# WSM

## WORKSHOP MANUAL
## TRACTOR

# M5091,M5111

Kubota

KiSC issued 02, 2017 A

# TO THE READER

This Workshop Manual tells the servicing personnel about the mechanism, servicing and maintenance of the *M50911 and M5111*. It contains 4 parts: "Information", "General", "Mechanism" and "Servicing".

**Information**

This section primarily contains information below.

- Safety First
- Safety Decal
- Specification
- Dimension

**General**

This section primarily contains information below.

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

**Mechanism**

This section contains information on the structure and the function of the unit. Before you continue with the subsequent sections, make sure that you read this section.
Refer to the latest version of Workshop Manual (Code No. *9Y021-01870* / *9Y021-18200*) for the *Diesel engine mechanism* / *Tractor mechanism* that this Workshop Manual does not include.

**Servicing**

This section primarily contains information below.

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

Regarding the servicing of Common Rail System (CRS), refer to "Diagnosis Manual" (*9Y120-03140*).
Regarding the servicing of Diesel Particulate Filter (DPF), refer to "*Diesel particulate filter handling manual*" (*9Y121-08130*).

All illustrations, photographs and specifications contained in this manual are of the newest information available at the time of publication.
KUBOTA reserves the right to change all information at any time without notice.
Since this manual includes many models, information or illustrations and photographs can show more than one model.

**November, 2016**

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# RECORD OF REVISIONS

For pdf, use search function [Search word] to find all the revised locations.

| Last digit of the Code No. | Issue month | Main revised point and corrective measure [Search word] | Reference page |
|---|---|---|---|
| 1 | 2016 Nov. | Update because of mass production. | – |
| 2 | 2017 Feb. | Revision of whole section. | – |

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# 1. INFORMATION

# SAFETY FIRST

## 1. Safety first

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you try to repair or use this unit.

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

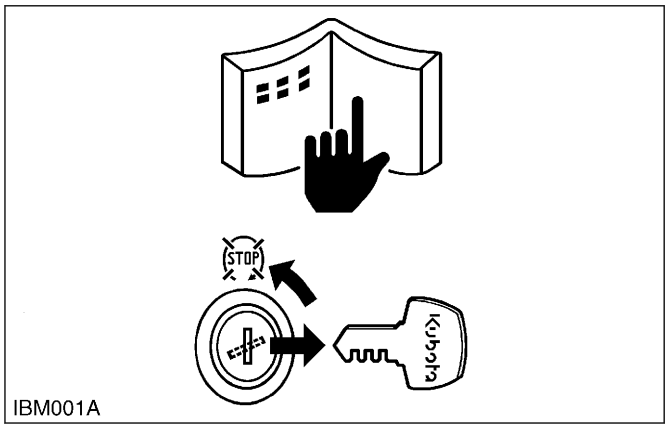
**WARNING**
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

**CAUTION**
- **Indicates a potentially hazardous situation which, if not avoided, 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.**

## 2. Before you start service



IBM001A

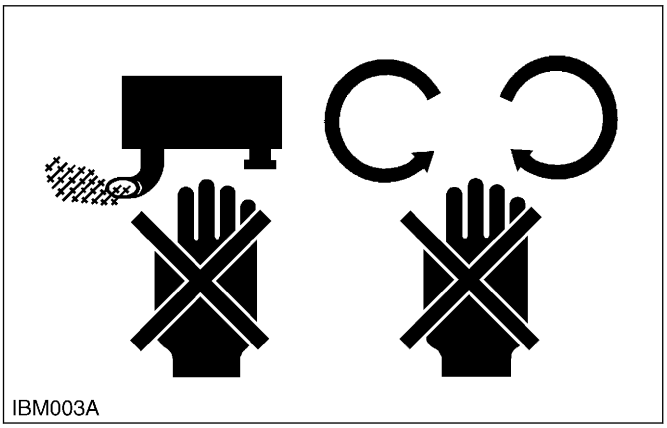
- Read all instructions and safety instructions in this manual and on your machine safety decals.
- Clean the work area and machine.
- Park the machine on a stable and level ground, and set the parking brake.
- Lower the implement to the ground.
- Stop the engine, then remove the key.
- Disconnect the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

## 3. Start safely


IBM002A

- Do not do the procedures below when you start the engine.
  1. Short across starter terminals.
  2. Bypass the safety start switch.
- Do not alter or remove any part of machine safety system.
- Before you start the engine, make sure that all shift levers are in neutral positions or in disengaged positions.
- Do not start the engine when you stay on the ground. Start the engine only from operator's seat.

## 4. Operate safely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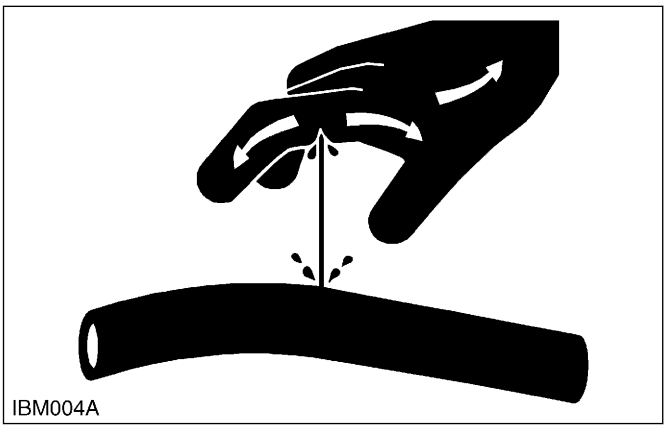
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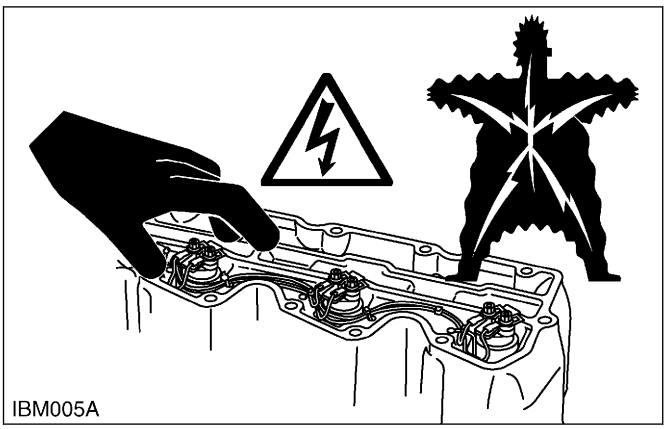

IBM005A

- Do not use the machine after you consume alcohol or medication or when you are tired.
- Put on applicable clothing and safety equipment.
- Use applicable tools only. Do not use alternative tools or parts.
- When 2 or more persons do servicing, make sure that you do it safely.
- Do not touch the hot parts or parts that turn when the engine operates.
- Do not remove the radiator cap when the engine operates, or immediately after it stops. If not, hot water can spout out from the radiator. Only remove the radiator cap when it is at a sufficiently low temperature to touch with bare hands. Slowly

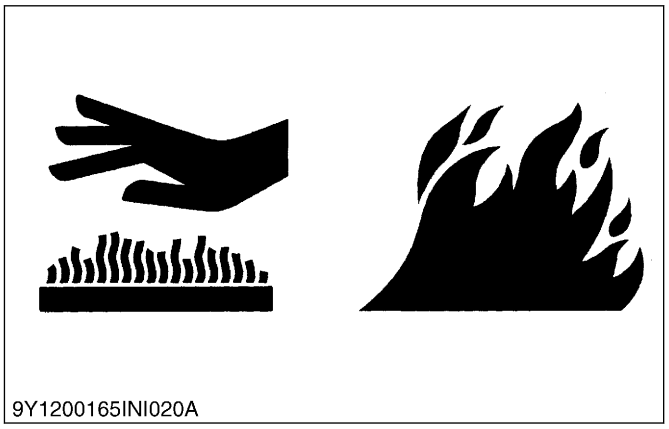
loosen the cap to release the pressure before you remove it fully.
- Released fluid (fuel or hydraulic oil) under pressure can cause damage to the skin and cause serious injury. Release the pressure before you disconnect hydraulic or fuel lines. Tighten all connections before you apply the pressure.
- Do not open a fuel system under high pressure. The fluid under high pressure that stays in fuel lines can cause serious injury. Do not disconnect or repair the fuel lines, sensors, or any other components between the fuel pump and injectors on engines with a common rail fuel system under high pressure.
- Put on an applicable ear protective device (earmuffs or earplugs) to prevent injury against loud noises.
- Be careful about electric shock. The engine generates a high voltage of more than DC100 V in the ECU and is applied to the injector.

# 5. Protect against high pressure spray


9Y1200165INI019A

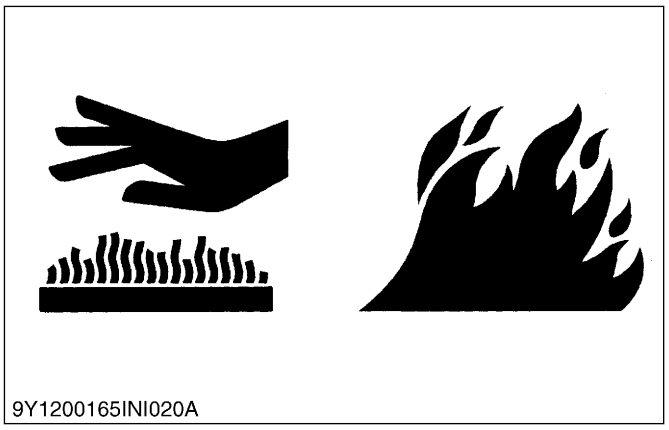
- Spray from high pressure nozzles can penetrate the skin and cause serious injury. Keep spray from contacting hands or body.
- If an accident occurs, see a doctor immediately. Any high pressure spray injected into the skin must be surgically removed within a few hours or gangrene may result.
  Doctors unfamiliar with this type of injury should reference a knowledgeable medical source.

# 6. Avoid hot exhaust


9Y1200165INI020A

- Servicing machine or attachments with engine operating can result in serious personal injury. Avoid exposure and skin contact with hot exhaust gases and components.
- Exhaust parts and streams become very hot during operation. Exhaust gases and components reach temperatures hot enough to burn people, ignite, or melt common materials.

# 7. Exhaust filter cleaning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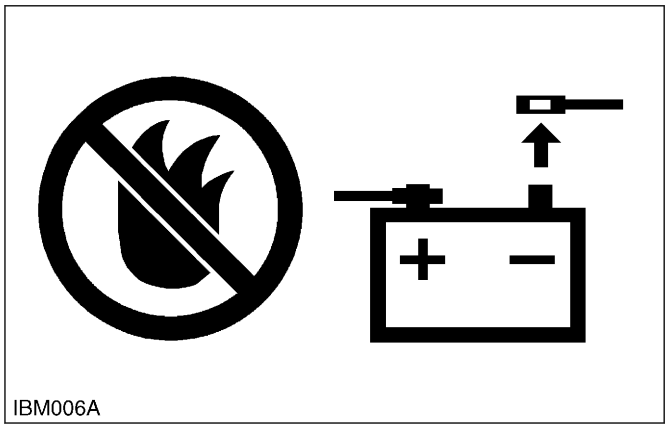
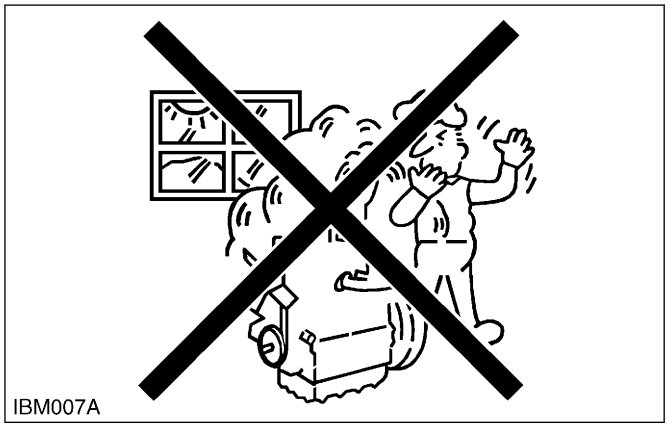
- Servicing machine or attachments during exhaust filter cleaning can result in serious personal injury. Avoid exposure and skin contact with hot exhaust gases and components.
- During auto or manual/stationary exhaust filter cleaning operations, the engine will operate at elevated idle and hot temperatures for an extended period of time. Exhaust gases and exhaust filter components reach temperatures hot enough to burn people, or ignite, or melt common materials.

## 8. Prevent a fire


IBM006A

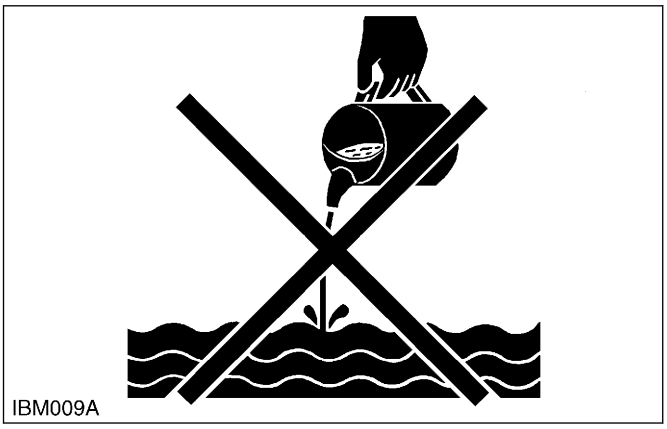
- Fuel is very flammable and explosive under some conditions. Do not smoke or let flames or sparks in your work area.
- To prevent sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- The battery gas can cause an explosion. Keep the sparks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

## 9. Keep a good airflow in the work area


IBM007A

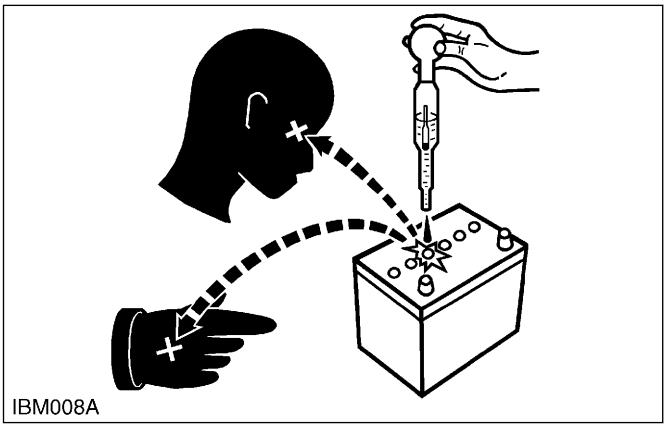
- If the engine is in operation, make sure that the area has good airflow. Do not operate the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.

## 10. Discard fluids correctly


IBM009A

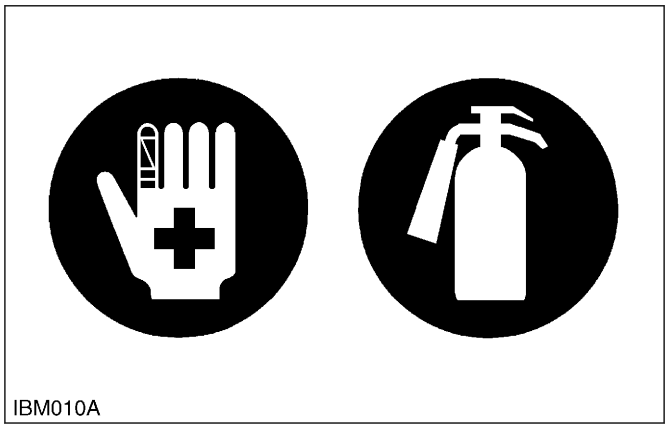
- Do not discard fluids on the ground, down the drain, into a stream, pond, or lake. Obey related environmental protection regulations when you discard oil, fuel, coolant, electrolyte and other dangerous waste.

## 11. Prevent acid burns


IBM008A

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

# 12. Prepare for emergencies


IBM010A

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

# PICTORIAL SAFETY LABELS

## 1. ROPS model

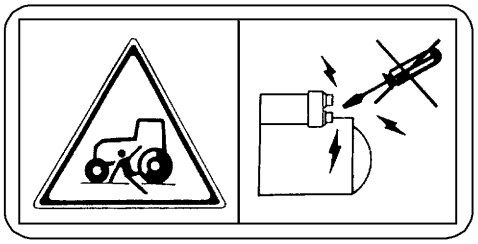
### 1.1 Pictorial safety labels (ROPS model)

The pictorial safety labels affixed are intended to alert persons to potential hazards. The hazard is identified by a pictorial in the safety alert triangle or by the safety alert symbol alone. An adjacent pictorial provides instructions and information on how to avoid the hazard.

(1) Part No. TA040-4958-1
Do not touch hot surface like muffler, etc.

1AGAEENAP007B

(2) Part No. 6C782-4718-1
Start engine from operator's seat only.

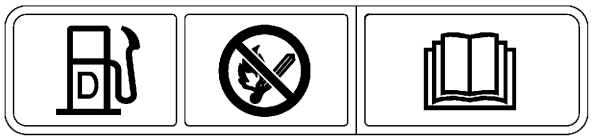


1BDABANAP083C

(3) Part No. 3B794-4719-1
Do not touch hot surface like muffler, etc.

1AGBDAAAP098A

(4) Part No. 3B794-4956-1
Diesel fuel only. No fire. Read operator's manual.



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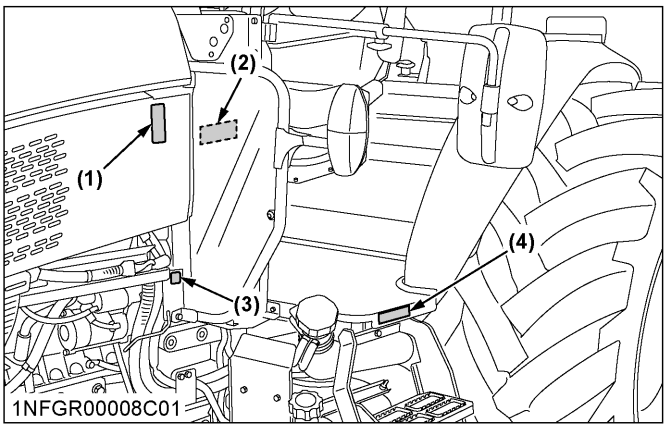


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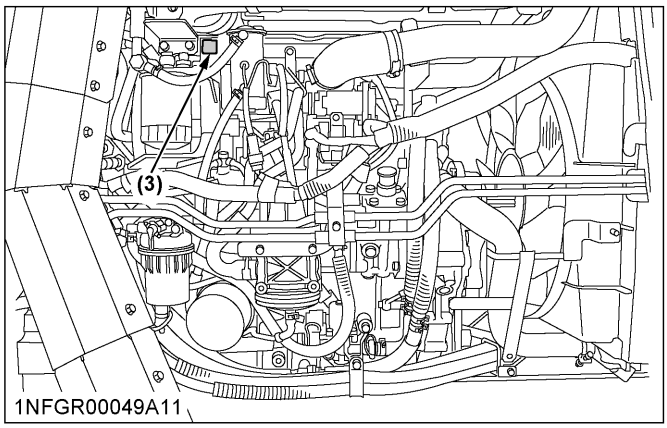


1NFGR00049A11

1NFGR00044A01

(1) Part No. 6C782-4958-1

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

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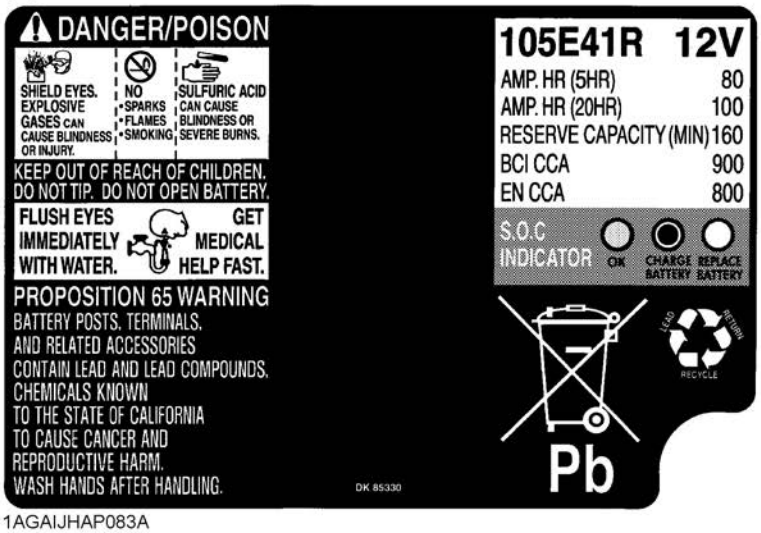
(2) Part No. 3Y205-9892-1




1AGAIJHAP083A

(3) Part No. 3P903-9837-1

DANGER/POISON

- Shield eyes.
  Explosive gases can cause blindness or injury.
- No sparks, flames, smoking.
- Sulfuric acid can cause blindness or severe burns.

KEEP OUT OF REACH OF CHILDREN.
DO NOT TIP. DO NOT OPEN BATTERY.

- Flush eyes immediately with water.
- Get medical help fast.

WASH HANDS AFTER HANDLING.

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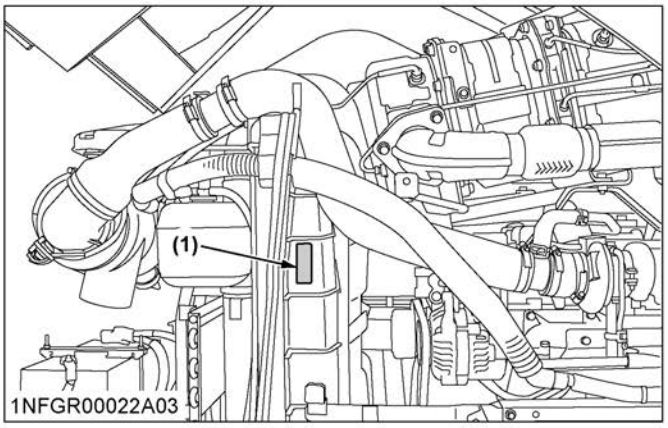


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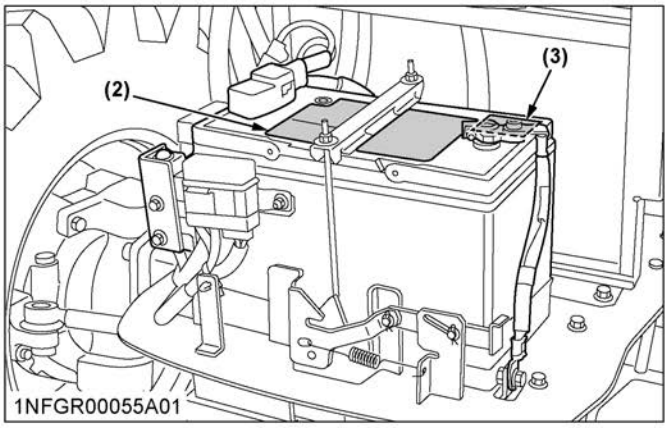


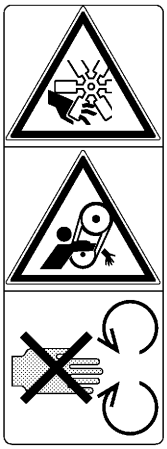

1NFGR00055A01

1NFGR00046A01

(1) Part No. TA040-4958-1
Do not touch hot surface like muffler, etc.

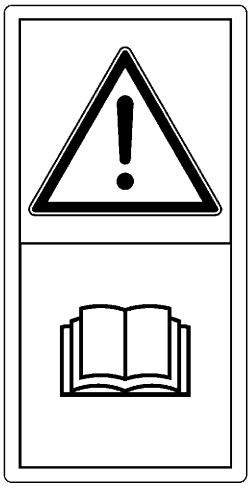
1AGAEENAP007B

(2) Part No. 6C782-4958-1
Do not get your hands close to engine fan and fan belt.



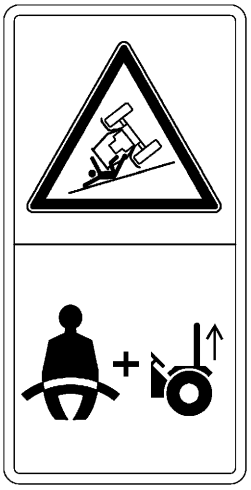
1AGAEENAP006A

(3) Part No. TD171-3491-1
Carefully read operator's manual before handling the machine.
Observe instructions and safety rules when operating.



1AGAWAEAP088A

(4) Part No. 3B294-9848-1
Always lock the ROPS in upright position unless it has to be folded down to allow operation underneath trees or bushes.
When the ROPS is locked in upright position, the seat belt should be used.



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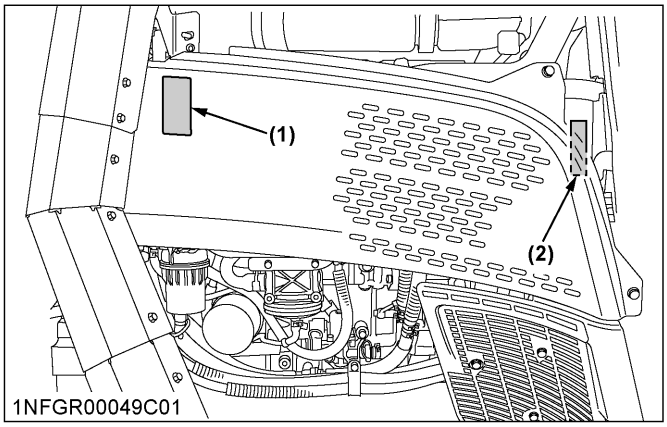


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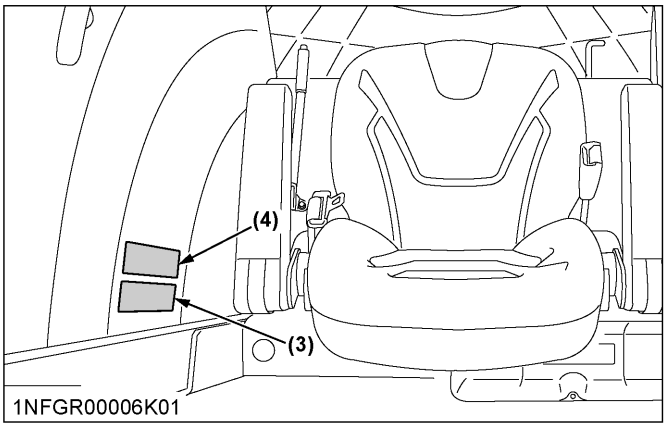


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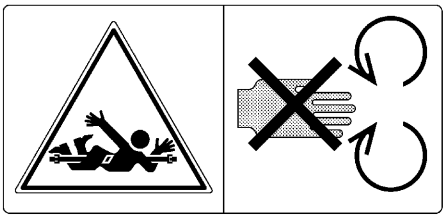
1NFGR00047A01

(1) Part No. 6C782-4711-1
Do not stand by IMPLEMENT or between implement and tractor while operating.



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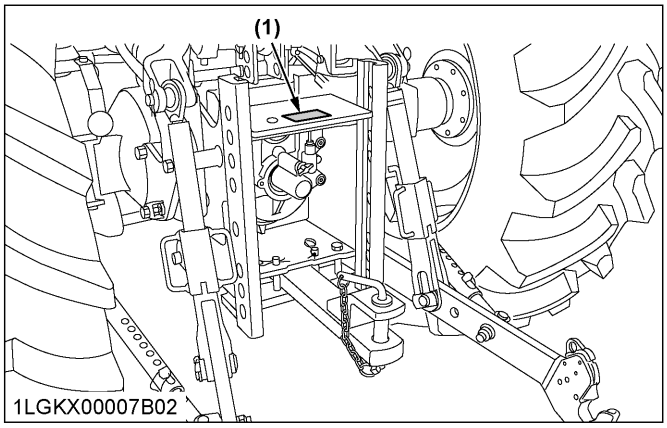



1LGKX00154A01

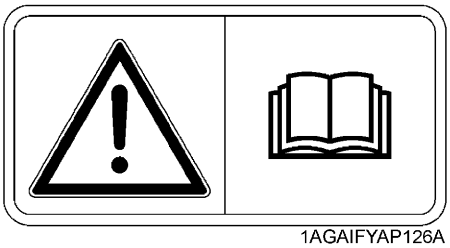
# 2. Cabin model

## 2.1 Pictorial safety labels (Cabin model)

The pictorial safety labels affixed are intended to alert persons to potential hazards. The hazard is identified by a pictorial in the safety alert triangle or by the safety alert symbol alone. An adjacent pictorial provides instructions and information on how to avoid the hazard.

(1) Part No. 3P903-9837-1

REFRIGERANT UNDER HIGH PRESSURE
Improper service methods may cause personal injury.
This air conditioning system should be serviced by your dealer or any other qualified service shop.
See Repair Manual for detail.



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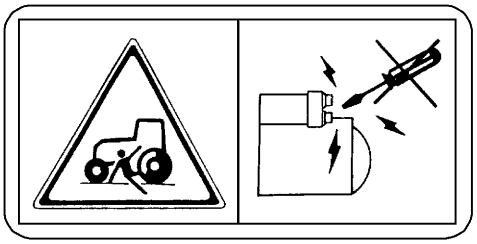
(2) Part No. K3512-4718-1

Start engine from operator's seat only.



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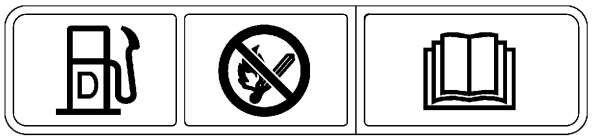
(3) Part No. 3B794-4956-1

Diesel fuel only. | No fire. | Read operator's manual.



1AGBDABAP224A

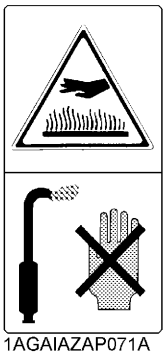
(4) Part No. 3B794-4719-1

Do not touch hot surface like muffler, etc.

1AGBDAAAP098A

(5) Part No. 32310-4958-1

Do not touch hot surface like muffler, etc.



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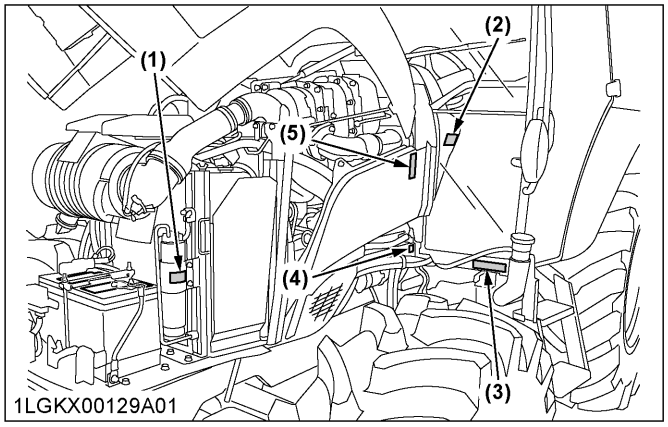


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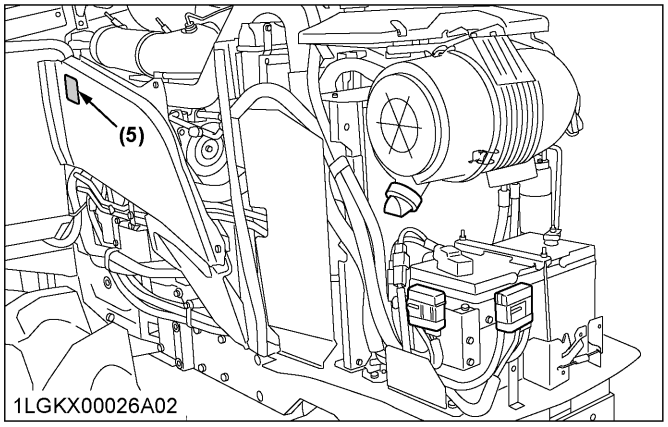



1LGKX00026A02

1LGKX00125A01

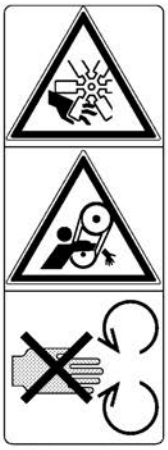
(1) Part No. K3512-4719-1

Do not touch hot surface like muffler, etc.

1AGBDAAAP098A

(2) Part No. 6C782-4958-1

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



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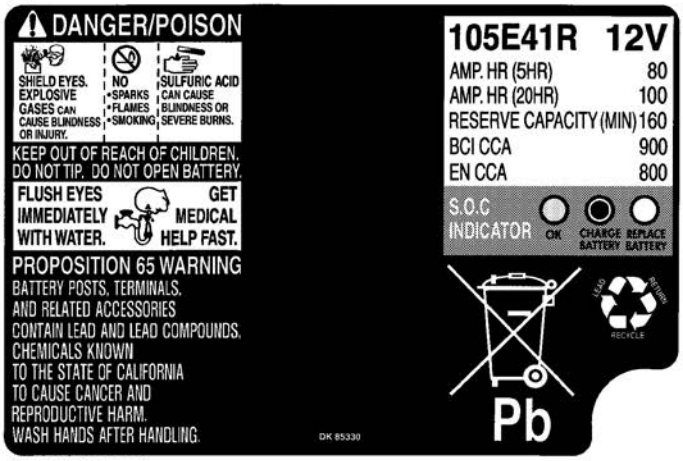
(3) Part No. 3Y205-9892-1




1AGAIJHAP083A

(4) Part No. 3P903-9837-1

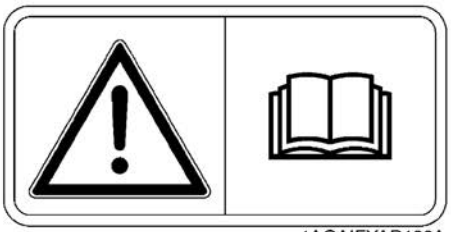
DANGER/POISON

- Shield eyes.
  Explosive gases can cause blindness or injury.
- No sparks, flames, smoking.
- Sulfuric acid can cause blindness or severe burns.

KEEP OUT OF REACH CHILDREN.
DO NOT TIP. DO NOT OPEN BATTERY.

- Flush eyes immediately with water.
- Get medical help fast.

WASH HANDS AFTER HANDLING



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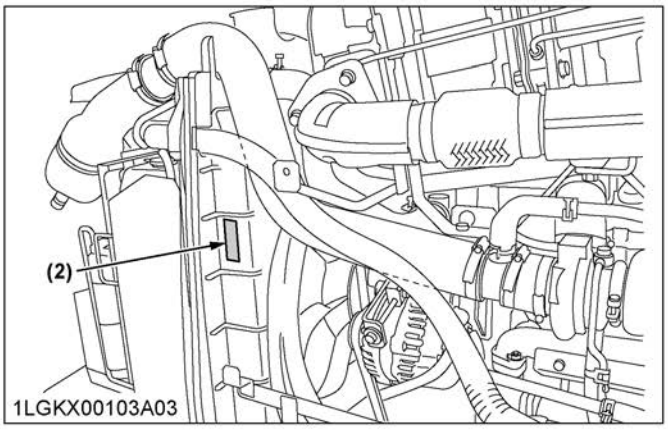


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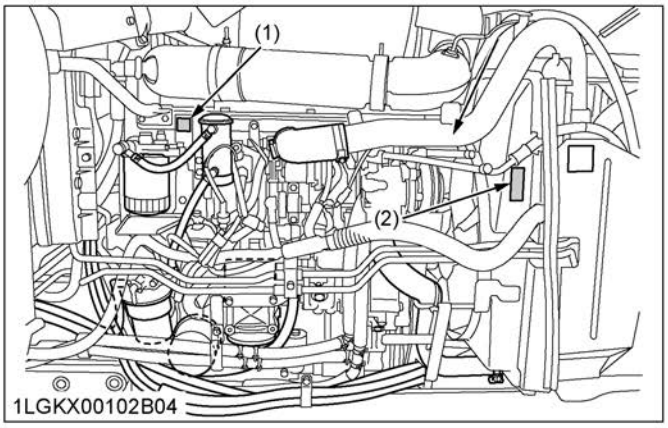
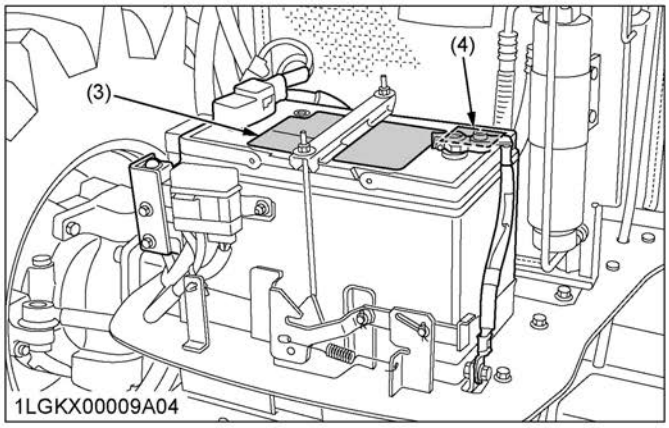


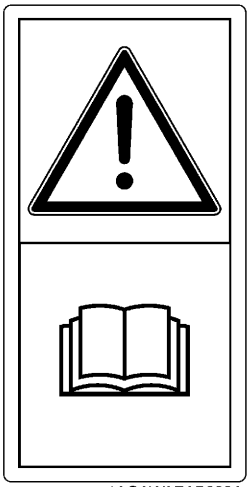

1LGKX00102B04




1LGKX00009A04

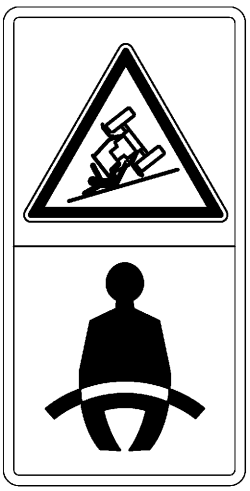
1LGKX00126A01

(1) Part No. TD179-3491-1
Carefully read operator's manual before handling the machine.
Observe instructions and safety rules when operating.



1AGAWAEAP088A

(2) Part No. 3B794-4902-1
For operator
Seat belt should be used.

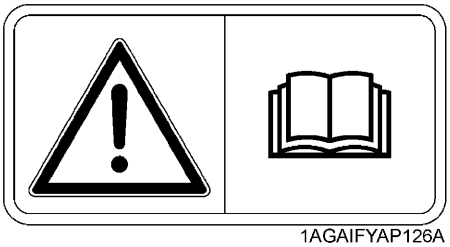


1AGBDABAP223A

(3) Part No. 3B794-9839-1
Emergency exit*1

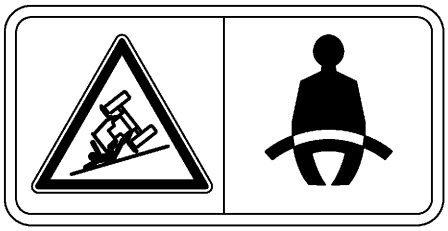
1AGBDABAP216A

(4) Part No. 3P903-9837-1
For passenger
Carefully read operator's manual before handling the machine.
Observe instructions and safety rules when operating.



1AGAIFYAP126A

(5) Part No. 3B794-4903-1
For passenger
Seat belt should be used.*2



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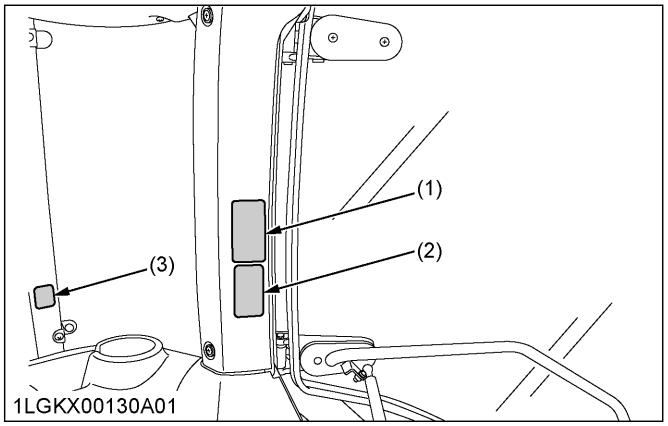
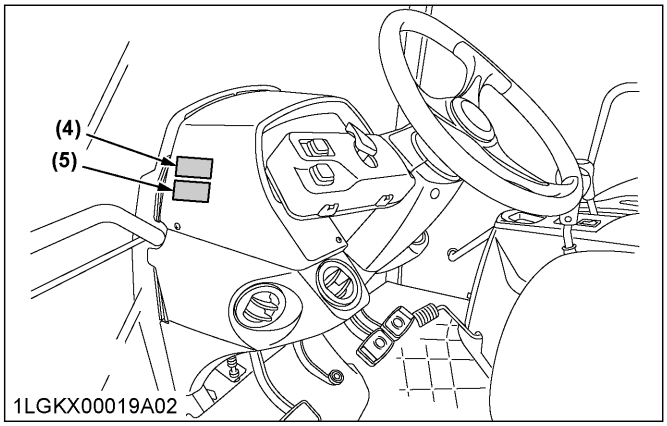


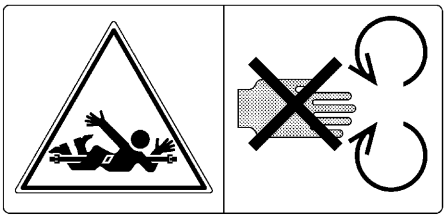

1LGKX00130A01



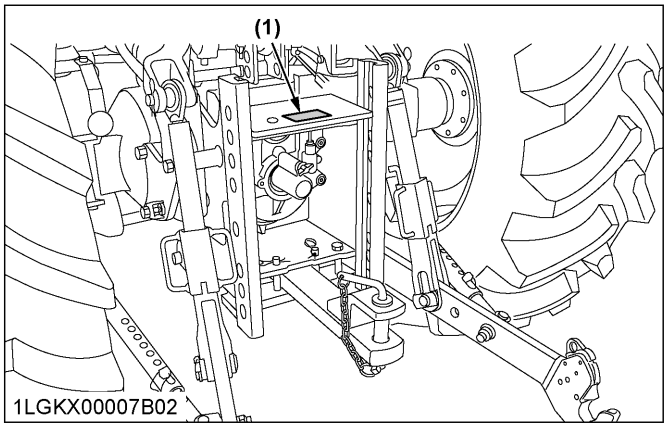

1LGKX00019A02

1LGKX00127A01

(1) Part No. 6C782-4711-1
Do not stand by IMPLEMENT or between implement and tractor while operating.



1AGAEENAP001A




1LGKX00154A01

# CARE OF DANGER, WARNING AND CAUTION LABELS

- Keep danger, warning and caution labels clean and free from obstructing material.
- Clean danger, warning and caution labels with soap and water, dry with a soft cloth.
- Replace damaged or missing danger, warning and caution labels with new labels.
- If a component with danger, warning and caution label(s) affixed is replaced with new part, make sure new label(s) is (are) attached in the same location(s) as the replace component.
- Mount new danger, warning and caution labels by applying on a clean dry surface and pressing any bubbles to outside edge.

# SPECIFICATIONS

## 1. Specification table (ROPS model)

| Model | | | M5091 | M5111 |
|---|---|---|---|---|
| | | | 4WD | 4WD |
| Engine | Model | | V3800-TIEF4 | |
| | Type | | Direct injection, water-cooled 4 cycle diesel, common rail system, turbocharger, intercooler | |
| | Number of cylinders | | 4 | |
| | Total displacement | | 3769 $cm^3$ (230 cu.in.) | |
| | Bore and stroke | | 100 x 120 mm (3.94 x 4.72 in.) | |
| | Rated revolution | | 2400 $min^{-1}$ (rpm) | |
| | Low idling revolution | | 800 to 850 $min^{-1}$ (rpm) | |
| | Rated engine HP (97/68/EC) | | 69 kW (92.5 PS) | 78.8 kW (105.6 PS) |
| | Net power *1 | | 65.9 kW (89.6 PS) | 75.7 kW (102.9 PS) |
| | Maximum torque | | 325.8 N·m (33.2 kgf·m, 2403 lbf·ft)/ 1500 $min^{-1}$ (rpm) | 357.8 N·m (36.5 kgf·m, 263.9 lbf·ft)/ 1500 $min^{-1}$ (rpm) |
| | Battery capacity | | 12 V, RC: 160 min, CCA 900 A | |
| | Fuel tank capacity | | 105 L (27.7 U.S.gals, 92.4 Imp.gals) | |
| | Engine oil capacity | | 10.75 L (2.84 U.S.qts, 9.46 Imp.qts) | |
| | Coolant capacity | | 10.05 L (2.66 U.S.qts, 8.84 Imp.qts) | |
| | DEF/AdBlue® capacity | | 12.35 L (3.26 U.S.qts, 10.87 Imp.qts) | |
| Dimensions | Overall length | | 4045 mm (159.3 in.) | |
| | Overall width (minimum tread) | | 2068 mm (81.4 in.) | |
| | Overall height | | 2680.5 mm (105.5 in.) | |
| | Wheel base | | 2250 mm (88.6 in.) | |
| | Tread | Front | 1610 to 1648 mm (63.4 to 64.9 in.) | |
| | | Rear | 1589 to 1695 mm (62.6 to 66.7 in.) | |
| | Minimum ground clearance | | 439 mm (17.3 in.) (drawbar bracket) | |
| Weight | | | 3055 kg (6735 lbs) | |
| Traveling system | Standard tire size | Front tires | 360/70R24 | |
| | | Rear tires *2 | 480/70R34 | |
| | Clutch | | Hydraulic multiple wet disks | |
| | Steering | | Hydraulic power steering | |
| | Braking system | | Hydraulically operated wet disk | |
| | Trailer brake | | Hydraulic | |
| | Trailer brake couple | | ISO 5676, ISO 16028 | |
| | Differential | | Bevel gears with differential lock (rear) | |
| Hydraulic unit | Hydraulic control system | | Position, draft (top link sensing) and mix control | |
| | Pump capacity | | 60.0 L (15.8 U.S.gals, 13.2 Imp.gals)/min. | |
| | 3-point hitch | | Category 2 | |

(Continued)

## 1. INFORMATION

| Model | | | M5091 | M5111 |
|---|---|---|---|---|
| | | | 4WD | 4WD |
| Hydraulic unit | Max. lifting force | At lifting points *3 | 4100 kg (9039 lbs) | |
| | Remote hydraulic control | | 2 standard (3rd and flow control valve optional) | |
| | Remote control valve coupler | | ISO 7241-1 standards "A" | |
| | System pressure | | 20.2 MPa (206 kgf/cm$^2$, 2930 psi) | |
| | Traction system | | Swinging drawbar, adjustable in direction | |
| PTO | Live PTO (independent) | Direction of turning | Clockwise, viewed from tractor rear | |
| | | PTO/engine speed | 6 spline: 540/2035 min$^{-1}$ (rpm)<br>6 spline: 540E/1519 min$^{-1}$ (rpm)<br>21 spline: 1000/2389 min$^{-1}$ (rpm) | |
| The level of protection against hazardous substance *4 | | | — | |
| Noise at the operator's ear *5 | | | 85 dB (A) | |
| Noise of the tractor in motion *6 | | | 81 dB (A) | |
| Value of the vibration level *7 | **Grammer MSG95A/721** | Light driver | 1.24 m/s$^2$ | |
| | | Heavy driver | 1.1 m/s$^2$ | |
| | **KAB 11/E6** | Light driver | 1.19 m/s$^2$ | |
| | | Heavy driver | 0.90 m/s$^2$ | |

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

*1 Manufacturer's estimate
*2 Cast iron disks available for wheels.
*3 At lower link end with links horizontal.
*4 According to EN 15695-1: 2009
*5 Commission delegated regulation (EU) No 1322/2014
*6 Commission delegated regulation (EU) 2015/96
*7 Measured according to Directive 78/764/EEC

# 2. Specification table (Cabin model)

| Model | | | M5091 | M5111 |
|---|---|---|---|---|
| | | | 4WD | 4WD |
| Engine | Model | | V3800-TIEF4 | |
| | Type | | Direct injection, water-cooled 4 cycle diesel, common rail system, turbocharger, intercooler | |
| | Number of cylinders | | 4 | |
| | Total displacement | | 3769 $cm^3$ (230 cu.in.) | |
| | Bore and stroke | | 100 x 120 mm (3.94 x 4.72 in.) | |
| | Rated revolution | | 2600 $min^{-1}$ (rpm) | |
| | Low idling revolution | | 800 to 850 $min^{-1}$ (rpm) | |
| | Rated engine HP (97/68/EC) | | 70.9 kW (95 PS) | 84.4 kW (113.2 PS) |
| | Net power *1 | | 65.4 kW (88.9 PS) | 78.6 kW (107.3 PS) |
| | Maximum torque | | 307 N·m (31.3 kgf·m, 227 lbf·ft)/ 1500 $min^{-1}$ (rpm) | 357 N·m (36.4 kgf·m, 263 lbf·ft)/ 1500 $min^{-1}$ (rpm) |
| | Battery capacity | | 12 V, RC: 160 min, CCA 900 A | |
| | Fuel tank capacity | | 105 L (27.7 U.S.gals, 92.4 Imp.gals) | |
| | Engine oil capacity | | 10.7 L (2.84 U.S.qts, 9.46 Imp.qts) | |
| | Coolant capacity | | 10.0 L (2.66 U.S.qts, 8.84 Imp.qts) | |
| | DEF/AdBlue® capacity | | 12.3 L (3.26 U.S.qts, 10.87 Imp.qts) | |
| Dimensions | Overall length | | 4045 mm (159.3 in.) | |
| | Overall width (minimum tread) | | 2045 mm (80.5 in.) | |
| | Overall height | | 2644 mm (104.1 in.) | |
| | Wheel base | | 2250 mm (88.6 in.) | |
| | Tread | Front | 1610 to 1648 mm (63.4 to 64.9 in.) | |
| | | Rear | 1503 to 1645 mm (59.2 to 64.8 in.) | |
| | Minimum ground clearance | | 439 mm (17.3 in.) (drawbar bracket) | |
| Weight | | | 3500 kg (7716 lbs) | |
| Traveling system | Standard tire size | Front tires | 360/70R24 | |
| | | Rear tires *2 | 480/70R34 | |
| | Clutch | | Hydraulic multiple wet disks | |
| | Steering | | Hydraulic power steering | |
| | Braking system | | Hydraulically operated wet disk | |
| | Trailer brake | | Hydraulic or pneumatic (option) | |
| | Trailer brake couple | | Hydraulic: ISO 5676, ISO 16028<br>Pneumatic: 2-line EU type | |
| | Differential | | Bevel gears with differential lock (rear) | |
| Hydraulic unit | Hydraulic control system | | Position, draft (top link sensing) and mix control | |
| | Pump capacity | | 64.3 L (17.0 U.S.gals, 14.1 Imp.gals)/min. | |
| | 3-point hitch | | Category 2 | |
| | Max. lifting force | At lifting points *3 | 4100 kg (9039 lbs) | |
| | Remote hydraulic control | | 2 standard (3rd and flow control valve optional) | |
| | Remote control valve coupler | | ISO 7241-1 standards "A" | |
| | System pressure | | 20.2 MPa (206 $kgf/cm^2$, 2930 psi) | |
| | Traction system | | Swinging drawbar, adjustable in direction | |

(Continued)

| Model | | | M5091 | M5111 |
|---|---|---|---|---|
| | | | 4WD | 4WD |
| PTO | Live PTO (independent) | Direction of turning | Clockwise, viewed from tractor rear | |
| | | PTO/engine speed | 6 spline: 540/2035 $min^{-1}$ (rpm)<br>6 spline: 540E/1519 $min^{-1}$ (rpm)<br>21 spline: 1000/2389 $min^{-1}$ (rpm) | |
| The level of protection against hazardous substance *4 | | | Category 2 | |
| Noise at the operator's ear *5 | | CAB/door closed | 79 dB (A) | |
| | | CAB/door opened | 81 dB (A) | |
| Noise of the tractor in motion *6 | | | 79 dB (A) | |
| Value of the vibration level *7 | **Grammer MSG95A/721** | Light driver | 1.24 $m/s^2$ | |
| | | Heavy driver | 1.1 $m/s^2$ | |
| | **Grammer DS85H/90** | Light driver | 1.24 $m/s^2$ | |
| | | Heavy driver | 0.98 $m/s^2$ | |
| | **KAB 11/E6** | Light driver | 1.19 $m/s^2$ | |
| | | Heavy driver | 0.90 $m/s^2$ | |
| | **KAB 15/E6** | Light driver | 1.09 $m/s^2$ | |
| | | Heavy driver | 0.90 $m/s^2$ | |
| | **Sears 3045** | Light driver | 1.20 $m/s^2$ | |
| | | Heavy driver | 1.12 $m/s^2$ | |

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

*1 Manufacturer's estimate

*2 Cast iron disks available for wheels.

*3 At lower link end with links horizontal.

*4 According to EN 15695-1: 2009

*5 Commission delegated regulation (EU) No 1322/2014

*6 Commission delegated regulation (EU) 2015/96

*7 Measured according to Directive 78/764/EEC

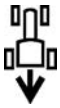
# TRAVELING SPEEDS

## 1. Traveling speeds (ROPS model)

| Model | | | M5091/M5111 |
|---|---|---|---|
| Rear tire size | | | 480/70R34 |
| Shuttle shift lever | Range gear shift lever | Main gear shift lever | km/h |
| Forward  | Creep | 1 | 0.37 |
| | | 2 | 0.51 |
| | | 3 | 0.66 |
| | | 4 | 0.85 |
| | | 5 | 1.05 |
| | | 6 | 1.50 |
| | L | 1 | 2.5 |
| | | 2 | 3.5 |
| | | 3 | 4.5 |
| | | 4 | 5.8 |
| | | 5 | 7.1 |
| | | 6 | 10.2 |
| | H | 1 | 11.2 |
| | | 2 | 15.4 |
| | | 3 | 19.8 |
| | | 4 | 25.6 |
| | | 5 | 31.6 |
| | | 6 | 39.2*1 |
| Reverse  | Creep | 1 | 0.37 |
| | | 2 | 0.51 |
| | | 3 | 0.66 |
| | | 4 | 0.85 |
| | | 5 | 1.04 |
| | | 6 | 1.50 |
| | L | 1 | 2.5 |
| | | 2 | 3.5 |
| | | 3 | 4.5 |
| | | 4 | 5.8 |
| | | 5 | 7.1 |
| | | 6 | 10.2 |

(Continued)

## 1. INFORMATION

| Model | | | M5091/M5111 |
|---|---|---|---|
| Reverse  | H | 1 | 11.2 |
| | | 2 | 15.3 |
| | | 3 | 19.7 |
| | | 4 | 25.4 |
| | | 5 | 31.4 |
| | | 6 | 39.0 |

At rated engine rpm
The company reserves the right to change the specifications without notice.

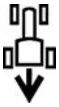
*1 At 2080 engine rpm.

# 2. Traveling speeds (Cabin model)

| Model | | | M5091/M5111 | |
|---|---|---|---|---|
| Rear tire size | | | 480/70R34 | |
| Shuttle shift lever | Range gear shift lever | Main gear shift lever | **Dual speed**: H | **Dual speed**: L |
| | | | km/h | km/h |
| Forward  | Creep | 1 | 0.40 | 0.34 |
| | | 2 | 0.55 | 0.46 |
| | | 3 | 0.71 | 0.60 |
| | | 4 | 0.91 | 0.77 |
| | | 5 | 1.13 | 0.95 |
| | | 6 | 1.61 | 1.36 |
| | L | 1 | 2.7 | 2.3 |
| | | 2 | 3.7 | 3.1 |
| | | 3 | 4.8 | 4.0 |
| | | 4 | 6.2 | 5.2 |
| | | 5 | 7.7 | 6.5 |
| | | 6 | 11.0 | 9.2 |
| | H | 1 | 12.1 | 10.1 |
| | | 2 | 16.5 | 13.9 |
| | | 3 | 21.3 | 17.9 |
| | | 4 | 27.5 | 23.1 |
| | | 5 | 33.9 | 28.5 |
| | | 6 | 38.8[*1] | 32.7 |
| Reverse  | Creep | 1 | 0.41 | 0.34 |
| | | 2 | 0.56 | 0.47 |
| | | 3 | 0.72 | 0.60 |
| | | 4 | 0.92 | 0.78 |
| | | 5 | 1.14 | 0.96 |
| | | 6 | 1.63 | 1.38 |
| | L | 1 | 2.8 | 2.3 |
| | | 2 | 3.8 | 3.2 |
| | | 3 | 4.9 | 4.1 |
| | | 4 | 6.3 | 5.3 |
| | | 5 | 7.8 | 6.5 |
| | | 6 | 11.1 | 9.4 |
| | H | 1 | 12.2 | 10.3 |
| | | 2 | 16.7 | 14.0 |
| | | 3 | 21.5 | 18.1 |
| | | 4 | 27.8 | 23.4 |

(Continued)

## 1. INFORMATION

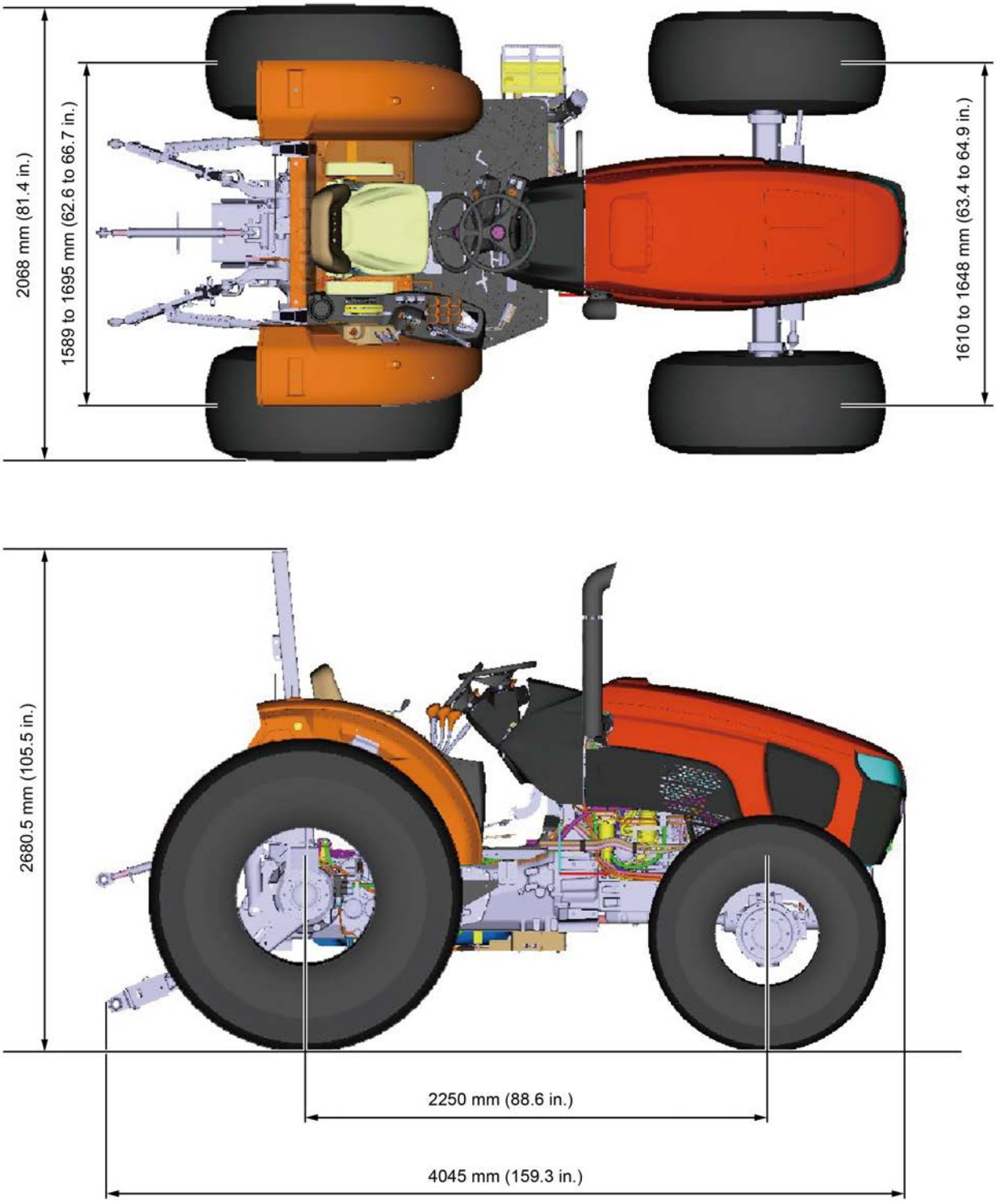
| Model | | | M5091/M5111 | |
|---|---|---|---|---|
| Reverse  | H | 5 | 34.3 | 28.9 |
| | | 6 | 39.3 | 33.1 |

At rated engine rpm
The company reserves the right to change the specifications without notice.

*1 At 2080 engine rpm.

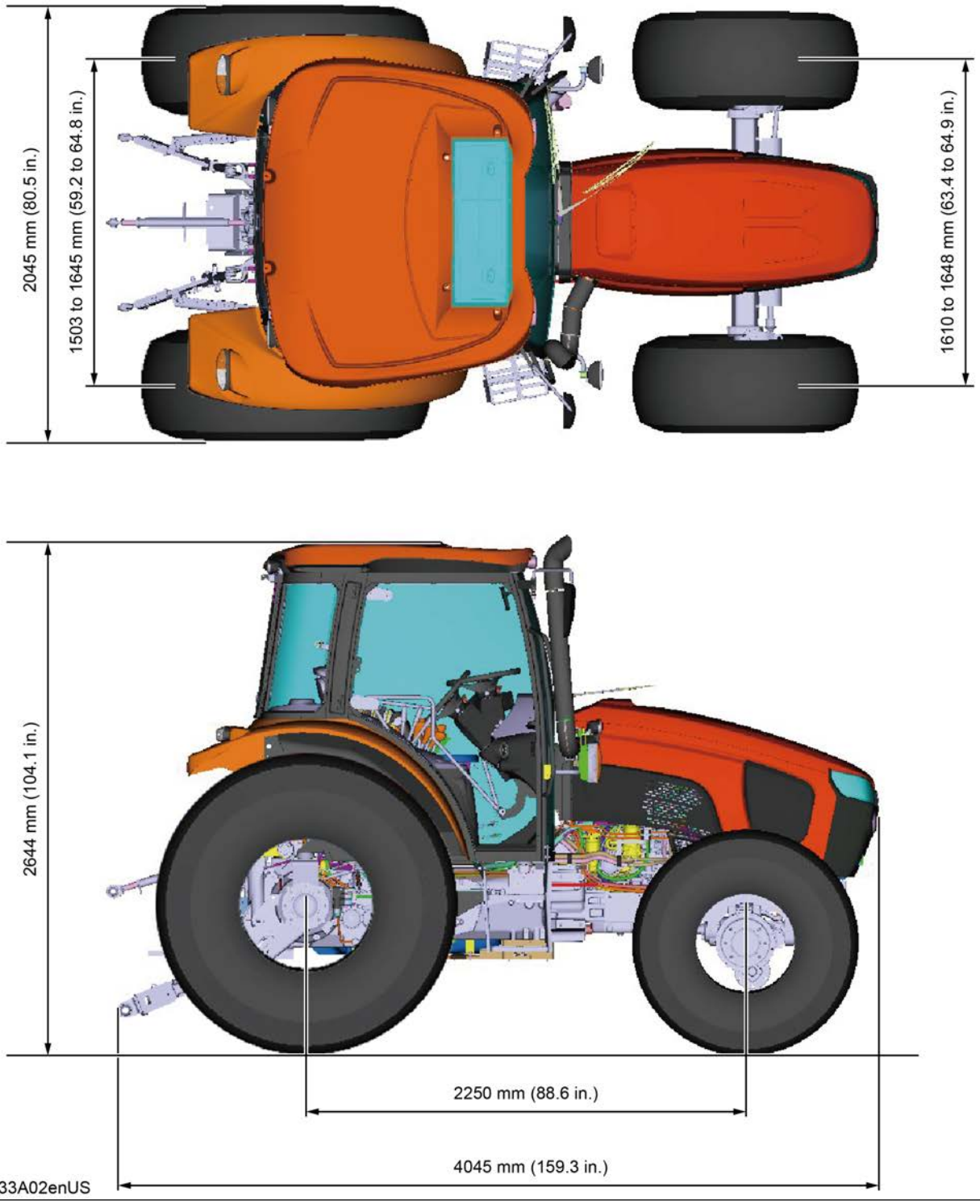
# DIMENSIONS

## 1. Dimension for ROPS model




2LPXB00634A02enUS

# 2. Dimension for Cabin model



# 2. GENERAL

# TRACTOR IDENTIFICATION

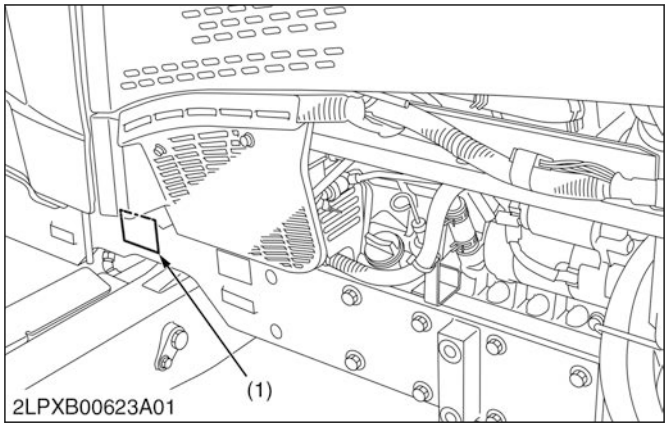
## 1. Model name and serial number

### 1.1 Tractor number

Engine serial number, tractor serial number and hourmeter reading.

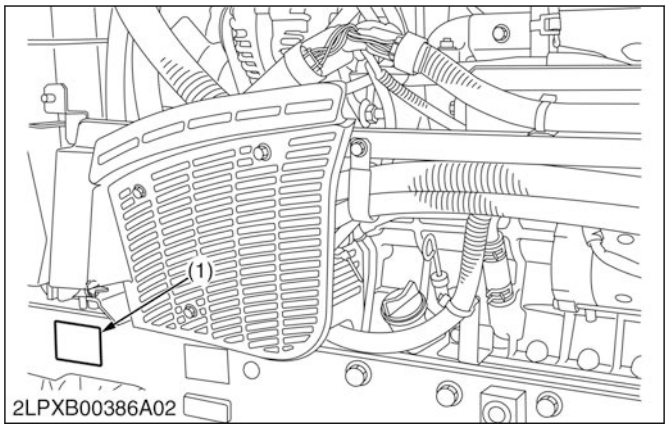
**Tractor identification plate**

**ROPS model**




(1) Tractor identification plate

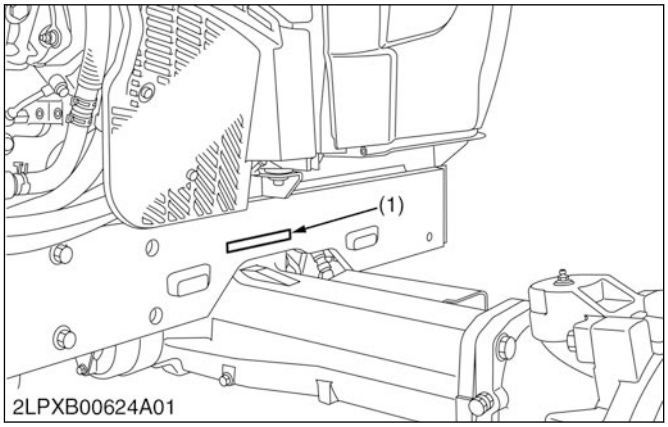
**Cabin model**




(1) Tractor identification plate

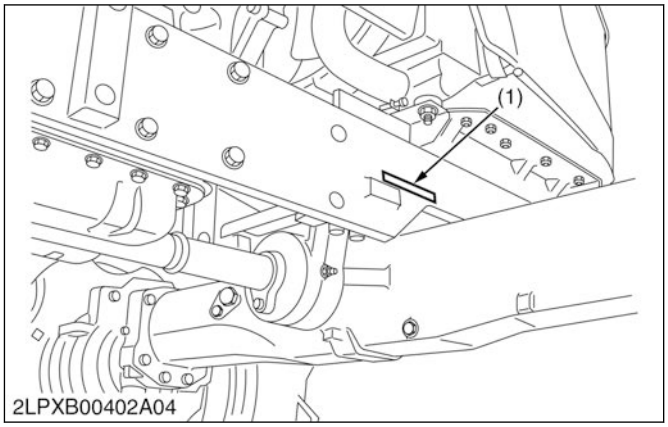
**Tractor serial number**

**ROPS model**




(1) Tractor serial number

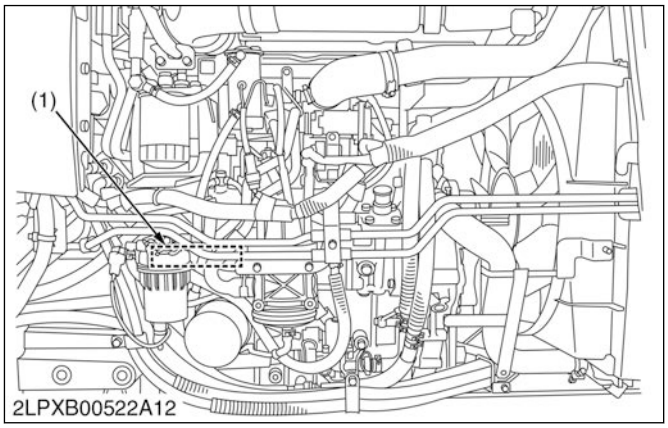
**Cabin model**




(1) Tractor serial number

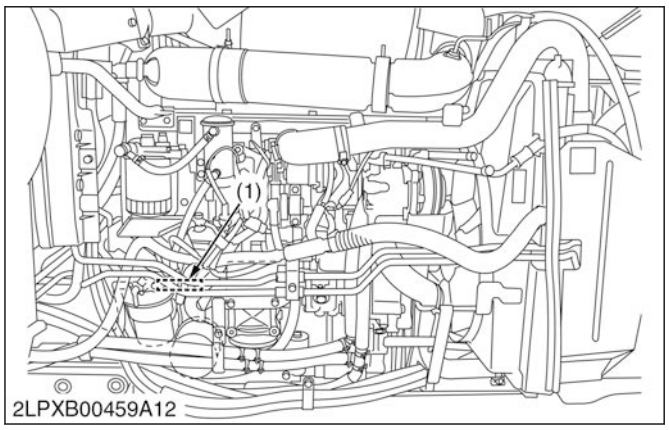
**Engine serial number**

**ROPS model**




(1) Engine serial number

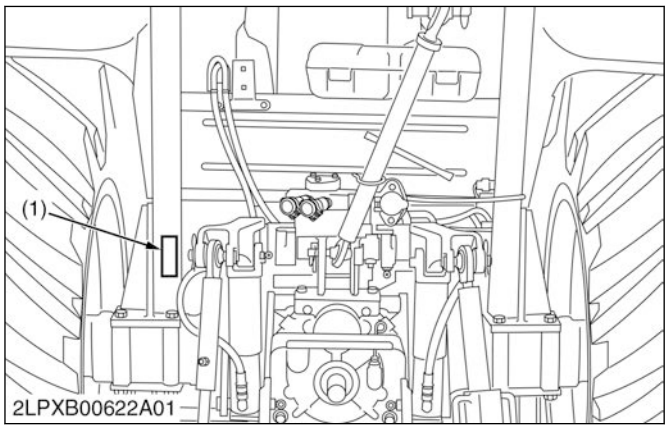
### Cabin model




(1) Engine serial number

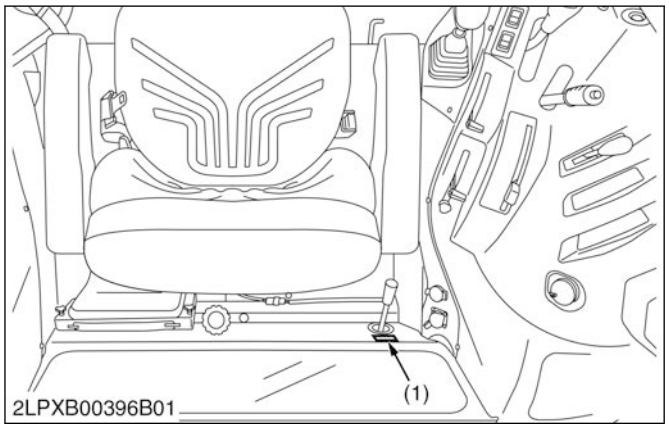
## ROPS and CAB identification plate

### ROPS model




(1) ROPS identification plate (ROPS Serial No.)

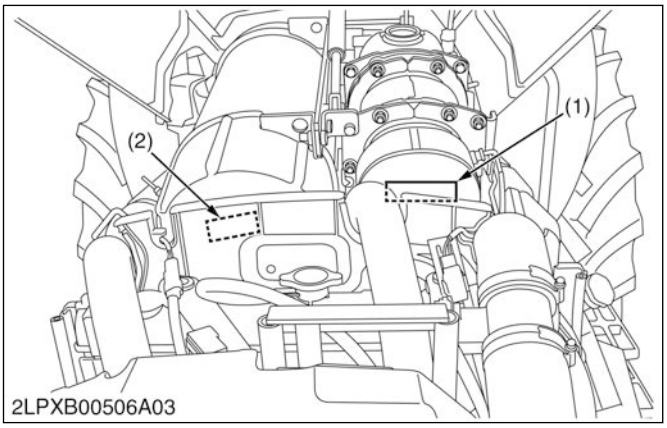
### Cabin model




(1) CAB identification plate (CAB serial No.)

## Diesel Particulate Filter (DPF) serial number and Selective Catalytic Reduction (SCR) muffler serial number

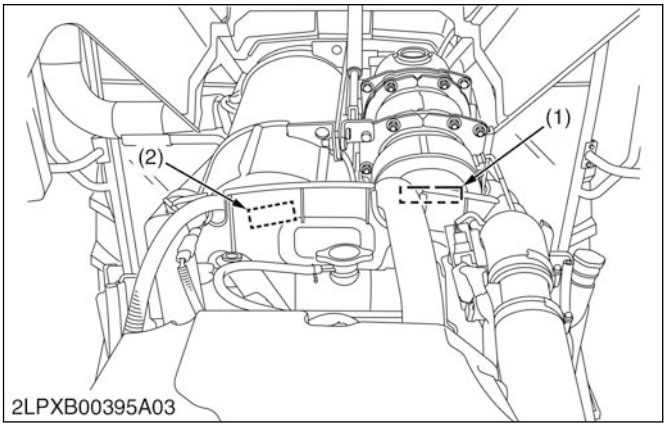
### ROPS model




(1) Diesel Particulate Filter (DPF) serial number

(2) Selective Catalytic Reduction (SCR) muffler serial number

### Cabin model



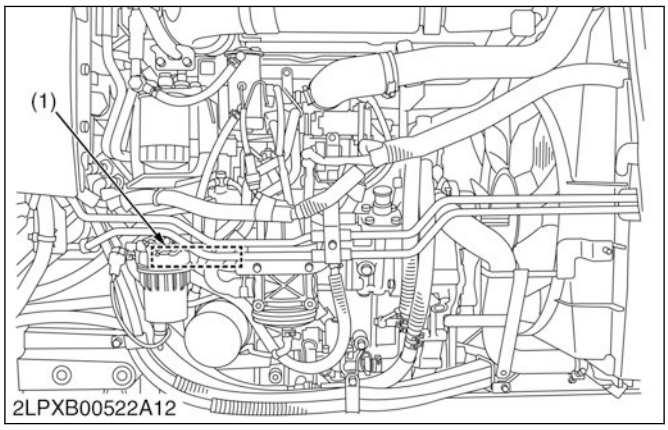

(1) Diesel Particulate Filter (DPF) serial number

(2) Selective Catalytic Reduction (SCR) muffler serial number

## 1.2 Engine serial number

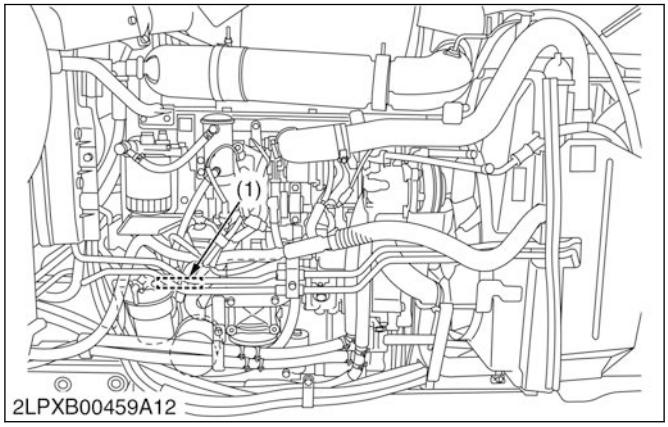
The engine serial number is an identified number for the engine. It is marked after the engine model number. It indicates month and year of manufacture as follows.

**ROPS model**




(1) Engine serial number

**Cabin model**




(1) Engine serial number

**Year of manufacture**

| Alphabet or number | Year |
|---|---|
| 1 | 2001 |
| 2 | 2002 |
| 3 | 2003 |
| 4 | 2004 |
| 5 | 2005 |
| 6 | 2006 |
| 7 | 2007 |
| 8 | 2008 |
| 9 | 2009 |
| A | 2010 |
| B | 2011 |
| C | 2012 |
| D | 2013 |
| E | 2014 |
| F | 2015 |
| G | 2016 |
| H | 2017 |
| J | 2018 |
| K | 2019 |
| L | 2020 |
| M | 2021 |
| N | 2022 |
| P | 2023 |
| R | 2024 |
| S | 2025 |
| T | 2026 |
| V | 2027 |

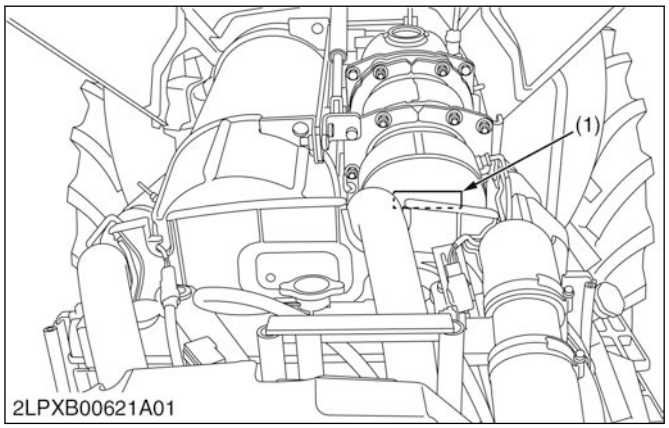
**Month of manufacture**

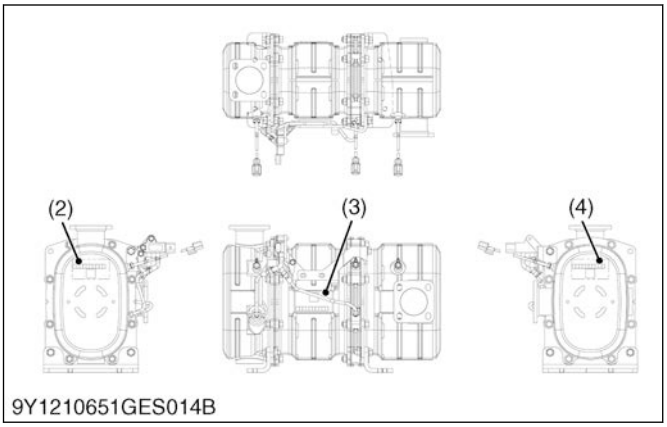
| Month | Engine serial number | |
|---|---|---|
| | 0001 ~ 9999 | 10000 ~ |
| January | A0001 ~ A9999 | B0001 ~ |
| February | C0001 ~ C9999 | D0001 ~ |
| March | E0001 ~ E9999 | F0001 ~ |
| April | G0001 ~ G9999 | H0001 ~ |
| May | J0001 ~ J9999 | K0001 ~ |
| June | L0001 ~ L9999 | M0001 ~ |
| July | N0001 ~ N9999 | P0001 ~ |
| August | Q0001 ~ Q9999 | R0001 ~ |
| September | S0001 ~ S9999 | T0001 ~ |
| October | U0001 ~ U9999 | V0001 ~ |
| November | W0001 ~ W9999 | X0001 ~ |
| December | Y0001 ~ Y9999 | Z0001 ~ |

V3800-6A0001
"6" indicates 2006 and "A" indicates January.
So, 6A indicates that the engine was manufactured on January, 2006.

## 1.3 DPF muffler serial number

The DPF muffler full assembly serial number is an identified number for the DPF muffler full assembly.

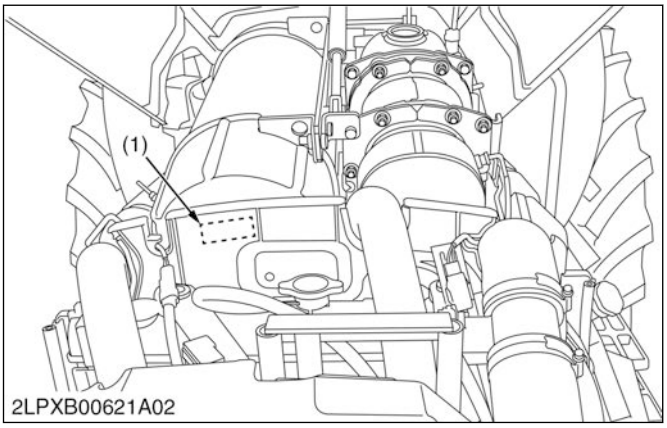



(1) DPF muffler full assembly part number and serial number
(2) Body (DPF outlet) part number and serial number
(3) Filter comp (DPF) part number and serial number
(4) Catalyst (DOC) part number and serial number

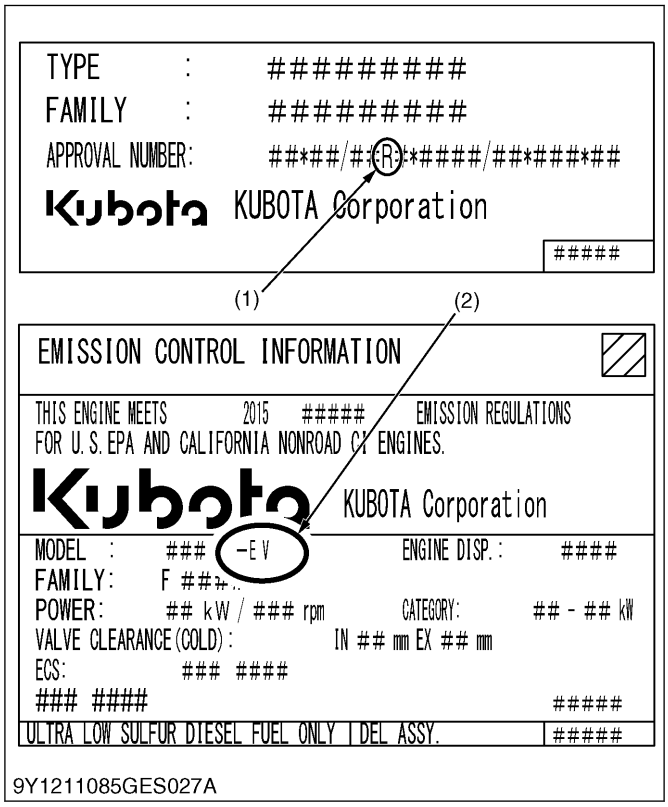
## 1.4 SCR muffler serial number

The SCR muffler full assembly serial number is an identified number for the SCR muffler full assembly.




(1) SCR muffler full assembly part number and serial number

## 1.5 EF4B engine




(1) EU regulation engine output classification category

(2) "EF4B" engines are identified with "EV" at the end of the Model designation, on the US EPA label. "EF4B" designates some Tier 4 models, depending on engine output classification.

| Category (1) | Engine output classification | EU regulation |
|---|---|---|
| K | From 19 to less than 37 kW | STAGE IIIA |
| P | From 37 to less than 56 kW | STAGE IIIB |
| R | From 56 to less than 130 kW | STAGE IV |

| Category (2) | Engine output classification | EPA regulation |
|---|---|---|
| EV | Less than 19 kW | Tier 4 |
| | From 19 to less than 56 kW | Tier 4 |
| | From 56 to less than 75 kW | Tier 4 |
| | From 75 to less than 130 kW | Tier 4 |

The emission controls previously implemented in various countries to prevent air pollution will be stepped up as Nonroad Emission Standards continue to change. The timing or applicable date of the specific Nonroad Emission regulations depends on the engine output classification.

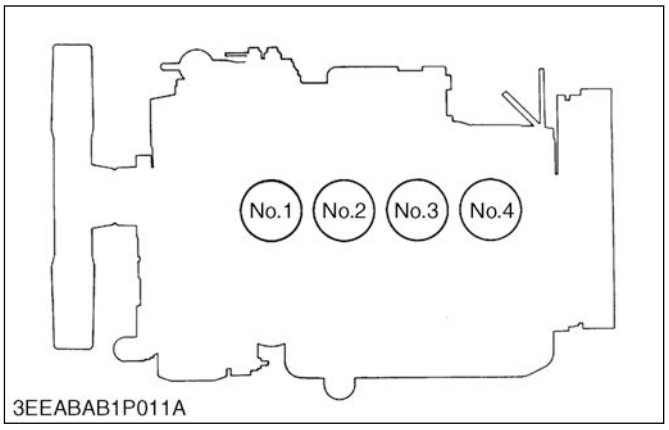
Over the past several years, KUBOTA has been supplying diesel engines that comply with regulations in the respective countries affected by Nonroad Emission regulations. For KUBOTA Engines, EF4B will be the designation that identifies engine models affected by the next emission phase.

When servicing or repairing ###-EF4B series engines, use only replacement parts for that specific EF4B engine, designated by the appropriate EF4B KUBOTA Parts List and perform all maintenance services listed in the appropriate KUBOTA Operator's Manual or in the appropriate EF4B KUBOTA Workshop Manual. Use of incorrect replacement parts or replacement parts from other emission level engines (for example: E4B engines), may result in emission levels out of compliance with the original EF4B design and EPA or other applicable regulations. Please refer to the emission label located on the engine head cover to identify Output classification and Emission Control Information. EF4B engines are identified with "EV" at the end of the Model designation, on the US EPA label. Please note: EF4B is not marked on the engine.

Example: Engine Model Name V3800-TIEF4-XXXX or V3800-TIEF4C-XXXX

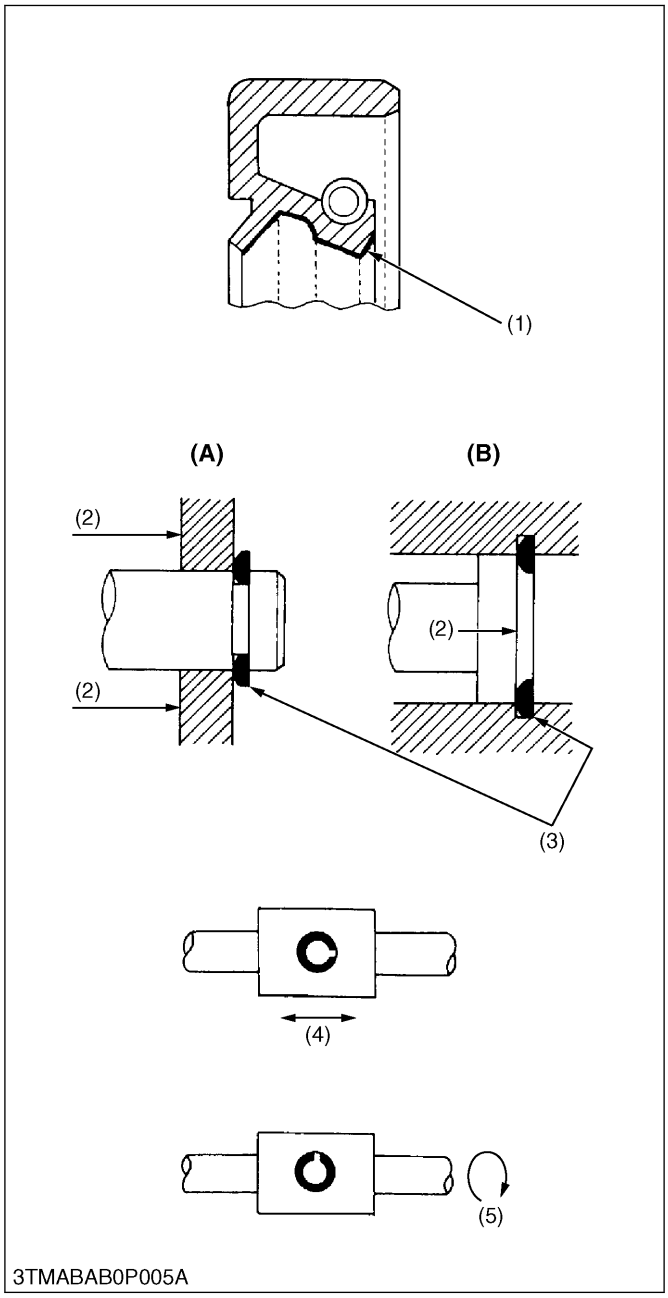
## 1.6 Cylinder number

You can see the cylinder numbers of KUBOTA diesel engine in the figure.




The sequence of cylinder numbers is No.1, No.2, No.3 and No.4 and it starts from the gear case side.

# GENERAL PRECAUTIONS




3TMABAB0P005A

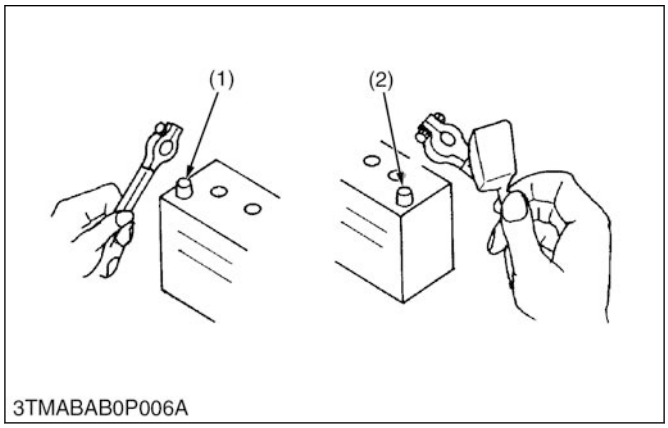
(1) Grease
(2) Force
(3) Sharp edge
(4) Axial force
(5) Rotating movement
(A) External circlip
(B) Internal circlip

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

# HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING

**■ IMPORTANT**

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

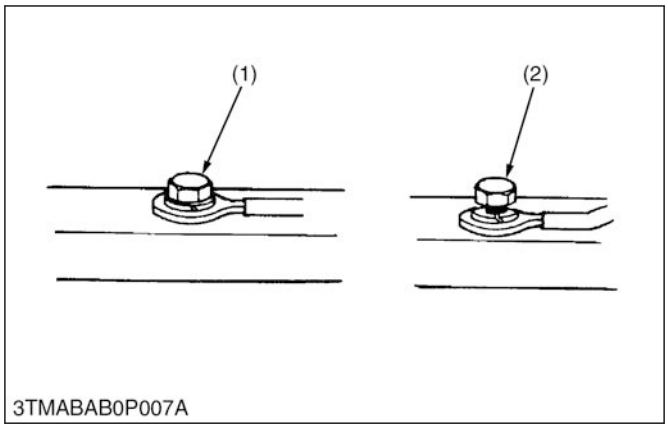



(1) Negative terminal (2) Positive terminal

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

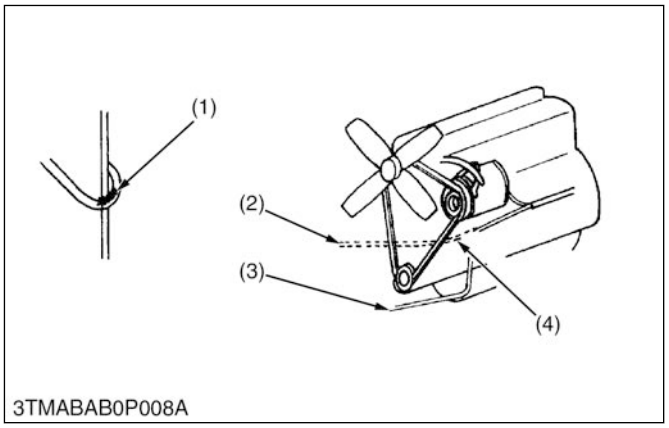
## 1. Handling of wiring

- Securely tighten wiring terminals.



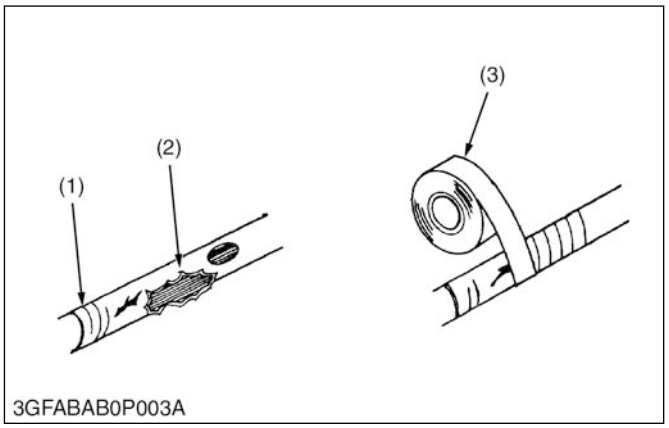

(1) Correct (Securely tighten) (2) Incorrect (Loosening leads to damaged contact)

- Do not let wiring contact dangerous part.



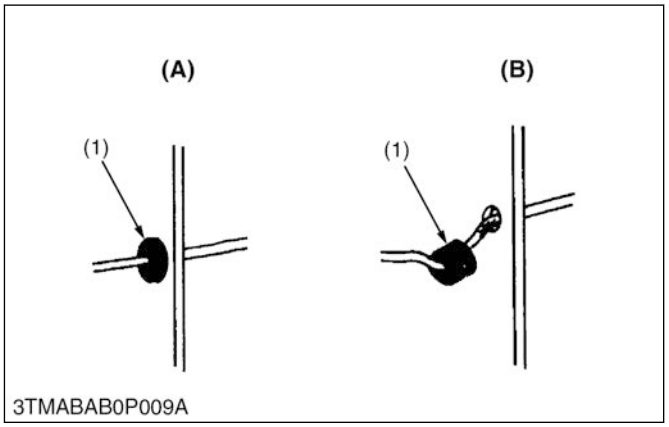

(1) Dangerous part (Sharp edge)
(2) Wiring (Incorrect)
(3) Wiring (Correct)
(4) Dangerous part

- Repair or change torn or aged wiring immediately.



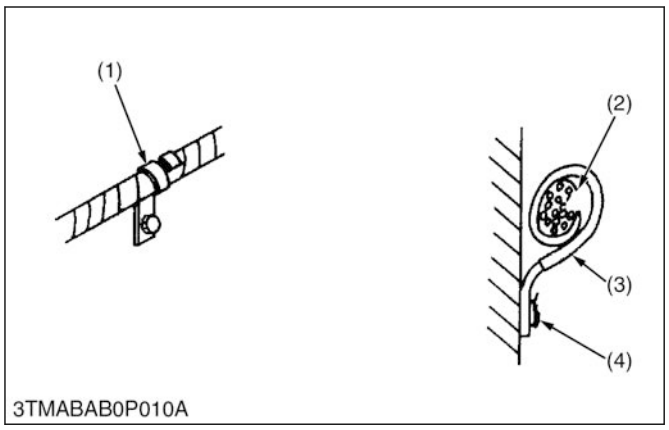

(1) Aged
(2) Torn
(3) Insulating vinyl tape

- Securely insert grommet.



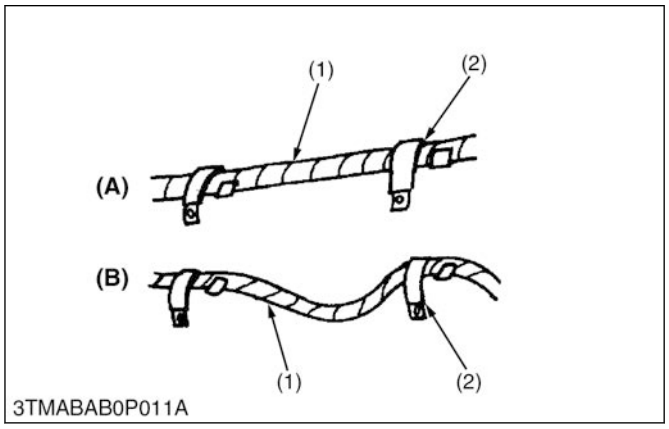

(1) Grommet
(A) Correct
(B) Incorrect

- Securely clamp, being careful not to damage wiring.



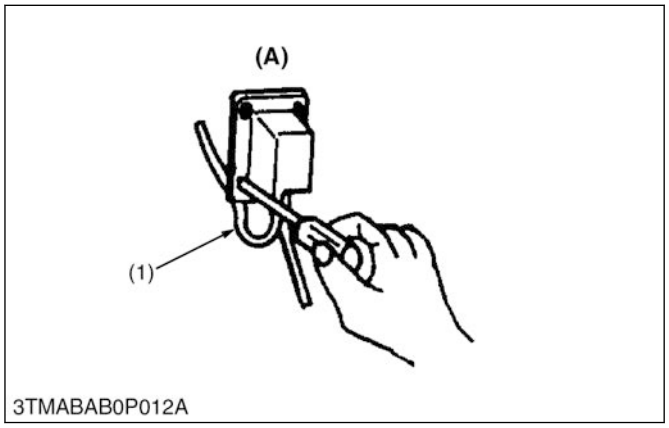

(1) Clamp (Wind clamp spirally)
(2) Wire harness
(3) Clamp
(4) Welding dent

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



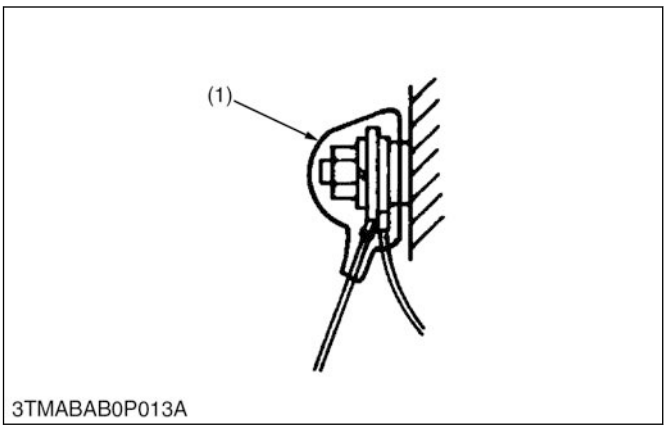

(1) Wiring
(2) Clamp
(A) Correct
(B) Incorrect

- In installing a part, be careful not to get wiring caught by it.




(1) Wiring
(A) Incorrect

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

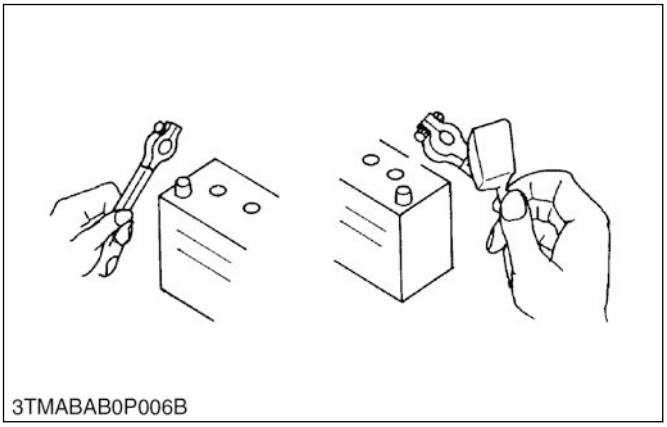



(1) Cover (Securely install cover)

# 2. Handling of battery

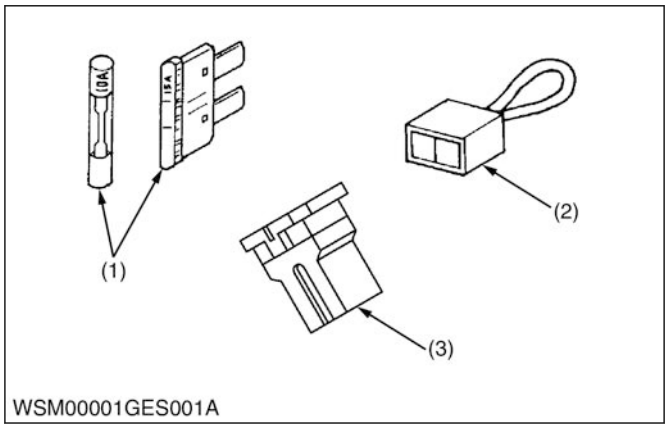
**⚠ WARNING**

- **Be careful 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.**




- Be careful 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.

# 3. Handling of fuse

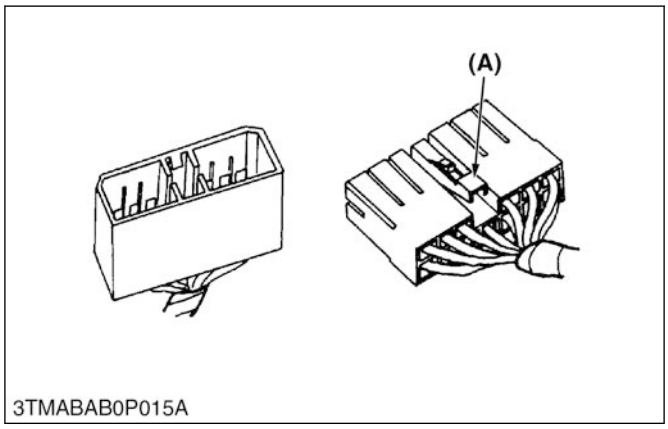



(1) Fuse
(2) Fusible link
(3) Slow blow fuse

- Use fuses with specified capacity.
  Neither too large nor 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.

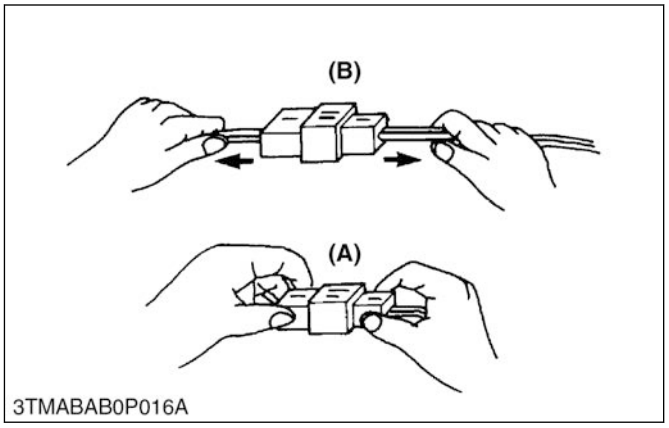
# 4. Handling of connector

- For connector with lock, push lock to separate.



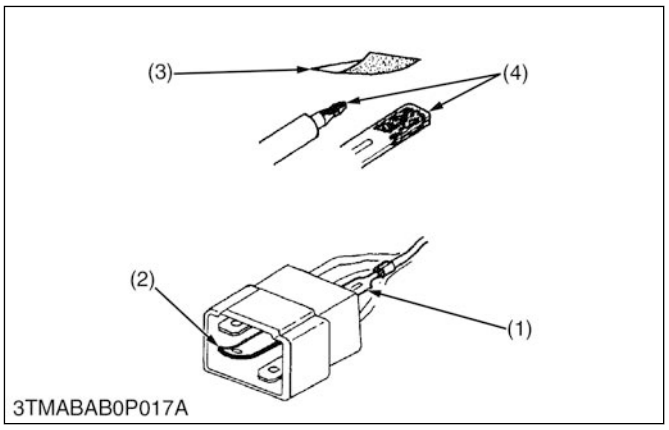

(A) Push

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



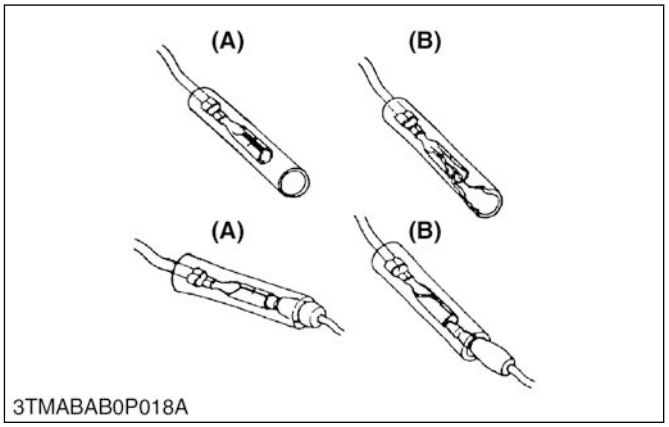

(A) Correct
(B) Incorrect

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



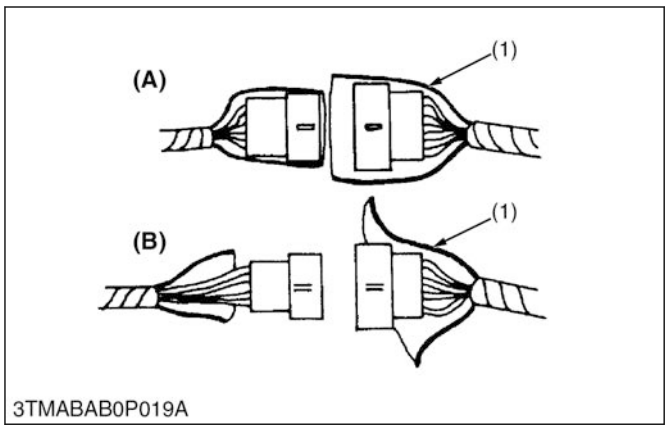

(1) Exposed terminal
(2) Deformed terminal
(3) Sandpaper
(4) Rust

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



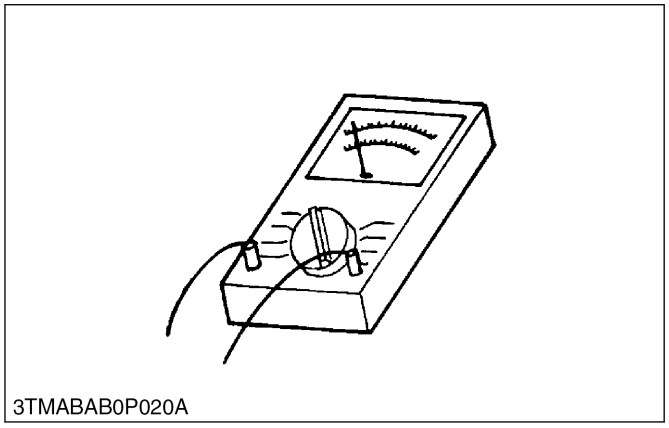

(A) Correct
(B) Incorrect

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



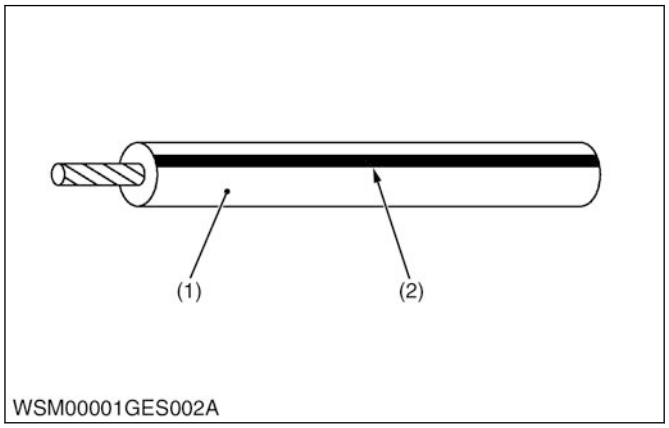

(1) Cover
(A) Correct
(B) Incorrect

# 5. Handling of circuit tester




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

# 6. Color of wiring




(1) Wire color
(2) Stripe

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

**(An example)**

**W/R:**
Red stripe on white color

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

# LUBRICANTS, FUEL AND COOLANT

## 1. Lubricants, fuel and coolant

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Place</th><th colspan="2">Capacity</th><th colspan="2" rowspan="2">Lubricants, fuel and coolant</th></tr>
<tr><th>M5091</th><th>M5111</th></tr>
<tr><td>1</td><td>Fuel</td><td colspan="2">105 L<br>27.7 U.S.gals<br>23.1 Imp.gals</td><td colspan="2">No.2-D S15 diesel fuel<br>No.1-D S15 diesel fuel if temperature is below −10 ℃ (14 ℉)</td></tr>
<tr><td>2</td><td>DEF/AdBlue®</td><td colspan="2">12.3 L<br>13.0 U.S.qts<br>10.8 Imp.qts</td><td colspan="2"></td></tr>
<tr><td rowspan="2">3</td><td>Coolant</td><td colspan="2">10 L<br>10.6 U.S.qts<br>8.8 Imp.qts</td><td colspan="2" rowspan="2">Fresh clean soft water with antifreeze</td></tr>
<tr><td>Recovery tank</td><td colspan="2">1.0 L<br>1.1 U.S.qts<br>0.88 Imp.qts</td></tr>
<tr><td>4</td><td>Washer liquid</td><td colspan="2">1.3 L<br>1.4 U.S.qts<br>1.1 Imp.qts</td><td colspan="2">Automobile washer liquid</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Engine crankcase (with filter)</td><td colspan="2" rowspan="4">10.7 L<br>11.3 U.S.qts<br>9.41 Imp.qts</td><td>• Engine oil:<br>API service classification</td><td>CJ-4<br>(DPF type engine)</td></tr>
<tr><td>Above 25 ℃ (77 ℉)</td><td>SAE30,<br>SAE10W-30 or 15W-40</td></tr>
<tr><td>−10 ℃ to 25 ℃ (14 to 77 ℉)</td><td>SAE10W-30 or 15W-40</td></tr>
<tr><td>Below −10 ℃ (14 ℉)</td><td>SAE10W-30</td></tr>
<tr><td>6</td><td>Transmission case</td><td colspan="2">60 L<br>16 U.S.gals<br>13 Imp.gals</td><td colspan="2">• KUBOTA UDT or SUPER UDT fluid*</td></tr>
<tr><td>7</td><td>Front differential case oil (4WD)</td><td colspan="2">6.0 L<br>6.3 U.S.qts<br>5.3 Imp.qts</td><td colspan="2" rowspan="2">• KUBOTA UDT or SUPER UDT fluid* or SAE 80 - SAE 90 gear oil</td></tr>
<tr><td>8</td><td>Front axle gear case oil (4WD)</td><td colspan="2">3.5 L<br>3.7 U.S.qts<br>3.1 Imp.qts</td></tr>
<tr><td rowspan="10">9</td><td>Greasing</td><td colspan="2">No. of greasing points</td><td>Capacity</td><td>Type of grease</td></tr>
<tr><td>Top link</td><td colspan="2">2</td><td rowspan="8">Until grease overflows.</td><td rowspan="9">Multipurpose grease<br>NLGI-2 or<br>NLGI-1 (GC-LB)</td></tr>
<tr><td>Top link bracket</td><td colspan="2">2</td></tr>
<tr><td>Lift rod</td><td colspan="2">2</td></tr>
<tr><td>Hydraulic lift cylinder pin</td><td colspan="2">4</td></tr>
<tr><td>Front axle gear case support</td><td colspan="2">2</td></tr>
<tr><td>Front axle support</td><td colspan="2">2</td></tr>
<tr><td>Steering joint shaft</td><td colspan="2">1</td></tr>
<tr><td>Battery terminal</td><td colspan="2">2</td><td>A small amount</td></tr>
</table>

**■ NOTE**

- **The product name of Kubota genuine UDT fluid may be different from that in the operator's manual depending on countries or territories.**

**Engine oil**

- The oil used in the engine should have an American Petroleum Institute (API) service classification and proper SAE engine oil according to the ambient temperatures shown in the previous table.
- Refer to the following table for the suitable API classification engine oil according to the diesel particulate filter (DPF) type engines and the fuel.

| Fuel used | Engine oil classification (API classification) |
|---|---|
| | Oil class for engines with DPF |
| Ultra low sulfur fuel <0.0015% (15 ppm) | **CJ-4** |

**Fuel**

- Use the ultra low sulfur diesel fuel only (below 0.0015% or 15 ppm) for these engines.
- Cetane number of 45 minimum. Cetane number greater than 50 is preferred, especially for temperatures below −20 ℃ (−4 ℉) or elevations above 1500 m (5000 ft).
- Diesel fuels specified to EN 590 or ASTM D975 are recommended.
- No.2-D is a distillate fuel of lower volatility for engines in industrial and heavy mobile service (SAE J313 JUN87).

**DEF/AdBlue®:**

The DEF/AdBlue®, used as reducing agent of SCR, is a 32.5% urea aqueous solution.
The product is available at gas stations, truck stops and specialty shops. Be sure to use the genuine product only.

- Use exclusively DEF/AdBlue® that complies with the requirements of ISO 22241-1.

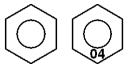
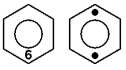
**Transmission oil**

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

**Indicated capacities of water and oil are manufacturer's estimate.**

# TIGHTENING TORQUES

## 1. General use screws, bolts and nuts

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

## 2. Stud bolts

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

# 3. Hydraulic fitting

## 3.1 Hydraulic hose fittings

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

## 3.2 Hydraulic pipe cap nuts

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

## 3.3 Adaptors, elbows and others

| Item | Thread side | Tightening torque | | |
|---|---|---|---|---|
| | | N·m | kgf·m | lbf·ft |
| Fitting with O-ring | G 1/8 | 45 to 53 | 4.5 to 5.5 | 33 to 39 |
| | G 1/4 | 74 to 83 | 7.5 to 8.5 | 55 to 61 |
| | G 3/8 | 93.2 to 102 | 9.50 to 10.5 | 68.8 to 75.9 |
| | G 1/2 | 113 to 122 | 11.5 to 12.5 | 83.2 to 90.4 |
| Elbow with O-ring | G 1/8 | 23 to 26 | 2.3 to 2.7 | 17 to 19 |
| | G 1/4 | 36 to 43 | 3.6 to 4.4 | 26 to 31 |
| | G 3/8 | 54 to 63 | 5.5 to 6.5 | 40 to 47 |
| | G 1/2 | 73 to 83 | 7.4 to 8.5 | 54 to 61 |
| Adapter | G 1/8 | 9.8 to 14 | 1.0 to 1.5 | 7.3 to 10 |
| | G 1/4 | 30 to 34 | 3.0 to 3.5 | 22 to 25 |
| | G 3/8 | 49 to 68 | 5.0 to 7.0 | 37 to 50 |
| | G 1/2 | 69 to 88 | 7.0 to 9.0 | 51 to 65 |

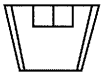
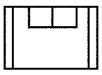
# 4. Metric screws, bolts and nuts

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

# 5. American standard screws, bolts and nuts with UNC or UNF threads

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

# 6. Plugs

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

# MAINTENANCE

## 1. Service intervals

### 1.1 Service intervals

| | Interval | Items | | Ref. page | |
|---|---|---|---|---|---|
| A | initial 50 Hr | Engine oil | Change | 2-24 | |
| | | Engine oil filter | Re-place | 2-24 | |
| B | every 50 Hr | Engine start system | Check | 2-25 | |
| | | Wheel bolt torque | Check | 2-26 | |
| | | Tie-rod dust cover | Check | 2-27 | |
| C | every 100 Hr | Greasing | --- | 2-27 | |
| | | Air cleaner primary element | Clean | 2-29 | *1 |
| | | Fan belt | Adjust | 2-29 | |
| | | Brake pedal | Adjust | 2-30 | |
| | | Parking brake | Check | 2-31 | |
| | | Battery condition | Check | 2-31 | *2 |
| | | Air conditioner drive belt | Adjust | 2-32 | |
| D | every 200 Hr | Toe-in | Adjust | 2-32 | |
| | | Fuel tank water | Drain | 2-32 | |
| | | Inner air filter | Clean | 2-33 | |
| | | Fresh air filter | Clean | 2-33 | *3 |
| E | every 400 Hr | Water separator | Clean | 2-34 | |
| F | every 500 Hr | Engine oil | Change | 2-34 | *4 |
| | | Engine oil filter | Re-place | 2-35 | *4 |
| | | Fuel filter | Re-place | 2-35 | |
| | | Hydraulic oil filter | Re-place | 2-35 | |
| | | Power steering oil line | Check | 2-36 | *5 |
| | | Radiator hose and clamp | Check | 2-37 | *5 |
| | | Fuel line | Check | 2-37 | *5 |
| | | Intake air line | Check | 2-38 | *5 |
| | | Lift cylinder hose | Check | 2-38 | *5 |
| | | Trailer brake hose | Check | 2-39 | *5 |

(Continued)

| | Interval | Items | | Ref. page | |
|---|---|---|---|---|---|
| F | every 500 Hr | Remote control valve hose for auto hitch, push back type (if equipped) | Check | 2-39 | *5 |
| | | Remote control valve hose for front 3-point hitch (if equipped) | Check | 2-39 | *5 |
| | | Air conditioner pipes and hoses | Check | 2-39 | *5 |
| G | every 600 Hr | Front axle pivot | Adjust | 2-39 | |
| H | every 1000 Hr | Transmission fluid | Change | 2-39 | |
| | | Front differential case oil | Change | 2-40 | |
| | | Front axle gear case oil | Change | 2-40 | |
| | | Engine valve clearance | Adjust | 2-40 | |
| I | every 1000 Hr or 1 year *6 | Air cleaner primary element | Re-place | 2-42 | |
| | | Air cleaner secondary element | Re-place | 2-42 | |
| | | Exhaust manifold | Check | 2-42 | |
| | | Fresh air filter | Re-place | - | *3 |
| J | every 1500 Hr | Fuel injector nozzle tip | Check | 2-42 | |
| | | DEF/AdBlue® injector tip | Clean | 2-43 | |
| | | DEF/AdBlue® line | Check | 2-43 | |
| | | Oil separator element | Re-place | 2-43 | |
| | | Positive crankcase ventilation (PCV) valve (oil separator) | Check | 2-44 | |
| | | EGR cooler | Check Clean | 2-44 | |
| K | every 2000 Hr or 2 years *7 | Cooling system | Flush | 2-45 | |
| | | Coolant | Change | 2-46 | |
| L | every 3000Hr | Turbocharger | Check | 2-46 2-47 2-47 | |
| | | Supply pump | Check | 2-47 | |

(Continued)

| | Interval | Items | | Ref. page | |
|---|---|---|---|---|---|
| L | every 3000Hr | Intake air heater | Check | 2-47 | |
| | | EGR system | Check Clean | 2-47 | |
| | | DPF muffler | Clean | 2-48 | |
| | | DEF/AdBlue® injector | Check | 2-48 | |
| | | DEF/AdBlue® pump filter | Re-place | 2-49 | |
| M | every 9000Hr | DEF/AdBlue® tank filter | Re-place | 2-49 | |
| N | every 1 year | Anti-frost heater for oil separator (if equipped) | Check | 2-49 | |
| | | CAB isolation cushion | Check | 2-50 | |
| | | DPF related pipe | Check | 2-50 | |
| | | EGR pipe | Check | 2-50 | |
| O | every 2 years | Oil separator related rubber pipe | Re-place | 2-50 | |
| | | PCV valve hose | Re-place | 2-51 | |
| | | Boost sensor hose | Re-place | 2-51 | |
| | | DPF related rubber pipe | Re-place | 2-51 | |
| | | EGR cooler hose | Re-place | 2-51 | |
| | | Master cylinder filter | Clean | 2-52 | |
| P | every 3 years | Parking brake cable | Re-place | 2-52 | |
| Q | every 4 years | Radiator hose and clamp | Re-place | 2-52 | |
| | | Fuel line | Re-place | 2-53 | |
| | | Intake air line | Re-place | 2-54 | |
| | | Power steering oil line | Re-place | 2-54 | |
| | | Lift cylinder hose | Re-place | 2-54 | |
| | | Master cylinder kit | Re-place | 2-55 | |
| | | Brake seal 1 and 2 | Re-place | 2-55 | |
| | | Trailer brake hose | Re-place | 2-55 | |
| | | Remote control valve hose for auto hitch, push back type (if equipped) | Re-place | 2-55 | |

(Continued)

| | Interval | Items | | Ref. page | |
|---|---|---|---|---|---|
| Q | every 4 years | Remote control valve hose for front 3-point hitch (if equipped) | Re-place | 2-55 | |
| | | Air conditioner pipes and hoses | Re-place | 2-55 | |
| R | every fuel refilling interval | Refilling DEF/AdBlue® | Add | 2-13 | |
| S | Service as required | Fuel system | Bleed | 2-55 | |
| | | Brake system | Bleed | 2-56 | |
| | | Secondary brake | Re-place | 2-57 | |
| | | Clutch housing water | Drain | 2-57 | |
| | | Fuse | Re-place | 2-57<br>2-57<br>2-59 | |
| | | Light bulb | Re-place | 2-60<br>2-60 | |
| | | Head lamp | Re-place | 2-60 | |
| | | Lubricating point for door and window | — | 2-61 | |
| | | Washer liquid | Add | 2-61 | |
| | | Refrigerant (gas) | Check | 2-61 | |

*1 Air cleaner should be cleaned more often in dusty conditions than in normal conditions.

*2 When the battery is used for less than 100 hours per year, check the battery condition by reading the indicator annually.

*3 Clean and replace the fresh air filter more frequently if used under dusty conditions. When the filter is very dirty from dusty conditions, replace the filter.

*4 The initial 50 hours should not be a replacement cycle.

*5 Replace if any deterioration (crack, hardening, scar, or deformation) or damage occurred.

*6 Every 1000 hours or every 1 year, whichever comes first.

*7 Every 2000 hours or every 2 years, whichever comes first.

## 1.2 Maintenance items chart

### How to use the chart

1. The circles in this at-a-glance chart indicate the relevant points between the tractor's hour meter readings and the service intervals. Following these circles and the maintenance item group (A thru P), keep up your tractor.
2. Details regarding maintenance items can be found in a different section.

## Chart at a glance

| Hour meter | Maintenance items | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q |
| 50 | ○ | ○ | | | | | | | | | | | | | | | |
| 100 | | ○ | ○ | | | | | | | | | | | | | | |
| 150 | | ○ | | | | | | | | | | | | | | | |
| 200 | | ○ | ○ | ○ | | | | | | | | | | | | | |
| 250 | | ○ | | | | | | | | | | | | | | | |
| 300 | | ○ | ○ | | | | | | | | | | | | | | |
| 350 | | ○ | | | | | | | | | | | | | | | |
| 400 | | ○ | ○ | ○ | ○ | | | | | | | | | | | | |
| 450 | | ○ | | | | | | | | | | | | | | | |
| 500 | | ○ | ○ | | | ○ | | | | | | | | | | | |
| 550 | | ○ | | | | | | | | | | | | | | | |
| 600 | | ○ | ○ | ○ | | | ○ | | | | | | | | | | |
| 650 | | ○ | | | | | | | | | | | | | | | |
| 700 | | ○ | ○ | | | | | | | | | | | | | | |
| 750 | | ○ | | | | | | | | | | | | | | | |
| 800 | | ○ | ○ | ○ | ○ | | | | | | | | | | | | |
| 850 | | ○ | | | | | | | | | | | | | | | |
| 900 | | ○ | ○ | | | | | | | | | | | | | | |
| 950 | | ○ | | | | | | | | | | | | | | | |
| 1000 | | ○ | ○ | ○ | | ○ | | ○ | | | | | | | | | |
| 1050 | | ○ | | | | | | | | | | | | | | | |
| 1100 | | ○ | ○ | | | | | | | | | | | | | | |
| 1150 | | ○ | | | | | | | | | | | | | | | |
| 1200 | | ○ | ○ | ○ | ○ | | ○ | | | | | | | | | | |
| 1250 | | ○ | | | | | | | | | | | | | | | |
| 1300 | | ○ | ○ | | | | | | | | | | | | | | |
| 1350 | | ○ | | | | | | | | | | | | | | | |
| 1400 | | ○ | ○ | ○ | | | | | | | | | | | | | |
| 1450 | | ○ | | | | | | | | | | | | | | | |
| 1500 | | ○ | ○ | | | ○ | | | | ○ | | | | | | | |
| 1550 | | ○ | | | | | | | | | | | | | | | |
| 1600 | | ○ | ○ | ○ | ○ | | | | | | | | | | | | |
| 1650 | | ○ | | | | | | | | | | | | | | | |
| 1700 | | ○ | ○ | | | | | | | | | | | | | | |
| 1750 | | ○ | | | | | | | | | | | | | | | |
| 1800 | | ○ | ○ | ○ | | | ○ | | | | | | | | | | |
| 1850 | | ○ | | | | | | | | | | | | | | | |
| 1900 | | ○ | ○ | | | | | | | | | | | | | | |

(Continued)

| Hour meter | Maintenance items | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q |
| 1950 | | ○ | | | | | | | | | | | | | | | |
| 2000 | | ○ | ○ | ○ | ○ | ○ | | ○ | | | | | | | | | |
| 2050 | | ○ | | | | | | | | | | | | | | | |
| 2100 | | ○ | ○ | | | | | | | | | | | | | | |
| 2150 | | ○ | | | | | | | | | | | | | | | |
| 2200 | | ○ | ○ | ○ | | | | | | | | | | | | | |
| 2250 | | ○ | | | | | | | | | | | | | | | |
| 2300 | | ○ | ○ | | | | | | | | | | | | | | |
| 2350 | | ○ | | | | | | | | | | | | | | | |
| 2400 | | ○ | ○ | ○ | ○ | | ○ | | | | | | | | | | |
| 2450 | | ○ | | | | | | | | | | | | | | | |
| 2500 | | ○ | ○ | | | ○ | | | | | | | | | | | |
| 2550 | | ○ | | | | | | | | | | | | | | | |
| 2600 | | ○ | ○ | ○ | | | | | | | | | | | | | |
| 2650 | | ○ | | | | | | | | | | | | | | | |
| 2700 | | ○ | ○ | | | | | | | | | | | | | | |
| 2750 | | ○ | | | | | | | | | | | | | | | |
| 2800 | | ○ | ○ | ○ | ○ | | | | | | | | | | | | |
| 2850 | | ○ | | | | | | | | | | | | | | | |
| 2900 | | ○ | ○ | | | | | | | | | | | | | | |
| 2950 | | ○ | | | | | | | | | | | | | | | |
| 3000 | | ○ | ○ | ○ | | ○ | ○ | ○ | | ○ | | ○ | | | | | |
| 9000 | | | | | | | | | | | | | ○ | | | | |
| Every 1000Hr or 1 year | | | | | | | | | ○ | | | | | | | | |
| Every 2000Hr or 2 years | | | | | | | | | | | ○ | | | | | | |
| Every 1 year | | | | | | | | | | | | | | ○ | | | |
| Every 2 years | | | | | | | | | | | | | | | ○ | | |
| Every 3 years | | | | | | | | | | | | | | | | ○ | |
| Every 4 years | | | | | | | | | | | | | | | | | ○ |

# CHECK AND MAINTENANCE

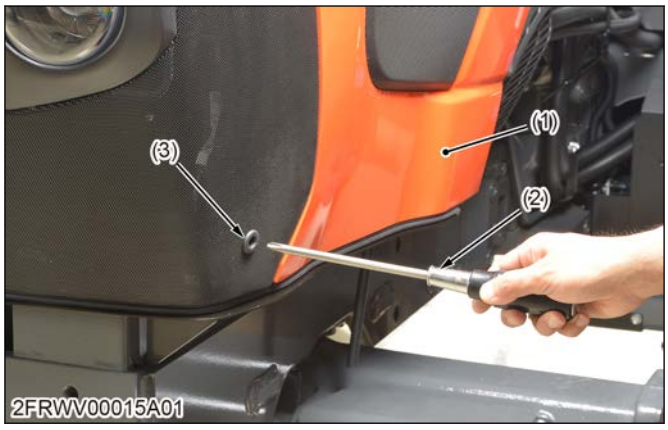
**CAUTION**
- **Check and service the tractor on a flat place with engine stop, the parking brake on and chock the wheels.**

## 1. Periodic service

**WARNING**
**To avoid serious injury:**
- **Do not work under any hydraulically supported devices. They can settle, suddenly leak down, or be accidentally lowered. If necessary to work under tractor or any machine elements for servicing or adjustment, securely support them with stands or suitable blocking beforehand.**

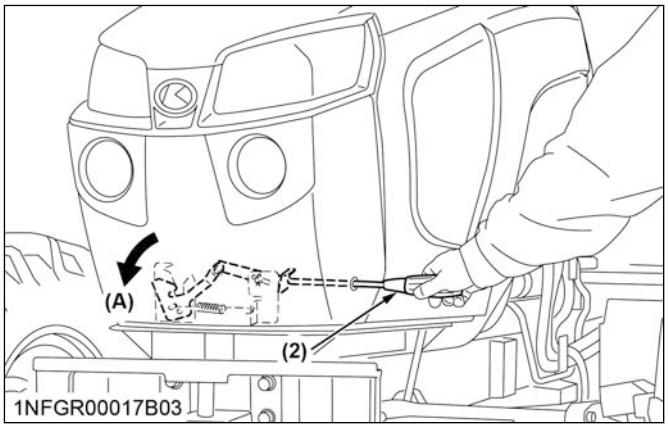
### 1.1 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).




(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).




(2) Screwdriver
(A) Unlock position

### 1.2 Daily check

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

#### 1.2.1 Warning

**WARNING**
**To avoid personal injury or death:**
- **Do not work under any hydraulically supported devices. They can settle, suddenly leak down, or be accidentally lowered. If necessary to work under tractor or any machine elements for servicing or adjustment, securely support them with stands or suitable blocking beforehand.**

#### 1.2.2 Checking daily

- Check areas where previous trouble was experienced.

1. Walk around the tractor.
   a. Check and refueling.
   b. Check the DEF/AdBlue® level and add the fluid.
   c. Check the water separator.
   d. Check the engine oil level.
   e. Check the transmission fluid level.
   f. Check the coolant level.
   g. Clean the air cleaner evacuator valve.
   h. Check the dust indicator.
   i. Check and clean the radiator screen, grill, oil cooler, and battery mount.
   j. Check and clean the air conditioner condenser screen. (Cabin model)
   k. Check the DPF/SCR Muffler.
   l. Clean around the exhaust manifold and the muffler of the engine.
   m. Check the condition of ROPS attaching hardware. (ROPS model).
   n. Check the tire pressure, and check for wear and damage.
   o. Check the nuts of tires are tight.
   p. Check the number plate for damage and replace as necessary if equipped.
   q. Care of danger, warning and caution labels (pictorial safety labels).
   r. Check the washer liquid level. (Cabin model)
2. While sitting in the operator's seat.
   a. Check the brake pedal.
   b. Check the clutch pedal.
   c. Check the parking brake.
   d. Check the steering wheel.
   e. Check seat belt.
3. Turning the key switch.
   a. Check the performance of the gauges, meter and Easy Checker™.
   b. Check head light, turn signal / hazard light etc..
4. Starting the engine.
   a. Check to see that the lights on the Easy Checker™ go off.
   b. Check the color of the exhaust gas.
   c. Check the brakes for proper operation.

## 1.3 Check points of initial 50 hours

With a new machine, be sure to do the servicing, as discussed below, after the first 50 operating hours.

### 1.3.1 Changing engine oil

**⚠ WARNING**

**To avoid personal injury or death:**

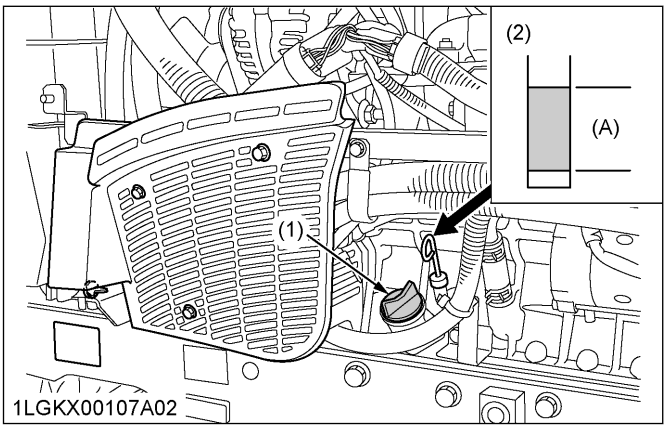
- **Be sure to stop the engine before changing the oil.**
- **Allow the engine to cool down sufficiently; oil can be hot and can burn.**

1. To drain the used oil, remove the drain plug at the bottom of the engine and drain the oil completely into the oil pan.
2. After draining, reinstall the drain plug.
3. Fill with new oil up to the upper notch on the dipstick.

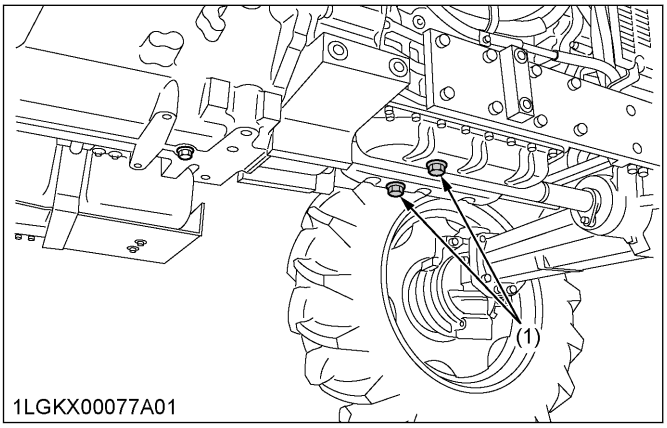
| | |
|---|---|
| Oil capacity with filter | 10.7 L<br>11.3 U.S.qts<br>9.4 Imp.qts |

**■ IMPORTANT**

- **Use DPF-compatible oil (CJ-4) for the engine.**




(1) Oil inlet
(2) Dipstick
(A) Oil level is acceptable within this range




(1) Drain plug

### 1.3.2 Replacing engine oil filter

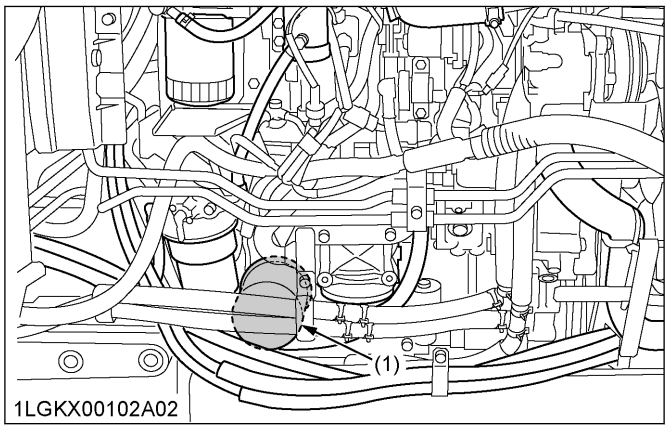
**⚠ WARNING**

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

**IMPORTANT**

- **To prevent serious damage to the engine, use of KUBOTA genuine filter is recommended.**

1. Remove the oil filter (1).




(1) Engine oil filter

2. Put a film of clean engine oil on rubber seal of new filter.
3. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hands an additional 1/2 turn only.

- After the new filter has been replaced, the engine oil normally decreases a little. Make sure that the engine oil does not leak through the seal and be sure to check the oil level on the dipstick. Then, fill the engine oil up to the prescribed level.

# 1.4 Check points of every 50 hours

## 1.4.1 Checking engine start system

**WARNING**

**To avoid personal injury or death:**

- **Do not allow anyone near the tractor while testing.**
- **If the tractor does not pass the test, do not operate the tractor.**

**Preparation before testing.**

1. Place all control levers in the **NEUTRAL** position.
2. Set the parking brake and stop the engine.

**Test: Switch for the shuttle shift lever.**

1. Sit on the operator's seat.
2. Shift the shuttle shift lever to the forward or reverse position.
3. Depress the clutch pedal fully.
4. Disengage the PTO clutch control switch or lever.
5. Turn the key to **START** position.
6. The engine must not crank.
7. If it cranks, inspect the safety switch.

**Test: Switch for the PTO clutch control switch or lever.**

1. Sit on operator's seat.
2. Engage the PTO clutch control switch or lever.
3. Depress the clutch pedal fully.
4. Shift the shuttle shift lever to the **neutral** position.
5. Turn the key to **START** position.
6. The engine must not crank.
7. If it cranks, inspect the safety switch.

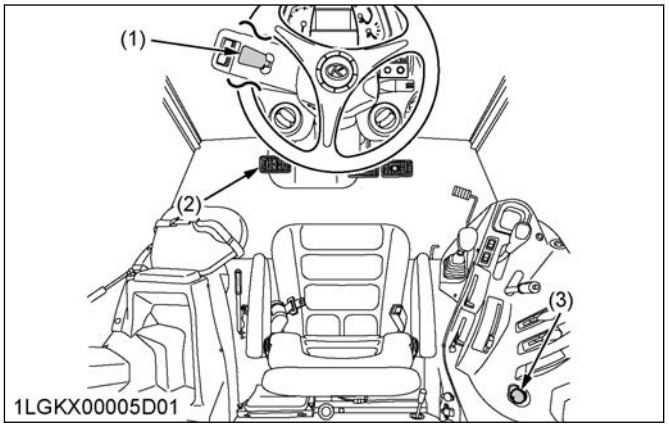
**Test: Checking Operator Presence Control (O.P.C.) System.**

**WARNING**

**To avoid personal injury or death:**

- **Before checking the PTO OPC, make sure that the PTO drive shaft should be disconnected from the tractor.**
- **If the buzzer does not sound during the PTO OPC check procedure, stop engine and inspect the PTO OPC system.**
- **The unit should not be operated until servicing is completed.**

1. Make sure the PTO drive shaft is disconnected from the tractor.
2. Sit on the operator's seat.
3. Start the engine.
4. Engage the PTO clutch control switch or lever. The PTO should begin to rotate. Disengage the PTO clutch control switch or lever.
5. While lifting yourself from the seat, engage the PTO clutch control switch or lever.
   a. The PTO should begin to rotate and a buzzer should sound.
   b. Disengage the PTO clutch control switch or lever.
   c. If the buzzer does not sound, stop the engine.
6. If the PTO OPC is operating properly, stop the engine, and reconnect the implement drive shaft to the PTO. Restart the engine per the available instructions.



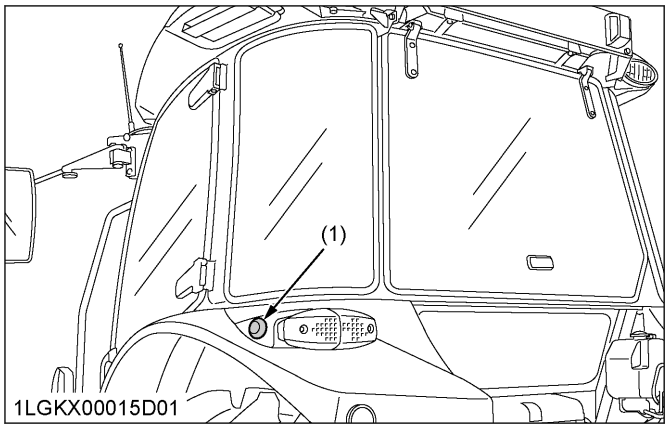

(1) Shuttle shift lever
(2) Clutch pedal
(3) PTO clutch control switch

## 1.4.2 Checking PTO control system

**⚠ WARNING**

**To avoid personal injury or death:**

- **Do not allow anyone near the tractor while testing.**
- **If the tractor does not pass the test, do not operate the tractor.**




(1) External switch for rear PTO

**Preparation before testing**

1. Place all control levers in the **NEUTRAL** position.
2. Set the parking brake and stop the engine and lower all implements.
3. Disconnect the PTO drive shaft from the tractor.

**Testing switch for the external rear PTO**

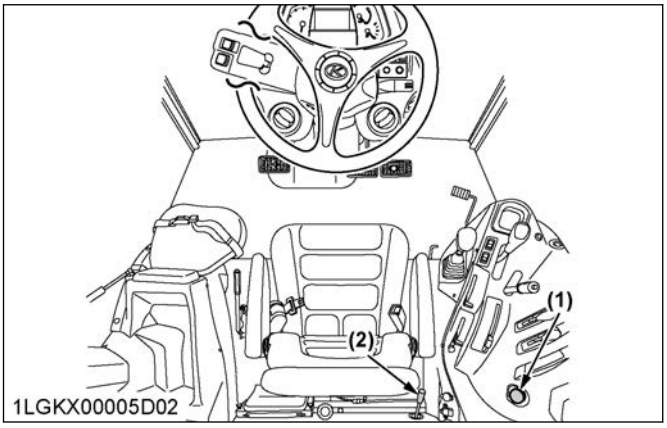
1. Park the tractor safely.
2. Sit on the operator's seat.
3. Make sure the parking brake lever is parked position and the PTO drive shaft is disconnected from any attached implement.
4. Start the engine.
5. Select PTO rotation with the PTO gear shift lever (if equipped).
6. Dismount from a tractor.
7. Exit the tractor.
8. Press the external rear PTO switch and check the following items:
   a. Pushing and holding down the switch for less than 3 seconds stops the PTO.
   b. Pushing and holding down the switch for more than 3 seconds does not stop the PTO.
   c. Pressing the switch again stops the PTO.
   d. Releasing the parking brake stops the PTO.

## 1.4.3 Checking operator presence control (OPC) system

**⚠ WARNING**

**To avoid personal injury or death:**

- **Do not allow anyone near the tractor while testing.**
- **If the tractor does not pass the test, do not operate the tractor.**
- **Before checking the PTO OPC, make sure that the PTO drive shaft is disconnected from the tractor.**
- **The unit should not be operated until servicing is completed.**




(1) PTO clutch control switch (2) PTO gear shift lever (if equipped)

**Preparation before testing**

1. Place all control levers in the **NEUTRAL** position.
2. Set the parking brake and stop the engine and lower all implements.

**Testing OPC system**

1. Park the tractor safely.
2. Make sure the PTO drive shaft is disconnected from the tractor.
3. Sit on the operator's seat.
4. Start the engine.
5. Engage the PTO gear shift lever (if equipped).
6. Engage the PTO clutch control switch. The PTO should begin to rotate. Disengage the PTO clutch control switch.
7. Check the following items.
   a. While the tractor is stopped, standing up from the operator's seat will stop the PTO within 1 second.
   b. Even if the PTO clutch control switch is engaged, the PTO will not start if the operator is standing up from the operator's seat.
   c. The PTO is rotating and the tractor is traveling at low speeds. Standing up from the operator's seat will set off the warning buzzer (the PTO will continue rotating).
   d. Standing up from the operator's seat while the key switch is at **ON** position and the parking brake is released will set off the warning buzzer.

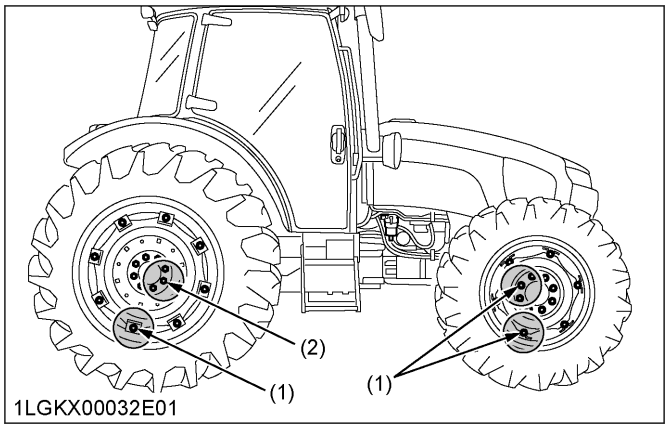
## 1.4.4 Checking wheel bolt torque

**⚠ WARNING**

**To avoid personal injury or death:**

- **Never operate the tractor with a loose rim, wheel or axle.**
- **Any time bolts and nuts are loosened, retighten to the specified torque.**
- **Check all bolts and nuts frequently and keep them tight.**

Check wheel bolts and nuts regularly, especially when new. If they are loose, tighten them as follows.




(1) Front wheel mounting nut / Rear disc mounting nut (2) Rear wheel mounting nut

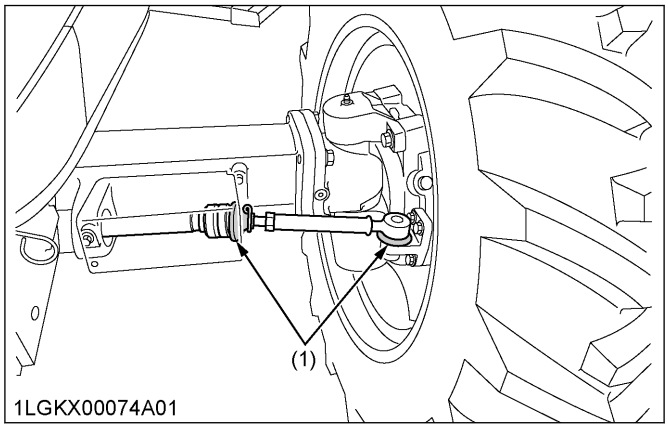
| | | |
|---|---|---|
| Tightening torque | Front wheel mounting nut / Rear disc mounting nut | 260 to 304 N·m<br>26.5 to 31 kgf·m<br>192 to 224 lbf·ft |
| | Rear wheel mounting nut | 343 to 401 N·m<br>35.0 to 41.0 kgf·m<br>253 to 295 lbf·ft |

### 1.4.5 Checking tie-rod dust cover

**■ IMPORTANT**

- **If dust covers are cracked, water and dust invade into tie-rod and it will be early wear.**

1. Check to see that dust covers are not damaged.




(1) Dust cover

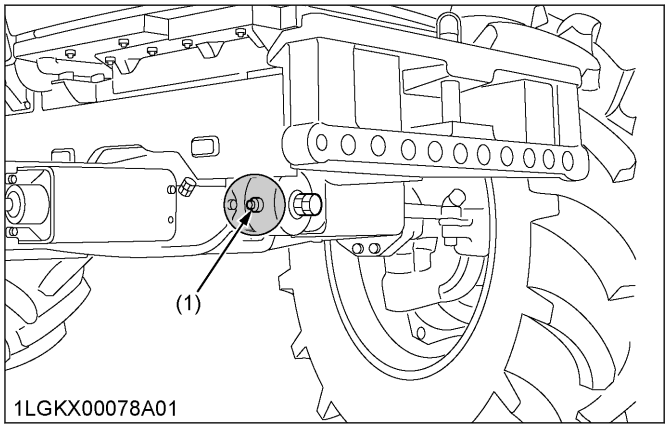
2. If dust covers are damaged, replace or repair them at once.

## 1.5 Check points of every 100 hours

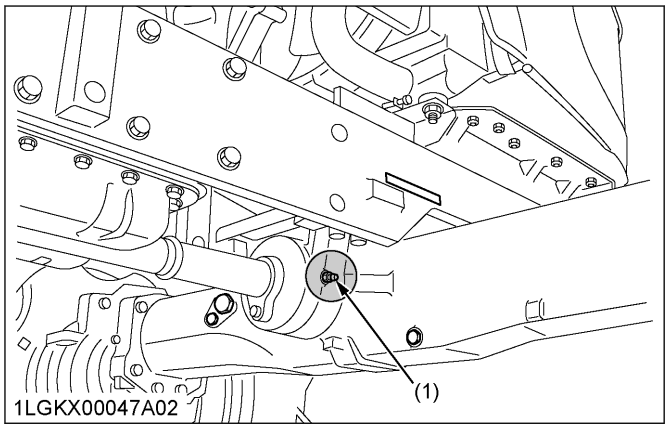
### 1.5.1 Lubricating grease fittings

1. Apply a small amount of multipurpose grease to the following points every 100 hours:

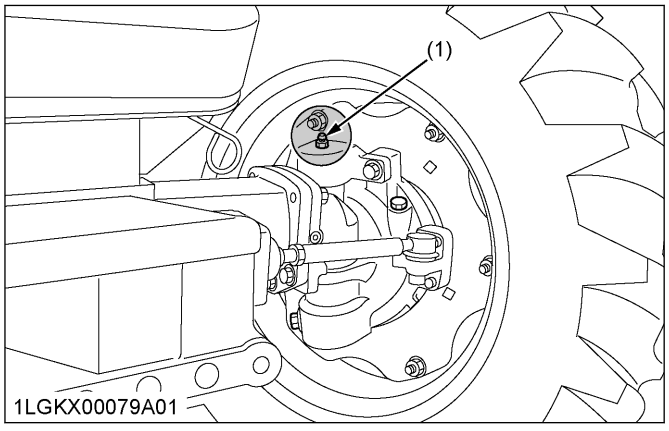
2. If you operated the machine in extremely wet and muddy conditions, lubricate grease fittings more often.



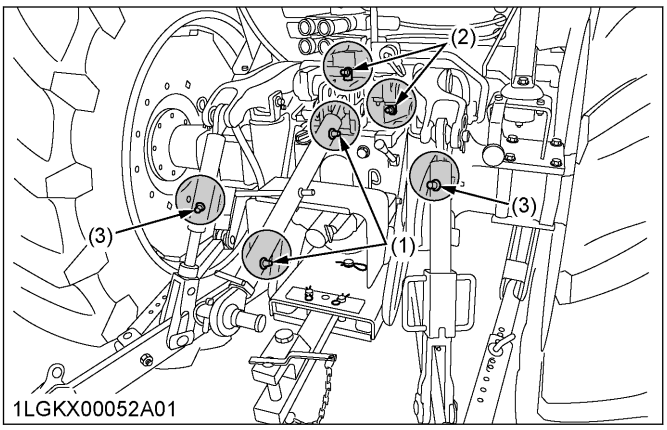

(1) Grease fitting (front axle support)



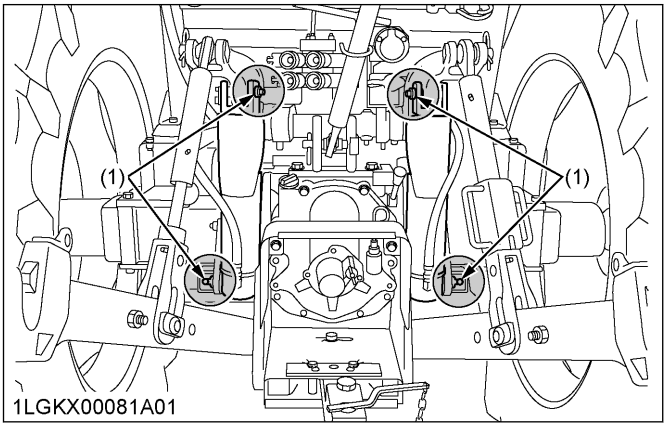

(1) Grease fitting (front axle support)



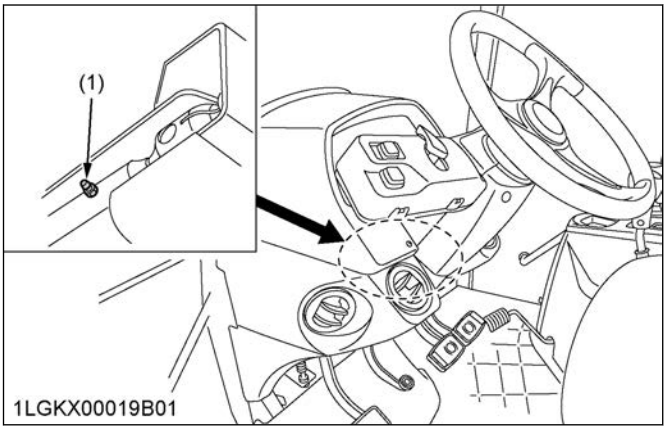

(1) Grease fitting (front axle gear case support) - RH, LH



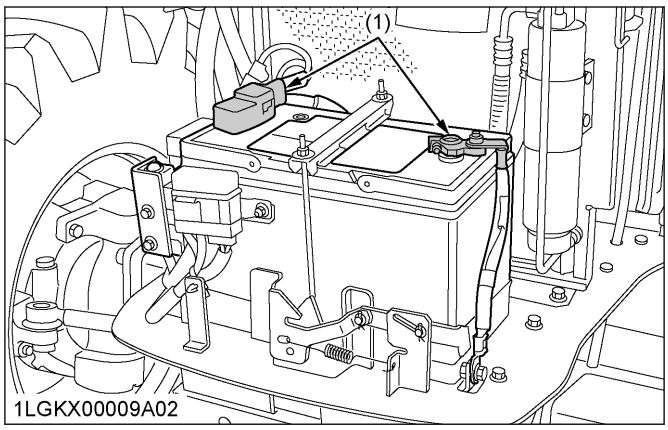

(1) Grease fitting (top link)
(2) Grease fitting (top link bracket)
(3) Grease fitting (lifting rod)




(1) Grease fitting (hydraulic lift cylinders pin)




(1) Grease fitting (steering joint shaft)




(1) Battery terminals

## 1.5.2 Cleaning air cleaner primary element

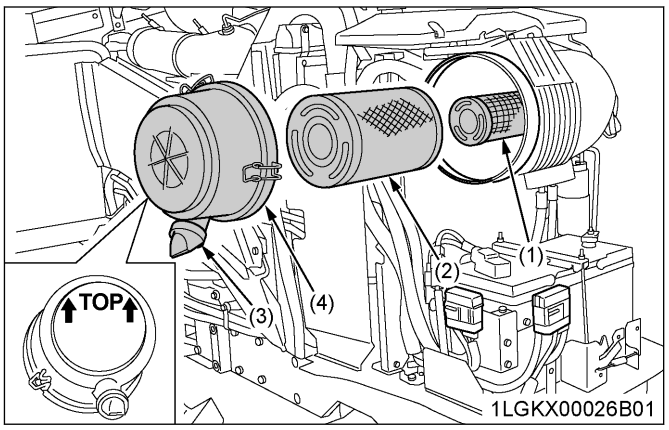
**■ NOTE**

- **If the air conditioner condenser is pulled out when cleaning the air cleaner, the air cleaner cover can be detached and attached easily.**

1. Remove the air cleaner cover and primary element.
2. Clean the primary element:
   - When dry dust adheres to the element, blow compressed air from the inside, turning the element. Pressure of compressed air must be under 205 kPa (2.1 kgf/cm$^2$, 30 psi).
   - When carbon or oil adheres to the element, soak the element in detergent for 15 minutes, then wash it several times in water, rinse with clean water and dry it naturally. After the element has fully dried, inspect inside the element with a light and check for damage.
3. Replace the air cleaner primary element:
   Once every 1000 hours or yearly, whichever comes first.

**■ NOTE**

- **Check to see if the evacuator valve is blocked with dust.**




(1) Secondary (safety) element (4) Cover
(2) Primary element
(3) Evacuator valve

**■ IMPORTANT**

- **The air cleaner uses a dry element; never apply oil.**
- **Do not run the engine with the filter element removed.**
- **Be sure to refit the cover with the arrow ⬆ (on the rear of the cover) upright. If the cover is improperly fitted, the evacuator valve will not function and dust will adhere to the element.**
- **Do not touch the secondary element except in cases where replacing is required.**

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

## 1.5.3 Adjusting fan belt tension

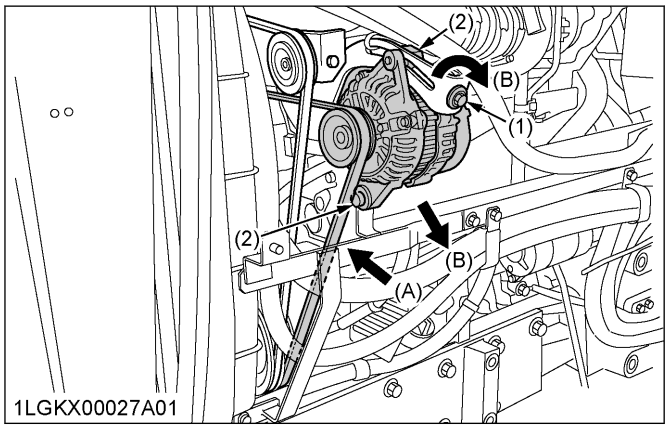
**⚠ WARNING**
**To avoid personal injury or death:**

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

| | |
|---|---|
| Proper fan belt tension | A deflection of between 13 to 15 mm (0.52 to 0.59 in.) when the belt is pressed in the middle of the span. |

1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to the belt between pulleys.
3. If the tension is incorrect, loosen the alternator mounting bolts and turn the adjusting bolt to adjust the belt tension within acceptable limits.

4. Replace the fan belt if it is damaged.




(1) Adjusting bolt
(2) Alternator mounting bolt
(A) Check the belt tension
(B) To tighten

## 1.5.4 Adjusting brake pedal

**⚠ WARNING**

**To avoid personal injury or death:**

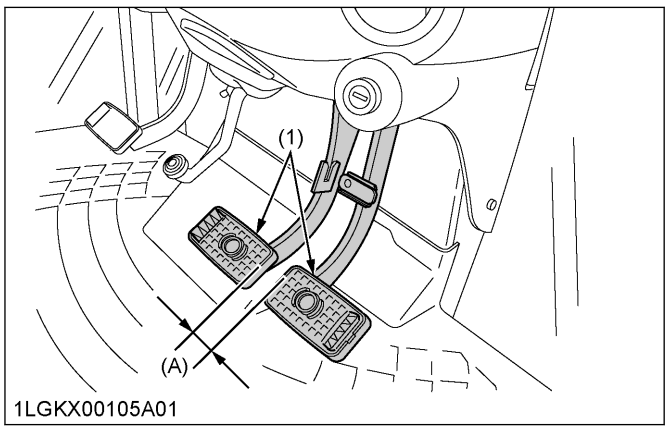
- **Stop the engine and chock the wheels before checking brake pedal.**
- **To prevent uneven braking, the specification must be within the recommended limit. If found out of the specifications, adjust the brakes.**

**Checking brake pedal free travel**

**■ NOTE**

- **Brake pedals should be equal when depressed.**

1. Set the parking brake.
2. Slightly depress the brake pedals and measure free travel at the top of pedal stroke.



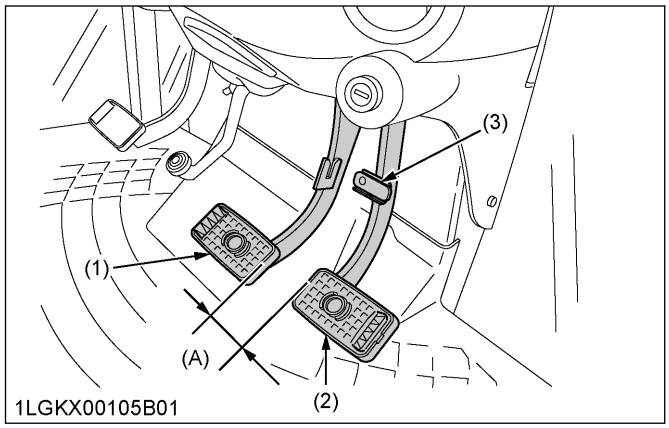

(1) Brake pedals
(A) Free travel

| | | |
|---|---|---|
| Proper brake pedal free travel | Right brake pedal | 7 to 14 mm (0.28 to 0.55 in.) on the pedal |
| | Left brake pedal | Right brake free travel (actual value) +5 to 10 mm (0.20 to 0.39 in.) on the pedal. |
| Step on the right brake, and the trailer hydraulic brake allows some pilot oil to flow. This means that the free travel is different between the left and right brakes. | | |

3. If the measured value is not within the factory specifications, adjust the free travel by the push rod (2).
4. After adjustment, tighten the lock nut firmly.

**Checking the brake pedal stroke**

1. Disengage the brake pedal lock.
2. Depress the brake pedal several times.
3. Step on the right-hand pedal and measure the level difference (pedal stroke) between this pedal and the left-hand pedal.



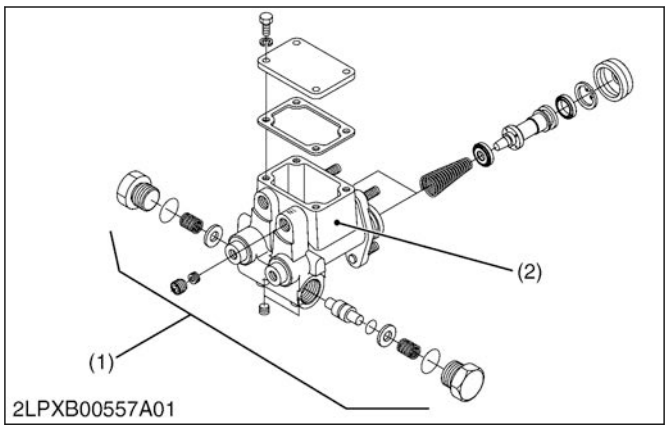

(1) Brake pedal (LH)
(2) Brake pedal (RH)
(3) Brake pedal lock
(A) Pedal stroke

| | |
|---|---|
| Pedal stroke | Less than 100 mm (3.94 in.) at each pedal |

4. Do the same for the left-hand pedal.
5. If the pedal stroke (L) exceeds the factory specification, check the air bleeding, master cylinder, equalizer or brake case.

**Checking the equalizer working level (anti-imbalance device)**

1. Gently step on both brake pedals at once.
2. Further step on the right-hand pedal (the left-hand pedal slightly raises itself) and measure the level difference between the pedals.
3. Do the same for the left-hand pedal.




(1) Equalizer (2) Master cylinder

| | |
|---|---|
| Equalizer working level | Minimum level difference of 5 mm (0.2 in.) between both pedals |

4. If the measured value is not within the factory specification, check the equalizer (2).

### 1.5.5 Checking parking brake lever

**⚠ WARNING**

**To avoid personal injury or death:**

- **Do not dismount the tractor while checking the parking brake.**

Confirm the tractor (tractor unit only) can surely be parked on the slope of about 15 degrees (slope that rises by 2.7 meters every 10 meters).

### 1.5.6 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.**

**⚠ WARNING**

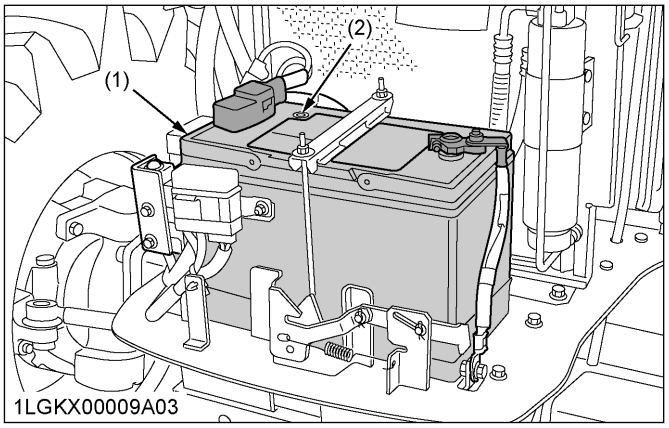
**To avoid personal injury or death:**

- **Never remove the battery cap while the engine is operating.**
- **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.**
- **Keep open sparks and flames away from the battery at all times. Hydrogen gas mixed with oxygen becomes very explosive.**
- **Wear eye protection and rubber gloves when working around battery.**

**■ NOTE**

- **The factory-installed battery is of non-refillable type. If the indicator turns white, do not charge the battery but replace it with new one.**

Mishandling the battery shortens the service life and adds to maintenance costs.
The original battery is maintenance free, but needs some servicing.
If the battery is weak, the engine will be difficult to start and the lights will be dim. It is important to check the battery periodically.




(1) Battery (2) Indicator

How to read the indicator.

**■ NOTE**

- **When seeing the indicator, check from directly above by removing the air cleaner cover or using a mirror.**
- **Check the battery condition by reading the indicator.**

| State of indicator display | |
|---|---|
| Green | Specific gravity of electrolyte and quality of electrolyte are both in good condition. |
| Black | Needs charging battery. |
| White | Needs replacing battery. |

#### 1.5.6.1 Directions for storage of battery

1. When storing the tractor for long periods of time, remove the battery from tractor, adjust the electrolyte to the proper level and store in a dry place out of direct sunlight.
2. To prevent battery self-discharge while the tractor is stored, recharge the battery once every 3 months in

hot seasons and once every 6 months in cold seasons.

**(Reference)**

**Self-discharge rate**

| Temperature | Self-discharge rate |
|---|---|
| 30 ℃ (86 ℉) | Approx. 1.0% per day |
| 20 ℃ (68 ℉) | Approx. 0.5% per day |
| 10 ℃ (50 ℉) | Approx. 0.25% per day |

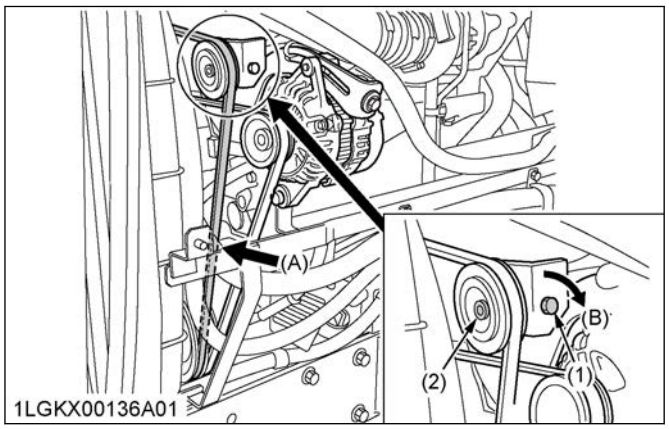
### 1.5.7 Adjusting air conditioner belt tension

**⚠ WARNING**

**To avoid personal injury or death:**

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

1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to belt between pulleys.
3. If tension is incorrect, loosen the tension pulley mounting nut and turn the adjusting bolt to adjust the belt tension within acceptable limits.




(1) Adjusting bolt
(2) Tension pulley mounting nut
(A) Check the belt tension
(B) To tighten

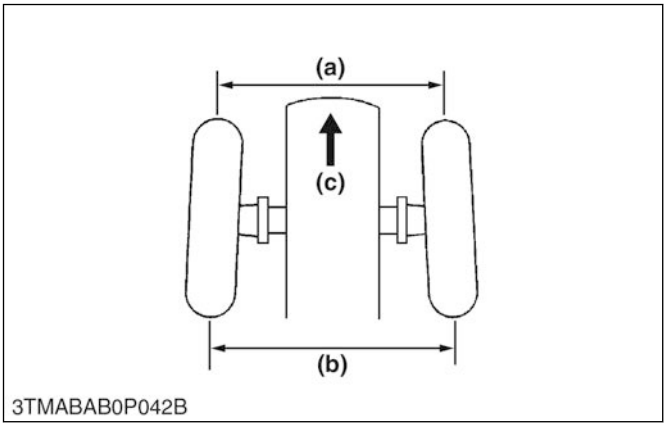
| | |
|---|---|
| Proper air conditioner belt tension | A deflection of between 10 to 12 mm (0.40 to 0.47 in.) when the belt is pressed (98 N / 10 kgf / 22 lbf) in the middle of the span. |

4. Replace air-conditioner belt if it is damaged.

## 1.6 Check points of every 200 hours

### 1.6.1 Checking toe-in

1. Park tractor on a flat place.
2. Turn steering wheel so that front wheels are in the straight ahead position.
3. Lower the implement, lock the park brake and stop the engine.
4. Measure distance (a) between tire beads at front of tire, hub height.
5. Measure distance (b) between tire beads at rear of tire, hub height.




(a) Wheel-to-wheel distance at front
(b) Wheel-to-wheel distance at rear
(c) "FRONT"

6. Front distance should be shorter than rear distance.
7. If not, adjust tie-rod length.

| | | |
|---|---|---|
| Toe-in (b–a) | Factory specification | 2.0 to 8.0 mm<br>0.079 to 0.31 in. |

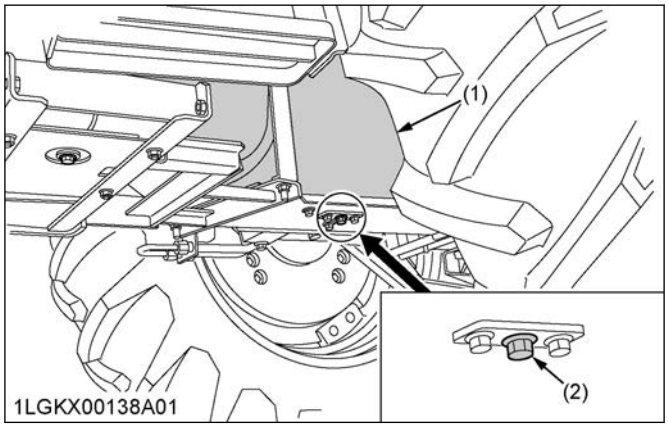
RELATED PAGE
2.6 Toe-in gauge on page 2-80

### 1.6.2 Draining fuel tank water

**■ IMPORTANT**

- **If the fuel contains impurities, such as water, drain it from the fuel tank at shorter intervals.**
- **Drain the water and the fuel from the fuel tank before operating the tractor after a long period of storage.**
- **The fuel tank is made of plastic. Don't overtighten the bolts.**

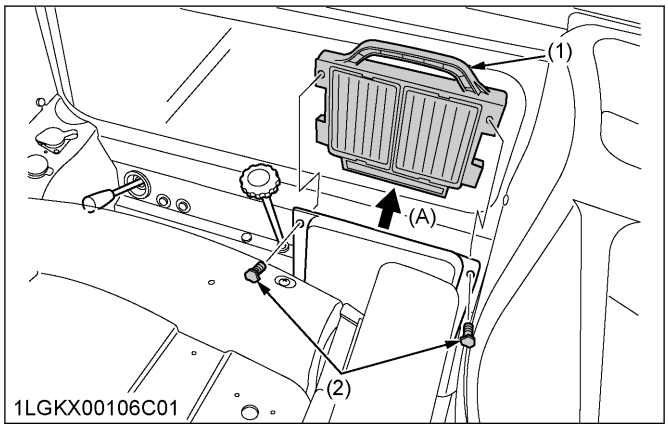
1. Loosen the drain plug at the bottom of the fuel tank to let sediments, impurities and water from the tank. Finally tighten up the plug.




(1) Fuel Tank (left) (2) Drain plug

## 1.6.3 Cleaning inner air filter

1. Remove the knob bolts and pull out filter.
2. Blow air from the direction opposite to the filter's normal air flow.
   Pressure of compressed air must be under 205 kPa (2.1 kgf/cm$^2$ , 30 psi).

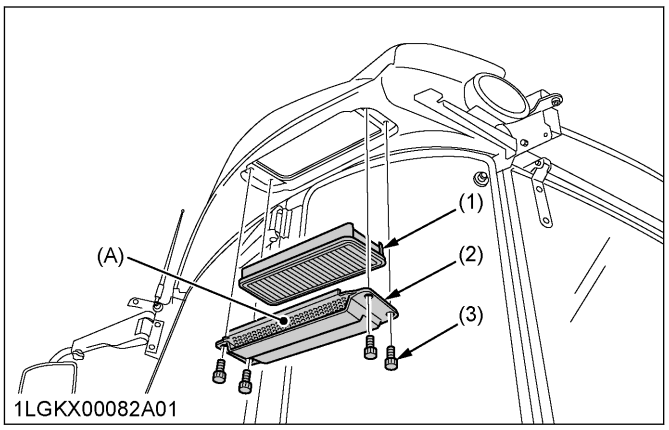



(1) Inner air filter (A) Pull out
(2) Knob bolts

## 1.6.4 Cleaning fresh air filter

**■ NOTE**
- **Attach the filter and cover as the illustrated below.**

1. Remove the knob bolts and pull out the fresh air filter.




(1) Fresh air filter (3) Knob bolt
(2) Cover (A) Air inlet port

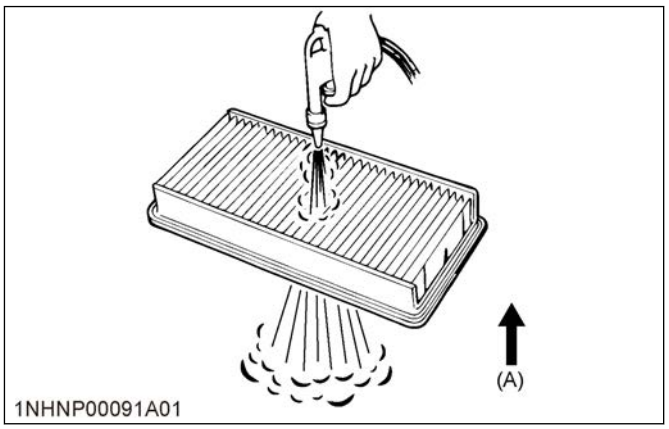
**Cleaning air filter**

**■ IMPORTANT**
- **Do not hit the filter. If the filter becomes deformed, dust may enter into the air-conditioner, which may cause damage and malfunction.**
- **Do not use gasoline, thinner or similar chemicals to clean the filter as damage to the filter may occur.**
- **It may also cause an unpleasant odor in the CAB when the system is used next.**

**■ NOTE**
- **If the filter is very dirty:**

1. **Dip the filter in lukewarm water with mild dish washing detergent.**
2. **Move it up and down as well as left and right to loosen dirt.**
3. **Rinse the filter with clean water and let it air-dry.**

Normal use
1. Blow air from the opposite direction to the filter's normal air flow.
2. Pressure of compressed air must be under 205 kPa (2.1 kgf/cm$^2$ , 30 psi).



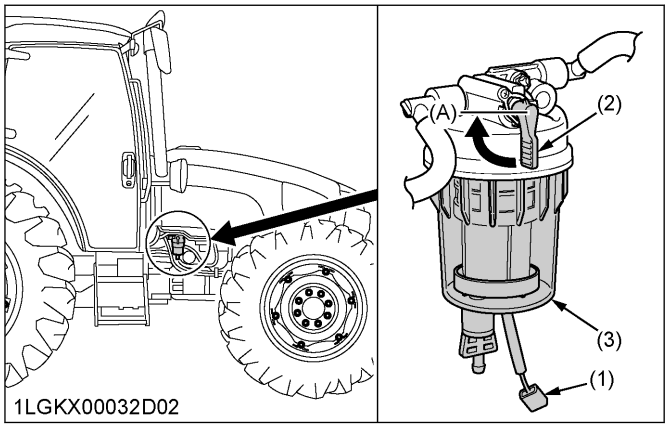

(A) Air conditioner airflow

# 1.7 Check points of every 400 hours

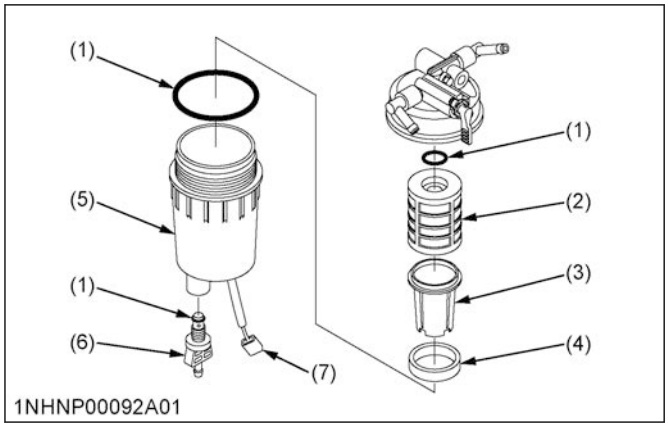
## 1.7.1 Cleaning water separator

This job should not be done in the field, but in a clean environment.

1. Disconnect the water sensor connector.
2. Close the fuel shutoff-valve.
3. Remove the cup then rinse the inside with kerosene.
4. Remove the element and dip it in the kerosene to rinse.
5. After cleaning, reassemble the water separator, keeping out dust and dirt.
6. Connect the water sensor connector.
7. Bleed the fuel system.




(1) Water sensor connector
(2) Fuel shutoff-valve
(3) Cup
(A) CLOSE




(1) O-ring
(2) Element
(3) Element cup
(4) Red float
(5) Cup
(6) Drain plug
(7) Water sensor connector

**IMPORTANT**

- **If the water separator and/or fuel filter is not well maintained, the supply pump and injector may be damaged earlier than expected.**

# 1.8 Check point of every 500 hours

## 1.8.1 Changing engine oil

**WARNING**

**To avoid personal injury or death:**

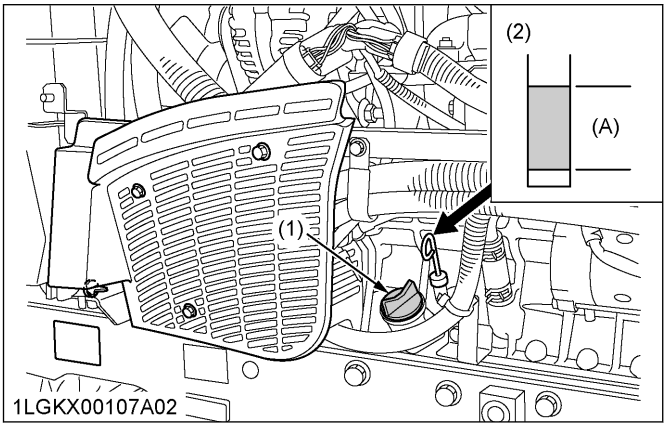
- **Be sure to stop the engine before changing the oil.**
- **Allow the engine to cool down sufficiently; oil can be hot and can burn.**

1. To drain the used oil, remove the drain plug at the bottom of the engine and drain the oil completely into the oil pan.
2. After draining, reinstall the drain plug.
3. Fill with new oil up to the upper notch on the dipstick.

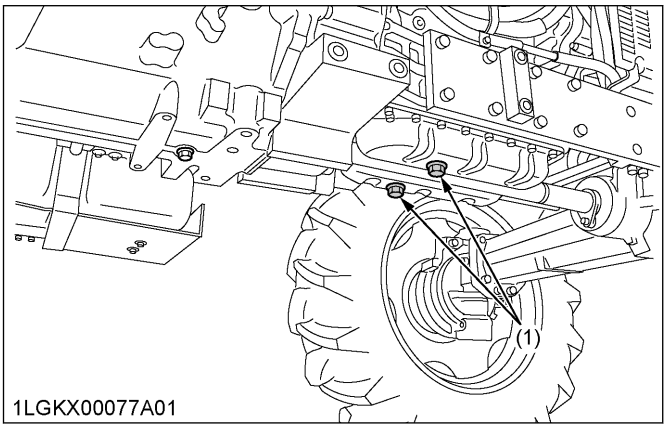
| | |
|---|---|
| Oil capacity with filter | 10.7 L<br>11.3 U.S.qts<br>9.4 Imp.qts |

**IMPORTANT**

- **Use DPF-compatible oil (CJ-4) for the engine.**




(1) Oil inlet
(2) Dipstick
(A) Oil level is acceptable within this range




(1) Drain plug

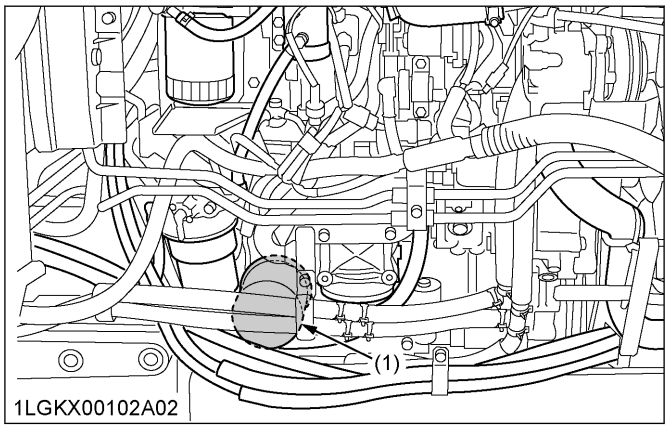
## 1.8.2 Replacing engine oil filter

**⚠ WARNING**

**To avoid personal injury or death:**

- **Be sure to stop the engine before changing the oil filter cartridge.**
- **Allow the engine to cool down sufficiently; oil can be hot and can burn.**

1. Remove the oil filter.
2. Put a film of clean engine oil on the rubber seal of the new filter.
3. Tighten the filter quickly until it contacts the mounting surface.
   Tighten the filter by hand an additional 1/2 turn only.
4. After the new filter has been replaced, the engine oil normally decreases by a small amount. Make sure that the engine oil does not leak through the seal and be sure to check the oil level on the dipstick. Then replenish the engine oil up to the prescribed level.



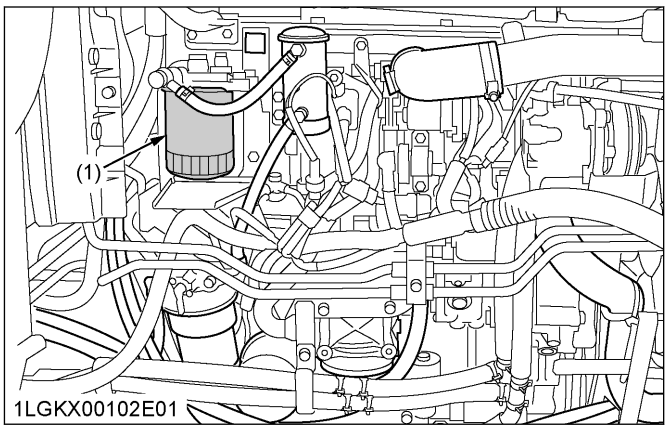

(1) Engine oil filter

**■ IMPORTANT**

- **To prevent serious damage to the engine, use of Kubota genuine filter is recommended.**

## 1.8.3 Replacing fuel filter

1. Remove the fuel filter.
2. Put a film of clean fuel on the rubber seal of the new filter.
3. Tighten the filter quickly until it contacts the mounting surface.
   Tighten the filter by hand an additional 1/2 turn only.
4. Bleed the fuel system.




(1) Fuel filter

## 1.8.4 Replacing hydraulic oil filter

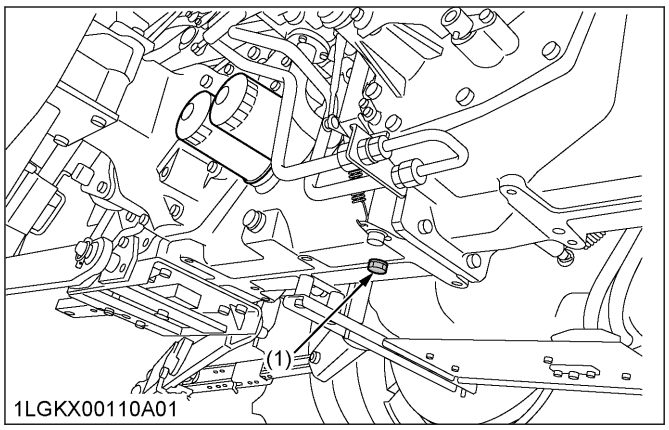
**⚠ WARNING**

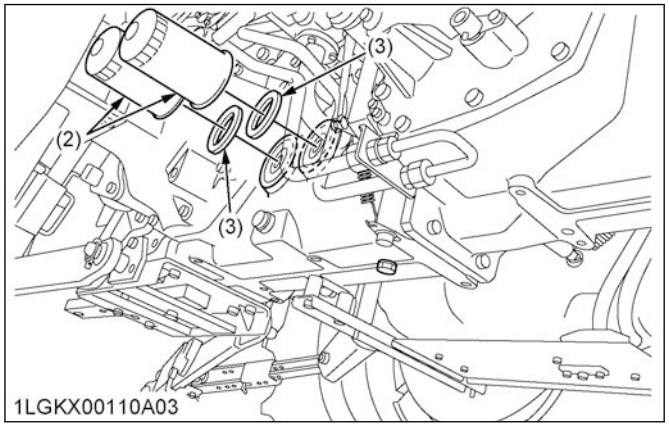
**To avoid personal injury or death:**

- **Be sure to stop the engine before changing the hydraulic oil filter cartridge.**
- **Allow engine to cool down sufficiently, or oil can be hot and can burn.**

**■ IMPORTANT**

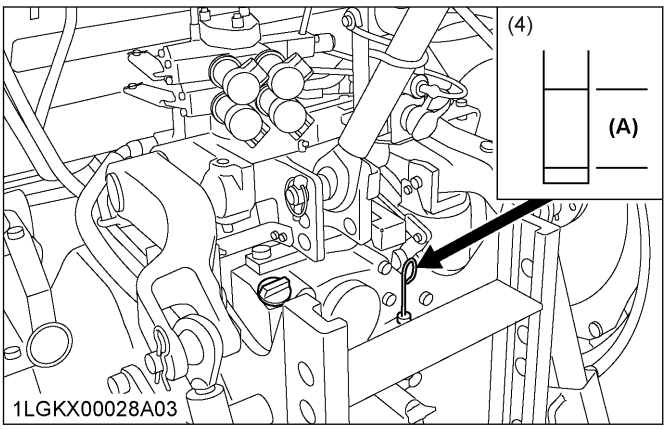
- **To prevent serious damage to the hydraulic system, use of KUBOTA genuine filter is recommended..**




(1) Drain plug
(2) Hydraulic oil filter
(3) Magnetic filter (wipe off metal filings)

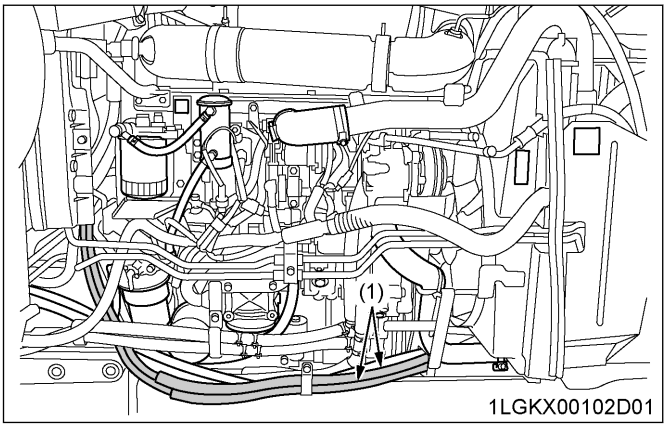
1. Remove the drain plug (1) at the bottom of the transmission case and drain the oil completely into the oil pan.
2. After draining, reinstall the drain plug (1).
3. Remove the two oil filters (2).
4. Wipe off metal fillings from the magnetic filters (3) with a clean rag.
5. Put a film of clean transmission fluid on rubber seal of new filters.
6. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hands and additional 1/2 turn only.
7. After the new filter has been replaced, fill with the oil up to the upper notch on the dipstick (4).



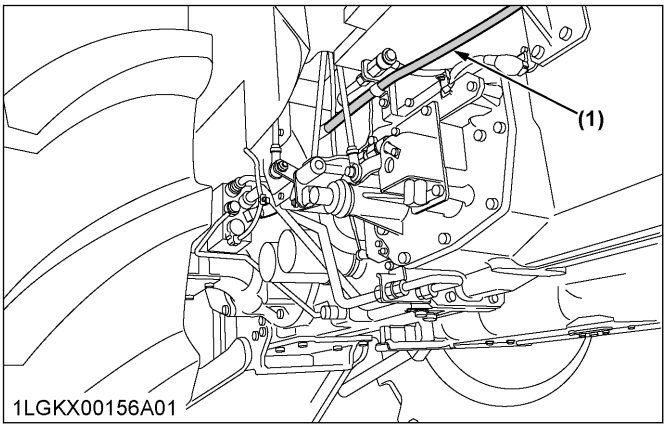

(4) Gauge
(A) Oil level is acceptable within this range.

- After operating the engine for a few minutes, stop the engine and check the oil level again, add oil to the prescribed level.
- Make sure that the transmission fluid doesn't leak pass the seal on the filter.

## 1.8.5 Checking power steering line




(1) Power steering pressure hoses




(1) Power steering pressure hoses

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

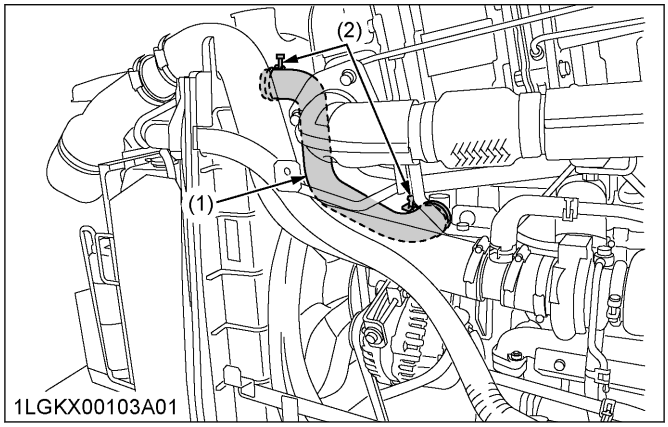
## 1.8.6 Checking radiator hose and hose clamp

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

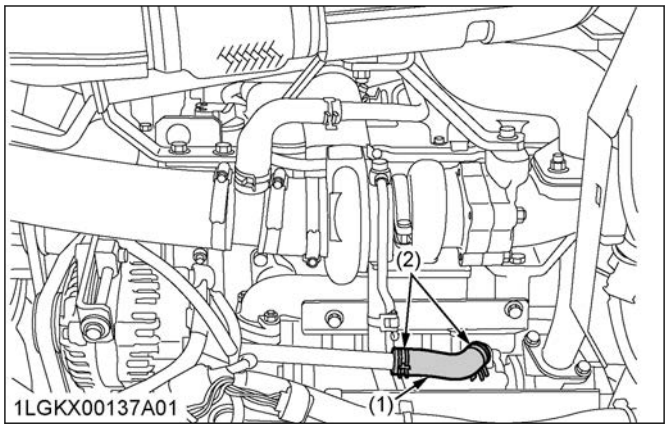
**Precaution at Overheating**

Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called "Overheating".

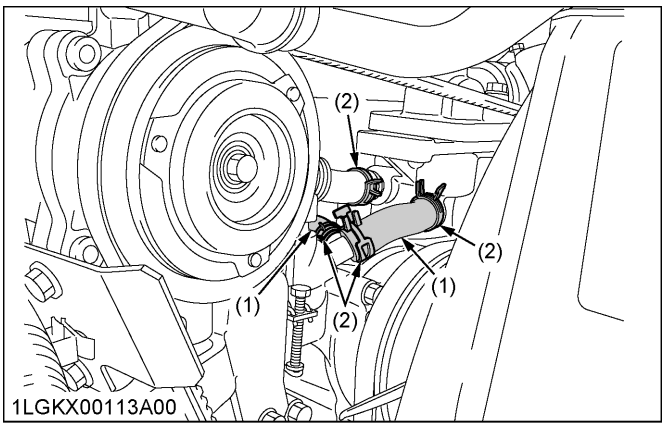
1. Stop the machine operation in a safe place and keep the engine unloaded idling.
2. Do not stop the engine suddenly, but stop it after about 5 minutes of unloaded idling.
3. Keep yourself well away from the machine for further 10 minutes or while the steam blown out.
4. Check that there gets no danger such as burn. Get rid of the causes of overheating and then start the engine again.

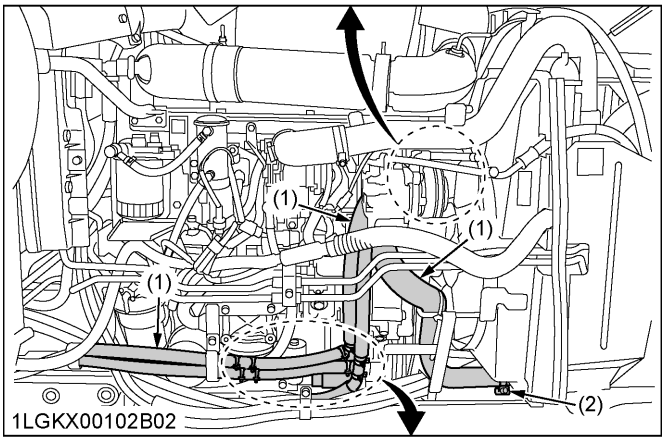


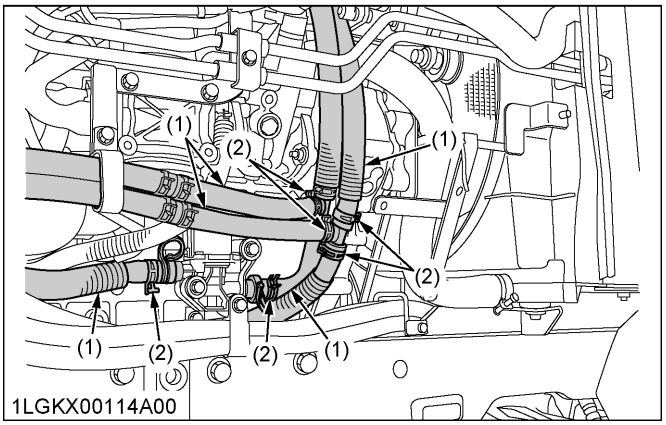

(1) Radiator hoses (2) Hose clamps




(1) Radiator hoses (2) Hose clamps



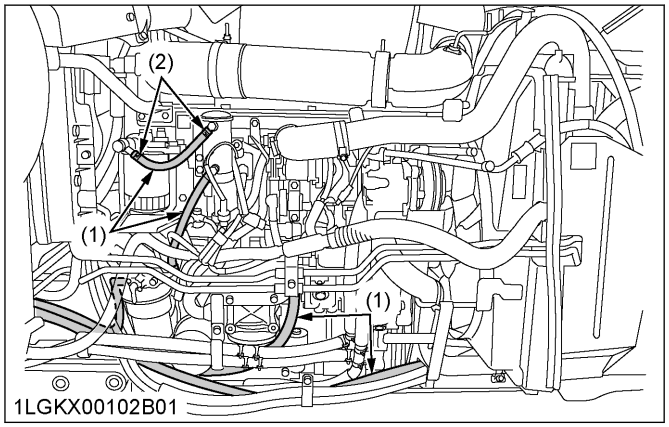

(1) Radiator hoses (2) Hose clamps

1. If hose clamps (2) are loose or water leaks, tighten hose clamp (2) securely.
2. Replace hoses (1) and tighten hose clamps (2) securely, if radiator hoses (1) are swollen, hardened or cracked.
   Replace hoses and hose clamps every 4years or earlier if checked and found that hoses are swollen, hardened or cracked.

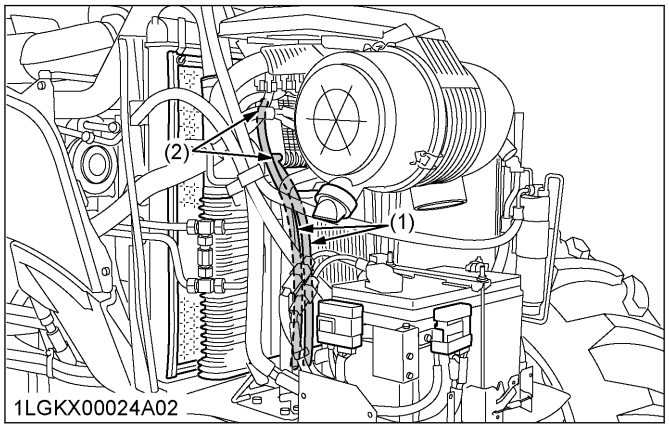
## 1.8.7 Checking fuel line

1. Check to see that all lines and hose clamps are tight and not damaged.

2. If the hoses and clamps are found to be worn or damaged, replace or repair them at once.




(1) Fuel lines (2) Clamp bands

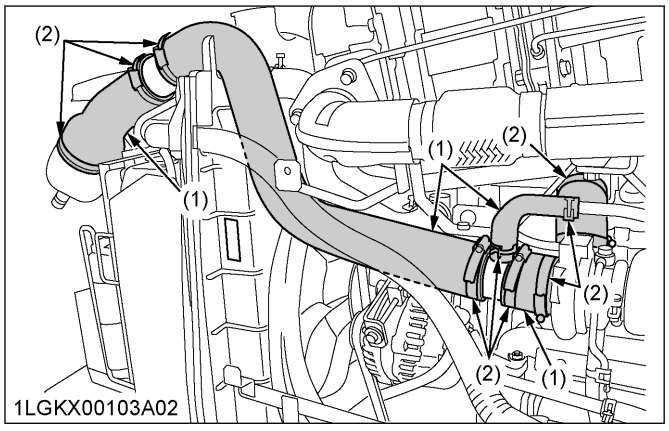



(1) Fuel lines (2) Clamp bands

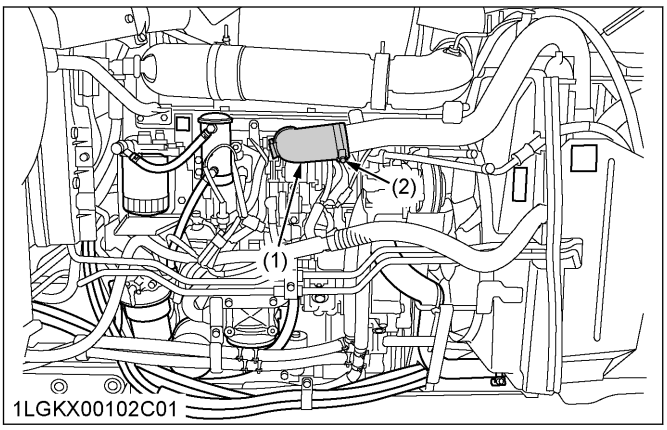
**NOTE**

- **If the fuel line has been replaced, be sure to properly bleed the fuel system.**

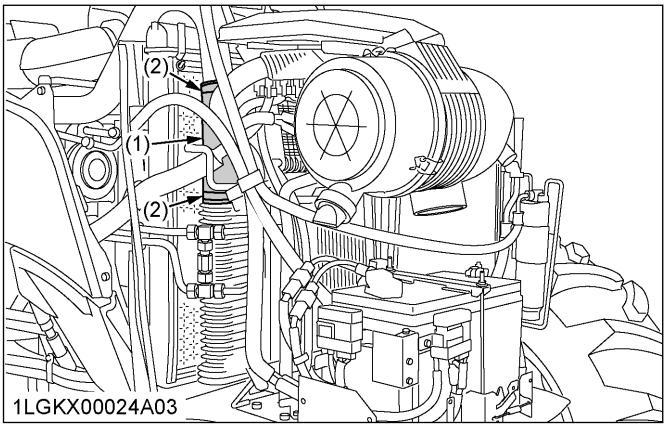
## 1.8.8 Checking intake air line



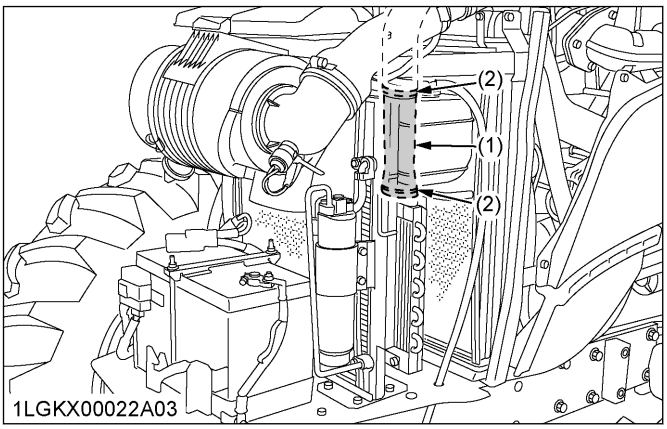

(1) Hose (2) Hose clamps




(1) Hose (2) Hose clamps




(1) Hose (2) Hose clamps



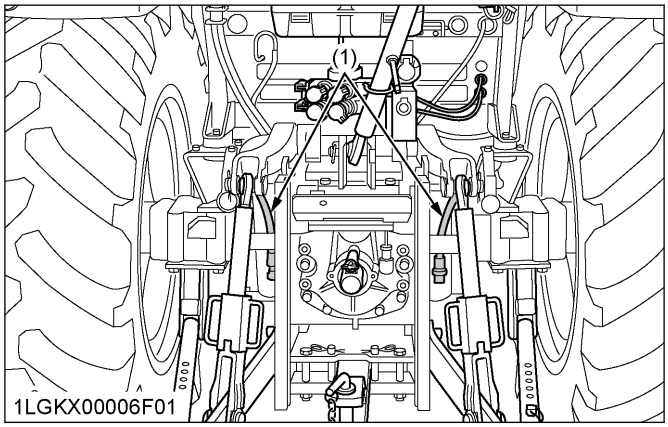

(1) Hose (2) Hose clamps

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

## 1.8.9 Checking lift cylinder hose

1. Check to see that hoses and hose clamps are tight and not damaged.

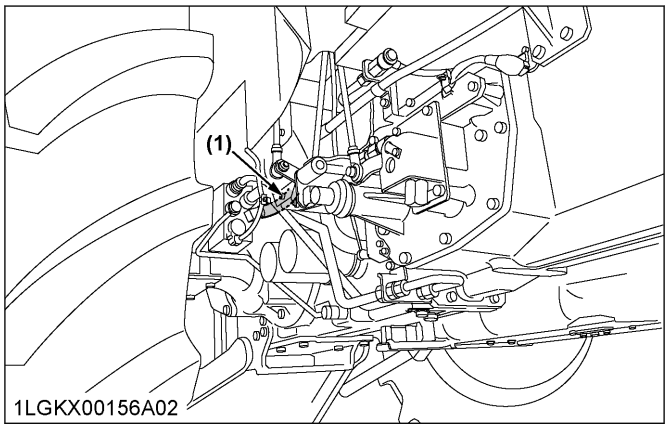
2. If hoses and clamps are found worn or damaged, replace or repair them at once.




(1) Lift cylinder hoses

### 1.8.10 Checking trailer brake hose

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




(1) Trailer brake hose

### 1.8.11 Checking remote control valve hose for auto hitch, push back type (if equipped)

1. Check to see that all lines and hose clamps are tight and not damaged.
2. If hoses and clamps are found to be worn or damaged, replace it.

