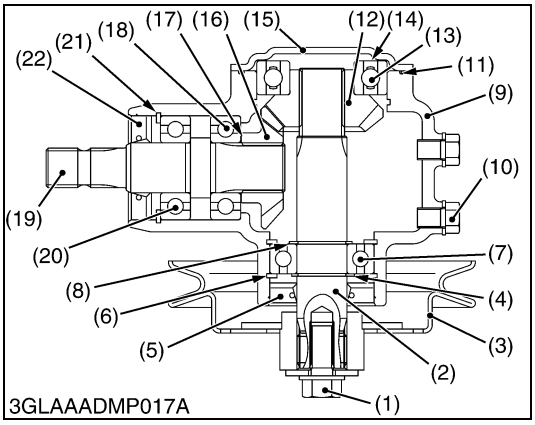

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## Disassembling Gear Box

1. Unscrew the drain plug (10), and drain the gear box oil.
2. Unscrew the pulley mounting screw (1), and remove the pulley (3).
3. Remove the case cover (15).
4. Remove the shim (14) and 18T spiral gear (12) with ball bearing (13).
5. Remove the 17T spiral gear (16) and shim (17).
6. Remove the oil seal (22) and internal snap ring (21).
7. Draw out the input shaft (19) with two ball bearing (18), (20).
8. Remove the oil seal (5) and internal snap ring (6).
9. Draw out the output shaft (2) with the ball bearing (7).
10. Remove two external snap rings (4), (8) on the output shaft (2) to remove the ball bearing (7).

**(When reassembling)**

- Replace the oil seals (5), (22) with new ones.
- Apply grease to the splines of input shaft and of output shaft.

■ **IMPORTANT**

- **Use the specified gear box oil.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8.)**

| | |
|---|---|
| Gear box oil capacity | 0.33 L<br>0.35 U.S.qts<br>0.29 Imp.qts |

| | | |
|---|---|---|
| Tightening torque | Pulley mounting screw | 77.5 to 90.2 N·m<br>7.9 to 9.2 kgf·m<br>57.2 to 66.5 ft-lbs |

(1) Pulley Mounting Screw
(2) Output Shaft
(3) Pulley
(4) External Snap Ring
(5) Oil Seal
(6) Internal Snap Ring
(7) Ball Bearing
(8) External Snap Ring
(9) Case
(10) Drain Plug
(11) O-ring
(12) 18T Spiral Gear
(13) Ball Bearing
(14) Shim
(15) Case Cover
(16) 17T Spiral Gear
(17) Shim
(18) Ball Bearing
(19) Input Shaft
(20) Ball Bearing
(21) Internal Snap Ring
(22) Oil Seal

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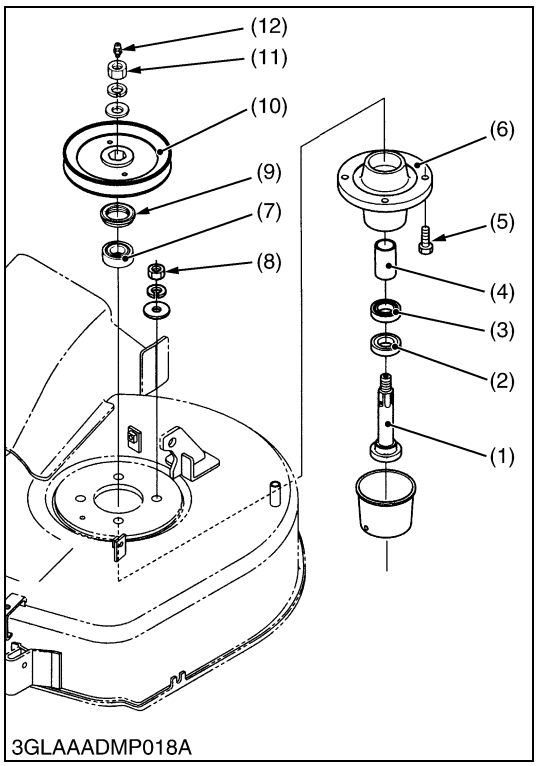