### 1.8.12 Checking remote control valve hose for front 3-point hitch (if equipped)

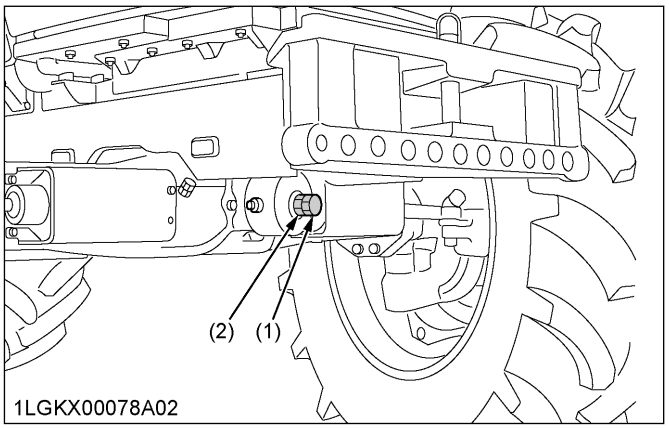
1. Check to see that all lines and hose clamps are tight and not damaged.
2. If hoses and clamps are found to be worn or damaged, replace it.

### 1.8.13 Checking air conditioner pipe and hose

1. Check to see that all lines and hose clamps are tight and not damaged.
2. If hoses and clamps are found to be worn or damaged, replace it.

## 1.9 Check points of every 600 hours

### 1.9.1 Adjusting front axle pivot




(1) Adjusting screw (2) Lock nut

If the front axle pivot pin adjustment is not correct, front wheel vibration can occur causing vibration in the steering wheel.

1. Loosen the lock nut, screw-in the adjusting screw until seated, then tighten the screw by 1/6 turn.
2. Retighten the lock nut.

## 1.10 Check point of every 1000 hours

### 1.10.1 Changing transmission fluid

**⚠ WARNING**

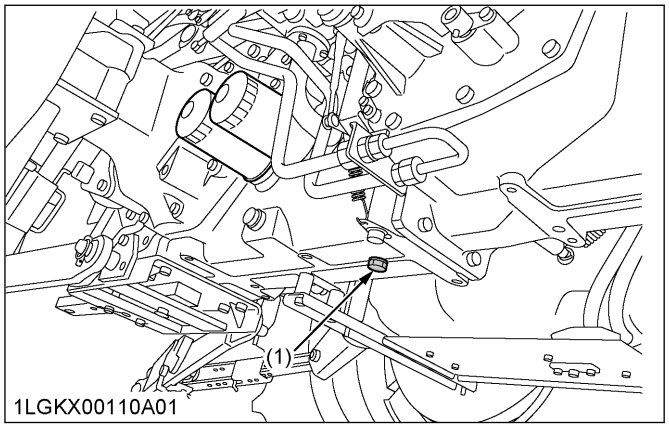
**To avoid personal injury or death:**

- **Allow the engine to cool down sufficiently; oil can be hot and can burn.**

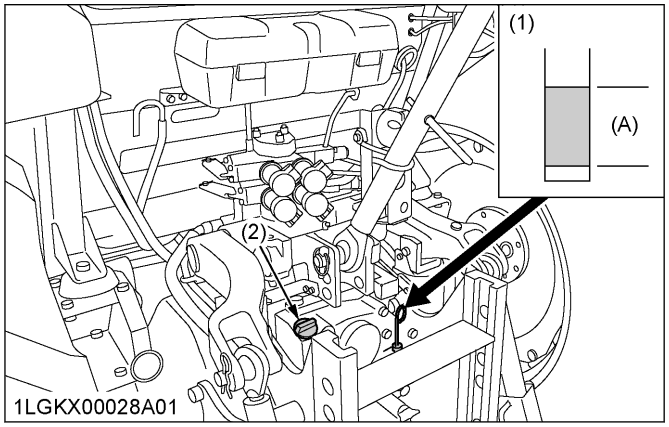
1. To drain the used oil, remove the drain plug at the bottom of the transmission case and drain the oil completely into the oil pan.
2. After draining, reinstall the drain plug.
3. Fill with new **KUBOTA SUPER UDT** fluid up to the upper notch on the dipstick.

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

| | |
|---|---|
| Oil capacity | 60 L<br>16 U.S.gals<br>13 Imp.gals |




(1) Drain plug




(1) Dipstick
(2) Oil inlet
(A) Oil level is acceptable within this range.

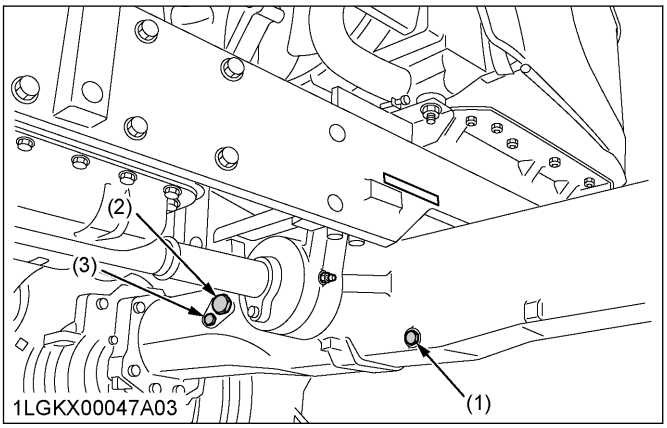
**■ IMPORTANT**

- **Do not operate the tractor immediately after changing the transmission fluid.**
  **Run the engine at medium speed for a few minutes to prevent damage to the transmission.**

## 1.10.2 Changing front differential case oil

1. To drain the used oil, remove the drain and filling plug at the front differential case and drain the oil completely into the oil pan.
2. After draining, reinstall the drain plug.
3. Remove the oil level check plug.
4. Fill with the new oil up to the lower rim of check plug port.
5. After filling, reinstall the filling plug and check plug.

| | |
|---|---|
| Oil capacity | 6.0 L<br>6.3 U.S.qts<br>5.3 Imp.qts |

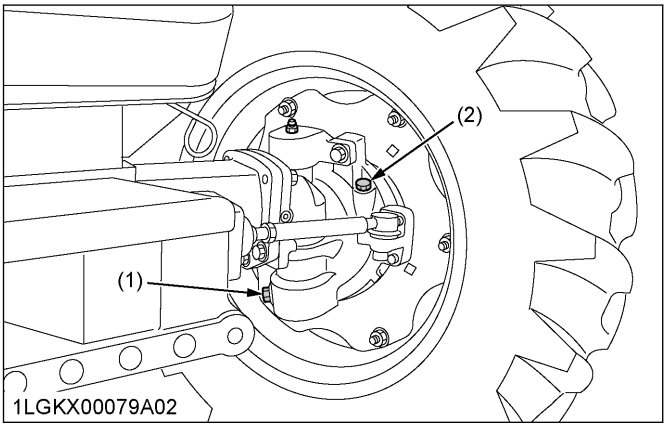



(1) Drain plug
(2) Filling plug
(3) Check plug

## 1.10.3 Changing front axle gear case oil

1. To drain the used oil, remove the right and left drain plugs and filling plugs at the front axle gear case and drain the oil completely into the oil pan.
2. After draining, reinstall the drain plugs.
3. Fill with the new oil up to the filling plug port.
4. After filling, reinstall the filling plugs.

| | |
|---|---|
| Oil capacity | 3.5 L<br>3.7 U.S.qts<br>3.1 Imp.qts<br>for each side |

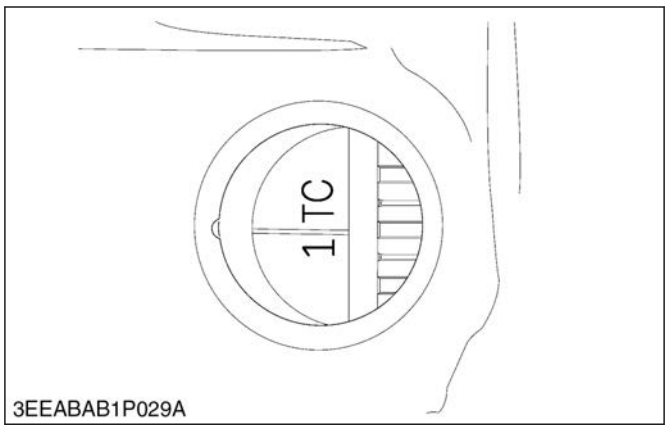


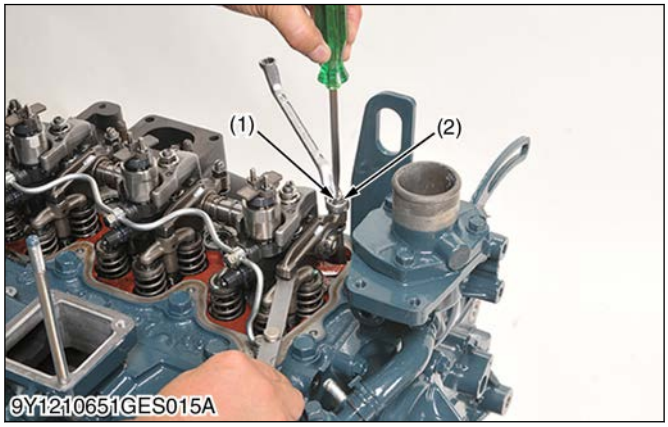

(1) Drain plug
(2) Filling plug

## 1.10.4 Adjusting valve clearance

**■ IMPORTANT**

- **You must check and adjust the valve clearance when the engine is cold.**




(1) Adjusting screw (2) Lock nut

1. Remove the steering controller with steering support.
2. Remove the bonnet support.
3. Remove the bracket.
4. Remove the fuel filter.
5. Remove the CCV hoses.
6. Remove the EGR cooler pipe.
7. Remove the head cover and injector harness.
8. Remove the injection pipes and cylinder head cover.
9. Align the "**1TC**" mark line on the flywheel and projection on the housing.
10. Make sure that the No. 1 piston comes to the compression or overlap top dead center.

| Adjustable Cylinder Location of Piston | | IN. | EX. |
|---|---|---|---|
| When No. 1 piston is at compression top dead center | 1 | ☆ | ☆ |
| | 2 | ☆ | |
| | 3 | | ☆ |
| | 4 | | |
| When No. 1 piston is at overlap position | 1 | | |
| | 2 | | ☆ |
| | 3 | ☆ | |
| | 4 | ☆ | ☆ |

11. Check the subsequent valve clearance at the mark "**1TC**" with a feeler gauge.
12. If the clearance is out of the factory specifications, adjust with the adjusting screw (1).

| | | |
|---|---|---|
| Valve clearance (Cold) | Factory specification | 0.23 to 0.27 mm<br>0.0091 to 0.010 in. |

13. Tighten the lock nut (2) of the adjusting screw.

**(When reassembling)**

**■ NOTE**

- **After you adjust the valve clearance, tighten the lock nut (2) of the adjusting screw.**
- **Tighten the injector clamp nut, the overflow pipe joint screw (M6 × 1.0) and the cylinder head cover 1 screw to the specified tightening torque.**
- **Tighten the cylinder head cover 2 screw, the injection pipe retaining nut and the base of SCR to the specified tightening torque.**
- **Tighten the mounting bolt for muffler bracket to aluminium parts, be sure the following table's torque.**

| | | |
|---|---|---|
| Tightening torque | Injector clamp nut | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | Overflow pipe joint screw (M6 × 1.0) | 9.81 to 11.2 N·m<br>1.00 to 1.15 kgf·m<br>7.24 to 8.31 lbf·ft |
| | Cylinder head cover 1 screw | 6.87 to 11.2 N·m<br>0.700 to 1.15 kgf·m<br>5.07 to 8.31 lbf·ft |
| | Cylinder head cover 2 screw | 9.81 to 11.2 N·m<br>1.00 to 1.15 kgf·m<br>7.24 to 8.31 lbf·ft |
| | Injection pipe retaining nut | 23 to 36 N·m<br>2.3 to 3.7 kgf·m<br>17 to 26 lbf·ft |
| | Muffler bracket mounting bolt (M10, 7T) | 33.67 to 39.13 N·m<br>3.434 to 3.990 kgf·m<br>24.84 to 28.86 lbf·ft |
| | Muffler bracket mounting bolt (M8, 7T) | 16.45 to 19.25 N·m<br>1.678 to 1.962 kgf·m<br>12.14 to 14.19 lbf·ft |
| | Slip band nut of SCR mixing pipe | 15 to 17 N·m<br>1.6 to 1.7 kgf·m<br>11 to 12 lbf·ft |

## 1.11 Check points of every 1000 hours or 1 year

Be sure to do the following servicing once every 1000 hours or yearly, whichever comes first.

### 1.11.1 Cleaning air cleaner primary element

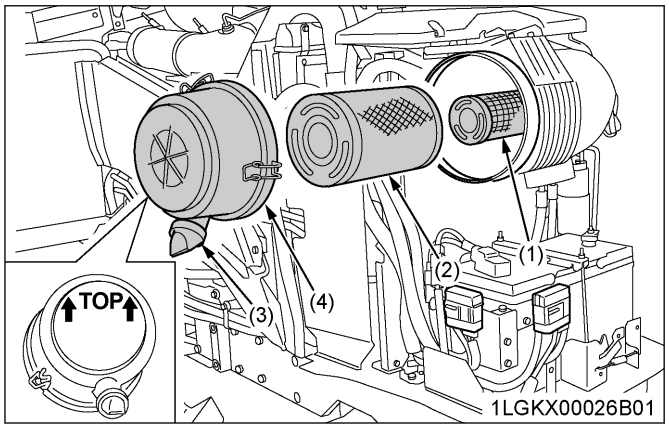
**NOTE**

- **If the air conditioner condenser is pulled out when cleaning the air cleaner, the air cleaner cover can be detached and attached easily.**

1. Remove the air cleaner cover and primary element.
2. Clean the primary element:
   - When dry dust adheres to the element, blow compressed air from the inside, turning the element. Pressure of compressed air must be under 205 kPa (2.1 kgf/cm$^2$ , 30 psi).
   - When carbon or oil adheres to the element, soak the element in detergent for 15 minutes, then wash it several times in water, rinse with clean water and dry it naturally. After the element has fully dried, inspect inside the element with a light and check for damage.
3. Replace the air cleaner primary element:
   Once every 1000 hours or yearly, whichever comes first.

**NOTE**

- **Check to see if the evacuator valve is blocked with dust.**




(1) Secondary (safety) element (4) Cover
(2) Primary element
(3) Evacuator valve

**IMPORTANT**

- **The air cleaner uses a dry element; never apply oil.**
- **Do not run the engine with the filter element removed.**
- **Be sure to refit the cover with the arrow ⬆ (on the rear of the cover) upright. If the cover is improperly fitted, the evacuator valve will not function and dust will adhere to the element.**
- **Do not touch the secondary element except in cases where replacing is required.**

**Evacuator valve**

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

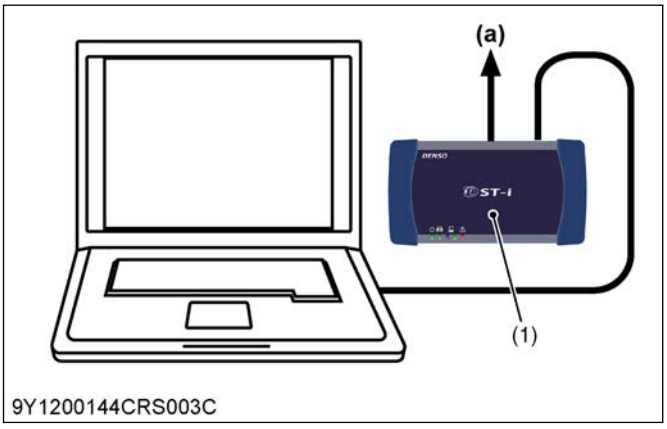
### 1.11.2 Checking exhaust manifold

1. Check the exhaust manifold for crack, exhaust gas leakage and loose exhaust manifold mounting screw.
2. If you find a crack, change the exhaust manifold.
3. If you find a gas leakage, tighten the mounting screw again or replace the gasket with a new one.
4. If you find a loose exhaust manifold mounting screw, tighten the exhaust manifold mounting screw again.

RELATED PAGE
1.14.1 Checking exhaust gas leakage of turbine side on page 2-46

## 1.12 Check points of every 1500 hours

### 1.12.1 Checking fuel injector nozzle tip




(1) Interface (a) CAN1 connector

1. Connect the diagnosis tool.
2. Stop the injector for each cylinder using active testing and make sure that the injectors are injecting normally.
   If it is injecting normally, the engine vibration and noise will not increase and engine speed will fluctuate when stopping the function of the injector.
3. If it is determined that there is a failure, check for a plug in the injection pipe.
4. If the injector pipe is normal, this may be an injector failure so replace the injector using the procedure for replacing injectors.

## 1.12.2 Checking DEF/AdBlue® injector tip

**⚠ CAUTION**

- **When removing the DEF tube from the clamp, remove after cooling down and DEF purge are complete. Maximum 12 minutes after engine stops.**
- **When removing the DEF tube from the DEF injector, don't scatter the DEF that remains in the DEF tube.**
- **Wait until the mixing pipe has cooled substantially before removing the DEF injector band.**
- **Do not apply excessive force when removing the DEF injector from the mixing pipe.**

1. Remove the DEF tube from the clamp.
2. Remove the DEF tube from the DEF injector.
3. Remove the DEF injector band.
4. Remove the DEF injector from the mixing pipe.
5. Make sure there are no deposit in the mixing pipe.
6. Check for rust on the DEF injector terminal. If there is rust, replace the DEF injector.
7. Make sure there are no issue with the external appearance (corrosion or deformation) of the DEF injector.
8. Check the tip of the DEF injector for deposits and if there are any solids deposited, wash the tip with water.

**(Washing the DEF injector tip with water)**

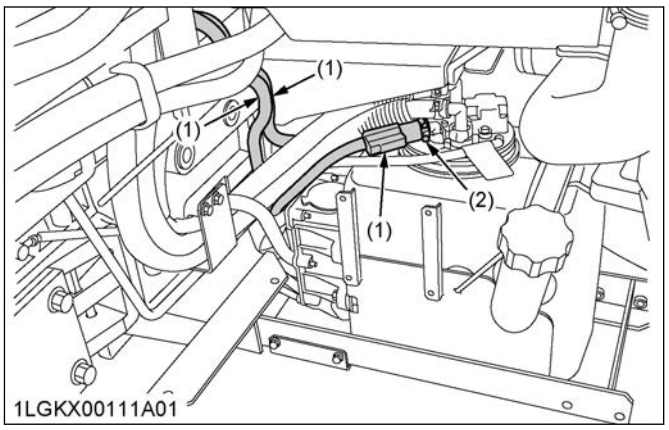
**■ NOTE**

- **Don't get any water on the connector of the DEF injector.**

1. Wipe the tip of the DEF injector several times with a soft sponge wet with clean water.
2. Visually check the injection holes after washing with water.

## 1.12.3 Checking DEF/AdBlue® line

1. Check to see that all lines from the DEF/AdBlue® injector to the tank are securely connected and not damaged.
2. If hoses and clamps are found worn or damaged, replace or repair them at once.



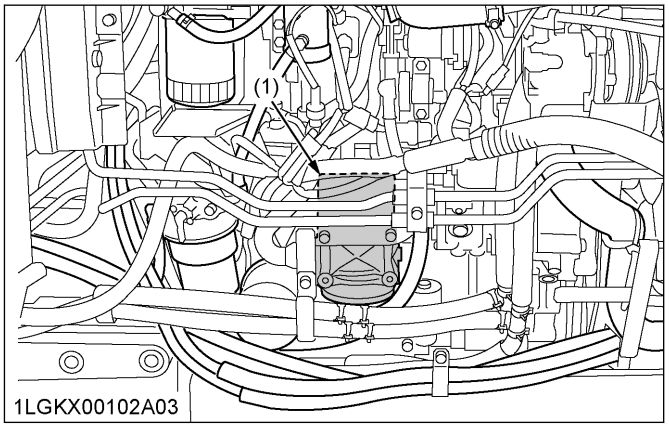

(1) DEF/AdBlue® lines (2) Clamp bands

## 1.12.4 Replacing oil separator element

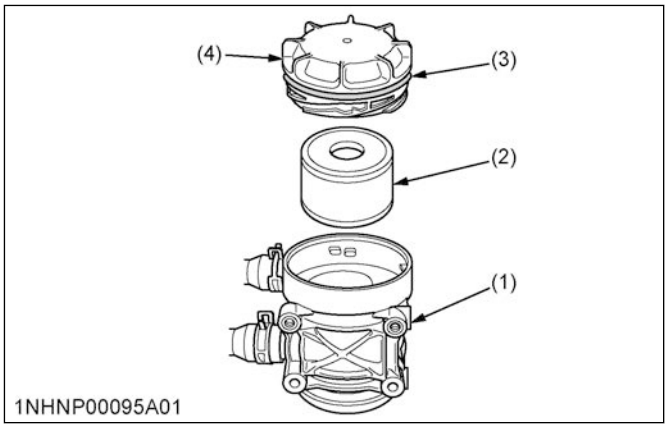
**⚠ WARNING**

**To avoid personal injury:**

- **Be sure to stop the engine before replacing the oil separator element.**




(1) Oil separator



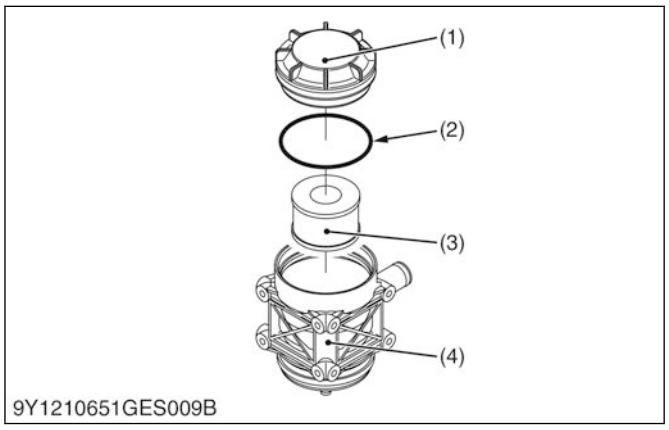

(1) Body (3) Gasket
(2) Oil separator element (4) Cover

1. Remove the cover and remove the element. Wipe off oil and the carbon in the case with a clean rag.
2. Fit a new oil separator element.

3. Tighten the cover.

## 1.12.5 Checking positive crankcase ventilation (PCV) valve

1. Remove the cover (1) and element (3).




(1) Cover
(2) O-ring
(3) Element
(4) Body

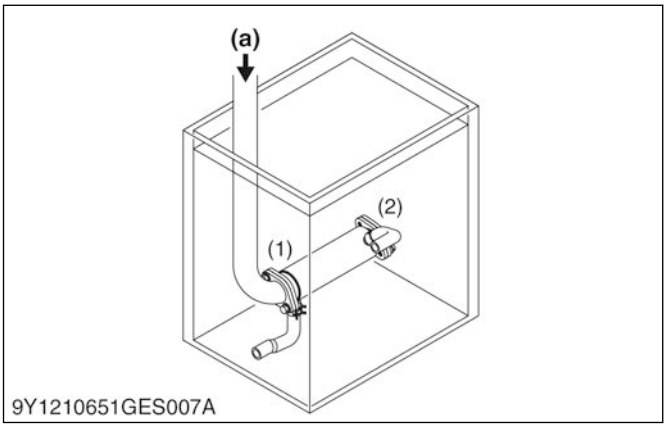
2. Press on the PCV valve (5) and check that it moves smoothly.


(1) Cover
(5) Positive crankcase ventilation (PCV) valve

3. If it does not move smoothly, replace the cover (1).

## 1.12.6 Checking and cleaning EGR cooler

**(Exhaust gas passage)**



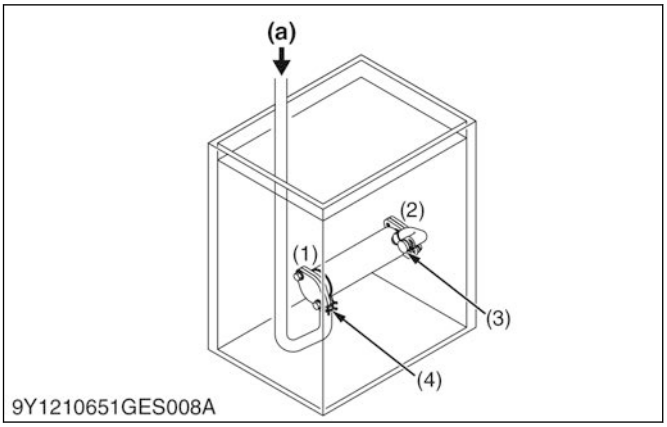

(1) Exhaust gas inlet
(2) Exhaust gas outlet
(a) Air pressure

1. Block the EGR cooler exhaust gas outlet (2).
2. Attach an air hose to the EGR cooler exhaust gas inlet (1) and then submerge it in a water tank.
3. Check that the coolant passage is full of water.
4. Apply the specified amount of air pressure (a) to the air hose side, and check that there are no air leak in any of the EGR cooler parts.

| | | |
|---|---|---|
| EGR cooler leakage test pressure | Factory specification | 290 kPa<br>2.96 kgf/cm$^2$<br>42.1 psi |

5. If there are air leaks, replace the EGR cooler.

**(Coolant passage)**




(1) Exhaust gas inlet
(2) Exhaust gas outlet
(3) Coolant outlet
(4) Coolant inlet
(a) Air pressure

1. Block the EGR cooler exhaust gas inlet (1), EGR cooler exhaust gas outlet (2), and the coolant outlet (3).
2. Attach an air hose to the EGR cooler coolant inlet (4), and then submerge it in a water tank.
3. Apply the specified amount of air pressure (a) to the air hose side, and check that there are no air leaks in any of the EGR cooler parts.

| | | |
|---|---|---|
| EGR cooler leakage test pressure | Factory specification | 250 kPa<br>2.55 kgf/cm$^2$<br>36.3 psi |

4. If there are air leaks, replace the EGR cooler.

## 1.13 Check points of every 2000 hours or 2 years

Be sure to do the following servicing once every 2000 hours or biennially, whichever comes first.

### 1.13.1 Flushing cooling system and changing coolant

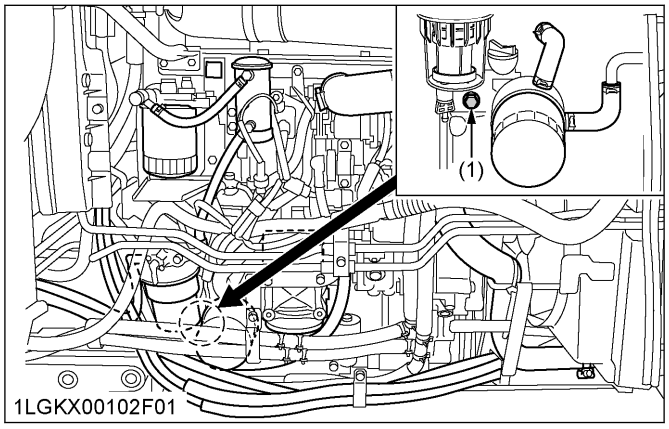
**⚠ WARNING**

**To avoid personal injury:**

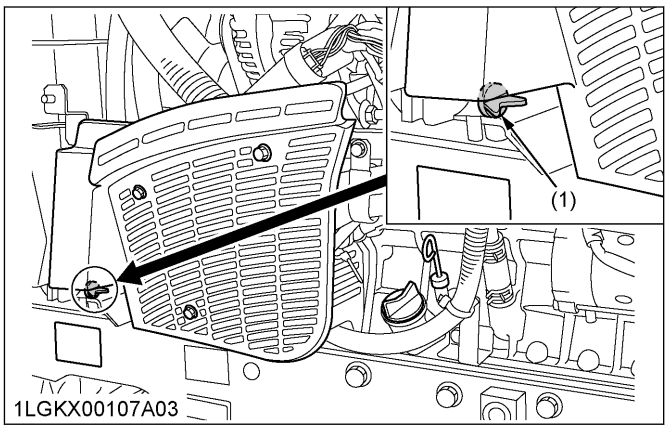
- **Do not remove radiator cap while coolant is hot. When cool, slowly rotate cap to the first stop and allow sufficient time for excess pressure to escape before removing the cap completely.**

**■ IMPORTANT**

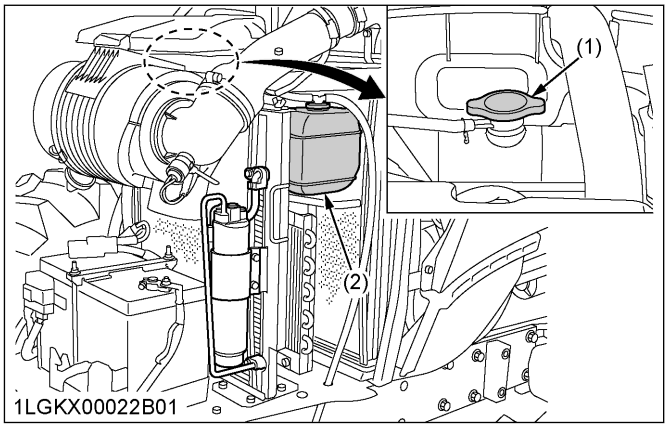
- **Do not start engine without coolant.**
- **Use clean, fresh soft water and anti-freeze to fill the radiator and recovery tank.**
- **When mixing the anti-freeze with water, the anti-freeze mixing ratio is 50%.**
- **Tighten radiator cap securely. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**




(1) Drain plug




(1) Drain plug




(1) Radiator cap
(2) Recovery tank

1. Stop the engine, remove the key and let it cool down.
2. To drain the coolant, open the radiator drain plug, remove the drain plug and remove radiator cap. The radiator cap must be removed to completely drain the coolant.
3. After all coolant is drained, reinstall the drain plug.
4. Fill with clean soft water and cooling system cleaner.
5. Follow directions of the cleaner instruction.
6. After flushing, fill with clean soft water and anti-freeze until the coolant level is just below the radiator cap. Install the radiator cap securely.
7. Fill with coolant up to the **FULL** mark of recovery tank.

| | |
|---|---|
| Coolant capacity | 10 L<br>10.6 U.S.qts<br>8.8 Imp.qts |

8. Start and operate the engine for few minutes.
9. Stop the engine, remove the key and let cool.
10. Check coolant level of recovery tank and add coolant if necessary.
11. Dispose of used coolant properly.

### 1.13.2 Anti-freeze

**⚠ WARNING**

**To avoid personal injury:**

- **When using antifreeze, put on some protection such as rubber gloves. (Antifreeze contains poison.)**
- **If it is swallowed, seek immediate medical help. Do NOT make a person throw up unless told to do so by poison control or a health care professional. Use standard first aid and CPR for signs of shock or cardiac arrest. Call your local Poison Control Center or your local emergency number for further assistance.**
- **When antifreeze comes in contact with the skin or clothing, wash it off immediately.**
- **Do not mix different types of Antifreeze. The mixture can produce chemical reaction causing harmful substances.**
- **Antifreeze is extremely flammable and explosive under certain conditions. Keep fire and children away from antifreeze.**
- **When draining fluids from the engine, place some container underneath the engine body.**
- **Do not pour waste onto the ground, down a drain, or into any water source.**
- **Also, observe the relevant environmental protection regulations when disposing of antifreeze.**

Always use a 50/50 mix of long-life coolant and clean soft water in KUBOTA engines.

1. Long-life coolant (hereafter LLC) comes in several types. Use ethylene glycol (EG) type for this engine.
2. Before employing LLC-mixed cooling water, fill the radiator with fresh water and empty it again. Repeat this procedure 2 or 3 times to clean up the inside.
3. Mixing the LLC
   Premix 50% LLC with 50% clean soft water. When mixing, stir it up well, and then fill into the radiator.
4. The procedure for the mixing of water and antifreeze differs according to the make of the antifreeze and the ambient temperature. Refer to SAE J1034 standard, more specifically also to SAE J814c.

| Vol% Anti-freeze | Freezing Point | | Boiling Point* | |
|---|---|---|---|---|
| | ℃ | ℉ | ℃ | ℉ |
| 50 | −37 | −34 | 108 | 226 |

* At 1.013 × $10^5$ Pa (760 mmHg) pressure (atmospheric).A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

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

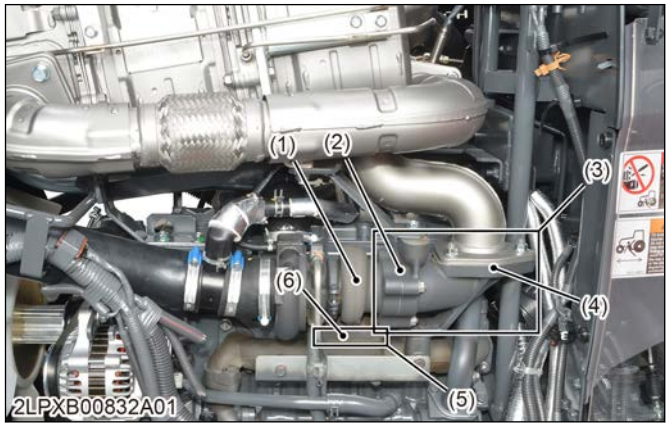
**■ NOTE**

- **The above data represent industry standards that necessitate a minimum glycol content in the concentrated antifreeze.**

## 1.14 Check points of every 3000 hours

### 1.14.1 Checking exhaust gas leakage of turbine side

1. Check the exhaust gas leakage at the exhaust port (3) and the inlet port (5) of the turbine housing (1).
2. If you find a gas leakage, tighten the screws and nuts again or replace the gasket (2), (4), (6) with a new one.




(1) Turbine housing
(2) Gasket
(3) Exhaust port
(4) Gasket
(5) Inlet port
(6) Gasket

## 1.14.2 Checking air leakage of compressor side

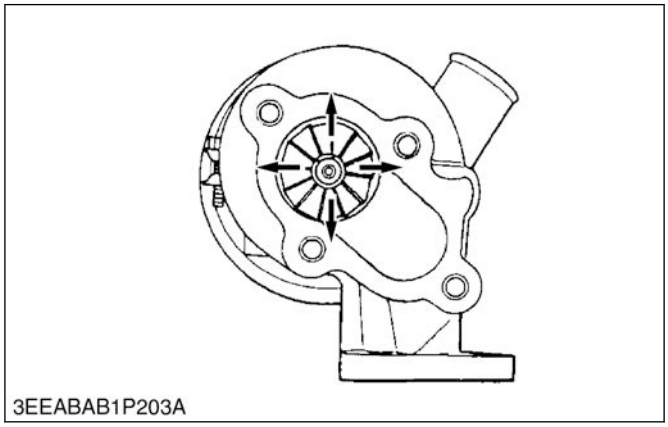
1. Check the inlet hose of the compressor cover (1) for air leakage.


(1) Compressor cover

2. Check the suction side of the inlet hose for loose connections or cracks.
3. If you find an air leakage, change the clamps and / or the inlet hose.

## 1.14.3 Checking radial clearance

1. If the wheel touches the housing, replace the turbocharger assembly with a new one.




## 1.14.4 Checking supply pump

1. Check the supply pump.

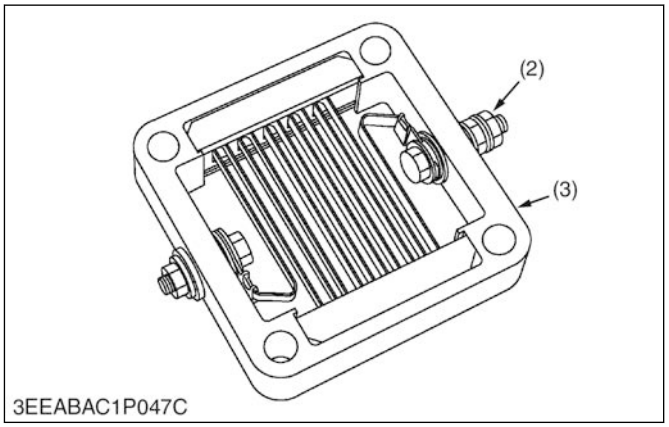
RELATED PAGE
4.2.1 Function of supply pump on page 3-4

## 1.14.5 Checking intake air heater

1. Disconnect the lead (1) from the intake air heater.


(1) Power supply lead

2. Measure the resistance between positive terminal (2) and intake air heater body (3).
3. If the resistance value is at 0 Ω (ground short), replace the intake air heater. If the resistance value is infinity, the heat coil is disconnected. Replace the intake air heater.




(2) Positive terminal (3) Intake air heater body

| | | |
|---|---|---|
| Resistance of the heater coil | Factory specification | Approximately 0.3 Ω (At cold occasion) |

## 1.14.6 Checking and cleaning EGR system

1. Perform an EGR actuation test.
2. Based on test results, check that the EGR valve gas passage and coolant passage are not clogged.
3. Clean any soot from the gas passage so that it does not damage the EGR valve.
4. Clean the coolant passage by operating it with water.

RELATED PAGE
5. EGR system on page 3-16

## 1.14.7 Cleaning DPF muffler

Cleaning DPF muffler requires a specific device and attention. Removing ash in the filter is necessary for good performance.

**■ IMPORTANT**

- **The DPF needs cleaning with a specific cleaning device. Do not clean the DPF by disassembling and try by yourself.**

**Removal of ash**

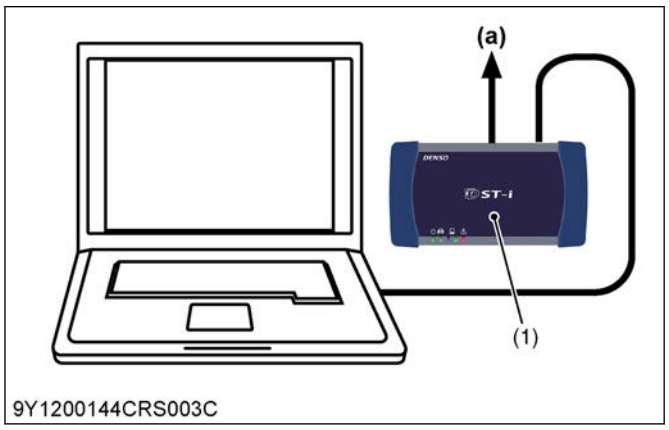
- The longer the DPF operates, the more ash (burnt residue) is collected in the filter. Too much ash build-up adversely affects the DPF performance.
- Refer to the *Diesel particulate filter handling manual* (*9Y121-08130*).

## 1.14.8 Checking DEF/AdBlue® injector

**⚠ CAUTION**

- **Get the temperature of the DEF closer to 20 ℃ to the extent possible.**
- **When removing the DEF tube from the clamp, remove after cooling down and DEF purge are complete. Maximum 12 minutes after engine stops.**
- **When removing the DEF tube from the DEF injector, be careful not to scatter the DEF that remains in the DEF tube.**
- **Wait until the mixing pipe has cooled substantially before removing the DEF injector band.**
- **Do not apply excessive force when removing the DEF injector from the mixing pipe.**
- **Be careful not to scatter DEF during an active test.**

Tools used: Diagmaster, interface, electronic scale (minimum scale value 0.01 g), approximately 250 ml container.




(1) Interface (a) CAN1 connector

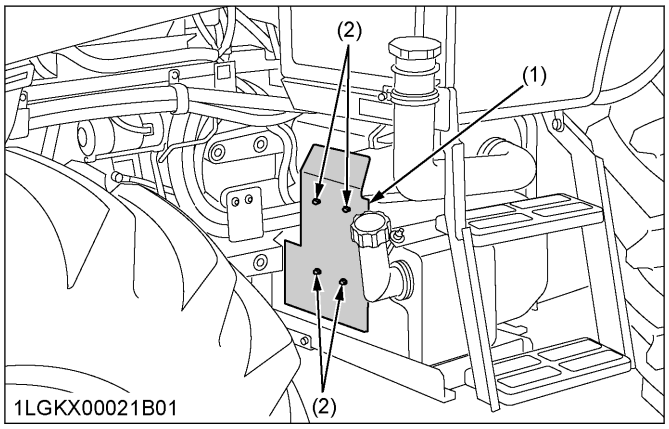
1. Remove the DEF tube from the clamp.
2. Remove the DEF tube from the DEF injector.
3. Remove the DEF injector band.
4. Remove the DEF injector from the mixing pipe.
5. Connect the DEF tube and connector to the DEF injector.
6. Start up the Diagmaster and initiate communication with the ACU.
7. Select "Urea Injector Injection Volume Specify Test Function (ACU)" from active tests.
8. Please select the following eight items as the display items during the active test.
   - DEF injector Duty (ACU)
   - DEF pressure (ACU)
   - DEF pump Duty (ACU)
   - DEF tank level (ACU)
   - DEF tank temperature (ACU)
   - DEF tank urea concentration (ACU)
   - DEF injection amount (ACU)
   - DEF injection test total injection amount
9. Select 0.8 as the duty for the DEF injector.
10. Enable visibility of the spray, start the active test, and check the spray conditions during injection.
11. Measure the weight of the container prior to collection.

| | | |
|---|---|---|
| Weight of DEF collected | Factory specification | 80.0 to 120 g<br>0.177 to 0.264 lbs |
| Atomizing State | | Make sure it is a cone shape and there are no deviations |

12. Set conditions so that all of the DEF injected can be collected and then start monitoring and active tests.
13. Store log data as needed.
14. After completing the active test, measure the increase in weight of the container for measuring DEF weight.
15. If the weight of the DEF collected does not meet evaluation criteria, perform the following corrective actions.
    - If the DEF pressure is unstable: leaking in of air is a possibility so check the connection status of the DEF tube.
    - If DEF pressure is low: replace the filter in the DEF tank and the filter in the DEF pump.
      Check the connection status of the DEF tube.
    - If DEF pressure is high: this may be caused by a plugged DEF injector so replace the DEF injector.
      Check the connection status of the DEF tube.
    - If DEF injection amount is low: wash the DEF injector holes.
16. Make sure there is no DEF leak or abnormal noise during the active test.

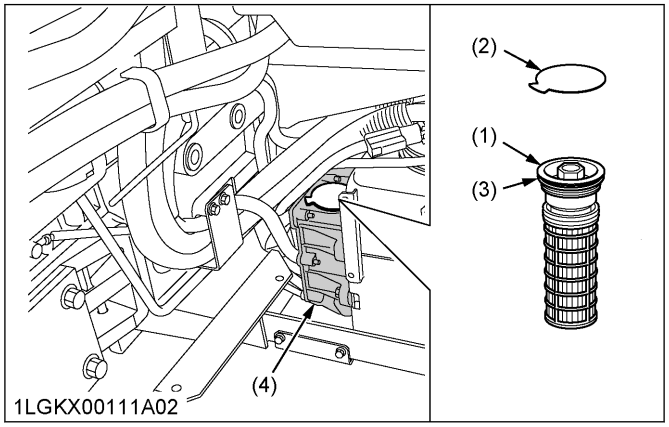
### 1.14.9 Replacing DEF/AdBlue® pump filter

1. Remove 4 bolts and then remove the pump cover.




(1) Pump cover (2) Bolt

2. Clean around the plug and remove the plug.
3. Loosen the top of the filter assembly and remove it from the pump.
4. Replace the filter assembly with a new one.




(1) Filter assembly (4) DEF/AdBlue® pump
(2) Plug
(3) O-ring

**NOTE**

- **Even after stopping the engine, the injector cooling DEF/AdBlue® fluid continues to circulate through the circuit for a couple of minutes.**
  **When this circulation has ended, do the replacement job. During cooling, the fluid's circulating noise is heard.**
- **Do not apply oil to the o-ring of the filter.**

## 1.15 Check points of every 9000 hours

### 1.15.1 Replacing DEF/AdBlue® tank filter

1. Remove the header assembly (2) from the DEF tank (1).
2. Remove the filter (3) from the header assembly (2).
3. Replace the filter (3) with a new one.

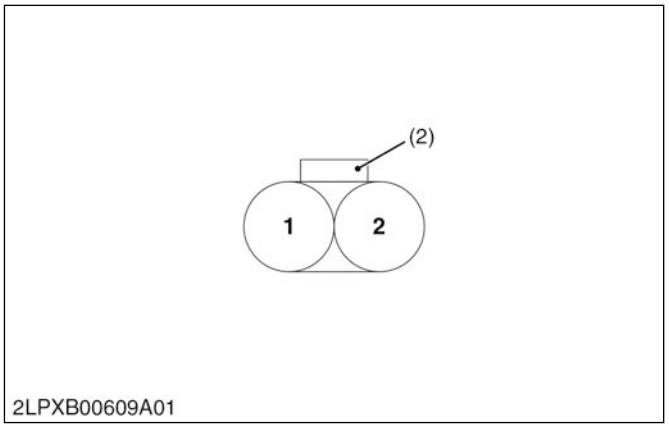

(1) DEF tank (3) Filter
(2) Header assembly

## 1.16 Check points of every 1 year

### 1.16.1 Checking antifrost heater of oil separator (if equipped)

1. Check the anti frost heater of oil separator.

#### 1.16.1.1 Checking connector voltage for CCV heater


(1) CCV heater (2) Connector (Harness side)

1. Disconnect the connector and turn the main key switch **ON** position.

2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 1 – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 1.16.2 Checking CAB isolation cushion (CAB model)

1. Check the cushion for any breakage or fatigue.
2. Replace them if they are deteriorated.

### 1.16.3 Checking DPF related pipe

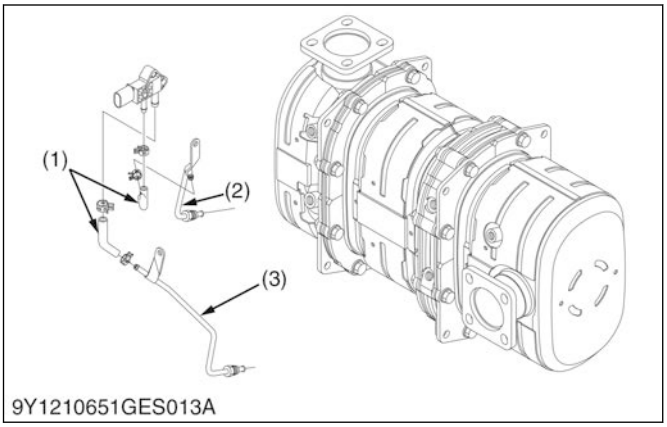
**■ IMPORTANT**

- **Be sure to loosen the differential pressure pipe tightening nut with crowfoot wrench to prevent the damage of the sensor or pipe. If it is still hard to loosen, apply the lubricant spray to threaded portion and soak it with lubricant.**
- **Tighten bolts and nuts to their specified torque. Also tighten the differential pressure pipe tightening nut to the specified torque with crowfoot wrench.**

**■ NOTE**

- **When you change the DPF differential pressure pipe, apply the anti-seize & lubricating compound (Bostik, NEVER-SEEZ, Pure nickel special grade) to the DPF differential pressure pipe.**

1. Check the DPF differential pressure pipe (2), (3) for crack, gas leakage and loose mounting nut.
2. If you find a crack, change the DPF differential pressure pipe.
3. If you find a gas leakage, remove the DPF differential pressure pipe and wipe off the anti-seize & lubricating compound.
4. Apply the anti-seize & lubricating compound again, then tighten the DPF differential pressure pipe to the specified torque.
5. Check the DPF differential pressure hose (1) for crack, gas leakage.

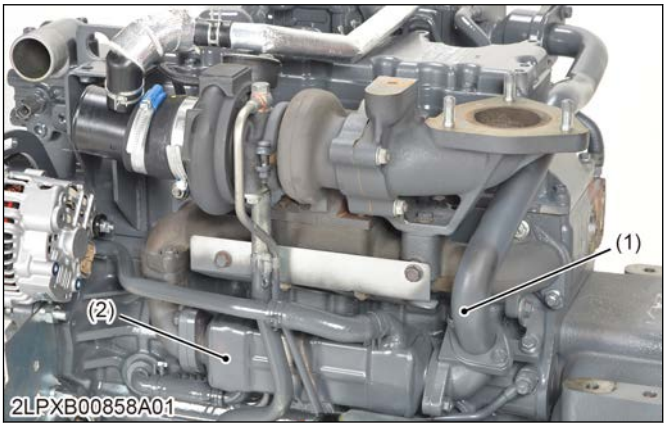



(1) DPF differential pressure hose
(2) DPF differential pressure pipe
(3) DPF differential pressure pipe

6. If you find a crack or gas leakage, change the DPF differential pressure hose.

### 1.16.4 Checking EGR pipe

1. Check the EGR cooler (2) and the EGR pipe (1) for crack, gas leakage and loose mounting screw.




(1) EGR pipe
(2) EGR cooler

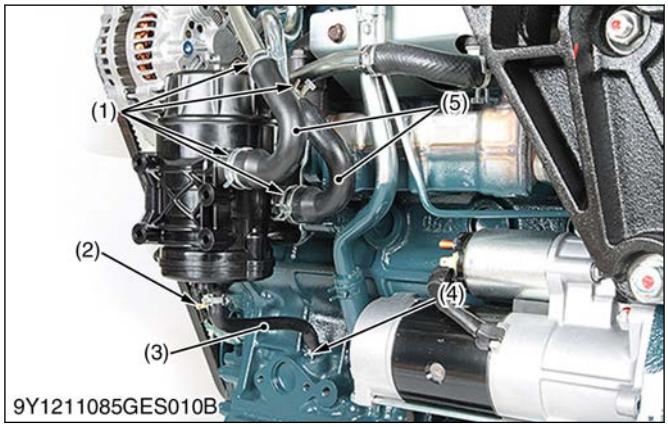
2. If you find a crack, the cracked EGR cooler (2) or the cracked EGR pipe (1), replace it.
3. If you find a gas leakage, tighten the mounting screw again or replace the gasket with a new one.
4. If you find a loose mounting screw, tighten the mounting screw again.

## 1.17 Check points of every 2 years

### 1.17.1 Replacing oil separator related rubber pipe

1. Loosen the clamp (1), (2), (4) and remove the rubber pipe (3), (5).

2. Replace the rubber pipe (3), (5) and clamp (1), (2), (4) with new ones.




(1) Clamp
(2) Clamp
(3) Rubber pipe
(4) Clamp
(5) Rubber pipe

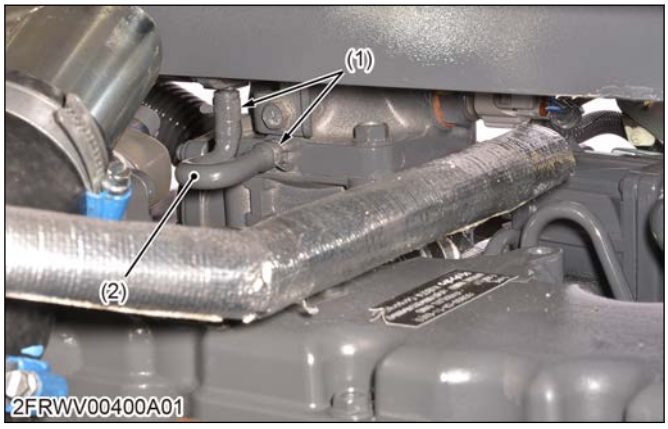
3. Tighten the clamp correctly.

## 1.17.2 Replacing positive crankcase ventilation (PCV) valve hose

1. Replace the positive crankcase ventilation (PCV) valve hose.

## 1.17.3 Replacing boost sensor hose

1. Loosen the clamp (1).
2. Remove the hose (2).
3. Replace the hose (2) and clamp (1) with new ones.

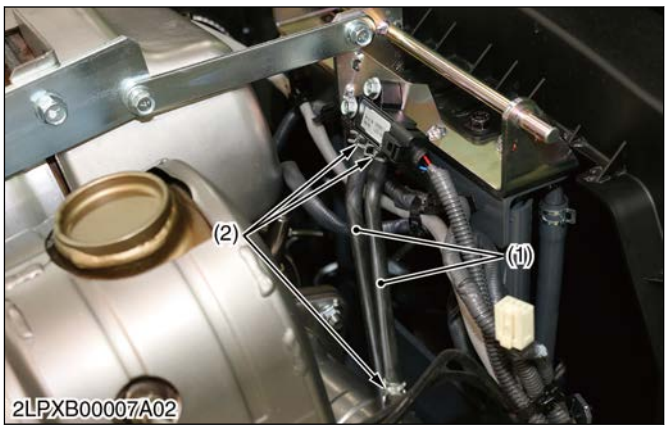



(1) Clamp
(2) Hose

4. Tighten the clamp correctly.

## 1.17.4 Replacing DPF related rubber pipe

1. Loosen the clamp (2).
2. Remove the rubber pipe (1).
3. Replace the rubber pipe (1) and clamp (2) with new ones.



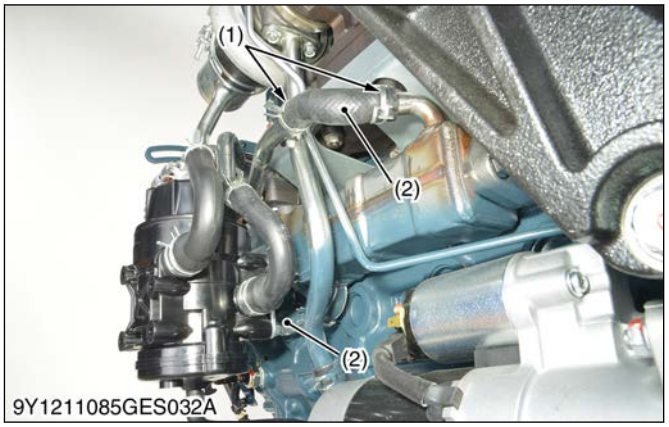

(1) Rubber pipe
(2) Clamp

4. Tighten the clamp correctly.

RELATED PAGE
1.16.3 Checking DPF related pipe on page 2-50

## 1.17.5 Replacing EGR cooler rubber pipe

1. Loosen the clamp (1) and remove the pipe (2).
2. Replace the pipe (2) with new ones.

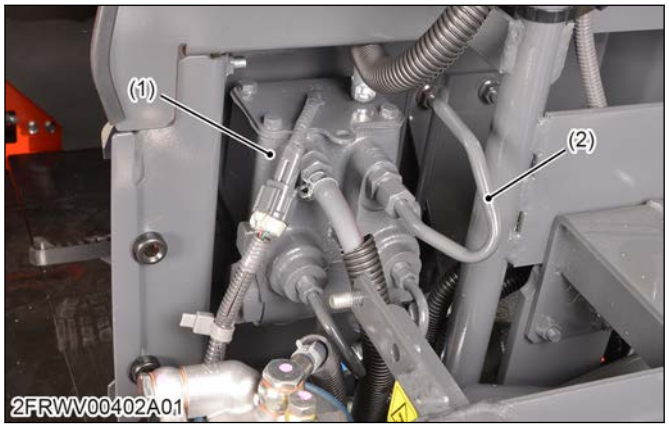


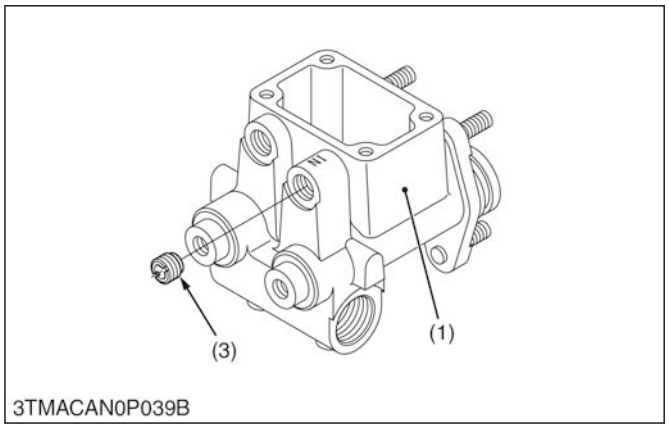

(1) Clamp
(2) Pipe

3. Tighten the clamp correctly.

### 1.17.6 Cleaning master cylinder filter

1. Disconnect the master cylinder line (2) from the master cylinder assembly (1).




(1) Master cylinder assembly
(2) Master cylinder delivery line
(3) Filter

2. Remove the filter (3) using the screwdriver.
3. Clean the filer (3) with kerosene and blow with air.

## 1.18 Every 3 years

### 1.18.1 Replacing parking brake cable

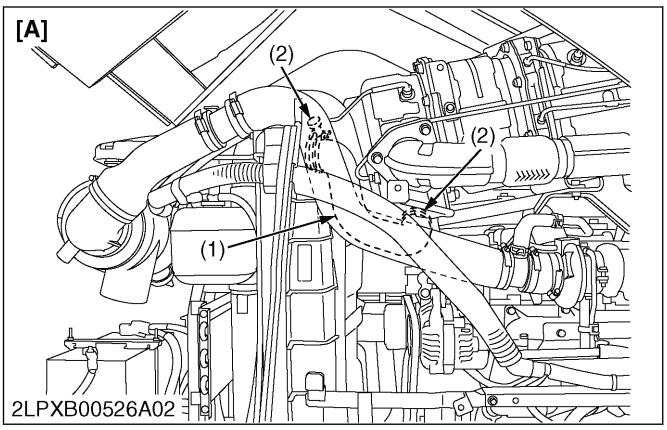
1. Replacing parking brake cable.

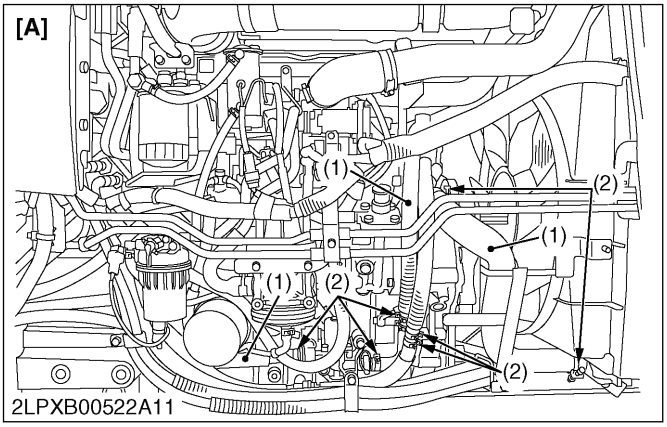
## 1.19 Check point of every 4 years

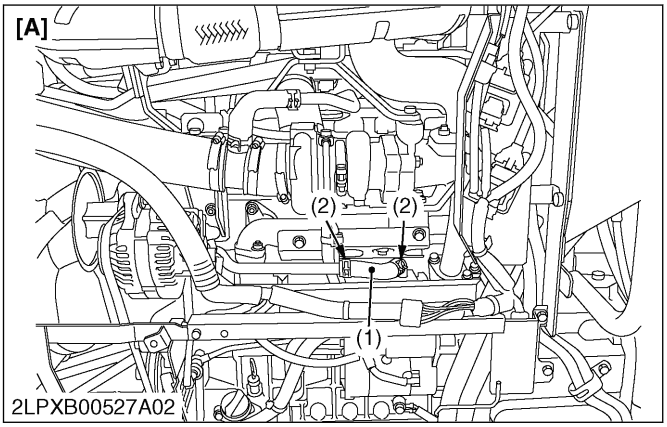
### 1.19.1 Replacing radiator hose (Water pipes)

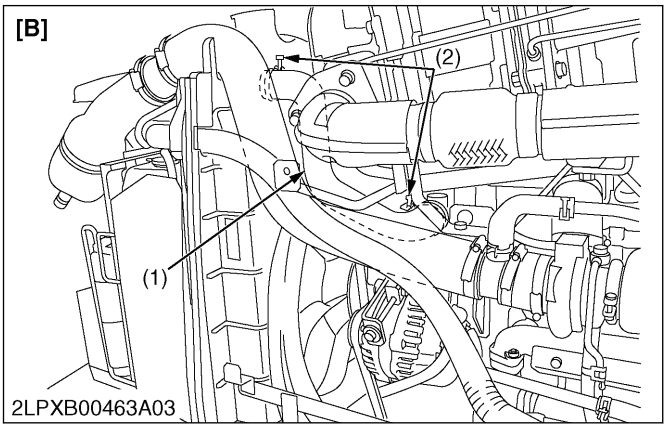
**⚠ CAUTION**

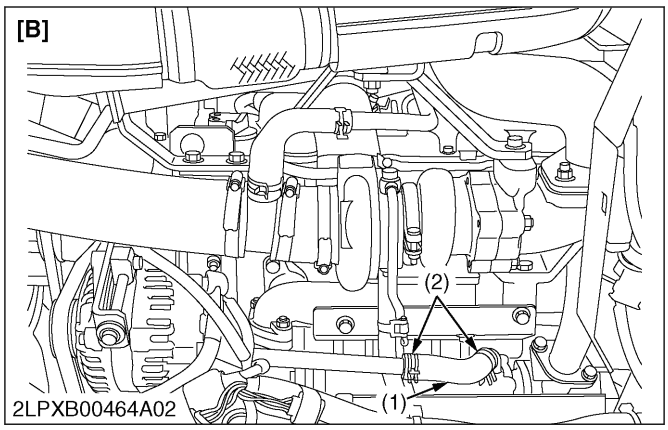
- **Do not remove the radiator cap when the engine is hot. Then loosen the cap slightly to release unwanted pressure before you remove the cap fully.**

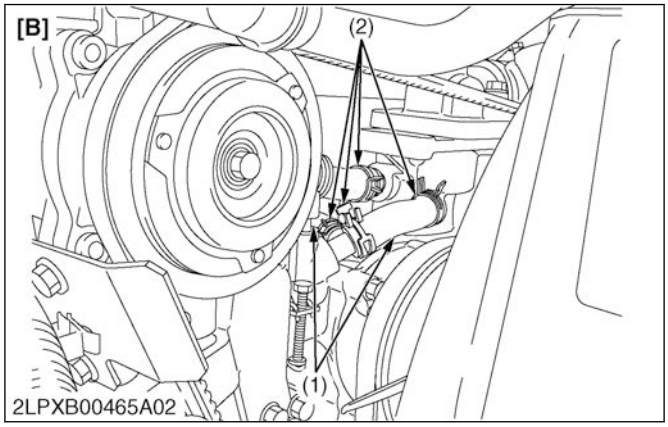


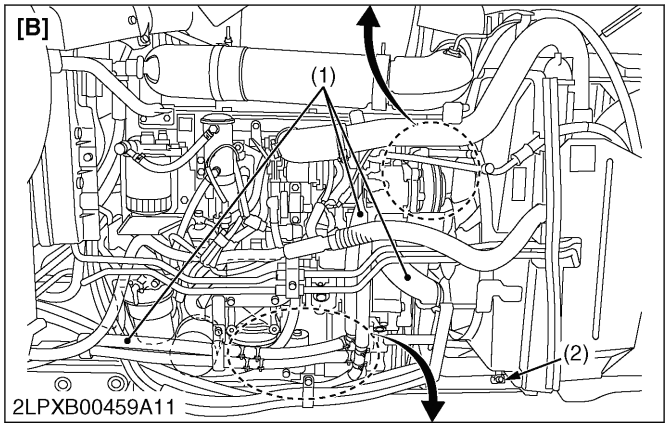



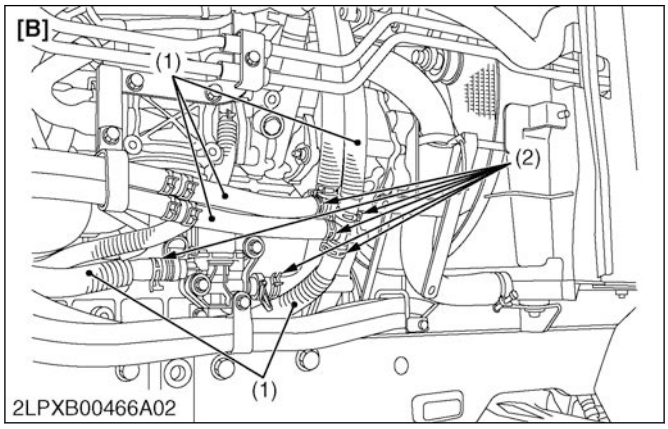





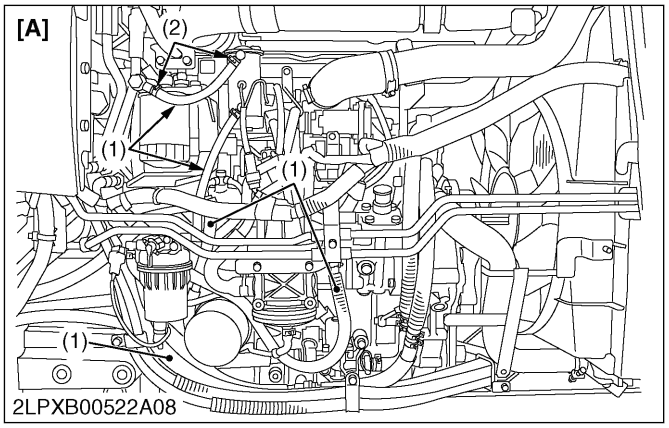



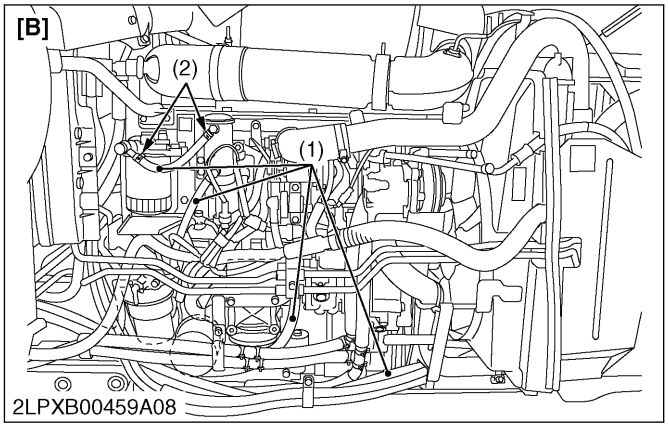

(1) Radiator hose
(2) Clamp
[A] ROPS
[B] Cabin

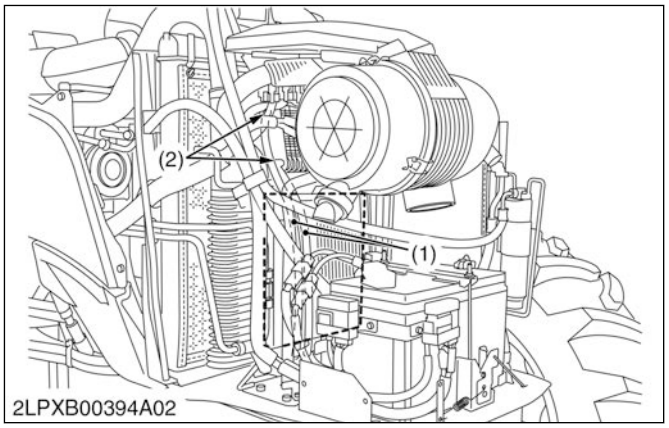
1. Drain the coolant.
2. Loosen the clamp bands (2).
3. Remove the hose (1).
4. Replace the hose (1) and clamp bands (2) with new ones.
5. Tighten the clamp bands (2) correctly.

## 1.19.2 Replacing fuel hose

1. Loosen the clamp (2) and remove the fuel hose (1).
2. Replace the fuel hose (1) and clamp (2) with new ones.




(1) Fuel hose
(2) Clamp
[A] ROPS model
[B] Cabin model

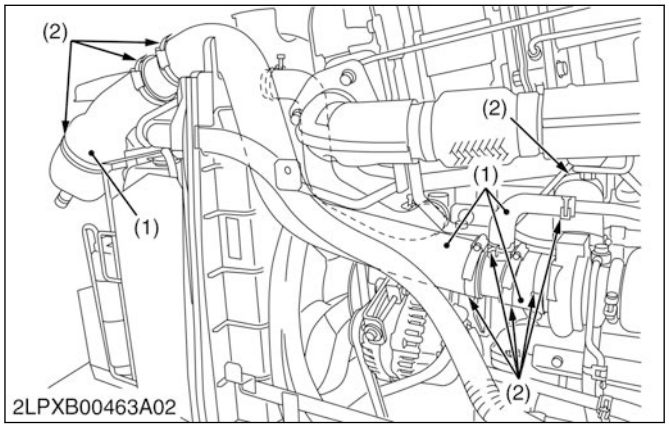
3. Tighten the clamp correctly.
4. After you replace the fuel hose and the clamp, bleed the fuel system.

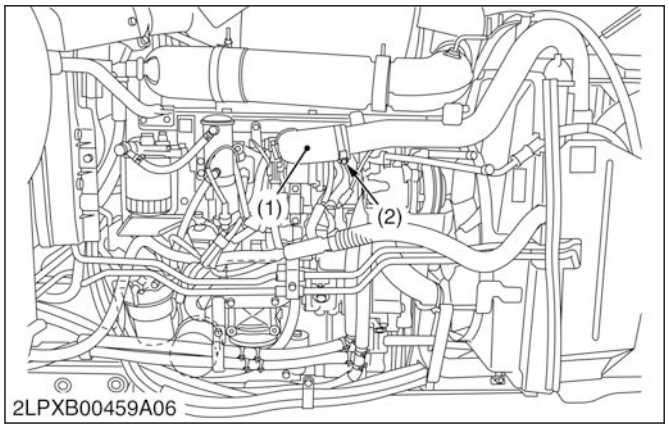
## 1.19.3 Replacing intake air line

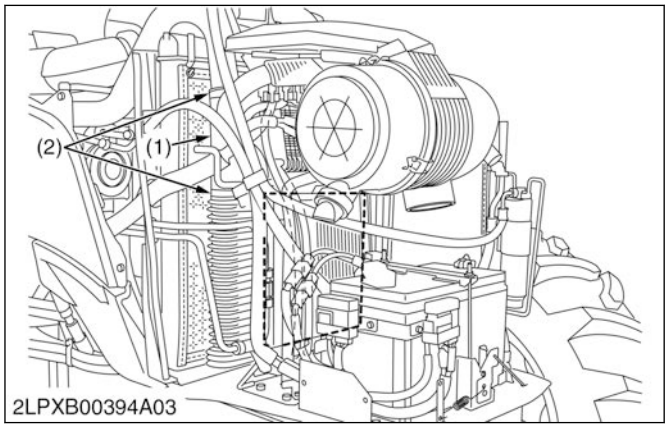
**IMPORTANT**

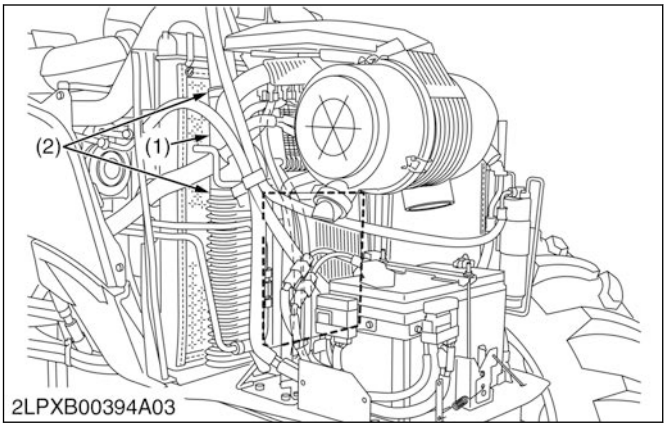
- **To prevent serious damage to the engine, keep out dust in the intake air line.**

1. Loosen the clamp (2).
2. Remove the intake air hose (1) and clamp (2).
3. Replace the intake air hose (1) and clamp (2) with new ones.



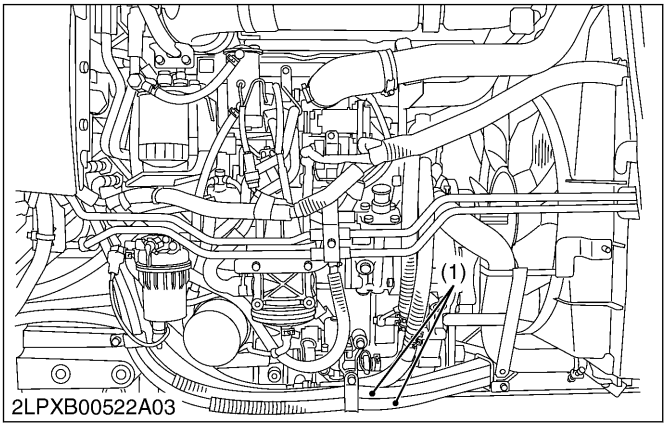




(1) Hose (2) Hose clamps

4. Tighten the clamp (2) correctly.

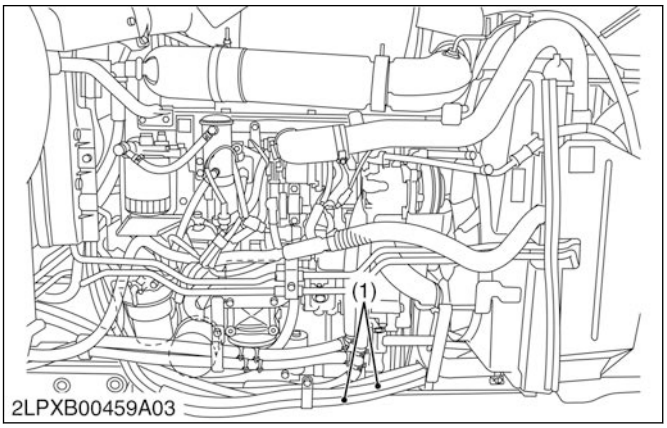
## 1.19.4 Replacing power steering hose

**ROPS model**




(1) Power steering hose

**CABIN model**




(1) Power steering hose

1. Replacing power steering hose (1).

## 1.19.5 Replacing lift cylinder hose

1. Replace the lift cylinder hose.

RELATED PAGE
5.5.1 Removing hydraulic cylinder on page 9-60

### 1.19.6 Replacing master cylinder kit

1. Replace the master cylinder kit.

RELATED PAGE
5.2.1 Disassembling master cylinder on page 6-33

### 1.19.7 Replacing brake seal 1 and 2

1. Replace the brake seal 1 and 2.

RELATED PAGE
5.5.1 Removing brake piston on page 6-37

### 1.19.8 Replacing trailer brake hose

1. Replace the trailer brake hose.

### 1.19.9 Replacing remote control valve hose for auto hitch, push back type (If equipped)

1. Replace the remote control valve hose.

### 1.19.10 Replacing remote control valve hose for front 3-point hitch (If equipped)

1. Replace the remote control valve hose for front 3-point hitch.

### 1.19.11 Replacing air conditioner hose

1. Replace the air conditioner hose.

RELATED PAGE
6.2.4 Removing air conditioner hose on page 11-72

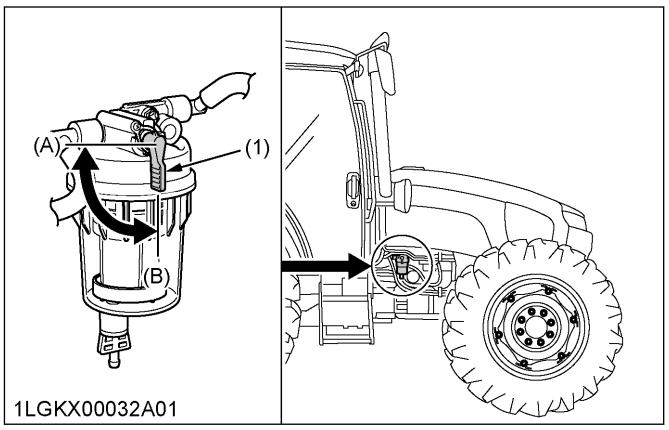
## 1.20 Others

### 1.20.1 Bleeding fuel system

Air must be removed:
- When the fuel filter or lines are removed.
- When the water is drained from the water separator.
- When the tank is completely empty.
- After the tractor has not been used for a long period of time.

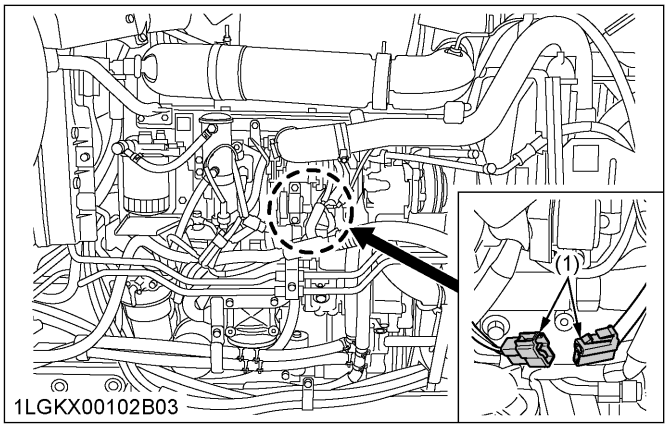
**Bleeding procedure is as follows:**

1. Fill the fuel tank with fuel, and open the fuel shutoff-valve.




(1) Fuel shutoff-valve (B) OPEN
(A) CLOSE

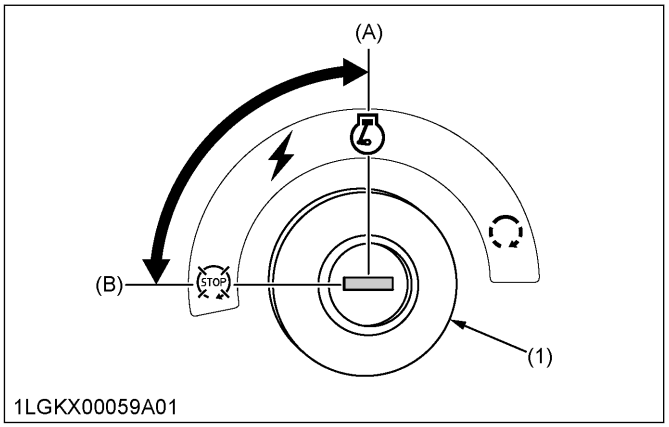
2. Disconnect the heater connector (if equipped).




(1) Connector

**IMPORTANT**
- **Do not try air-bleeding with the heater in operation. Otherwise the battery may be damaged.**

3. Turn **ON** and **OFF** the key switch repeatedly 10 times or so at the following intervals. This lets the air out of the fuel line.
   a. Key switch **ON** time: 30 seconds
   b. Key switch **OFF** time: 15 seconds




(1) Key switch (B) OFF
(A) ON

4. Connect the heater connector (if equipped).
5. Set the hand throttle lever at the maximum speed position, turn the key switch to start the engine and then reset the throttle lever at the mid speed (around 1500 $min^{-1}$(rpm)) position.
   If the engine does not start, try it several times at 30 second intervals.

**■ IMPORTANT**
- **Do not hold the key switch at the engine start position for more than 10 seconds continuously. If more engine cranking is needed, try again after 30 seconds.**

6. Accelerate the engine to remove the small portion of air left in the fuel system.
7. If air still remains and the engine stops, repeat the previous steps.

## 1.20.2 Bleeding brake system

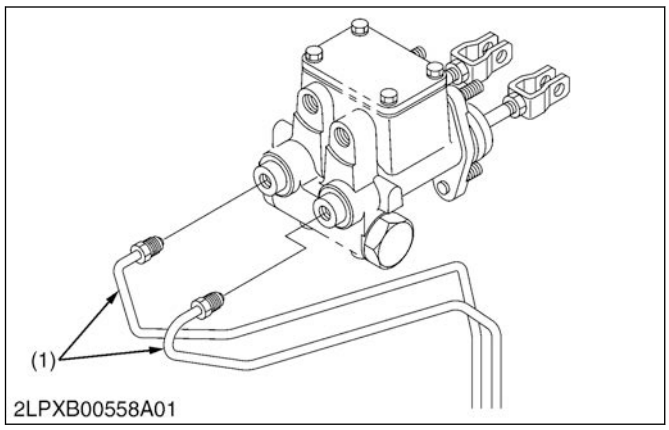
**⚠ CAUTION**
- **Be careful to hot part such a muffler and rotating part of engine during air bleeding procedure.**

**■ IMPORTANT**
- **The shuttle lever and main change lever are shift in NEUTRAL position.**
- **Set the parking brake lever to ON position.**
- **Fill the transmission fluid to the equalizer and master cylinder when overhaul the master cylinder assembly.**

**■ NOTE**
- **While bleeding, operate the engine at low speed to keep enough oil in the master cylinder assembly.**

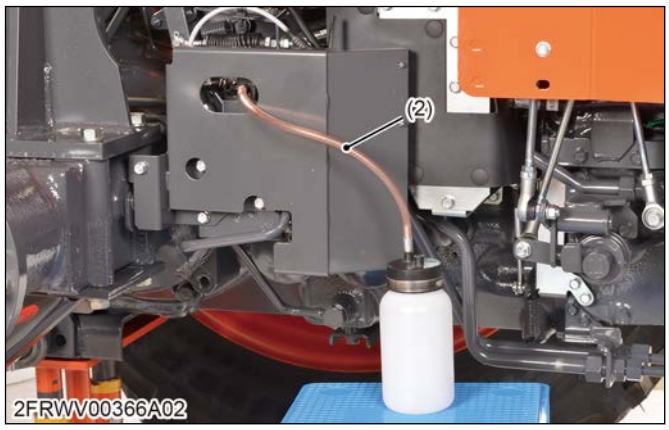
**(Reference: Importance of bleeding)**
- If the air mixes in the brake hydraulic circuit, poor or no braking force is obtained due to compress the air even when the brake pedal is pressed.
  Accordingly whenever the hydraulic brake system is disassembled, be sure to bleed after reassembling.

1. Disconnect the brake pipes (1) from the master cylinder.




(1) Brake pipe

2. Move the brake pedal up and down by hand. At this time, when raising the pedal, close the master cylinder outlet by a finger, and when lowering, release the finger.
   Repeat this operation several times. (Prepare the oil can.)
3. After bleeding the master cylinder, install the front brake pipes.
4. After installing the vinyl pipe (2) to the bleeder, loosen the bleeder two turns.




(2) Vinyl pipe

5. Move the brake pedal up and down.
   Repeat this motion until air bubble in brake oil disappears.

**(When reassembling)**
- After bleeding, tighten the bleeders firmly.
- Tighten the brake pipe retaining nut and the bleeder to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Brake pipe retaining nut | 20 to 28 N·m<br>2.1 to 2.8 kgf·m<br>15 to 20 lbf·ft |
| | Bleeder | 6.5 to 6.8 N·m<br>0.66 to 0.70 kgf·m<br>4.8 to 5.0 lbf·ft |

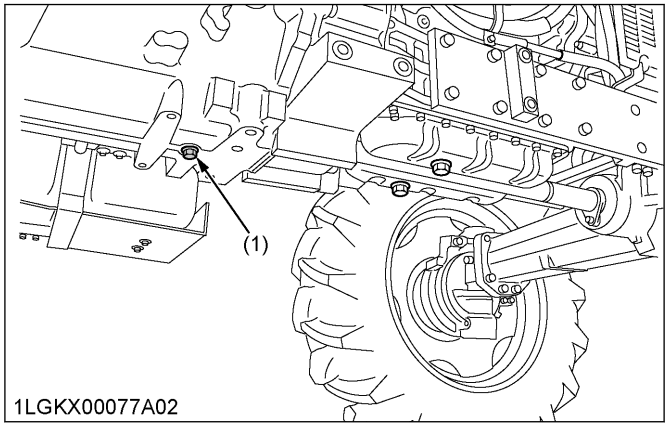
## 1.20.3 Replacing secondary brake pad

1. Check the secondary brake pad.
2. If any wear found, replace the secondary brake pad.

RELATED PAGE
5.6.2 Disassembling secondary brake disc and plate on page 4-105

## 1.20.4 Draining clutch housing water

The tractor is equipped with a drain plug under the clutch housing.
After operation in the rain or snow, or if the tractor has been washed, water may get into the clutch housing.
Remove the drain plug and drain the water, then reinstall the plug.

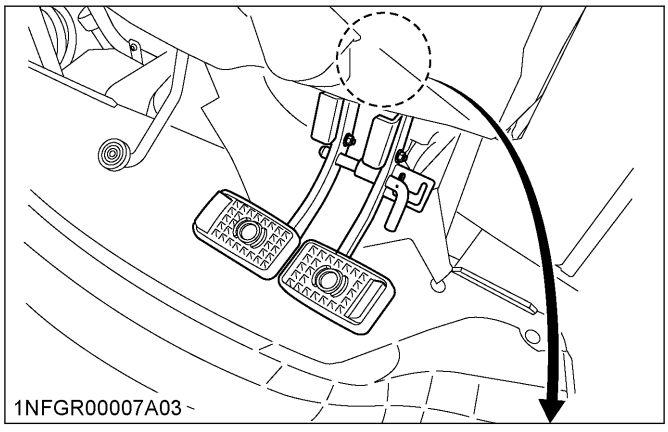


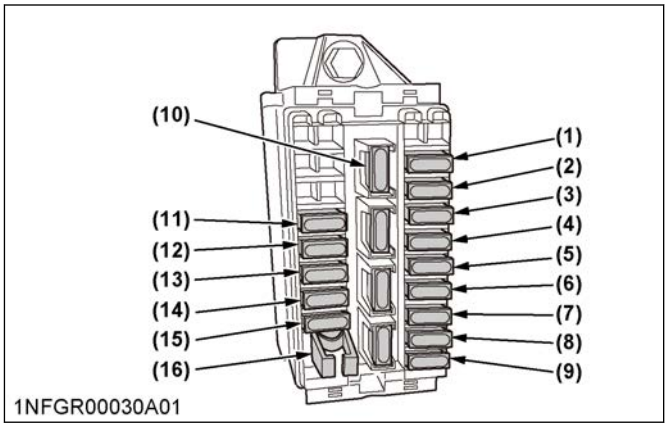

(1) Water drain plug

## 1.20.5 Checking fuse (ROPS model)

**IMPORTANT**

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



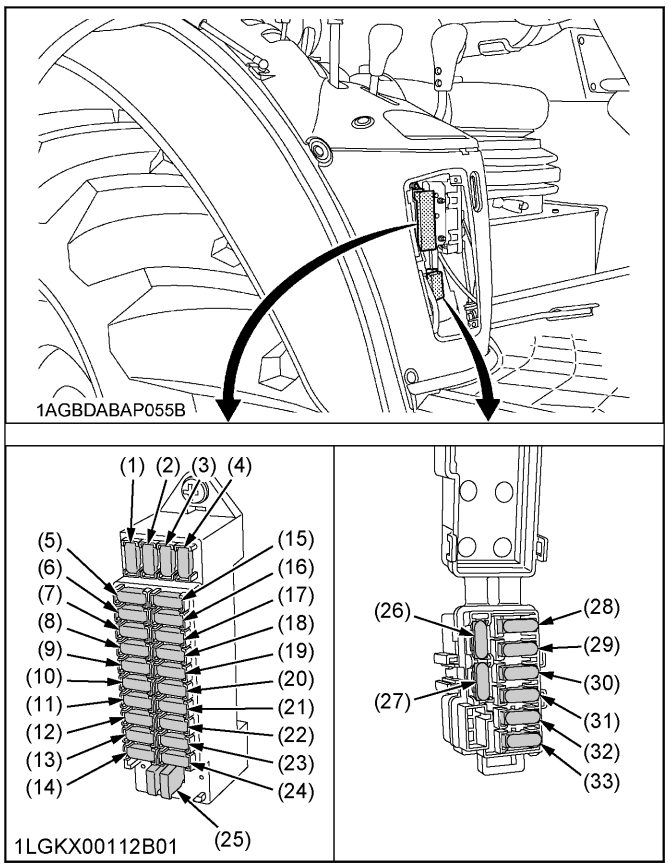

| Fuse No. | Capacity | Protected circuit |
|---|---|---|
| (1) | 15 A | Work light |
| (2) | 5 A | Meter (Backup) |
| (3) | 5 A | ECU (Backup) |
| (4) | 10 A | Turn signal, stop lamp |
| (5) | 15 A | Auxiliary power |
| (6) | 5 A | Meter panel |
| (7) | 20 A | Headlight |
| (8) | 15 A | Flasher |
| (9) | 5 A | Starter relay |
| (10) | | Spare fuse |
| (11) | 25 A | AUX socket |
| (12) | 10 A | Horn |
| (13) | 5 A | PTO, engine |
| (14) | 5 A | Transmission control |
| (15) | 15 A | ECU |
| (16) | | Fuse puller |

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

## 1.20.6 Checking fuse 1 (Cabin model)

**IMPORTANT**

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



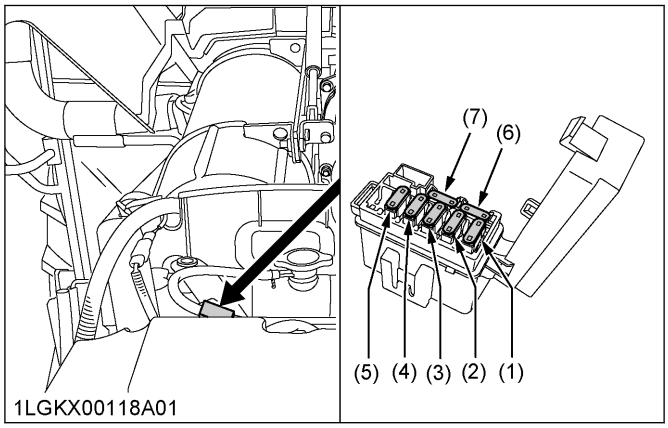

| Fuse No. | Capacity | Protected circuit |
|---|---|---|
| (1) | 5 A | Spare fuse |
| (2) | 10 A | Spare fuse |
| (3) | 15 A | Spare fuse |
| (4) | 20 A | Spare fuse |
| (5) | 15 A | Work light (Rear) |
| (6) | 15 A | Work light (Front) |
| (7) | 15 A | Cigarette lighter |
| (8) | 30 A | Air conditioner (Fan motor) |
| (9) | 10 A | Air conditioner (Compressor) |
| (10) | 20 A | Work light (Front side) |
| (11) | 5 A | Transmission control |
| (12) | 15 A | Loader plug |
| (13) | 15 A | ECU |
| (14) | 5 A | Starter relay |
| (15) | 5 A | Radio |
| (16) | 5 A | Air conditioner (Control) |
| (17) | 15 A | Wiper |
| (18) | 10 A | Alternator, PTO, engine |
| (19) | 5 A | Meter |
| (20) | 10 A | Turn signal |
| (21) | 10 A | Back up (Meter) |
| (22) | 20 A | Head light |
| (23) | 20 A | Flasher (Hazard) |
| (24) | 5 A | Back up (ECU) |
| (25) | Fuse puller | |
| (26) | 15 A | Spare fuse |
| (27) | 20 A | Spare fuse |
| (28) | 20 A | Quarter window defogger |
| (29) | 20 A | Rear window defogger |
| (30) | 15 A | Work light (Option) |
| (31) | 15 A | Stop lamp |
| (32) | 10 A | OBD |
| (33) | 10 A | Trailer brake valve |

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

## 1.20.7 Checking fuse 2 (Cabin model)

**■ IMPORTANT**

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



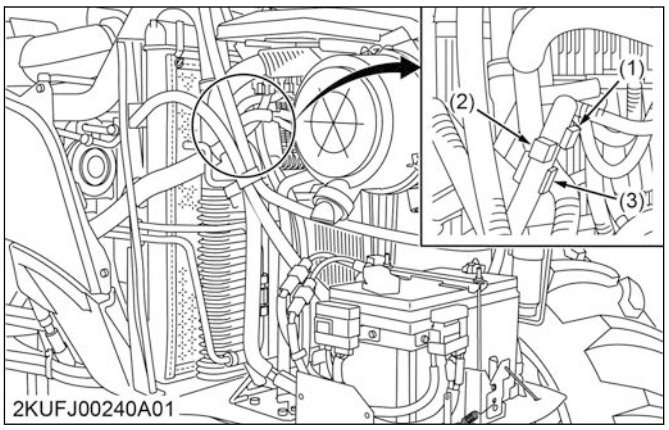

| Fuse No. | Capacity | Protected circuit |
|---|---|---|
| (1) | 30 A | CRS system fuel pump |
| (2) | 20 A | SCR system |
| (3) | 30 A | SCR heater system |
| (4) | 10 A | NOx sensor, SCR tank sensor |
| (5) | 10 A | EGR valve air flow sensor |
| (6) | 10 A | Spare fuse |
| (7) | 30 A | Spare fuse |

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

## 1.20.8 Checking oil separator fuse

**■ IMPORTANT**

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




**Oil separator fuse (If equipped)**

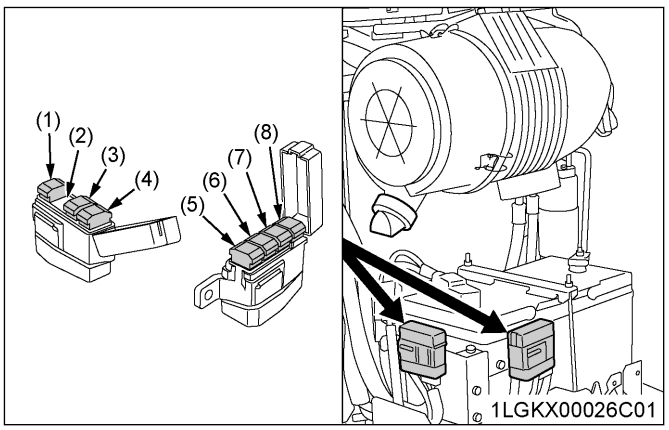
| Fuse No. | Capacity | Protected circuit |
|---|---|---|
| (1) | 15 A | Heater (Oil separator, out 1) |
| (2) | 15 A | Heater (Oil separator, in) |
| (3) | 15 A | Heater (Oil separator, out 2) |

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

## 1.20.9 Checking slow blow fuse (ROPS model)

**■ NOTE**

- **The slow blow fuse are intended to protect the electrical cabling. If any of them has blown out, be sure to pinpoint the cause. Never use any substitute, use only a KUBOTA genuine part.**



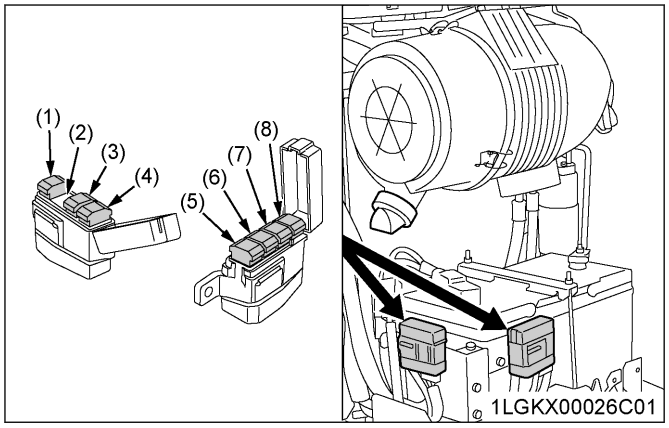
| Fuse No. | Capacity | Protected circuit | Type |
|---|---|---|---|
| (1) | 30 A | Main key switch | Bolt fixed |
| (2) | — | — | — |
| (2) | 50 A | SCR system | Non bolt fixed |
| (4) | 60 A | Hazard | |
| (6) | 120 A | Engine preheat | Bolt fixed |
| (6) | 40 A | Work light | |
| (7) | 30 A | Electrical outlet | Non bolt fixed |
| (8) | 60 A | Starter | |

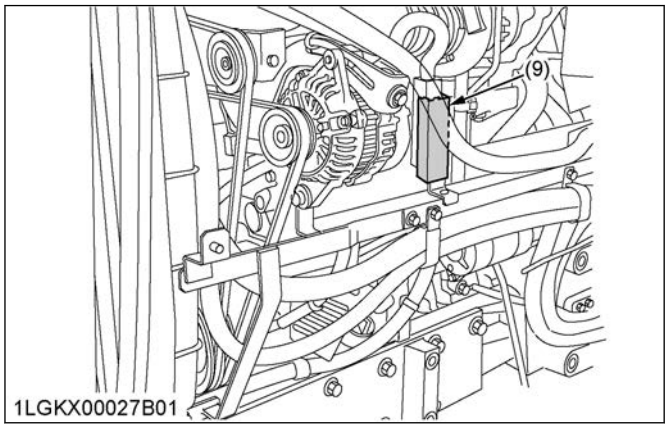
## 1.20.10 Checking slow blow fuses (Cabin model)

The slow blow fuses are intended to protect the electrical cabling.

**■ NOTE**

- **The slow blow fuse are intended to protect the electrical cabling. If any of them has blown out, be sure to pinpoint the cause. Never use any substitute, use only a KUBOTA genuine part.**




| Fuse No. | Capacity | Protected circuit | Type |
|---|---|---|---|
| (1) | 30 A | Main key switch | Bolt fixed |
| (2) | — | — | — |
| (3) | 50 A | SCR system | Non bolt fixed |
| (4) | 60 A | Defogger, hazard | |
| (5) | 120 A | Engine preheat | Bolt fixed |
| (6) | 40 A | Work light | |
| (7) | 30 A | Electrical outlet | Non bolt fixed |
| (8) | 60 A | Starter, air conditioner | |
| (9) | 150 A | Charge | |

## 1.20.11 Replacing light bulb (ROPS model)

| Light | Capacity |
|---|---|
| Headlight | 12 V, 60 W (HB3) |
| Turn signal and hazard light (front) | 12 V, 21 W |
| Turn signal and hazard light (rear) | 12 V, 21 W |
| Brake stop light and tail light | 12 V, 21/5 W |
| Front work light | 12 V, 35 W |
| Work light (fender) | 12 V, 35 W |
| Front position light | 12 V, 5 W |
| Registration plate light | 12 V, 10 W |

## 1.20.12 Replacing light bulb (Cabin model)

| Light | Capacity |
|---|---|
| Headlight | 12 V, 60 W (HB3) |
| Turn signal and hazard light (front) | 12 V, 21 W |
| Turn signal and hazard light (rear) | 12 V, 21 W |
| Brake stop light and tail light | 12 V, 21/5 W |
| Front work light | 12 V, 35 W |
| Work light (for outer roof) | 12 V, 55 W |
| Dome light (room lamp) | 12 V, 5 W |
| Front position light | 12 V, 5 W |
| Registration plate light | 12 V, 10 W |

## 1.20.13 Replacing head lamp

**⚠ CAUTION**

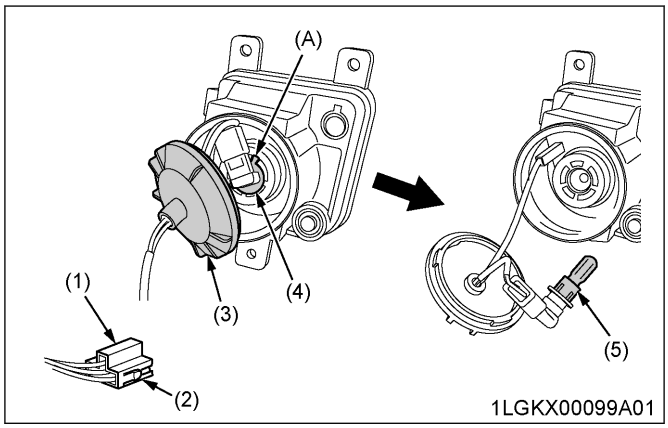
**To avoid personal injury:**

- **Be careful not to drop the bulb, hit anything against the lamp, apply excess force, and get the lamp scratched. If broken, glass may cause injury. Pay more attention to halogen lamps in particular, which have high pressure inside.**

- **Before replacing the lamp, be sure to turn off the light and wait until the bulb cools down, otherwise, you may get burned.**

**IMPORTANT**

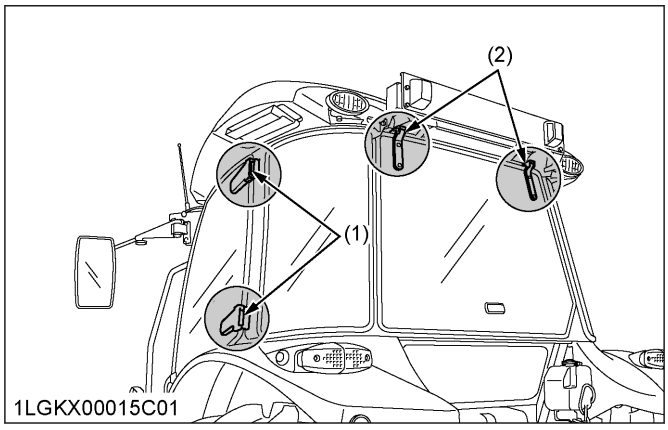
- **Be sure to use a new bulb of the specified wattage.**
- **Never touch the bulb surface (glass) with bare hands.**
  **Fingerprints, for example, may break the bulb.**




(1) Electrical connector
(2) Lock buttons
(3) Cover
(4) Bulb base
(5) Bulb
(A) Base's wider projection to face upward

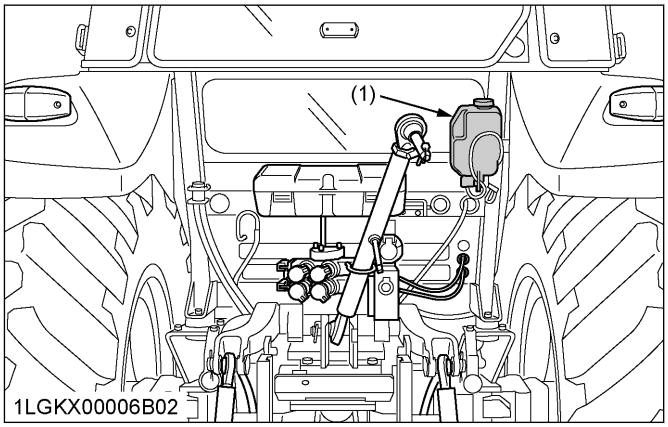
1. While pushing the right and left lock buttons (2), pull and remove the electrical connector (1).
2. Turn the cover (3) counterclockwise to remove it.
3. Turn the bulb base (4) counterclockwise to remove the bulb (5).
4. Replace with a new bulb and reinstall the head lamp assembly in the reverse order.

## 1.20.14 Lubricating points (Cabin model)




(1) Door hinge
(2) Rear window hinge

## 1.20.15 Adding washer liquid (Cabin model)




(1) Washer liquid tank

1. Add a proper amount of automobile washer liquid.

| | |
|---|---|
| Washer tank capacity | 1.3 L<br>1.4 U.S.qts<br>1.1 Imp.qts |

## 1.20.16 Checking amount of refrigerant (gas)

**⚠ WARNING**

**To avoid personal injury or death:**

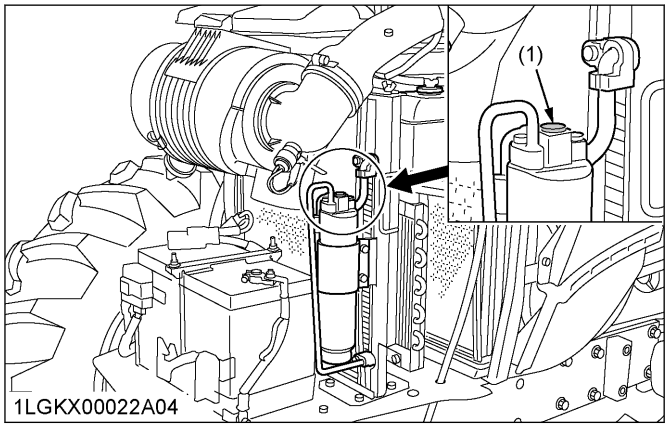
- **Liquid contact with eyes or skin may cause frostbite.**
- **In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes.**
- **In contact with a flame, R134a refrigerant produces a toxic gas.**

A shortage of refrigerant impairs the air conditioner performance. Check the following points. If it is indicated that the amount of refrigerant is extremely low, ask your dealer to inspect and refill.

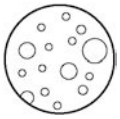
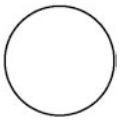
**Checking procedure**

1. Run the air conditioner in the following conditions.
   - Engine speed: About 1500 $min^{-1}$ (rpm)
   - Temperature control dial: Maximum cooling position
   - Fan switch: Highest blow
   - Air conditioner switch: **ON**

2. Look into the sight glass to see if and how the refrigerant is flowing through its circuit.




(1) Sight glass

| | | |
|---|---|---|
|  | Proper | Little or no air bubbles in the refrigerant flow. |
|  | Low | Lots of air bubbles in the refrigerant flow (air bubbles or foam passing continuously). |
|  | Overfull or no refrigerant: | Colorless and transparent. |

**■ IMPORTANT**

- **Charge only with R134a not R12 refrigerant.**

# SPECIAL TOOLS

## 1. Special tools for engine

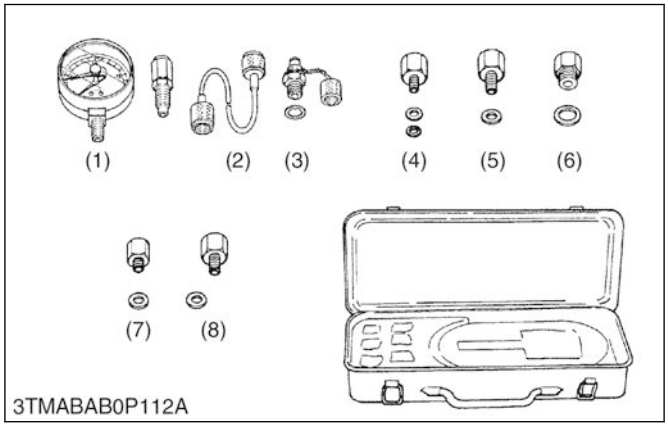
### 1.1 Diesel engine compression tester

To measure the diesel engine compression and to make a decision for a large overhaul if necessary.
**Code No.**
07909-30208 (Assembly)


(1) Gauge

### 1.2 Oil pressure tester

To measure the engine oil pressure.

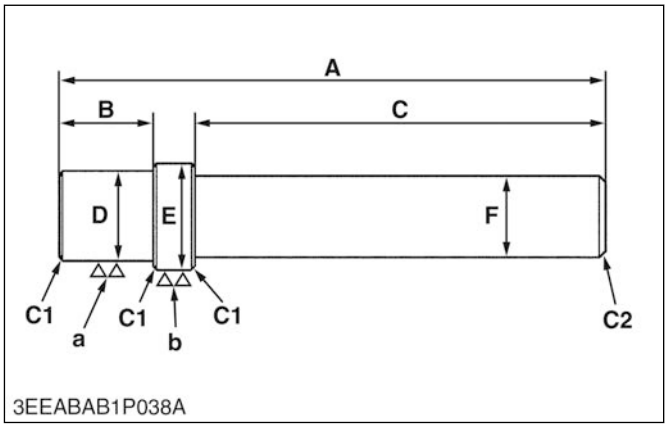



(1) Gauge
(2) Cable
(3) Threaded joint
(4) Adaptor 1
(5) Adaptor 2
(6) Adaptor 3
(7) Adaptor 4
(8) Adaptor 5

### 1.3 Small end bushing replacing tool

Use to press out and to press fit the small end.

**NOTE**
- **The special tool is not provided, therefore make it by referring to the figure below.**




**[Press out]**

| | |
|---|---|
| A | 157 mm (6.1811 in.) |
| B | 14.5 mm (0.571 in.) |
| C | 120 mm (4.7244 in.) |
| D | 30.0 mm dia. (1.1811 in. dia.) |
| E | 32.95 mm dia. (1.2972 in. dia.) |
| F | 20 mm dia. (0.7874 in. dia.) |
| a | 6.3 µm (0.00025 in.) |
| b | 6.3 µm (0.00025 in.) |
| C1 | Chamfer 1.0 mm (0.039 in.) |
| C2 | Chamfer 2.0 mm (0.079 in.) |

**[Press fit]**

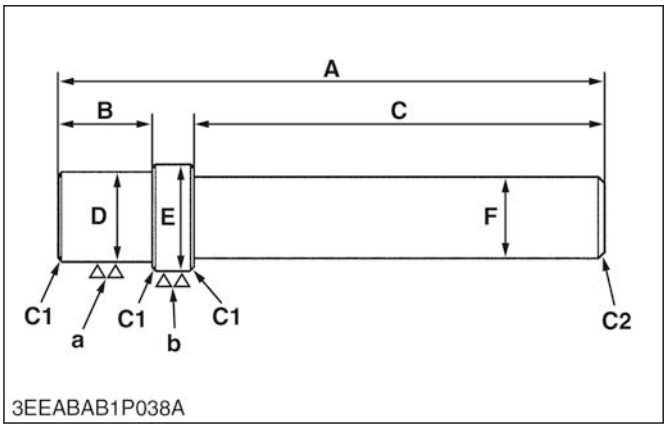
| | |
|---|---|
| A | 157 mm (6.1811 in.) |
| B | 14.5 mm (0.571 in.) |
| C | 120 mm (4.7244 n.) |
| D | 30.0 mm dia. (1.1811 in. dia.) |
| E | 42.000 mm dia. (1.6535 in. dia.) |
| F | 20 mm dia. (0.7874 in. dia.) |
| a | 6.3 µm (0.00025 in.) |
| b | 6.3 µm (0.00025 in.) |
| C1 | Chamfer 1.0 mm (0.039 in.) |
| C2 | Chamfer 2.0 mm (0.079 in.) |

## 1.4 Idle gear bushing replacing tool

Use to press out and to press fit the bushing.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure below.**



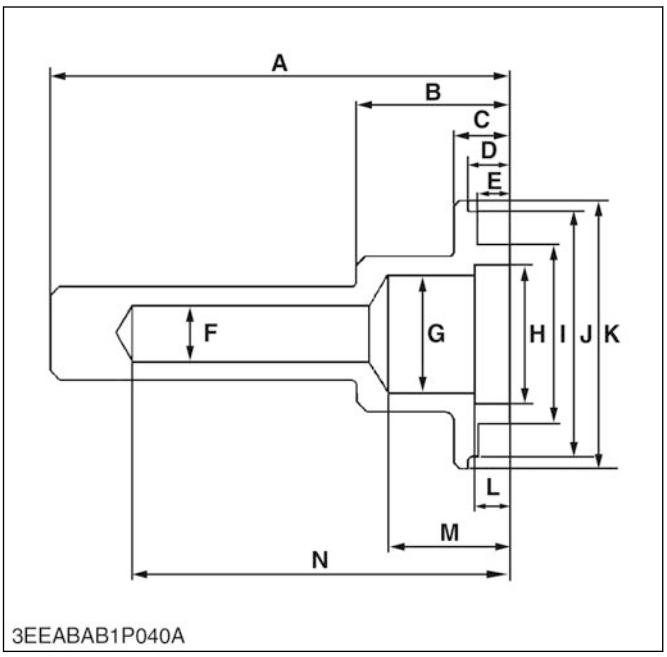

| | |
|---|---|
| A | 196 mm (7.7165 in.) |
| B | 37.5 mm (1.476 in.) |
| C | 150 mm (5.9055 in.) |
| D | 44.95 mm dia. (1.7697 in. dia.) |
| E | 48.075 to 48.100 mm dia. (1.8927 to 1.8937 in. dia.) |
| F | 20 mm dia. (0.7874 in. dia.) |
| a | 6.3 µm (0.00025 in.) |
| b | 6.3 µm (0.00025 in.) |
| C1 | Chamfer 1.0 mm (0.039 in.) |
| C2 | Chamfer 2.0 mm (0.079 in.) |

## 1.5 Gear case oil seal press fit tool

To press fit the oil seal.

**NOTE**

- **This special tool is not provided, therefore make it by referring to the figure below.**



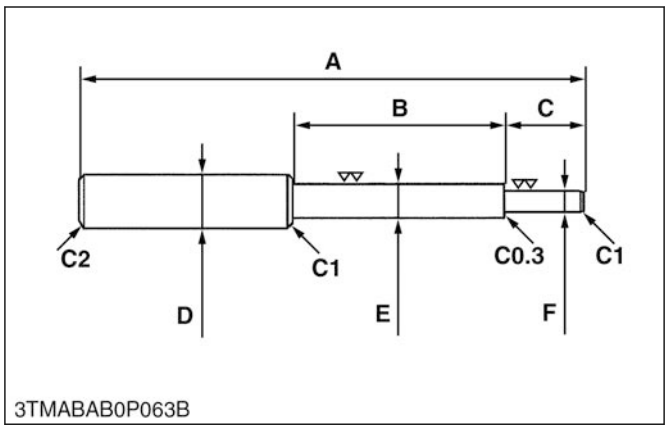

| | |
|---|---|
| A | 148.8 mm (5.858 in.) |
| B | 50 mm (2.0 in.) |
| C | 18.8 mm (0.740 in.) |
| D | 13.7 to 13.9 mm (0.540 to 0.547 in.) |
| E | 11 mm (0.43 in.) |
| F | 18 mm dia. (0.71 in. dia.) |
| G | 38 mm dia. (1.5 in. dia.) |
| H | 45 mm dia. (1.8 in. dia.) |
| I | 57.90 to 58.10 mm dia. (2.280 to 2.287 in. dia.) |
| J | 79.5 mm dia. (3.13 in. dia.) |
| K | 87 mm dia. (3.4 in. dia.) |
| L | 12 mm (0.47 in.) |
| M | 40 mm (1.6 in.) |
| N | 120 mm (4.72 in.) |

## 1.6 Valve guide replacing tool

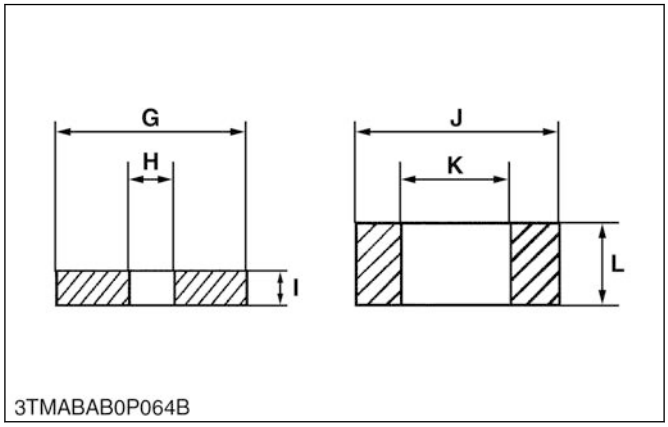
To press out and press fit the valve guide.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure below.**



3TMABAB0P063B



3TMABAB0P064B

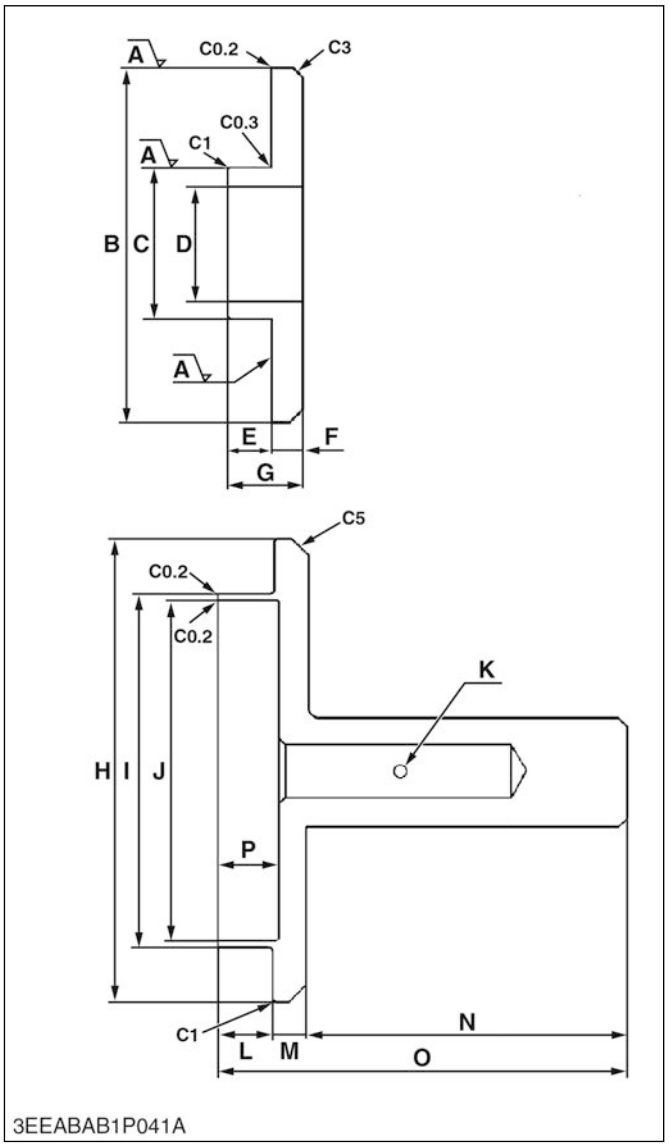
| | |
|---|---|
| A | 225 mm (8.86 in.) |
| B | 70 mm (2.8 in.) |
| C | 45 mm (1.8 in.) |
| D | 20 mm dia. (0.79 in. dia.) |
| E | 11.7 to 11.9 mm dia. (0.461 to 0.468 in. dia.) |
| F | 6.50 to 6.60 mm dia. (0.256 to 0.259 in. dia.) |
| G | 25 mm dia. (0.98 in. dia.) |
| H | 6.70 to 7.00 mm dia. (0.264 to 0.275 in. dia.) |
| I | 5 mm (0.2 in.) |
| J | 20 mm dia. (0.79 in. dia.) |
| K | 12.5 to 12.8 mm dia. (0.493 to 0.503 in. dia.) |
| L | 7.90 to 8.10 mm (0.311 to 0.318 in.) |
| C1 | Chamfer 1.0 mm (0.039 in.) |
| C2 | Chamfer 2.0 mm (0.079 in.) |
| C0.3 | Chamfer 0.3 mm (0.01 in.) |

## 1.7 Crankshaft sleeve press fit tool

To press fit the crankshaft sleeve.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure below.**



3EEABAB1P041A

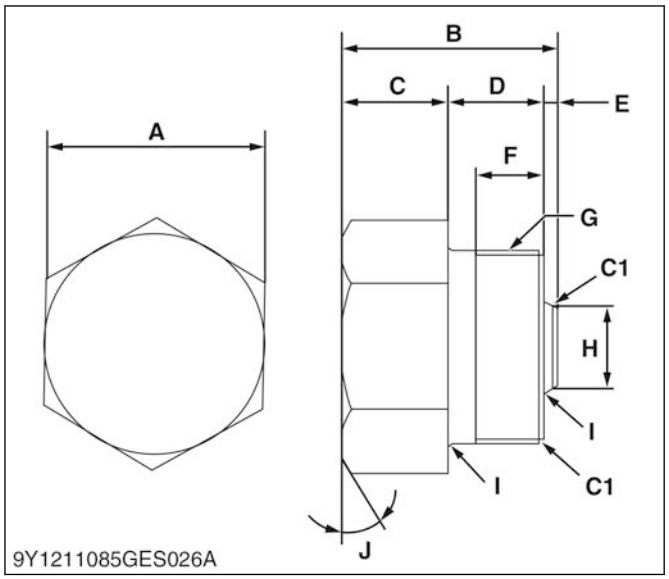
| | |
|---|---|
| A | Rmax = 12.5 S |
| B | 94.5 to 95.0 mm dia. (3.72 to 3.74 in. dia.) |
| C | 40 mm dia. (1.6 in. dia.) |
| D | 30 mm dia. (1.2 in. dia.) |
| E | 12 mm (0.47 in.) |
| F | 7.90 to 8.10 mm (0.311 to 0.318 in.) |
| G | 20 mm (0.79 in.) |
| H | 130 mm dia. (5.12 in. dia.) |
| I | 99.40 to 99.60 mm dia. (3.914 to 3.921 in. dia.) |
| J | 95.05 to 95.20 mm dia. (3.743 to 3.748 in. dia.) |
| K | 3 mm dia. (0.1 in. dia.) |
| L | 15 mm (0.59 in.) |
| M | 10 mm (0.39 in.) |
| N | 90 mm (3.5 in.) |
| O | 115 mm (4.53 in.) |
| P | 16.9 to 17.1 mm (0.666 to 0.673 in.) |
| C1 | Chamfer 1.0 mm (0.039 in.) |
| C3 | Chamfer 3.0 mm (0.12 in.) |
| C5 | Chamfer 5.0 mm (0.20 in.) |
| C0.2 | Chamfer 0.2 mm (0.008 in.) |
| C0.3 | Chamfer 0.3 mm (0.01 in.) |

## 1.8 Supply pump gear puller

To remove the injection pump gear.

**■ NOTE**

- **These special tools are not provided, therefore make it by referring to the figure below.**



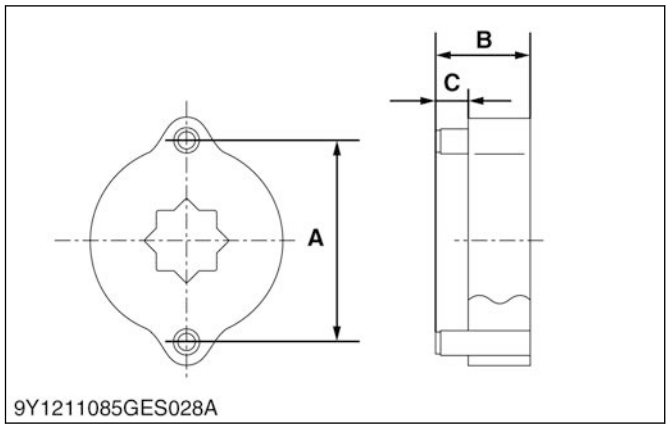

| | |
|---|---|
| A | 41 mm (1.6 in.) |
| B | 40.5 mm (1.59 in.) |
| C | 20 mm (0.79 in.) |
| D | 18 mm (0.71 in.) |
| E | 2.5 mm (0.098 in.) |
| F | 13 mm (0.51 in.) |
| G | M36 × Pitch 1.5 |
| H | 16 mm dia. (0.63 in. dia.) |
| I | 1 mm radius (0.04 in. radius) |
| J | 0.52 rad (30°) |
| C1 | Chamfer 1.0 mm (0.039 in.) |

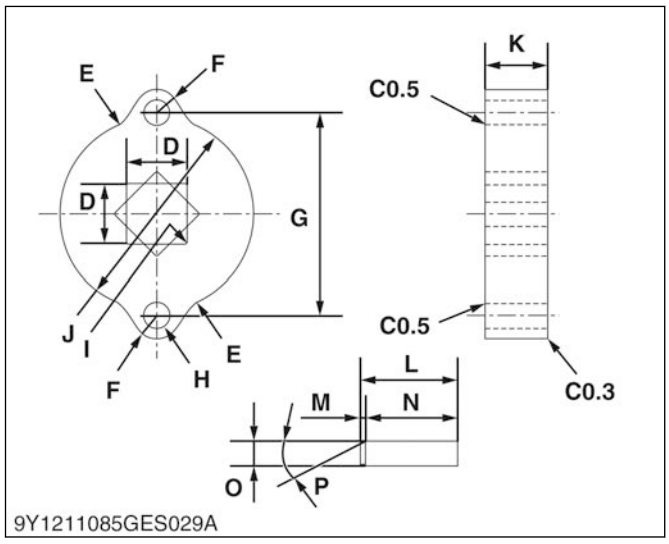
## 1.9 Supply pump gear reinstall jig

To remove the injection pump gear.

**■ NOTE**

- **These special tools are not provided, therefore make it by referring to the figure.**



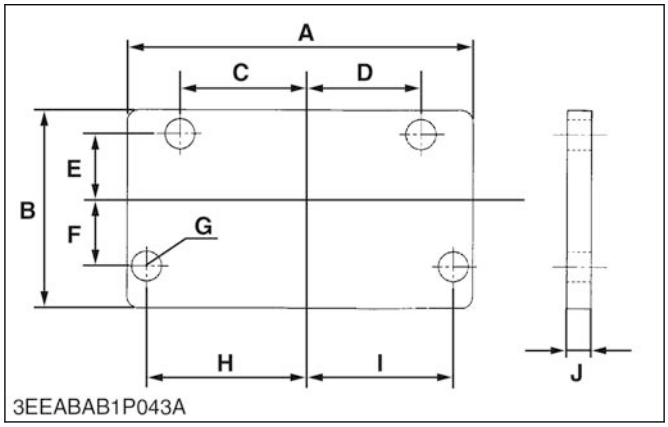
| | |
|---|---|
| A | 43.95 to 44.05 mm (1.731 to 1.734 in.) |
| B | 21 mm (0.83 in.) |
| C | 8 mm (0.3 in.) |
| D | 12.9 to 13.1 mm square (0.508 to 0.515 in. square) |
| E | 10 mm radius (0.39 in. radius) |
| F | 5 mm radius (0.2 in. radius) |
| G | 43.95 to 44.05 mm (1.731 to 1.734 in.) |
| H | 5.240 to 5.255 mm dia. (0.2063 to 0.2068 in. dia.) |
| I | 0.4 mm radius (0.02 in. radius) |
| J | 42 mm (1.7 in.) |
| K | 13 mm (0.51 in.) |
| L | 21 mm (0.83 in.) |
| M | 1 mm (0.04 in.) |
| N | 20 mm (0.79 in.) |
| O | 5.265 to 5.275 mm dia. (0.2073 to 0.2076 in. dia.) |
| P | 0.52 rad (30°) |
| C0.3 | Chamfer 0.3 mm (0.01 in.) |
| C0.5 | Chamfer 0.5 mm (0.02 in.) |

## 1.10 Flywheel stopper

To loosen and tighten the flywheel screw.

**NOTE**

- **This special tool is not provided, therefore make it by referring to the figure.**



3EEABAB1P043A

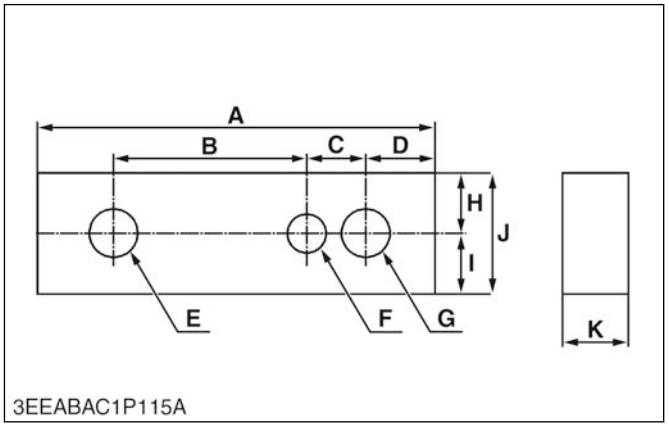
| | |
|---|---|
| A | 140 mm (5.51 in.) |
| B | 80 mm (3.1 in.) |
| C | 49.3 mm (1.94 in.) |
| D | 49.3 mm (1.94 in.) |
| E | 23.8 mm (0.937 in.) |
| F | 23.8 mm (0.937 in.) |
| G | 11 mm dia. (0.43 in. dia.) |
| H | 56.5 mm (2.22 in.) |
| I | 56.5 mm (2.22 in.) |
| J | 8 mm (0.3 in.) |

## 1.11 Crankcase 1 and 2 aligning tool

To aligning the crankcase 1 and 2.

**NOTE**

- **This special tool is not provided, therefore make it by referring to the figure.**



3EEABAC1P115A

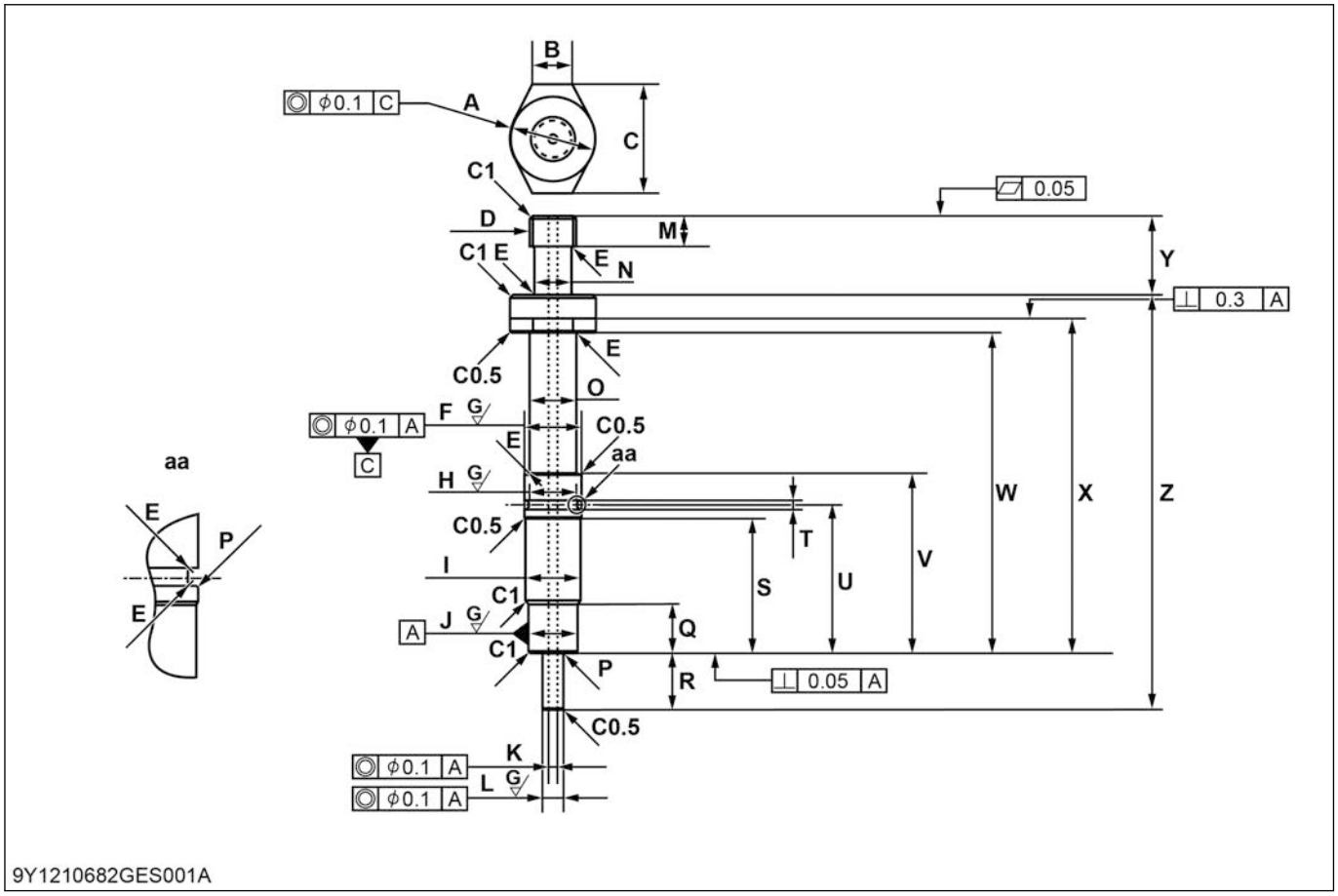
| | |
|---|---|
| A | 115 mm (4.53 in.) |
| B | 56 mm (2.2 in.) |
| C | 17 mm (0.67 in.) |
| D | 20 mm (0.79 in.) |
| E | 14 mm dia. (0.55 in. dia.) |
| F | 11 mm dia. (0.43 in. dia.) |
| G | 14 mm dia. (0.55 in. dia.) |
| H | 17.5 mm (0.689 in.) |
| I | 17.5 mm (0.689 in.) |
| J | 35 mm (1.4 in.) |
| K | 19 mm (0.75 in.) |

## 1.12 Compression tester adaptor

To measure the diesel engine compression pressure and to make a decision for a large overhaul if necessary.

**■ NOTE**

- **These special tools are not provided, therefore make it by referring to the figure.**



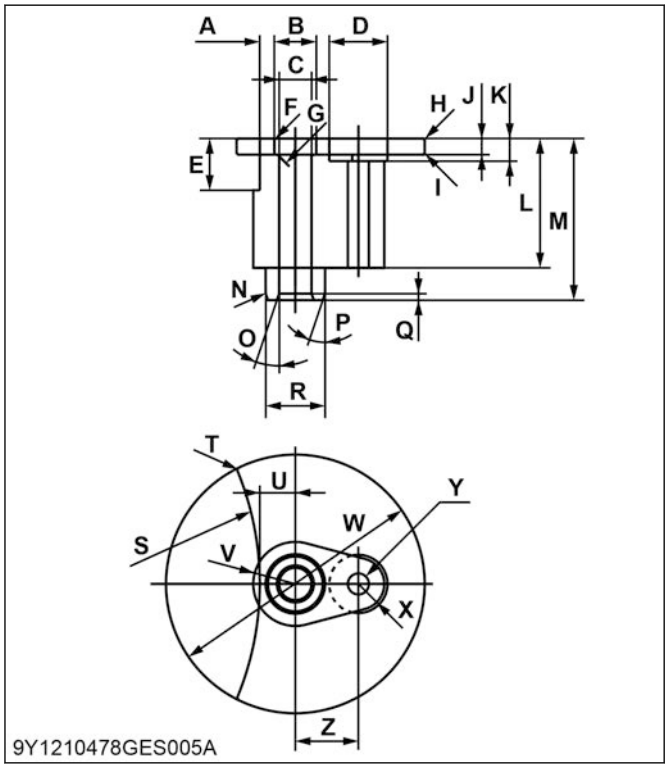
| | |
|---|---|
| A | 29.80 to 30.00 mm dia. (1.174 to 1.181 in. dia.) |
| B | 14 mm (0.55 in.) |
| C | 39.2 to 40.2 mm (1.55 to 1.58 in.) |
| D | 5/8-18UNF-2B |
| E | 0.8 mm radius (0.03 in. radius) |
| F | 19.84 to 19.95 mm (0.7811 to 0.7854 in.) |
| G | Ra = 3.2a |
| H | 16.14 to 16.20 mm (0.6355 to 0.6377 in.) |
| I | 19.08 to 19.20 mm (0.7512 to 0.7559 in.) |
| J | 16.89 to 17.00 mm (0.6650 to 0.6692 in.) |
| K | 3.0 mm dia. (0.12 in. dia.) |
| L | 7.10 to 7.20 mm (0.280 to 0.283 in.) |
| M | 11 mm (0.43 in.) |
| N | 13 mm dia. (0.51 in. dia.) |
| O | 16 mm dia. (0.63 in. dia.) |
| P | 0.4 mm radius (0.02 in. radius) |
| Q | 18 mm (0.71 in.) |
| R | 20.4 mm (0.803 in.) |
| S | 48.6 mm (1.91 in.) |
| T | 3.20 to 3.45 mm (0.126 to 0.135 in.) |
| U | 53.6 mm (2.11 in.) |
| V | 65 mm (2.6 in.) |
| W | 116 mm (4.57 in.) |
| X | 120.7 to 121.3 mm (4.752 to 4.775 in.) |
| Y | 28.5 mm (1.12 in.) |
| Z | 150 mm (5.91 in.) |
| C0.5 | Chamfer 0.5 mm (0.02 in.) |
| C1 | Chamfer 1.0 mm (0.039 in.) |

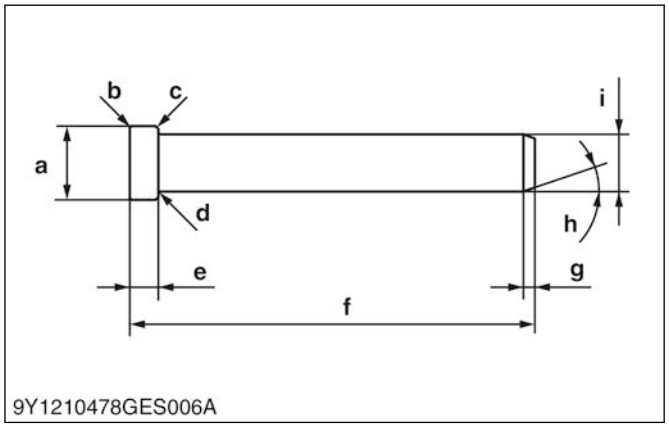
## 1.13 Air gap of the crankshaft position sensor measuring jig 1

To measure the air gap of the crankshaft position sensor.

**■ NOTE**

- **These special tools are not provided, therefore make it by referring to the figure.**



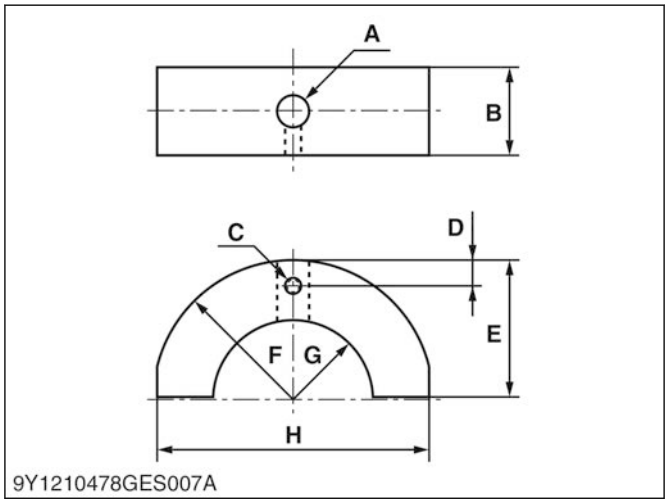

| | |
|---|---|
| A | 92 mm radius (3.6 in. radius) |
| B | 13.0 to 13.1 mm dia. (0.512 to 0.515 in. dia.) |
| C | 10.000 to 10.015 mm dia. (0.39370 to 0.39429 in. dia.) |
| D | 18 mm dia. (0.71 in. dia.) |
| E | 16 mm (0.63 in.) |
| F | Chamfer 0.3 mm (0.01 in.) |
| G | Chamfer 0.5 mm (0.02 in.) |
| H | Chamfer 0.5 mm (0.02 in.) |
| I | Chamfer 0.5 mm (0.02 in.) |
| J | 5.00 to 5.05 mm (0.197 to 0.198 in.) |
| K | 7.0 mm (0.28 in.) |
| L | 39.990 to 40.010 mm (1.5744 to 1.5751 in.) |
| M | 50 mm (2.0 in.) |
| N | 5.0 mm radius (0.20 in. radius) |
| O | 0.35 rad (20°) |
| P | 0.35 rad (20°) |
| Q | 2.0 mm (0.079 in.) |
| R | 18.380 to 18.393 mm dia. (0.72363 to 0.72413 in. dia.) |
| S | 92 mm radius (3.6 in. radius) |
| T | Chamfer 0.5 mm (0.02 in.) |
| U | 11 mm (0.43 in.) |
| V | 13 mm radius (0.51 in. radius) |
| W | 80 mm dia. (3.1 in. dia.) |
| X | 8.0 mm radius (0.31 in. radius) |
| Y | 6.5 mm dia. (0.26 in. dia.) |
| Z | 19.5 mm (0.768 in.) |
| a | 12.8 to 12.9 mm dia. (0.504 to 0.507 in. dia.) |
| b | Chamfer 0.3 mm (0.01 in.) |
| c | Chamfer 0.5 mm (0.02 in.) |
| d | 0.4 mm radius (0.02 in. radius) |
| e | 4.95 to 5.00 mm (0.195 to 0.196 in.) |
| f | 70.940 to 70.960 mm (2.7930 to 2.7937 in.) |
| g | 2.0 mm (0.079 in.) |
| h | 0.35 rad (20°) |
| i | 9.978 to 9.987 mm (0.3929 to 0.3931 in.) |

## 1.14 Air gap of the crankshaft position sensor measuring jig 2

To measure the air gap of the crankshaft position sensor.

**■ NOTE**

- **This special tool is not provided, therefore make it by referring to the figure.**



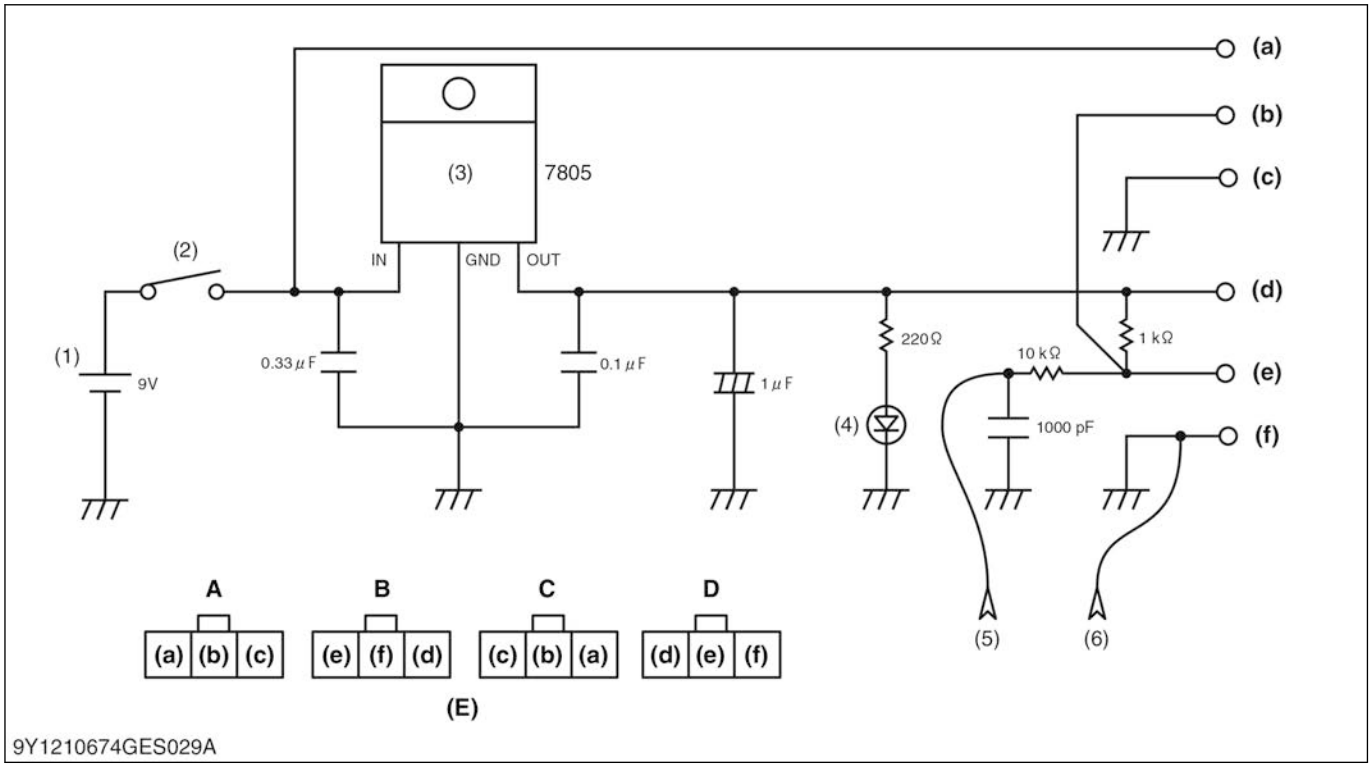

| | |
|---|---|
| A | 8.0 mm dia. reamer (0.31 in. dia. reamer) |
| B | 22.0 mm (0.866 in.) |
| C | M4 × Pitch 0.7 |
| D | 6.5 mm (0.26 in.) |
| E | 34.0 mm (1.34 in.) |
| F | 35 mm radius (1.4 in. radius) |
| G | 20 mm radius (0.79 in. radius) |
| H | 68.0 mm (2.68 in.) |

# 1.15 Rotation sensor signal interface unit

Use for reading rotation sensor signal.

**NOTE**

- **This special tool is not provided, therefore make it by referring to the figure.**



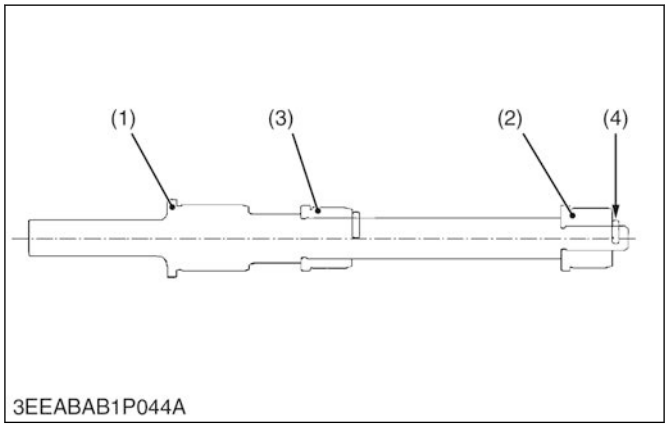

(1) 9 V battery
(2) Switch
(3) 3-terminal regulator
(4) LED
(5) Clip (Red)
(6) Clip (Black)
A: for Panasonic
B: for DENSO
C: for BOSCH cam angle
D: for BOSCH crank angle
(E) Connector side
(a) +9 V
(b) Signal
(c) GND
(d) +5 V
(e) Signal
(f) GND

## 1.16 Balancer bushing replacing tool 1 assembly

Use to press fit the bushing.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**



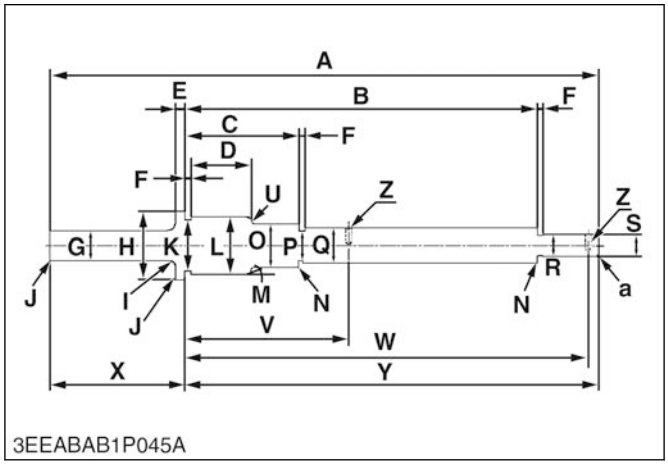
3EEABAB1P044A

| No. | Name of part | Q'ty | Remarks |
|---|---|---|---|
| 1 | Shaft | 1 | — |
| 2 | Piece 1 | 1 | — |
| 3 | Piece 2 | 1 | — |
| 4 | Bolt | 2 | M6 × P1.0 |

## 1.17 Balancer bushing replacing tool 1 components parts

**NOTE**

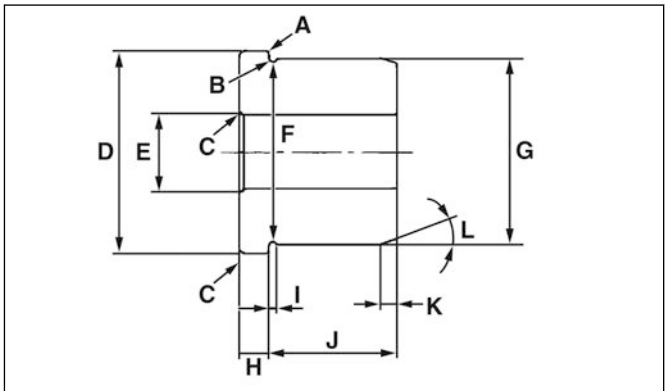
- **The special tools are not provided, therefore make them by referring to the figure.**



3EEABAB1P045A

**Shaft**

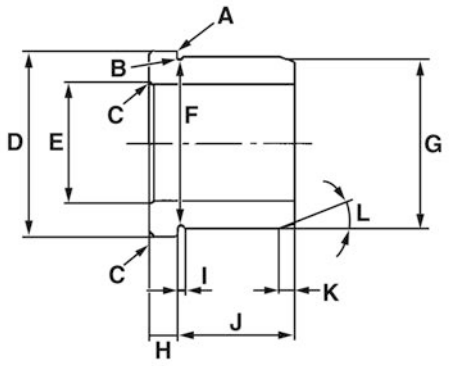
| | |
|---|---|
| A | 498 mm (19.61 in.) |
| B | 318.8 to 319.2 mm (12.5726 to 12.5669 in.) |
| C | 102.8 to 103.2 mm (4.0472 to 4.0630 in.) |
| D | 60 mm (2.36 in.) |
| E | 8 mm (0.31 in.) |
| F | 5 mm (0.20 in.) |
| G | 30 mm dia. (1.18 in. dia.) |
| H | 65 mm dia. (2.56 in. dia.) |
| I | 6 mm (0.24 in.) |
| J | Chamfer 1 mm (0.04 in.) |
| K | 53 mm dia. (2.09 in. dia.) |
| L | 54.7 to 54.9 mm dia. (2.1535 to 2.1614 in. dia.) |
| M | 0.26 rad (15°) |
| N | Chamfer 0.5 mm (0.02 in.) |
| O | 41 mm dia. (1.61 in. dia.) |
| P | 32 mm dia. (1.26 in. dia.) |
| Q | 33.961 to 34.0 mm dia. (1.3370 to 1.3386 in. dia.) |
| R | 18 mm dia. (0.71 in. dia.) |
| S | 19.967 to 20.0 mm dia. (0.7861 to 0.7874 in. dia.) |
| U | 3 mm (0.12 in.) |
| V | 149.1 to 149.4 mm (5.8701 to 5.8819 in.) |
| W | 365.1 to 365.4 mm (14.3740 to 14.3858 in.) |
| X | 123 mm (4.84 in.) |
| Y | 375 mm (14.76 in.) |
| Z | M6 × P1.0 depth 7 mm (0.28 in.) |
| a | Chamfer 2 mm (0.08 in.) |



3EEABAB1P046A

**Piece 1**

| | |
|---|---|
| A | Chamfer 0.1 mm (0.004 in.) |
| B | 1 mm (0.04 in.) |
| C | Chamfer 1 mm (0.04 in.) |
| D | 53.8 to 53.9 mm dia. (2.1181 to 2.1220 in. dia.) |
| E | 20.02 to 20.041 mm dia. (0.7882 to 0.7890 in. dia.) |
| F | 48 mm dia. (1.89 in. dia.) |
| G | 49.934 to 49.94 mm dia. (1.9659 to 1.9661 in. dia.) |
| H | 8 mm (0.31 in.) |
| I | 2 mm (0.08 in.) |
| J | 35 mm (1.38 in.) |
| K | 5 mm (0.20 in.) |
| L | 0.26 rad (15°) |



3EEABAB1P047A

**Piece 2**

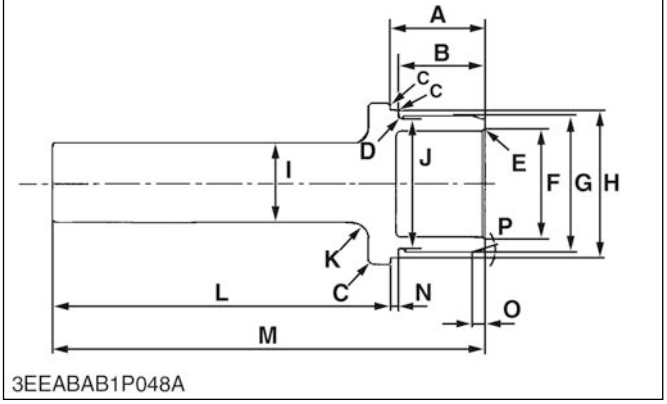
| | |
|---|---|
| A | Chamfer 0.1 mm (0.004 in.) |
| B | 1 mm (0.04 in.) |
| C | Chamfer 1 mm (0.04 in.) |
| D | 54.3 to 54.4 mm dia. (2.1378 to 2.1417 in. dia.) |
| E | 34.025 to 34.05 mm dia. (1.3396 to 1.3406 in. dia.) |
| F | 48.5 mm dia. (1.9094 in. dia.) |
| G | 50.421 to 50.44 mm dia. (1.9851 to 1.9858 in. dia.) |
| H | 8 mm (0.31 in.) |
| I | 2 mm (0.08 in.) |
| J | 35 mm (1.38 in.) |
| K | 5 mm (0.20 in.) |
| L | 0.26 rad (15°) |

## 1.18 Balancer bushing replacing tool 2

Use to press fit the bushing.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**



3EEABAB1P048A

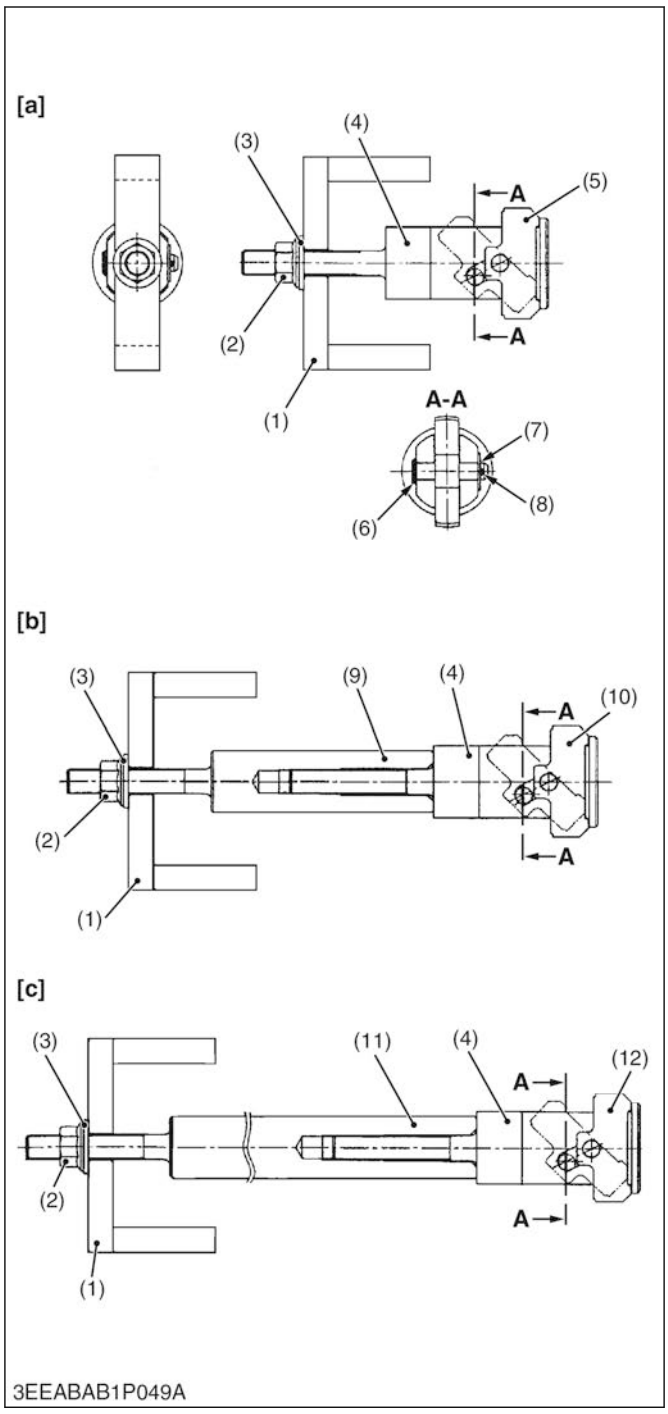
| | |
|---|---|
| A | 35 mm (1.38 in.) |
| B | 33 mm (1.30 in.) |
| C | Chamfer 0.5 mm (0.02 in.) |
| D | 1 mm (0.04 in.) |
| E | Chamfer 1 mm (0.04 in.) |
| F | 40 mm dia. (1.57 in. dia.) |
| G | 50.921 to 50.94 mm dia. (2.0048 to 2.0055 in. dia.) |
| H | 54.8 to 54.9 mm dia. (2.1575 to 2.1614 in. dia.) |
| I | 30 mm dia. (1.18 in. dia.) |
| J | 49 mm dia. (1.93 in. dia.) |
| K | 6 mm (0.24 in.) |
| L | 125 mm (4.92 in.) |
| M | 160 mm (6.30 in.) |
| N | 3 mm (0.12 in.) |
| O | 5 mm (0.20 in.) |
| P | 0.26 rad (15°) |

## 1.19 Balancer replacing tools 3, 4, 5

Use to press fit the bushing.

**NOTE**

- **The special tools are not provided, therefore make them by referring to the figure.**



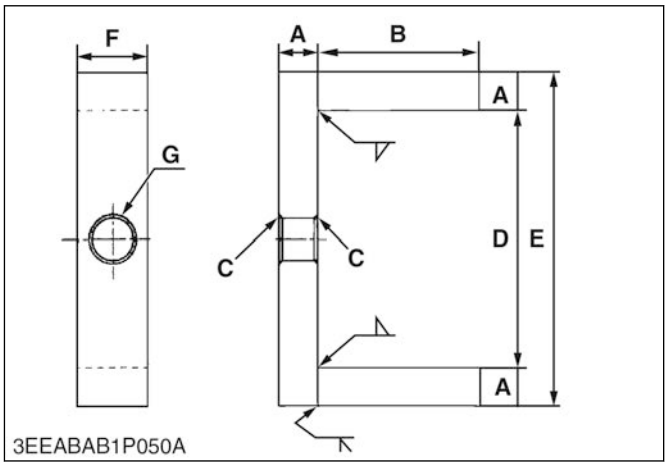

[a] Tool 3
[b] Tool 4
[c] Tool 5

| No. | Name of part | Q'ty |
|---|---|---|
| 1 | Bracket | 1 |
| 2 | Flange nut | 1 |
| 3 | Washer | 1 |
| 4 | Shaft | 1 |
| 5 | Piece 1 | 1 |
| 6 | Clevis | 1 |
| 7 | Washer | 1 |
| 8 | Cotter pin | 1 |
| 9 | Joint 1 | 1 |
| 10 | Piece 2 | 1 |
| 11 | Joint 2 | 1 |
| 12 | Piece 3 | 1 |

## 1.20 Balancer bushing tool components parts

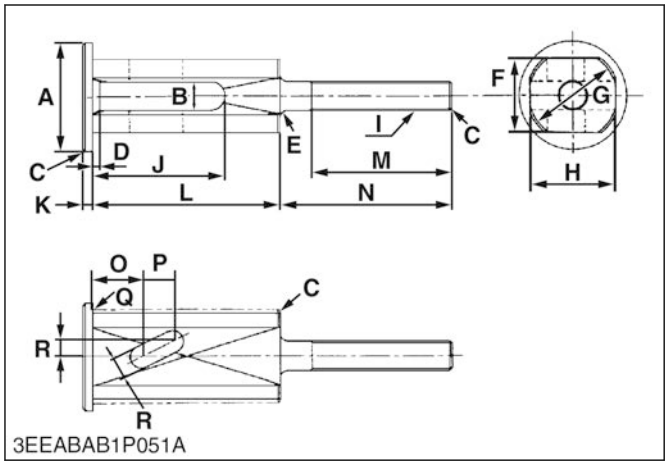
**NOTE**

- **The special tools are not provided, therefore make them by referring to the figure.**



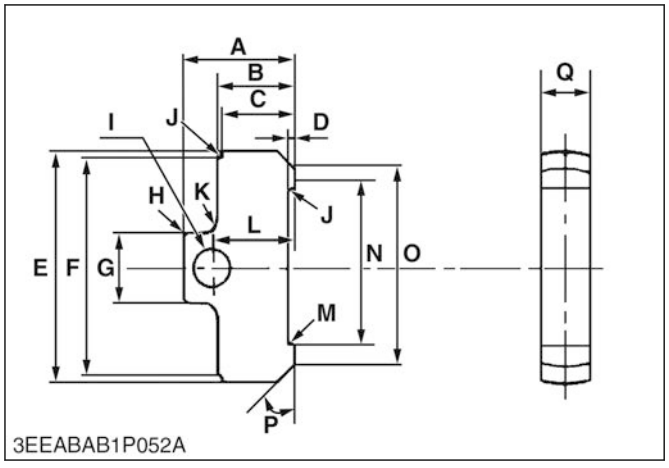

**Bracket**

| | |
|---|---|
| A | 12 mm (0.47 in.) |
| B | 50 mm (1.97 in.) |
| C | Chamfer 1 mm (0.04 in.) |
| D | 80 mm (3.15 in.) |
| E | 104 mm (4.09 in.) |
| F | 22 mm (0.87 in.) |
| G | 13 mm dia. (0.51 in. dia.) |



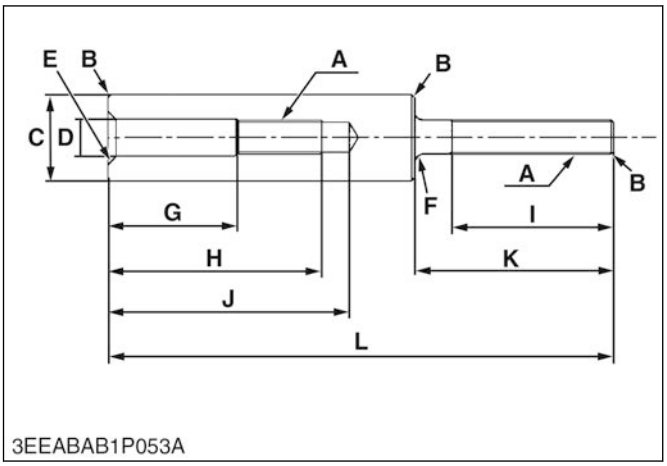

**Shaft**

| | |
|---|---|
| A | 44 mm dia. (1.73 in. dia.) |
| B | 12 mm (0.47 in.) |
| C | Chamfer 1 mm (0.04 in.) |
| D | 3 mm (0.12 in.) |
| E | 3 mm (0.12 in.) |
| F | 30 mm (1.18 in.) |
| G | 38 mm (1.38 in.) |
| H | 35 mm (1.38 in.) |
| I | M12 × P1.25 |
| J | 53 mm (2.09 in.) |
| K | 4 mm (0.16 in.) |
| L | 75 mm (2.95 in.) |
| M | 57 mm (2.24 in.) |
| N | 70 mm (2.76 in.) |
| O | 19.5 mm (0.77 in.) |
| P | 12 mm (0.47 in.) |
| Q | 0.8 mm (0.03 in.) |
| R | 6 mm (0.24 in.) |



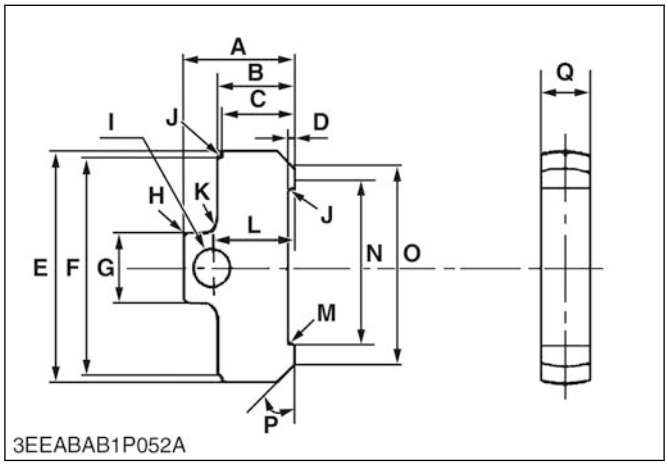

**Piece 1**

| | |
|---|---|
| A | 26 mm (1.02 in.) |
| B | 18 mm (0.71 in.) |
| C | 16.5 to 17.0 mm (0.6496 to 0.6693 in.) |
| D | 1.5 mm (0.06 in.) |
| E | 54.0 to 54.2 mm dia. (2.1260 to 2.1339 in. dia.) |
| F | 50.55 to 50.75 mm dia. (1.9902 to 1.9980 in. dia.) |
| G | 16 mm (0.63 in.) |
| H | Chamfer 1 mm (0.04 in.) |
| I | 8.5 mm dia. (0.33 in. dia.) |
| J | 0.4 mm (0.0157 in.) |
| K | 3 mm (0.12 in.) |
| L | 19 mm (0.75 in.) |
| M | Chamfer 0.5 mm (0.02 in.) |
| N | 36 mm (1.42 in.) |
| O | 45 mm dia. (1.77 in. dia.) |
| P | 0.78 rad (45°) |
| Q | 11.5 mm (0.45 in.) |



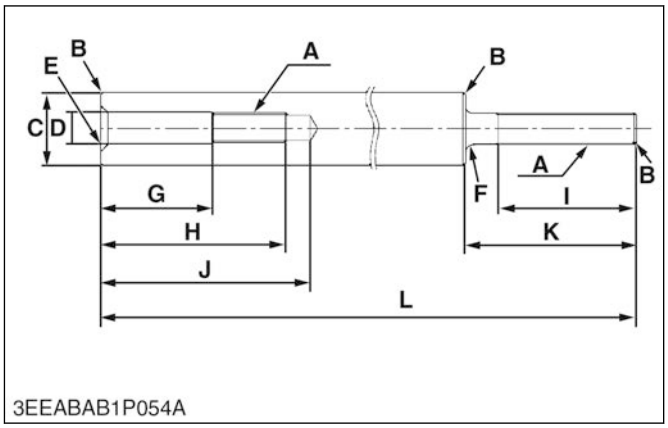
### Joint 1

| | |
|---|---|
| A | M12 × P1.25 |
| B | Chamfer 1 mm (0.04 in.) |
| C | 30 mm dia. (1.18 in. dia.) |
| D | 13 mm dia. (0.51 in. dia.) |
| E | Chamfer 3 mm (0.12 in.) |
| F | R3 mm (0.12 in. radius) |
| G | 45 mm (1.77 in.) |
| H | 75 mm (2.95 in.) |
| I | 57 mm (2.24 in.) |
| J | 85 mm (3.35 in.) |
| K | 70 mm (2.76 in.) |
| L | 178 mm (7.01 in.) |



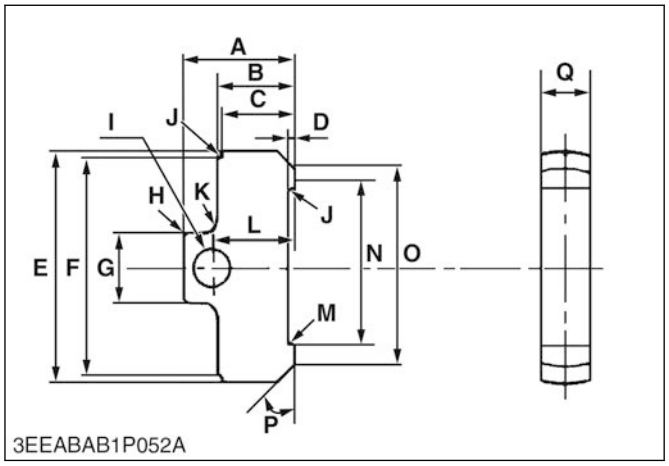

### Piece 2

| | |
|---|---|
| A | 26 mm (1.02 in.) |
| B | 18 mm (0.71 in.) |
| C | 16.5 to 17.0 mm (0.6496 to 0.6693 in.) |
| D | 1.5 mm (0.06 in.) |
| E | 53.5 to 53.7 mm dia. (2.1063 to 2.1142 in. dia.) |
| F | 50.05 to 50.25 mm dia. (1.9705 to 1.9783 in. dia.) |
| G | 16 mm (0.63 in.) |
| H | Chamfer 1 mm (0.04 in.) |
| I | 8.5 mm dia. (0.33 in. dia.) |
| J | 0.4 mm (0.0157 in.) |
| K | 3 mm (0.12 in.) |
| L | 19 mm (0.75 in.) |
| M | Chamfer 0.5 mm (0.02 in.) |
| N | 36 mm (1.42 in.) |
| O | 45 mm dia. (1.77 in. dia.) |
| P | 0.78 rad (45°) |
| Q | 11.5 mm (0.45 in.) |



**Joint 2**

| | |
|---|---|
| A | M12 × P1.25 |
| B | Chamfer 1 mm (0.04 in.) |
| C | 30 mm dia. (1.18 in. dia.) |
| D | 13 mm dia. (0.51 in. dia.) |
| E | Chamfer 3 mm (0.12 in.) |
| F | R3 mm (0.12 in. radius) |
| G | 45 mm (1.77 in.) |
| H | 75 mm (2.95 in.) |
| I | 57 mm (2.24 in.) |
| J | 85 mm (3.35 in.) |
| K | 70 mm (2.76 in.) |
| L | 394 mm (15.51 in.) |




**Piece 3**

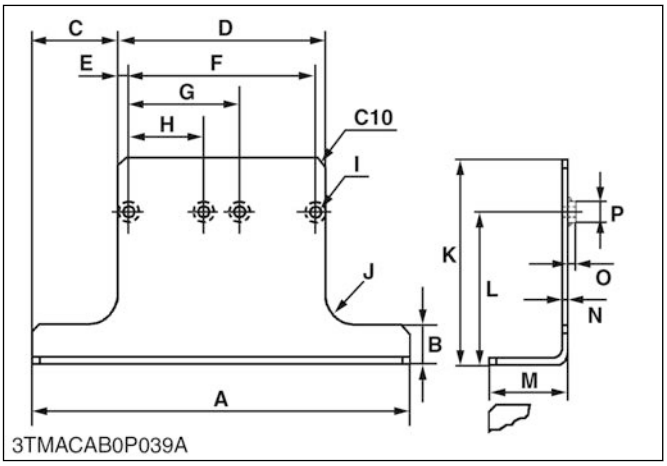
| | |
|---|---|
| A | 26 mm (1.02 in.) |
| B | 18 mm (0.71 in.) |
| C | 16.5 to 17.0 mm (0.6496 to 0.6693 in.) |
| D | 1.5 mm (0.06 in.) |
| E | 53.0 to 53.2 mm dia. (2.0866 to 2.0945 in. dia.) |
| F | 49.55 to 49.75 mm dia. (1.9508 to 1.9587 in. dia.) |
| G | 16 mm (0.63 in.) |
| H | Chamfer 1 mm (0.04 in.) |
| I | 8.5 mm dia. (0.33 in. dia.) |
| J | 0.4 mm (0.0157 in.) |
| K | 3 mm (0.12 in.) |
| L | 19 mm (0.75 in.) |
| M | Chamfer 0.5 mm (0.02 in.) |
| N | 36 mm (1.42 in.) |
| O | 45 mm dia. (1.77 in. dia.) |
| P | 0.78 rad (45°) |
| Q | 11.5 mm (0.45 in.) |

## 1.21 Engine stand

Use to support engine.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**

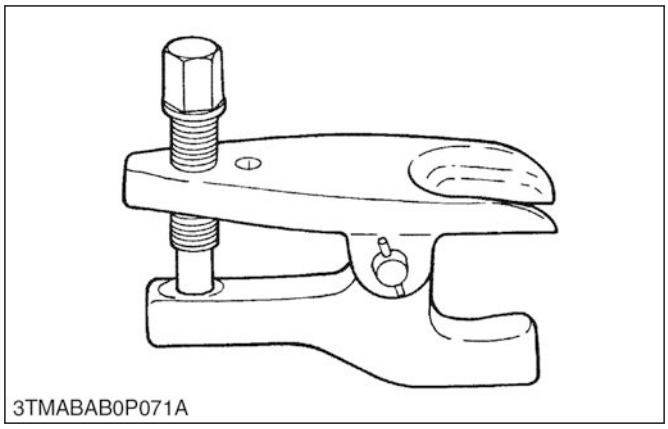


| | |
|---|---|
| A | 480 mm (18.90 in.) |
| B | 50 mm (1.97 in.) |
| C | 108.5 mm (4.272 in.) |
| D | 263 mm (10.35 in.) |
| E | 12.5 mm (0.492 in.) |
| F | 237.5 mm (9.350 in.) |
| G | 142.5 mm (5.610 in.) |
| H | 95 mm (3.74 in.) |
| I | 4.14 mm dia. (0.55 in. dia.) |
| J | 40 mm (1.57 in.) |
| K | 210 mm (8.27 in.) |
| L | 190 mm (7.48 in.) |
| M | 100 mm (3.94 in.) |
| N | 6 mm (0.24 in.) |
| O | 6 mm (0.24 in.) |
| P | 25 mm dia. (0.98 in. dia.) |
| C10 | Chamfer 10 mm (0.394 in.) |

# 2. Special tools for tractor

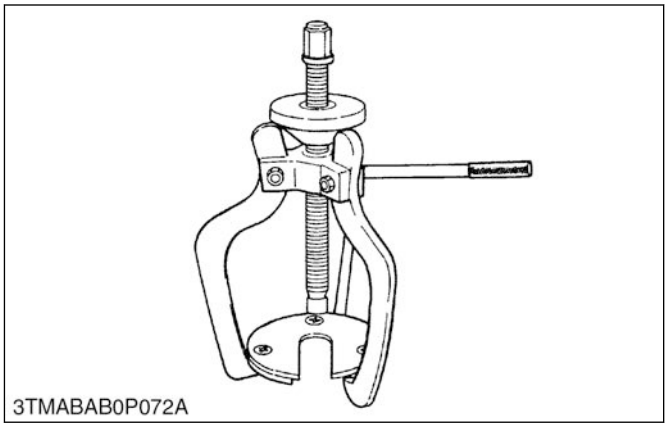
## 2.1 Tie-rod end lifter

Use for removing the tie-rod end with ease.
**Code No.**
07909-39051


3TMABAB0P071A

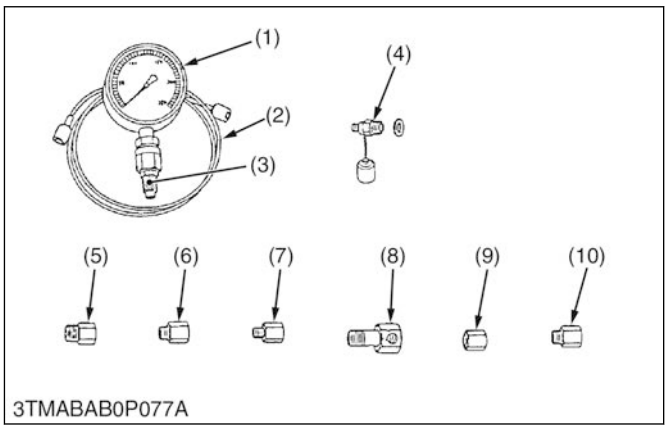
## 2.2 Steering wheel puller

Use to remove the steering wheel without damage to the steering shaft.
**Code No.**
07916-51090


3TMABAB0P072A

## 2.3 Relief valve pressure tester

This allows easy measurement of relief set pressure.
**Code No.**
07916-50045

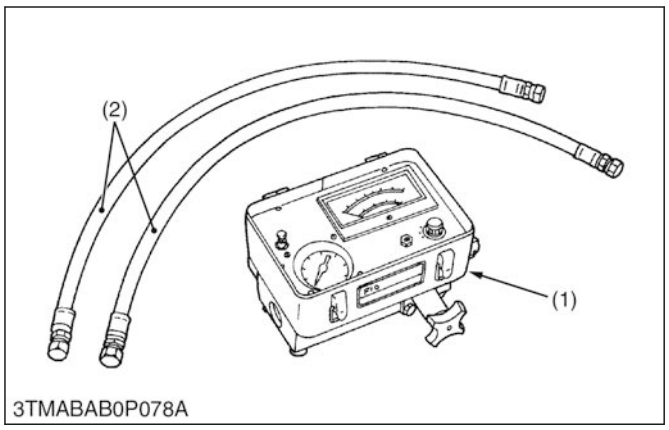


3TMABAB0P077A

(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)

## 2.4 Flow meter

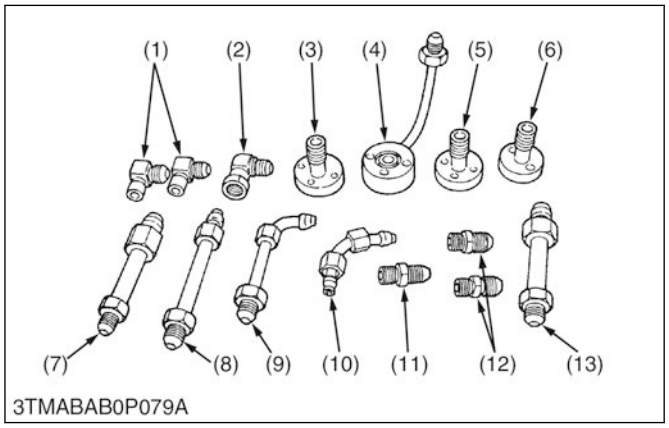
This allows easy testing of hydraulic system.
**Code No.**
07916-52791 (Flow meter)
07916-52651 (Hydraulic test hose)




(1) Flow meter
(2) Hydraulic test hose

## 2.5 Adaptor set for flow meter

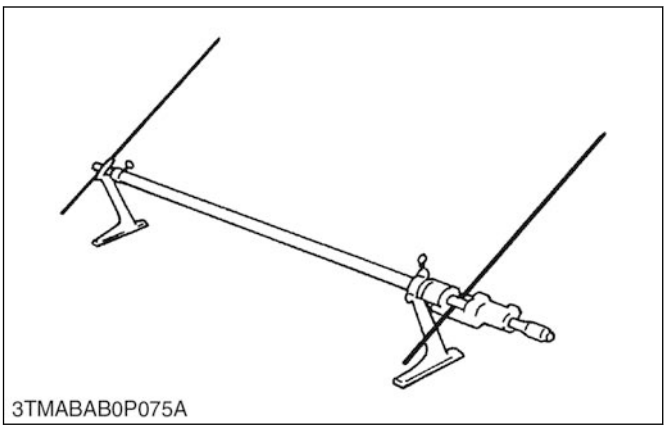
Use for testing the hydraulic system.
**Code No.**
07916-54031




(1) Adaptor 52
(2) Adaptor 53
(3) Adaptor 54
(4) Adaptor 61
(5) Adaptor 62
(6) Adaptor 63
(7) Adaptor 64
(8) Adaptor 65
(9) Adaptor 66
(10) Adaptor 67
(11) Adaptor 68
(12) Adaptor 69
(13) Hydraulic adaptor 1

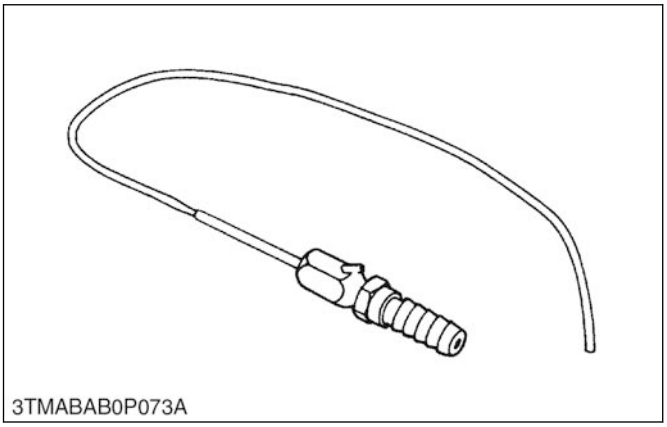
## 2.6 Toe-in gauge

This allows easy measurement of toe-in for all machine models.
**Code No.**
07909-31681



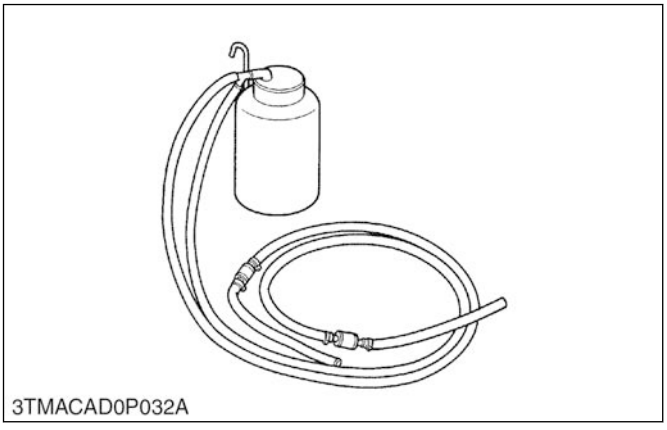

## 2.7 Injector CH3

Use to put calcium chloride solution into a rear wheel and to remove it.
**Code No.**
07916-52501




## 2.8 Brake air bleeder

This allows easy air bleed of the hydraulic brake line.
**Code No.**
07916-54001

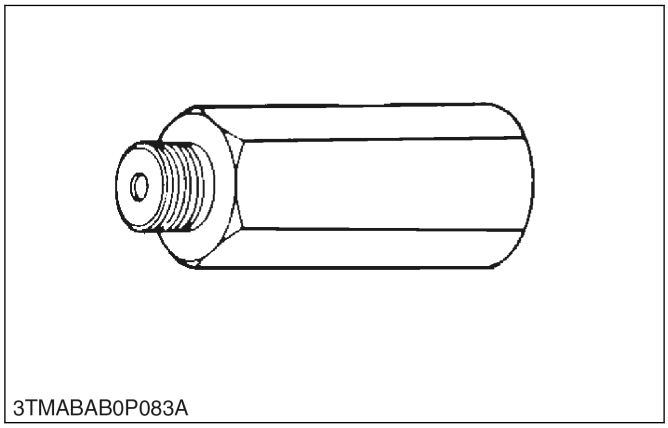


## 2.9 Relief valve setting pressure adaptor G

This allows easy measurement of relief valve setting pressure from the hydraulic coupler. This is available with the relief valve setting pressure tester.

**Code No.**

07916-52751



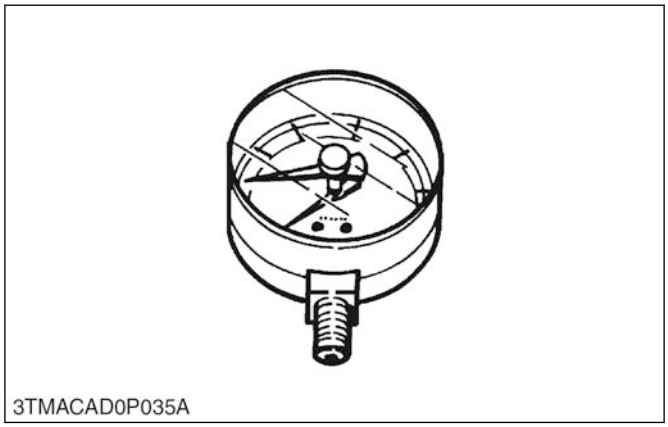
3TMABAB0P083A

## 2.10 Pressure gauge 50

This pressure gauge is to measure the low oil pressure.

**Code No.**

07916-52961



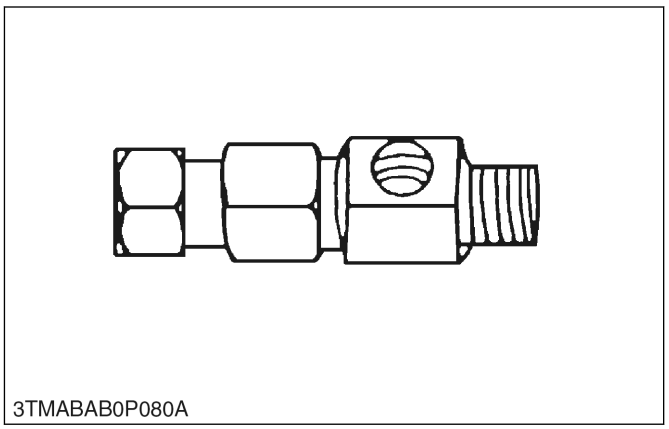
3TMACAD0P035A

## 2.11 Power steering adaptor

Use for measuring the relief valve setting pressure for power steering.

**Code No.**

07916-54021

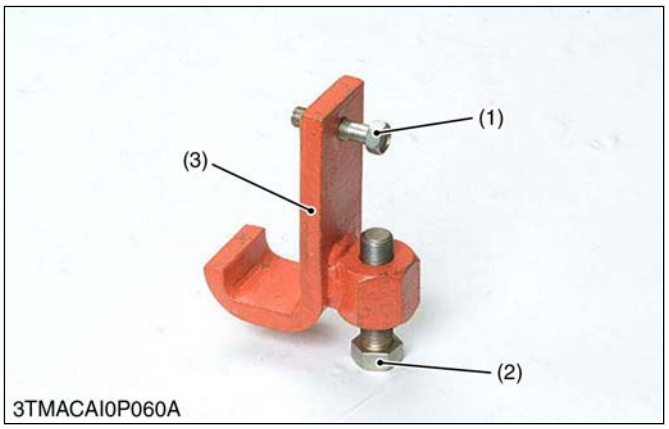


3TMABAB0P080A

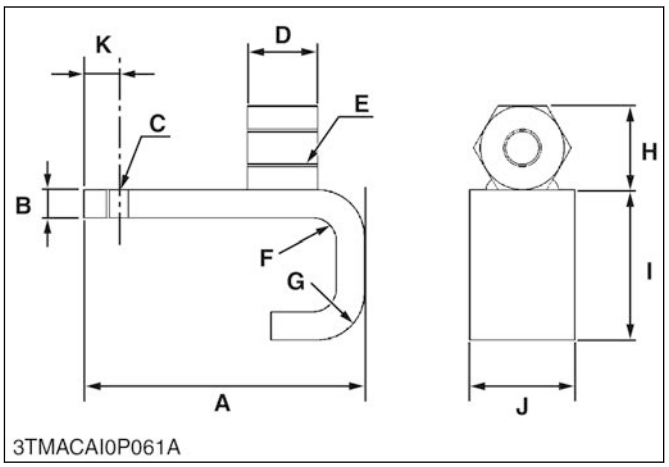
## 2.12 Front axle rocking restrictor

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**




3TMACAI0P060A




3TMACAI0P061A

(1) Screw M10 × P1.25 × L50 mm (2 in.)
(2) Screw M16 × P1.5 × L50 mm (2 in.)
(3) Rocking restrictor

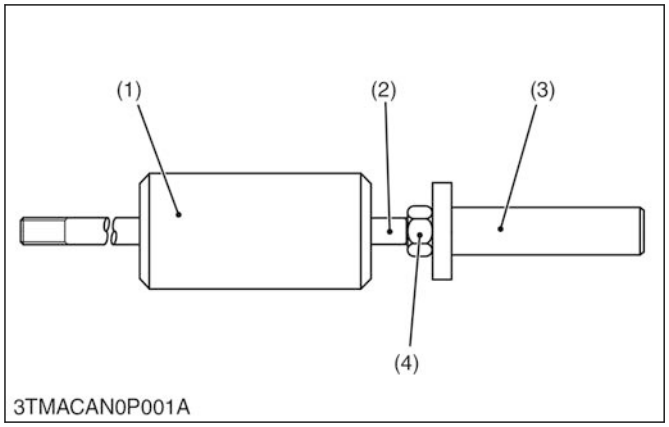
| | |
|---|---|
| A | 120 mm (4.72 in.) |
| B | 12 mm (0.72 in.) |
| C | M10 × P1.25 |
| D | 30 mm (1.18 in.) |
| E | M16 × P1.5 |
| F | 10 mm (0.39 in.) |
| G | 20 mm (0.79 in.) |
| H | 36 mm (1.42 in.) |
| I | 64 mm (2.52 in.) |
| J | 45 mm (1.77 in.) |
| K | 20 mm (0.79 in.) |

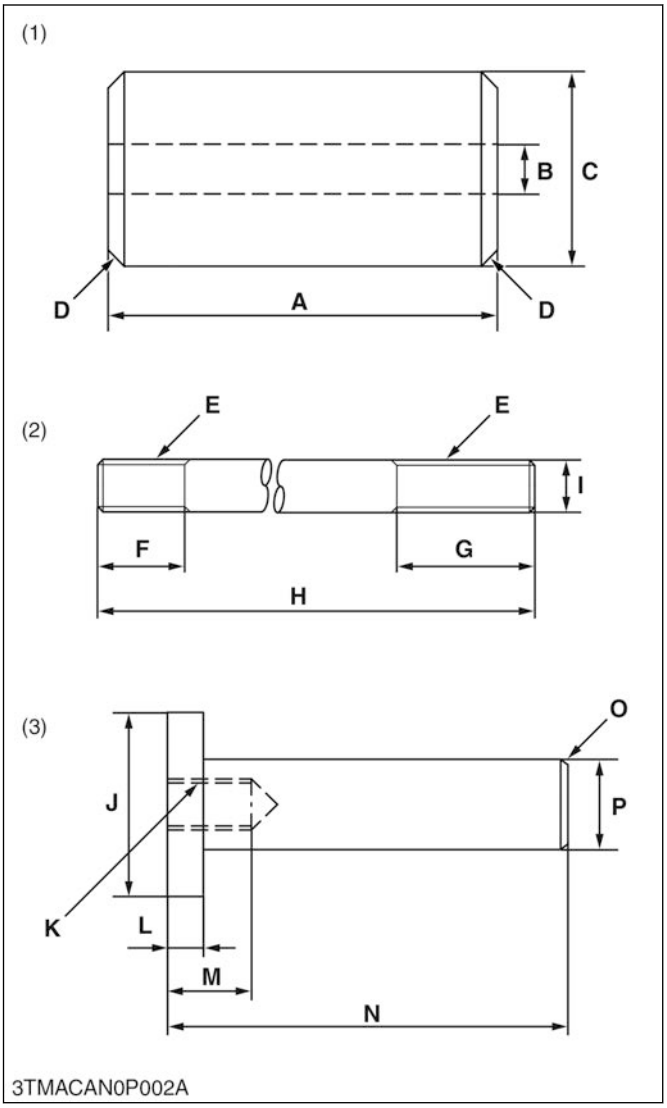
## 2.13 Sliding hammer

Use for removing the bevel pinion shaft with adaptor for front axle.

**■ NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**




(1) Hammer
(2) Sliding shaft
(3) Handle
(4) Nut (M14 × P1.5)

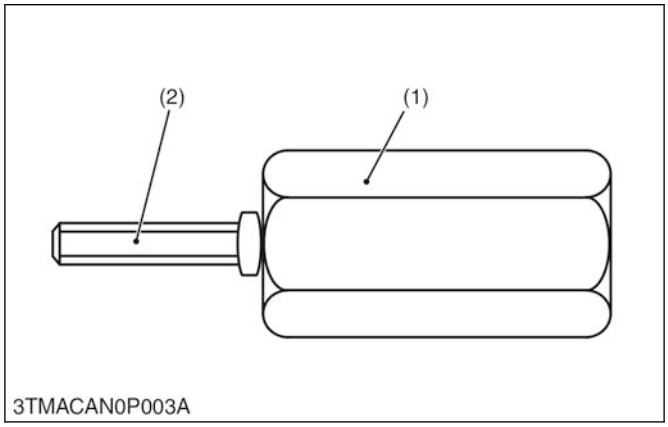
| | |
|---|---|
| A | 120 mm (4.72 in.) |
| B | 14.5 mm dia. (0.57 in. dia.) |
| C | 60 mm dia. (2.36 in. dia.) |
| D | Chamfer 5 mm (0.20 in.) |
| E | M14 × P1.5 |
| F | 25 mm (0.98 in.) |
| G | 40 mm (1.57 in.) |
| H | 450 mm (17.72 in.) |
| I | 14 mm dia. (0.55 in. dia.) |
| J | 50 mm dia. (1.97 in. dia.) |
| K | M14 × P1.5 |
| L | 10 mm (0.39 in.) |
| M | 30 mm (1.18 in.) |
| N | 110 mm (4.3 in.) |
| O | Chamfer 2 mm (0.08 in.) |
| P | 25 mm dia. (0.98 in. dia.) |

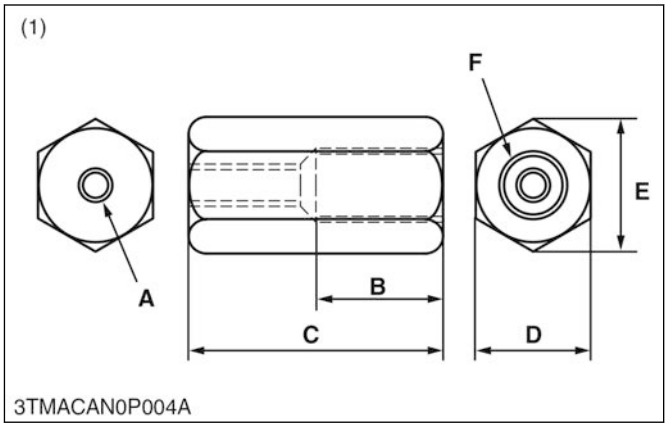
## 2.14 Adaptor (M6) for sliding hammer

Use for removing the front axle bevel pinion shaft with sliding hammer.

**■ NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**




(1) Adaptor (M6) (2) Stud bolt (M6 × P1.0)

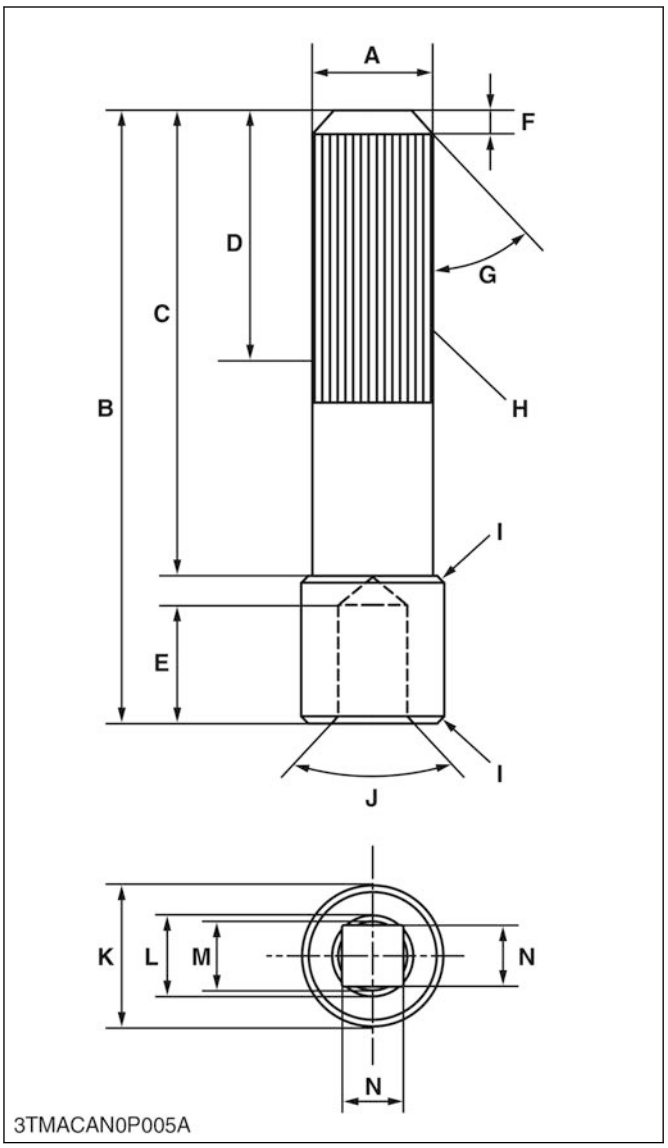
| | |
|---|---|
| A | M6 × P1.0 |
| B | 25 mm (0.98 in.) |
| C | 50 mm (1.97 in.) |
| D | 23 mm (0.91 in.) |
| E | 27 mm (1.06 in.) |
| F | M14 × P1.5 |

## 2.15 LSD adaptor

Use for measuring the turning torque of LSD.

**■ NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**




| | |
|---|---|
| A | 24.65 to 24.80 mm dia. (0.970 to 0.976 in. dia.) |
| B | 131.85 to 132.15 mm (5.19 to 5.20 in.) |
| C | 99.25 to 100.75 mm (3.91 to 3.97 in.) |
| D | 54 to 60 mm full spline (2.12 to 2.36 in. full spline) |
| E | 22.4 to 28.4 mm (0.88 to 1.11 in.) |
| F | 4 to 6 mm (0.16 to 0.23 in.) |
| G | 0.52 rad (30°) |
| H | Involute spline (refer to below) |
| I | Chamfer 3.0 mm (0.12 in.) |
| J | 1.05 rad (60°) |
| K | 29.5 to 30.5 mm dia. (1.16 to 1.20 in. dia.) |
| L | 17.87 mm dia. (0.7 in. dia.) |
| M | 13.95 to 14.25 mm dia. (0.55 to 0.56 in. dia.) |
| N | 12.75 to 12.90 mm square (0.50 to 0.51 in. square) |

**(Involute spline)**

- EXTERNAL 25 × 24Z × 1.0 m × 30

| | | |
|---|---|---|
| Coefficient of profile shifting | | 0.000 |
| Tool | Tooth form | Stub tooth |
| | Module | 1.00 |
| | Pressure angle | 0.52 rad (30°) |
| Number of teeth | | 24 |
| Diameter of basic pitch circle | | 24 mm |
| Tooth thickness | Grade | Class a |
| | Over pitch diameter | 26.534 to 26.645 mm (Pin diameter = 1.8 mm) |

**(Reference)**

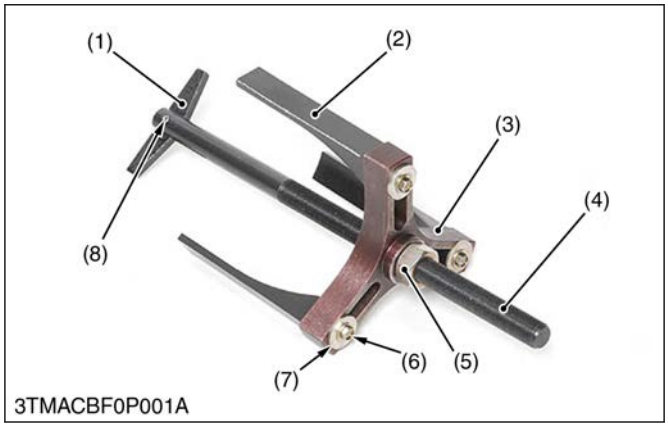
- This tool can be made by welding the yoke shaft R.H. (3C091-43210) and socket wrench.

# 2.16 Hydraulic clutch spring compressor

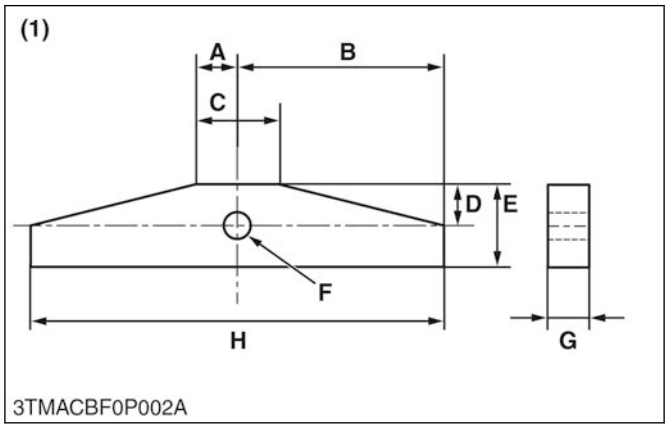
Use exclusively for pushing the return spring and removing the cir-clip for hydraulic clutch.

**■ NOTE**

- **The special tools are not provided, therefore make them by referring to the figure.**

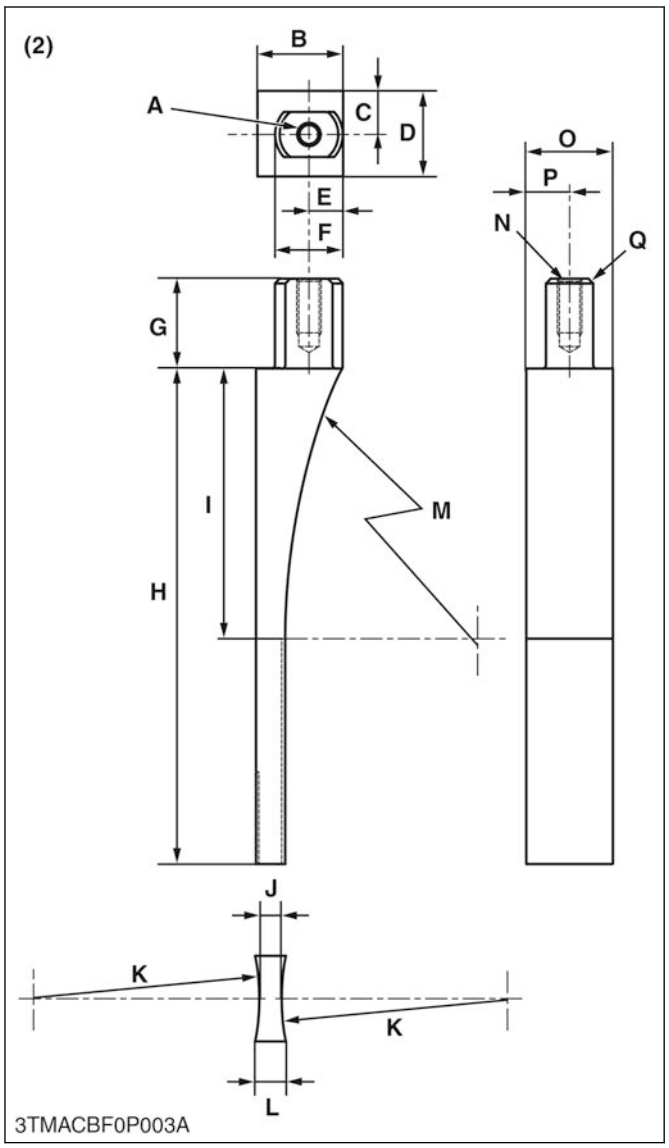



(1) Tool 4 (Plate)
(2) Tool 3 (Claw)
(3) Tool 1 (Body)
(4) Tool 2 (Center bar)
(5) Nut (M × P1.5)
(6) Screw (M5 × P1.0 - L10 mm)
(7) Washer (M5)
(8) Spring pin (5.0 mm dia. - L16 mm)




**(1) Tool 4 (Plate)**

| | |
|---|---|
| A | 8 mm (0.3 in.) |
| B | 40 mm (1.6 in.) |
| C | 16 mm (0.63 in.) |
| D | 8 mm (0.3 in.) |
| E | 16 mm (0.63 in.) |
| F | 5.2 mm dia. (0.20 in. dia.) |
| G | 5.70 to 5.90 mm (0.225 to 0.232 in.) |
| H | 80 mm (3.1 in.) |

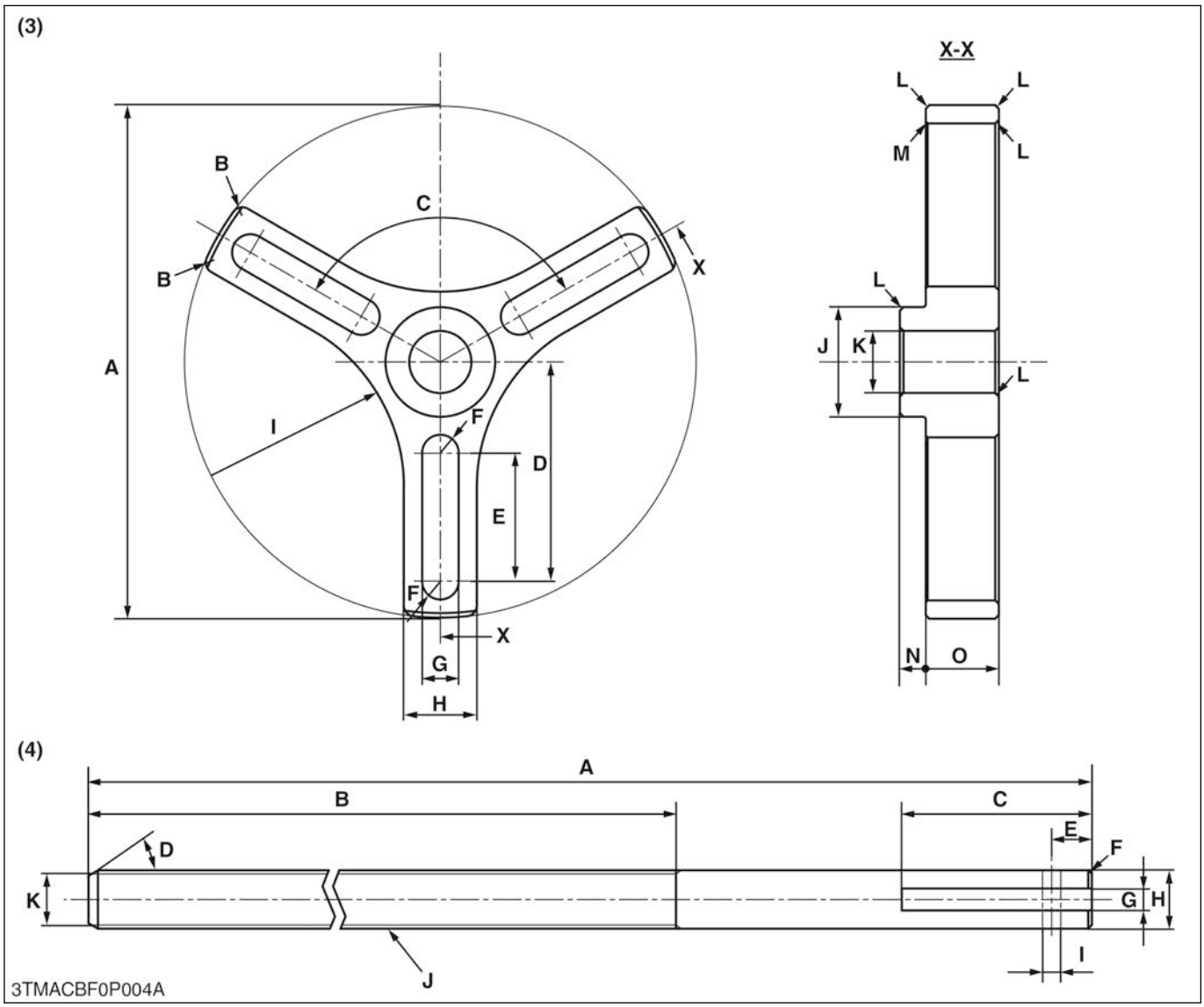



**(2) Tool 3 (Claw): 3 pcs.**

| | |
|---|---|
| A | M5 × P1.0 × 12 mm depth (0.47 in. depth) |
| B | 19 mm (0.75 in.) |
| C | 5 mm (0.2 in.) |
| D | 9.73 to 10.0 mm (0.383 to 0.393 in.) |
| E | 7.5 mm (0.30 in.) |
| F | 15 mm dia. (0.59 in. dia.) |
| G | 20.05 to 20.10 mm (0.7894 to 0.7913 in.) |
| H | 110 mm (4.33 in.) |
| I | 60 mm (2.4 in.) |
| J | 5 mm (0.2 in.) |
| K | 50 mm (2.0 in.) |
| L | 6.8 mm (0.27 in.) |
| M | Radius 150 to 160 mm (5.91 to 6.29 in.) |

(Continued)

| | |
|---|---|
| N | 4.2 mm dia. × 15 mm depth (0.17 in. dia. × 0.59 in. depth) |
| O | 19 mm (0.75 in.) |
| P | 9.5 mm (0.37 in.) |
| Q | Chamfer 1.0 mm (0.039 in.) |




### (3) Tool 1 (Body)

| | |
|---|---|
| A | 140 mm dia. (5.51 in. dia.) |
| B | Radius 3 mm (0.1 in.) |
| C | 2.09 rad (120°) |
| D | 60 mm (2.4 in.) |
| E | 35 mm (1.4 in.) |
| F | Radius 5 mm (0.2 in.) |
| G | 10.00 to 10.27 mm (0.3937 to 0.4043 in.) |
| H | 20 mm (0.79 in.) |
| I | Radius 50 mm (2.0 in.) |

(Continued)

| | |
|---|---|
| J | 30 mm dia. (1.2 in. dia.) |
| K | 17 mm dia. (0.67 in. dia.) |
| L | Chamfer 1.0 mm (0.039 in.) |
| M | Chamfer 0.5 mm (0.02 in.) |
| N | 7 mm (0.3 in.) |
| O | 20 mm (0.79 in.) |
| X (X-X) | View direction |

### (4) Tool 2 (Center Bar)

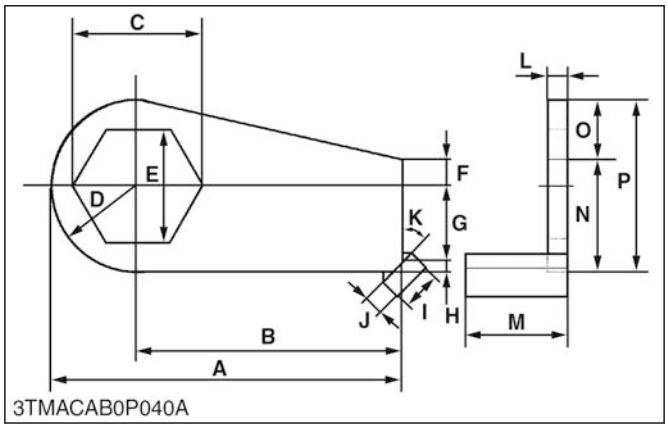
| | |
|---|---|
| A | 330 mm (13.0 in.) |
| B | 210 mm (8.27 in.) |
| C | 52 mm (2.0 in.) |
| D | 0.52 rad (30°) |
| E | 11 mm (0.43 in.) |
| F | Chamfer 1.0 mm (0.039 in.) |
| G | 6.00 to 6.58 mm (0.237 to 0.259 in.) |
| H | 16 mm dia. (0.63 in. dia.) |
| I | 5.00 to 5.18 mm dia. (0.197 to 0.203 in. dia.) |
| J | M16 × P1.5 mm |
| K | 13 mm dia. (0.51 in. dia.) |

## 2.17 Locking wrench

Use for locking pinion shaft nut.

**■ NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**



3TMACAB0P040A

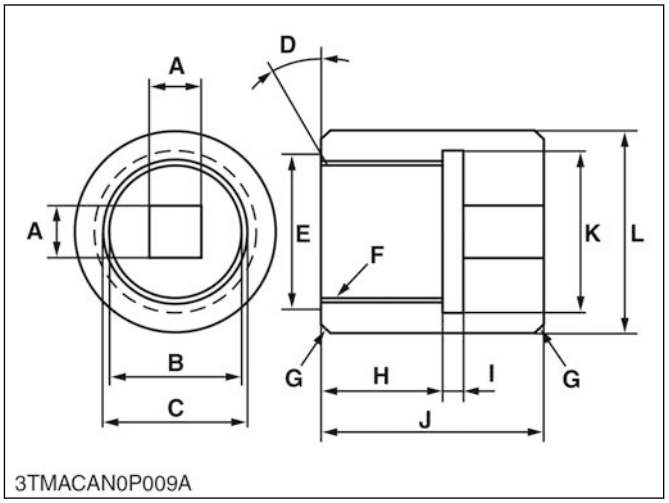
| | |
|---|---|
| A | 170 mm (6.69 in.) |
| B | 130 mm (5.12 in.) |
| C | 63.5 mm (2.5 in.) |
| D | 40 mm radius (1.57 in. radius) |
| E | 55 mm (2.17 in.) |
| F | 15 mm (0.59 in.) |
| G | 35 mm (1.38 in.) |
| H | 5 mm (0.2 in.) |
| I | 20 mm (0.55 in.) |
| J | 10 mm (0.39 in.) |
| K | 0.78 rad (45°) |
| L | 10 mm (0.39 in.) |
| M | 50 mm (1.97 in.) |
| N | 55 mm (2.17 in.) |
| O | 25 mm (0.97 in.) |
| P | 80 mm (3.15 in.) |

## 2.18 Bevel gear shaft (8T) tool

Use for measuring turning torque of spiral bevel gear shaft and tightening staking nut.

**■ NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**



3TMACAN0P009A

| | |
|---|---|
| A | 12.75 to 12.90 mm square (0.50 to 0.51 in. square) |
| B | 32.500 to 32.525 mm dia. (1.2795 to 1.2805 in. dia.) |
| C | 35 mm dia. (1.378 in. dia.) |
| D | 0.52 rad (30°) |
| E | 35.1 to 35.5 mm dia. (1.38 to 1.39 in. dia.) |
| F | Involute spline (refer to below) |
| G | Chamfer 1.0 mm (0.039 in.) |
| H | 30 mm (1.18 in.) |
| I | 5 mm (0.19 in.) |
| J | 55 mm (2.17 in.) |
| K | 40 mm dia. (1.57 in. dia.) |
| L | 50 mm dia. (1.97 in. dia.) |

**(Involute spline)**

- INTERNAL 35 × 26Z × 1.25 m × 20

| | | |
|---|---|---|
| Coefficient of profile shifting | | +0.800 |
| Tool | Tooth form | Stub tooth |
| | Module | 1.250 |
| | Pressure angle | 0.35 rad (20°) |
| Number of teeth | | 26 |
| Diameter of basic pitch circle | | 32.50 mm |
| Tooth thickness | Grade | Class a |
| | Between pin diameter | 30.084 to 30.156 mm (Pin diameter = 2.50 mm) |

**(Reference)**

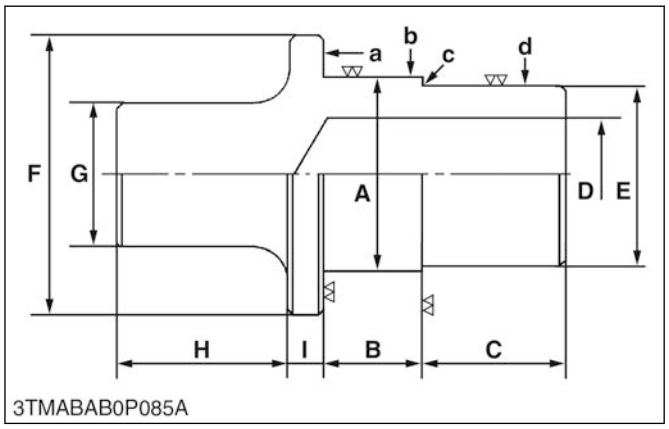
- This tool can be made by welding the coupling (3C081-28910) and socket wrench.

## 2.19 Hydraulic arm shaft bushing press-fitting tool

Use for replacing the hydraulic arm shaft bushings in the hydraulic cylinder body.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**
- **Finishing on all surface not specified 12.5 µm (0.0005 in.)**



3TMABAB0P085A

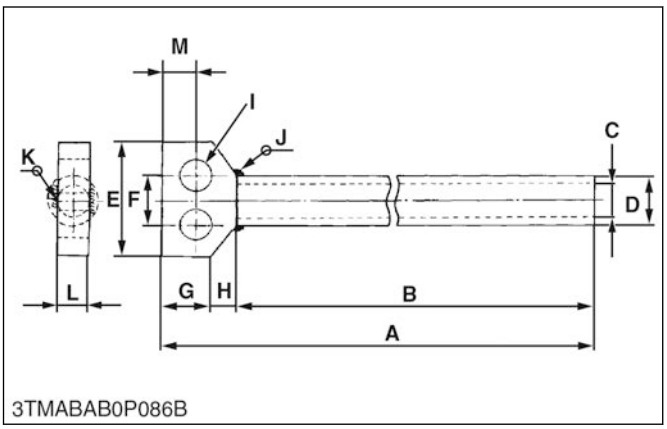
| | |
|---|---|
| A | 54.85 to 54.95 mm (2.159 to 2.163 in.) |
| B | 11 mm (0.43 in.) |
| C | 60 mm (2.36 in.) |
| D | 30 mm (1.18 in.) |
| E | 48.85 to 48.95 mm (1.923 to 1.927 in.) |
| F | 78 mm dia. (3.07 in. dia.) |
| G | 40 mm dia. (1.57 in. dia.) |
| H | 50 mm (1.97 in.) |
| I | 20 mm (0.79 in.) |
| a | 6.3 µm (0.00025 in.) |
| b | 6.3 µm (0.00025 in.) |
| c | 6.3 µm (0.00025 in.) |
| d | 6.3 µm (0.00025 in.) |

## 2.20 Draft control test bar

Use for checking the lift range and floating range of hydraulic draft control.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**



3TMABAB0P086B

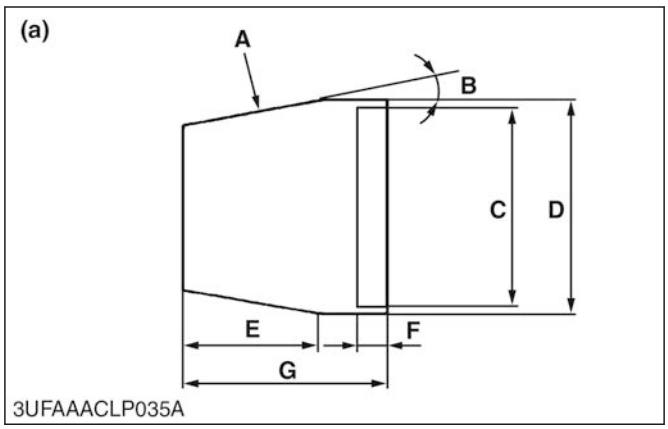
| | |
|---|---|
| A | 1045 mm (41.14 in.) |
| B | 1000 mm (29.37 in.) |
| C | 20 mm dia. (0.79 in. dia.) |
| D | 30 mm dia. (1.18 in. dia.) |
| E | 100 mm (3.94 in.) |
| F | 35.5 mm (1.4 in.) |
| G | 30 mm (1.18 in.) |
| H | 15 mm (0.59 in.) |
| I | 20 mm dia. (0.79 in. dia.) |
| J | Weld all around |
| K | Weld all around |
| L | 20 mm (0.79 in.) |
| M | 26 mm (1.02 in.) |

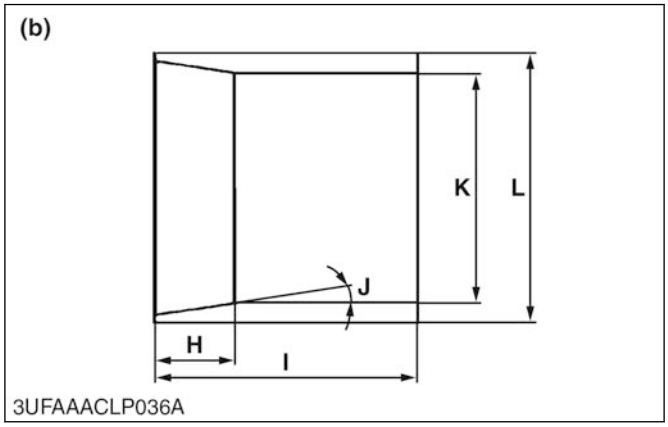
## 2.21 Hydraulic cylinder piston sealing tool

Tool (a): Use for installing the piston seals to the piston.
Tool (b): Use for installing the piston to the cylinder.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**



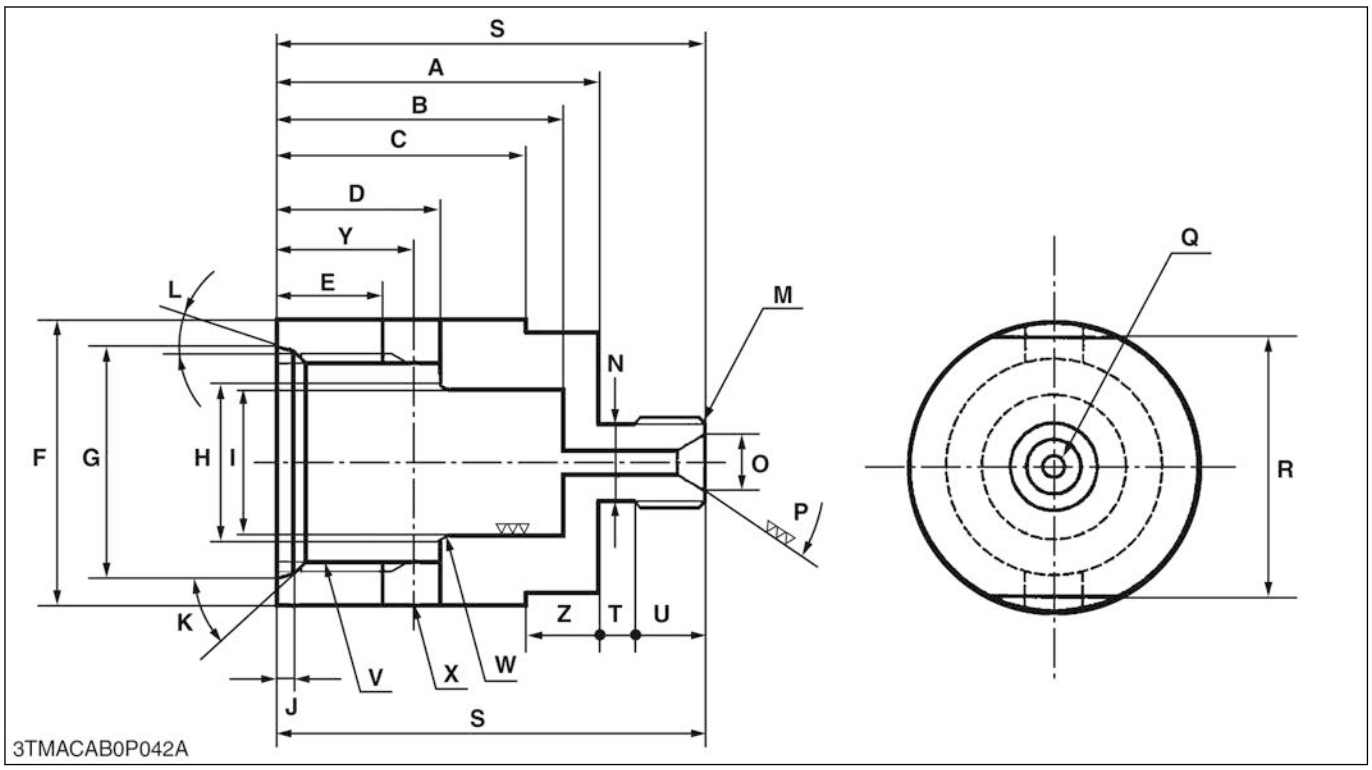

| Cylinder size | 60 mm (2.36 in.) | 65 mm (2.56 in.) | 75 mm (2.95 in.) |
|---|---|---|---|
| A | 80√ | 80√ | 80√ |
| B | 0.16 rad (9.0°) | 0.16 rad (9.0°) | 0.16 rad (9.0°) |
| C | 60.18 mm (2.369 in.) | 65.18 mm (2.566 in.) | 75.18 mm (2.960 in.) |
| D | 61.18 mm (2.409 in.) | 66.18 mm (2.606 in.) | 76.18 mm (2.999 in.) |
| E | 42 mm (1.7 in.) | 42 mm (1.7 in.) | 42 mm (1.7 in.) |
| F | 10 mm (0.39 in.) | 10 mm (0.39 in.) | 10 mm (0.39 in.) |
| G | 58.5 mm (2.30 in.) | 58.5 mm (2.30 in.) | 58.5 mm (2.30 in.) |
| H | 14 mm (0.55 in.) | 14 mm (0.55 in.) | 14 mm (0.55 in.) |
| I | 35 mm (1.4 in.) | 35 mm (1.4 in.) | 35 mm (1.4 in.) |
| J | 0.12 rad (7.0°) | 0.12 rad (7.0°) | 0.12 rad (7.0°) |
| K | 60.0 mm (2.36 in.) | 65.0 mm (2.56 in.) | 75.0 mm (2.95 in.) |
| L | 68.9 mm (2.71 in.) | 73.9 mm (2.91 in.) | 83.9 mm (3.30 in.) |

## 2.22 Cylinder safety valve setting pressure adaptor

Use for installing the safety valve to the nozzle tester to measure safety valve cracking pressure and measure setting pressure of the check valve on the safety valves.

**■ NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**




| | |
|---|---|
| A | 45 mm (1.77 in.) |
| B | 40 mm (1.58 in.) |
| C | 35 mm (13.8 in.) |
| D | 23 to 23.3 mm (0.9055 to 0.9713 in.) |
| E | 16 mm (0.63 in.) |
| F | 40 mm dia. (1.58 in. dia.) |
| G | 32.4 to 32.7 mm dia. (1.2756 to 1.2874 in. dia.) |
| H | 21 mm dia. (0.83 in. dia.) |
| I | 20 to 20.05 mm dia. (0.7874 to 0.7894 in. dia.) |
| J | 2.5 to 2.59 mm (0.0984 to 0.1097 in.) |
| K | 0.79 rad (45°) |
| L | 0.26 rad (15°) |
| M | M12 × P1.5 |
| N | 10 mm dia. (0.39 in. dia.) |
| O | 7.5 mm dia. (0.3 in. dia.) |
| P | 1.05 rad (60°) |
| Q | 3 mm dia. (1.18 in. dia.) |
| R | 36 mm (1.18 in.) |
| S | 60 mm (2.36 in.) |
| T | 5 mm (0.20 in.) |
| U | 10 mm (0.39 in.) |
| V | M30 × P1.5 |

(Continued)

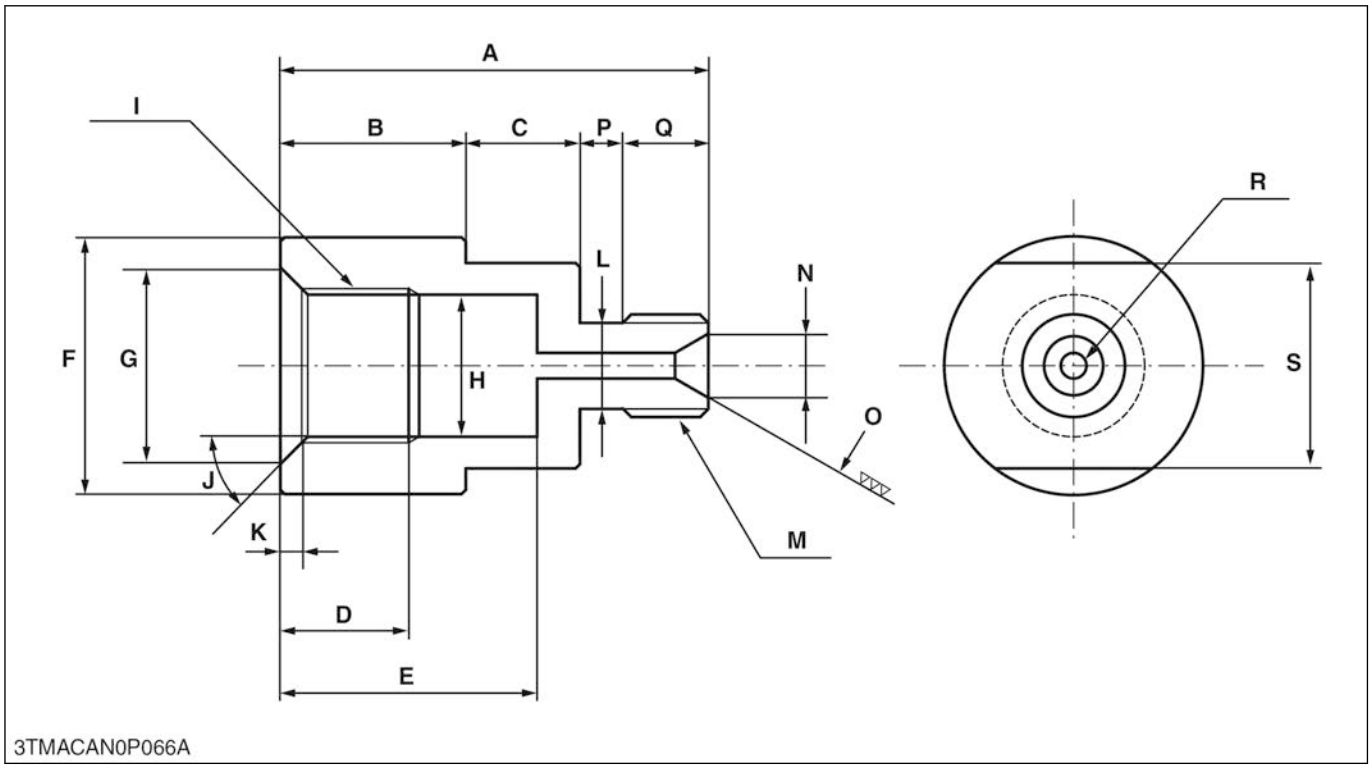
| | |
|---|---|
| W | 0.52 rad (30°) |
| X | 8 mm dia. (0.32 in. dia.) |
| Y | 19 mm (0.75 in.) |
| Z | 10 mm (0.39 in.) |

## 2.23 Oil cooler relief valve setting pressure adaptor

Use for installing the oil cooler relief valve to the nozzle tester to measure cracking pressure and measure setting pressure of the oil cooler relief valve.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**




| | |
|---|---|
| A | 50 mm (2.0 in.) |
| B | 22 mm (0.87 in.) |
| C | 13 mm (0.51 in.) |
| D | 15 mm (0.59 in.) |
| E | 30 mm (1.2 in.) |
| F | 30 mm (1.2 in.) |
| G | 23 mm (0.91 in.) |
| H | 16.5 mm (0.650 in.) |
| I | M18 × P1.5 |
| J | 0.79 rad (45°) |
| K | 2.5 mm (0.039 in.) |
| L | 10 mm dia. (0.39 in. dia.) |
| M | M12 × P1.5 |
| N | 7.5 mm dia. (0.30 in. dia.) |
| O | 1.0 rad (60°) |
| P | 5 mm (0.2 in.) |
| Q | 10 mm (0.39 in.) |
| R | 3 mm dia. (0.1 in. dia.) |
| S | 24 mm (0.94 in.) |

RELATED PAGE

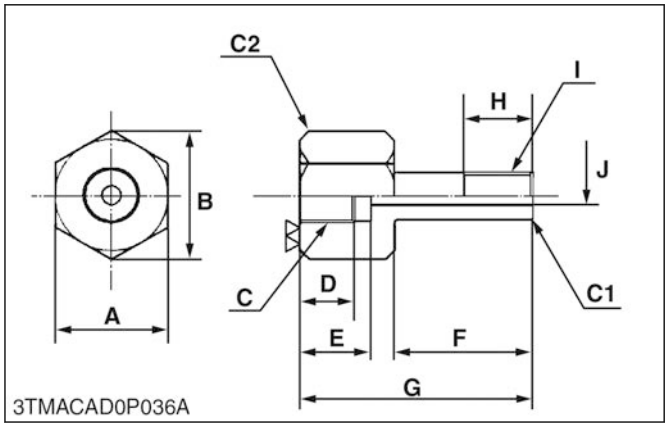
2.23 Oil cooler relief valve setting pressure adaptor on page 2-94

## 2.24 Valve adaptor

Use for measuring the system pressure of shuttle valve, system pressure relief pressure, 4WD valve, PTO valve and dual hi-lo valve.

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**



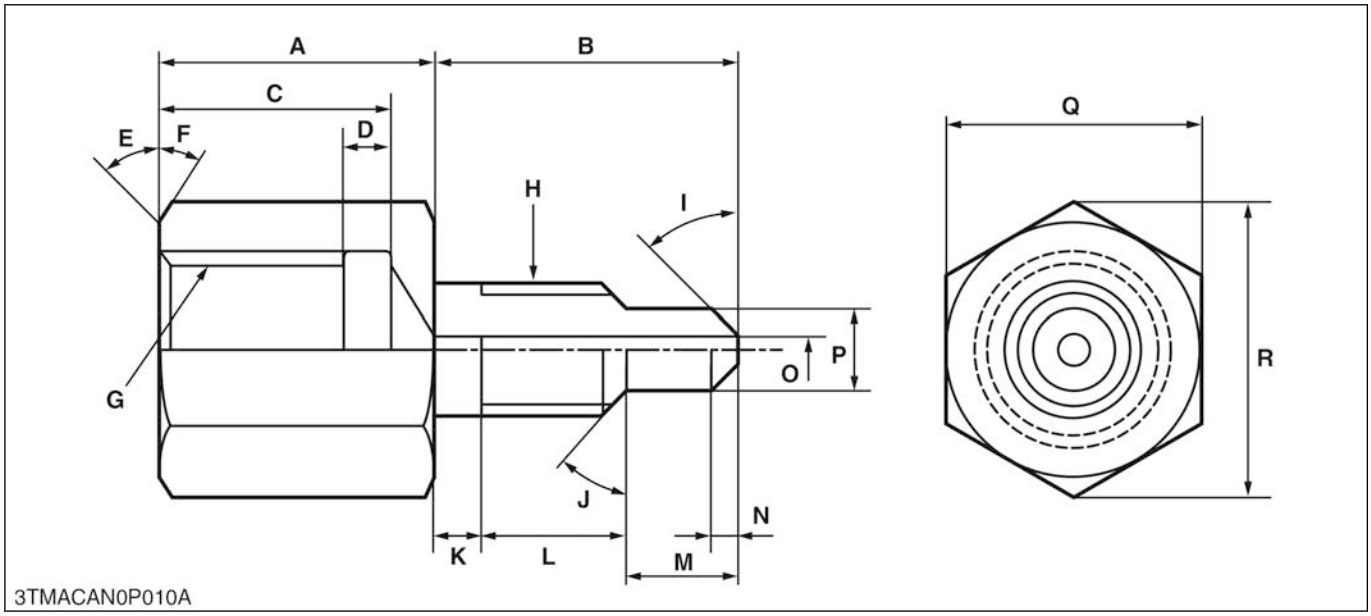

| | |
|---|---|
| A | 24 mm (0.94 in.) |
| B | 27.7 mm (1.09 in.) |
| C | PS1/4 |
| D | 11 mm (0.43 in.) |
| E | 15 mm (0.59 in.) |
| F | 40 mm (1.57 in.) |
| G | 60 mm (2.36 in.) |
| H | 15 mm (0.59 in.) |
| I | PT1/8 |
| J | 4 mm dia. (0.15 in. dia.) |
| C1 | Chamfer 1 mm (0.039 in.) |
| C2 | Chamfer 2 mm (0.079 in.) |

## 2.25 Hydraulic brake adaptor

Use for testing the hydraulic brake oil linkage.

**■ NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**



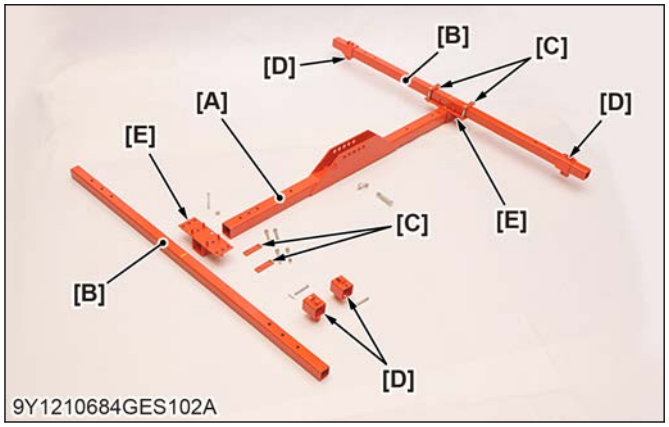

| | |
|---|---|
| A | 18 mm (0.71 in.) |
| B | 15 mm (0.59 in.) |
| C | 15 mm (0.59 in.) |
| D | 3 mm (0.12 in.) |
| E | 0.79 rad (45°) |
| F | 0.52 rad (30°) |
| G | PS1/4 |
| H | M7 × P1.0 |
| I | 0.79 rad (45°) |
| J | 0.79 rad (45°) |
| K | 6 mm (0.24 in.) |
| L | 5 mm (0.20 in.) |
| M | 4 mm (0.16 in.) |
| N | 2 mm (0.079 in.) |
| O | 2 mm dia. (0.079 in. dia.) |
| P | 5 mm dia. (0.20 in. dia.) |
| Q | 17 mm (0.67 in.) |
| R | 19.6 mm (0.77 in.) |

## 2.26 Tools for dismounting cabin

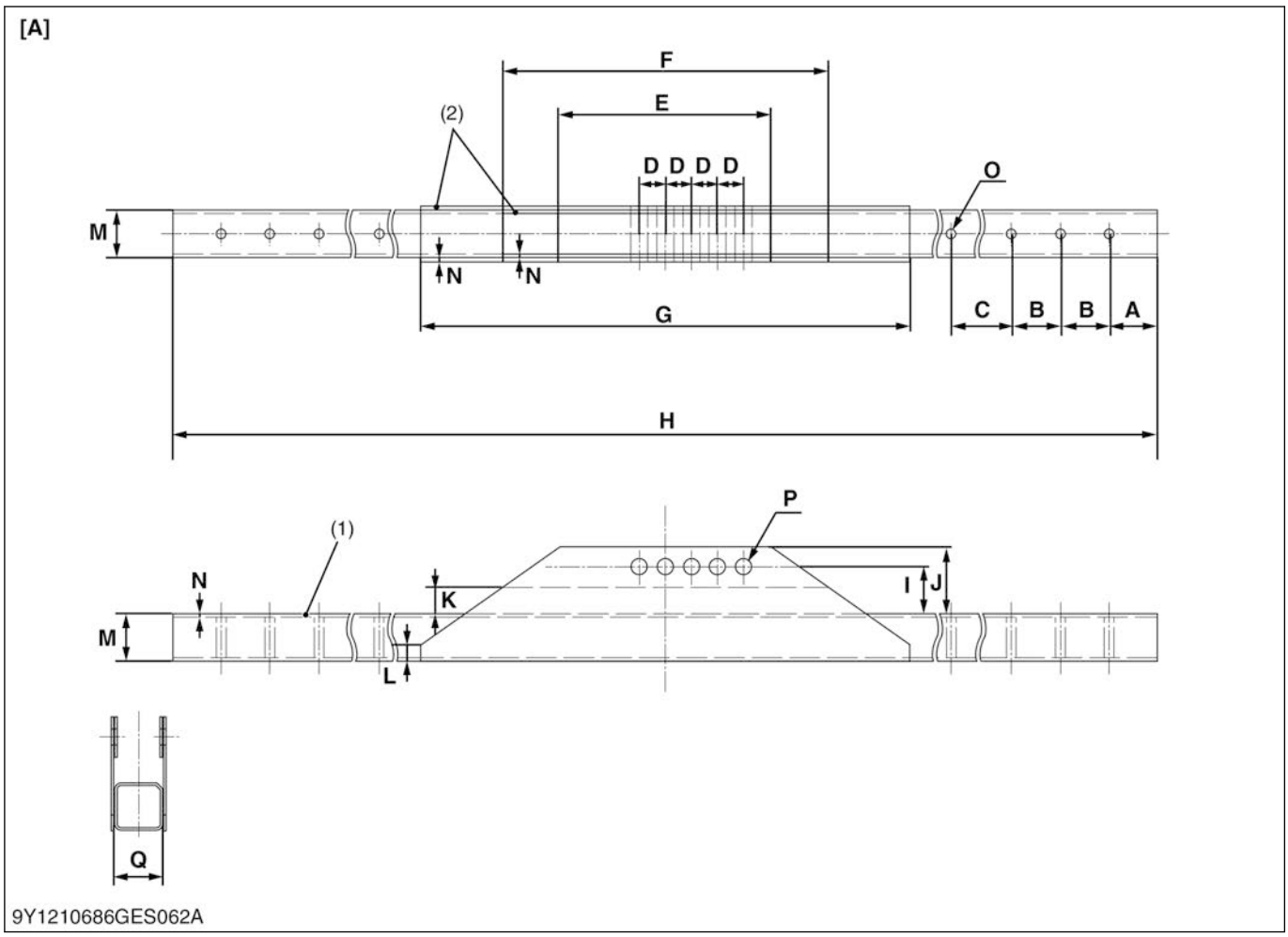
Use for dismounting and mounting the cabin.

**NOTE**

- **This special tool is not provided, therefore make it by referring to the figure.**



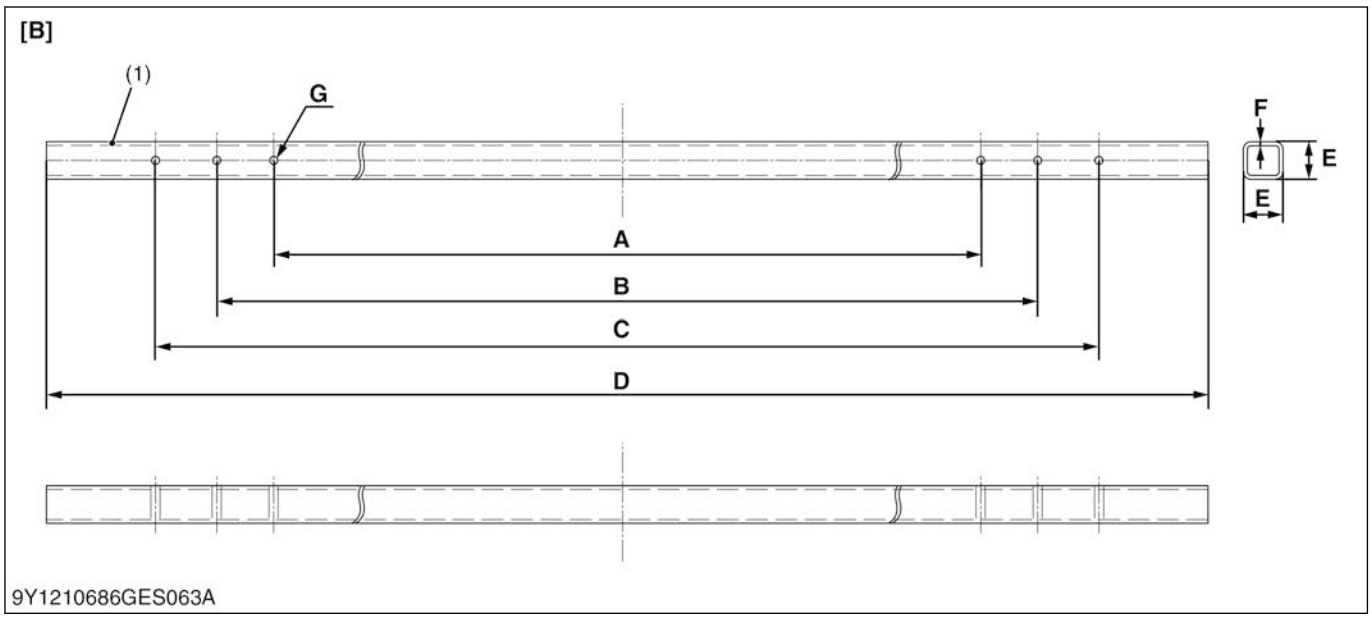

| | Q'ty |
|---|---|
| Piece [A] | 1 |
| Piece [B] | 2 |
| Piece [C] | 4 |
| Piece [D] | 4 |
| Piece [E] | 2 |




(1) Material:
STKR400 (60 × 60 × t45)

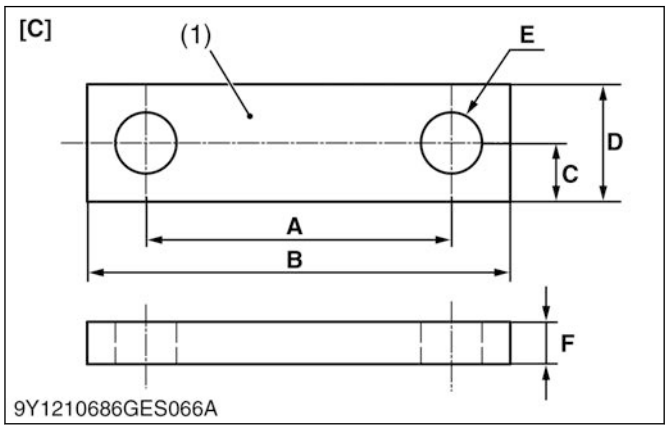
(2) Material:
SPHC-P

| | |
|---|---|
| A | 77.0 mm (3.03 in.) |
| B | 50.0 mm (2.17 in.) |
| C | 200 mm (7.87 in.) |
| D | 32.0 mm (1.26 in.) |
| E | 260 mm (10.2 in.) |
| F | 400 mm (15.7 in.) |
| G | 600 mm (23.6 in.) |
| H | 1562 mm (61.50 in.) |
| I | 65.0 mm (2.56 in.) |
| J | 15.0 mm (0.984 in.) |
| K | 40.0 mm (2.17 in.) |
| L | 20.0 mm (0.787 in.) |
| M | 60.0 mm (2.36 in.) |
| N | 4.5 mm (0.18 in.) |
| O | 8-11.0 mm dia. (0.433 in. dia.) |
| P | 5-20.0 mm dia. (0.787 in. dia.) |
| Q | 60.0 mm (2.36 in.) |




(1) Material:
STKR400 (50 × 50 × t45)

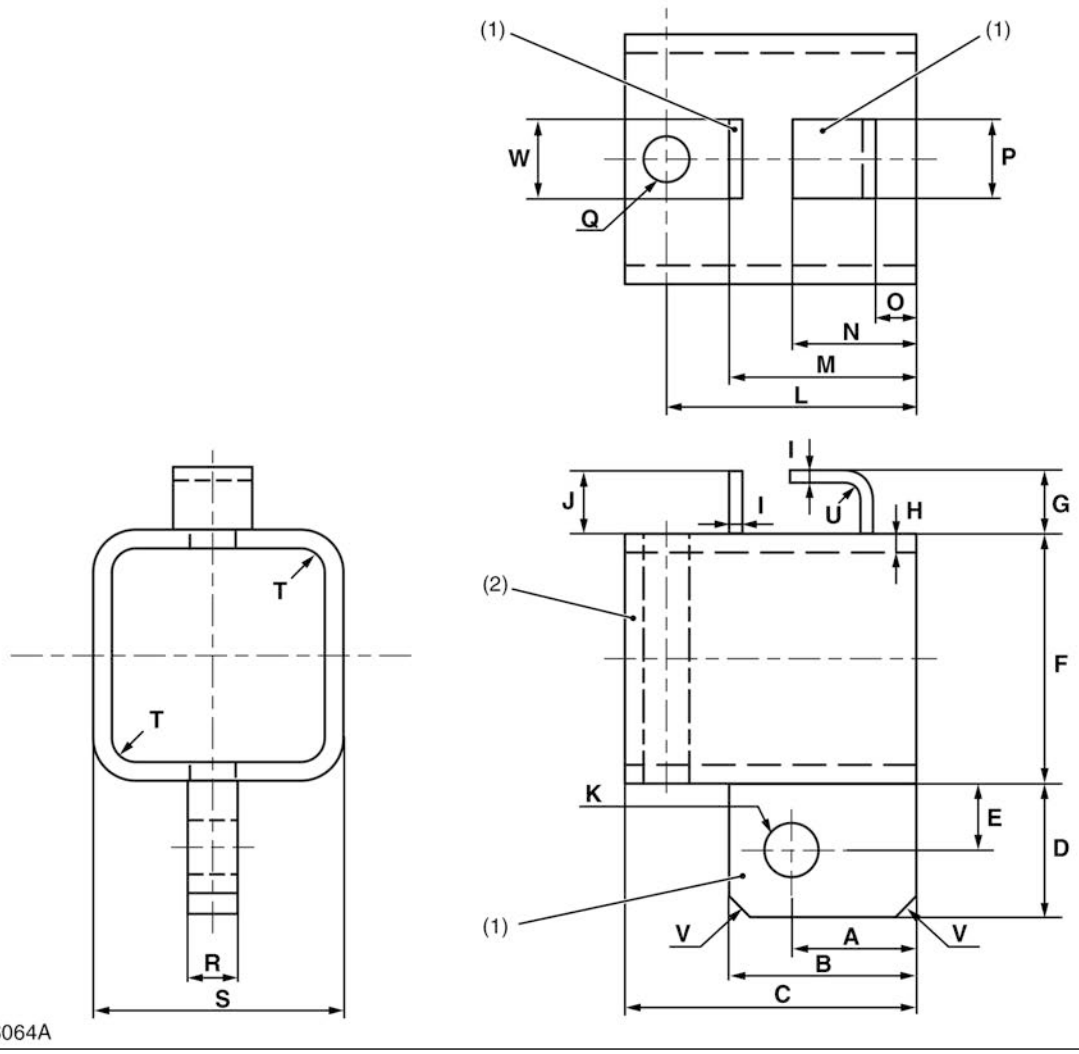
| | |
|---|---|
| A | 1050 mm (41.34 in.) |
| B | 1200 mm (47.24 in.) |
| C | 1362 mm (53.62 in.) |
| D | 1650 mm (64.96 in.) |
| E | 50.0 mm (1.97 in.) |
| F | 4.5 mm (0.18 in.) |
| G | 6-11.0 mm dia. (0.433 in. dia.) |




(1) Material:
SS400

| | |
|---|---|
| A | 62.0 mm (2.44 in.) |
| B | 90.0 mm (3.54 in.) |
| C | 12.5 mm (0.492 in.) |
| D | 25.0 mm (0.984 in.) |
| E | 2-13 mm dia. (2-0.512 in. dia.) |
| F | 9.0 mm (0.35 in.) |

[D]




(1) Material:
SS400

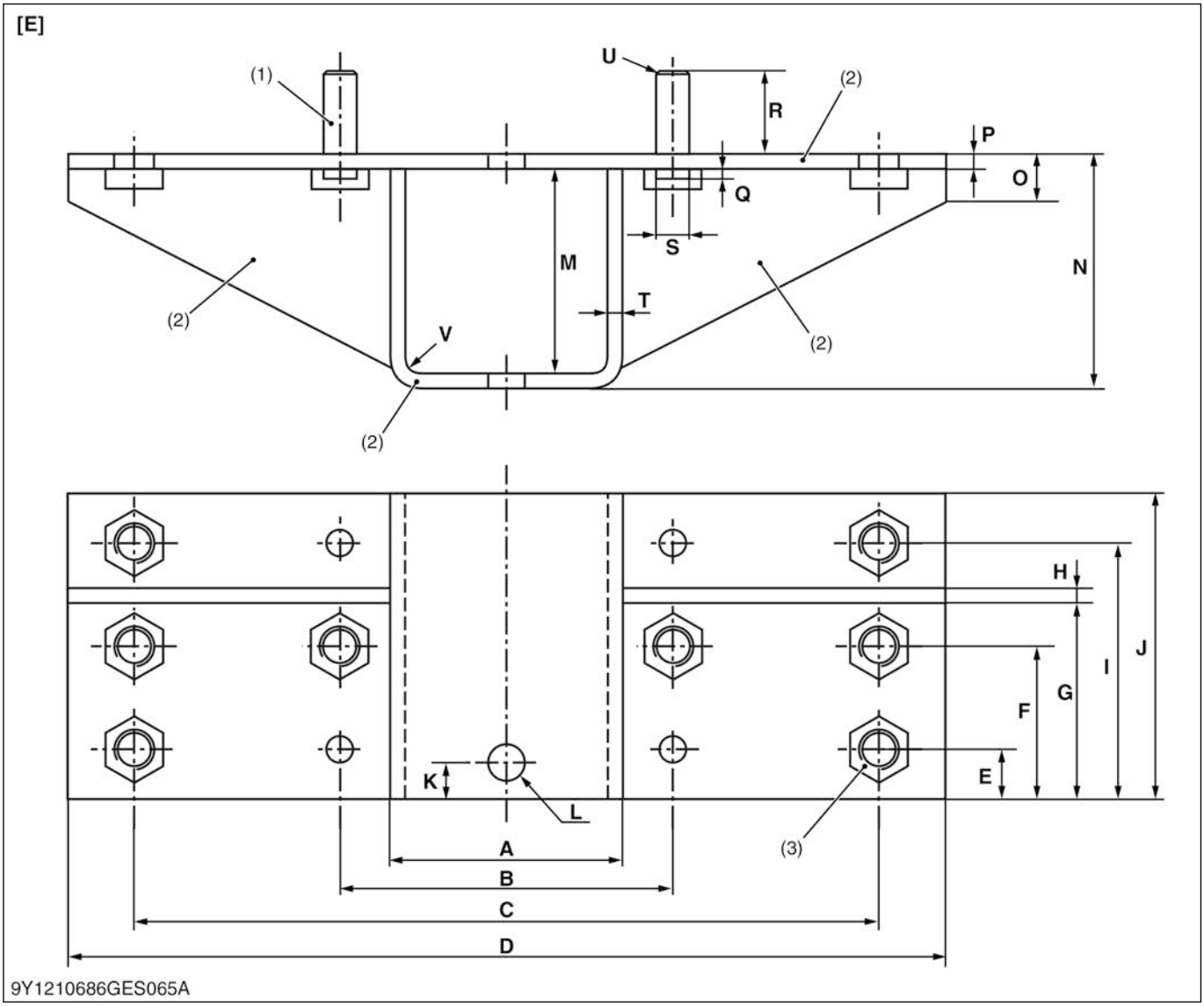
(2) Material:
STKR400 (60 × 60 × t45)

| | |
|---|---|
| A | 30.0 mm (1.18 in.) |
| B | 45.0 mm (1.77 in.) |
| C | 70.0 mm (2.76 in.) |
| D | 32.0 mm (1.26 in.) |
| E | 16.0 mm (0.630 in.) |
| F | 60.0 mm (2.36 in.) |
| G | 15.0 mm (0.591 in.) |
| H | 4.5 mm (0.18 in.) |
| I | 3.2 mm (0.13 in.) |
| J | 15.0 mm (0.591 in.) |
| K | 13.0 mm dia. (0.512 in. dia.) |
| L | 60.0 mm (2.36 in.) |
| M | 45.0 mm (1.77 in.) |
| N | 30.0 mm (1.18 in.) |
| O | 10.0 mm (0.394 in.) |

(Continued)

| | |
|---|---|
| P | 19.0 mm (0.748 in.) |
| Q | 11.0 mm dia. (0.433 in. dia.) |
| R | 12.0 mm (0.472 in.) |
| S | 60.0 mm (2.36 in.) |
| T | 4.5 mm radius (0.18 in. radius) |
| U | 3.5 mm radius (0.14 in. radius) |
| V | Chamfer 5.0 mm (0.20 in.) |
| W | 19.0 mm (0.748 in.) |

[E]




(1) Material: SGD400
(2) Material: SS400
(3) 8-M12 × 1.25 nut

| | |
|---|---|
| A | 70.0 mm (2.76 in.) |
| B | 100 mm (3.94 in.) |
| C | 224 mm (8.82 in.) |
| D | 264 mm (10.4 in.) |
| E | 15.0 mm (0.591 in.) |

(Continued)

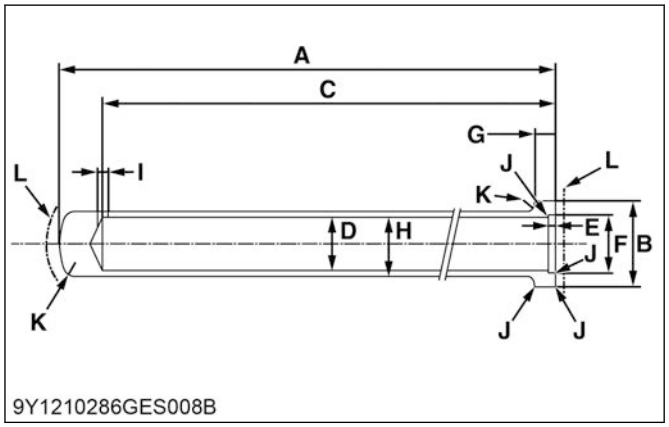
| | |
|---|---|
| F | 46.0 mm (1.81 in.) |
| G | 59.0 mm (2.32 in.) |
| H | 4.5 mm (0.18 in.) |
| I | 77.0 mm (3.03 in.) |
| J | 92.0 mm (3.62 in.) |
| K | 11.0 mm (0.433 in.) |
| L | 11.0 mm dia. (0.433 in. dia.) |
| M | 61.0 mm (2.40 in.) |
| N | 64.5 mm (2.54 in.) |
| O | 14.5 mm (0.571 in.) |
| P | 4.5 mm (0.18 in.) |
| Q | 3.0 mm (0.12 in.) |
| R | 25.0 mm (0.984 in.) |
| S | 10.0 mm dia. (0.394 in. dia.) |
| T | 4.5 mm (0.18 in.) |
| U | Chamfer 5.0 mm (0.039 in.) |
| V | 5.0 mm radius (0.18 in. radius) |

## 2.27 Propeller shaft sleeve fitting tool

To use for replacing the sleeve for the propeller shaft.

**NOTE**

- **This special tool is not provided, therefore make it by referring to the figure.**





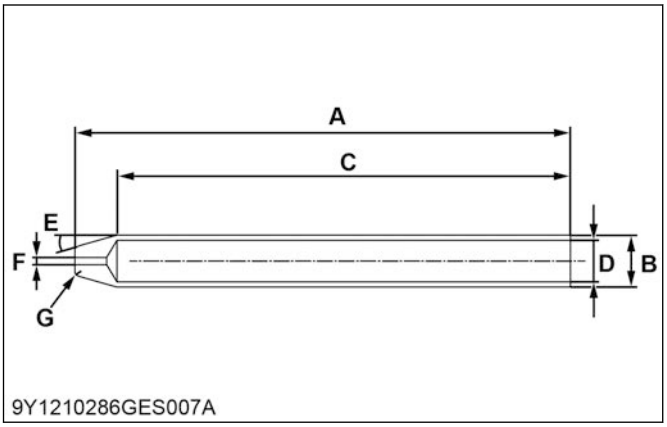
| | |
|---|---|
| A | 404 mm (15.9 in.) |
| B | 38 mm (1.5 in.) |
| C | 374 mm (14.7 in.) |
| D | 30.5 mm dia. (1.20 in. dia.) |
| E | 5 mm dia. (0.2 in. dia.) |
| F | Frame hardening and tempering (HRC 45 to 50) |

## 2.28 Arbor for oil seal of propeller shaft

To use for attaching the oil seal for the propeller shaft.

**NOTE**

- **Apply hard chrome plating to whole part.**
- **This special tool is not provided, therefore make it by referring to the figure.**





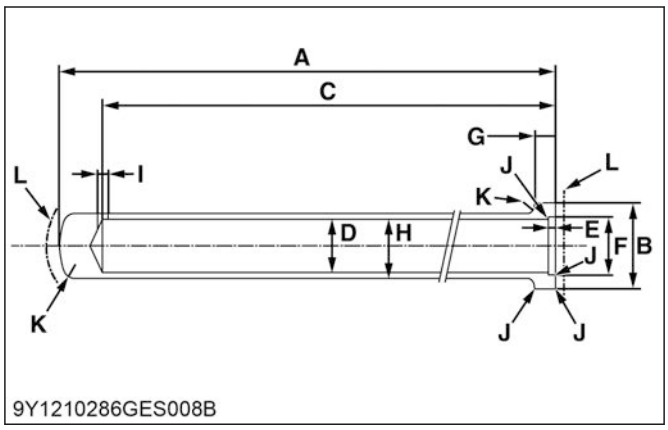
| | |
|---|---|
| A | 404 mm (15.9 in.) |
| B | 37.5 mm (1.48 in.) |
| C | 374 mm (14.7 in.) |
| D | 30 mm dia. (1.2 in. dia.) |
| E | 0.26 rad (15°) |
| F | 5 mm dia. (0.2 in. dia.) |
| G | 3 mm radius (0.1 in. radius.) |

## 2.29 Propeller shaft oil seal fitting tool

To use for replacing the oil seal of propeller shaft.

**NOTE**

- **This special tool is not provided, therefore make it by referring to the figure.**





| | |
|---|---|
| A | 440 mm (17.3 in.) |
| B | 60 mm dia. (2.4 in. dia.) |
| C | 410 mm (16.1 in.) |
| D | 37.9 mm dia. (1.49 in. dia.) |
| E | 5 mm (0.2 in.) |
| F | 42 mm dia. (1.7 in. dia.) |
| G | 15 mm (0.59 in.) |
| H | 45 mm dia. (1.8 in. dia.) |
| I | 5 mm dia. (0.2 in. dia.) |
| J | Chamfer 0.5 mm (0.02 in.) |
| K | 5 mm radius (0.2 in. radius) |
| L | Flame hardening and tempering (HRC 45 to 50) |

# 3. Special tools for air conditioner unit

## 3.1 Air conditioner service tool

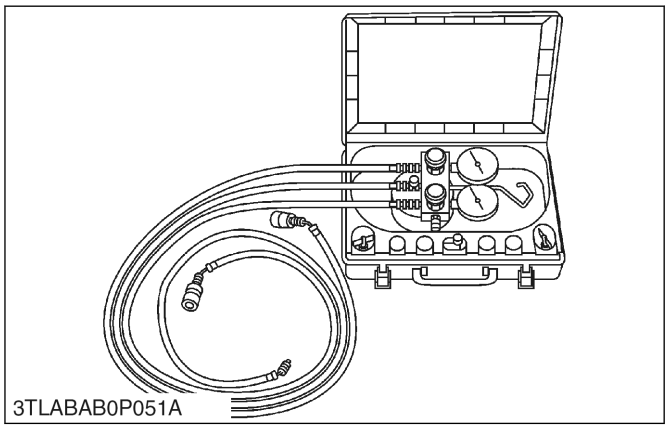
Use for charging, testing or discharging the air conditioning system.

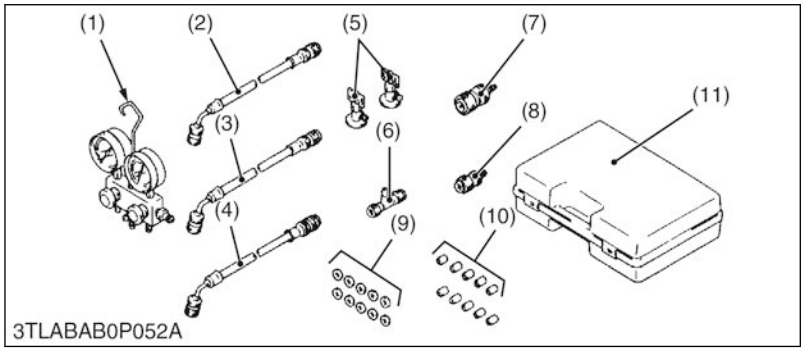
**NOTE**

- **Special tools for R134a refrigerant air conditioning system below are available from DENSO CO. LTD.**

**Code No.**

DENSO 95048-00063




(1) Manifold gauge assembly (95048-10090)
(2) Charging hose (Red: HI) (95948-10270)
(3) Charging hose (Blue: LO) (95948-10280)
(4) Charging hose (Green) (95948-10260)
(5) Can tap valve (95048-10150)
(6) T joint (95048-10160)
(7) Quick coupler (HI) (95048-10130)
(8) Quick coupler (LO) (95048-10140)
(9) Service valve packing (95906-10310)
(10) Charging hose packing (95906-10300)
(11) Tool case (95949-10610)

## 3.2 Electric gas leak tester

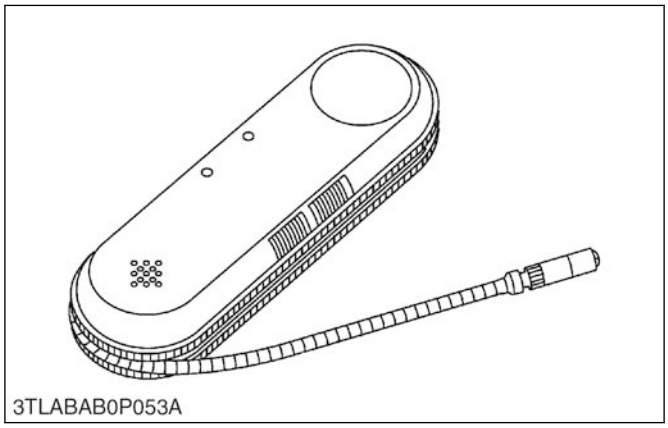
Use for testing gas leakage from the air conditioning system.

**NOTE**

- **Special tools for R134a refrigerant air conditioning system below are available from DENSO CO. LTD.**

**Code No.**

DENSO 95146-00060




## 3.3 Vacuum pump

Use for evacuating the air conditioning system.

**NOTE**

- **Special tools for R134a refrigerant air conditioning system below are available from DENSO CO. LTD.**

**Code No.**

DENSO 95046-00130 (AC220V)
DENSO 95046-00140 (AC240V)

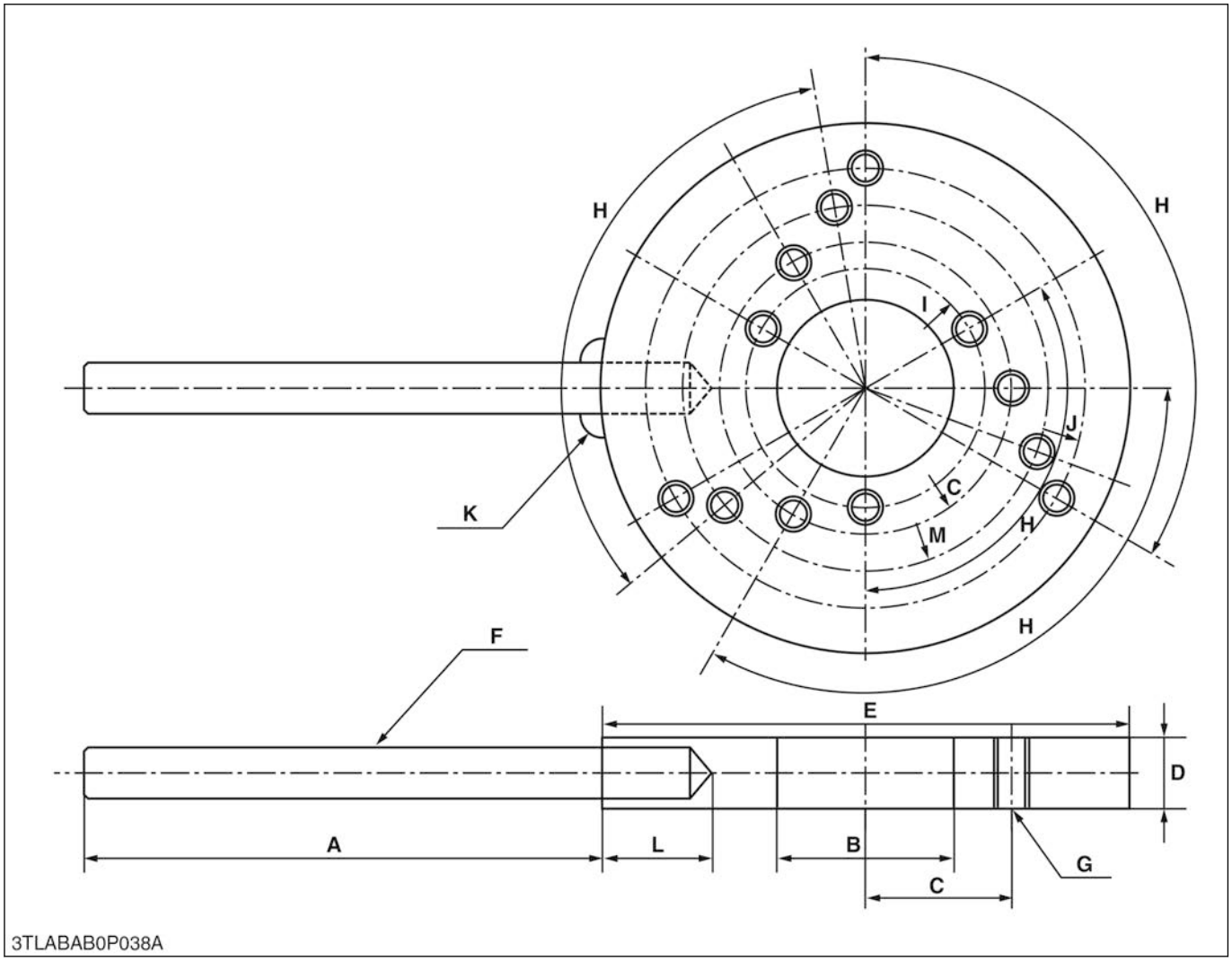

(1) Adaptor (For 134a) (2) Vacuum pump

## 3.4 Magnet clutch stopper (for A/C compressor)

Use for loosening and tightening the magnet clutch mounting nut. (Use radius M)

**NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**




| | |
|---|---|
| A | 125 mm (4.92 in.) |
| B | 40 mm dia. (1.57 in. dia.) |
| C | Radius 33 mm (Radius 1.30 in.) |
| D | 16 mm (0.63 in.) |
| E | 120 mm dia. (4.72 in. dia.) |
| F | 12 mm dia. (0.47 in. dia.) |
| G | 3 × M8 × 1.25 all screws |
| H | 4.52 rad (120°) |
| I | Radius 27 mm (Radius 1.06 in.) |
| J | Radius 50 mm (Radius 1.97 in.) |
| K | Weld all around |
| L | 20 mm (0.78 in.) |

(Continued)

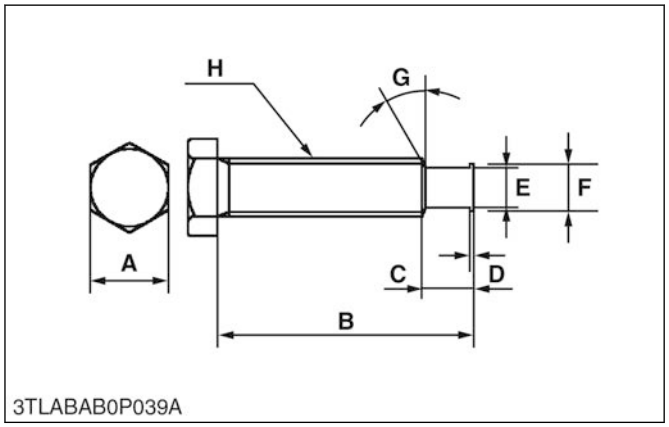
| | |
|---|---|
| M | Radius 41 mm (Radius 1.61 in.) |

## 3.5 Stopper bolt (for A/C compressor)

Use for installing to the magnet clutch stopper.

**■ NOTE**

- **The special tool is not provided, therefore make it by referring to the figure.**




3TLABAB0P039A

| | |
|---|---|
| A | 12 mm (0.47 in.) |
| B | 35 mm (1.38 in.) |
| C | 7 mm (0.28 in.) |
| D | 0.4 mm (0.016 in.) |
| E | 5.5 mm dia. (0.22 in. dia.) |
| F | 6.5 mm dia. (0.26 in. dia.) |
| G | 0.52 rad (30°) |
| H | M8 × P1.25 |

# TIRES

**WARNING**

**To avoid personal injury:**

- **Do not try to mount a tire on a rim. This should be done by a qualified person with the proper equipment.**
- **Always keep the correct tire pressure. Do not inflate tires above the recommended pressure show in the operator's manual.**

**IMPORTANT**

- **Do not use tires other than those approved by KUBOTA.**
- **Dual tires are not approved.**

**NOTE**

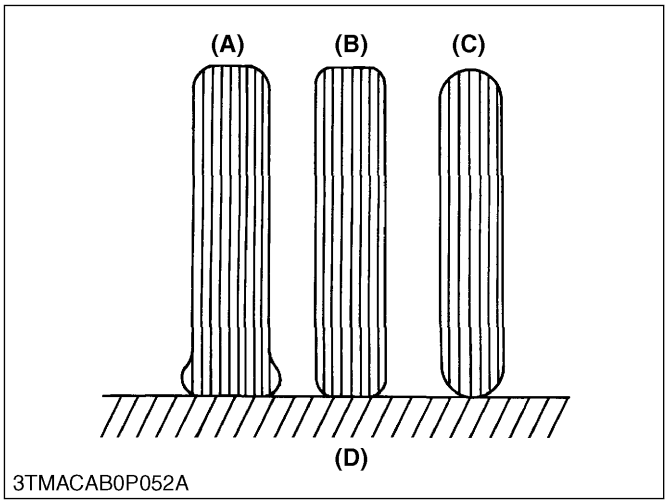
- **When optional different-diameter tires are fitted on the machine, the travel speed display mode must be changed. Otherwise the travel speed will not get correctly displayed. Such mode switching is also needed when the original tires are back on the machine.**

## 1. Tire size and inflation pressure

Though the tire 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.

**NOTE**

- **Keep the maximum pressure in front tires, if using a front loader or when equipped with a full load of front weights.**




(A) Insufficient
(B) Standard
(C) Excessive
(D) Ground

**Inflation pressure**

- Keep the pressure shown below for normal use.

| | Tire sizes | Inflation pressure |
|---|---|---|
| Front | 320/85R20 | 140 kPa (1.4 kgf/cm$^2$, 20.3 psi) |
| | 320/70R24 | 140 kPa (1.4 kgf/cm$^2$, 20.3 psi) |
| | 360/70R24 | 160 kPa (1.6 kgf/cm$^2$, 23.2 psi) |
| | 320/85R24 | 140 kPa (1.4 kgf/cm$^2$, 20.3 psi) |
| | 380/70R20 | 160 kPa (1.6 kgf/cm$^2$, 23.2 psi) |
| | 44X18.00-20 (Cabin model) | 140 kPa (1.4 kgf/cm$^2$, 20.3 psi) |
| | 340/80R24 (Cabin model) | 320 kPa (3.2 kgf/cm$^2$, 46.4 psi) |
| Rear | 420/85R30 | 120 kPa (1.2 kgf/cm$^2$, 17.4 psi) |
| | 460/85R30 | 110 kPa (1.1 kgf/cm$^2$, 16.0 psi) |
| | 420/85R34 | 120 kPa (1.2 kgf/cm$^2$, 17.4 psi)) |
| | 480/70R34 | 120 kPa (1.2 kgf/cm$^2$, 17.4 psi) |
| | 340/85R38 | 160 kPa (1.6 kgf/cm$^2$, 23.2 psi) |
| | 480/70R30 | 160 kPa (1.6 kgf/cm$^2$, 23.2 psi) |
| | 23.1-26 (Cabin model) | 165 kPa (1.65 kgf/cm$^2$, 23.9 psi) |
| | 300/85R42 | 240 kPa (2.4 kgf/cm$^2$, 34.8 psi) |
| | 440/80R34 (Cabin model) | 320 kPa (3.2 kgf/cm$^2$, 46.4 psi) |

# 2. Wheel adjustment

**⚠ WARNING**

**To avoid personal injury or death:**

- **When working on slopes or when working with a trailer, set the wheel tread as wide as practical for maximum stability.**
- **Support the tractor securely on stands before removing a wheel.**
- **Do not work under any hydraulically supported devices. They can settle, suddenly leak, or be accidentally lowered. If necessary to work under the tractor or any machine elements for servicing or adjustments, securely support them with stands or suitable blocking beforehand.**
- **Never operate the tractor with a loose rim, wheel or axle.**

# 2.1 ROPS model

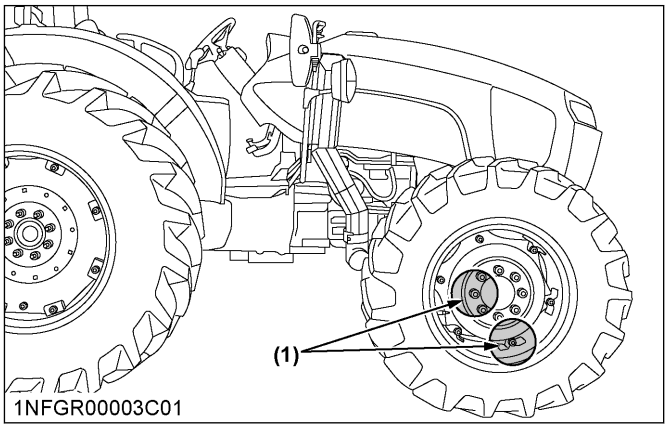
## 2.1.1 Front wheels-4WD (ROPS model)

Front tread width can be adjusted as shown with the standard equipped tires.
To change the tread width:

1. Remove the wheel rim and disk mounting bolts.
2. Change the position of the rim and tire to the desired position, and tighten the bolts.
3. Adjust the toe-in as 2 to 8 mm (0.08 to 0.3 in.).

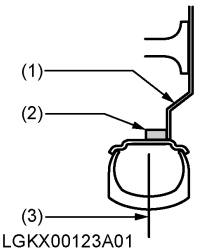
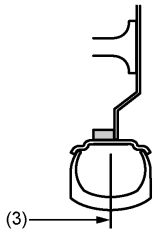
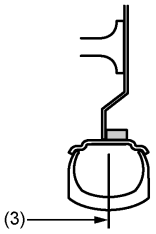
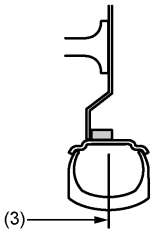
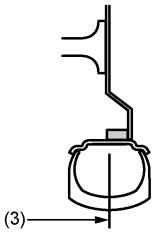
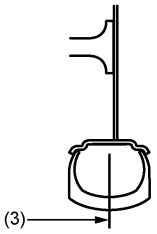
**IMPORTANT**

- **Always attach wheels as shown in the drawing.**
- **If not attached as illustrated, transmission parts may be damaged.**
- **When re-fitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m and 10 times of shuttle movement by 5 m, and thereafter according to service interval.**




(1) Front wheel mounting nut

| | | |
|---|---|---|
| Tightening torque | Front wheel mounting nut | 260 to 304 N·m<br>26.5 to 31 kgf·m<br>192 to 224 lbf·ft |

|  1LGKX00123A01 | |  1LGKX00123A02 |  1LGKX00123A03 |  1LGKX00123A04 |  1LGKX00123A05 |  1LGKX00123A06 |
|---|---|---|---|---|---|---|
| 320/85R20 | 1567 mm<br>61.69 in. | 1654 mm<br>65.12 in. | — | — | — | — |
| 320/70R24 | — | — | 1560 mm<br>61.42 in. | 1613 mm<br>63.50 in. | — | — |
| 320/85R24 | — | — | — | 1611 mm<br>63.43 in. | — | — |
| 320/85R24*1 | — | 1628 mm<br>64.09 in. | — | — | — | — |
| 320/85R24*2 | — | 1570 mm<br>61.81 in. | — | 1616 mm<br>63.62 in. | — | — |
| 360/70R24 | — | — | — | 1611 mm<br>63.43 in. | — | — |
| 360/70R24*3 | — | — | 1628 mm<br>64.09 in. | 1648 mm<br>64.88 in. | — | — |
| 360/70R24*4 | — | — | — | — | — | 1610 mm<br>63.39 in. |
| 380/70R20 | — | — | 1588 mm<br>62.52 in. | — | 1615 mm<br>63.58 in. | — |

(1) Front wheel disc
(2) Front wheel rim
(3) Tread

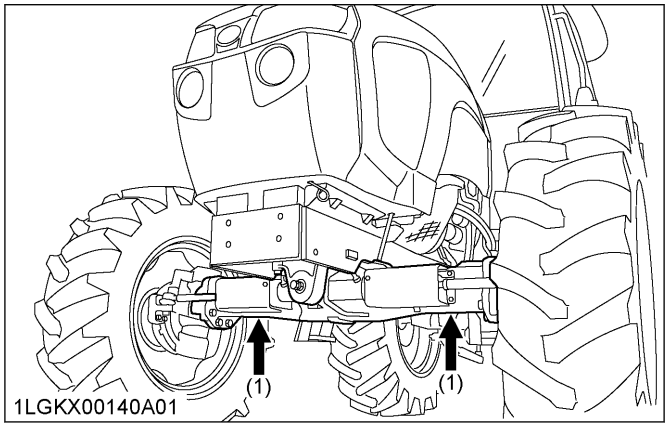
*1 Part No. W23TK01141 only
*2 Part No. W23TK00981 only
*3 Part No. W26TS01473 only
*4 Part No. W26TS01381 only

### 2.1.1.1 Front jack point

**WARNING**

**To avoid personal injury or death:**

- **Before jacking up the tractor, park it on a firm and level ground and chock the rear wheels.**
- **Fix the front axle to keep it from pivoting.**
- **Select jacks that withstand the machine weight and set them up as follows.**




(1) Jack point

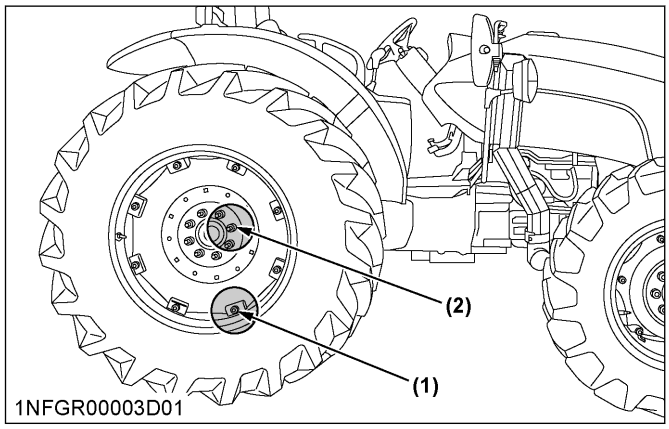
## 2.1.2 Rear wheels (ROPS model)

Rear tread width can be adjusted as shown with the standard equipped tires.
To change the tread width

1. Remove the wheel rim and/or disk mounting bolts.
2. Change the position of the rim and/or disk (right and left) to the desired position, and tighten the bolts.

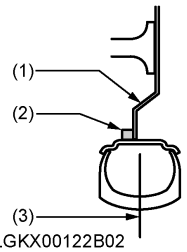
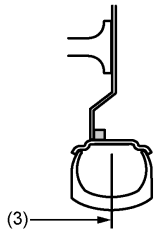
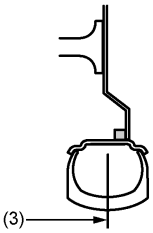
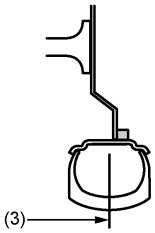
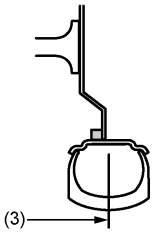
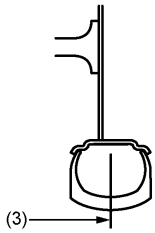
**■ IMPORTANT**

- **Always attach wheels as shown in the drawing.**
- **If not attached as illustrated, transmission parts may be damaged.**
- **When re-fitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m and 10 times of shuttle movement by 5 m, and thereafter according to service interval.**




(1) Rear disc mounting nut
(2) Rear wheel mounting nut

| | | |
|---|---|---|
| Tightening torque | Rear disc mounting nut | 260 to 304 N·m<br>26.5 to 31 kgf·m<br>192 to 224 lbf·ft |
| | Rear wheel mounting nut | 343 to 401 N·m<br>35.0 to 41.0 kgf·m<br>253 to 295 lbf·ft |

|  1LGKX00122B02 | |  1LGKX00122A03 |  1LGKX00122A04 |  1LGKX00122A05 |  1LGKX00122A06 |  1LGKX00123A07 |
|---|---|---|---|---|---|---|
| 420/85R30 | — | 1499 mm<br>59.02 in. | 1599 mm<br>62.95 in. | 1691 mm<br>66.57 in. | — | — |
| 460/85R30 | — | — | 1599 mm<br>62.96 in. | 1691 mm<br>66.57 in. | — | — |
| 420/85R34 | — | 1503 mm<br>59.18 in. | 1599 mm<br>62.95 in. | 1695 mm<br>66.73 in. | — | — |
| 480/70R34 | — | — | 1599 mm<br>62.95 in. | 1695 mm<br>66.73 in. | — | — |
| 480/70R34 *1 | — | — | 1589 mm<br>62.56 in. | — | 1659 mm<br>65.31 in. | — |
| 480/70R34 *2 | — | — | — | — | — | 1649 mm<br>64.92 in. |
| 340/85R38 | — | 1442 mm<br>56.78 in. | 1660 mm<br>65.35 in. | 1714 mm<br>67.48 in. | 1788 mm<br>70.39 in. | — |
| 480/70R30 | — | — | 1599 mm<br>62.95 in. | 1691 mm<br>66.57 in. | — | — |
| 300/85R42 | 1489 mm<br>58.63 in. | 1543 mm<br>60.74 in. | 1559 mm<br>62.95 in. | 1613 mm<br>63.50 in. | — | — |

(1) Rear wheel disc
(2) Rear wheel rim
(3) Tread

*1 Part No. W26TS01474 only

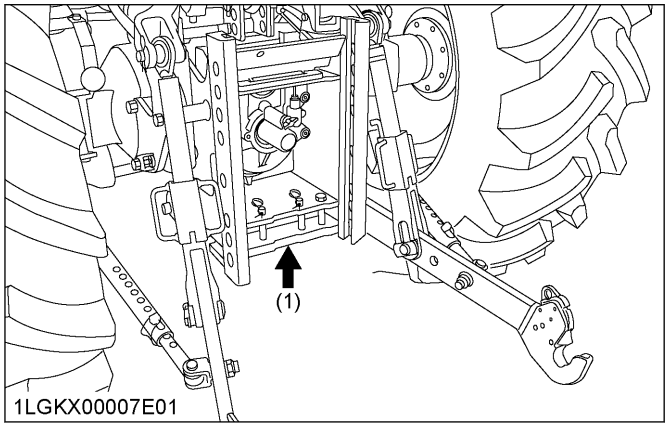
*2 Part No. W26TS01382 only

## 2.1.2.1 Rear jacking point

**⚠ WARNING**

**To avoid personal injury or death:**

- **Before jacking up the tractor, park it on a firm and level ground and chock the front wheels.**
- **Fix the front axle to keep it from pivoting.**
- **Select a jack that withstands the machine weight and set it up as follows.**




(1) Jack point

# 2.2 Cabin model

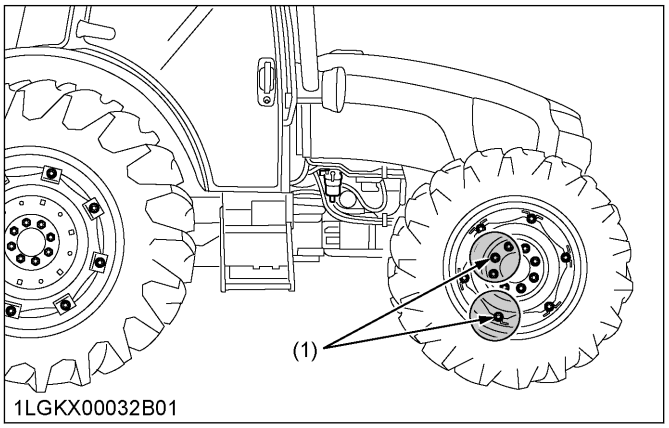
## 2.2.1 Front wheels-4WD (Cabin model)

Front tread width can be adjusted as shown with the standard equipped tires.
To change the tread width:

1. Remove the wheel rim and disk mounting bolts.
2. Change the position of the rim and tire to the desired position, and tighten the bolts.
3. Adjust the toe-in as 2 to 8 mm (0.08 to 0.3 in.).

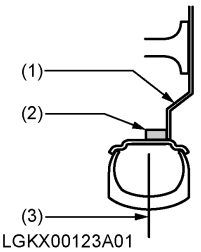
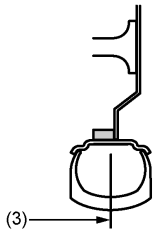
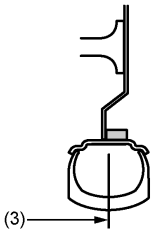
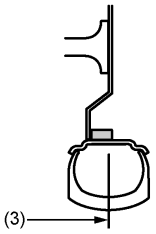
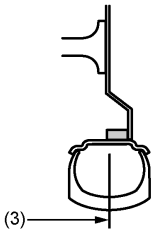
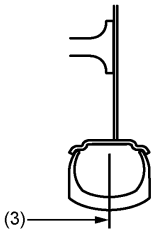
**IMPORTANT**

- **Always attach wheels as shown in the drawing.**
- **If not attached as illustrated, transmission parts may be damaged.**
- **When re-fitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m and 10 times of shuttle movement by 5 m, and thereafter according to service interval.**




(1) Front wheel mounting nut

| | | |
|---|---|---|
| Tightening torque | Front wheel mounting nut | 260 to 304 N·m<br>26.5 to 31 kgf·m<br>192 to 224 lbf·ft |

|  1LGKX00123A01 | |  1LGKX00123A02 |  1LGKX00123A03 |  1LGKX00123A04 |  1LGKX00123A05 |  1LGKX00123A06 |
|---|---|---|---|---|---|---|
| 320/85R20 | 1567 mm<br>61.69 in. | 1654 mm<br>65.12 in. | — | — | — | — |
| 320/70R24 | — | — | 1560 mm<br>61.42 in. | 1613 mm<br>63.50 in. | — | — |
| 320/85R24 | — | — | — | 1611 mm<br>63.43 in. | — | — |
| 320/85R24*1 | — | 1628 mm<br>64.09 in. | — | — | — | — |
| 320/85R24*2 | — | 1570 mm<br>61.81 in. | — | 1616 mm<br>63.62 in. | — | — |
| 360/70R24 | — | — | — | 1611 mm<br>63.43 in. | — | — |
| 360/70R24*3 | — | — | 1628 mm<br>64.09 in. | 1648 mm<br>64.88 in. | — | — |
| 360/70R24*4 | — | — | — | — | — | 1610 mm<br>63.39 in. |
| 380/70R20 | — | — | 1588 mm<br>62.52 in. | — | 1615 mm<br>63.58 in. | — |
| 44X18.00-20 | — | — | — | — | — | 1617 mm<br>63.67 in. |
| 340/80R24 | — | — | — | — | — | 1666 mm<br>65.59 in. |

(1) Front wheel disc
(2) Front wheel rim
(3) Tread

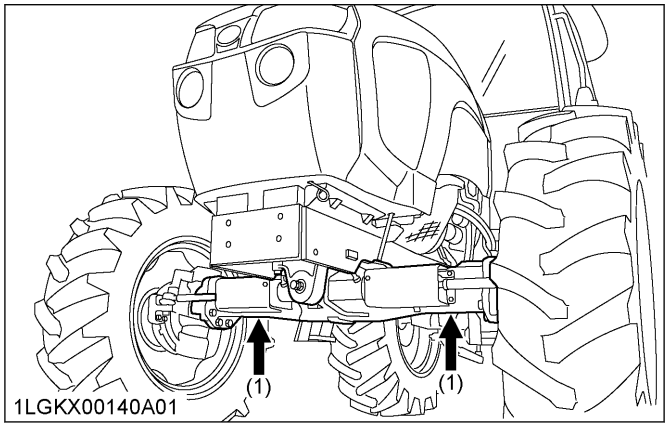
*1 Part No. W23TK01141 only
*2 Part No. W23TK00981 only
*3 Part No. W26TS01473 only
*4 Part No. W26TS01381 only

### 2.2.1.1 Front jack point

**WARNING**

**To avoid personal injury or death:**

- **Before jacking up the tractor, park it on a firm and level ground and chock the rear wheels.**
- **Fix the front axle to keep it from pivoting.**
- **Select jacks that withstand the machine weight and set them up as follows.**




(1) Jack point

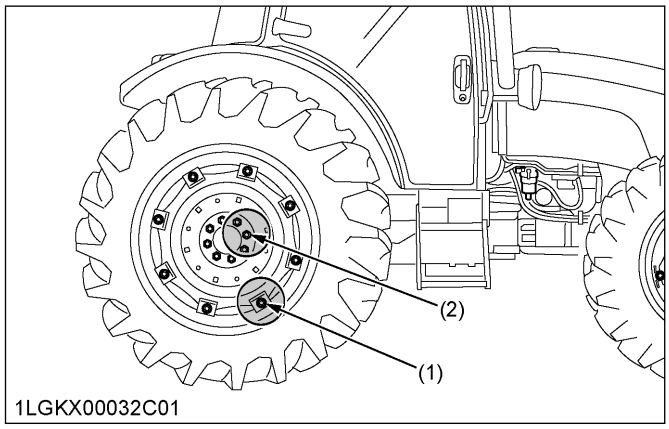
## 2.2.2 Rear wheels (Cabin model)

Rear tread width can be adjusted as shown with the standard equipped tires.
To change the tread width

1. Remove the wheel rim and/or disk mounting bolts.
2. Change the position of the rim and/or disk (right and left) to the desired position, and tighten the bolts.

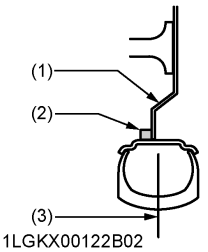
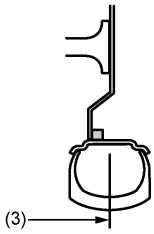
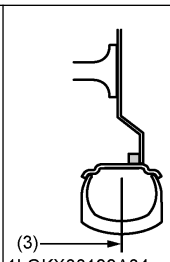
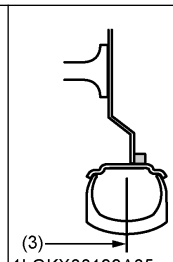
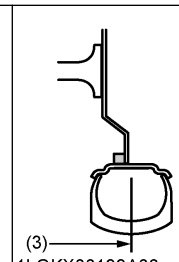
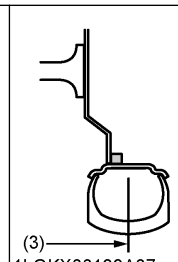
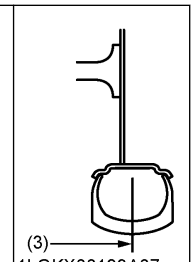
**■ IMPORTANT**

- **Always attach wheels as shown in the drawing.**
- **If not attached as illustrated, transmission parts may be damaged.**
- **When re-fitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m and 10 times of shuttle movement by 5 m, and thereafter according to service interval.**




(1) Rear disc mounting nut
(2) Rear wheel mounting nut

| | | |
|---|---|---|
| Tightening torque | Rear disc mounting nut | 260 to 304 N·m<br>26.5 to 31 kgf·m<br>192 to 224 lbf·ft |
| | Rear wheel mounting nut | 343 to 401 N·m<br>35.0 to 41.0 kgf·m<br>253 to 295 lbf·ft |

|  1LGKX00122B02 | |  1LGKX00122A03 |  1LGKX00122A04 |  1LGKX00122A05 |  1LGKX00122A06 |  1LGKX00122A07 |  1LGKX00123A07 |
|---|---|---|---|---|---|---|---|
| 420/85R30 | — | 1499 mm<br>59.02 in. | 1599 mm<br>62.95 in. | 1691 mm<br>66.57 in. | — | — | — |
| 460/85R30 | — | 1499 mm<br>59.02 in. | 1599 mm<br>62.95 in. | 1691 mm<br>66.57 in. | — | — | — |
| 420/85R34 | — | 1503 mm<br>59.18 in. | 1599 mm<br>62.95 in. | 1695 mm<br>66.73 in. | — | — | — |
| 480/70R34 | — | 1503 mm<br>59.18 in. | 1599 mm<br>62.95 in. | 1695 mm<br>66.73 in. | — | — | — |
| 480/70R34*1 | — | 1513 mm<br>59.57 in. | 1589 mm<br>62.56 in. | — | 1659 mm<br>65.31 in. | — | — |
| 480/70R34*2 | — | — | — | — | — | — | 1649 mm<br>64.92 in. |
| 340/85R38 | — | 1442 mm<br>56.78 in. | 1660 mm<br>65.35 in. | 1714 mm<br>67.48 in. | 1788 mm<br>70.39 in. | 1842 mm<br>72.52 in. | — |
| 480/70R30 | — | 1499 mm<br>59.02 in. | 1599 mm<br>62.95 in. | 1691 mm<br>66.57 in. | — | — | — |
| 23.1-26 | — | — | — | — | — | — | 1750 mm<br>68.90 in. |
| 300/85R42 | 1489 mm<br>58.62 in. | 1543 mm<br>60.75 in. | 1559 mm<br>61.38 in. | 1613 mm<br>63.50 in. | — | — | — |
| 440/80R34 | — | — | — | — | — | — | 1819 mm<br>71.61 in. |

(1) Rear wheel disc
(2) Rear wheel rim
(3) Tread

*1 Part No. W26TS01474 only

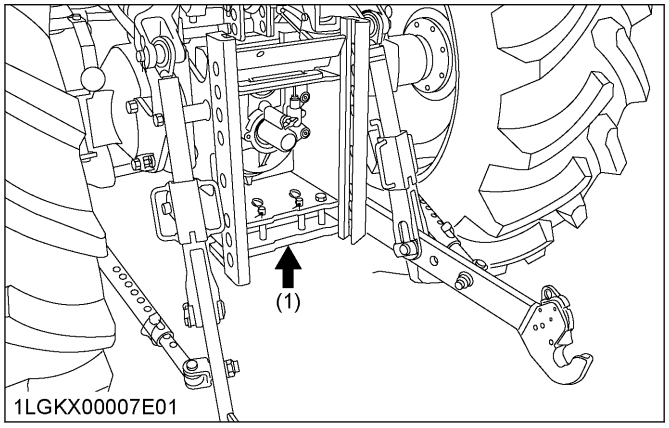
*2 Part No. W26TS01382 only

### 2.2.2.1 Rear jacking point

**WARNING**

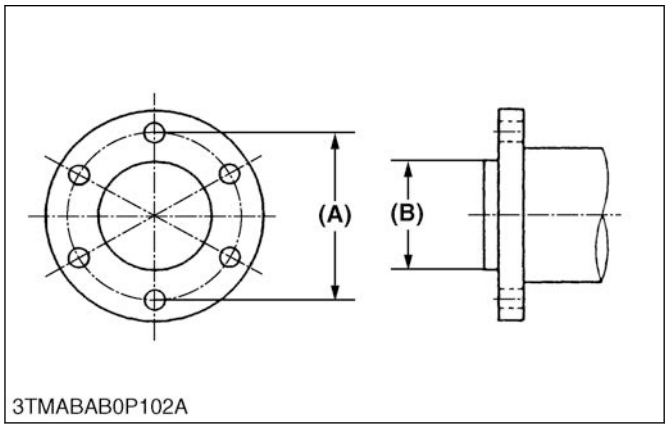
**To avoid personal injury or death:**

- **Before jacking up the tractor, park it on a firm and level ground and chock the front wheels.**
- **Fix the front axle to keep it from pivoting.**
- **Select a jack that withstands the machine weight and set it up as follows.**




(1) Jack point

# 3. Wheel hub




| General | Front wheel hub | Rear wheel hub |
|---|---|---|
| Screw circle diameter (A) | 203.2 mm (8 in.) | 203.2 mm (8 in.) |
| Number of screws | 8 | 8 |
| Screws | M16 × P1.5 | M18 × P1.5 |
| Hub pilot diameter (B) | 152.4 mm (6 in.) | 152.4 mm (6 in.) |

# 4. Tire liquid injection

Auxiliary weights can be used to increase traction force for plowing in fields or clayey grounds.

**IMPORTANT**

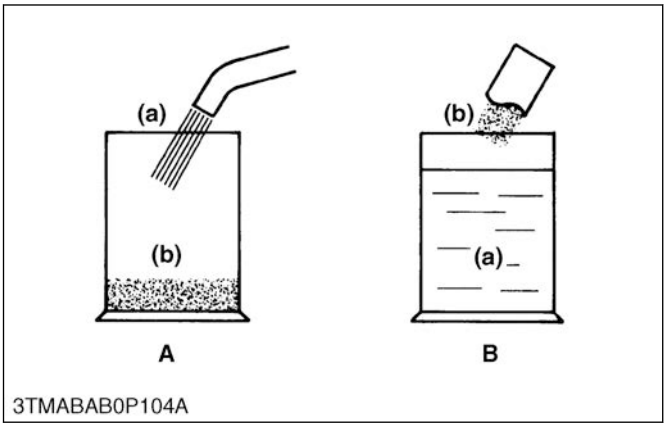
- **Do not fill the front tires with liquid.**

Another way is to inject water or another liquid, such as a calcium chloride solution in the tires. Water must not be used in winter since it freezes at 0 ℃ (32 ℉). The calcium chloride solution will not freeze and moreover, affords higher effect than water since its specific gravity is higher than that of water by about 20%. Below is an explanation of calcium chloride solution injection.

## 4.1 Preparation of calcium chloride solution

**CAUTION**

- **When making a calcium chloride solution, do not pour water over calcium chloride because this results in chemical reaction which will cause high temperature. Instead, add a small amount of calcium chloride to the water at a time until the desired solution is achieved.**

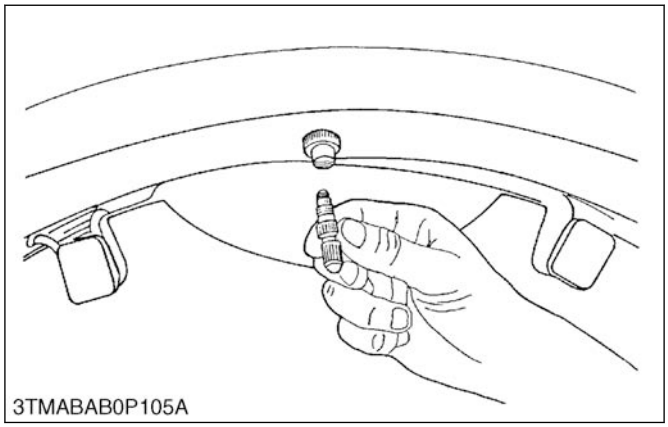


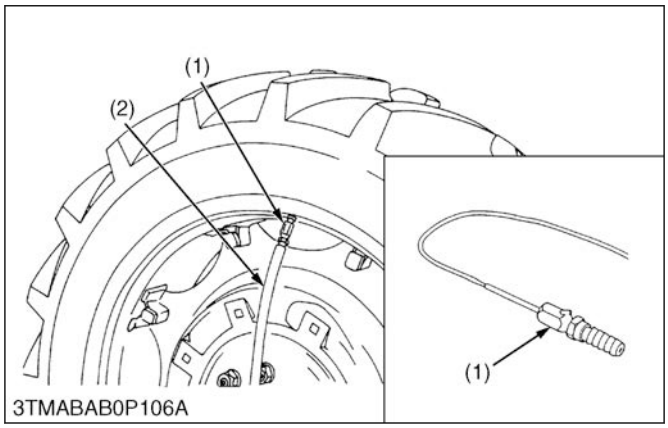

(a) Water
(b) $CaCl_2$ (Calcium chloride)
A Bad
B Good

| Freezing temp. | Weight of $CaCl_2$ to be dissolved in 100 L (26.5 U.S.gals, 22.0 Imp.gals) of water |
|---|---|
| −5 ℃ (23 ℉) | 12 kg (26.4 lbs) |
| −10 ℃ (14 ℉) | 21 kg (46.3 lbs) |
| −15 ℃ (5 ℉) | 28 kg (61.7 lbs) |
| −20 ℃ (−4 ℉) | 34 kg (75.0 lbs) |
| −25 ℃ (−13 ℉) | 40 kg (88.2 lbs) |
| −33 ℃ (−22 ℉) | 44 kg (97.0 lbs) |
| −35 ℃ (−31 ℉) | 49 kg (108.0 lbs) |
| −40 ℃ (−40 ℉) | 52 kg (114.6 lbs) |
| −45 ℃ (−49 ℉) | 56 kg (123.5 lbs) |
| −50 ℃ (−58 ℉) | 61 kg (134.5 lbs) |

## 4.2 Attaching injector

1. Lift the rear tires off the ground.
2. Turn the tire so that the air valve is at the top.
3. Remove the air valve, and attach the injector. (Code No. 07916-52501)




(1) Injector (2) Hose

RELATED PAGE
2.7 Injector CH3 on page 2-80

## 4.3 Injecting liquid

**CAUTION**

- **When a calcium chloride solution is used, cool it before pouring it into the tire.**
- **Do not fill tires with water or solution more than 75% of full capacity (to the valve stem level).**

**NOTE**

- **Once injection is completed, reset the air valve, and pump air into the tire to the specified pressure.**

Fig. 1

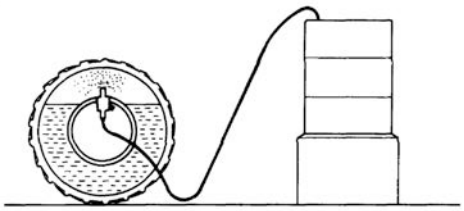


Fig. 2

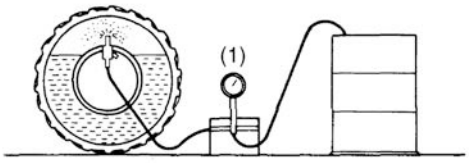
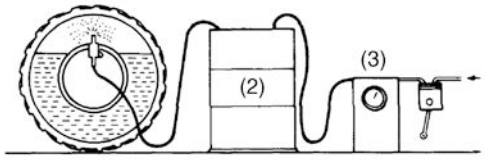



Fig. 3

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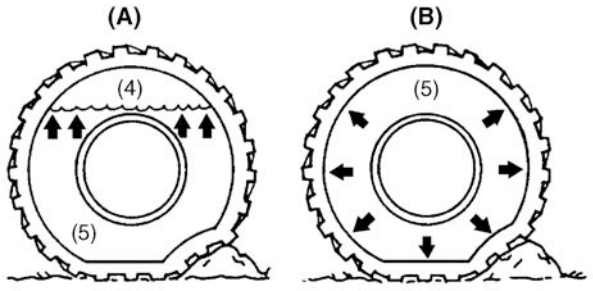



3TMABAB0P107A

(1) Pump
(2) Pressure tank
(3) Compressor
(4) Air
(5) Water
(A) Correct: 75%
Air compresses like a cushion.
(B) Incorrect: 100% full
Water can not be compressed.

The following four ways can be used to inject water or a calcium chloride solution into tires.

1. Gravity injection (Fig. 1)
2. Pump injection (Fig. 2)
3. Pressure tank injection (Fig. 3)
4. Injection directly from tap (only when water is being used.)

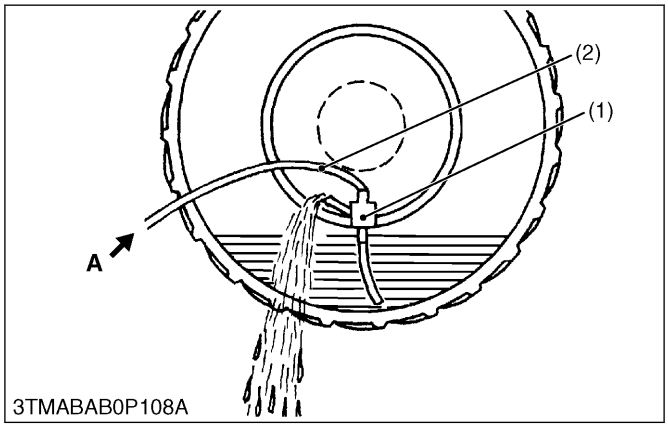
**Weight of calcium chloride solution filling 75% of full capacity of a tire**

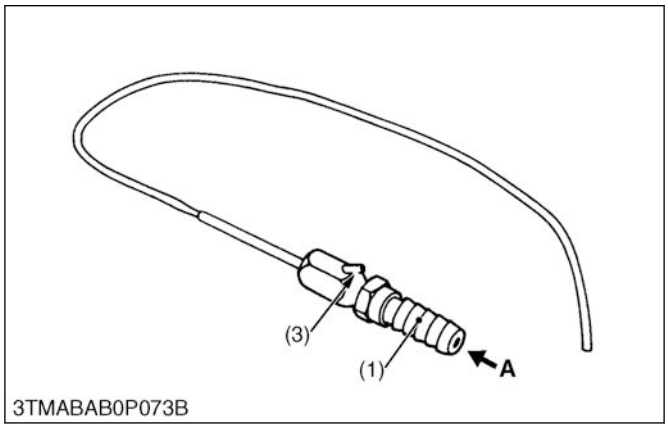
| Tire sizes | 16.9-30 | 16.9-34 | 18.4-30 |
|---|---|---|---|
| Slush free at −10 ℃ (14 ℉)<br>Solid at −30 ℃ (−22 ℉)<br>[Approx. 1 kg (2 lbs) $CaCl_2$ per 4 L (1 gal) of water] | 314 kg (693 lbs) | 342 kg (755 lbs) | 385 kg (848 lbs) |
| Slush free at −24 ℃ (−11 ℉)<br>Solid at −47 ℃ (−53 ℉)<br>[Approx. 1.5 kg (3.5 lbs) $CaCl_2$ per 4 L (1 gal) of water] | 338 kg (746 lbs) | 376 kg (829 lbs) | 414 kg (912 lbs) |
| Slush free at −47 ℃ (−53 ℉)<br>Solid at −52 ℃ (−62 ℉)<br>[Approx. 2.25 kg (5 lbs) $CaCl_2$ per 4 L (1 gal) of water] | 357 kg (787 lbs) | 399 kg (880 lbs) | 436 kg (960 lbs) |

## 4.4 Draining water or solution

1. Lift the rear tires off the ground.
2. Turn the tire so that the air valve is at the bottom.
3. Remove the air valve, and drain liquid (liquid can only be drained to the level of the valve and liquid under that level remains inside.).

4. To drain liquid completely, use the injector (1), and direct compressed air into the tire to force out the liquid through the injector's vent (3).




(1) Injector
(2) Hose
(3) Vent

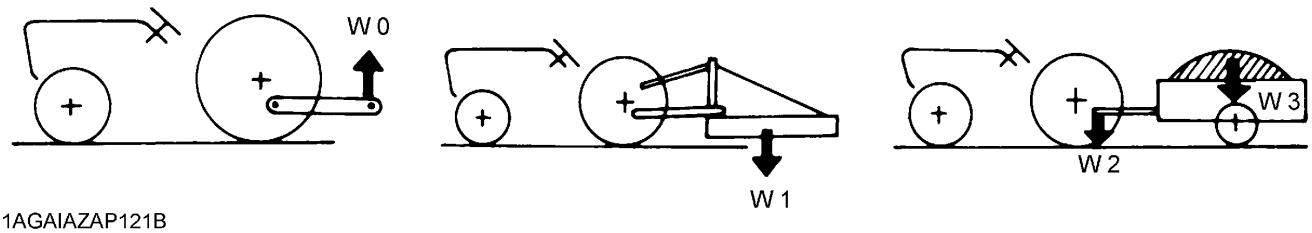
A: Compressed air

# IMPLEMENT LIMITATIONS

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

| | Tread (max. width) | | Lower link end max. lifting capacity: W0 |
|---|---|---|---|
| | Front | Rear | |
| M5091<br>M5111 | 1628 mm (64.09 in.) | 1714 mm (67.48 in.) | 4100 kg (9039 lbs) |

| | Actual figures | | |
|---|---|---|---|
| | Implement weight and/or size: W1 | Max. drawbar load: W2 | Trailer loading weight max. capacity: W3 |
| M5091<br>M5111 | As in the following list (See 1. Implement specification table on page 2-130.) | | |

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W0 Lower link end max, hydraulic lifting capacity
W1 Implement weight-the implement's weight which can be put on the lower link
W2 Max. drawbar load
W3 Trailer loading weight-the max. loading weight for trailer

**NOTE**

- **Implement size may vary depending on soil operating conditions.**
- **Strictly follow the instructions outlined in the operator's manual of the mounted or trailed machinery or trailer, and do not operate the combination tractor-machine or tractor-trailer unless all instructions have been followed**
- **Forestry application**
  **Following hazards exist:**
  - **toppling trees, primarily in case a rear-mounted tree grab-crane is mounted at the rear of the tractor.**
  - **penetrating objects in the operator's enclosure, primarily in case a winch is mounted at the rear of the tractor.**

  **Optional equipments such as operator protective structure (OPS), falling object protective structure (FOPS), etc. to deal with these hazards and other related hazards are not available for this tractor. Without such optional equipment use is limited to tractor specific applications like transport and stationary work.**

# 1. Implement specification table

| No. | Implement | | Remarks | | M5091 | M5111 |
|---|---|---|---|---|---|---|
| | | | | | 4WD | 4WD |
| 1 | Slurry tank | | Max. tank capacity | | 4000 L (1057 U.S.gals, 880 Imp.gals) | |
| | | | Max. load capacity | | 5000 kg (11000 lbs) | |
| 2 | Trailer | | Max. load capacity | | 2-131 | |
| | | | Max. drawbar load | | 2-131 | |
| 3 | Mower | Rotary-cutter | Max. cutting width | | 2800 mm (110 in.) | |
| | | | Max. weight | | 600 kg (1320 lbs) | |
| | | Flail mower (heavy) | Max. cutting width | | 3660 mm (144 in.) | |
| | | | Max. weight | | 1000 kg (2200 lbs) | |
| | | Sickle bar | Max. cutting width | | 2743 mm (108 in.) | |
| 4 | Sprayer | | Max. tank capacity | Mid | 800 L (212 U.S.gals, 176 Imp.gals) | 1000 L (264 U.S.gals, 220 Imp.gals) |
| | | | | Rear 3P | 800 L (212 U.S.gals, 176 Imp.gals) | 1000 L (264 U.S.gals, 220 Imp.gals) |
| | | | | Drawbar | 4500 L (1189 U.S.gals, 990 Imp.gals) | 5000 L (1320 U.S.gals, 1100 Imp.gals) |
| 5 | Rotary tiller | | Max. tilling width | | 2400 mm (96 in.) | |
| | | | Max. weight | | 1000 kg (2200 lbs) | |
| 6 | Bottom plow | | Max. size | | 16 in. x 4<br>18 in. x 3<br>24 in. x 1 | 14 in. x 5<br>16 in. x 4<br>20 in. x 3<br>24 in. x 1 |
| | | | Max. weight | | 750 kg (1650 lbs) | 900 kg (2000 lbs) |
| 7 | Disk harrow | 3P type | Max. size | | 24 in. x 24 | 24 in. x 28 |
| | | | Max. harrowing width | | 2850 mm (112 in.) | 3300 mm (130 in.) |
| | | | Max. weight | | 750 kg (1650 lbs) | 900 kg (2000 lbs) |
| | | Drawbar type | Max. harrowing width | | 3660 mm (144 in.) | 4300 mm (168 in.) |
| 8 | Disc plow | | Max. size | | 26 in. x 4<br>28 in. x 4 | 26 in. x 4<br>28 in. x 4 |
| | | | Max. weight | | 750 kg (1650 lbs) | 900 kg (2000 lbs) |
| 9 | Subsoiler | | Numbers of cultivating tines | | 2 | |
| | | | Cultivating depth | | 500 mm (20 in.) | 550 mm (22 in.) |
| 10 | Cultivator | | Max. width | | 4880 mm (192 in.) | 5490 mm (216 in.) |
| | | | Number of rows | | 6 | |
| | | | Max. weight | | 750 kg (1650 lbs) | 900 kg (2000 lbs) |
| 11 | Front blade *1*2 | | Max. cutting width | | 2430 mm (96 in.) | 2600 mm (102 in.) |
| | | | Max. oil pressure | | 19.6 MPa (200 kgf/cm$^2$, 2840 psi) | |
| 12 | Rear blade | | Max. cutting width | | 2430 mm (96 in.) | 2600 mm (102 in.) |
| | | | Max. oil pressure | | 19.6 MPa (200 kgf/cm$^2$, 2840 psi) | |
| 13 | Front loader *1*2 | | Max. lifting capacity (bucket pivot pin, max. height) | | 1880 kg (4145 lbs) *3 | |
| | | | Max. oil pressure (extra hydro kit) | | 20.5 MPa (209 kgf/cm$^2$, 2970 psi) | |
| 14 | Box blade | | Max. cutting width | | 2430 mm (96 in.) | |
| | | | Max. weight | | 750 kg (1650 lbs) | 800 kg (1760 lbs) |
| 15 | Back hoe *2 | | Max. digging depth | | 3050 mm (120 in.) | |
| | | | Max. weight | | 1200 kg (2650 lbs) | |

(Continued)

| No. | Implement | Remarks | M5091 | M5111 |
|---|---|---|---|---|
| | | | 4WD | 4WD |
| 16 | Snow blade | Max. width | 2430 mm (96 in.) | 2600 mm (102 in.) |
| | | Max. weight | 750 kg (1650 lbs) | 800 kg (1760 lbs) |

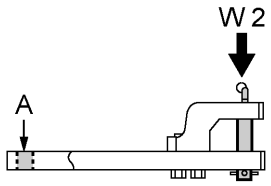
**NOTE**
- **Implement size may vary depending on soil operating conditions.**

*1 Must remove front weight with this implement.
*2 Need subframe
*3 The value contains the weight of Kubota standard bucket.

## 1.1 Trailer load capacity

| | | Drawbar | | High-hitch | | | | Piton-fix |
|---|---|---|---|---|---|---|---|---|
| | | Short | Long | Normal | Automatic | CUNA C | CUNA D2 | |
| Vertical load W2 | A | 1500 kg 3306 lbs | 600 kg 1330 lbs | 580 kg 1240 lbs | 560 kg 1270 lbs | 590 kg 1300 lbs | 590 kg 1300 lbs | 1800 kg 3968 lbs |
| | B | — | 800 kg 1770 lbs | 830 kg 1820 lbs | 810 kg 1790 lbs | 850 kg 1870 lbs | 850 kg 1870 lbs | — |
| | C | — | 900 kg 1990 lbs | 1050 kg 2314 lbs | 1010 kg 2227 lbs | 1060 kg 2336 lbs | 1070 kg 2358 lbs | — |
| | D | — | — | 1280 kg 2821 lbs | 1240 kg 2734 lbs | 1310 kg 2888 lbs | 1320 kg 2910 lbs | — |
| | E | — | — | 1550 kg 3417 lbs | 1500 kg 3307 lbs | 1500 kg 3307 lbs | 1600 kg 3527 lbs | — |
| Trailer loading weight max. capacity W3 | Unbraked towable mass | 3000 kg 6614 lbs | 3000 kg 6614 lbs | 3000 kg 6614 lbs | 3000 kg 6614 lbs | 3000 kg 6614 lbs | 3000 kg 6614 lbs | 3000 kg 6614 lbs |
| | Independently braked mass | 8000 kg 17630 lbs | 8000 kg 17630 lbs | 8000 kg 17630 lbs | 8000 kg 17630 lbs | 6000 kg 13230 lbs | 8000 kg 17630 lbs | 8000 kg 17630 lbs |
| | Inertia-braked towable mass | | | | | | | |
| | Towable mass when fitted with hydraulic or pneumatic braking | 12000 kg 26455 lbs | A: 11000 kg 24251 lbs<br>B: 12000 kg 26455 lbs<br>C: 12000 kg 26455 lbs | 12000 kg 26455 lbs | 12000 kg 26455 lbs | | 12000 kg 26455 lbs | 12000 kg 26455 lbs |

Drawbar/Short type

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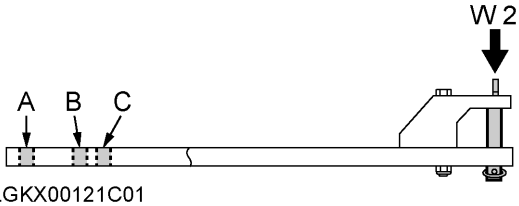
Drawbar/Long type

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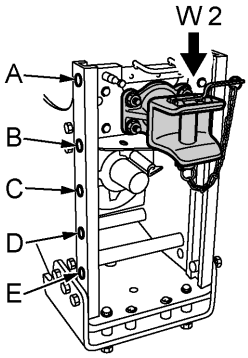
High-hitch

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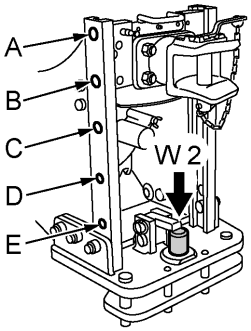
Piton-fix

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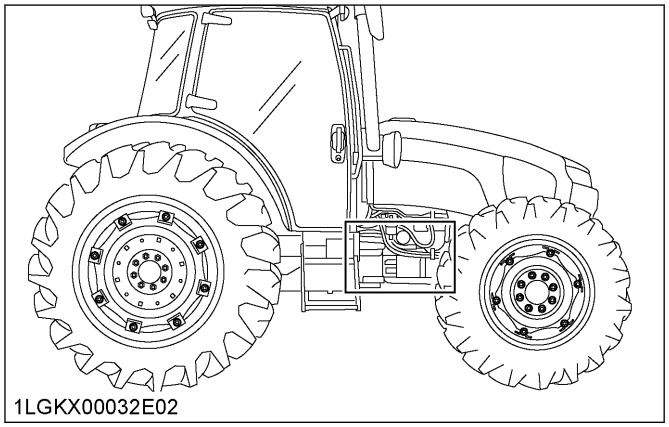
* When the tractor equipped with piton-fix, the E hole of High-hitch cannot use.

# 2. Front loader

Fixation points on the body of the tractor where the front loader must be installed.
Install the front loader frame to the clutch housing and the front axle frame as shown.

| | M5091, M5111 | |
|---|---|---|
| | (1) | (2) |
| Size-length | M20-60 bolt | M20-80 bolt |
| Strength division | 8.8 Approx. SAE GR5 | |
| Number of pieces | 12 | 4 |
| Spring lock washers | M20 | |
| Hardened plain washers | 3/4 | |
| Tightening torque | 389 N·m (40 kgf·m, 290 lbf·ft) | |



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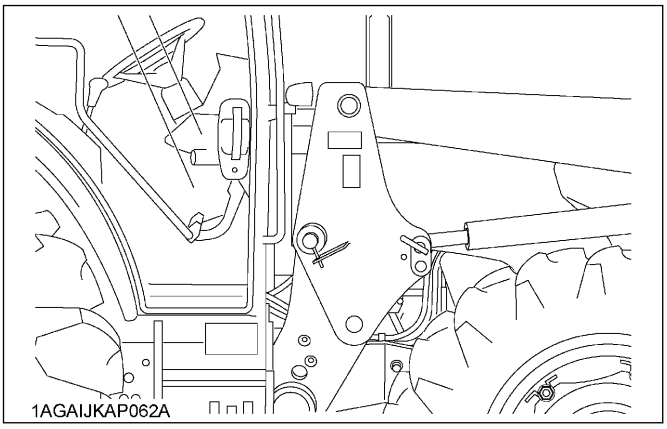

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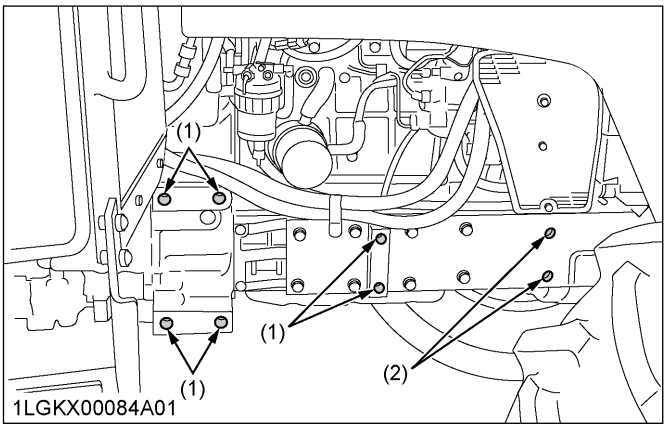



1LGKX00084A01

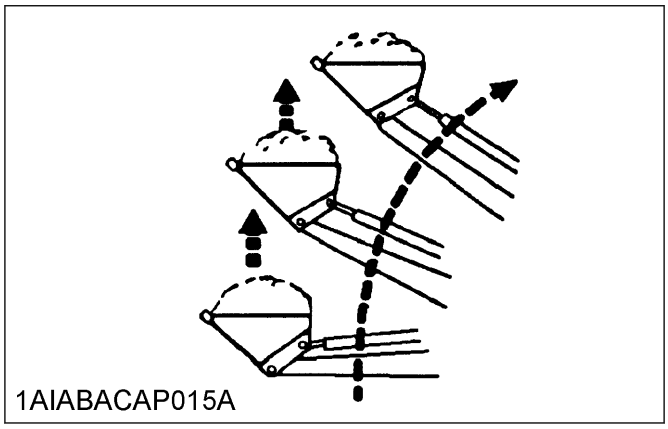
**DANGER**

**To avoid personal injury or death:**

- **Special attention should be made when lifting the load, keep the bucket correctly positioned to prevent spillages.**

**■ NOTE**

- **Not all risks are listed.**
  **Refer to front loader operator's manual.**

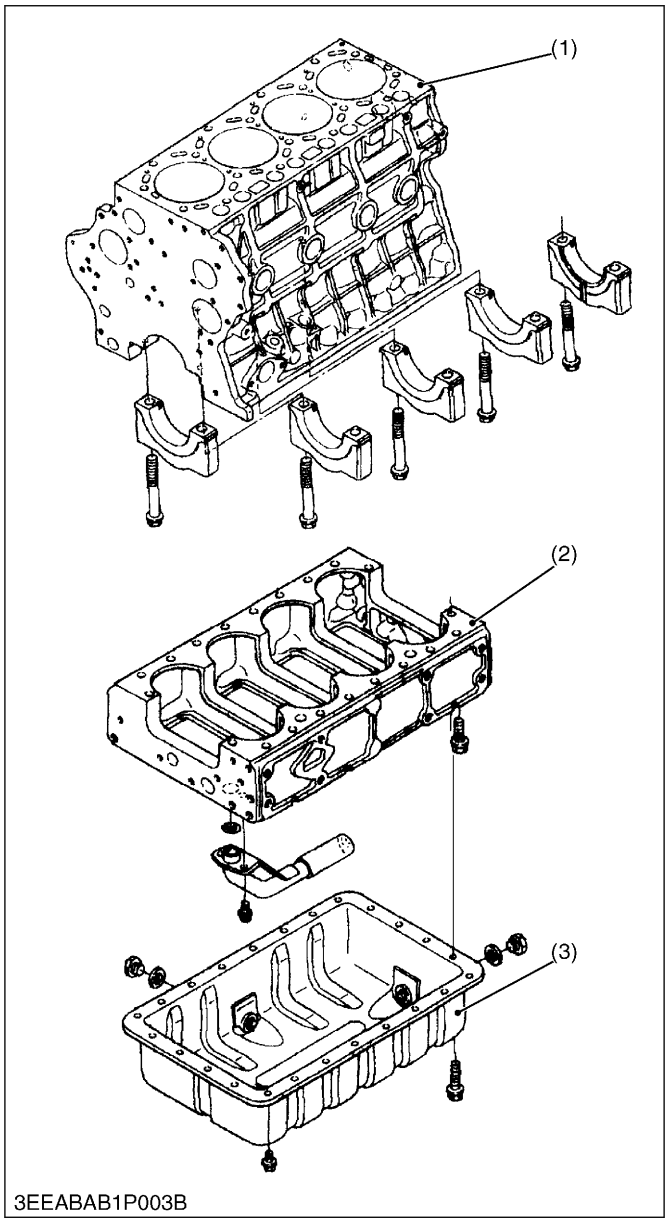

1AIABACAP015A

# 3. ENGINE

# MECHANISM

## 1. Engine

### 1.1 Feature of cylinder block

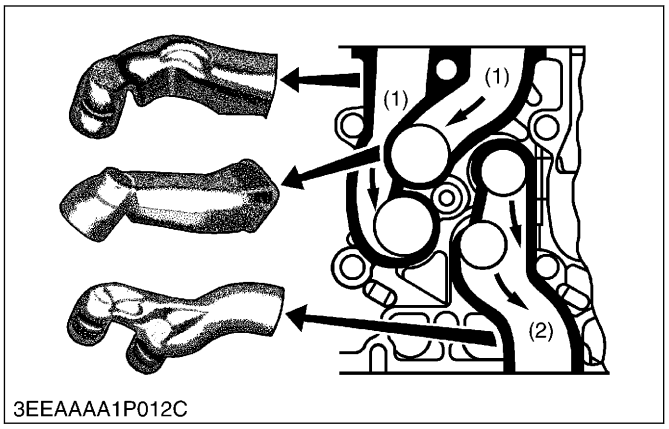



3EEABAB1P003B

(1) Crankcase 1
(2) Crankcase 2
(3) Oil pan

The engine uses a split crankcase to produce greater durability and operate more quietly; the crankcase is split into two parts, crankcase 1 (1), which houses the parts for combustion and crankcase 2 (2), which completes crankcase 1 and produces low-noise.
It uses a hanger type of crankshaft support which allows for easy dis/assembly and the lining of the cylinder is a linerless type, which offers good cooling performance and excellent resistance to wear as it is little affected by distortion.

### 1.2 Cylinder head

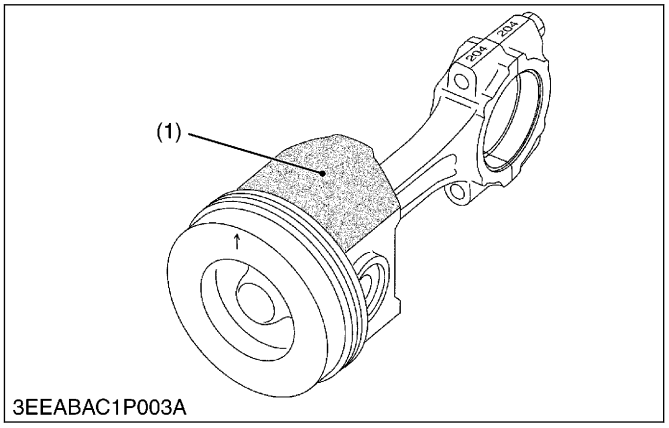



3EEAAAA1P012C

(1) Intake port
(2) Exhaust port

We have improved the helical shaped 2-valve, 2-stage ports in order to generate an ideal swirl and intake air inertia at the intake port and to gain a greater amount of air for the air/fuel mixture.

### 1.3 Feature of piston



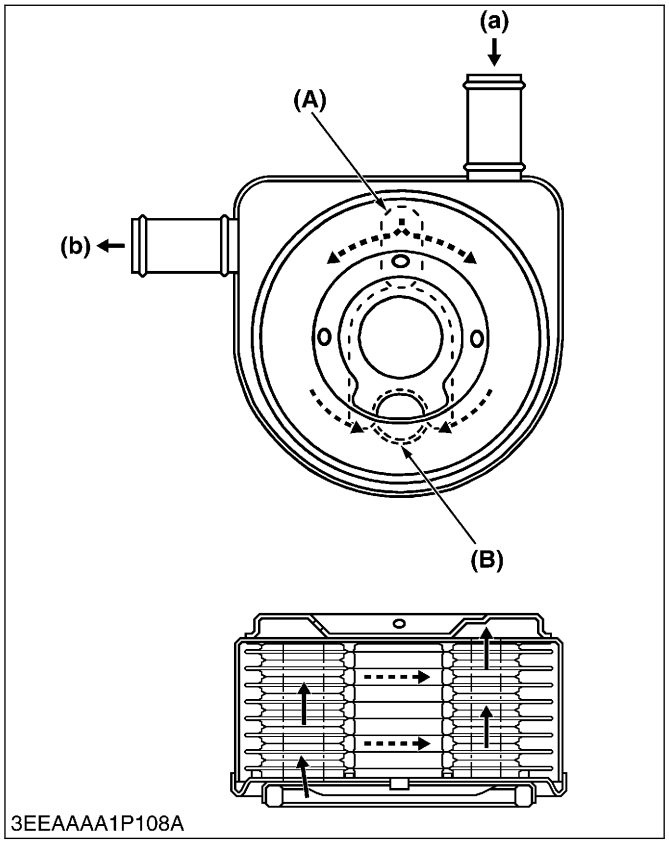

3EEABAC1P003A

(1) Molybdenum

The piston skirt has a disulfide molybdenum coating (1), to improve the fit of the piston with the cylinder and to prevent scorching.

# 2. Lubricating system

## 2.1 Feature of oil cooler

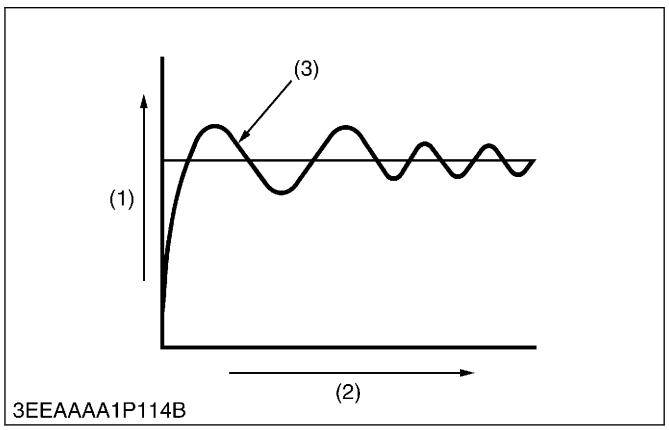


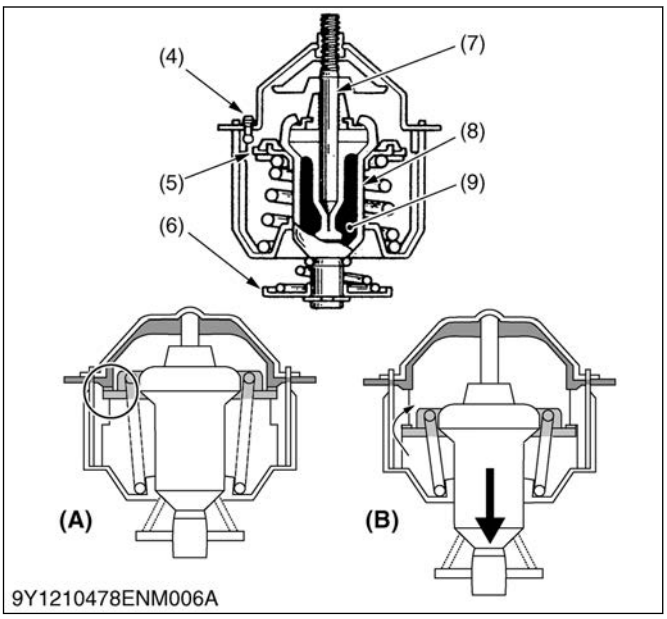

(A) Oil inlet
(B) Oil outlet
(a) Coolant inlet
(b) Coolant outlet

The engine is equipped with a water-cooled oil cooler to keep the temperature of the oil from rising while the engine is operating and provide it with proper lubrication.
The oil flows on the inside of the cooler plate and is cooled by the coolant flowing on the outside of the plate.

# 3. Cooling system

## 3.1 Feature of thermostat

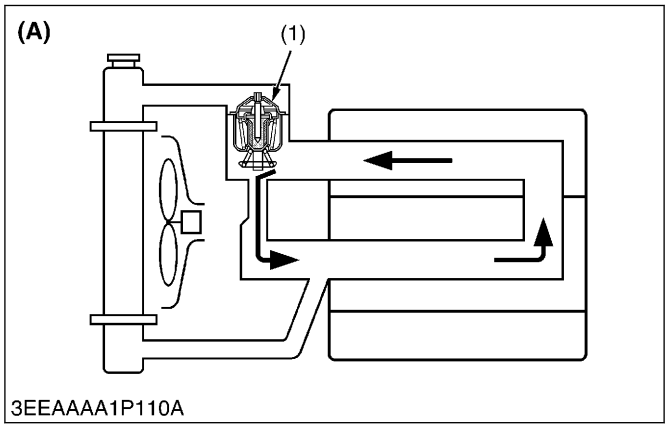


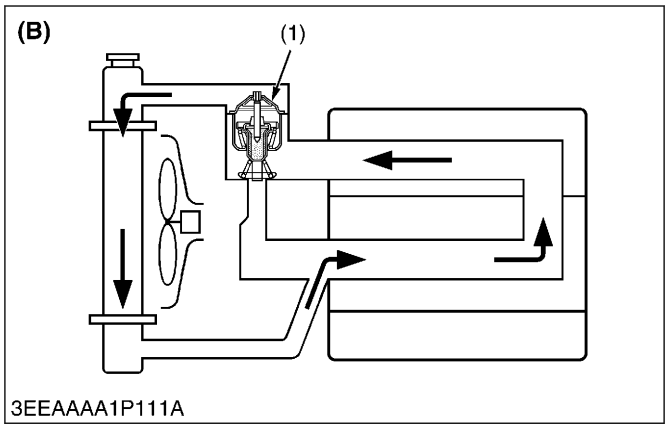




(1) Coolant temperature
(2) Time
(3) Overshoot
(4) Jiggle valve
(5) Valve
(6) Bypass valve
(7) Piston
(8) Pellet
(9) Wax
(A) When the valve is closed.
(B) When the valve is opened.

This thermostat uses a wax-pellet type. When temperature goes up, wax in metal container (pellet) changes to a liquid from a solid.
The volume starts to expand in this process. As spindle is fixed, pellet goes down and valve goes down.
There is a jiggle valve on the top depending on the specification.
When you put coolant and thermostat is closed, coolant can not go in easily because air at the engine side can not go out.
The jiggle valve helps to remove air from this hole, and then coolant can go in easily.

## 3.2 Feature of bottom bypass system



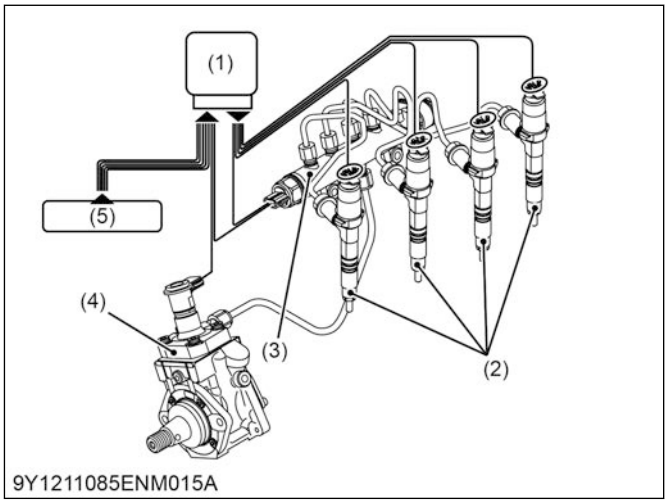




(1) Thermostat
(A) Bypass opened
(B) Bypass closed

In addition to improving the cooling performance of the radiator by using a bottom bypass system, the mechanism uses a 3-stage thermostat valve that reduces thermal shock considerably compared to previous radiators.
When the coolant inside the engine is cool, the thermostat (1) stays closed and coolant circulates inside the engine via the bypass pipe.
When the temperature of the coolant exceeds the opening temperature of the thermostat (1), the bypass valve of the thermostat opens in three stages, sending the now hot coolant to the radiator. Further, when the bypass valve of the thermostat is fully open, it is structured so the hot coolant does not flow into the engine via the bypass circuit, thus increasing the cooling performance of the system.

# 4. Common rail system (CRS)

## 4.1 Overview of common rail system

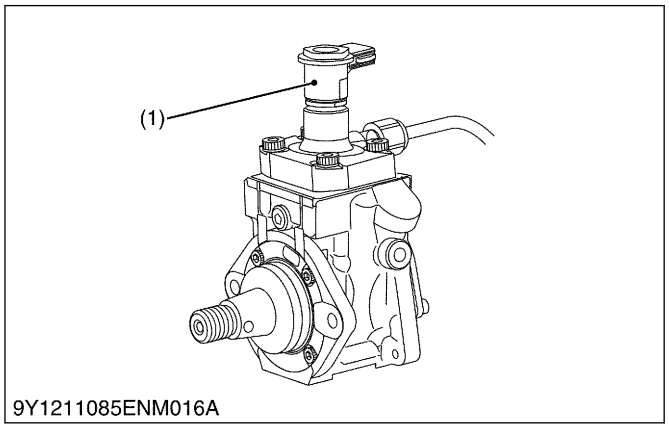


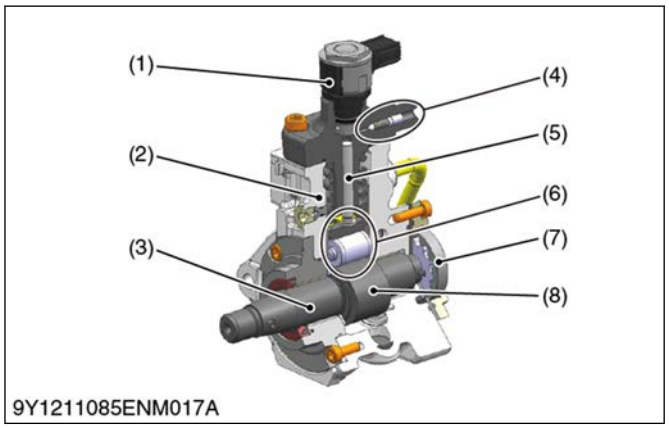

(1) Engine ECU
(2) Injector
(3) Rail
(4) Supply pump
(5) Different sensors

The fuel system of this engine is completely different from previous jerk fuel injection pumps. Our common rail system not only complies with strict emission regulations, it enables multiple, precise high-pressure injections that do not vary with engine RPM.
The system is an electronically controlled fuel injection device, with a supply pump (4) that pressurizes the fuel, a rail (3) that stores the high-pressure fuel, injectors (2) that inject the fuel under high-pressure via solenoids into each cylinder and an engine ECU that controls them all.
Various parameters are controlled by the engine ECU, such as the amount of fuel from the injectors and their timing, the pressure of fuel in the rail, etc., as sensed via signals from each sensor and CAN communications from the engine's ECU.
This results in fuel always being injected under ideal conditions, which suppresses the hallmark of a diesel engine, the black smoke during takeoff and acceleration, so there is less smoke, it is cleaner and with a higher output of power.

# 4.2 Supply pump

## 4.2.1 Function of supply pump

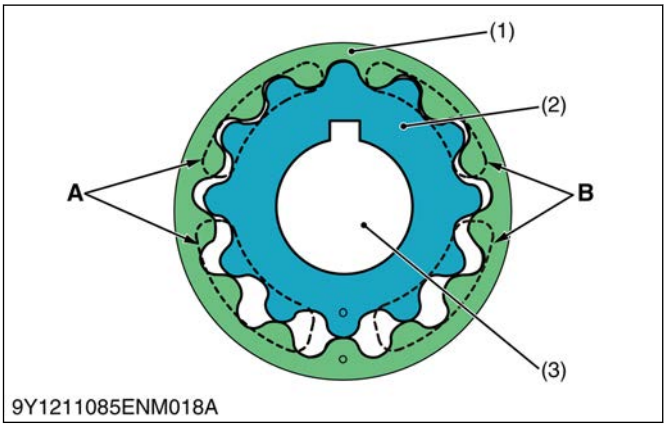



(1) PCV (Pre-stroke Control Valve)
(2) Housing
(3) Camshaft
(4) Delivery valve
(5) Plunger
(6) Tappet
(7) Feed pump
(8) Cam

The supply pump is equivalent to previously used injection pumps and it delivers fuel to the rail at a pressure more than double that of previous pumps.
It consists of a feed pump (7), PCV (Pre-stroke Control Valve) (1) and delivery valve (4).

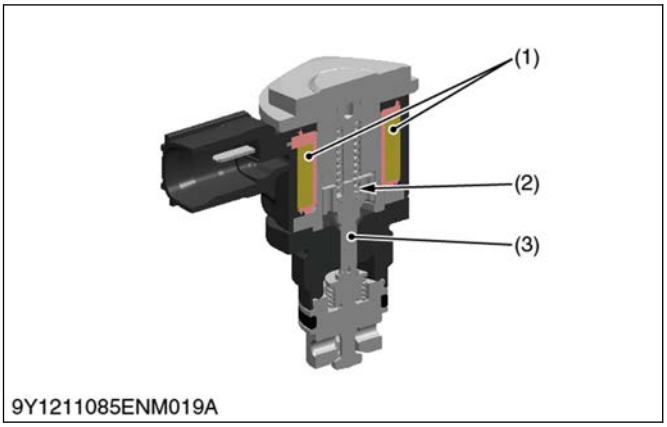
## 4.2.2 Function of feed pump




(1) Outer rotor
(2) Inner rotor
(3) Camshaft
A: Suction port
B: Discharge port

The feed pump sucks up fuel filtered by the fuel filter and supplies it to the pump unit.
The feed pump is a trochoid pump with an inner rotor and outer rotor (1) geared elliptically; the inner rotor (2) is driven by the camshaft (3) and drives the outer rotor in turn in the same direction. In the process, the volume of the part enclosed by the teeth of the rotor changes and thus pumps the fuel.

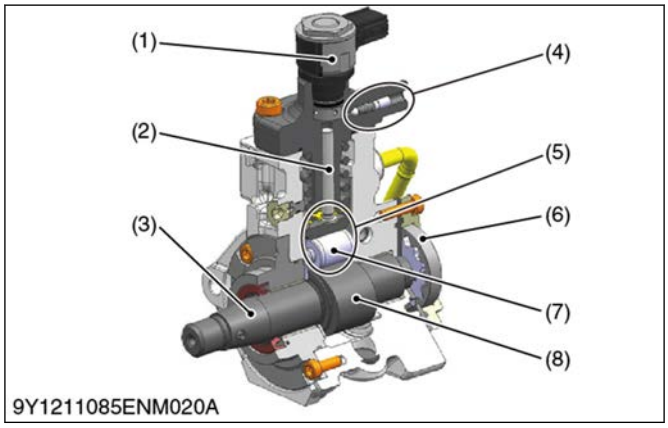
## 4.2.3 Function of pre-stroke control valve (PCV)

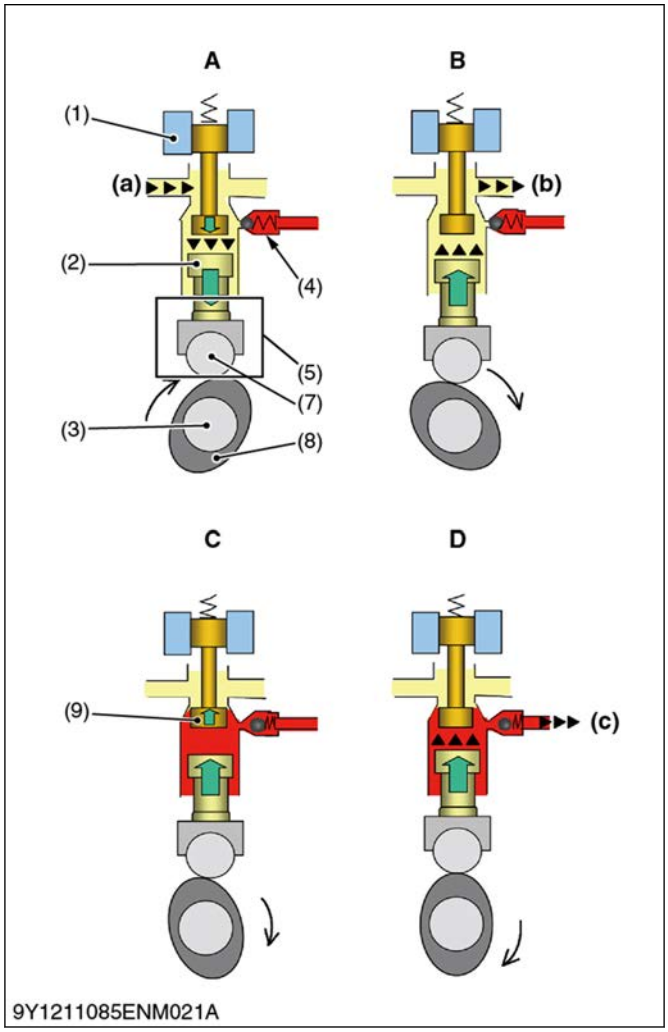



(1) Solenoid
(2) Armature
(3) Push rod

The pre-stroke control valve (PCV) adjusts the amount of fuel discharged from the supply pump to adjust rail pressure.
The amount of fuel discharged from the supply pump to the rail is determined by the energize timing of the PCV. The valve is opened and closed by the ON/OFF of energizing the PCV.
ON/OFF of the PCV is controlled by the ECU and the ON/OFF timing is controlled based on signals from various sensors to provide optimal rail pressure.

## 4.2.4 Function of pump unit




(1) PCV (Pre-stroke Control Valve)
(2) Plunger
(3) Camshaft
(4) Delivery valve
(5) Tappet
(6) Feed pump
(7) Roller
(8) Cam
(9) Plunger chamber
A: Suction stroke
B: Pre-stroke
C: Compression start stroke
D: Pressure feed stroke
(a) From fuel filter
(b) To return
(c) To rail

The pump unit works to increase the pressure of fuel received from the PCV and consists of a camshaft (3), cam (8), tappet (5) and plunger (2).

When the camshaft (3) rotates, the cam (8) rotates eccentrically and the tappet (5) is driven up and down by it, which operates the plunger (2) through their cycles.

**A: Suction stroke**

The PCV is opened when the plunger falls and fuel is suctioned into the plunger chamber via the PCV.

**B: Pre-stroke**

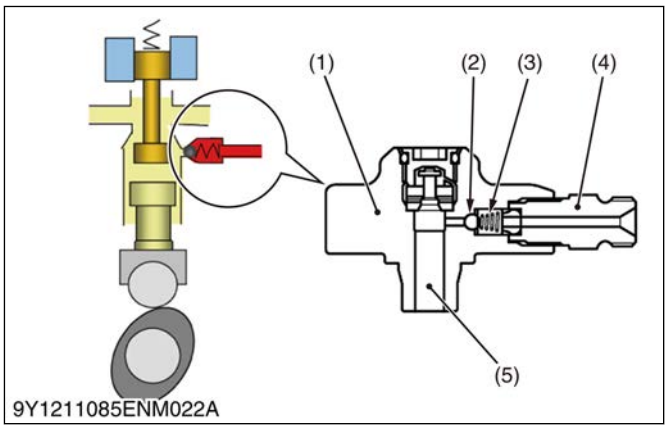
Even after the plunger enters the raise process, fuel suctioned passes through the PCV and is discharged without being pressurized while the PCV is not energized and the valve is open.

**D: Pressure feed stroke**

When the PCV is energized and the valve opened based on timing suitable for the amount of fuel needed, the return path is closed by the PCV and the fuel inside the plunger chamber is pressurized. This opens the delivery valve and fuel is fed into the rail.

The discharge amount is based on the lift distance of the plunger after the PCV valve closes.
Changing of the PCV valve close timing changes the amount discharged, thus controlling rail pressure.

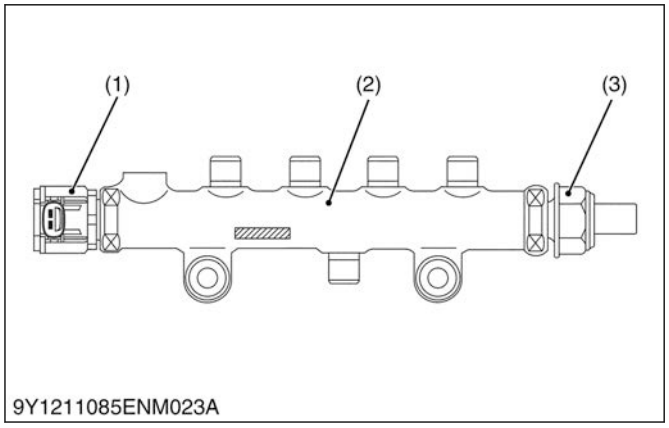
## 4.2.5 Function of delivery valve




(1) Element
(2) Check ball
(3) Spring
(4) Holder
(5) Plunger

The delivery valve is integrated with the element (1) and consists of a check ball (2), spring (3) and holder (4).
When the pressure on the plunger side (5) equals/ exceeds the pressure on the rail side, the check ball opens and discharges fuel. As soon as the fuel pressure feed is complete, the check ball is pressed back by the spring and when it touches the seat of the element, it cuts off the rail side from the plunger side, thus preventing any backflow of fuel.

## 4.3 Function of rail for common rail system




(1) Pressure discharge valve
(2) Rail
(3) Rail pressure sensor

The rail (2) stores fuel at the high pressure applied by the supply pump and supplies the shared pressure to the injectors of each cylinder. The rail incorporates control parts - a rail pressure sensor (3) and a pressure discharge valve (1).
The pressure of the fuel in the rail is detected by the rail pressure sensor, and optimal feedback control is provided for the engine RPM and load. This greatly improves the ability to raise the pressure at low RPMs and enables high-pressure injection from low speed ranges.

**Pressure discharge valve**

When the PCV is energized and the valve opened based on timing suitable for the amount of fuel needed, the return path is closed by the PCV and the fuel inside the plunger chamber is pressurized. This opens the delivery valve and fuel is fed into the rail.
The discharge amount is based on the lift distance of the plunger after the PCV valve closes.
Changing of the PCV valve close timing changes the amount discharged, thus controlling rail pressure.

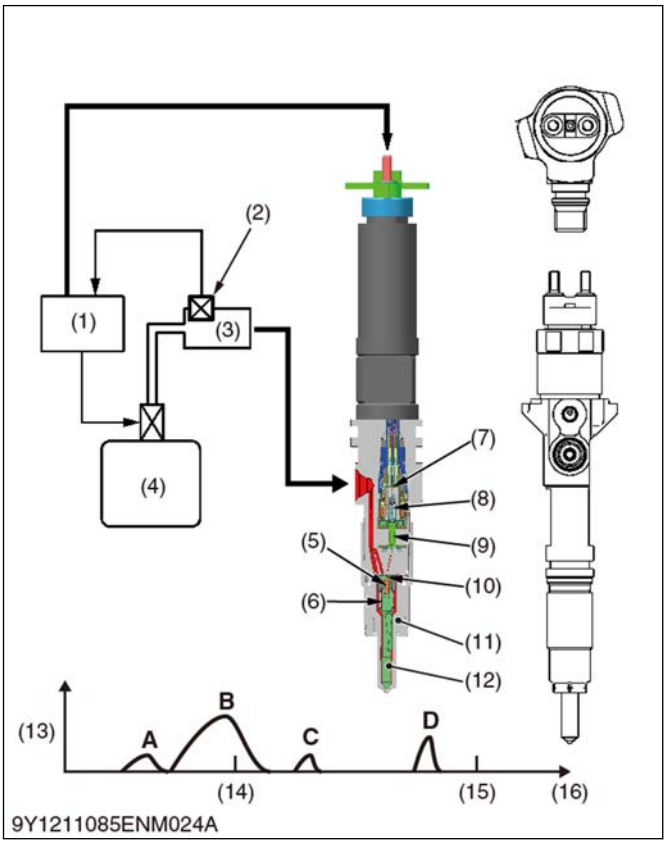
| | | |
|---|---|---|
| Valve opening pressure | Reference value | Approximately 250 MPa (2550 kgf/cm$^2$, 36300 psi) |
| Valve closing pressure | | Approximately 50 MPa (510 kgf/cm$^2$, 7300 psi) |

**Rail pressure sensor**

The rail pressure sensor is mounted on the rail, detects the pressure inside the rail and sends a signal to the engine ECU.
This sensor is a semiconductor type of pressure sensor, which uses the piezo resistance effect, in which increasing the pressure on its silicon element changes its electrical resistance. Please note that the rail pressure sensor is not treated as a part, so replacement requires replacing the rail assembly.

## 4.4 Injector

### 4.4.1 Function of injector



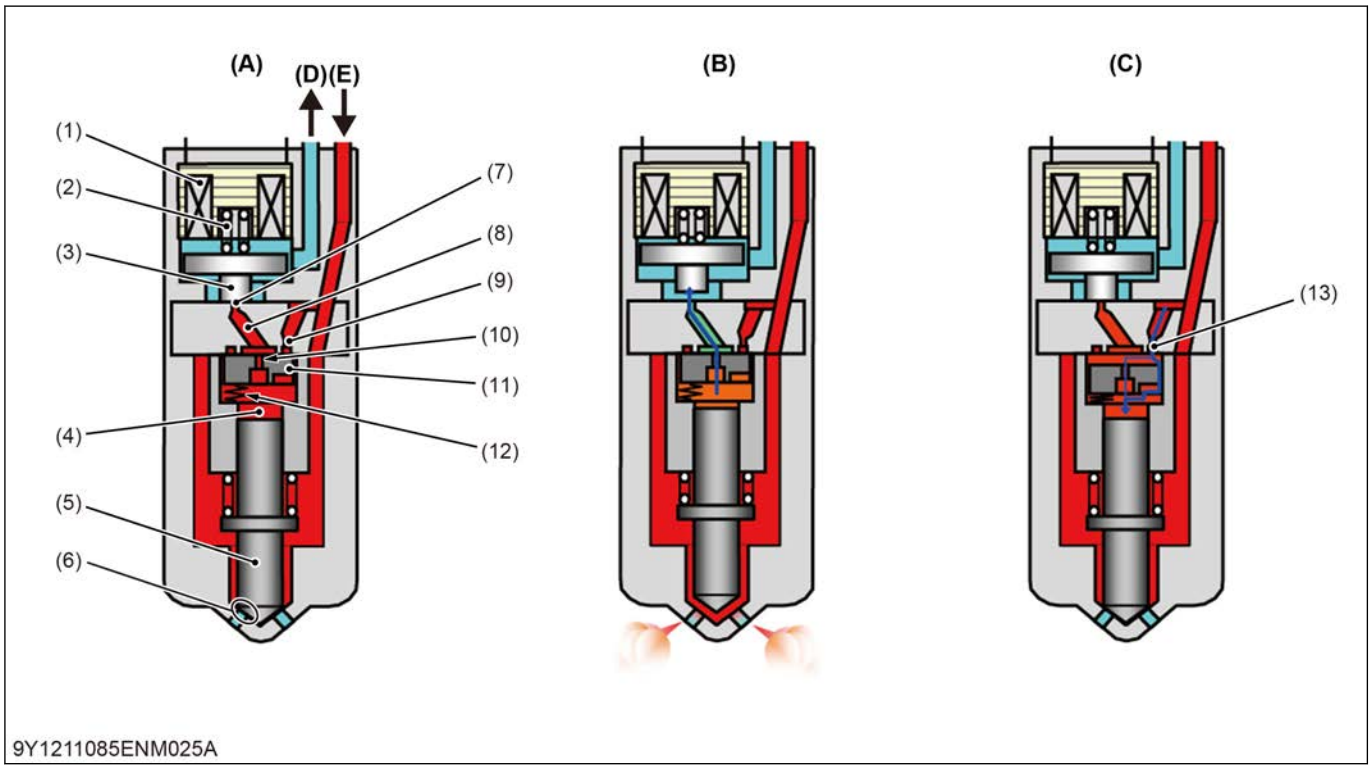

(1) Engine ECU
(2) Rail pressure sensor
(3) Rail
(4) Supply pump
(5) Solenoid
(6) Control valve spring
(7) Control valve
(8) Control plate
(9) Control plate spring
(10) Nozzle pressure spring
(11) Nozzle body
(12) Needle valve
(13) Injection amount
(14) T.D.C (Top Dead Center)
(15) B.D.C (Bottom Dead Center)
(16) Crank angle
A: Pre-injection
B: Main injection
C: After injection
D: Post injection

The injectors inject high-pressure fuel from the rail into the combustion chamber of the engine, using signals from the engine's ECU to produce the ideal timing, amount of fuel, mixture and spray.
The injector injects a finely tuned spray in three pulses during the combustion stage. First a small amount is injected, mitigating the effect of the initial burn and reducing NOx (Oxides of Nitrogen) and noise. The main injection follows with the real burn, and in the last stage, a diffuse combustion is induced, thus reducing Particulate Matter (PM) generated by the main injection.

**Injector architecture**

Injectors consist of nozzle components (nozzle body (11) and needle valve (12)), a solenoid (5), which controls the volume and mixture of fuel, a control valve spring (6), control valve (7), control plate (8), control plate spring (9) and nozzle pressure spring (10).

## 4.4.2 Operation of injector




(1) Solenoid
(2) Control valve spring
(3) Control valve
(4) Control chamber
(5) Needle valve
(6) Nozzle seat
(7) Sub discharge orifice
(8) Intermediate chamber
(9) Intake orifice
(10) Discharge orifice
(11) Control plate
(12) Control plate spring
(13) High pressure circular groove
(A) Injection stop
(B) Injection start
(C) Injection finish
(D) To fuel tank
(E) From rail

The injector uses the signal output from the engine ECU to control the injection with the fuel pressure in the control chamber.
The system for controlling the pressure of the control chamber works by energizing the solenoid, which opens the passage of the chamber's discharge orifice and the fuel is injected due to the drop in pressure. When the current stops, the pressure in the control chamber returns to what it was and injection ceases.

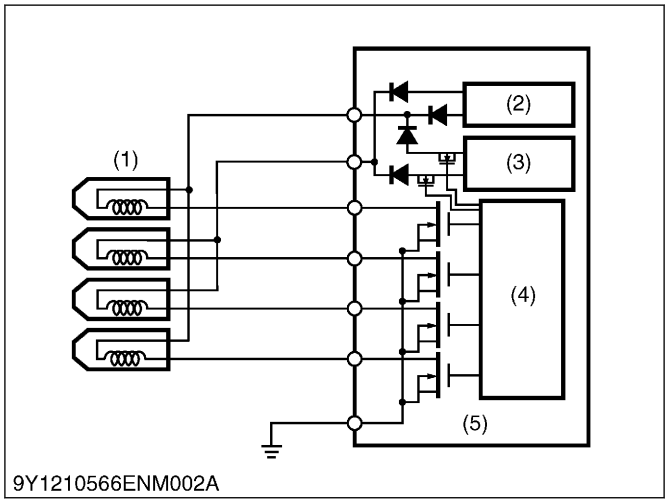
**A. Injection stop**
While the solenoid (1) is not energized, the control valve (3) closes the sub-discharge orifice (7) based on the spring (2) force of the control valve so depending on the pressure difference between the control chamber (4) and nozzle seat (6), the needle valve (5) remains closed and no injection is performed.

**B. Injection start**
When the solenoid (1) is energized, the control valve (3) is pulled up and the fuel in the control chamber (4) flows from the sub-discharge orifice (7) and discharge orifice (10).
When pressure inside the control chamber (4) is lowered, the pressure at the nozzle seat grows large, thus the pressure applied to the nozzle seat (6) overcomes the pressure inside the chamber, pushes up the needle valve (5) causing fuel to be injected.
The control plate (11) is pushed up by the pressure difference between the control chamber (4) and middle chamber (8) and the control plate spring (12) force, closing the intake orifice (9).
Therefore, fuel leak during injection is limited to the residual fuel in the control chamber and is suppressed to a minimum.

**C. Injection finish**
When energization of the solenoid is stopped, the control valve (3) closes the sub-discharge orifice (7) and fuel in the control chamber flows into the middle chamber (8) causing increase in pressure in the middle chamber.
Thereafter, the pressure in the middle chamber (8) and high pressure annular groove (13) becomes higher than that of the control chamber (4) and control plate spring (12) causing the control plate (11) to fall and fuel to flow from the intake orifice (9) into the control chamber (4).
Upon increase in pressure inside the control chamber, push down force of the needle valve (5) increases causing the needle valve (5) to lower and terminating injection.

Thereafter, pressure equalizes between the control chamber (4), middle chamber (8), and high pressure annular groove (13) and the control plate (11) is pushed up by the control plate spring (12).

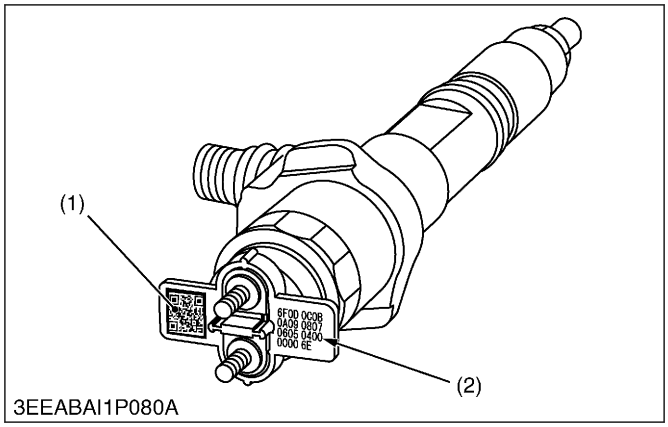
### 4.4.3 Function of injector drive circuit




(1) Injector
(2) Rated amperage circuit
(3) High voltage generating circuit
(4) Control circuit
(5) Engine ECU

To increase the responsiveness of the injector, the voltage that drives the injector is raised to a high voltage, accelerating the magnetization of the solenoid and increasing the responsiveness of the TWV.
The battery voltage is raised to about 110 V by a high voltage generating circuit (3) inside the engine ECU (5) and that voltage is supplied to the injector to actuate it.

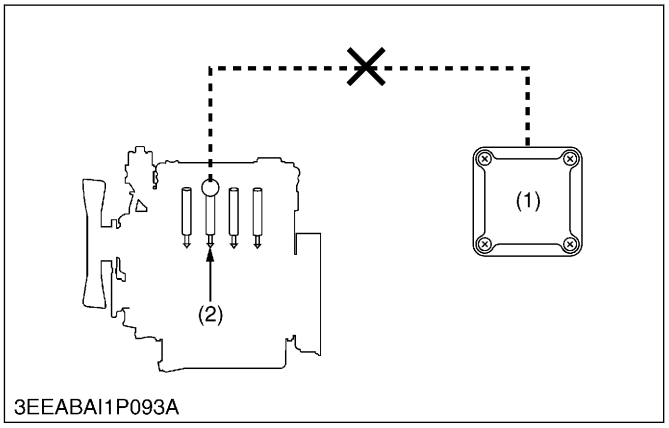
### 4.4.4 Function of injector QR/ID codes




(1) QR code (2) ID code

Injectors are processed to exacting tolerances, but there are minute variations in the amount they inject, so to correct for these variations, a correction volume is recorded on the QR code (1) and ID codes (2) of the injectors.
During manufacture, the QR code (1) is read by a scanner and the correction value is registered in the engine ECU.

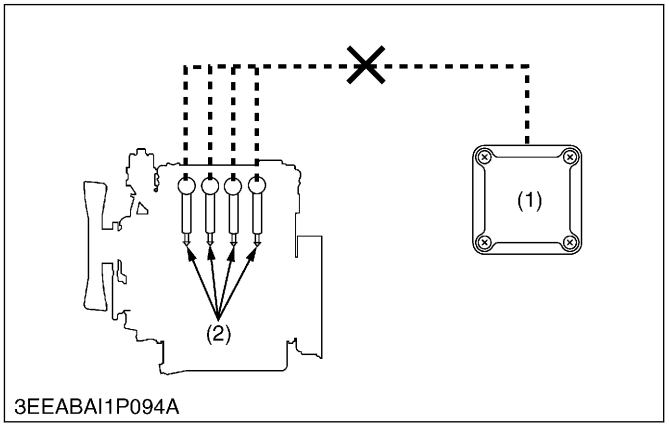
### 4.4.5 When replacing an injector




(1) Engine ECU (2) Replacement injector

Register the ID code of the replacement injector (2) registers into the engine ECU (1).

### 4.4.6 When replacing the engine ECU



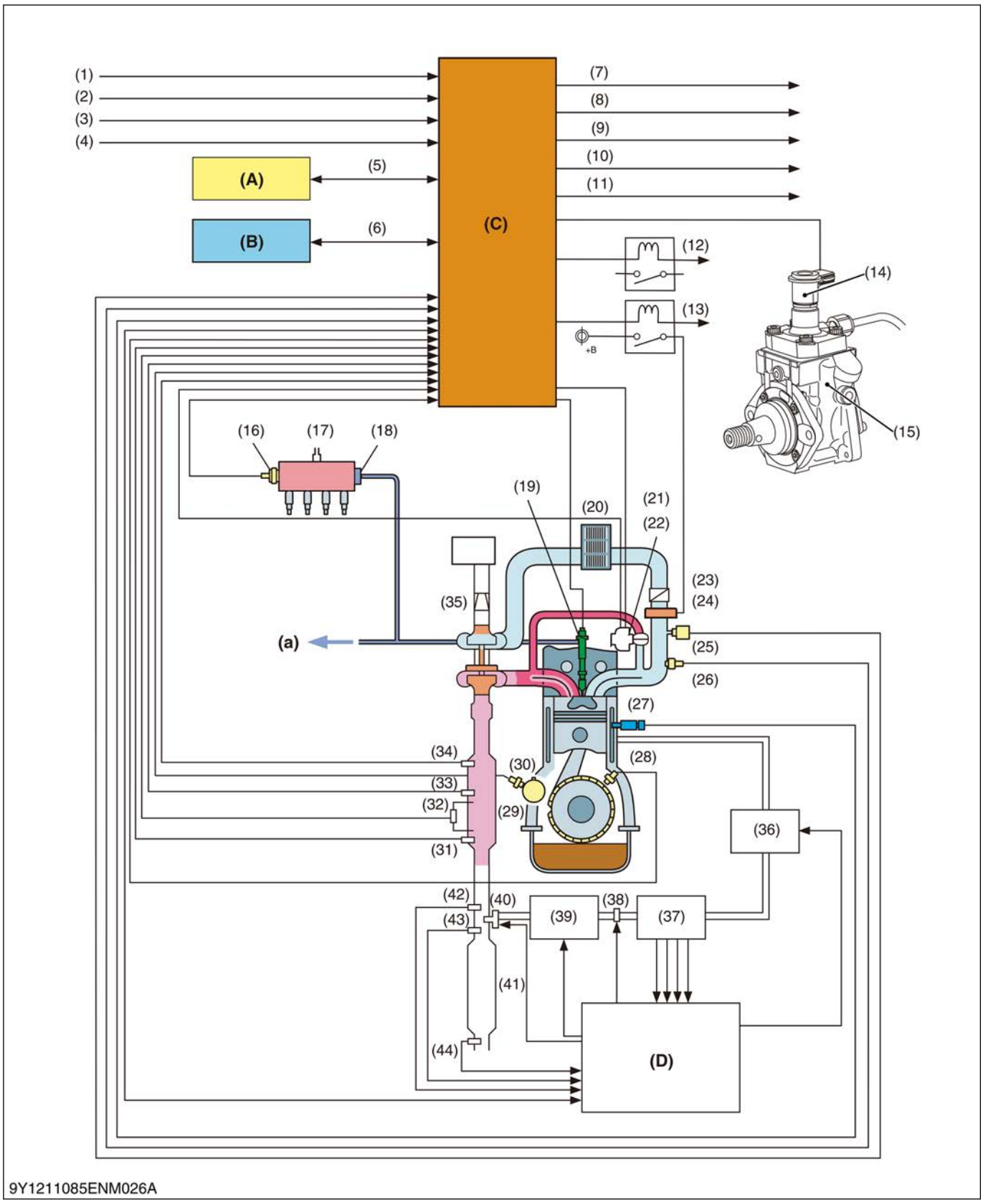

(1) Replacement ECU (2) Injector

Register the ID codes of all of the injectors into the replacement engine ECU.
When replacing an ECU, as it is necessary to write all of the data, including the injector corrections, only KUBOTA can write the data to the ECU.

## 4.5 Structure of engine control system

■ **NOTE**

- **The signals marked with * are CAN communication.**


(1)
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(3)
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9Y1211085ENM026A

(1) Key switch ON signal
(2) Starter switch signal
(3) Emergency stop switch
(4) Oil pressure switch
(5) CAN communication for tractor (Accelerator position signal*, neutral switch*, machine travel speed signal*)
(6) CAN communication for service
(7) Engine warning light signal
(8) Stop lamp signal
(9) Oil pressure warning lamp signal
(10) Overheat lamp signal
(11) Glow (air heater) lamp signal
(12) Starter relay
(13) Glow (air heater) relay
(14) PCV (Pre-stroke Control Valve)
(15) Supply pump
(16) Rail pressure sensor
(17) Rail
(18) Pressure discharge valve
(19) Injector
(20) Inter cooler
(21) EGR DC motor
(22) EGR lift sensor
(23) Intake throttle valve
(24) Intake air heater
(25) Intake air pressure sensor
(26) Intake air temperature sensor
(27) Coolant temperature sensor
(28) Crankshaft position sensor
(29) Diesel Particulate Filter (hereinafter referred to as the "DPF") muffler
(30) Camshaft position sensor
(31) Temperature sensor (DPF outlet exhaust temperature) ($T_2$)
(32) Differential pressure sensor (DPF differential pressure) ($\Delta P$)
(33) Temperature sensor (DPF inlet exhaust temperature) ($T_1$)
(34) Temperature sensor (DOC inlet exhaust temperature) ($T_0$)
(35) Air flow sensor
(36) Coolant valve
(37) DEF tank
(38) DEF tube heater
(39) DEF pump
(40) DEF injector
(41) SCR (Selective Catalytic Reduction)
(42) Pre NOx sensor
(43) SCR inlet temperature sensor
(44) Post NOx sensor
(A) CAN2 connector (for Tractor)
(B) CAN1 connector (for service)
(C) Engine ECU
(D) ACU (After treatment Control Unit)
(a) To fuel tank

## 4.5.1 Function of engine ECU


(1) Engine ECU (2) ECU connector

The engine ECU (1) controls the amount, timing, mixture and pressure of fuel that is injected. The engine ECU (1) operates each kind of control based on the signals from each type of sensor.
The actuator for controlling the amount, timing and mixture of fuel injection is the injector, while the actuator for controlling fuel pressure is the supply pump.

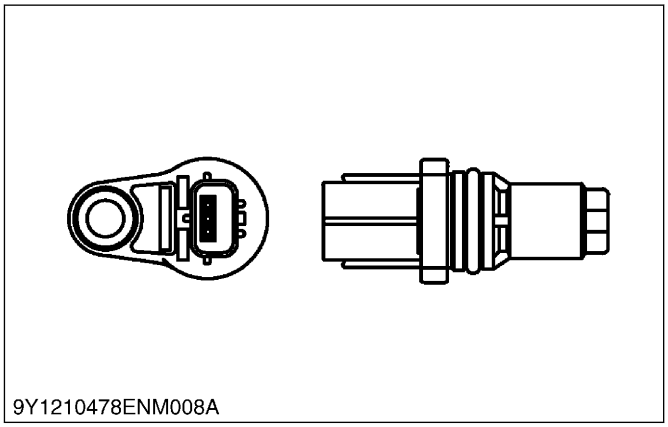
**Fuel quantity control**
The amount of fuel to be injected is determined using a basic injection amount, which is calculated based on the state of the engine and driving conditions, with corrections added for parameters such as water temperature, fuel temperature, intake air temperature, intake pressure, etc..

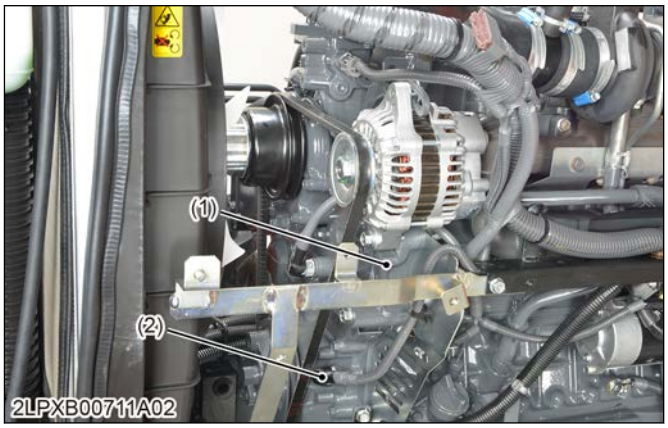
**Injection timing control**
The ECU controls the timing for starting to energize the injectors, first determining the timing for the main injection and then setting the timing of other injections, such as pilot injections.

**Fuel mixture control**
By conducting a pilot injection, the initial fuel mixture is kept to a minimum, mitigating the explosive initial combustion and reducing NOx and noise.

**Fuel pressure control**
The ECU calculates the set fuel injection pressure based on the engine load (last injection amount and engine RPM) and controls the amount the supply pump supplies and the fuel pressure inside the rail.

## 4.5.2 Function of crankshaft position sensor

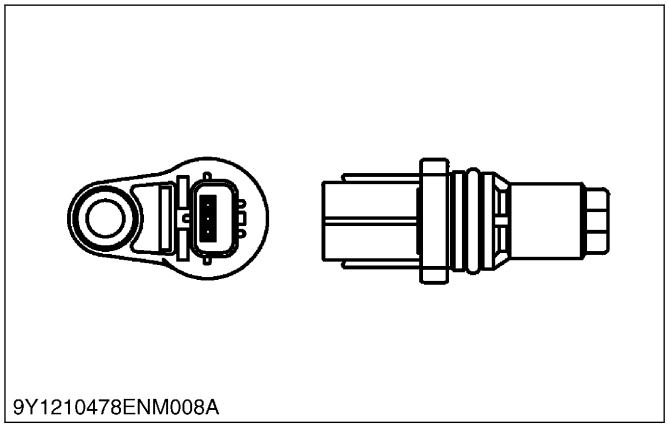


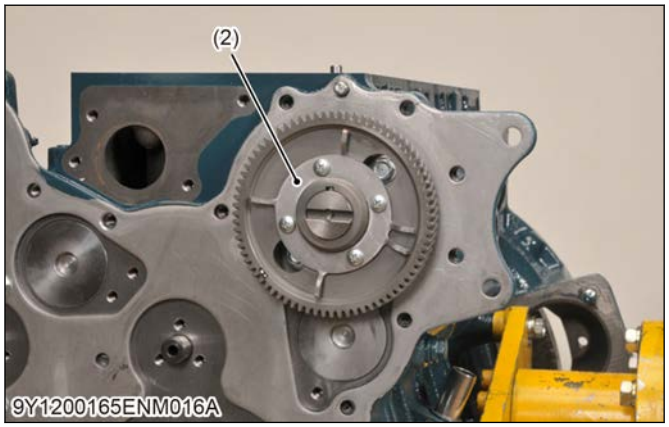




(1) Gear case (2) Crankshaft position sensor

The crankshaft position sensor (2) is mounted near the crankshaft gear of the gear case (1) and the sensor uses a MRE (magnetic resistance element) type of sensor.
When the crankshaft pulsar gear passes by the sensor, it alters the magnetic field inside the sensor, generating an AC voltage, which is output to the engine ECU.
Further, the gear has a wide part between teeth, which alters the waveform of the AC voltage and the sensor detects the crankshaft position with every revolution; this change in the voltage is amplified by the IC circuit inside the sensor and outputs it to the engine ECU.
The engine ECU uses the signals to calculate the piston position and engine RPM.

## 4.5.3 Function of camshaft position sensor

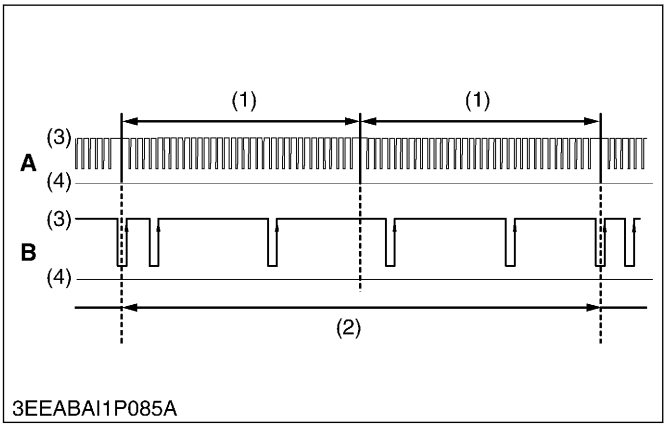

9Y1210478ENM008A


(1) Camshaft position sensor (2) Camshaft pulsar gear

The camshaft position sensor (1) is mounted near the camshaft gear and the sensor functions in the same way as the crankshaft position sensor.
This sensor detects the extra teeth (two teeth) of the camshaft pulsar gear (2) and the engine ECU uses the signal to calculate the piston position.

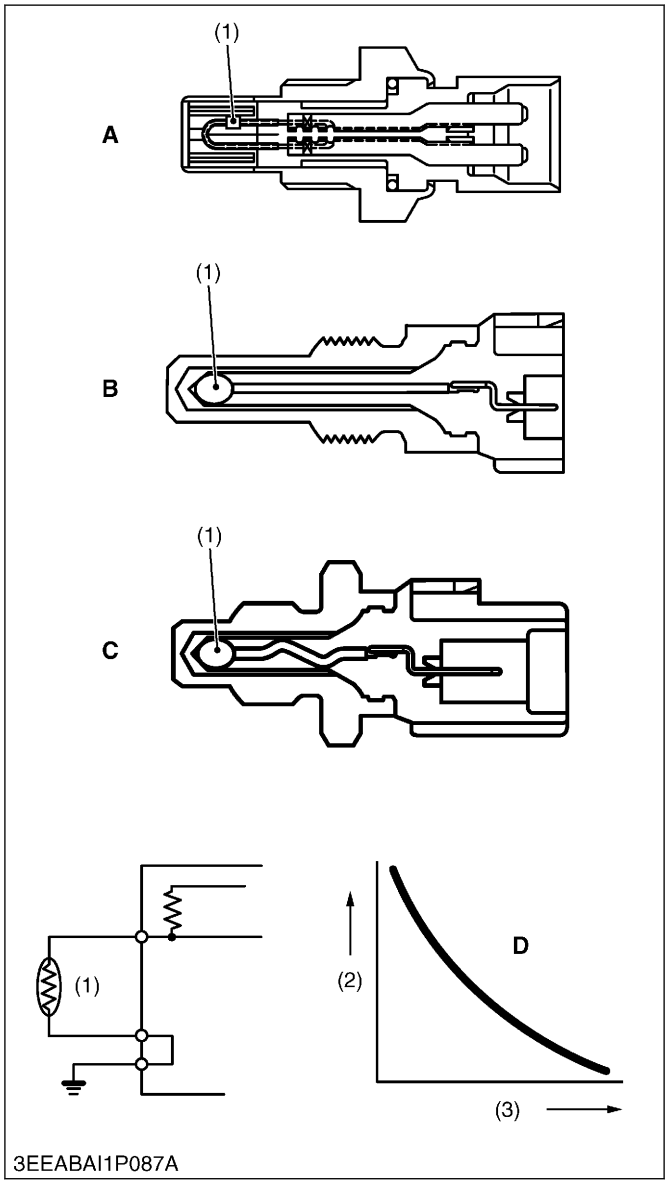
## 4.5.4 The pulse chart of the crankshaft position sensor output signal and camshaft position sensor output signal




(1) 56 pulses (6.28 rad (360°) crank angle)
(2) 5 pulses (12.6 rad (720°) crank angle)
(3) 5 V
(4) 0 V
A: Crankshaft position sensor output voltage
B: Camshaft position sensor output voltage

This figure shows the pluse chart of the crankshaft position sensor output signal and camshaft position sensor output signal.
The camshaft pulsar gear rotates once when the crankshaft pulsar gear rotates twice (12.6 rad (720°) crank angle).
There is a gearless section in the crankshaft pulsar gear. The ECU determines whether it is TDC if the camshaft position sensor signal is detected while the crankshaft position sensor is passing this gearless section.

## 4.5.5 Function of temperature sensors




3EEABAI1P087A

(1) Thermistor
(2) Resistance
(3) Temperature
A: Intake air temperature sensor
B: Coolant temperature sensor
C: Fuel temperature sensor
D: Thermistor temperature curve

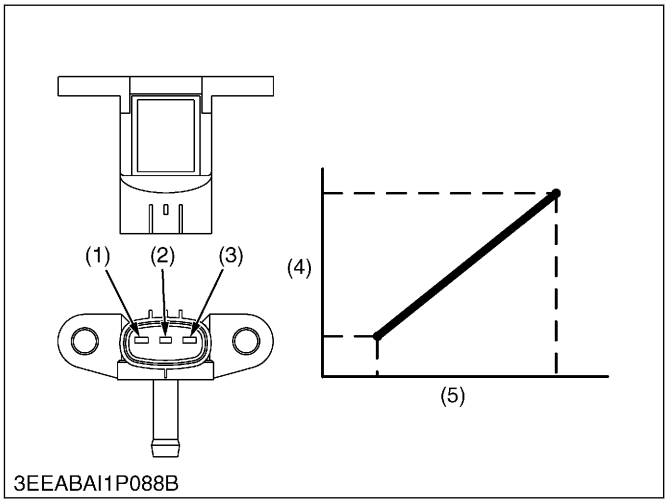
These sensors use thermistors to detect temperature.
A characteristic of thermistors is that their electrical resistance varies with temperature, and this characteristic is used by the different sensors to detect temperature via voltage.

**A) Intake air temperature sensor**
The intake air temperature sensor "A" measures the intake temperature after it passes through the turbocharger.

**B) Coolant temperature sensor**
The coolant temperature sensor "B" is mounted on the cylinder head and detects the temperature of the coolant.

**C) Fuel temperature sensor**
The fuel temperature sensor "C" is mounted on the fuel intake side of the supply pump and detects the temperature of the fuel.

## 4.5.6 Function of boost sensor



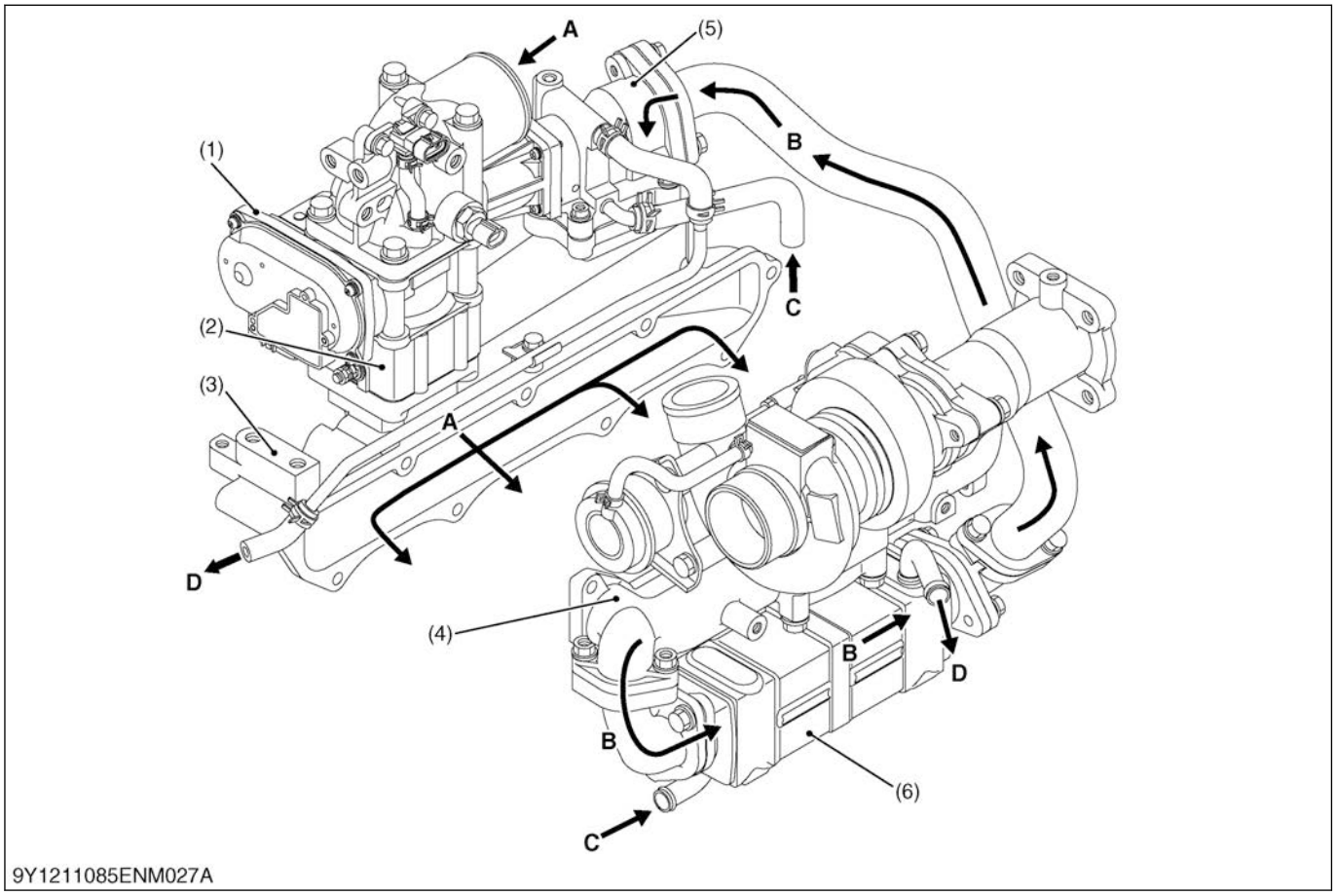

3EEABAI1P088B

(1) Supply terminal
(2) Output terminal
(3) Ground terminal
(4) Output voltage
(5) Intake air pressure

The boost sensor is a semiconductor pressure sensor and when there are changes in the pressure on the silicon element inside the sensor, its electrical resistance changes and this piezo resistance effect is used to detect pressure using voltage.
The boost sensor measures the intake air pressure after it passes through the turbocharger.

# 5. EGR system

## 5.1 Overview of EGR system




(1) Intake throttle valve
(2) Intake air heater
(3) Intake manifold
(4) Exhaust manifold
(5) EGR valve
(6) EGR cooler
A: Intake air
B: Exhaust gas
C: Coolant inlet
D: Coolant outlet

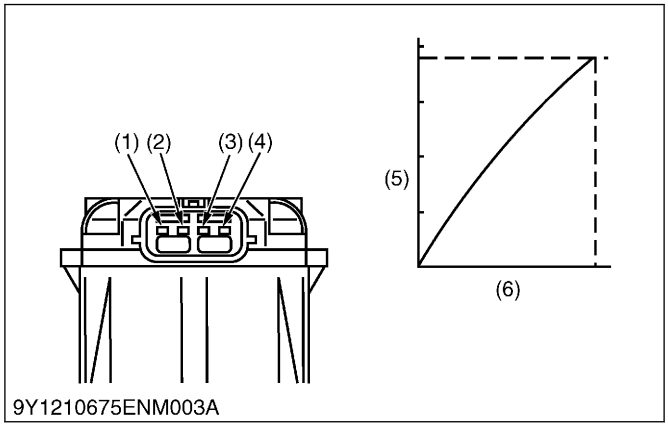
An EGR (Exhaust Gas Recirculation) system gets out a portion of the exhaust gas and recirculates it to the intake side, thus reducing the amount of available oxygen and lowering the temperature of combustion, which suppresses the generation of Nitrogen Oxide (NOx).

## 5.2 EGR valve

### 5.2.1 Function of water cooled EGR valve


This is a device that regulates EGR gas flow. The degree the valve is open is detected using a lift sensor and a motor is used to set this to the degree of open calculated using signals including the engine speed.
Also, passing engine coolant through the housing enables controlling temperature rise of the EGR valve.

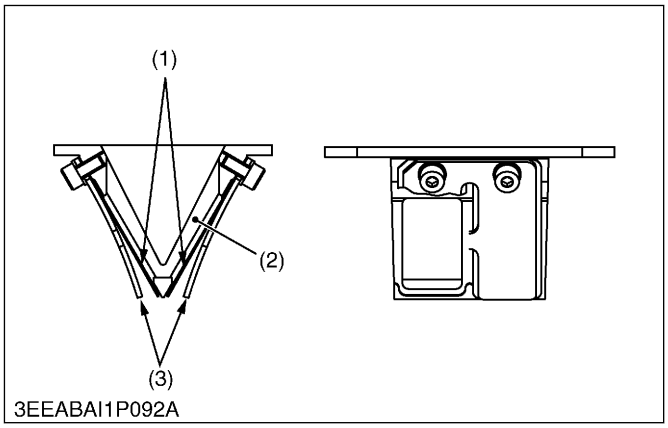
### 5.2.2 Function of EGR valve lift sensor




(1) CAN H
(2) CAN L
(3) GND (−)
(4) Power (+)
(5) Exhaust gas flow
(6) CAN communication data

How far the EGR valve is open is detected by a contact type of position sensor that detects the movement of the motor's shaft. The motor's shaft opens and closes the valve by changing the rotation of the motor into linear motion via a screw deceleration mechanism.

## 5.3 Function of reed valve

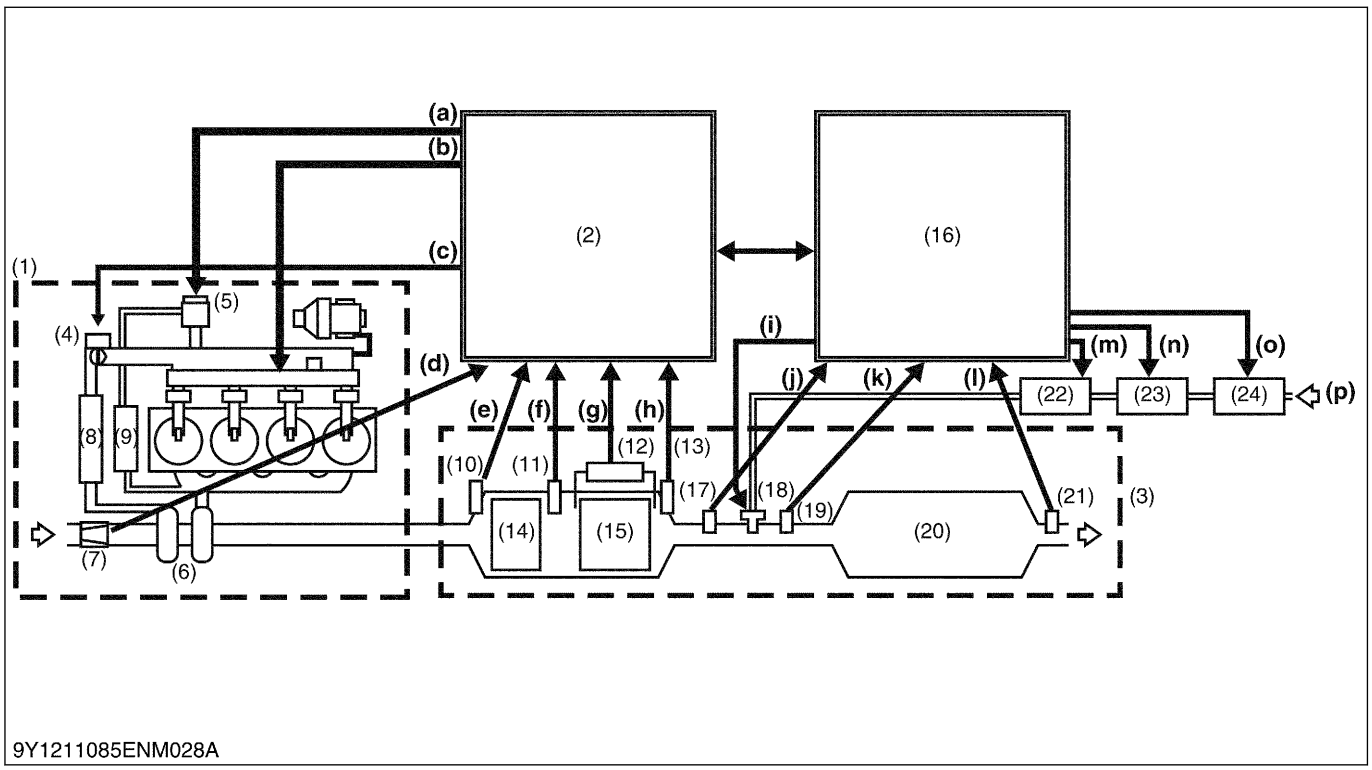



(1) Valve
(2) Case
(3) Stopper

The reed valves are set at the point where exhaust gases that have passed through the EGR valve mix with intake air and they prevent air on the air cleaner side from flowing to the EGR cooler side.
These thin plate springs (reed valves) mounted at the bottom of the EGR valve motor open and close the EGR gas passage (during intake: reed valve is closed; during exhaust: open) and prevent the intake air from back flowing to the exhaust side.

# 6. After treatment system

## 6.1 Overview of after treatment devices




(1) Common rail system
(2) ECU
(3) After treatment devices
(4) Intake throttle valve
(5) EGR valve
(6) Turbocharger
(7) Air flow sensor
(8) Inter cooler
(9) EGR cooler
(10) Temperature sensor (DOC inlet exhaust temperature) ($T_0$)
(11) Temperature sensor (DPF inlet exhaust temperature) ($T_1$)
(12) Differential pressure sensor (DPF differential pressure) ($\Delta P$)
(13) Temperature sensor (DPF outlet exhaust temperature) ($T_2$)
(14) Diesel Oxidation Catalyst (DOC)
(15) Diesel Particulate Filter (DPF)
(16) ACU
(17) Pre NOx sensor
(18) DEF injector
(19) SCR inlet temperature sensor
(20) SCR
(21) Post NOx sensor
(22) DEF pump
(23) DEF tank
(24) Coolant valve
(a) EGR valve opening
(b) Injection pattern
(c) Inlet throttle valve angle
(d) Air flow sensor
(e) $T_0$ (DOC inlet exhaust temperature)
(f) $T_1$ (DPF inlet exhaust temperature)
(g) $\Delta P$ (DPF differential pressure)
(h) $T_2$ (DPF outlet exhaust temperature)
(i) DEF injector
(j) Pre NOx
(k) SCR inlet temperature
(l) Post NOx
(m) DEF pump
(n) DEF tank
(o) Coolant valve
(p) Coolant from engine

## 6.2 DPF regeneration process

**NOTE**

- **If you stop the engine once, the "Auto Regeneration" mode will be activated.**

DPF regeneration process can be performed by choosing from "Auto Regeneration" or "Regeneration inhibit" mode according to your job conditions. For jobs not affected by hot gases emitted during regeneration, the "Auto Regeneration" is advisable.

- Auto Regeneration Mode;
  When starting the engine (switch operation is unnecessary), the "Auto Regeneration" mode is automatically activated.
  With the auto regeneration mode on, when a specific amount of PM has accumulated, and the regeneration conditions are satisfied, the DPF will be automatically regenerated whether the tractor is in motion or parked.
- Regeneration Inhibit Mode;
  After starting the engine, if the "DPF INHIBIT switch" is pressed to turn on the switch lamp, the "Regeneration inhibit" mode will be activated.
  With "Regeneration Inhibit" mode on, the PM which has accumulated inside the DPF will not be burnt, unless the operator performs the regeneration work manually. The "Regeneration Inhibit" mode is effective for work in poorly ventilated work spaces.

## 6.3 PM warning level

PM warning level 0 to 5 as shown below is set according to the amount of accumulated PM to prompt the operator to perform the required procedure in each level.

- Level 0: Normal operation. Regeneration is not required.
- Level 1: Auto Regeneration is possible in the Auto Regeneration Mode.
- Level 2: Auto Regeneration is possible in the Auto Regeneration Mode. Parked Regeneration is possible in both of the Auto Regeneration Mode and Inhibit Mode.
- Level 3: Auto Regeneration is not possible in above level 3. Parked Regeneration is required as soon as possible.
- Level 4: Only by using diagmaster, Parked Regeneration is possible. Parked Regeneration is required as soon as possible.
- Level 5: Cleaning or replacement is required. Regeneration is not possible.

## 6.4 Auto regeneration mode

| Warning level | Buzzer | Engine output limitation | | | n/min | | P | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 0 | No | No limitation | | | | | | | Normal operation, Regeneration is not required. |
| 1 | No | No limitation | | ★ | ★ | | | | Condition for Auto Regeneration is not satisfied and engine speed is low. |
| | | | | ★ | | | | | DPF temperature for Auto Regeneration is not satisfied.<br>Engine speed is OK. |
| | | | | ● | | | | | Under the Auto Regeneration. |
| **Level 2-1:**<br>Every 5 second<br>**Level 2-2:**<br>Every 3 second | | No limitation | | ★ | ★ | | ★ | | Condition for Auto Regeneration is not satisfied and engine speed is low. |
| | | | | ★ | | | ★ | | DPF temperature for Auto Regeneration is not satisfied.<br>Engine speed is OK. |
| | | | | ● | | | ★ | | Under the Parked Regeneration. |
| 3 | Every seconds | 50% | | | | | ★ | ★ | Condition for Parked Regeneration is not satisfied. |
| | | | | | | ★ | ★ | ★ | Condition for Parked Regeneration is satisfied. When pressing the parked regeneration switch, Parked Regeneration will start. |
| | | | | | | ● | ★ | ★ | Under the preparation for Parked Regeneration. |
| | | | | ● | | ● | | ★ | Under the Parked Regeneration. |
| 4 | Every seconds | 50% | | | | | | ● | Without diagmaster. |
| | | | | | | | ★ | ★ | When using diagmaster and condition for Parked Regeneration is not satisfied.<br>This indication switch to the following if cancel the DPF INHIBIT switch in the state of condition for Parked Regeneration is satisfied. |
| | | | | | | ★ | ★ | ★ | When using diagmaster and condition for Parked Regeneration is satisfied. When pressing the parked regeneration switch, Parked Regeneration will start. |
| | | | | | | ● | ★ | ★ | Under the preparation for Parked Regeneration when using diagmaster. |
| | | | | ● | | ● | | ★ | Under the Parked Regeneration when using diagmaster. |
| 5 | Every seconds | 50% | | | | | | ● | Even when using diagmaster, it is not possible to do Parked Regeneration. |

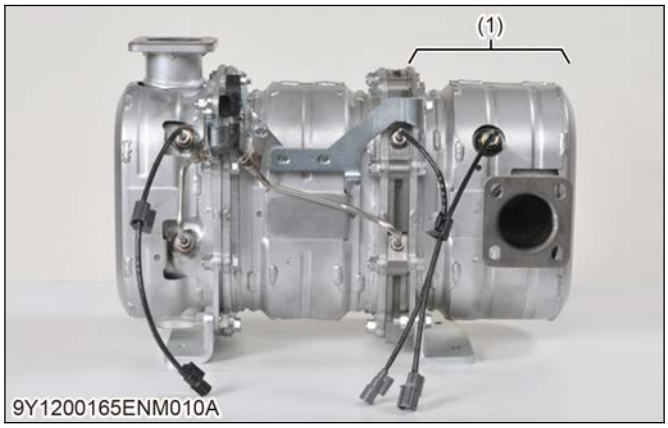
★: Blink
●: ON

## 6.5 Regeneration inhibit mode

| Warning level | Buzzer | Engine output limitation |  |  |  |  |  |  | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 0 | No | No limitation | ● | | | | | | Normal operation, Regeneration is not required. |
| 1 | No | No limitation | ● | ★ | | | | | Regeneration is required, but Auto Regeneration is not permitted.<br>Parking Regeneration is not possible. |
| **Level 2-1:** Every 5 second<br>**Level 2-2:** Every 3 second | | No limitation | ● | ★ | | | ★ | | Auto Regeneration is prohibited. Condition for Parked Regeneration is not satisfied.<br>This indication switch to the following if cancel the DPF INHIBIT switch in the state of condition for Parked Regeneration is satisfied. Shift to the Auto Regeneration if cancel the DPF INHIBIT switch in the state of condition for Parked Regeneration is not satisfied. |
| | | | | ★ | ★ | ★ | ★ | | Condition for Parked Regeneration is satisfied. When pressing the parked regeneration switch, Parked Regeneration will start. |
| | | | | ★ | ★ | ● | ★ | | Under the preparation for Parked Regeneration. |
| | | | | ● | | ● | | | Under the Parked Regeneration. |
| 3 | Every seconds | 50% | ● | | | | ★ | ★ | This indication switch to the following if cancel the DPF INHIBIT switch in the state of condition for Parked Regeneration is satisfied. |
| | | | | | | ★ | ★ | ★ | Condition for Parked Regeneration is satisfied. When pressing the parked regeneration switch, Parked Regeneration will start. |
| | | | | | | ● | ★ | ★ | Under the preparation for Parked Regeneration. |
| | | | | ● | | ● | | ★ | Under the Parked Regeneration. |
| 4 | Every seconds | 50% | ● | | | | | ● | Without diagmaster. |
| | | | ● | | | | ★ | ★ | When using diagmaster and condition for Parked Regeneration is not satisfied.<br>This indication switch to the following if cancel the DPF INHIBIT switch in the state of condition for Parked Regeneration is satisfied. |
| | | | | | | ★ | ★ | ★ | When using diagmaster and condition for Parked Regeneration is satisfied. When pressing the parked regeneration switch, Parked Regeneration will start. |
| | | | | | | ● | ★ | ★ | Under the preparation for Parked Regeneration when using diagmaster. |
| | | | | ● | | ● | | ★ | Under the Parked Regeneration when using diagmaster. |
| 5 | Every seconds | 50% | ● | | | | | ● | Even when using diagmaster, it is not possible to do Parked Regeneration. |

★: Blink
●: ON

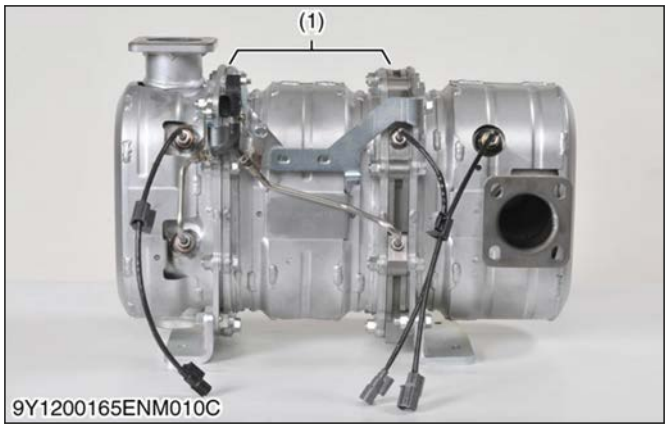
## 6.6 Diesel Oxidation Catalyst (DOC)




(1) Diesel oxidation catalyst (DOC)

An oxidizing catalyst positioned in front of the Diesel Particulate Filter (DPF) step that uses post injection unburned fuel to actively regenerate the DPF.