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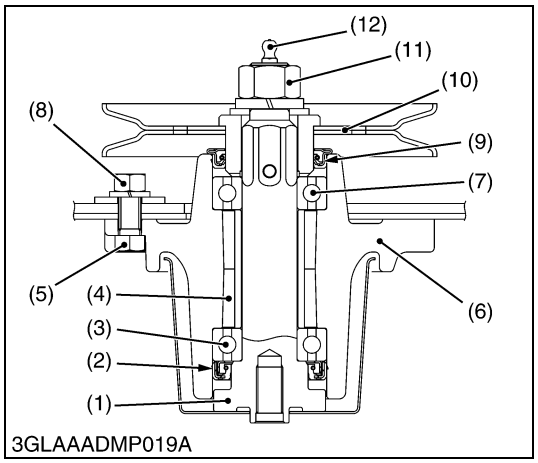

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## Disassembling Pulley Holder

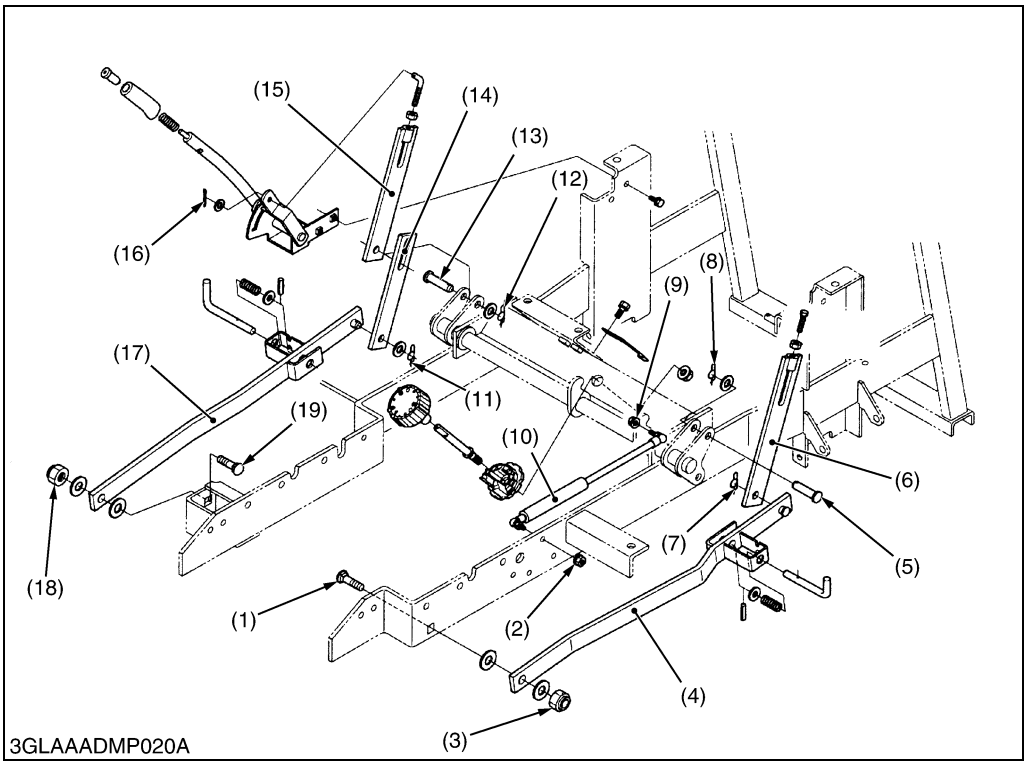
1. Remove the grease nipple (12).
2. Unscrew the pulley mounting nut (11), and remove the pulley (10).
3. Tap out the blade shaft (1).
4. Remove the pulley holder (6) from the mower deck.
5. Remove the oil seal (2), (9).
6. Remove the ball bearings (3), (7) and collar (4).

| | | |
|---|---|---|
| Tightening torque | Pulley mounting nut | 103 to 118 N·m<br>10.5 to 12.0 kgf·m<br>76.0 to 87.0 ft-lbs |
| | Pulley holder mounting screw | 48.1 to 55.8 N·m<br>4.9 to 5.7 kgf·m<br>35.5 to 41.2 ft-lbs |

(1) Blade Shaft
(2) Oil Seal
(3) Ball Bearing
(4) Collar
(5) Pulley Holder Mounting Screw
(6) Pulley Holder
(7) Ball Bearing
(8) Pulley Holder Mounting Nut
(9) Oil Seal
(10) Pulley
(11) Pulley Mounting Nut
(12) Grease Nipple

W1024413

## (2) Mower Lift Linkage



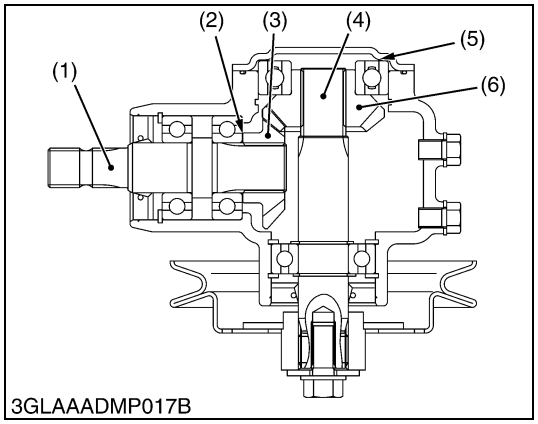

(1) Screw
(2) Gas Spring Mounting Nut
(3) Lock Nut
(4) Rear Link LH
(5) Clevis Pin
(6) Lift Link LH
(7) Rue Ring
(8) Rue Ring
(9) Gas Spring Mounting Nut
(10) Gas Spring
(11) Rue Ring
(12) Rue Ring
(13) Clevis Pin
(14) Lift Link RH
(15) Lift Link
(16) Cotter Pin
(17) Rear Link RH
(18) Lock Nut
(19) Screw

W1025253

1. Dismount the mower. (See page 7-S6.)
2. Remove the fender. (See page 2-S12.)
3. Set the mower lift lever to **"LIFT"** position.
4. Unscrew the gas spring mounting nuts (2), (9), and then remove the gas spring (10).
5. Remove the screws (1), (19) and lock nuts (2), (18), and pull out the rue rings (7), (11).
6. Remove the rear link LH (4) and RH (17).
7. Pull out the rue rings (7), (12) and remove the clevis pins (5), (13).
8. Remove the lift link LH (6) and RH (14).
9. Pull out the cotter pin (16), and remove the lift link (15) from the mower lift lever.

# [4] SERVICING

## (1) Gear Box




**Backlash between 17T Spiral Gear and 18 Spiral Gear**

1. Remove the 18T spiral gear (6) from gear box.
2. Stick the strip of fuse the 18T spiral gear (6) with grease.
3. Reassemble the gear box.
4. Turn the input shaft (1).
5. Take out the fuses, and measure the thickness of fuses with an outside micrometer. (Backlash equal thickness of fuse.)
6. If the backlash exceeds the allowable limit, adjust with shims (2), (5).

| | | |
|---|---|---|
| Backlash between 17T spiral gear and 18T spiral gear | Factory spec. | 0.13 to 0.25 mm<br>0.0051 to 0.0098 in. |
| | Allowable limit | 0.40 mm<br>0.0157 in. |

**(Reference)**

- Thickness of adjusting shims
  for 17T spiral gear (2) : 0.2 mm (0.0079 in.)
  0.3 mm (0.0118 in.)
  for 18T spiral gear (5) : 0.2 mm (0.0079 in.)
  0.3 mm (0.0118 in.)

(1) Input Shaft
(2) Shim (for 17T Spiral Gear)
(3) 17T Spiral Gear
(4) Output Shaft
(5) Shim (for 18T Spiral Gear)
(6) 18T Spiral Gear

W1024471

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