## 6.7 Diesel Particulate Filter (DPF)

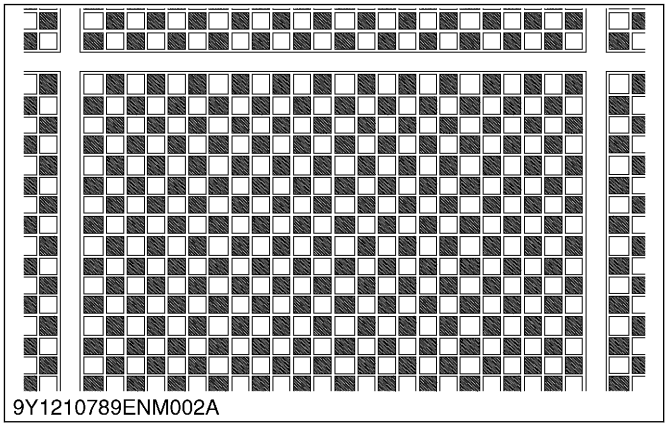


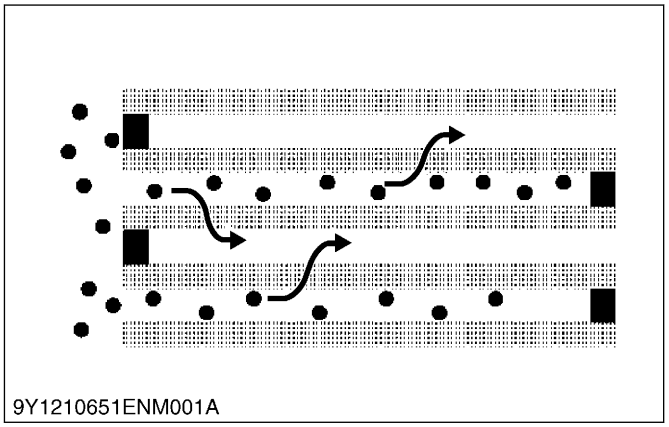

(1) Diesel particulate filter (DPF)

The diesel particulate filter (DPF) is a device that captures and combusts PM in the exhaust gas.
Physically captures the PM using a filter which spontaneously combusts when exhaust gas temperature is high.
However, while exhaust gas temperature is low PM does not spontaneously combust the pressure differential between the inlet and outlet of the DPF is detected and the PM is combusted using a heat source generated using DOC to regenerate the filter.

## 6.8 Function of Diesel Particulate Filter (DPF)

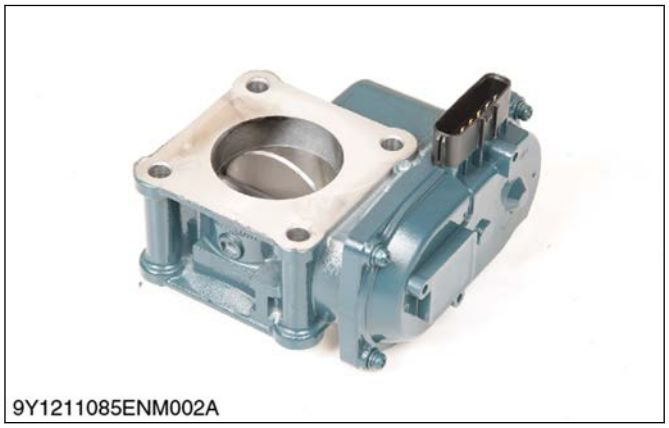
The Diesel Particulate Filter (DPF) is a filter to capture fine particles (soot and ash) contained in the exhaust gas of a diesel engine.


The ash content is mainly metallic additives contained in burnt lubricating oil.
The filter has a honeycomb structure with adjacent cell holes alternately closed.
In addition, by alternately closing the inlet side and the outlet side of the exhaust gas, the thin ceramics wall is used as a filter.
As shown in the figure, fine particles in the exhaust gas are captured when they pass through this thin wall, and the exhaust gas is discharged as clean gas.

## 6.9 Function of intake throttle valve

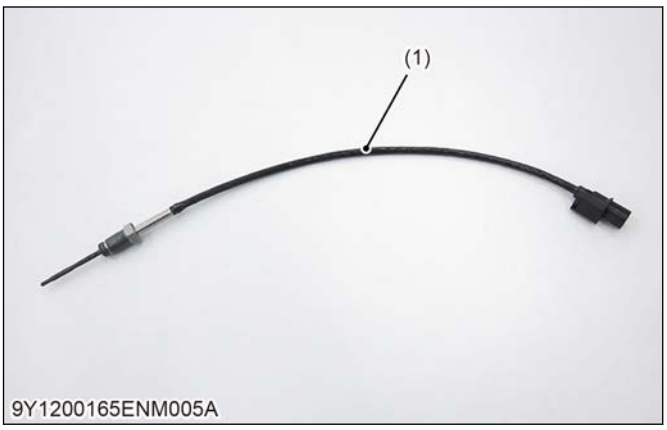



The amount of air intake is regulated by the angle of the throttle valve and the exhaust temperature is controlled when regenerating the DPF muffler.

## 6.10 Function of air flow sensor


The amount of air intake required for control of the EGR valve used to reduce NOx is measured.

## 6.11 Function of temperature sensor


(1) Temperature sensor

This is mounted on the DPF muffler and the DPF muffler DOC intake, DPF intake, and DPF discharge exhaust temperature, needed for the post processing system, are measured.

## 6.12 Function of differential pressure sensor


(1) Differential pressure sensor

The differential pressure sensor is a sensor that detects the pressure differential between the inlet and the outlet of the DPF.
The engine ECU calculates the amount of accumulated PM in the DPF using this signal.

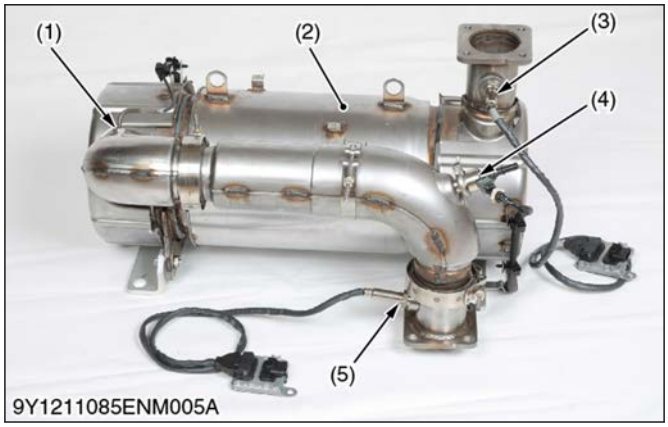
## 6.13 Function of oil separator

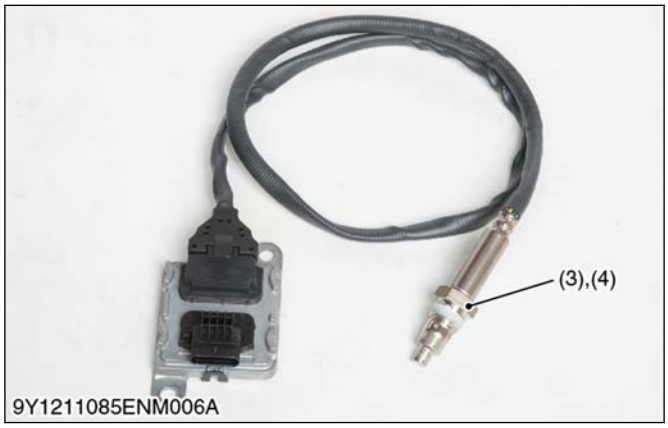

(1) Element

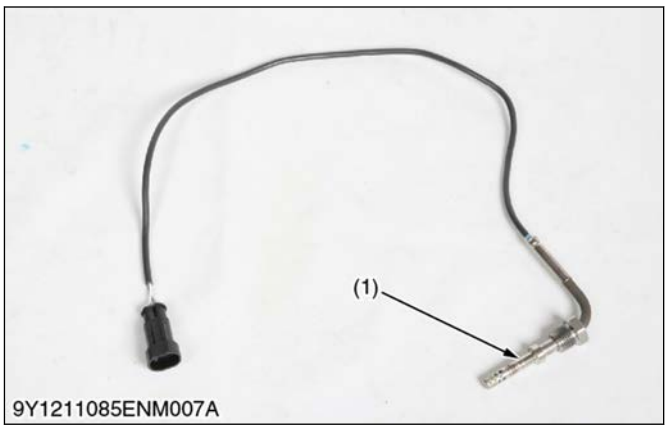
Removes oil in the blowby gases that pass through the element (1) and the oil is returned to the oil pan.
Blowby gases that pass through the element (1) are mixed into the intake upstream from the turbo charger.

## 6.14 Function of Selective Catalytic Reduction (SCR)

The purpose of Selective Catalytic Reduction (SCR) is to reduce NOx by chemical reaction on SCR catalyst.



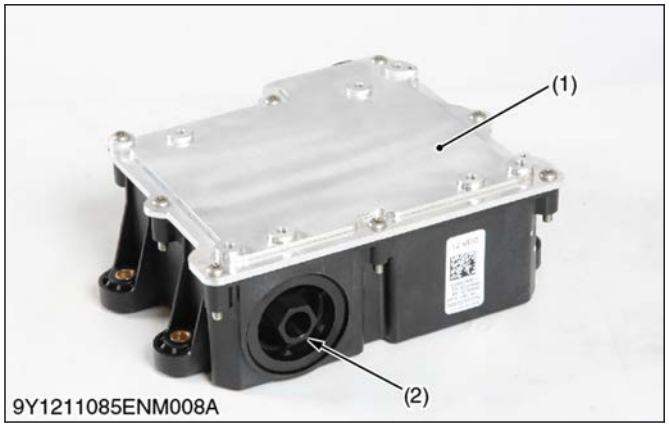



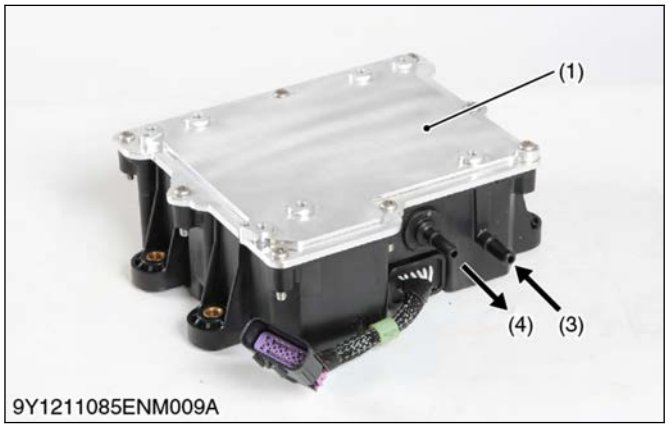




(1) SCR inlet temperature sensor
(2) Selective catalyst reduction (SCR)
(3) Post NOx sensor
(4) DEF injector
(5) Pre NOx sensor

Urea is converted to ammonia by heat and NOx generates a reduction reaction with ammonia in a SCR converter so that nitrogen and water are discharged.
Ammonia that is not used in the reduction reaction is changed to nitrogen using an Ammonia Slip Catalyst (ASC) and then discharged.
The SCR is equipped with a NOx sensor that detects the concentration of NOx at the inlet and exit of the SCR as well as a SCR inlet temperature sensor that detects the exhaust temperature at the inlet of the SCR.

## 6.15 Function of Diesel Exhaust Fluid (DEF) pump




(1) DEF pump
(2) Filter
(3) DEF inlet
(4) DEF outlet

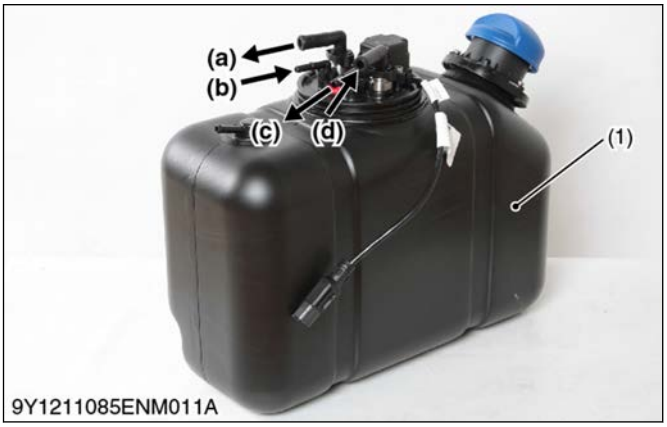
Urea is fed from a Diesel Exhaust Fluid (DEF) tank to an injector at a pressure of 550 kPa (5.61 kgf/cm$^2$, 79.8 psi).
A DEF pressure sensor monitors DEF pressure.
The DEF is equipped with a heater to prevent freezing.
The pump operates in the range of −40 to 70 ℃ and if the operating temperature is exceeded, operating at 85 ℃ condition for 120 minutes is permitted.

## 6.16 Function of DEF injector


(1) DEF injector

DEF (Diesel Exhaust Fluid) is injected into a mixing pipe.
When DEF (Diesel Exhaust Fluid) is injected into the mixing pipe by the DEF injector (1), the DEF converts into ammonia.
The DEF injector is continually cooled by the DEF (Diesel Exhaust Fluid).
The amount of urea injected by the injector is detected by the Pre NOx sensor and is controlled by the ACU according to concentration of NOx.
The injector ID code must be entered into the ACU using a service tool.
The injector operates in a range of outdoor temperature from −40 to 125 ℃ (−40.0 to 257 ℉).

## 6.17 Function of DEF tank





(1) DEF tank
(2) Header unit
(a) Coolant return to engine
(b) DEF return from DEF injector
(c) DEF outlet to DEF pump
(d) Coolant into DEF tank

The DEF tank (1) performs the role of storing DEF and is equipped with a header unit (2).
The header unit (2) is made up of a DEF line, coolant line, and three sensors.
The heater unit sensors are a level sensor, quality sensor, and temperature sensor.

**Level sensor**

The level sensor is limited by the amount of DEF remaining.

Amount remaining 15%

**Low level:**
No limitation (Warning lamp only)
Amount remaining 5%

**Empty level:**
Operating at 50% torque and 60% engine speed feasible for approximately 45 minutes (Idling only)
Amount remaining 0%

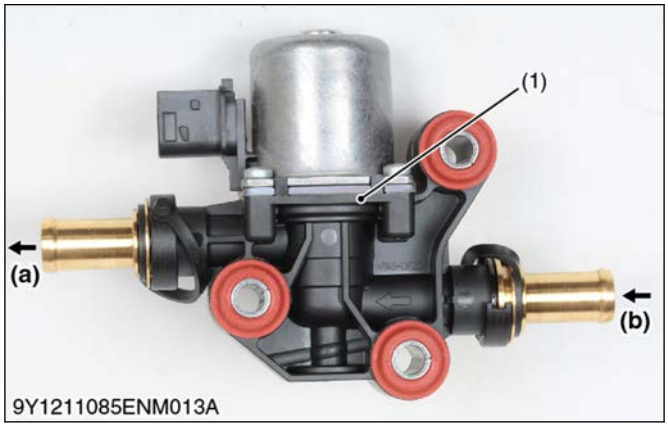
**Leakage level:**
Idling only (Immediately)

**Quality sensor**
The quality sensor detects density using thermal conductivity and can detect water and diesel as well.

**Temperature sensor**
Detects the temperature of the DEF in the DEF tank and checks whether the DEF is frozen or not.
If the ACU determines that the DEF is frozen based on the signal from the temperature sensor, it starts thaw control.

## 6.18 Function of coolant valve

The coolant valve controls flow of coolant that flows from the DEF tank to the header unit.




(1) Coolant valve
(a) Coolant outlet
(b) Coolant inlet

While in DEF thaw control, the coolant valve opens up.

## 6.19 Function of after treatment control unit (ACU)

Based on various sensor values, the ACU controls the DEF injector, DEF pump, and DEF tank and coolant valve.


The ACU communicates with the ECU via CAN communication.
After the engine is stopped, the ACU submits cooling down and DEF purge instructions.
Cooling down (approximately 10 minutes)
Sent from DEF pump to DEF and DEF injector.
DEF purge (approximately 2 minutes)
The DEF pump is inverted in order to return DEF in the DEF tube to the DEF tank.

# SERVICING

## 1. Troubleshooting for engine

This troubleshooting shows only mechanical failures.
The failures related to the Common Rail System (CRS), and DPF, refer to the Diagnosis Manual (DM) for common rail system engine (*9Y120-03140*).

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| The engine does not start | 1. No fuel | Fill up the fuel | 2-13 |
| | 2. Air in the fuel system | Bleed the air | — |
| | 3. Water in the fuel system | Change the fuel and repair or replace the fuel system | 2-53 |
| | 4. The fuel pump is damaged | Replace | — |
| | 5. The fuel hose is clogged | Clean or replace | 2-53 |
| | 6. The fuel filter is clogged | Replace | 2-35 |
| | 7. The viscosity of fuel at low temperature is too high | Replace the specified fuel | 2-13 |
| | 8. The cetane number of fuel is low | Replace the specified fuel | 2-13 |
| | 9. Fuel leakage because of loose injection pipe retaining nut | Tighten the retaining nut | 3-86 |
| | 10. The injector is clogged | Replace | 3-90 |
| | 11. The supply pump is damaged | Replace | 3-97 |
| | 12. Seizure of the crankshaft, camshaft, piston or bearing | Repair or replace | — |
| | 13. Compression leakage from the cylinder | Replace the head gasket<br>Tighten the cylinder head screw | 3-93<br>3-94 |
| | 14. Incorrect valve timing | Check the timing gear | 3-102 |
| | 15. Piston ring and cylinder are worn out | Replace | 3-124<br>3-124<br>3-129 |
| | 16. Incorrect valve clearance | Adjust valve clearance | 2-40 |
| The starter does not operate | 1. Discharged battery | Charge or replace | — |
| | 2. Starter is damaged | Repair or replace | 10-103 |
| | 3. The key switch is damaged | Replace | — |
| | 4. The connection of the wires is incorrect | Check or correct | — |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| The engine revolution is not smooth | 1. The fuel filter is clogged | Replace | 2-35 |
| | 2. The air cleaner is clogged | Clean or replace the air cleaner element | 2-29 |
| | 3. Fuel leakage because of loose injection pipe retaining nut | Tighten the retaining nut | 3-86 |
| | 4. The supply pump is damaged | Replace | 3-97 |
| | 5. The injector is damaged | Replace | 3-90 |
| | 6. The turbocharger bearing is worn out | Replace the turbocharger assembly | 3-85 |
| | 7. The turbocharger shaft is bent | Replace the turbocharger assembly | 3-85 |
| | 8. The turbocharger fin or other part has a damage because of unwanted materials | Replace the turbocharger assembly | 3-85 |
| The exhaust gas is white or blue | 1. Too much engine oil | Reduce it to the specified level | 2-24 |
| | 2. The piston ring, piston and cylinder is worn out | Replace the piston ring or piston, or repair the cylinder | 3-124<br>3-124<br>3-129 |
| There is oil leakage into the exhaust pipe or suction pipe | 1. The oil pipe is clogged or has a damage | Check, replace or clean the oil pipe | — |
| | 2. The piston ring seal of the turbocharger is damaged | Replace the turbocharger assembly | 3-85 |
| The exhaust gas is black or dark gray | 1. Overload | Decrease the load | — |
| | 2. Filter comp (DPF) is damaged | Replace | 3-51 |
| | 3. The grade of the fuel is low | Replace the specified fuel | 2-13 |
| | 4. The fuel filter is clogged | Replace | 2-35 |
| | 5. The air cleaner is clogged | Clean or replace the element | 2-29 |
| | 6. The injector is damaged | Replace | 3-90 |
| The output is deficient | 1. The moving parts of engine have a seizure | Repair or replace | — |
| | 2. The supply pump is damaged | Replace | 3-97 |
| | 3. The injector is damaged | Replace | 3-90 |
| | 4. There is compression leakage | Check the compression pressure and repair | 3-40 |
| | 5. There is a gas leakage from the exhaust system | Repair or replace | 3-85 |
| | 6. The air cleaner is clogged | Clean or replace the element | 2-29 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| The output is deficient | 7. There is an air leakage from the compressor discharge side | Replace the turbocharger assembly | 3-85 |
| The lubricant oil consumption is too much | 1. The gap of the piston ring points to the same direction | Move the ring gap direction | 3-105 |
| | 2. The oil ring is worn out or cannot move | Replace | 3-105 |
| | 3. The piston ring groove is worn out | Replace the piston and piston ring | 3-124 |
| | 4. The valve stem and valve guide are worn out | Replace | 3-96 |
| | 5. The crankshaft bearing and the crank pin bearing is worn out | Replace | 3-126 |
| The fuel is mixed into the lubricant oil | 1. The injector is damaged | Replace | 3-90 |
| | 2. Fuel leak from the overflow pipe of the inner cylinder head cover | Replace the gasket | — |
| | 3. Oil dilution due to regeneration | Change the engine oil | 2-24 |
| Water is mixed into the lubricant oil | 1. The head gasket is damaged | Replace | 3-93 |
| | 2. The cylinder block or cylinder head is damaged | Replace | 3-93 |
| The oil pressure is low | 1. The engine oil is not sufficient | Fill oil to the specified amount | 2-24 |
| | 2. The oil strainer is clogged | Clean | 3-103 |
| | 3. The relief valve does not operate with dirt | Repair or replace | 3-101 |
| | 4. The oil clearance of the bearings are too much | Replace the metal, bushing or shaft | 3-104<br>3-111<br>3-126<br>3-127 |
| | 5. The oil passage is clogged | Clean | — |
| | 6. The type of oil used is incorrect | Use the specified type of oil | 2-13 |
| | 7. The oil pump is damaged | Replace | 3-129<br>3-130<br>3-130 |
| The oil pressure is high | 1. The type of oil used is incorrect | Use the specified type of oil | 2-13 |
| | 2. The relief valve is damaged | Repair or replace | 3-101 |
| The engine is overheated | 1. The engine oil is not sufficient | Fill oil to the specified amount | 2-24 |
| | 2. The fan belt is broken or the fan belt tension is too loose | Replace or adjust | 3-42 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| The engine is overheated | 3. The coolant is not sufficient | Fill to the specified amount | 3-45 |
| | 4. The radiator net and the radiator fin are clogged with dust | Clean | — |
| | 5. There is corrosion in the inner side of the radiator | Clean or replace | 2-45 |
| | 6. There is clogged in the coolant flow route | Clean or replace | 2-45 |
| | 7. The radiator or radiator cap is damaged | Replace | 3-43 |
| | 8. The load is too much | Reduce the load | — |
| | 9. The head gasket is damaged | Replace | 3-93 |
| | 10. The fuel used is incorrect | Replace the specified fuel | 2-13 |

# 2. Servicing specifications for engine

## Engine body

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Cylinder head surface | Flatness | — | 0.005 mm<br>0.002 in. |
| Top clearance | | 0.701 to 0.930 mm<br>0.0276 to 0.0366 in. | — |
| Compression pressure | | 3.09 to 3.28 MPa / 200 $min^{-1}$ (rpm)<br>31.5 to 33.5 $kgf/cm^2$ / 200 $min^{-1}$ (rpm)<br>448 to 476 psi / 200 $min^{-1}$ (rpm) | 2.41 MPa / 200 $min^{-1}$ (rpm)<br>24.6 $kgf/cm^2$ / 200 $min^{-1}$ (rpm)<br>350 psi / 200 $min^{-1}$ (rpm) |
| Variance among cylinders | | — | 10% or less |
| Valve seat | Angle (Intake) | 1.0 rad<br>60° | — |
| | Angle (Exhaust) | 0.79 rad<br>45° | — |
| | Width (Intake) | 1.5 to 1.9 mm<br>0.059 to 0.074 in. | — |
| | Width (Exhaust) | 2.0 to 2.3 mm<br>0.079 to 0.091 in. | — |
| Valve face | Angle (Intake) | 1.0 rad<br>60° | — |
| | Angle (Exhaust) | 0.79 rad<br>45° | — |
| Valve recessing | Intake | 0.60 to 0.80 mm<br>0.024 to 0.031 in. | 1.2 mm<br>0.047 in. |
| | Exhaust | 0.85 to 1.05 mm<br>0.0335 to 0.0413 in. | 1.2 mm<br>0.047 in. |
| Valve stem to valve guide | Clearance (Intake) | 0.035 to 0.065 mm<br>0.0014 to 0.0025 in. | 0.1 mm<br>0.004 in. |
| • Valve stem | O.D. (Intake) | 6.960 to 6.975 mm<br>0.2741 to 0.2746 in. | — |
| • Valve guide | I.D. (Intake) | 7.010 to 7.025 mm<br>0.2760 to 0.2765 in. | — |
| Valve stem to valve guide | Clearance (Exhaust) | 0.035 to 0.065 mm<br>0.0014 to 0.0025 in. | 0.1 mm<br>0.004 in. |
| • Valve stem | O.D. (Exhaust) | 6.960 to 6.975 mm<br>0.2741 to 0.2746 in. | — |
| • Valve guide | I.D. (Exhaust) | 7.010 to 7.025 mm<br>0.2760 to 0.2765 in. | — |
| Valve clearance (Cold) | | 0.23 to 0.27 mm<br>0.0091 to 0.010 in. | — |
| Intake valve timing | Open | 0.24 rad (14°) before T.D.C. | — |
| | Close | 0.63 rad (36°) after B.D.C. | — |
| Exhaust valve timing | Open | 0.79 rad (45°) before B.D.C. | — |
| | Close | 0.30 rad (17°) after T.D.C. | — |
| Valve spring | Free length (Intake) | 35.1 to 35.6 mm<br>1.39 to 1.40 in. | 34.6 mm<br>1.36 in. |

(Continued)

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Valve spring | Free length (Exhaust) | 35.1 to 35.6 mm<br>1.39 to 1.40 in. | 34.6 mm<br>1.36 in. |
| | Tilt | — | 1.0 mm<br>0.039 in. |
| Valve spring | Setting load / Setting length (Intake) | 63.5 N / 31.5 mm<br>6.48 kgf / 31.5 mm<br>14.3 lbf / 1.24 in. | 45.9 N / 31.5 mm<br>4.68 kgf / 31.5 mm<br>10.3 lbf / 1.24 in. |
| | Setting load / Setting length (Exhaust) | 63.5 N / 31.5 mm<br>6.48 kgf / 31.5 mm<br>14.3 lbf / 1.24 in. | 45.9 N / 31.5 mm<br>4.68 kgf / 31.5 mm<br>10.3 lbf / 1.24 in. |
| Rocker arm shaft to rocker arm | Clearance | 0.016 to 0.045 mm<br>0.00063 to 0.0017 in. | 0.15 mm<br>0.0059 in. |
| • Rocker arm shaft | O.D. | 15.973 to 15.984 mm<br>0.62886 to 0.62929 in. | — |
| • Rocker arm | I.D. | 16.000 to 16.027 mm<br>0.62993 to 0.63098 in. | — |
| Valve bridge arm and valve bridge arm shaft | Clearance | 0.018 to 0.042 mm<br>0.00071 to 0.0016 in. | 0.15 mm<br>0.0059 in. |
| • Valve bridge arm | I.D. | 9.050 to 9.065 mm<br>0.3563 to 0.3568 in. | — |
| • Valve bridge arm shaft | O.D. | 9.023 to 9.032 mm<br>0.3552 to 0.3555 in. | — |
| Push rod | Alignment | — | 0.25 mm<br>0.0098 in. |
| Tappet to tappet guide | Clearance | 0.020 to 0.062 mm<br>0.00079 to 0.0024 in. | 0.07 mm<br>0.003 in. |
| • Tappet guide bore | I.D. | 24.000 to 24.021 mm<br>0.94489 to 0.94570 in. | — |
| • Tappet | O.D. | 23.959 to 23.980 mm<br>0.94327 to 0.94409 in. | — |
| Camshaft | Side clearance | 0.070 to 0.22 mm<br>0.0028 to 0.0086 in. | 0.30 mm<br>0.012 in. |
| | Alignment | — | 0.01 mm<br>0.0004 in. |
| Cam height | Intake | 37.64 mm<br>1.482 in. | 37.14 mm<br>1.462 in. |
| | Exhaust | 38.96 mm<br>1.534 in. | 38.46 mm<br>1.514 in. |
| Camshaft | Oil clearance | 0.050 to 0.091 mm<br>0.0020 to 0.0035 in. | 0.15 mm<br>0.0059 in. |
| • Camshaft journal | O.D. | 45.934 to 45.950 mm<br>1.8085 to 1.8090 in. | — |
| • Camshaft bearing | I.D. | 46.000 to 46.025 mm<br>1.8111 to 1.8120 in. | — |
| Timing gear | | | |
| • Idle gear 1 to crank gear | Backlash | 0.0490 to 0.193 mm<br>0.00193 to 0.00759 in. | 0.22 mm<br>0.0087 in. |
| • Idle gear 1 to cam gear | Backlash | 0.0490 to 0.189 mm<br>0.00193 to 0.00744 in. | 0.22 mm<br>0.0087 in. |
| • Idle gear 1 to idle gear 2 | Backlash | 0.0440 to 0.185 mm<br>0.00174 to 0.00728 in. | 0.22 mm<br>0.0087 in. |

(Continued)

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| • Idle gear 2 to supply pump gear | Backlash | 0.0440 to 0.177 mm<br>0.00174 to 0.00696 in. | 0.22 mm<br>0.0087 in. |
| idle gear shaft 1, 2 to idle gear 1, 2 bushing | Oil Clearance | 0.050 to 0.091 mm<br>0.0020 to 0.0035 in. | 0.10 mm<br>0.0039 in. |
| • Idle gear 1, 2 bushing | I.D. | 45.025 to 45.050 mm<br>1.7727 to 1.7736 in. | — |
| • Idle gear shaft 1, 2 | O.D. | 44.959 to 44.975 mm<br>1.7701 to 1.7706 in. | — |
| Idle gear | Side clearance | 0.15 to 0.30 mm<br>0.0059 to 0.011 in. | 0.90 mm<br>0.035 in. |
| Piston pin bore | I.D. | 30.006 to 30.013 mm<br>1.1814 to 1.1816 in. | 30.05 mm<br>1.183 in. |
| Top ring to ring groove | Clearance | 0.05 to 0.09 mm<br>0.002 to 0.003 in. | 0.15 mm<br>0.0059 in. |
| Second ring to ring groove | Clearance | 0.0930 to 0.120 mm<br>0.00367 to 0.00472 in. | 0.20 mm<br>0.0079 in. |
| Oil ring to ring groove | Clearance | 0.020 to 0.060 mm<br>0.00079 to 0.0023 in. | 0.15 mm<br>0.0059 in. |
| Piston ring gap | Top ring | 0.30 to 0.45 mm<br>0.012 to 0.017 in. | 1.25 mm<br>0.0492 in. |
| | Second ring | 0.45 to 0.60 mm<br>0.018 to 0.023 in. | 1.25 mm<br>0.0492 in. |
| | Oil ring | 0.025 to 0.045 mm<br>0.0099 to 0.017 in. | 1.25 mm<br>0.0492 in. |
| Connecting rod | Alignment | — | 0.05 mm<br>0.002 in. |
| Piston pin to small end bushing | Clearance | 0.020 to 0.040 mm<br>0.00079 to 0.0015 in. | 0.15 mm<br>0.0059 in. |
| • Piston pin | O.D. | 30.006 to 30.011 mm<br>1.1814 to 1.1815 in. | — |
| • Small end bushing | I.D. | 30.031 to 30.046 mm<br>1.1824 to 1.1829 in. | — |
| Crankshaft | Side clearance | 0.15 to 0.31 mm<br>0.0059 to 0.012 in. | 0.50 mm<br>0.020 in. |
| | Alignment | — | 0.02 mm<br>0.0008 in. |
| Crankshaft journal to crankshaft bearing | Oil clearance | 0.018 to 0.062 mm<br>0.00071 to 0.0024 in. | 0.20 mm<br>0.0079 in. |
| • Crankshaft journal | O.D. | 74.977 to 74.990 mm<br>2.9519 to 2.9523 in. | — |
| Crank pin to pin bearing | Oil clearance | 0.018 to 0.051 mm<br>0.00071 to 0.0020 in. | 0.20 mm<br>0.0079 in. |
| • Crank pin | O.D. | 52.977 to 52.990 mm<br>2.0857 to 2.0862 in. | — |
| Cylinder bore | I.D. | 100.000 to 100.022 mm<br>3.93701 to 3.93787 in. | 100.150 mm<br>3.9429 in. |
| Cylinder bore (oversize) | I.D. | 100.500 to 100.522 mm<br>3.95670 to 3.95755 in. | 100.650 mm<br>3.96260 in. |

## Lubricating system

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Engine oil pressure | At idle speed | — | 50 kPa<br>0.5 kgf/cm$^2$<br>7 psi |
| | At rated speed | 200 to 390 kPa<br>2.0 to 4.0 kgf/cm$^2$<br>29 to 56 psi | 150 kPa<br>1.5 kgf/cm$^2$<br>21 psi |
| Engine oil pressure switch | Working pressure | 40 to 50 kPa<br>0.4 to 0.6 kgf/cm$^2$<br>6 to 8 psi | — |
| Inner rotor to outer rotor | Clearance | 0.040 to 0.16 mm<br>0.0016 to 0.0062 in. | 0.3 mm<br>0.01 in. |
| Outer rotor to pump body | Clearance | 0.100 to 0.184 mm<br>0.00394 to 0.00724 in. | 0.3 mm<br>0.01 in. |
| Inner rotor to cover | Clearance | 0.025 to 0.075 mm<br>0.00099 to 0.0029 in. | 0.225 mm<br>0.00886 in. |

## Cooling system

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Thermostat | Valve opening temperature | 74.5 to 78.5 ℃<br>166.1 to 173.3 ℉ | — |
| | Valve full opening temperature (opened completely) | 90 ℃<br>194 ℉ | — |
| Radiator | Water tightness | No leak at specified pressure | — |
| Radiator cap | Air leakage | 10 seconds or more<br>90 → 60 kPa<br>0.9 → 0.6 kgf/cm$^2$<br>10 → 9 psi | — |
| Fan belt | Tension (ROPS model) | 10 to 12 mm / 98 N (10 kgf, 22 lbf)<br>0.40 to 0.47 in. / 98 N (10 kgf, 22 lbf) | — |
| | Tension (Cabin model) | 13 to 15 mm / 98 N (10 kgf, 22 lbf)<br>0.51 to 0.59 in. / 98 N (10 kgf, 22 lbf) | — |

# 3. Tightening torques for engine

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to 2-15, 2-15.)

| Item | Dimension × Pitch | N·m | kgf·m | lbf·ft |
|---|---|---|---|---|
| Injector clamp nut | M8 × 1.25 | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Overflow pipe joint screw | M6 × 1.0 | 9.81 to 11.2 | 1.00 to 1.15 | 7.24 to 8.31 |
| Cylinder head cover 1 screw | M6 × 1.0 | 6.87 to 11.2 | 0.700 to 1.15 | 5.07 to 8.31 |
| Cylinder head cover 2 screw | M6 × 1.0 | 9.81 to 11.2 | 1.00 to 1.15 | 7.24 to 8.31 |
| Injection pipe retaining nut | M12 × 1.5 | 23 to 36 | 2.3 to 3.7 | 17 to 26 |
| Base of SCR | M14 × 1.5 | 124 to 147 | 12.6 to 15.0 | 91.2 to 108 |
| SCR stay | M10 × 1.25 | 49 to 55 | 5.0 to 5.7 | 37 to 41 |
| SCR mounting screw | M10 × 1.25 | 49 to 55 | 5.0 to 5.7 | 37 to 41 |
| Slip band nut of SCR mixing pipe | M10 × 1.25 | 15 to 17 | 1.6 to 1.7 | 11 to 12 |
| Oil pressure switch taper screw | R 1/8 | 15 to 19 | 1.5 to 2.0 | 11 to 14 |
| Filter comp (DPF) mounting screw | M10 × 1.25 | 49 to 55 | 5.0 to 5.7 | 37 to 41 |
| Temperature sensor | M12 × 1.25 | 25 to 34 | 2.5 to 3.5 | 18 to 25 |
| Differential pressure pipe | M12 × 1.0 | 16 to 22 | 1.6 to 2.3 | 12 to 16 |
| DPF stay | M8 | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| | M10 | 49 to 55 | 5.0 to 5.7 | 37 to 41 |
| EGR cooler flange screw | M8 × 1.25 | 30 to 34 | 3.0 to 3.5 | 22 to 25 |
| Common rail mounting screw | M8 × 1.25 | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Overflow pipe joint screw | M8 × 1.25 | 16 to 19 | 1.6 to 2.0 | 12 to 14 |
| Overflow pipe joint screw | M10 × 1.0 | 7.9 to 12 | 0.80 to 1.3 | 5.8 to 9.4 |
| Coolant temperature sensor | — | 16 to 23 | 1.6 to 2.4 | 12 to 17 |
| Camshaft position sensor mounting screw | — | 4 to 5 | 0.4 to 0.6 | 3 to 4 |
| Crankshaft position sensor mounting screw | — | 4 to 5 | 0.4 to 0.6 | 3 to 4 |
| Intake air temperature sensor mounting screw | — | 30 to 39 | 3.0 to 4.0 | 22 to 28 |
| Boost sensor mounting screw | M6 × 1.0 | 4 to 5 | 0.4 to 0.6 | 3 to 4 |
| Injector terminal nut | — | 1.6 to 2.2 | 0.16 to 0.23 | 1.2 to 1.6 |
| Injector clamp nut | M8 × 1.25 | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Rocker arm bracket nut | M10 × 1.25 | 49 to 55 | 5.0 to 5.7 | 37 to 41 |
| Cylinder head mounting screw | M12 × 1.25 | 98.1 to 107 | 10.0 to 11.0 | 72.4 to 79.5 |
| Exhaust manifold mounting nut | M8 × 1.25 | 30 to 34 | 3.0 to 3.5 | 22 to 25 |
| Supply pump mounting nut | M8 × 1.25 | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Supply pump gear mounting nut | M14 × 1.5 | 59 to 68 | 6.0 to 7.0 | 44 to 50 |

(Continued)

| Item | Dimension × Pitch | N·m | kgf·m | lbf·ft |
|---|---|---|---|---|
| Supply pump gear cover mounting screw | M8 × 1.25 | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Oil cooler joint screw | M20 × 1.5 | 40 to 44 | 4.0 to 4.5 | 29 to 32 |
| *Crankshaft screw | M16 × 1.5 | 255 to 274 | 26.0 to 28.0 | 188 to 202 |
| Gear case cover mounting screw | M8 × 1.25 | 33 to 36 | 3.3 to 3.7 | 24 to 26 |
| Relief valve retaining screw | M22 × 1.5 | 69 to 78 | 7.0 to 8.0 | 51 to 57 |
| Idle gear mounting screw | M8 × 1.25 | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Camshaft set screw | M8 × 1.25 | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Camshaft position pulsar gear mounting screw | M5 | 4.7 to 5.6 | 0.48 to 0.58 | 3.5 to 4.1 |
| Gear case plate mounting screw | M8 × 1.25 | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| *Connecting rod screw | M10 × 1.25 | 79 to 83 | 8.0 to 8.5 | 58 to 61 |
| *Flywheel screw | M12 × 1.25 | 98.1 to 107 | 10.0 to 11.0 | 72.4 to 79.5 |
| Flywheel housing mounting screw | M12 × 1.25 | 103 to 117 | 10.5 to 12.0 | 76.0 to 86.7 |
| Bearing case cover mounting screw | M8 × 1.25 | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Crankcase 2 mounting screw | M10 × 1.25 | 49 to 55 | 5.0 to 5.7 | 37 to 41 |
| *Main bearing case screw | M14 × 1.5 | 138 to 147 | 14.0 to 15.0 | 102 to 108 |
| Intake air heater terminal nut | M6 × 1.0 | 3.5 to 5.3 | 0.35 to 0.55 | 2.6 to 3.9 |
| Oil pump cover screw | M6 | 7.9 to 9.3 | 0.80 to 0.95 | 5.8 to 6.8 |

**■ NOTE**

- **The alphabet M in Dimension × Pitch shows that the screw, bolt or nut dimensions are in the metric system.**
  **The dimension is the nominal external diameter in mm of the threads. The pitch is the nominal distance in mm between 2 threads.**

* Apply engine oil to their threads and seats before you tighten.

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Power steering delivery hose retaining nut | 22.6 to 27.5 | 2.31 to 2.80 | 16.7 to 20.2 |
| Universal joint mounting bolt | 23.5 to 27.5 | 2.4 to 2.8 | 17.3 to 20.3 |
| Steering mounting nut | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Brake delivery pipe retaining nut | 23 to 27 | 2.3 to 2.8 | 17 to 20 |
| Engine and clutch housing mounting bolt (M14, 9T) | 166.7 to 196.1 | 17.00 to 19.99 | 123.0 to 144.6 |
| Engine and clutch housing mounting nut | 123.6 to 147.1 | 12.61 to 15.00 | 91.17 to 108.4 |
| Hose band (Inlet air) | 4.0 to 5.0 | 0.41 to 0.50 | 3.0 to 3.6 |
| Alternator terminal nut | 9.80 to 11.3 | 1.00 to 1.15 | 7.23 to 8.33 |
| Starter B terminal mounting nut | 9.80 to 11.8 | 1.00 to 1.20 | 7.23 to 8.70 |
| Hose band (Intercooler) | 4.0 to 5.0 | 0.41 to 0.50 | 3.0 to 3.6 |
| Shuttle valve pipe retaining nut | 49.1 to 68.6 | 5.00 to 7.00 | 36.2 to 50.6 |

(Continued)

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Master cylinder delivery hose retaining nut | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Power steering joint shaft mounting screw | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Muffler bracket mounting bolt 1 (M10, 7T) | 33.67 to 39.13 | 3.434 to 3.990 | 24.84 to 28.86 |
| Muffler bracket mounting bolt 2 (M8, 7T) | 16.45 to 19.25 | 1.678 to 1.962 | 12.14 to 14.19 |
| Engine mounting screw (M14, 9T, UBS) | 167 to 196 | 17.0 to 20.0 | 123 to 144 |
| Damper disk mounting screw | 48 to 55 | 4.9 to 5.7 | 36 to 41 |
| Clutch cable mounting nut 1 | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Clutch cable mounting nut 2 | 17.7 to 20.6 | 18.1 to 2.10 | 13.1 to 15.1 |

# 4. Checking and adjusting

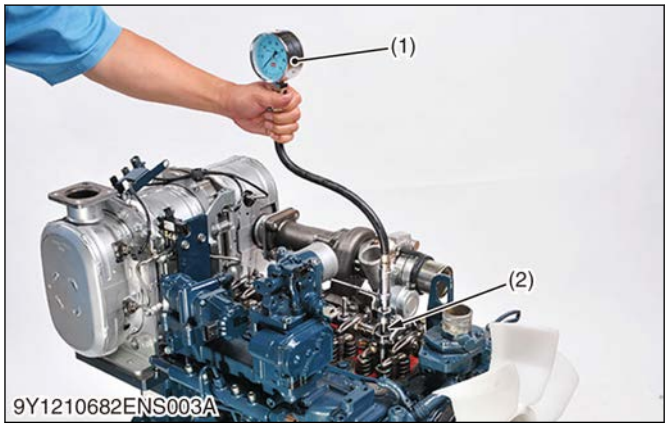
## 4.1 Engine body

### 4.1.1 Checking compression pressure

**■ NOTE**

- **Always use a fully charged battery for you do this test.**
- **Variances in cylinder compression values must be less than 10%.**

1. Warm-up and stop the engine.
2. Remove the air cleaner and muffler.
3. Remove the SCR muffler assembly.
4. Remove the SCR stay.
5. Remove the base of SCR.
6. Disconnect the connector for injector.
7. Disconnect the connector for intake air heater.
8. Disconnect the connector for pre-stroke control valve (PCV).
9. Disconnect the connector for fuel feed pump.
10. Remove the harness.
11. Remove the EGR cooler pipe.
12. Remove the injection pipe, cylinder head cover, overflow pipe, injectors and gaskets of injector.
13. Set a compression tester (1) with the adaptor (2) to the injector hole.





(1) Compression tester (2) Injector adaptor

14. Crank the engine with the starter to operate the engine approximately 200 $min^{-1}$ (rpm).
15. Measure a maximum value of the compression pressure. Do the same steps twice for each cylinder.

**■ NOTE**

- **Check the compression pressure with the specified valve clearance.**
- **Always use a fully charged battery for you do this test.**
- **Variances in cylinder compression values must be less than 10%.**

| | | |
|---|---|---|
| Compression pressure | Factory specification | 3.09 to 3.28 MPa / 200 $min^{-1}$ (rpm)<br>31.5 to 33.5 $kgf/cm^2$ / 200 $min^{-1}$ (rpm)<br>448 to 476 psi / 200 $min^{-1}$ (rpm) |
| | Allowable limit | 2.41 MPa / 200 $min^{-1}$ (rpm)<br>24.6 $kgf/cm^2$ / 200 $min^{-1}$ (rpm)<br>350 psi / 200 $min^{-1}$ (rpm) |

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Injector clamp nut | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | Overflow pipe joint screw (M6 × 1.0) | 9.81 to 11.2 N·m<br>1.00 to 1.15 kgf·m<br>7.24 to 8.31 lbf·ft |
| | Cylinder head cover 1 screw | 6.87 to 11.2 N·m<br>0.700 to 1.15 kgf·m<br>5.07 to 8.31 lbf·ft |
| | Cylinder head cover 2 screw | 9.81 to 11.2 N·m<br>1.00 to 1.15 kgf·m<br>7.24 to 8.31 lbf·ft |
| | Injection pipe retaining nut | 23 to 36 N·m<br>2.3 to 3.7 kgf·m<br>17 to 26 lbf·ft |
| | Base of SCR | 124 to 147 N·m<br>12.6 to 15.0 kgf·m<br>91.2 to 108 lbf·ft |
| | SCR stay | 49 to 55 N·m<br>5.0 to 5.7 kgf·m<br>37 to 41 lbf·ft |
| | SCR mounting screw | 49 to 55 N·m<br>5.0 to 5.7 kgf·m<br>37 to 41 lbf·ft |
| | Slip band nut of SCR mixing pipe | 15 to 17 N·m<br>1.6 to 1.7 kgf·m<br>11 to 12 lbf·ft |

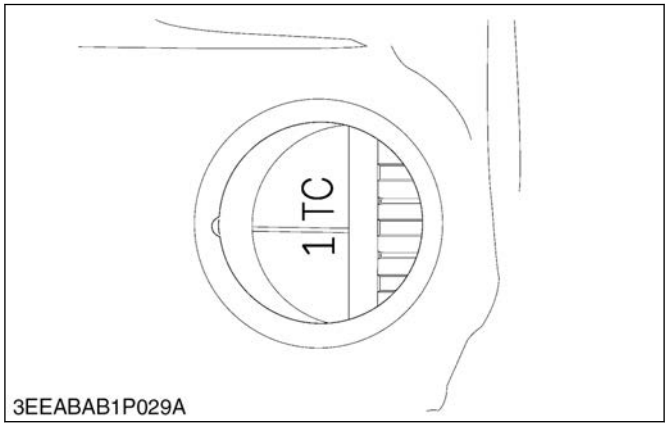
RELATED PAGE
1.1 Diesel engine compression tester on page 2-63

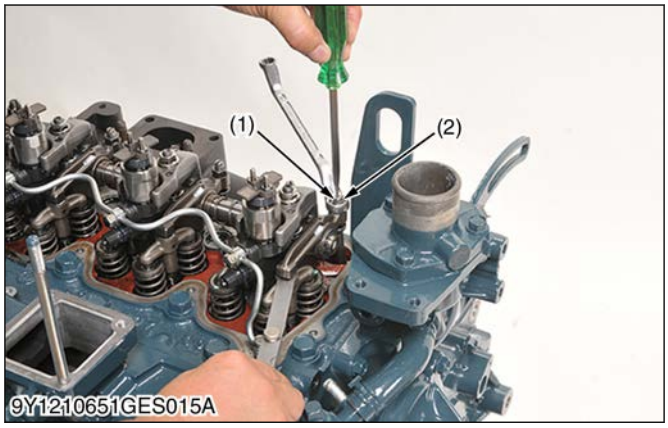
1.12 Compression tester adaptor on page 2-68

## 4.1.2 Adjusting valve clearance

**IMPORTANT**

- **You must check and adjust the valve clearance when the engine is cold.**




(1) Adjusting screw (2) Lock nut

1. Remove the steering controller with steering support.
2. Remove the bonnet support.
3. Remove the bracket.
4. Remove the fuel filter.
5. Remove the CCV hoses.
6. Remove the EGR cooler pipe.
7. Remove the head cover and injector harness.
8. Remove the injection pipes and cylinder head cover.
9. Align the "**1TC**" mark line on the flywheel and projection on the housing.
10. Make sure that the No. 1 piston comes to the compression or overlap top dead center.

| Adjustable Cylinder Location of Piston | | IN. | EX. |
|---|---|---|---|
| When No. 1 piston is at compression top dead center | 1 | ☆ | ☆ |
| | 2 | ☆ | |
| | 3 | | ☆ |
| | 4 | | |
| When No. 1 piston is at overlap position | 1 | | |
| | 2 | | ☆ |
| | 3 | ☆ | |
| | 4 | ☆ | ☆ |

11. Check the subsequent valve clearance at the mark "**1TC**" with a feeler gauge.
12. If the clearance is out of the factory specifications, adjust with the adjusting screw (1).

| | | |
|---|---|---|
| Valve clearance (Cold) | Factory specification | 0.23 to 0.27 mm<br>0.0091 to 0.010 in. |

13. Tighten the lock nut (2) of the adjusting screw.

**(When reassembling)**

**NOTE**

- **After you adjust the valve clearance, tighten the lock nut (2) of the adjusting screw.**
- **Tighten the injector clamp nut, the overflow pipe joint screw (M6 × 1.0) and the cylinder head cover 1 screw to the specified tightening torque.**
- **Tighten the cylinder head cover 2 screw, the injection pipe retaining nut and the base of SCR to the specified tightening torque.**
- **Tighten the mounting bolt for muffler bracket to aluminium parts, be sure the following table's torque.**

| | | |
|---|---|---|
| Tightening torque | Injector clamp nut | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | Overflow pipe joint screw (M6 × 1.0) | 9.81 to 11.2 N·m<br>1.00 to 1.15 kgf·m<br>7.24 to 8.31 lbf·ft |
| | Cylinder head cover 1 screw | 6.87 to 11.2 N·m<br>0.700 to 1.15 kgf·m<br>5.07 to 8.31 lbf·ft |
| | Cylinder head cover 2 screw | 9.81 to 11.2 N·m<br>1.00 to 1.15 kgf·m<br>7.24 to 8.31 lbf·ft |
| | Injection pipe retaining nut | 23 to 36 N·m<br>2.3 to 3.7 kgf·m<br>17 to 26 lbf·ft |
| | Muffler bracket mounting bolt (M10, 7T) | 33.67 to 39.13 N·m<br>3.434 to 3.990 kgf·m<br>24.84 to 28.86 lbf·ft |
| | Muffler bracket mounting bolt (M8, 7T) | 16.45 to 19.25 N·m<br>1.678 to 1.962 kgf·m<br>12.14 to 14.19 lbf·ft |
| | Slip band nut of SCR mixing pipe | 15 to 17 N·m<br>1.6 to 1.7 kgf·m<br>11 to 12 lbf·ft |

# 4.2 Lubricating system

## 4.2.1 Checking engine oil pressure

1. Remove the engine oil pressure switch, and set the oil pressure tester (Code No. 07916-32032).


2. Operate the engine for warming-up.
3. Measure the oil pressure at the idle speed and rated speed.
4. If the oil pressure is less than the allowable limit, check the following.
   - Engine oil level
   - Oil pump
   - Oil strainer
   - Oil filter cartridge
   - Oil passage
   - Oil clearance
   - Relief valve

| | | | |
|---|---|---|---|
| Engine oil pressure | Allowable limit | At idle speed | 50 kPa<br>0.5 kgf/cm$^2$<br>7 psi |
| | Factory specification | At rated speed | 200 to 390 kPa<br>2.0 to 4.0 kgf/cm$^2$<br>29 to 56 psi |
| | Allowable limit | | 150 kPa<br>1.5 kgf/cm$^2$<br>21 psi |

**(When reassembling)**

- After you check the oil pressure of the engine, tighten the oil pressure switch taper screw to the specified tighening torque.

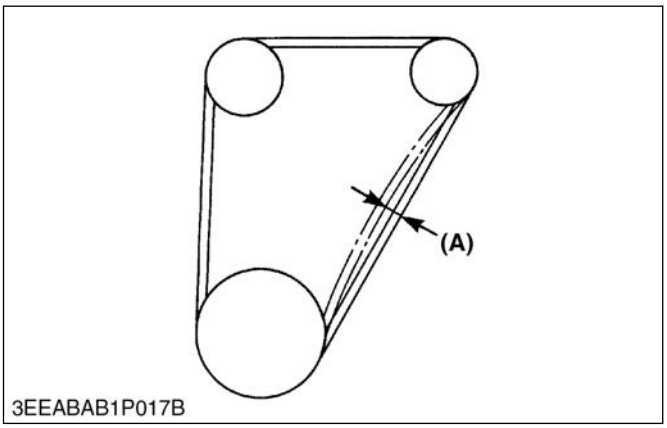
| | | |
|---|---|---|
| Tightening torque | Oil pressure switch taper screw | 15 to 19 N·m<br>1.5 to 2.0 kgf·m<br>11 to 14 lbf·ft |

RELATED PAGE
1.2 Oil pressure tester on page 2-63

# 4.3 Cooling system

## 4.3.1 Checking fan belt tension

1. Push the belt halfway between the fan drive pulley and alternator pulley at a specified force 98 N (10 kgf, 22 lbf) to measure the deflection (A).



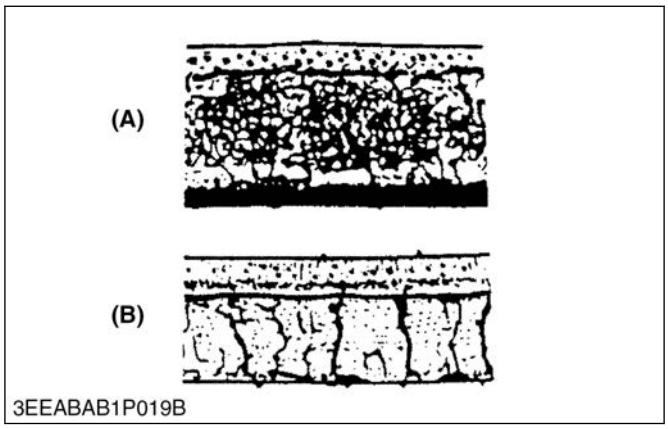

(A) Deflection

| | | | |
|---|---|---|---|
| Deflection (A) | Factory specification | ROPS model | 10 to 12 mm<br>0.40 to 0.47 in. |
| | | Cabin model | 13 to 15 mm<br>0.51 to 0.59 in. |

2. If the measured value is out of the factory specifications, loosen the alternator mounting screws and adjust its position.

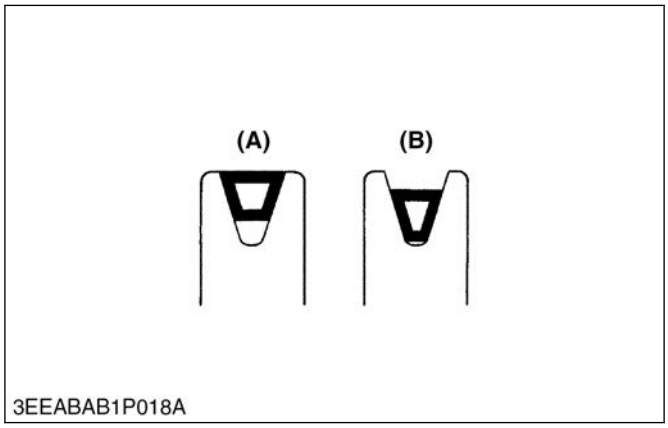
## 4.3.2 Checking fan belt damage and wear

1. Check the fan belt for damage.




(A) Good (B) Bad

2. If the fan belt has a damage, replace it.
3. Check if the fan belt is worn out and sunk in the pulley groove.



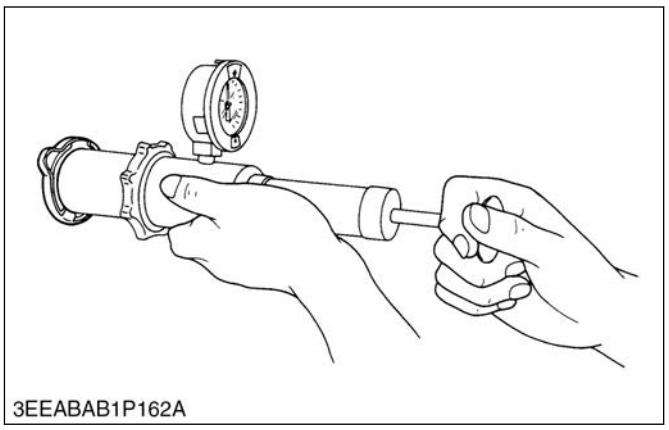

(A) Good (B) Bad

4. If it is, replace it.

## 4.3.3 Checking radiator cap air leakage

**⚠ CAUTION**

- **Remove the radiator cap only after you stop the engine for a minimum of 10 minutes to decrease its temperature. If not, hot water can gush out and cause injury.**



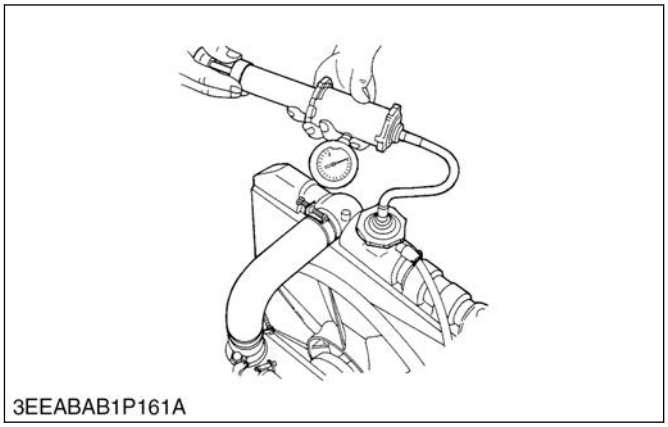

1. Set a radiator tester and an adaptor on the radiator cap.
2. Apply the specified pressure 90 kPa (0.9 kgf/cm$^2$, 10 psi).
3. Measure the time for the pressure to decrease to 60 kPa (0.6 kgf/cm$^2$, 9 psi).
4. If the measurement is less than the factory specification, replace the radiator cap.

| | | |
|---|---|---|
| Pressure decreasing time | Factory specification | More than 10 seconds for pressure decrease from 90 to 60 kPa (from 0.9 to 0.6 kgf/cm$^2$, from 10 to 9 psi) |

## 4.3.4 Checking radiator water leakage

**■ NOTE**

- **The pressure of the leak test is different for each radiator specification. Thus, refer to the test pressure of each radiator specification to do the leakage test.**



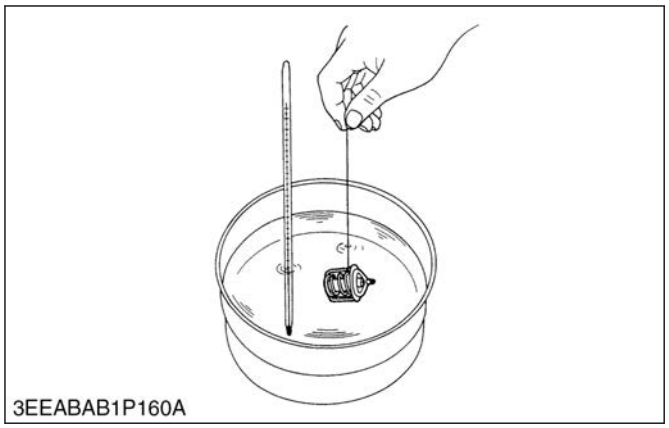

1. Fill a specified quantity of water into the radiator.
2. Set a radiator tester and an adaptor on the radiator. Increase the water pressure to the specified pressure with the radiator tester and adaptor.
3. Check the radiator for water leakage.

4. For water leakages from the pinhole, replace the radiator or repair with the radiator cement.
5. When water leak is too much, replace the radiator.

| | | |
|---|---|---|
| Radiator water leakage test | Factory specification | No leak at specified pressure |

### 4.3.5 Checking opening-temperature of thermostat valve

1. Push down the thermostat valve and put the thread between the valve and the valve seat.
2. Put the thermostat and the thermometer in the container and increase the temperature of the water gradually.
3. Take the thread, and float the thermostat in the water. As the water temperature rises, the valve will open, and the thermostat will separate from the thread. Measure the temperature at this moment.




| | | |
|---|---|---|
| Thermostat valve opening temperature | Factory specification | 74.5 to 78.5 ℃<br>166.1 to 173.3 ℉ |

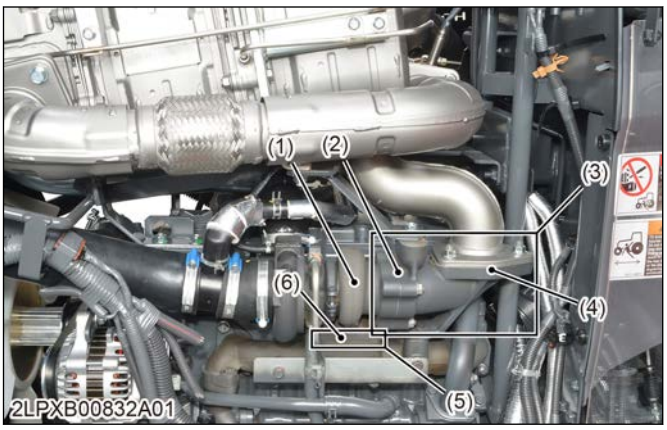
4. Continue to increase the temperature and read the temperature when the valve opens approximately 8 mm (0.3 in.).
5. If the measured value is out of the factory specifications, replace the thermostat.

| | | |
|---|---|---|
| Full opening temperature | Factory specification | 90 ℃<br>194 ℉ |

## 4.4 Turbocharger

### 4.4.1 Checking exhaust gas leakage of turbine side

1. Check the exhaust gas leakage at the exhaust port (3) and the inlet port (5) of the turbine housing (1).
2. If you find a gas leakage, tighten the screws and nuts again or replace the gasket (2), (4), (6) with a new one.




(1) Turbine housing
(2) Gasket
(3) Exhaust port
(4) Gasket
(5) Inlet port
(6) Gasket

### 4.4.2 Checking air leakage of compressor side

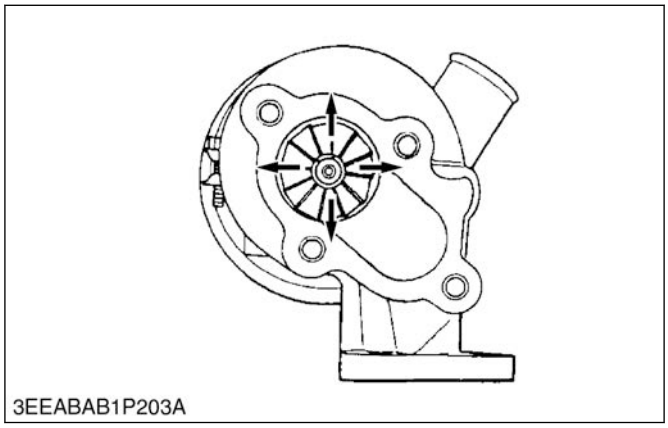
1. Check the inlet hose of the compressor cover (1) for air leakage.


(1) Compressor cover

2. Check the suction side of the inlet hose for loose connections or cracks.
3. If you find an air leakage, change the clamps and / or the inlet hose.

### 4.4.3 Checking radial clearance

1. If the wheel touches the housing, replace the turbocharger assembly with a new one.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## 4.5 EGR system

### 4.5.1 Checking and cleaning EGR system

1. Perform an EGR actuation test.
2. Based on test results, check that the EGR valve gas passage and coolant passage are not clogged.
3. Clean any soot from the gas passage so that it does not damage the EGR valve.
4. Clean the coolant passage by operating it with water.

## 4.6 DPF system

### 4.6.1 Checking the DPF accumulate level

1. Refer to the mechanism section.

RELATED PAGE
6.3 PM warning level on page 3-20

# 5. Disassembling and assembling

## 5.1 Separating engine from tractor (ROPS model)

### 5.1.1 Draining coolant

**WARNING**

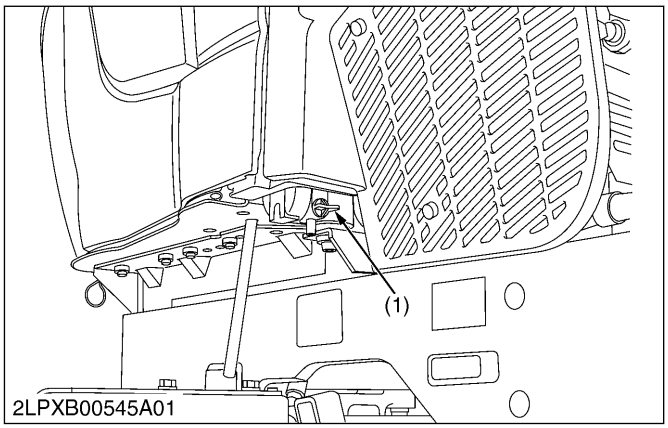
**To avoid personal injury:**

- **Do not remove radiator cap while coolant is hot. When cool, slowly rotate cap to the first stop and allow sufficient time for excess pressure to escape before removing the cap completely.**

**IMPORTANT**

- **Do not start engine without coolant.**
- **Use clean, fresh soft water and anti-freeze to fill the radiator and recovery tank.**
- **When mixing the anti-freeze with water, the anti-freeze mixing ratio is 50%.**
- **Tighten radiator cap securely. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**

1. Stop the engine and let the engine cool down.
2. To drain the coolant, open the radiator drain plug (1), remove the drain plug and remove radiator cap (2). The radiator cap must be removed to completely drain the coolant.



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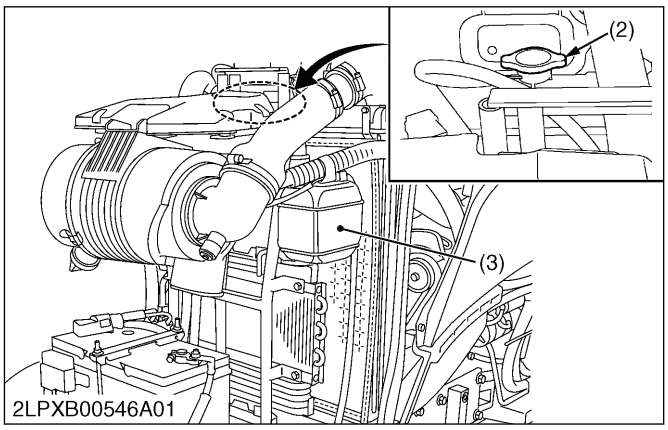

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(1) Drain plug
(2) Radiator cap
(3) Recovery tank

3. After all coolant is drained, reinstall the drain plug (1).
4. Fill with coolant up to the "**FULL**" mark of recovery tank (3).

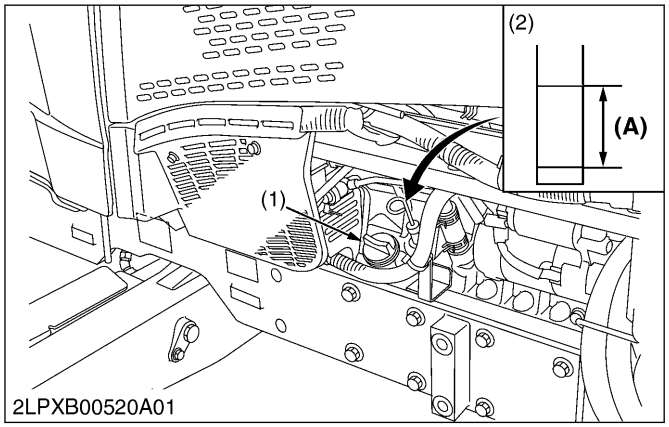
| | |
|---|---|
| Coolant capacity | 10 L<br>10.6 U.S.qts<br>8.8 Imp.qts |

5. Start and operate the engine for a few minutes.
6. Stop the engine, remove the key and let cool.
7. Check coolant level of recovery tank (3) and add coolant if necessary.
8. Properly dispose of used coolant.

## 5.1.2 Draining engine oil

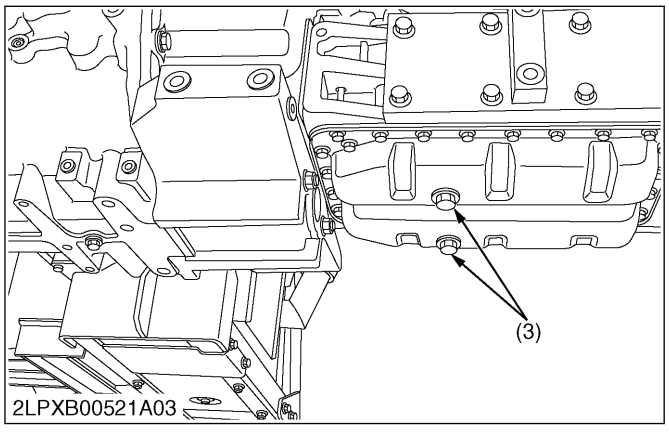
**⚠ CAUTION**
- **Be sure to stop the engine before changing the oil.**
- **Allow engine to cool down sufficiently, oil can be hot and can burn.**

**■ NOTE**
- **Use DPF-compatible oil (CJ-4) for the engine.**




(1) Oil inlet
(2) Dipstick
(A) Oil level is acceptable within this range.

1. To drain the used oil, remove the drain plugs (3) at the bottom of the engine and drain the oil completely into the oil pan.
   All the used oil can be drained out easily when the engine is still warm.
2. After draining reinstall the drain plugs (3).
3. Fill with the new oil up to the upper notch on the dipstick (2).

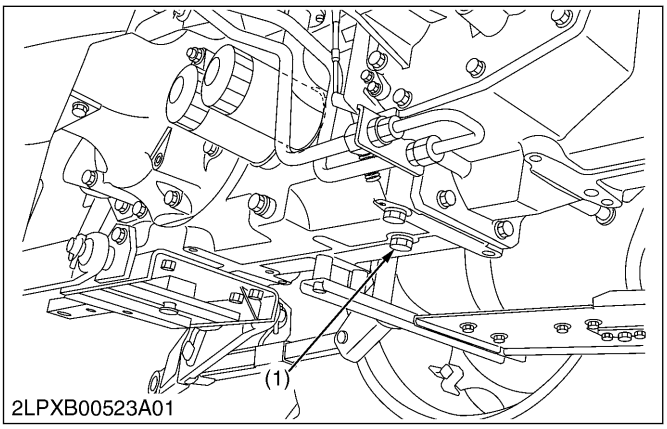



(3) Drain plugs

| | | |
|---|---|---|
| Engine oil (with filter) | Capacity | 10.7 L<br>11.3 U.S.qts<br>9.41 Imp.qts |

## 5.1.3 Draining transmission fluid

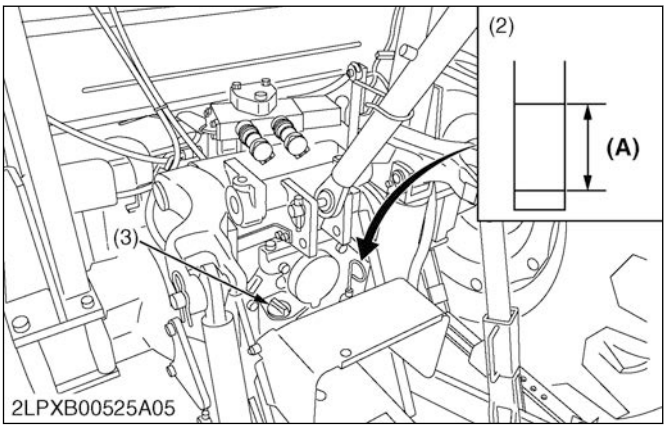
1. Place oil pan underneath the transmission case.
2. Remove the drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1).




(1) Drain plug

**(When reassembling)**

**■ IMPORTANT**
- **For an enhanced ownership experience, we strongly recommend KUBOTA SUPER UDT. Use of other oil may damage the transmission or hydraulic system.**
- **Do not mix different brands of fluid together.**



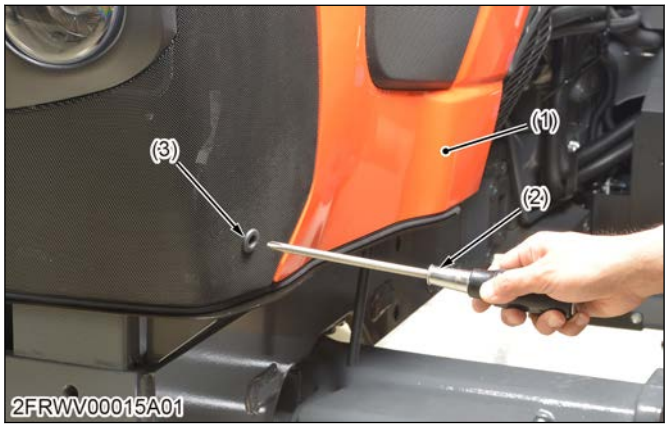

(2) Dipstick
(3) Filling port
(A) Oil level is acceptable within this range.

- Fill up from filling port (3) after removing the filling plug up to the upper notch on the dipstick (2).
- After operating the engine for a few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

| | | |
|---|---|---|
| Transmission fluid | Capacity | 60.0 L<br>16 U.S.gals<br>13 Imp.gals |

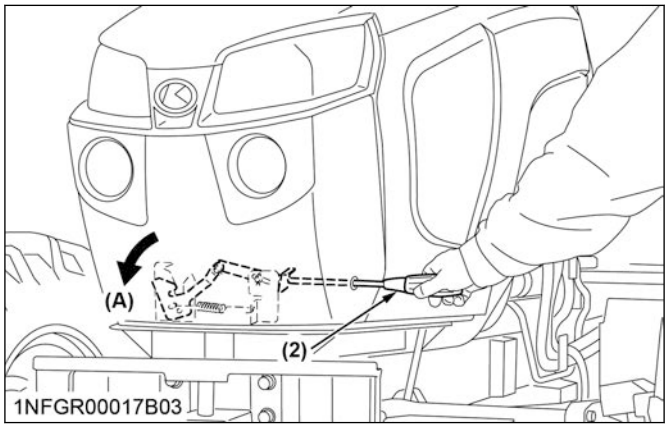
## 5.1.4 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).




(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).




(2) Screwdriver
(A) Unlock position

## 5.1.5 Removing bonnet and cover

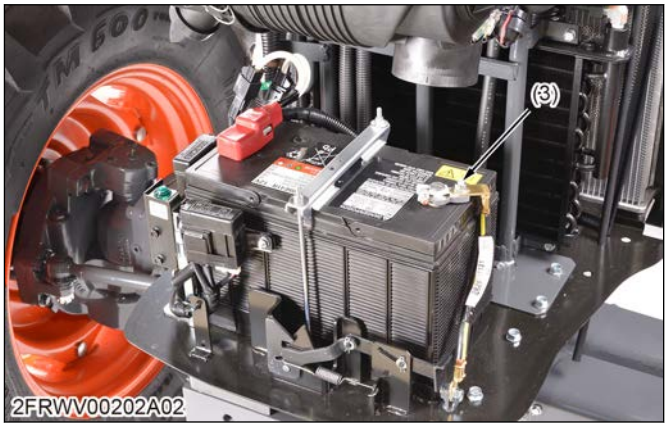
**■ IMPORTANT**

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

1. Remove the side bonnets (2) and the side covers (1) on both sides.

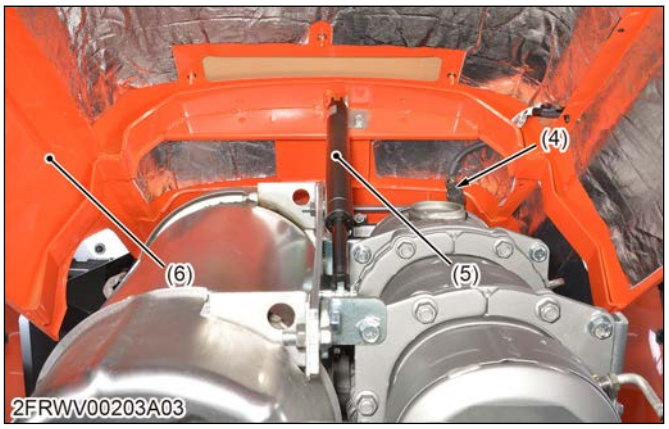

(1) Side cover
(2) Side bonnet

2. Disconnect the negative cable (3) from the battery negative terminal.




(3) Negative cable

3. Disconnect the head light connector (4).
4. Remove the bonnet damper (5).
5. Remove the bonnet (6).

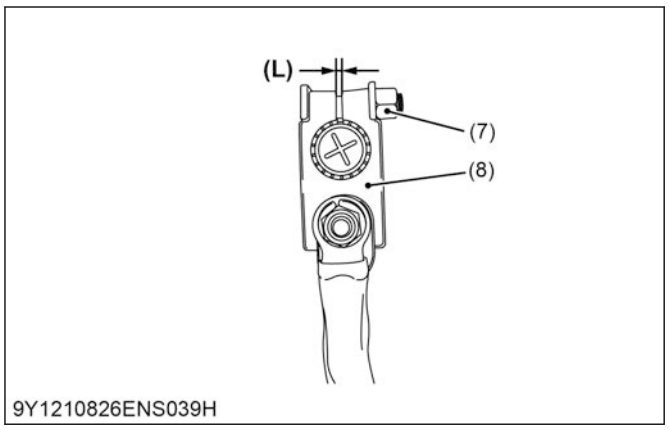



(4) Head light connector
(5) Bonnet damper
(6) Bonnet

**(When reassembling)**

**■ IMPORTANT**

- **Tighten the battery cable terminal nut (7) so that the clearance (L) is within the following chart.**



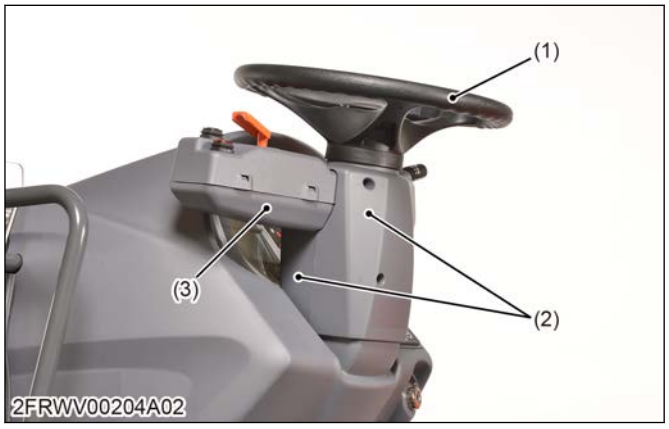

(7) Terminal nut
(8) Battery cable terminal
(L) Clearance between the battery cable terminal

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

- When assembling the bonnet damper (5), be sure that the cylinder parts should be on the backward.

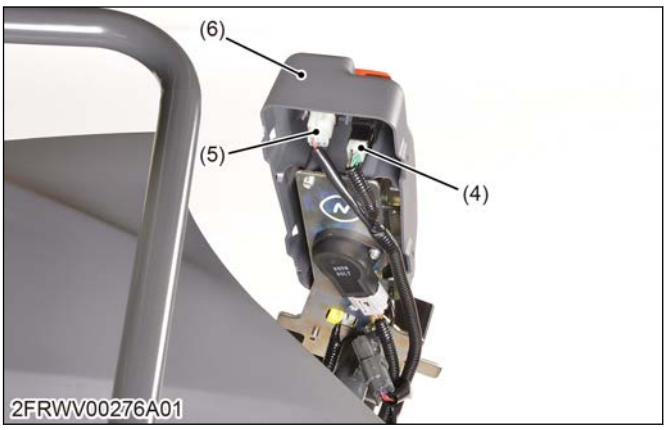
## 5.1.6 Removing steering and panel cover

1. Remove the steering post covers (2).
2. Remove the steering mounting nut and remove the steering (1).
3. Remove the shuttle under cover (3).



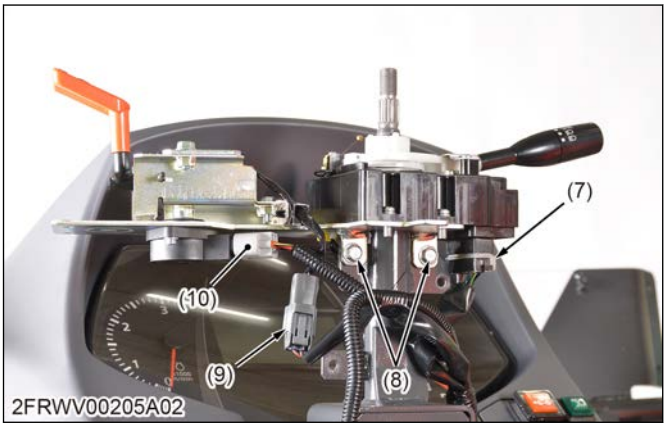

(1) Steering
(2) Steering post cover
(3) Shuttle under cover

4. Disconnect the hazard switch connector (4) and auto differential lock switch connector (5).
5. Remove the shuttle upper cover (6).




(4) Hazard switch connector
(5) Auto differential lock switch connector
(6) Shuttle upper cover

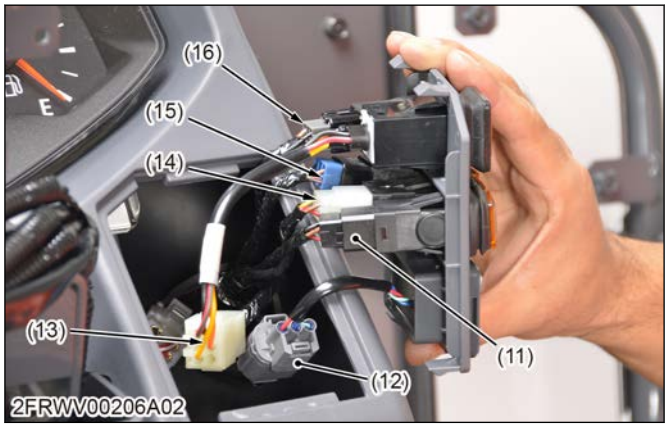
6. Disconnect the combination lever switch connector (7).
7. Disconnect the connector for shuttle lever neutral switch (9) and shuttle lever sensor connector (10).
8. Disconnect the horn connector.
9. Remove the combination lever mounting bolts (8) and then remove the combination lever switch assembly.




(7) Combination lever switch connector
(8) Combination lever switch mounting bolt
(9) Shuttle lever neutral switch connector
(10) Shuttle lever sensor connector

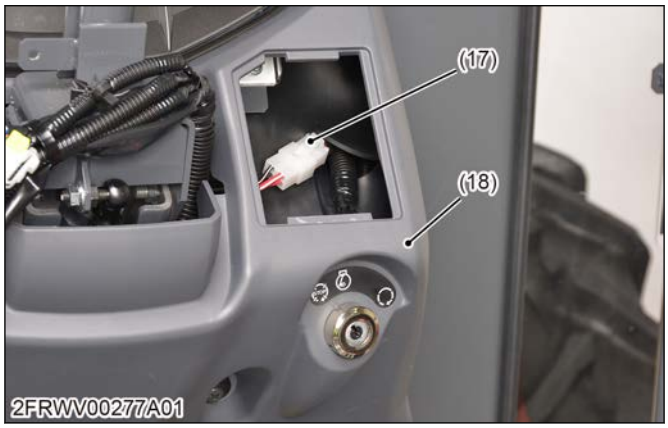
10. Disconnect the meter select switch connector (12) and 4WD switch connector (13).
11. Disconnect the connectors for parked regeneration switch (11) and DPF inhibit switch connector (14).

12. Disconnect the constant RPM management switch connector (15) and front work light switch connector (16).




(11) Parked regeneration switch
(12) Meter select switch connector
(13) 4WD switch connector
(14) DPF inhibit switch connector
(15) Constant RPM management switch connector
(16) Front work light switch connector

13. Disconnect the main switch connector (17).
14. Remove the panel cover (18).




(17) Main switch connector
(18) Panel cover

**(When reassembling)**

- Tighten the steering mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Steering mounting nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

RELATED PAGE
2.2 Steering wheel puller on page 2-79

## 5.1.7 Removing DPF muffler (If necessary)

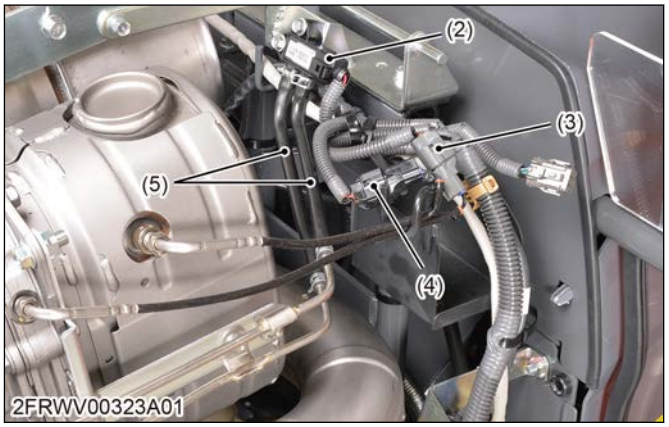
**CAUTION**

- **After operating the engine, DPF muffler is very hot. When disconnecting the connectors, wait a moment for cool down.**

1. Disconnect the exhaust temperature sensor connector (1).

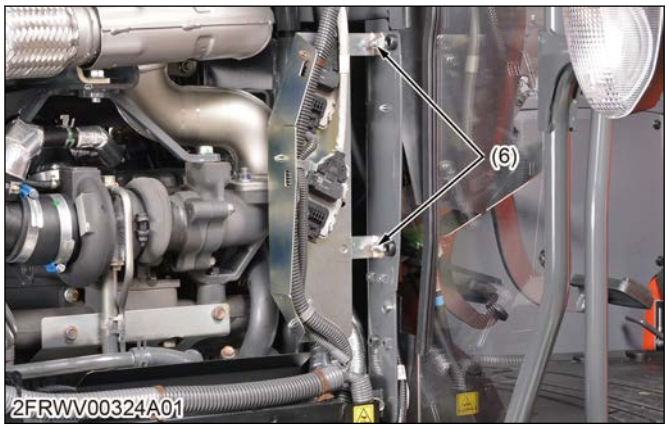

(1) Exhaust temperature sensor (T2)

2. Disconnect the exhaust temperature sensor connectors (3) and (4).
3. Disconnect the differential pressure sensor connector (2).
4. Remove the differential pressure sensor hoses (5).




(2) Differential pressure sensor connector
(3) Exhaust temperature sensor connector (T1)
(4) Exhaust temperature sensor connector (T2)
(5) Differential pressure sensor hose

5. Remove the stay mounting bolts (6).

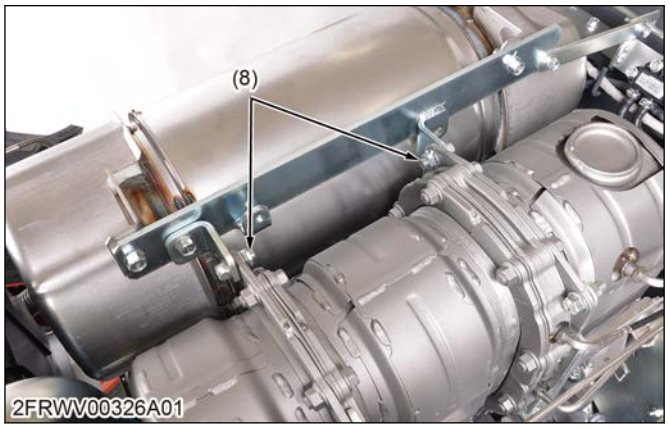


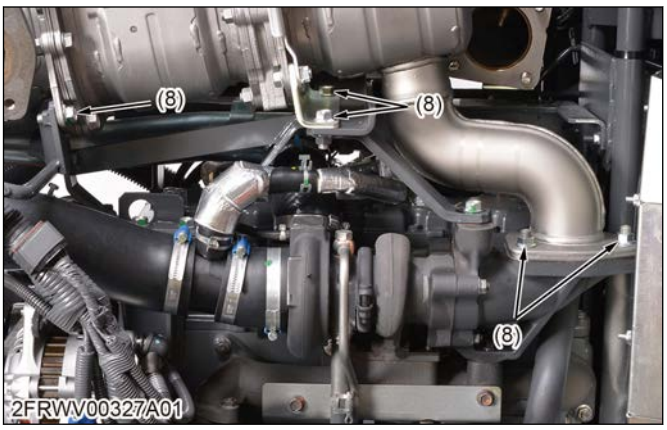

(6) Stay mounting bolt

6. Remove the pipe (7).


(7) Pipe

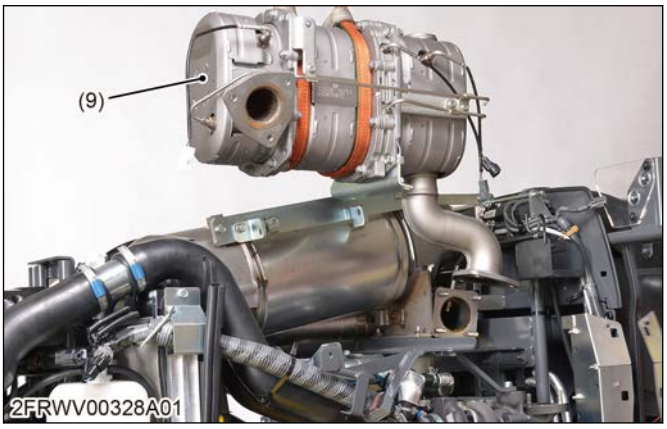
7. Remove the DPF muffler mounting bolts and nuts (8).




(8) DPF muffler mounting bolt and nut

8. Set the nylon sling to the DPF muffler (9).
9. Remove the DPF muffler (9) using hoist.




(9) DPF muffler

**(When reassembling)**

- Parts number of each exhaust gas temperature sensor is different.
  Be attention for the color of connectors.

  **T0:**
  Black [Rear side]

  **T1:**
  Gray

  **T2:**
  White [Front side]
- Firstly, pre-tighten all bolts and nuts around DPF muffler assembly.
  Lastly, tighten all bolts and nut around DPF muffler assembly.
- Replace the gasket with new one.

## 5.1.8 Disassembling filter comp (DPF) (If necessary)

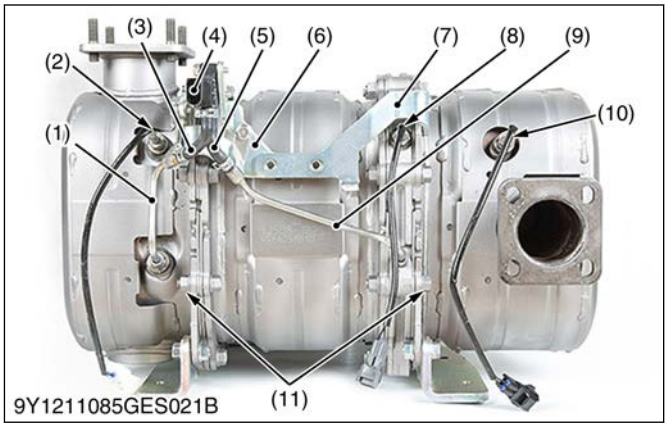
**■ IMPORTANT**

- **Since the DPF that was dropped or given a shock cannot be reused even if there is no damage outwardly, replace it with a new one.**
- **Be sure to loosen the temperature sensor tightening nut or the differential pressure pipe tightening nut with crowfoot wrench to prevent the damage of the sensor or pipe. If it is still hard to loosen, apply the lubricant spray to threaded portion and soak it with lubricant.**

**■ NOTE**

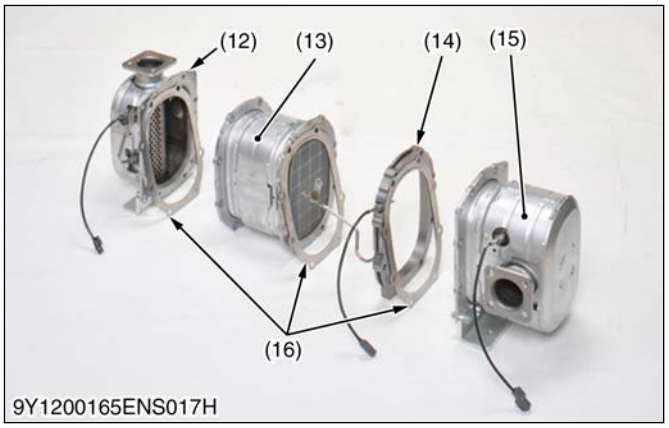
- **Always work in the workshop equipped with a electric hoist (including mobile hoist).**
- **Put a product (engine) on a stable ground, and set the parking brake.**
- **As the DPF muffler full assembly is hot just after the engine shutdown, make sure to start operation after it gets cool.**
- **Make sure not to let any foreign substances enter the opening section during the operation.**
- **Make sure not to damage the DPF muffler full assembly by falling or impact as it contains a ceramic filter.**
- **Before removing the DPF muffler full assembly from a product (engine), connect the diagnosis tool (Diagmaster), check the failure history, and save the project.**
- **Before removing the DPF for cleaning, keep the records of the engine serial number, filter comp (DPF) part number, filter comp (DPF) serial number, catalyst (DOC) part number, catalyst (DOC) serial number, and engine operating time, which are required in preparing the DPF cleaning order form.**
  **Since the engine operating time is recorded in the ECU, check the operating time by connecting the service tool (Diagmaster).**
- **When installing and removing the muffler full assembly (DPF), make sure that the temperature sensor, differential pressure sensor, and differential pressure pipe do not make contact with surrounding parts.**

1. Remove the tube (3), (5) from the differential pressure pipe (1), (9).
2. Remove the differential pressure sensor (4).
3. Remove the DPF stay (6), (7).




(1) Differential pressure pipe
(2) Temperature sensor ($T_2$)
(3) Tube
(4) Differential pressure sensor
(5) Tube
(6) DPF stay
(7) DPF stay
(8) Temperature sensor ($T_1$)
(9) Differential pressure pipe
(10) Temperature sensor ($T_0$)
(11) Filter comp (DPF) mounting screw

4. Loosen the filter comp (DPF) mounting screw (11) and remove the filter comp (DPF) (13).




(12) Body (DPF outlet)
(13) Filter comp (DPF)
(14) Collar (DPF)
(15) Catalyst (DOC)
(16) Gasket

**(When reassembling)**

- Replacing the gaskets (16) with new ones.
- If the differential pressure tube is damaged or cracked, replace it.
- When the differential pressure pipe (1), (9) and temperature sensor (2), (8), (10) is removed, wipe off the anti-seize & lubricating compound, apply a anti-seize & lubricating compound (Bostik, NEVER SEEZ, Pure Nickel Special Grade), and then attach them to their correct position.
- When replacing the differential pressure pipe (1), (9) apply a anti-seize & lubricating compound (Bostik, NEVER SEEZ, Pure Nickel Special Grade), and then attach it to its correct position.
- When replacing the temperature sensor, check that it is coated with anti-seize & lubricating compound, and then attach it to its correct position.
- Tighten the filter comp (DPF) mounting screw, the temperature sensor tightening nut, the differential

pressure pipe tightening nut and the DPF stay bolt to the specified torque with crowfoot wrench.
- After installing the DPF filter assembly, start the engine and make sure that there are no gas leaks.
- Reassemble the filter comp (DPF) (13) in the correct direction by referring the mark "**GAS FLOW→**" (17) (Catalyst (DOC) to Body (DPF Outlet)) on the side showing the flow of exhaust gas.

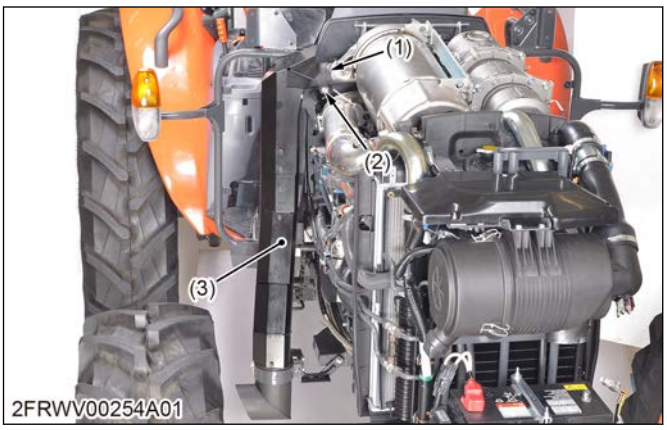

(17) "**GAS FLOW →**"

| | | | |
|---|---|---|---|
| Tightening torque | Filter comp (DPF) mounting screw | | 49 to 55 N·m<br>5.0 to 5.7 kgf·m<br>37 to 41 lbf·ft |
| | Temperature sensor tightening nut | | 25 to 34 N·m<br>2.5 to 3.5 kgf·m<br>18 to 25 lbf·ft |
| | Differential pressure pipe tightening nut | | 16 to 22 N·m<br>1.6 to 2.3 kgf·m<br>12 to 16 lbf·ft |
| | DPF stay bolt | M8 | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | | M10 | 49 to 55 N·m<br>5.0 to 5.7 kgf·m<br>37 to 41 lbf·ft |

## 5.1.9 Removing muffler pipe

**CAUTION**
- **After operating the engine, muffler pipe is very hot. When removing the muffler pipe, wait a moment for cool down.**

1. Remove the muffler pipe cover (3).
2. Loosen the muffler pipe fixing bolt (2) and nut
3. Remove the muffler pipe (1).




(1) Muffler pipe
(2) Muffler pipe fixing bolt
(3) Muffler pipe cover

## 5.1.10 Disconnecting wiring harness for DPF muffler and SCR muffler

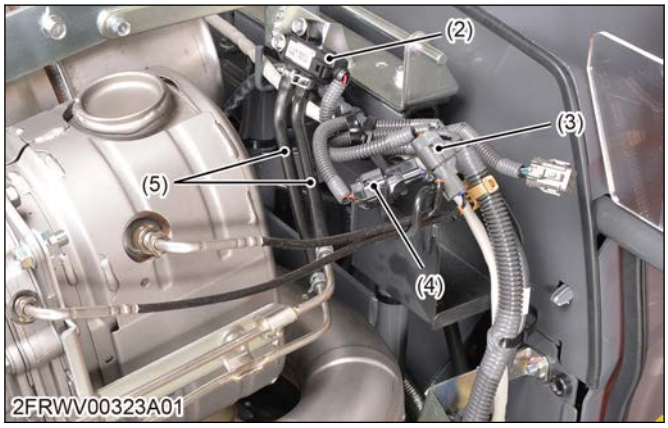
**CAUTION**
- **After operating the engine, muffler is very hot. When disconnecting the connectors, wait a moment for cool down.**

1. Disconnect the exhaust temperature sensor (T2) connector (1).


(1) Exhaust temperature sensor (T2) connector

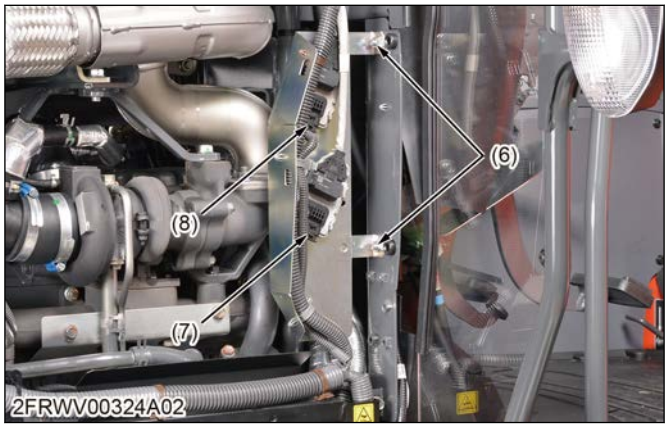
2. Disconnect the exhaust temperature sensor (T0) connector (4) and (T1) connector (3).
3. Disconnect the differential pressure sensor connector (2).

4. Remove the differential pressure sensor hoses (5).



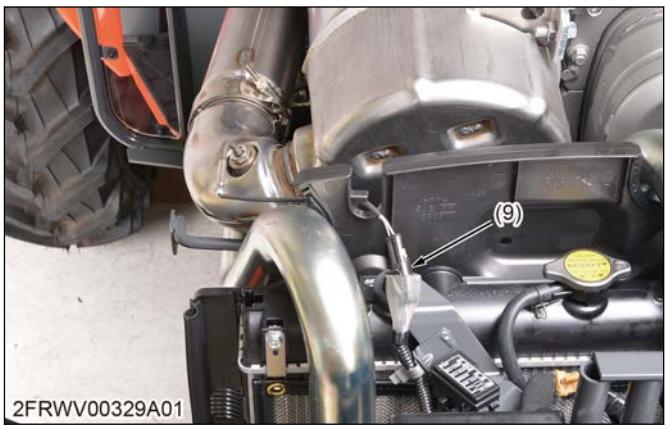

(2) Differential pressure sensor connector
(3) Exhaust temperature sensor (T1) connector
(4) Exhaust temperature sensor (T0) connector
(5) Differential pressure sensor hose

5. Disconnect the pre NOx sensor connector (7) and post NOx sensor connector (8).
6. Remove the NOx sensor stay mounting bolts (6).



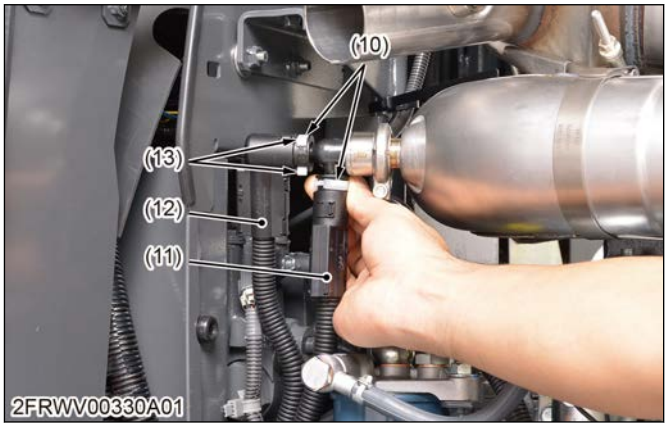

(6) NOx sensor stay mounting bolt
(7) Pre NOx sensor connector
(8) Post NOx sensor connector

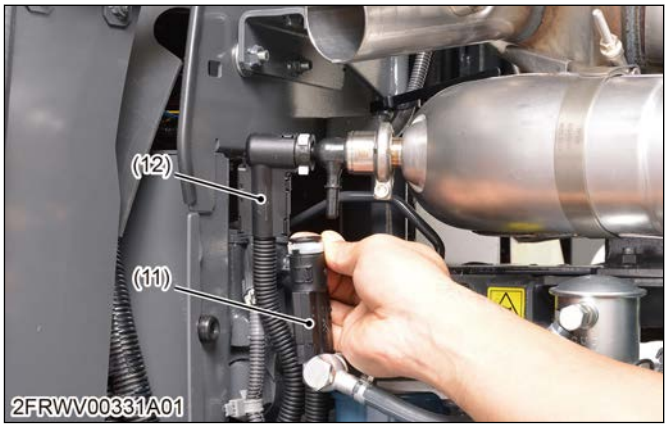
7. Disconnect the SCR temperature sensor connector (9).




(9) SCR temperature sensor connector

8. Pinch the tabs (13) of white clamp (10) and pull out the DEF delivery hose (11).
9. Pinch the tabs (13) of white clamp (10) and pull out the DEF return hose (12).




(10) White clamp
(11) DEF delivery hose
(12) DEF return hose
(13) Tab

10. Disconnect the DEF injector connector (14).


(14) DEF injector connector

**(When reassembling)**

- Parts number of each DPF exhaust gas temperature sensor connector is different. Be sure to connect with same color of connector.

  **T0:**
  Black

  **T1:**
  Gray

  **T2:**
  White
- Each SCR NOx sensor harness color is different.

  **Pre NOx sensor muffler:**
  Black

  **Post NOx sensor:**
  Gray

## 5.1.11 Removing DPF and SCR muffler

**CAUTION**

- **After operating the engine, muffler is very hot. When removing the DPF and SCR muffler, wait a moment for cool down.**

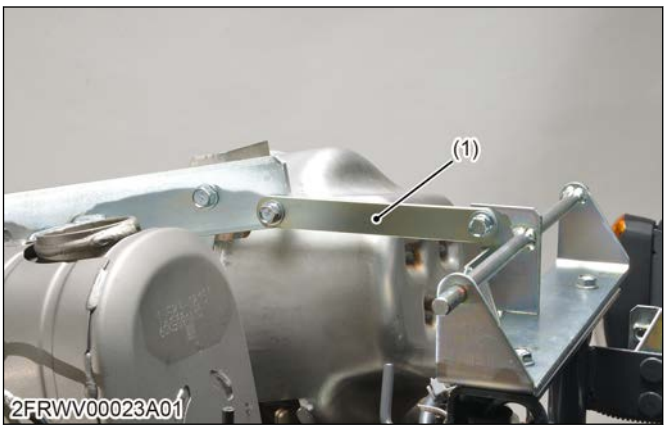
**IMPORTANT**

- **Since muffler assembly is heavy, use the hoist for safety.**

| | |
|---|---|
| DPF and SCR muffler assembly weight | About 66 kg<br>About 150 lbs |

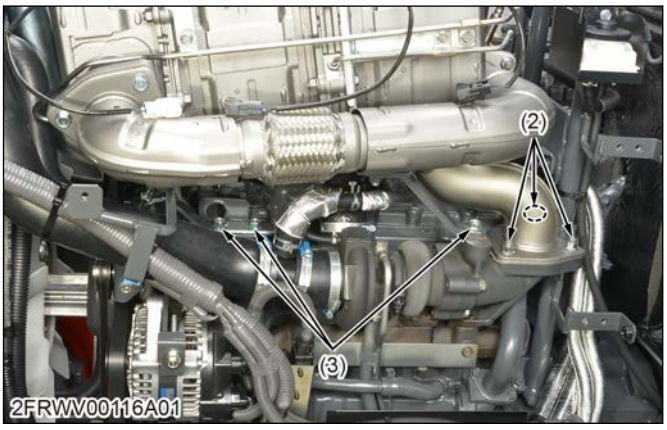
- **Be attention for each sensor when assembling and removing. Each sensor is easy to corrupt by shock.**

1. Prepare the hoist for removing.
2. Remove the support stay (1).




(1) Support stay

3. Remove the DPF muffler mounting nuts (2).
4. Remove the DPF muffler bracket mounting bolts (3).



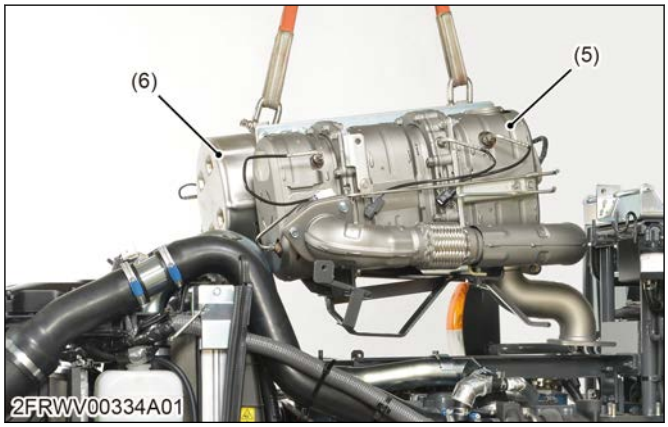

(2) DPF muffler mounting nut
(3) DPF muffler bracket mounting bolt

5. Remove the SCR muffler bracket mounting bolts and nut (4).


(4) SCR muffler bracket mounting bolt and nut

6. Support the DPF muffler (5) and SCR muffler (6) assemblies with nylon sling and hoist.

7. Remove the DPF muffler (5) and SCR muffler (6) assemblies.




(5) DPF muffler (6) SCR muffler

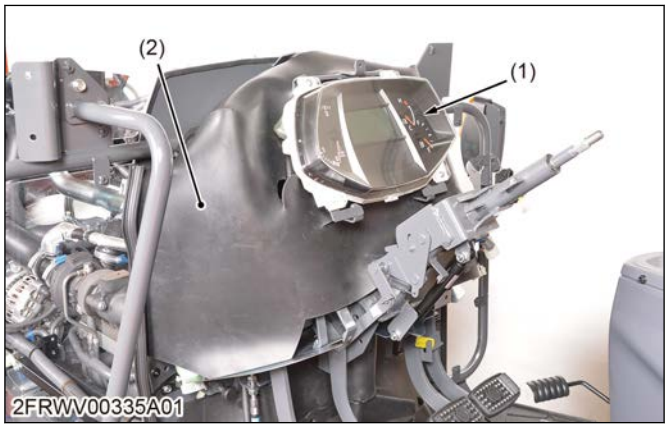
**(When reassembling)**

- Firstly, pre-tighten all bolts and nuts around the DPF and SCR muffler assembly.
- Lastly, tighten the DPF muffler mounting nut, the DPF muffler bracket mounting bolt and the SCR muffler bracket mounting bolt and nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | DPF muffler mounting nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | DPF muffler bracket mounting bolt | 60.8 to 70.6 N·m<br>6.20 to 7.19 kgf·m<br>44.9 to 52.0 lbf·ft |
| | SCR muffler bracket mounting bolt and nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

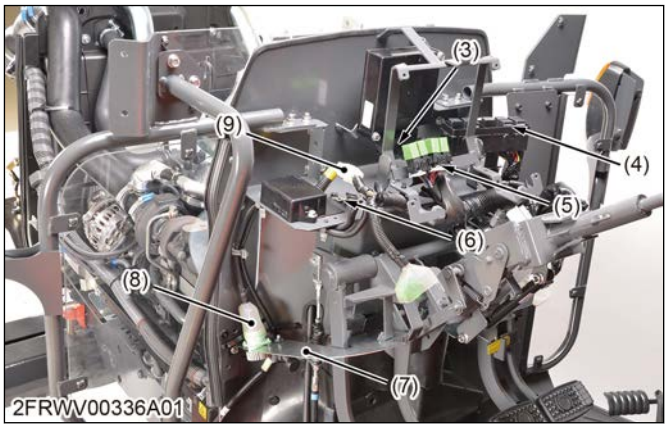
## 5.1.12 Disconnecting wiring harness

1. Remove the meter panel (1).
2. Remove the insulator (2).



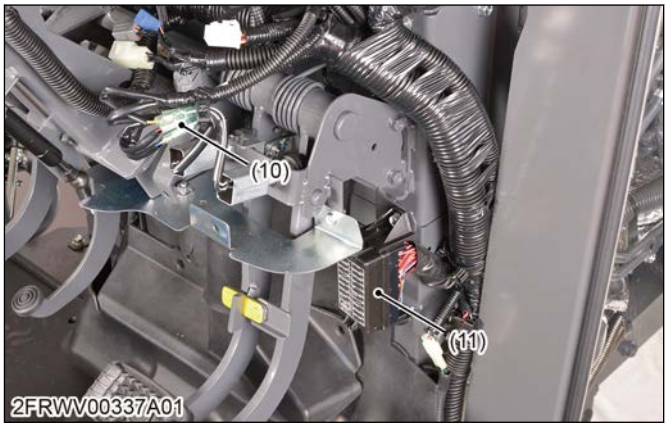

(1) Meter panel (2) Insulator

3. Remove the plate (7).
4. Disconnect the K-OBD connector (8).
5. Disconnect the flasher unit connector (9).
6. Remove the grounding cable mounting bolt (6).
7. Remove the relays (5).
8. Disconnect the tractor ECU connector (3).
9. Remove the relay box (4).




(3) Tractor ECU connector
(4) Relay box
(5) Relay
(6) Grounding cable mounting bolt
(7) Plate
(8) K-OBD connector
(9) Flasher unit connector

10. Disconnect the brake switch connectors (10).
11. Remove the fuse box (11).

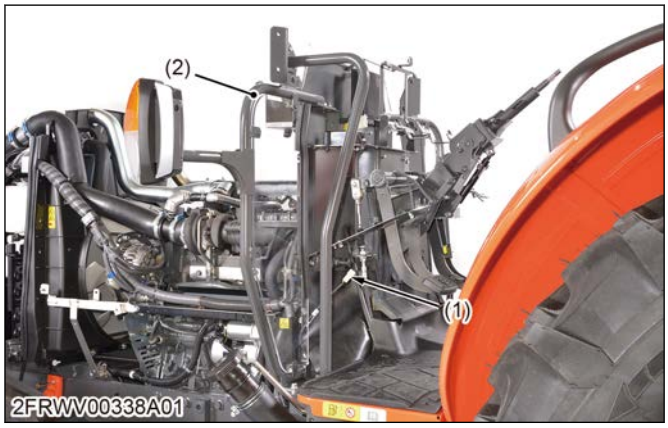



(10) Brake switch connector (11) Fuse box

## 5.1.13 Removing guard

1. Disconnect both side combination lamp connectors (1).

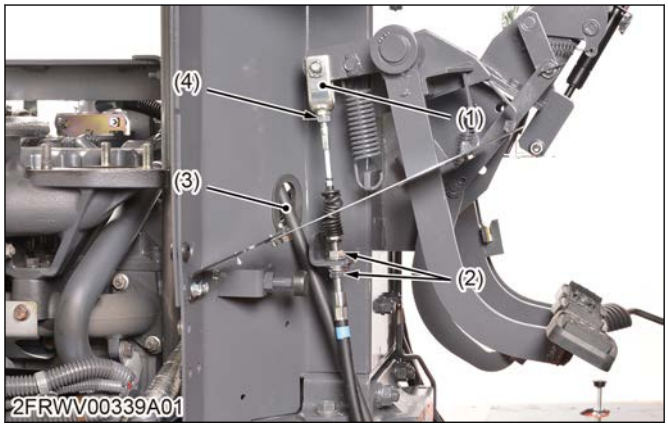
2. Remove both side guards (2).




(1) Combination lamp connector (2) Side guard

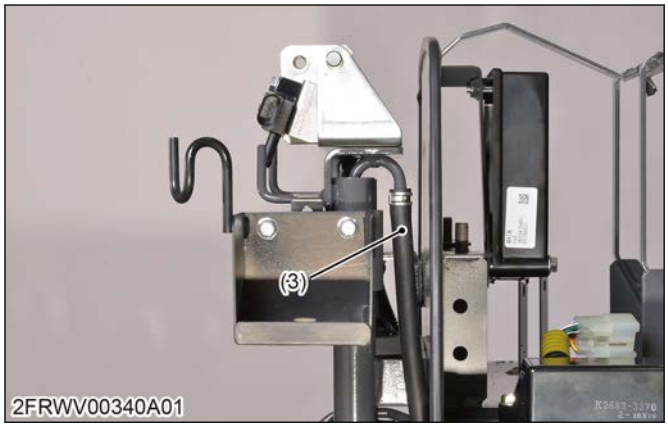
## 5.1.14 Disconnecting clutch cable

1. Loosen the clutch cable mounting nuts 1 (2).
2. Disconnect the clutch cable (1).




(1) Clutch cable
(2) Clutch cable mounting nut 1
(3) DEF tank breather hose
(4) Clutch cable mounting nut 2

3. Disconnect the DEF tank breather hose (3).




(3) DEF tank breather hose

**(When reassembling)**

- Be sure to adjust the clutch cable for the clutch pedal free travel.
- Tighten the clutch cable mounting nuts 1 (2) and 2 (4) to the specified torque.

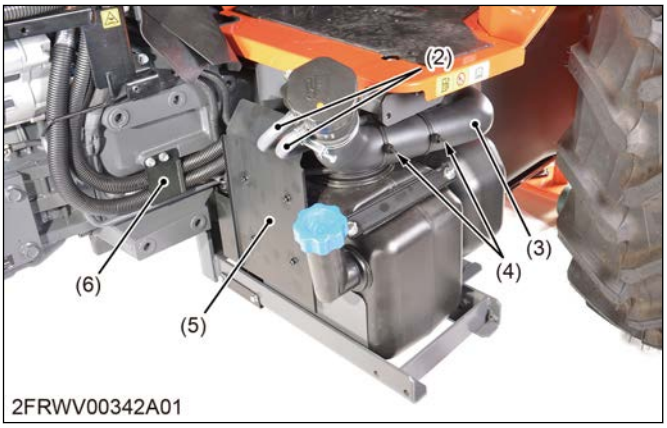
| | | |
|---|---|---|
| Tightening torque | Clutch cable mounting nut 1 | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |
| | Clutch cable mounting nut 2 | 17.7 to 20.6 N·m<br>18.1 to 2.10 kgf·m<br>13.1 to 15.1 lbf·ft |

## 5.1.15 Removing DEF tank

1. Remove the auxiliary step (1).

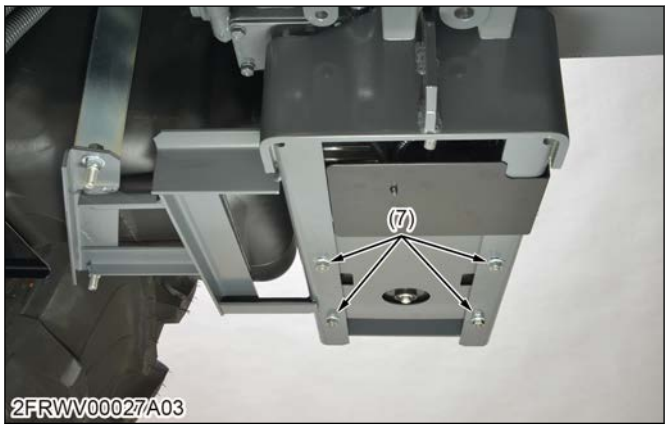

(1) Auxiliary step

2. Disconnect the breather hoses (2).
3. Remove the camps (4) and fuel filling hose (3).
4. Remove the DEF tank protection plate (5) and the hose clamp (6).



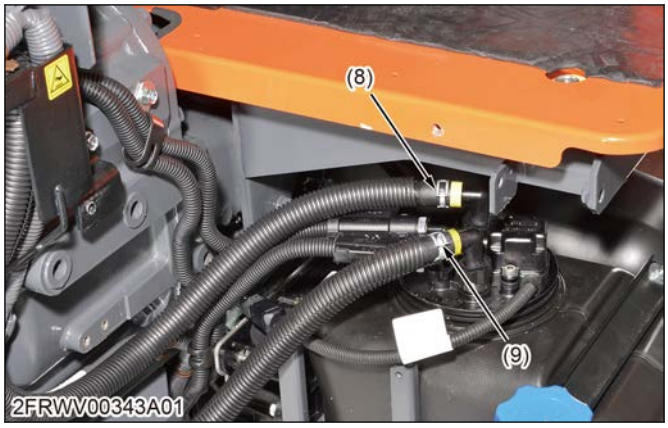

(2) Breather hose
(3) Fuel filling hose
(4) Hose clamp
(5) DEF tank protection plate
(6) Hose clamp

5. Remove the DEF tank mounting nuts (7).



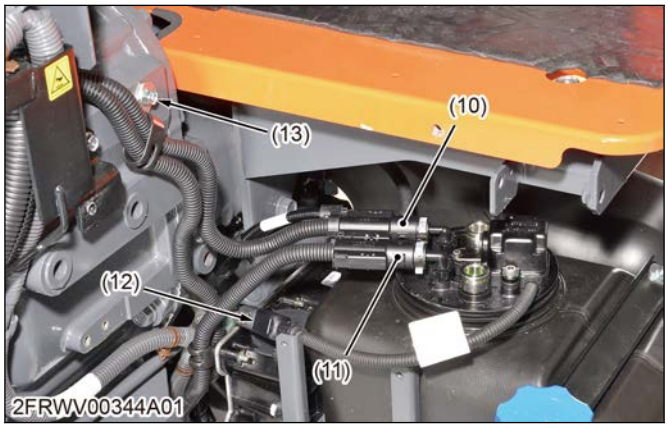

(7) DEF tank mounting nut

6. Disconnect the coolant return hose (9) and coolant hose (8).



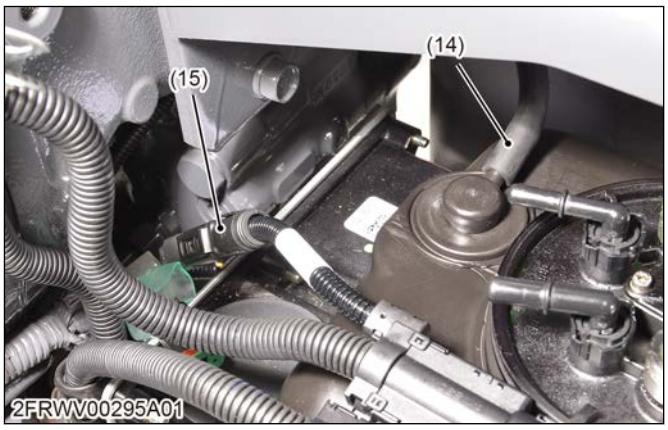

(8) Coolant hose
(9) Coolant return hose

7. Remove the clamp mounting bolt (13).
8. Disconnect the DEF suction hose (11) and DEF return hose (10).
9. Disconnect the DEF tank header unit connector (12).



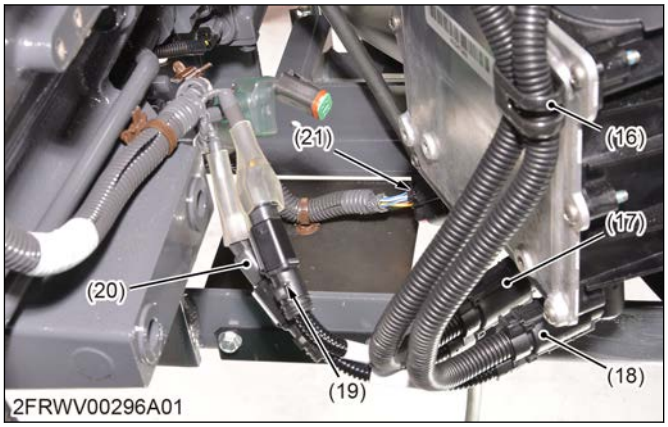

(10) DEF return hose
(11) DEF suction hose
(12) DEF tank header unit connector
(13) Clamp mounting bolt

10. Disconnect the DEF return hose electric heater connector (15).
11. Disconnect the DEF tank breather hose (14).




(14) DEF tank breather hose
(15) DEF return hose electric heater connector

12. Remove the clamp (16).
13. Disconnect the DEF suction hose (18) and DEF suction hose electric heater connector (20).
14. Disconnect the DEF delivery hose (17) and DEF delivery hose electric heater connector (19).
15. Disconnect the DEF pump connector (21).




(16) Clamp
(17) DEF delivery hose
(18) DEF suction hose
(19) DEF delivery hose electric heater connector
(20) DEF suction hose electric heater connector
(21) DEF pump connector

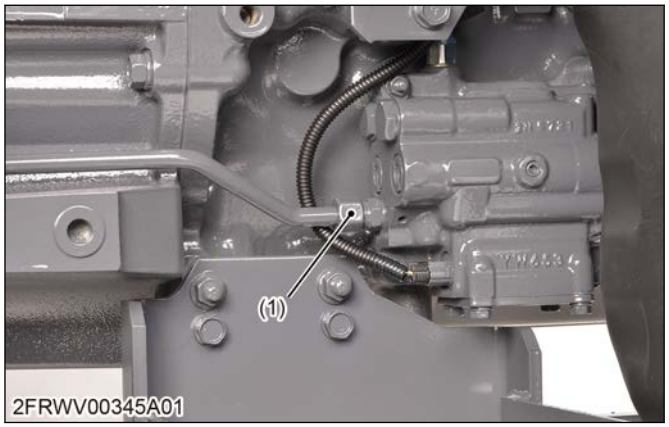
16. Remove the DEF tank.


**(When assembling)**

- Connect the coolant hose (8) with yellow color tape to tractor backward.
- Connect the DEF return hose (10) to backward of DEF tank unit.
- Connect the DEF suction hose (11) to forward of DEF tank unit.
- Connect the DEF delivery hose (17) to backward of DEF pump.
- Connect the DEF suction hose (18) to forward of DEF pump.

## 5.1.16 Disconnecting hydraulic shuttle delivery pipe

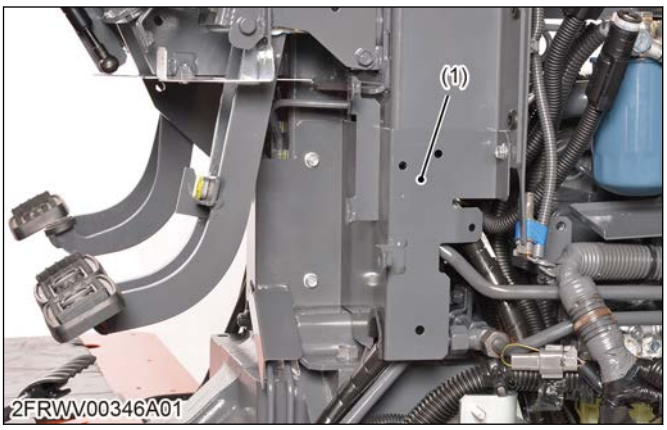
1. Disconnect the hydraulic shuttle delivery pipe (1).




(1) Hydraulic shuttle delivery pipe

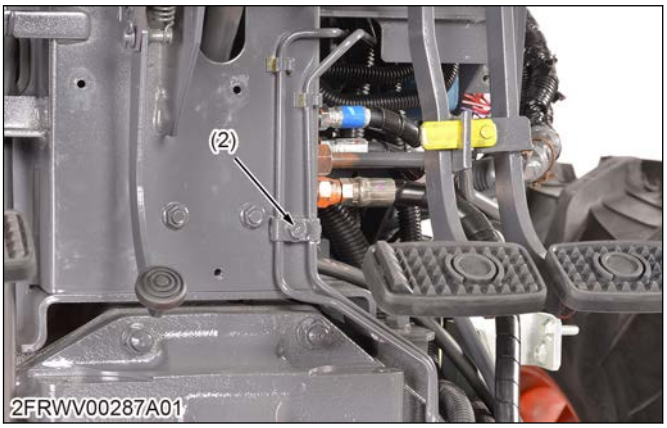
## 5.1.17 Disconnecting brake pipe and hose

1. Remove the steering support cover (1).



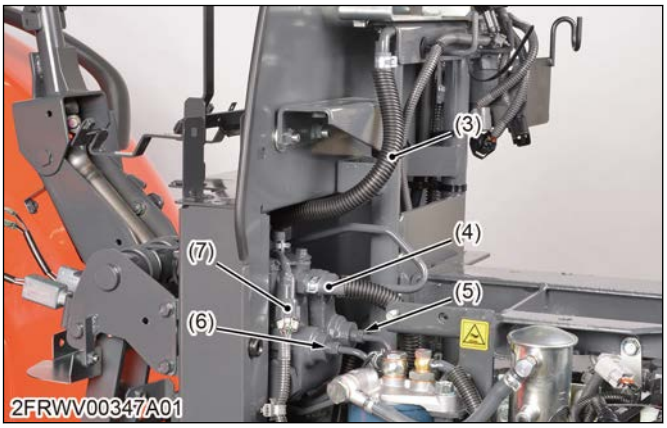

(1) Steering support cover

2. Remove the brake pipe clamp mounting bolt (2).




(2) Brake pipe clamp mounting bolt

3. Disconnect the master cylinder return hose (4).
4. Disconnect the master cylinder connector (7).
5. Disconnect the brake delivery pipe (R.H.) (6).
6. Disconnect the brake delivery pipe (L.H.) (5).
7. Disconnect the master cylinder hose (3).




(3) Master cylinder hose
(4) Master cylinder return hose
(5) Brake delivery pipe (L.H)
(6) Brake delivery pipe (R.H.)
(7) Master cylinder connector

**(When reassembling)**

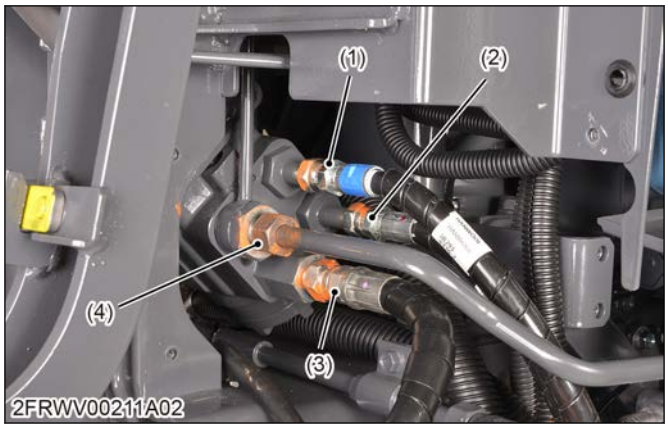
**IMPORTANT**

- **After assembling the brake delivery pipes, be sure to bleed the air from brake system.**
- Tighten the brake delivery pipe retaining nuts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Brake delivery pipe retaining nut | 23 to 27 N·m<br>2.3 to 2.8 kgf·m<br>17 to 20 lbf·ft |

## 5.1.18 Disconnecting steering controller pipe and hose

1. Disconnect the oil cooler pipe (4).
2. Disconnect the power steering delivery hose (3).
3. Disconnect the power steering delivery hose (L.H.) (1) and (R.H.) (2) from the power steering controller.




(1) Power steering delivery hose (L.H.)
(2) Power steering delivery hose (R.H.)
(3) Power steering delivery hose
(4) Oil cooler pipe

**(When reassembling)**

- Connect the power steering delivery hose (L.H.) (1) with blue tape to upper port of power steering controller.
- Tighten the power steering delivery hose (L.H.) (1) and (R.H) (2) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Power steering delivery hose retaining nut | 22.6 to 27.5 N·m<br>2.31 to 2.80 kgf·m<br>16.7 to 20.2 lbf·ft |

## 5.1.19 Removing steering support unit

1. Set the steering support unit (1) with nylon sling and hoist.
2. Remove the steering support mounting bolts.
3. Remove the steering support unit (1).


(1) Steering support unit

## 5.1.20 Disconnecting hydraulic pipe

1. Remove the oil cooler pipe (1).
2. Remove the oil cooler return pipe 1 (2).
3. Remove the shuttle valve delivery pipe (3).

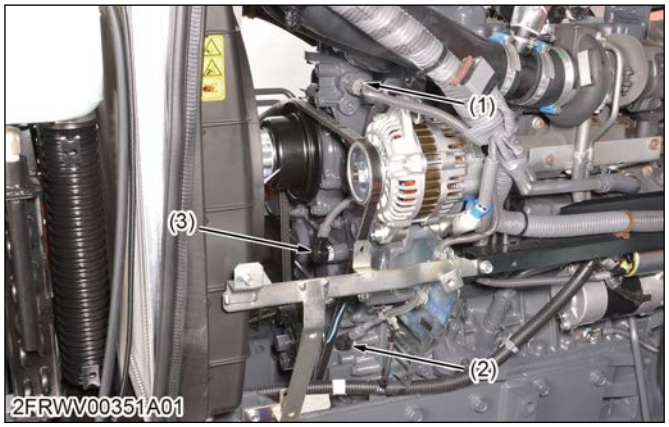


(1) Oil cooler pipe
(2) Oil cooler return pipe 1
(3) Shuttle valve delivery pipe

## 5.1.21 Removing wire harness for left side

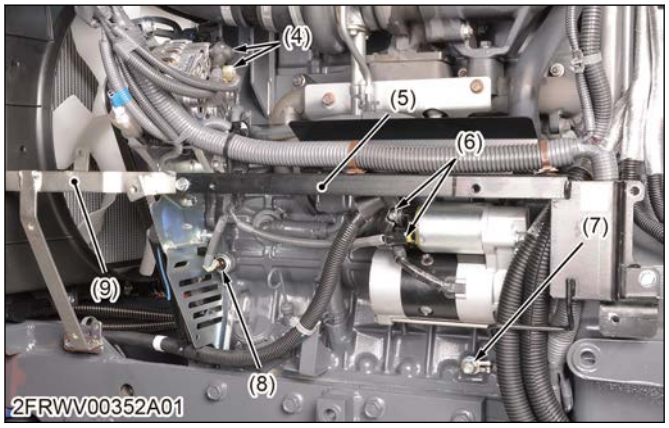
1. Disconnect the coolant temperature sensor connector (1).
2. Disconnect the crankshaft position sensor connector (2).

3. Disconnect the camshaft position sensor connector (3).




(1) Coolant temperature sensor connector
(2) Crankshaft position sensor connector (NE sensor)
(3) Camshaft position sensor connector (G sensor)

4. Remove the wire harness stay (5) and cover stay (9).
5. Disconnect the starter connectors (6).
6. Disconnect the grounding cable mounting bolt (7).
7. Disconnect the oil pressure switch connector (8).
8. Disconnect the alternator connectors (4).




(4) Alternator connector
(5) Wire harness stay
(6) Starter connector
(7) Grounding cable mounting bolt
(8) Oil pressure switch connector
(9) Cover stay

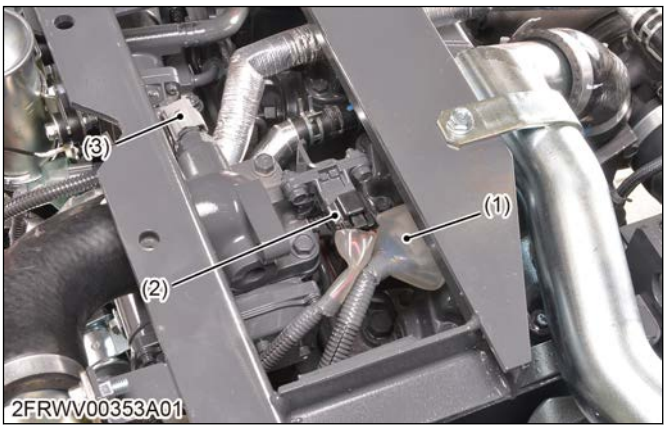
**(When reassembling)**

- Do not confuse the sensor position between crankshaft position sensor (2) and camshaft position sensor (3).
- Be sure the connector cover of crankshaft position sensor (2) and camshaft position sensor (3) is connected surely.
- Be sure the connector color should be as follows.
  - Oil pressure switch connector (8) → White
  - Starter connector (6) → Black
- Tighten the alternator terminal nut and the starter B terminal mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Alternator terminal nut | 9.80 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.23 to 8.33 lbf·ft |
| | Starter B terminal mounting nut | 9.80 to 11.8 N·m<br>1.00 to 1.20 kgf·m<br>7.23 to 8.70 lbf·ft |

## 5.1.22 Removing wire harness for center section

1. Disconnect the injector harness connector (1).
2. Disconnect the boost pressure sensor connector (2).
3. Disconnect the intake air temperature sensor connector (3).



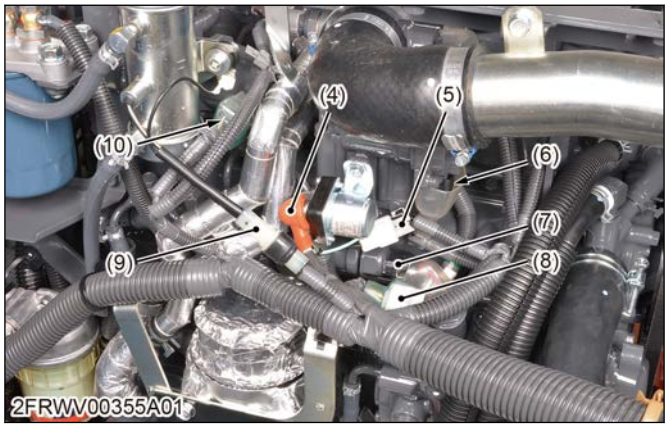

(1) Injector harness connector
(2) Boost pressure sensor connector
(3) Intake air temperature connector

## 5.1.23 Removing wire harness for right side

1. Disconnect the coolant valve connector (2).
2. Disconnect the water separator connector (3).
3. Disconnect the pressure discharge valve connector (1).


(1) Pressure discharge valve connector
(2) Coolant valve connector
(3) Water separator connector

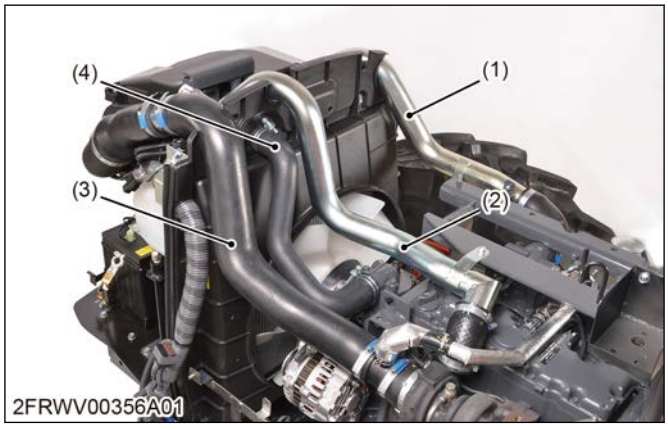
4. Disconnect the feed pump connector (9).
5. Disconnect the EGR valve connector (10).
6. Disconnect the intake air heater relay terminal mounting nut (4).
7. Disconnect the intake air heater relay connector (5).
8. Disconnect the intake throttle valve connector (6).
9. Disconnect the supply pump connector (8).
10. Disconnect the rail pressure sensor connector (7).




(4) Intake air heater relay terminal mounting nut
(5) Intake air heater relay connector
(6) Intake throttle valve connector
(7) Rail pressure sensor connector
(8) Supply pump connector (PCV)
(9) Feed pump connector
(10) EGR valve connector

## 5.1.24 Removing air cleaner hose and pipe

1. Disconnect the air inlet hose (3).
2. Loosen the bands and disconnect the inter cooler inlet pipe (2).
3. Loosen the hose bands and disconnect the coolant hose (4).
4. Loosen the bands and disconnect the inter cooler outlet pipe (1).




(1) Inter cooler outlet pipe
(2) Inter cooler inlet pipe
(3) Air inlet hose
(4) Coolant hose

**(When assembling)**

- Be sure the bands of air inlet hose are connected securely.
- Be sure the bands of inter cooler hoses are connected securely.

| | | |
|---|---|---|
| Tightening torque | Hose band (Air inlet and inter cooler) | 4.0 to 5.0 N·m<br>0.41 to 0.50 kgf·m<br>3.0 to 3.6 lbf·ft |

## 5.1.25 Removing power steering hose

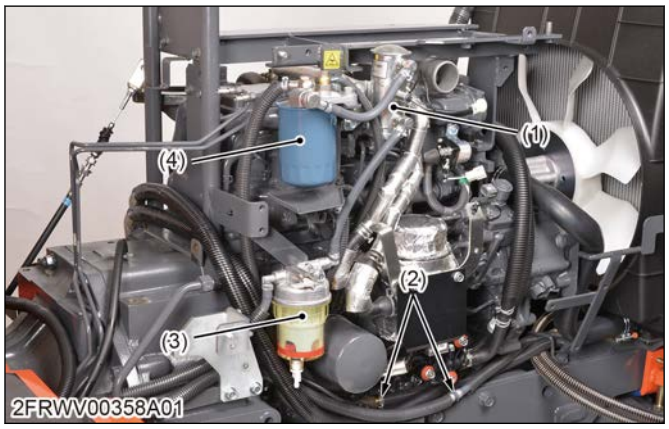
1. Remove the clamps (1), (2).
2. Disconnect the power steering hose (R.H.) (3).
3. Disconnect the power steering hose (L.H.) (4).


(1) Clamp
(2) Clamp
(3) Power steering hose (R.H.)
(4) Power steering hose (L.H.)

## 5.1.26 Removing fuel filter and feed pump

1. Disconnect the fuel hoses and remove the sedimenter (3).
2. Disconnect the fuel hoses and remove the fuel filter (4).
3. Disconnect the fuel hoses and remove the fuel feed pump (1).

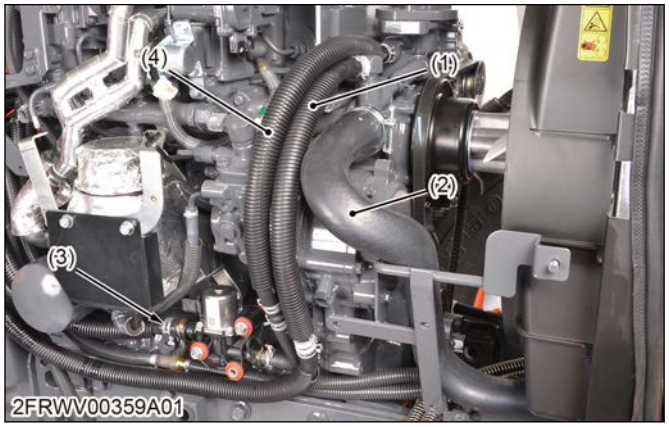
4. Disconnect the fuel cooler hoses (2).




(1) Feed pump
(2) Fuel cooler hose
(3) Sedimenter
(4) Fuel filter

## 5.1.27 Removing coolant hose

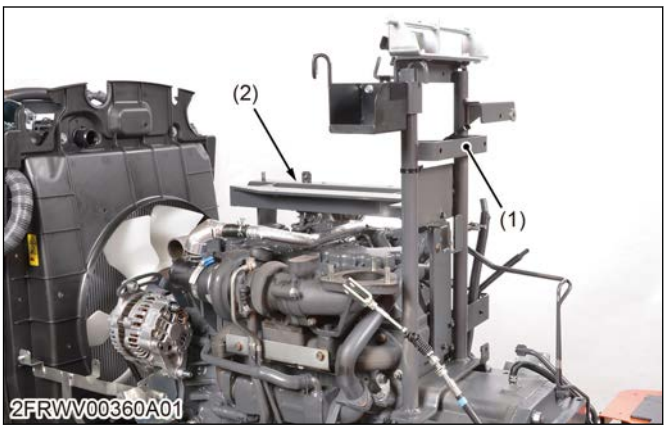
1. Remove the radiator lower hose (2).
2. Remove the coolant hose (1).
3. Remove the coolant inlet hose (4) and outlet hose (3).




(1) Coolant hose
(2) Radiator lower hose
(3) Coolant outlet hose
(4) Coolant inlet hose

## 5.1.28 Removing bonnet support

1. Remove the muffler bracket (2).
2. Remove the bonnet support (1).

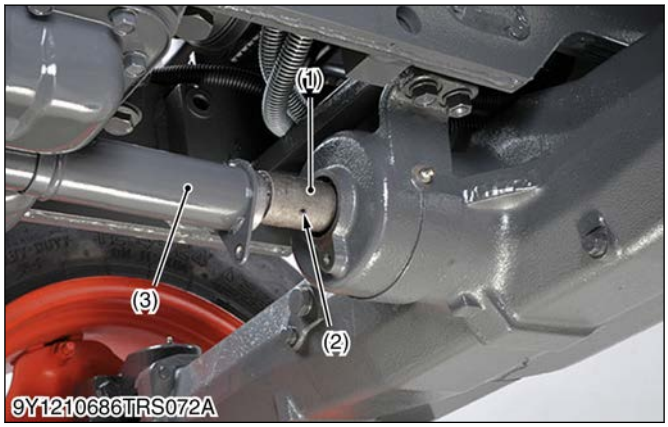


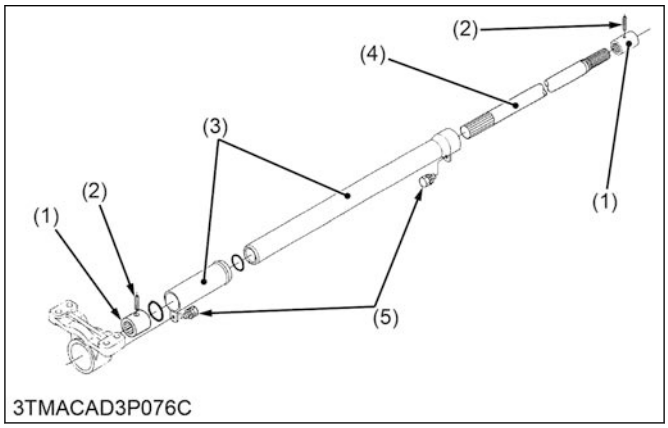

(1) Bonnet support
(2) Muffler bracket

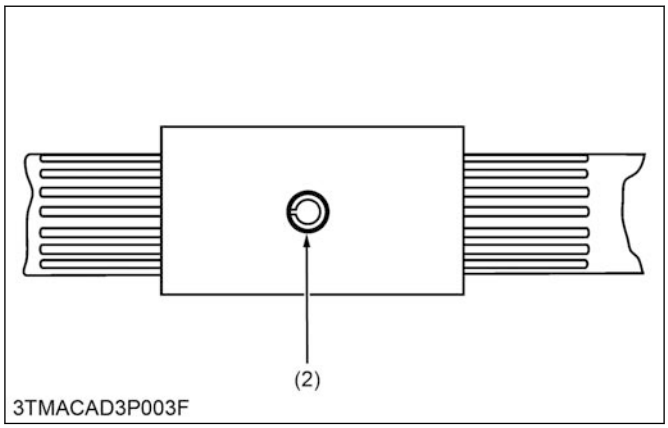
## 5.1.29 Removing propeller shaft

1. Slide the propeller shaft covers (3) after removing the screws (5).
2. Tap out the roll pins (2).

3. Slide the couplings (1) and remove the propeller shaft (4).




(1) Coupling
(2) Roll pin
(3) Propeller shaft cover
(4) Propeller shaft
(5) Screw

**(When reassembling)**
- Apply the grease to the splines of couplings (1).
- Tap in the roll pins (2) as shown in the figure.

## 5.1.30 Installing front axle rocking restrictor

1. Chock the wheels and set the front axle rocking restrictor (1) to the front axle frame on both sides.


(1) Front axle rocking restrictor

RELATED PAGE
2.12 Front axle rocking restrictor on page 2-81

## 5.1.31 Separating engine from clutch housing

1. Make sure the engine and clutch housing case are securely mounted on the disassembling stands.
2. Prepare the hoist for separating.
3. Remove the engine mounting bolts, and separate the engine from the clutch housing.


**(When reassembling)**
- Apply the molybdenum disulphide (Three Bond 1901 or its equivalents) to the splines of damper disc boss.
- Apply the liquid gasket (Three Bond 1141, 1211 or its equivalents) to the joint face of the engine and clutch housing.
- Tighten the engine and clutch housing mounting bolt (M14, 9T) and the engine and clutch housing mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Engine and clutch housing mounting bolt (M14, 9T) | 166.7 to 196.1 N·m<br>17.0 to 19.99 kgf·m<br>123.0 to 144.6 lbf·ft |
| | Engine and clutch housing mounting nut | 123.6 to 147.1 N·m<br>12.61 to 15.00 kgf·m<br>91.17 to 108.4 lbf·ft |

## 5.1.32 Removing damper disc

1. Remove the damper disc mounting bolts and the damper disc (1).


(1) Damper disc

**(When reassembling)**

- Direct the shorter end of the damper disc boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or its equivalents) to the spline.
- Tighten the damper disc mounting bolts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Damper disc mounting bolt | 48 to 55 N·m<br>4.9 to 5.7 kgf·m<br>36 to 41 lbf·ft |

## 5.1.33 Separating engine from front axle frame

**NOTE**

- **When you replace the engine with a new one, record the following items for incorporating with its new engine.**
  - **Engine serial number**
  - **Engine parts number**
  - **DPF muffler full assembly serial number**
  - **SCR muffler full assembly serial number**

1. Set the disassembling stands under the front axle frame and engine.
2. Remove the engine mounting bolts (1).


(1) Engine mounting bolt

3. Remove the engine from front axle frame.


**(When reassembling)**

- Tighten the engine mounting bolt to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Engine mounting bolt (M14, 9T, UBS) | 167 to 196 N·m<br>17.0 to 20.0 kgf·m<br>123 to 144 lbf·ft |

RELATED PAGE
1.21 Engine stand on page 2-78

# 5.2 Separating engine from tractor (Cabin model)

## 5.2.1 Draining coolant

**WARNING**

**To avoid personal injury:**

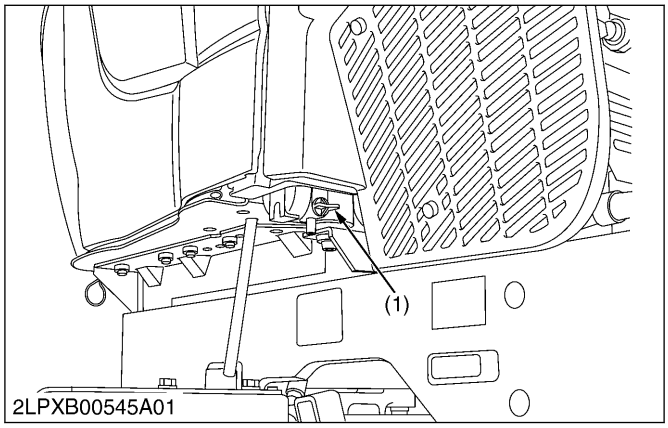
- **Do not remove radiator cap while coolant is hot. When cool, slowly rotate cap to the first stop and allow sufficient time for excess pressure to escape before removing the cap completely.**

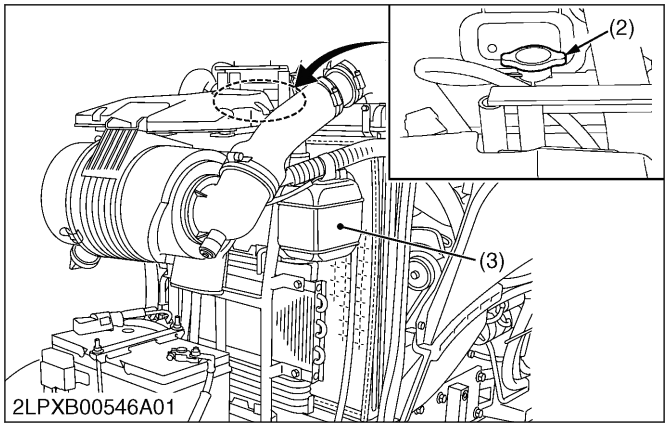
**IMPORTANT**

- **Do not start engine without coolant.**

- **Use clean, fresh soft water and anti-freeze to fill the radiator and recovery tank.**
- **When mixing the anti-freeze with water, the anti-freeze mixing ratio is 50%.**
- **Tighten radiator cap securely. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**

1. Stop the engine and let the engine cool down.
2. To drain the coolant, open the radiator drain plug (1), remove the drain plug and remove radiator cap (2). The radiator cap must be removed to completely drain the coolant.




(1) Drain plug
(2) Radiator cap
(3) Recovery tank

3. After all coolant is drained, reinstall the drain plug (1).
4. Fill with coolant up to the "**FULL**" mark of recovery tank (3).

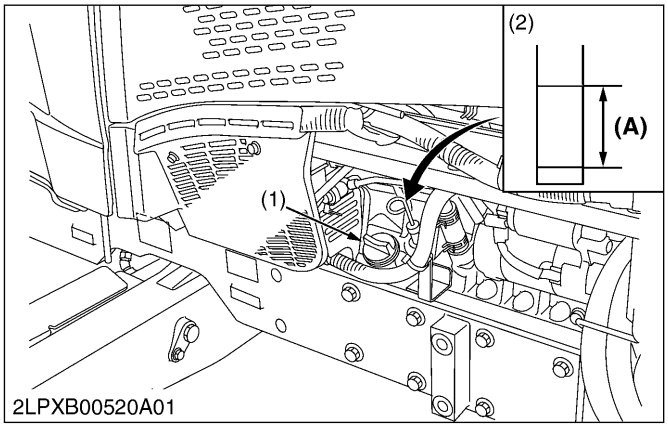
| | |
|---|---|
| Coolant capacity | 10 L<br>10.6 U.S.qts<br>8.8 Imp.qts |

5. Start and operate the engine for a few minutes.
6. Stop the engine, remove the key and let cool.
7. Check coolant level of recovery tank (3) and add coolant if necessary.
8. Properly dispose of used coolant.

## 5.2.2 Draining engine oil

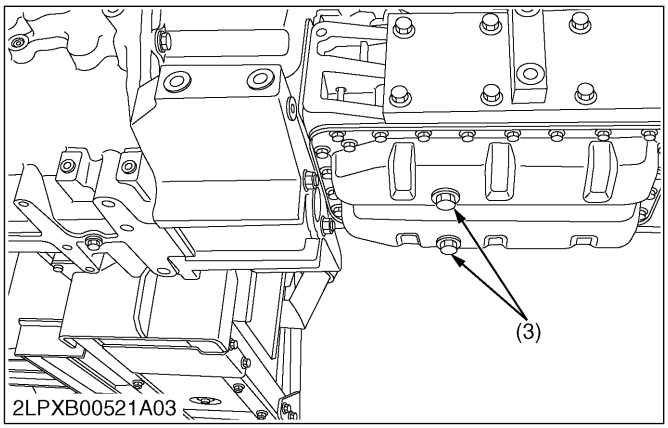
**⚠ CAUTION**
- **Be sure to stop the engine before changing the oil.**
- **Allow engine to cool down sufficiently, oil can be hot and can burn.**

**■ NOTE**
- **Use DPF-compatible oil (CJ-4) for the engine.**




(1) Oil inlet
(2) Dipstick
(A) Oil level is acceptable within this range.

1. To drain the used oil, remove the drain plugs (3) at the bottom of the engine and drain the oil completely into the oil pan.
   All the used oil can be drained out easily when the engine is still warm.
2. After draining reinstall the drain plugs (3).
3. Fill with the new oil up to the upper notch on the dipstick (2).

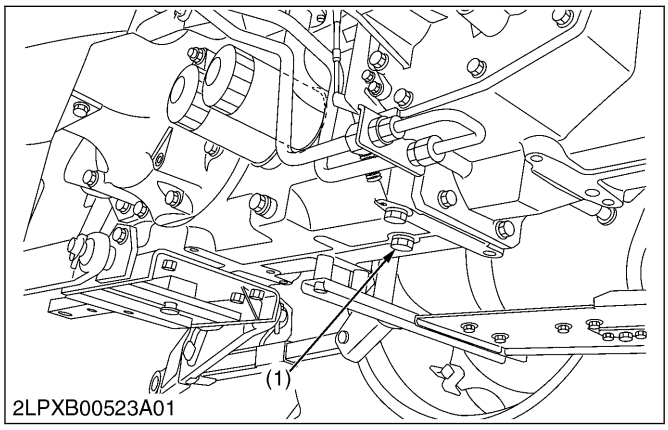



(3) Drain plugs

| | | |
|---|---|---|
| Engine oil (with filter) | Capacity | 10.7 L<br>11.3 U.S.qts<br>9.41 Imp.qts |

## 5.2.3 Draining transmission fluid

1. Place oil pan underneath the transmission case.
2. Remove the drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1).

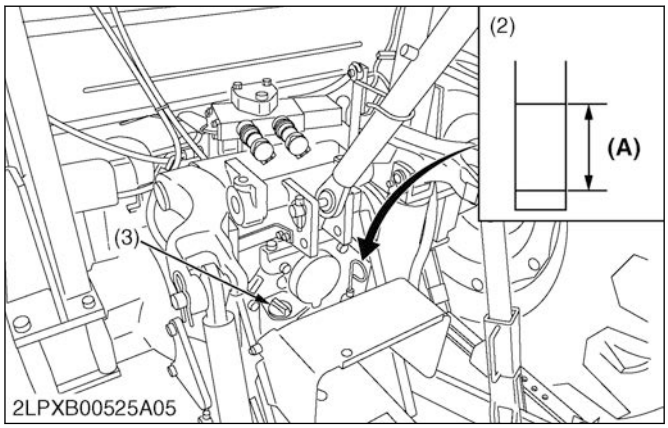



(1) Drain plug

**(When reassembling)**

**■ IMPORTANT**

- **For an enhanced ownership experience, we strongly recommend KUBOTA SUPER UDT. Use of other oil may damage the transmission or hydraulic system.**
- **Do not mix different brands of fluid together.**



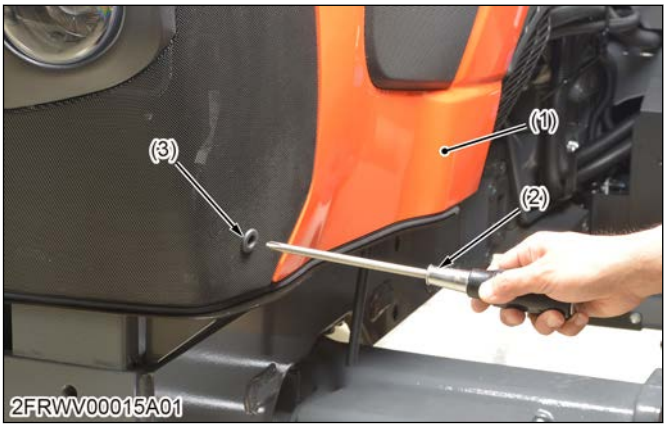

(2) Dipstick
(3) Filling port
(A) Oil level is acceptable within this range.

- Fill up from filling port (3) after removing the filling plug up to the upper notch on the dipstick (2).
- After operating the engine for a few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

| | | |
|---|---|---|
| Transmission fluid | Capacity | 60.0 L<br>16 U.S.gals<br>13 Imp.gals |

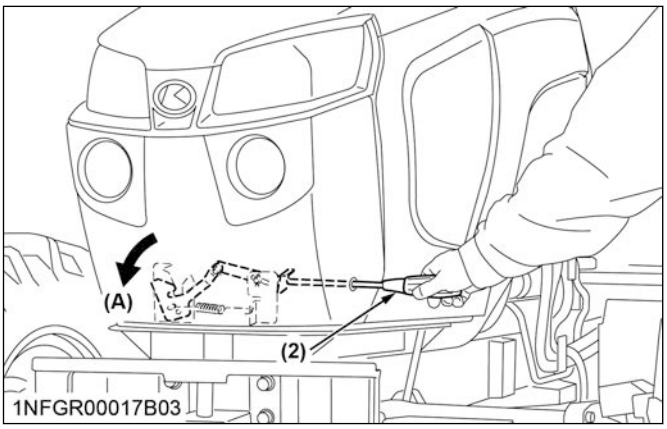
## 5.2.4 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).




(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).




(2) Screwdriver
(A) Unlock position

## 5.2.5 Removing bonnet and cover

**■ IMPORTANT**

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

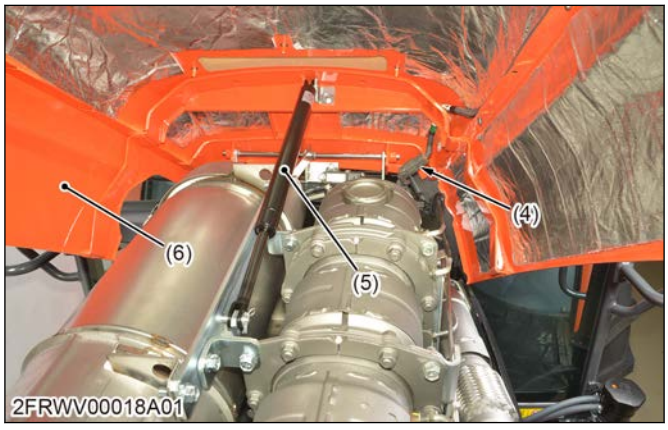
1. Remove the side bonnets (2) and the side covers (1) on both sides.


(1) Side cover (2) Side bonnet

2. Disconnect the negative cable (3) from the battery negative terminal .


(3) Negative cable

3. Disconnect the head light connector (4).
4. Remove the bonnet damper (5).
5. Remove the bonnet (6).

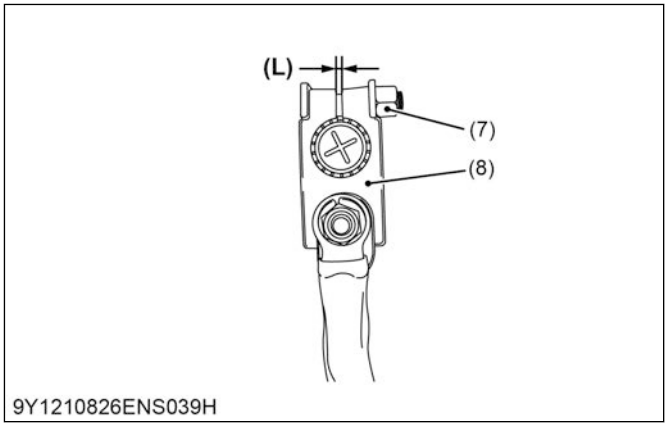



(4) Head light connector (6) Bonnet
(5) Bonnet damper

**(When reassembling)**

**IMPORTANT**

- **Tighten the battery cable terminal nut (7) so that the clearance (L) is within the following chart.**




(7) Terminal nut (L) Clearance between the battery cable terminal
(8) Battery cable terminal

- When assembling the bonnet damper (5), be sure that the cylinder parts should be on the backward.

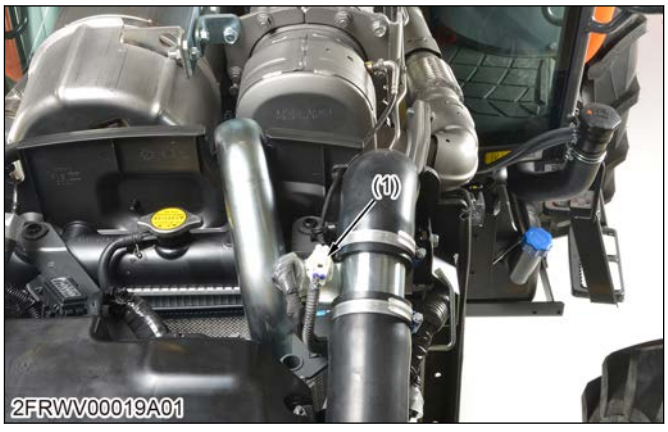
| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

## 5.2.6 Removing DPF muffler (If necessary)

**CAUTION**

- **After operating the engine, DPF muffler is very hot. When disconnecting the connectors, wait a moment for cool down.**

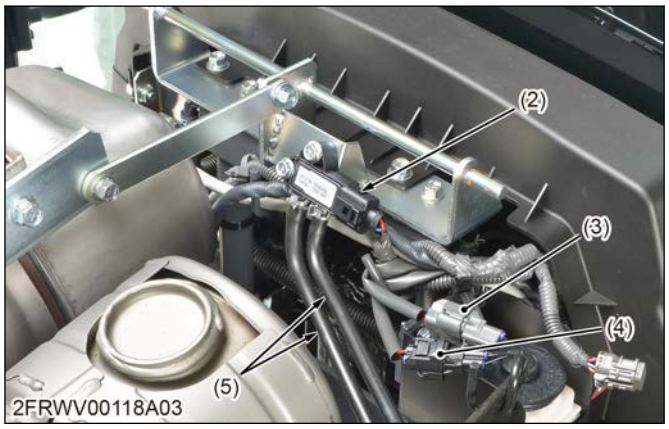
1. Disconnect the exhaust temperature sensor connector (1).




(1) Exhaust temperature sensor (T2) connector

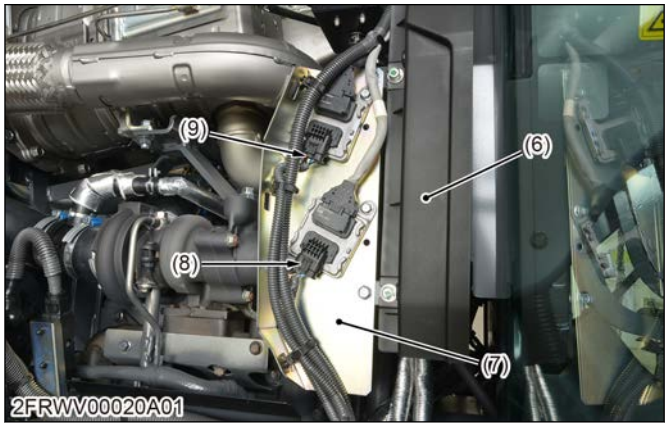
2. Disconnect the exhaust temperature sensor connectors (3) and (4).
3. Disconnect the differential pressure sensor connector (2).

4. Remove the differential pressure sensor hoses (5).



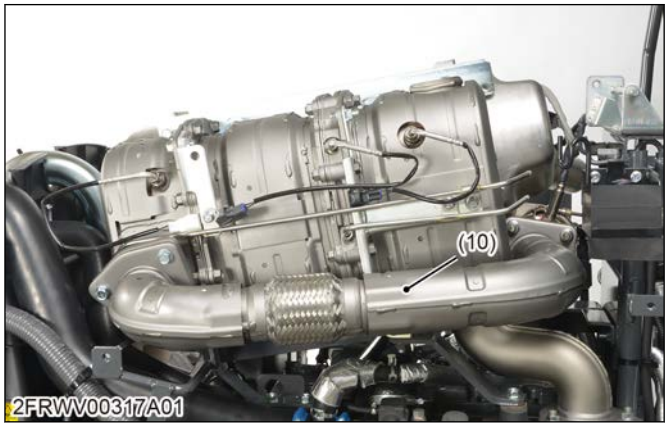

(2) Differential pressure sensor connector
(3) Exhaust temperature sensor (T1) connector
(4) Exhaust temperature sensor (T2) connector
(5) Differential pressure sensor hose

5. Remove the cover (6).
6. Disconnect the pre NOx sensor connector (8) and post NOx sensor connector (9).
7. Remove the stay (7) mounting bolts.



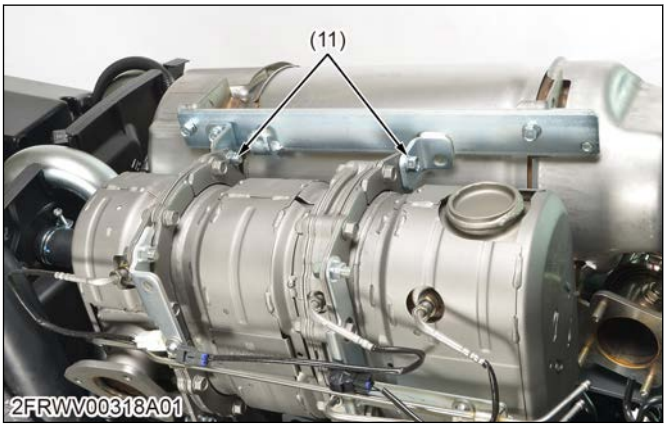

(6) Cover
(7) Stay
(8) Pre NOx sensor connector
(9) Post NOx sensor connector

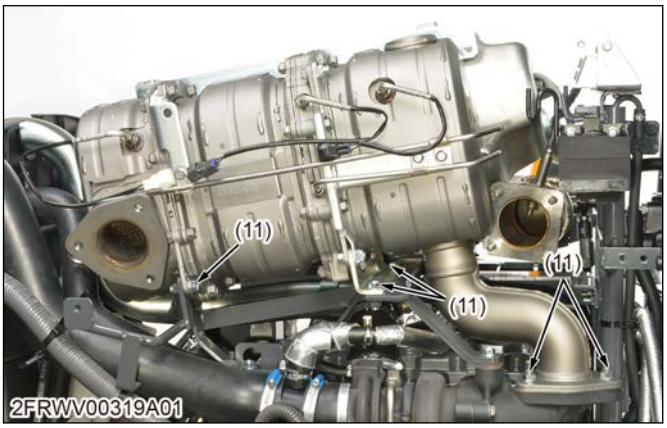
8. Remove the pipe (10).




(10) Pipe

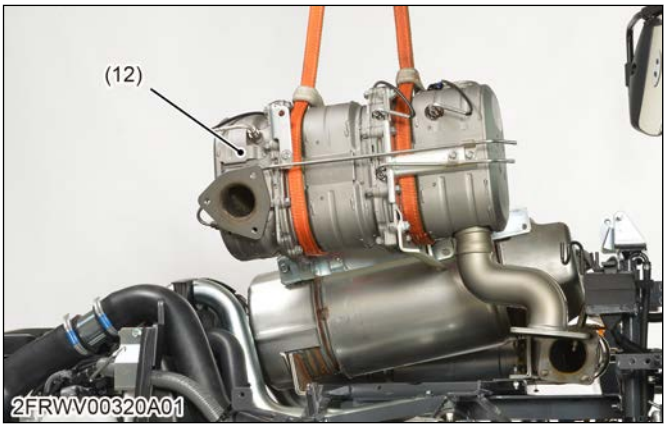
9. Remove the DPF muffler mounting bolts and nuts (11).




(11) DPF muffler mounting bolt and nut

10. Set the nylon sling to the DPF muffler (12).
11. Remove the DPF muffler (12).




(12) DPF muffler

**(When reassembling)**

- Parts number of each exhaust gas temperature sensor is different.
  Be attention for the color of connectors.

  **T0:**
  Black [Rear side]

**T1:**
Gray

**T2:**
White [Front side]

- Firstly, pre-tighten all bolts and nuts around DPF muffler assembly.
  Lastly, tighten all bolts and nut around DPF muffler assembly.
- Replace the gasket with new one.

## 5.2.7 Disassembling filter comp (DPF) (If necessary)

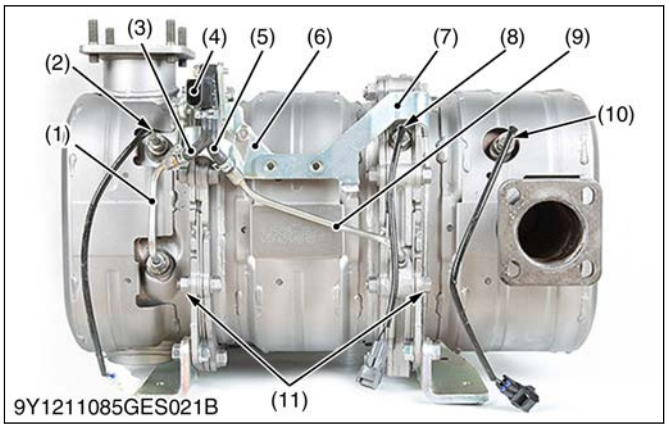
**■ IMPORTANT**

- **Since the DPF that was dropped or given a shock cannot be reused even if there is no damage outwardly, replace it with a new one.**
- **Be sure to loosen the temperature sensor tightening nut or the differential pressure pipe tightening nut with crowfoot wrench to prevent the damage of the sensor or pipe. If it is still hard to loosen, apply the lubricant spray to threaded portion and soak it with lubricant.**

**■ NOTE**

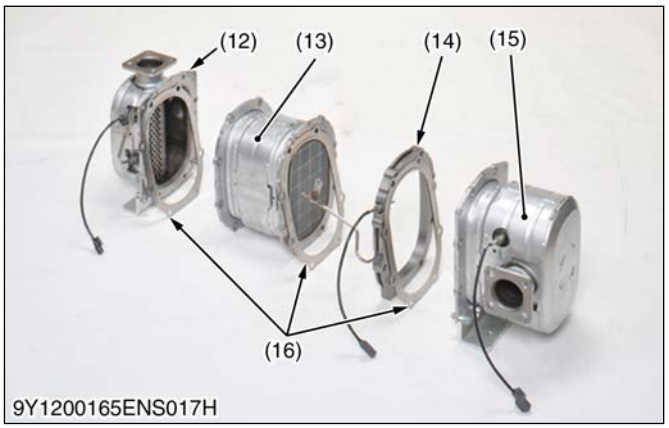
- **Always work in the workshop equipped with a electric hoist (including mobile hoist).**
- **Put a product (engine) on a stable ground, and set the parking brake.**
- **As the DPF muffler full assembly is hot just after the engine shutdown, make sure to start operation after it gets cool.**
- **Make sure not to let any foreign substances enter the opening section during the operation.**
- **Make sure not to damage the DPF muffler full assembly by falling or impact as it contains a ceramic filter.**
- **Before removing the DPF muffler full assembly from a product (engine), connect the diagnosis tool (Diagmaster), check the failure history, and save the project.**
- **Before removing the DPF for cleaning, keep the records of the engine serial number, filter comp (DPF) part number, filter comp (DPF) serial number, catalyst (DOC) part number, catalyst (DOC) serial number, and engine operating time, which are required in preparing the DPF cleaning order form.**
  **Since the engine operating time is recorded in the ECU, check the operating time by connecting the service tool (Diagmaster).**
- **When installing and removing the muffler full assembly (DPF), make sure that the temperature sensor, differential pressure sensor, and differential pressure pipe do not make contact with surrounding parts.**

1. Remove the tube (3), (5) from the differential pressure pipe (1), (9).
2. Remove the differential pressure sensor (4).
3. Remove the DPF stay (6), (7).




(1) Differential pressure pipe
(2) Temperature sensor ($T_2$)
(3) Tube
(4) Differential pressure sensor
(5) Tube
(6) DPF stay
(7) DPF stay
(8) Temperature sensor ($T_1$)
(9) Differential pressure pipe
(10) Temperature sensor ($T_0$)
(11) Filter comp (DPF) mounting screw

4. Loosen the filter comp (DPF) mounting screw (11) and remove the filter comp (DPF) (13).




(12) Body (DPF outlet)
(13) Filter comp (DPF)
(14) Collar (DPF)
(15) Catalyst (DOC)
(16) Gasket

**(When reassembling)**

- Replacing the gaskets (16) with new ones.
- If the differential pressure tube is damaged or cracked, replace it.
- When the differential pressure pipe (1), (9) and temperature sensor (2), (8), (10) is removed, wipe off the anti-seize & lubricating compound, apply a anti-seize & lubricating compound (Bostik, NEVER SEEZ, Pure Nickel Special Grade), and then attach them to their correct position.
- When replacing the differential pressure pipe (1), (9) apply a anti-seize & lubricating compound (Bostik, NEVER SEEZ, Pure Nickel Special Grade), and then attach it to its correct position.

- When replacing the temperature sensor, check that it is coated with anti-seize & lubricating compound, and then attach it to its correct position.
- Tighten the filter comp (DPF) mounting screw, the temperature sensor tightening nut, the differential pressure pipe tightening nut and the DPF stay bolt to the specified torque with crowfoot wrench.
- After installing the DPF filter assembly, start the engine and make sure that there are no gas leaks.
- Reassemble the filter comp (DPF) (13) in the correct direction by referring the mark "**GAS FLOW→**" (17) (Catalyst (DOC) to Body (DPF Outlet)) on the side showing the flow of exhaust gas.


(17) "**GAS FLOW →**"

| | | | |
|---|---|---|---|
| Tightening torque | Filter comp (DPF) mounting screw | | 49 to 55 N·m<br>5.0 to 5.7 kgf·m<br>37 to 41 lbf·ft |
| | Temperature sensor tightening nut | | 25 to 34 N·m<br>2.5 to 3.5 kgf·m<br>18 to 25 lbf·ft |
| | Differential pressure pipe tightening nut | | 16 to 22 N·m<br>1.6 to 2.3 kgf·m<br>12 to 16 lbf·ft |
| | DPF stay bolt | M8 | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | | M10 | 49 to 55 N·m<br>5.0 to 5.7 kgf·m<br>37 to 41 lbf·ft |

## 5.2.8 Removing muffler pipe

**CAUTION**

- **After operating the engine, muffler pipe is very hot. When removing the muffler pipe, wait a moment for cool down.**

1. Loosen the muffler pipe clamp (1).
2. Remove the muffler pipe mounting bolts (3).
3. Remove the muffler pipe (4).
4. Remove the muffler pipe stay (2).


(1) Muffler pipe clamp
(2) Muffler pipe stay
(3) Muffler pipe mounting bolt
(4) Muffler pipe

**(When reassembling)**

- Firstly, tighten all bolts around muffler pipe (4).
- Be sure to tighten the muffler pipe mounting bolts (3) at first, and then tighten the muffler pipe stay (2) mounting bolts.
- Lastly, tighten the muffler pipe clamp (1).

## 5.2.9 Disconnecting wiring harness for DPF muffler and SCR muffler

**CAUTION**

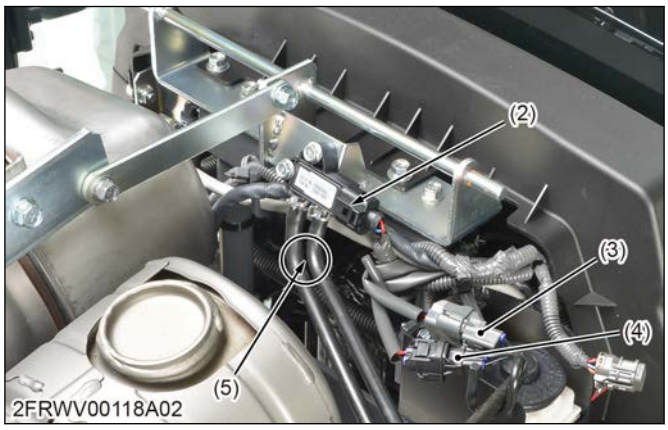
- **After operating the engine, muffler is very hot. When disconnecting the connectors, wait a moment for cool down.**

1. Disconnect the exhaust temperature sensor (T2) connector (1).


(1) Exhaust temperature sensor connector (T2)

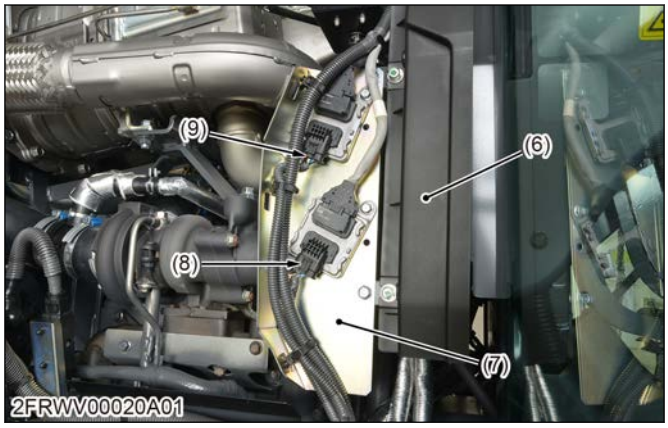
2. Disconnect the exhaust temperature sensor (T0) connector (4) and (T1) connector (3).

3. Disconnect the differential pressure sensor connector (2).
4. Remove the differential pressure sensor hoses (5).




(2) Differential pressure sensor connector
(3) Exhaust temperature sensor (T1) connector
(4) Exhaust temperature sensor (T0) connector
(5) Differential pressure sensor hose

5. Remove the cover (L.H.) (6).
6. Disconnect the pre NOx sensor connector (8) and post NOx sensor connector (9).
7. Remove the NOx sensor mounting stay (7).

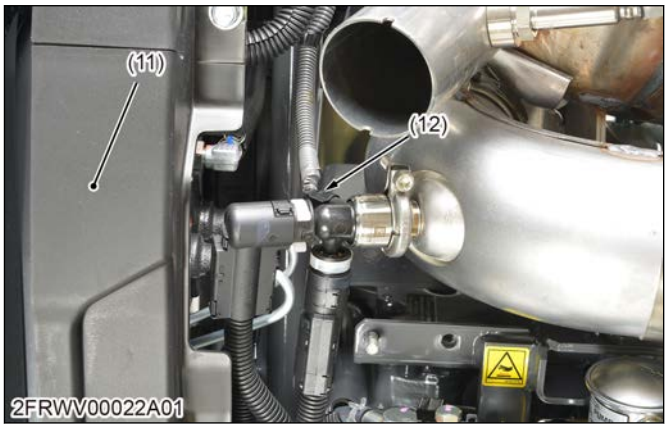



(6) Cover (L.H.)
(7) NOx sensor mounting stay
(8) Pre NOx sensor connector
(9) Post NOx sensor connector

8. Disconnect the SCR temperature sensor connector (10).


(10) SCR temperature sensor connector

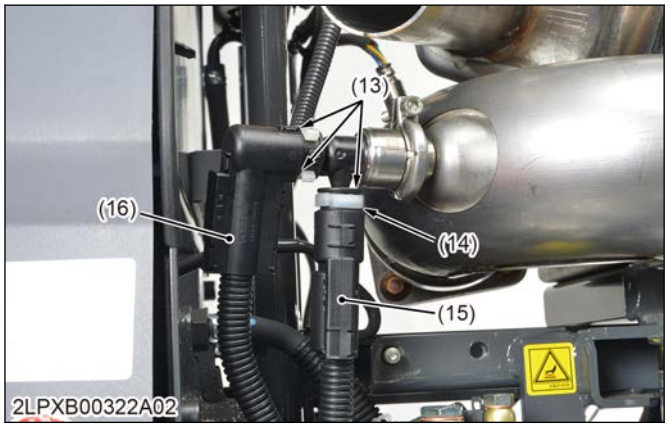
9. Remove the cover (R.H.) (11).
10. Disconnect the DEF injector connector (12).

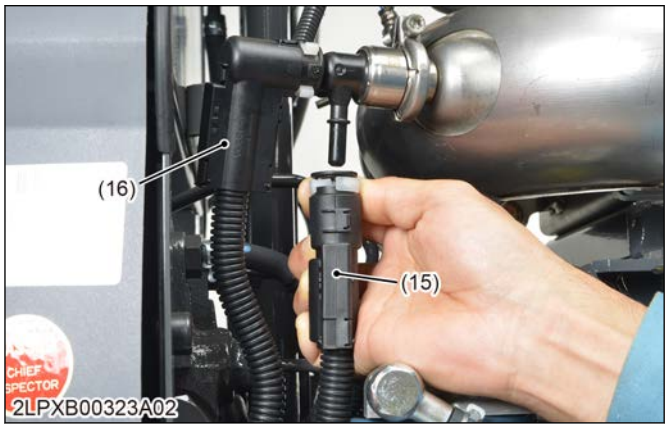



(11) Cover (R.H.)
(12) DEF injector connector

11. Pinch the tabs (13) of white clamp (14) and pull out the DEF delivery hose (15).

12. Pinch the tabs (13) of white clamp (14) and pull out the DEF return hose (16).




(13) Tab
(14) White clamp
(15) DEF delivery hose
(16) DEF return hose

**(When reassembling)**

- Parts number of each DPF exhaust gas temperature sensor connector is different. Be sure to connect with same color of connector.
- – T0: Black
  – T1: Gray
  – T2: White
- Each SCR NOx sensor harness color is different.
  – Pre NOx sensor muffler: Black
  – Post NOx sensor: Gray

## 5.2.10 Removing DPF and SCR muffler

**⚠ CAUTION**

- **After operating the engine, muffler is very hot. When removing the DPF and SCR muffler, wait a moment for cool down.**

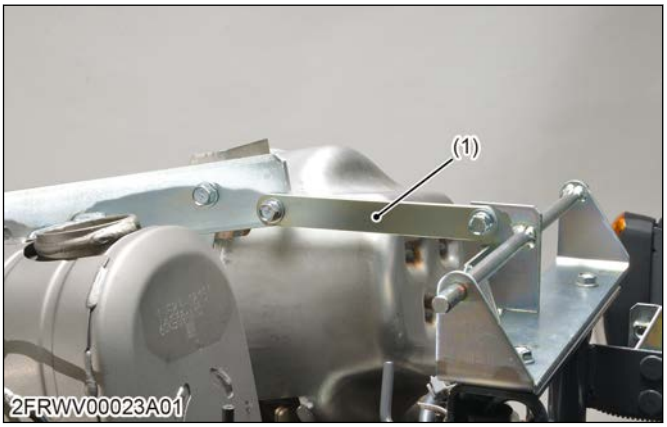
**■ IMPORTANT**

- **Since muffler assembly is heavy, use the hoist for safety.**

| | |
|---|---|
| DPF and SCR muffler assembly weight | About 66 kg<br>About 150 lbs |

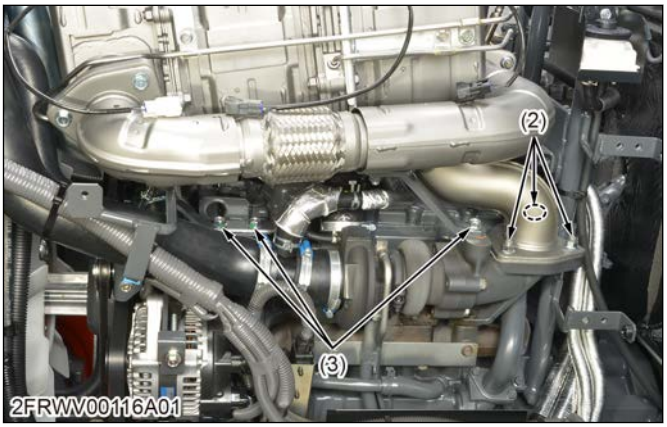
- **Be attention for each sensor when assembling and removing. Each sensor is easy to corrupt by shock.**

1. Prepare the hoist for removing.
2. Remove the support stay (1).



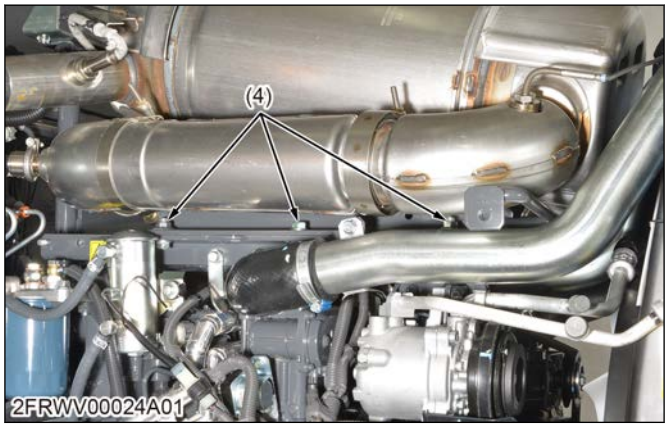

(1) Support stay

3. Remove the DPF muffler mounting nuts (2).
4. Remove the DPF muffler bracket mounting bolts (3).



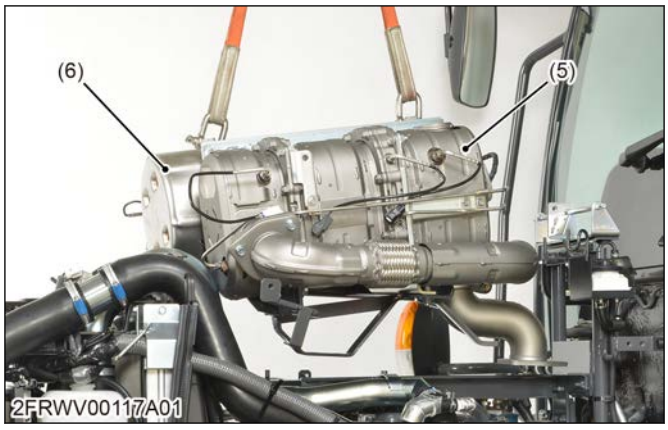

(2) DPF muffler mounting nut
(3) DPF muffler bracket mounting bolt

5. Remove the SCR muffler bracket mounting bolts and nut (4).




(4) SCR muffler bracket mounting bolt and nut

6. Support the DPF muffler (5) and SCR muffler (6) assemblies with nylon sling and hoist.
7. Remove the DPF muffler (5) and SCR muffler (6) assemblies.




(5) DPF muffler (6) SCR muffler

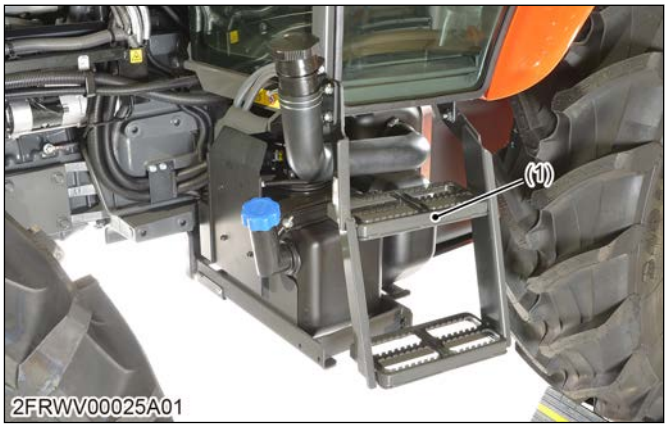
**(When reassembling)**

- Firstly, pre-tighten all bolts and nuts around the DPF and SCR muffler assembly.
- Lastly, tighten the DPF muffler mounting nut, the DPF muffler bracket mounting bolt and the SCR muffler bracket mounting bolt and nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | DPF muffler mounting nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | DPF muffler bracket mounting bolt | 60.8 to 70.6 N·m<br>6.20 to 7.19 kgf·m<br>44.9 to 52.0 lbf·ft |
| | SCR muffler bracket mounting bolt and nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

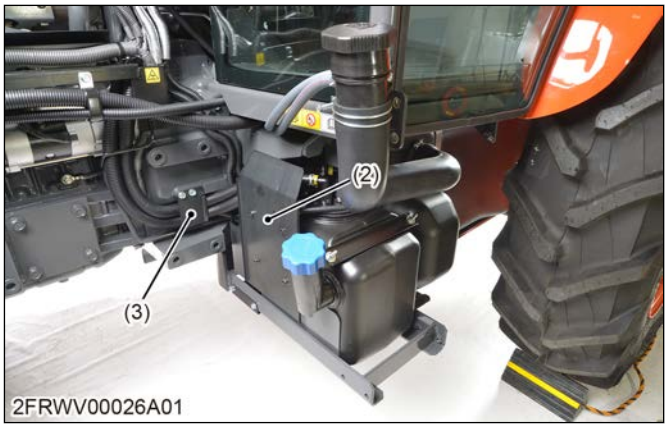
## 5.2.11 Removing DEF tank

1. Remove the auxiliary step (1).



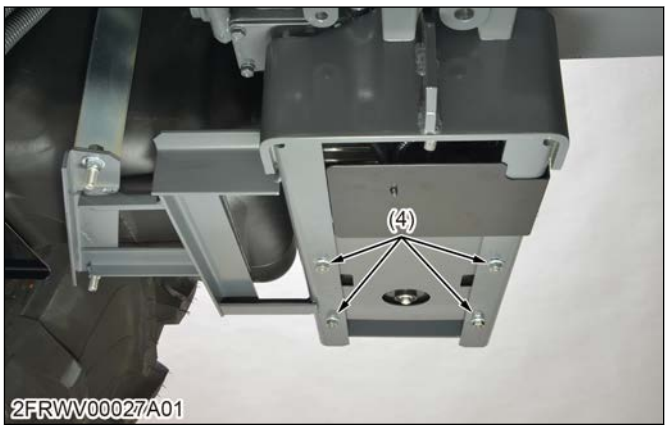

(1) Auxiliary step

2. Remove the DEF tank protection plate (2).
3. Remove the hose clamp (3).



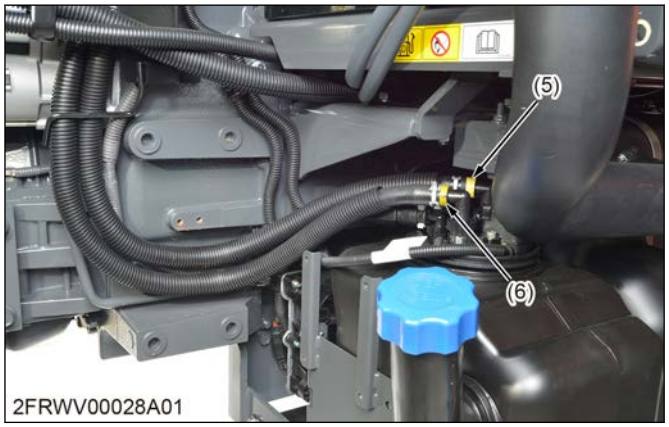

(2) DEF tank protection plate (3) Hose clamp

4. Remove the DEF tank mounting nuts (4).




(4) DEF tank mounting nut

5. Disconnect the coolant return hose (6) and coolant hose (5).




(5) Coolant hose
(6) Coolant return hose

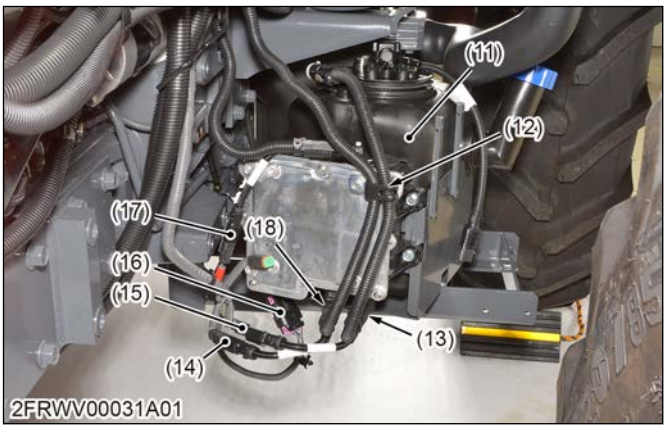
6. Disconnect the DEF suction hose (8) and DEF return hose (7).
7. Disconnect the DEF tank header unit connector (9).


(7) DEF return hose
(8) DEF suction hose
(9) DEF tank header unit connector

8. Disconnect the DEF tank breather hose (10).


(10) DEF tank breather hose

9. Remove the clamp (12).
10. Disconnect the DEF suction hose (13) and DEF suction hose electric heater connector (14).
11. Disconnect the DEF delivery hose (18) and DEF delivery hose electric heater connector (15).
12. Disconnect the DEF pump connector (16).
13. Disconnect the DEF return hose electric heater connector (17).




(11) DEF tank
(12) Clamp
(13) DEF suction hose
(14) DEF suction hose electric heater connector
(15) DEF delivery hose electric heater connector
(16) DEF pump connector
(17) DEF return hose electric heater connector
(18) DEF delivery hose

14. Remove the DEF tank.


**(When reassembling)**

- Connect the DEF return hose (7) to backward of DEF tank unit.
- Connect the DEF suction hose (13) to forward of DEF tank unit.
- Connect the DEF delivery hose (18) to backward of DEF pump.
- Connect the DEF suction hose (13) to forward of DEF pump.

## 5.2.12 Removing shuttle valve delivery pipe (Cabin model)

1. Disconnect the shuttle valve delivery pipe (1).


(1) Shuttle valve delivery pipe

## 5.2.13 Disconnecting steering shaft

1. Remove the universal joint mounting bolt (2).
2. Disconnect the steering shaft (1) from the steering controller.


(1) Steering shaft (2) Universal joint mounting bolt

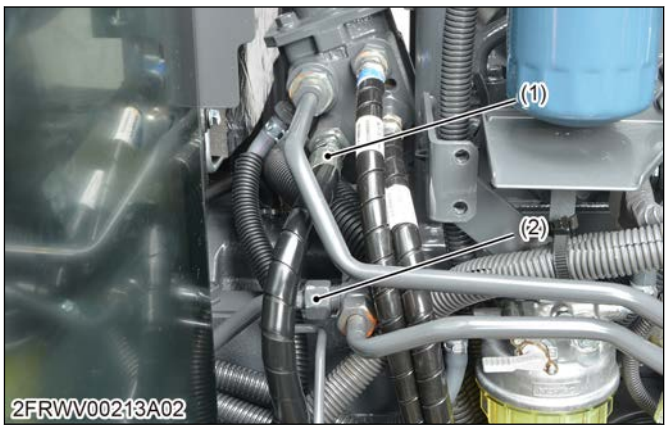
**(When reassembling)**

- Tighten the universal joint mounting bolt (2) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Universal joint mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 5.2.14 Disconnecting steering controller pipe and hose

1. Disconnect the oil cooler return pipe (2).
2. Disconnect the power steering delivery hose (1).
3. Disconnect the master cylinder delivery hose.




(1) Power steering delivery hose (2) Oil cooler return pipe

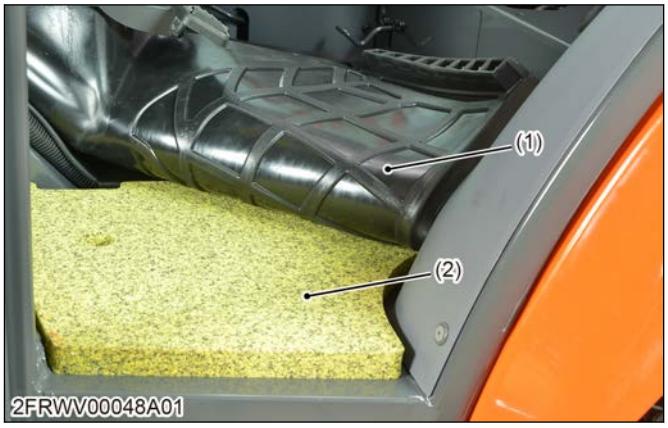
**(When reassembling)**

- Tighten the power steering delivery hose (1) retaining nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Power steering delivery hose retaining nut | 45.1 to 53.0 N·m<br>4.60 to 5.40 kgf·m<br>33.3 to 39.0 lbf·ft |

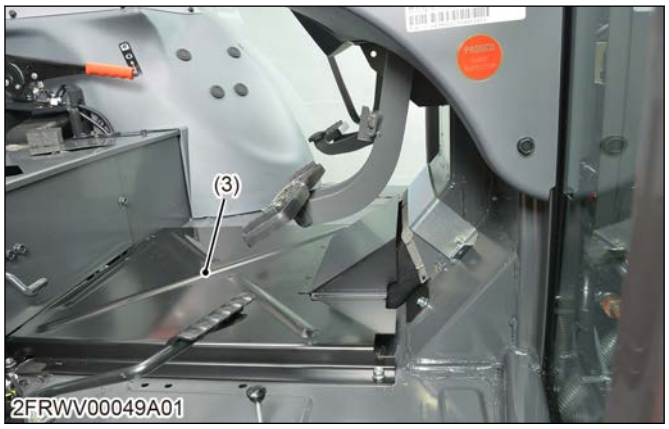
## 5.2.15 Removing floor mat and air conditioner duct

1. Remove the floor mat (1) and sponges (2).



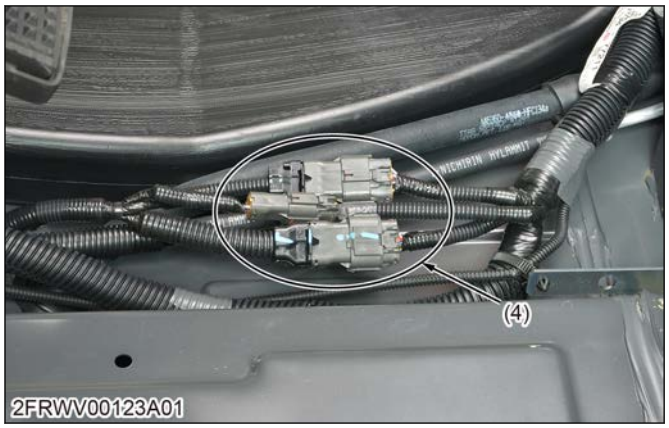

(1) Floor mat (2) Sponge

2. Remove the access plate (3).



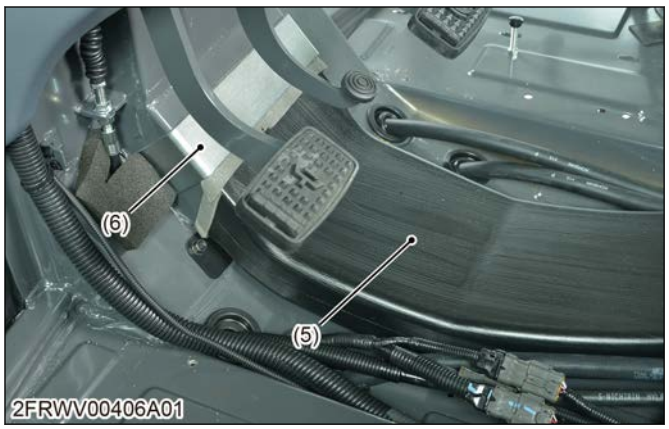

(3) Access plate

3. Disconnect the joint connectors (4).



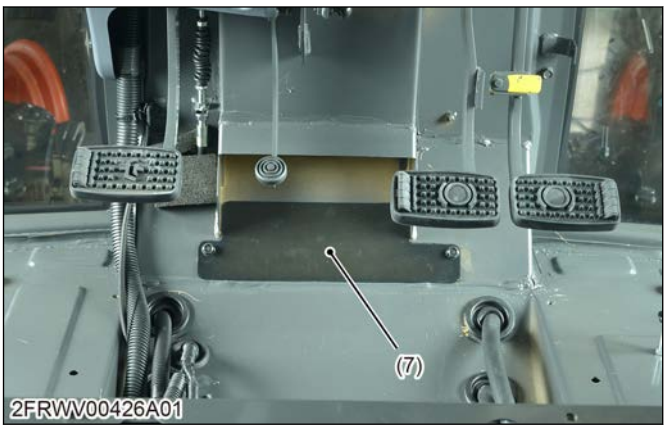

(4) Joint connector

4. Remove the duct (5).
5. Remove the air conditioner duct retainer plate (6).




(5) Duct
(6) Air conditioner duct retainer plate

6. Remove the access plate 1 (7).



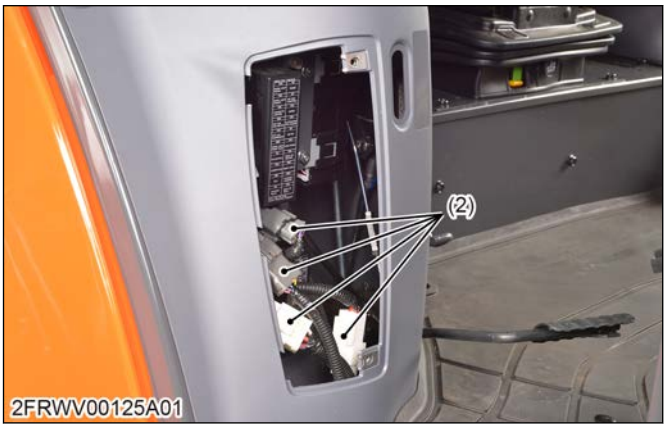

(7) Access plate 1

## 5.2.16 Disconnecting wire harness inside cabin

1. Remove the cover (1).


(1) Cover

2. Disconnect the joint connectors (2).
3. Pull out the main harness to the out side of cabin.

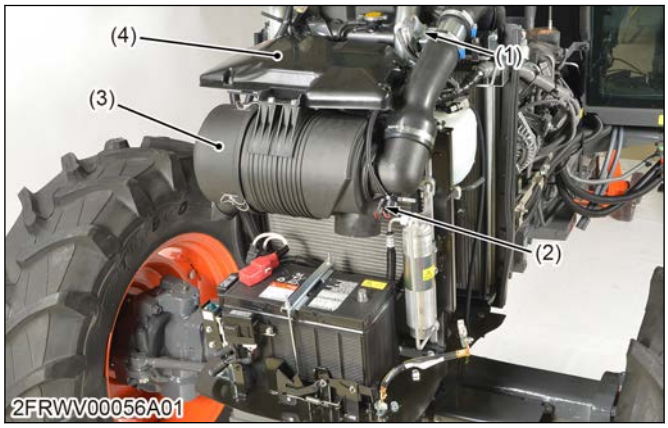



(2) Joint connector

## 5.2.17 Removing air cleaner hose and pipe

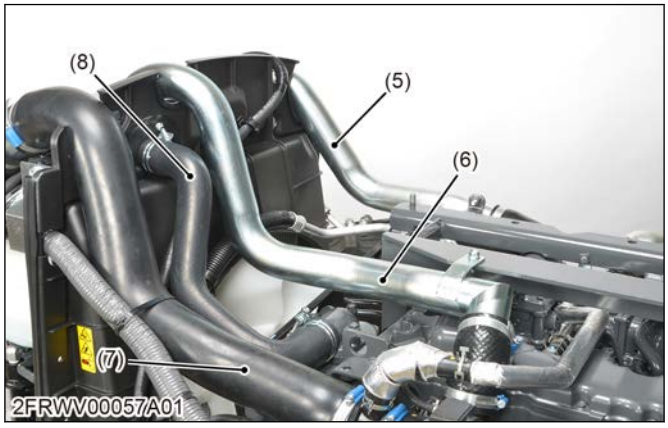
1. Disconnect the air flow sensor connector (1) and air cleaner switch connector (2).

2. Remove the engine ECU and ACU cover (4).
3. Remove the air cleaner (3).




(1) Air flow sensor connector
(2) Air cleaner switch connector
(3) Air cleaner
(4) Cover

4. Disconnect the air inlet hose (7).
5. Loosen the bands and disconnect the inter cooler inlet pipe (6).
6. Loosen the bands and disconnect the inter cooler outlet pipe (5).
7. Loosen the hose bands and disconnect the coolant hose (8).




(5) Inter cooler outlet pipe
(6) Inter cooler inlet pipe
(7) Air inlet hose
(8) Coolant hose

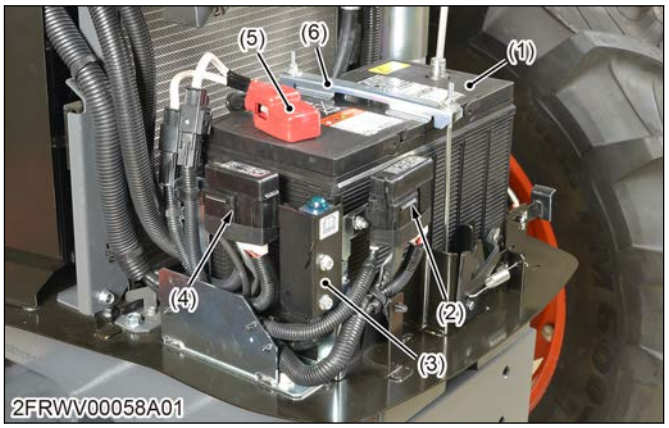
**(When assembling)**

- Be sure the bands of air inlet hose are connected securely.
- Be sure the bands of inter cooler hoses are connected securely.

| | | |
|---|---|---|
| Tightening torque | Hose band (Inlet air, inter cooler) | 4.0 to 5.0 N·m<br>0.41 to 0.50 kgf·m<br>3.0 to 3.6 lbf·ft |

## 5.2.18 Removing battery

1. Disconnect the positive cable (5) from the battery positive terminal.
2. Disconnect the slow blow fuse box 1 (2) and slow blow fuse box 2 (4).
3. Disconnect the ACU operating lamp (3).
4. Remove the battery stay (6) and battery (1).

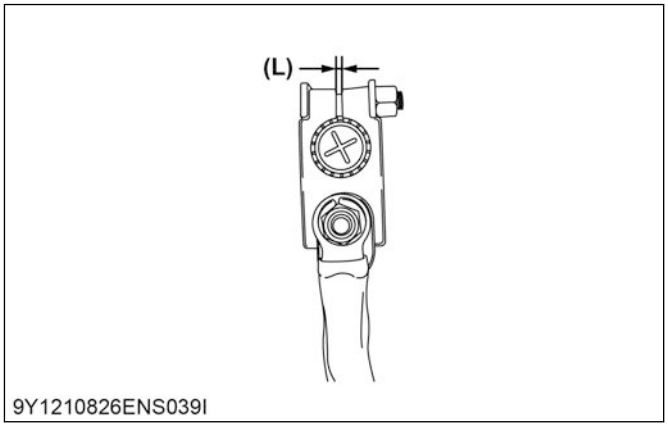



(1) Battery
(2) Slow blow fuse box 1
(3) ACU operating lamp
(4) Slow blow fuse box 2
(5) Positive cable
(6) Battery stay

**(When reassembling)**

**IMPORTANT**

- **Tighten the battery cable terminal nut so that the clearance (L) is within the following chart.**




(L) Clearance between the battery cable terminal

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

## 5.2.19 Disconnecting heater hose

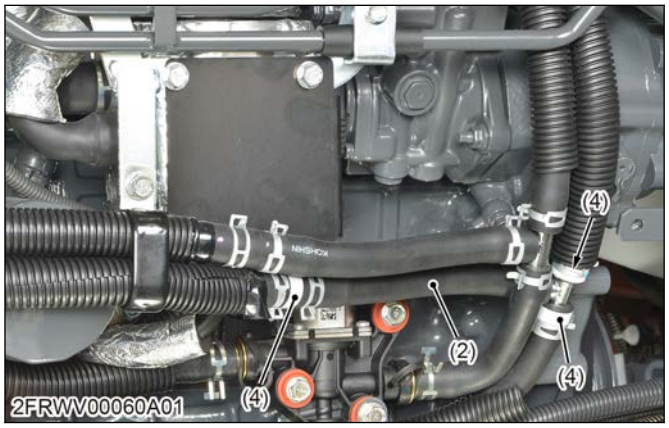
1. Remove the heater hose clamps (3).
2. Disconnect the heater hose (1).

3. Disconnect the heater return hose (2).


(1) Heater hose
(2) Heater return hose
(3) Heater hose clamp

**(When reassembling)**

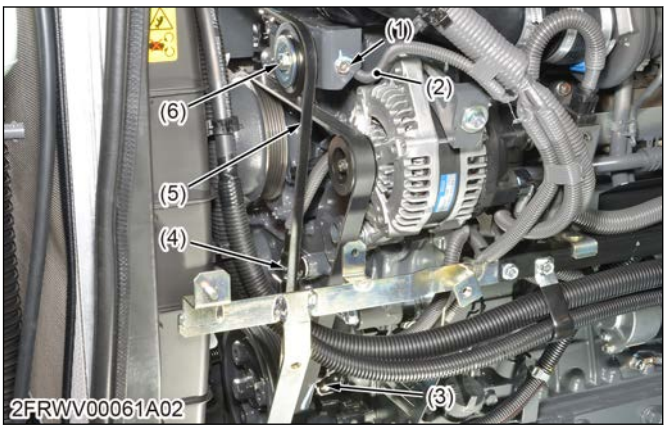
- The heater return hose (2) with white tape (4) should be connected to the hose which has also white tape (4).




(2) Heater return hose
(4) White tape

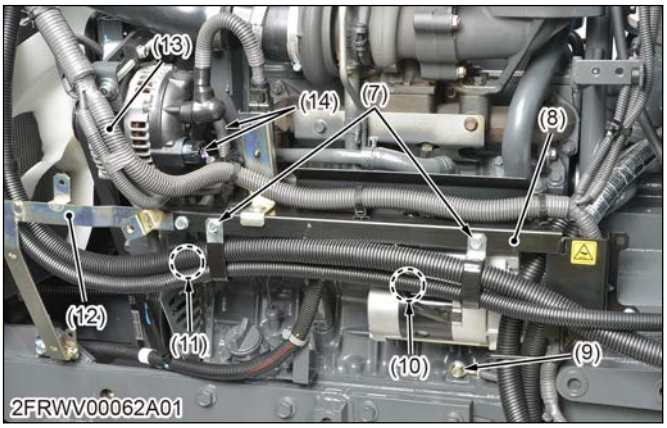
## 5.2.20 Removing compressor and condenser

1. Loosen the air conditioner belt tension pulley mounting nut (6).
2. Loosen the air conditioner belt adjusting bolt (1).
3. Remove the air conditioner belt (5).
4. Disconnect the coolant temperature sensor connector (2).
5. Disconnect the camshaft position sensor connector (4).
6. Disconnect the crankshaft position sensor connector (3).




(1) Air conditioner belt adjusting bolt
(2) Coolant temperature sensor connector
(3) Crankshaft position sensor connector
(4) Camshaft position sensor connector
(5) Air conditioner belt
(6) Tension pulley mounting nut

7. Remove the high and low pressure hose clamps (7).
8. Disconnect the starter motor connectors (10) and oil switch connector (11).
9. Disconnect the grounding wire (9).
10. Disconnect the alternator connectors (14).
11. Remove the stay 1 (8) and stay 2 (12).
12. Set aside the engine harness (13) to the front side.




(7) High and low pressure hose clamp
(8) Stay 1
(9) Grounding wire
(10) Starter motor connector
(11) Oil switch
(12) Stay 2
(13) Engine harness
(14) Alternator connectors

13. Remove the high and low pressure hose clamp (16).
14. Remove the condenser stopper bolt (17).

15. Loosen the condenser wing nut (15).


(15) Condenser wing nut
(16) High and low pressure hose clamp
(17) Condenser stopper bolt

16. Disconnect the compressor 1P connector (20).
17. Remove the grounding wire mounting screw (18).
18. Remove the compressor (19) with stay.


(18) Ground wire mounting screw
(19) Compressor
(20) Compressor 1P connector

19. Jack up the front axle and turn the front tires to the left side.
20. Slide the condenser with the reviver to the left side.
21. Remove the compressor (19), the condenser with the receiver and air-conditioner hose as a unit.


**(When reassembling)**

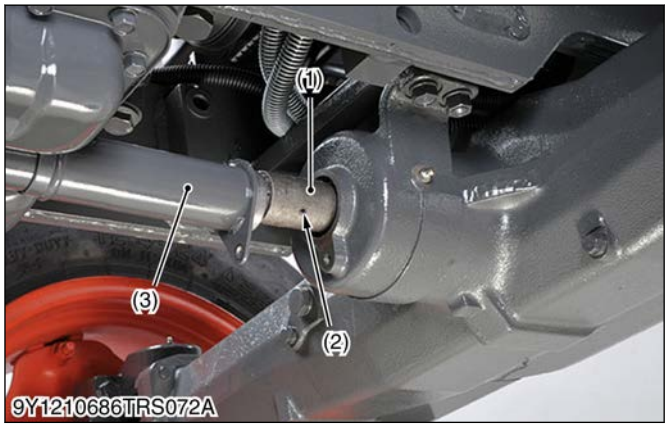
- After reassembling the compressor, be sure to adjust the air conditioner belt tension.
- Tighten the alternator terminal nut to the specified tightening torque.

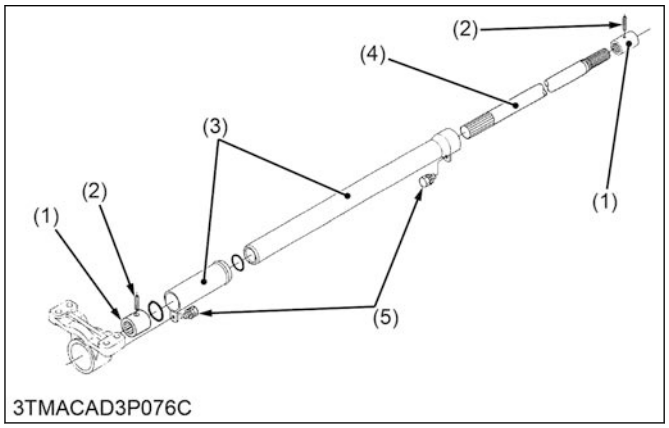
| | | |
|---|---|---|
| Tightening torque | Alternator terminal nut | 9.80 to11.3 N·m<br>1.00 to 1.15kgf·m<br>7.23 to 8.33 lbf·ft |

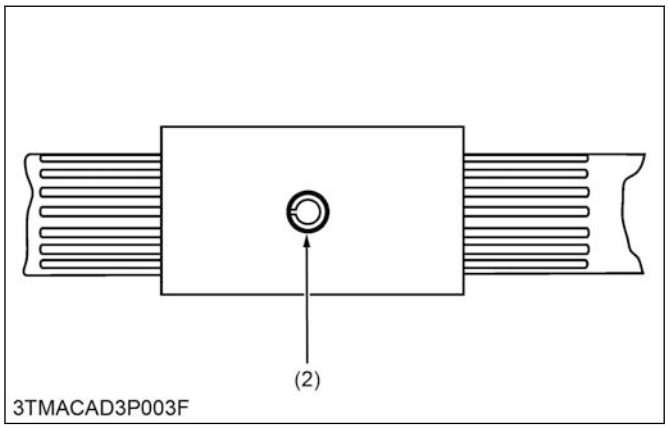
## 5.2.21 Removing propeller shaft

1. Slide the propeller shaft covers (3) after removing the screws (5).
2. Tap out the roll pins (2).

3. Slide the couplings (1) and remove the propeller shaft (4).




(1) Coupling
(2) Roll pin
(3) Propeller shaft cover
(4) Propeller shaft
(5) Screw

**(When reassembling)**

- Apply the grease to the splines of couplings (1).
- Tap in the roll pins (2) as shown in the figure.

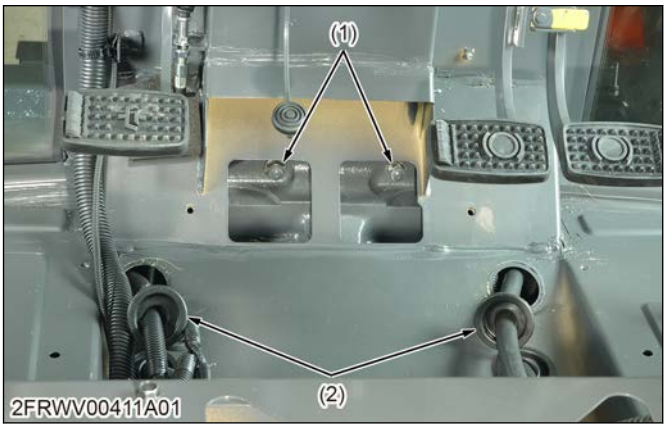
## 5.2.22 Installing front axle rocking restrictor

1. Chock the wheels and set the front axle rocking restrictor (1) to the front axle frame on both sides.


(1) Front axle rocking restrictor

## 5.2.23 Separating engine from clutch housing (Cabin model)

1. Make sure the clutch housing case and engine are securely mounted on the disassembling stands.
2. Disconnect the grommets (2).
3. Remove the mounting nuts (1) between engine and clutch housing.
4. Remove the mounting bolts between engine and clutch housing.





(1) Engine and clutch housing mounting nut
(2) Grommet

5. Separate the engine and clutch housing.

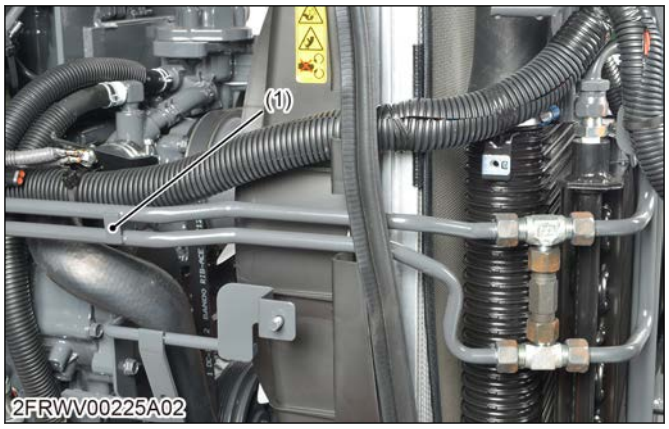

**(When reassembling)**

- Apply molybdenum disulphide (Three Bond 1901 or its equivalents) to the splines of damper disk boss.
- Apply liquid gasket (Three Bond 1211 / 1141 or its equivalents) to the joint face of the engine and clutch housing.
- Tighten the engine and clutch housing mounting bolt and the engine and clutch housing mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Engine and clutch housing mounting bolt (M14, 9T) | 166.7 to 196.1 N·m<br>17.00 to 19.99 kgf·m<br>123.0 to 144.6 lbf·ft |
| | Engine and clutch housing mounting nut | 123.6 to 147.1 N·m<br>12.61 to 15.00 kgf·m<br>91.17 to 108.4 lbf·ft |

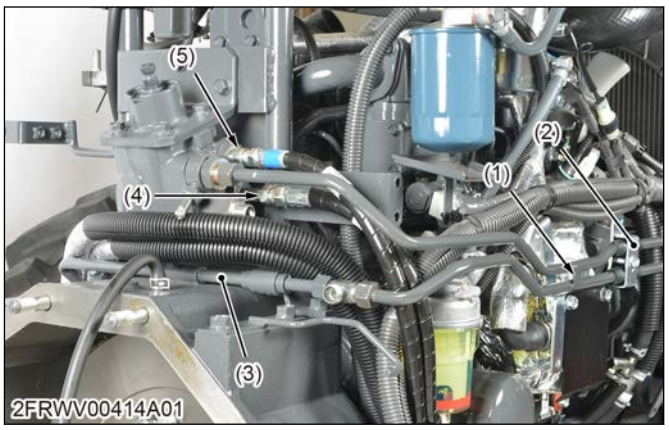
## 5.2.24 Removing hydraulic pipe and hose

1. Remove the oil cooler pipe (1).




(1) Oil cooler pipe

2. Remove the pipe clamp (2) and oil cooler pipe (1).
3. Remove the shuttle valve delivery pipe (3).
4. Remove the power steering delivery hose (L.H.) (5).
5. Remove the power steering delivery hose (R.H.) (4).




(1) Oil cooler pipe
(2) Pipe clamp
(3) Shuttle valve delivery pipe
(4) Power steering delivery hose (R.H.)
(5) Power steering delivery hose (L.H.)

## 5.2.25 Disconnecting heater hose

1. Disconnect the heater hose (1).
2. Disconnect the heater return hose (2).
3. Remove the coolant lower hose (3).


(1) Heater hose
(2) Heater return hose
(3) Coolant lower hose

**(When reassembling)**

- The heater return hose (2) with white tape should be connected to the hose which has also white tape.

## 5.2.26 Removing wire harness for right side

1. Disconnect the water separator connector (2).

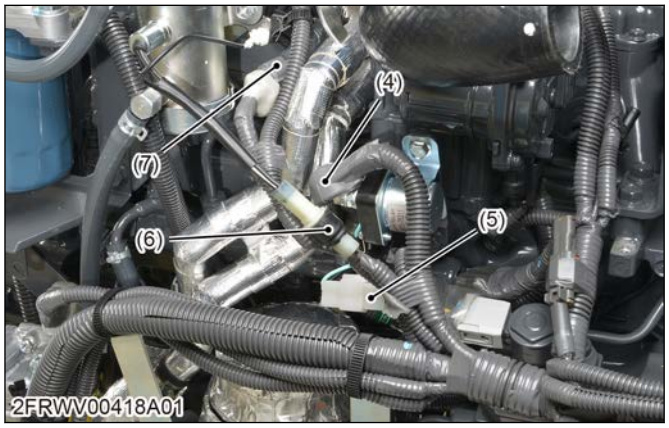
2. Disconnect the pressure discharge valve connector (1).


(1) Pressure discharge valve connector
(2) Water separator connector

3. Disconnect the coolant valve connector (3).


(3) Coolant valve connector

4. Disconnect the feed pump connector (6).
5. Disconnect the intake air heater relay terminal mounting nut (4).
6. Disconnect the intake air heater relay connector (5).
7. Disconnect the EGR valve connector (7).



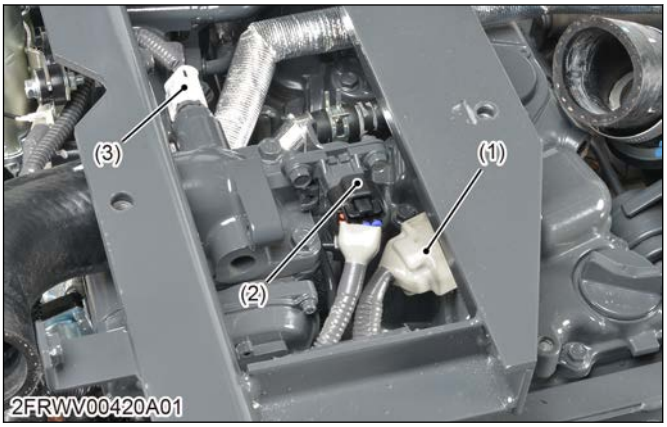

(4) Intake air heater relay terminal mounting nut
(5) Intake air heater relay connector
(6) Feed pump connector
(7) EGR valve connector

8. Disconnect the intake throttle valve connector (8).
9. Disconnect the supply pump connector (10).
10. Disconnect the rail pressure sensor connector (9).


(8) Intake throttle valve connector
(9) Rail pressure sensor connector
(10) Supply pump connector (PCV)

## 5.2.27 Removing wire harness for center section

1. Disconnect the injector harness connector (1).
2. Disconnect the boost pressure sensor connector (2).
3. Disconnect the intake air temperature sensor connector (3).

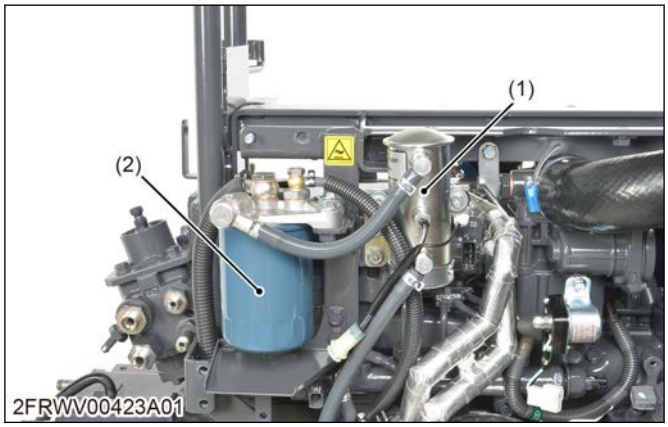



(1) Injector harness connector
(2) Boost pressure sensor connector
(3) Intake air temperature connector

## 5.2.28 Removing fuel filter and feed pump

1. Disconnect the fuel hoses and remove the fuel filter (2).

2. Disconnect the fuel hoses and remove the fuel feed pump (1).




(1) Fuel feed pump (2) Fuel filter

3. Disconnect the fuel hose (3).
4. Disconnect the fuel cooler hose (4).
5. Disconnect the fuel hoses and remove the sedimenter (5).


(3) Fuel hose (5) Sedimenter
(4) Fuel cooler hose

## 5.2.29 Removing wire harness for left side

1. Disconnect the slow blow fuse connector (2).
2. Disconnect the starter connectors (1).


(1) Starter connector (2) Slow blow fuse connector

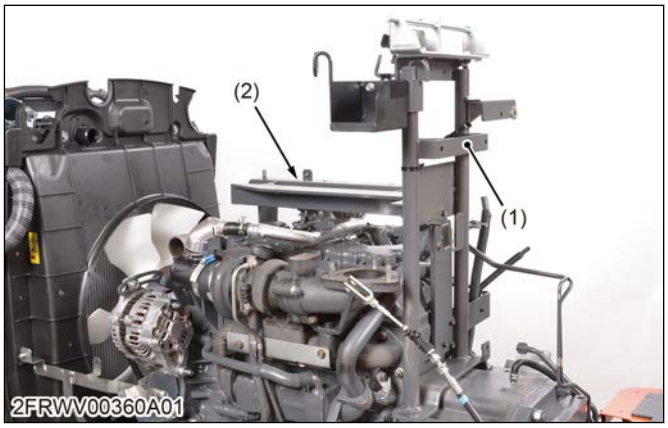
**(When reassembling)**

- Tighten the alternator terminal nut and the starter B terminal mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Alternator terminal nut | 9.80 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.23 to 8.33 lbf·ft |
| | Starter B terminal mounting nut | 9.80 to 11.8 N·m<br>1.00 to 1.20 kgf·m<br>7.23 to 8.70 lbf·ft |

## 5.2.30 Removing bonnet support

1. Remove the muffler bracket (2).
2. Remove the bonnet support (1).




(1) Bonnet support (2) Muffler bracket

## 5.2.31 Separating engine from front axle frame

**■ NOTE**

- **When you replace the engine with a new one, record the following items for incorporating with its new engine.**
  - **Engine serial number**
  - **Engine parts number**
  - **DPF muffler full assembly serial number**
  - **SCR muffler full assembly serial number**

1. Set the disassembling stands under the front axle frame and engine.
2. Remove the engine mounting bolts.

3. Remove the engine from front axle frame.


**(When reassembling)**

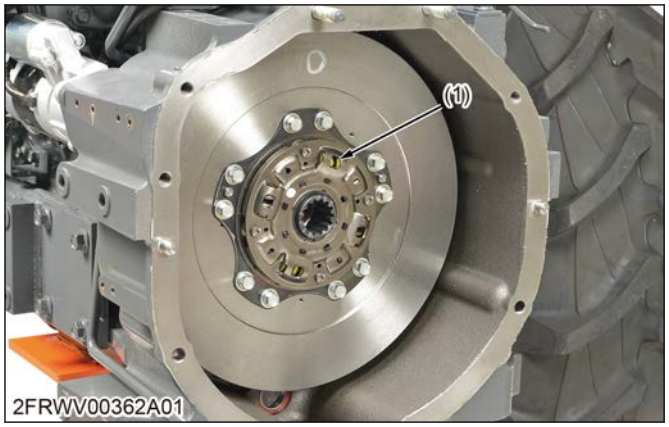
- Tighten the engine mounting bolts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Engine mounting bolt (M14, 9T, UBS) | 167 to 196 N·m<br>17.0 to 20.0 kgf·m<br>123 to 144 lbf·ft |

RELATED PAGE
1.21 Engine stand on page 2-78

### 5.2.32 Removing damper disc

1. Remove the damper disc mounting bolts and the damper disc (1).




(1) Damper disc

**(When reassembling)**

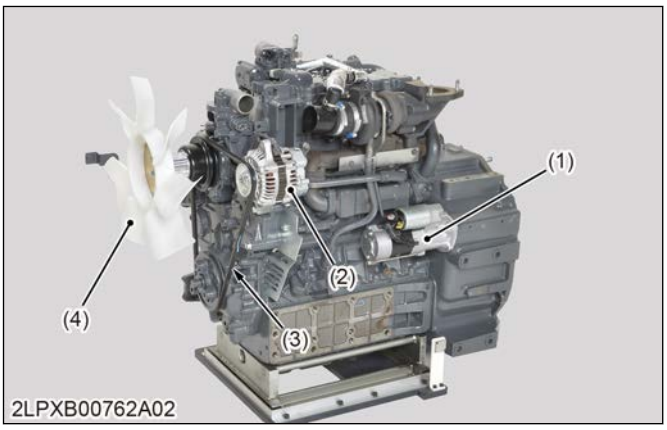
- Direct the shorter end of the damper disc boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or its equivalents) to the spline.
- Tighten the damper disc mounting bolts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Damper disc mounting bolt | 48 to 55 N·m<br>4.9 to 5.7 kgf·m<br>36 to 41 lbf·ft |

## 5.3 External parts

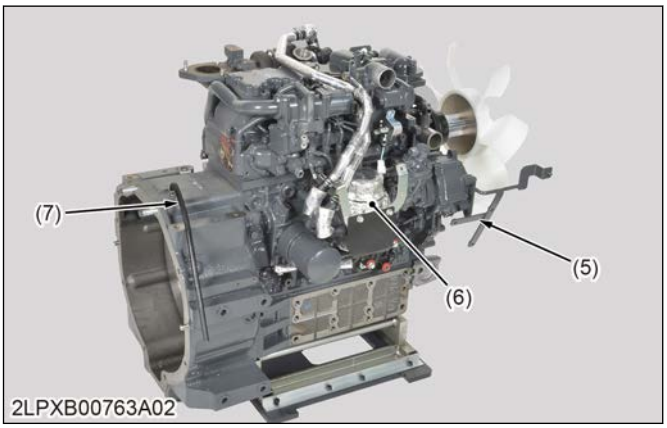
### 5.3.1 Removing fan, starter, alternator and oil separator

1. Remove the alternator (2) and fan drive belt (3).
2. Remove the fan (4).
3. Remove the starter motor (1).




(1) Starter motor
(2) Alternator
(3) Fan drive belt
(4) Fan

4. Remove the stay (5).
5. Remove the oil separator (6) with related hoses and pipes.
6. Remove the breather hose (7).




(5) Stay
(6) Oil separator
(7) Breather hose

**(When reassembling)**

- Adjust the fan belt tension.
- Apply liquid gasket (Three Bond 1211 or equivalent) to joint face of the flywheel housing and starter motor.

RELATED PAGE
4.3.1 Checking fan belt tension on page 3-42

## 5.4 Turbocharger and EGR

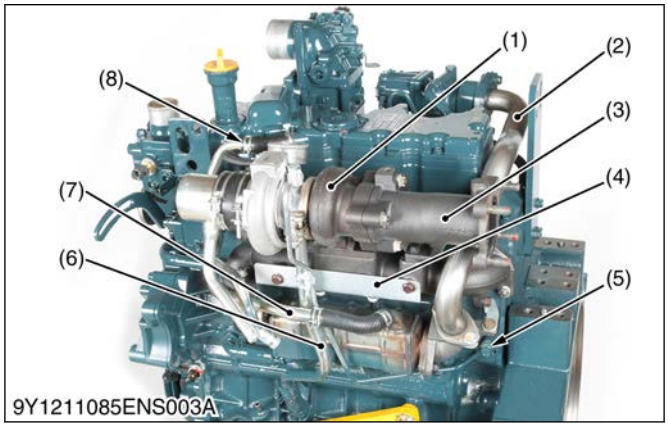
**CAUTION**
- **While the engine operates or just after it stops, do not touch the hot turbocharger.**

**NOTE**
- **When you remove or install the turbocharger assembly, do not let dust, dirt and other unwanted materials in the oil pipes.**
- **After you replace the turbocharger assembly, fill clean engine oil through the oil filter port of the turbocharger.**
- **Before you start the engine, make sure that the air cleaner is in the correct position.**

### 5.4.1 Removing EGR pipe, turbocharger and EGR cooler

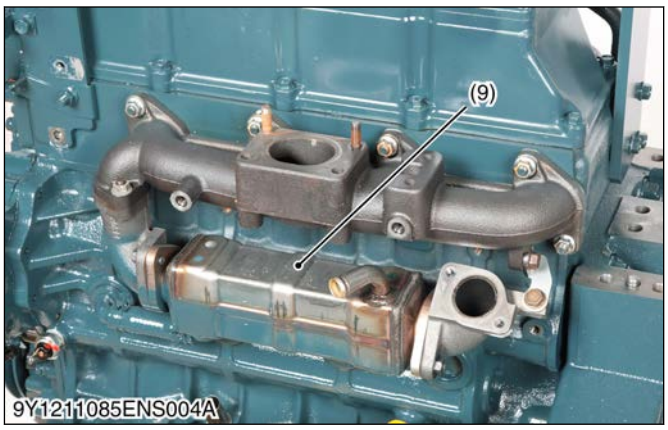
**NOTE**
- **Put tape or cover on all openings to prevent damage in the oil holes in the turbocharger by unwanted materials.**

1. Remove the intake hose.
2. Remove the EGR pipe (2).
3. Remove the muffler flange (3).
4. Remove the EGR cooler pipe (7).
5. Remove the breather pipe (8).
6. Remove the screw (5) for the oil pipe.
7. Remove the return pipe (crankcase side) (6).
8. Remove the cover (4).
9. Remove the turbocharger assembly (1).




(1) Turbocharger assembly
(2) EGR pipe
(3) Muffler flange
(4) Cover
(5) Screw
(6) Return pipe
(7) EGR cooler pipe
(8) Breather pipe

10. Remove the EGR cooler (9).



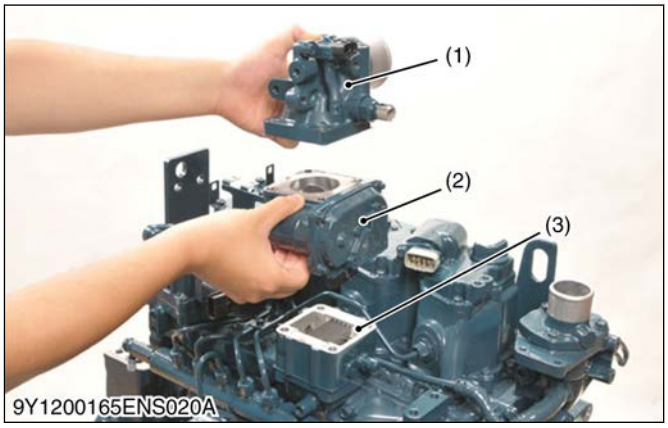

(9) EGR cooler

**(When reassembling)**
- Fill clean engine oil through the oil filter port of the turbocharger.
- Replace the gaskets with new ones.
- Do not let dust, dirt and other unwanted materials in the oil pipes.
- Tighten the EGR cooler flange screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | EGR cooler flange screw | 30 to 34 N·m<br>3.0 to 3.5 kgf·m<br>22 to 25 lbf·ft |

### 5.4.2 Removing intake throttle valve and intake air heater

**NOTE**
- **Do not disassemble the intake throttle valve.**



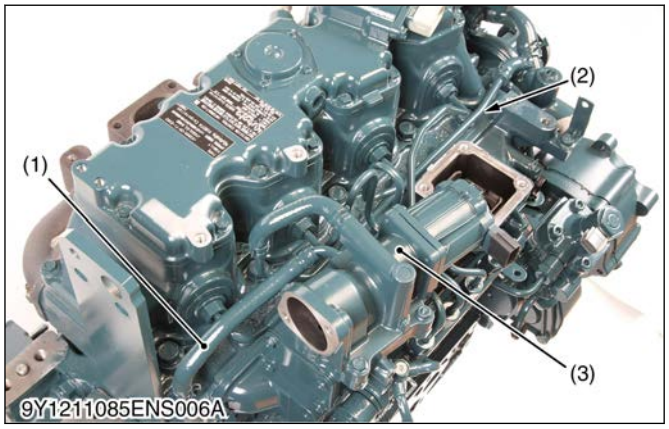

(1) Air cleaner flange
(2) Intake throttle valve
(3) Intake air heater

1. Remove the air cleaner flange (1).
2. Remove the intake throttle valve (2).
3. Remove the intake air heater (3).

**(When reassembling)**
- Replace the gaskets with new ones.

### 5.4.3 Removing EGR valve

**■ NOTE**
- **Do not disassemble the EGR valve assembly.**




(1) Cooler hose
(2) Cooler pipe
(3) EGR valve

1. Disconnect the cooler hose (1), and the cooler pipe (2) from the EGR valve (3).
2. Remove the EGR valve (3).

**(When reassembling)**
- Replace the gaskets with new ones.

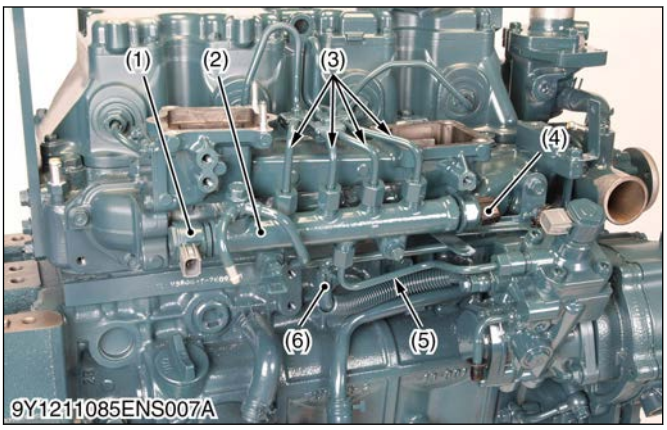
## 5.5 Common rail

### 5.5.1 Removing injection pipes and common rail

**⚠ CAUTION**
- **Do not loosen the injection pipe when the fuel is under high pressure (within five minutes after stopping the engine).**

**■ IMPORTANT**
- **Store the injection pipes (3), (5) so it does not get any dust in it.**
- **Store the common rail (2) so it does not get any dust in it.**

**■ NOTE**
- **Please replace the rail assembly, if the exchange of the pressure limiter or the rail pressure sensor is necessary.**
- **Do not remove the pressure discharge valve (1) and rail pressure sensor (4) from the common rail (2).**
- **When removing the common rail (2), do not hold it by the pressure discharge valve (1) and rail pressure sensor (4).**




(1) Pressure discharge valve
(2) Common rail
(3) Injection pipe
(4) Rail pressure sensor
(5) Injection pipe
(6) Overflow pipe

1. Remove the injection pipe (5).
2. Remove the overflow pipe (6).
3. Remove the injection pipes (3).
4. Remove the common rail (2).

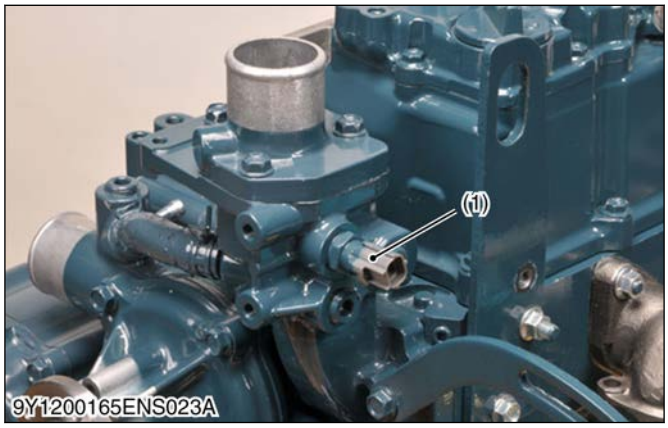
**(When reassembling)**

**■ NOTE**
- **Tighten the common rail mounting screw, the Injection pipe retaining nut, the overflow pipe joint screw (M8) and the overflow pipe joint screw (M10) to the specified tightening torque.**

| | | |
|---|---|---|
| Tightening torque | Common rail mounting screw | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | Injection pipe retaining nut | 23 to 36 N·m<br>2.3 to 3.7 kgf·m<br>17 to 26 lbf·ft |
| | Overflow pipe joint screw (M8) | 16 to 19 N·m<br>1.6 to 2.0 kgf·m<br>12 to 14 lbf·ft |
| | Overflow pipe joint screw (M10) | 7.9 to 12 N·m<br>0.80 to 1.3 kgf·m<br>5.8 to 9.4 lbf·ft |

## 5.5.2 Removing coolant temperature sensor

1. Remove the coolant temperature sensor (1).




(1) Coolant temperature sensor

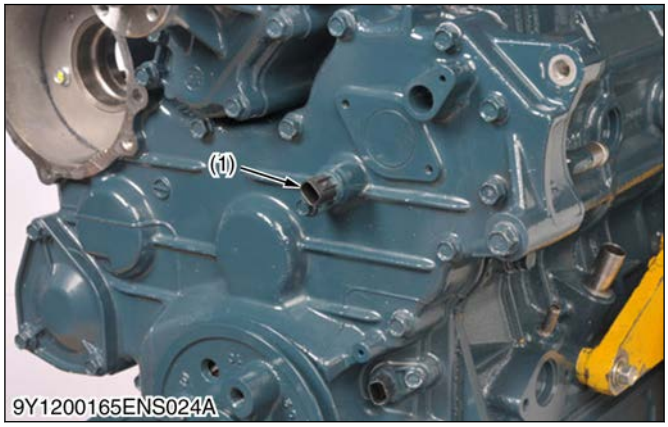
**(When reassembling)**

- Replace the gaskets with new ones.
- Tighten the coolant temperature sensor to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Coolant temperature sensor | 16 to 23 N·m<br>1.6 to 2.4 kgf·m<br>12 to 17 lbf·ft |

## 5.5.3 Removing camshaft position sensor

1. Remove the camshaft position sensor mounting screw.
2. Remove the camshaft position sensor (1).




(1) Camshaft position sensor

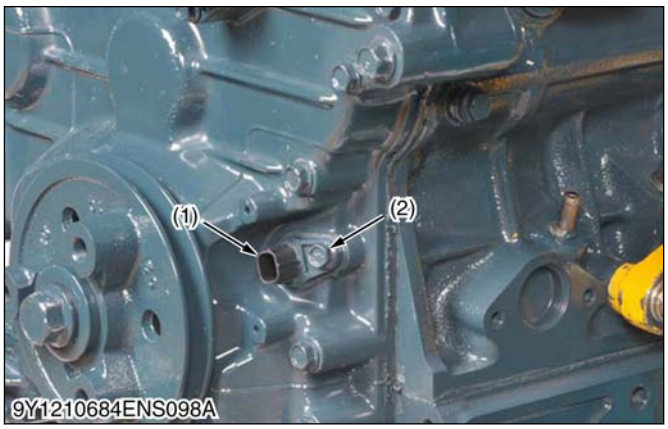
**(When reassembling)**

- Replace the O-ring with a new one.
- Tighten the camshaft position sensor mounting screws to the specified tightening torque.

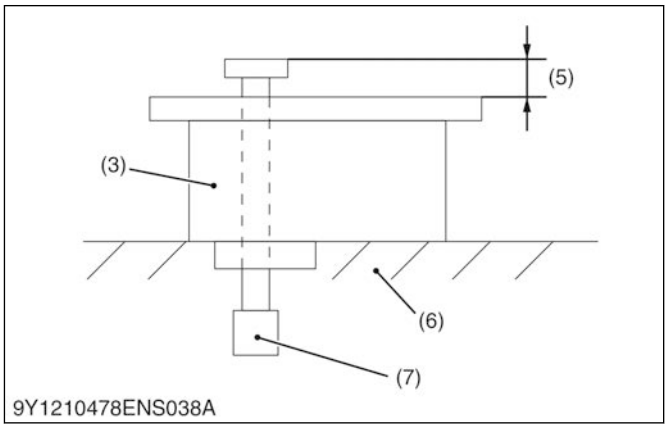
| | | |
|---|---|---|
| Tightening torque | Camshaft position sensor mounting screw | 4 to 5 N·m<br>0.4 to 0.6 kgf·m<br>3 to 4 lbf·ft |

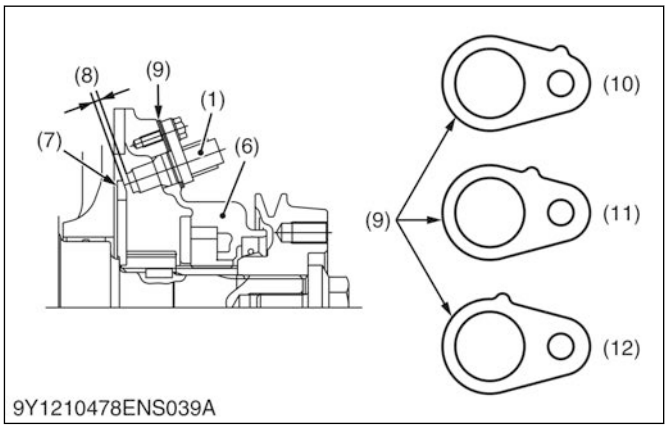
## 5.5.4 Removing crankshaft position sensor

1. Remove the crankshaft position sensor mounting screw (2).
2. Remove the crankshaft position sensor (1).




(1) Crankshaft position sensor
(2) Crankshaft position sensor mounting screw




(1) Crankshaft position sensor
(3) Jig 1
(5) Protrusion
(6) Gear case
(7) Pulsar gear
(8) Air gap
(9) Shim
(10) Shim (0.25 mm (0.0098 in.))
(11) Shim (0.50 mm (0.020 in.))
(12) Shim (1.00 mm (0.0394 in.))

**(When reassembling)**

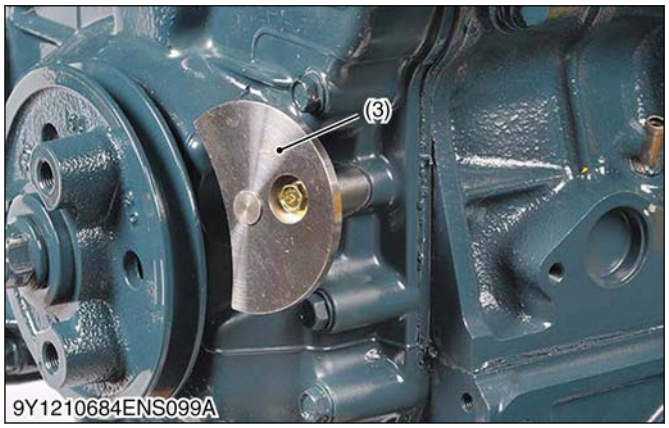
**■ IMPORTANT**

- **If you drop the sensor, do not reuse it.**

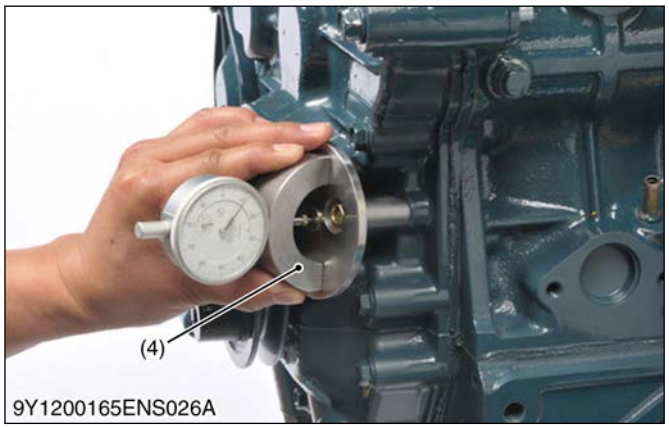
- **If the sensor (1), gear case (6) and/or pulsar gear (7) are replaced, use a combination of shims (9) to adjust the sensor air gap.**
- Replace the O-ring with a new one.

## 5.5.5 Selecting adjustment shims

1. Align the "**TC**" mark of flywheel with the flywheel housing timing window.
2. Install the measurement jig 1 (3) to the sensor mounting position.
3. Set the dial gauge at the measurement jig 2 (4), then measure the protrusion (5) of the jig 1 (3).




(3) Jig 1




(4) Jig 2

4. Refer to the protrusion (5) you measured, and select the number of adjusting shims (9) from the following table.

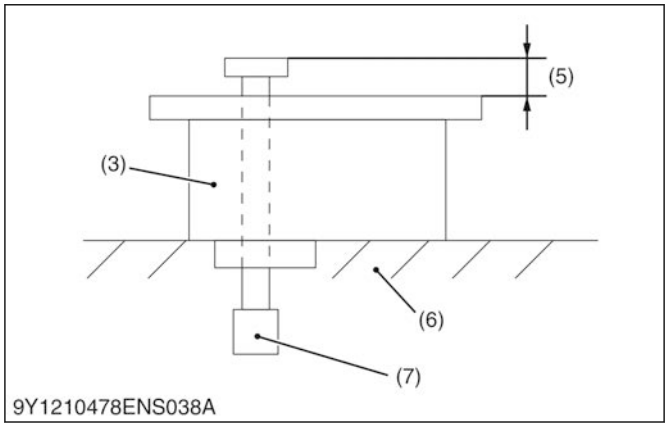
**Combination of shims**

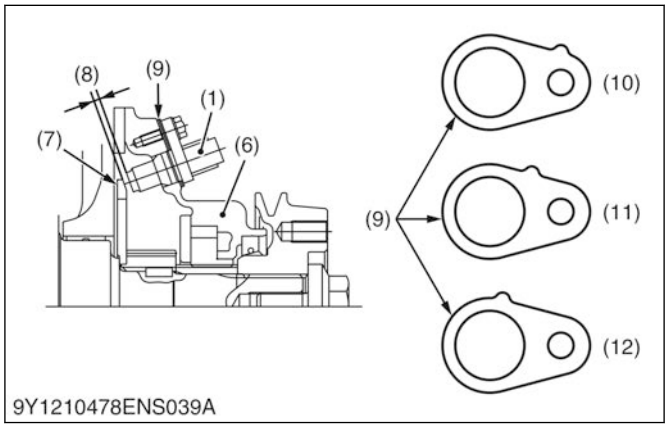
| Protrusion (5) | Thickness and number of shims | | |
|---|---|---|---|
| | 0.25 mm (0.0098 in.) (10) | 0.50 mm (0.020 in.) (11) | 1.00 mm (0.0394 in.) (12) |
| | 1G381-04420 | 1G381-04430 | 1G381-04440 |
| 2.25 to 2.50 mm 0.0886 to 0.0984 in. | 1 | | 2 |
| 2.00 to 2.25 mm 0.0788 to 0.0885 in. | | | 2 |
| 1.75 to 2.00 mm 0.0689 to 0.0787 in. | 1 | 1 | 1 |
| 1.50 to 1.75 mm 0.0591 to 0.0688 in. | | 1 | 1 |
| 1.25 to 1.50 mm 0.0493 to 0.0590 in. | 1 | | 1 |
| 1.00 to 1.25 mm 0.0394 to 0.0492 in. | | | 1 |
| 0.750 to 1.00 mm 0.0296 to 0.0393 in. | 1 | 1 | |
| 0.500 to 0.750 mm 0.0197 to 0.0295 in. | | 1 | |
| 0.250 to 0.500 mm 0.00985 to 0.0196 in. | 1 | | |
| 0 to 0.250 mm 0 to 0.00984 in. | | | |

5. When reassembling, tighten the crankshaft position sensor mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Crankshaft position sensor mounting screw | 4 to 5 N·m<br>0.4 to 0.6 kgf·m<br>3 to 4 lbf·ft |

| | | |
|---|---|---|
| Air gap (8) | Factory specification | 0.25 to 1.4 mm<br>0.0099 to 0.055 in. |




(1) Crankshaft position sensor
(3) Jig 1
(5) Protrusion
(6) Gear case
(7) Pulsar gear
(8) Air gap
(9) Shim
(10) Shim (0.25 mm (0.0098 in.))
(11) Shim (0.50 mm (0.020 in.))
(12) Shim (1.00 mm (0.0394 in.))

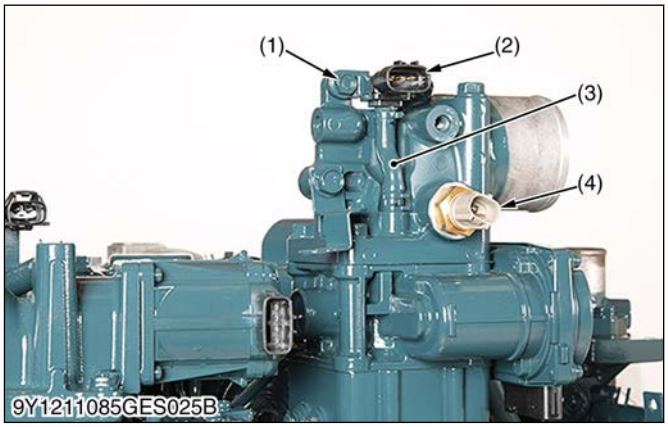
RELATED PAGE
1.13 Air gap of the crankshaft position sensor measuring jig 1 on page 2-70
1.14 Air gap of the crankshaft position sensor measuring jig 2 on page 2-71

## 5.5.6 Removing intake air temperature sensor and boost sensor

**IMPORTANT**

- **Be careful not to damage the sensor when removing the hose from the boost sensor.**

1. Remove the intake air temperature sensor (4).
2. Remove the hose (3) from the boost sensor (2).
3. Remove the boost sensor mounting screw (1).
4. Remove the boost sensor (2).




(1) Boost sensor mounting screw
(2) Boost sensor
(3) Hose
(4) Intake air temperature sensor

**(When reassembling)**

- Replace the gaskets with new ones.
- If the hose is damaged, replace it with a new hose.
- Tighten the intake air temperature sensor mounting screw and the boost sensor mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Intake air temperature sensor mounting screw | 30 to 39 N·m<br>3.0 to 4.0 kgf·m<br>22 to 28 lbf·ft |
| | Boost sensor mounting screw | 4 to 5 N·m<br>0.4 to 0.6 kgf·m<br>3 to 4 lbf·ft |

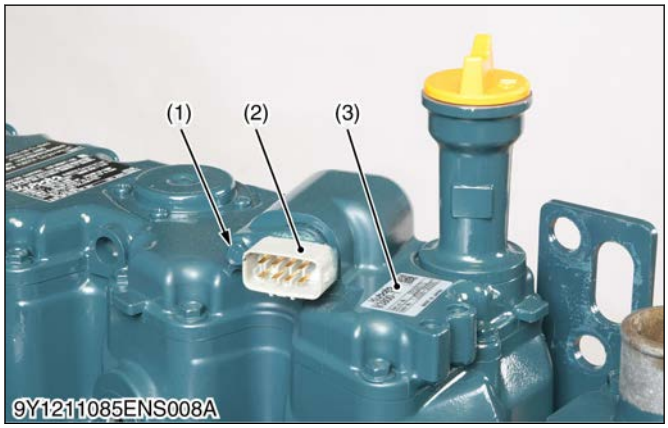
## 5.5.7 Removing injector harness connector

**IMPORTANT**

- **Be careful not to damage the harness when you pull the connector out.**

1. Remove the screw (1).
2. Pull the injector harness connector (2) out from cylinder head cover 2 (3).

3. Remove the connector (2) from the injector harness (4).





(1) Screw
(2) Injector harness connector
(3) Cylinder head cover 2
(4) Injector harness
(5) O-ring

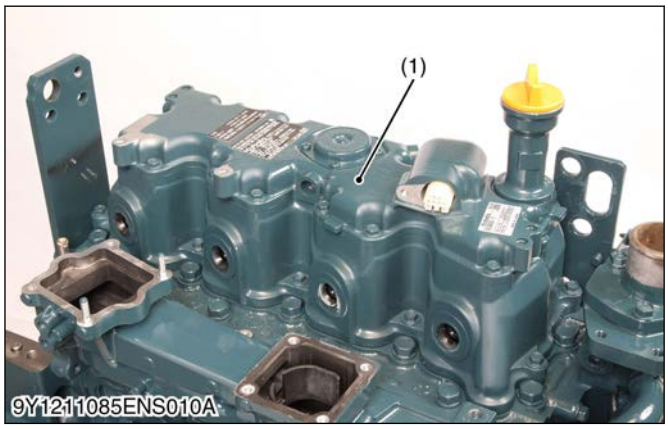
**(When reassembling)**

- If the O-ring (5) is damaged, replace the injector harness connector (2).

# 5.6 Cylinder head and valve

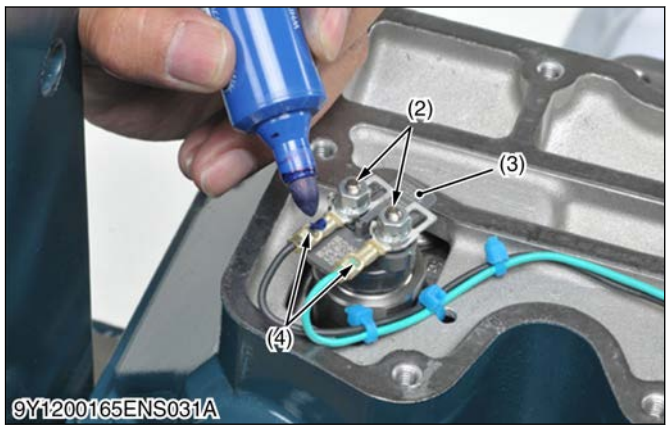
## 5.6.1 Removing cylinder head cover

1. Remove cylinder head cover 2 (1).



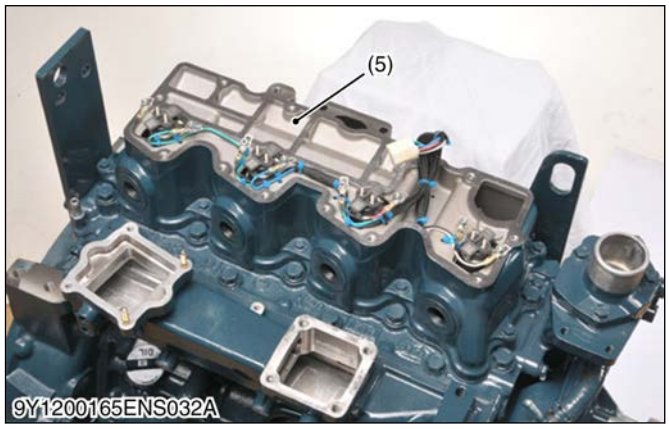

(1) Cylinder head cover 2

2. To prevent miswiring during reassembly, mark the injector terminals (2) and the leads (4).




(2) Injector terminal
(3) Injector QR code tag
(4) Lead

3. Remove the injector harness from the injectors.
4. Remove cylinder head cover 1 (5).




(5) Cylinder head cover 1

**(When reassembling)**

- Do not damage injector QR code tags (3) when installing cylinder head cover 1 (5).
- Replace the gasket of cylinder head cover 2 with a new one.
- Tighten the cylinder head cover 1 screw , the cylinder head cover 2 screw and the injector terminal nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Cylinder head cover 1 screw | 6.87 to 11.2 N·m<br>0.700 to 1.15 kgf·m<br>5.07 to 8.31 lbf·ft |
| | Cylinder head cover 2 screw | 9.81 to 11.2 N·m<br>1.00 to 1.15 kgf·m<br>7.24 to 8.31 lbf·ft |
| | Injector terminal nut | 1.6 to 2.2 N·m<br>0.16 to 0.23 kgf·m<br>1.2 to 1.6 lbf·ft |

## 5.6.2 Removing overflow pipe and injectors

**IMPORTANT**

- **Do not disassemble the injector (3).**

- **Do not remove the injector QR code tag (8).**
- **Do not damage the injector QR code tag (8).**
- **Do not lose the ball (4) of the rocker arm bracket.**
- **Do not get the injectors out of order. If the injectors get out of order, it is necessary to perform injector correction (writing the injector ID codes (9) to the ECU).**
- **Store the injectors so that they do not get any dust in them.**

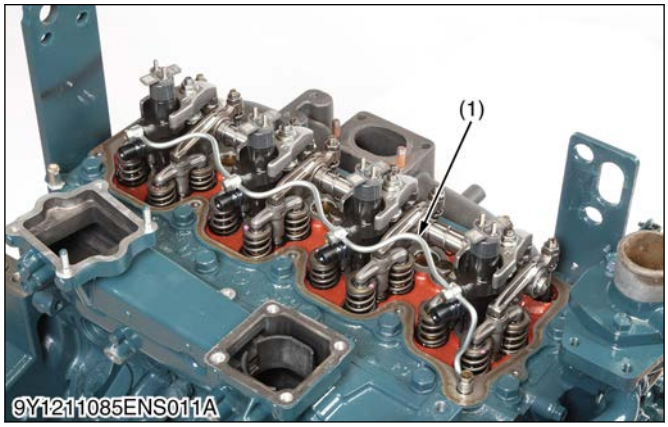
1. Remove the overflow pipe (1).
2. Remove the injector clamp (2).
3. Remove the injector (3) and its gasket (7).

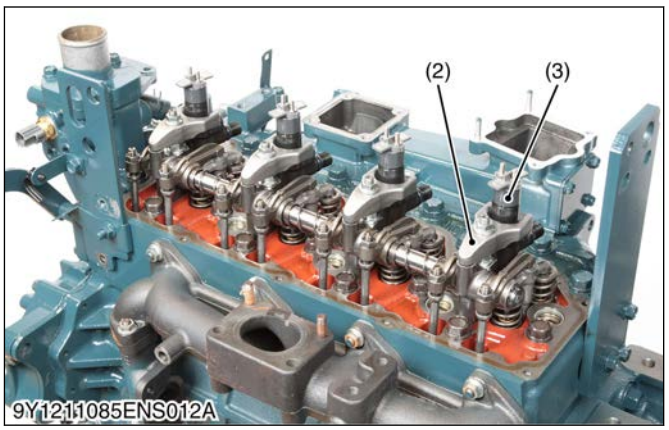
**(When reassembling)**

**■ NOTE**

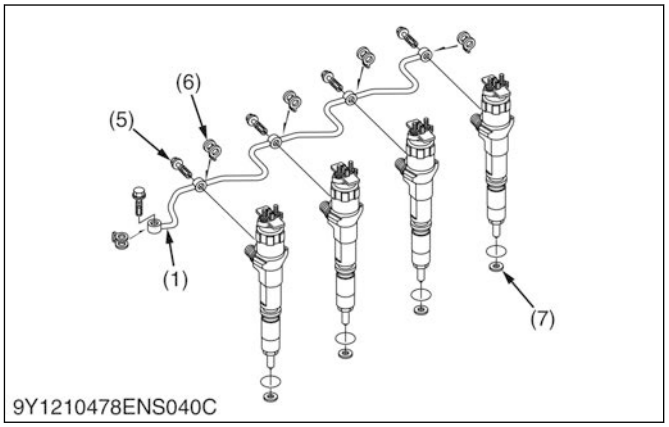
- **If you replace the injectors, it is necessary to perform injector correction (writing the injector ID codes (9) to the ECU).**

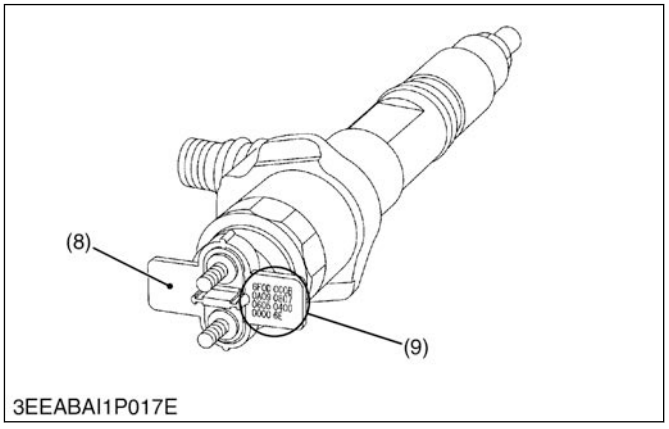
- Replace the injectors' gaskets (7) with new ones.
- When installing injector clamps (2), check and make sure the ball (4) is in the rocker arm bracket.
- When attaching the overflow pipe (1) to the injector, replace the gasket (6) with a new one.
- Install the overflow pipe joint screw (5).
- Tighten the injector clamp nut to the specified tightening torques.
- Tighten the overflow pipe joint screw (5) to the specified tightening torques.
- After installing the overflow pipe, in order to check the fuel leakage, add pressure by air from the fuel pipe joint, and check the fuel leakage of overflow pipe and gasket (6).
- In case there is fuel leakage, replace the gasket (6), then check the fuel leakage again.







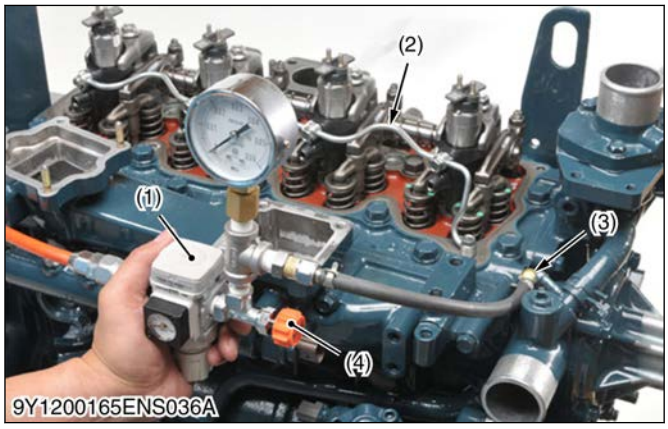



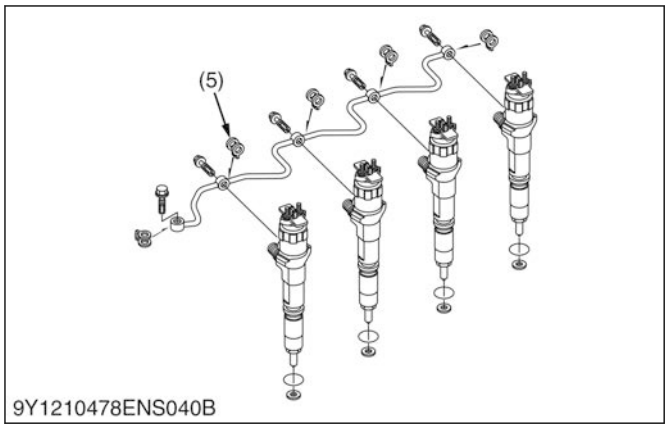

(1) Overflow pipe
(2) Injector clamp
(3) Injector
(4) Ball
(5) Overflow pipe joint screw
(6) Gasket
(7) Gasket
(8) Injector QR code tag
(9) Injector ID code

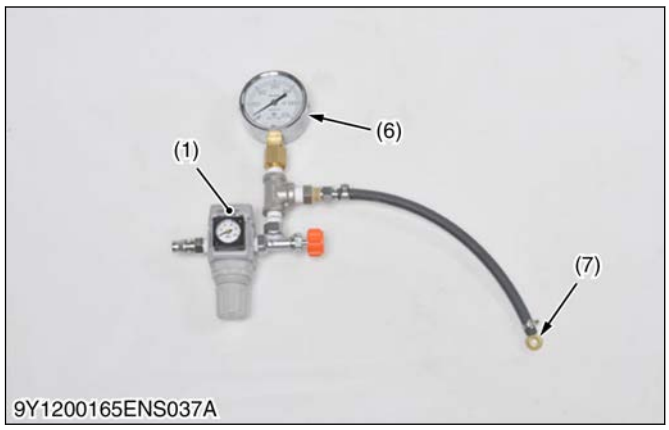
| | | |
|---|---|---|
| Tightening torque | Injector clamp nut | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | Overflow pipe joint screw (M6 × 1.0) | 9.81 to 11.2 N·m<br>1.00 to 1.15 kgf·m<br>7.24 to 8.31 lbf·ft |

## 5.6.3 Checking fuel leakage of the overflow pipe

1. Connect the fuel pipe joint (7) of air pressure adjustment equipment to the eye joint bolt (3).
2. Tighten the valve (4).
3. Connect the air hose to the air pressure adjustment equipment.
4. Adjust air pressure of the regulator (1) between 0.03 and 0.05 MPa (0.3 and 0.5 kgf/cm$^2$, 5 and 7 psi).
5. Open the valve (4) gradually, then add 0.03 MPa (0.3 kgf/cm$^2$, 4 psi) pressure.
6. Tighten the valve (4).
7. Check the decreased pressure after 4 seconds.




(1) Regulator
(2) Overflow pipe
(3) Eye joint bolt
(4) Valve
(5) Gasket
(6) Pressure gauge
(7) Fuel pipe joint

8. If the pressure decreases higher than 0.001 MPa (0.01 kgf/cm$^2$, 0.1 psi), it means that there is fuel leakage. Replace the gasket (5).
9. Check the fuel leakage again.

| | |
|---|---|
| Leakage check | Pressure decreases more than 0.001 MPa (0.01 kgf/cm$^2$, 0.1 psi) after 4 seconds |

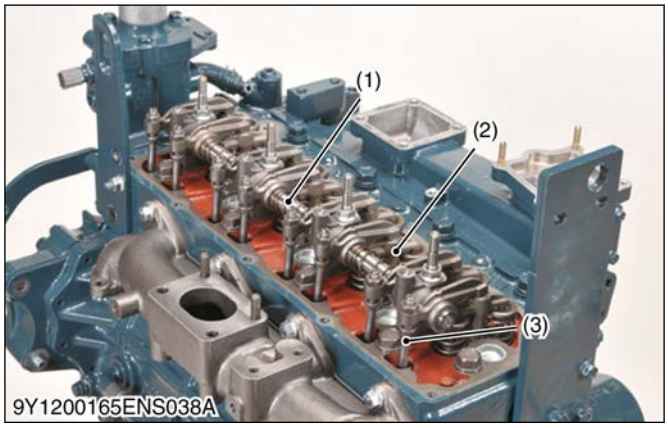
### Specification of components

| Parts name | Specification or code No. |
|---|---|
| Regulator (1) | 0.030 to 0.85 MPa<br>0.31 to 8.7 kgf/cm$^2$<br>4.4 to 120 psi |
| Pressure gauge (6) | 0 to 0.06 MPa<br>0 to 0.6 kgf/cm$^2$<br>0 to 8 psi |
| Fuel pipe joint (7) | 14117-42560 |

## 5.6.4 Removing rocker arms and push rods

1. Remove the rocker arm (1).
2. Remove the push rod (3).

3. Remove the valve bridge arm (2).

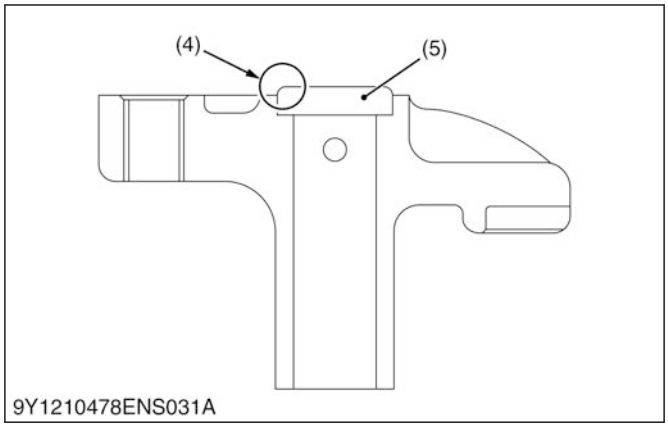



(1) Rocker arm
(2) Valve bridge arm
(3) Push rod

**(When reassembling)**

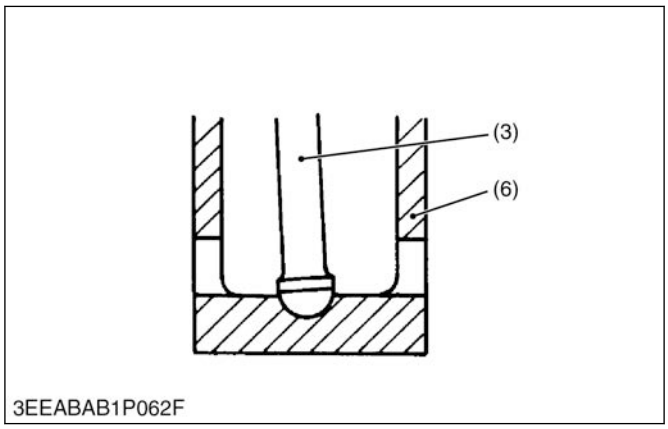
**■ IMPORTANT**

- **After installing the rocker arm, adjust the valve clearance.**
- Face up the R face (4) of the pad (5) and install it on the bridge arm.




(4) R face
(5) Pad

- When installing the push rod (3), mount it securely in the groove of the tappet (6).



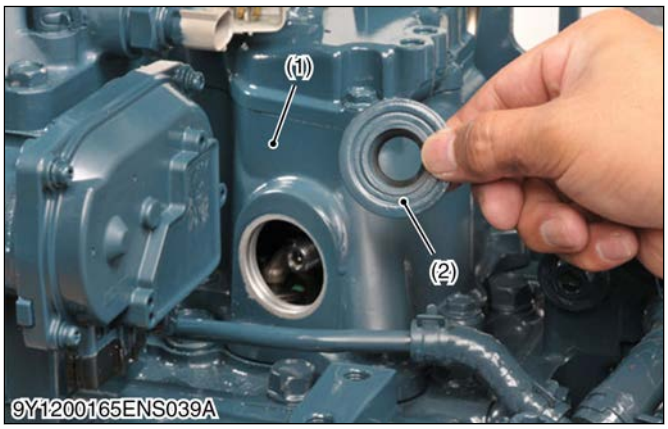

(3) Push rod
(6) Tappet

- Tighten the rocker arm bracket nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Rocker arm bracket nut | 49 to 55 N·m<br>5.0 to 5.7 kgf·m<br>37 to 41 lbf·ft |

## 5.6.5 Removing injector oil seal (If necessary)

1. Remove the injector oil seal (2) from cylinder head cover1 (1).




(1) Cylinder head cover 1
(2) Injector oil seal

**(When reassembling)**

- When installing the injector oil seal (2), use a new one.

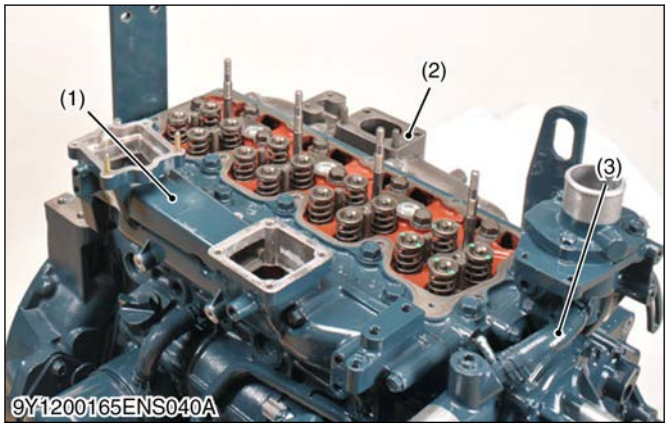
## 5.6.6 Removing cylinder head and tappet

**■ NOTE**

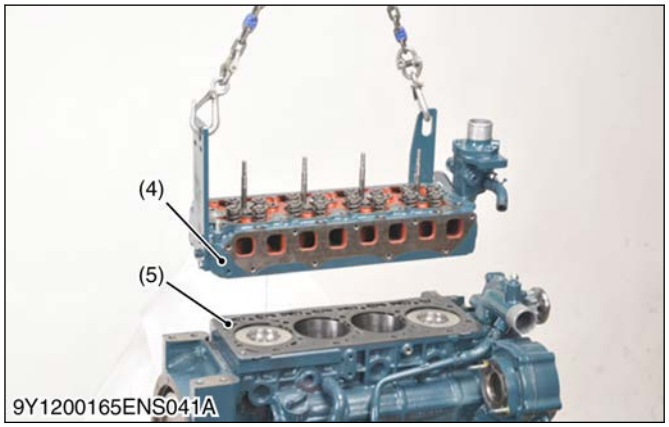
- **Mark the cylinder number to the tappets to prevent interchanging.**

1. Loosen the pipe clamp and remove the water return hose (3).
2. Remove the inlet manifold (1) and exhaust manifold (2).
3. Remove the cylinder head mounting screw in the sequence of 18 to 1, and remove the cylinder head (4).
4. Remove the cylinder head gasket (5).

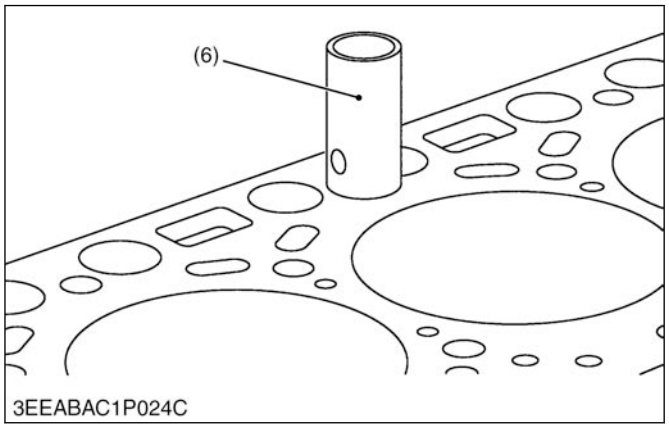
5. Remove the tappets (6) from the crankcase.




(1) Inlet manifold
(2) Exhaust manifold
(3) Return hose




(4) Cylinder head
(5) Cylinder head gasket

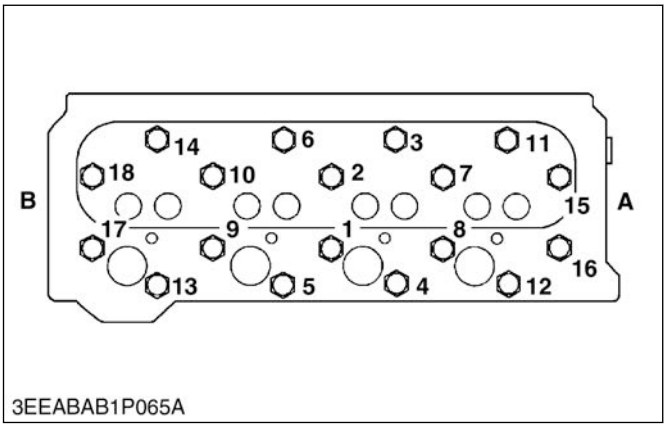



(6) Tappet

**(When reassembling)**

**■ IMPORTANT**

- **When replacing the piston, piston pin bushing, connecting rod or crank pin bearing, select the cylinder head gasket thickness to meet with the top clearance.**
- Replace the cylinder head gasket (5) with a new one.
- Before installing the tappets (6), apply engine oil thinly around them.
- When mounting the gasket, set it to the knock pin hole. Be careful not to mount it reversely.
- The cylinder head should be free of scratches and dust.
- Be careful for handling the gasket not to damage it.
- Install the cylinder head.
- Tighten the cylinder head mounting screw gradually in the sequence of 1 to 18 after applying engine oil.




A: Gear case side
B: Flywheel side

- Be sure to adjust the valve clearance.
- It is not necessary to retighten the cylinder head mounting screw after operating the engine for 30 minutes.
- Tighten the cylinder head mounting screw and the exhaust manifold mounting nut to the specified tightening torque.

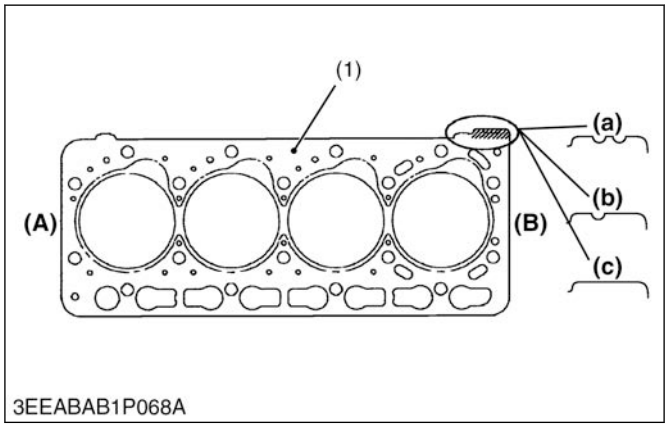
| | | |
|---|---|---|
| Tightening torque | Cylinder head mounting screw | 98.1 to 107 N·m<br>10.0 to 11.0 kgf·m<br>72.4 to 79.5 lbf·ft |
| | Exhaust manifold mounting nut | 30 to 34 N·m<br>3.0 to 3.5 kgf·m<br>22 to 25 lbf·ft |

RELATED PAGE
1.10.4 Adjusting valve clearance on page 2-40
5.6.8 Selecting cylinder head gasket on page 3-95

## 5.6.7 Replacing cylinder head gasket

1. Make sure to note the notch (a), (b) or (c) of cylinder head gasket in advance.

2. Replace the same notch (a), (b) or (c) as the original cylinder head gasket (1).




(1) Cylinder head gasket
(A) Gear case side
(B) Flywheel side
(a) 2 notches
(b) 1 notch
(c) Without notch

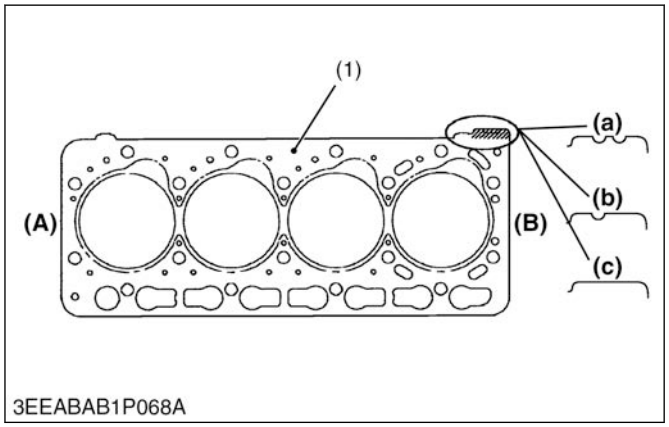
| Notch of cylinder head gasket | Thickness of cylinder head gasket | | Code number | Piston head protrusion or recessing from the level of crankcase cylinder face. (average of 4 pistons) |
|---|---|---|---|---|
| | Before tightening | After tightening | | |
| 2 notches (a) | 0.90 mm 0.035 n. | 0.80 mm 0.031 in. | 1G514-03 310 | −0.0700 to +0.0490 m m −0.00275 to +0.00192 i n. |
| 1 notch (b) | 1.00 mm 0.0394 in. | 0.90 mm 0.035 in. | 1G514-03 600 | +0.0500 to +0.149 m m +0.00197 to +0.00586 i n. |
| Without notch (c) | 1.05 m 0.0413 in. | 0.95 mm 0.037 in. | 1G514-03 610 | +0.150 to +0.200 m m 0.00591 to +0.00787 i n. |

## 5.6.8 Selecting cylinder head gasket

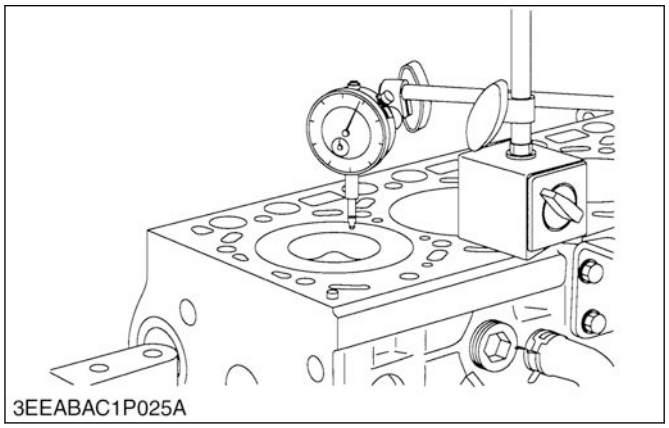
- When replacing the piston, piston pin bushing, connecting rod or crank pin bearing, select the cylinder head gasket thickness to meet with the top clearance.

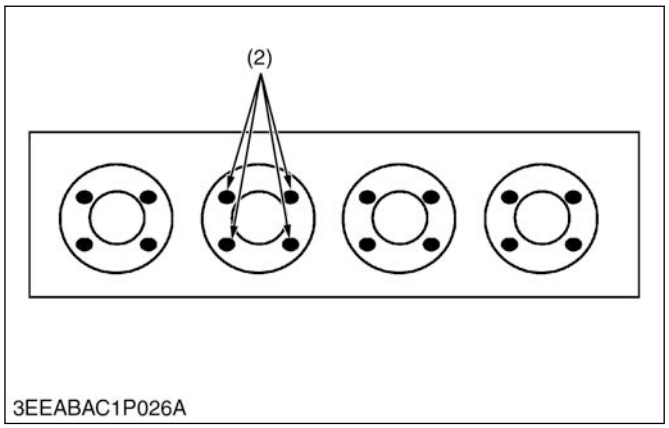
1. Measure the piston head protrusion or recessing from the crankcase cylinder face 4 spots (2) per each piston using the dial gauge as shown in figure, and get the average of the measured values.

2. Use the table below to select an applicable cylinder head gasket.



3EEABAB1P068A


3EEABAC1P025A



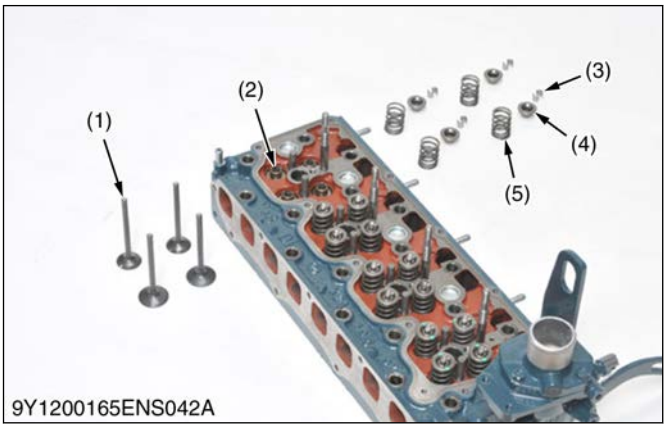
3EEABAC1P026A

(1) Cylinder head gasket
(2) Points of measurement
(A) Gear case side
(B) Flywheel side
(a) 2 notches
(b) 1 notch
(c) Without notch

| Notch of cylinder head gasket | Thickness of cylinder head gasket | | Code number | Piston head protrusion or recessing from the level of crankcase cylinder face. (average of 4 pistons) |
|---|---|---|---|---|
| | Before tightening | After tightening | | |
| 2 notches (a) | 0.90 mm 0.035 in. | 0.80 mm 0.031 in. | 1G514-03310 | −0.0700 to +0.0490 mm −0.00275 to +0.00192 in. |
| 1 notch (b) | 1.00 mm 0.0394 in. | 0.90 mm 0.035 in. | 1G514-03600 | +0.0500 to +0.149 mm +0.00197 to +0.00586 in. |
| Without notch (c) | 1.05 mm 0.0413 in. | 0.95 mm 0.037 in. | 1G514-03610 | +0.150 to +0.200 mm +0.00591 to +0.00787 in. |

## 5.6.9 Removing valve

1. Push the valve spring (5) with the valve spring retainer (4) and remove the valve spring collets (3).
2. Remove the valve spring (5) and valve (1).



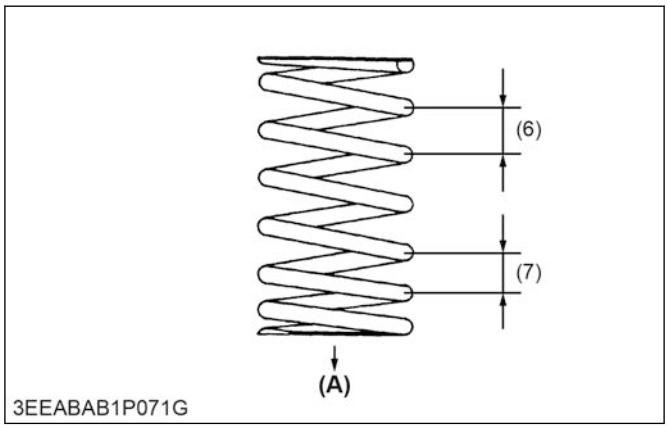
9Y1200165ENS042A

(1) Valve
(2) Valve stem seal
(3) Valve spring collet
(4) Valve spring retainer
(5) Valve spring

**(When reassembling)**

- Install the valve spring with its small pitch (7) end downward (at the head side).

- Clean the valve stem and valve guide hole, and apply engine oil sufficiently.
- After you install the valve spring collets (3), lightly tap the stem tip to attach it correctly with the plastic hammer.

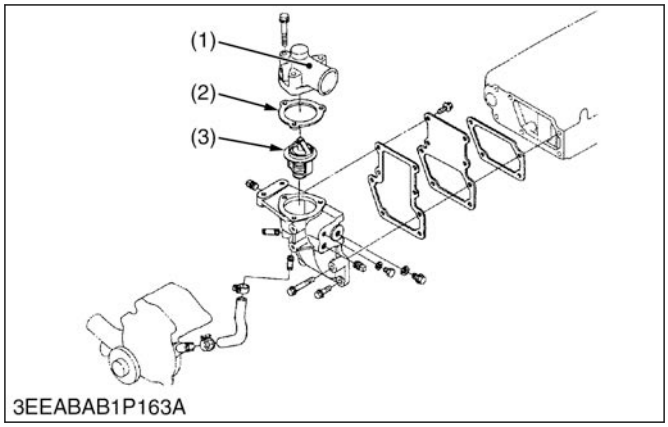


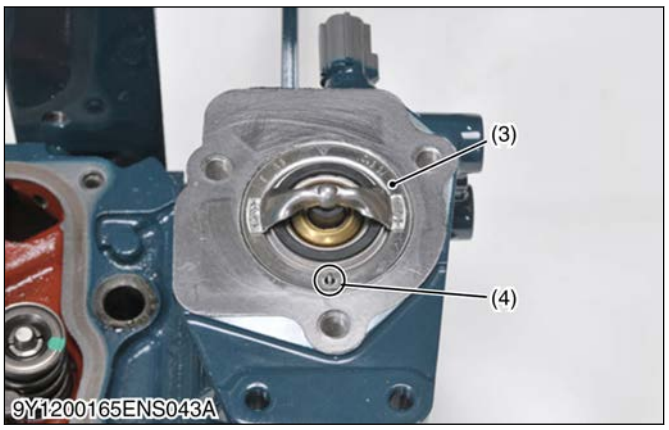

(6) Large pitch
(7) Small pitch
(A) Install valve spring with its smaller pitch end downward (at the head side).

# 5.7 Thermostat

## 5.7.1 Removing thermostat assembly

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




(1) Thermostat cover
(2) Thermostat cover gasket
(3) Thermostat assembly
(4) Hole

**(When reassembling)**

- Replace the gasket with a new one.
- Apply a liquid gasket (Three Bond 1217H or its equivalents) only at the thermostat cover side of the gasket (2).
- Install the thermostat facing its hole (4) toward the air suction side.

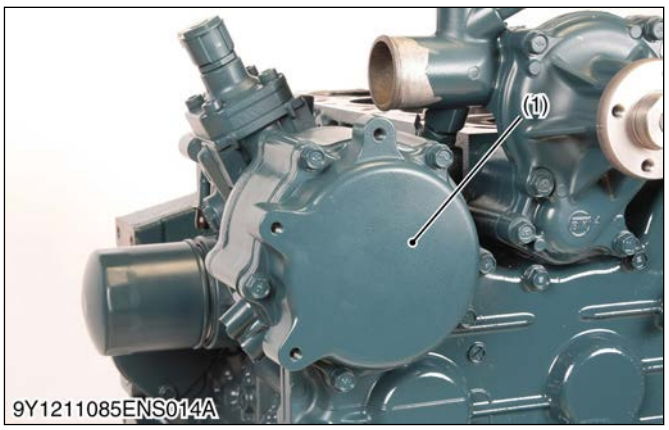
# 5.8 Supply pump

## 5.8.1 Removing supply pump

**⚠ CAUTION**

- **Do not loosen the injection pipe when the fuel pressure is high (within five minutes after stopping the engine).**

1. Remove the supply pump gear cover (1).




(1) Supply pump gear cover

2. Put the piston of the number 4 cylinder at T.D.C.

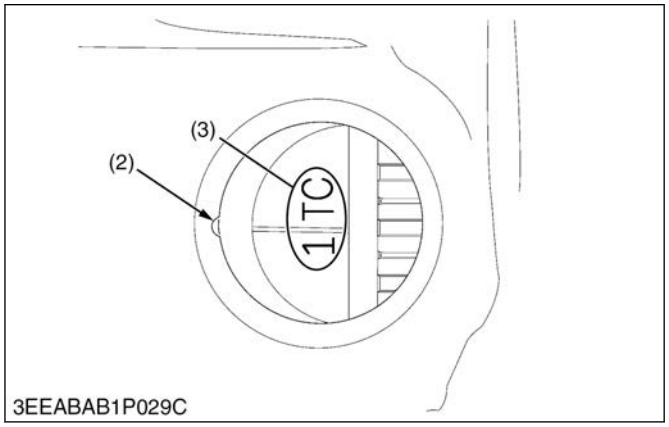
**■ NOTE**

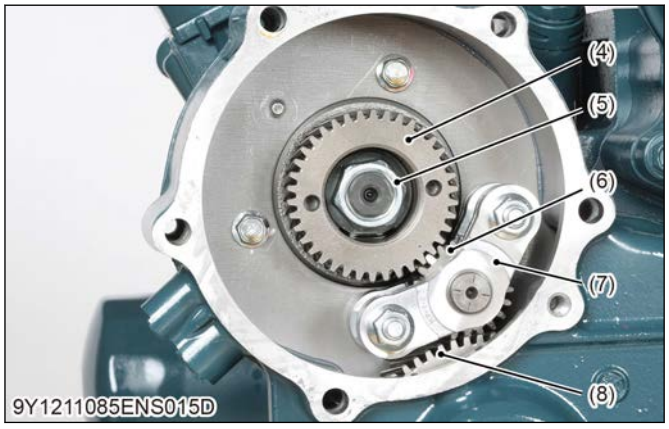
- **When positioning the piston of the 4th cylinder to T.D.C., rotate the flywheel counterclockwise and align the "TC" mark (3) on the flywheel with the mark (2) on the housing of the flywheel. If the supply pump gear timing mark (10) meshes with idle gear 3 (6), then the piston of the 4th cylinder is T.D.C.. If they do not mesh, rotate the flywheel counterclockwise one revolution.**

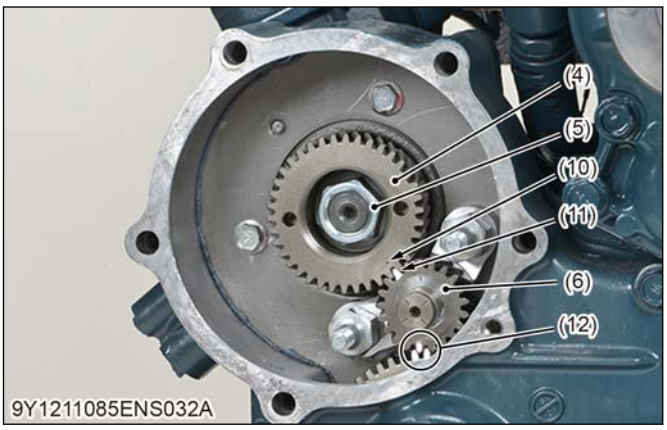
3. Fix the flywheel in place.
4. Loosen the supply pump gear's mounting nut (5).
5. Remove the idle gear 3 holder (7).
6. Make a temporary mark (11) with a white paint marker pen on the tooth of idle gear 3 (6).
7. Make a temporary mark 1 (12) with a white paint marker pen on the tooth of idle gear 3 (6) and idle gear 2 (8) or idle gear 1 (9).

**■ NOTE**

- **This mark is extremely useful during reassembly of the supply pump gear and idle gear 3 (7) to get the timing right.**



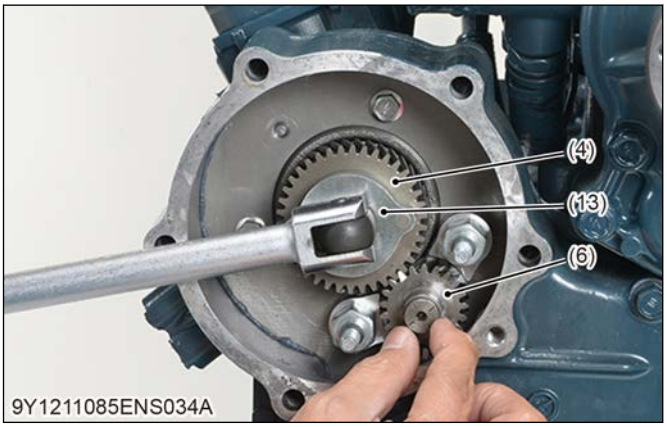




(2) Mark
(3) TC mark
(4) Supply pump gear
(5) Supply pump gear mounting nut
(6) Idle gear 3
(7) Idle gear 3 holder
(8) Idle gear 2
(9) Idle gear 1
(10) Timing mark
(11) Temporary mark
(12) Temporary mark 1

8. Set the supply pump gear reinstalling jig (13).


(13) Supply pump gear reinstalling jig

9. Turn the supply pump gear (4) clockwise and counterclockwise until being able to remove the idle gear 3 (6).
10. Remove the supply pump gear mounting nut (5).

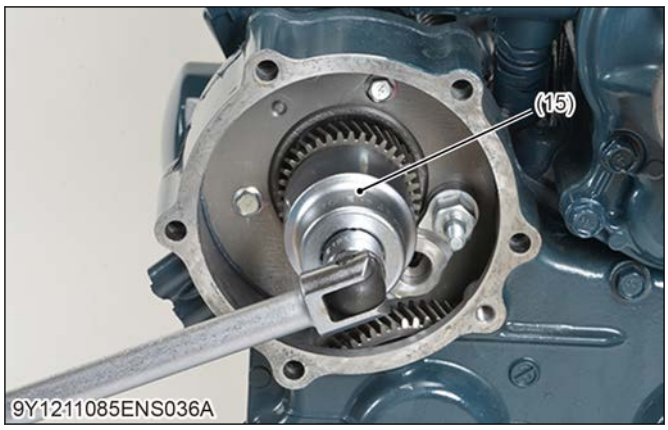



(4) Supply pump gear
(6) Idle gear 3
(13) Supply pump gear reinstalling jig

11. Set the gear puller (14).


(14) Gear puller

12. Remove the supply pump gear (4) with a 41 mm (1.6 in.) deep socket wrench (15).

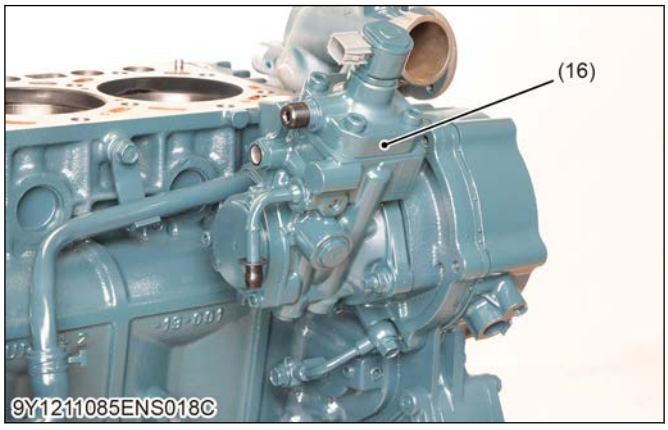



(15) 41 mm (1.6 in.) deep socket wrench

13. Remove the supply pump (16).

**■ NOTE**

- **Do not disassemble the supply pump.**
- **Store the supply pump so that it does not get any dust in it.**




(16) Supply pump

**(When reassembling)**

**■ NOTE**

- **When replacing the supply pump with a new one, use the diagnosis tool to conduct learning of discrepancies in the new supply pump.**

- Replace the O-ring of the supply pump (16) with a new one.
- Line up the key of the supply pump gear (4) and install the supply pump (16).
- Tighten the supply pump gear mounting nut (5).
- Tighten the supply pump mounting nut.
- Set the supply pump gear reinstalling jig (13).
- Turn the supply pump gear (4) clockwise and counterclockwise until being able to install the idle gear 3 (6).
- Align the alignment marks of the supply pump gear (4) and idle gear 3 (6).
- Align the alignment marks of the idle gear 3 (6) and idle gear 2 (8) or idle gear 1 (9).
- Install the idle gear 3 holder (7).
- Tighten the supply pump gear mounting nut (5) to its specified torque.
- Replace the gasket of supply pump gear cover with a new one.
- Mount the supply pump gear cover (1).

| | | |
|---|---|---|
| Tightening torque | Supply pump mounting nut | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | Supply pump gear mounting nut | 128 to 147 N·m<br>13.0 to 15.0 kgf·m<br>94.1 to 108 lbf·ft |
| | Supply pump gear cover mounting screw | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |

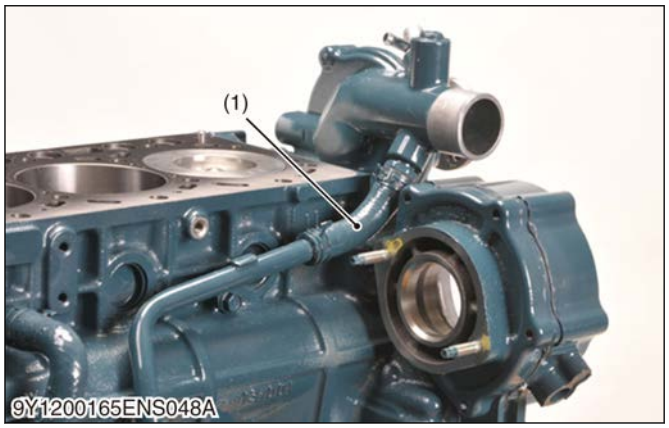
RELATED PAGE

1.8 Supply pump gear puller on page 2-66
1.9 Supply pump gear reinstall jig on page 2-66

# 5.9 Water pump and oil cooler

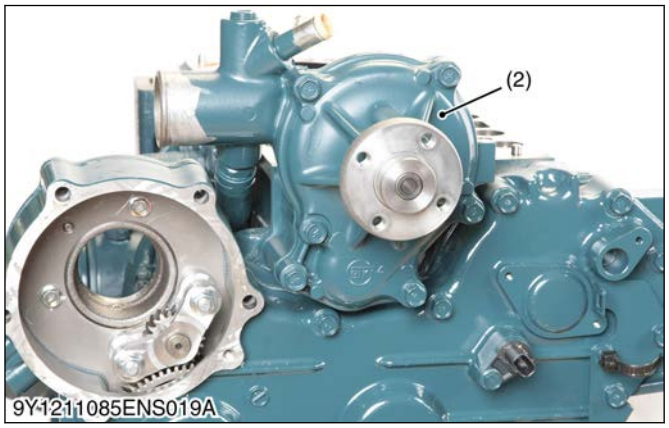
## 5.9.1 Removing water pump (V3800-TIEF4)

1. Loosen the hose bands and remove the water hose (water pump side) (1).




(1) Water hose

2. Remove the water pump (2).



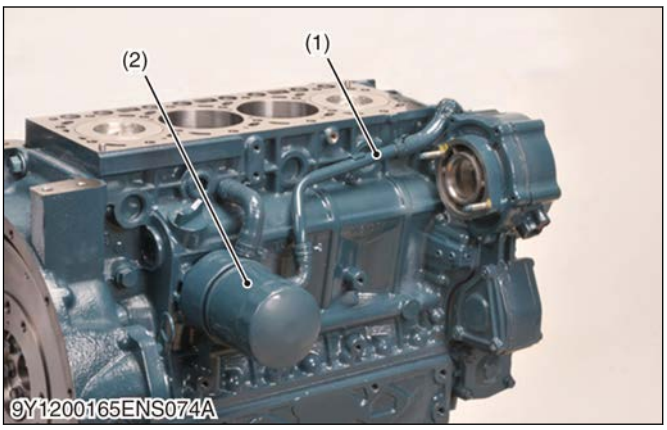

(2) Water pump

**(When reassembling)**

- When installing the water pump,install the O-ring and do not let it out of position.

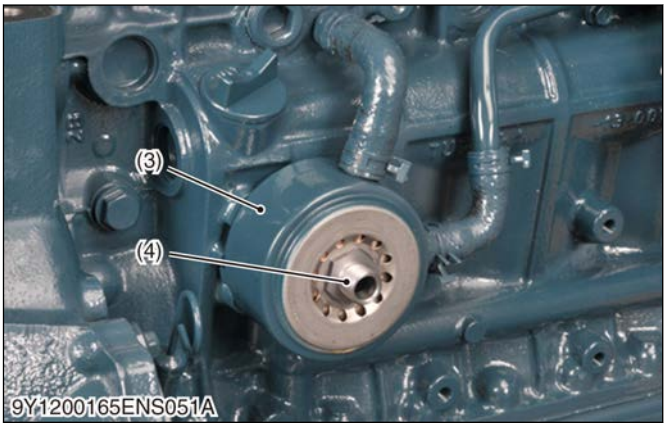
## 5.9.2 Removing oil cooler

1. Loosen the hose bands and remove the water hose.




(1) Water pipe (2) Oil filter cartridge

2. Remove the oil filter cartridge (2).
3. Remove the oil cooler joint screw (4).




(3) Oil cooler (4) Oil cooler joint screw

4. Remove the oil cooler (3).

**(When reassembling)**

- Tighten the oil cooler joint screw to the specified tightening torque.

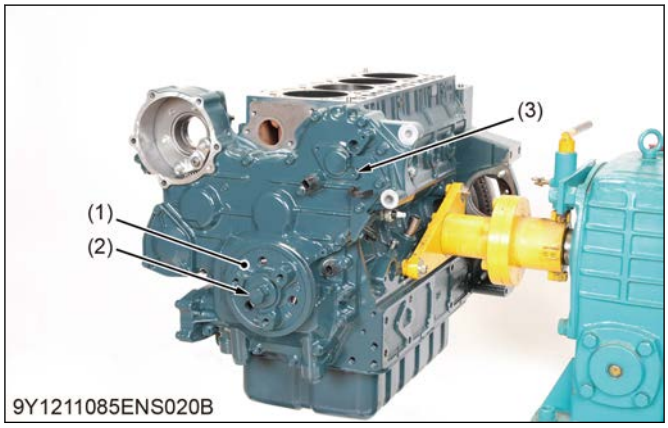
| | | |
|---|---|---|
| Tightening torque | Oil cooler joint screw | 40 to 44 N·m<br>4.0 to 4.5 kgf·m<br>29 to 32 lbf·ft |

# 5.10 Gear case and timing gear

## 5.10.1 Removing fan drive pulley and gear case cover

1. Fix a flywheel stopper on the flywheel and the flywheel housing case.

2. Remove the crankshaft screw (2).




(1) Fan drive pulley
(2) Crankshaft screw
(3) Gear case cover

3. Remove the fan drive pulley (1) with a puller.
4. After removing the gear case mounting screws, remove the gear case cover (3).

**(When reassembling)**

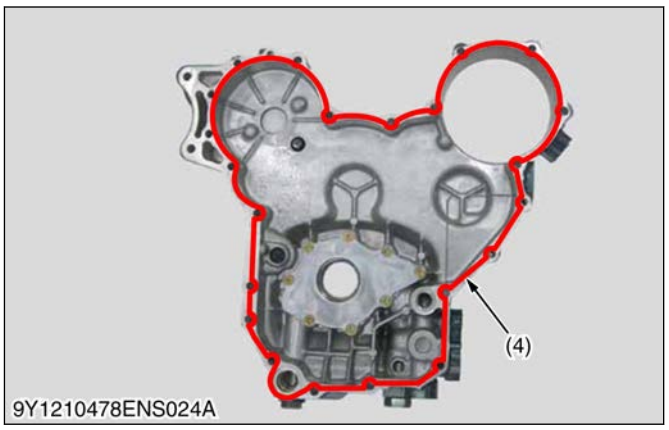
**■ NOTE**

- **Make sure the surfaces align when installing the gear case cover with a liquid gasket applied to them.**
- **Install the gear case cover within a limited time of liquid gasket application.**

| | |
|---|---|
| Limited time of liquid gasket | 10 minutes |

- **Apply a liquid gasket (4) to the gear case cover (Three Bond 1217H or its equivalents).**
- **When the gear case cover is replaced, check the air gap of the crankshaft position sensor.**
- **When the gear case cover is replaced, it is necessary to calibrate the injection timing with the diagnosis tool.**

- In order to keep an airtight seal, check and make sure there is no water, debris, or oil on the surface where the liquid gasket will be applied.
- Be careful to apply the liquid gasket (4) evenly. (Refer to the photo.)




(4) Liquid gasket

- Tighten the crankshaft screw and the gear case cover mounting screw to the specified tightening torque.

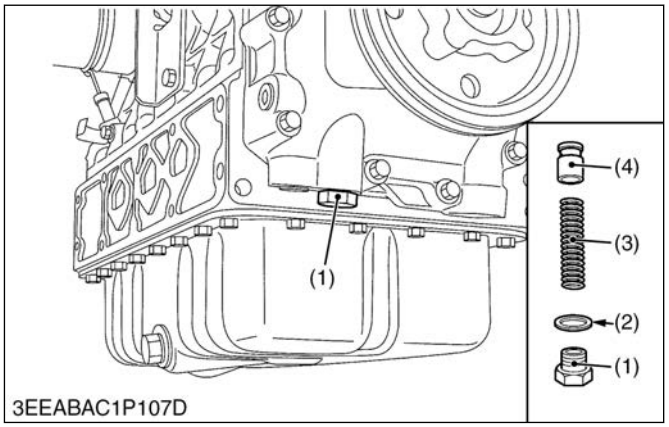
| | | |
|---|---|---|
| Tightening torque | Crankshaft screw | 255 to 274 N·m<br>26.0 to 28.0 kgf·m<br>188 to 202 lbf·ft |
| | Gear case cover mounting screw | 33 to 36 N·m<br>3.3 to 3.7 kgf·m<br>24 to 26 lbf·ft |

RELATED PAGE

1.5 Gear case oil seal press fit tool on page 2-64
1.10 Flywheel stopper on page 2-67

## 5.10.2 Removing relief valve

1. Remove the relief valve retaining screw (1).




(1) Relief valve retaining screw
(2) Packing
(3) Spring
(4) Relief valve

2. Remove the relief valve (4), the spring (3) and the packing (2).

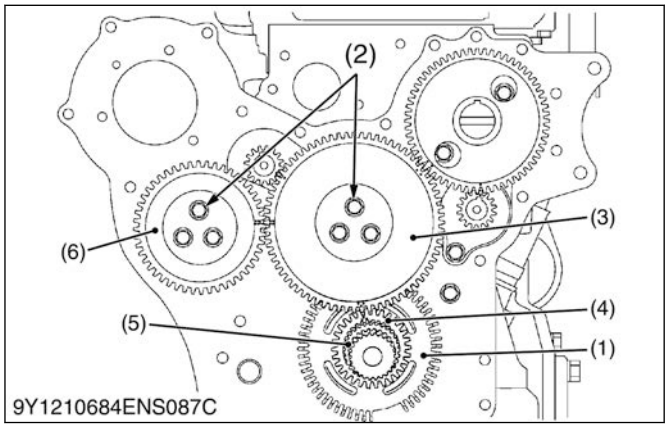
**(When reassembling)**

- Tighten the relief valve retaining screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Relief valve retaining screw | 69 to 78 N·m<br>7.0 to 8.0 kgf·m<br>51 to 57 lbf·ft |

## 5.10.3 Removing idle gear 1, 2, 3, oil pump drive gear and crank gear

1. Remove the idle gear mounting screw (2).




(1) Crankshaft position pulsar gear
(2) Idle gear mounting screw
(3) Idle gear 1
(4) Crank gear
(5) Oil pump drive gear
(6) Idle gear 2

2. Remove the idle gear 1 (3) and idle gear 2 (6).
3. Remove the oil pump drive gear (5).
4. Remove the crank gear (4).

**(When reassembling)**

**■ NOTE**

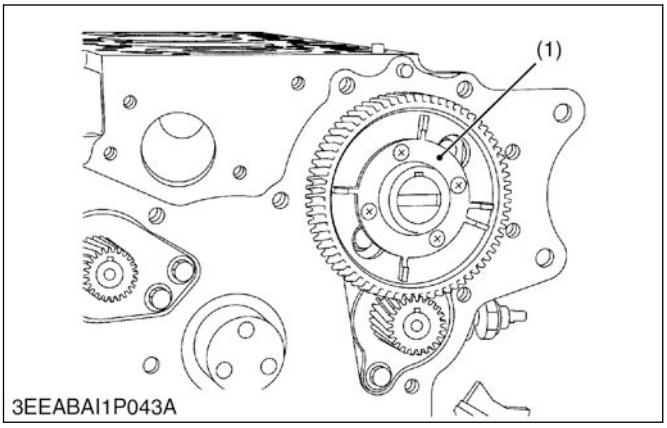
- **When the crank gear is replaced, check the air gap of the crankshaft position sensor.**
- **When the crank gear is replaced, it is necessary to calibrate the injection timing with the diagnosis tool.**

- When installing idle gear 1 (3), idle gear 2 (6), bring the piston of cylinder 4 to T.D.C. and install the gears with their marks aligned to the respective gears.
- Tighten the idle gear mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Idle gear mounting screw | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |

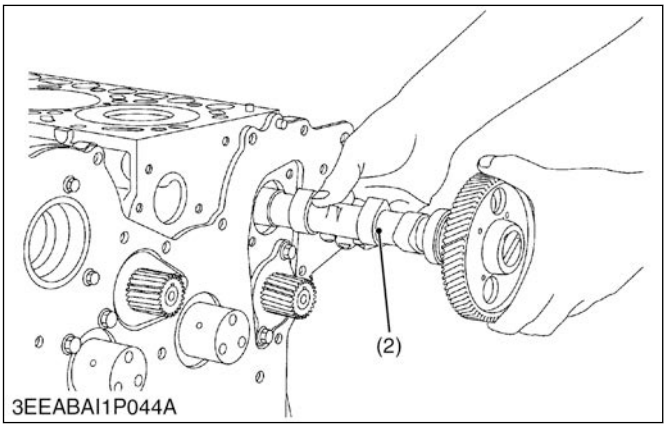
## 5.10.4 Removing camshaft

1. Remove the camshaft position pulsar gear (1).



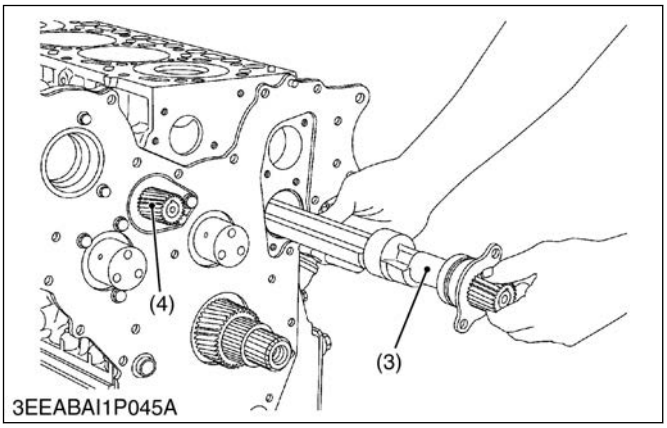

(1) Camshaft position pulsar gear

2. Remove the camshaft set screws and draw out the camshaft (2).




(2) Camshaft

3. Remove the balancer shaft 1 mounting screws and draw out the balancer shaft 1 (3).
4. Remove the balancer shaft 2 mounting screws and draw out the balancer shaft 2 (4).

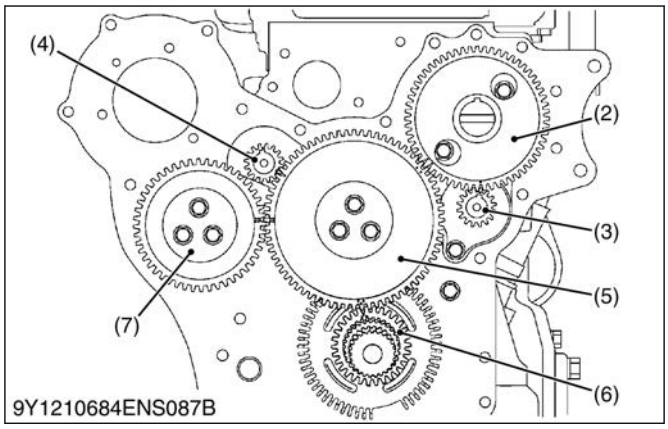



(3) Balancer shaft 1
(4) Balancer shaft 2
(5) Idle gear 1
(6) Crank gear
(7) Idle gear 2

**(When reassembling)**

- When installing the balancer shaft 1 and 2, be sure to place the 4th cylinder piston at the top dead

center in compression then, align all mating marks on each gear to assemble the timing gears, set the idle gear last.

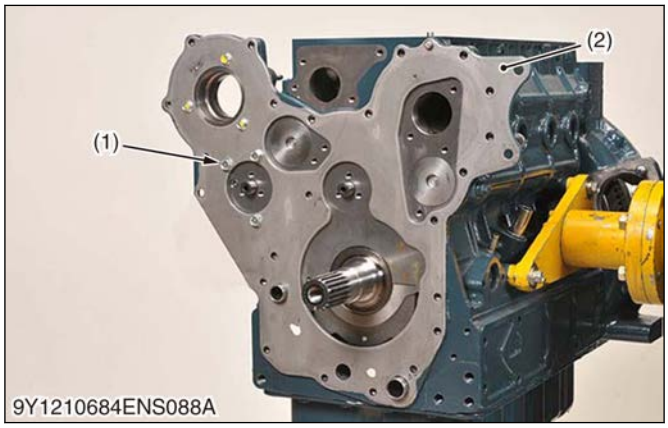



(5) Idle gear 1
(6) Crank gear
(7) Idle gear 2

| | | |
|---|---|---|
| Tightening torque | Balancer shaft mounting screw | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | Camshaft mounting screw | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | Camshaft position pulsar gear mounting screw | 4.7 to 5.6 N·m<br>0.48 to 0.58 kgf·m<br>3.5 to 4.1 lbf·ft |

### 5.10.5 Removing gear case plate (V3800-TIEF4)

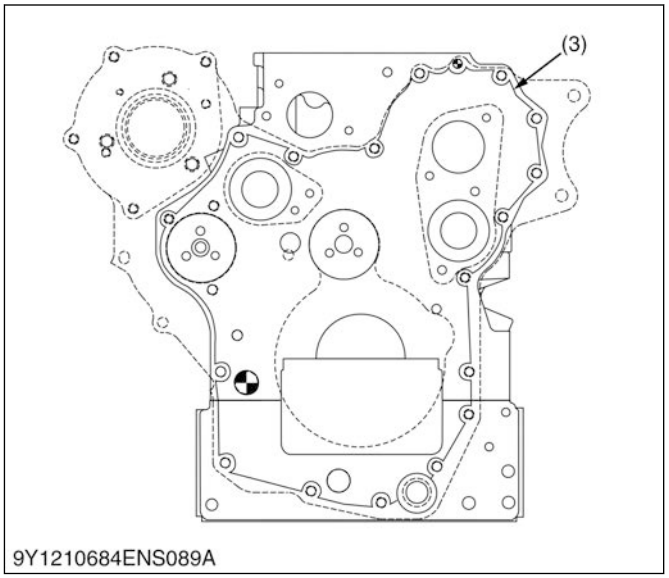
1. Remove the gear case plate mounting screws (1) and the gear case plate (2).




(1) Gear case plate mounting screw
(2) Gear case plate

**(When reassembling)**

- Apply liquid gasket (3) (Three Bond1217H or its equivalents) on the surface of the crankcase side where the gear case plate will be installed to.
- Tighten the gear case plate mounting screw to the specified tightening torque.



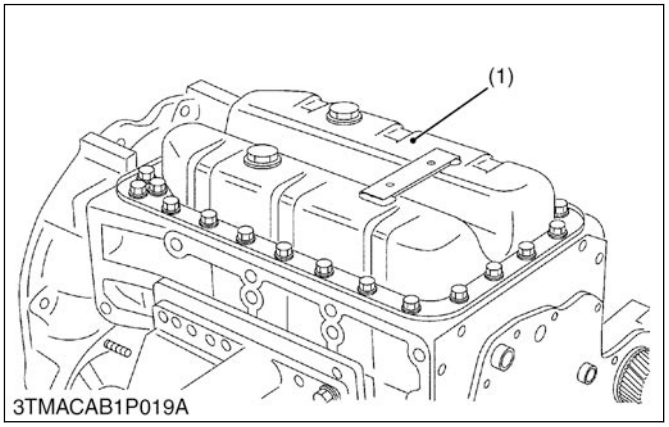

(3) Liquid gasket

| | | |
|---|---|---|
| Tightening torque | Gear case plate mounting screw | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |

## 5.11 Piston and connecting rod

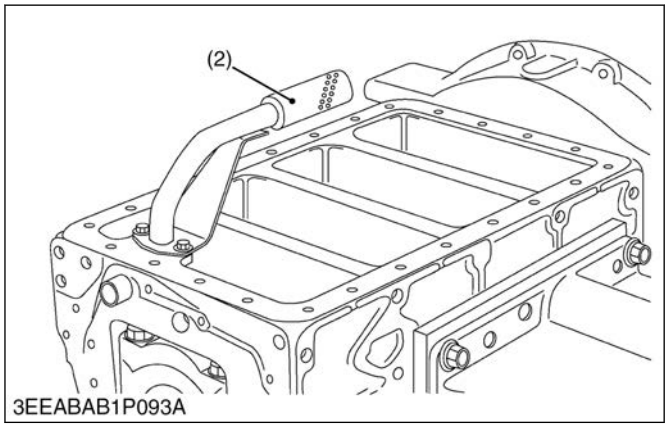
### 5.11.1 Removing oil pan and oil strainer

1. Remove the oil pan mounting screws and remove the oil pan (1).




(1) Oil pan

2. Remove the oil strainer mounting screw, and remove the oil strainer (2).



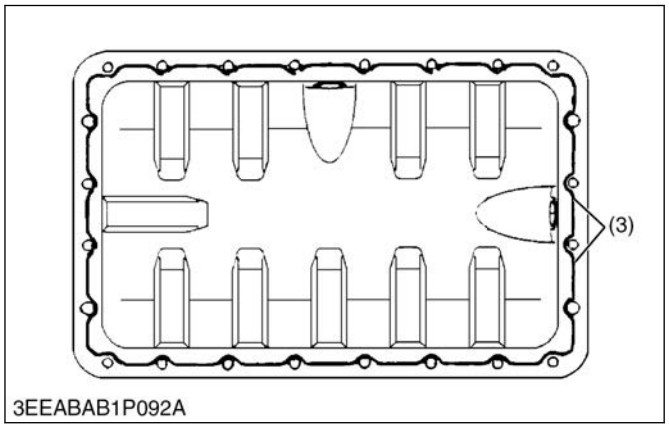

(2) Oil strainer

**(When reassembling)**

**■ NOTE**

- **Make sure the surfaces align when installing parts with a liquid gasket applied to them.**
- **Install parts with a liquid gasket within 10 minutes of application.**
- **Tighten the mounting screws of the oil pan in diagonal sequence from the center to tighten equally.**
- **After cleaning the oil strainer, install it.**
- **Install the oil pan facing central drain plug toward the air suction side.**

- Install the oil strainer not to damage the O-ring.
- Apply liquid gasket (3) (Three Bond 1217H or its equivalents) to the oil pan as shown in the figure.

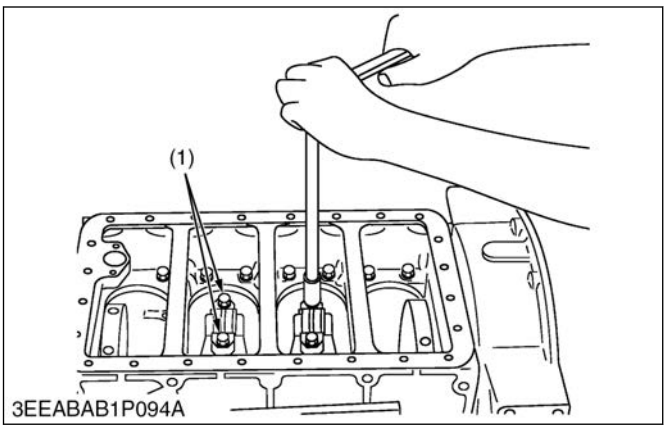



(3) Liquid gasket

- Make sure that the liquid gasket coating surface is free of water, dust and oil in order to keep sealing effect.
- Carefully apply the adhesive evenly.

## 5.11.2 Removing connecting rod cap

1. Remove the connecting rod screws (1).

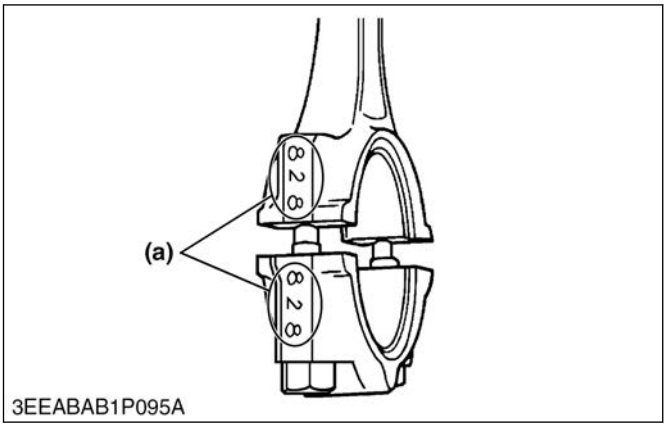



(1) Connecting rod screw

2. Remove the connecting rod cap.

**(When reassembling)**

- Align the marks (a) with each other. (Face the marks toward the supply pump.)

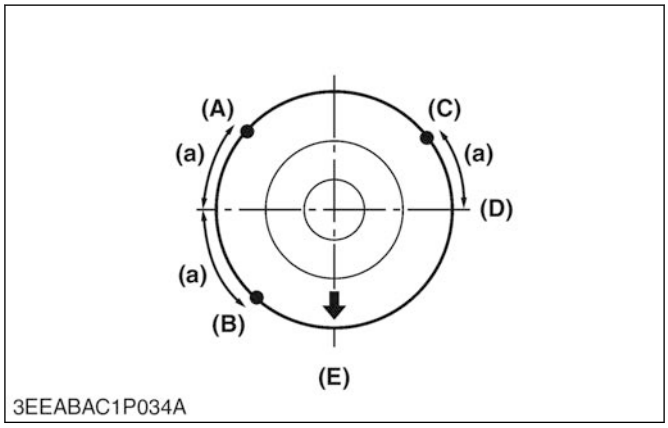



(a) Mark

- Apply engine oil to the connecting rod screws and lightly screw it in by hand, and then tighten it to the specified tightening 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.
- When using the existing crank pin bearing again, put tally marks on the crank pin bearing and the connecting rod in order to keep their positioning.

| | | |
|---|---|---|
| Tightening torque | Connecting rod screw | 79 to 83 N·m<br>8.0 to 8.5 kgf·m<br>58 to 61 lbf·ft |

## 5.11.3 Removing piston



3EEABAC1P034A

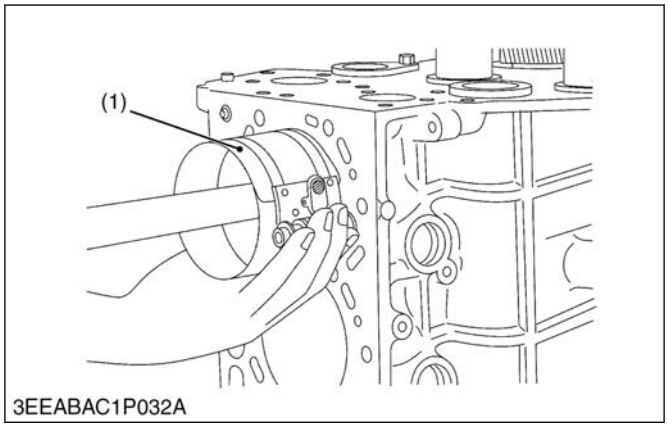
(a) 0.79 rad (45°)
(A) Top ring gap
(B) Second ring gap
(C) Oil ring gap
(D) Piston pin hole
(E) Supply pump side

1. Fully clean the carbon in the cylinders.
2. Turn the flywheel and move the piston to top dead center.
3. Lightly tap the connecting rod from the bottom of the crankcase with the grip of a hammer to pull the piston out.

**(When reassembling)**

**■ IMPORTANT**

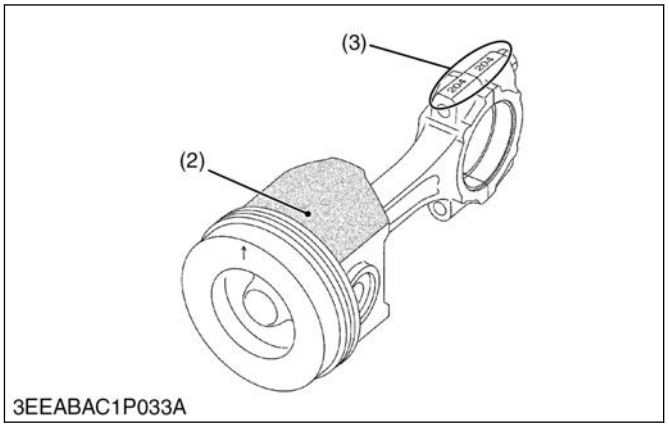
- **Do not change the combination of cylinder and piston. Align the position of each piston by the its mark. For example, mark "1" on the No. 1 piston.**
- **When inserting the piston into the cylinder, place the gap of each piston ring like the figure.**
- **Install the pistons with a piston ring compressor (1) carefully. Otherwise, their chrome-plated section of piston rings may be scratched, causing trouble inside the liner.**



3EEABAC1P032A

(1) Piston ring compressor

- **When you install the piston in position, do not give a damage to the layer of molybdenum disulfide on the piston skirt. This layer can decrease the clearance with the cylinder liner. Immediately after you press-fit the piston pin, the piston is hot and the layer comes off easily. Only put in the piston after its temperature decreases.**
- Before you install the piston into the cylinder, apply sufficient engine oil to the piston and inner face of the cylinder.
- When you install the piston into the cylinder, point the mark (3) on the connecting rod to the supply pump side.

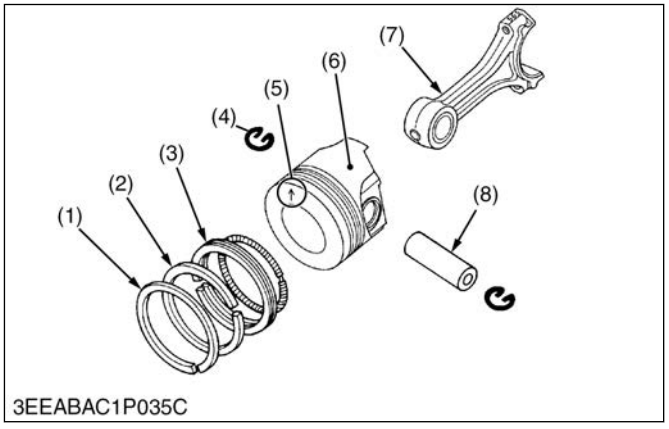


3EEABAC1P033A

(2) Layer of molybdenum disulfide in piston skirt
(3) Mark

## 5.11.4 Removing piston ring and connecting rod

1. Remove the piston rings with a piston ring tool.
2. Remove the piston pin (8) to disconnect the connecting rod (7) from the piston (6).



3EEABAC1P035C

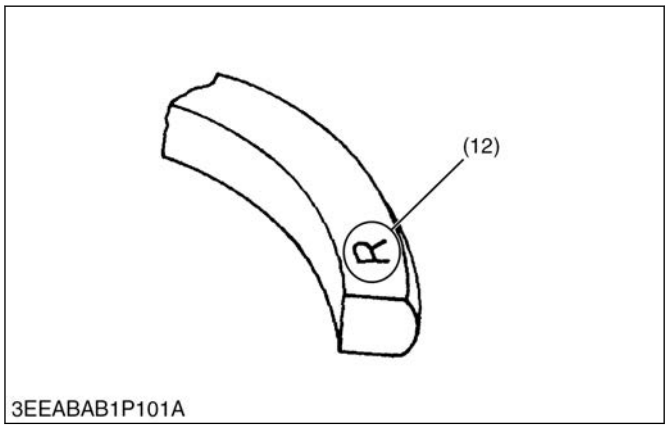
(1) Top ring
(2) Second ring
(3) Oil ring
(4) Piston pin snap ring
(5) Mark "↑"
(6) Piston
(7) Connecting rod
(8) Piston pin

**(When reassembling)**

**■ IMPORTANT**

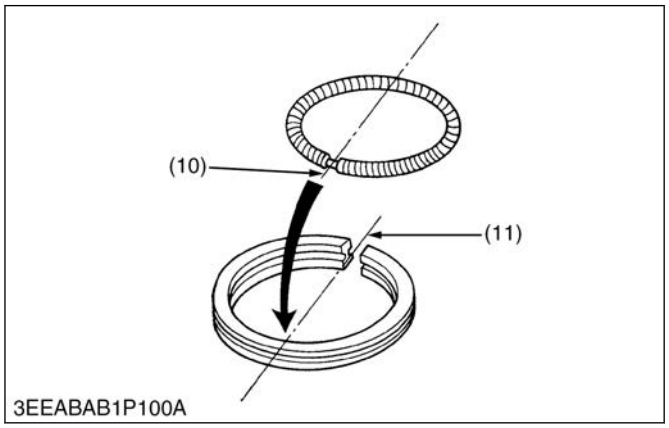
- **Put a mark on the connecting rod and the piston with the same number to keep the same combination.**

- Be sure the crank pin bearing and the connecting rod are same ID colors.
- When you install the rings to the piston, set the manufacturer mark (12) upward.



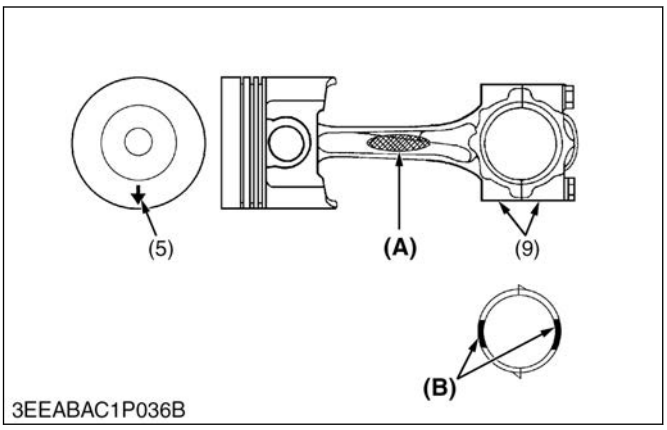

(12) Manufacturer mark

- When you install the oil ring on the each groove of the piston, set the expander joint (10) on the opposite side of the oil ring gap (11).




(10) Expander joint (11) Oil ring gap

- Apply engine oil to the piston pin.
- When you install the piston pin, put the piston fully in 80 ℃ (176 ℉) oil for 10 to 15 minutes.
- When you install the piston to the connecting rod, align the mark "↑" (5) on the piston to the connecting rod numbering mark (9).




(5) Mark "↑"
(9) Numbering mark
(A) Connecting rod ID color: Blue or without color
(B) Crank pin bearing ID color: Blue or without color

- The end faces of the oil ring are plated with hard chrome. When you install the piston into the cylinder, do not give a damage to the cylinder by the oil ring. If the ring planting is scratched, it may get stuck on the cylinder wall, causing serious damage.

# 5.12 Flywheel and crankshaft

## 5.12.1 Removing flywheel

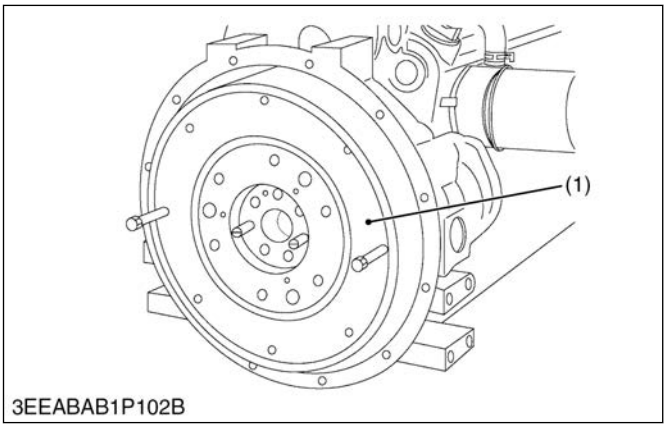
**■ IMPORTANT**

- **Since the flywheel is very heavy, hold the flywheel securely when removing.**

**■ NOTE**

- **Do not use an impact wrench. Serious damage will occur.**

1. Lock the flywheel by using a flywheel stopper.
2. Remove the flywheel screws.
3. Remove the flywheel (1) by using guide bolts.




(1) Flywheel

**(When reassembling)**

- Apply engine oil to the flywheel screws.
- Check that there are no metal particles that remain on the flywheel mounting surfaces.

- The flywheel and the crankshaft fit together in just one position. Make sure they are fit securely and tighten the screws.
- Tighten the flywheel screw to the specified tightening torque.

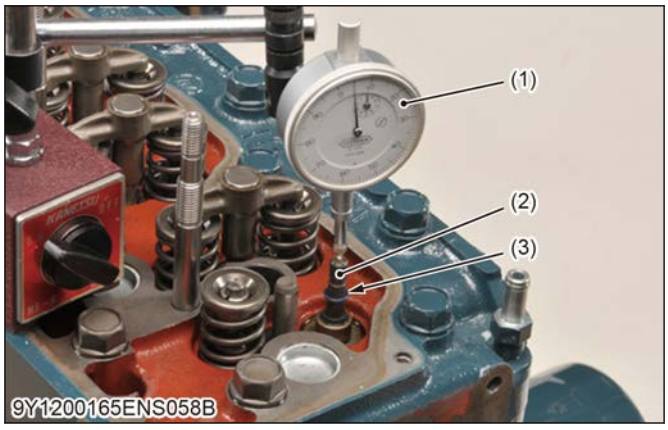
| | | |
|---|---|---|
| Tightening torque | Flywheel screw | 98.1 to 107 N·m<br>10.0 to 11.0 kgf·m<br>72.4 to 79.5 lbf·ft |

RELATED PAGE
1.10 Flywheel stopper on page 2-67

## 5.12.2 Measuring angular deviation between mechanical T.D.C. (crankshaft T.D.C.) and electrical T.D.C. (crank position sensor detected T.D.C.)

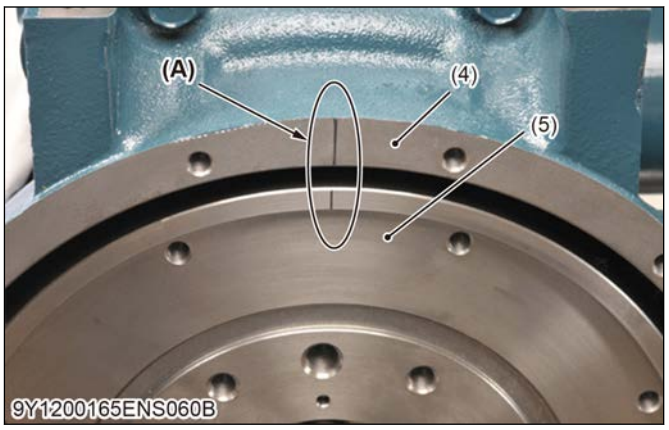
**IMPORTANT**

- **If the crankshaft, gear case and/or crank gear are replaced, it is necessary to calibrate the injection timing with the diagnosis tool.**
- **Do not drop the valve (2) into the cylinder.**



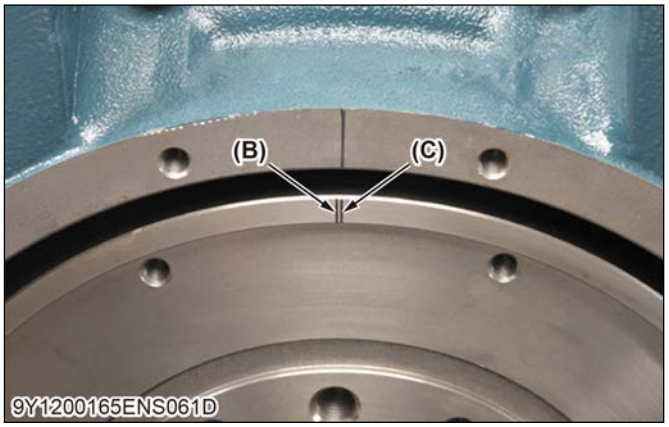

(1) Dial gauge
(2) Valve
(3) O-ring

- **When measuring the highest position of the tip of the valve, do not rotate the flywheel clockwise. If you go past the highest point of the valve, back the flywheel up slightly and measure the highest point of the valve.**
- **The reference line (A) indicates the T.D.C. of the crankshaft.**




(4) Flywheel housing
(5) Flywheel
(A) Reference line

- **When the crankshaft position sensor detects the teeth of the pulsar gear, the tester indicates 0 voltage.**
- **The position where the needle of the tester changes momentarily from 0 voltage → approximately 5 voltage is the detection point of crankshaft position sensor T.D.C. (C).**

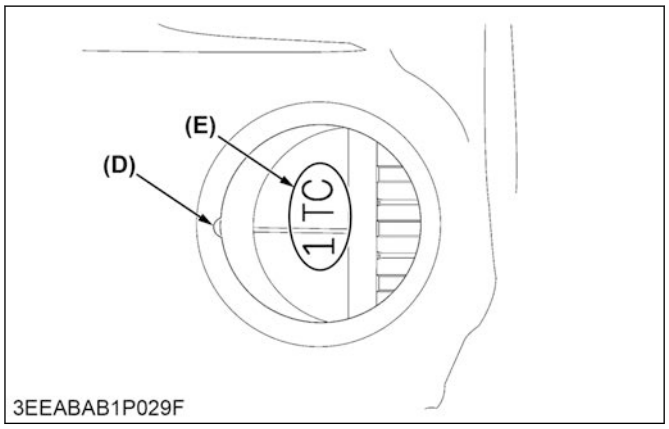



(B) Crankshaft T.D.C.
(C) Detection point of crankshaft position sensor T.D.C.

- **The reference line indicates the crankshaft T.D.C. (B) of the crankshaft. If the detected T.D.C. is ahead of the crankshaft T.D.C., it is considered minus. If the detected T.D.C. lags behind the crankshaft T.D.C., it is considered plus.**

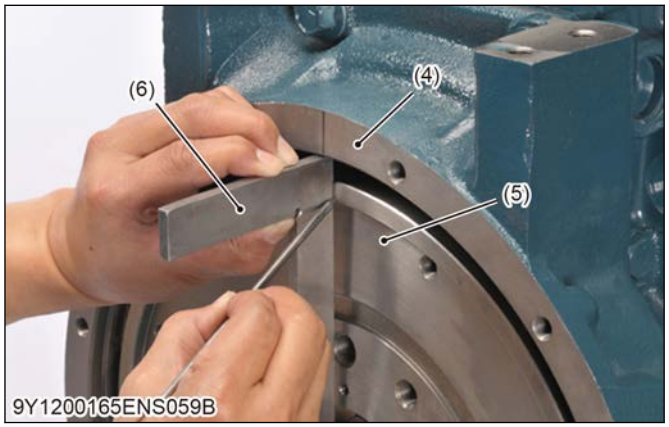
1. Remove the cylinder head cover, an injector and rocker arm.

2. Bring the piston of cylinder 4 to T.D.C.



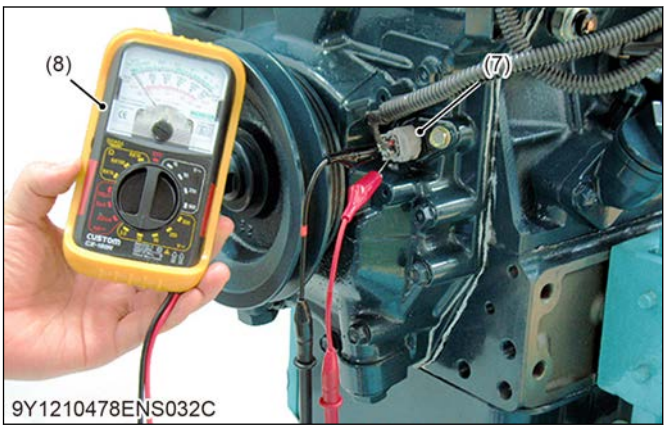

(D) "**TC**" mark (Flywheel housing) (E) "**TC**" mark (Flywheel)

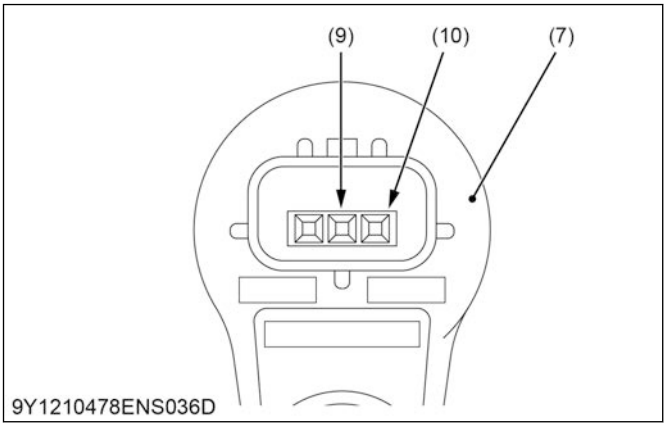
3. Remove the #4 exhaust valve bridge arm and valve spring.
4. Insert a small O-ring (3) so that the valve does not fall into the cylinder.
5. Set a dial gauge (1) on the tip of the valve (2).
6. Turn the flywheel counterclockwise and measure the position where the tip of the valve is the highest.
7. Stop the flywheel at the position where the tip of the valve is the highest.
8. Put a tri-square (6) on the flywheel housing (4) and flywheel (8) and draw a reference line (A).




(4) Flywheel housing (6) Tri-square
(5) Flywheel

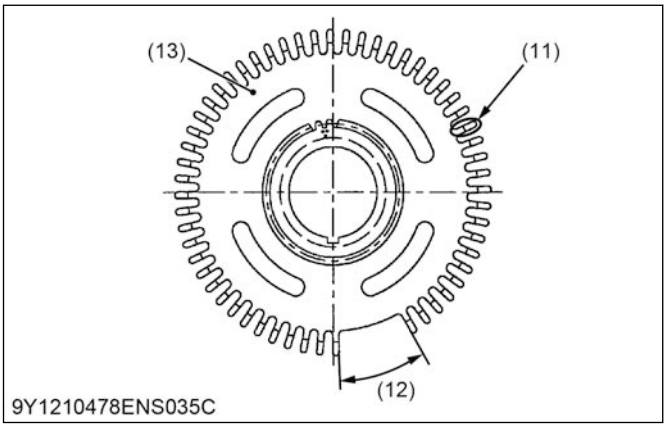
9. Connect the engine harness and the main switch.
10. Connect the battery.
11. Attach a tester (8) to the output terminal (10) and ground terminal (9) of the crankshaft position sensor (7).




(7) Crankshaft position sensor (10) Output terminal
(8) Tester
(9) Ground terminal

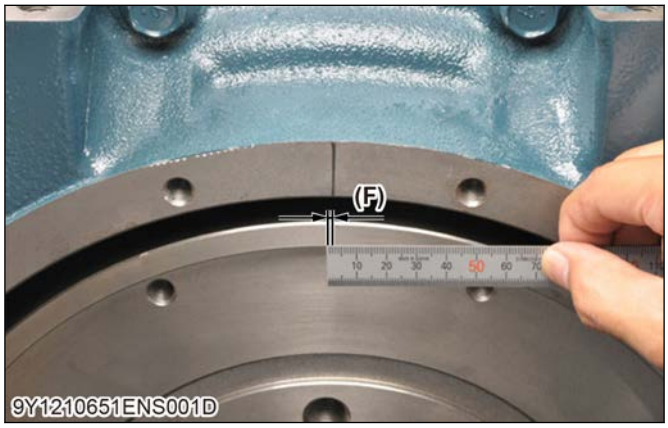
12. Turn the main switch **ON**.
13. Turn the flywheel and make sure that the voltage of the crankshaft position sensor (7) goes from 0 voltage → approximately 5 voltage or approximately 5 voltage → 0 voltage.
14. Rotate the flywheel and align the crankshaft position sensor to the part of the pulsar gear (13) that is missing teeth (12).




(11) 14th tooth (13) Pulsar gear
(12) Missing teeth

15. The 14th tooth (11) from the missing teeth (12) is the standard.

16. Slowly turn the flywheel counterclockwise and stop the flywheel at the point where the needle of the tester changes momentarily from 0 voltage → approximately 5 voltage, the 14th tooth.
17. That point is where the crankshaft position sensor detects T.D.C.
18. Set the tri-square (6) on the reference line (A) on the flywheel housing side and mark the detection point of crankshaft position sensor T.D.C. (C) on the flywheel.
19. Measure the interval (D) between the crankshaft T.D.C. (B) and the detection point of crankshaft position sensor T.D.C. (C).

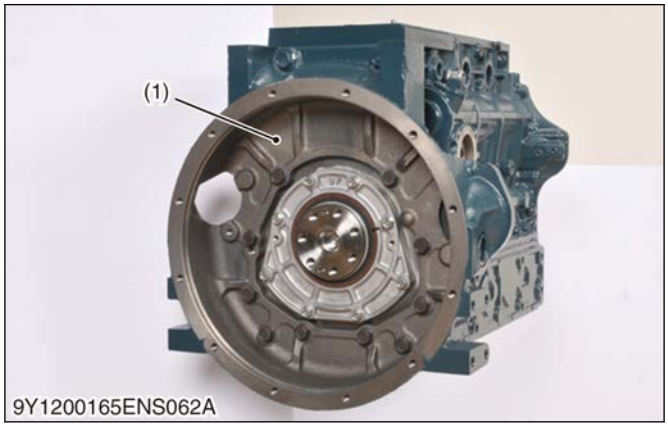



(F) Interval

20. Calculation of fuel injection timing correction.
    1.0 mm (0.039 in.): 0.286°
    Corrected angle = 0.286° × actual interval
21. Overwrite the injection timing correction value in the ECU.

## 5.12.3 Removing flywheel housing

1. Remove the flywheel housing mounting screws. Remove the flywheel housing (1).




(1) Flywheel housing

**(When reassembling)**

**■ NOTE**

- **Make sure the surfaces of the flywheel housing and the crankcase align when installing these parts with a liquid gasket applied to them.**
- **Install parts with a liquid gasket within 10 minutes of application.**

- Apply liquid gasket (Three Bond 1217H or its equivalents) to flywheel housing.
- Make sure that the liquid gasket coating surface is free of water, dust and oil in order to keep sealing effect.
- Make sure the surface of the crankcase 1 and the crankcase 2 are clean and alignment between crankcase 1 and the crankcase 2 is correct.
- Tighten the flywheel housing mounting screws with even force on the diagonal line.
- Tighten the flywheel housing mounting screw to the specified tightening torque.

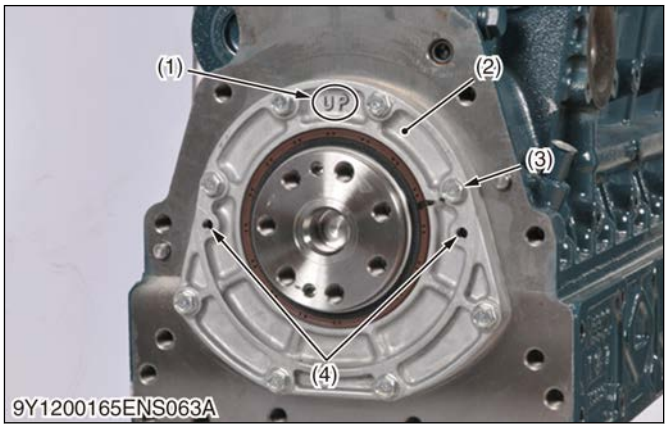
| | | |
|---|---|---|
| Tightening torque | Flywheel housing mounting screw | 103 to 117 N·m<br>10.5 to 12.0 kgf·m<br>76.0 to 86.7 lbf·ft |

## 5.12.4 Removing bearing case cover

**■ NOTE**

- **Before disassembling, check the side clearance of crankshaft. Also check it after reassembling.**

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



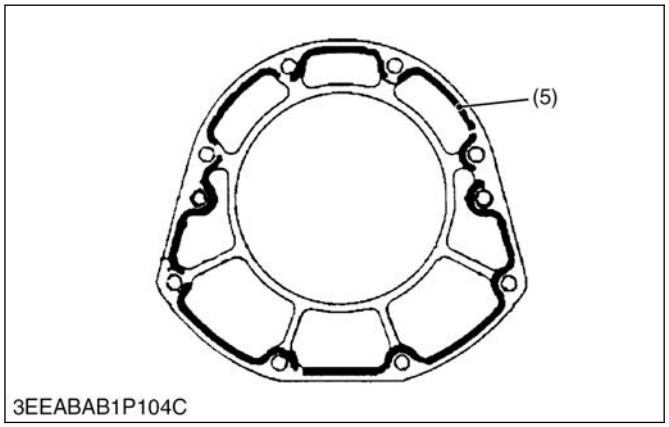

(1) Bearing case cover
(2) Bearing case cover mounting screw
(A) Casting mark"**UP**"
(B) Jack-up hole

2. Set the screws in the jack-up holes (B) to remove the bearing case cover (1).

**(When reassembling)**

**■ IMPORTANT**

- **In case of replacing the oil seal, insert the oil seal to the bearing case cover not to be tilted. The seal should be flush with the cover.**
- **Make sure that the liquid gasket coating surface is free of water, dust and oil in order to keep sealing effect.**
- **Apply liquid gasket (5) (Three Bond 1217H or its equivalents) to the bearing case cover as shown in the figure.**




(5) Liquid gasket

- **Before installing the bearing case cover / oil seal assembly, lube the seal and install it not to damage the seal.**
- **Install the bearing case cover / oil seal assembly to position the casting mark "UP" (1) on it upward.**
- **Tighten the bearing case cover mounting screws with even force on the diagonal line.**
- **Tighten the bearing case cover mounting screw to the specified tightening torque.**

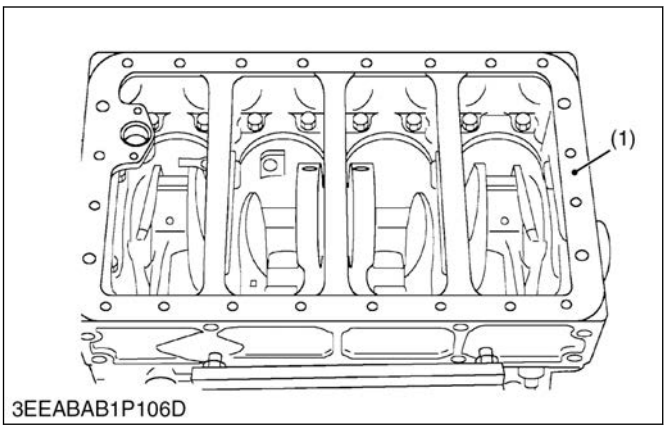
**■ NOTE**

- **When installing the adhesive-applied parts, be careful to fit them to the mating parts.**
- **Assemble the adhesive-applied parts within ten minutes.**

| | | |
|---|---|---|
| Tightening torque | Bearing case cover mounting screw | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |

## 5.12.5 Removing crankcase 2

1. Remove the crankcase 2 (1).

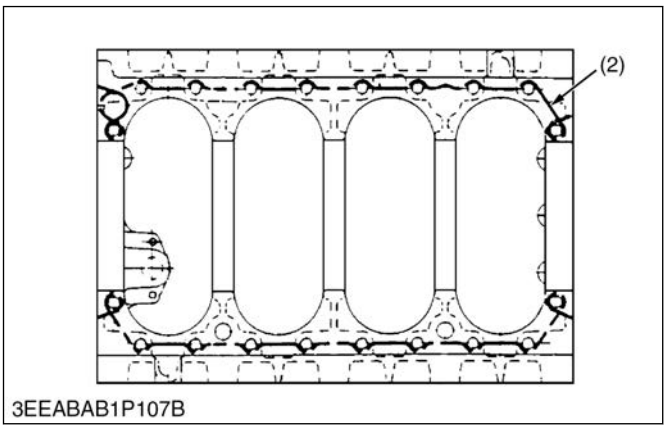



(1) Crankcase 2

**(When reassembling)**

**■ IMPORTANT**

- **Make sure the crankcase 1 and the crankcase 2 are clean.**
- **Apply liquid gasket (2) (Three Bond 1217H or its equivalents) to the crankcase 2 as shown in the figure.**




(2) Liquid gasket

- **Tighten the crankcase 2 mounting screws with even force on the diagonal line.**
- **Make sure that the liquid gasket coating surface is free of water, dust and oil in order to keep sealing effect.**
- **Apply the adhesive evenly and carefully.**
- **Tighten the crankcase 2 mounting screw to the specified tightening torque.**

**■ NOTE**

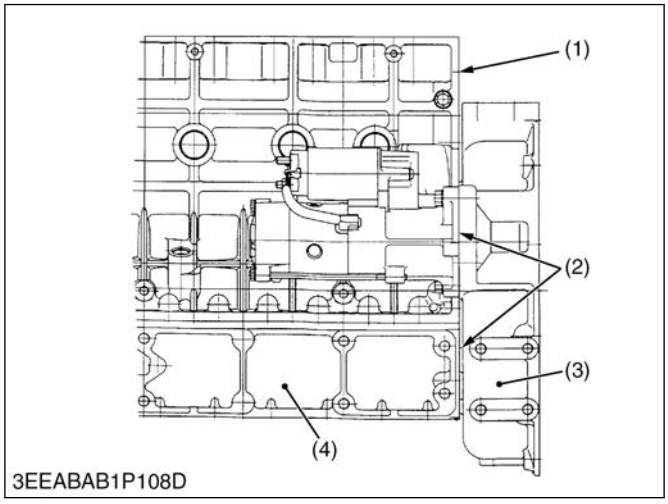
- **Make sure the surfaces of the crankcase 1 and the crankcase 2 align when installing them with a liquid gasket applied to them.**
- **Install the crankcase 1 and the crankcase 2 with a liquid gasket within 10 minutes of application.**

| | | |
|---|---|---|
| Tightening torque | Crankcase 2 mounting screw | 49 to 55 N·m<br>5.0 to 5.7 kgf·m<br>37 to 41 lbf·ft |

## 5.12.6 Assembling crankcase 1 and crankcase 2

**NOTE**

- **Make sure the surfaces the crankcases 1 and the crankcase 2 align when installing them with a liquid gasket applied to them.**
- **Install the crankcases 1 and the crankcase 2 with a liquid gasket within 10 minutes of application. Get the difference in the levels of the crankcases 1 and the crankshaft 2 to as little as possible. The gap has to be 0.05 mm (0.002 in.) or less.**




(1) Crankcase 1
(2) Gap in alignment at 0.05 mm (0.002 in.) or less
(3) Flywheel housing
(4) Crankcase 2

1. Using the surface that touches the flywheel housing as a reference, line up crankcases 1 and 2.
2. Temporarily screw in the crankcase 2 mounting screws.
3. Tighten the flywheel housing to the specified torque.

| | | |
|---|---|---|
| Tightening torque | Crankcase 2 mounting screw | 49 to 55 N·m<br>5.0 to 5.7 kgf·m<br>37 to 41 lbf·ft |
| | Flywheel housing mounting screw | 103 to 117 N·m<br>10.5 to 12.0 kgf·m<br>76.0 to 86.7 lbf·ft |

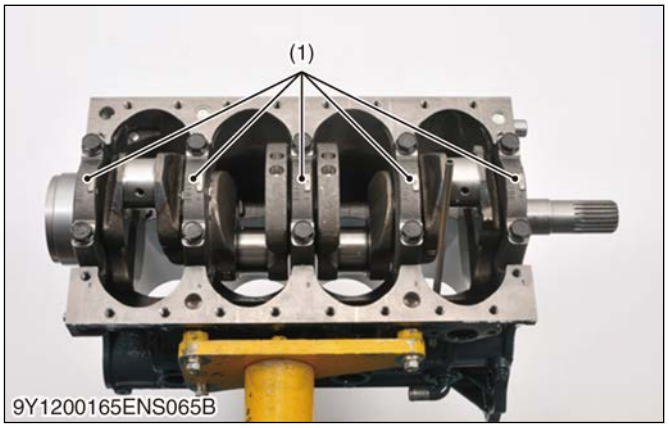
4. Get the difference in the levels of crankcases 1 and 2 to as little as possible. The gap has to be within (A).

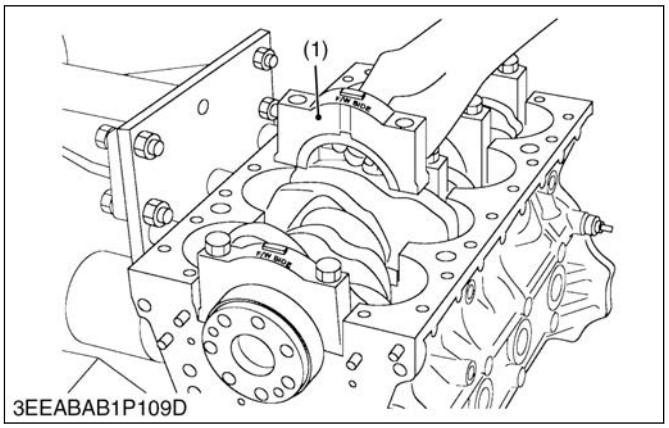
| | |
|---|---|
| Gap (A) | 0.05 mm<br>0.002 in. |

RELATED PAGE
1.11 Crankcase 1 and 2 aligning tool on page 2-67

## 5.12.7 Removing crankshaft

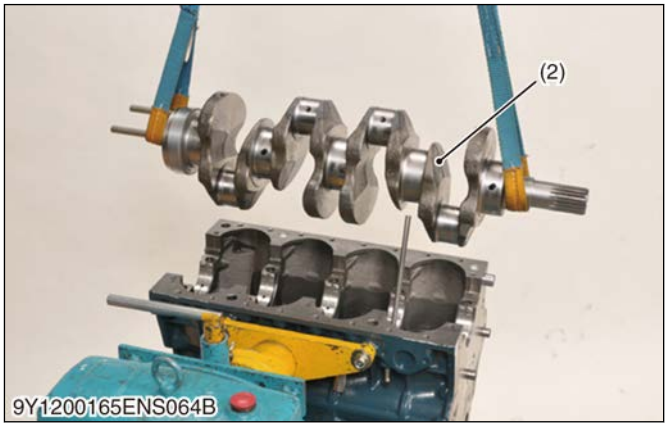
1. After removing the main bearing case screws, remove the main bearing case (1).




(1) Main bearing case

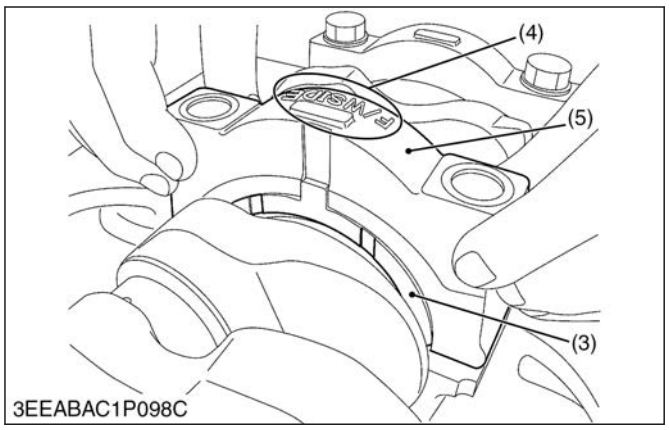
2. Remove the crankshaft (2).

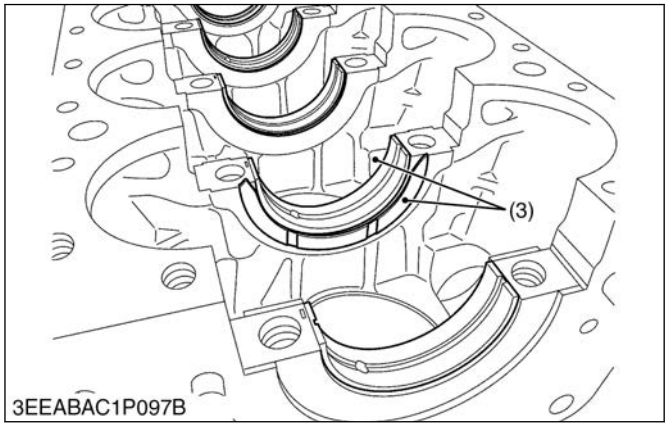



(2) Crankshaft

**(When reassembling)**

- Reassemble the main bearing case having the same number as the one engraved on the crankcase, and set the casting mark "**F / W SIDE**" (4) on the main bearing case facing towards the flywheel side.




(3) Thrust bearing
(4) "**F / W SIDE**" mark
(5) 4th main bearing case

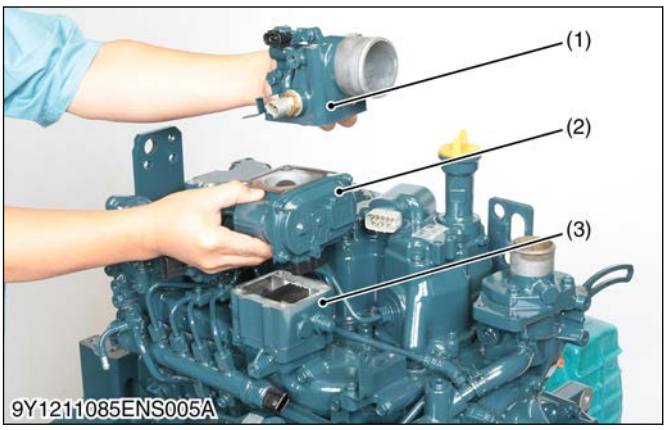
- Reassemble the thrust bearing (3), with the oil groove facing outside, into both side of the 4th main bearing case (5).
- Apply oil to the main bearing case screws.
- Tighten the to the main bearing case screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Main bearing case screw | 138 to 147 N·m<br>14.0 to 15.0 kgf·m<br>102 to 108 lbf·ft |

## 5.13 Intake air heater

### 5.13.1 Removing intake air heater

1. Remove the inlet hose.
2. Disconnect the lead.
3. Remove the air cleaner flange (1) and intake throttle valve (2).




(1) Air cleaner flange
(2) Intake throttle valve
(3) Intake air heater

4. Remove the intake air heater (3).

**(When reassembling)**

- Tighten the intake air heater terminal nut to the specified tightening torque.

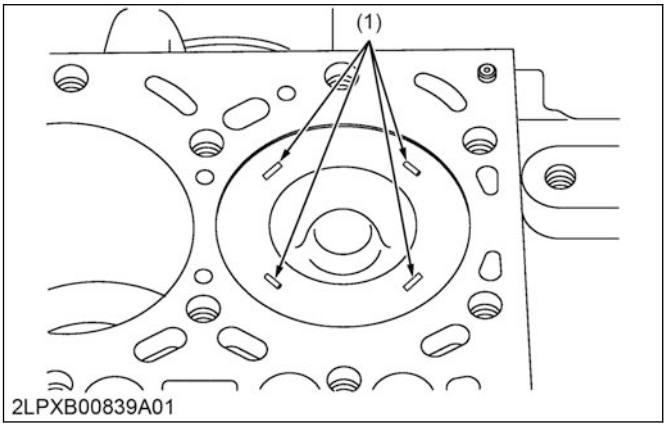
| | | |
|---|---|---|
| Tightening torque | Intake air heater terminal nut | 3.5 to 5.3 N·m<br>0.35 to 0.55 kgf·m<br>2.6 to 3.9 lbf·ft |

# 6. Servicing

## 6.1 Cylinder head

### 6.1.1 Measuring top clearance

1. Remove the cylinder head.
2. With the piston at T.D.C., use grease to affix three or four plastigauges (1) long to the crown of the piston; keep the gauges away from the intake valve and combustion chamber fittings.




(1) Plastigauge

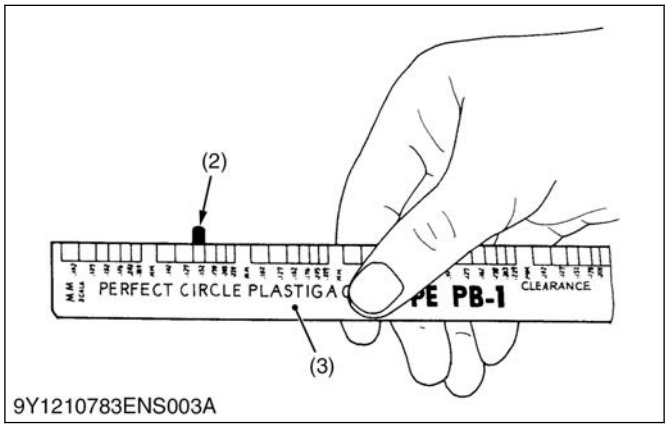
| | |
|---|---|
| Plastigauge | 1.5 mm (0.059 in.) diameter<br>5.0 to 7.0 mm (0.20 to 0.27 in.) long |

3. Take the piston to an intermediate position, and install the cylinder head gasket and the cylinder head. Tighten the cylinder head mounting screws to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Cylinder head mounting screw | 98.1 to 107 N·m<br>10.0 to 11.0 kgf·m<br>72.4 to 79.5 lbf·ft |

4. Turn the crankshaft so that the piston goes through T.D.C.
5. Remove the cylinder head and compare the width of the crushed plastigauges (2) with the scale (3).

**■ NOTE**
- **Top clearance = Width of the crushed plastigauge (2).**



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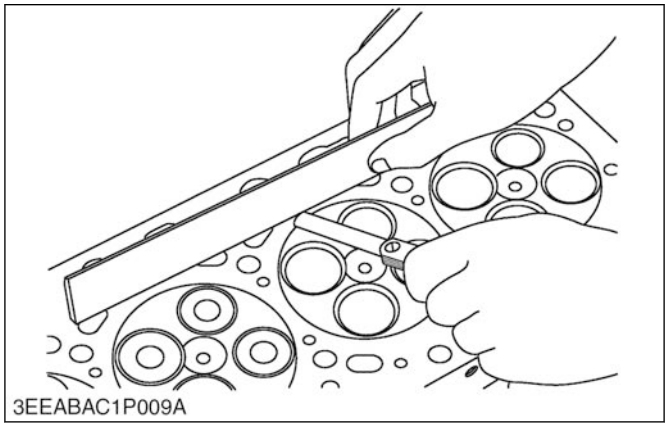
(2) Crushed plastigauge (3) Scale

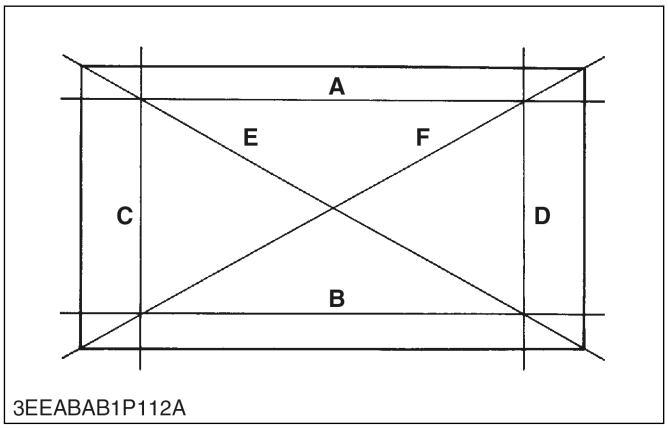
| | | |
|---|---|---|
| Top clearance | Factory specification | 0.701 to 0.930 mm<br>0.0276 to 0.0366 in. |

6. If the measured values are out of the factory specification, check the oil clearance of the crank pin, journal and piston pins.

## 6.1.2 Checking cylinder head surface flatness


3EEABAC1P009A

1. Clean the cylinder head surface.
2. Place a straightedge on four sides "A", "B", "C" and "D" and two diagonal "E" and "F" of the cylinder head as shown in the figure. Measure the clearance with a feeler gauge.



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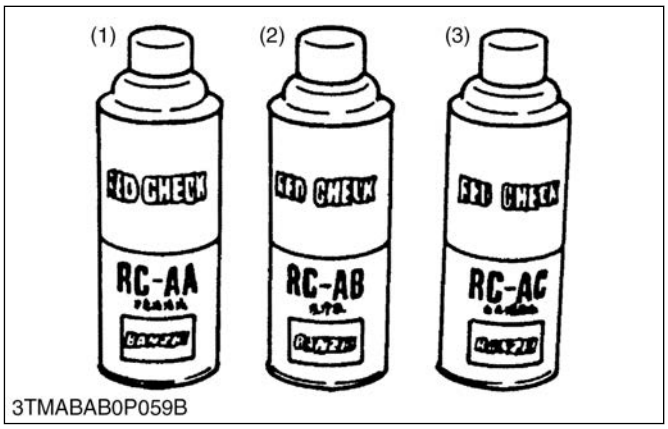
3. If the measured value is more than the allowable limit, make it flat with a surface grinder.

| | | |
|---|---|---|
| Cylinder head surface flatness | Allowable limit | 0.05 mm<br>0.002 in. |

**■ IMPORTANT**
- **Check the valve recessing after you correct.**

## 6.1.3 Checking cylinder head flaw

1. Prepare an air spray red check.
2. Clean the surface of the cylinder head with detergent (2).



3TMABAB0P059B

(1) Red permeative liquid (3) White developer
(2) Detergent

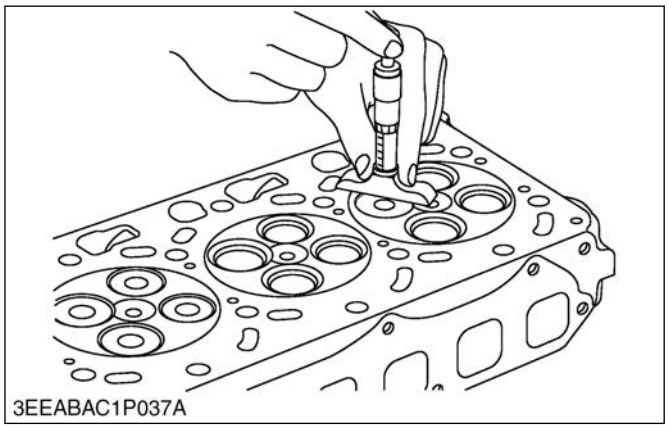
3. Apply some red permeative liquid (1) on the cylinder head surface. After you apply, do not touch it for a wait time.

| | |
|---|---|
| Wait time | 5 to 10 minutes |

4. Clean away the red permeative liquid on the cylinder head surface with detergent (2).
5. Apply the white developer (3) on the cylinder head surface.

6. If you found a red flaw, replace the cylinder head.

## 6.1.4 Measuring valve recessing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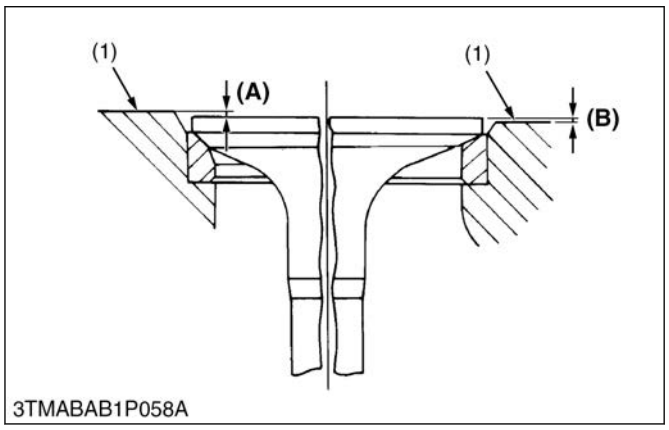

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(1) Cylinder head surface
(A) Recessing
(B) Protrusion

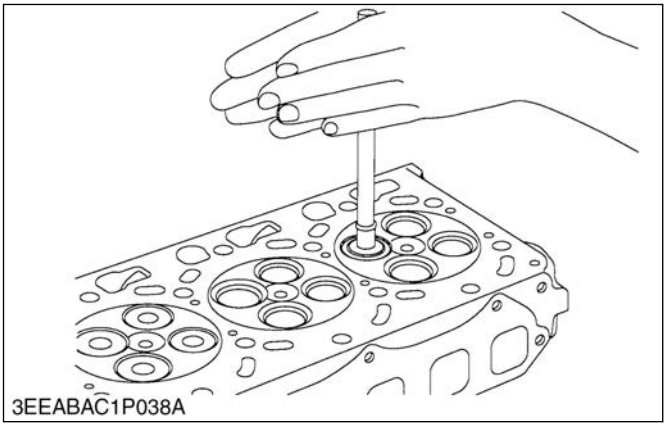
1. Clean the cylinder head surface, valve face and valve seat.
2. Set the valve into the valve guide.
3. Measure the valve recessing with a depth gauge.
4. If the measured value is more than the allowable limit, replace the valve. If it stays more than the allowable limit after you replace the valve, replace the cylinder head.

| | | | |
|---|---|---|---|
| Valve recessing | Factory specification | Intake valve | (Recessing)<br>0.60 to 0.80 mm<br>0.024 to 0.031 in. |
| | | Exhaust valve | (Recessing)<br>0.850 to 1.05 mm<br>0.0335 to 0.0413 in. |
| | Allowable limit | (Recessing)<br>1.2 mm<br>0.047 in. | |

## 6.1.5 Checking valve lapping

**IMPORTANT**

- **After you complete the valve lapping and assemble the valve, check the valve lapping and adjust the valve clearance.**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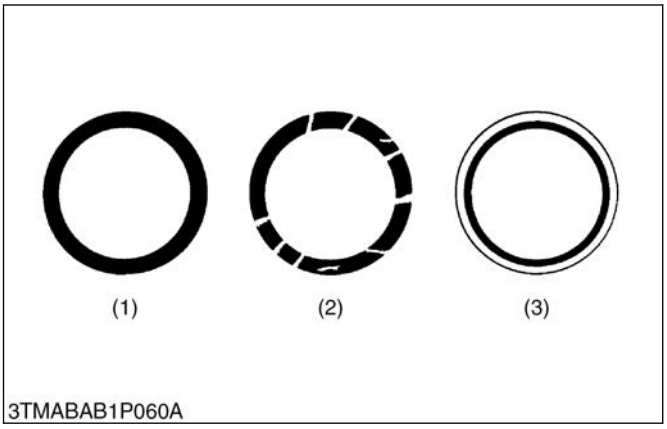

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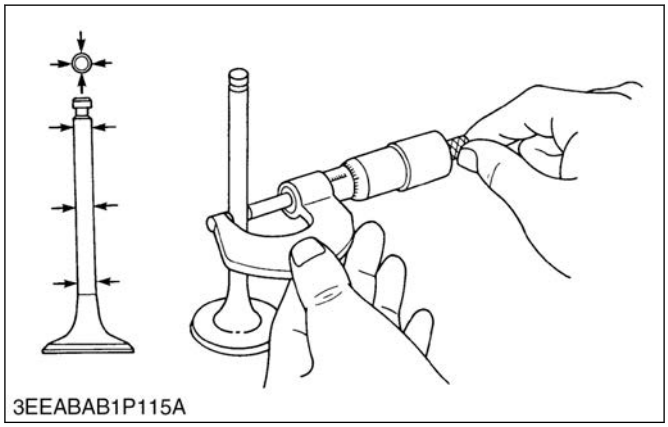
(1) Good
(2) Bad
(3) Bad

1. Apply the compound equally to the valve lapping surface.
2. Put the valve into the valve guide. Lap the valve on its seat with a valve lapping tool.
3. After you lap the valve, clean away the compound and apply oil, then lap the valve again with oil.
4. Apply Prussian Blue to the contact surface to measure the seated rate. If the seated rate is less than 70%, lap the valve again.

## 6.1.6 Measuring clearance between valve stem and valve guide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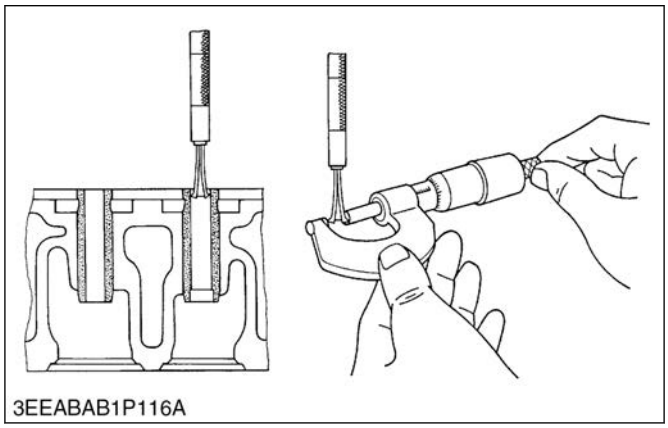
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1. Remove carbon from the valve guide section.
2. Measure the valve stem O.D. with an external micrometer.

| | | | |
|---|---|---|---|
| Valve stem outside diameter | Factory specification | Intake valve | 6.960 to 6.975 mm 0.2741 to 0.2746 in. |
| | | Exhaust valve | 6.960 to 6.975 mm 0.2741 to 0.2746 in. |

3. Measure the valve guide I.D. with a small hole gauge. Calculate the clearance.

| | | | |
|---|---|---|---|
| Valve guide inside diameter | Factory specification | Intake valve | 7.010 to 7.025 mm 0.2760 to 0.2765 in. |
| | | Exhaust valve | 7.010 to 7.025 mm 0.2760 to 0.2765 in. |

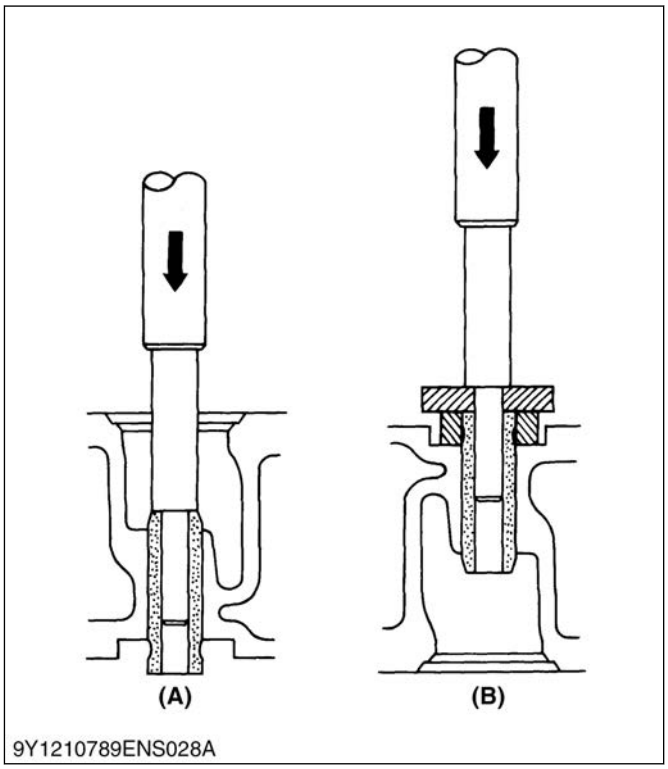
4. If the clearance is more than the allowable limit, replace the valves. If the clearance stays more than the allowable limit, replace the valve guide also.

| | | | |
|---|---|---|---|
| Clearance between valve stem and valve guide | Factory specification | Intake valve | 0.035 to 0.065 mm 0.0014 to 0.0025 in. |
| | | Exhaust valve | 0.035 to 0.065 m 0.0014 to 0.0025 in. |
| | Allowable limit | 0.1 mm 0.004 in. | |

## 6.1.7 Replacing valve guide

**IMPORTANT**

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



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(A) When removing (B) When installing

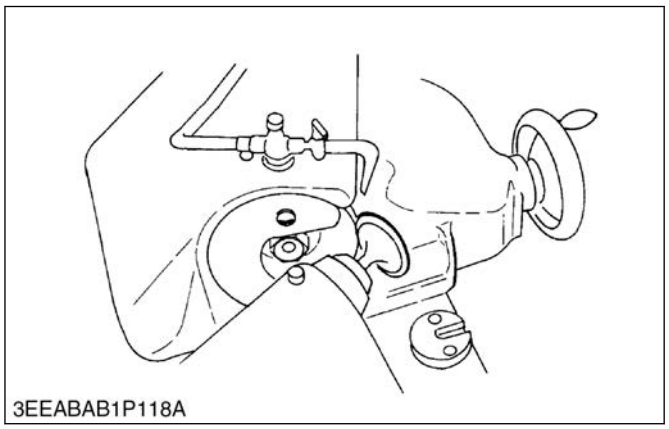
1. Press out the used valve guide with the valve guide replacing tool.
2. Clean the new valve guide and valve guide bore, and apply engine oil to them.
3. Press fit the new valve guide with the valve guide replacing tool.
4. Ream accurately the I.D. of the valve guide to the specified dimension.

RELATED PAGE
1.6 Valve guide replacing tool on page 2-64

## 6.1.8 Correcting valve

**■ NOTE**

- **Before you correct the valve and valve seat, check the valve stem and measure the I.D. of the valve guide section. Repair them if necessary.**
- **After you correct the valve seat, be sure to check the valve recessing.**


3EEABAB1P118A

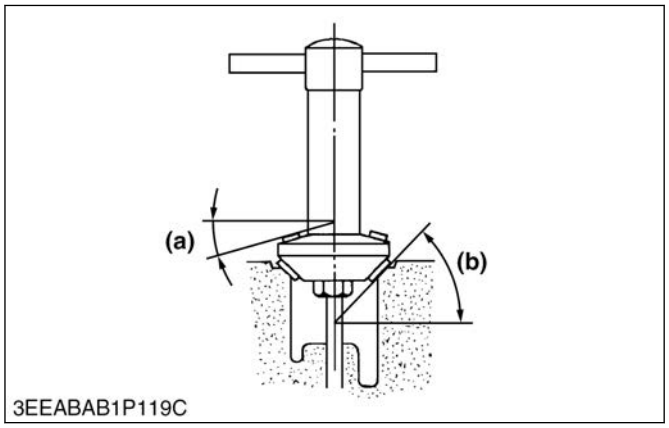
1. Correct the valve face angle with a valve refacer.

| | | | |
|---|---|---|---|
| Valve face angle | Factory specification | Intake | 1.0 rad<br>60° |
| | | Exhaust | 0.79 rad<br>45° |

## 6.1.9 Correcting valve seat

**■ NOTE**

- **Before you correct the valve and valve seat, check the valve stem and measure the I.D. of the valve guide section. Repair them if necessary.**
- **After you correct the valve seat, be sure to check the valve recessing.**



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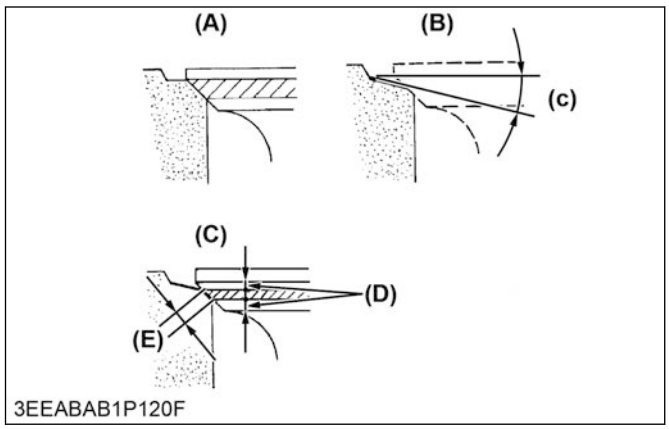

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(A) Check the contact
(B) Correct seat width
(C) Check the contact
(D) Identical dimensions
(E) Valve seat width
(a) 0.26 rad (15°) or 0.52 rad (30°)
(b) 0.79 rad (45°) or 1.0 rad (60°)
(c) 0.52 rad (30°) or 0.26 rad (15°)

1. Slightly correct the seat surface with a valve cutter. Use 0.52 rad (30°) valve seat cutter for intake and 0.26 rad (15°) valve seat cutter for exhaust.
2. Correct the seat surface with a valve seat cutter.

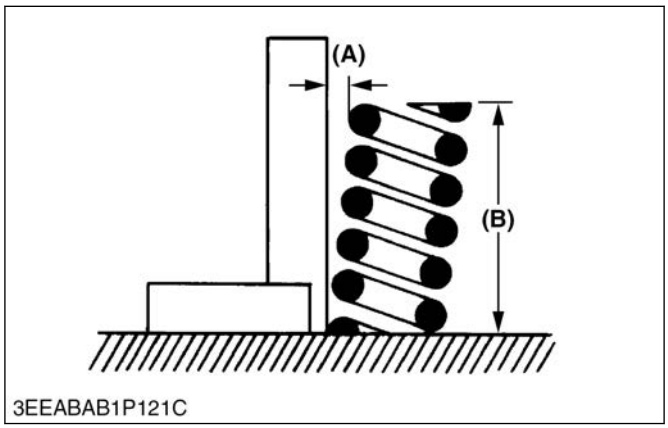
| | | | |
|---|---|---|---|
| Valve seat angle | Factory specification | Intake | 1.0 rad<br>60° |
| | | Exhaust | 0.79 rad<br>45° |

3. After you correct the seat, check that the valve seating is flat. Apply a thin layer of compound between the valve face and valve seat, and lap them with a valve lapping tool.
4. Check the valve seating with Prussian Blue. The valve seating surface must show good contact on all sides.

| | | | |
|---|---|---|---|
| Valve seat width | Factory specification | Intake | 1.5 to 1.9 mm<br>0.059 to<br>0.074 in. |
| | | Exhaust | 2.0 to 2.3 mm<br>0.079 to<br>0.091 in. |

## 6.1.10 Checking free length and tilt of valve spring

1. Measure the free length (B) of valve spring with a vernier calipers. If the measured value is less than the allowable limit, replace it.




(A) Tilt (B) Free length

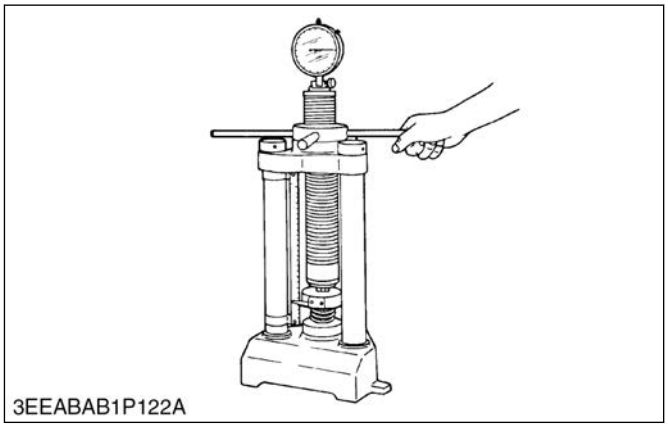
| | | | |
|---|---|---|---|
| Free length (B) | Factory specification | Intake valve | 35.1 to 35.6 mm 1.39 to 1.40 in. |
| | | Exhaust valve | 35.1 to 35.6 mm 1.39 to 1.40 in. |
| | Allowable limit | Intake valve | 34.6 mm 1.36 in. |
| | | Exhaust valve | 34.6 mm 1.36 in. |

2. Put the valve spring on a surface plate, and put a square on the side of the valve spring. Turn the valve spring to measure the maximum tilt (A). If the measured value is more than the allowable limit, replace it.

| | | |
|---|---|---|
| Tilt (A) | Allowable limit | 1.0 mm 0.039 in. |

3. Check the full surface of the valve spring for scratches. If there is a problem, replace it.

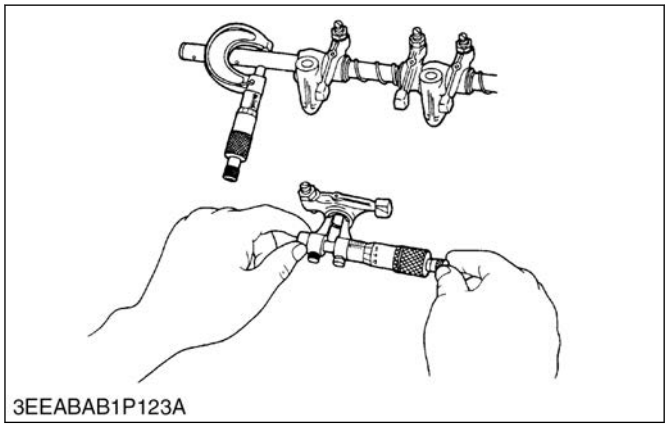
## 6.1.11 Measuring setting load / setting length of valve spring




1. Put the valve spring on a tester and compress the valve spring to the specified setting length.
2. Read the compression load on the gauge.
3. If the measured value is less than the allowable limit, replace the valve spring.

| | | | |
|---|---|---|---|
| Setting load / setting length | Factory specification | Intake valve | 63.5 N / 31.5 mm 6.48 kgf / 31.5 mm 14.3 lbf / 1.24 in. |
| | | Exhaust valve | 63.5 N / 31.5 mm 6.48 kgf / 31.5 mm 14.3 lbf / 1.24 in. |
| | Allowable limit | Intake valve | 45.9 N / 31.5 mm 4.68 kgf / 31.5 mm 10.3 lbf / 1.24 in. |
| | | Exhaust valve | 45.9 N / 31.5 mm 4.68 kgf / 31.5 mm 10.3 lbf / 1.24 in. |

## 6.1.12 Measuring oil clearance between rocker arm and rocker arm shaft




1. Measure the rocker arm I.D. with an internal micrometer.

| | | |
|---|---|---|
| Rocker arm I.D. | Factory specification | 16.000 to 16.027 mm<br>0.62993 to 0.63098 in. |

2. Measure the rocker arm shaft O.D. with an external micrometer.

| | | |
|---|---|---|
| Rocker arm shaft O.D. | Factory specification | 15.973 to 15.984 mm<br>0.62886 to 0.62929 in. |

3. Calculate the oil clearance.
4. If the oil clearance is more than the allowable limit, replace the rocker arm and measure the oil clearance again. If the oil clearance stays more than the allowable limit, replace the rocker arm shaft also.

| | | |
|---|---|---|
| Oil clearance between rocker arm and rocker arm shaft | Factory specification | 0.016 to 0.054 mm<br>0.00063 to 0.0021 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |

## 6.1.13 Measuring oil clearance between valve bridge shaft and valve bridge arm



1. Measure the valve bridge arm I.D. with an internal micrometer.

| | | |
|---|---|---|
| Valve bridge arm I.D. | Factory specification | 9.050 to 9.065 mm<br>0.3563 to 0.3568 in. |

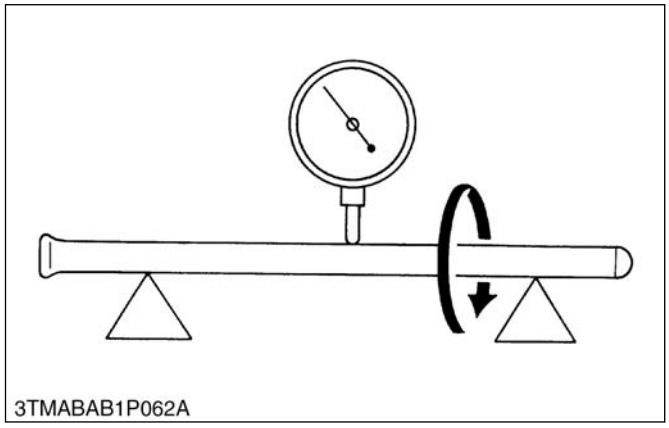
2. Measure the valve bridge shaft O.D. with an external micrometer.
   Calculate the oil clearance.

| | | |
|---|---|---|
| Valve bridge shaft O.D. | Factory specification | 9.023 to 9.032 mm<br>0.3552 to 0.3555 in. |

3. Calculate the oil clearance.
4. If the oil clearance is more than allowable limit, replace the valve bridge arm and measure the oil clearance again. If the oil clearance stays more than the allowable limit, replace the valve bridge shaft also.

| | | |
|---|---|---|
| Oil clearance between valve bridge shaft and valve bridge arm | Factory specification | 0.018 to 0.042 mm<br>0.00071 to 0.0016 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |

## 6.1.14 Measuring push rod alignment

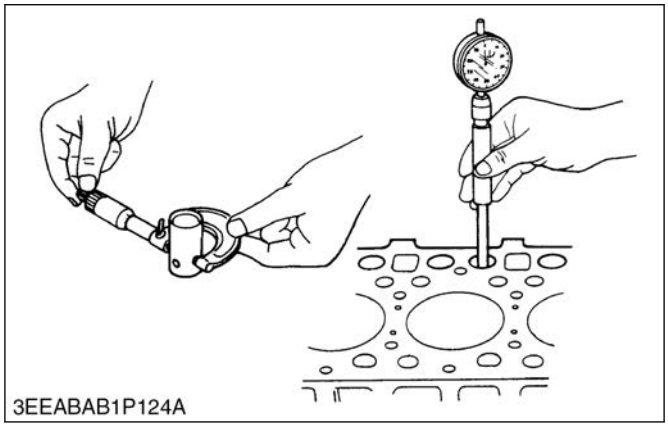



1. Put the push rod on V blocks.
2. Measure the push rod alignment.

3. If the measured value is more than the allowable limit, replace the push rod.

| | | |
|---|---|---|
| Push rod alignment | Allowable limit | 0.25 mm<br>0.0098 in. |

### 6.1.15 Measuring oil clearance between tappet and tappet guide bore




1. Measure the tappet O.D. with an external micrometer.

| | | |
|---|---|---|
| Tappet O.D. | Factory specification | 23.959 to 23.980 mm<br>0.94327 to 0.94409 in. |

2. Measure the tappet guide bore I.D. with a cylinder gauge.

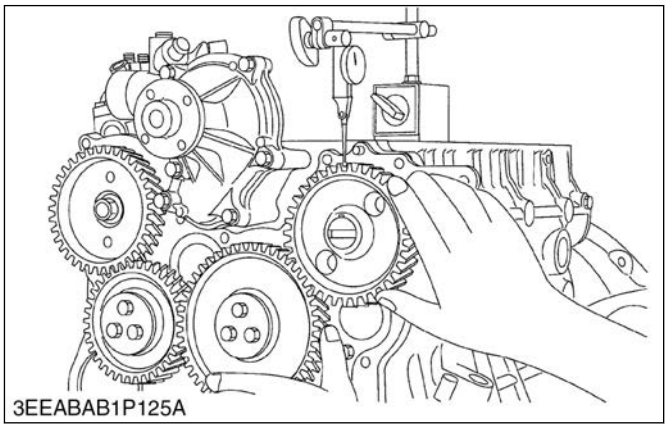
| | | |
|---|---|---|
| Tappet guide bore I.D. | Factory specification | 24.000 to 24.021 mm<br>0.94489 to 0.94570 in. |

3. Calculate the oil clearance.
4. If the oil clearance is more than the allowable limit or the tappet has a damage, replace the tappet.

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

## 6.2 Timing gears

### 6.2.1 Measuring timing gear backlash



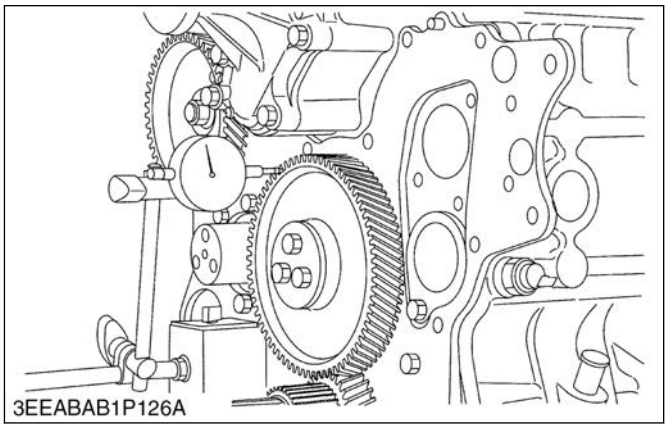

1. Set a dial indicator (lever type) with its point on the gear tooth.
2. Hold the mating gear and move the gear to measure the backlash.
3. If the backlash is more than the allowable limit, measure the oil clearance in the journal part of each shaft.

| | | |
|---|---|---|
| Backlash between crank gear and idle gear 1 | Factory specification | 0.0490 to 0.193 mm<br>0.00193 to 0.00759 in. |
| | Allowable limit | 0.22 mm<br>0.0087 in. |

| | | |
|---|---|---|
| Backlash between idle gear 1 and cam gear | Factory specification | 0.0490 to 0.189 mm<br>0.00193 to 0.00744 in. |
| | Allowable limit | 0.22 mm<br>0.0087 in. |

4. If the oil clearance is correct, replace the gear.

### 6.2.2 Measuring side clearance of idle gear

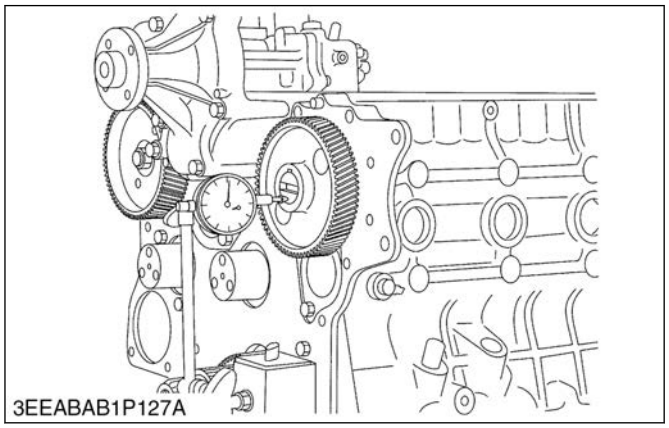



1. Set a dial indicator with its point on the idle gear.
2. Move the idle gear to the front and rear to measure the side clearance.

3. If the measured value is more than the allowable limit, replace the idle gear collar.

| | | |
|---|---|---|
| Side clearance of idle gear | Factory specification | 0.15 to 0.30 mm<br>0.0059 to 0.011 in. |
| | Allowable limit | 0.90 mm<br>0.035 in. |

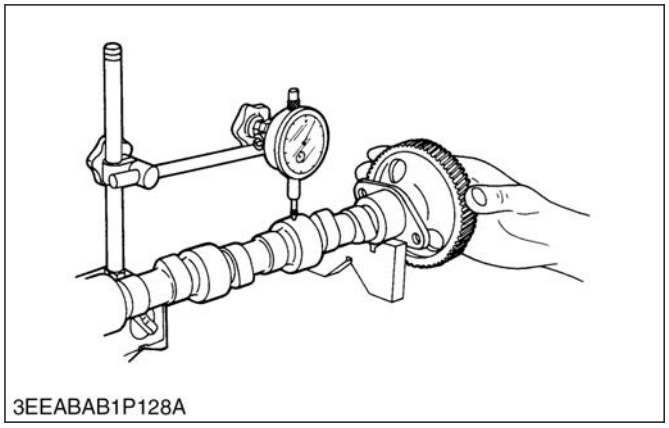
## 6.2.3 Measuring side clearance of camshaft




1. Set a dial indicator with its point on the camshaft.
2. Move the cam gear to the front and rear to measure the side clearance.
3. If the measured value is more than the allowable limit, replace the camshaft stopper.

| | | |
|---|---|---|
| Side clearance of camshaft | Factory specification | 0.070 to 0.22 mm<br>0.0028 to 0.0086 in. |
| | Allowable limit | 0.30 mm<br>0.012 in. |

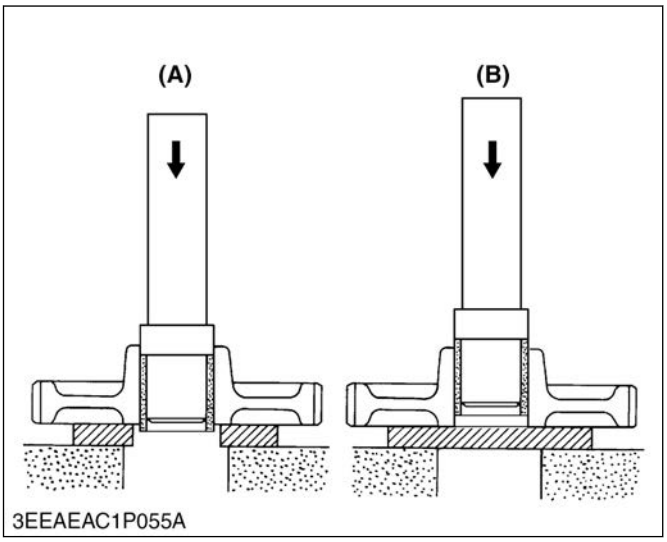
## 6.2.4 Measuring camshaft alignment




1. Hold the 2 end journals of camshaft with V blocks on the surface plate.
2. Set a dial indicator with its point on the middle journal.
3. Turn the camshaft slowly and read the variation on the indicator. (Half of the measurement)
4. If the measured value is more than the allowable limit, replace the camshaft.

| | | |
|---|---|---|
| Camshaft alignment | Allowable limit | 0.01 mm<br>0.0004 in. |

## 6.2.5 Replacing idle gear bushing

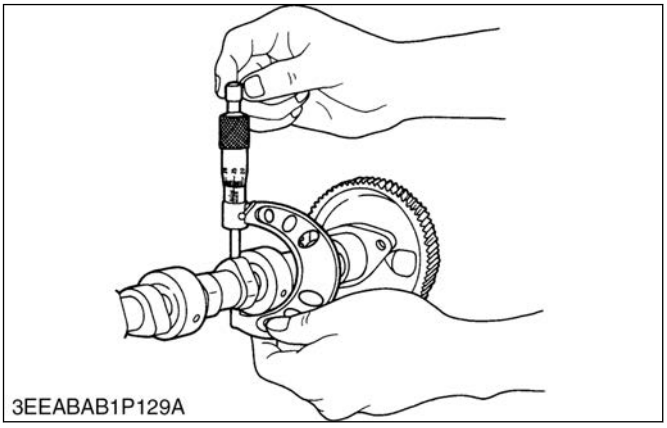



(A) When removing (B) When installing

1. Press out the used idle gear bushing with the replacing tool.
2. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
3. Press fit the new bushing with the replacing tool. Make sure that the bushing end aligns the end of the idle gear.

RELATED PAGE
1.4 Idle gear bushing replacing tool on page 2-64

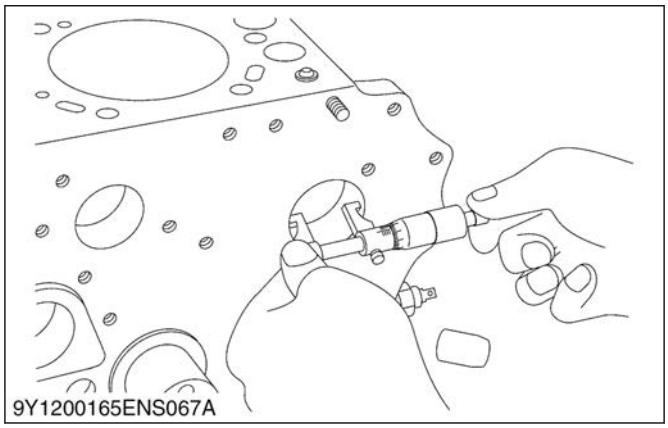
## 6.2.6 Measuring cam height

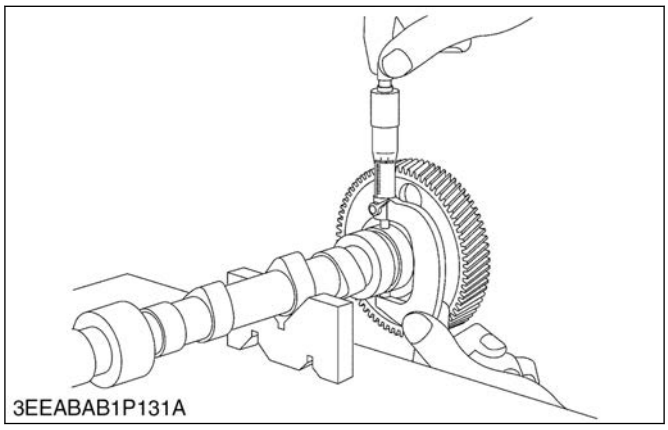


1. Measure the height of the cam at its highest point with an external micrometer.
2. If the measured value is less than the allowable limit, replace the camshaft.

| | | | |
|---|---|---|---|
| Cam height | Factory specification | Intake valve | 37.64 mm<br>1.482 in. |
| | | Exhaust valve | 38.96 mm<br>1.534 in. |
| | Allowable limit | Intake valve | 37.14 mm<br>1.462 in. |
| | | Exhaust valve | 38.46 mm<br>1.514 in. |

## 6.2.7 Measuring oil clearance between camshaft journal and cylinder block bore




1. Measure the camshaft journal O.D. with an external micrometer.

| | | |
|---|---|---|
| Camshaft journal O.D. | Factory specification | 45.934 to 45.950 mm<br>1.8085 to 1.8090 in. |

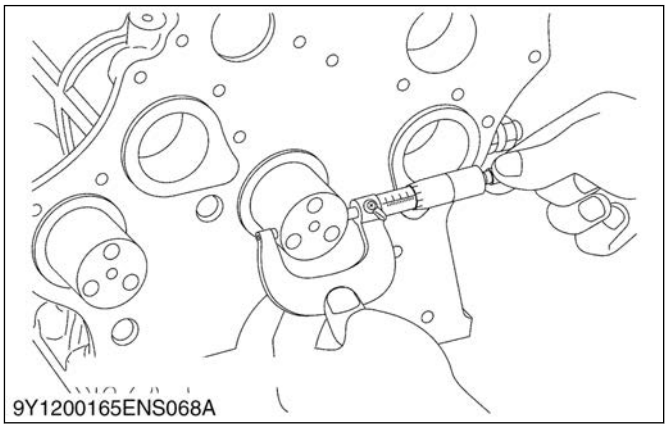
2. Measure the cylinder block bore I.D. for the camshaft with an internal micrometer.

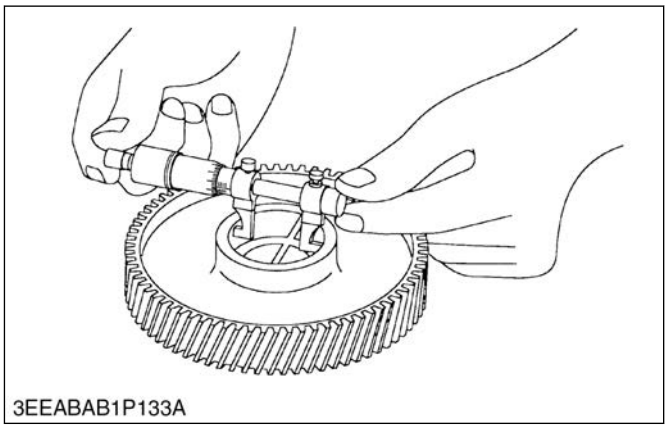
| | | |
|---|---|---|
| Camshaft bearing I.D. | Factory specification | 46.000 to 46.025 m<br>1.8111 to 1.8120 in. |

3. Calculate the oil clearance.
4. If the oil clearance is more than the allowable limit, replace the camshaft.

| | | |
|---|---|---|
| Oil clearance of camshaft journal | Factory specification | 0.050 to 0.091 mm<br>0.0020 to 0.0035 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |

## 6.2.8 Measuring oil clearance between idle gear shaft 1, 2 and idle gear 1, 2 bushing




1. Measure the idle gear shaft O.D. with an external micrometer.

| | | |
|---|---|---|
| Idle gear shaft 1, 2 O.D. | Factory specification | 44.959 to 44.975 mm<br>1.7701 to 1.7706 in. |

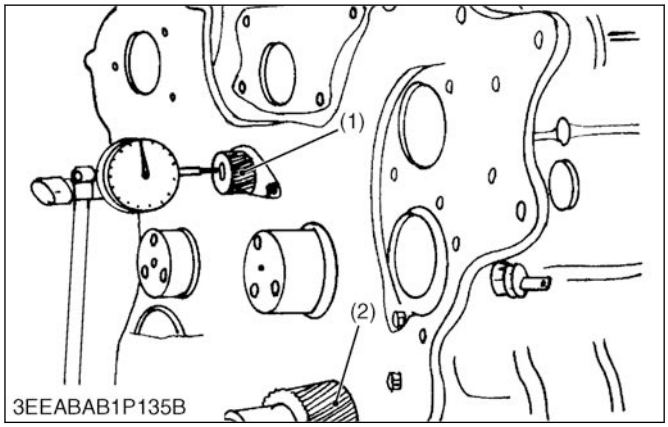
2. Measure the idle gear bushing I.D. with an internal micrometer.

| | | |
|---|---|---|
| Idle gear 1, 2 bushing I.D. | Factory specification | 45.025 to 45.050 mm<br>1.7727 to 1.7736 in. |

3. Calculate the oil clearance.
4. If the oil clearance is more than the allowable limit, replace the bushing.

| | | |
|---|---|---|
| Oil clearance between idle gear shaft 1, 2 and idle gear 1, 2 bushing | Factory specification | 0.050 to 0.091 mm<br>0.0020 to 0.0035 in. |
| | Allowable limit | 0.10 mm<br>0.0039 in. |

## 6.2.9 Measuring balancer shaft side clearance



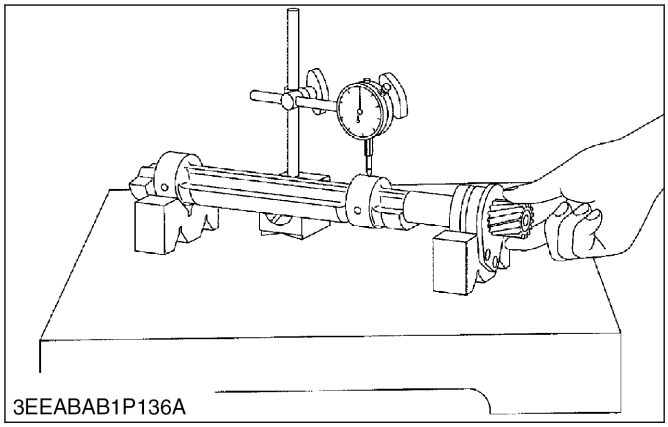

(1) Balancer shaft 1 (2) Balancer shaft 2

1. Set a dial indicator with tip on the balancer shaft.
2. Measure the side clearance by moving the balancer shaft to the front and rear.

| | | |
|---|---|---|
| Side clearance of balancer shaft 1, 2 | Factory specification | 0.070 to 0.215 mm<br>0.00276 to 0.00846 in. |
| | Allowable limit | 0.3 mm<br>0.0118 in. |

3. If the measured value exceeds the allowable limit, replace the balancer shaft.

## 6.2.10 Measuring balancer shaft alignment



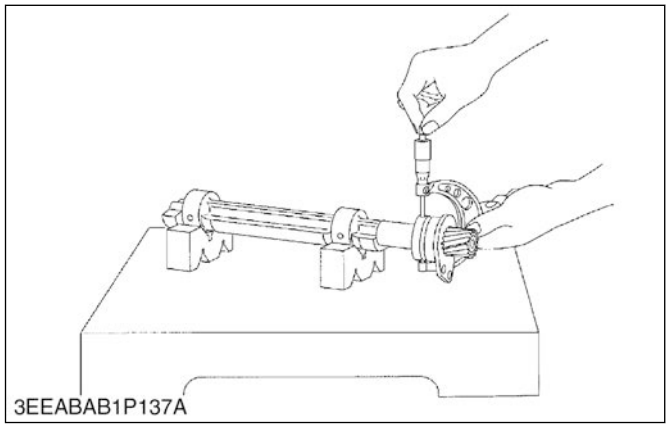

1. Support the balancer shaft with V blocks on the surface plate and set a dial indicator with its tip on the intermediate journal at high angle.
2. Rotate the balancer shaft on the V block and get the misalignment (half of the measurement value).

| | | |
|---|---|---|
| Balancer shaft 1, 2 alignment | Allowable limit | 0.02 mm<br>0.0008 in. |

3. If the alignment exceeds the allowable limit, replace the balancer shaft.

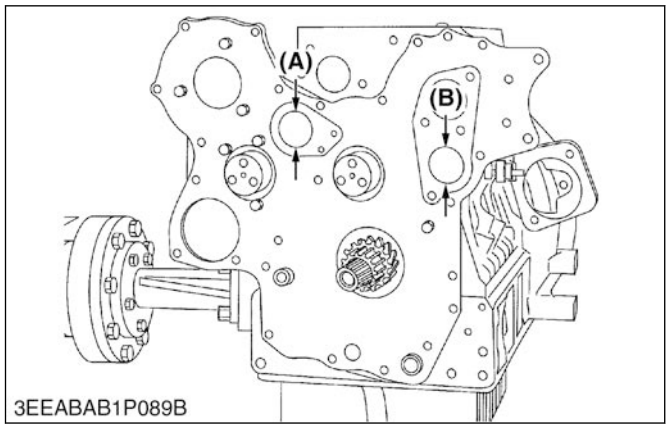
## 6.2.11 Measuring oil clearance of balancer shaft journal

1. Measure the balancer shaft journal O.D. with an outside micrometer.




| | | |
|---|---|---|
| Balancer-shaft journal O.D. | Factory specification | 50.920 to 50.940 mm<br>2.0048 to 2.0055 in. |

2. Measure the cylinder block bore I.D. (A), (B) for balancer shaft with an inside micrometer.




(A) Balancer-shaft bearing bore I.D. (B) Balancer-shaft bearing bore I.D.

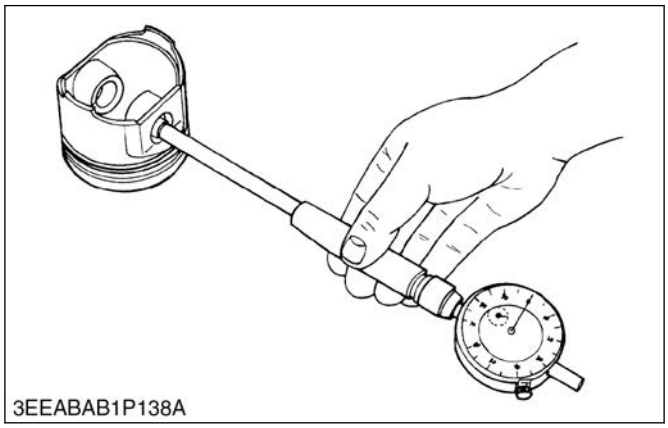
| | | |
|---|---|---|
| Balancer-shaft bearing bore I.D. (A), (B) | Factory specification | 51.01 to 51.08 mm<br>2.009 to 2.011 in. |

3. If the oil clearance of the balancer shaft journal exceeds the allowable limit, replace the balancer shaft.

| | | |
|---|---|---|
| Oil clearance of balancer-shaft journal | Factory specification | 0.0700 to 0.159 mm<br>0.00276 to 0.00625 in. |
| | Allowable limit | 0.2 mm<br>0.008 in. |

# 6.3 Piston and connecting rod

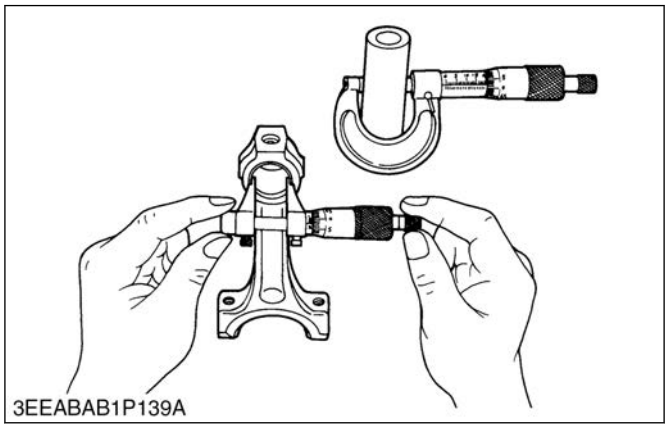
## 6.3.1 Measuring piston pin bore I.D.


3EEABAB1P138A

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

| | | |
|---|---|---|
| Piston pin bore I.D. | Factory specification | 30.006 to 30.013 mm<br>1.1814 to 1.1816 in. |
| | Allowable limit | 30.05 mm<br>1.183 in. |

## 6.3.2 Calculating oil clearance between piston pin and small end bushing


3EEABAB1P139A

1. Measure the O.D. of the piston pin with an outside micrometer.

| | | |
|---|---|---|
| Piston pin O.D. | Factory specification | 30.006 to 30.011 mm<br>1.1814 to 1.1815 in. |

2. Measure the I.D. of the piston pin bushing at the connecting rod small end with a cylinder gauge.

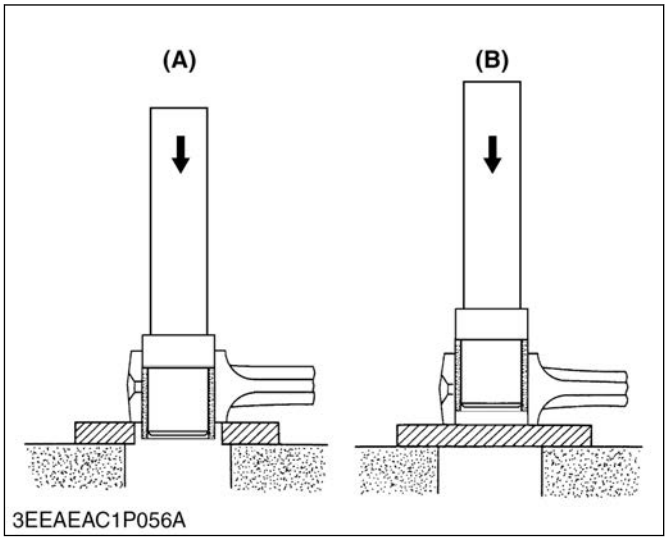
| | | |
|---|---|---|
| Small end bushing I.D. | Factory specification | 30.031 to 30.046 mm<br>1.1824 to 1.1829 in. |

3. Calculate the oil clearance.
4. If the clearance more than the allowable limit, replace the bushing.

| | | |
|---|---|---|
| Oil clearance between piston pin and small end bushing | Factory specification | 0.020 to 0.040 mm<br>0.00079 to 0.0015 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |

5. If it is still more than the allowable limit, replace the piston pin.

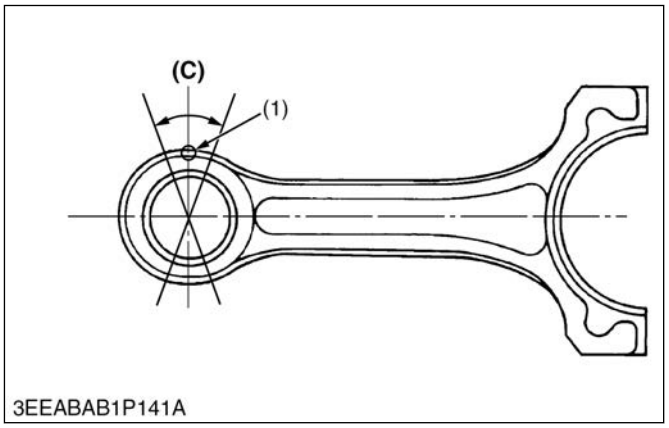
## 6.3.3 Replacing small end bushing



3EEAEAC1P056A

(A) When removing (B) When installing

1. Press out the used bushing with small end bushing replacing tool.
2. Clean a new small end bushing and bore.
3. Apply engine oil to a new small end bushing and bore.
4. Insert a new bushing onto the tool.
5. Press-fit it with a press so that the seam (1) of bushing position as shown in the figure, until it is flash with the connecting rod.



3EEABAB1P141A

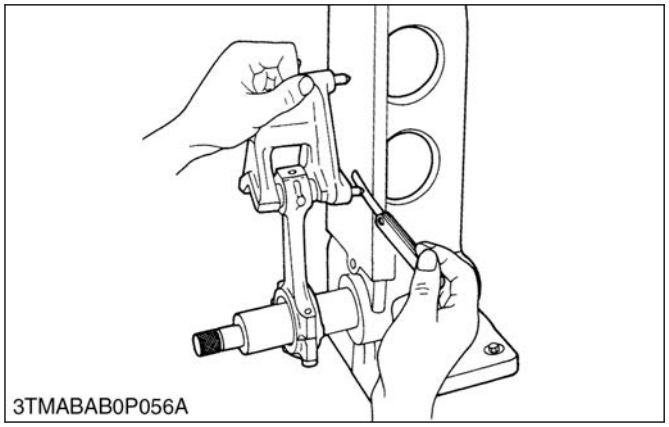
(1) Seam (C) 0.26 rad (15°)

— RELATED PAGE —
1.3 Small end bushing replacing tool on page 2-63

## 6.3.4 Checking connecting rod alignment

**■ NOTE**

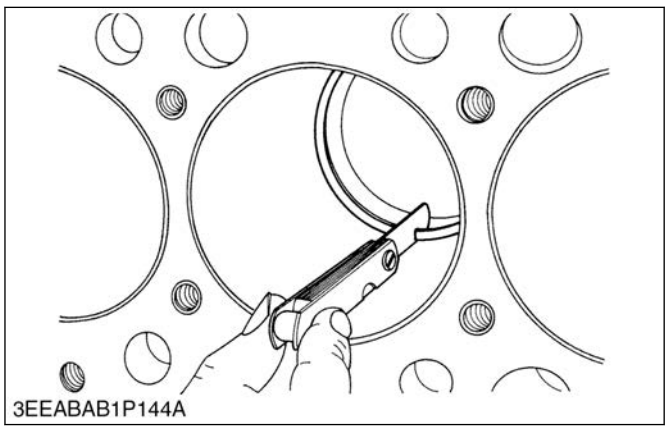
- **Make sure that the oil clearance of the small end bushing is less than the allowable limit.**




1. Remove the piston pin from the piston.
2. Install the piston pin into the connecting rod.
3. Install the connecting rod on the alignment tool of the connecting rod.
4. Put a gauge on the piston pin, and move it against the face plate.
5. If the gauge does not touch fully against the face plate, measure the space between the gauge pin and face plate.
6. If the measured value is more than the allowable limit, replace the connecting rod.

| | | |
|---|---|---|
| Connecting rod alignment | Allowable limit | 0.05 mm<br>0.002 in. |

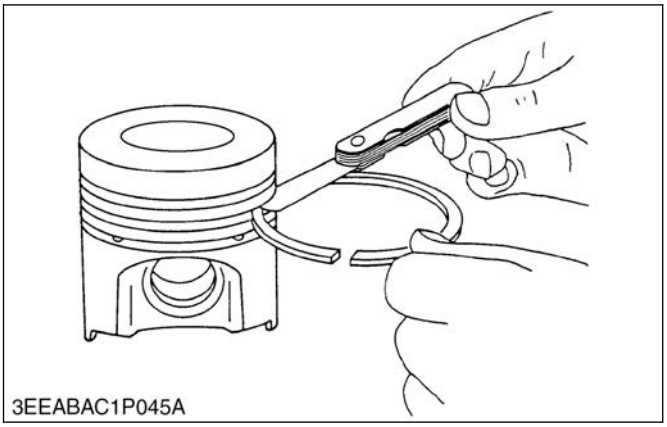
## 6.3.5 Checking piston ring gap




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

| | | |
|---|---|---|
| Top ring gap | Factory specification | 0.30 to 0.45 mm<br>0.012 to 0.017 in. |
| | Allowable limit | 1.25 mm<br>0.0492 in. |
| Second ring gap | Factory specification | 0.45 to 0.60 mm<br>0.018 to 0.023 in. |
| | Allowable limit | 1.25 mm<br>0.0492 in. |
| Oil ring gap | Factory specification | 0.25 to 0.45 mm<br>0.0099 to 0.017 in. |
| | Allowable limit | 1.25 mm<br>0.0492 in. |

## 6.3.6 Checking clearance between piston ring and ring groove




1. Clean the rings and the ring grooves, and install each ring in its groove.
2. Measure the clearance between the ring and the groove with a feeler gauge or depth gauge.

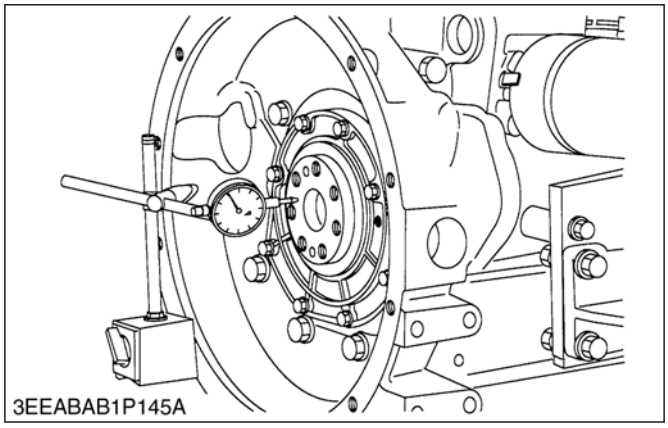
3. If the clearance is more than the allowable limit, replace the piston ring.

| | | | |
|---|---|---|---|
| Clearance between piston ring and ring groove | Factory specification | Top ring | 0.05 to 0.09 mm 0.002 to 0.003 in. |
| | | Second ring | 0.065 to 0.10 mm 0.0026 to 0.0039 in. |
| | | Oil ring | 0.020 to 0.060 mm 0.00079 to 0.0023 in. |
| | Allowable limit | Top ring | 0.15 mm 0.0059 in. |
| | | Second ring | 0.15 mm 0.0059 in. |
| | | Oil ring | 0.15 mm 0.0059 in. |

4. If the clearance stays more than the allowable limit with new ring, replace the piston also.

# 6.4 Crankshaft

## 6.4.1 Measuring side clearance of crankshaft

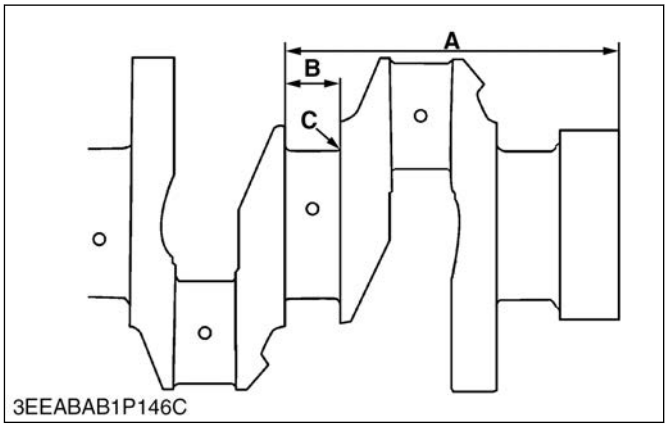



1. Set a dial indicator with its point on the end of the crankshaft.
2. Move the crankshaft to the front and rear to measure the side clearance.
3. If the measured value is more than the allowable limit, replace the thrust bearings.

| | | |
|---|---|---|
| Side clearance of crankshaft | Factory specification | 0.15 to 0.31 mm 0.0059 to 0.012 in. |
| | Allowable limit | 0.50 mm 0.020 in. |

4. If the same dimension bearing is not applicable because of the crankshaft journal wear, replace it with an oversize one. Refer to the table and figure.

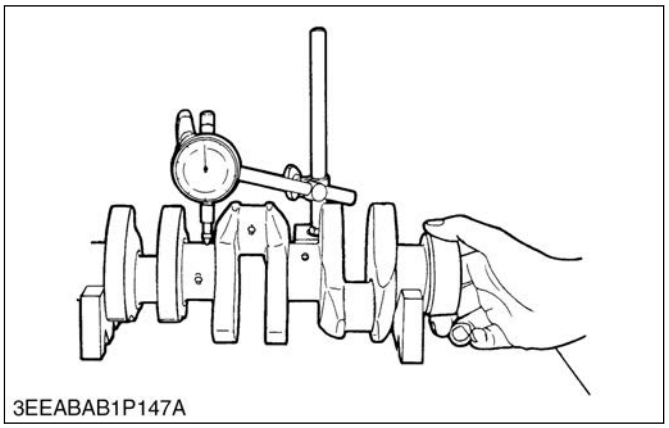
**(Reference)**




- Oversize dimensions of crankshaft journal

| Oversize | 0.2 mm 0.008 in. | 0.4 mm 0.02 in. |
|---|---|---|
| Dimension A | 169.10 to 169.15 mm 6.6575 to 6.6594 in. | 169.2 to 169.25 mm 6.6615 to 6.6633 in. |
| Dimension B | 29.20 to 29.25 mm 1.150 to 1.151 in. | 29.40 to 29.45 mm 1.158 to 1.159 in. |
| Dimension C | 2.8 to 3.2 mm radius 0.11 to 0.12 in. radius | 2.8 to 3.2 mm radius 0.11 to 0.12 in. radius |
| The crankshaft journal must be fine-finished to higher than Rmax. = 0.8S | | |

## 6.4.2 Measuring crankshaft alignment




1. Hold the two end journals of crankshaft with V blocks on the surface plate.
2. Set a dial indicator with its point on the middle journal.
3. Turn the crankshaft slowly and read the variation on the indicator. (Half of the measured value)

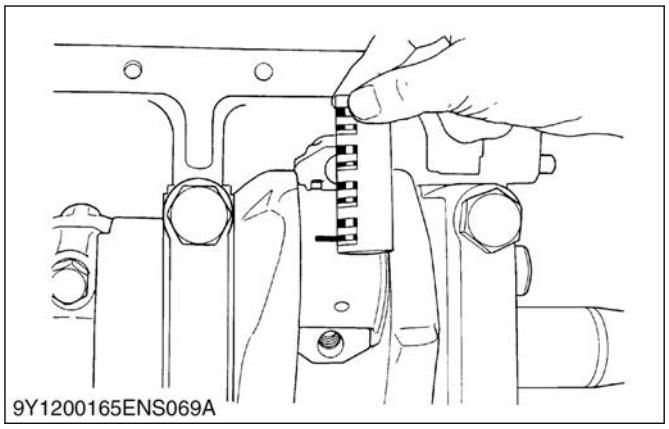
4. If the measured value is more than the allowable limit, replace the crankshaft.

| | | |
|---|---|---|
| Crankshaft alignment | Allowable limit | 0.02 mm<br>0.0008 in. |

## 6.4.3 Checking oil clearance between crank pin and crank pin bearing

**NOTE**

- **Do not put the plastigauge into the crank pin oil hole.**
- **When you tighten the connecting rod screws, do not move the crankshaft.**




1. Clean the crank pin and crank pin bearing.
2. Put a strip of plastigauge on the center of the crank pin.
3. Install the connecting rod cap.
4. Tighten the connecting rod screw to the specified tightening torque.
5. Remove the connecting rod cap again.
6. Measure the width that it becomes flat with the scale to get the oil clearance.

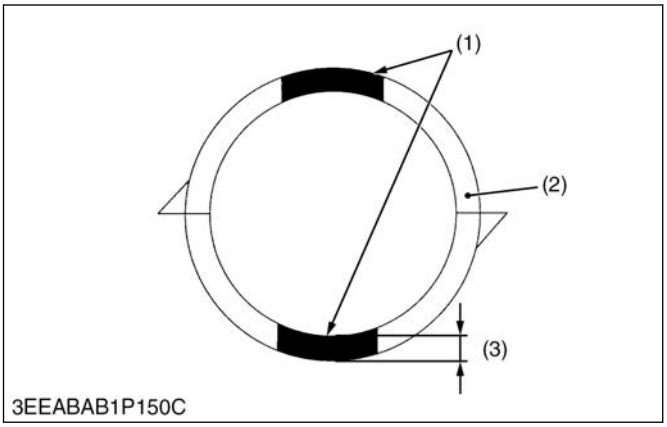
| | | |
|---|---|---|
| Oil clearance between crank pin and crank pin bearing | Factory specification | 0.018 to 0.051 mm<br>0.00071 to 0.0020 in. |
| | Allowable limit | 0.20 mm<br>0.0079 in. |

| | | |
|---|---|---|
| Crank pin O.D. | Factory specification | 52.977 to 52.990 mm<br>2.0857 to 2.0862 in. |

7. If the oil clearance is more than the allowable limit, replace the crank pin bearing.

**IMPORTANT**

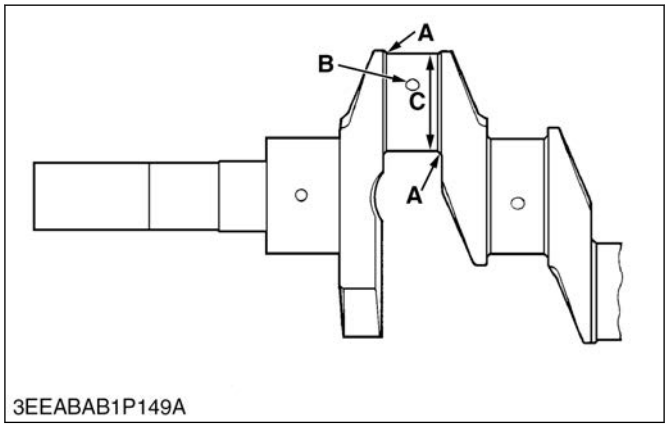
- **To replace it with a specific STD service part, make sure the crank pin bearing has the same ID color as the connecting rod.**




(1) ID color
(2) Crank pin bearing
(3) Center wall thick

| ID color | Connecting rod | Crank pin bearing | | |
|---|---|---|---|---|
| | Large-end in. dia. | Class | Part code | Center wall thick |
| Blue | 56.010 to 56.020 mm<br>2.2052 to 2.2055 in. | L | 1C020-22313 | 1.496 to 1.501 mm<br>0.05890 to 0.05909 in. |
| Without color | 56.00 to 56.01 mm<br>2.2048 to 2.2051 in. | S | 1C020-22334 | 1.491 to 1.496 mm<br>0.05870 to 0.05889 in. |

8. If the same dimension of the bearing is not applicable because of the crank pin wear, replace it with an undersize one. Refer to the table and figure.




**(Reference)**

**Undersize dimensions of crank pin**

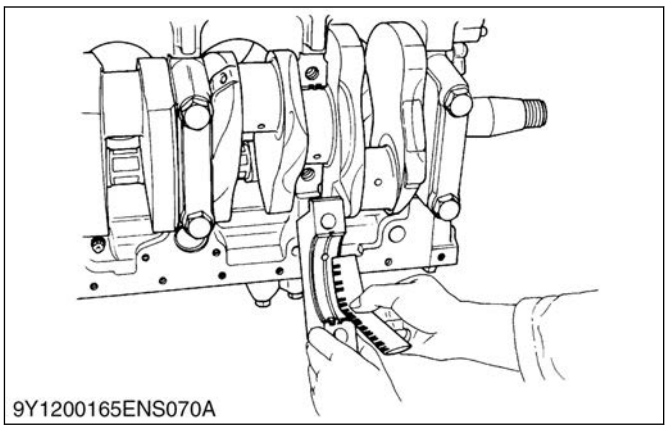
| Undersize | 0.2 mm 0.008 in. | 0.4 mm 0.02 in. |
|---|---|---|
| Dimension A | 3.3 to 3.7 mm radius 0.13 to 0.14 in. radius | 3.3 to 3.7 mm radius 0.13 to 0.14 in. radius |
| *Dimension B | 1.0 to 1.5 mm relief 0.040 to 0.059 in. relief | 1.0 to 1.5 mm relief 0.040 to 0.059 in. relief |
| Dimension C | 52.777 to 52.790 mm dia. 2.0779 to 2.0783 in. dia. | 52.577 to 52.590 mm dia. 2.0700 to 2.0704 in. dia. |
| The crank pin must be fine-finished to higher than Rmax. = 0.8S | | |

* Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.040 to 0.059 in.) relief.

## 6.4.4 Checking oil clearance between crankshaft journal and crankshaft bearing

**■ IMPORTANT**

- **Do not put the plastigauge into the oil hole of the journal.**

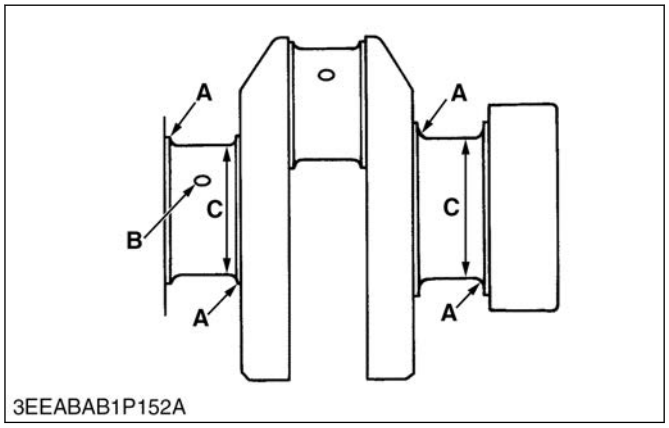



| | | |
|---|---|---|
| Crankshaft journal O.D. | Factory specification | 74.977 to 74.990 mm 2.9519 to 2.9523 in. |

1. Clean the crankshaft journal and crankshaft bearing.
2. Put a strip of plastigauge on the center of the journal.
3. Install the main bearing case.
4. Tighten the screws to the specified torque.
5. Remove the main bearing case again.
6. Measure the width that it becomes flat with the scale to get the oil clearance.
7. If the clearance is more than the allowable limit, replace the crankshaft bearing.

| | | |
|---|---|---|
| Oil clearance between crankshaft journal and crankshaft bearing | Factory specification | 0.018 to 0.062 mm 0.00071 to 0.0024 in. |
| | Allowable limit | 0.20 mm 0.0079 in. |

8. If the same dimension of the bearing is not applicable because of the crankshaft journal wear, replace it with an undersize one. Refer to the table and figure.
**(Reference)**



3EEABAB1P152A

- Undersize dimensions of crankshaft journal

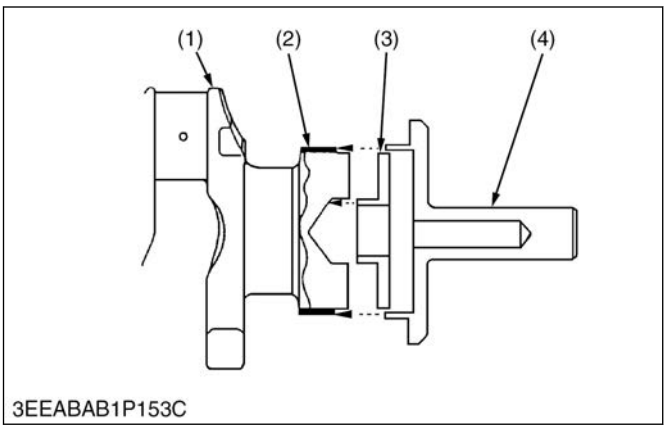
| Undersize | 0.2 mm 0.008 in. | 0.4 mm 0.02 in. |
|---|---|---|
| Dimension A | 2.8 to 3.2 mm radius 0.11 to 0.12 in. radius | 2.8 to 3.2 mm radius 0.11 to 0.12 in. radius |
| *Dimension B | 1.0 to 1.5 mm relief 0.040 to 0.059 in. relief | 1.0 to 1.5 mm relief 0.040 to 0.059 in. relief |
| Dimension C | 74.777 to 74.790 mm dia. 2.9440 to 2.9444 in. dia. | 74.577 to 74.590 mm dia. 2.9361 to 2.9366 in. dia. |
| The crankshaft journal must be fine-finished to higher than Rmax. = 0.8S* | | |

* Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.040 to 0.059 in.) relief.

## 6.4.5 Replacing crankshaft sleeve

**■ NOTE**
- **Make sure that the large chamfer of the sleeve points to outward.**

1. Remove the used crankshaft sleeve (2).



3EEABAB1P153C

(1) Crankshaft
(2) Crankshaft sleeve
(3) Sleeve guide
(4) Crankshaft sleeve press fit tool

2. Set the sleeve guide (3) to the crankshaft (1).
3. Heat a new sleeve.

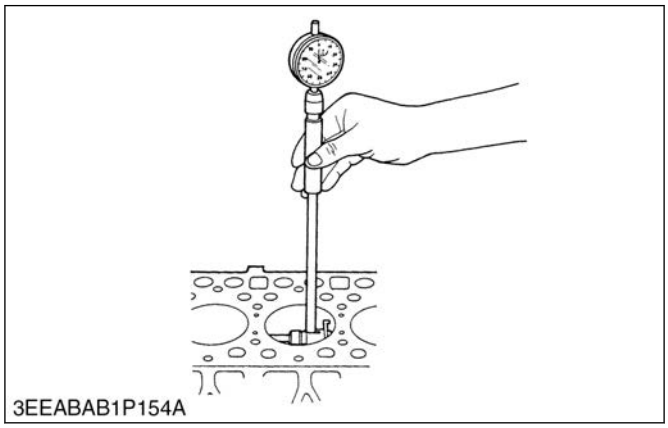
| | |
|---|---|
| New sleeve temperature | 150 and 200 ℃ (302 and 392 ℉) |

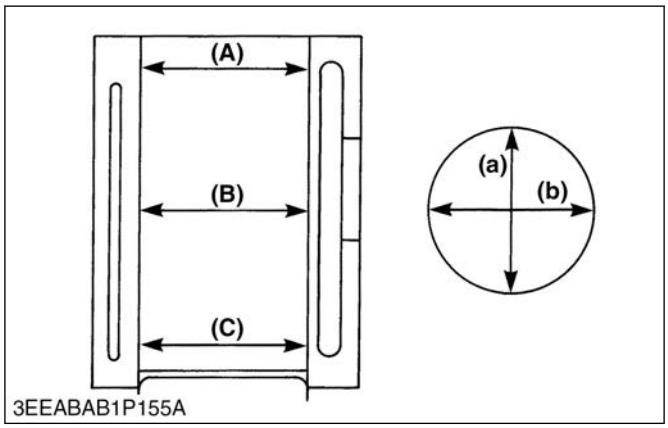
4. Set the new sleeve to the crankshaft as shown in figure.
5. Press fit the sleeve using the crankshaft sleeve press fit tool (4).

RELATED PAGE
1.7 Crankshaft sleeve press fit tool on page 2-65

# 6.5 Cylinder

## 6.5.1 Measuring cylinder wear


3EEABAB1P154A



3EEABAB1P155A

(A) Top
(B) Middle
(C) Bottom
(a) Right-angled to piston pin
(b) Piston pin direction

1. Measure the I.D. of the cylinder at the 6 positions (see figure) with a cylinder gauge and find the maximum and minimum inner diameters.
2. Find the difference between the maximum and the minimum inner diameters.
3. If the maximum I.D. or the difference is more than the allowable limit, bore and hone it to the oversize dimension.

| | | |
|---|---|---|
| Cylinder bore I.D. | Factory specification | 100.000 to 100.022 mm<br>3.93701 to 3.93787 in. |
| | Allowable limit | 100.150 mm<br>3.9429 in. |

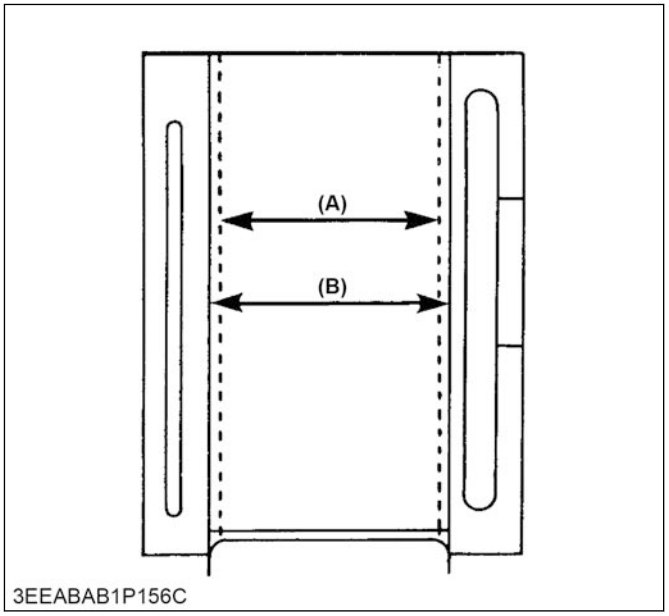
4. Check the cylinder wall for scratches. If you find deep scratches, bore the cylinder.

RELATED PAGE
6.5.2 Correcting cylinder to oversize on page 3-129

## 6.5.2 Correcting cylinder to oversize

**NOTE**

- **If the oversize cylinder I.D. is more than the allowable limit, replace the crankcase with a new one.**



3EEABAB1P156C

(A) Standard cylinder I.D.
(B) Oversize cylinder I.D.

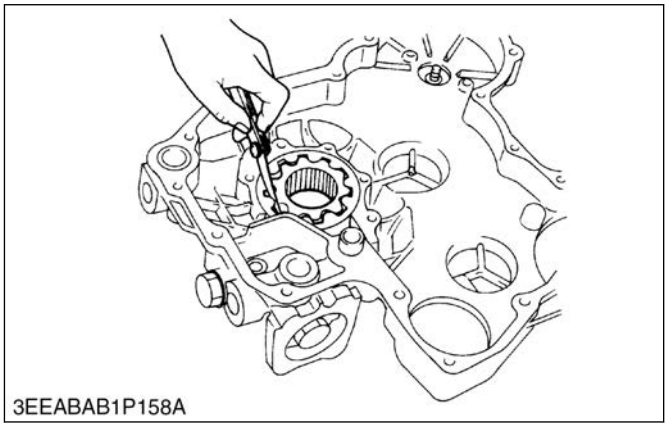
1. If the cylinder wear is more than the allowable limit, bore and hone it to the specified dimension.

| | | |
|---|---|---|
| Oversize cylinder I.D. | Factory specification | 100.500 to 100.522 mm<br>3.95670 to 3.95755 in. |
| | Allowable limit | 100.650 mm<br>3.96260 in. |
| Finishing | Hone to 1.2 to 3.0 μmRz (0.000048 to 0.00011 in.Rz) | |

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

# 6.6 Oil pump

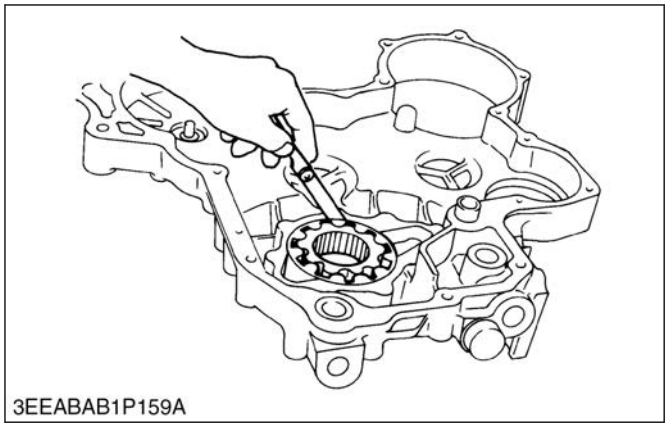
## 6.6.1 Checking clearance between inner rotor and outer rotor


3EEABAB1P158A

1. Measure the clearance between the lobes of the inner rotor and the outer rotor with a feeler gauge.
2. If the clearance is more than the allowable limit, replace the oil pump rotor assembly.

| | | |
|---|---|---|
| Clearance between inner rotor and outer rotor | Factory specification | 0.040 to 0.16 mm<br>0.0016 to 0.0062 in. |
| | Allowable limit | 0.3 mm<br>0.01 in. |

## 6.6.2 Checking clearance between outer rotor and pump body

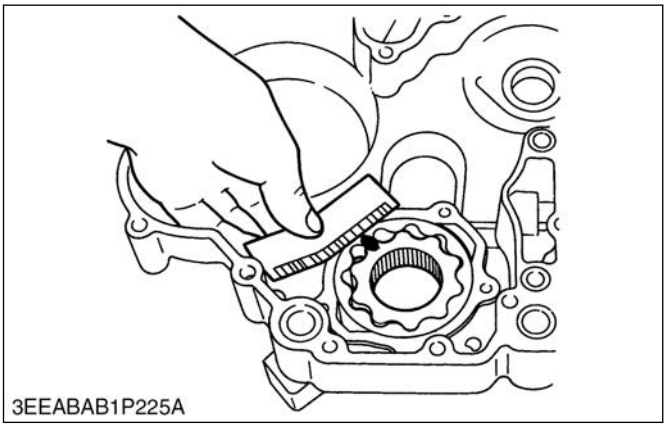

3EEABAB1P159A

1. Measure the clearance between the outer rotor and the pump body with a feeler gauge.
2. If the clearance is more than the allowable limit, replace the oil pump rotor assembly.

| | | |
|---|---|---|
| Clearance between outer rotor and pump body | Factory specification | 0.100 to 0.184 mm<br>0.00394 to 0.00724 in. |
| | Allowable limit | 0.3 mm<br>0.01 in. |

3. If the clearance is more than the allowable limit after replacing the oil pump rotor assembly, replace the gear case.

## 6.6.3 Checking clearance between rotor and cover


3EEABAB1P225A

1. Put a strip of plastigauge on the rotor face with grease.
2. Install the cover and tighten the oil pump cover screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Oil pump cover screw | 7.9 to 9.3 N·m<br>0.80 to 0.95 kgf·m<br>5.8 to 6.8 lbf·ft |

3. Remove the cover carefully.
4. Measure the width that plastigauge becomes flat with the scale to get the oil clearance.
5. If the clearance is more than the allowable limit, replace oil pump rotor assembly and the cover.

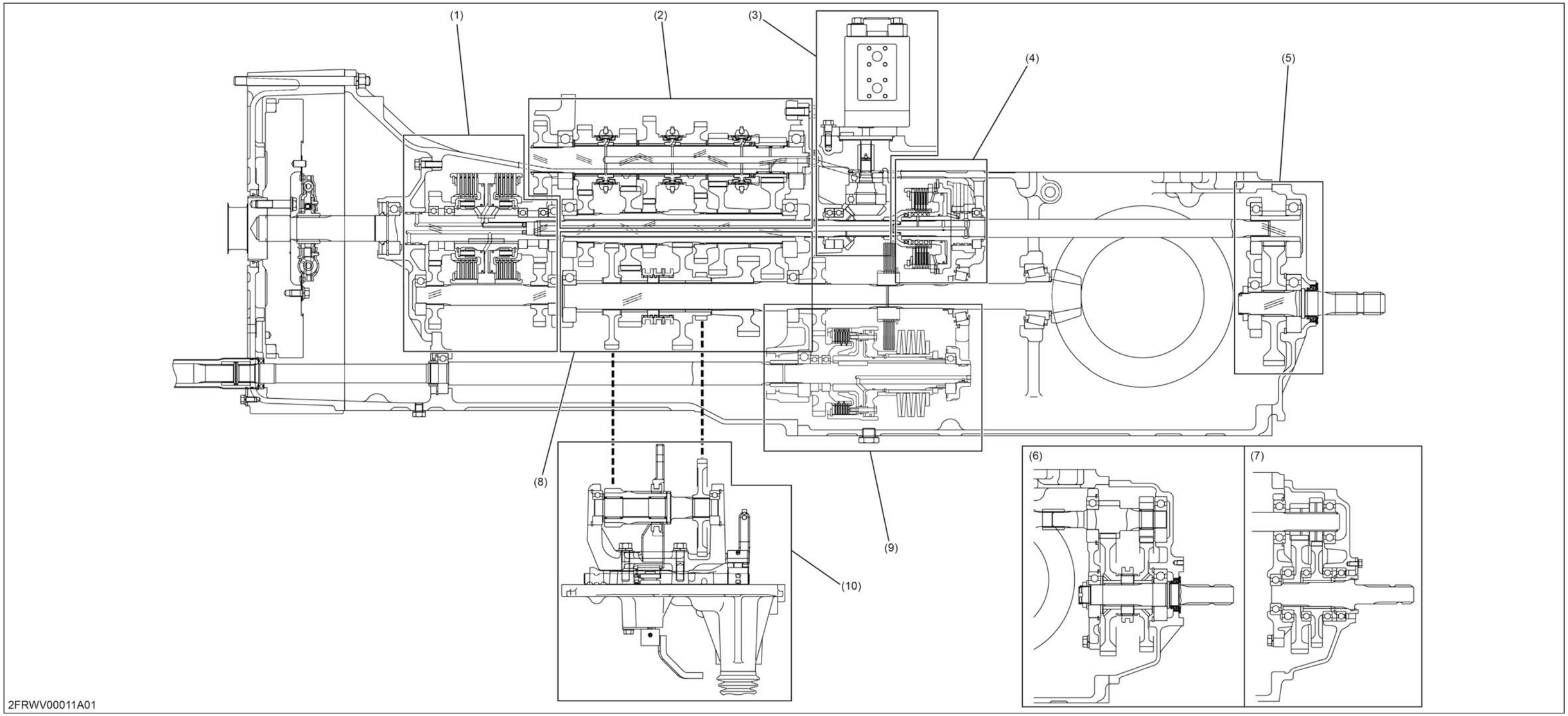
| | | |
|---|---|---|
| Clearance between rotor and cover | Factory specification | 0.025 to 0.075 mm<br>0.00099 to 0.0029 in. |
| | Allowable limit | 0.225 mm<br>0.00886 in. |

# 4. TRANSMISSION

# MECHANISM

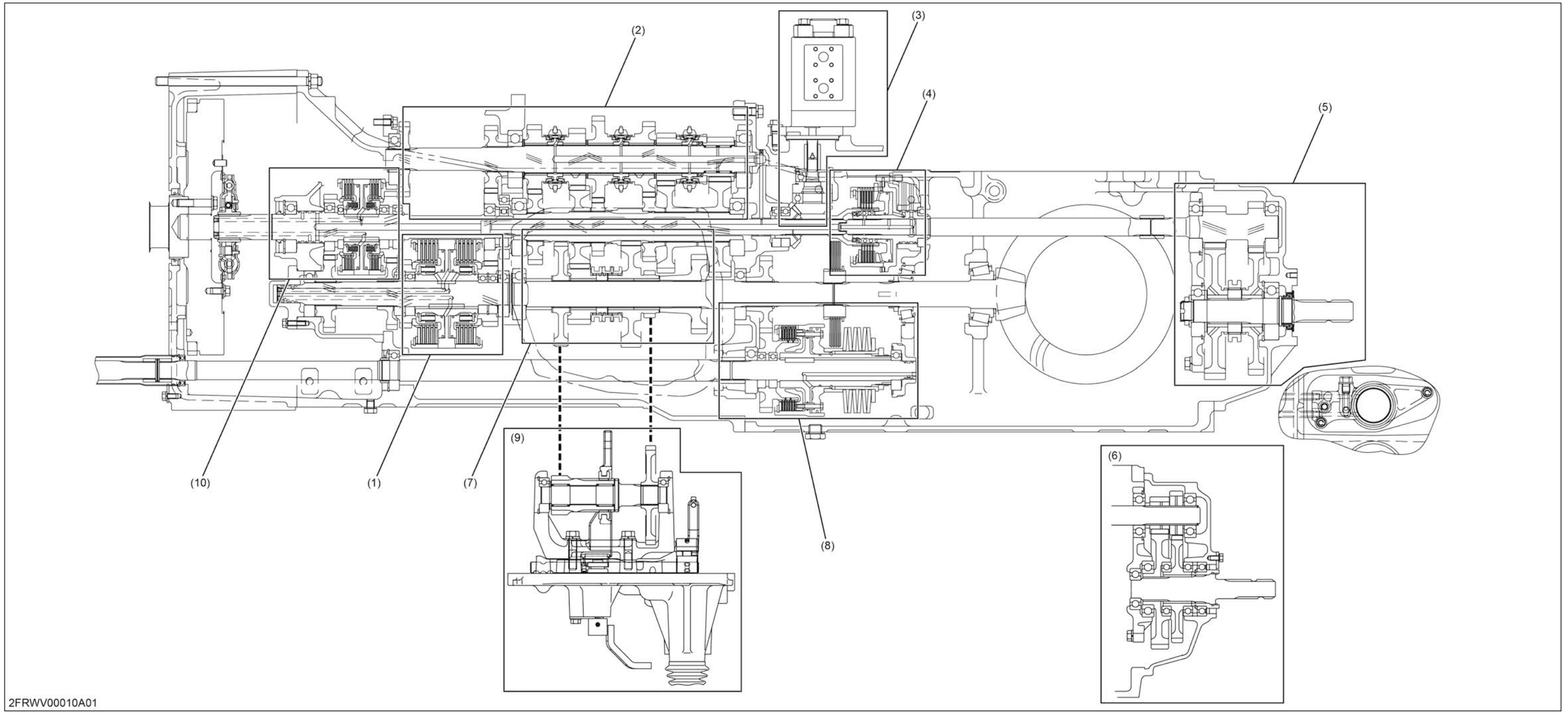
## 1. Structure

### 1.1 F18/R18 speed transmission model




(1) Hydraulic shuttle section
(2) Main gear shift section
(3) Hydraulic pump and drive section
(4) PTO clutch section
(5) PTO gear section (540 type)
(6) PTO gear section (540/540E shift type)
(7) PTO gear section (540/1000 interchange type)
(8) Range gear shift section
(9) 4WD clutch section
(10) Creep gear section (Cassette type)

## 1.2 F36/R36 speed transmission model

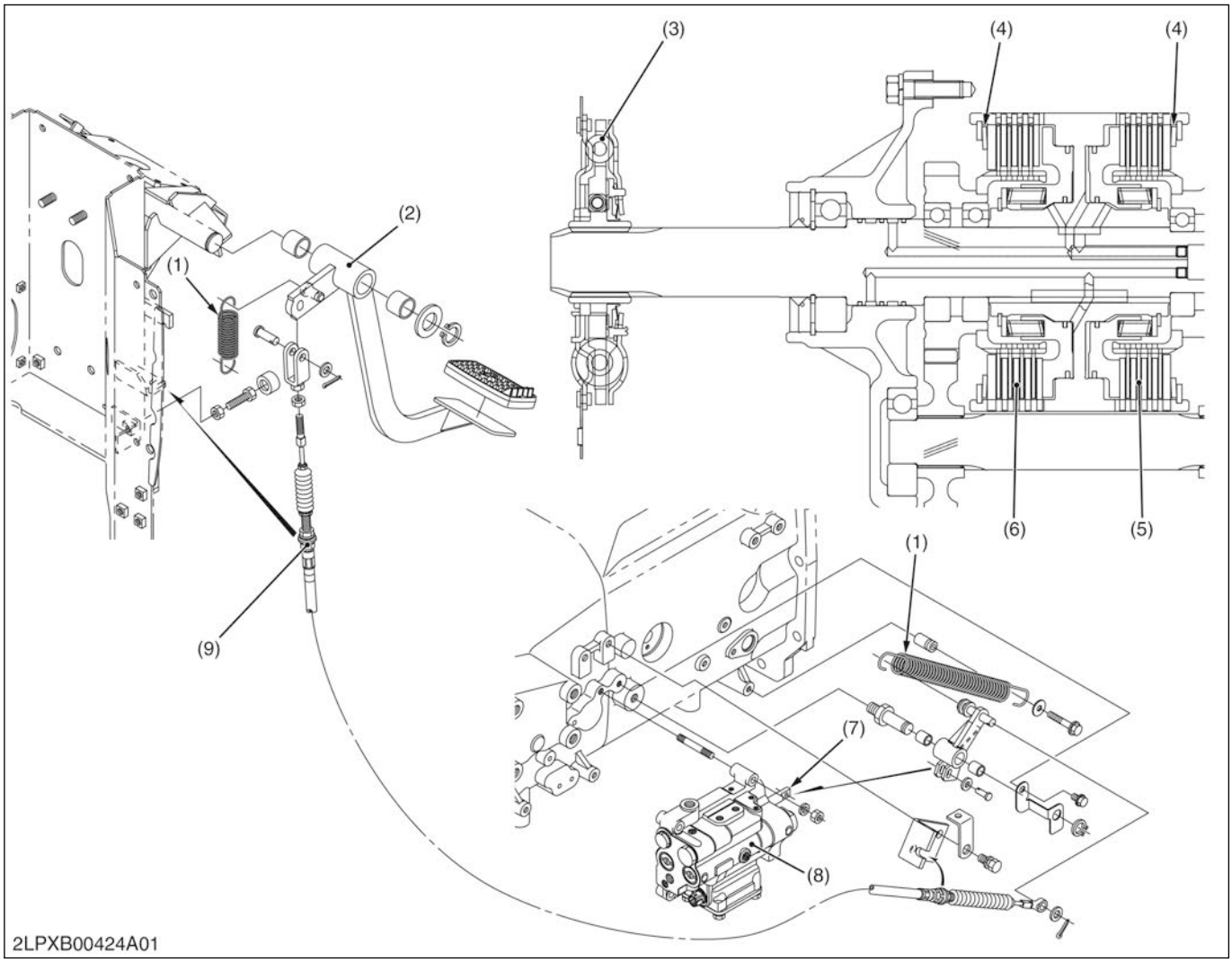



(1) Hydraulic shuttle section
(2) Main gear shift section
(3) Hydraulic pump and drive section
(4) PTO clutch section
(5) PTO gear section (540/540E shift type)
(6) PTO gear section (540/1000 interchange type)
(7) Range gear shift section
(8) 4WD clutch section
(9) Creep gear section (Cassette type)
(10) Dual speed section

# 2. Power train for traveling gear

## 2.1 Hydraulic shuttle shift section

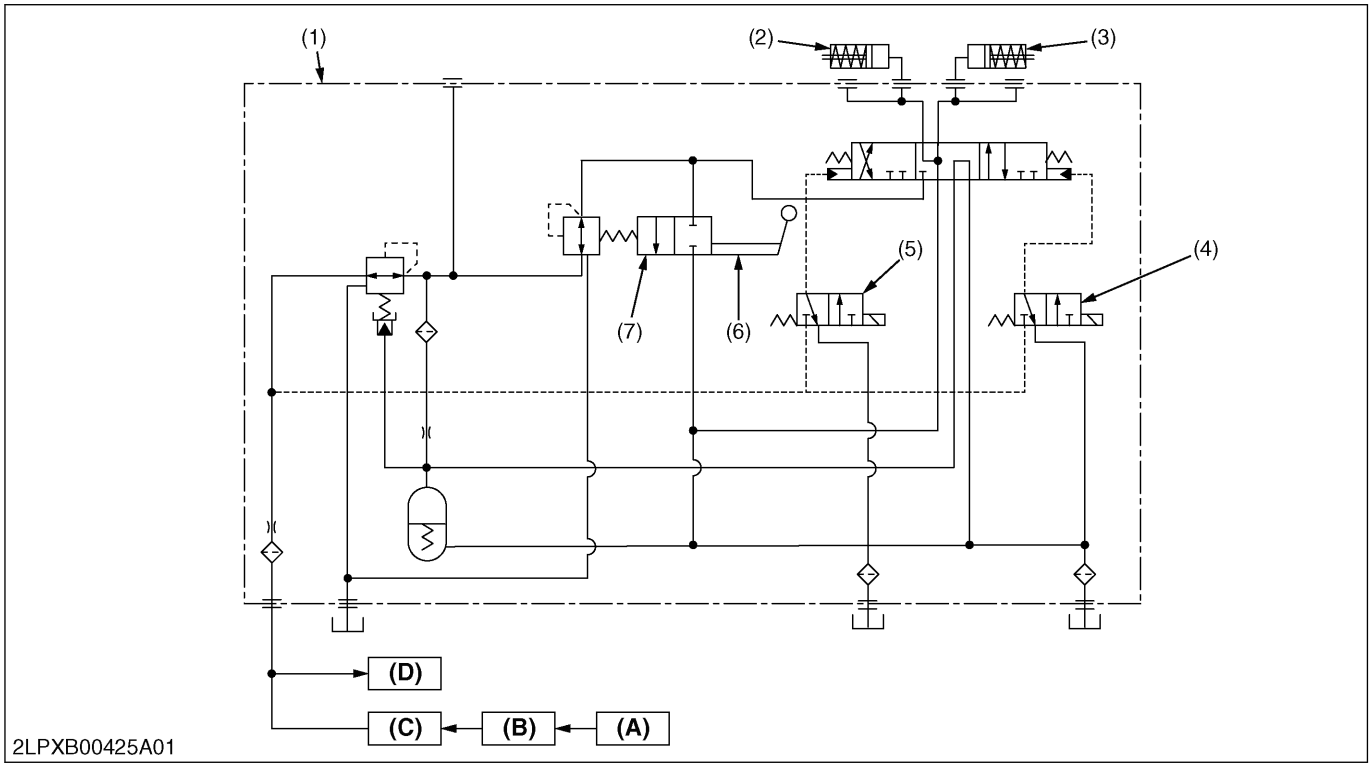
### 2.1.1 Structure of hydraulic shuttle




(1) Return spring
(2) Clutch pedal
(3) Damper disk
(4) Belleville washer (Cupped spring washer)
(5) Forward side clutch
(6) Reverse side clutch
(7) Clutch spool
(8) Hydraulic shuttle valve
(9) Clutch cable

The damper disk (3) helps ease the shock load when engaging the shuttle clutch.
The belleville washer (cupped spring washer) (4) helps ease the engaging shock together with modulating valve effect.
The hydraulic shuttle clutch, which switches forward and reverse operating, function as the traveling clutch. When the clutch pedal (2) is depressed, the clutch spool of shuttle valve (8) moves via the clutch cable (9).
As for the oil, it does not flow to both the forward side (5) and reverse side (6) of the clutch pack, the clutch pack enters the state of "Disengaged" and power is not transmitted.

## 2.1.2 Oil flow of hydraulic shuttle



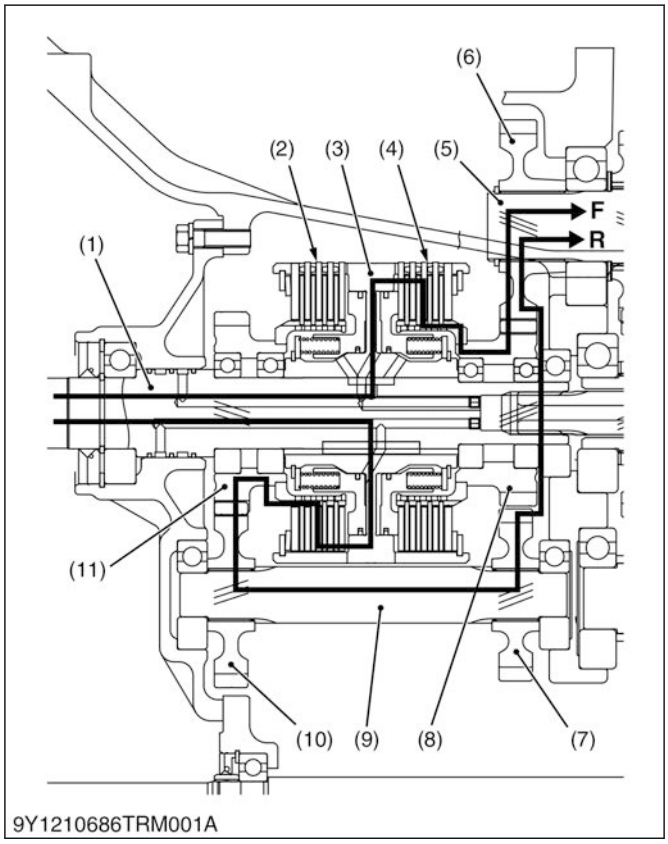

(1) Shuttle valve
(2) Reverse clutch
(3) Forward clutch
(4) Reverse clutch solenoid valve
(5) Forward clutch solenoid valve
(6) Clutch pedal
(7) Spool
(A) Pump
(B) Power steering controller
(C) Oil cooler
(D) PTO clutch and other clutches

When the shuttle lever is shifted to the “**forward**” or “**reverse**”, the oil flows to the forward clutch (3) or reverse clutch (2).
When clutch pedal (6) is depressed, feeding oil returns to the tank through the spool (7), and the clutch is in a "Disengage" position.

## 2.1.3 Power train of shuttle shift section

The shuttle shift section allows the operators to change forward and reverse with a shuttle lever. It is using hydraulic clutch shifting.
When the shuttle lever is moved to the **F** or **R** position, clutch is engaged to the front or rear by the hydraulic.

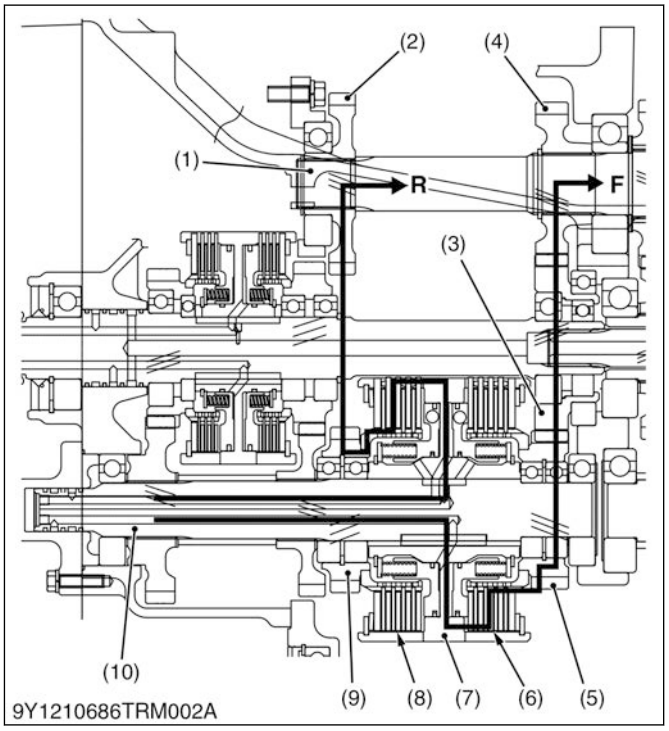
**Non dual speed model**




(1) Input shaft
(2) Clutch disk and plate
(3) Shuttle clutch body
(4) Clutch disk and plate
(5) 1st shaft
(6) 30T gear
(7) 24T gear
(8) 26T gear
(9) Counter shaft
(10) 26T gear
(11) 28T gear
F: Forward
R: Reverse

**(Forward)**
Input shaft (1) → Shuttle clutch body (3) → Clutch disk and plate (4) → Gear (8) → Gear (6) → 1st shaft (5)
**(Reverse)**
Input shaft (1) → Shuttle clutch body (3) → Clutch disk and plate (2) → Gear (11) → Gear (10) → Counter shaft (9) → Gear (7) → Gear (6) → 1st shaft (5)

**Dual speed model**



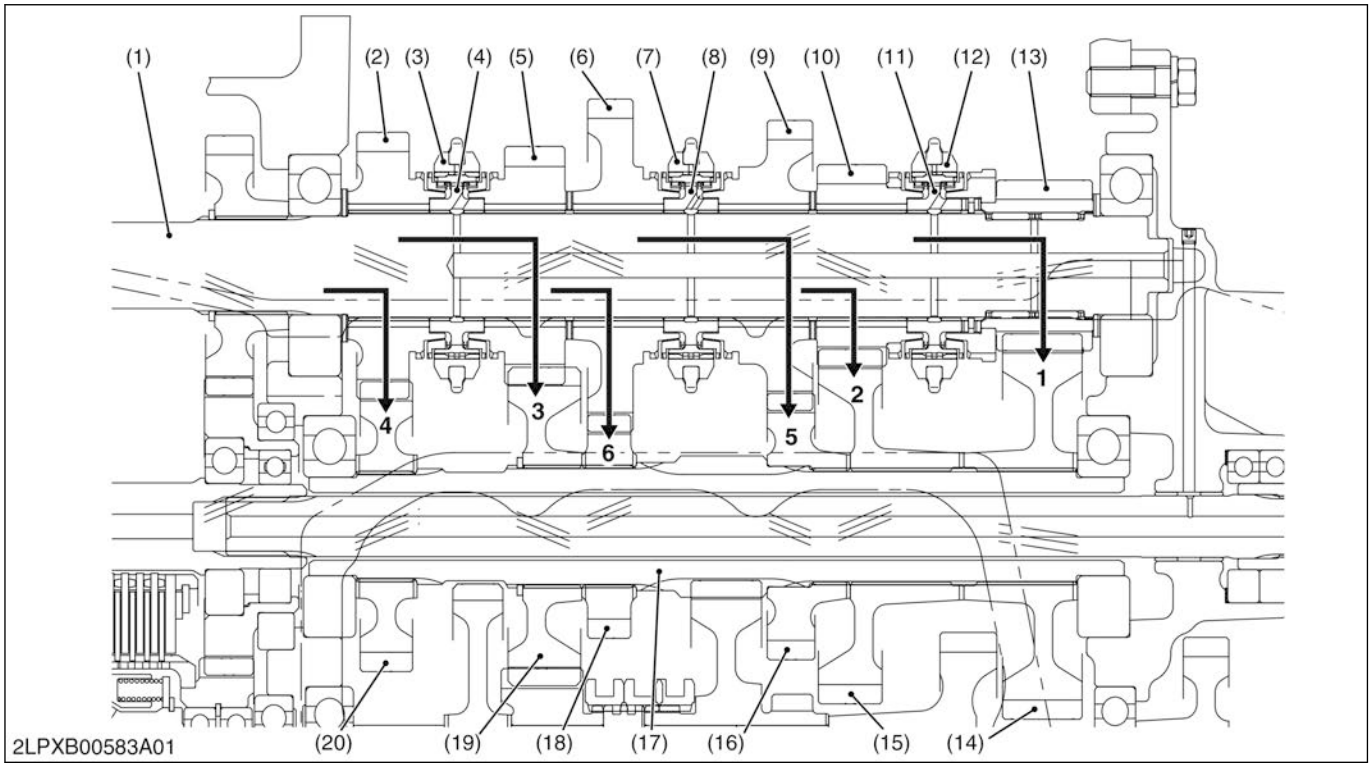

(1) 1st shaft
(2) 30T gear
(3) 31T gear
(4) 27T gear
(5) 24T gear
(6) Clutch disk and plate
(7) Shuttle clutch body
(8) Clutch disk and plate
(9) 27T gear
(10) Shuttle shaft
F: Forward
R: Reverse

**(Forward)**
Shuttle shaft (10) → Shuttle clutch body (7) → Clutch disk and plate (6) → Gear (5) → Gear (3) → Gear (4) → 1st shaft (1)
**(Reverse)**
Shuttle shaft (10) → Shuttle clutch body (7) → Clutch disk and plate (8) → Gear (9) → Gear (2) → 1st shaft (1)

# 2.2 Main gear shift section

## 2.2.1 Main gear shift section (F18/R18, F36/R36 speed transmission model)

**F18/R18 and F36/R36 Speed Transmission Model**




(1) 1st shaft
(2) 27T gear
(3) Shifter
(4) Coupling
(5) 23T gear
(6) 35T gear
(7) Shifter
(8) Coupling
(9) 30T gear
(10) 20T gear
(11) Coupling
(12) Shifter
(13) 17T gear
(14) 43T gear
(15) 37T gear
(16) 27T gear
(17) 14T gear shaft
(18) 22T gear
(19) 33T gear
(20) 30T gear

**1st Speed**
1st Shaft (1) → Coupling (11) → Shifter (12) → 17T Gear (13) → 43T Gear (14) → 14T Gear Shaft (17).

**2nd Speed**
1st Shaft (1) → Coupling (11) → Shifter (12) → 20T Gear (10) → 37T Gear (15) → 14T Gear Shaft (17).

**3rd Speed**
1st Shaft (1) → Coupling (4) → Shifter (3) → 23T Gear (5) → 33T Gear (19) → 14T Gear Shaft (17).

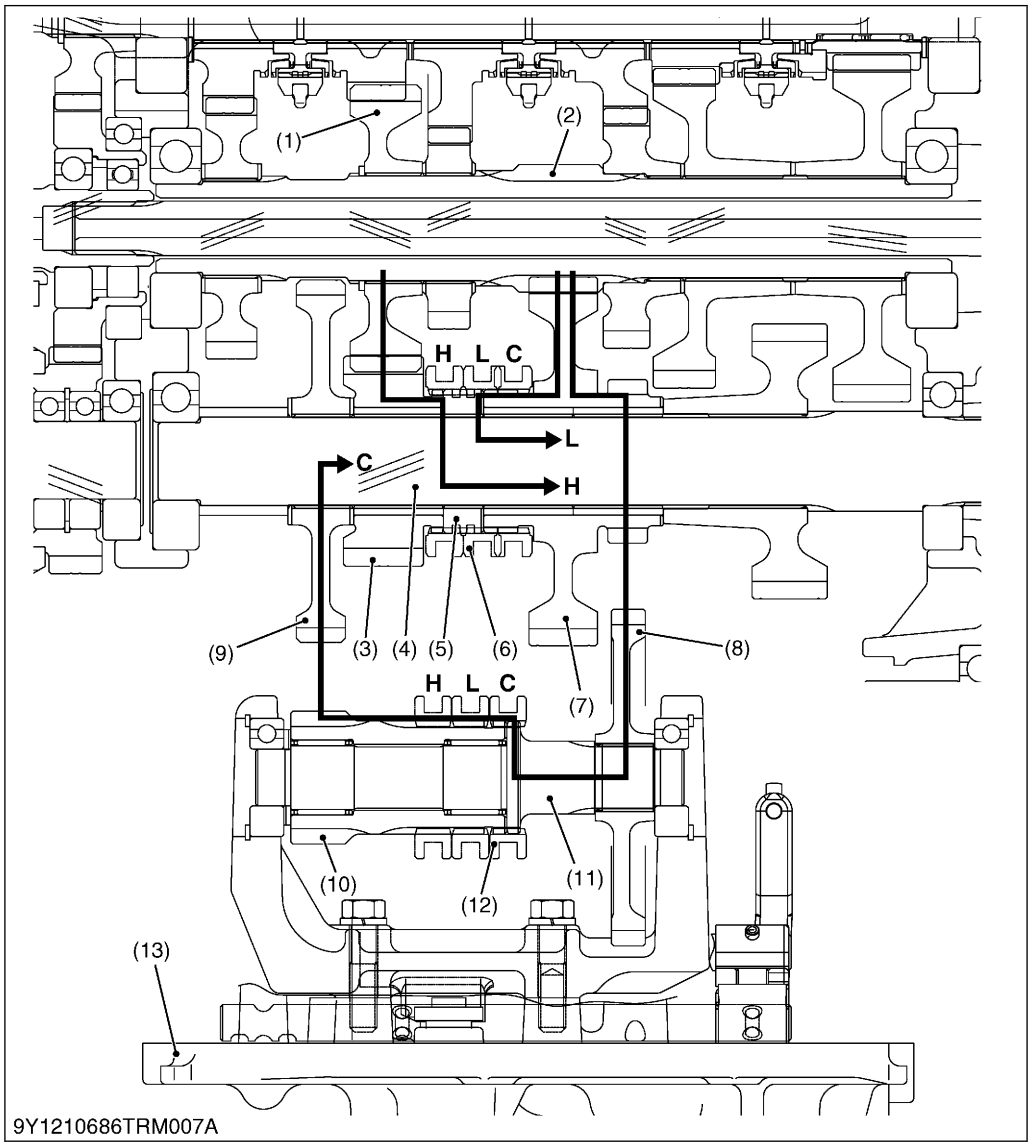
**4th Speed**
1st Shaft (1) → Coupling (4) → Shifter (3) → 27T Gear (2) → 30T Gear (20) → 14T Gear Shaft (17).

**5th Speed**
1st Shaft (1) → Coupling (8) → Shifter (7) → 30T Gear (9) → 27T Gear (16) → 14T Gear Shaft (17).

**6th Speed**
1st Shaft (1) → Coupling (8) → Shifter (7) → 35T Gear (6) → 22T Gear (18) → 14T Gear Shaft (17).

# 2.3 Range gear shift section

## 2.3.1 Range / creep gear shift section (Option)




(1) 35T gear
(2) 14T gear shaft (2nd shaft)
(3) 22T gear
(4) 3rd shaft
(5) Coupling
(6) Shifter 1
(7) 45T-22T gear
(8) 48T gear
(9) 53T gear
(10) 17T gear
(11) Creep shaft
(12) Shifter 2
(13) Shift charge cover
H: Hi speed range
L: Lo speed range
C: Creep speed range

The range gear shift section allows the operator to change an range speed change lever is moved to the "**H**"-"**L**"-"**C**" position. The shifter 1 (6) slides to the front or rear by mechanical linkage to be engaged with the 24T Gear (3) or 45T-22T gear (7) for H and L position. The shifter 2 (12) slides to H, L or C position by mechanical linkage to be engaged with the 17T gear (10) and creep shaft (11) for L or C position.
Then, power is transmitted as follows.
The shifter 1 (6) for H-L locates on the 3rd shaft (4) and shifter 2 (12) for creep locates on the creep shaft (11).
They operated by one piece type shift fork at the same time.

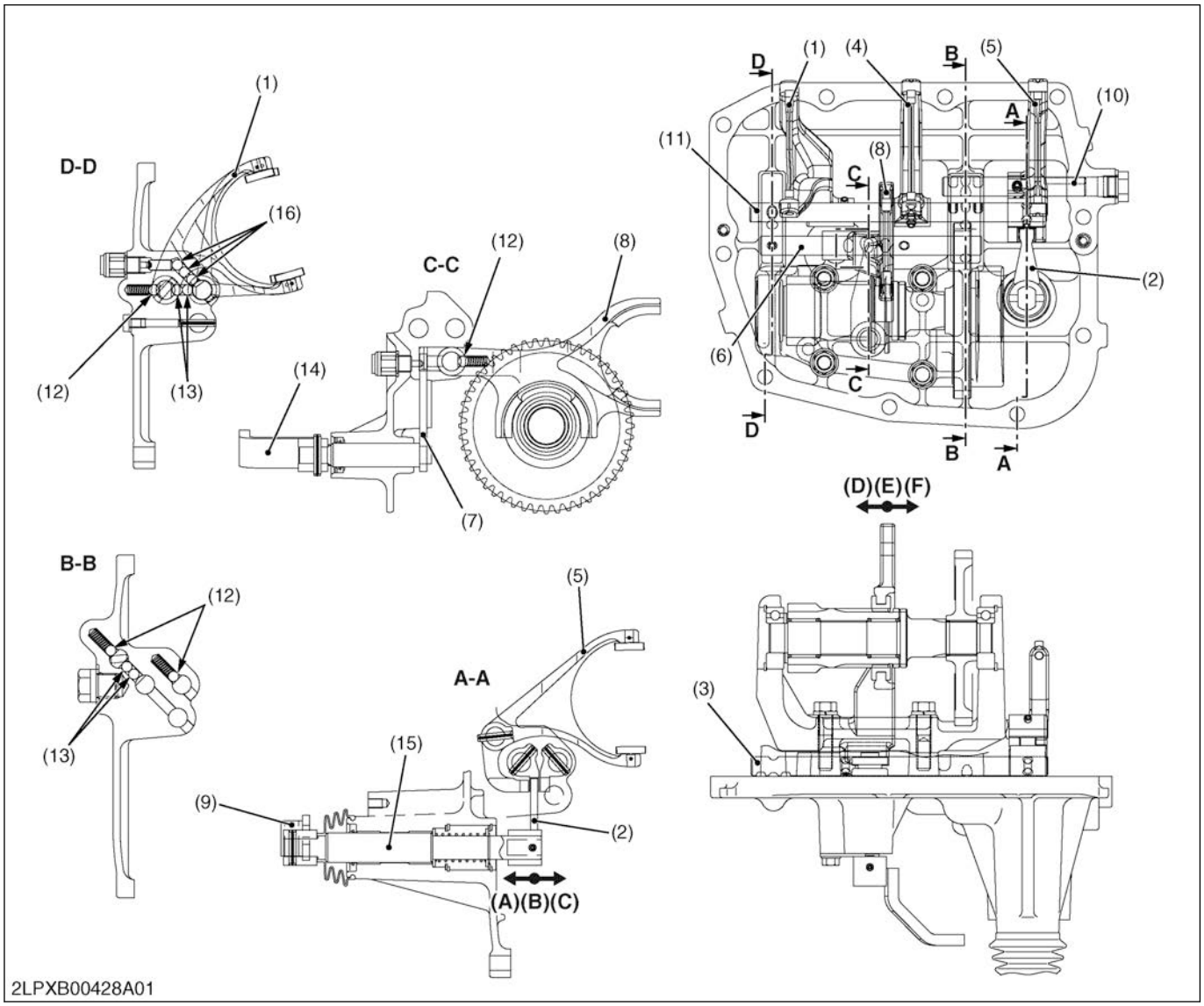
**(Hi speed range)**
14T gear shaft (2) → 33T Gear (1) → 24T Gear (3) → Shifter 1 (6) → Coupling (5) → 3rd shaft (4).

**(Lo speed range)**
14T gear shaft (2) → 45T-22T gear (7) → Shifter 1 (6) → Coupling (5) → 3rd shaft (4).

**(Creep speed range) (Option)**
14T gear shaft (2) → 45T-22T gear (7) → 48T gear (8) → Creep shaft (11) → Shifter 2 (12) → 17T gear (10) → 53T gear (9) → 3rd shaft (4).

# 2.4 Shift fork rod and fork

## 2.4.1 Structure of creep gear shift section (Option)

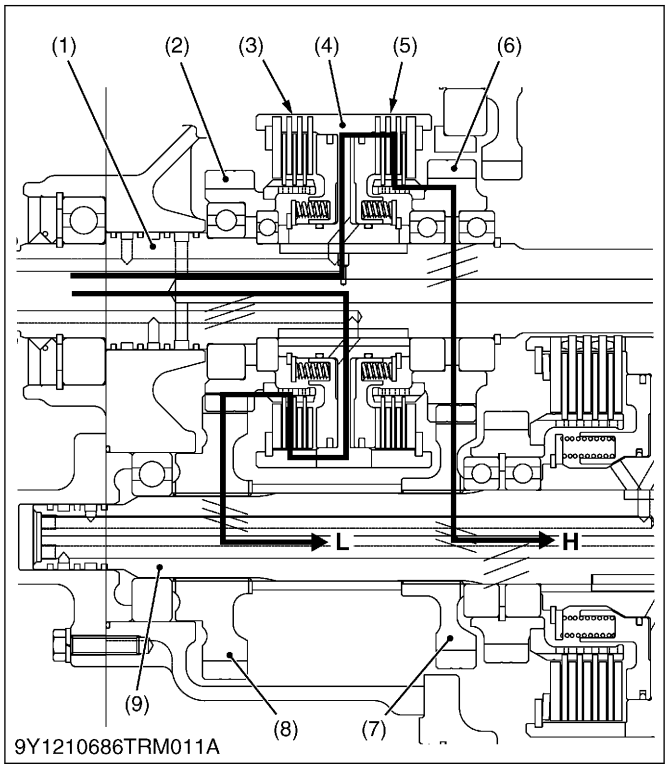



(1) 3rd-4th shift fork
(2) Select arm
(3) 3rd-4th shift fork rod
(4) 5th-6th shift fork
(5) 1st-2nd shift fork
(6) H-L-C rod
(7) H-L-C arm
(8) H-L-C fork
(9) Main shift lever
(10) 1st-2nd shift fork rod
(11) 5th-6th shift fork rod
(12) Detent ball
(13) Interlock ball 1
(14) H-L-C lever
(15) Main shift shaft
(16) Interlock ball 2
(A) Select 1st-2nd shift fork rod
(B) Select 3rd-4th shift fork rod
(C) Select 5th-6th shift fork rod
(D) Engage to Hi position
(E) Engage to Lo position
(F) Engage to Creep position
H: Hi speed range
L: Lo speed range
C: Creep speed range (Option)

1. Interlock balls (13) restrain the movement of the 1st-2nd shift fork rod (10), 3rd-4th shift fork rod (3) and 5th-6th shift fork rod (11) at the same time. As a result, double engagement of the gear is prevented.
2. Detent balls (12) prevent the self disengagement of the gears.
3. When the main shift lever (9) is operated, the select arm (2) is pushed by the main shift shaft (15). Therefore select arm (2) select (A) (1st-2nd shift fork (5)) or (B) (3rd-4th shift fork (1)) or (C) (5th-6th shift fork (4)).
4. When operating the H-L-C lever (14), the H-L-C fork (8) engages to H, L or C position.

# 2.5 Dual speed shift section

## 2.5.1 Dual speed section



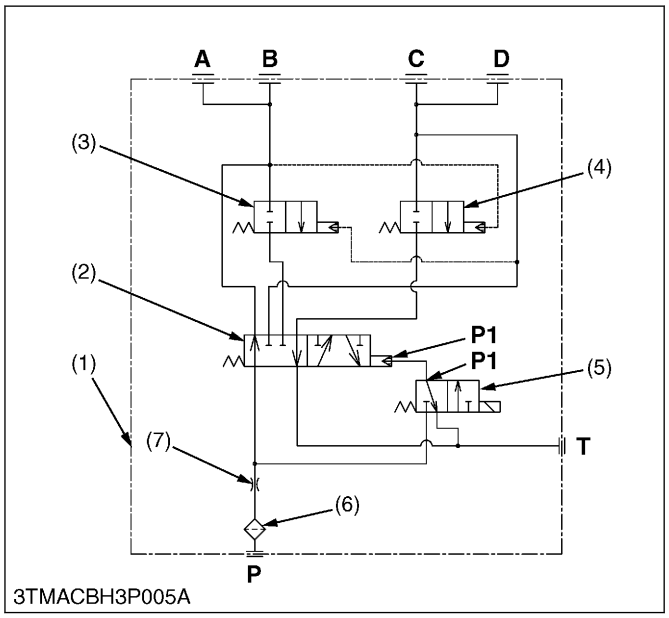

(1) Input shaft
(2) 26T gear
(3) Clutch disk and plate
(4) Dual speed clutch body
(5) Clutch disk and plate
(6) 28T gear
(7) 29T gear
(8) 32T gear
(9) 1st shaft
H: Hi speed range
L: Lo speed range

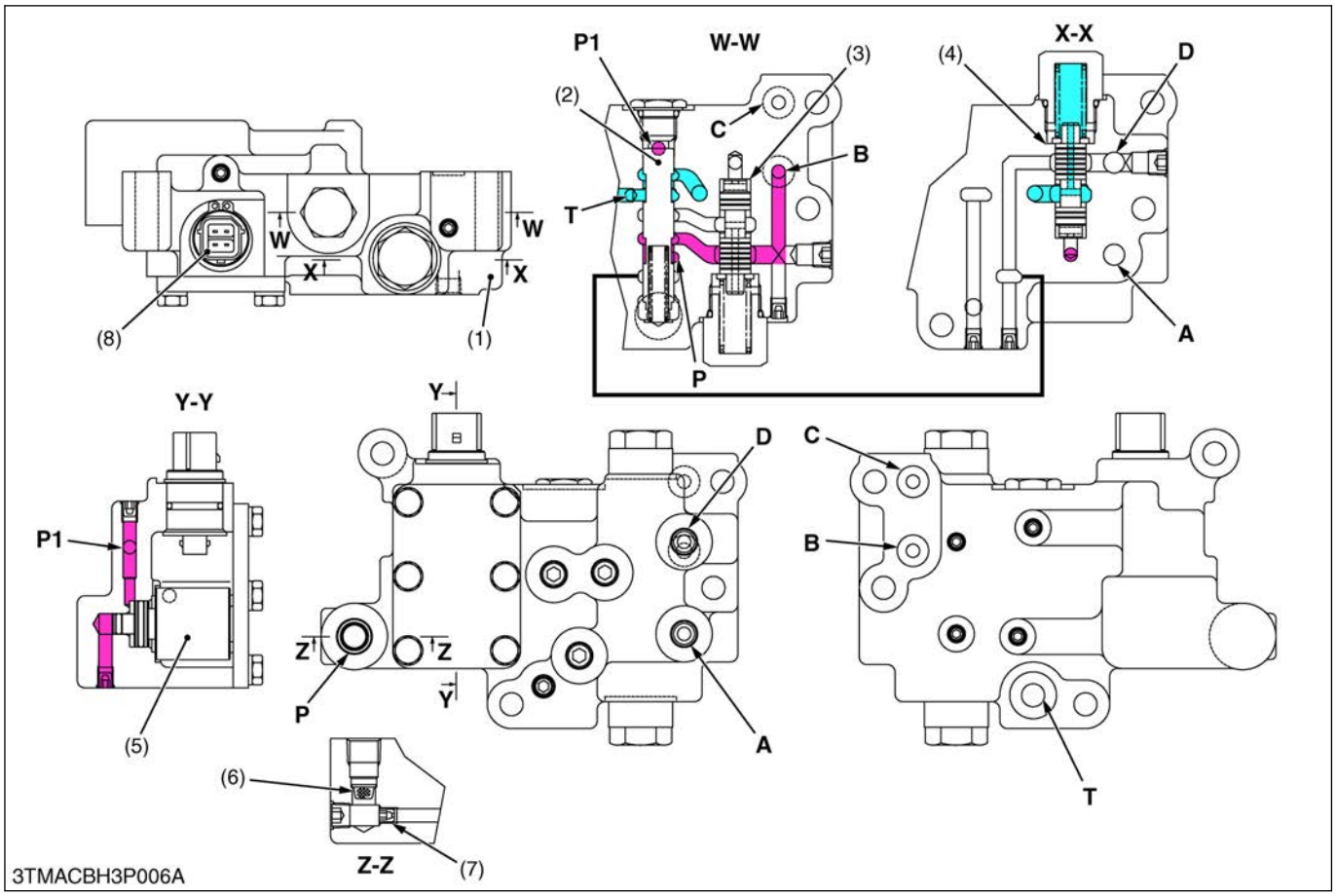
The dual speed section is operated hydraulic clutch, solenoid valve and dual speed switch. When operate the L to H position, travelling speed increase approximately 19%.
When the H-L solenoid valve is operated to the H or L position, hydraulic clutch is engaged to the H or L position by the hydraulic. Then the power is transmitted as follows.

**(H position)**
Input Shaft (1) → Dual Speed Clutch Body (4) → Clutch Disk and Plate (5) → 28T Gear (6) → 29T Gear (7) → 1st Shaft (9).

**(L position)**
Input Shaft (1) → Dual Speed Clutch Body (4) → Clutch Disk and Plate (3) → 26T Gear (2) → 32T Gear (8) → 1st Shaft (9).

## 2.5.2 Dual speed valve



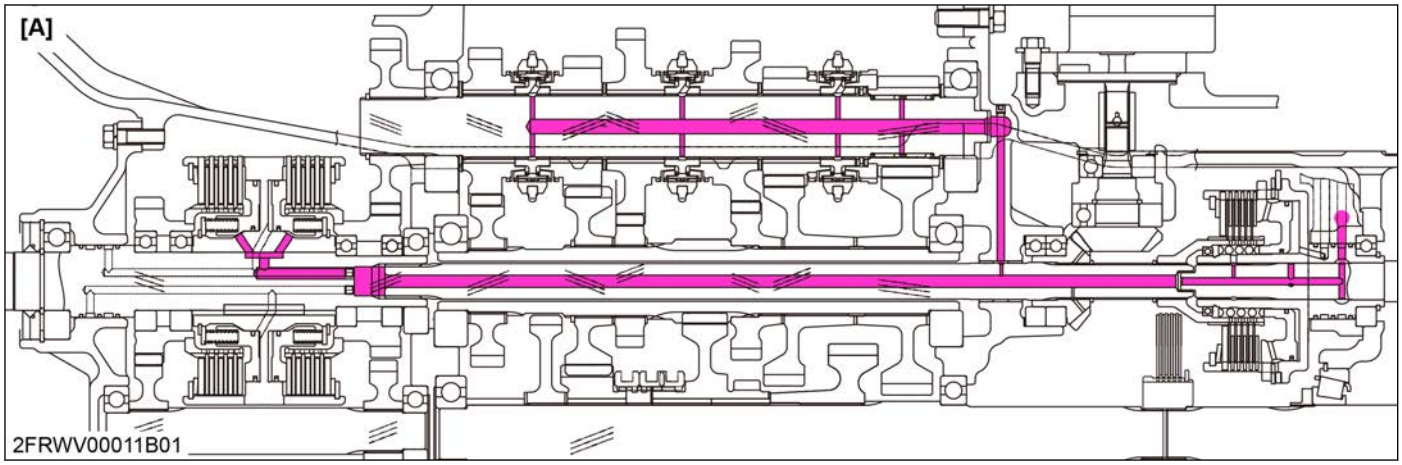

(1) Valve body
(2) DS spool
(3) Pilot valve HI
(4) Pilot valve LO
(5) Pilot valve DS (Solenoid valve)
(6) Line filter
(7) Orifice
A: Check port HI
B: To clutch pack HI
C: To clutch pack LO
D: Check port LO
P: P port
T: Tank port
W- View W
W:
X-X: View X
Y-Y: View Y
Z-Z: View Z

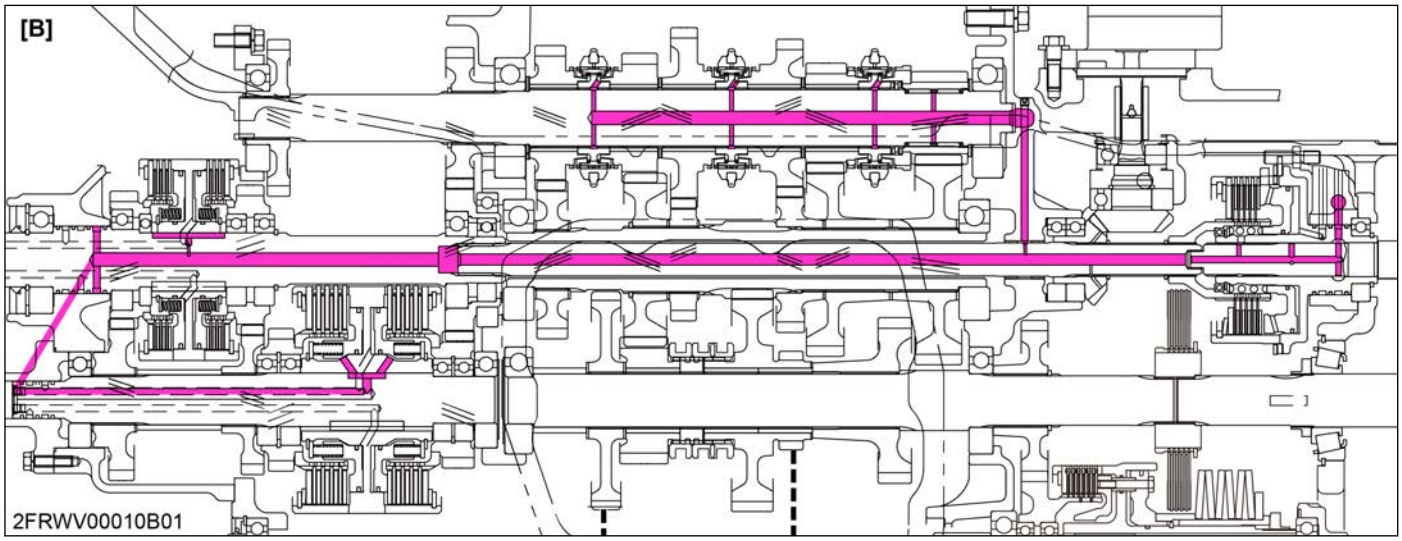
This valve change the oil flow to the dual speed HI clutch or LO clutch.
As the pilot valve DS (solenoid valve) (5) operates by energizing the solenoid, the flow of oil is switched to the HI side (B) or LO side (C) of dual speed clutch with DS spool (2).

When one of clutches are engaged, pilot valve HI (3) and pilot valve LO (4) are object in free which makes it do as for the other clutch.

# 3. Lubrication for transmission

Hydraulic shuttle section, main shift change synchromesh gears, hydraulic pump drive / driven gear, PTO hydraulic pack and PTO brake are forcibly lubricated.
The lubrication oil from the PTO valve lubricates to PTO clutch holder and the each sections through PTO propeller shaft and 1st shaft.

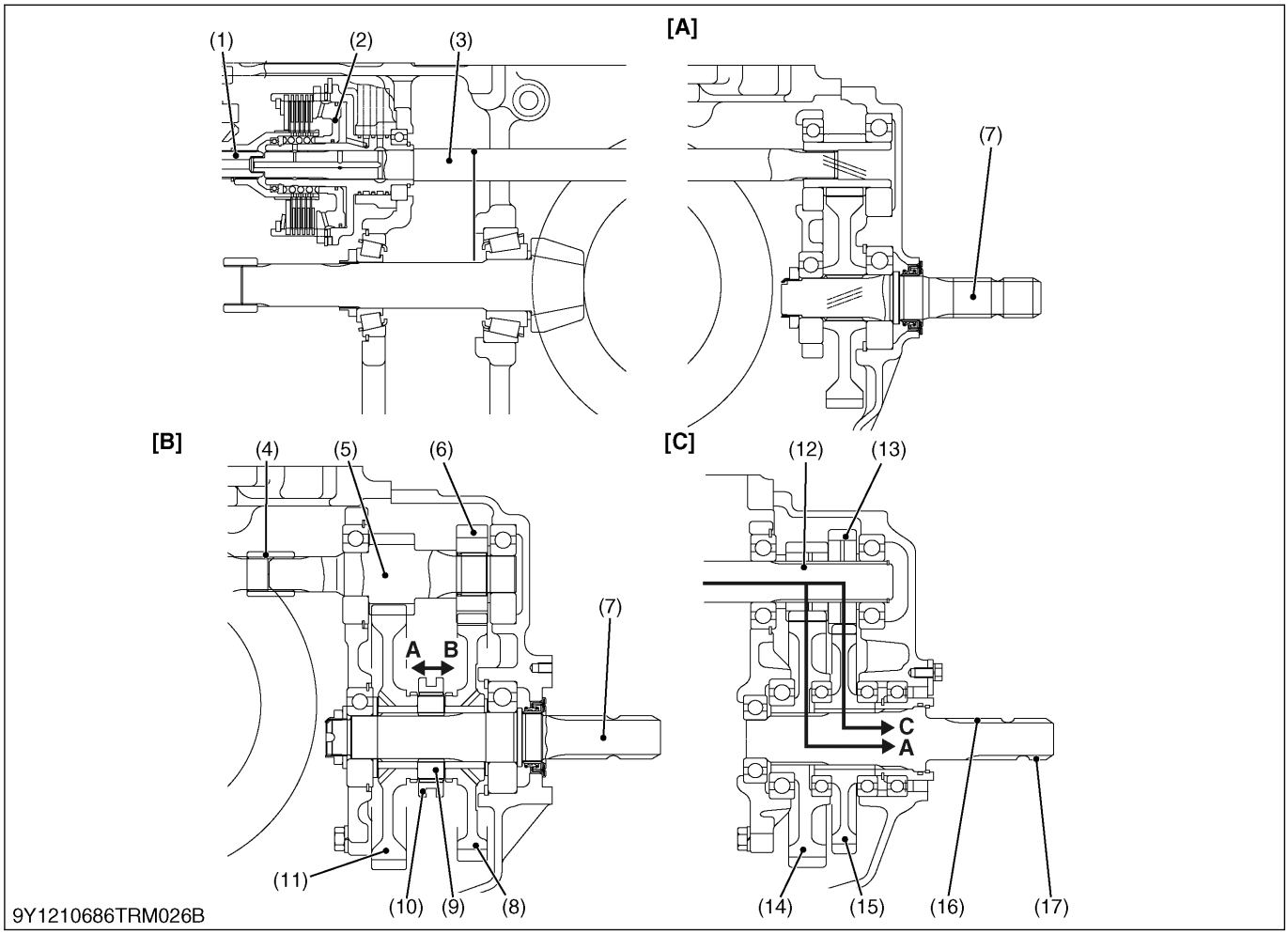



[A] F18/R18 speed transmission model
[B] F36/R36 speed transmission model

# 4. Power train for PTO system

## 4.1 PTO gear section




(1) PTO propeller shaft 1
(2) PTO clutch
(3) PTO propeller shaft 2
(4) Coupling
(5) 13T gear shaft
(6) 16T gear
(7) PTO shaft
(8) 45T gear
(9) Hub
(10) Shifter
(11) 49T gear
(12) 13T gear shaft
(13) 18T gear
(14) 49T gear
(15) 43T gear
(16) 6-spline 540 $min^{-1}$ (rpm) PTO shaft (Interchangeable)
(17) 21-spline 1000 $min^{-1}$ (rpm) PTO shaft (Interchangeable)
[A] 540 type
[B] 540-540E shift type (Option)
[C] 540-1000 interchange type (Option)
A: 540 PTO
B: 540E PTO
C: 1000 PTO

**[540 Type]**
The PTO propeller shaft 1 is splined to the spline hub and is always rotating while the engine is operating.

**■ NOTE**
- **This PTO gear section does not have neutral position.**

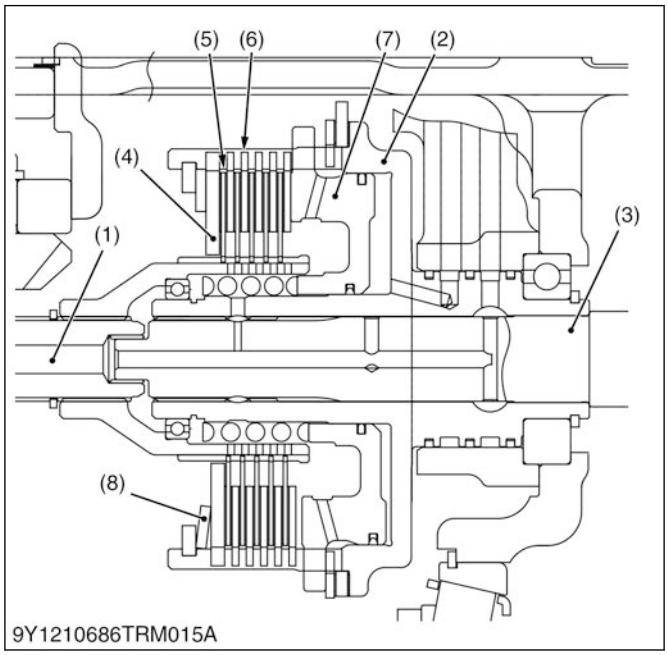
**[540/540E Shift type] (Option)**
Two different PTO speeds are available by operating the shift lever, to shift position of the shifter (10). Power is transmitted as follows.
- **Position A: 540 [540 $min^{-1}$ (rpm) at 2035 $min^{-1}$ (rpm) engine speed]**
  PTO propeller shaft 1 (1) → PTO clutch (2) → PTO propeller shaft 2 (3) → 13T gear shaft (5) → 49T gear (11) → Shifter (10) → Hub (9) → PTO shaft (7).
- **Position B: 540E [540 $min^{-1}$ (rpm) at 1519 $min^{-1}$ (rpm) engine speed]**
  PTO propeller shaft 1 (1) → PTO clutch (2) → PTO propeller shaft 2 (3) → 13T gear shaft (5) → 16T gear (6) → 45T gear (8) → Shifter (10) → Hub (9) → PTO shaft (7).

**[540/1000 interchange type] (Option)**
By interchanging the PTO shafts (16), (17), two different PTO shaft speeds are available. Power is transmitted as follows.

- **Position A: With 6-spline PTO shaft (540 $min^{-1}$ (rpm) PTO speed)**
  PTO transmitting shaft → 13T Gear (12) → 49T Gear (14) → PTO Shaft (16).
- **Position C: With 21-spline PTO shaft (1000 $min^{-1}$ (rpm) PTO speed)**
  PTO transmitting shaft → 18T gear (13) → 43T gear (15) → PTO shaft (17).

# 4.2 PTO hydraulic clutch section

## 4.2.1 PTO hydraulic clutch




(1) PTO propeller shaft 1
(2) PTO clutch pack
(3) PTO propeller shaft 2
(4) Pressure plate
(5) Clutch disk
(6) Drive plate
(7) Clutch piston
(8) Belleville washer (Cupped spring washer)

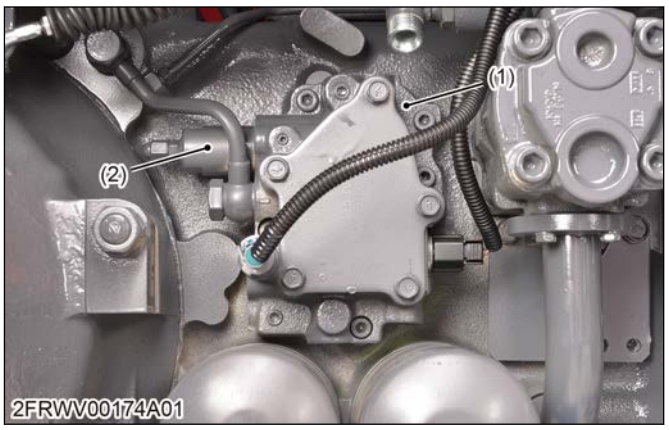
The PTO clutch pack has five clutch disks (5), five drive plates (6), a belleville washer (cupped spring washer) (8) and one pressure plate (4). The clutch piston (7) actuated by hydraulic from PTO clutch valve, tightly presses the clutch disks (5) and drive plates (6) toward the pressure plate (4).
As a result, the rotation of the PTO propeller shaft 1 is transmitted to the PTO propeller shaft 2 (3) through the PTO clutch pack (2).
The belleville washer (cupped spring washer) (8) reduce the engaging shock. Thereby, the PTO clutch is engaged very smoothly.

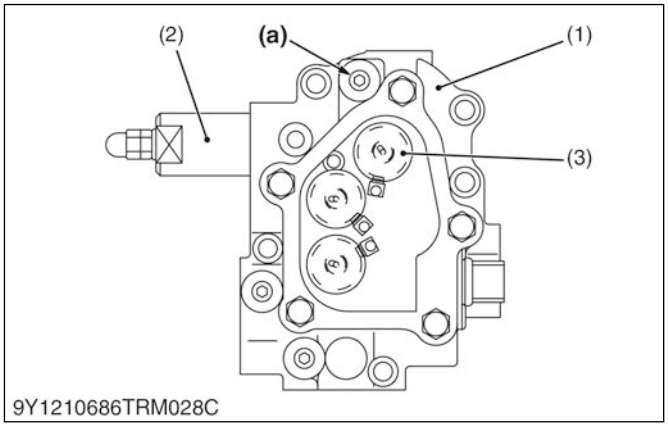
## 4.2.2 Oil flow of solenoid valve

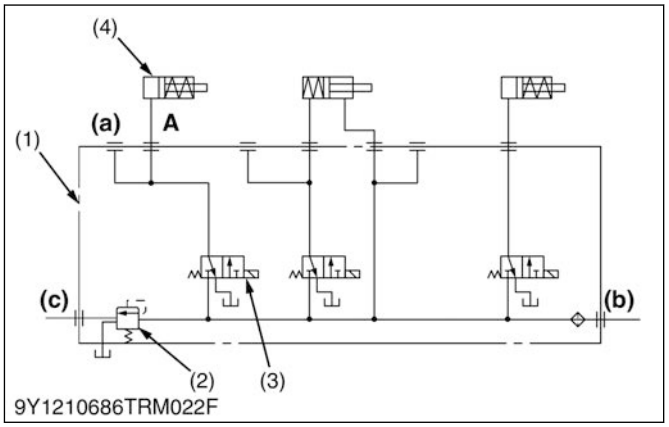
**■ NOTE**

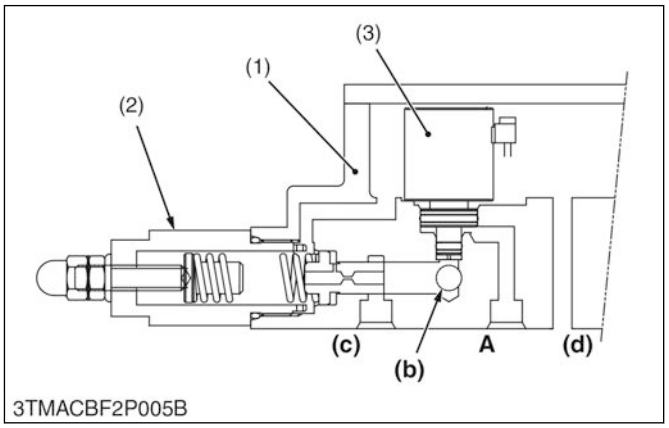
- **Hydraulic system pressure is a operating pressure for the PTO clutch pack. (2.16 MPa, 22.0 kgf/cm$^2$, 313 psi)**

When the PTO switch is at the **OFF** position, the oil flows is stopped by the PTO solenoid valve (3).
When the PTO switch is at **ON** position, the solenoid valve (3) is activated and the oil flows through the PTO solenoid valve (3) to the PTO clutch pack (4) to engage it.
The relief valve (2) keeps the hydraulic system pressure and supply the oil to lubricate the shuttle section, synchro-mesh gears, PTO clutch pack and PTO brake section.



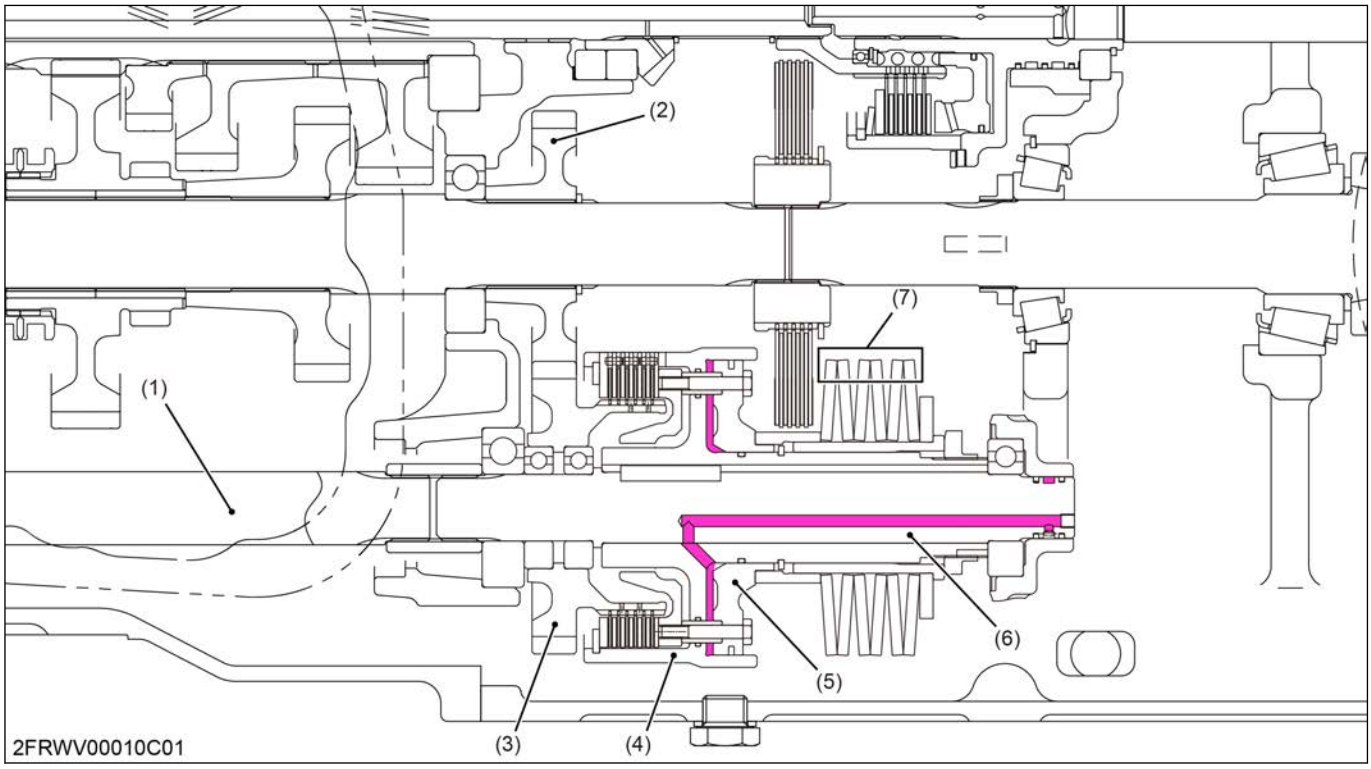




(1) Solenoid valve assembly
(2) Relief valve
(3) PTO solenoid valve
(4) PTO clutch pack
A: PTO port
(a) Check port for PTO pressure
(b) P port (From power steering pump)
(c) Lubricating port
(d) T port (To transmission case)

# 5. Power train for 4WD

## 5.1 4WD hydraulic clutch section

### 5.1.1 Function of 4WD hydraulic clutch




(1) 4WD propeller shaft
(2) 33T gear
(3) 35T gear
(4) Clutch body
(5) 2WD piston
(6) 4WD shaft
(7) Dish spring

The 4WD clutch is controlled by the hydraulic flow and dish spring force.
When the 4WD switch is turned on, the front wheel drive (4WD) is engaged. When it is pushed once more, the 2-wheel drive is engaged. The power train is as follows.

**2-wheel drive (4WD switch is turned to "OFF")**

- The hydraulic pressure is fed to between the clutch body (4) and 2WD piston (5) at 4WD switch is turned to **OFF** position. In this state, 2WD piston (5) pushes the dish springs (7) and 4WD clutch is disengaged.
- When the brake pedals are depressed while driving in 2WD mode, the tractor switches to 4WD mode to secure the braking force. In this state 4WD indicator on meter panel lights up.

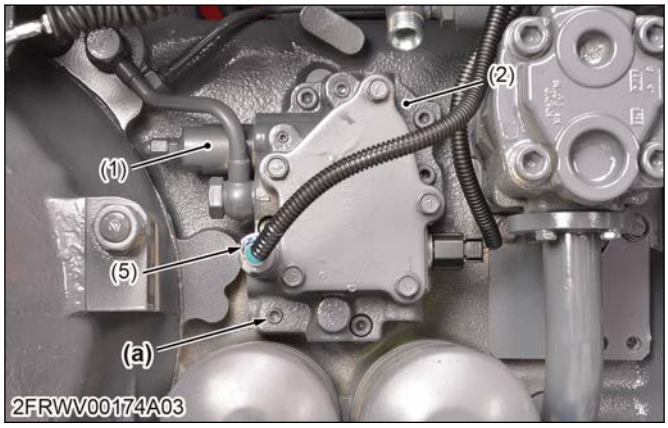
**4-wheel drive (4WD switch is turned to "ON")**

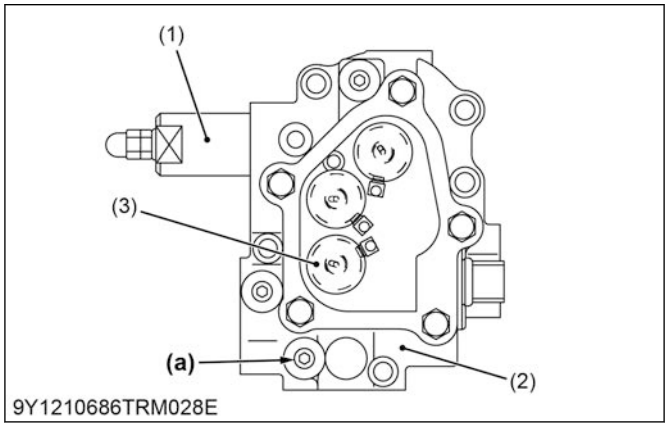
- If the 4WD switch is turned **ON** position, the 4WD solenoid stops the oil flow to the 2WD piston (5). In this state, the power of the dish springs (7) pushes the 2WD piston (5) and 4WD clutch is engaged.
  The power is transmitted as follow.
  33T gear (2) → 35T gear (3) → Clutch body (4) → 4WD shaft (6) → 4WD propeller shaft (1).

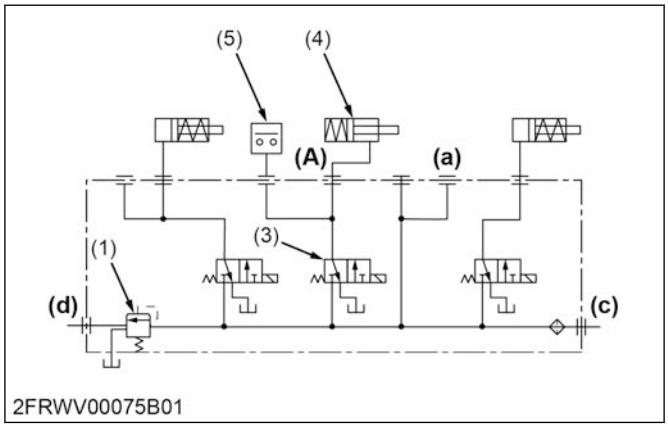
**Engine stop**

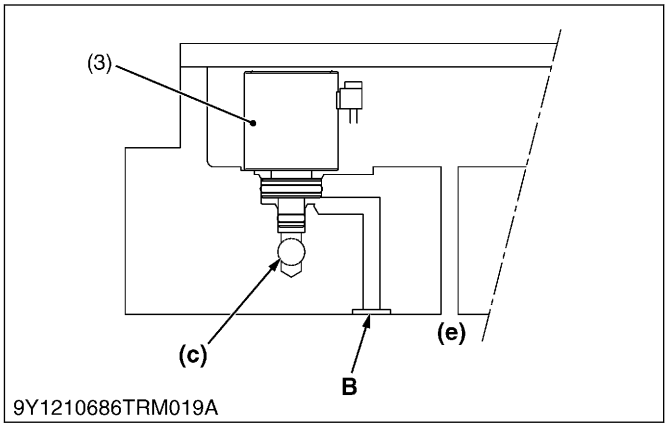
- The 2WD piston (5) shifts to 4WD mode by dish springs (7) tension force.

## 5.1.2 4WD oil flow



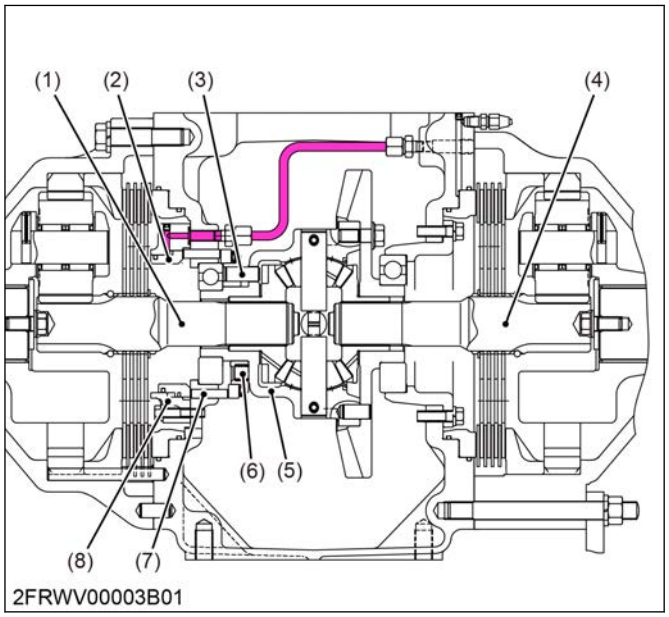

(1) Relief valve
(2) Solenoid valve assembly
(3) 2WD solenoid valve
(4) 2WD clutch pack
(5) 2WD clutch pressure switch
(A) 2WD port
(a) Check port for solenoid valve pressure (System pressure)
(c) P port (from power steering pump)
(d) Lubricating port
(e) T port (to transmission case)

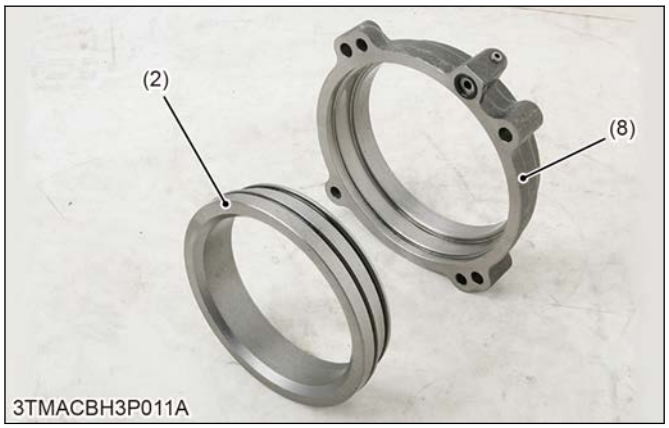
Oil pressure fed from the power steering hydraulic pump is flowed to the 2WD solenoid valve (3) through the steering controller and oil cooler. When 4WD switch is at 4WD position, the system hydraulic pressure is not fed to 2WD clutch (4). In this state, the tractor is in 4WD mode. When 4WD switch is at 2WD position, the oil is fed to 2WD clutch (4) and tractor becomes 2WD mode. The 2WD clutch pressure switch (5) detects the pressure is fed to 2WD clutch (4) or not.
The maximum pressure against the clutch piston is regulated under approximately 2.16 MPa (22.0 kgf/cm$^2$, 313 psi) by the relief valve (1) of system pressure.
On the other hand, the return oil is flowed to the transmission case through the valve case.

# 6. Differential lock

## 6.1 Hydraulic actuated type

### 6.1.1 Structure of differential lock (Hydraulic actuated type)

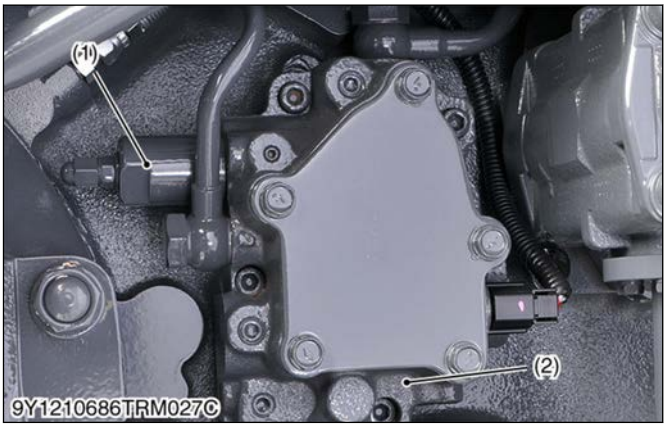


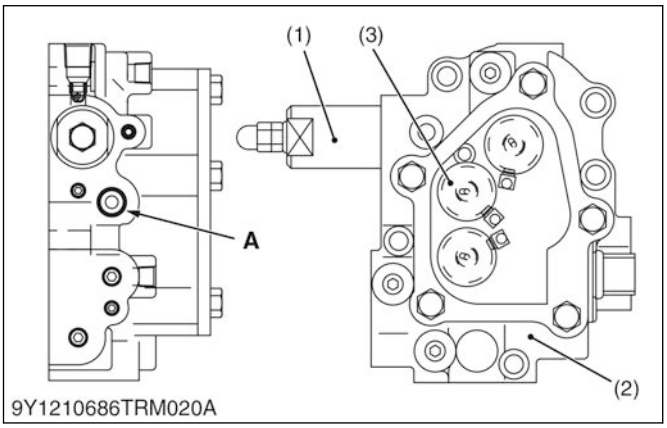



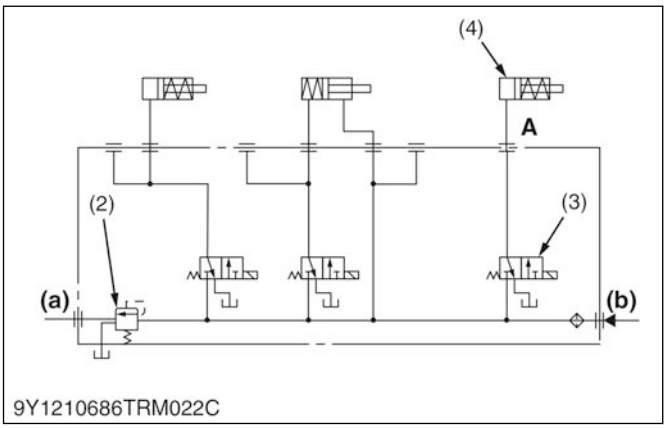

(1) Brake shaft (L.H.)
(2) Piston
(3) Differential lock pin
(4) Brake shaft (R.H.)
(5) Differential case
(6) Spring
(7) Pin
(8) Piston support

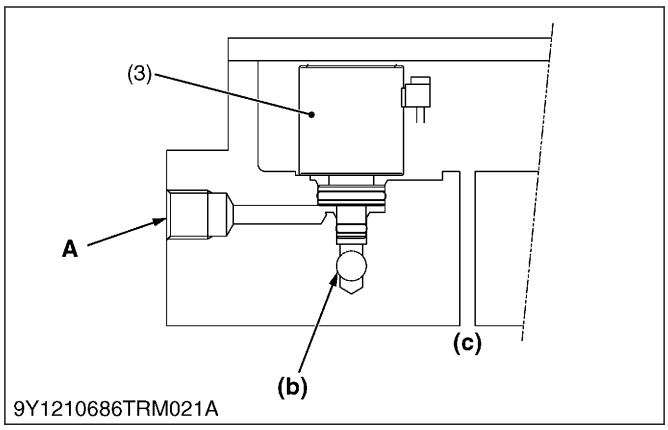
The differential lock can be operated easily with an electric switch.
When the switch is turned **ON**, the solenoid valve operates and oil flows to the piston (2). The differential lock pin (3) engages, and as a result, brake left shaft (R.H.) (4) and the brake shaft (L.H.) (1) rotates as a unit through differential case (5).
On the other hand, oil is not supplied when the switch is **OFF**, and differential lock pin (3) is kept at the disengaged position by force of spring (6).

### 6.1.2 Oil flow of differential lock (hydraulic actuated type)






(1) Relief valve
(2) Solenoid valve assembly
(3) Differential lock solenoid valve
(4) Differential lock piston
A: Differential lock port
(a) Lubricating port
(b) P port (From power steering pump)
(c) T port (To transmission case)

Oil pressure-fed from the power steering hydraulic pump is flowed to the differential lock solenoid valve (3) through the steering controller and oil cooler. When the differential lock switch turned on, the differential lock solenoid valve is electrified, the oil flow is switched and engage the differential lock pin to lock position.
The maximum pressure against the clutch piston is regulated under approximately 2.16 MPa (22.0 kgf/cm$^2$, 313 psi) by the relief valve (1) of system pressure.
On the other hand, the return oil is flowed to the transmission case through the valve case.

# SERVICING

## 1. Troubleshooting for transmission

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Shuttle clutch slip | 1. Operating pressure is low | Adjust | 4-34 |
| | 2. Shuttle clutch valve malfunctioning | Replace | 4-78 |
| | 3. Clutch disk or steel plate excessively worn | Replace | 4-78 |
| | 4. Deformation of piston or steel plate | Replace | — |
| Shuttle clutch operating pressure is low. | 1. Transmission oil improper or insufficient | Fill or change | 2-13 |
| | 2. Relief valve malfunctioning | Adjust or replace | 4-34<br>4-37<br>4-38 |
| Shuttle clutch drags | 1. Return spring weak or broken | Replace | — |
| | 2. Modulating valve malfunctioning | Replace | 4-78 |
| | 3. Deformation of piston or steel plate | Replace | — |
| Dual speed clutch slip | 1. Operating pressure is low | Adjust | 4-42 |
| | 2. Dual speed clutch valve malfunctioning | Replace | 4-42<br>4-87 |
| | 3. Clutch disc or steel plate excessively worn | Replace | 4-88 |
| | 4. Deformation of piston or steel plate | Replace | — |
| Dual speed clutch operating pressure is low | 1. Transmission oil improper or insufficient | Fill or change | 2-13 |
| | 2. Relief valve malfunctioning | Adjust or replace | 4-38 |
| Dual speed clutch drags | 1. Return spring weak or broken | Replace | — |
| | 2. Modulating valve malfunctioning | Replace | 4-87 |
| | 3. Deformation of piston | Replace | 4-89 |
| PTO clutch slip | 1. Operating pressure is low | Adjust | 4-39<br>4-40 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| PTO clutch slip | 2. PTO solenoid valve malfunctioning | Replace | 4-67 |
| | 3. Clutch disc or drive plate excessively worn | Replace | 4-120<br>4-120 |
| | 4. Deformation of piston or return plate | Replace | 4-107<br>4-120 |
| PTO clutch operating pressure is low | 1. Transmission oil improper or insufficient | Fill or change | 2-13 |
| | 2. Relief valve malfunctioning | Adjust or replace | 4-39<br>4-40 |
| PTO clutch drags | 1. Return spring weak or broken | Replace | — |
| | 2. Modulating valve malfunctioning | Replace | 4-106 |
| | 3. Deformation of piston or steel plate | Replace | — |
| PTO does not rotate | 1. PTO clutch malfunctioning | Replace | 4-106 |
| 4WD clutch slip | 1. Operating pressure is low | Adjust | 4-37<br>4-38 |
| | 2. 4WD solenoid valve malfunctioning | Repair or replace | 4-67 |
| | 3. Clutch disc or plate excessively worn | Replace | 4-106 |
| Front wheel does not rotate | 1. 4WD clutch malfunctioning | Replace | 4-106 |
| | 2. 4WD propeller shaft coupling disengaged | Engage | — |
| 4WD operating pressure is low | 1. Transmission oil improper or insufficient | Fill or change | 2-13 |
| | 2. Relief valve malfunctioning | Adjust or replace | 4-37<br>4-38 |
| Differential lock can not be set | 1. Solenoid valve damaged | Replace | 4-67 |
| | 2. Piston seal damaged | Replace | 4-109 |
| Excessive transmission noise | 1. Transmission fluid insufficient | Fill | 2-13 |
| | 2. Improper backlash between bevel pinion shaft and bevel gear | Adjust | 4-124 |
| | 3. Improper backlash between differential pinion and side gear | Adjust | 4-125<br>4-126 |
| | 4. Collars or shims have not been installed | Repair | — |
| | 5. Bearing worn | Replace | 4-115 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Refer-ence page |
|---|---|---|---|
| Gears slip out of mesh | 1. Shifter or shift fork worn or damaged | Replace | 4-116 |
| | 2. Shift fork spring weaken or damaged | Replace | — |
| | 3. Interlock ball fallen | Reassemble | — |
| | 4. Synchronizer unit damaged | Repair or replace | 4-94<br>4-116 |
| Hard shifting | 1. Shifter or shift fork worn or damaged | Replace | 4-90<br>4-116 |
| | 2. Shift fork rod bent | Replace | - |
| | 3. Synchronizer unit damaged | Repair or replace | 4-94<br>4-116 |
| Gears clash when shifting | 1. Synchronizer unit damaged | Repair or replace | 4-94<br>4-116 |

# 2. Servicing specifications for transmission

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Clutch pedal | Free travel (ROPS model) | 15 to 20 mm<br>0.59 to 0.79 in. | — |
| | Free travel (Cabin model) | 15 to 25 mm<br>0.59 to 0.98 in. | — |
| | Total stroke (ROPS model) | 145 to 155 mm<br>5.71 to 6.10 in. | — |
| | Total stroke (Cabin model) | 155 to 165 mm<br>6.11 to 6.49 in. | — |
| Hand accelerator lever | Operating force | 10 to 30 N<br>1.1 to 3.0 kgf<br>2.3 to 6.7 lbf | — |
| PTO clutch valve | Operating pressure (when PTO switch is at **ON** position.) | 1.96 to 2.16 MPa<br>20.0 to 22.0 kgf/cm$^2$<br>285 to 313 psi | — |
| | Operating pressure (when PTO switch is at **OFF** position.) | No pressure | — |
| Solenoid valve | System pressure | 1.96 to 2.16 MPa<br>20.0 to 22.0 kgf/cm$^2$<br>285 to 313 psi | — |
| Dual speed clutch valve | Operating pressure (at Hi and Lo check port) | 1.96 to 2.16 MPa<br>20.0 to 22.0 kgf/cm$^2$<br>285 to 313 psi | — |
| Battery cable terminal | Clearance | 1.0 to 1.5 mm<br>0.040 to 0.059 in. | — |
| Secondary brake lever | Free play | 3 notches | — |
| External circlip to collar on 1st shaft | Clearance | Less than<br>0.2 mm<br>0.008 in. | — |
| Shift fork to shift groove for main change section and range section | Clearance | 0.15 to 0.35 mm<br>0.0059 to 0.013 in. | 0.80 mm<br>0.031 in. |
| Damper disk edge | Displacement | — | 2.0 mm<br>0.079 in. |
| Lever pin | O.D. | 13.957 to 13.984 mm<br>0.54959 to 0.55055 in. | — |
| Lever bushing | I.D. | 14.033 to 14.113 mm<br>0.55248 to 0.55562 in. | — |
| Lever pin to lever bushing | Clearance | 0.0490 to 0.156 mm<br>0.00193 to 0.00614 in. | 0.5 mm<br>0.02 in. |
| Internal circlip to belleville washer (Cupped spring washer) | Clearance | 1.8 to 2.0 mm<br>0.071 to 0.078 in. | 3.6 mm<br>0.14 in. |
| Steel plate | Thickness | 3.10 to 3.30 mm<br>0.122 to 0.129 in. | — |
| Pressure plate | Thickness | 4.42 to 4.58 mm<br>0.174 to 0.180 in. | — |
| Clutch disk (3C151-23131) | Thickness | 3.15 to 3.25 mm<br>0.124 to 0.127 in. | — |
| Clutch disk (3C151-23031) | Thickness | 3.30 to 3.40 mm<br>0.130 to 0.133 in. | — |
| Internal circlip to pressure plate | Clearance | 1.3 to 1.7 mm<br>0.052 to 0.066 in. | 2.0 mm<br>0.079 in. |

(Continued)

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Steel plate | Thickness | 1.93 to 2.07 mm<br>0.0760 to 0.0814 in. | — |
| Pressure plate | Thickness | 3.72 to 3.88 mm<br>0.147 to 0.152 in. | — |
| PTO clutch disk | Thickness | 2.1 to 2.3 mm<br>0.083 to 0.091 in. | 1.8 mm<br>0.071 in. |
| PTO steel plate | Thickness | 1.95 to 2.05 mm<br>0.0768 to 0.0807 in. | 1.80 mm<br>0.071 in. |
| PTO piston | Flatness | — | 0.15 mm<br>0.006 in. |
| PTO steel plate | Flatness | — | 0.30 mm<br>0.012 in. |
| PTO return spring | Free length | 42.5 to 43.5 mm<br>1.68 to 1.71 in. | 37.5 mm<br>1.48 in. |
| Seal ring | Thickness | 2.4 to 2.5 mm<br>0.095 to 0.098 in. | 2.0 mm<br>0.079 in. |
| Seal ring | Thickness | 2.39 to 2.44 mm<br>0.0941 to 0.0960 in. | 2.0 mm<br>0.079 in. |
| 18T bevel gear to 19T bevel gear | Backlash | 0.15 to 0.30 mm<br>0.0059 to 0.011 in. | — |
| Spiral bevel pinion shaft only | Turning torque | 3.2 to 3.6 N·m<br>0.32 to 0.37 kgf·m<br>2.4 to 2.6 lbf·ft | — |
| Spiral bevel gear to spiral bevel pinion shaft | Backlash | 0.2 to 0.3 mm<br>0.008 to 0.01 in. | 0.4 mm<br>0.02 in. |
| Differential case bore | I.D. | 49.07 to 49.15 mm<br>1.932 to 1.9354 in. | — |
| 35T bevel gear bore | I.D. | 49.07 to 49.15 mm<br>1.932 to 1.9354 in. | — |
| Differential side gear boss | O.D. | 48.961 to 49.000 mm<br>1.9276 to 1.9291 in. | — |
| Differential case bore to differential side gear boss | Clearance | 0.0700 to 0.189 mm<br>0.00276 to 0.00744 in. | 0.35 mm<br>0.014 in. |
| 35T bevel gear bore to differential side gear boss | Clearance | 0.0700 to 0.189 mm<br>0.00276 to 0.00744 in. | 0.35 mm<br>0.014 in. |
| Differential pinion shaft | O.D. | 22.959 to 22.980 mm<br>0.90390 to 0.90472 in. | — |
| Differential pinion | I.D. | 23.040 to 23.061 mm<br>0.90709 to 0.90791 in. | — |
| Differential pinion shaft to differential pinion | Clearance | 0.0600 to 0.102 mm<br>0.00237 to 0.00401 in. | 0.25 mm<br>0.010 in. |
| Differential pinion to differential side gear | Backlash | 0.15 to 0.30 mm<br>0.0059 to 0.011 in. | 0.4 mm<br>0.02 in. |

# 3. Tightening torques for transmission

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to 2-15, 2-15.)

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Rear wheel mounting nut | 343.2 to 393.3 | 35.0 to 40.1 | 253.2 to 290.0 |
| ROPS under frame mounting bolt | 260 to 304 | 26.6 to 30.9 | 192 to 224 |
| Seat suspension mounting nut | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Secondary brake wire mounting nut | 20 to 25 | 2.1 to 2.5 | 15 to 18 |
| Lock nut and adjusting nut | 7.8 to 9.3 | 0.80 to 0.94 | 5.8 to 6.8 |
| Seat support mounting bolt | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Steering mounting nut | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Step mounting bolt (7T, M10) | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Step mounting bolt (7T, M12) | 77.5 to 90.2 | 7.91 to 9.19 | 57.2 to 66.5 |
| Brake delivery pipe retaining nut | 23 to 27 | 2.3 to 2.8 | 17 to 20 |
| Power steering delivery hose retaining nut | 22.6 to 27.5 | 2.31 to 2.80 | 16.7 to 20.2 |
| Power steering delivery hose | 45.1 to 53.0 | 4.60 to 5.40 | 33.3 to 39.0 |
| Shuttle valve delivery pipe | 34.5 to 39.2 | 3.52 to 3.99 | 25.5 to 28.9 |
| Engine and clutch housing mounting bolt (M14, 9T) | 166.7 to 196.1 | 17.00 to 19.99 | 123.0 to 144.6 |
| Engine and clutch housing mounting nut (M14, 7T) | 123.6 to 147.1 | 12.61 to 15.00 | 91.17 to 108.4 |
| Secondary brake cable mounting nut | 20 to 25 | 2.1 to 2.5 | 15 to 18 |
| Secondary brake cable adjusting nut 1 | 7.8 to 9.3 | 0.80 to 0.94 | 5.8 to 6.8 |
| Secondary brake cable adjusting nut 1 | 17.1 to 20.6 | 1.75 to 2.10 | 12.7 to 15.1 |
| Cable stay mounting bolt | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Clutch cable mounting nut | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Brake delivery pipe retaining nut | 20 to 28 | 2.1 to 2.8 | 15 to 20 |
| Delivery hose retaining nut | 57.6 to 70.4 | 5.88 to 7.17 | 42.5 to 51.9 |
| Fitting of delivery hose (Trailer brake valve side) | 100 to 110 | 10.2 to 11.2 | 73.8 to 81.1 |
| Elbow of delivery hose (Hydraulic pump side) | 73.5 to 83.4 | 7.50 to 8.50 | 54.3 to 61.5 |
| 3-point hitch delivery pipe 2 retaining nut | 108 to 117 | 11.0 to 12.0 | 79.6 to 86.7 |
| Pump flange mounting bolt | 9.80 to 11.3 | 1.00 to 1.15 | 7.23 to 8.33 |
| Relief valve folder mounting bolt | 9.80 to 11.3 | 1.00 to 1.15 | 7.23 to 8.33 |
| Clutch housing and transmission case mounting bolt (M14, 7T) | 123.6 to 147.1 | 12.61 to 15.00 | 91.17 to 108.4 |
| Clutch housing and transmission mounting nut (M14, 9T) | 166.7 to 196.1 | 17.0 to 19.99 | 123.0 to 144.6 |
| Trailer brake return pipe joint bolt (Trailer brake valve side) | 63.7 to 73.5 | 6.50 to 7.49 | 47.0 to 54.2 |
| Trailer brake return pipe joint bolt (Transmission case side) | 75 to 85 | 7.7 to 8.6 | 56 to 62 |
| Trailer brake pipe 1 joint bolt (Trailer brake valve side) | 53.9 to 63.7 | 5.50 to 6.49 | 39.8 to 46.9 |

(Continued)

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Trailer brake pipe 1 flare nut | 49.0 to 68.6 | 5.00 to 5.99 | 36.2 to 50.5 |
| Trailer brake pipe 2 joint bolt | 53.9 to 63.7 | 5.50 to 6.49 | 39.8 to 46.9 |
| Trailer brake pipe 2 flare nut | 49.0 to 68.6 | 5.00 to 5.99 | 36.2 to 50.5 |
| Trailer brake actuating pipe | 15.7 to 23.5 | 1.60 to 2.39 | 11.6 to 17.3 |
| Trailer brake actuating pipe joint (Trailer brake valve side) | 35 to 40 | 3.6 to 4.0 | 26 to 29 |
| Trailer brake actuating pipe connector (Transmission case side) | 9.80 to 14.7 | 1.00 to 1.49 | 7.23 to 10.8 |
| Hydraulic cylinder delivery hose retaining nut | 46 to 53 | 4.6 to 5.4 | 34 to 39 |
| PTO gear case assembly mounting screw | 78 to 90 | 7.9 to 9.2 | 58 to 66 |
| Rear axle case mounting screw and nut (M16, 9T) | 260.0 to 304.1 | 26.52 to 31.00 | 191.8 to 224.2 |
| Transmission case mounting bolt (M14, 7T) | 123.6 to 147.1 | 12.61 to 15.00 | 91.17 to 108. |
| Mount bracket mounting bolt | 234 to 274 | 23.9 to 27.9 | 173 to 202 |
| Top cover mounting screw (M14, 9T) | 167 to 196 | 17.0 to 20.0 | 123 to 144 |
| Top cover mounting nut (M14, 7T) | 124 to 147 | 12.7 to 14.9 | 91.5 to 108 |
| Shuttle case mounting bolt and nut | 48 to 55 | 4.9 to 5.7 | 36 to 41 |
| Shuttle case and shuttle holder mounting screw and nut | 48 to 55 | 4.9 to 5.7 | 36 to 41 |
| Joint screw for hydraulic pipe 2 | 34.3 to 39.2 | 3.50 to 3.99 | 25.3 to 28.9 |
| Shift cover mounting bolt | 78 to 90 | 7.9 to 9.2 | 58 to 66 |
| PTO clutch holder mounting screw | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Differential bearing support mounting screw | 60 to 70 | 6.2 to 7.1 | 45 to 51 |
| Spiral bevel pinion shaft staking nut | 93.2 to 102 | 9.5 to 10.5 | 68.8 to 75.9 |
| Spiral bevel gear mounting UBS screw | 143 to 161 | 14.5 to 16.5 | 105 to 119 |
| PTO shaft staking nut | 226 to 264 | 23.0 to 27.0 | 167 to 195 |
| PTO case cover mounting screw and reamer bolt | 78 to 90 | 7.9 to 9.2 | 58 to 66 |
| PTO gear case mounting screws | 78 to 90 | 7.9 to 9.2 | 58 to 66 |
| Staking nut | 93.2 to 102 | 9.50 to 10.5 | 68.8 to 75.9 |

RELATED PAGE

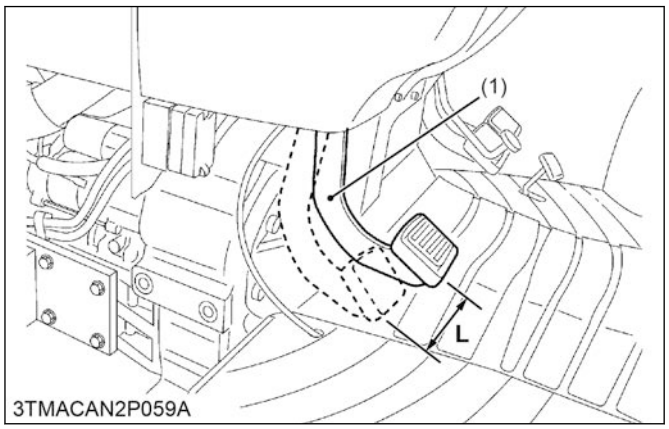
1. General use screws, bolts and nuts on page 2-15

# 4. Checking and adjusting

## 4.1 Clutch pedal

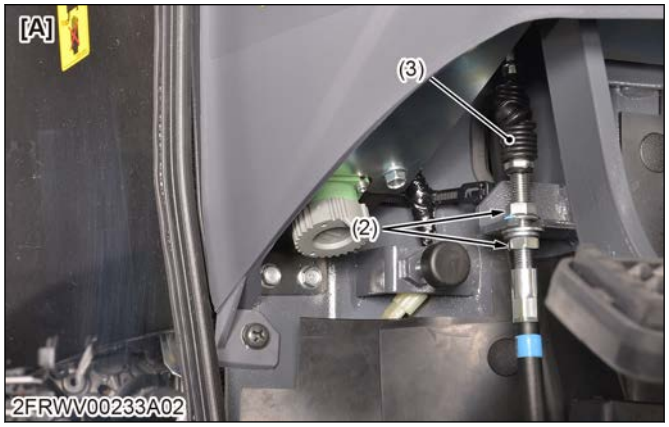
### 4.1.1 Adjusting clutch pedal free travel

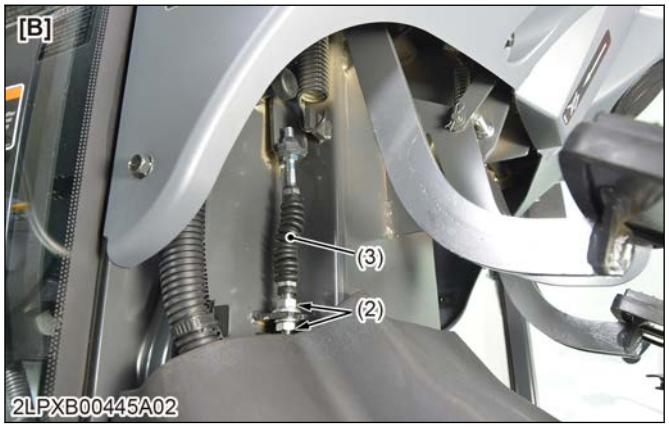
1. Measure the clutch pedal free travel "L".




(1) Clutch pedal L: Free travel

2. If adjustment is needed, change with the retaining nuts (2) of the clutch cable (3) to the factory specification shown in the following table.
3. After adjustment is completed, securely tighten the retaining nuts (2).




(2) Retaining nut [B] Cabin model
(3) Clutch cable
[A] ROPS model

**ROPS model**

| | | |
|---|---|---|
| Clutch pedal free travel "L" | Factory specification | 15 to 20 mm<br>0.59 to 0.79 in. |
| Clutch pedal total stroke | | 145 to 155 mm<br>5.71 to 6.10 in. |

**Cabin model**

| | | |
|---|---|---|
| Clutch pedal free travel "L" | Factory specification | 15 to 25 mm<br>0.59 to 0.98 in. |
| Clutch pedal total stroke | | 155 to 165 mm<br>6.11 to 6.49 in. |

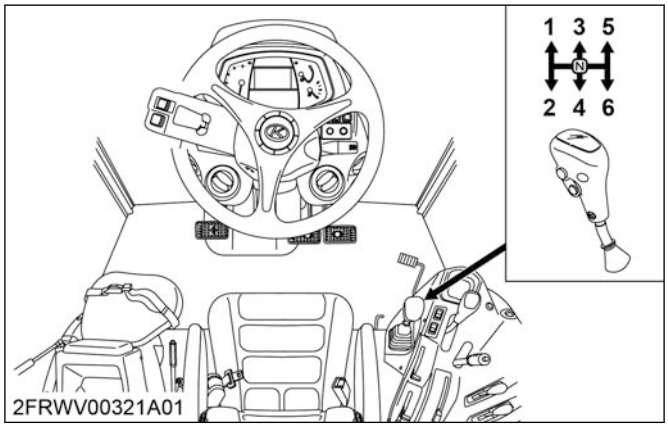
## 4.2 Gear shifting linkage

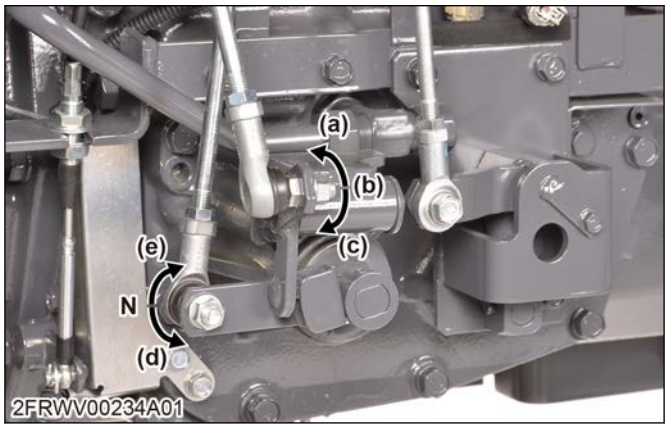
### 4.2.1 Main gear shift

#### 4.2.1.1 Checking function of main gear shift

1. Check the function of the main gear shift.
   - **Neutral** position to **1st** gear position.
   - **Neutral** position to **2nd** gear position.
   - **Neutral** position to **3rd** gear position.
   - **Neutral** position to **4th** gear position.
   - **Neutral** position to **5th** gear position.
   - **Neutral** position to **6th** gear position.

2. If shifting is not smooth, adjust the main gear shift rods.

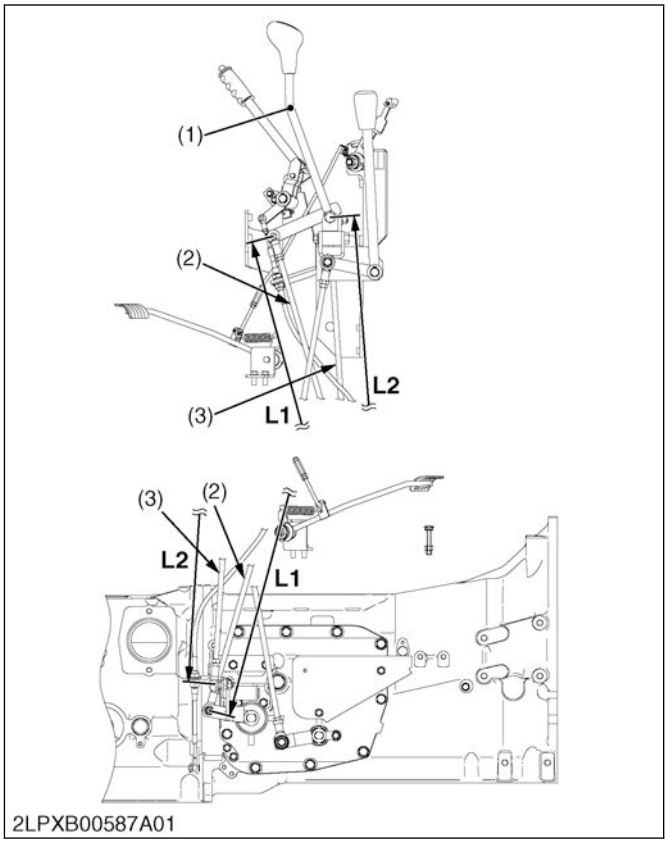


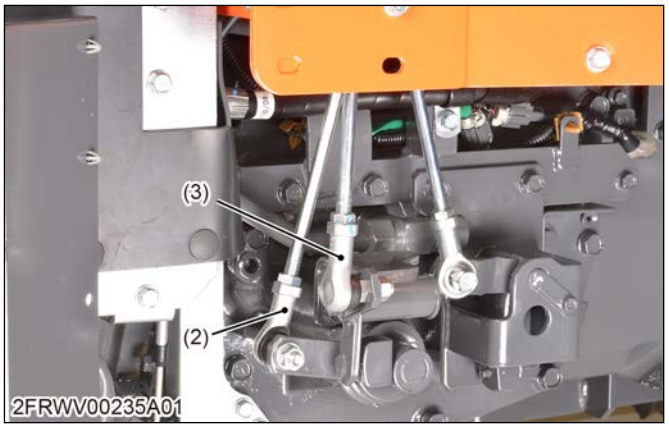




(a) Select 1st-2nd gear shift position.
(b) Select 3rd-4th gear shift position.
(c) Select 5th-6th gear shift position.
(d) Engage to 1st or 3rd or 5th gear position.
(e) Engage to 2nd or 4th or 6th gear position.
N: Neutral position

## 4.2.1.2 Adjusting main gear shift (ROPS model)

1. Check the operation of main gear shift lever (1) is smooth or not.
2. If the operation of main gear shift lever (1) is not smooth or the main gear shift lever (1) contacts to lever guide, adjust the length of main gear shift rod (2) and selecting rod (3) referring to the following table.




(1) Main gear shift lever
(2) Main gear shift rod
(3) Selecting rod
L1: Length between main gear shift rod
L2: Length between selecting rod

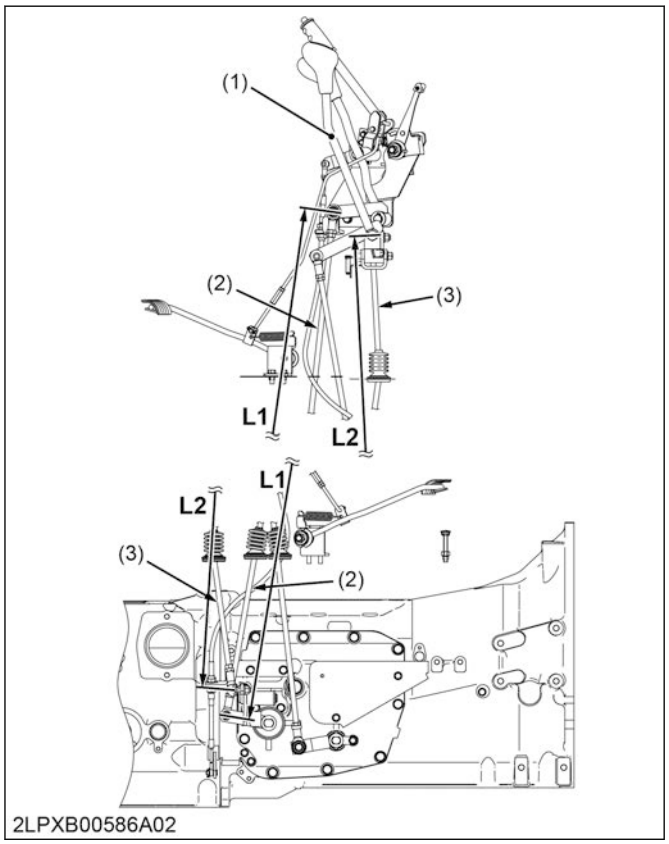
**(Reference)**

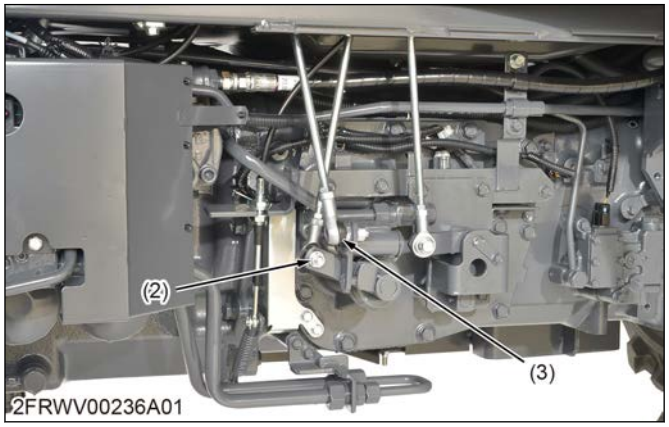
| | | |
|---|---|---|
| Main gear shift rod length "L1" | Reference value | 550 mm<br>21.7 in. |
| Selecting rod length "L2" | | 512 mm<br>20.2 in. |

## 4.2.1.3 Adjusting main gear shift (Cabin model)

1. Check the operation of main gear shift lever (1) is smooth or not.

2. If the operation of main gear shift lever (1) is not smooth or the main gear shift lever (1) contacts to lever guide, adjust the length of main gear shift rod (2) and selecting rod (3) refer to the following table.




(1) Main gear shift lever
(2) Main gear shift rod
(3) Selecting rod
L1: Length between main gear shift rod
L2: Length between selecting rod

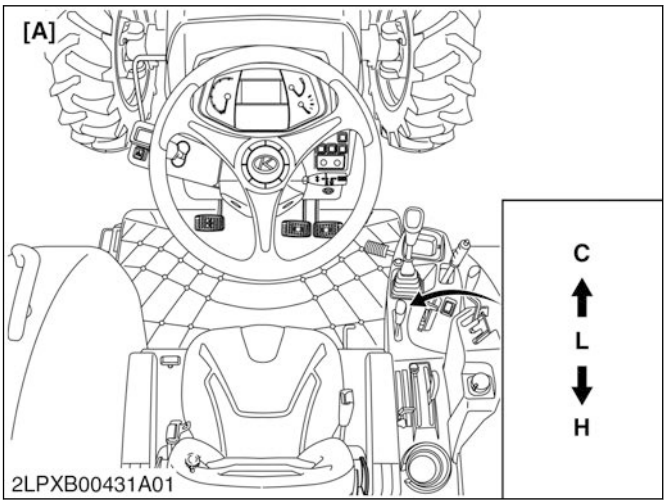
**(Reference)**

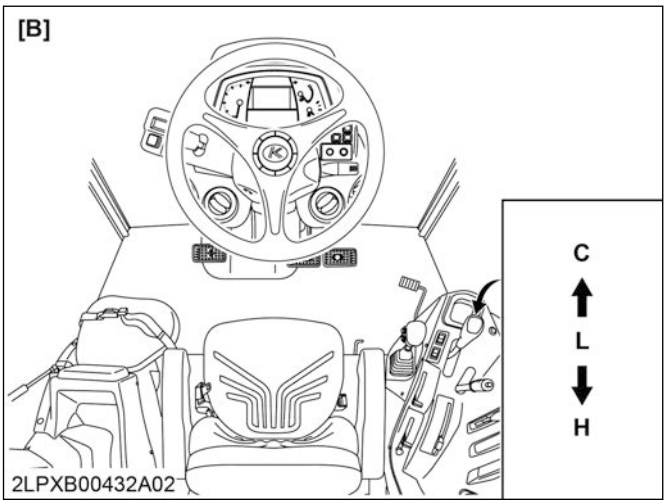
| | | |
|---|---|---|
| Main gear shift rod length "L1" | Reference value | 564 mm 22.2 in. |
| Selecting rod length "L2" | | 545 mm 21.5 in. |

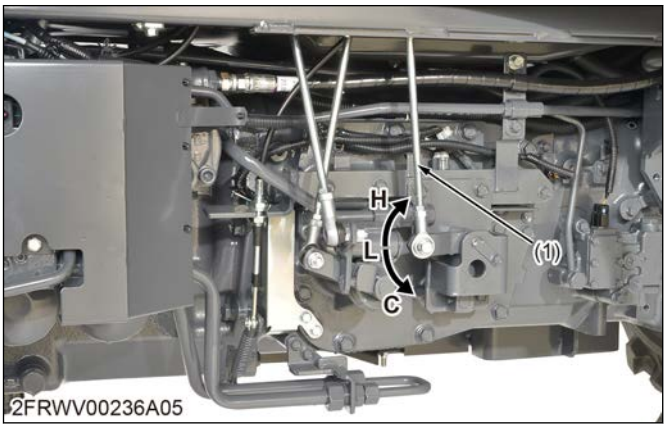
## 4.2.2 Range / creep gear shift

### 4.2.2.1 Checking function of range gear shift

1. Check the function of the range gear shift lever shifting.
   - **H**, **L** and **C** position.
2. If shifting is not smooth, adjust the range gear shift rod (1).



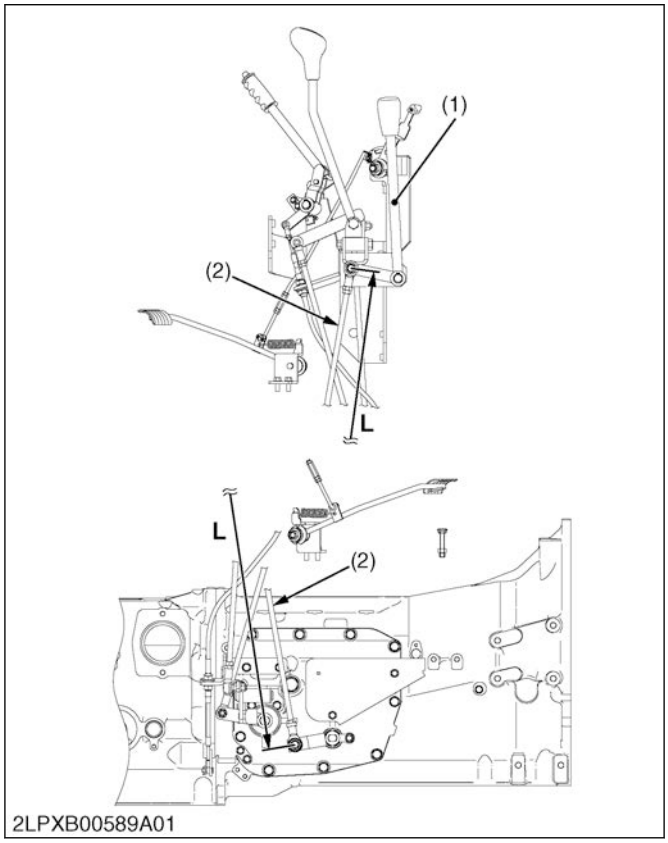




(1) Range gear shift rod
H: Hi speed range position
L: Lo speed range position
C: Creep speed range position
[A] ROPS model
[B] Cabin model

## 4.2.2.2 Adjusting range gear shift (ROPS model)

1. Check the operation of range gear shift lever (1) is smooth or not.
2. If the operation of range gear shift lever (1) is not smooth or the range gear shift lever (1) contacts to lever guide, adjust the range gear shift rod length (L) to the reference value shown in the following table.



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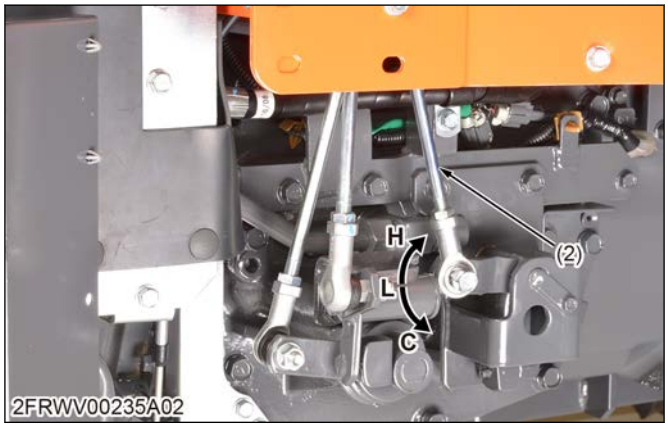


2FRWV00235A02

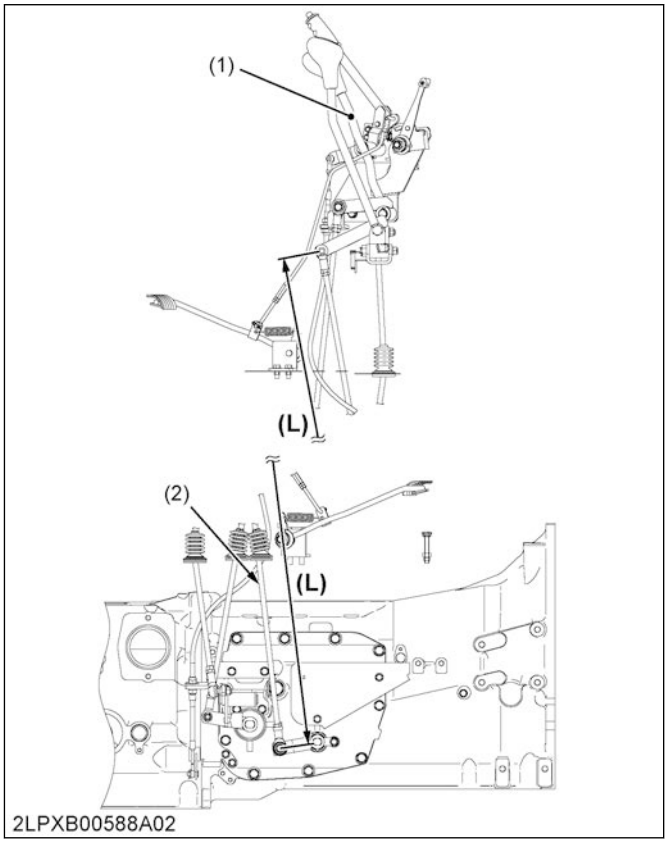
(1) Range gear shift lever
(2) Range gear shift rod
(L) Length between range gear shift rod
H: Hi speed range
L: Low speed range
C: Creep range

**(Reference)**

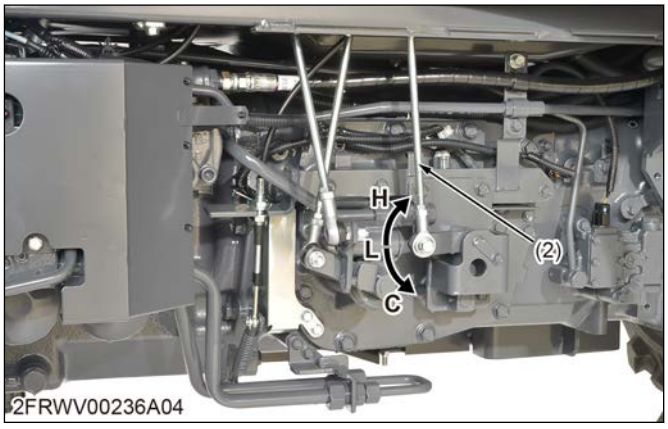
| | | |
|---|---|---|
| Range gear shift rod length (L) | Reference value | 550 mm<br>21.7 in. |

## 4.2.2.3 Adjusting range gear shift (Cabin model)

1. Check the operation of range gear shift lever (1) is smooth or not.
2. If the operation of range gear shift lever (1) is not smooth or the range gear shift lever (1) contacts to lever guide, adjust the range gear shift rod length (L) to the reference value shown in the following table.



2LPXB00588A02



2FRWV00236A04

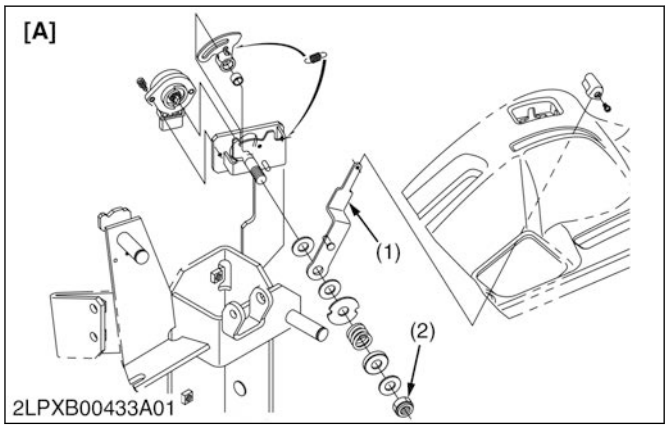
(1) Range gear shift lever
(2) Range gear shift rod
H: Hi speed position
L: Lo speed position
C: Creep speed position

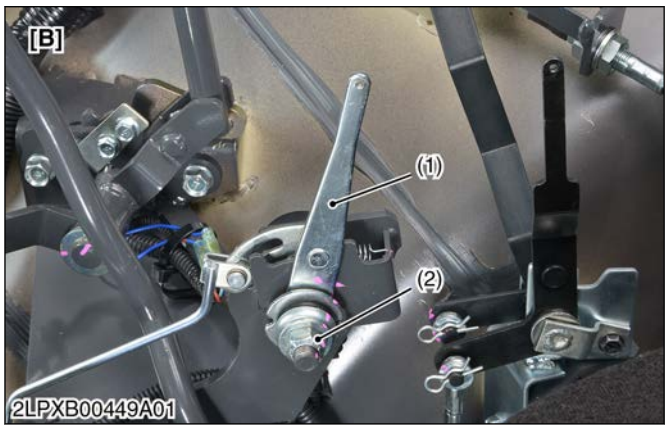
**(Reference)**

| | | |
|---|---|---|
| Range gear shift rod length (L) | Reference value | 698 mm<br>27.5 in. |

# 4.3 Accelerator section

## 4.3.1 Checking hand accelerator lever operating force

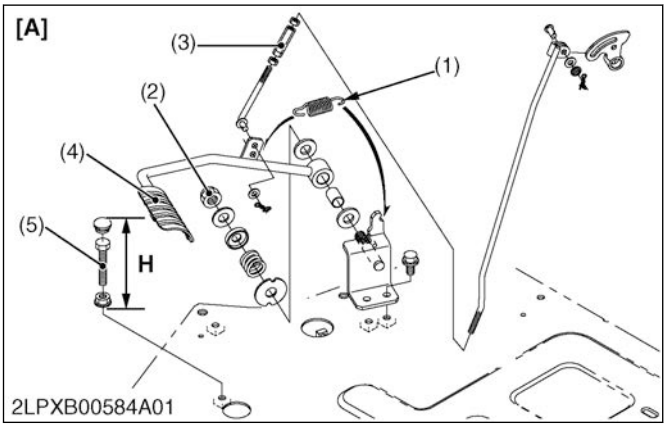



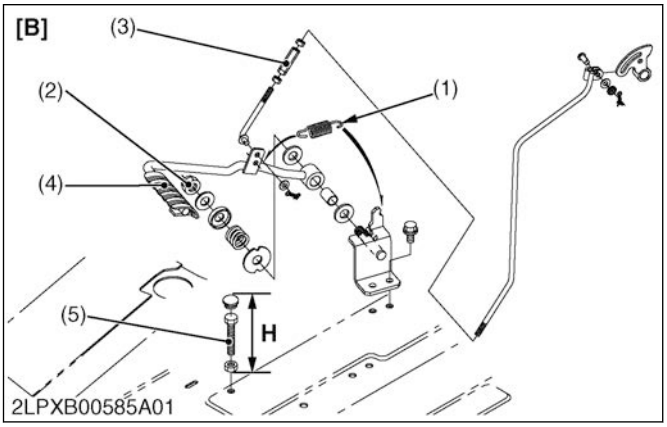

(1) Hand accelerator lever
(2) Locking nut
[A] ROPS model
[B] Cabin model

1. Check the hand accelerator lever (1) operating force.
2. If the measured value is not within the factory specification, adjust the hand accelerator lever operating force with locking nut.

| | | |
|---|---|---|
| Operating force for hand accelerator lever | Factory specification | 10 to 30 N<br>1.1 to 3.0 kgf<br>2.3 to 6.7 lbf |

## 4.3.2 Checking accelerator pedal




(1) Spring
(2) Nut
(3) Turnbuckle
(4) Accelerator pedal
(5) Bolt
[A] ROPS model
[B] Cabin model

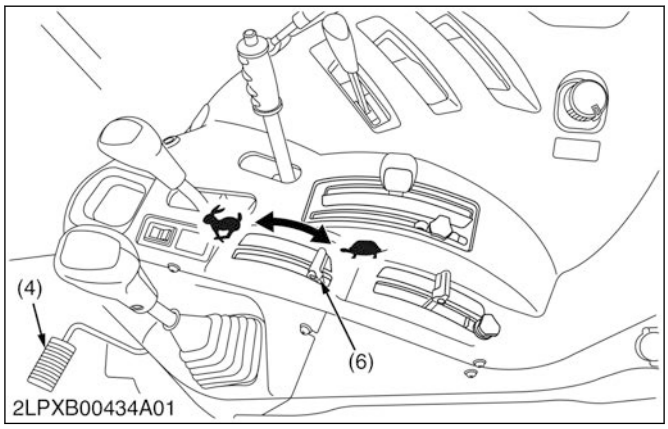
1. Remove the spring (1) to check the accelerator pedal operation force itself.
2. Tighten the nut (2) to get the accelerator pedal operating force shown in the following table.

| | | |
|---|---|---|
| Operation force of accelerator pedal without spring (1) | Reference value | 3 to 5 N<br>0.3 to 0.5 kgf<br>0.7 to 1 lbf |

3. Install the spring (1) and check the accelerator pedal operating force .

| | | |
|---|---|---|
| Operation force of accelerator pedal with spring (1) | Reference value | 20 to 30 N<br>2.1 to 3.0 kgf<br>4.5 to 6.7 lbf |

4. When setting the hand accelerator lever (6) to engine idling speed position and setting the accelerator pedal (4) to the neutral position, adjust the turnbuckle (3) to hold the engine speed to idling speed.




(4) Accelerator pedal (6) Hand accelerator lever

5. Depress the accelerator pedal (4) to touch the accelerator pedal restriction bolt (5) and adjust the length of the accelerator pedal restriction bolt (5) to get the engine speed to the maximum speed.

| | | |
|---|---|---|
| Length of bolt "H" (ROPS model) | Reference value | 13 mm<br>0.51 in. |
| Length of bolt "H" (Cabin model) | | 48 mm<br>1.9 in. |

# 4.4 Hydraulic shuttle clutch valve

## 4.4.1 Checking hydraulic shuttle clutch valve operating pressure

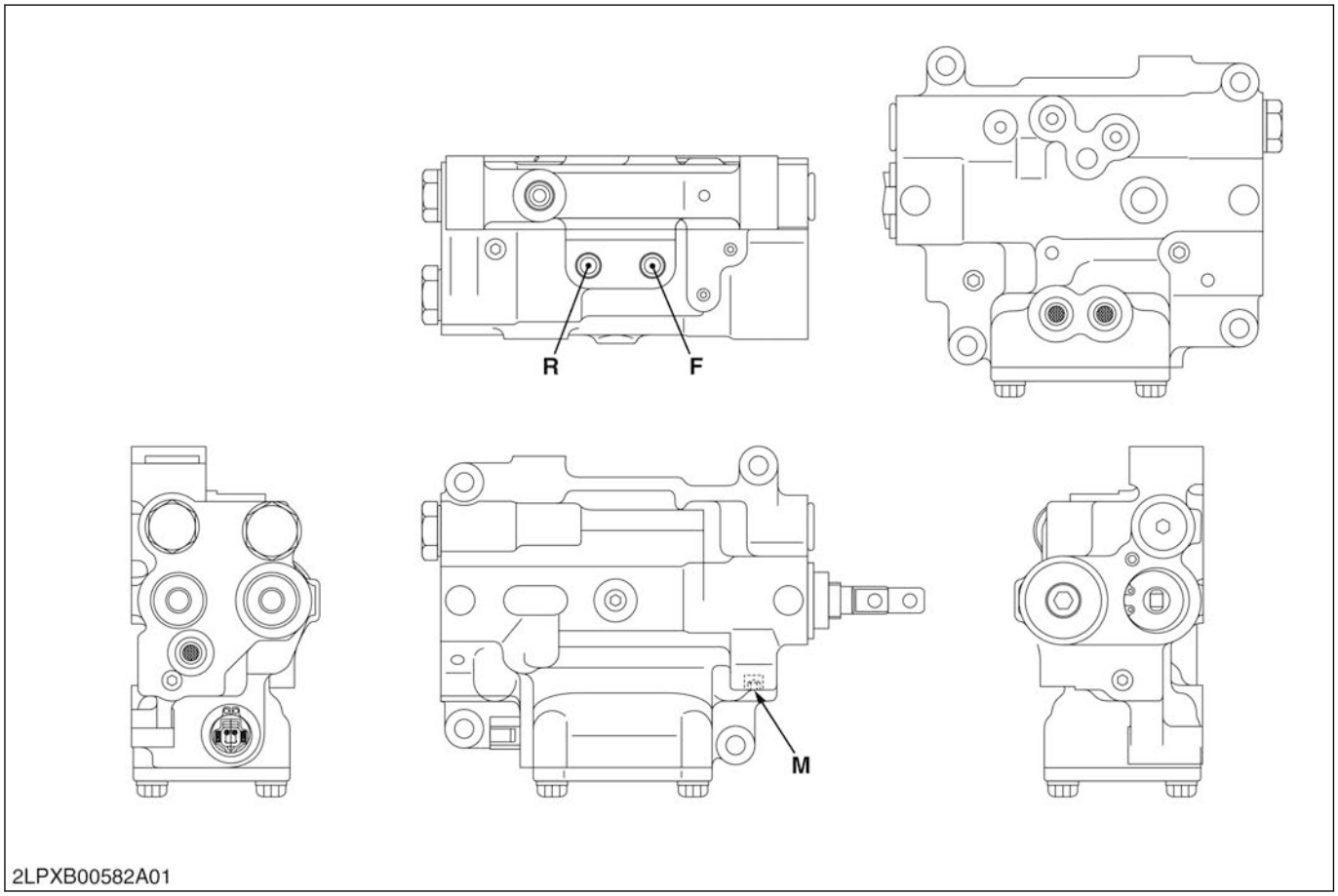
**⚠ WARNING**

- **Be sure to place the main gear shift lever in Neutral position.**

**■ NOTE**

- **Be sure to use a pressure gauge with 5 MPa (50 kgf/cm$^2$, 700 psi) capacity.**
- **Apply Three Bond 1324N or its equivalents to the plugs "F", "R" and "M", when installing them.**
- **Plug ("F", "R" and "M") thread size is R1/8.**

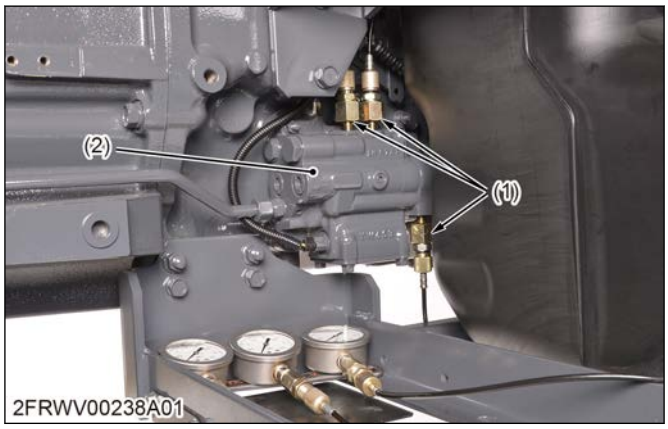
1. Remove the DEF tank.
2. Remove the each port plugs (R1/8) of "F", "R" and "M".




F: Operation oil pressure (for forward)
R: Operation oil pressure (for reverse)
M: Operation oil pressure (for modulation)

3. Install the adapters (1) to the each ports of hydraulic shuttle valve (2).

4. Install the cables and pressure gauges (Code No. 07916-52961).




(1) Adapter (2) Hydraulic shuttle valve

5. Reassemble the DEF tank.
6. Start the engine and set the conditions as shown in the table below.

**Condition for ROPS model**

| Engine speed | Oil temperature |
|---|---|
| Approximately 2400 $min^{-1}$ (rpm) | 45 to 55 ℃<br>113 to 131 ℉ |

**Condition for Cabin model**

| Engine speed | Oil temperature |
|---|---|
| Approximately 2600 $min^{-1}$ (rpm) | 45 to 55 ℃<br>113 to 131 ℉ |

7. Measure the pressure of each ports and each shuttle lever positions as the pressure table.


2FRWV00239A01

| Shuttle lever | Clutch pedal | F port pressure | R port pressure | M port pressure |
|---|---|---|---|---|
| Forward | Fully pressed | 0 | 0 | 2.06 to 2.25 MPa<br>21.0 to 22.9 kgf/cm$^2$<br>229 to 326 psi |
| | Free | 2.06 to 2.25 MPa<br>21.0 to 22.9 kgf/cm$^2$<br>299 to 326 psi | 0 | |
| Reverse | Fully pressed | 0 | 0 | |
| | Free | 0 | 2.06 to 2.25 MPa<br>21.0 to 22.9 kgf/cm$^2$<br>299 to 326 psi | |
| Neutral | — | 0 | 0 | Less than<br>0.28 MPa<br>2.9 kgf/cm$^2$<br>41 psi |

RELATED PAGE
2.24 Valve adaptor on page 2-96

# 4.5 Solenoid valve

## 4.5.1 Checking system pressure (ROPS model)

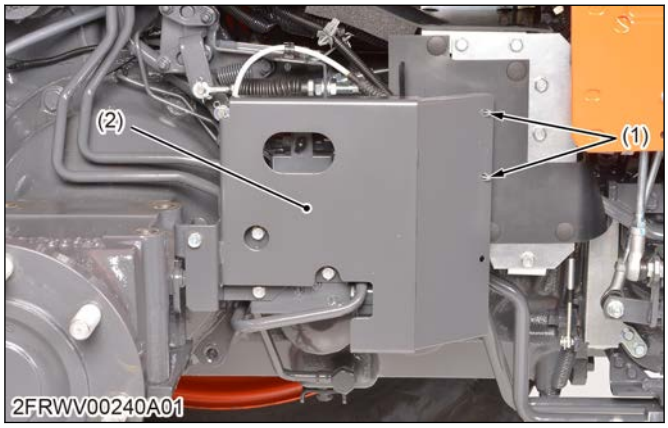
**■ IMPORTANT**

- **Set the hydraulic shuttle lever in Neutral position.**
- **Set the main gear shift lever in Neutralposition.**
- **Set the parking brake lever in Parking position.**
- **Be sure to set the disassembling stand under the transmission case when removing the rear wheel.**
- **Be sure to set the disassembling stand under the rear axle case after removing the rear wheel.**

**■ NOTE**

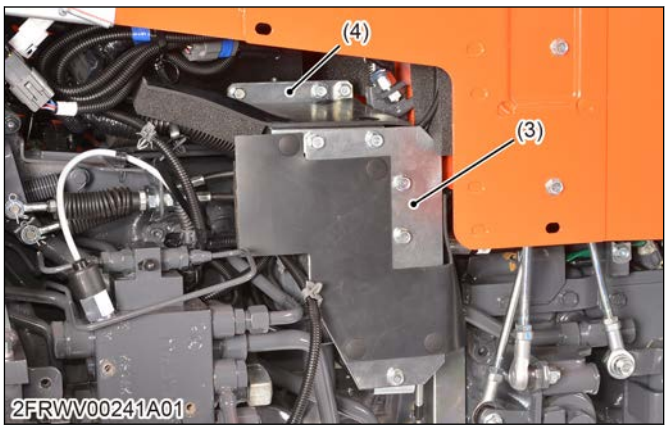
- **Be sure to use a pressure gauge with 5 MPa (50 kgf/cm$^2$, 700 psi) capacity.**
- **System pressure check port plug thread size: R1/8**

1. Place the disassembling stand under the transmission case.
2. Remove the right rear wheel and place the disassembling stand under the right rear axle case.
3. Disconnect the clamps (1) and remove the trailer brake valve cover (2).




(1) Clamp
(2) Trailer brake valve cover

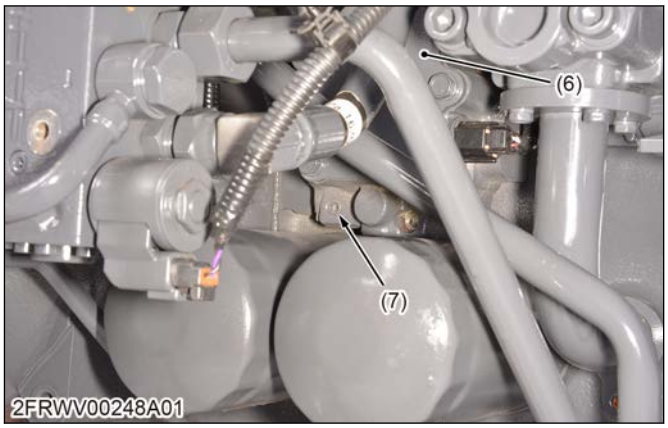
4. Remove the cover 1 (3).
5. Remove the cover 2 retaining nut (5) and cover 2 (4).





(3) Cover 1
(4) Cover 2
(5) Retaining nut

6. Remove the system pressure check port plug (R1/8) (7) on the solenoid valve assembly (6).



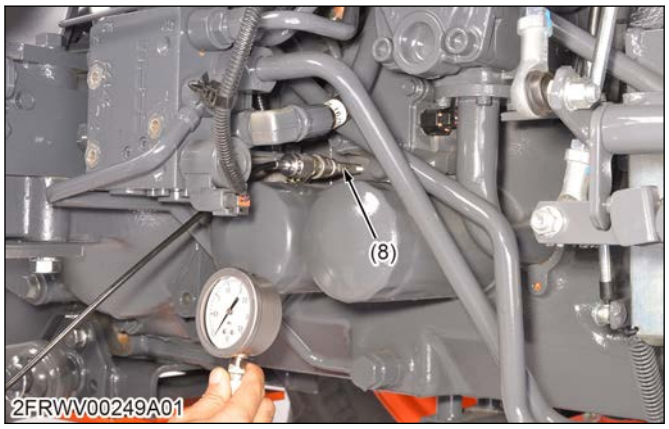

(6) Solenoid valve assembly
(7) System pressure check port plug (R1/8)

7. Assemble the threaded joint (8), hose and pressure gauge.
8. Start the engine and set the conditions as shown in the table below.

**Condition**

| Engine speed | Oil temperature |
|---|---|
| Approximately 2400 min$^{-1}$ (rpm) | 45 to 55 ℃<br>113 to 131 ℉ |

9. Measure the system pressure.

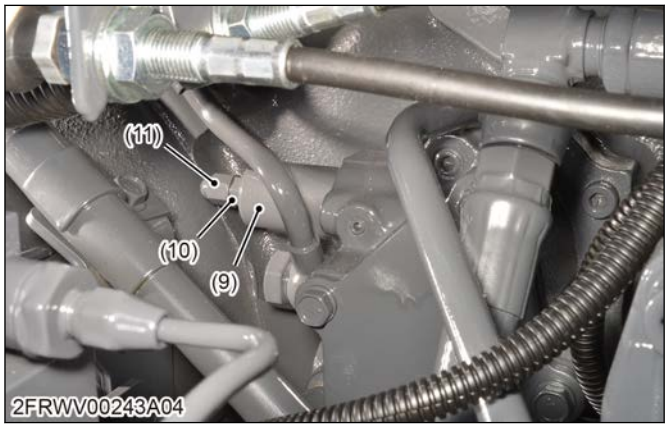



(8) Thread joint

| | | |
|---|---|---|
| System pressure | Factory specification | 1.96 to 2.16 MPa<br>20.0 to 22.0 kgf/cm$^2$<br>285 to 313 psi |

**(Reference)**

- If the measured value is not within the factory specification, adjust the system pressure with relief valve (9).
- Turn the adjusting screw after removing the cap nut (11) and loosing lock nut (10).
- Turn the adjusting screw clockwise. → Pressure increases.
- Turn the adjusting screw counterclockwise. → Pressure decreases.




(9) Relief valve
(10) Lock nut
(11) Cap nut

RELATED PAGE
2.24 Valve adaptor on page 2-96

## 4.5.2 Checking system pressure (Cabin model)

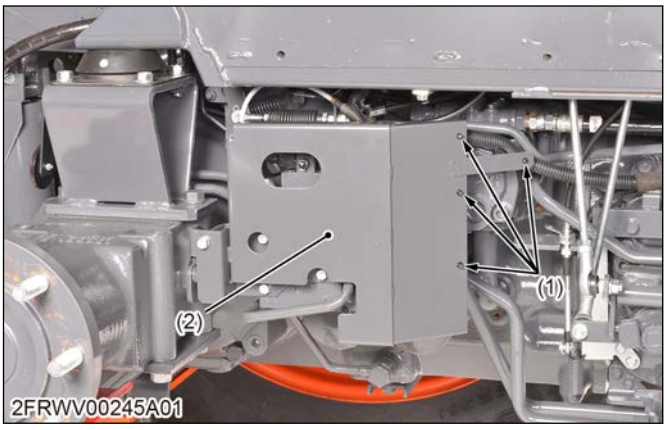
**■ IMPORTANT**

- **Set the hydraulic shuttle lever in Neutral position.**
- **Set the main gear shift lever in Neutralposition.**
- **Set the parking brake lever in Parking position.**
- **Be sure to set the disassembling stand under the transmission case when removing the rear wheel.**
- **Be sure to set the disassembling stand under the rear axle case after removing the rear wheel.**

**■ NOTE**

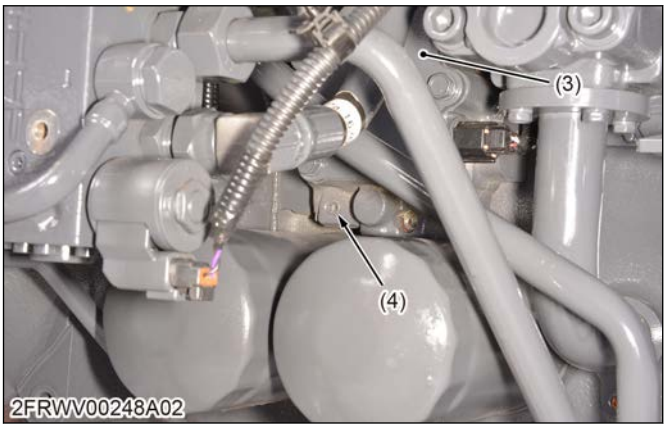
- **Be sure to use a pressure gauge with 5 MPa (50 kgf/cm$^2$, 700 psi) capacity.**
- **System pressure check port plug thread size: R1/8**

1. Place the disassembling stand under the transmission case.
2. Remove the right rear wheel and place the disassembling stand under the right side of rear axle case.
3. Remove the clamps (1) and trailer brake valve cover (2).



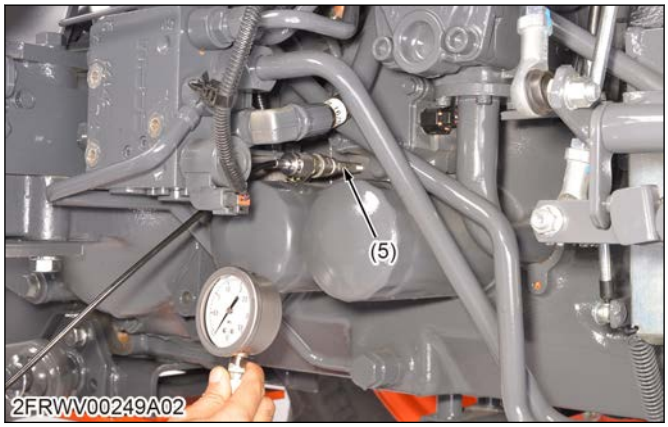

(1) Clamp
(2) Trailer brake valve cover

4. Remove the system pressure check port plug (R1/8) (4) on the solenoid valve assembly (3).




(3) Solenoid valve assembly
(4) System pressure check port plug

5. Install the threaded joint (5), hose and pressure gauge.




(5) Threaded joint

6. Start the engine and set the conditions as shown in the table below.

**Condition**

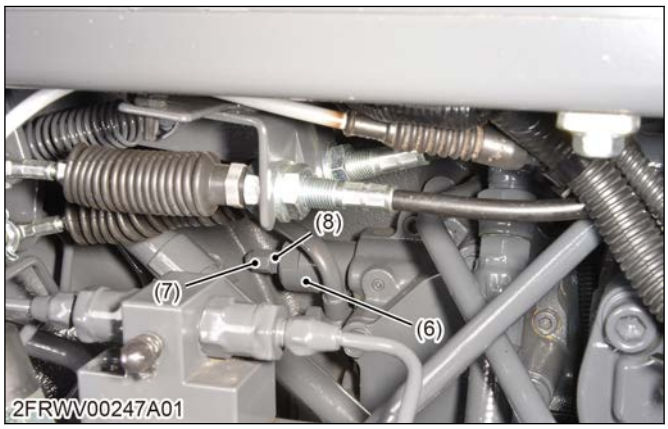
| Engine speed | Oil temperature |
|---|---|
| Approximately 2600 $min^{-1}$ (rpm) | 45 to 55 ℃<br>113 to 131 ℉ |

7. Measure the system pressure.

| | | |
|---|---|---|
| System pressure | Factory specification | 1.96 to 2.16 MPa<br>20.0 to 22.0 $kgf/cm^2$<br>285 to 313 psi |

**(Reference)**

- If the measured value is not within the factory specification, adjust the system pressure with relief valve (6) if necessary.
- Turn the adjusting screw after removing the cap nut (7) and loosing lock nut (8).
- Turn the adjusting screw clockwise. → Pressure increases.
- Turn the adjusting screw counterclockwise. → Pressure decreases.




(6) Relief valve
(7) Cap nut
(8) Lock nut

RELATED PAGE
2.24 Valve adaptor on page 2-96

## 4.5.3 Checking PTO clutch valve operating pressure (ROPS model)

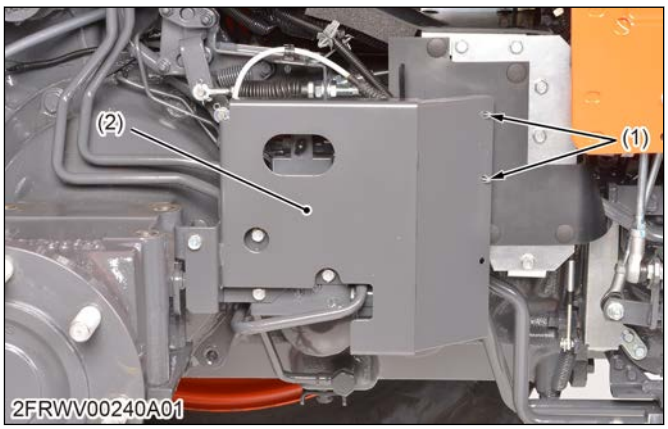
**IMPORTANT**

- **Do not connect the universal joint of the implement to the tractor PTO shaft while testing.**
- **Set the shuttle lever in Neutral position.**
- **Set the main gear shift lever in Neutral position.**
- **Set the parking brake lever in Parking position.**
- **Be sure to set the disassembling stand under the transmission case when removing the rear wheel.**
- **Be sure to set the disassembling stand under the rear axle after removing the rear wheel.**

**NOTE**

- **Be sure to use a pressure gauge with 5 MPa (50 $kgf/cm^2$, 700 psi) capacity.**
- **PTO clutch operating pressure check port plug thread size: R1/8**

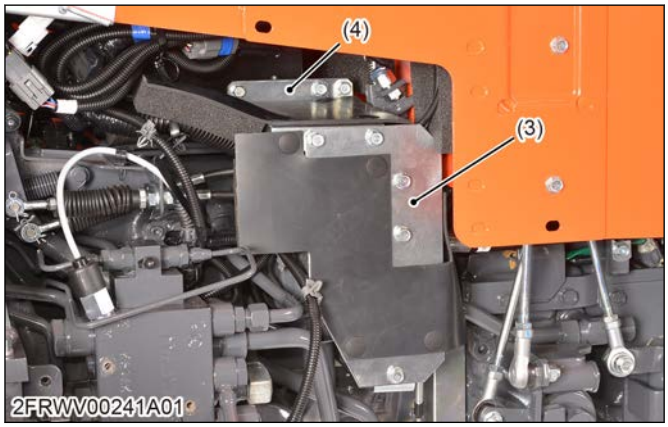
1. Place the disassembling stand under the transmission case.
2. Remove the right rear wheel and place the disassembling stand under the right rear axle case.
3. Disconnect the clamps (1) and remove the trailer brake valve cover (2).




(1) Clamp
(2) Trailer brake valve cover

4. Remove the cover 1 (3).

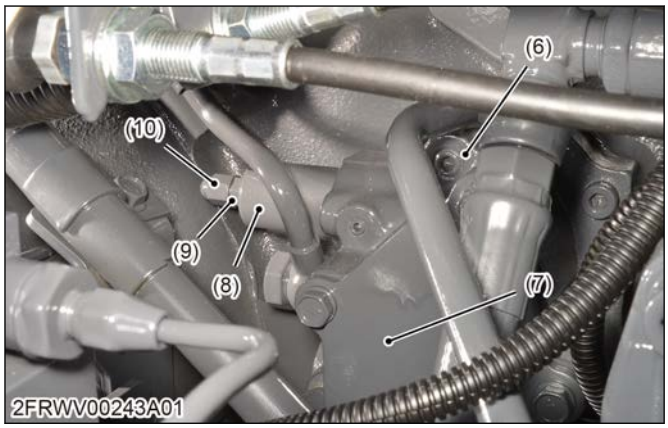
5. Remove the cover 2 retaining nut (5) and cover 2 (4).





(3) Cover 1
(4) Cover 2
(5) Retaining nut

6. Remove the PTO clutch check port plug (R1/8) (6) on the solenoid valve assembly (7).



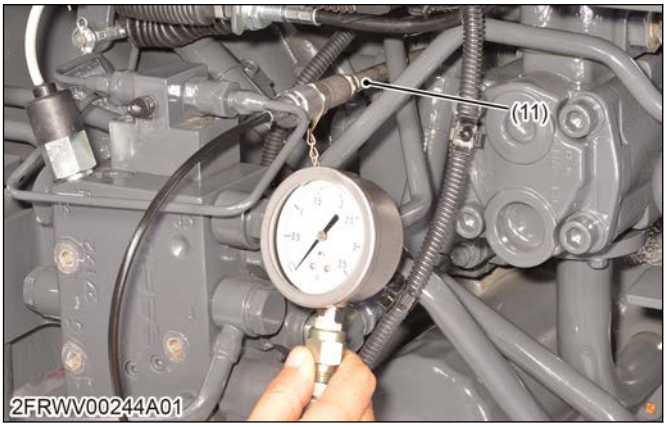

(6) PTO clutch check port plug (R1/8)
(7) Solenoid valve assembly
(8) Relief valve
(9) Lock nut
(10) Cap nut

7. Assemble the threaded joint (11), hose and pressure gauge.
8. Start the engine.

**Condition**

| Engine speed | Oil temperature |
|---|---|
| Approximately 2400 $min^{-1}$ (rpm) | 45 to 55 ℃<br>113 to 131 ℉ |

9. Turn on the PTO switch and measure the pressure.




(11) Thread joint

| | | |
|---|---|---|
| PTO clutch valve operating pressure (When PTO switch is at **ON** position.) | Factory specification | 1.96 to 2.16 MPa<br>20.0 to 22.0 $kgf/cm^2$<br>285 to 313 psi |
| PTO clutch valve operating pressure (When PTO switch is at **OFF** position.) | | No pressure |

**(Reference)**

- If only the pressure in the PTO clutch engaged position is low, check the hydraulic PTO clutch system.
- If the measured value is not within the factory specifications, measure the system pressure, and adjust the system pressure with relief valve (8) if necessary.
- Turn the adjusting screw after removing the cap nut (10) and loosing lock nut (9).
- Turn the adjusting screw clockwise. → Pressure increases.
- Turn the adjusting screw counterclockwise. → Pressure decreases.

RELATED PAGE
2.24 Valve adaptor on page 2-96

## 4.5.4 Checking PTO clutch valve operating pressure (Cabin model)

**IMPORTANT**

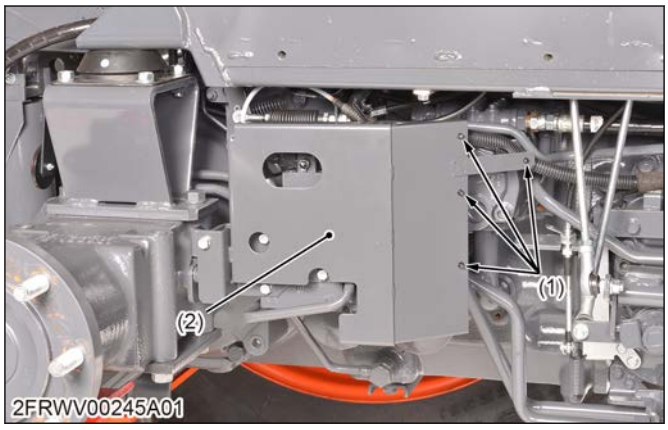
- **Do not connect the universal joint of the implement to the tractor PTO shaft while testing.**
- **Set the shuttle lever in Neutral position.**

- **Set the main gear shift lever in Neutral position.**
- **Set the parking brake lever in Parking position.**
- **Be sure to set the disassembling stand under the transmission case when removing the rear wheel.**
- **Be sure to set the disassembling stand under the rear axle case after removing the rear wheel.**

**■ NOTE**

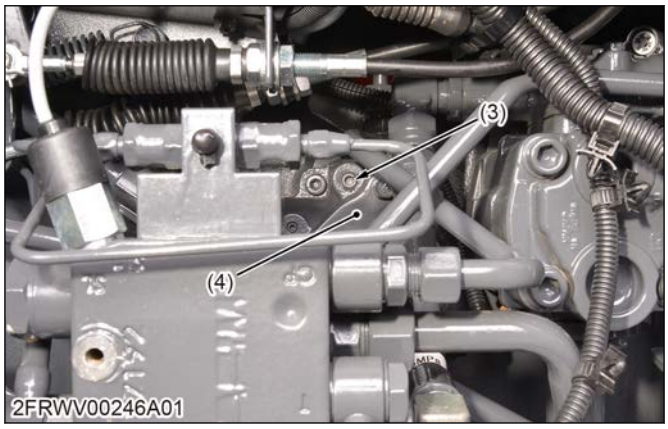
- **Be sure to use a pressure gauge with 5 MPa (50 kgf/cm$^2$, 700 psi) capacity.**
- **PTO clutch operating pressure check port plug thread size: R1/8**

1. Place the disassembling stand under the transmission case.
2. Remove the right rear wheel and place the disassembling stand under the right side of rear axle case.
3. Remove the clamps (1) and trailer brake valve cover (2).




(1) Clamp (2) Trailer brake valve cover

4. Remove the PTO clutch check port plug (R1/8) (3) on the solenoid valve assembly (4).




(3) PTO clutch check port plug (4) Solenoid valve assembly

5. Install the threaded joint (5), hose and pressure gauge.


(5) Threaded joint

6. Start the engine and set the conditions as shown in the table below.

**Condition**

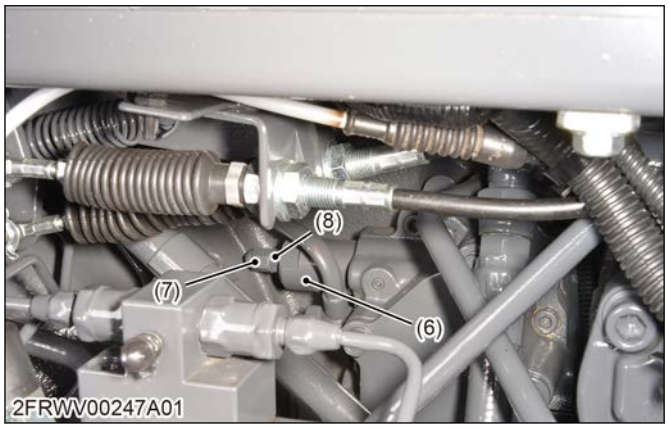
| Engine speed | Oil temperature |
|---|---|
| Approximately 2600 min$^{-1}$ (rpm) | 45 to 55 ℃<br>113 to 131 ℉ |

7. Turn on the PTO switch and measure the pressure.

| | | |
|---|---|---|
| PTO clutch valve operating pressure (When PTO switch is at **ON** position.) | Factory specification | 1.96 to 2.16 MPa<br>20.0 to 22.0 kgf/cm$^2$<br>285 to 313 psi |
| PTO clutch valve operating pressure (When PTO switch is at **OFF** position.) | | No pressure |

**(Reference)**

- If only the pressure in the PTO clutch engaged position is low, check the hydraulic PTO clutch system.
- If the measured value is not within the factory specifications, measure the system pressure, and adjust the system pressure with relief valve (6) if necessary.
- Turn the adjusting screw after removing the cap nuts (7) and loosing lock nut (8).
- Turn the adjusting screw clockwise. → Pressure increases.
- Turn the adjusting screw counterclockwise. → Pressure decreases.




(6) Relief valve
(7) Cap nut
(8) Lock nut

RELATED PAGE
2.24 Valve adaptor on page 2-96

# 4.6 Dual speed valve

## 4.6.1 Checking dual speed clutch valve operating pressure

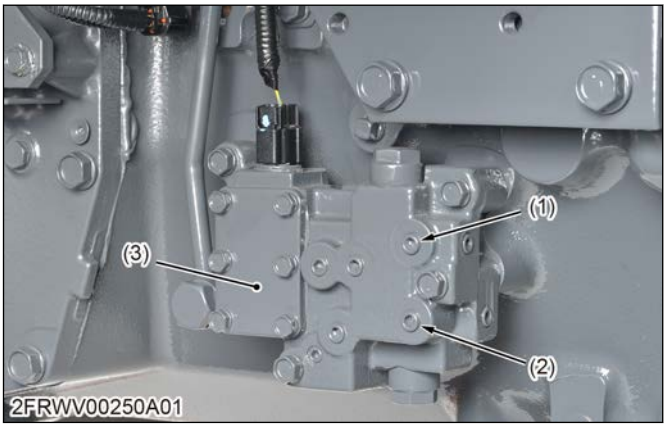
**IMPORTANT**

- **Set the shuttle lever in Neutral position.**
- **Set the main gear shift lever in Neutral position.**
- **Set the parking brake lever in Parking position.**
- **Be sure to set the disassembling stand under the transmission case when removing the rear wheel.**
- **Be sure to set the disassembling stand under the rear axle case after removing the rear wheel.**

**NOTE**

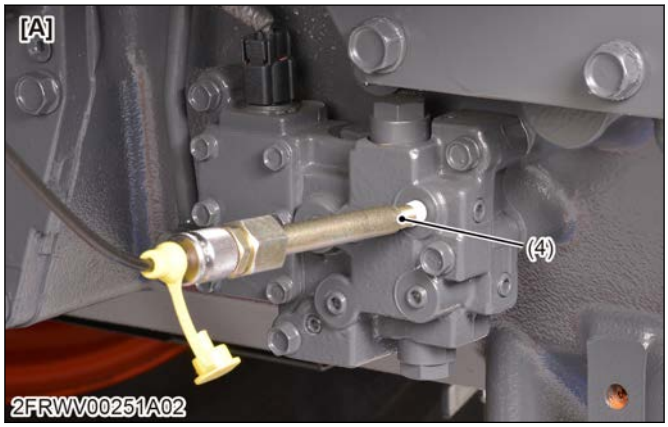
- **Be sure to use a pressure gauge with 5 MPa (50 kgf/cm$^2$, 700 psi) capacity.**
- **Check port plug thread size: R1/8.**

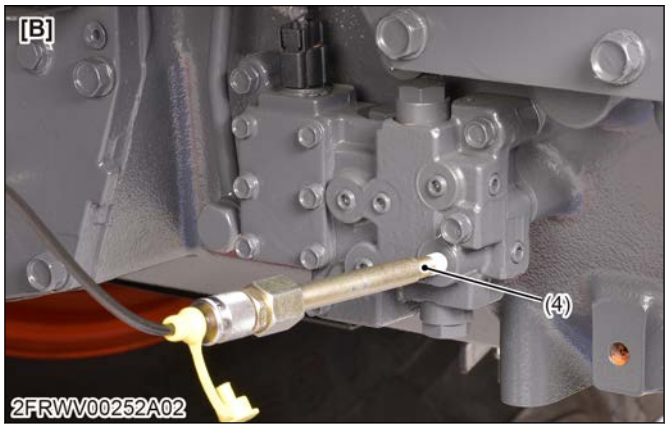
1. Remove the check port plug (R1/8) for **Lo** speed (1) and/or **Hi** speed (2) on the solenoid valve assembly (3).




(1) Check port plug for **Lo** speed
(2) Check port plug for **Hi** speed
(3) Dual speed solenoid valve

2. Install the threaded joint (4), cable and pressure gauge.




(4) Threaded joint
[A] Checking for **Lo** speed
[B] Checking for **Hi** speed

3. Start the engine and set the conditions as shown in the table below.

### Condition for ROPS model

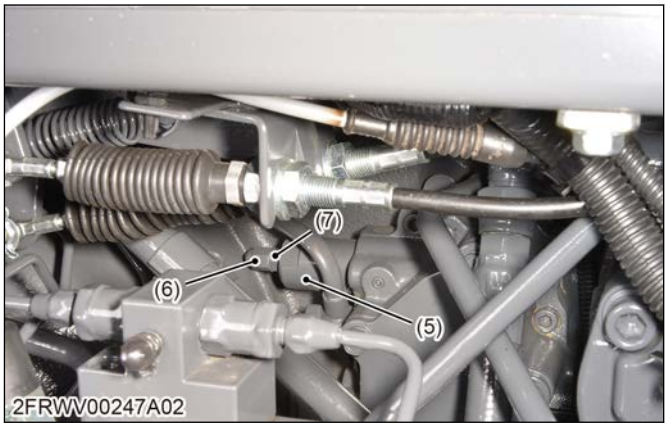
| Engine speed | Oil temperature |
|---|---|
| Approximately 2400 $min^{-1}$ (rpm) | 45 to 55 ℃<br>113 to 131 ℉ |

### Condition for Cabin model

| Engine speed | Oil temperature |
|---|---|
| Approximately 2600 $min^{-1}$ (rpm) | 45 to 55 ℃<br>113 to 131 ℉ |

4. Turn on the main gear shift lever switch (dual speed switch) at **Hi** or **Lo** position and measure the oil pressure.


5. If the pressure is not within factory specification, remove the cap nut (6), lock nut (7) and turn the screw on the relief valve (5).




(5) Relief valve
(6) Cap nut
(7) Lock nut

| | | |
|---|---|---|
| Dual speed clutch valve operating pressure (at **Hi** and **Lo** check port) | Factory specification | 1.96 to 2.16 MPa<br>20.0 to 22.0 kgf/$cm^2$<br>285 to 313 psi |

**(Reference)**

- Turn the adjusting screw clockwise direction. → Pressure increases.
- Turn the adjusting screw counterclockwise direction. → Pressure decreases.

RELATED PAGE
2.24 Valve adaptor on page 2-96

# 5. Disassembling and assembling

## 5.1 Separating each block (ROPS model)

### 5.1.1 Draining coolant

**⚠ WARNING**

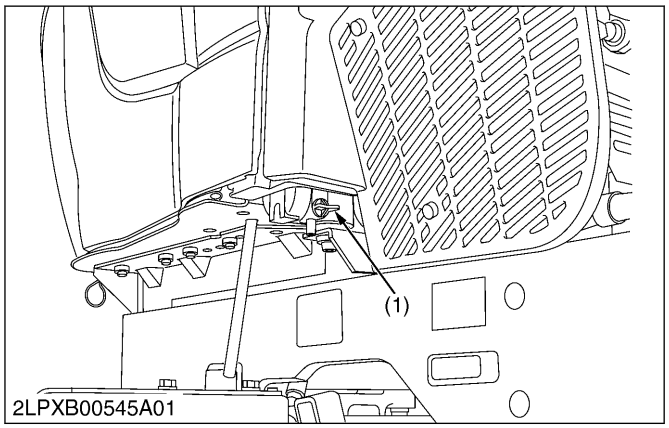
**To avoid personal injury:**

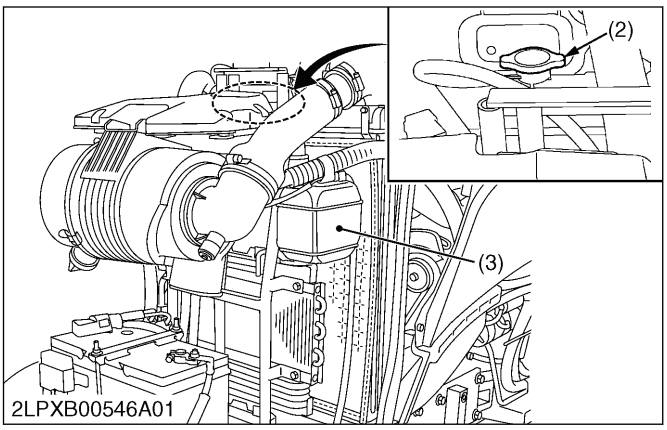
- **Do not remove radiator cap while coolant is hot. When cool, slowly rotate cap to the first stop and allow sufficient time for excess pressure to escape before removing the cap completely.**

**■ IMPORTANT**

- **Do not start engine without coolant.**
- **Use clean, fresh soft water and anti-freeze to fill the radiator and recovery tank.**
- **When mixing the anti-freeze with water, the anti-freeze mixing ratio is 50%.**
- **Tighten radiator cap securely. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**

1. Stop the engine and let the engine cool down.
2. To drain the coolant, open the radiator drain plug (1), remove the drain plug and remove radiator cap (2). The radiator cap must be removed to completely drain the coolant.




(1) Drain plug
(2) Radiator cap
(3) Recovery tank

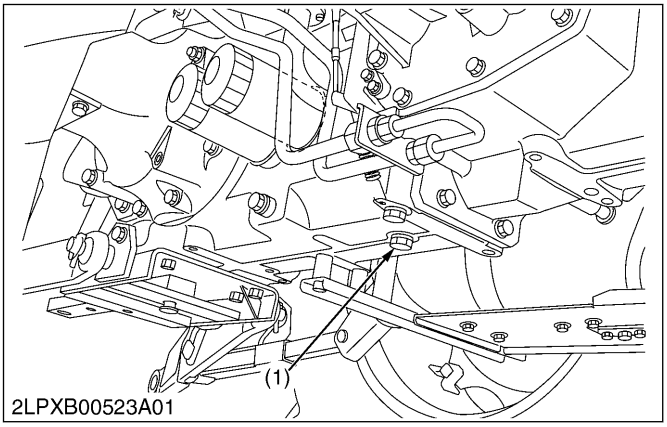
3. After all coolant is drained, reinstall the drain plug (1).
4. Fill with coolant up to the "**FULL**" mark of recovery tank (3).

| | |
|---|---|
| Coolant capacity | 10 L<br>10.6 U.S.qts<br>8.8 Imp.qts |

5. Start and operate the engine for a few minutes.
6. Stop the engine, remove the key and let cool.
7. Check coolant level of recovery tank (3) and add coolant if necessary.
8. Properly dispose of used coolant.

### 5.1.2 Draining transmission fluid

1. Place oil pan underneath the transmission case.
2. Remove the drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1).



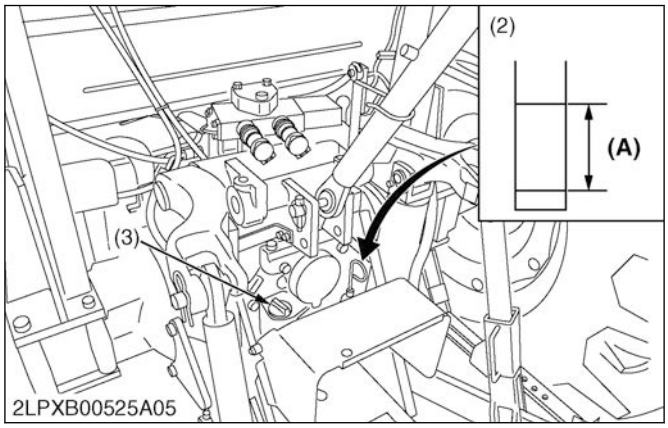

(1) Drain plug

**(When reassembling)**

**■ IMPORTANT**

- **For an enhanced ownership experience, we strongly recommend KUBOTA SUPER UDT. Use**

**of other oil may damage the transmission or hydraulic system.**
- **Do not mix different brands of fluid together.**

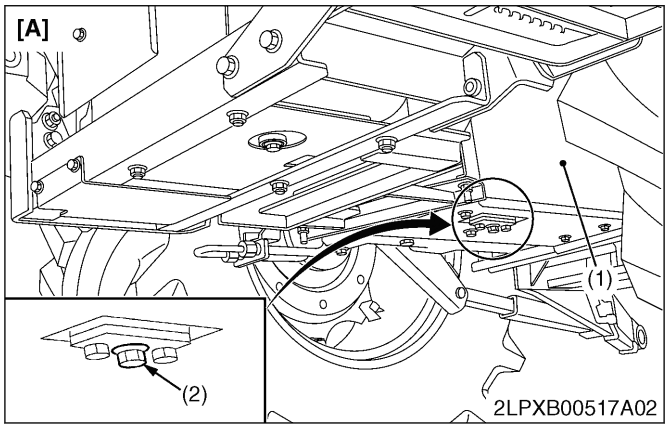


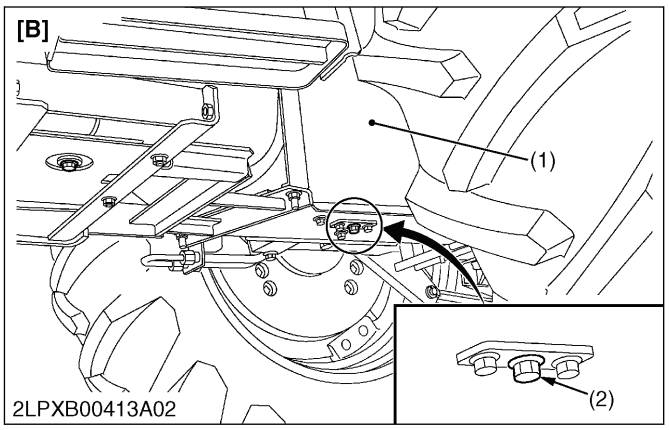

(2) Dipstick
(3) Filling port
(A) Oil level is acceptable within this range.

- Fill up from filling port (3) after removing the filling plug up to the upper notch on the dipstick (2).
- After operating the engine for a few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

| | | |
|---|---|---|
| Transmission fluid | Capacity | 60.0 L<br>16 U.S.gals<br>13 Imp.gals |

## 5.1.3 Draining fuel




(1) Fuel tank
(2) Drain plug
[A] ROPS model
[B] Cabin model

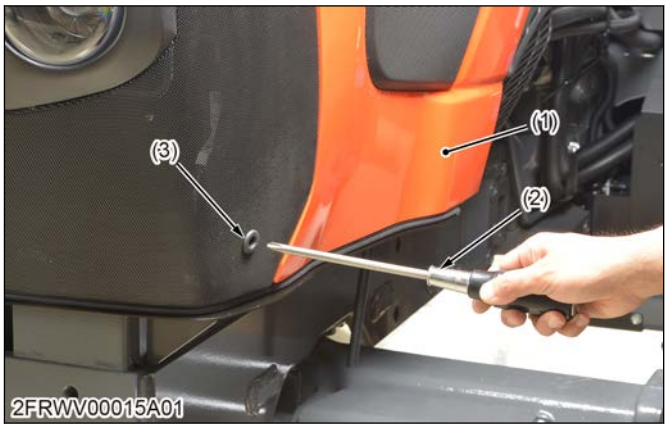
1. Place oil pans under the fuel tank (1).
2. Remove the drain plug (2) at the bottom of fuel tank (1).
3. Drain the fuel.
4. Reinstall the drain plug (2) on the fuel tank (1).

**(When reassembling)**
- Be sure to fix the seal washer is in the original position on the drain plug (2).

| | | |
|---|---|---|
| Fuel tank | Capacity | 105 L<br>27.7 U.S.gals<br>23.1 Imp.gals |

## 5.1.4 Opening bonnet

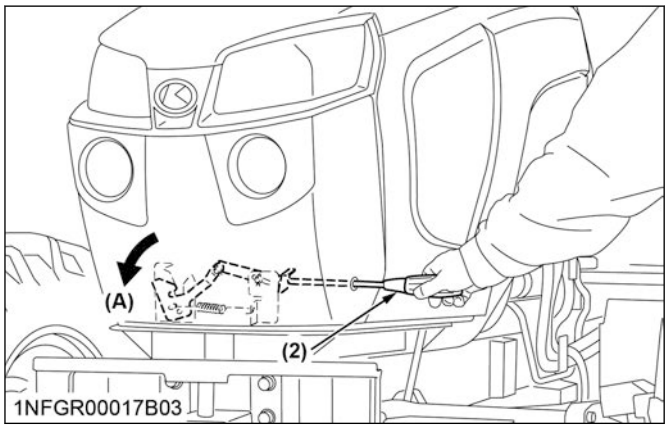
1. To open the bonnet (1), use a tool such as a screwdriver (2).




(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.

4. Pull the tool (2) and open the bonnet (1).




(2) Screwdriver (A) Unlock position

## 5.1.5 Removing bonnet and cover

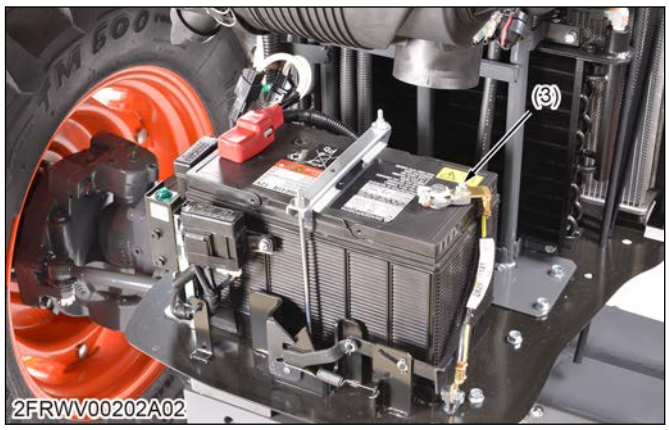
**IMPORTANT**

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

1. Remove the side bonnets (2) and the side covers (1) on both sides.

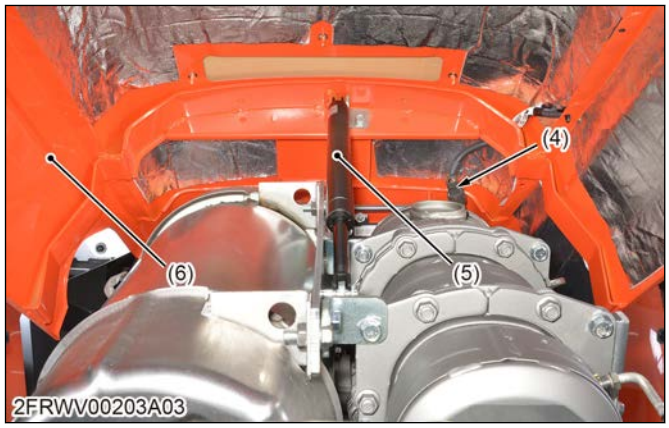

(1) Side cover (2) Side bonnet

2. Disconnect the negative cable (3) from the battery negative terminal.




(3) Negative cable

3. Disconnect the head light connector (4).
4. Remove the bonnet damper (5).
5. Remove the bonnet (6).

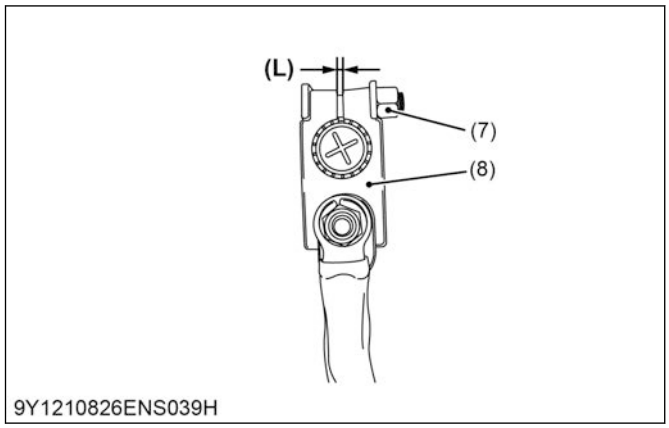



(4) Head light connector (6) Bonnet
(5) Bonnet damper

**(When reassembling)**

**IMPORTANT**

- **Tighten the battery cable terminal nut (7) so that the clearance (L) is within the following chart.**




(7) Terminal nut (L) Clearance between the battery cable terminal
(8) Battery cable terminal

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

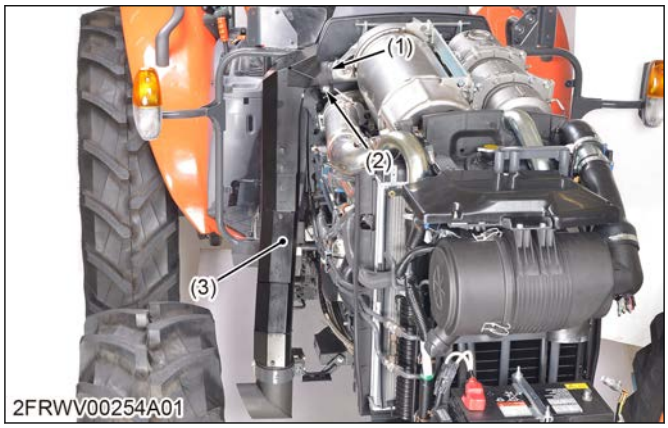
- When assembling the bonnet damper (5), be sure that the cylinder parts should be on the backward.

## 5.1.6 Removing muffler pipe

**CAUTION**

- **After operating the engine, muffler pipe is very hot. When removing the muffler pipe, wait a moment for cool down.**

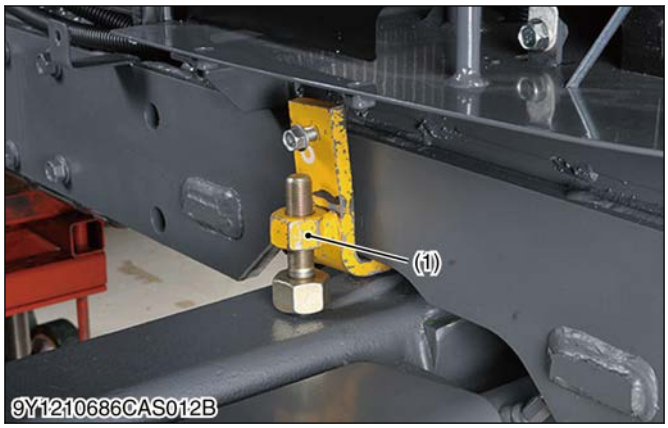
1. Remove the muffler pipe cover (3).
2. Loosen the muffler pipe fixing bolt (2) and nut
3. Remove the muffler pipe (1).




(1) Muffler pipe
(2) Muffler pipe fixing bolt
(3) Muffler pipe cover

## 5.1.7 Installing front axle rocking restrictor

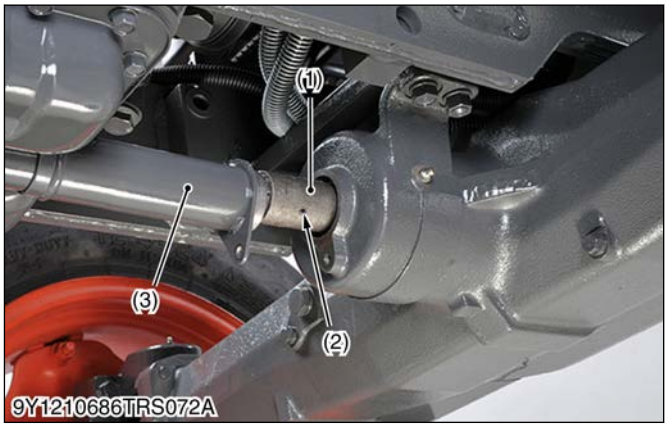
1. Chock the wheels and set the front axle rocking restrictor (1) to the front axle frame on both sides.

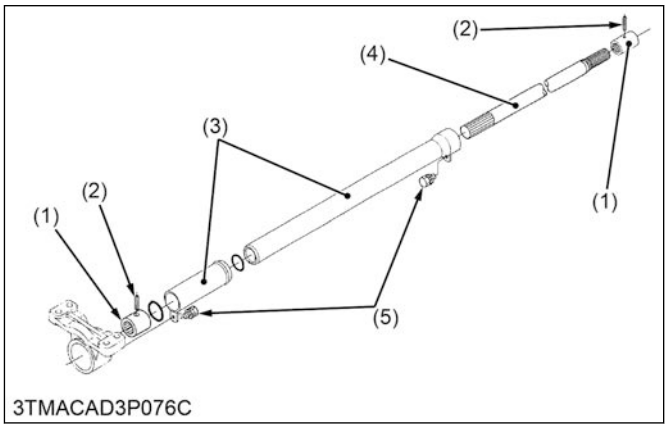


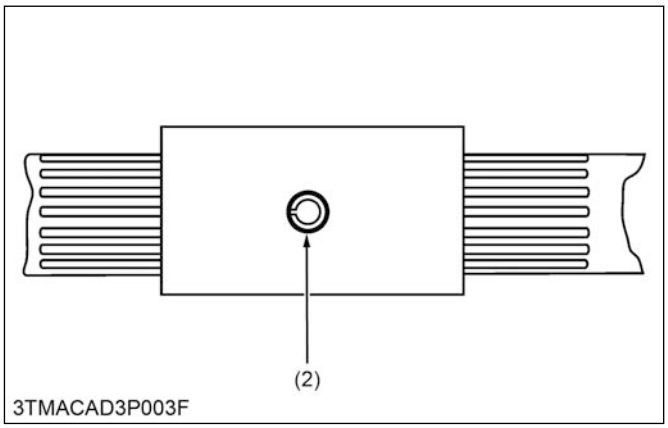

(1) Front axle rocking restrictor

## 5.1.8 Removing propeller shaft

1. Slide the propeller shaft covers (3) after removing the screws (5).
2. Tap out the roll pins (2).
3. Slide the couplings (1) and remove the propeller shaft (4).




(1) Coupling
(2) Roll pin
(3) Propeller shaft cover
(4) Propeller shaft
(5) Screw

**(When reassembling)**

- Apply the grease to the splines of couplings (1).
- Tap in the roll pins (2) as shown in the figure.

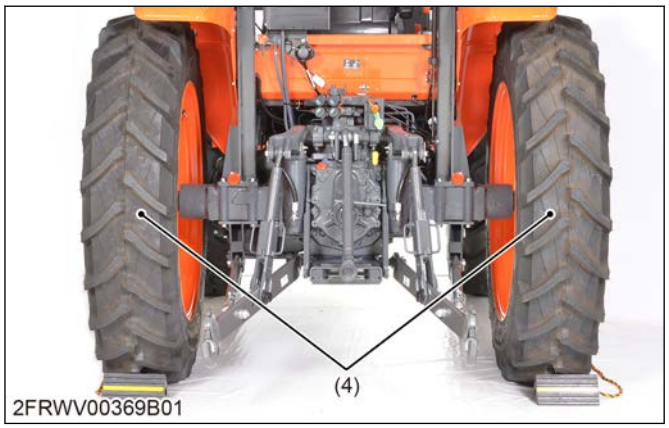
## 5.1.9 Removing ROPS upper frame and rear wheel

1. Support the ROPS upper frame with nylon sling and hoist.
2. Remove the damper (2).
3. Remove both side lynch pins (3).

4. Remove both side ROPS upper frame set bolts
5. Remove the ROPS upper frame (1).


(1) ROPS upper frame (3) Lynch pin
(2) Damper

6. Set the disassembling stand under the transmission case.
7. Remove the rear wheels (4).




(4) Rear wheel

**(When reassembling)**

- Be sure to set the disassembling stands under the rear axle case after removing the rear wheels.
- To assemble the ROPS, fix the upper frame with bolt temporarily, then tighten the ROPS under frame bolts evenly to the specified tightening torque.
- Tighten the rear wheel mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Rear wheel mounting nut | 343.2 to 393.3 N·m<br>35.0 to 40.1 kgf·m<br>253.2 to 290.0 lbf·ft |
| | ROPS under frame bolt | 260 to 304 N·m<br>26.6 to 30.9 kgf·m<br>192 to 224 lbf·ft |

## 5.1.10 Removing ROPS upper frame

1. Support the ROPS upper frame (1) with nylon sling and hoist.
2. Remove the damper (2).
3. Remove the both side lynch pins (3).
4. Remove the both side ROPS upper frame set bolts.
5. Remove the ROPS upper frame (1).


(1) ROPS upper frame (3) Lynch pin
(2) Damper

## 5.1.11 Removing seat

1. Disconnect the seat switch connector.
2. Remove the seat (1) with the seat suspension.


(1) Seat

**(When reassembling)**

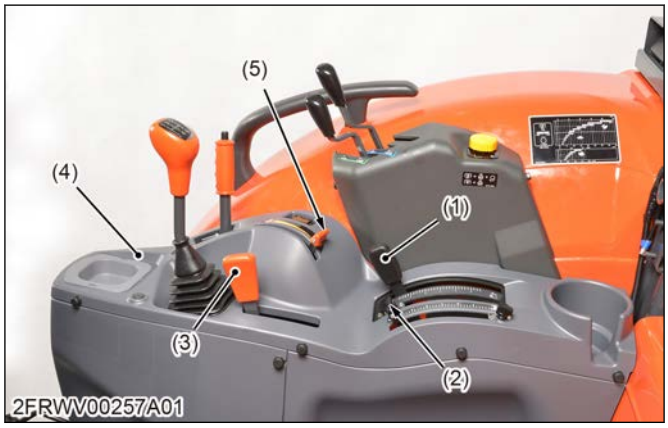
- Tighten the seat suspension mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Seat suspension mounting nut | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 5.1.12 Removing shift cover

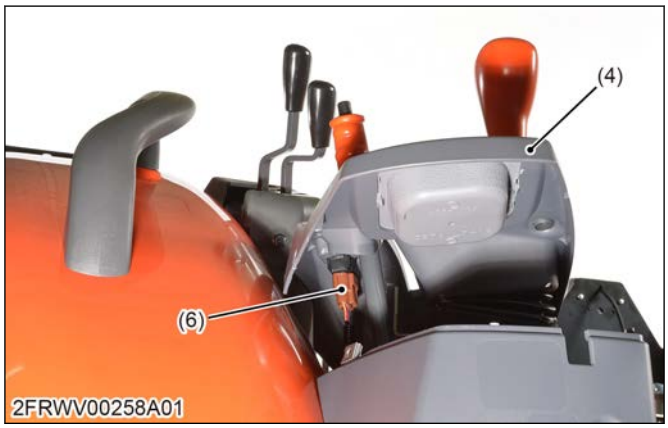
1. Remove the position control lever grip (1) and draft control lever grip (2).
2. Remove the range gear shift lever grip (3) and hand throttle lever grip (5).

3. Loosen the shift cover 1 (4) mounting bolts.




(1) Position control lever grip
(2) Draft control lever grip
(3) Range gear shift lever grip
(4) Shift cover 1
(5) Hand throttle lever grip

4. Disconnect the RPM dual memory switch connector (6).




(6) RPM dual memory switch connector

5. Remove the shift cover 2 (7) and shift cover 3 (8).

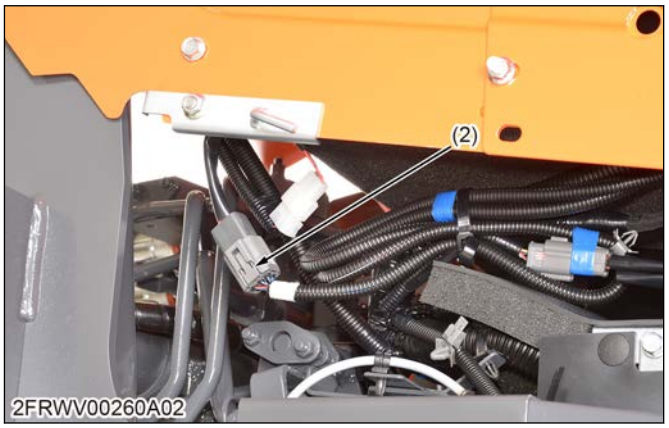

(7) Shift cover 2
(8) Shift cover 3

## 5.1.13 Removing auxiliary control wire

1. Disconnect the auxiliary control wires (1).

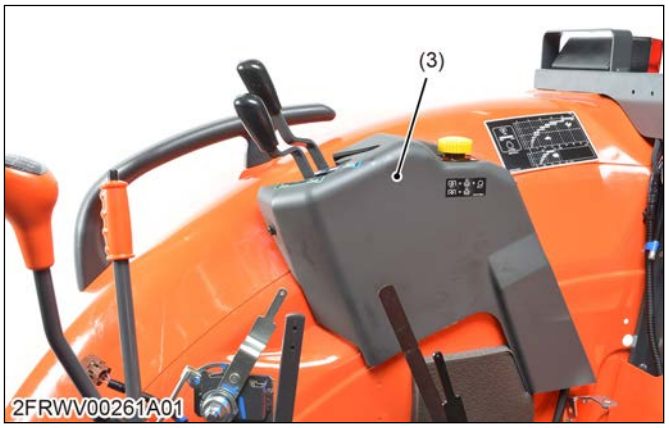

(1) Auxiliary control wire

2. Disconnect the PTO clutch switch connector (2).



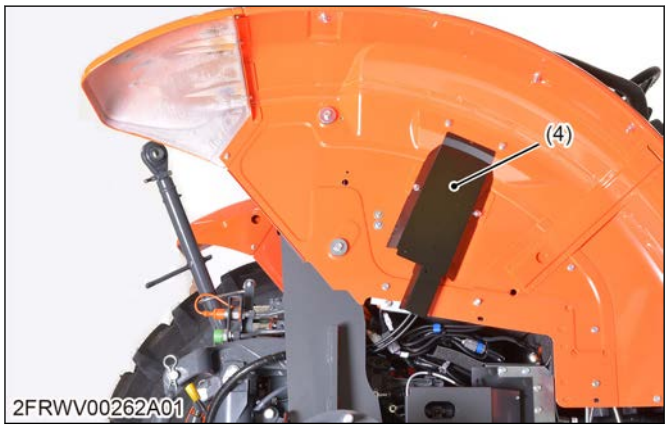

(2) PTO switch connector

3. Remove the auxiliary control lever cover (3).



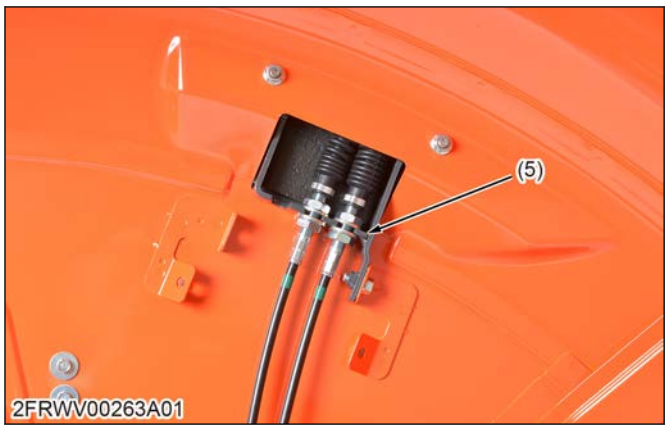

(3) Auxiliary control lever cover

4. Remove the cover (4).




(4) Cover

5. Remove the auxiliary control lever bracket (5) with auxiliary control wires.



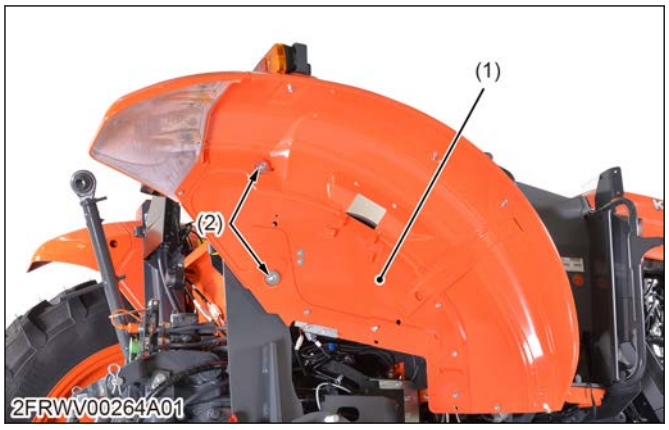

(5) Auxiliary control lever bracket

**(When reassembling)**

- Be sure to adjust the auxiliary control wires (1).

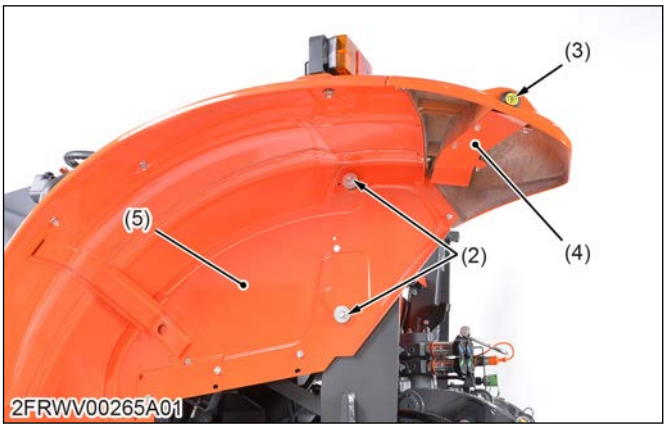
## 5.1.14 Removing fender

1. Disconnect the combination lamp connector.
2. Remove the fender mounting bolts and nut.
3. Remove the fender (R.H.) (1).




(1) Fender (R.H.) (2) Bolt

4. Disconnect the combination lamp connector.
5. Remove the cover (4) and disconnect the external PTO switch (3) connector.
6. Remove the fender (L.H.) (5).




(2) Bolt
(3) External PTO switch
(4) Cover
(5) Fender (L.H.)

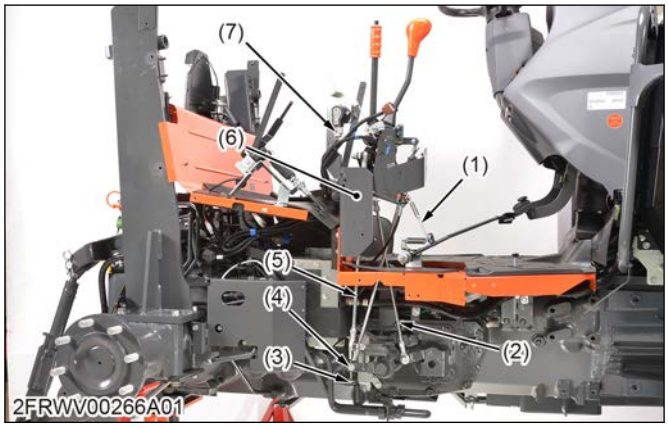
**(When reassembling)**

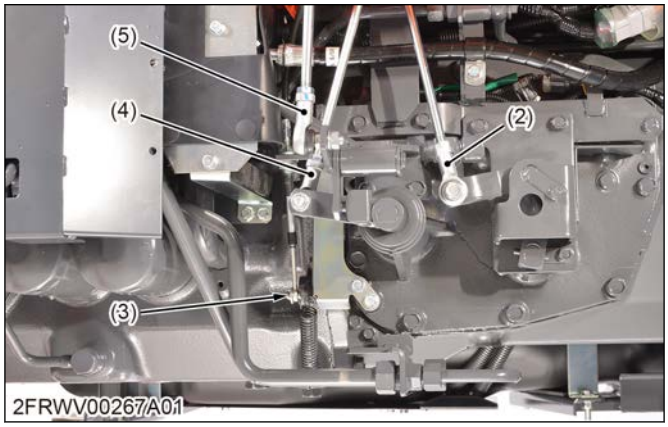
- Tighten the bolts (2) with the cushion rubbers, spacer and plane washer.

## 5.1.15 Removing shift lever linkage

1. Disconnect the parking brake lever connector and hand throttle lever sensor connector (7).
2. Disconnect the foot throttle linkage (1).
3. Disconnect the parking brake lever wire (3).
4. Disconnect the main shift lever rods (4) and selecting rod (5).
5. Disconnect the range gear shift rod (2).

6. Remove the shift rod bracket assembly (6).

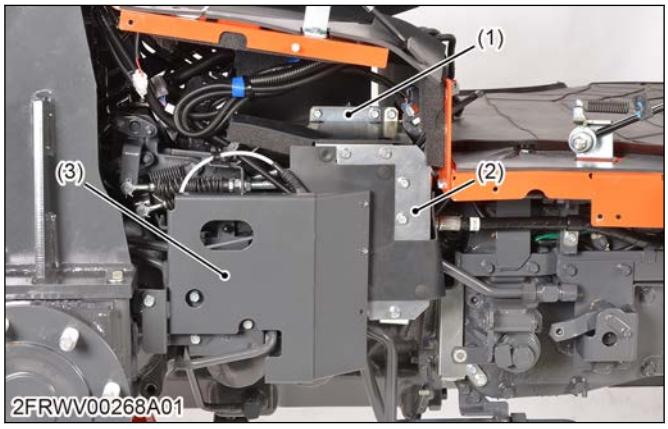



(1) Foot throttle linkage
(2) Range gear shift rod
(3) Parking brake lever wire
(4) Main gear shift rod
(5) Selecting rod
(6) Shift rod bracket assembly
(7) Hand throttle lever sensor connector

## 5.1.16 Removing hydraulic lever bracket

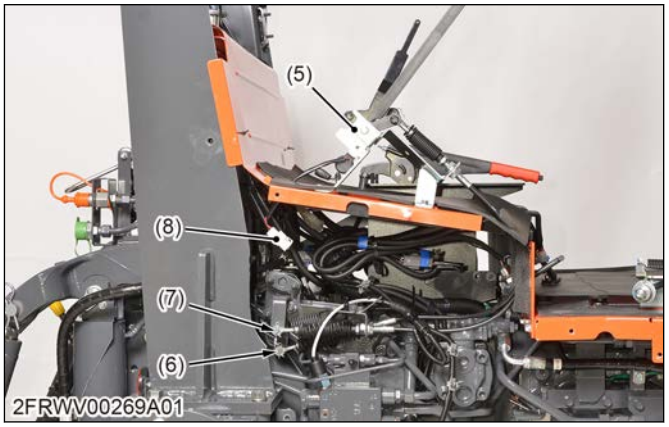
1. Remove the trailer brake valve cover (3).
2. Remove the cover 1 (2).
3. Remove the retaining nut (4) and cover 2 (1).





(1) Cover 2
(2) Cover 1
(3) Trailer brake valve cover
(4) Retaining nut

4. Disconnect the buzzer connector (8).
5. Disconnect the draft control wire (7) and position control wire (6).
6. Remove the hydraulic lever bracket (5).




(5) Hydraulic lever bracket
(6) Position control wire
(7) Draft control wire
(8) Buzzer connector

**(When reassembling)**

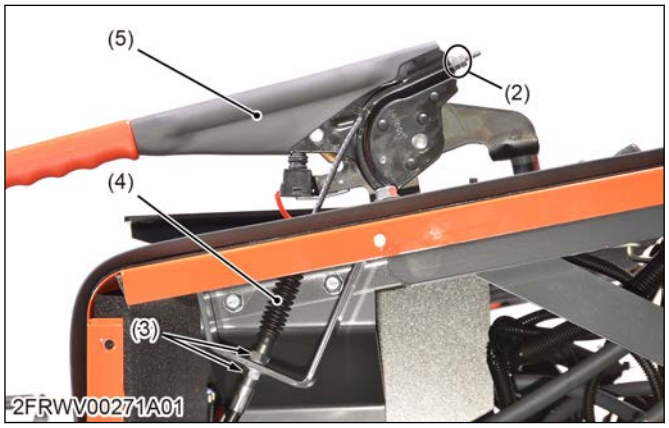
- Be sure to adjust the draft control wire (7) and position control wire (6).

## 5.1.17 Removing secondary brake lever

1. Disconnect the secondary brake lever switch connector (1).


(1) Secondary brake lever switch connector

2. Remove the lock nut and adjusting nut (2).
3. Loosen the secondary brake wire mounting nuts (3) and disconnect the secondary brake wire (4).
4. Remove the secondary brake lever (5).




(2) Lock nut and adjusting nut
(3) Secondary brake wire mounting nut
(4) Secondary brake wire
(5) Secondary brake lever

**(When reassembling)**

- Be sure to adjust the secondary brake wire (4).
- Adjust the free play of the secondary blare wire (4).

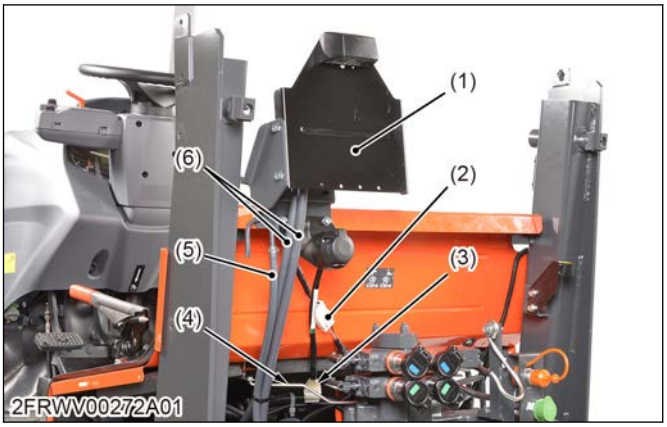
| | | |
|---|---|---|
| Secondary brake lever free play (Number of notches) | Factory specification | 3 notches |

- Tighten the secondary brake wire mounting nut (3), lock nut and adjusting nut (2) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Secondary brake wire mounting nut | 20 to 25 N·m<br>2.1 to 2.5 kgf·m<br>15 to 18 lbf·ft |
| | Lock nut and adjusting nut | 7.8 to 9.3 N·m<br>0.80 to 0.94 kgf·m<br>5.8 to 6.8 lbf·ft |

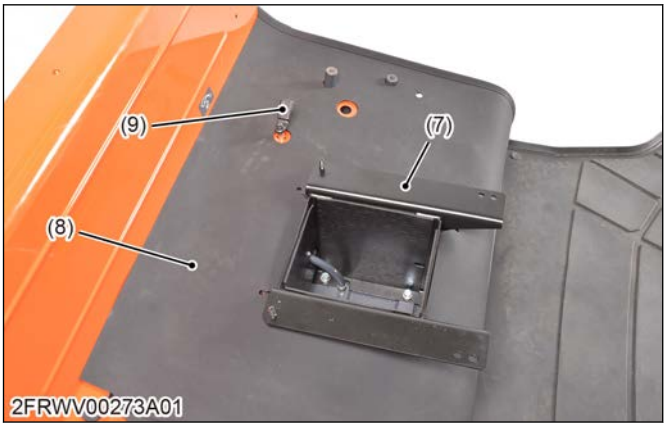
## 5.1.18 Removing floor sheet cover and ROPS under frame

1. Disconnect the breather hose for transmission case (5) and for fuel tank (6).
2. Disconnect the lowering speed rod (4).
3. Disconnect the trailer connector (3).
4. Disconnect the license lamp connector (2) and remove the license plate (1).



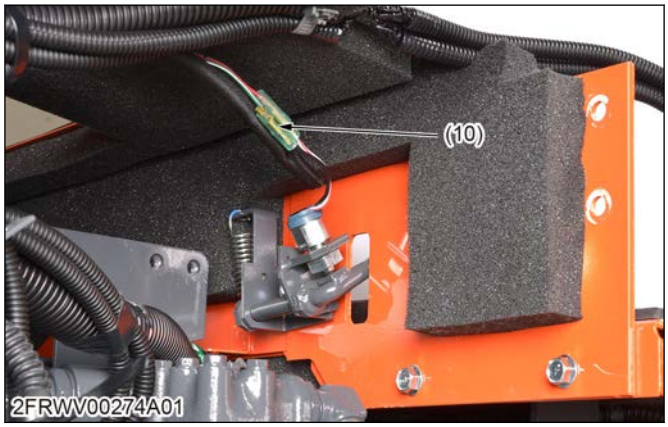

(1) License plate
(2) License lamp connector
(3) Trailer connector
(4) Lowering speed rod
(5) Breather hose for transmission case
(6) Breather hose for fuel tank

5. Remove the seat support (7) and lowering lock lever (9).
6. Remove the sound absorber (8).



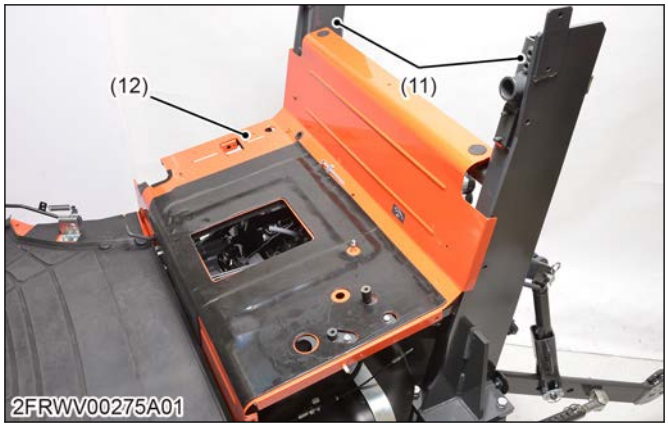

(7) Seat support
(8) Sound absorber
(9) Lowering lock lever

7. Disconnect the differential lock switch connectors (10).




(10) Differential lock switch connector

8. Remove the floor sheet cover (12).
9. Remove the ROPS under frames (11).




(11) ROPS under frames (12) Floor sheet cover

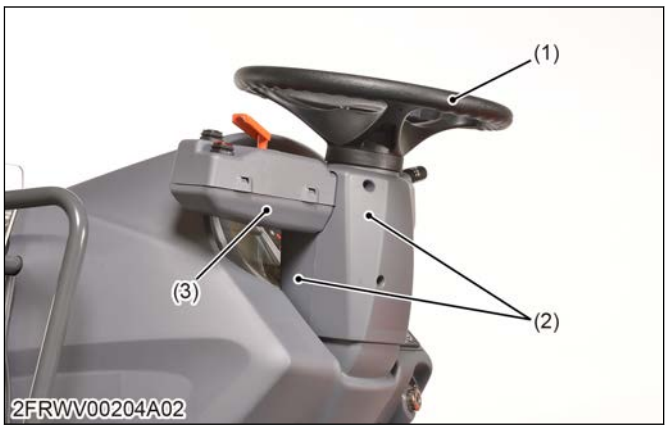
**(When reassembling)**

- Tighten the seat support mounting bolts and ROPS under frame mounting bolts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Seat support mounting bolt | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | ROPS under frame mounting bolt | 260 to 304 N·m<br>26.6 to 30.9 kgf·m<br>192 to 224 lbf·ft |

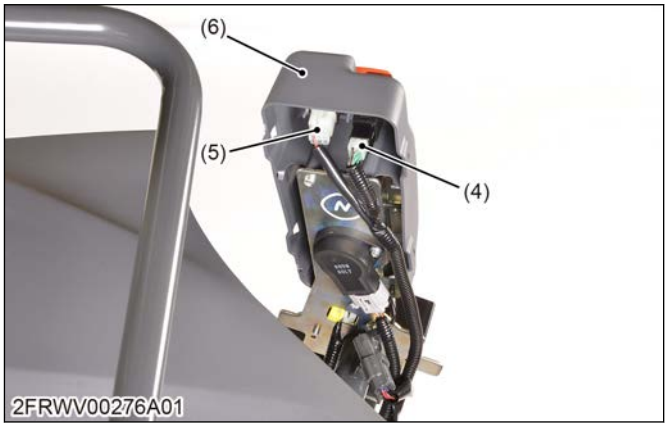
## 5.1.19 Removing steering and panel cover

1. Remove the steering post covers (2).
2. Remove the steering mounting nut and remove the steering (1).
3. Remove the shuttle under cover (3).




(1) Steering
(2) Steering post cover
(3) Shuttle under cover

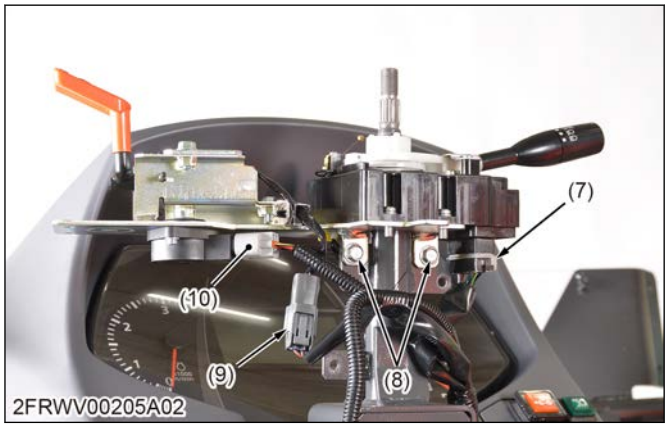
4. Disconnect the hazard switch connector (4) and auto differential lock switch connector (5).
5. Remove the shuttle upper cover (6).




(4) Hazard switch connector
(5) Auto differential lock switch connector
(6) Shuttle upper cover

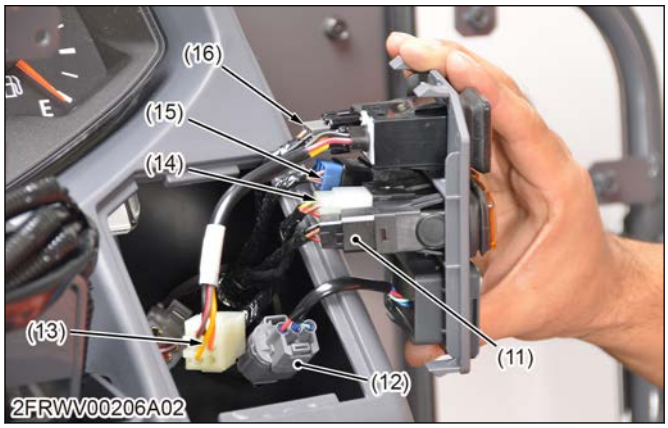
6. Disconnect the combination lever switch connector (7).
7. Disconnect the connector for shuttle lever neutral switch (9) and shuttle lever sensor connector (10).
8. Disconnect the horn connector.

9. Remove the combination lever mounting bolts (8) and then remove the combination lever switch assembly.



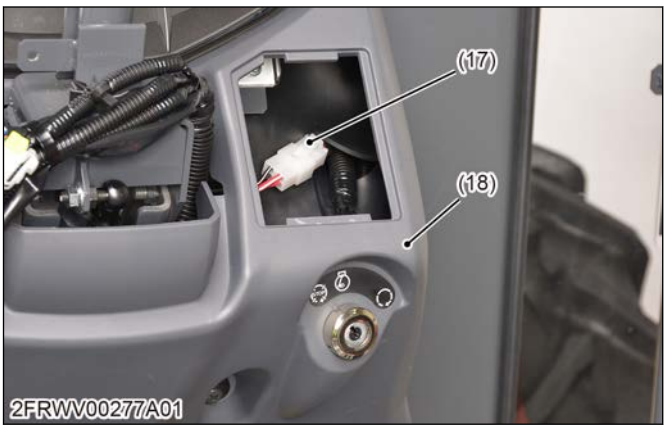

(7) Combination lever switch connector
(8) Combination lever switch mounting bolt
(9) Shuttle lever neutral switch connector
(10) Shuttle lever sensor connector

10. Disconnect the meter select switch connector (12) and 4WD switch connector (13).
11. Disconnect the connectors for parked regeneration switch (11) and DPF inhibit switch connector (14).
12. Disconnect the constant RPM management switch connector (15) and front work light switch connector (16).




(11) Parked regeneration switch
(12) Meter select switch connector
(13) 4WD switch connector
(14) DPF inhibit switch connector
(15) Constant RPM management switch connector
(16) Front work light switch connector

13. Disconnect the main switch connector (17).
14. Remove the panel cover (18).




(17) Main switch connector
(18) Panel cover

**(When reassembling)**

- Tighten the steering mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Steering mounting nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

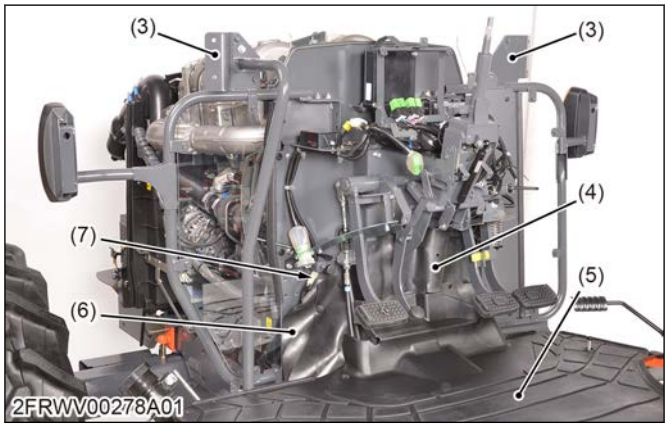
## 5.1.20 Removing guard and mat

1. Remove the meter panel (1).
2. Remove the insulator (2).


(1) Meter panel
(2) Insulator

3. Remove the mat (5) and insulator 1 (4) and insulator 2 (6).
4. Disconnect both side combination lamp connectors (7).

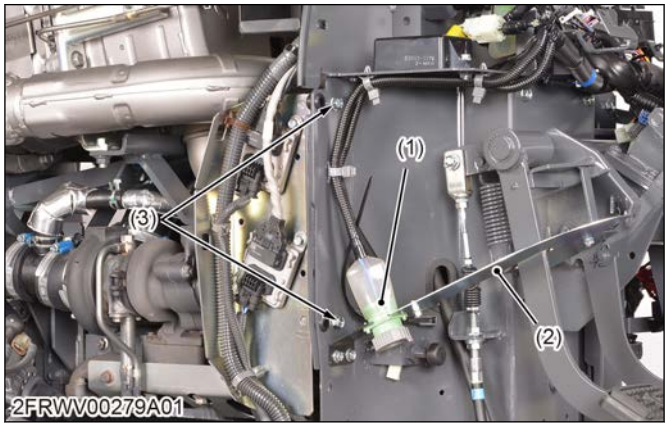
5. Remove both side guards (3).




(3) Guard
(4) Insulator 1
(5) Mat
(6) Insulator 2
(7) Combination lamp connector

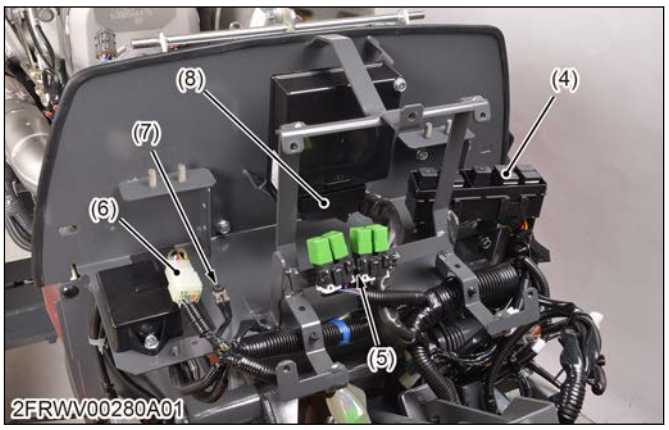
## 5.1.21 Removing wiring harness

1. Remove the plate (2).
2. Remove the K-OBD connector (1) mounting screws.
3. Remove the NOx sensor stay mounting bolts (3).



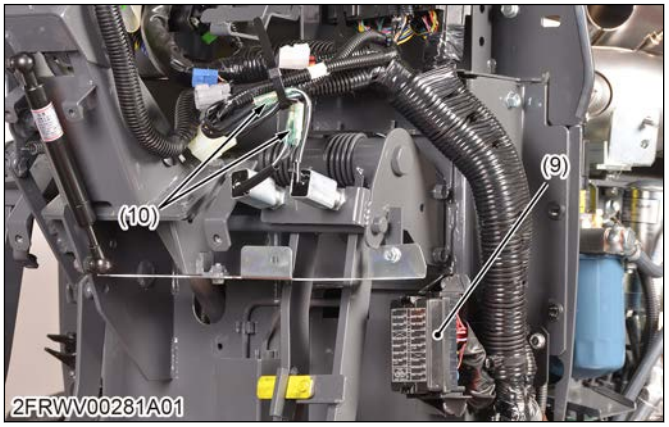

(1) K-OBD connector
(2) Plate
(3) NOx sensor stay mounting bolt

4. Disconnect the flasher unit connector (6) and grounding wire mounting screw (7).
5. Disconnect the tractor ECU connector (8), relays (5) and relay box (4).



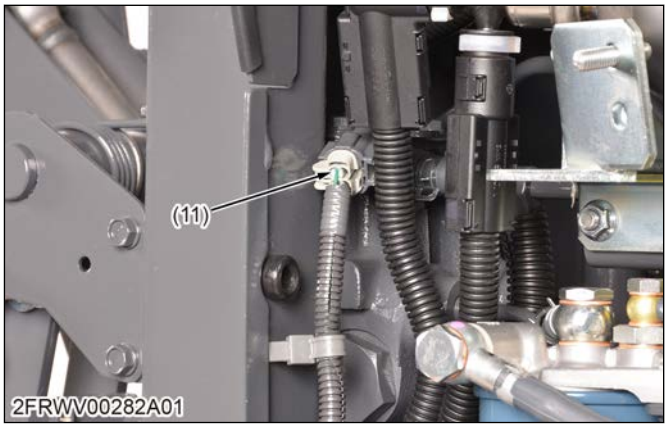

(4) Relay box
(5) Relay
(6) Flasher unit connector
(7) Grounding wire mounting screw
(8) Tractor ECU connector

6. Remove the fuse box (9).
7. Disconnect the brake switch connectors (10).




(9) Fuse box
(10) Brake switch connector

8. Disconnect the master cylinder oil level sensor connector (11).




(11) Master cylinder oil level sensor connector

9. Remove the step mounting bolts (12).
10. Disconnect the joint connectors (13).

11. Set aside the main harness to the front side.


(12) Step mounting bolt (13) Joint connector

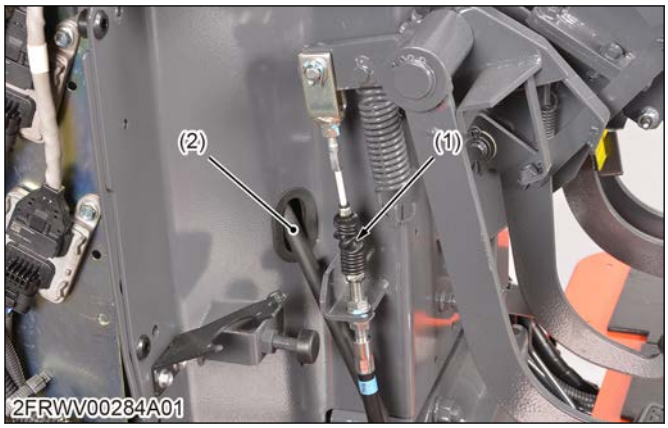
**(When reassembling)**

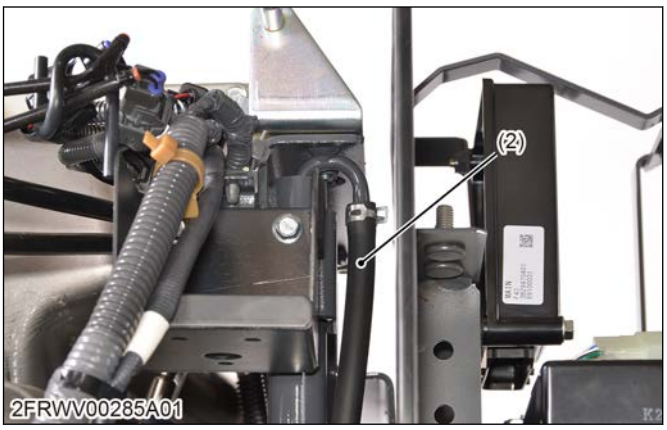
- Tighten the step mounting bolt (7T, M10) and the step mounting bolt (7T, M12) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Step mounting bolt (7T, M10) | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | Step mounting bolt (7T, M12) | 77.5 to 90.2 N·m<br>7.91 to 9.19 kgf·m<br>57.2 to 66.5 lbf·ft |

## 5.1.22 Disconnecting clutch cable and breather hose

1. Disconnect the clutch cable (1).
2. Remove the DEF tank breather hose (2).



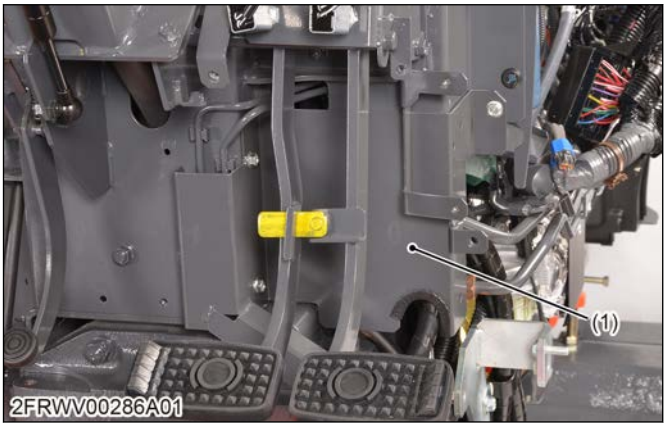

(1) Clutch cable (2) DEF tank breather hose

**(When reassembling)**

- Be sure to adjust the clutch cable for the clutch pedal free travel.

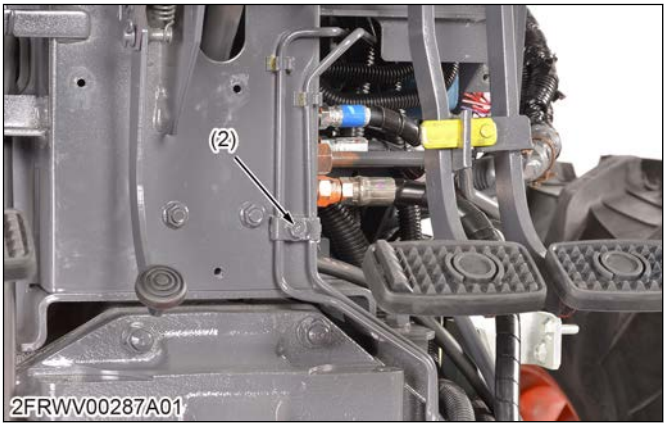
## 5.1.23 Disconnecting brake pipe and hose

1. Remove the steering support cover (1).




(1) Steering support cover

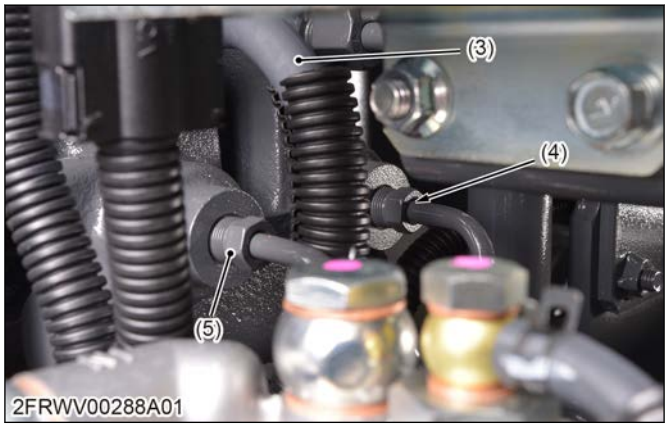
2. Remove the brake pipe clamp (2).




(2) Brake pipe clamp

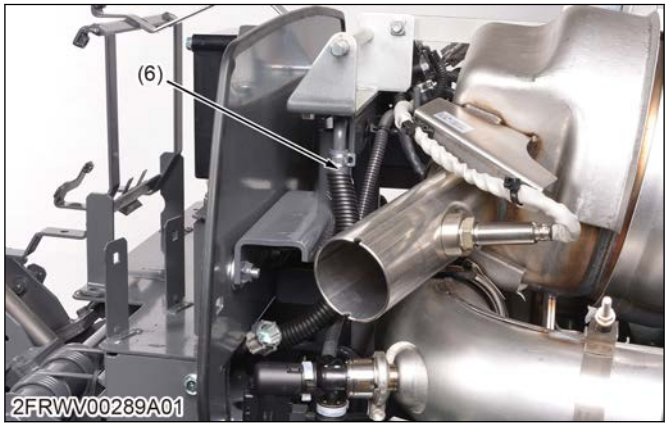
3. Disconnect the master cylinder return hose (3).
4. Disconnect the brake delivery pipe (R.H.) (5).

5. Disconnect the brake delivery pipe (L.H.) (4).




(3) Master cylinder return hose
(4) Brake delivery pipe (L.H.)
(5) Brake delivery pipe (R.H.)

6. Disconnect the breather hose (6).




(6) Breather hose

**(When reassembling)**

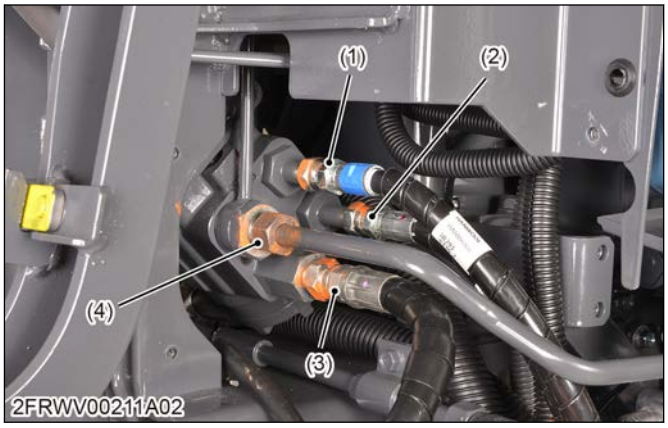
**■ IMPORTANT**

- **After assembling the brake delivery pipes, be sure to bleed the air from brake system.**
- Tighten the brake delivery pipe retaining nuts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Brake delivery pipe retaining nut | 23 to 27 N·m<br>2.3 to 2.8 kgf·m<br>17 to 20 lbf·ft |

## 5.1.24 Disconnecting steering controller pipe and hose

1. Disconnect the oil cooler pipe (4).
2. Disconnect the power steering delivery hose (3).
3. Disconnect the power steering delivery hose (L.H.) (1) and (R.H.) (2) from the power steering controller.




(1) Power steering delivery hose (L.H.)
(2) Power steering delivery hose (R.H.)
(3) Power steering delivery hose
(4) Oil cooler pipe

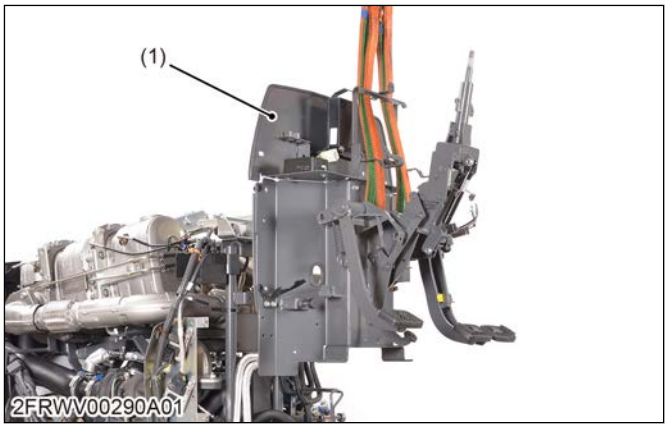
**(When reassembling)**

- Connect the power steering delivery hose (L.H.) (1) with blue tape to upper port of power steering controller.
- Tighten the power steering delivery hose (L.H.) (1) and (R.H) (2) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Power steering delivery hose retaining nut | 22.6 to 27.5 N·m<br>2.31 to 2.80 kgf·m<br>16.7 to 20.2 lbf·ft |

## 5.1.25 Removing steering support unit

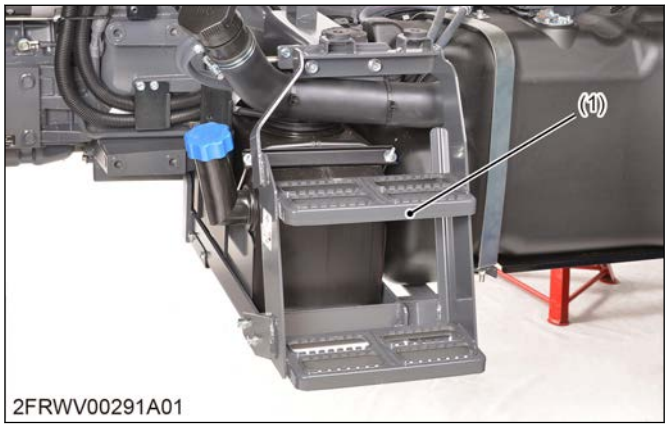
1. Set the steering support unit (1) with nylon sling and hoist.
2. Remove the steering support mounting bolts.
3. Remove the steering support unit (1).




(1) Steering support unit

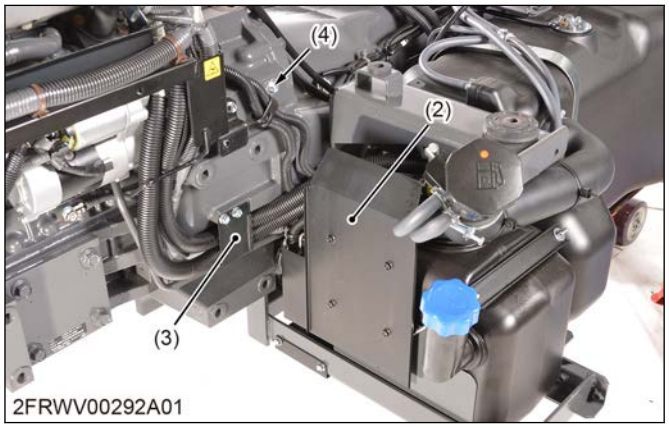
## 5.1.26 Removing DEF tank

1. Remove the auxiliary step (1).




(1) Auxiliary step

2. Remove the DEF tank protection plate (2).
3. Remove the plate (3) and hose clamp (4).

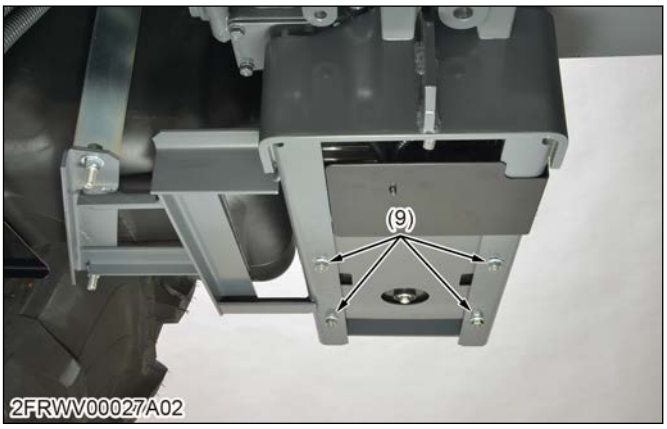



(2) DEF tank protection plate
(3) Plate
(4) Hose clamp

4. Remove the clamps (5).
5. Disconnect the breather hoses (7).
6. Remove the fuel filling hose mounting bolt (8).
7. Remove the fuel filling hose (6).

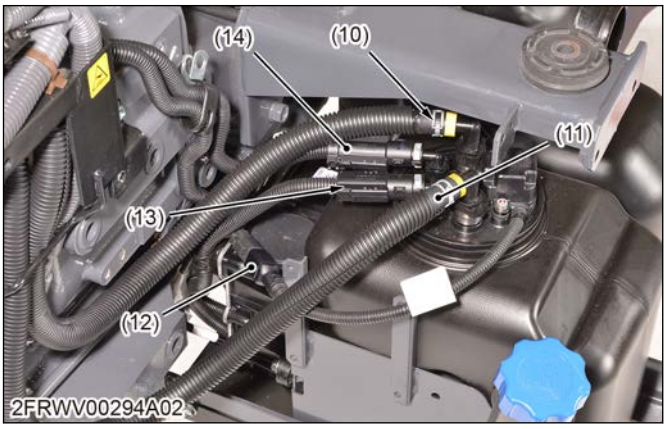

(5) Clamp
(6) Fuel filling hose
(7) Breather hose
(8) Fuel filling hose mounting bolt

8. Remove the DEF tank mounting nuts (9).




(9) DEF tank mounting nut

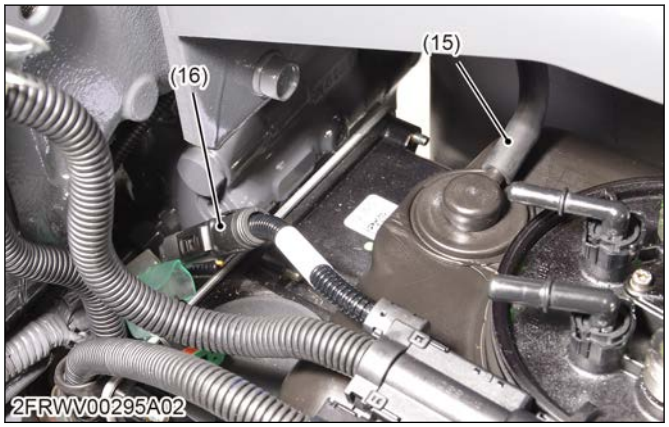
9. Disconnect the coolant return hose (10) and coolant hose (11).
10. Disconnect the DEF suction hose (13) and DEF return hose (14).
11. Disconnect the DEF tank header unit connector (12).




(10) Coolant return hose
(11) Coolant hose
(12) DEF tank header unit connector
(13) DEF suction hose
(14) DEF return hose

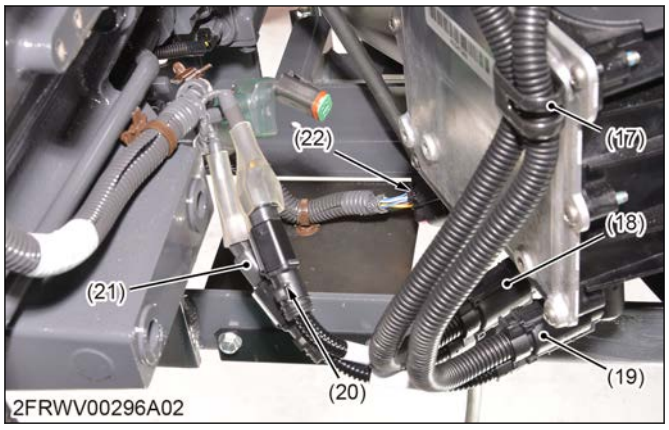
12. Disconnect the DEF tank breather hose (15).

13. Disconnect the DEF return hose electric heater connector (16).




(15) DEF tank breather hose
(16) DEF return hose electric heater connector

14. Draw out the DEF tank to tractor outside from the tank stay.
15. Remove the clamp (17).
16. Disconnect the DEF suction hose (19) and DEF suction hose electric heater connector (21).
17. Disconnect the DEF delivery hose (18) and DEF delivery hose electric heater connector (20).
18. Disconnect the DEF pump connector (22).




(17) Clamp
(18) DEF delivery hose
(19) DEF suction hose
(20) DEF delivery hose electric heater connector
(21) DEF suction hose electric heater connector
(22) DEF pump connector

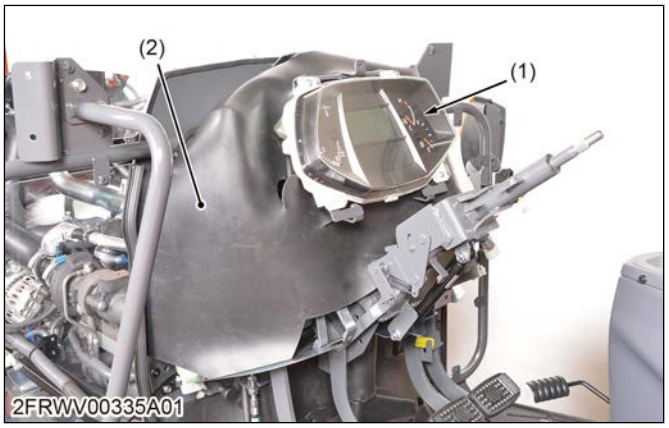
19. Remove the DEF tank.


**(When reassembling)**

- Connect the DEF return hose (14) to backward of DEF tank unit.
- Connect the DEF suction hose (13) to forward of DEF tank unit.
- Connect the DEF delivery hose (18) to backward of DEF pump.
- Connect the DEF suction hose (19) to forward of DEF pump.

## 5.1.27 Removing wiring harness

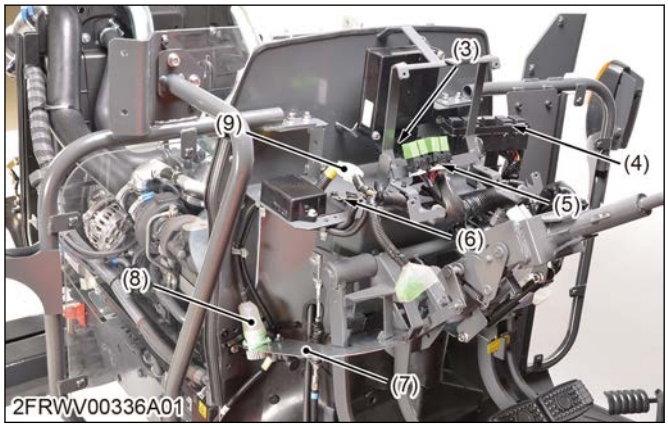
1. Remove the meter panel (1).
2. Remove the insulator (2).




(1) Meter panel
(2) Insulator

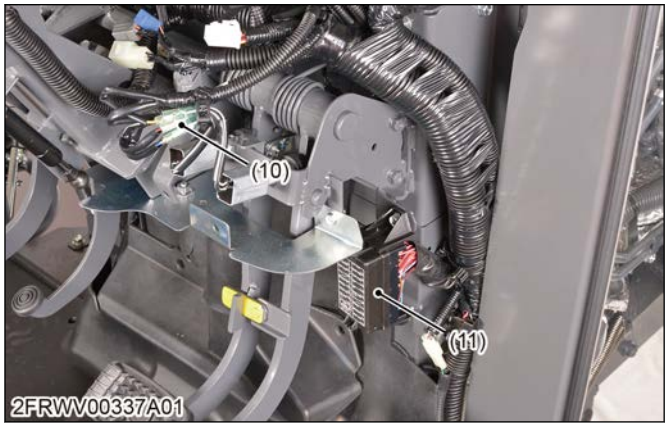
3. Remove the plate (7).
4. Remove the K-OBD connector (8) mounting screws.
5. Disconnect the flasher unit connector (9) and grounding cable mounting screw (6).

6. Disconnect the tractor ECU connector (3), relays (5) and relay box (4).




(3) Tractor ECU connector
(4) Relay box
(5) Relay
(6) Grounding cable mounting screw
(7) Plate
(8) K-OBD connector
(9) Flasher unit connector

7. Disconnect the brake switch connectors (10).
8. Remove the fuse box (11).



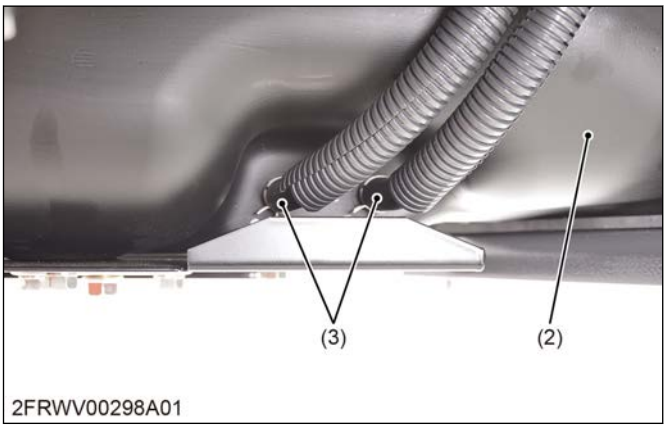

(10) Brake switch connector
(11) Fuse box

## 5.1.28 Removing fuel tank

1. Disconnect the fuel level sensor connector (1).
2. Disconnect the clamps of breather hose.


(1) Fuel lever sensor connector
(2) Fuel tank

3. Disconnect the fuel hoses (3) from the fuel tank (2).




(2) Fuel tank
(3) Fuel hose

4. Set the disassembling stands under the fuel tank (2).

5. Remove the front and rear support mounting bolts and nuts (4), (5) of fuel tank (2).

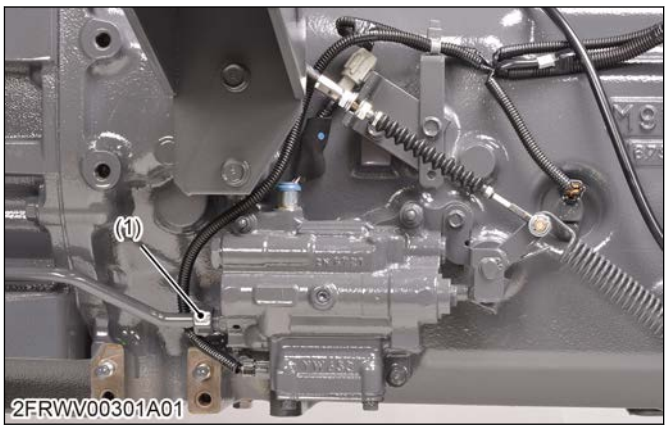


(4) Front support mounting bolt and nut (5) Rear support mounting bolt and nut

6. Lower the fuel tank (2) together with disassembling stands.

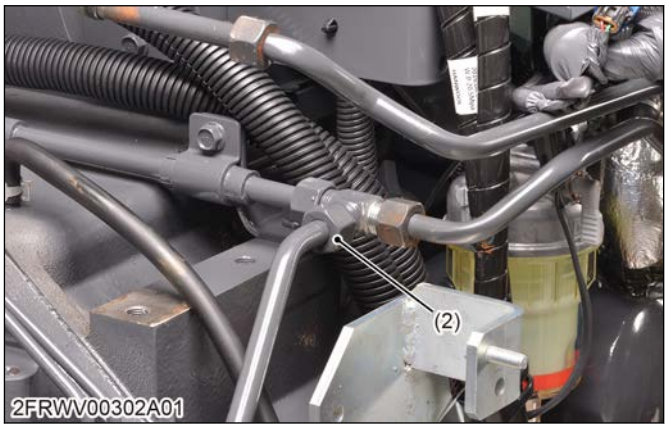

## 5.1.29 Disconnecting hydraulic pipe

1. Disconnect the shuttle valve delivery pipe (1).




(1) Shuttle valve delivery pipe

2. Disconnect the oil cooler return pipe (2).




(2) Oil cooler return pipe

**(When reassembling)**

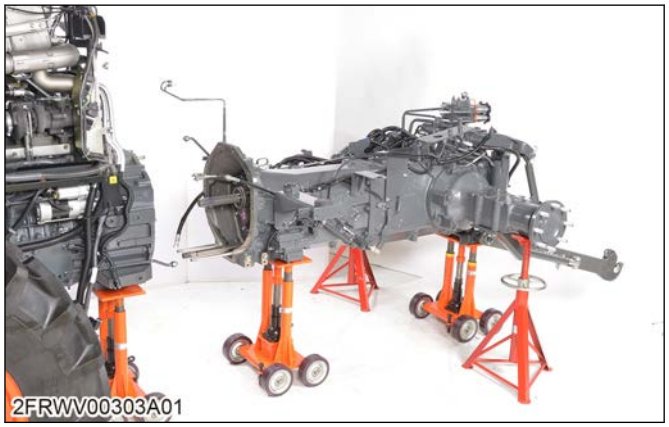
- Tighten the power steering delivery hose and shuttle valve delivery pipe to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Power steering delivery hose | 45.1 to 53.0 N·m<br>4.60 to 5.40 kgf·m<br>33.3 to 39.0 lbf·ft |
| | Shuttle valve delivery pipe | 34.5 to 39.2 N·m<br>3.52 to 3.99 kgf·m<br>25.5 to 28.9 lbf·ft |

## 5.1.30 Separating clutch housing from engine

1. Set the disassembling stands under the engine (flywheel housing) and the clutch housing.
2. Remove the mounting bolts and nuts between the engine (flywheel housing) and the clutch housing.

3. Separate engine (flywheel housing) and the clutch housing.




**(When reassembling)**

- Apply molybdenum disulphide (Three Bond 1901 or its equivalents) to the splines of damper disk boss.
- Apply liquid gasket (Three Bond 1211 / 1141 or its equivalents) to the joint face of the engine (flywheel housing) and clutch housing.
- Tighten the engine (flywheel housing) and clutch housing mounting bolt (M14, 9T) to the specified tightening torque.

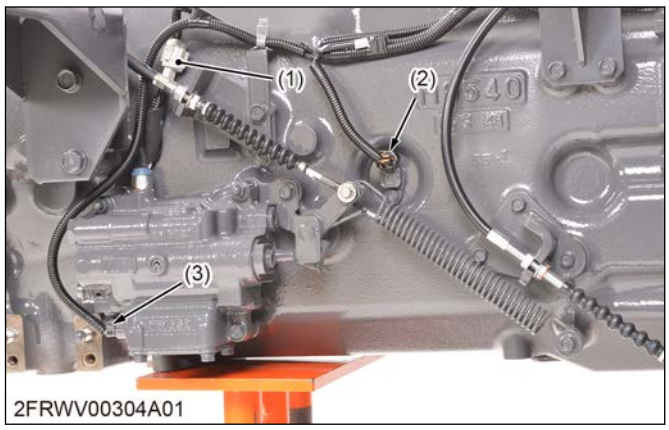
| | | |
|---|---|---|
| Tightening torque | Engine and clutch housing mounting bolt (M14, 9T) | 166.7 to 196.1 N·m<br>17.0 to 19.99 kgf·m<br>123.0 to 144.6 lbf·ft |

- Tighten the engine (flywheel housing) and clutch housing mounting nut (M14, 7T) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Engine and clutch housing mounting nut (M14, 7T) | 123.6 to 147.1 N·m<br>12.61 to 15.00 kgf·m<br>91.17 to 108.4 lbf·ft |

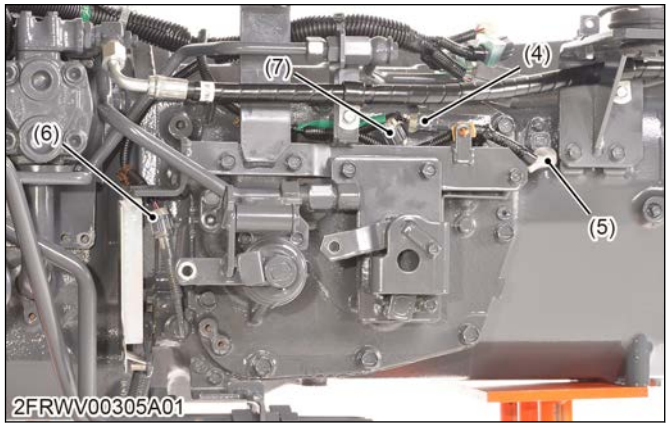
## 5.1.31 Disconnecting connector for clutch housing case

1. Disconnect the shuttle valve spool neutral switch connector (1) and shuttle solenoid connector (3).
2. Disconnect the traveling speed sensor connector (2).




(1) Shuttle valve spool neutral switch connector
(2) Traveling speed sensor connector
(3) Shuttle solenoid connector

3. Disconnect the shuttle rotation sensor connector (5).
4. Disconnect the main gear shift (6th) switch connector (4).
5. Disconnect the range gear shift (Hi) switch connector (7).
6. Remove the gear lock parking detect switch cover mounting bolt and then disconnect the gear lock parking detect switch connector (6).

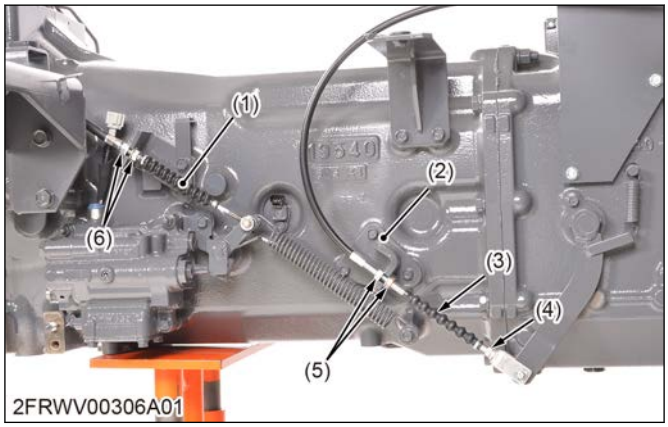



(4) Main gear shift (6th) switch connector
(5) Shuttle rotation sensor connector
(6) Gear lock parking detect switch connector
(7) Range gear shift (Hi) switch connector

## 5.1.32 Disconnecting secondary brake cable and clutch cable

1. Loosen the clutch cable mounting nuts (6) and disconnect the clutch cable (1).

2. Loosen the secondary brake cable mounting nuts (5) and disconnect the secondary brake cable (3).




(1) Clutch cable
(2) Cable stay
(3) Secondary brake cable
(4) Secondary brake cable adjusting nut 1
(5) Secondary brake cable mounting nut
(6) Clutch cable mounting nut

**(When reassembling)**

- Be sure that the split pin of joint pin is bent to both sides.
- Be sure to adjust the free play of the secondary brake cable.

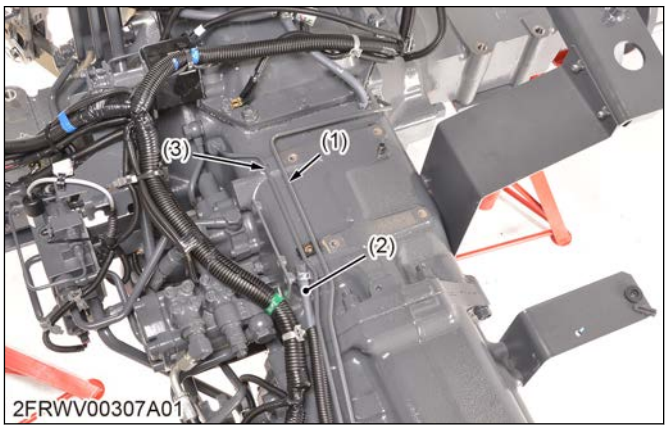
| | | |
|---|---|---|
| Secondary brake lever free play (Number of notches) | Factory specification | 3 notches |

- Tighten the secondary brake cable mounting nuts (5) to the specified tightening torque.
- Tighten the secondary brake cable adjusting nut 1 (4) to the specified tightening torque.
- Tighten the cable stay (2) mounting bolts to the specified tightening torque.
- Tighten the clutch cable mounting nuts (6) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Secondary brake cable mounting nut | 20 to 25 N·m<br>2.1 to 2.5 kgf·m<br>15 to 18 lbf·ft |
| | Secondary brake cable adjusting nut 1 | 7.8 to 9.3 N·m<br>0.80 to 0.94 kgf·m<br>5.8 to 6.8 lbf·ft |
| | Secondary brake cable adjusting nut 1 | 17.1 to 20.6 N·m<br>1.75 to 2.10 kgf·m<br>12.7 to 15.1 lbf·ft |
| | Cable stay mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |
| | Clutch cable mounting nut | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 5.1.33 Disconnecting brake pipe

1. Disconnect the breather hose (2).
2. Disconnect the brake delivery pipe (R.H.) (3) and (L.H.) (1).




(1) Brake delivery pipe (L.H.)
(2) Breather hose
(3) Brake delivery pipe (R.H.)

**(When reassembling)**

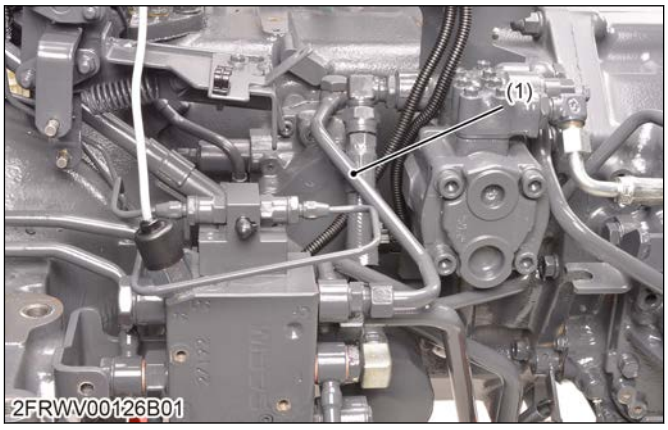
**IMPORTANT**

- **After assembling the brake delivery pipes, bleed the air from brake system.**
- Tighten the brake delivery pipe retaining nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Brake delivery pipe retaining nut | 20 to 28 N·m<br>2.1 to 2.8 kgf·m<br>15 to 20 lbf·ft |

## 5.1.34 Disconnecting hydraulic pipe for 3-point hitch

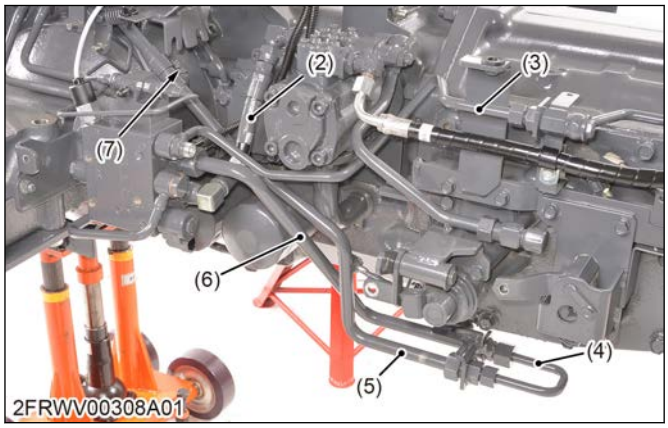
1. Remove the solenoid valve delivery pipe (1).




(1) Solenoid valve delivery pipe

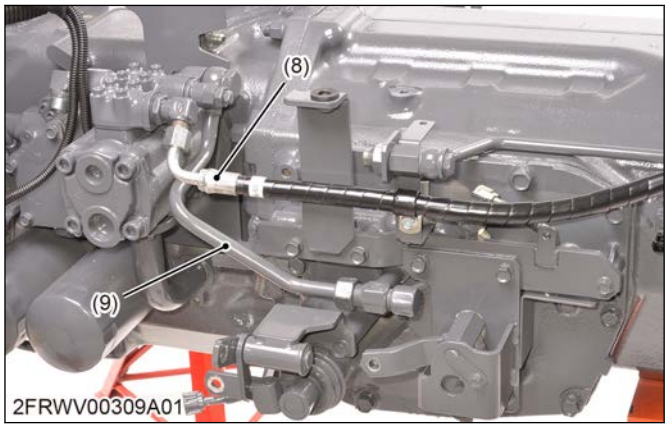
2. Remove the oil cooler return pipe (3).
3. Remove the U pipe (4).
4. Remove the 3-point hitch delivery pipe 1 (6).
5. Remove the delivery hose (2).

6. Remove the clamp mounting bolt (7).
7. Remove the 3-point hitch delivery pipe 2 (5).




(2) Delivery hose
(3) Oil cooler return pipe
(4) U pipe
(5) 3-point hitch delivery pipe 2
(6) 3-point hitch delivery pipe 1
(7) Clamp mounting bolt

8. Remove the power steering delivery hose (8).
9. Remove the return pipe (9).




(8) Power steering delivery hose (9) Return pipe

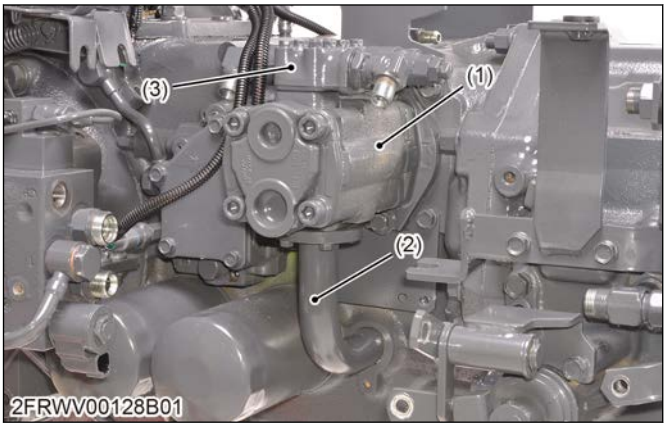
**(When reassembling)**

- Tighten the delivery hose (2) retaining nut to the specified tightening torque.
- Tighten the fitting and elbow of delivery hose to the specified tightening torque.
- Tighten the 3-point hitch delivery pipe 2 retaining nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Delivery hose retaining nut | 57.6 to 70.4 N·m<br>5.88 to 7.17 kgf·m<br>42.5 to 51.9 lbf·ft |
| | Fitting of delivery hose (Trailer brake valve side) | 100 to 110 N·m<br>10.2 to 11.2 kgf·m<br>73.8 to 81.1 lbf·ft |
| | Elbow of delivery hose (Hydraulic pump side) | 73.5 to 83.4 N·m<br>7.50 to 8.50 kgf·m<br>54.3 to 61.5 lbf·ft |
| | 3-point hitch delivery pipe 2 retaining nut | 108 to 117 N·m<br>11.0 to 12.0 kgf·m<br>79.6 to 86.7 lbf·ft |

## 5.1.35 Removing hydraulic pump

1. Remove the relief valve folder and pump flange (3).
2. Remove the suction pipe (2).
3. Remove the hydraulic pump (1).





(1) Hydraulic pump
(2) Suction pipe
(3) Pump flange

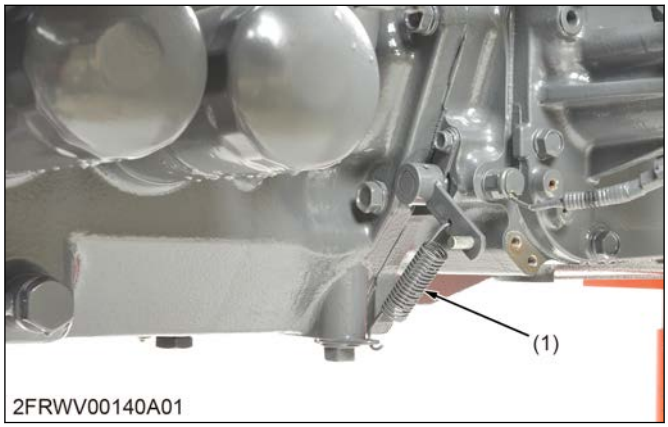
**(When reassembling)**

- Replace the O-ring with new one.
- Apply the transmission oil to the O-ring.
- Tighten the relief valve folder and pump flange (3) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Pump flange mounting bolt | 9.80 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.23 to 8.33 lbf·ft |
| | Relief valve folder mounting bolt | 9.80 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.23 to 8.33 lbf·ft |

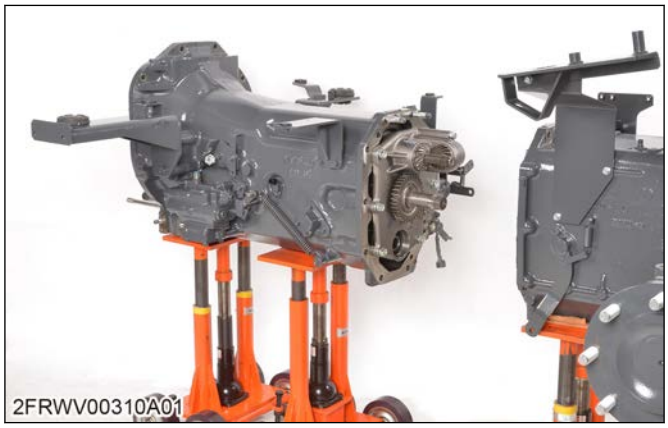
## 5.1.36 Separating clutch housing from transmission case

1. Remove the gear lock parking brake return spring (1).




(1) Gear lock parking brake return spring

2. Set the disassembling stands under the clutch housing and the transmission case.
3. Remove the mounting bolts and nuts between the clutch housing and the transmission case.
4. Separate the clutch housing and the transmission case.



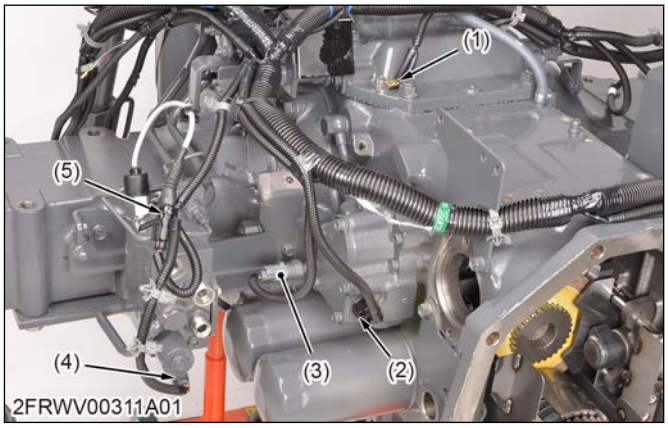

**(When reassembling)**

- Apply liquid gaskets (Three Bond TB1206C or its equivalents) to the joint face of the clutch housing and the transmission case.
- Tighten the clutch housing and transmission case mounting bolt (M14, 7T) to the specified tightening torque.
- Tighten the clutch housing and transmission case mounting nut (M14, 9T) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Clutch housing and transmission case mounting bolt (M14, 7T) | 123.6 to 147.1 N·m<br>12.61 to 15.00 kgf·m<br>91.17 to 108.4 lbf·ft |
| | Clutch housing and transmission case mounting nut (M14, 9T) | 166.7 to 196.1 N·m<br>17.00 to 19.99 kgf·m<br>123.0 to 144.6 lbf·ft |

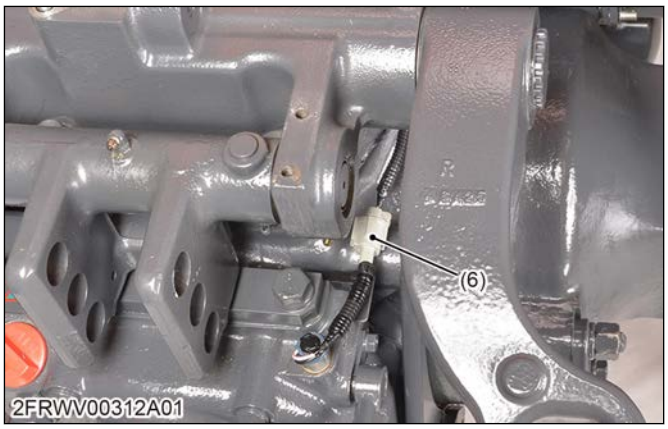
## 5.1.37 Disconnecting connector for transmission case

1. Remove the grounding cable mounting bolt (1).
2. Disconnect the solenoid valve connector (2) and 2WD clutch pressure switch connector (3).
3. Disconnect the trailer brake solenoid connector (4) and trailer brake pressure switch connector (5).




(1) Grounding cable mounting bolt
(2) Solenoid valve connector
(3) 2WD clutch pressure switch connector
(4) Trailer brake solenoid connector
(5) Trailer brake pressure switch connector

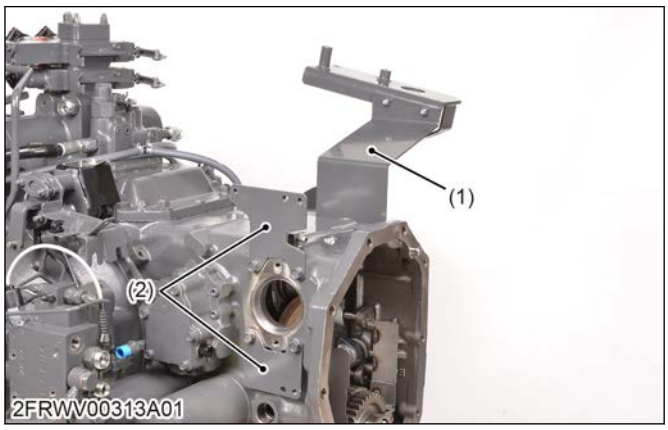
4. Remove the PTO speed detect switch and disconnect the PTO speed detect switch connector (6).




(6) PTO speed detect switch connector

## 5.1.38 Removing pump cover and secondary brake stay

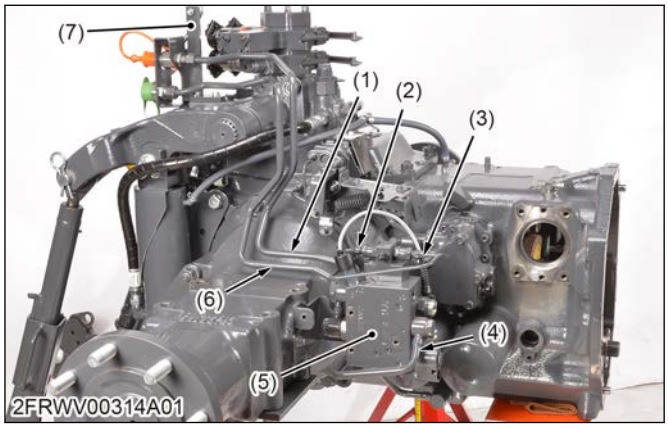
1. Remove the secondary brake stay (1).
2. Remove the pump covers (2).




(1) Secondary brake stay (2) Pump cover

## 5.1.39 Removing trailer brake valve

1. Remove the trailer brake return pipe (4).
2. Remove the trailer brake actuating pipe (R.H.) (3) and trailer brake actuating pipe (L.H.) (2).
3. Remove the trailer brake pipe 1 (6) and trailer brake pipe 2 (1) together with top link holder (7).
4. Remove the trailer brake valve (5).



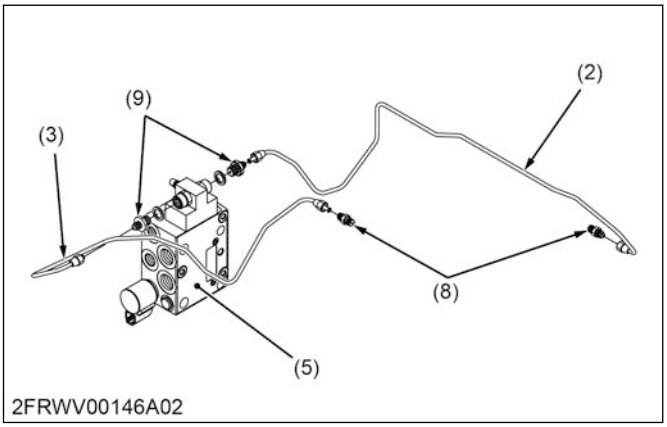

(1) Trailer brake pipe 2
(2) Trailer brake actuating pipe (L.H.)
(3) Trailer brake actuating pipe (R.H.)
(4) Trailer brake return pipe
(5) Trailer brake valve
(6) Trailer brake pipe 1
(7) Top link holder

**(When reassembling)**

**■ IMPORTANT**

- **After assembling the trailer brake valve, be sure to bleed the air from the brake system.**

- Tighten the trailer brake return pipe (4), trailer brake pipes (1), (6) to the specified tightening torque.
- If the trailer brake actuating pipe connector (8) was removed, wrap the seal tape to the transmission case side of connector (8).
- If the trailer brake actuating pipe joint (9) was removed, replace the gasket with new one.
- Tighten the trailer brake actuating pipe joint (9) and trailer brake actuating pipe connector (8) to the specified tightening torque.

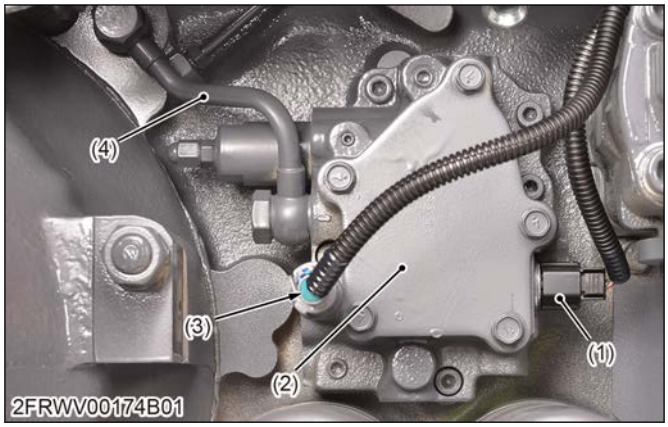



(2) Trailer brake actuating pipe (L.H.)
(3) Trailer brake actuating pipe (R.H.)
(5) Trailer brake valve
(8) Trailer brake actuating pipe connector
(9) Trailer brake actuating pipe joint

| | | |
|---|---|---|
| Tightening torque | Trailer brake return pipe joint bolt (Trailer brake valve side) | 63.7 to 73.5 N·m<br>6.50 to 7.49 kgf·m<br>47.0 to 54.2 lbf·ft |
| | Trailer brake return pipe joint bolt (Transmission case side) | 75 to 85 N·m<br>7.7 to 8.6 kgf·m<br>56 to 62 lbf·ft |
| | Trailer brake pipe 1 joint bolt (Trailer brake valve side) | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 1 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake pipe 2 joint bolt | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 2 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake actuating pipe | 15.7 to 23.5 N·m<br>1.60 to 2.39 kgf·m<br>11.6 to 17.3 lbf·ft |
| | Trailer brake actuating pipe joint (Trailer brake valve side) | 35 to 40 N·m<br>3.6 to 4.0 kgf·m<br>26 to 29 lbf·ft |
| | Trailer brake actuating pipe connector (Transmission case side) | 9.80 to 14.7 N·m<br>1.00 to 1.49 kgf·m<br>7.23 to 10.8 lbf·ft |

## 5.1.40 Removing solenoid valve assembly

1. Disconnect the solenoid valve connector (1) and 2WD clutch pressure switch connector (3).
2. Disconnect the PTO clutch delivery pipe (4).
3. Remove the solenoid valve assembly (2).




(1) Solenoid valve connector
(2) Solenoid valve assembly
(3) 2WD clutch pressure switch connector
(4) PTO clutch delivery pipe

**(When reassembling)**
- Replace the O-rings with new one (5).
- Apply transmission fluid to the O-rings (5).

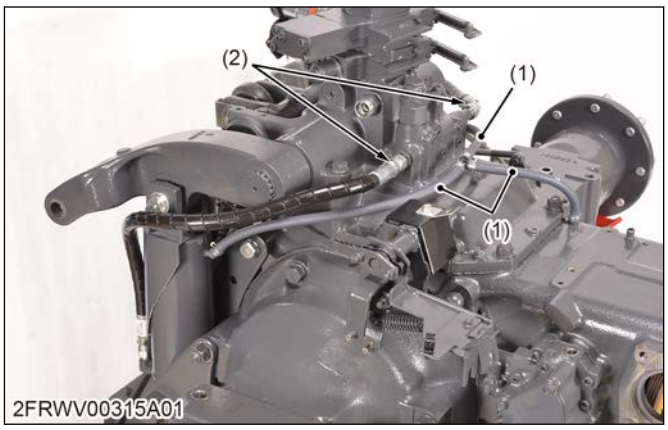

(5) O-ring

- Apply liquid gasket (Three Bond 1206C or equivalent) to joint face of transmission case and solenoid valve assembly.

## 5.1.41 Removing 3-point linkage and hydraulic cylinder

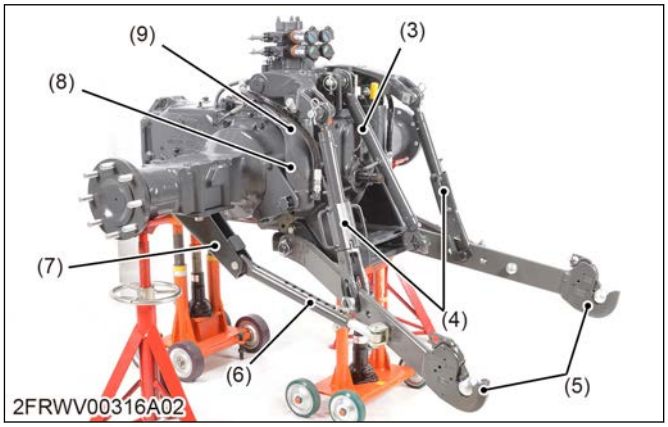
**NOTE**
- **Be careful not to damage the grease fitting when removing the hydraulic cylinder pin.**

1. Remove the hydraulic cylinder delivery hoses (2).
2. Remove the hydraulic cylinder breather hoses (1).




(1) Hydraulic cylinder breather hose
(2) Hydraulic cylinder delivery hose

3. Remove the top link (3).
4. Remove the stabilizers (6), lower links (5) and lift rods (4) on both sides.
5. Remove the brackets (7) on both sides.
6. Remove the hydraulic cylinder covers (9) on both sides.
7. Remove the hydraulic cylinders (8) on both sides.




(3) Top link
(4) Lift rod
(5) Lower link
(6) Stabilizer
(7) Bracket
(8) Hydraulic cylinder
(9) Hydraulic cylinder cover

**(When reassembling)**
- Apply grease to the grease fitting.
- Be careful not to damage the grease fitting when reassembling the hydraulic cylinder.
- Tighten the hydraulic cylinder delivery hoses (2) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Hydraulic cylinder delivery hose retaining nut | 46 to 53 N·m<br>4.6 to 5.4 kgf·m<br>34 to 39 lbf·ft |

## 5.1.42 Removing PTO gear case assembly

1. Remove the PTO gear case assembly mounting screws.

2. Remove the PTO gear case and PTO drive shaft as a unit.

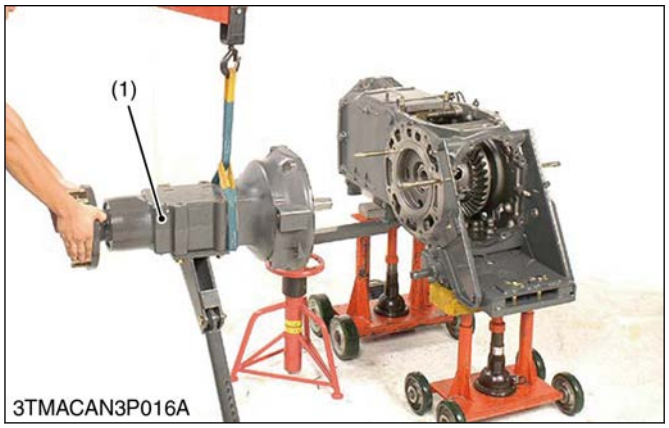

**(When reassembling)**

- Apply liquid gasket (Three Bond 1206C or its equivalents) to the joint face of the transmission case and the PTO gear case assembly.
- Tighten the PTO gear case assembly mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | PTO gear case assembly mounting screw | 78 to 90 N·m<br>7.9 to 9.2 kgf·m<br>58 to 66 lbf·ft |

### 5.1.43 Removing rear axle case assembly

1. Remove the rear axle case mounting screws and nuts.
2. Remove the rear axle case assembly (1).




(1) Rear axle case assembly

**(When reassembling)**

- Apply liquid gasket (Three Bond 1206C or its equivalents) to the joint face of the transmission case and the rear axle case.
- Temporally tighten all bolt and nut for rear axle case assembly.
- After temporally tighten all bolt and nut, firstly tighten the nut of most forward.
  And then, tighten the bolt of most rearward.
- Tighten the rear axle case mounting screw and nut (M16, 9T) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Rear axle case mounting screw and nut (M16, 9T) | 260.0 to 304.1 N·m<br>26.52 to 31.00 kgf·m<br>191.8 to 224.2 lbf·ft |

## 5.2 Separating each block (Cabin model)

### 5.2.1 Draining coolant

**⚠ WARNING**

**To avoid personal injury:**

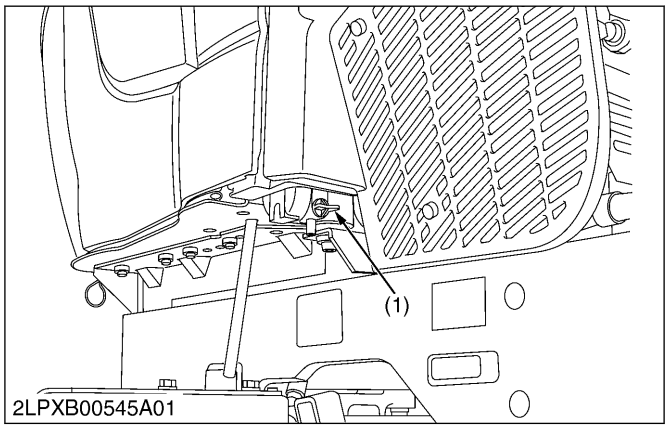
- **Do not remove radiator cap while coolant is hot. When cool, slowly rotate cap to the first stop and allow sufficient time for excess pressure to escape before removing the cap completely.**

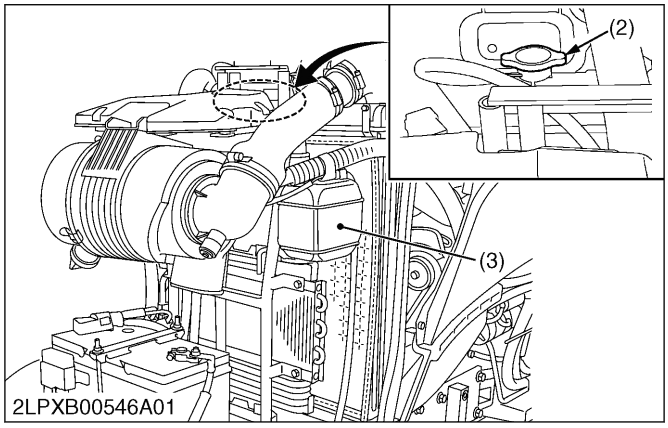
**■ IMPORTANT**

- **Do not start engine without coolant.**
- **Use clean, fresh soft water and anti-freeze to fill the radiator and recovery tank.**
- **When mixing the anti-freeze with water, the anti-freeze mixing ratio is 50%.**
- **Tighten radiator cap securely. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**

1. Stop the engine and let the engine cool down.

2. To drain the coolant, open the radiator drain plug (1), remove the drain plug and remove radiator cap (2). The radiator cap must be removed to completely drain the coolant.




(1) Drain plug
(2) Radiator cap
(3) Recovery tank

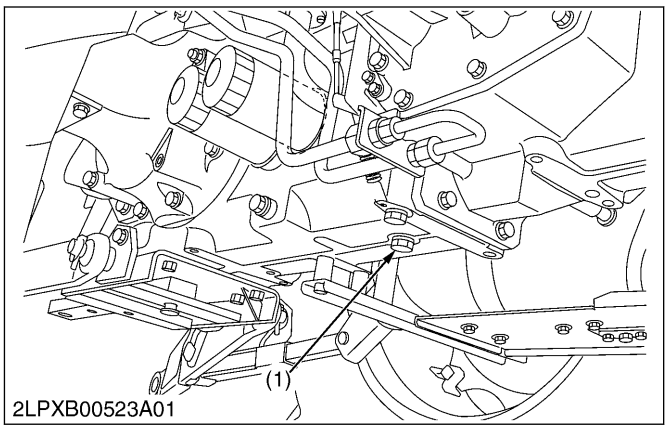
3. After all coolant is drained, reinstall the drain plug (1).
4. Fill with coolant up to the "**FULL**" mark of recovery tank (3).

| | |
|---|---|
| Coolant capacity | 10 L<br>10.6 U.S.qts<br>8.8 Imp.qts |

5. Start and operate the engine for a few minutes.
6. Stop the engine, remove the key and let cool.
7. Check coolant level of recovery tank (3) and add coolant if necessary.
8. Properly dispose of used coolant.

## 5.2.2 Draining transmission fluid

1. Place oil pan underneath the transmission case.
2. Remove the drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1).

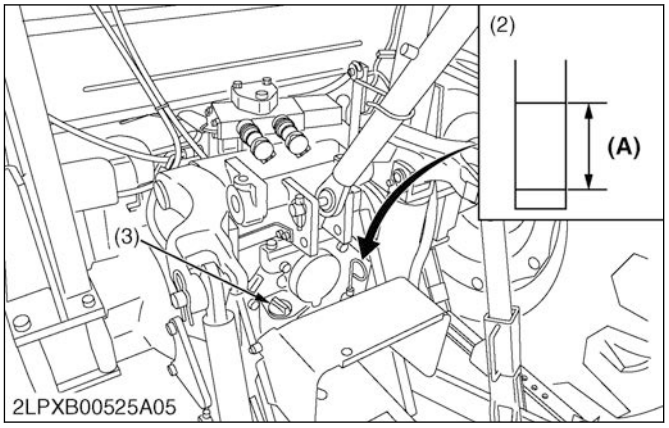



(1) Drain plug

**(When reassembling)**

**■ IMPORTANT**

- **For an enhanced ownership experience, we strongly recommend KUBOTA SUPER UDT. Use of other oil may damage the transmission or hydraulic system.**
- **Do not mix different brands of fluid together.**

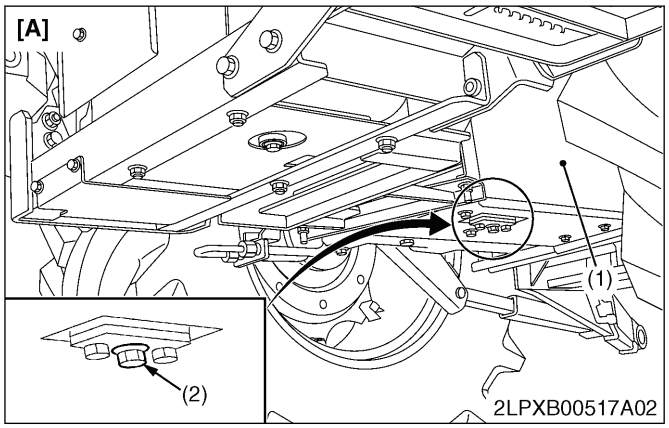


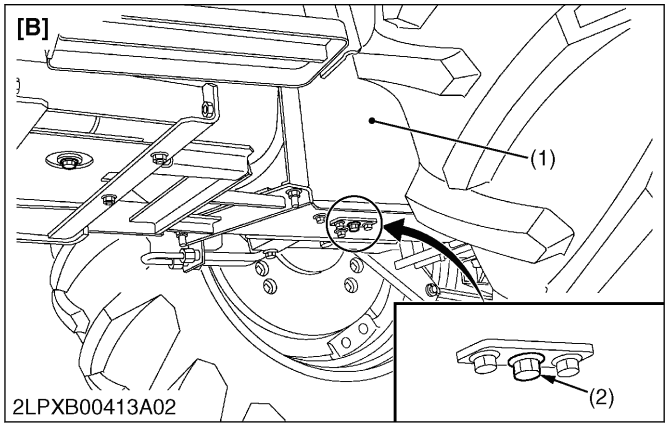

(2) Dipstick
(3) Filling port
(A) Oil level is acceptable within this range.

- Fill up from filling port (3) after removing the filling plug up to the upper notch on the dipstick (2).
- After operating the engine for a few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

| | | |
|---|---|---|
| Transmission fluid | Capacity | 60.0 L<br>16 U.S.gals<br>13 Imp.gals |

## 5.2.3 Draining fuel




(1) Fuel tank
(2) Drain plug
[A] ROPS model
[B] Cabin model

1. Place oil pans under the fuel tank (1).
2. Remove the drain plug (2) at the bottom of fuel tank (1).
3. Drain the fuel.
4. Reinstall the drain plug (2) on the fuel tank (1).

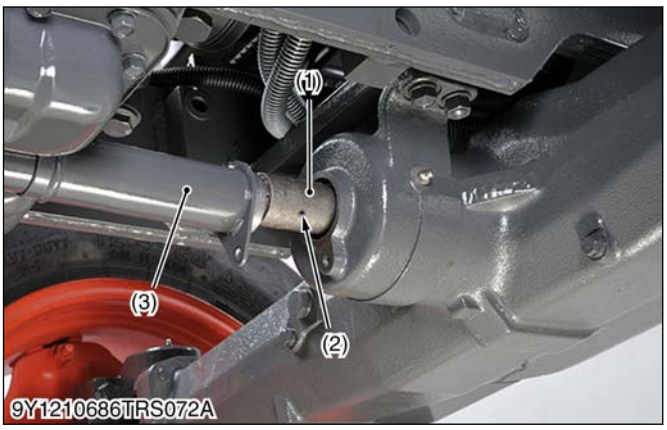
**(When reassembling)**

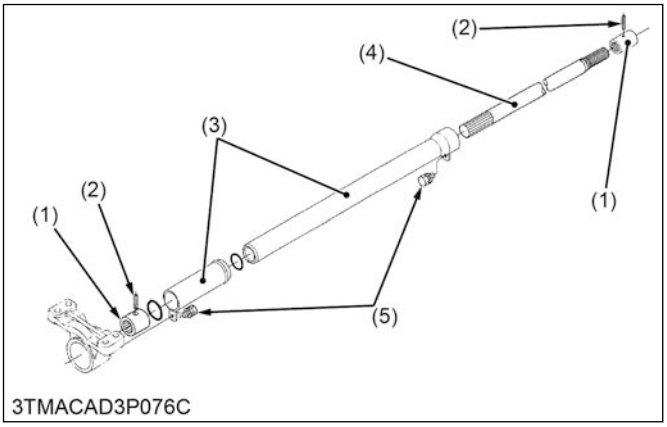
- Be sure to fix the seal washer is in the original position on the drain plug (2).

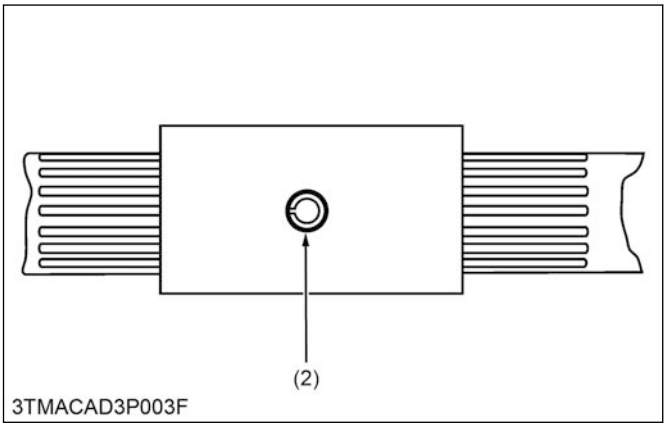
| | | |
|---|---|---|
| Fuel tank | Capacity | 105 L<br>27.7 U.S.gals<br>23.1 Imp.gals |

## 5.2.4 Removing propeller shaft

1. Slide the propeller shaft covers (3) after removing the screws (5).
2. Tap out the roll pins (2).
3. Slide the couplings (1) and remove the propeller shaft (4).



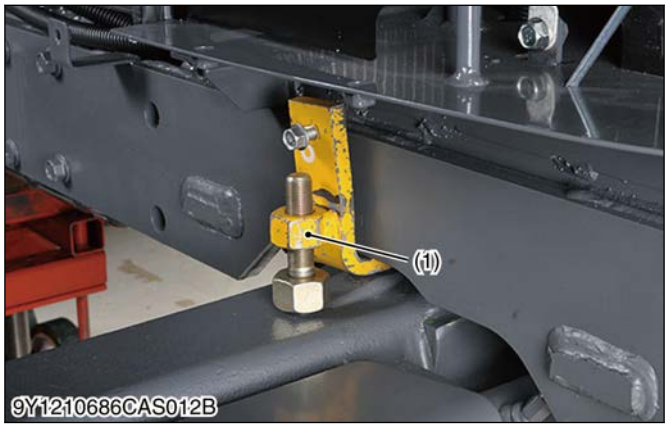

(1) Coupling
(2) Roll pin
(3) Propeller shaft cover
(4) Propeller shaft
(5) Screw

**(When reassembling)**

- Apply the grease to the splines of couplings (1).
- Tap in the roll pins (2) as shown in the figure.

## 5.2.5 Installing front axle rocking restrictor

1. Chock the wheels and set the front axle rocking restrictor (1) to the front axle frame on both sides.




(1) Front axle rocking restrictor

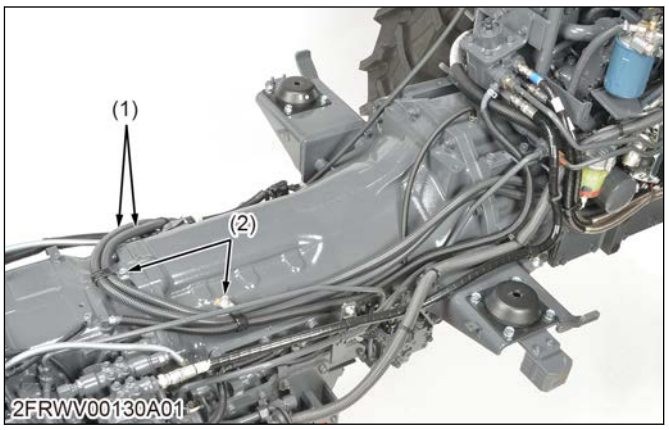
## 5.2.6 Removing cabin from body

1. Remove cabin from body.


RELATED PAGE
5.1.2.1 Separating cabin from tractor on page 8-15

## 5.2.7 Disconnecting fuel hose

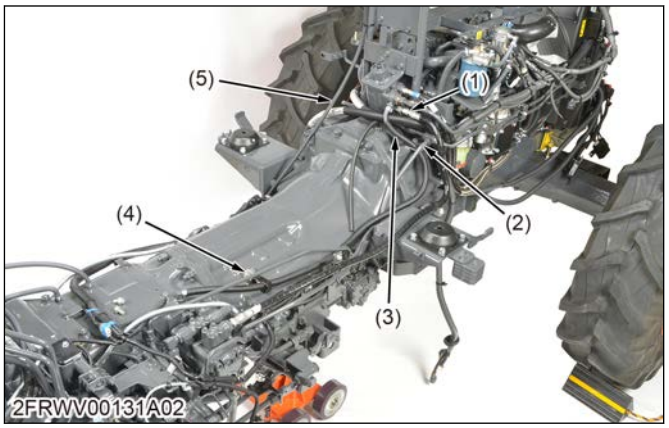
1. Remove the clamp mounting bolts (2).
2. Disconnect the fuel hoses (1).




(1) Fuel hose
(2) Clamp mounting bolt

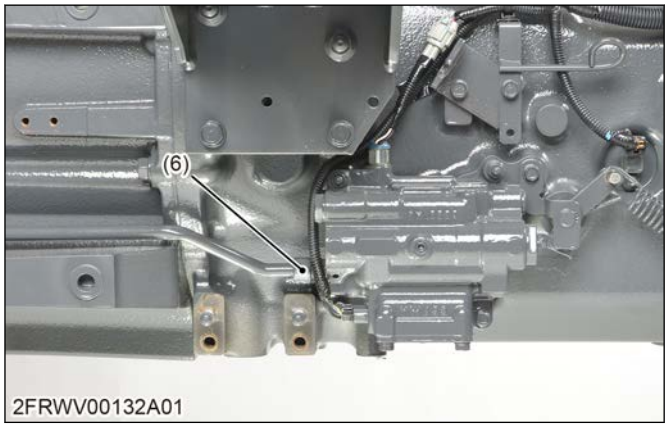
## 5.2.8 Disconnecting hydraulic pipe and hose

1. Remove the clamp (4).
2. Disconnect the power steering return hose (3).
3. Disconnect the power steering delivery hose (1).
4. Disconnect the oil cooler return pipe (2).
5. Disconnect the DEF tank breather hose (5).




(1) Power steering delivery hose
(2) Oil cooler return pipe
(3) Power steering return hose
(4) Clamp
(5) DEF tank breather hose

6. Disconnect the shuttle valve delivery pipe (6) from shuttle valve.




(6) Shuttle valve delivery pipe

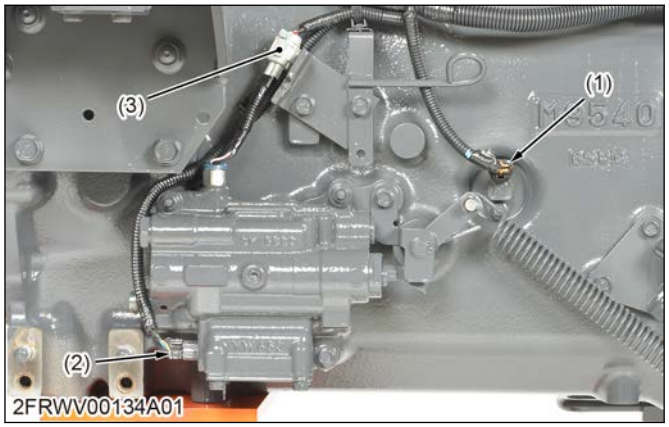
**(When reassembling)**

- Tighten the power steering delivery hose and shuttle valve delivery pipe to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Power steering delivery hose | 45.1 to 53.0 N·m<br>4.60 to 5.40 kgf·m<br>33.3 to 39.0 lbf·ft |
| | Shuttle valve delivery pipe | 34.5 to 39.2 N·m<br>3.52 to 3.99 kgf·m<br>25.5 to 28.9 lbf·ft |

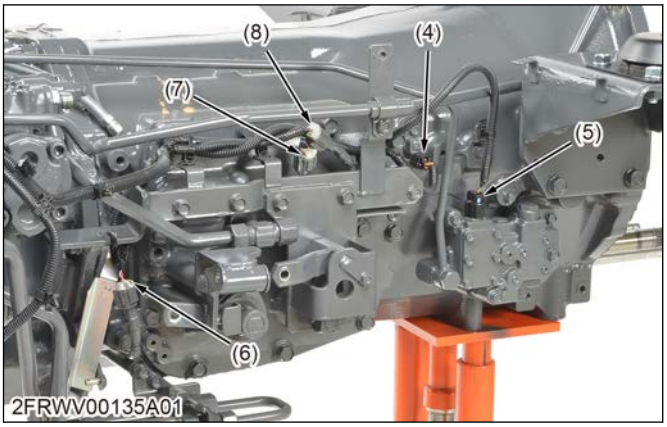
## 5.2.9 Disconnecting wiring harness

1. Disconnect the traveling speed sensor connector (1).
2. Disconnect the shuttle solenoid valve connector (2).
3. Disconnect the shuttle valve spool neutral switch connector (3).




(1) Traveling speed sensor connector
(2) Shuttle solenoid valve connector
(3) Shuttle spool neutral switch connector

4. Disconnect the shuttle rotation sensor connector (4).
5. Disconnect the dual speed solenoid connector (5).
6. Remove the gear lock parking detect switch protective plate and disconnect the gear lock parking detect switch connector (6).
7. Disconnect the main gear shift (6th) switch connector (8).
8. Disconnect the range gear shift (Hi) switch connector (7).



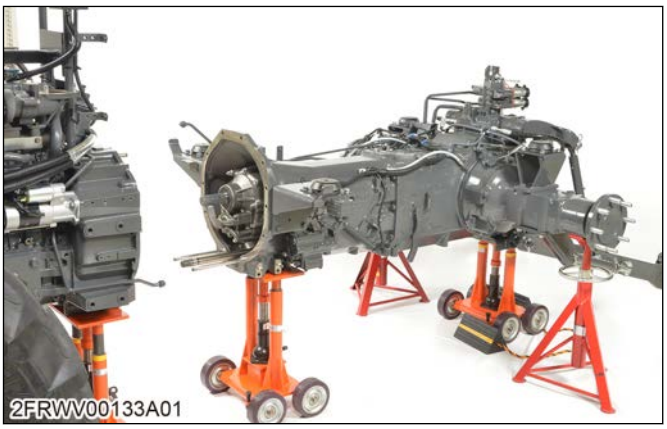

(4) Shuttle rotation sensor connector
(5) Dual speed solenoid connector
(6) Gear lock parking detect switch connector
(7) Range gear shift (Hi) switch connector
(8) Main gear shift (6th) switch connector

**(When reassembling)**

- The range gear shift (Hi) switch connector (7) should be connected to the wiring harness which has electrical white tape.

## 5.2.10 Separating clutch housing from engine

1. Set the disassembling stands under the engine (flywheel housing) and the clutch housing.
2. Remove the mounting bolts and nuts between the engine(flywheel housing) and the clutch housing.
3. Separate engine (flywheel housing) and the clutch housing.



**(When reassembling)**

- Apply molybdenum disulphide (Three Bond 1901 or its equivalents) to the splines of damper disk boss.
- Apply liquid gasket (Three Bond 1211 / 1141 or its equivalents) to the joint face of the engine (flywheel housing) and clutch housing.
- Tighten the engine (flywheel housing) and clutch housing mounting bolt (M14, 9T) to the specified tightening torque.
- Tighten the engine (flywheel housing) and clutch housing mounting nut (M14, 7T) to the specified tightening torque.

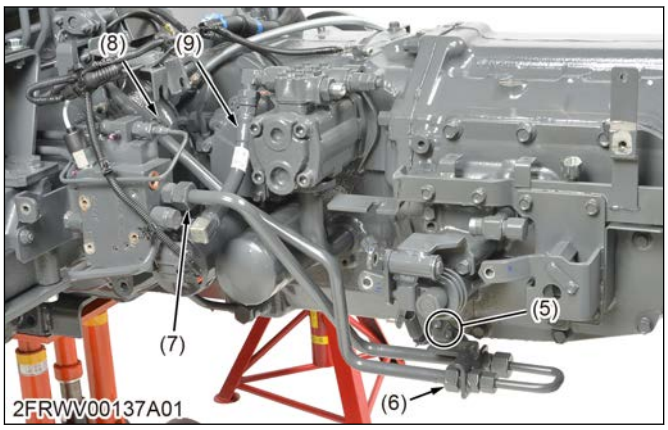
| | | |
|---|---|---|
| Tightening torque | Engine and clutch housing mounting bolt (M14, 9T) | 166.7 to 196.1 N·m<br>17.0 to 19.99 kgf·m<br>123.0 to 144.6 lbf·ft |
| | Engine and clutch housing mounting nut (M14, 7T) | 123.6 to 147.1 N·m<br>12.61 to 15.00 kgf·m<br>91.17 to 108.4 lbf·ft |

## 5.2.11 Removing hydraulic pipe

1. Remove the dual speed delivery pipe (1).
2. Remove the solenoid valve delivery pipe (4).
3. Remove the oil cooler return pipe (2).
4. Remove the return pipe (3).

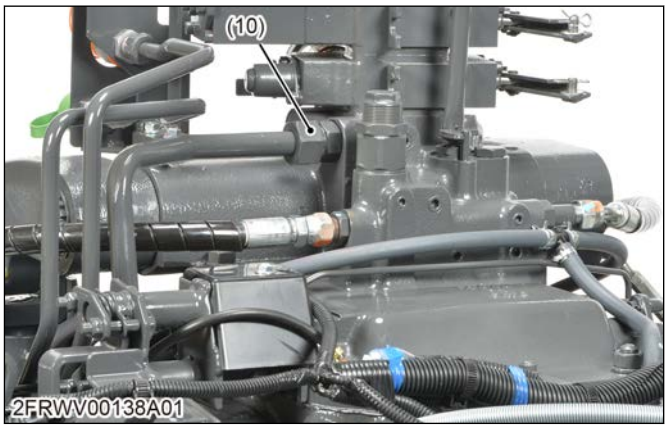

(1) Dual speed delivery pipe
(2) Oil cooler return pipe
(3) Return pipe
(4) Solenoid valve delivery pipe

5. Remove the U pipe.
6. Disconnect the 3-point hitch delivery pipe 2 mounting nut (6).
7. Disconnect the 3-point hitch delivery pipe 1 mounting nut (7) and remove the 3-point hitch delivery pipe 1 mounting bolts (5).
8. Remove the delivery hose (9).
9. Remove the 3-point hitch delivery pipe 2 mounting bolt (8).




(5) 3-point hitch delivery pipe 1 mounting bolt
(6) 3-point hitch delivery pipe 2 mounting nut
(7) 3-point hitch delivery pipe 1 mounting nut
(8) 3-point hitch delivery pipe 2 mounting bolt
(9) Delivery hose

10. Disconnect the 3-point hitch delivery pipe 2 mounting nut (10).
11. Remove the 3-point hitch delivery pipe 2.




(10) 3-point hitch delivery pipe 2 mounting nut

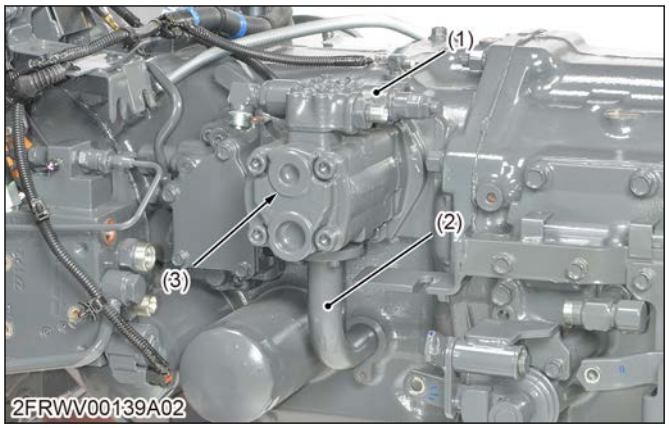
**(When reassembling)**

- Tighten the delivery hose retaining nut to the specified tightening torque.
- Tighten the fitting and elbow of delivery hose to the specified tightening torque.
- Tighten the 3-point hitch delivery pipe 2 retaining nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Delivery hose retaining nut | 57.6 to 70.4 N·m<br>5.88 to 7.17 kgf·m<br>42.5 to 51.9 lbf·ft |
| | Fitting of delivery hose (Trailer brake valve side) | 100 to 110 N·m<br>10.2 to 11.2 kgf·m<br>73.8 to 81.1 lbf·ft |
| | Elbow of delivery hose (Hydraulic pump side) | 73.5 to 83.4 N·m<br>7.50 to 8.50 kgf·m<br>54.3 to 61.5 lbf·ft |
| | 3-point hitch delivery pipe 2 retaining nut | 108 to 117 N·m<br>11.0 to 12.0 kgf·m<br>79.6 to 86.7 lbf·ft |

## 5.2.12 Removing hydraulic pump

1. Remove the relief valve folder and pump flange (1).
2. Remove the suction pipe (2).
3. Remove the hydraulic pump (3).




(1) Pump flange
(2) Suction pipe
(3) Hydraulic pump

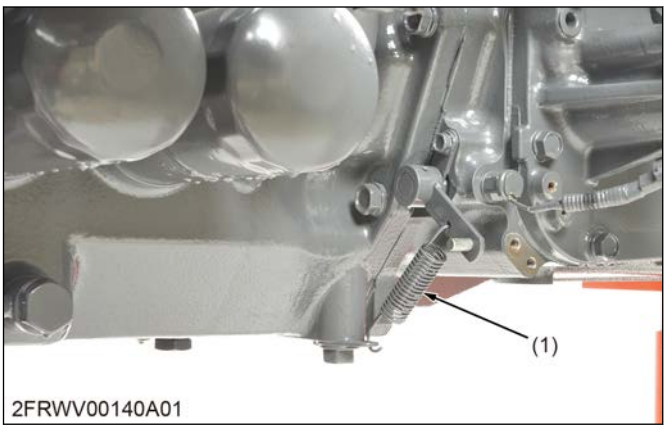
**(When reassembling)**

- Replace the O-ring with new one.
- Apply the transmission oil to the O-ring.
- Tighten the relief valve folder and pump flange (1) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Pump flange mounting bolt | 9.80 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.23 to 8.33 lbf·ft |
| | Relief valve folder mounting bolt | 9.80 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.23 to 8.33 lbf·ft |

## 5.2.13 Separating clutch housing from transmission case

1. Remove the gear lock parking brake return spring (1).




(1) Gear lock parking brake return spring

2. Set the disassembling stands under the clutch housing and the transmission case.
3. Remove the mounting bolts and nuts between the clutch housing and the transmission case.
4. Separate the clutch housing and the transmission case.


**(When reassembling)**

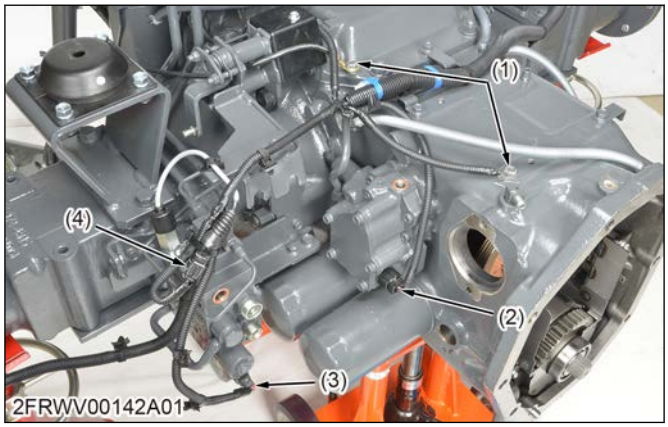
- Apply liquid gaskets (Three Bond TB1206C or its equivalents) to the joint face of the clutch housing and the transmission case.
- Tighten the transmission case mounting bolt (M14, 7T) to the specified tightening torque.
- Tighten the clutch housing and transmission mounting nut (M14, 9T) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Transmission case mounting bolt (M14, 7T) | 123.6 to 147.1 N·m<br>12.61 to 15.00 kgf·m<br>91.17 to 108.4 lbf·ft |
| | Clutch housing and transmission mounting nut (M14, 9T) | 166.7 to 196.1 N·m<br>17.00 to 19.99 kgf·m<br>123.0 to 144.6 lbf·ft |

## 5.2.14 Disconnecting connector for transmission case

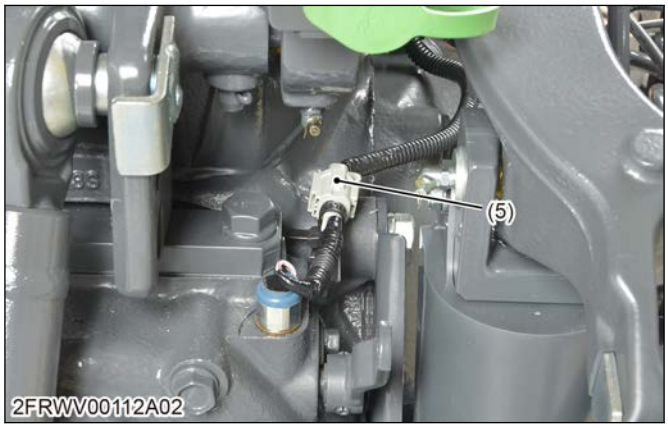
1. Remove the grounding cable mounting bolts (1).

2. Disconnect the solenoid valve connector (2).
3. Disconnect the trainer brake solenoid connector (3).
4. Disconnect the trailer brake pressure switch connector (4).
5. Disconnect the 2WD clutch pressure switch connector.




(1) Grounding cable mounting bolt
(2) Solenoid valve connector
(3) Trailer brake solenoid valve connector
(4) Trailer brake pressure switch connector

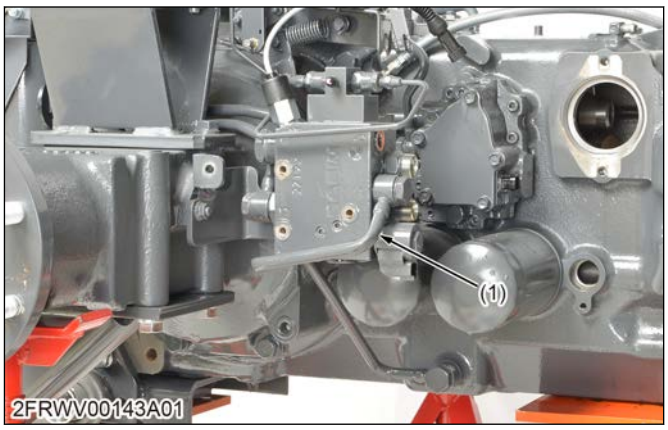
6. Remove the switch cover and disconnect the PTO speed detect switch connector (5).




(5) PTO speed detect switch connector

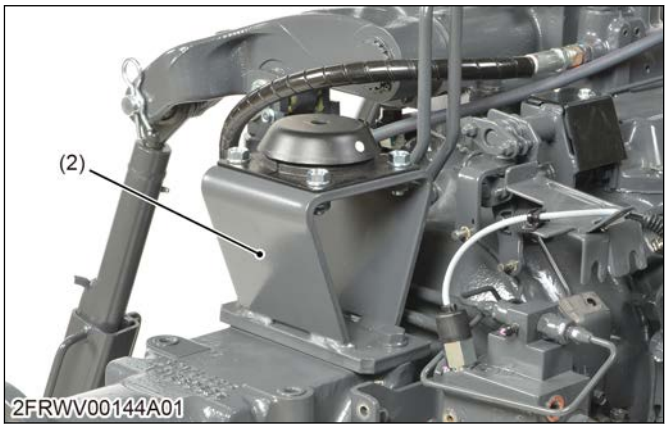
## 5.2.15 Removing trailer brake valve

1. Remove the trailer brake return pipe (1).



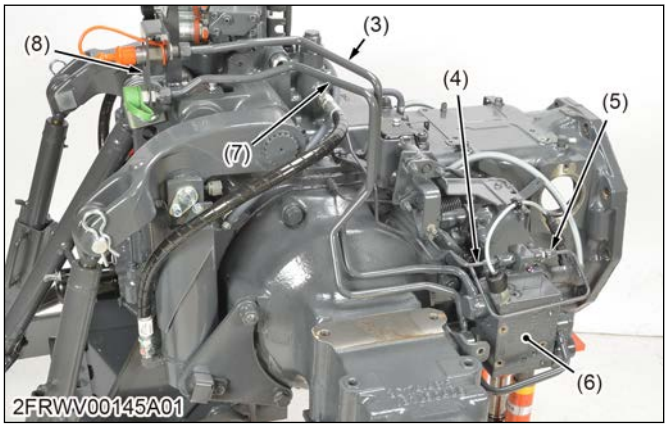

(1) Trailer brake return pipe

2. Remove the mount bracket (2).




(2) Mount bracket

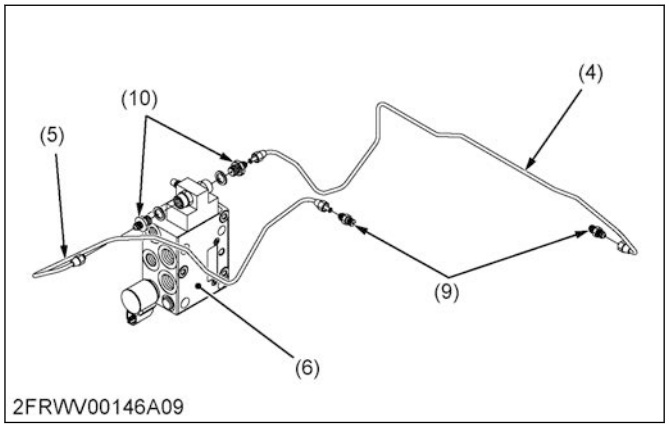
3. Remove the trailer brake pipe 1 (7) and trailer brake pipe 2 (3) together with top link holder (8).
4. Remove the trailer brake actuating pipe (R.H.) (4) and trailer brake actuating pipe (L.H.) (5).
5. Remove the trailer brake valve (6).




(3) Trailer brake pipe 2
(4) Trailer brake actuating pipe (R.H.)
(5) Trailer brake actuating pipe (L.H.)
(6) Trailer brake valve
(7) Trailer brake pipe 1
(8) Top link holder

**(When reassembling)**

- **■ IMPORTANT**
  - **– After assembling the trailer brake valve, be sure to bleed the air from the brake system.**
- Tighten the mount bracket to the specified tightening torque.
- Tighten the trailer brake return pipe, trailer brake pipes to the specified tightening torque.
- If the trailer brake actuating pipe joint (10) was removed, wrap the seal tape to the transmission case side of joint (10).
- Tighten the trailer brake actuating pipe connector (9) and trailer brake actuating pipe joint (10) to the specified tightening torque.




(4) Trailer brake actuating pipe (R.H.)
(5) Trailer brake actuating pipe (L.H.)
(6) Trailer brake valve
(9) Trailer brake actuating pipe connector
(10) Trailer brake actuating pipe joint

| | | |
|---|---|---|
| Tightening torque | Trailer brake return pipe joint bolt (Trailer brake valve side) | 63.7 to 73.5 N·m<br>6.50 to 7.49 kgf·m<br>47.0 to 54.2 lbf·ft |
| | Trailer brake return pipe joint bolt (Transmission case side) | 75 to 85 N·m<br>7.7 to 8.6 kgf·m<br>56 to 62 lbf·ft |
| | Mount bracket mounting bolt | 234 to 274 N·m<br>23.9 to 27.9 kgf·m<br>173 to 202 lbf·ft |
| | Trailer brake pipe 1 joint bolt (Trailer brake valve side) | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 1 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake pipe 2 joint bolt | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 2 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake actuating pipe | 15.7 to 23.5 N·m<br>1.60 to 2.39 kgf·m<br>11.6 to 17.3 lbf·ft |
| | Trailer brake actuating pipe connector (Trailer brake valve side) | 35 to 40 N·m<br>3.6 to 4.0 kgf·m<br>26 to 29 lbf·ft |
| | Trailer brake actuating pipe joint (Transmission case side) | 9.80 to 14.7 N·m<br>1.00 to 1.49 kgf·m<br>7.23 to 10.8 lbf·ft |

## 5.2.16 Removing 3-point linkage, hydraulic cylinder and auxiliary control valve

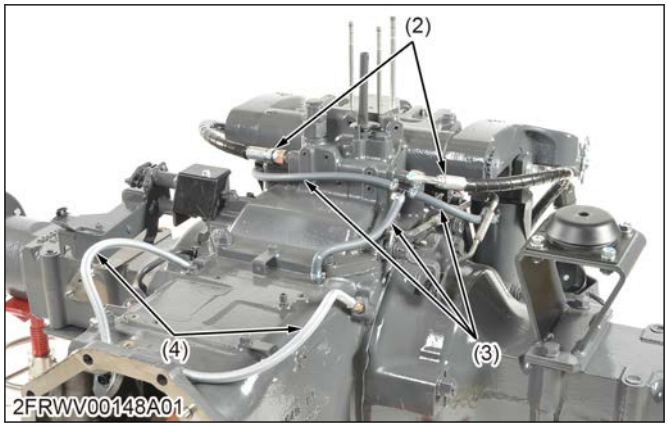
**■ NOTE**

- **Be careful not to damage the grease fitting when removing the hydraulic cylinder pin.**

1. Remove the auxiliary control valves (1).

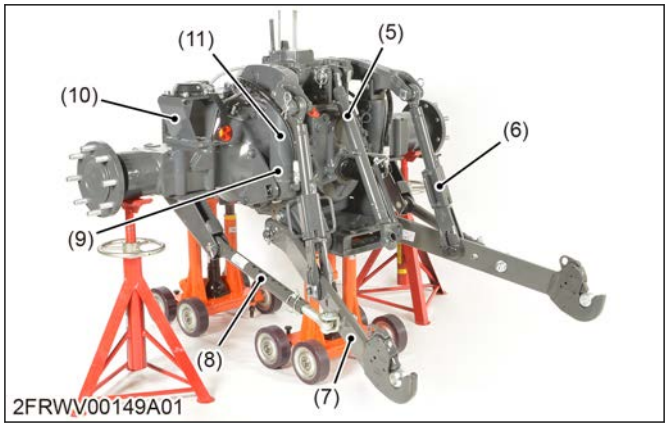

(1) Auxiliary control valve

2. Remove the hydraulic cylinder delivery hoses (2).
3. Remove the hydraulic cylinder breather hoses (3).
4. Remove the brake delivery hoses (4).




(2) Hydraulic cylinder delivery hose
(3) Hydraulic cylinder breather hose
(4) Brake delivery hose

5. Remove the top link (5).
6. Remove the stabilizers (8), lower links (7) and lift rods (6) on both sides.
7. Remove the mount bracket (10).
8. Remove the hydraulic cylinder covers (11) on both sides.
9. Remove the hydraulic cylinders (9) on both sides.




(5) Top link
(6) Lift rod
(7) Lower link
(8) Stabilizer
(9) Hydraulic cylinder
(10) Mount bracket
(11) Hydraulic cylinder cover

**(When reassembling)**

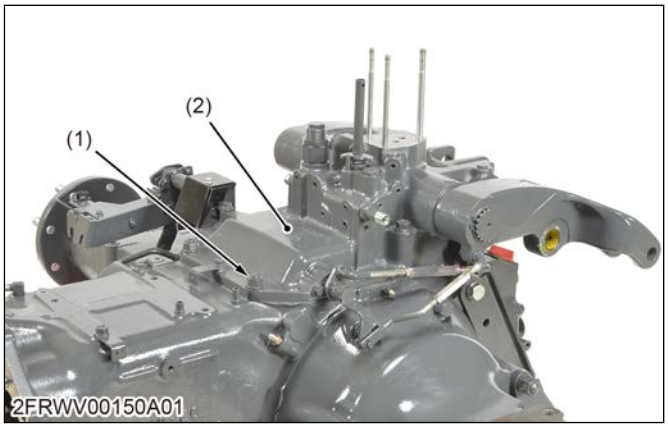
- Apply grease to the grease fitting.
- Be careful not to damage the grease fitting when reassembling the hydraulic cylinder.
- Tighten the hydraulic cylinder delivery hoses to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Hydraulic cylinder delivery hose retaining nut | 46 to 53 N·m<br>4.6 to 5.4 kgf·m<br>34 to 39 lbf·ft |

- Be sure to adjust the auxiliary control valve wire.
- Be sure to fit the O-rings for auxiliary control valve.

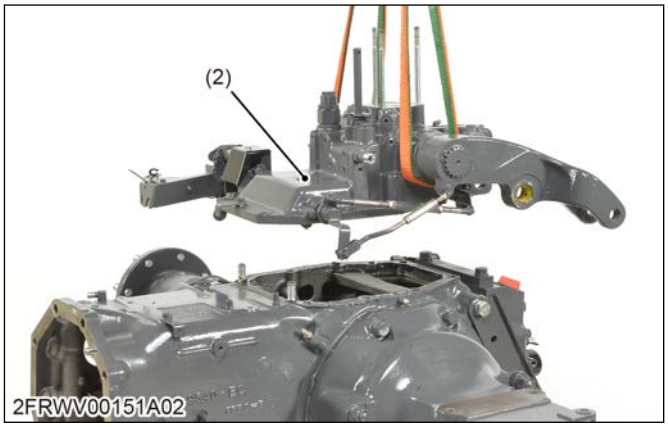
## 5.2.17 Separating hydraulic block from transmission case

1. Remove the hydraulic block mounting bolts and nuts (1).




(1) Hydraulic block mounting bolt and nut
(2) Hydraulic block assembly

2. Set the hydraulic block assembly (2) with nylon slings and hoist.
3. Separate the hydraulic block assembly (2) from transmission case.




(2) Hydraulic block assembly

**(When reassembling)**

**■ NOTE**

- **After reassembling the hydraulic block assembly to the tractor, be sure to adjust the position / draft wires and position / draft feedback rods.**
- **Since the hydraulic block assembly mounting bolt has two different length, be sure to assemble the original position.**

- Apply liquid gasket (Three Bond 1206C or its equivalents) to the joint face of transmission case and the hydraulic block assembly.

- Tighten the top cover mounting screw (M14, 9T) and the Top cover mounting nut (M14, 7T) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Top cover mounting screw (M14, 9T) | 167 to 196 N·m<br>17.0 to 20.0 kgf·m<br>123 to 144 lbf·ft |
| | Top cover mounting nut (M14, 7T) | 124 to 147 N·m<br>12.7 to 14.9 kgf·m<br>91.5 to 108 lbf·ft |

### 5.2.18 Removing PTO gear case assembly

1. Remove the PTO gear case assembly mounting screws.
2. Remove the PTO gear case and PTO drive shaft as a unit.

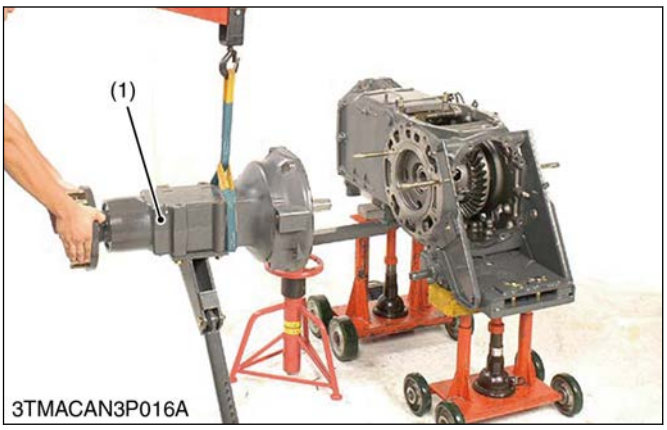

**(When reassembling)**

- Apply liquid gasket (Three Bond 1206C or its equivalents) to the joint face of the transmission case and the PTO gear case assembly.
- Tighten the PTO gear case assembly mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | PTO gear case assembly mounting screw | 78 to 90 N·m<br>7.9 to 9.2 kgf·m<br>58 to 66 lbf·ft |

### 5.2.19 Removing rear axle case assembly

1. Remove the rear axle case mounting screws and nuts.
2. Remove the rear axle case assembly (1).




(1) Rear axle case assembly

**(When reassembling)**

- Apply liquid gasket (Three Bond 1206C or its equivalents) to the joint face of the transmission case and the rear axle case.
- Temporally tighten all bolt and nut for rear axle case assembly.
- After temporally tighten all bolt and nut, firstly tighten the nut of most forward.
  And then, tighten the bolt of most rearward.
- Tighten the rear axle case mounting screw and nut (M16, 9T) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Rear axle case mounting screw and nut (M16, 9T) | 260.0 to 304.1 N·m<br>26.52 to 31.00 kgf·m<br>191.8 to 224.2 lbf·ft |

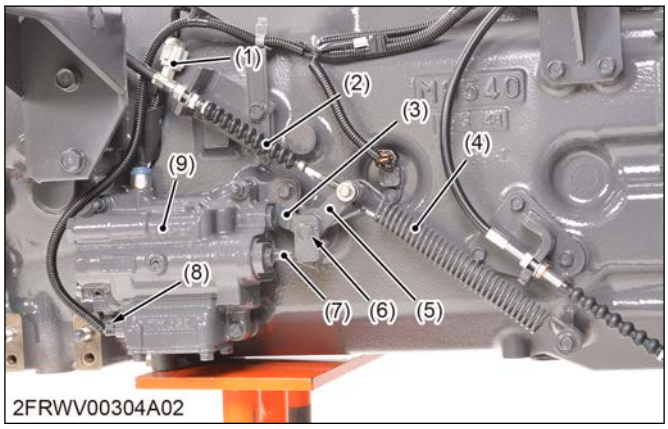
## 5.3 Shuttle and dual speed clutch

### 5.3.1 Removing hydraulic shuttle clutch

#### 5.3.1.1 Removing hydraulic shuttle valve assembly

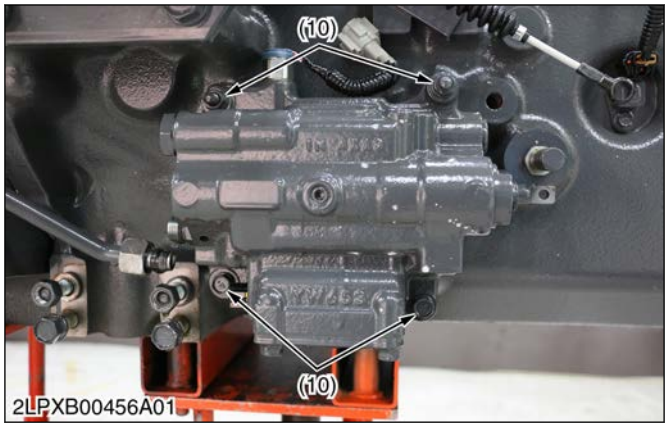
1. Disconnect the shuttle valve spool neutral switch connector (1).
2. Disconnect the shuttle solenoid connector (8).
3. Disconnect the clutch cable (2) and spring (4).
4. Remove the external circlip (6) and plate (3).
5. Remove the split pun, plain washer and clevis pin from the shuttle valve spool (7).

6. Remove the clutch lever (5).




(1) Shuttle valve spool neutral switch connector
(2) Clutch cable
(3) Plate
(4) Spring
(5) Clutch lever
(6) External circlip
(7) Shuttle valve spool
(8) Shuttle solenoid connector
(9) Shuttle valve assembly

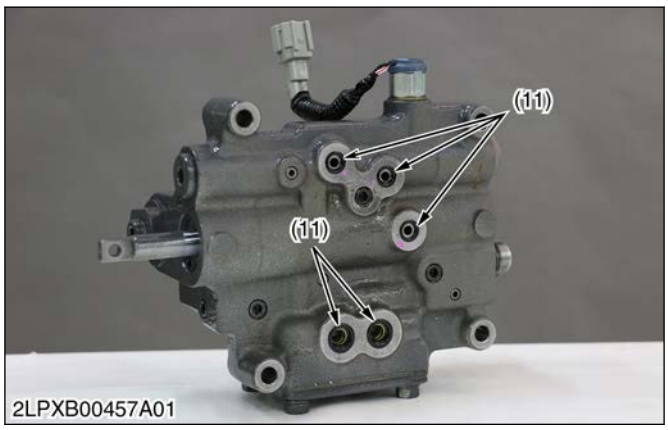
7. Remove the mounting bolts and nuts (10) for hydraulic shuttle valve assembly (9).




(10) Shuttle valve assembly mounting bolt and nut

**(When reassembling)**

- Be sure to fix the O-ring (11) to the position as shown in the photo and apply transmission fluid.




(11) O-ring

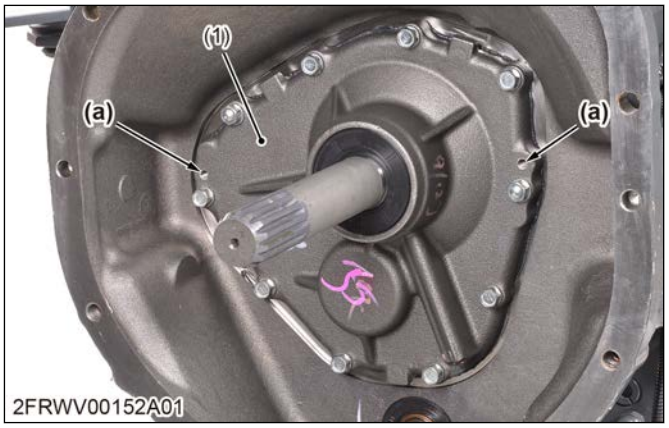
- Be sure to adjust the clutch pedal free travel.

## 5.3.1.2 Removing hydraulic shuttle case assembly (F18/R18 speed transmission model)

**CAUTION**

- **The shuttle case assembly is heavy.**

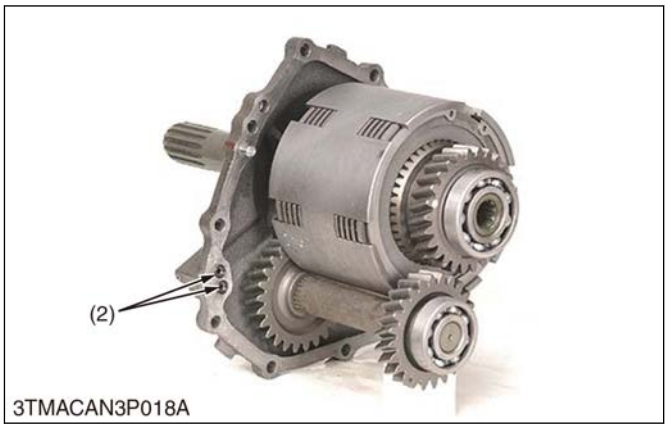
1. Remove the shuttle case mounting bolts and nuts.
2. Remove the shuttle case assembly (1) by using M10 × Pitch 1.25 mm bolts into holes (a).




(1) Shuttle case assembly
(a) Threaded hole

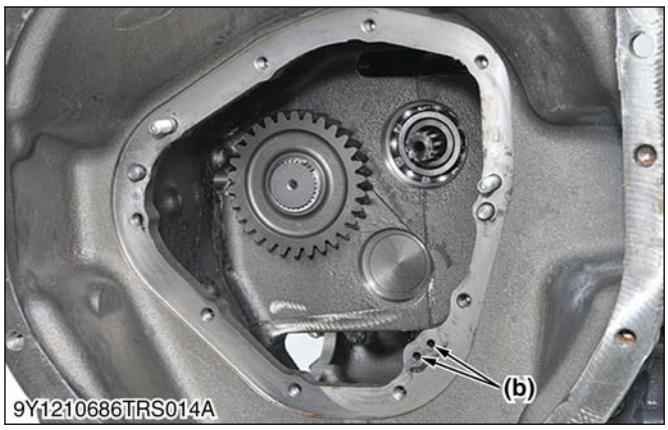
**(When reassembling)**

- Be sure to fit the O-rings (2) and apply transmission fluid.




(2) O-ring

- The oil passage hole of oil (b) is free from liquid gaskets.



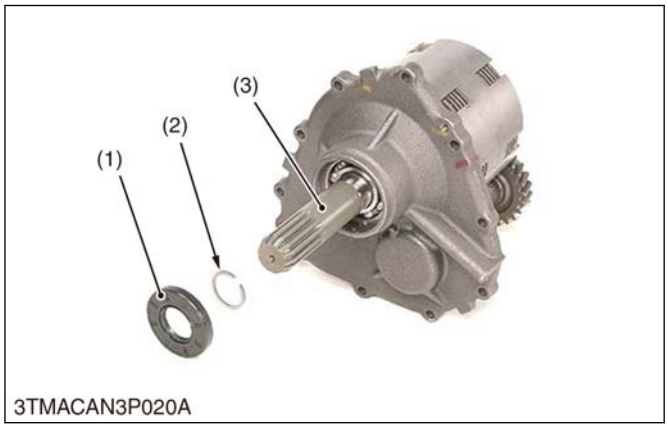

(b) Oil passage hole

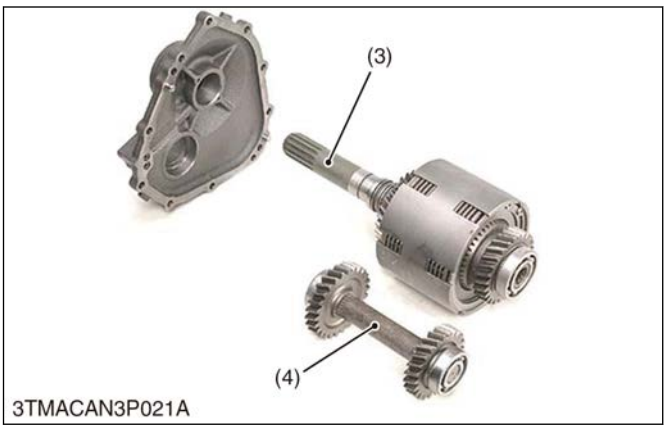
- Apply liquid gaskets (Three Bond 1206C or its equivalents) to the joint face of the shuttle case and clutch housing case.
- Tighten the shuttle case mounting bolt and nut to the specified tightening torque.

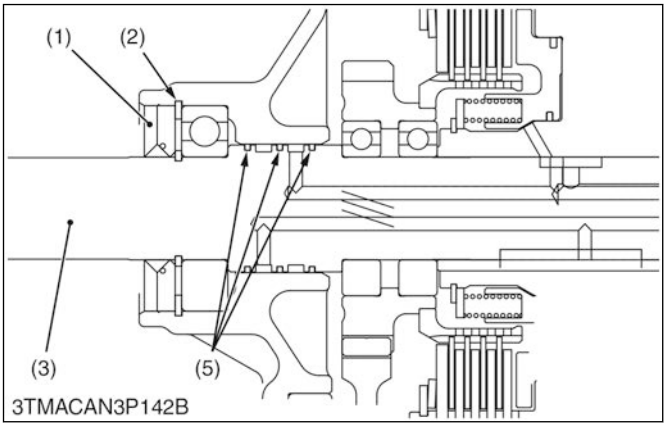
| | | |
|---|---|---|
| Tightening torque | Shuttle case mounting bolt and nut | 48 to 55 N·m<br>4.9 to 5.7 kgf·m<br>36 to 41 lbf·ft |

## 5.3.1.3 Removing hydraulic shuttle clutch pack (F18/R18 speed transmission model)

1. Remove the oil seal (1).
2. Remove the external circlip (2).
3. Tap out the input shaft (3) with shuttle clutch and 26T, 24T gear with shuttle shaft (4) together.




(1) Oil seal
(2) External circlip
(3) Input shaft
(4) Shuttle shaft
(5) Seal ring

**(When reassembling)**

**■ NOTE**

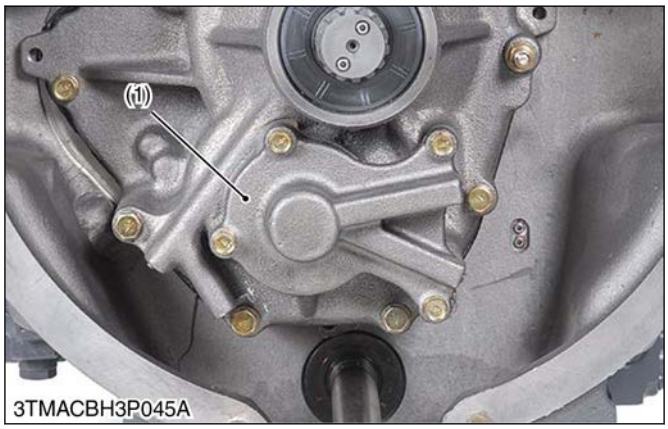
- **Do not get in the seal rings (5) between input shaft (3) and shuttle case.**
- Replace the seal rings (5), oil seal (1) and external circlip (2) with new ones.
- Apply transmission fluid to seal rings (5) and bearings.
- Apply grease to oil seal (1).
- Apply grease to seal rings (5).

## 5.3.1.4 Removing hydraulic shuttle case assembly (F36/R36 speed transmission model)

**⚠ CAUTION**

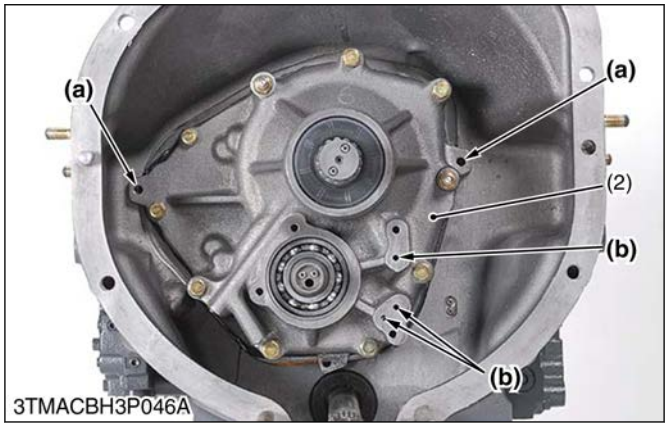
- **The shuttle case assembly is heavy.**

1. Remove the shuttle holder (1).




(1) Shuttle holder

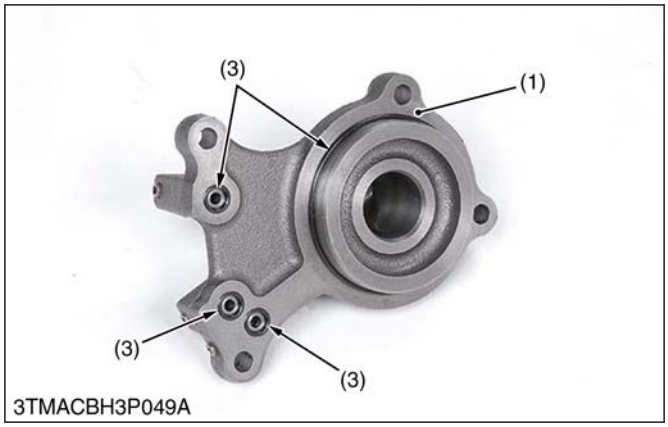
2. Remove the shuttle case mounting screws and nuts.
3. Remove the shuttle case assembly (2) by using M10 × Pitch 1.25 mm screws into holes (a).

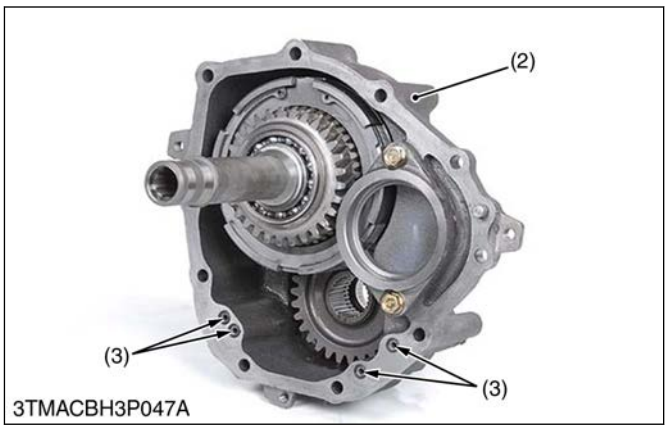



(2) Shuttle case assembly (b) Oil passage hole
(a) Threaded hole

**(When reassembling)**

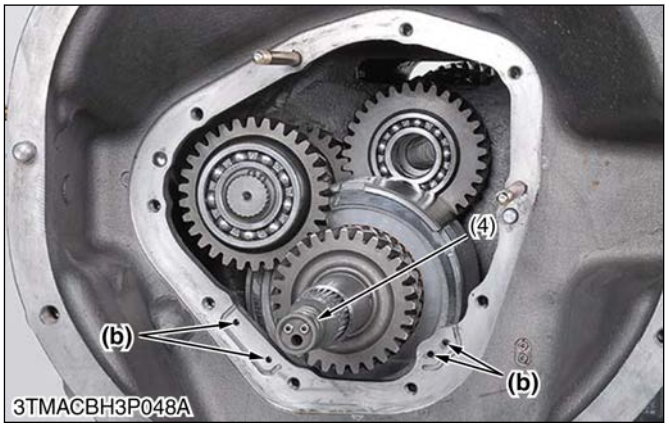
- Be sure to fit the O-rings (3).




(1) Shuttle holder (3) O-ring
(2) Shuttle case assembly

- The oil passage hole (b) is free from liquid gasket.
- Apply liquid gasket (Three Bond 1206C or its equivalents) to the joint face of the shuttle case and clutch housing.
- Apply grease to seal rings (4).
- Tighten the shuttle case and shuttle holder mounting screw and nut to the specified tightening torque.




(4) Seal ring (b) Oil passage hole

| | | |
|---|---|---|
| Tightening torque | Shuttle case and shuttle holder mounting screw and nut | 48 to 55 N·m<br>4.9 to 5.7 kgf·m<br>36 to 41 lbf·ft |

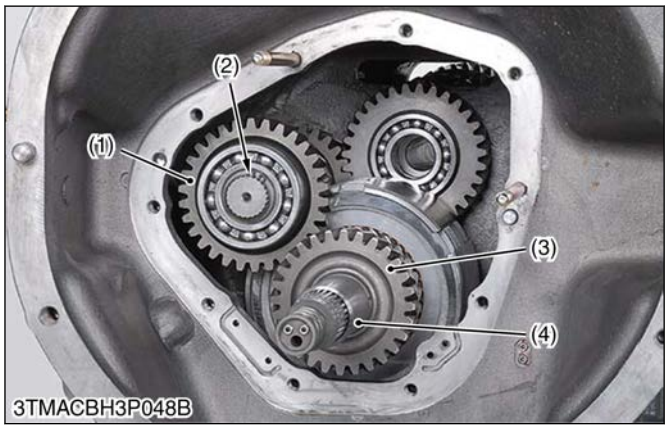
## 5.3.1.5 Removing hydraulic shuttle clutch pack (F36/R36 speed transmission model)

**■ NOTE**

- **Remove the 31T gear (5), then remove the shuttle pack.**

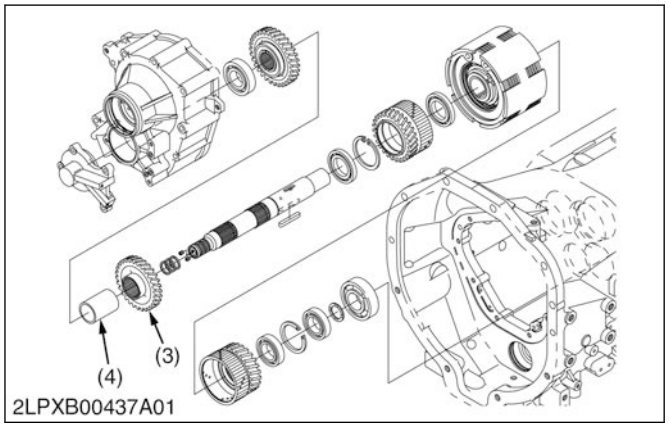
1. Remove the external circlip (2) and 30T gear (1).

2. Remove the spacer (4) and 29T gear (3).

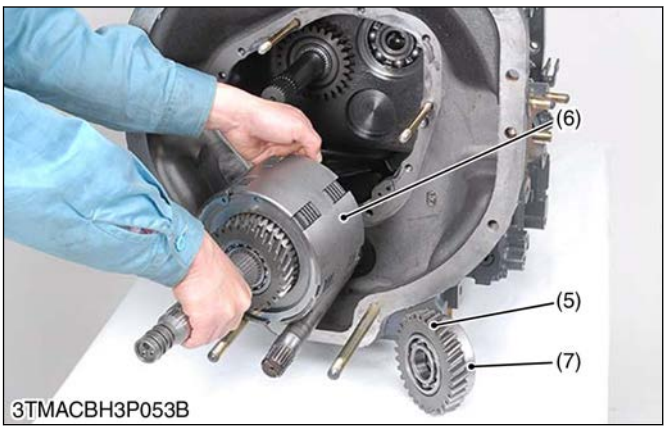



(1) 30T gear
(2) External circlip
(3) 29T gear
(4) Spacer

3. Pull the shuttle clutch pack (6) and lower the shuttle clutch pack (6) in the housing case.
4. Pull out the 31T gear (5) with bearing (7).
5. Remove the shuttle clutch pack (6).








(5) 31T gear
(6) Shuttle clutch pack
(7) Bearing

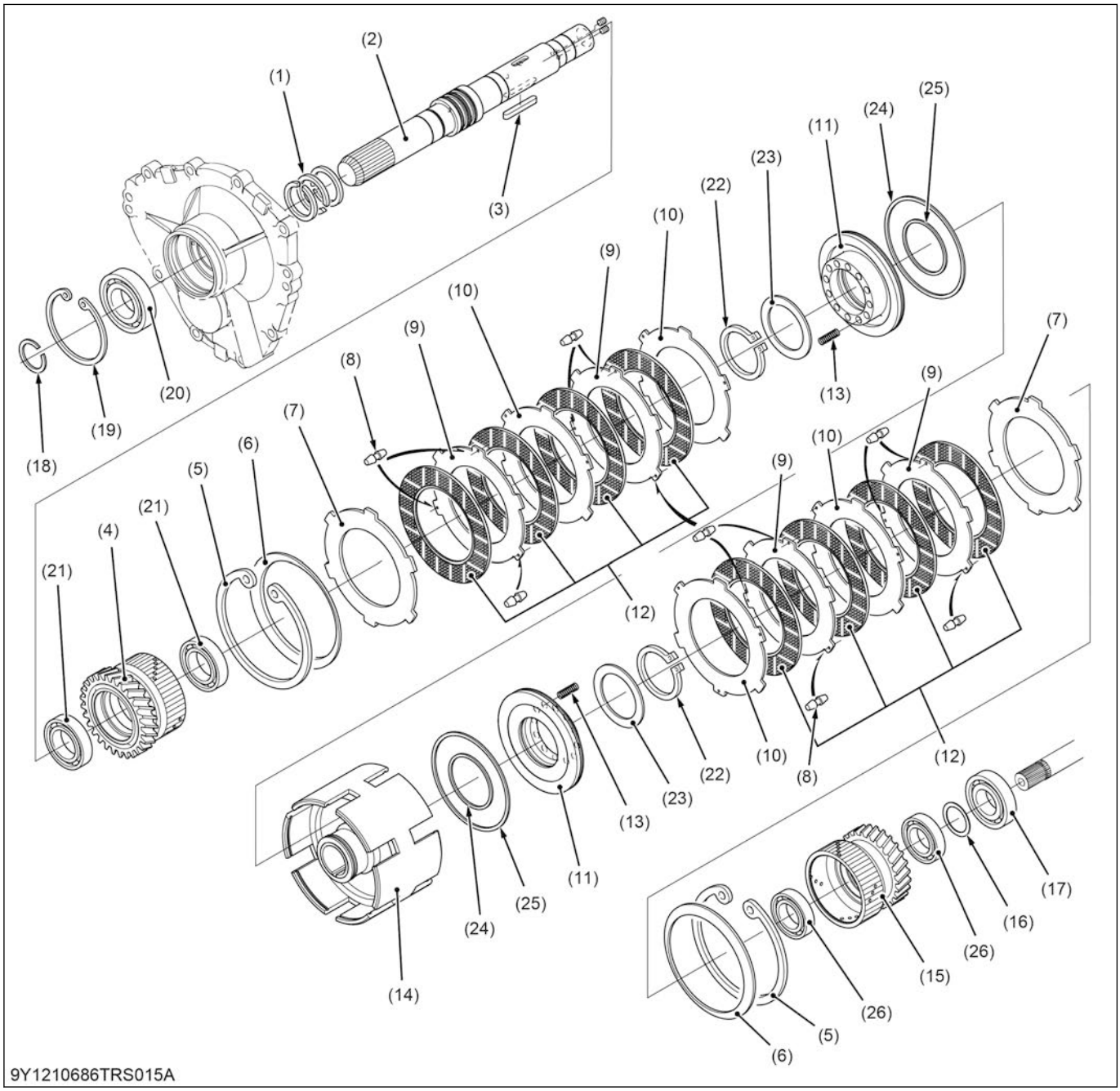
**(When reassembling)**

- Put in the shuttle clutch pack (6) to the housing case first, then be sure to assemble the 31T gear (5) with bearing (7).

## 5.3.2 Shuttle clutch assembly

### 5.3.2.1 Disassembling hydraulic shuttle clutch assembly (F18/R18 speed transmission model)

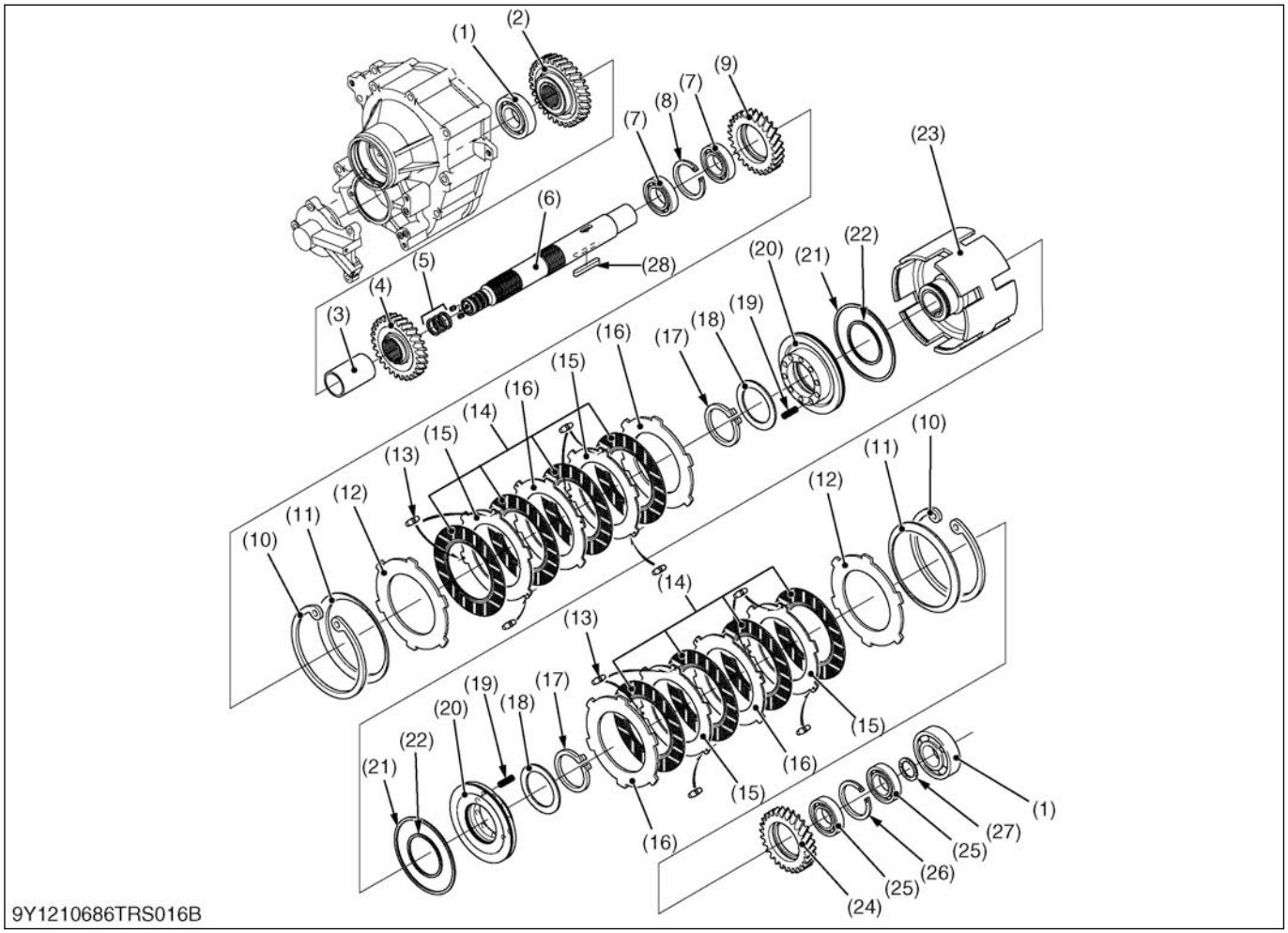
1. Disassemble the each parts as shown in the figure.




(1) Seal ring
(2) Shuttle shaft
(3) Key
(4) 28T gear
(5) Internal circlip
(6) Belleville washer (Cupped spring washer)
(7) Pressure plate
(8) Rubber
(9) Steel plate with rubber
(10) Steel plate without rubber
(11) Piston
(12) Disk
(13) Spring
(14) Clutch body
(15) 26T gear
(16) Washer
(17) Bearing
(18) External circlip
(19) Internal circlip
(20) Bearing
(21) Bearing
(22) External circlip
(23) Thrust collar
(24) Seal ring
(25) Seal ring
(26) Bearing

## 5.3.2.2 Disassembling hydraulic shuttle clutch assembly (F36/R36 speed transmission model)

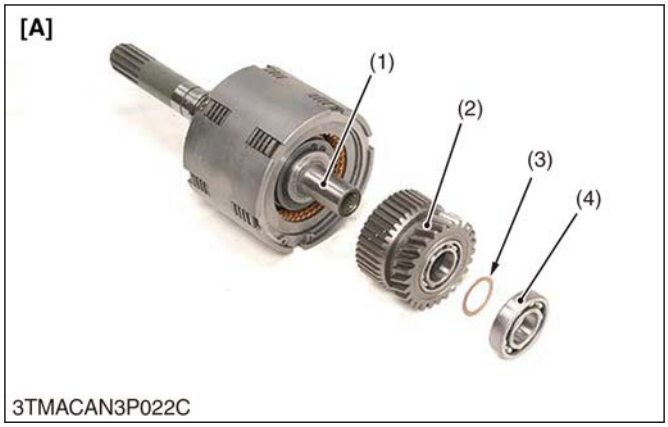
1. Disassemble the each parts as shown in the figure.

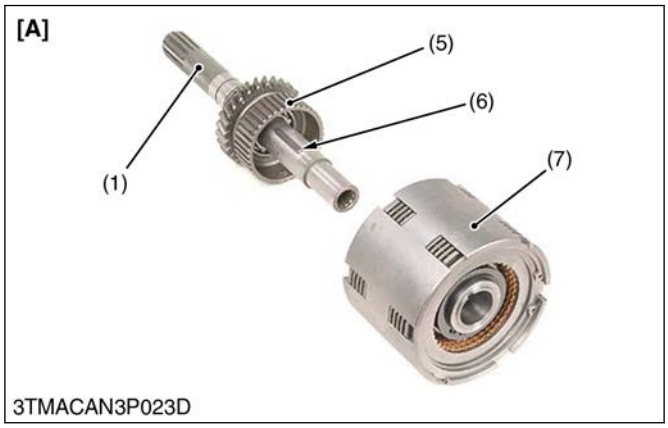


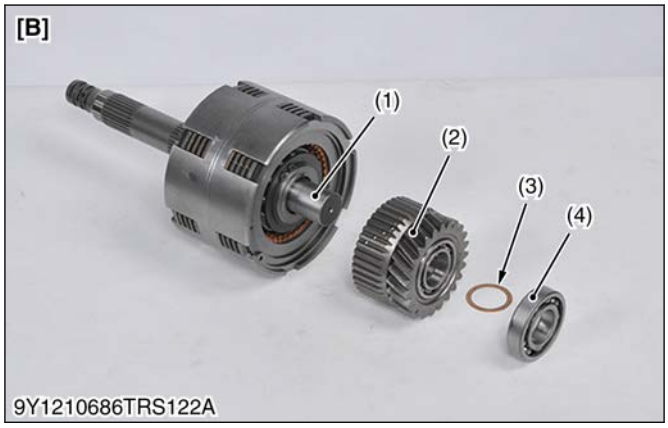

(1) Bearing
(2) 32T gear
(3) Spacer
(4) 29T gear
(5) Seal ring
(6) Shuttle shaft
(7) Bearing
(8) Internal circlip
(9) 27T gear
(10) Internal circlip
(11) Belleville washer (Cupped spring washer)
(12) Pressure plate
(13) Rubber
(14) Disk
(15) Steel plate with rubber
(16) Steel plate without rubber
(17) External circlip
(18) Thrust collar
(19) Spring
(20) Piston
(21) Seal ring
(22) Seal ring
(23) Clutch body
(24) 24T gear
(25) Bearing
(26) Internal circlip
(27) Washer
(28) Key

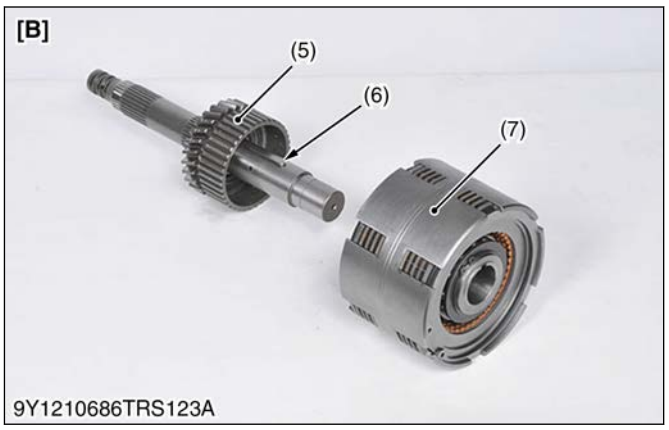
## 5.3.2.3 Disassembling shuttle shaft

1. Remove the bearing (4) and washer (3).
2. Remove the gear (2).
3. Tap out the shuttle shaft (1) with gear (5) to the forward.




(1) Shuttle shaft
(2) Gear
(3) Washer
(4) Bearing
(5) Gear
(6) Key
(7) Shuttle pack
[A] F18/R18 speed transmission model
[B] F36/R36 speed transmission model

**(When reassembling)**

- Align the key (6) and groove.

**F18/R18 speed transmission model**

| | |
|---|---|
| Gear (2) | 26T gear |
| Gear (5) | 28T gear |

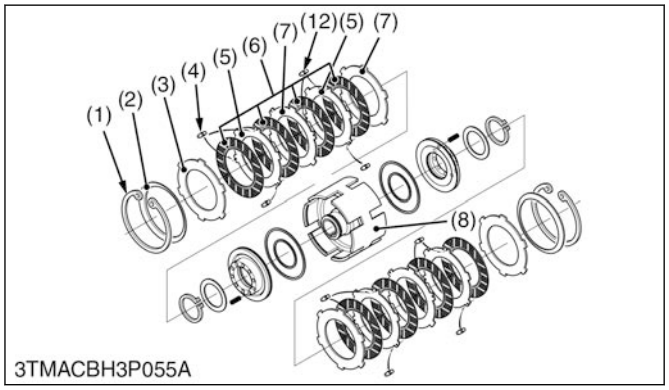
**F36/R36 speed transmission model**

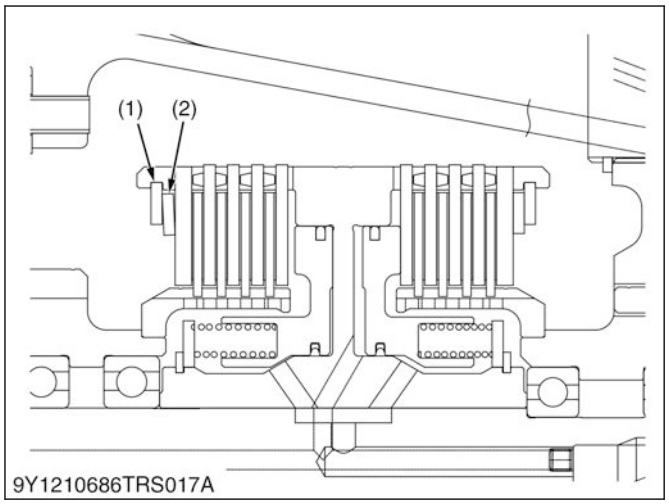
| | |
|---|---|
| Gear (2) | 24T gear |
| Gear (5) | 27T gear |

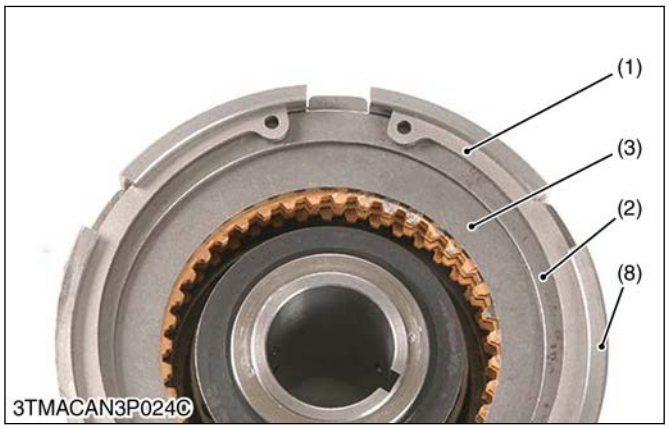
## 5.3.2.4 Disassembling hydraulic shuttle clutch pack

1. Remove the internal circlip (1).

2. Remove the belleville washer (2), pressure plate (3), steel plate (5), (7) and clutch discs (6).



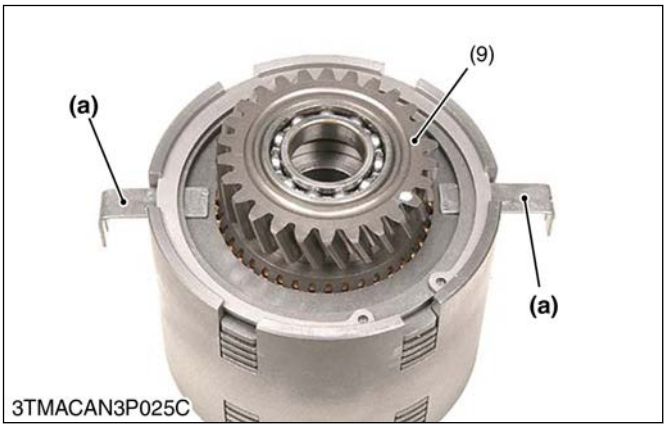



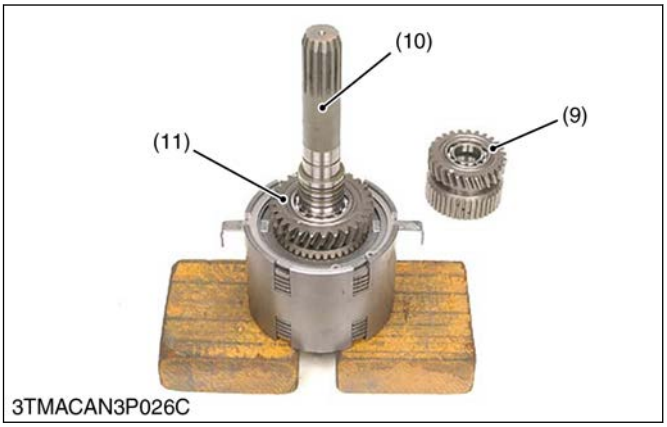




(1) Internal circlip
(2) Belleville washer (Cupped spring washer)
(3) Pressure plate
(4) Rubber
(5) Steel plate with rubber
(6) Clutch disc
(7) Steel plate without rubber
(8) Clutch body
(12) Rubber

**(When reassembling)**

- Install the clutch discs (6) and steel plate (5), (7) mutually.
- Apply enough transmission fluid to the discs (6).
- Do not confuse the two types of steel plates.
  The steel plate with rubbers (5) and without rubbers (7).
- Two steel plate match the position of rubber (4) from the piston side, and one remaining steel plate (7) is not matched.
- Do not confuse the pressure plates (3) and steel plate (7). The pressure plate (3) is thicker than the steel plate (7).
- Be sure to assemble the belleville washer (cupped spring washer) (2) direction as shown in the figure.
- When installing the internal circlip (1) to the clutch body (8), align its split portion to the notched portion of clutch body as shown in the photo.
- When assembling the shuttle shaft (10) with gear (11) for reverse side, temporary align the spline and clutch disc teeth using the gear (9).
  – Insert the steel piece (a) between belleville washer (cupped spring washer) (2) and pressure plate (3) to prevent the clutch discs (6) from turning during assembling.
  – Draw out the gear (9) after inserting the steel piece (a). And then tap in the shuttle shaft (10) with gear (11).
  – Same procedure for forward side.
- Make sure the piston moves smoothly when 0.50 to 0.60 MPa (5.1 to 6.1 kgf/cm$^2$, 73 to 87 psi) of pressure air is sent to the clutch pack.
- After assembling the clutch pack, check the clearance between the clutch plate and clutch disc.




(9) Gear
(10) Shuttle shaft
(11) Gear
(a) Steel piece

**F18/R18 speed transmission model**

| | |
|---|---|
| Gear (9) | 26T gear |
| Gear (11) | 28T gear |

**F36/R36 speed transmission model**

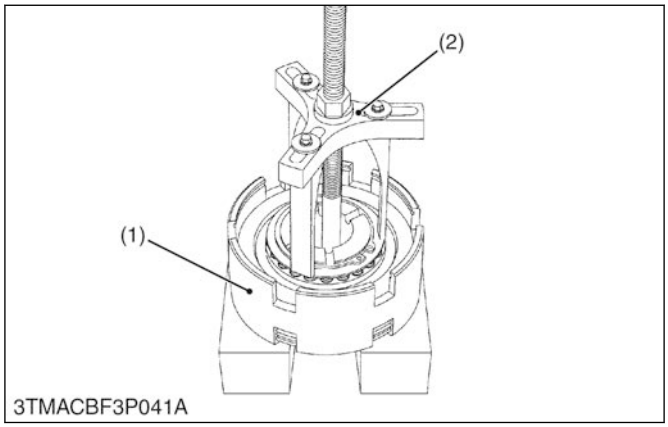
| | |
|---|---|
| Gear (9) | 24T gear |
| Gear (11) | 27T gear |

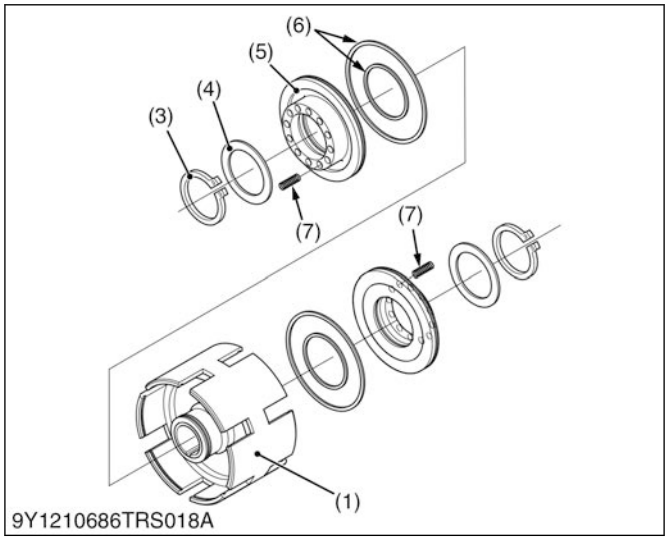
## 5.3.2.5 Disassembling shuttle clutch piston

**NOTE**

- **12 springs for one side.**
- **The passage holes for the piston are beside the feather key groove.**

1. Press the thrust collar (4) lightly by the hydraulic clutch spring compressor (2), and remove the external circlip (3).
2. Remove the springs (7).




(1) Clutch case
(2) Hydraulic clutch spring compressor
(3) External circlip
(4) Thrust collar
(5) Piston
(6) Seal ring
(7) Spring

3. Draw out the piston (5) using a compressed air.

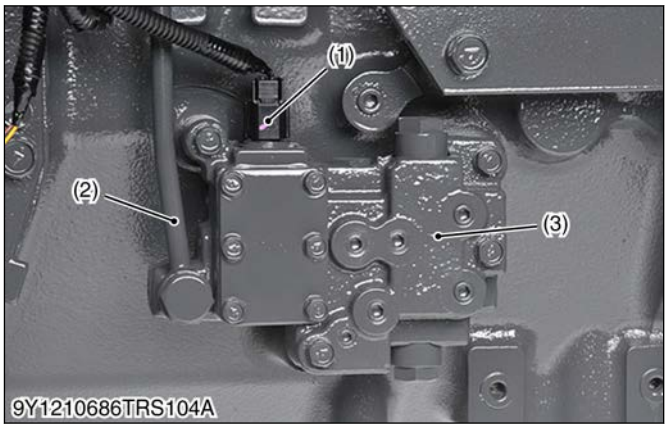

**(When reassembling)**

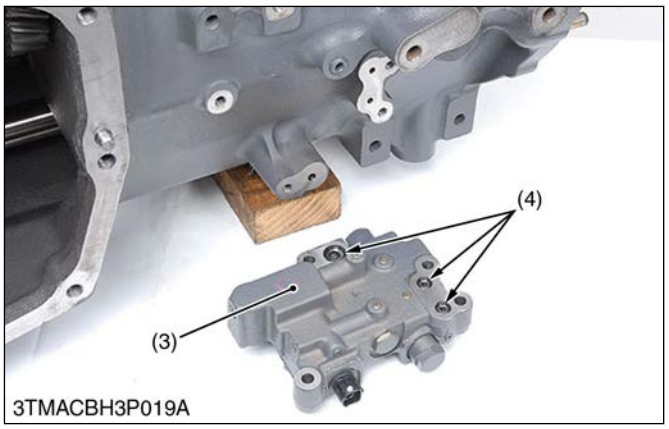
- Apply transmission fluid to the seal rings (6).

RELATED PAGE
2.16 Hydraulic clutch spring compressor on page 2-85

## 5.3.3 Removing dual speed clutch

### 5.3.3.1 Removing dual speed solenoid valve assembly




(1) 3P connector (Dual speed solenoid valve)
(2) Dual speed solenoid valve delivery pipe
(3) Dual speed solenoid valve
(4) O-ring

1. Disconnect the 3P connector (1).

2. Remove the dual speed solenoid valve delivery pipe (2).
3. Remove the dual speed solenoid valve (3).

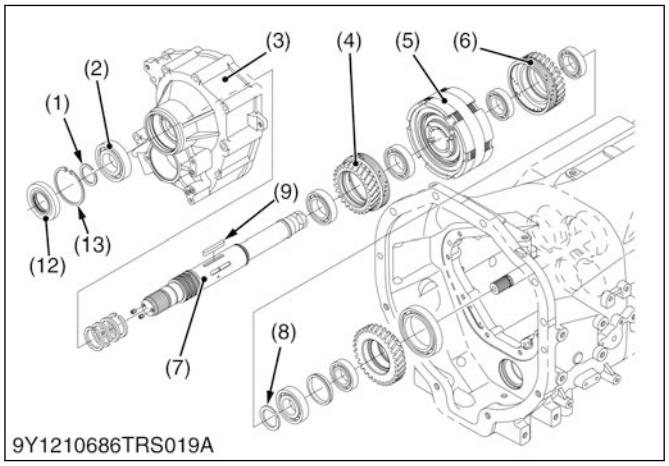
**(When reassembling)**

- Be sure to fix the O-rings (4) in position as shown photo and apply transmission fluid to the O-rings (4).

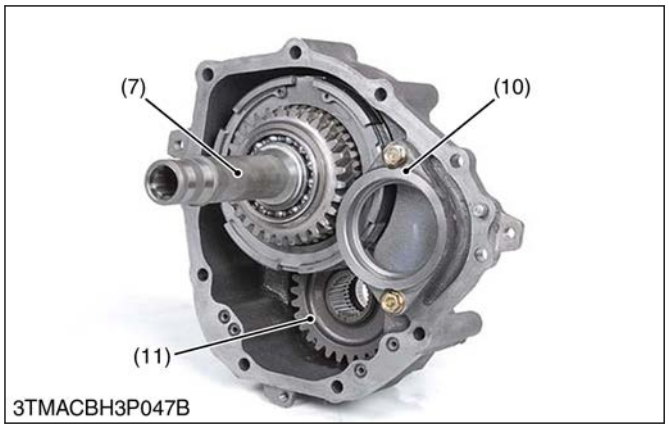
| | | |
|---|---|---|
| Tightening torque | Joint screw for hydraulic pipe 2 | 34.3 to 39.2 N·m<br>3.50 to 3.99 kgf·m<br>25.3 to 28.9 lbf·ft |

## 5.3.3.2 Disassembling dual speed clutch assembly (F36/R36 speed transmission model)

1. Remove the holder (10).
2. Remove the oil seal (12), external circlip (1) and internal circlip (13).
3. Tap out the dual speed shaft (7) with clutch pack (5).
4. Remove the external circlip (8) and 28T gear (6).
5. Tap out the dual speed shaft (7) with 26T gear (4) to forward.



9Y1210686TRS019A



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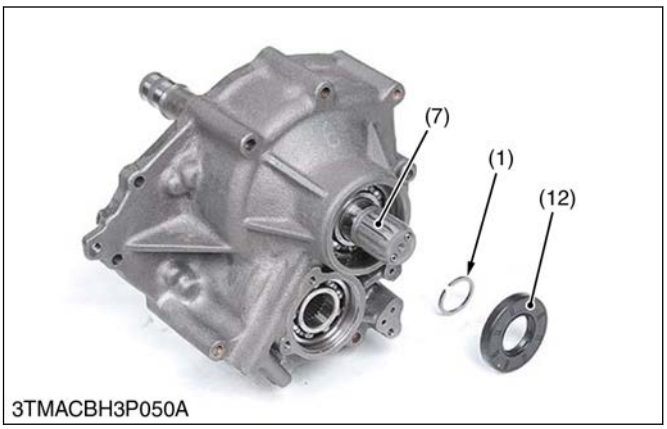
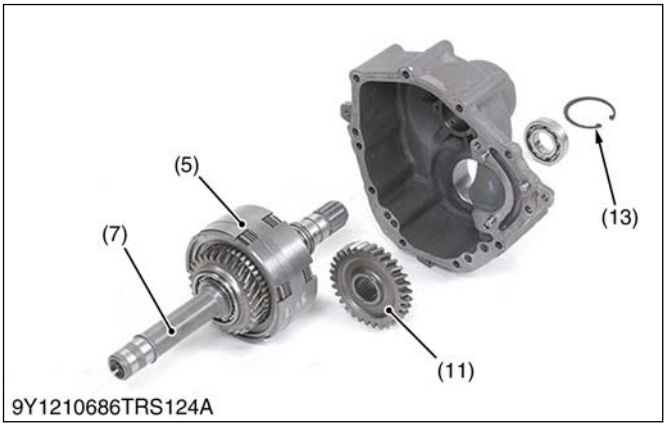


3TMACBH3P050A



9Y1210686TRS124A

(1) External circlip
(2) Bearing
(3) Shuttle gear case
(4) 26T gear
(5) Clutch pack
(6) 28T gear
(7) Dual speed shaft
(8) External circlip
(9) Key
(10) Holder
(11) 32T gear
(12) Oil seal
(13) Internal circlip

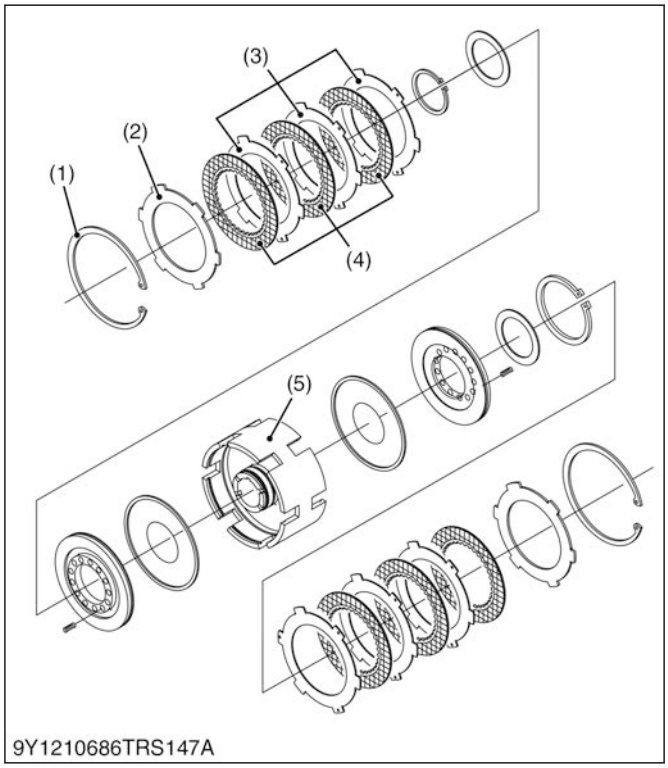
**(When reassembling)**

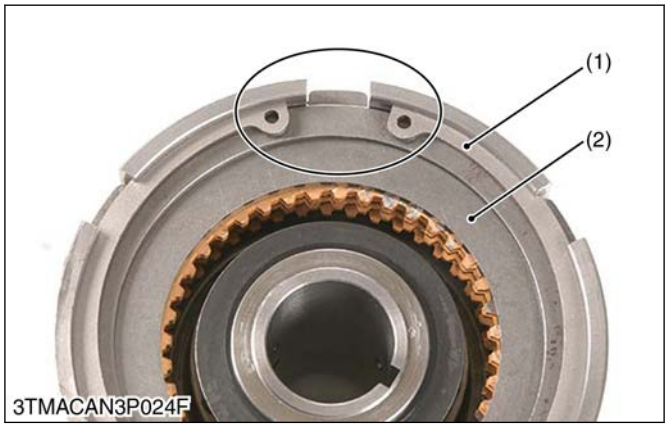
- Align the key (9) and groove of clutch pack (5).
- Replace the oil seal (12) with new one.

## 5.3.3.3 Disassembling dual speed clutch pack (F36/R36 speed transmission model)

1. Remove the internal circlip (1).

2. Remove the pressure plate (2), clutch discs (4) and steel plates (3).

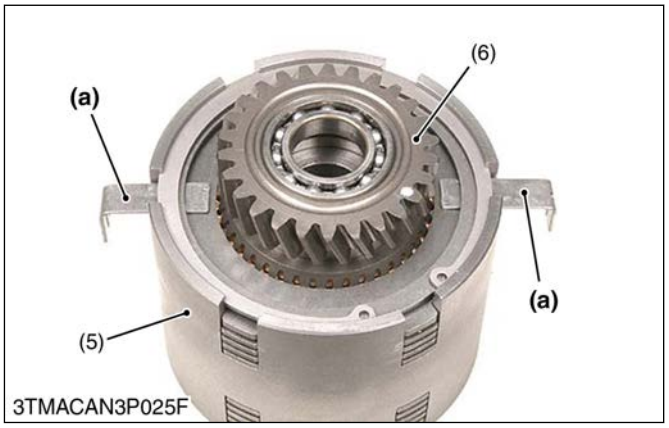


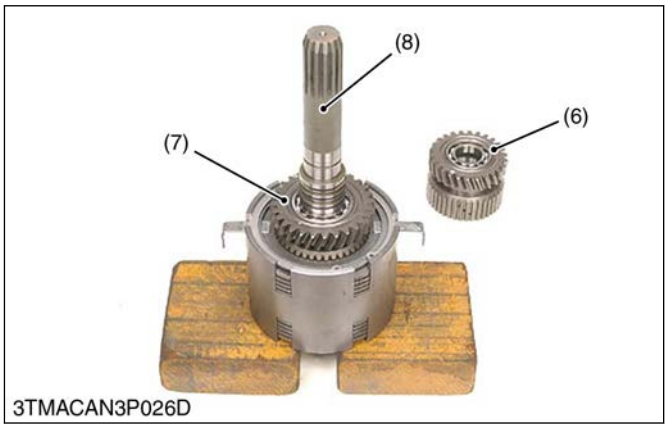




(1) Internal circlip
(2) Pressure plate
(3) Steel plate
(4) Clutch disc
(5) Clutch case

**(When reassembling)**

- Install the clutch discs (4) and steel plates (3) mutually.
- Apply enough transmission fluid to the discs (4).
- Do not confuse the pressure plate (2) and steel plate (3). The pressure plate (2) is thicker than the steel plate (3).
- When installing the internal circlip (1) to the clutch case (5) align its split portion to the notched portion of clutch case as shown in photo.
- When assembling the dual speed shaft (8) with 26T gear (7) for low speed side, temporary align the spline and clutch disk's teeth using the 28T gear (6).
  - Insert the steel piece (a) between the internal circlip (1) and pressure plate (2) to prevent the clutch discs (4) from turning during assembling.
  - Draw out the 28T gear (6) after inserted the steel piece (a). Then tap in the dual speed shaft (8) with 26T gear (7).
  - Do the same procedure for high speed side.
- Make sure the piston moves smoothly when 0.50 to 0.60 MPa (5.1 to 6.1 kgf/cm$^2$, 73 to 87 psi) of pressure air is sent to the clutch pack.




(5) Clutch case
(6) 28T gear
(7) 26T gear
(8) Dual speed shaft
(a) Steel piece

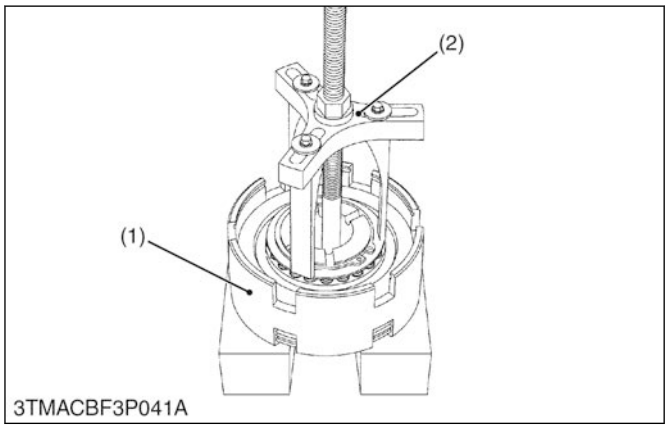
## 5.3.3.4 Disassembling dual speed clutch piston (F36/R36 speed transmission model)

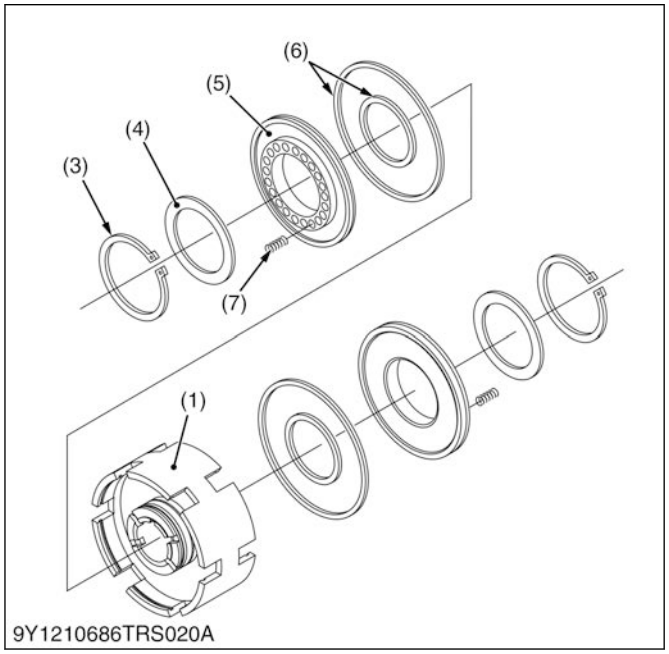
**NOTE**

- **13 springs for one side.**
- **The passage holes for the piston are beside the feather key groove.**

1. Press the washer (4) lightly by the hydraulic clutch spring compressor (2), and the remove the external circlip (3).

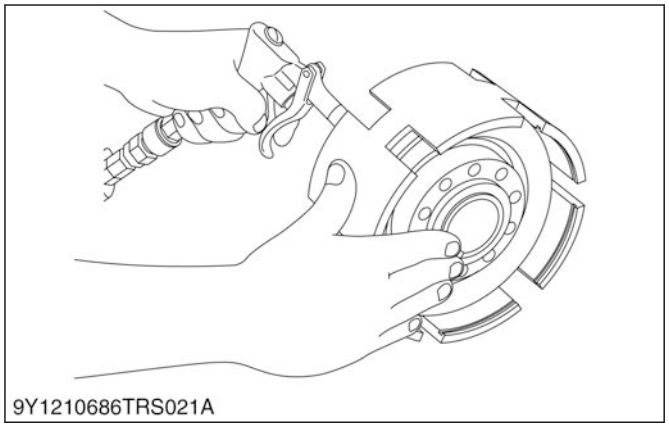
2. Remove the springs (7).




(1) Clutch case
(2) Hydraulic clutch spring compressor
(3) External circlip
(4) Washer
(5) Piston
(6) Seal ring
(7) Spring

3. Draw out the piston (5) using a compressed air.




**(When reassembling)**

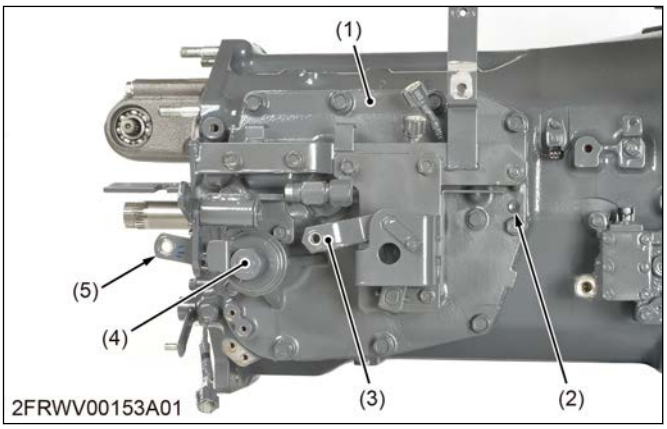
- Apply the enough transmission fluid to seal rings (6).

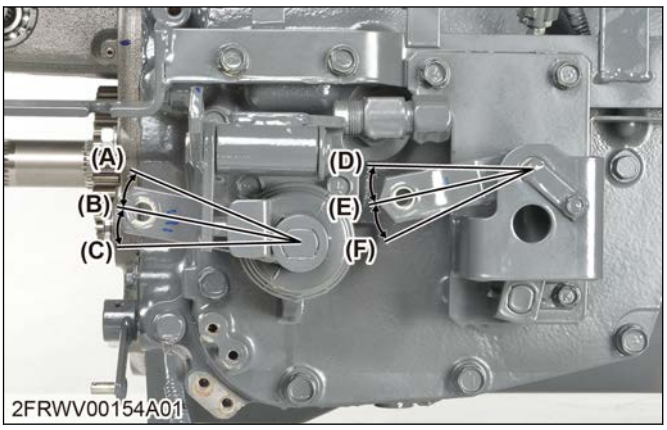
RELATED PAGE
2.16 Hydraulic clutch spring compressor on page 2-85

## 5.4 Shift cover

### 5.4.1 Removing shift cover

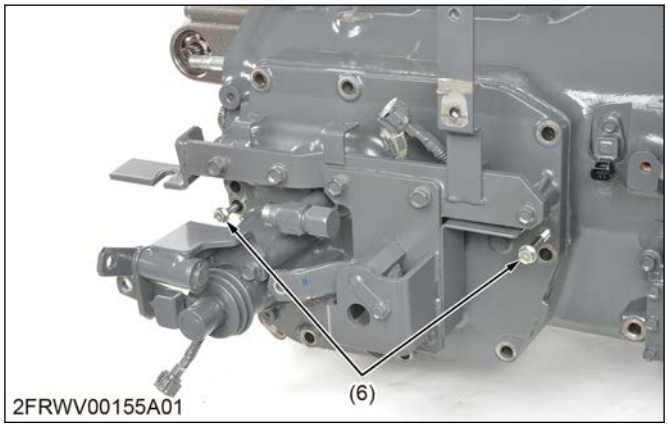
1. Set the main shift lever (5) to the **Neutral** position (B).
2. Set the range shift lever (3) to the H speed range position (D).
3. Remove the shift cover (1) mounting screws.



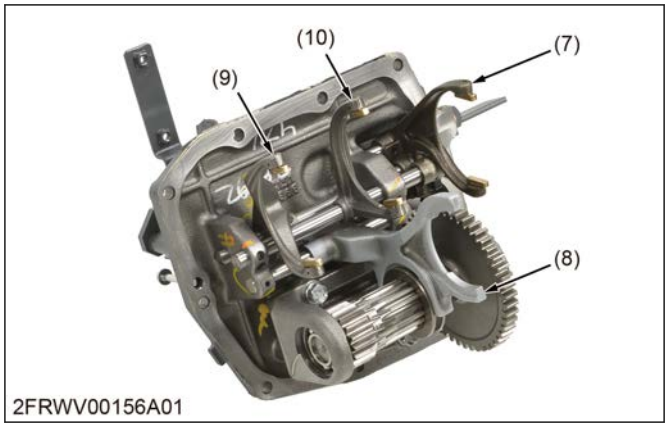

(1) Shift cover
(2) Threaded hole (for jack up)
(3) Range shift lever
(4) Main shift shaft
(5) Main shift lever
(A) 2nd, 4th or 6th gear position
(B) Neutral position
(C) 1st, 3rd or 5th gear position
(D) H speed range position
(E) L speed range position
(F) Creep speed range position

4. Screw in the M8 × 1.25 mm bolts (6) to threaded hole (2) for jacking up the shift cover (1).




(6) M8 × 1.25 mm bolt

5. Remove the shift cover (1) gently.




(7) 1st-2nd shift fork
(8) Range shift fork
(9) 3rd-4th shift fork
(10) 5th-6th shift fork

**(When reassembling)**

- Set all main change shift fork (7), (9) and (10) to **Neutral** position and shifters in the transmission on neutral position, and range shift fork (8) and shifter in the transmission on H speed range position side.
- Apply liquid gaskets (Three Bond 1206C or its equivalents) to joint face of the clutch housing and the shifter cover.
- Tighten the shift cover mounting bolts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Shift cover mounting bolt | 78 to 90 N·m<br>7.9 to 9.2 kgf·m<br>58 to 66 lbf·ft |

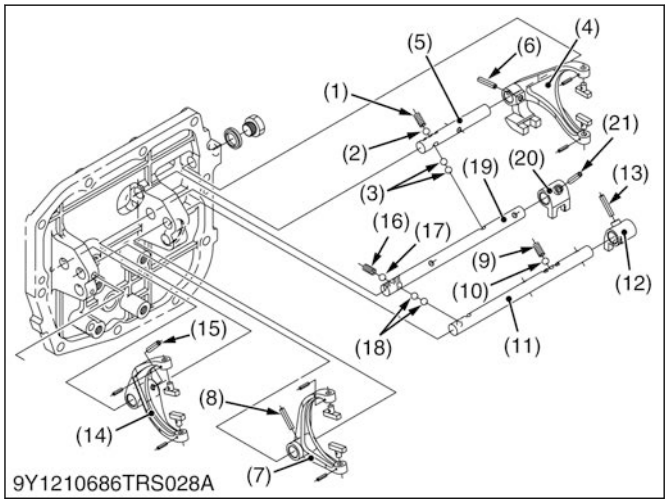
## 5.4.2 Disassembling main shift fork

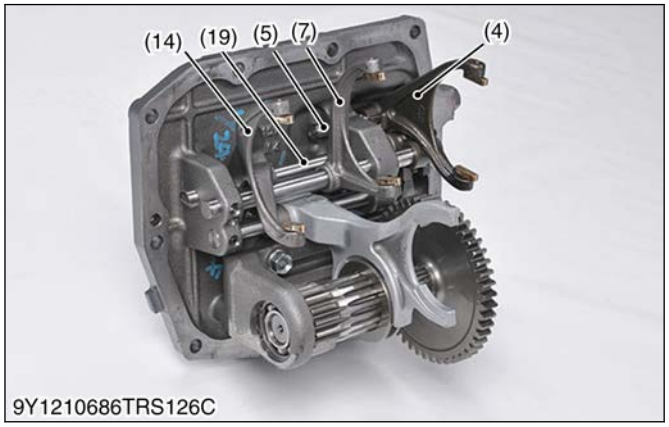
**■ NOTE**

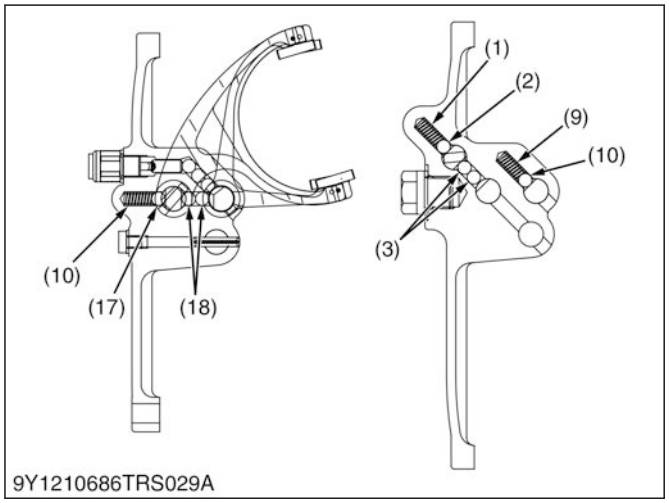
- **Be careful not to lose the balls and springs.**

1. Remove the roll pins (8), (13), fork rod (11), shifter (12) and 5th-6th fork (7).
2. Remove the roll pins (15), (21), fork rod (19), shifter (20) and 3rd-4th fork (14).

3. Remove the roll pin (6), fork rod (5) and 1st-2nd fork (4).




(1) Spring
(2) Ball (Detent)
(3) Ball (Interlock)
(4) 1st-2nd fork
(5) Fork rod
(6) Roll pin
(7) 5th-6th fork
(8) Roll pin
(9) Spring
(10) Ball (Detent)
(11) Fork rod
(12) Shifter
(13) Roll pin
(14) 3rd-4th fork
(15) Roll pin
(16) Spring
(17) Ball (Detent)
(18) Ball (Interlock)
(19) Fork rod
(20) Shifter
(21) Roll pin

**(When reassembling)**

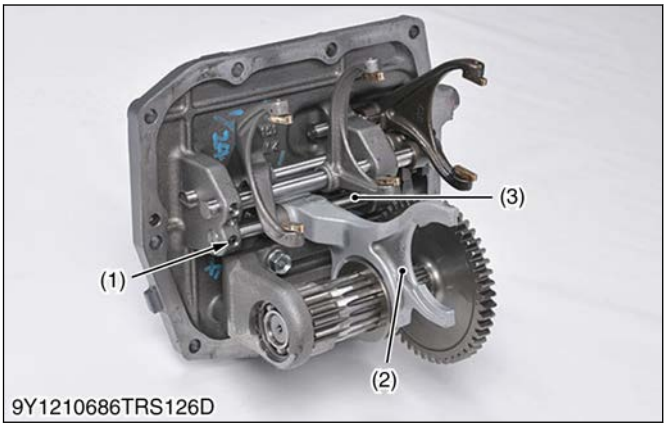
- Be sure to assemble the detent balls (2), (10), (17) with springs (1), (9), (16) and interlock balls (3), (18).

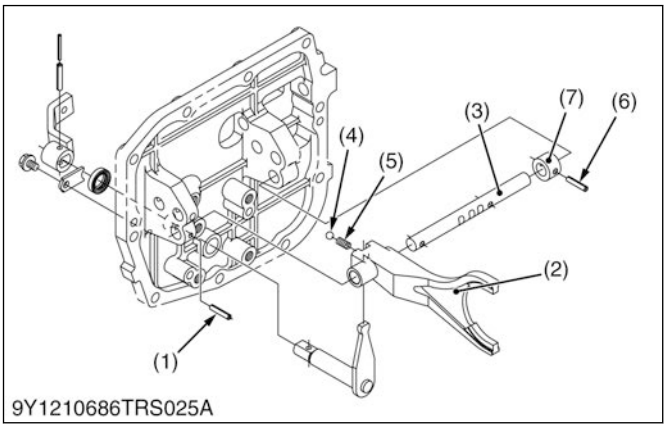
## 5.4.3 Disassembling range gear shift fork

**NOTE**

- **Be careful not to lose the detent ball (4) and spring (5).**

1. Remove the roll pin (1), (6), fork rod stopper collar (7), fork rod (3) and range shift fork (2).
2. Remove the ball (4) and spring (5).



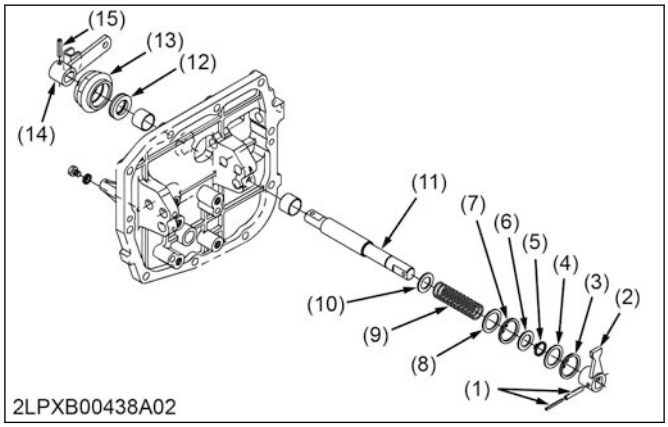




(1) Roll pin
(2) Range shift fork
(3) Fork rod
(4) Ball (Detent)
(5) Spring
(6) Roll pin
(7) Fork rod stopper collar

## 5.4.4 Removing main shift arm

1. Remove the roll pins (1) and main shift arm (2).
2. Remove the internal circlip (3) and collar (4).
3. Remove the external circlip (5) and collar (6).
4. Remove the internal circlip (7), collar (8), spring (9) and collar (10).

5. Remove the roll pin (15), main shift lever (14) and rubber boots (13) then slide the main shift shaft (11).

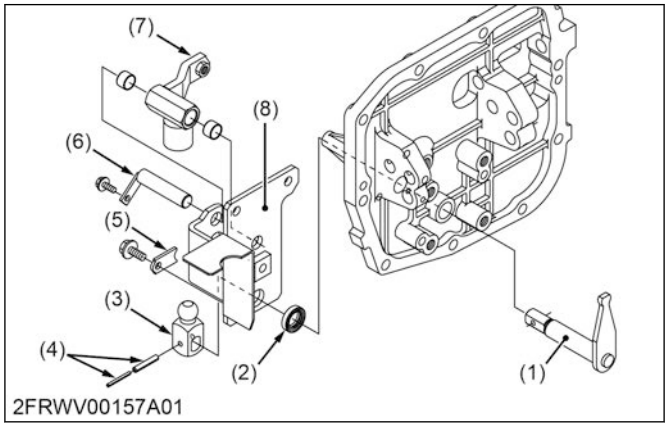



(1) Roll pin
(2) Main shift arm
(3) Internal circlip
(4) Collar
(5) External circlip
(6) Collar
(7) Internal circlip
(8) Collar
(9) Spring
(10) Collar
(11) Main shift shaft
(12) Oil seal
(13) Rubber boots
(14) Main shift lever
(15) Roll pin

**(When reassembling)**
- Replace the oil seal (12) with new one.
- Assemble the main shift arm (2) and main shift lever (14) with align both levers are the same direction as shown in the figure.

## 5.4.5 Disassembling range shift fork

1. Remove the range shift shaft (6) and then remove the range lever (7).
2. Remove the stopper plate (5).
3. Remove the roll pins (4) and range shift lever (3).
4. Remove the bracket (8).
5. Remove the range shift fork (1).

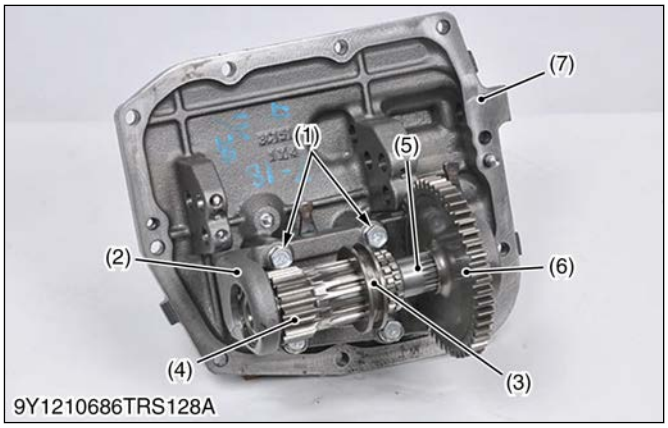


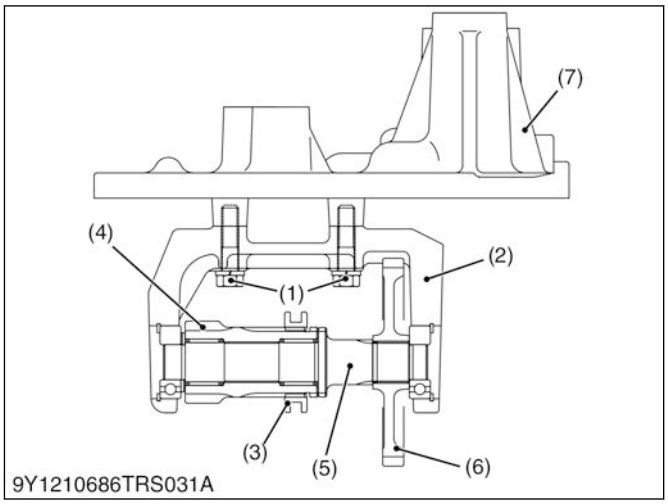

(1) Range shift fork
(2) Oil seal
(3) Range shift lever
(4) Roll pin
(5) Stopper plate
(6) Range shift shaft
(7) Range lever
(8) Bracket

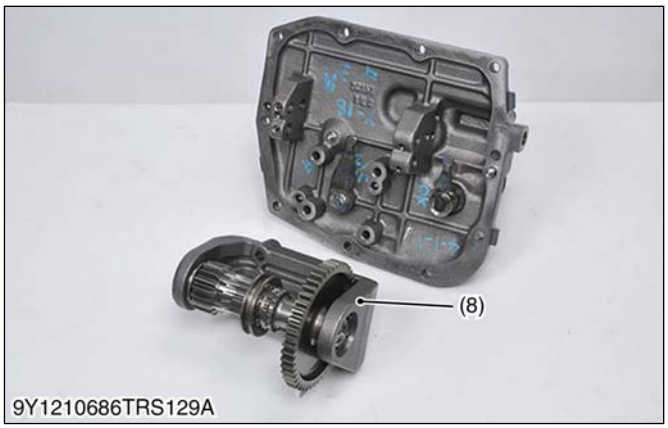
**(When reassembling)**
- Be sure to assemble the range shift fork (1) as an original direction as shown in the figure.
- Replace the oil seal (2) with new one.

## 5.4.6 Disassembling creep gear assembly

1. Remove the creep holder mounting bolts (1) and the creep gear assembly (8).



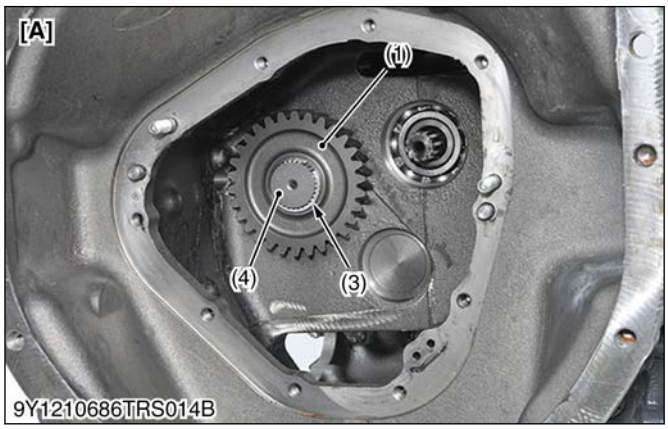

(1) Creep holder mounting bolt
(2) Creep holder
(3) Shifter
(4) 17T gear
(5) Creep shaft
(6) 48T gear
(7) Shift cover
(8) Creep gear assembly

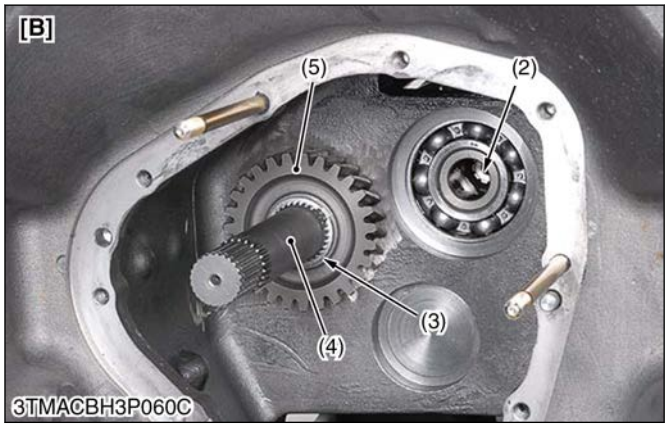
# 5.5 Disassembling clutch housing case

## 5.5.1 Removing 1st shaft, 2nd shaft and 3rd shaft

### 5.5.1.1 Removing 30T gear (27T gear)

1. Remove the external circlip 1 (3).
2. Remove the 30T gear (1) or 27T gear (5).

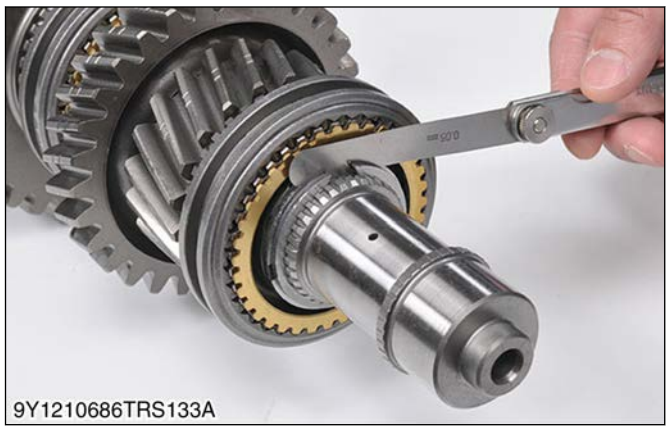


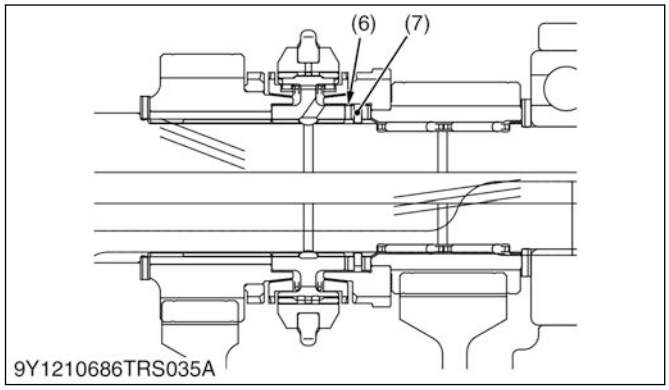




(1) 30T gear (F18/R18 speed transmission model)
(2) PTO propeller shaft
(3) External circlip 1
(4) 1st shaft
(5) 27T gear (F36/R36 speed transmission model)
[A] F18/R18 speed transmission model
[B] F36/R36 speed transmission model

**(When reassembling)**

- Adjust the side clearance of 1st-2nd gears on the 1st shaft by adjusting collar (6).




(6) Adjusting collar
(7) External circlip 2

**(Reference)**

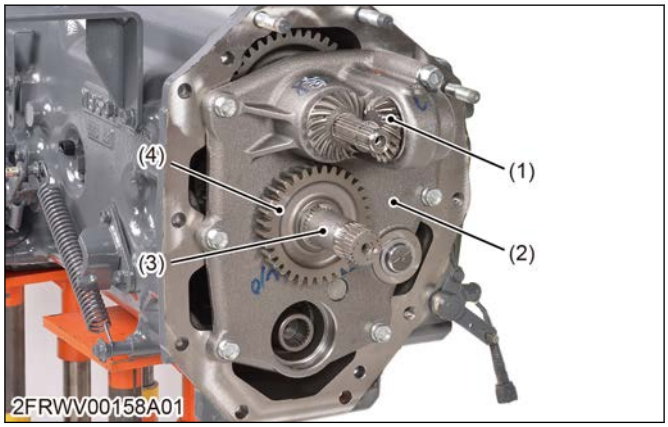
| | |
|---|---|
| Thickness of adjusting collar (6) | 2.6 mm<br>0.10 in. |
| | 2.8 mm<br>0.110 in. |
| | 3.0 mm<br>0.118 in. |
| | 3.2 mm<br>0.126 in. |
| | 3.4 mm<br>0.134 in. |

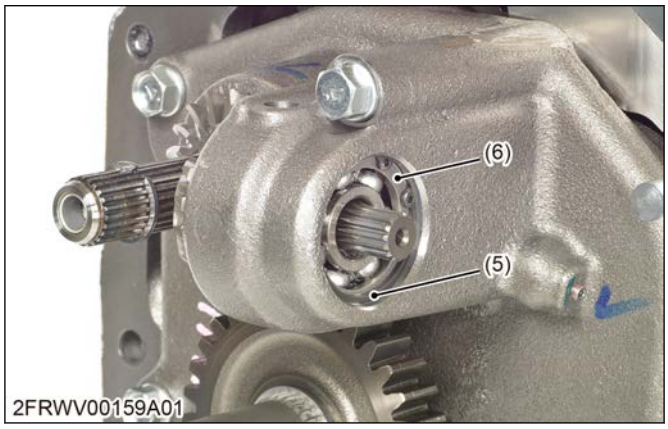
| | | |
|---|---|---|
| Clearance between external circlip and collar on 1st shaft | Factory specification | Less than<br>0.2 mm<br>0.008 in. |

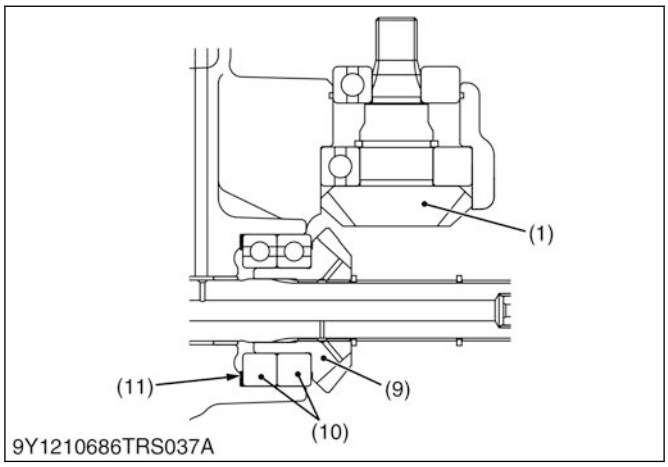
### 5.5.1.2 Removing PTO propeller shaft, bearing holder and pump gear

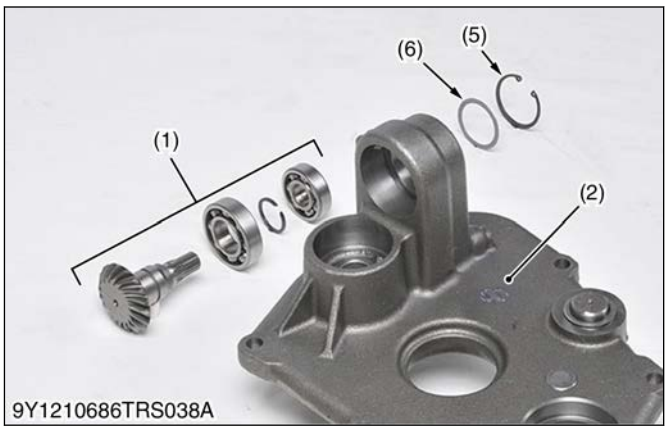
1. Remove the internal circlip (5), shim 1 (6) and slide the 18T spiral bevel gear assembly (1).
2. Tap out the PTO propeller shaft (7) frontward and then remove the external circlips (8), 19T spiral bevel gear (9), bearing (10) and shim 2 (11).
3. Remove the external circlip and 33T gear (4).
4. Remove the bearing holder mounting bolts, and draw out the bearing holder (2).

5. If the 3rd shaft (3) comes out with bearing holder, tap in the 3rd shaft (3) during drawing out the bearing holder (2).



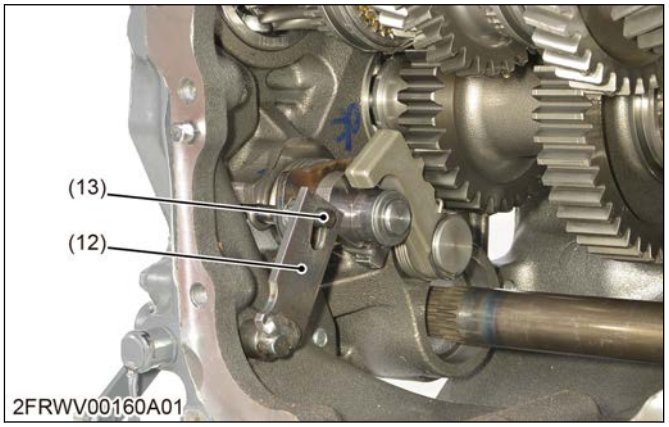





(1) 18T spiral bevel gear assembly
(2) Bearing holder
(3) 3rd shaft
(4) 33T gear
(5) Internal circlip
(6) Shim 1
(7) PTO propeller shaft
(8) External circlip
(9) 19T spiral bevel gear
(10) Bearing
(11) Shim 2

**(When reassembling)**

- Check the backlash between 18T spiral bevel gear (1) and 19T spiral bevel gear (9).
- Be sure to fix the parking brake arm (13) and parking cam lever (12).



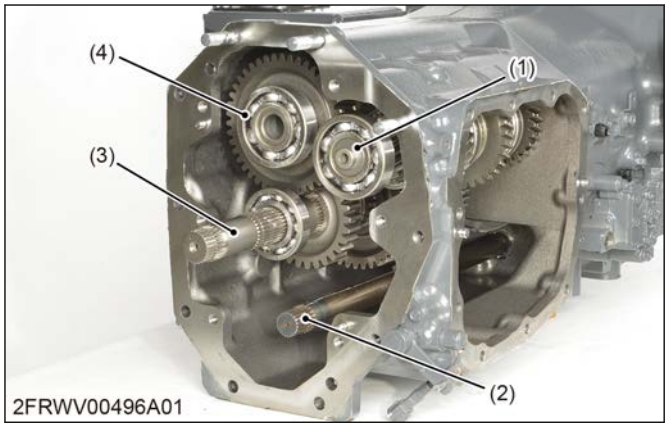

(12) Parking cam lever
(13) Parking brake arm

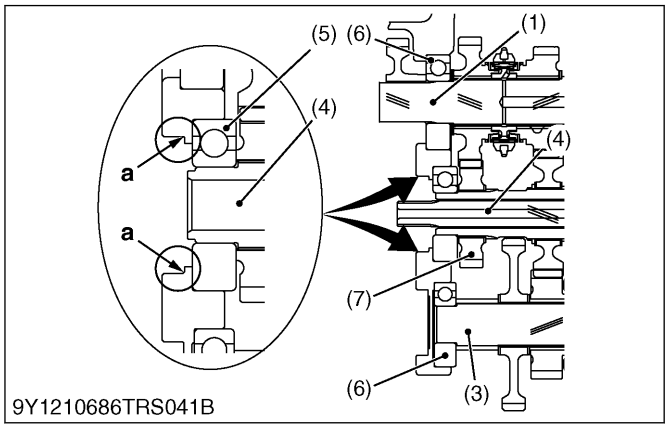
## 5.5.1.3 Removing 1st shaft, 2nd shaft and 3rd shaft

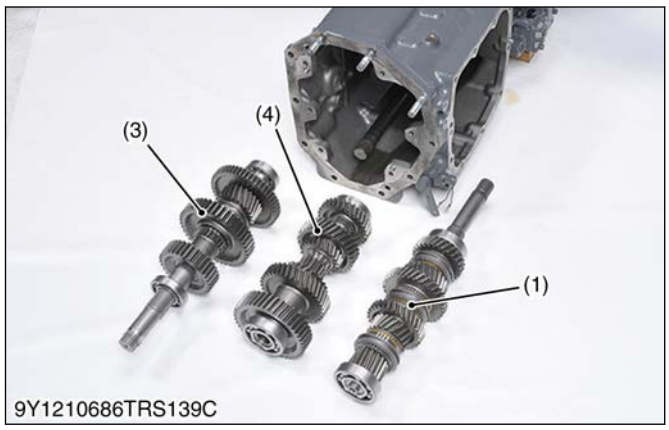
**IMPORTANT**

- **Do not fall down the shaft when removing the shafts with gears.**
- **Do not tap the bearing stop part (a) of clutch housing. Otherwise it damage the part of clutch housing. Be sure to tap at the inner race of bearing 1 (5) or 2nd shaft when removing the 2nd shaft assembly (4).**

1. Slowly draw out the three shafts with gears together by step by step.
2. Remove the three shafts from clutch housing .




(1) 1st shaft assembly
(2) 4WD propeller shaft
(3) 3rd shaft assembly
(4) 2nd shaft assembly
(5) Bearing 1
(6) Bearing 2
(7) Gear
a: Bearing stop part

**(When reassembling)**

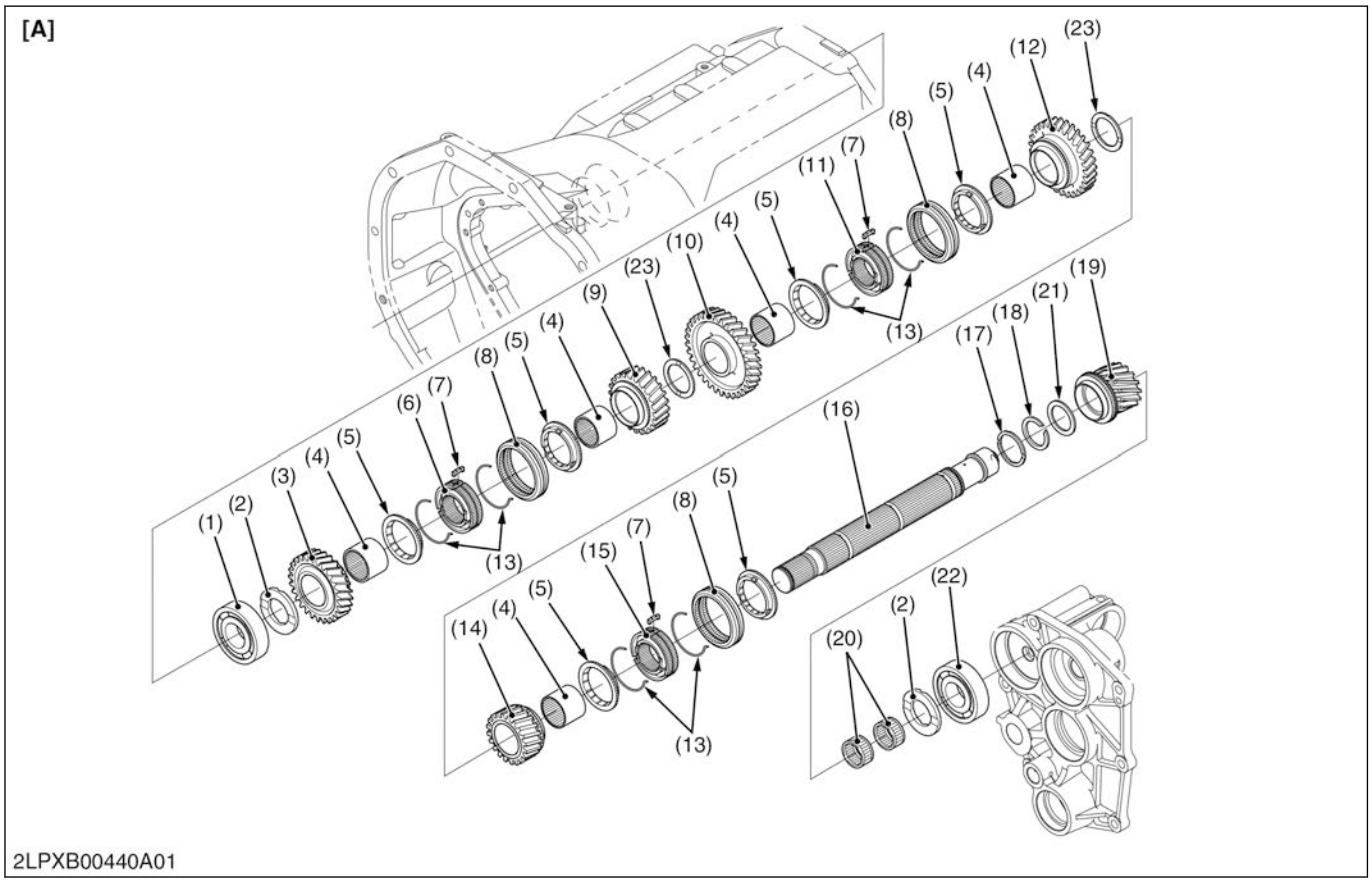
- For easily assembling, stand the clutch housing and assemble the 1st shaft assembly (1) except bearing 2 (6), 2nd shaft assembly (4) except bearing 1 (5) and gear (7) and 3rd shaft assembly (3) except bearing 2 (6) at same time, and then assemble the bearings (5), (6) and gear (7) into those shafts.

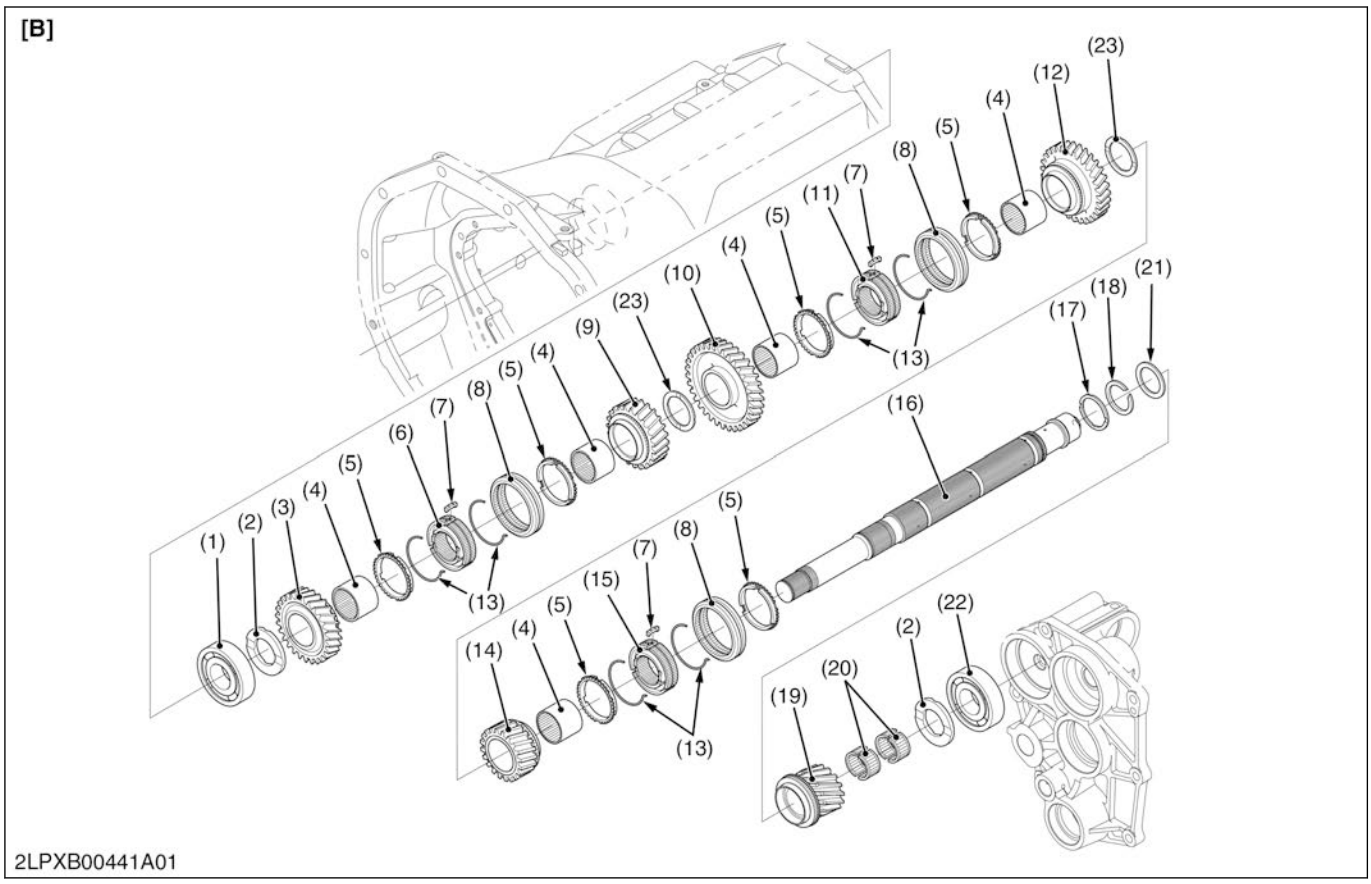
## 5.5.2 1st shaft

### 5.5.2.1 Disassembling 1st shaft

1. Remove the bearing (22).

2. Remove all synchronize unit and gears.




[B]
(1)
(2)
(3)
(4)
(5)
(6)
(7)
(8)
(9)
(10)
(11)
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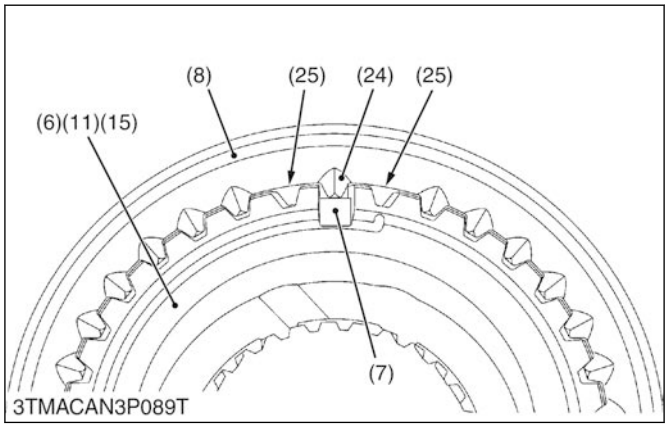
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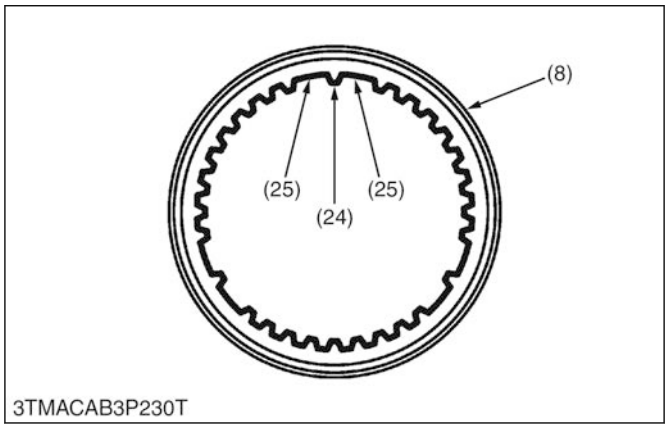
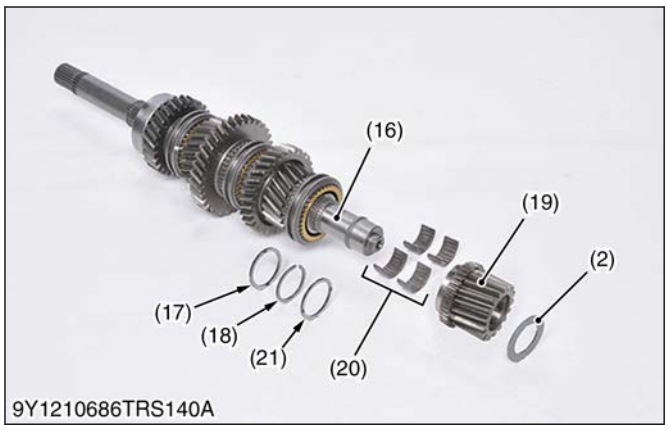
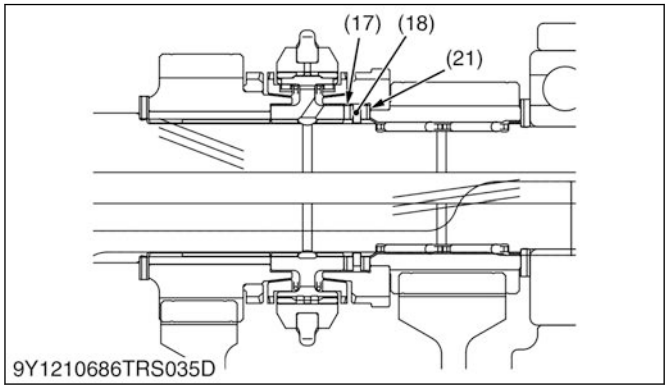
3TMACAN3P089T


(8)
(25)
(24)
(25)
3TMACAB3P230T





(1) Bearing
(2) Thrust collar
(3) 27T gear
(4) Inner race
(5) Synchronizer ring
(6) Coupling (3-4 speed)
(7) Synchronizer key
(8) Shifter
(9) 23T gear
(10) 35T gear
(11) Coupling (5-6 speed)
(12) 30T gear
(13) Synchronizer spring
(14) 20T gear
(15) Coupling (1-2 speed)
(16) 1st shaft
(17) Adjusting collar
(18) External circlip
(19) 17T gear
(20) Needle bearing (Split type)
(21) Thrust collar
(22) Bearing
(23) Thrust collar
(24) Teeth
(25) Without teeth
[A] F18/R18 speed transmission model
[B] F36/R36 speed transmission model

**(When reassembling)**

- Apply molybdenum disulfide (Three Bond 1901 or its equivalents) to the inner races (4).
- Apply transmission fluid to synchronizer unit.
- Be sure to assemble the synchronizer unit, setting the teeth (24) on the shifter (8) to the key (7) as shown in the figure.
- Set the split type needle bearing (20) on the 1st shaft, then install the 17T gear (19).
- Set the thrust needle bearing (20) and thrust collar (21) toward the needle side to the 17T gear (19).
- Do not confuse the adjusting collar (17) and thrust collar (21).
- Adjust the side clearance of the 1st-2nd gears on the 1st shaft by adjusting collar (17). Check the clearance between external circlip (18) and adjusting collar (17).

| | | |
|---|---|---|
| Clearance between external circlip and adjusting collar on 1st shaft | Factory specification | Less than<br>0.2 mm<br>0.008 in. |

- Replace the external circlip (18) with new one.

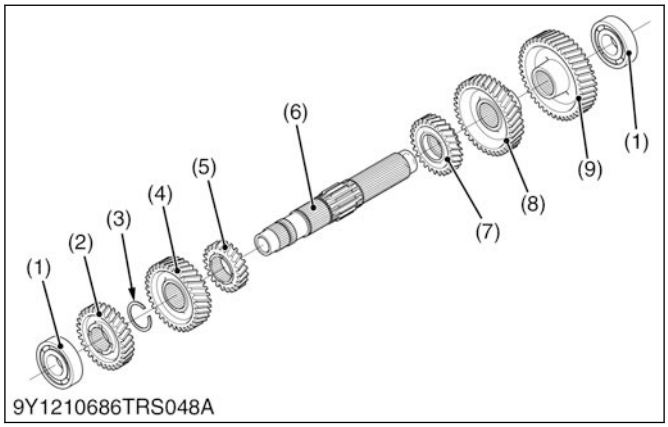
**(Reference)**

| | |
|---|---|
| Thickness of adjusting collar (17) | 2.6 mm<br>0.10 in. |
| | 2.8 mm<br>0.110 in. |
| | 3.0 mm<br>0.118 in. |
| | 3.2 mm<br>0.126 in. |
| | 3.4 mm<br>0.134 in. |

## 5.5.3 2nd shaft and 3rd shaft

### 5.5.3.1 Disassembling 2nd shaft

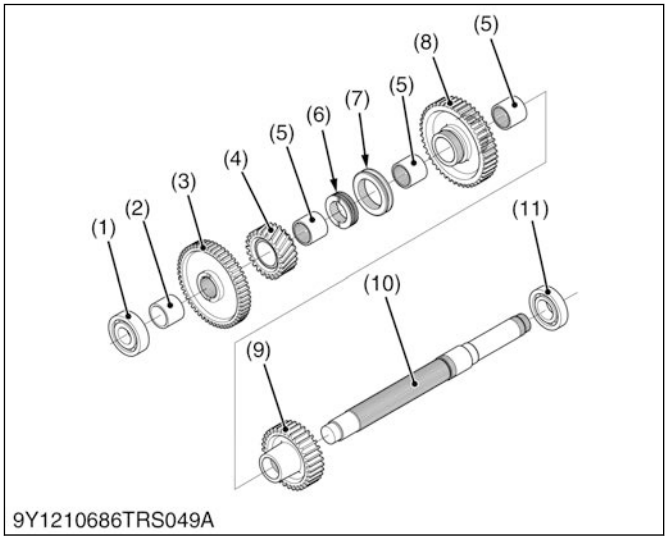
1. Remove the bearing (1).
2. Draw out the gears.




(1) Bearing
(2) 30T gear
(3) External circlip
(4) 33T gear
(5) 22T gear
(6) 2nd shaft
(7) 27T gear
(8) 37T gear
(9) 43T gear

### 5.5.3.2 Disassembling 3rd shaft

1. Remove the bearing (1).
2. Draw out the gears.




(1) Bearing
(2) Collar
(3) 53T gear
(4) 24T gear
(5) Inner race
(6) Spline boss
(7) Shifter
(8) 45T-22T gear
(9) Gear
F18/R18: 33T, F36/R36: 29T
(10) 3rd shaft
(11) Bearing

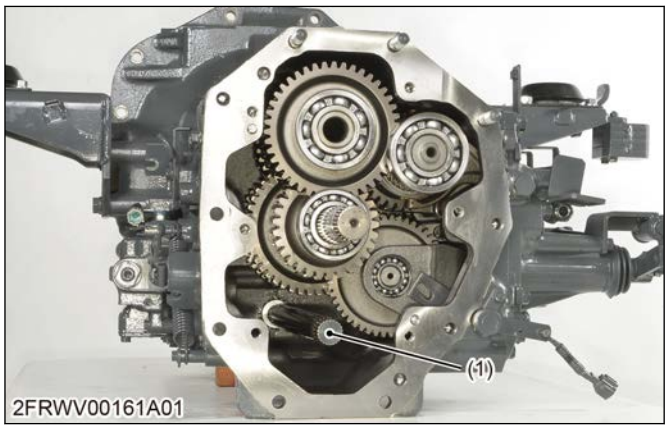
**(When reassembling)**

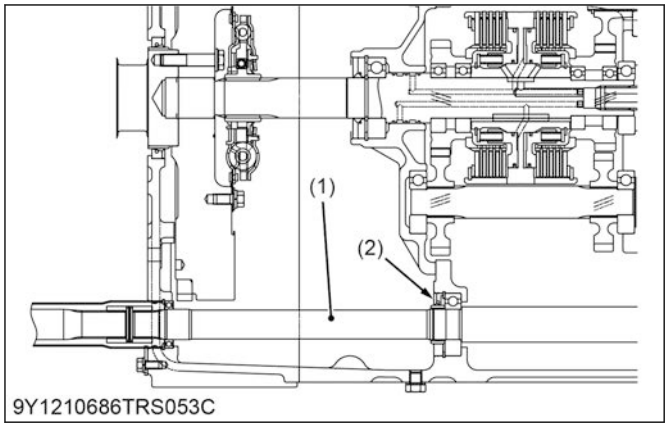
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner races (5).

## 5.5.4 4WD propeller shaft

### 5.5.4.1 Removing 4WD propeller shaft

1. Tap out the 4WD propeller shaft (1) rearwards.




(1) 4WD propeller shaft (2) Oil seal

**(When reassembling)**

**■ IMPORTANT**

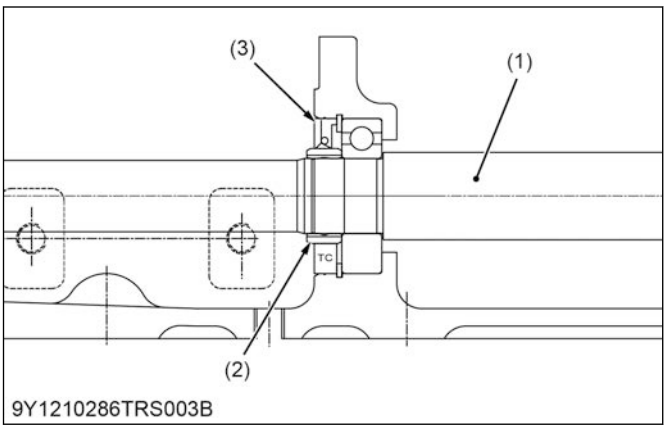
- **When replacing the oil seal (2) without removing the 4WD propeller shaft (1), be sure to use "Propeller shaft oil seal fitting tool" to attach the oil seal appropriately.**

**■ NOTE**

- **When replacing the oil seal (2), apply the grease to the oil seal (2).**

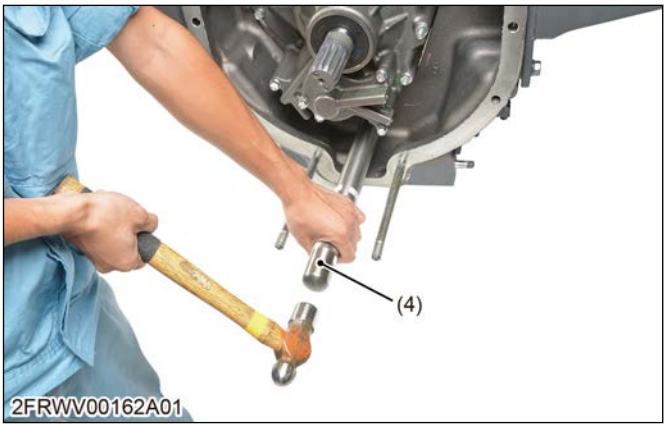
### 5.5.4.2 Replacing oil seal and sleeve to the propeller shaft

1. Attach the propeller shaft (1) into the position.



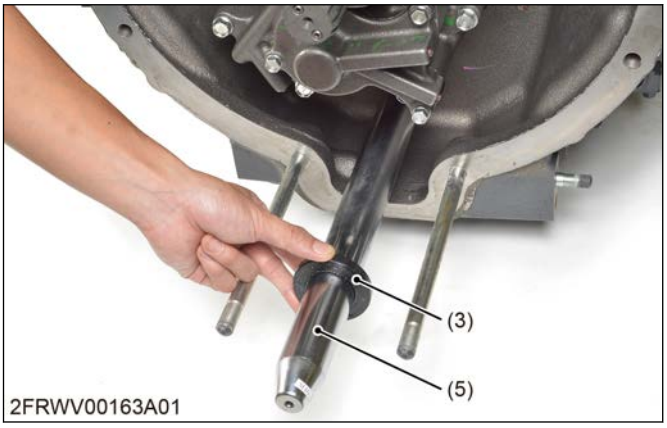

(1) Propeller shaft (3) Oil seal
(2) Sleeve

2. Fit the sleeve (2) to the propeller shaft (1) and tap it by using "Propeller shaft sleeve fitting tool" (4).




(4) Propeller shaft sleeve fitting tool

3. Fit the oil seal (3) to the propeller shaft by using "Arbor for oil seal of propeller shaft" (5) to prevent damage for inner of the oil seal (3).




(5) Arbor for oil seal of propeller shaft

4. Tap the oil seal (3) by using "Propeller shaft oil seal fitting tool" (6).


(6) Propeller shaft oil seal fitting tool

**(When reassembling)**

**■ NOTE**

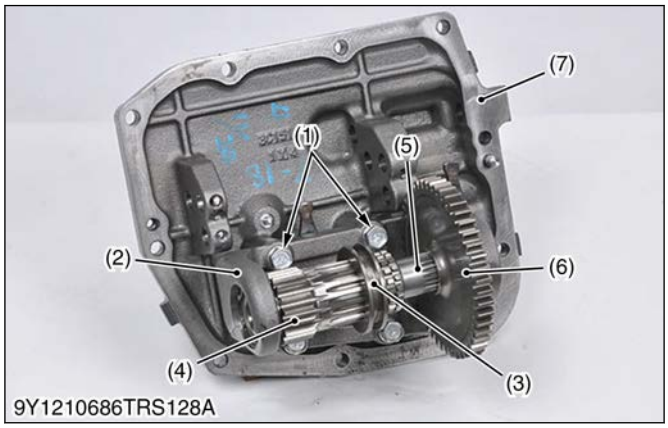
- **When replacing the sleeve (2), apply the grease to the sleeve (2).**
- **When replacing the oil seal (3), apply the grease to the oil seal (3).**

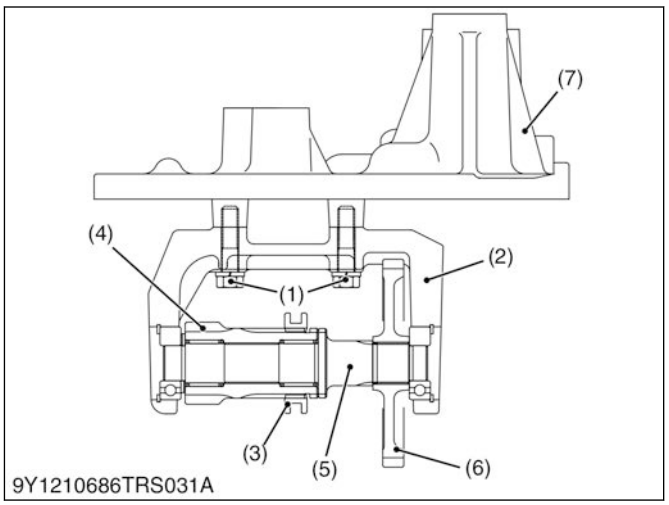
RELATED PAGE
2.27 Propeller shaft sleeve fitting tool on page 2-104
2.28 Arbor for oil seal of propeller shaft on page 2-104
2.29 Propeller shaft oil seal fitting tool on page 2-104

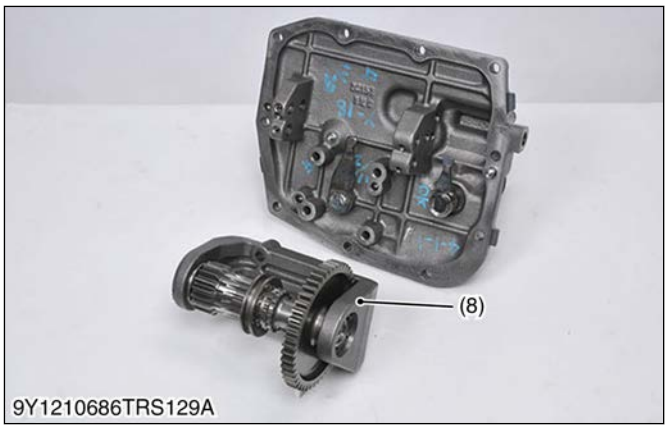
## 5.5.5 Creep gear

### 5.5.5.1 Disassembling creep gear and shaft

1. Remove the creep holder mounting bolts (1) and the creep shaft assembly (8).

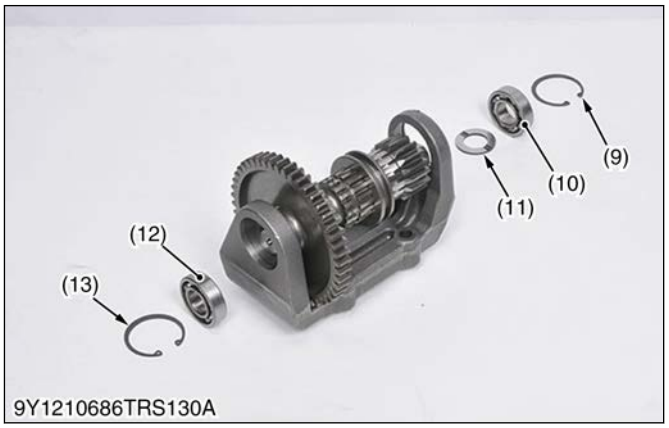



(1) Creep holder mounting bolt
(2) Creep holder
(3) Shifter
(4) 17T gear
(5) Creep shaft
(6) 48T gear
(7) Shift cover
(8) Creep shaft assembly

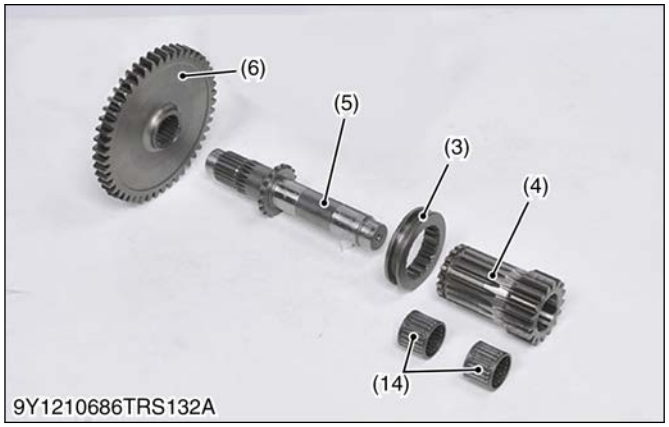
2. Remove the internal circlips (9), (13) and the bearings (10), (12).




(9) Internal circlip
(10) Bearing
(11) Thrust collar
(12) Bearing
(13) Internal circlip

3. Slide the creep shaft (5) with 17T gear (4) to the side of 48T gear (6) and then remove the creep shaft with 17T gear (4) from the creep holder (2).

4. Disassemble the creep shaft with 17T gear (4).


(3) Shifter
(4) 17T gear
(5) Creep shaft
(6) 48T gear
(14) Needle bearing

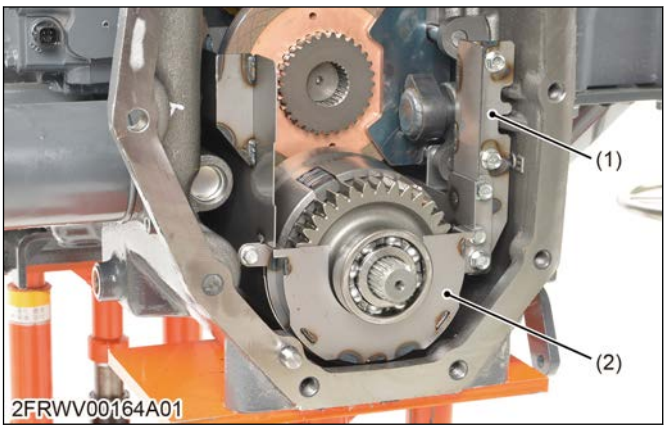
**(When reassembling)**

- Apply the oil to needle bearings (14) and the thrust collar (11).
- Replace the internal circlip (9), (13) with the new one.

## 5.6 Disassembling transmission case

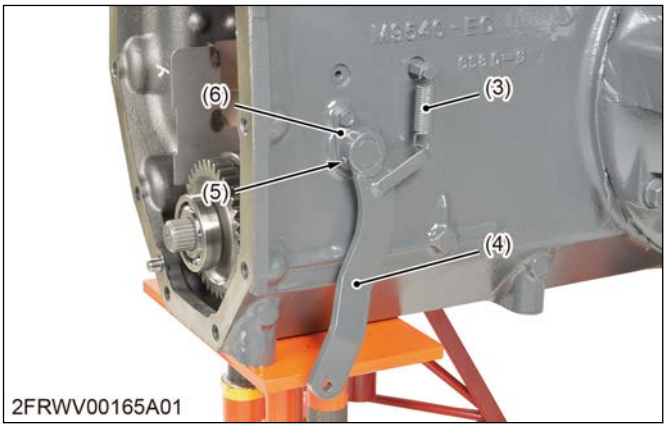
### 5.6.1 Removing secondary brake disc and plate

1. Remove the cover 2 (2) and cover 1 (1).




(1) Cover 1
(2) Cover 2

2. Remove the brake spring (3).
3. Remove the spring pin (5) and brake cam lever (4).
4. Remove the stopper plate (6) and O-ring.



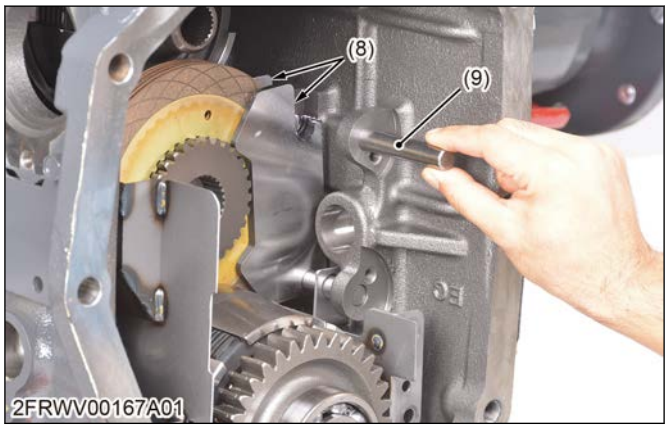

(3) Brake spring
(4) Brake cam lever
(5) Spring pin
(6) Stopper plate

5. Remove the brake cam shaft (7).


(7) Brake cam lever

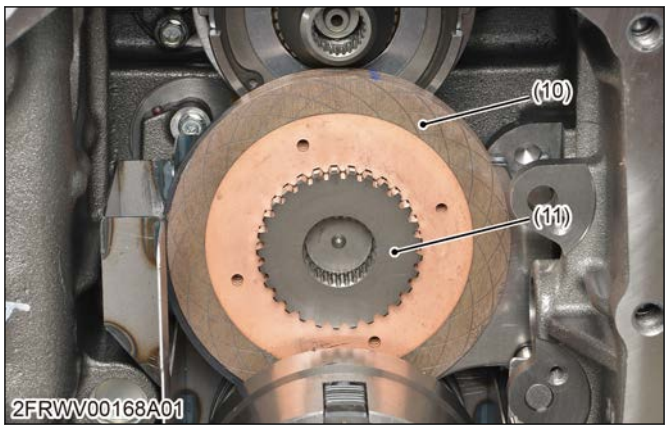
6. Remove the upper pin (9).

7. Remove the pressure plates (8).




(8) Pressure plate (9) Upper pin

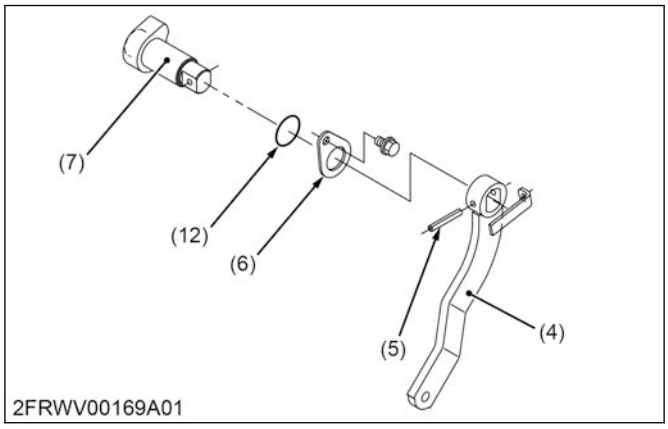
8. Remove the secondary brake assembly (10) with coupling (11).




(10) Secondary brake assembly (11) Coupling

**(When reassembling)**

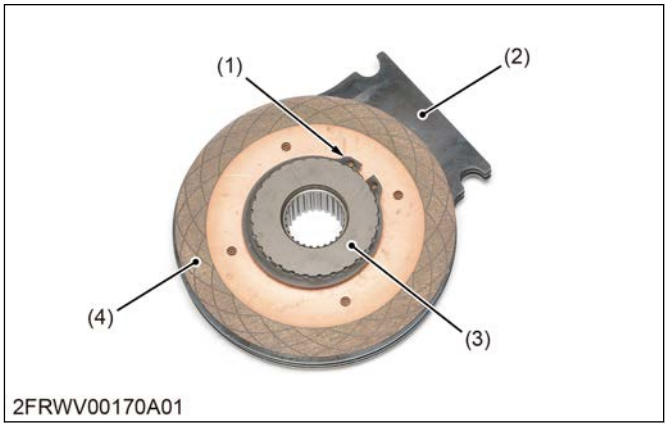
- Apply the transmission fluid to the brake discs and plates.
- Apply the transmission fluid to the brake cam lever (7).
- Replace the O-ring (12) with the new one.
- Apply grease to the O-ring (12).

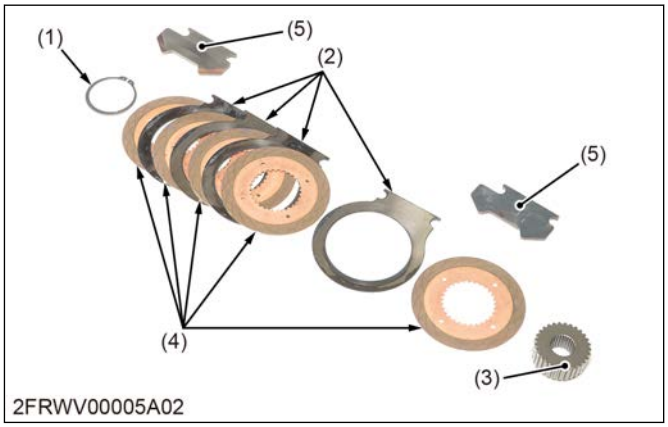



(4) Brake cam lever (7) Brake cam lever
(5) Spring pin (12) O-ring
(6) Stopper plate

## 5.6.2 Disassembling secondary brake disc and plate

1. Remove the external cir-clip (1).
2. Remove the secondary brake discs (4) and plates (2).




(1) External cir-clip (4) Secondary brake disc
(2) Plate (5) Pressure plate
(3) Coupling

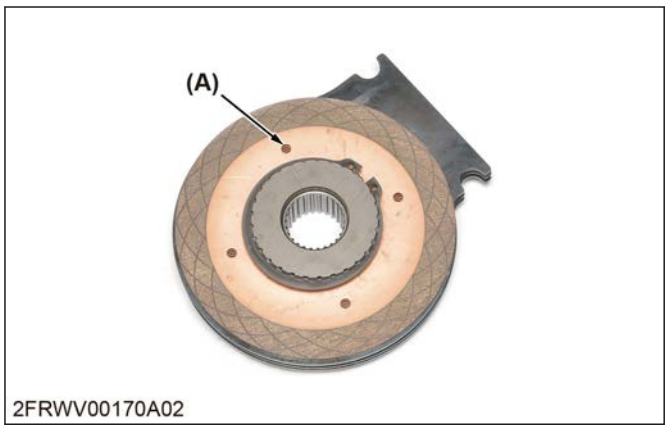
**(When reassembling)**

**■ IMPORTANT**

- **Check the plates (2) and brake discs (4). If they are worn or damaged, be sure to replace the their parts with new one.**

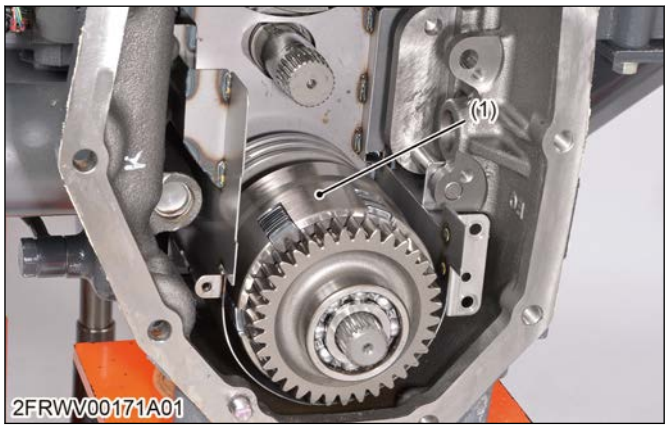
**■ NOTE**

- **Apply the transmission fluid to the plates (2) and secondary brake discs (4).**
- **Place the secondary brake discs (4) so that the hole (A) of secondary brake discs should be overlapped.**




## 5.6.3 Removing 4WD clutch

1. Remove the 4WD clutch (1).

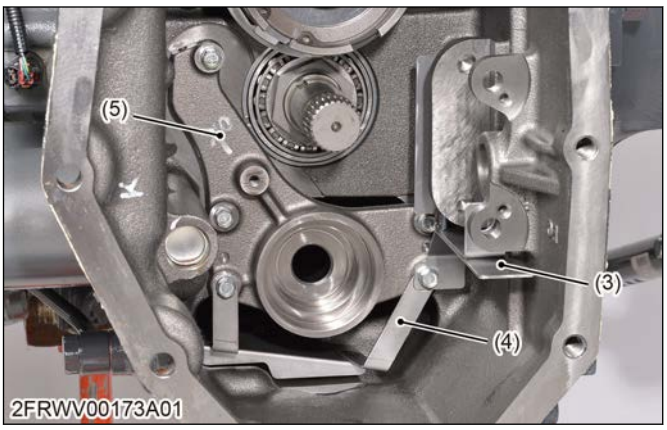



(1) 4WD clutch

2. Remove the cover 1 (2).


(2) Cover 1

3. Remove the cover 2 (3) and 3 (4).
4. Remove the 4WD clutch holder (5).




(3) Cover 2
(4) Cover 3
(5) 4WD clutch holder

**(When reassembling)**

**IMPORTANT**

- **Do not disassemble the 4WD clutch (1). Replace the 4WD clutch with new one.**
- Replace the seal rings (6) with new one.
- Apply the transmission fluid to the seal rings (6).


(6) Seal ring

## 5.6.4 Removing PTO clutch pack

### 5.6.4.1 Removing PTO clutch and holder

1. Remove the PTO clutch holder mounting screws.

2. Remove the PTO clutch (1) with holder (2).


(1) PTO clutch (2) Holder

**(When reassembling)**

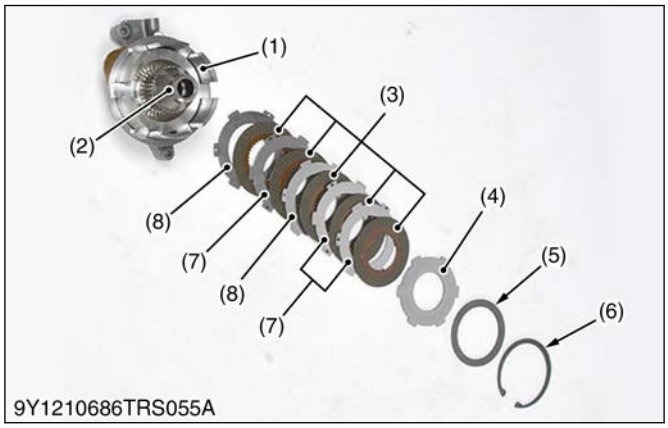
- Tighten the PTO clutch holder mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | PTO clutch holder mounting screw | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |

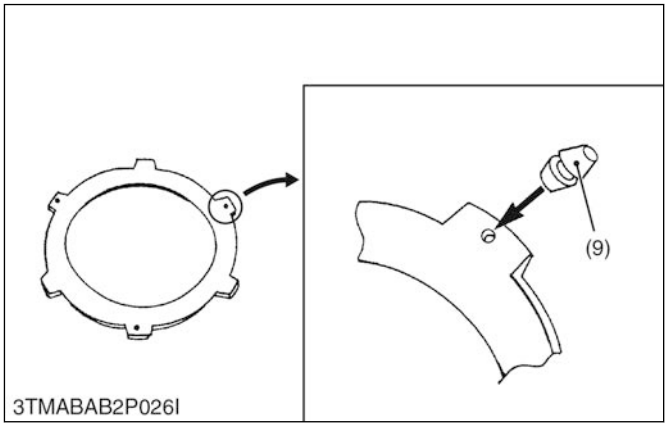
## 5.6.5 Disassembling PTO clutch pack

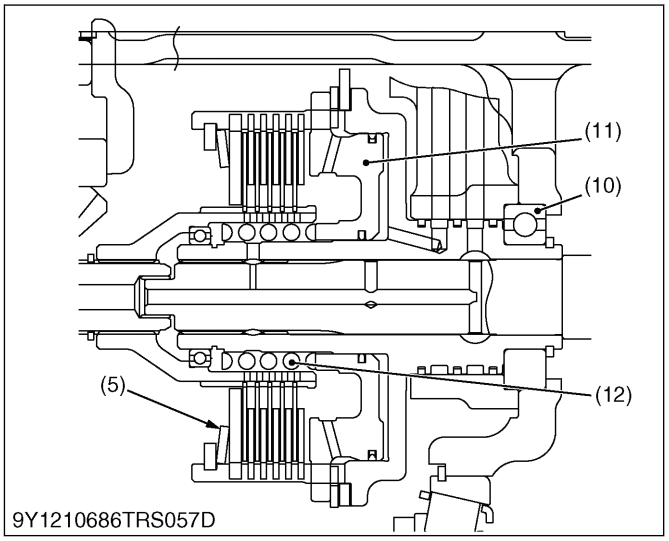
### 5.6.5.1 Disassembling clutch hub and clutch disc

1. Remove the internal circlip (6), and then remove the clutch discs (3), belleville washer (cupped spring washer) (5), back plate (4), steel plates (7), (8) and the hub (2).








(1) Clutch case
(2) Hub
(3) Clutch disc
(4) Back plate
(5) Belleville washer (Cupped spring washer)
(6) Internal circlip
(7) Steel plate (with plug rubber)
(8) Steel plate (without plug rubber)
(9) Plug rubber
(10) Bearing
(11) Piston
(12) Spring

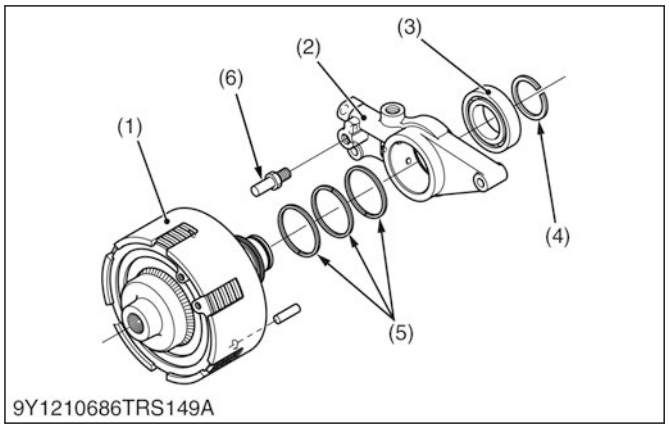
**(When reassembling)**

- Install the clutch discs (3) and steel plates (7), (8) alternately referring to figure.
- Do not confuse the two types of the steel plates. One is the steel plate with plug rubber (9), and other is the steel plate without plug rubber (9).

- Do not confuse the back plate (4) and steel plates. The back plate (4) is the thicker than the steel plates.
- Assemble the plug rubbers portion of the two steel plates (7) are same positions while assembling them.
- Apply the enough transmission fluid to the discs (3).
- Make sure the piston (11) moves smoothly when 0.30 to 0.39 MPa (3.0 to 4.0 kgf/cm$^2$, 43 to 56 psi) of compressed air is sent to clutch pack. (Refer to the photo.)
- Assemble the steel plates with rubber (7) and steel plates without rubber (8) referring to the photo, and steel plates are built in so that the part of rubber is not corresponding to the part of the hole.
- Be sure to assemble the belleville washer (cupped spring washer) (5) as shown in the figure.

## 5.6.5.2 Disassembling clutch case and clutch holder

1. Remove the external circlip (4).
2. Remove the clutch holder (2).



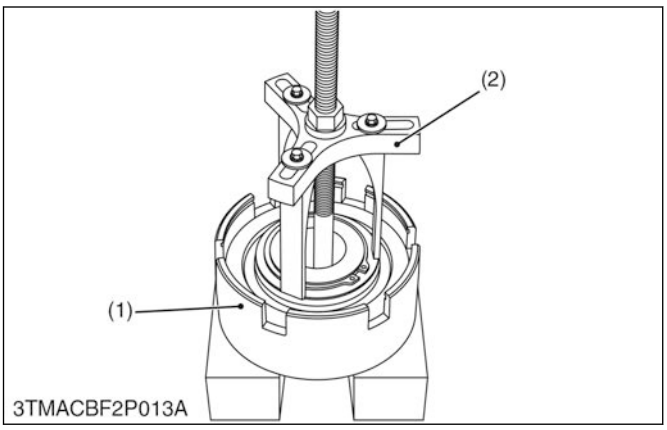

(1) Clutch case
(2) Clutch holder
(3) Bearing
(4) External circlip
(5) Seal ring
(6) Pin

**(When reassembling)**

- Apply small amount of grease to the seal rings (5).
- Apply liquid lock (Three Bond 1324N or equivalent) to the thread part of pin (6).

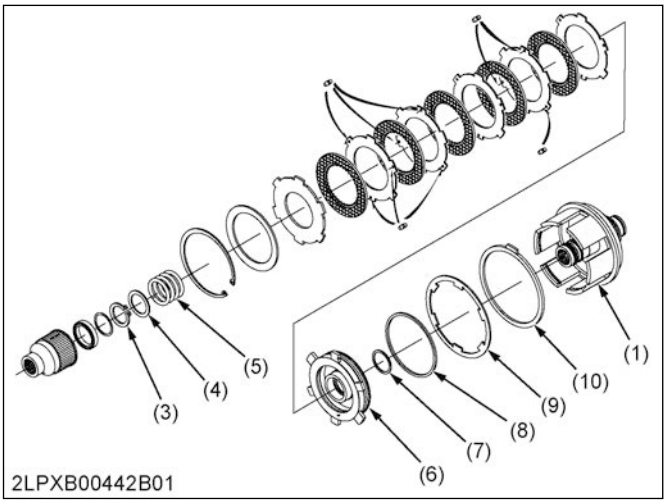
## 5.6.5.3 Disassembling PTO clutch piston

1. Remove the external circlip (3), pressing the washer (4) lightly with a hydraulic clutch spring compressor (2).




(1) Clutch case
(2) Hydraulic clutch spring compressor

2. Remove the piston (6), the brake plate (9) and the brake disc (10).




(3) External circlip
(4) Washer
(5) Spring
(6) Piston
(7) Seal ring
(8) Seal ring
(9) Brake plate
(10) Brake disc

**(When reassembling)**

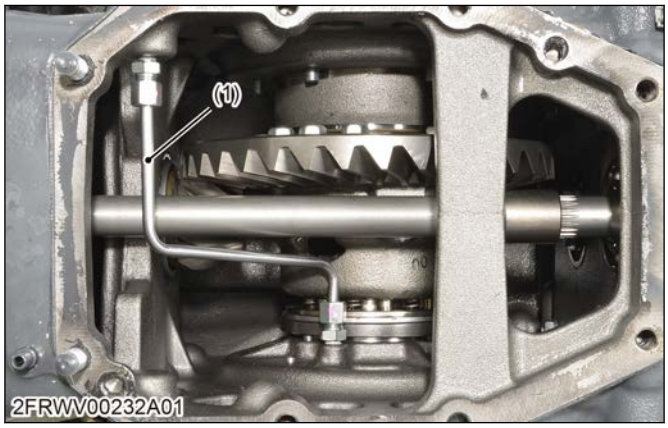
- Apply enough transmission fluid to the seal ring (7) and (8).

RELATED PAGE
2.16 Hydraulic clutch spring compressor on page 2-85

## 5.6.6 Removing differential gear and bevel pinion shaft (4WD model)

### 5.6.6.1 Removing differential pipe

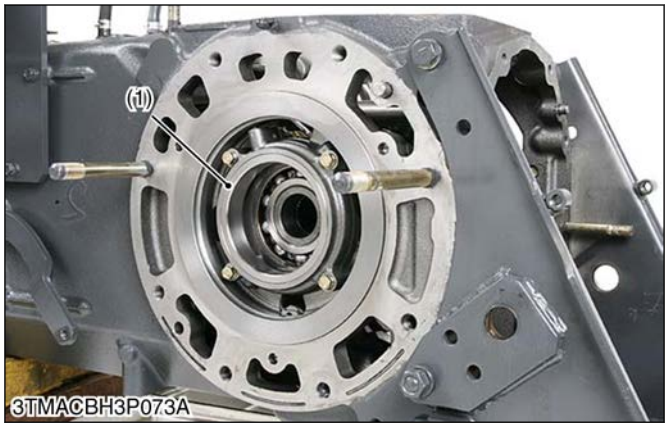
1. Remove the differential pipe (1).




(1) Differential pipe

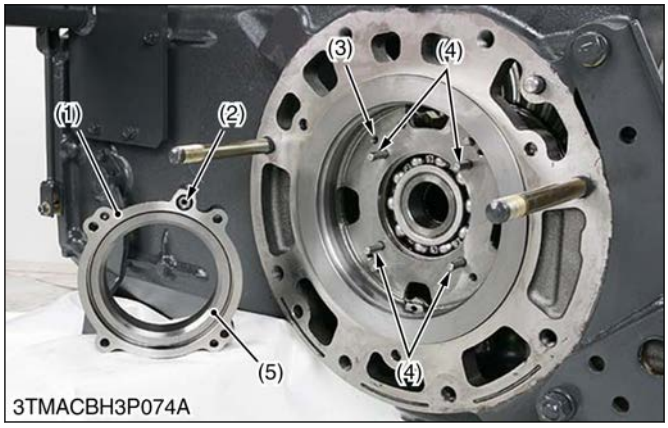
### 5.6.6.2 Removing differential lock device

1. Remove the differential lock support (1) with piston (5).




(1) Differential lock holder

2. Remove the pins (4).



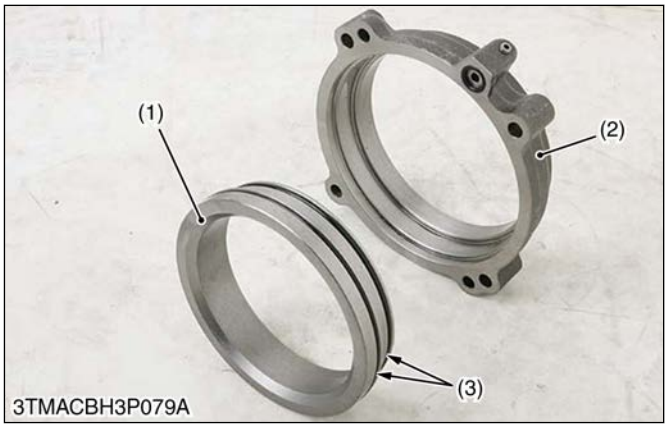

(1) Differential lock holder
(2) O-ring
(3) Oil passage
(4) Pin
(5) Piston

**(When reassembling)**

- Apply transmission fluid to the O-ring (2).
- Align the oil passage (3).

### 5.6.6.3 Removing differential lock piston

1. Remove the piston (1) from the differential lock support (2).



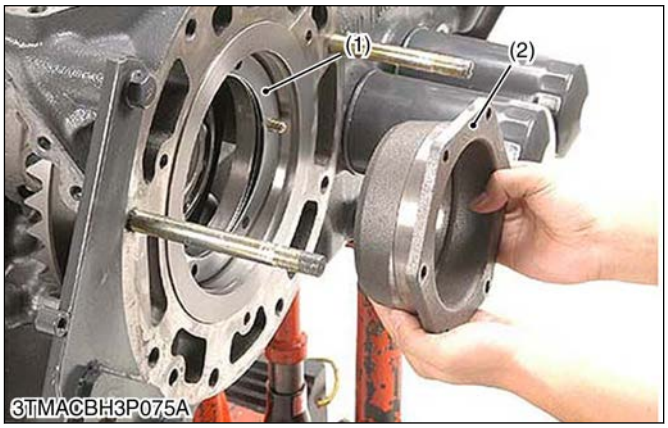

(1) Piston
(2) Differential lock support
(3) O-ring

**(When reassembling)**

- Replace the O-rings (3) with new one.
- Apply transmission fluid to the O-rings (3).

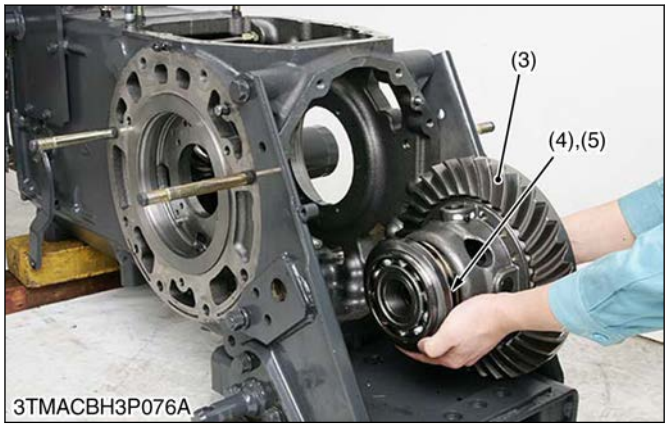
### 5.6.6.4 Removing differential gear assembly

1. Remove the differential support (2), noting the number of shims (1).



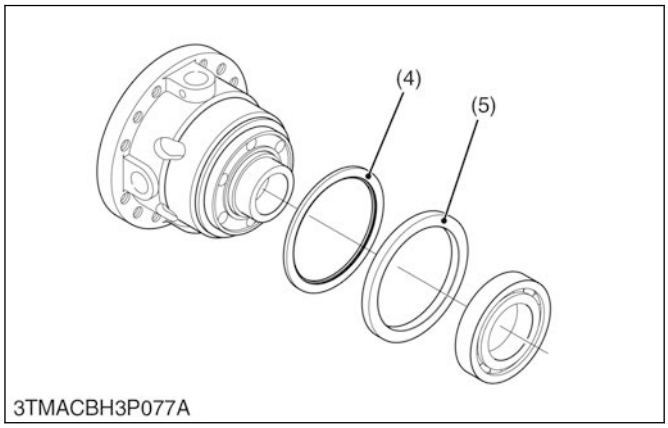

(1) Shim
(2) Differential support

2. Remove the differential gear assembly (3) from transmission case.




(3) Differential gear assembly (5) Differential lock collar
(4) Thrust bearing

3. Remove the differential lock collar (5) and thrust bearing (4).




(4) Thrust bearing (5) Differential lock collar

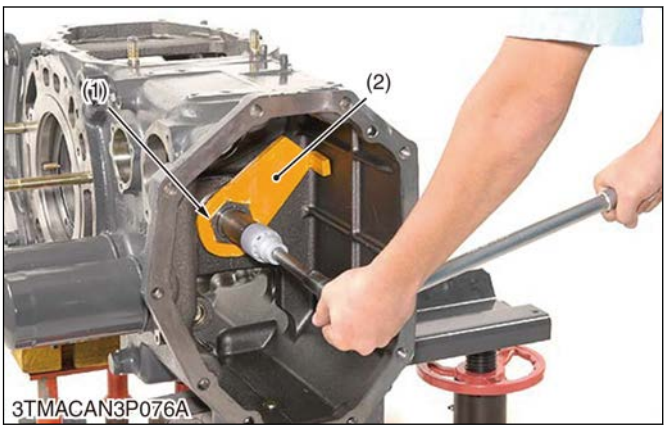
**(When reassembling)**

- Be sure to adjust the turning torque of spiral bevel pinion shaft.
- Be sure to adjust the backlash and tooth contact between the spiral bevel gear and spiral bevel pinion shaft.
- Tighten the differential bearing support mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Differential bearing support mounting screw | 60 to 70 N·m<br>6.2 to 7.1 kgf·m<br>45 to 51 lbf·ft |

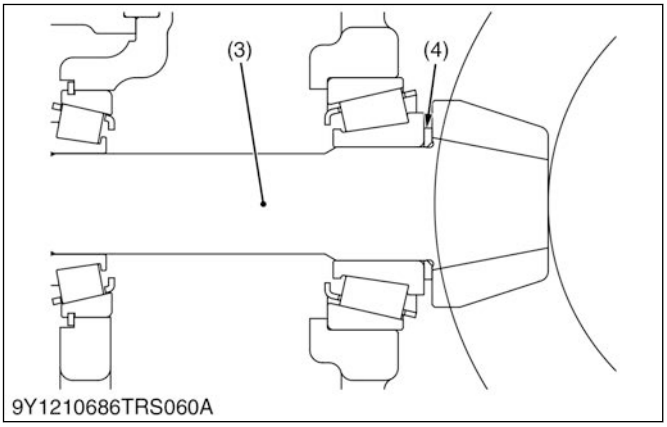
## 5.6.6.5 Removing spiral bevel pinion shaft

1. Remove the stake of staking nut (1).
2. Set the staking nut locking wrench (2).




(1) Staking nut (2) Locking wrench

3. Set the spiral bevel pinion shaft turning wrench.
4. Turn the spiral bevel pinion shaft turning wrench to the counterclockwise, then remove it.
5. Tap out the spiral bevel pinion shaft (3) to the rear.




(3) Spiral bevel pinion shaft (4) Collar

**(When reassembling)**

- Replace the staking nut with a new one, and be sure to adjust the turning torque of spiral bevel pinion shaft itself.
- Stake the staking nut after installing the differential gear assembly.

| | | |
|---|---|---|
| Tightening torque | Spiral bevel pinion shaft staking nut | 93.2 to 102 N·m<br>9.5 to 10.5 kgf·m<br>68.8 to 75.9 lbf·ft |

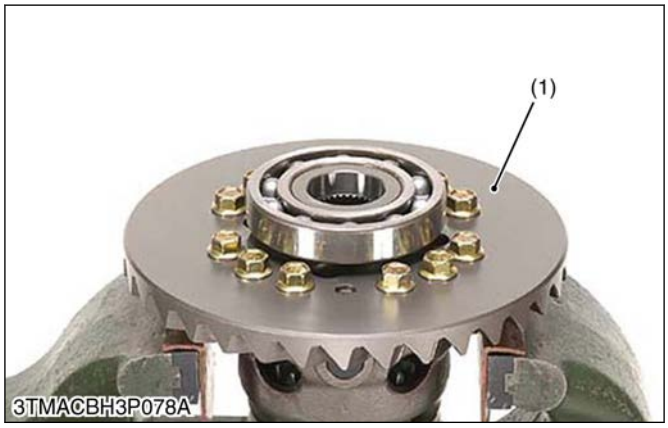
RELATED PAGE
2.17 Locking wrench on page 2-89
2.18 Bevel gear shaft (8T) tool on page 2-89

## 5.6.7 Differential gear

## 5.6.7.1 Removing spiral bevel gear

1. Set the spiral bevel gear assembly to a vise.
2. Remove the ball bearing with a puller.
3. Remove the spiral bevel gear mounting UBS screw

4. Remove the spiral bevel gear (1).




(1) Spiral bevel gear

**(When reassembling)**

- Check the spiral bevel gear for wear or damage. If it is no longer serviceable, replace it. Then, also replace the spiral bevel pinion shaft.
- Apply liquid lock (Three Bond 1324N or its equivalents) to the spiral bevel gear mounting UBS screws.
- Tighten the spiral bevel gear mounting UBS screw to the specified tightening torque.

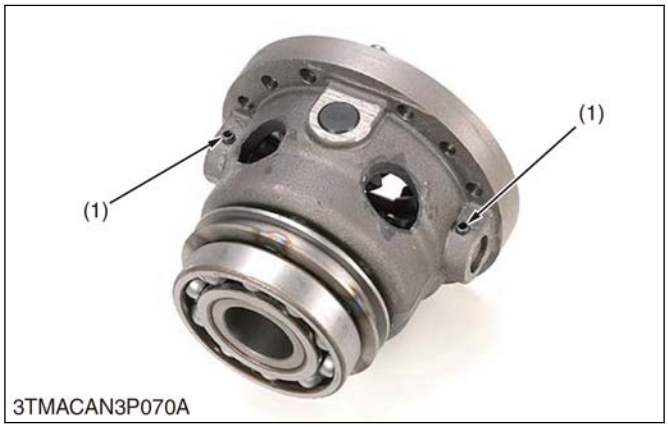
| | | |
|---|---|---|
| Tightening torque | Spiral bevel gear mounting UBS screw | 143 to 161 N·m<br>14.5 to 16.5 kgf·m<br>105 to 119 lbf·ft |

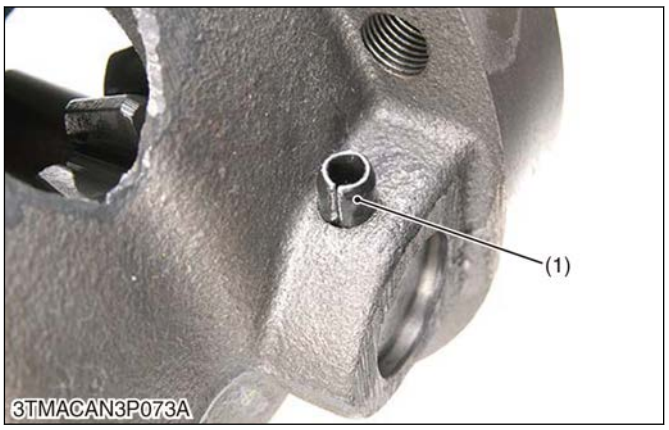
## 5.6.7.2 Disassembling differential pinion shaft and differential pinion gear

**■ NOTE**

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

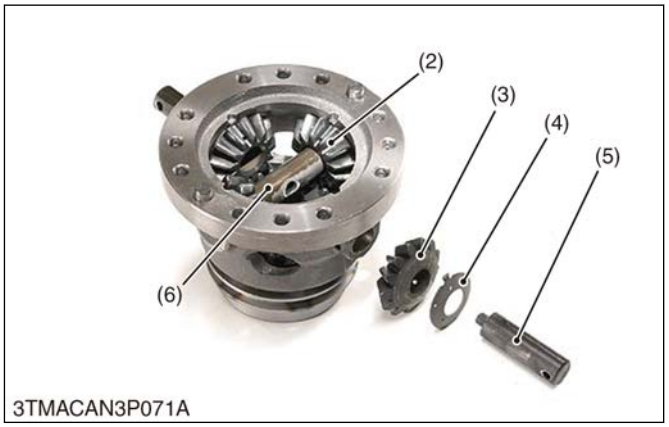
1. Tap out the split pin (1).




(1) Split pin

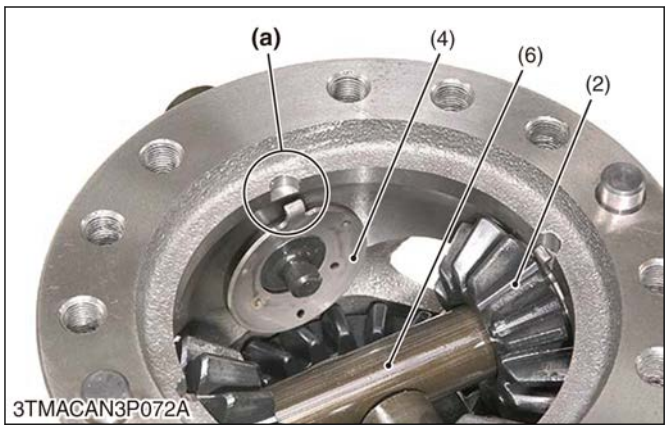
2. Draw out the differential pinion shaft 2 (5), and remove the differential pinion gear (3) and the differential pinion washer (4).
3. Draw out the differential pinion shaft 1 (6), and remove the differential pinion gear (2) and the differential pinion washer (7).




(2) Differential pinion gear
(3) Differential pinion gear
(4) Differential pinion washer
(5) Differential pinion shaft 2
(6) Differential pinion shaft 1
(7) Differential pinion washer

**(When reassembling)**

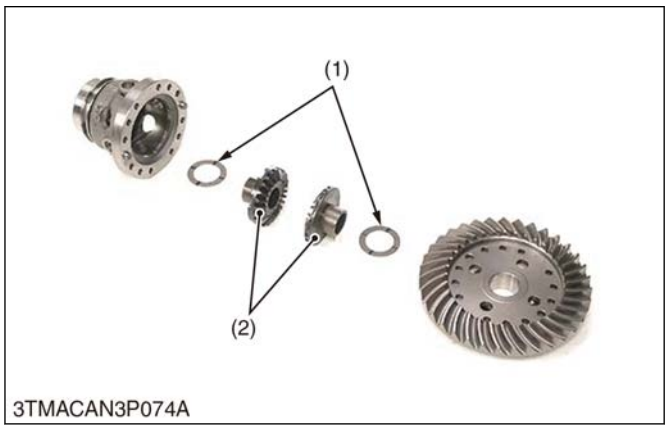
- Check the differential pinion gear (2), (3), and pinion shaft (6), (5) for excessive wear. If these parts are damaged or excessively worn, replace both parts with new ones.
- Apply molybdenum disulfide (Three Bond 1901 or its equivalents) to the inner circumferential surface of the differential pinions.
- Install the parts to their original positions.
- Install the differential pinion washer (4), noting its fitting groove (a).




(2) Differential pinion gear (a) Fitting groove
(4) Differential pinion washer
(6) Differential pinion shaft 1

- Be sure the direction of the split pin (1).

### 5.6.7.3 Disassembling differential side gear




(1) Differential side gear washer (2) Differential side gear

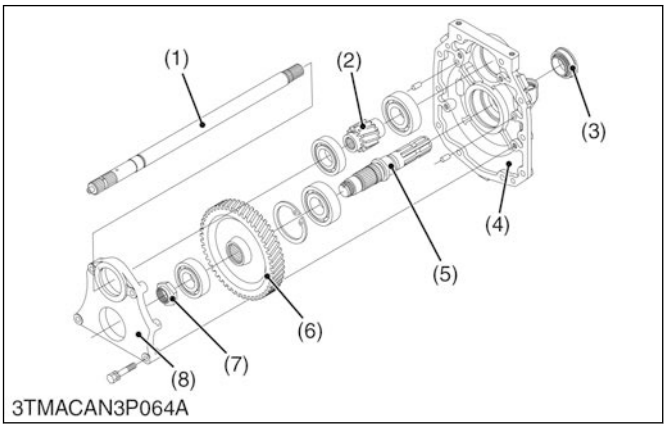
1. Remove the differential side gear (2) and differential side gear washer (1).

**(When reassembling)**

- Check the thrust and bearing surface of both differential side gears (2). If they are worn or damaged, bores in the differential case may also be damaged. Be sure to replace their parts.

## 5.7 PTO gear case

### 5.7.1 Disassembling PTO gear case (540 type)




(1) PTO propeller shaft 2
(2) 12T PTO gear
(3) Oil seal
(4) Gear case
(5) PTO shaft
(6) 49T PTO gear
(7) Staking nut
(8) PTO case cover

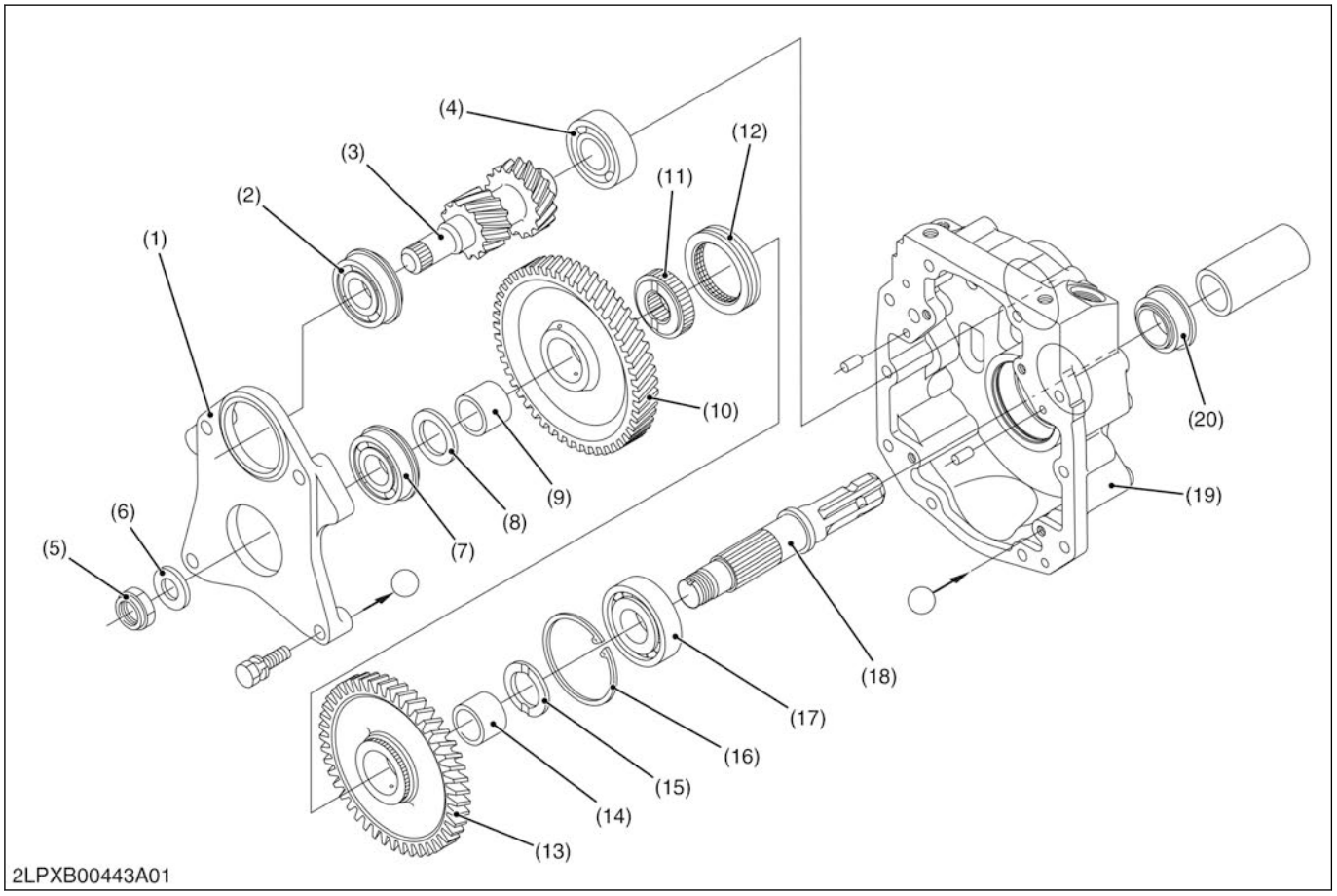
1. Remove the PTO propeller shaft 2 (1).
2. Remove the PTO case cover mounting screws and then remove the PTO case cover (8).
3. Remove the staking nut (7).
4. Tap out the PTO shaft (5) to the rear side.

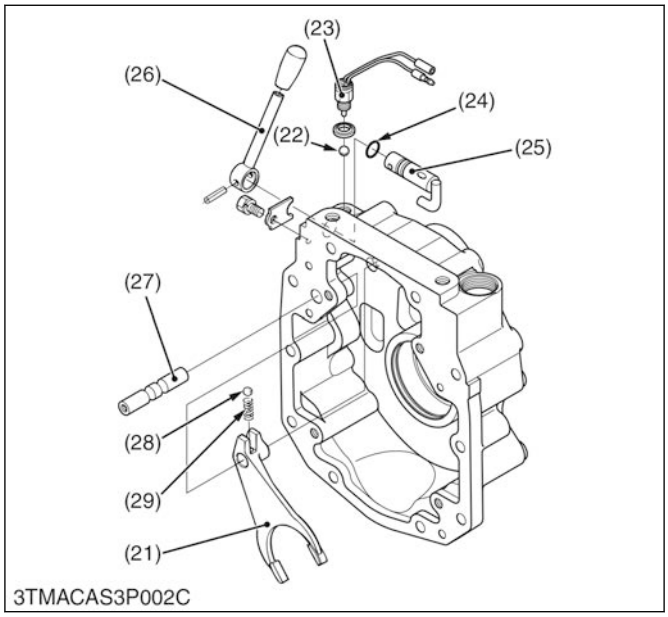
**(When reassembling)**

- Replace the PTO shaft staking nut (7) with new one, and stake it firmly after tightening.
- Apply grease to the oil seal (3).
- Tighten the PTO shaft staking nut and the PTO case cover mounting screw and reamer bolt to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | PTO shaft staking nut | 226 to 264 N·m<br>23.0 to 27.0 kgf·m<br>167 to 195 lbf·ft |
| | PTO case cover mounting screw and reamer bolt | 78 to 90 N·m<br>7.9 to 9.2 kgf·m<br>58 to 66 lbf·ft |

## 5.7.2 Disassembling PTO gear case (540/540E shift type)




(1) PTO gear case cover
(2) Ball bearing
(3) PTO drive gear shaft
(4) Ball bearing
(5) Staking nut
(6) Washer
(7) Ball bearing
(8) Thrust collar
(9) Inner ring
(10) Gear
(11) Hub
(12) Shifter
(13) Gear
(14) Inner ring
(15) Thrust collar
(16) Internal circlip
(17) Ball bearing
(18) PTO shaft
(19) PTO gear case
(20) Oil seal
(21) PTO shift fork
(22) Ball
(23) PTO speed select switch
(24) O-ring
(25) PTO shift arm
(26) PTO shift lever
(27) Shift rod
(28) Ball (detent)
(29) Spring

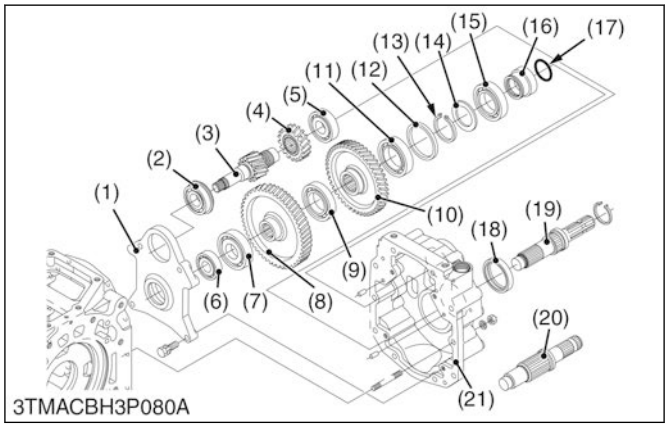
1. Remove the PTO speed select switch (23) and ball (22).

2. Remove the PTO case cover mounting screws and then remove the PTO gear case cover (1).
3. Remove the stake of the staking nut (5), and then remove it.
4. Remove the bearing (7) by using the bearing puller.
5. Tap out the PTO shaft (18) to the rear side.
6. Remove the gears (10), (13), thrust collars (8), (15), inner rings (9), (14), hub (11) and shifter (12).
7. Pull out the PTO drive gear shaft (3) as a unit.
8. Remove the PTO shift fork parts and PTO shift lever parts.

**(When reassembling)**
- Direct the grooves of thrust collars (8), (15) to the inner rings (9), (14) sides.
- Replace the PTO shaft staking nut (5) with new one, and stake it firmly after tightening.
- Apply grease to the oil seal (20) and O-ring (24).
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner rings (9) and (14).
- Do not loose the ball (22) and (28).
- Tighten the PTO shaft staking nut and the PTO case cover mounting screw and reamer bolt to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | PTO shaft staking nut | 226 to 264 N·m<br>23.0 to 27.0 kgf·m<br>167 to 195 lbf·ft |
| | PTO case cover mounting screw and reamer bolt | 78 to 90 N·m<br>7.9 to 9.2 kgf·m<br>58 to 66 lbf·ft |

### 5.7.3 Disassembling PTO gear case (540/1000 interchangeable type)




(1) PTO gear case cover
(2) Ball bearing
(3) PTO drive gear shaft
(4) 18T gear
(5) Ball bearing
(6) Ball bearing
(7) Bearing
(8) 49T gear
(9) Bearing
(10) 43T gear
(11) Bearing
(12) Spacer
(13) External circlip
(14) Washer
(15) Bearing
(16) Holder
(17) O-ring
(18) Oil seal
(19) PTO shaft (6 spline)
(20) PTO shaft (21 spline)
(21) PTO gear case

1. Remove the PTO shaft (19) or (20).
2. Remove the PTO case cover mounting screws and then remove the PTO gear case cover (1).
3. Remove the gears (8) and (10) as a unit.
4. Pull out the PTO drive gear shaft (3) as a unit.

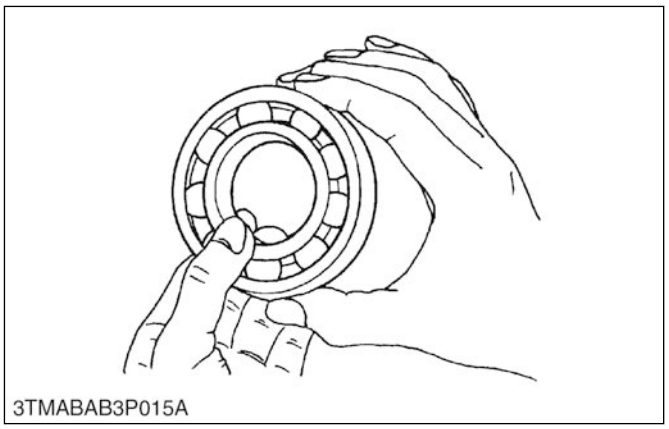
**(When reassembling)**
- Apply grease to the oil seal (18) and O-ring (17).
- Tighten the PTO gear case mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | PTO gear case mounting screw | 78 to 90 N·m<br>7.9 to 9.2 kgf·m<br>58 to 66 lbf·ft |

# 6. Servicing

## 6.1 Bearing

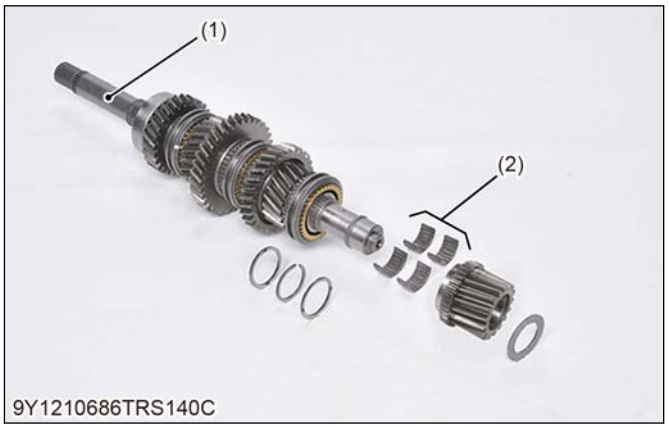
### 6.1.1 Checking ball bearing




1. Hold the inner race, 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 problem, replace it.

### 6.1.2 Checking split type needle bearing

1. Check abrasion, color change or other damage of the split type needle bearing (2).
2. If there is any doubt on the condition of a needle bearing (2), replace it.

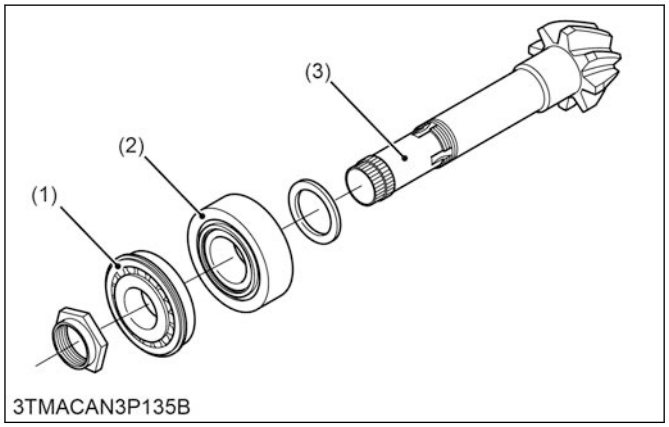



(1) 1st shaft
(2) Split type needle bearing

### 6.1.3 Checking taper roller bearing

1. Check the abrasion, color change or other damage of the taper roller bearing 1 (1) and the taper roller bearing 2 (2).

2. If there is any doubt on the condition of the taper roller bearing (1), (2), replace them.

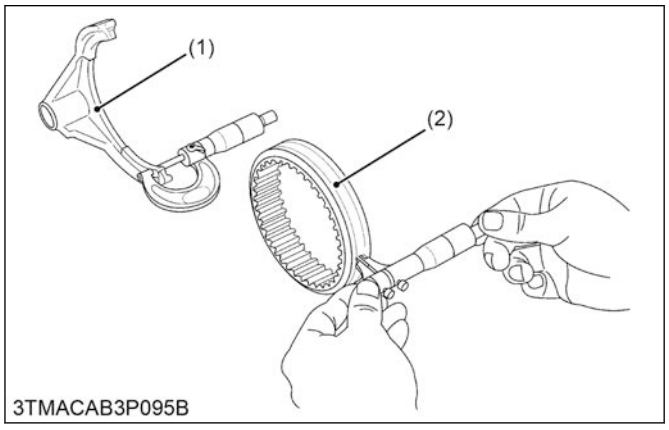



(1) Taper roller bearing 1
(2) Taper roller bearing 2
(3) Bevel pinion shaft

# 6.2 Shift fork and synchronizer

## 6.2.1 Checking clearance between shift fork and shifter groove

1. Measure the width of shift fork (1).
2. Measure the width of the shifter (2), and calculate the clearance between the shift fork (1) and the shifter (2).
3. If the clearance exceeds the allowable limit, replace them.

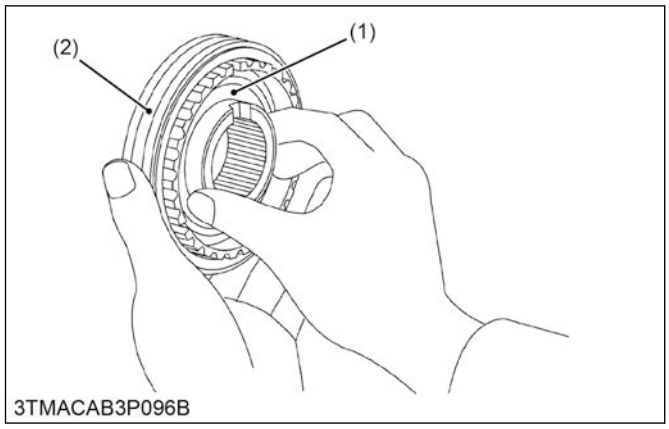



(1) Shift fork
(2) Shifter

| | | |
|---|---|---|
| Clearance between shift fork and shifter for main change section and range section | Factory specification | 0.15 to 0.35 mm<br>0.0059 to 0.013 in. |
| | Allowable limit | 0.80 mm<br>0.031 in. |

## 6.2.2 Checking smooth sliding and moving of coupling and shifter

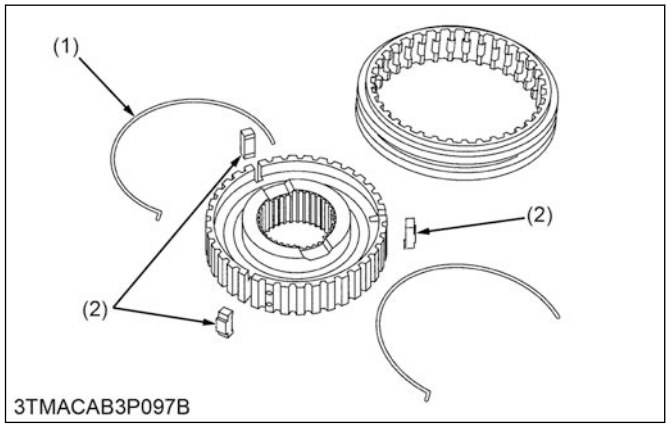
1. See if there is flaw or wear on the spline of the coupling (1) and shifter (2), and the key groove on the coupling (1).
2. Move the shifter (2) with the coupling (1), and check that they slide smoothly.
3. See that there is any flaw or wear on the gear splines.
4. If there is any problem, replace them.




(1) Coupling
(2) Shifter

## 6.2.3 Checking wear on synchronizer key and spring

1. See wear on the center projection (a) of the synchronizer key (2) .
2. See fatigue and wear the on the area where the spring (1) contacts with the synchronizer keys (2).
3. If there is any problem, replace them.



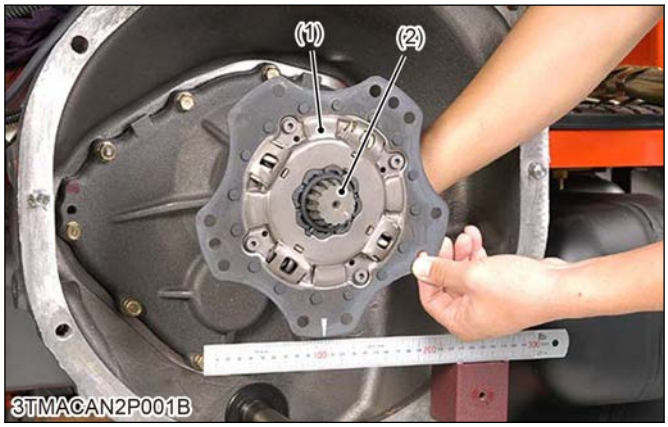

(1) Spring
(2) Synchronizer keys

# 6.3 Travelling clutch

## 6.3.1 Checking displacement around damper disk edge

1. Mount the damper disk (1) to the input shaft (2).
2. Hold the input shaft (2) so that it (2) does not turn.
3. Rotate the damper disk (1) lightly and measure the displacement around the disk edge.

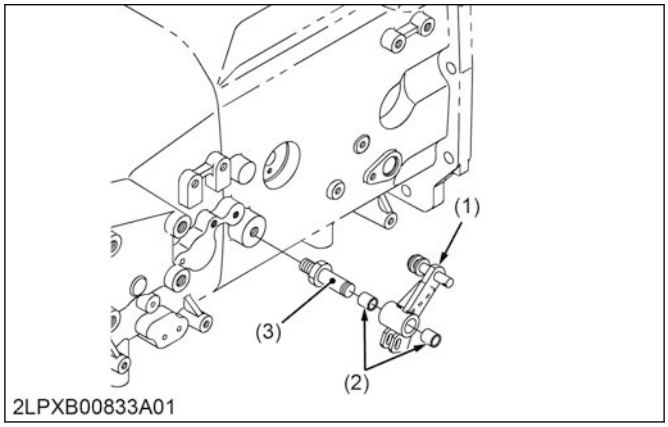
4. If the measured value exceeds the allowable limit, replace the damper disk (1).

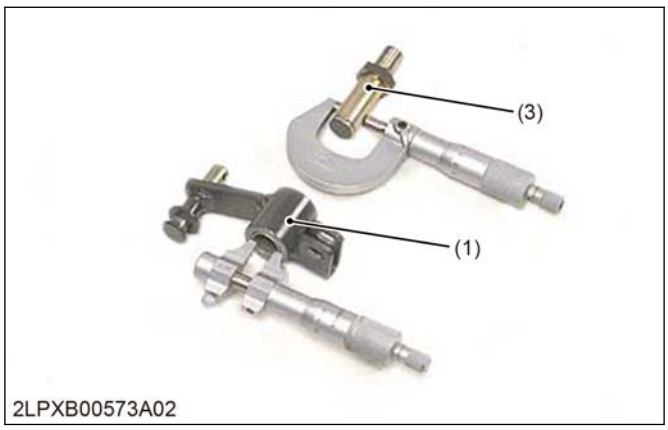



(1) Damper disk (2) Input shaft

| | | |
|---|---|---|
| Displacement around damper disk edge | Allowable limit | 2.0 mm<br>0.079 in. |

### 6.3.2 Checking clearance between inching lever pin and lever bushing




(1) Lever (3) Lever pin
(2) Bush

1. Measure outer diameter (O.D.) of the lever pin (3) with an outside micrometer.

| | | |
|---|---|---|
| Lever pin O.D. | Factory specification | 13.957 to 13.984 mm<br>0.54959 to 0.55055 in. |

2. Measure inner diameter (I.D.) of the bushing (2) of the lever (1) with an inside micrometer, and calculate the clearance.

| | | |
|---|---|---|
| Lever bushing I.D. | Factory specification | 14.033 to 14.113 mm<br>0.55248 to 0.55562 in. |

3. If the clearance exceeds the allowable limit, replace it.

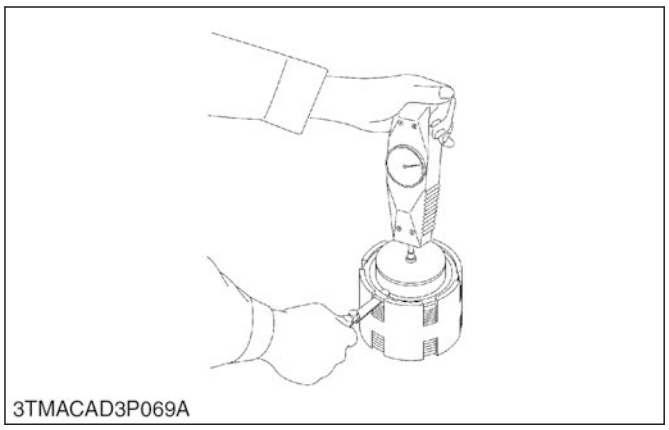
| | | |
|---|---|---|
| Clearance between inching lever pin and lever bushing | Factory specification | 0.0490 to 0.156 mm<br>0.00193 to 0.00614 in. |
| | Allowable limit | 0.5 mm<br>0.02 in. |

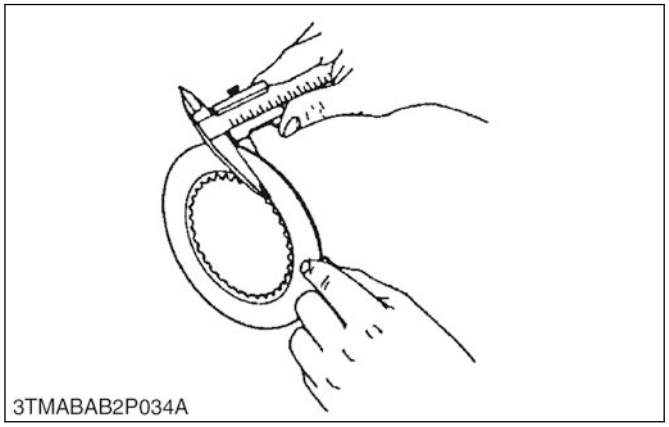
## 6.4 Shuttle clutch pack

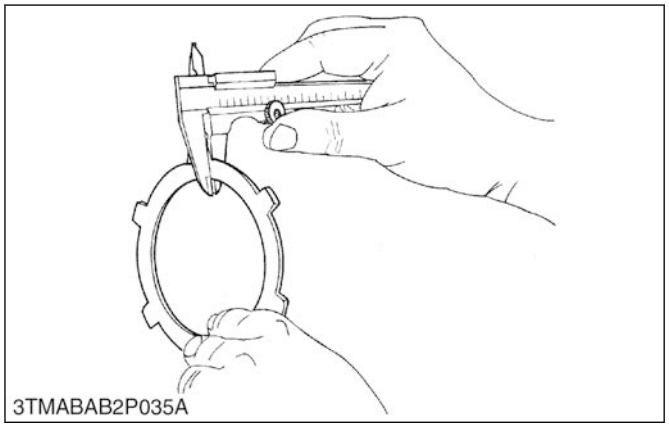
### 6.4.1 Checking clearance between internal circlip and belleville washer (Cupped spring washer) for shuttle clutch pack

**NOTE**

- **Clearance between internal circlip and belleville washer (cupped spring washer) is adjusted by two kinds of clutch disks with different thickness. Therefore, use the one of the same thickness when you change clutch disk.**


3TMACAD3P069A


3TMABAB2P034A


3TMABAB2P035A

1. Measure the clearance between internal circlip and belleville washer (cupped spring washer) with a feeler gauge while applying specified force.

| | |
|---|---|
| Specified force | 177 to 294 N<br>18.0 to 30.0 kgf<br>39.7 to 66.1 lbf |

2. 3-points are measured, and the smallest value is assumed to be clearance.

| | | |
|---|---|---|
| Clearance between internal circlip and belleville washer (cupped spring washer) | Factory specification | 1.8 to 2.0 mm<br>0.071 to 0.078 in. |
| | Allowable limit | 3.6 mm<br>0.14 in. |

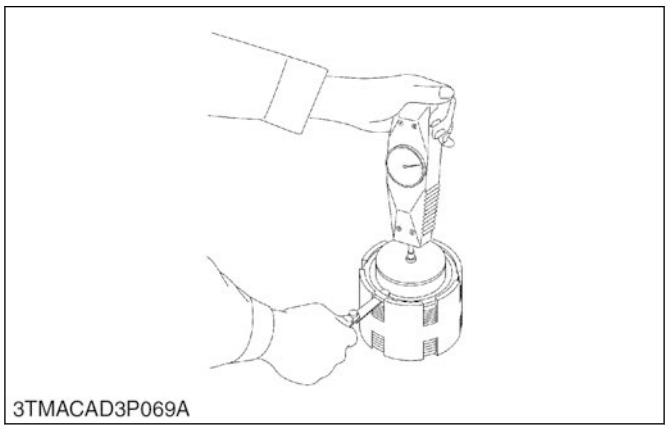
3. If the measured clearance exceeds the allowable limit, measure the thickness of clutch disk and steel plate with vernier calipers.
   **(Reference)**
   - There are two kinds of thickness of clutch disks.
   - Thickness of the steel plate,the pressure plate and the clutch disk is as follows.

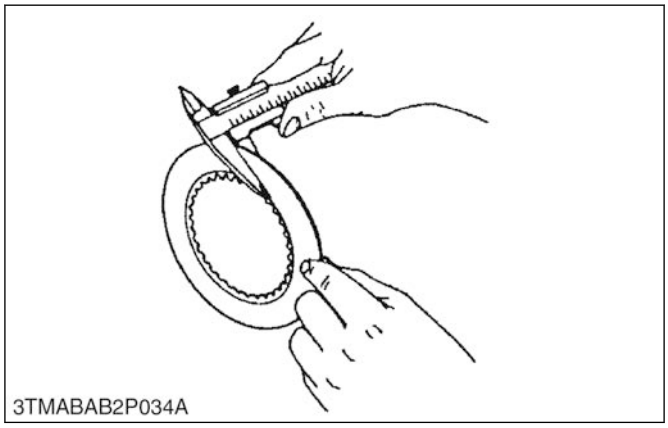
| | | |
|---|---|---|
| Thickness of steel plate | Factory specification | 3.10 to 3.30 mm<br>0.122 to 0.129 in. |
| Thickness of pressure plate | | 4.42 to 4.58 mm<br>0.174 to 0.180 in. |
| Thickness of clutch disk (3C151-23131) | | 3.15 to 3.25 mm<br>0.124 to 0.127 in. |
| Thickness of cutch disk (3C151-23031) | | 3.30 to 3.40 mm<br>0.130 to 0.133 in. |

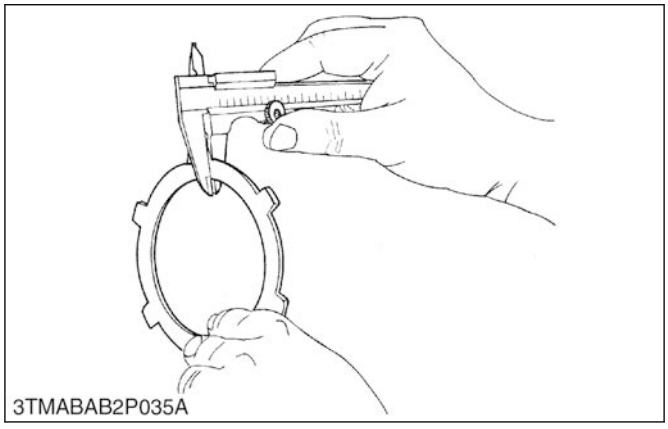
4. If the measured thickness is less than the allowable limit, replace them.
5. Remeasure to make sure the correct clearance.

# 6.5 Dual speed clutch pack

## 6.5.1 Checking clearance between internal circlip and pressure plate for dual speed clutch pack


3TMACAD3P069A


3TMABAB2P034A


3TMABAB2P035A

1. Measure the clearance between the internal circlip and the pressure plate with a feeler gauge while applying specified force.

| | |
|---|---|
| Specified force | 177 to 294 N<br>18.0 to 30.0 kgf<br>39.7 to 66.1 lbf |

2. 3-points are measured, and the smallest value is assumed to be clearance.

| | | |
|---|---|---|
| Clearance between internal circlip and pressure plate | Factory specification | 1.3 to 1.7 mm<br>0.052 to 0.066 in. |
| | Allowable limit | 2.0 mm<br>0.079 in. |

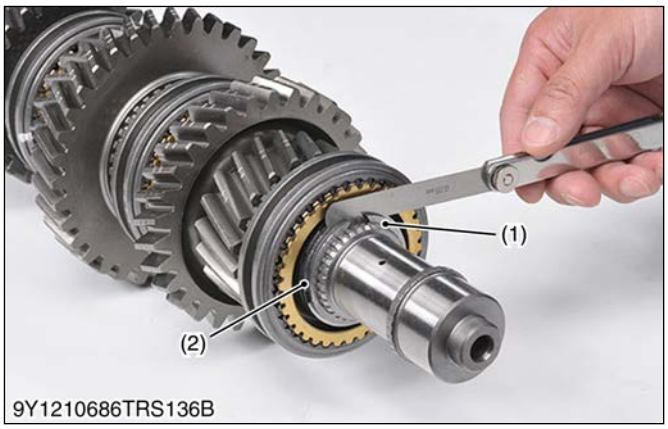
3. If the measured clearance exceeds the allowable limit, measure the thickness of the steel plate, the pressure plate and the clutch disk with vernier calipers.
   **(Reference)**
   - Thickness of the steel plate, the pressure plate and the clutch disk is as follows.

| | | |
|---|---|---|
| Thickness of steel plate | Factory specification | 1.93 to 2.07 mm<br>0.0760 to 0.0814 in. |
| Thickness of pressure plate | | 3.72 to 3.88 mm<br>0.147 to 0.152 in. |
| Thickness of clutch disk | | 2.3 to 2.5 mm<br>0.091 to 0.098 in. |

4. If the measured thickness is less than the allowable limit, replace them.
5. Remeasure to make sure the correct clearance.

# 6.6 Shaft and gear

## 6.6.1 Checking side clearance of 1st shaft



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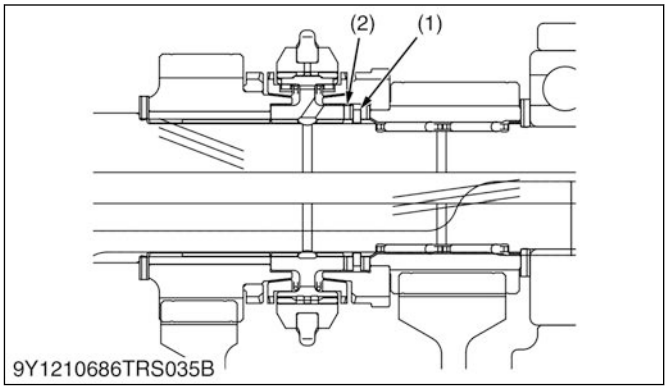


9Y1210686TRS035B

(1) External circlip (2) Adjusting collar

1. Measure the side clearance between the external circlip (1) and adjusting collar (2).

2. If the measured clearance exceeds the factory specification, adjust the clearance using adjusting collar (2).

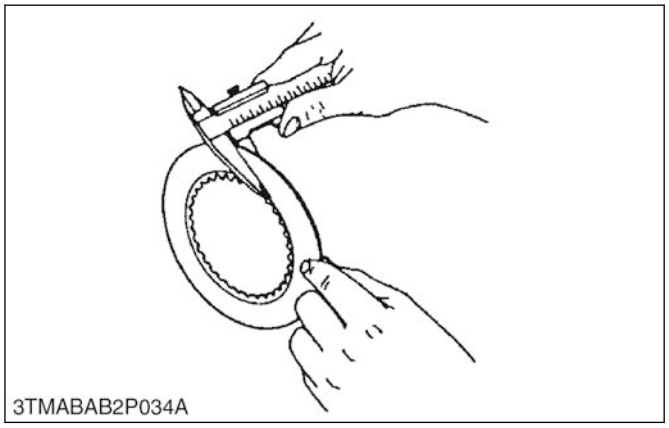
**(Reference)**

| | |
|---|---|
| Thickness of adjusting collar (2) | 2.6 mm<br>0.10 in. |
| | 2.8 mm<br>0.110 in. |
| | 3.0 mm<br>0.118 in. |
| | 3.2 mm<br>0.126 in. |
| | 3.4 mm<br>0.134 in. |

| | | |
|---|---|---|
| Clearance between external circlip and adjusting collar on 1st shaft | Factory specification | Less than<br>0.2 mm<br>0.008 in. |

# 6.7 PTO clutch pack

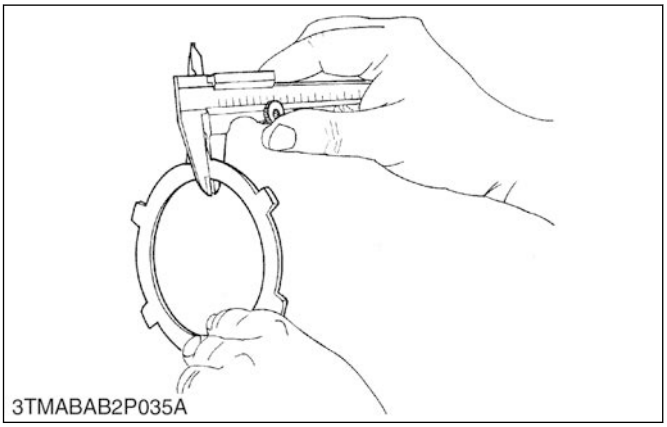
## 6.7.1 Checking PTO clutch disk wear




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

| | | |
|---|---|---|
| Thickness of PTO clutch disk | Factory specification | 2.1 to 2.3 mm<br>0.083 to 0.091 in. |
| | Allowable limit | 1.8 mm<br>0.071 in. |

## 6.7.2 Checking PTO steel plate wear




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

| | | |
|---|---|---|
| Thickness of PTO steel plate | Factory specification | 1.95 to 2.05 mm<br>0.0768 to 0.0807 in. |
| | Allowable limit | 1.80 mm<br>0.071 in. |

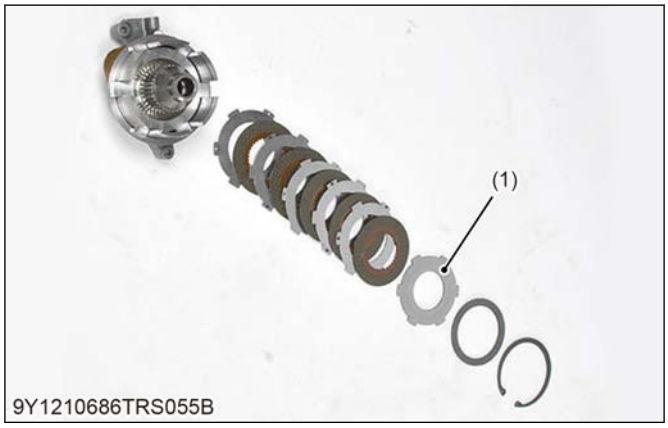
## 6.7.3 Checking flatness of PTO piston and PTO steel plate

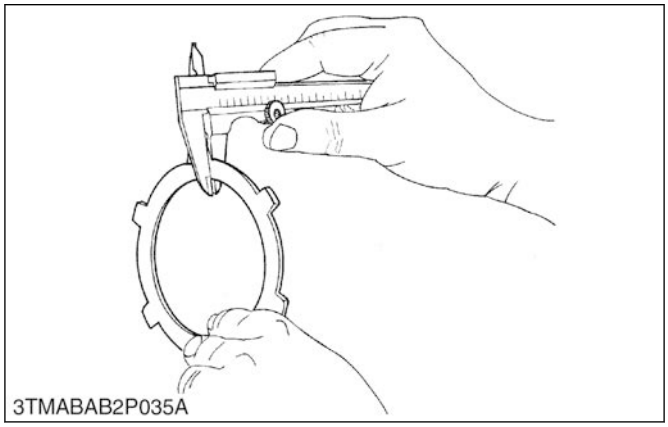

1. Place the part on a surface plate.
2. Try to insert a feeler gauge (allowable limit size) underneath it at least four points.

| | | |
|---|---|---|
| Flatness of PTO piston | Allowable limit | 0.15 mm<br>0.006 in. |
| Flatness of PTO steel plate | | 0.30 mm<br>0.012 in. |

3. If the gauge can be inserted, replace it.

## 6.7.4 Checking PTO clutch back plate

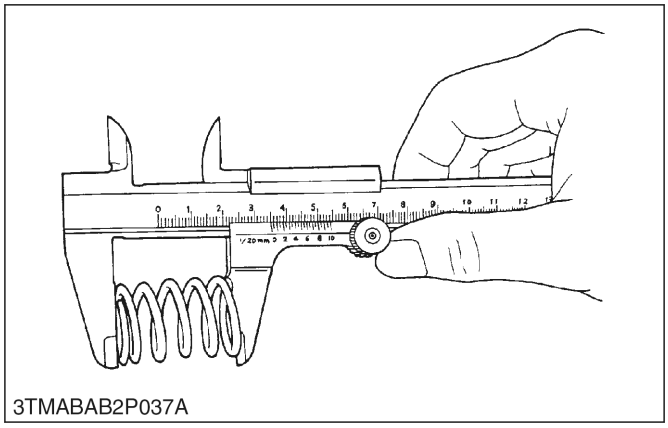



(1) PTO clutch back plate

1. Check the contact surface of the PTO clutch back plate (1) and the belleville washer (cupped spring washer).
2. If the PTO clutch back plate (1) has deformed or is scratched and/or scared, replace it.

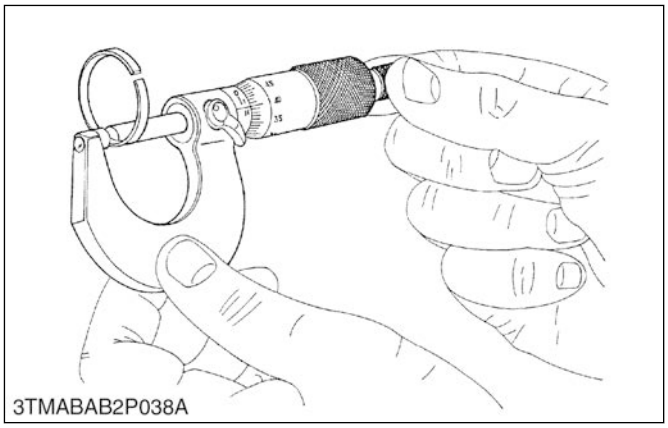
## 6.7.5 Checking piston return spring free length

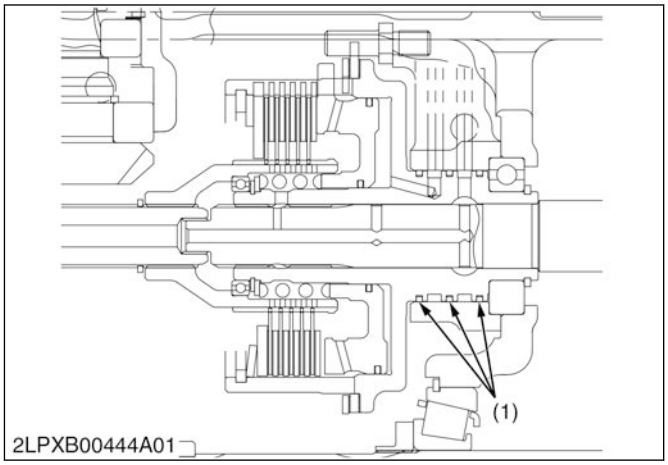



1. Measure the free length of piston return spring with vernier calipers.
2. If the measured value is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Piston return spring free length | Factory specification | 42.5 to 43.5 mm<br>1.68 to 1.71 in. |
| | Allowable limit | 37.5 mm<br>1.48 in. |

## 6.7.6 Checking thickness of seal ring




(1) Seal ring

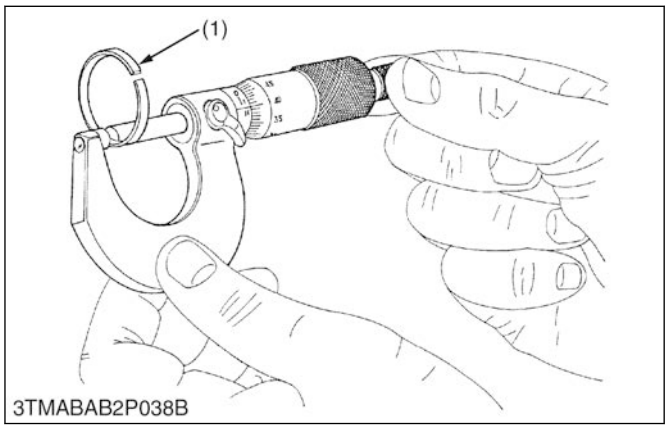
1. Measure the thickness of seal rings (1) with an outside micrometer.
2. If the measured value is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Thickness of seal ring | Factory specification | 2.4 to 2.5 mm<br>0.095 to 0.098 in. |
| | Allowable limit | 2.0 mm<br>0.079 in. |

# 6.8 4WD clutch pack

## 6.8.1 Checking thickness of seal ring

1. Measure the thickness of seal rings (1) with an outside micrometer.

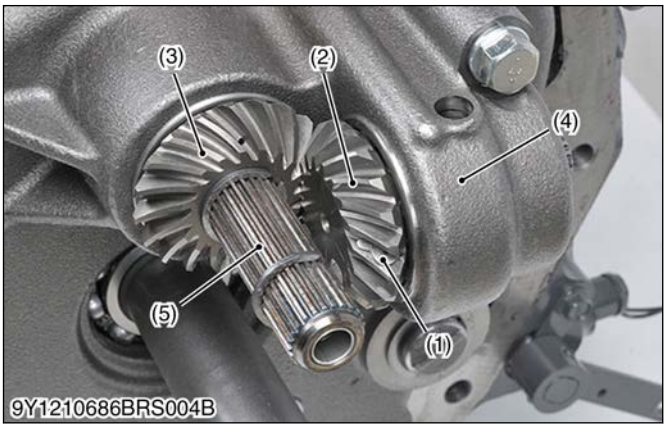

(1) Seal ring

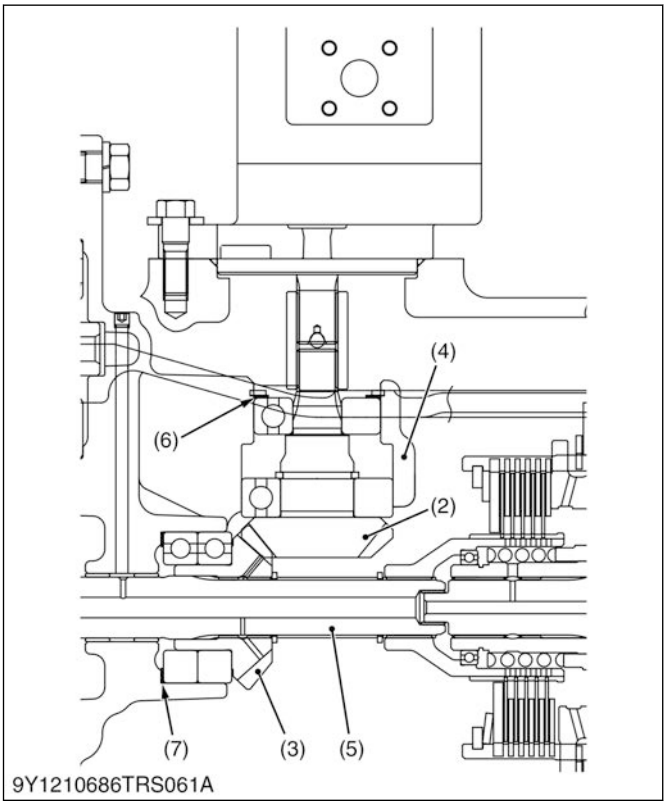
| | | |
|---|---|---|
| Thickness of seal ring | Factory specification | 2.39 to 2.44 mm<br>0.0941 to 0.0960 in. |
| | Allowable limit | 2.0 mm<br>0.079 in. |

2. If the measured value is less than the allowable limit, replace it.

# 6.9 Hydraulic pump drive gear

## 6.9.1 Checking backlash between 18T bevel gear and 19T bevel gear




(1) Wire solder
(2) 18T spiral bevel gear
(3) 19T spiral bevel gear
(4) Bearing holder
(5) PTO propeller shaft
(6) Shim for 18T bevel gear shaft
(7) Shim for 19T bevel gear

1. Hold the wire solder (1) in place with grease.
2. Assemble the 18T spiral bevel gear (2) to the bearing holder (4).
3. Turn the PTO propeller shaft (5) using a damper disk.
4. Remove the wire solder (1) and measure the thickness of pressed wire solder.

5. If the measured value is not within the factory specification, adjust with shims (6), (7).

**(Reference)**

| | |
|---|---|
| Thickness of 18T bevel gear shim | 1.0 mm<br>0.039 in. |
| Thickness of 19T bevel gear shim | 0.5 mm<br>0.02 in. |

| | | |
|---|---|---|
| Backlash between 18T bevel gear and 19T bevel gear | Factory specification | 0.15 to 0.30 mm<br>0.0059 to 0.011 in. |

RELATED PAGE
5.6.1 Removing PTO propeller shaft, bearing holder and pump gear on page 6-37

# 6.10 Differential gear

## 6.10.1 Spiral bevel pinion shaft

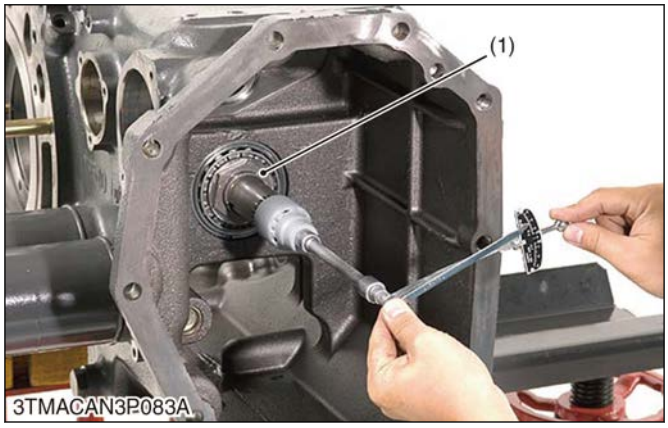
**IMPORTANT**

- **When reassembling spiral bevel pinion shaft and differential assembly, be sure to adjust the following items.**
  - **Turning torque of spiral bevel pinion shaft only.**
  - **Backlash and tooth contact between spiral bevel gear and spiral bevel pinion shaft.**

### 6.10.1.1 Measuring turning torque of spiral bevel pinion shaft only

**NOTE**

- **Stake the staking nut after performing adjustment described in the following instructions.**




(1) Staking nut

1. Reassemble the spiral bevel pinion shaft and tighten the staking nut (1) with locking wrench and turning wrench.
2. After tapping the bevel pinion shaft to the front and rear, retighten the staking nut (1) to the specified tightening torque.
3. Measure the turning torque of the spiral bevel pinion shaft.

| | | |
|---|---|---|
| Turning torque of spiral bevel pinion shaft only | Factory specification | 3.2 to 3.6 N·m<br>0.32 to 0.37 kgf·m<br>2.4 to 2.6 lbf·ft |

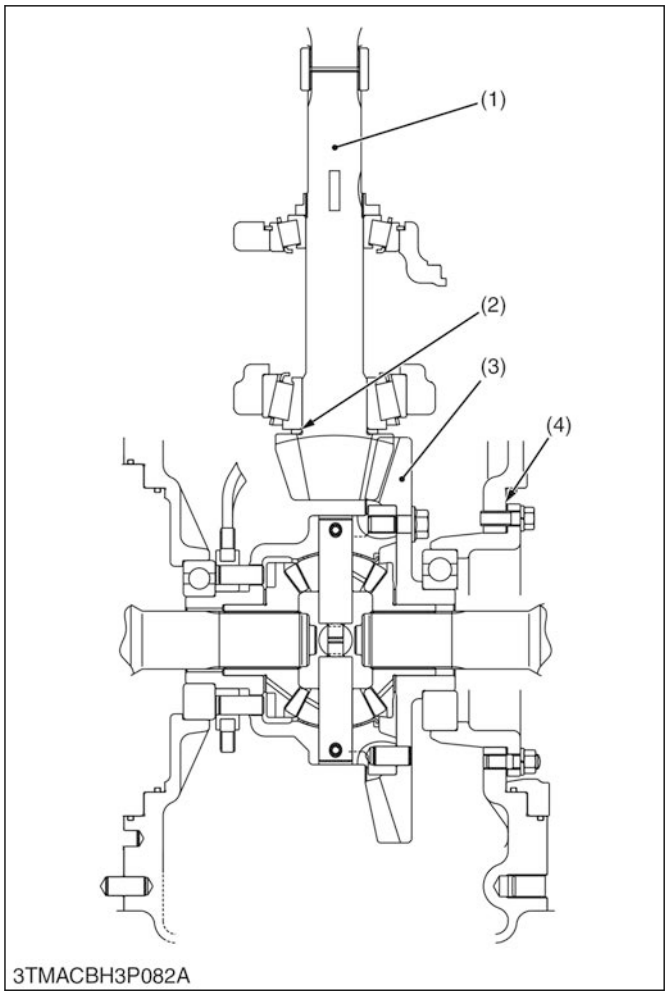
4. If the measured value is not within the factory specifications, adjust the tightening torque of the staking nut (1).
   **(Reference)**

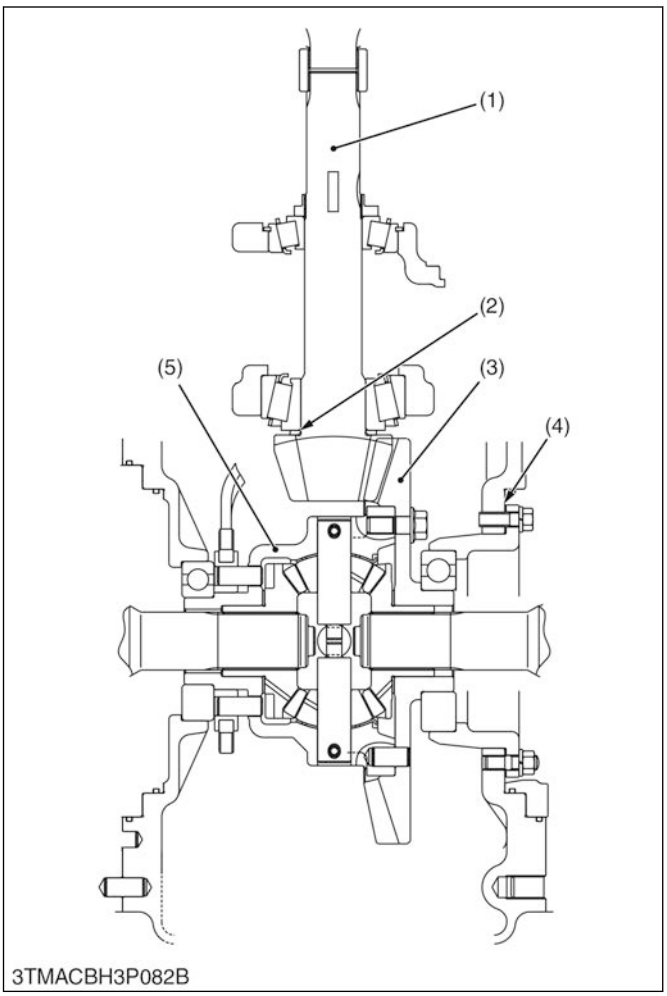
| | | |
|---|---|---|
| Tightening torque | Staking nut | 93.2 to 102 N·m<br>9.50 to 10.5 kgf·m<br>68.8 to 75.9 lbf·ft |

RELATED PAGE
2.17 Locking wrench on page 2-89
2.18 Bevel gear shaft (8T) tool on page 2-89

## 6.10.2 Backlash and tooth contact

### 6.10.2.1 Checking backlash and tooth contact between spiral bevel gear and spiral bevel pinion shaft


(1) Spiral bevel pinion shaft
(2) Adjusting collar
(3) Spiral bevel gear
(4) Shim
(5) Differential case

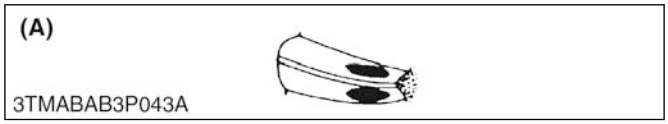
1. Set the dial indicator (lever type) with its finger on the tooth surface.
2. Measure the backlash by fixing the spiral bevel pinion shaft (1) and moving the spiral bevel gear (3) by hand.

3. When the backlash is too large, decrease the number of shims (4). When the backlash is too small, increase the number of shims (4).

| | | |
|---|---|---|
| Backlash between spiral bevel gear and spiral bevel pinion shaft | Factory specification | 0.2 to 0.3 mm<br>0.008 to 0.01 in. |
| | Allowable limit | 0.4 mm<br>0.02 in. |

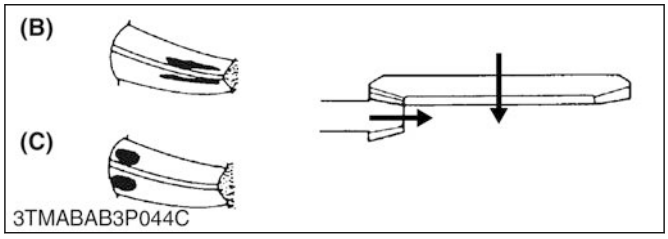
**(Reference)**
- Thickness of adjusting shim (4)
  0.40 mm (0.016 in.)
  0.60 mm (0.024 in.)
  0.80 mm (0.031 in.)
- Thickness of adjusting collar (2)
  2.80 mm (0.110 in.)
  3.00 mm (0.118 in.)
  3.20 mm (0.126 in.)
  3.40 mm (0.134 in.)
  3.60 mm (0.142 in.)

4. Adjust the backlash properly by repeating the above procedure.
5. Apply red lead lightly over several teeth at three positions equally spaced on the spiral bevel gear.
6. Turn the spiral bevel pinion shaft, while pressing a wooden piece against the periphery on the spiral bevel gear.
7. Check the tooth contact. If not proper, adjust according to the following instructions.
   - **Proper contact**
     More than 35% red lead contact area on the gear tooth surface.
     The center of tooth contact at 1/3 of the entire width from the small end.



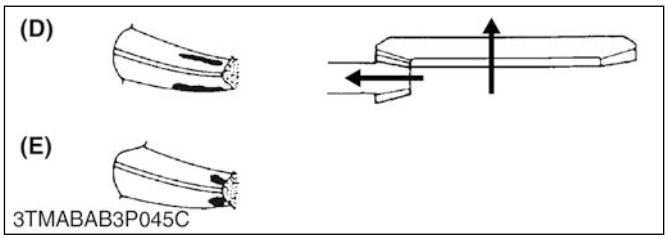

(A) Proper contact

   - **Shallow or heel contact**
     Replace the adjusting collar (2) with thicker one to move the spiral bevel pinion shaft backward.
     And reduce the shim (4) to move the spiral bevel gear leftward.
     Repeat above until the proper tooth contact and backlash are achieved.




(B) Shallow contact (C) Heel contact

   - **Deep or toe contact**
     Replace the adjusting collar (2) with a thinner one to move the spiral bevel pinion shaft forward.
     And increase the shim (4) to move the spiral bevel gear rightward.
     Repeat above until the proper tooth contact and backlash are achieved.




(D) Deep contact (E) Toe contact

## 6.10.3 Differential case differential pinion gear and differential side gear

### 6.10.3.1 Checking clearance between differential case bore (35T bevel gear bore) and differential side gear boss


1. Measure the bore I.D. of the differential case and 35T bevel gear.

| | | |
|---|---|---|
| Differential case bore I.D. | Factory specification | 49.07 to 49.15 mm<br>1.932 to 1.9354 in. |
| 35T bevel gear bore I.D. | | 49.07 to 49.15 mm<br>1.932 to 1.935 in. |

2. Measure the differential side gear boss O.D. and calculate the clearance.

| | | |
|---|---|---|
| Differential side gear boss O.D. | Factory specification | 48.961 to 49.000 mm<br>1.9276 to 1.9291 in. |

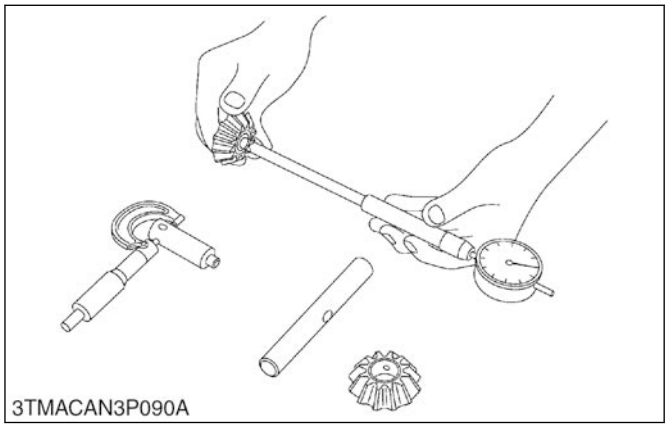
| | | |
|---|---|---|
| Clearance between differential case bore and differential side gear boss | Factory specification | 0.0700 to 0.189 mm<br>0.00276 to 0.00744 in. |
| | Allowable limit | 0.35 mm<br>0.014 in. |

3. If the clearance exceeds the allowable limit, replace them.
4. Measure the differential side gear boss O.D. and calculate the clearance.

| | | |
|---|---|---|
| Clearance between 35T bevel gear bore and differential side gear boss | Factory specification | 0.0700 to 0.189 mm<br>0.00276 to 0.00744 in. |
| | Allowable limit | 0.35 mm<br>0.014 in. |

5. If the clearance exceeds the allowable limit, replace them.

## 6.10.3.2 Checking clearance between differential pinion shaft and differential pinion


3TMACAN3P090A

1. Measure the differential pinion shaft O.D.

| | | |
|---|---|---|
| Differential pinion shaft O.D. | Factory specification | 22.959 to 22.980 mm<br>0.90390 to 0.90472 in. |

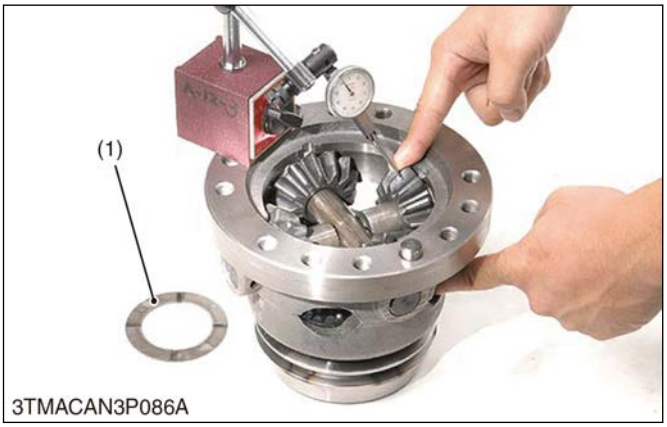
2. Measure the differential pinion I.D. and calculate the clearance.

| | | |
|---|---|---|
| Differential pinion I.D. | Factory specification | 23.040 to 23.061 mm<br>0.90709 to 0.90791 in. |

| | | |
|---|---|---|
| Clearance between differential pinion shaft and differential pinion | Factory specification | 0.0600 to 0.102 mm<br>0.00237 to 0.00401 in. |
| | Allowable limit | 0.25 mm<br>0.010 in. |

3. If the clearance exceeds the allowable limit, replace them.

## 6.10.3.3 Checking backlash between differential pinion gear and differential side gear



(1) Side gear washer

1. Set a dial indicator (lever type) on the tooth of the differential pinion gear.
2. Hold the differential side gear and move the differential pinion gear to measure the backlash.

| | | |
|---|---|---|
| Backlash between differential pinion gear and differential side gear | Factory specification | 0.15 to 0.30 mm<br>0.0059 to 0.011 in. |
| | Allowable limit | 0.4 mm<br>0.02 in. |

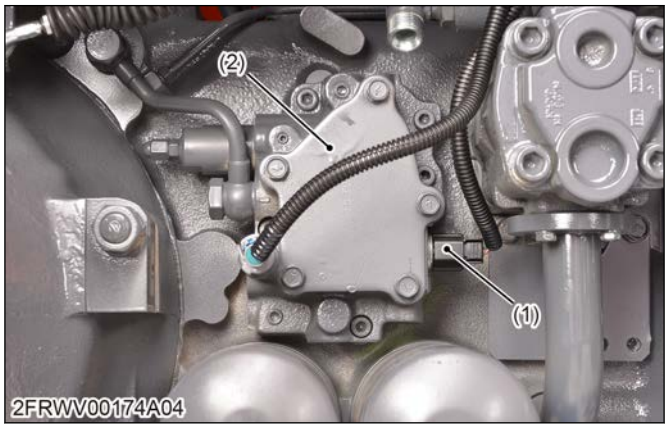
**(Reference)**

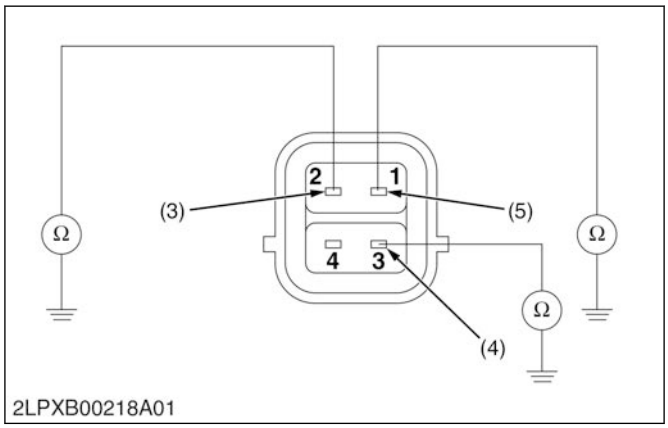
| | |
|---|---|
| Thickness of differential side gear washer | 1.5 mm<br>0.059 in. |
| | 1.6 mm<br>0.063 in. |
| | 1.7 mm<br>0.067 in. |

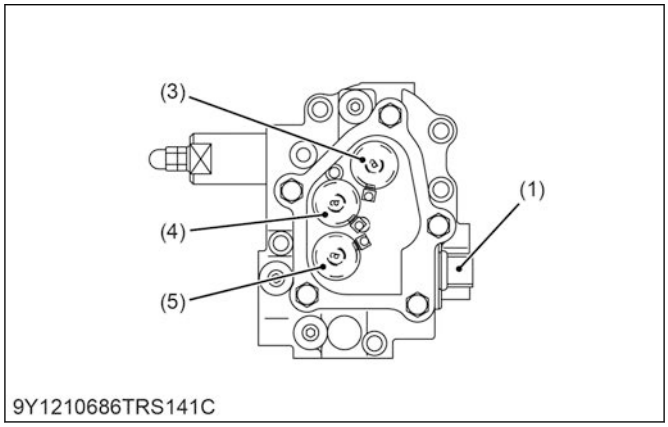
3. If the measured value is not within the factory specifications, adjust with the differential side gear washer.

# 6.11 Solenoid valve

## 6.11.1 Checking PTO, 2WD and rear differential lock solenoid valve



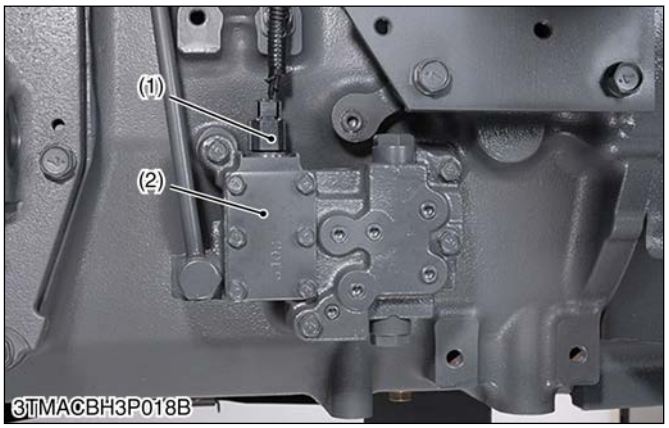

(1) Connector (Solenoid valve side)
(2) Solenoid valve assembly
(3) PTO solenoid valve
(4) Rear differential lock solenoid valve
(5) 2WD solenoid valve
1: 2WD solenoid valve terminal
2: PTO solenoid valve terminal
3: Rear differential lock solenoid valve terminal
4: Ground terminal

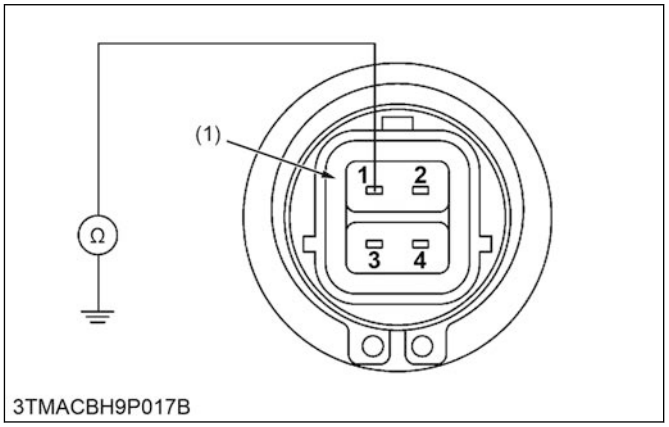
1. Disconnect the wire harness connector (1).
2. Measure the resistance across the each terminal 1, the terminal 2 and the terminal 3 on the connector (1) and chassis with an ohmmeter .

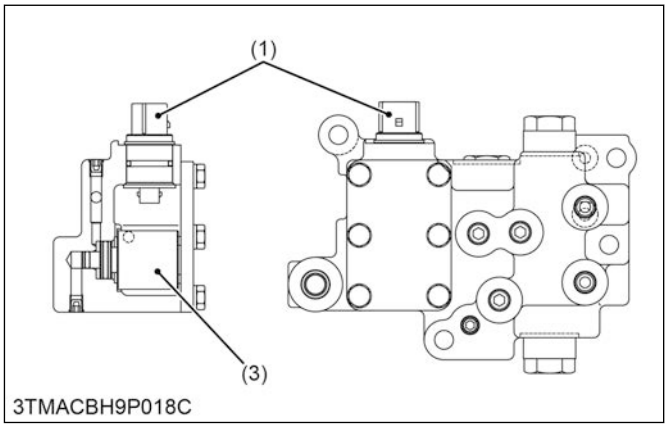
| | | |
|---|---|---|
| Resistance | 4WD solenoid valve terminal - Chassis | 10 to 12 Ω |

3. If infinity is indicated, the solenoid valve assembly is damaged.

## 6.11.2 Checking dual speed solenoid valve




(1) Connector
(2) Dual speed solenoid valve assembly
(3) Dual speed solenoid valve
1: Dual speed solenoid valve terminal 1
2: Terminal 2
3: Terminal 3
4: Terminal 4

1. Disconnect the wire harness connector (1).
2. Measure the resistance across the dual speed solenoid valve terminal 1 on the connector (1) and chassis with an ohmmeter.

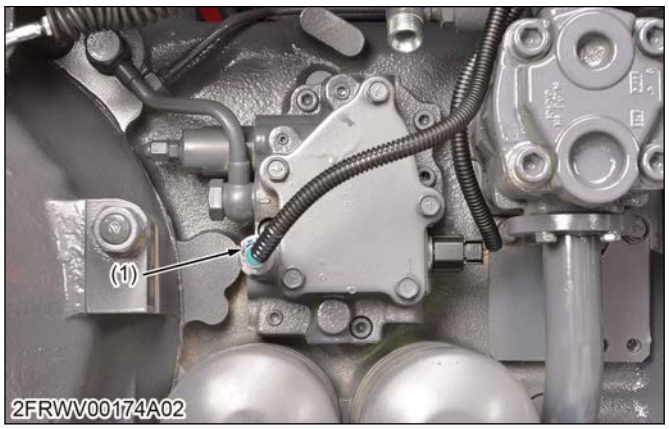
3. If infinity is indicated, the dual speed solenoid valve (3) is damaged.

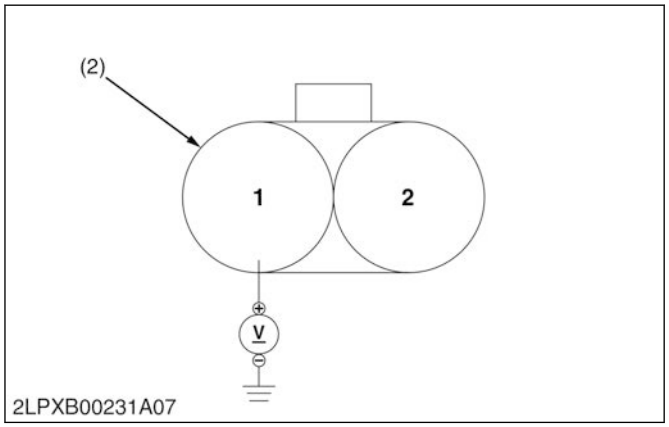
| | | |
|---|---|---|
| Resistance | Dual speed solenoid valve terminal 1 to chassis | 10 to 12 Ω |

# 6.12 Pressure switch

## 6.12.1 2WD clutch pressure switch

### 6.12.1.1 Checking connector voltage 2WD clutch pressure switch




(1) 2WD clutch pressure switch (2) 2WD clutch pressure switch connector (Wire harness side)

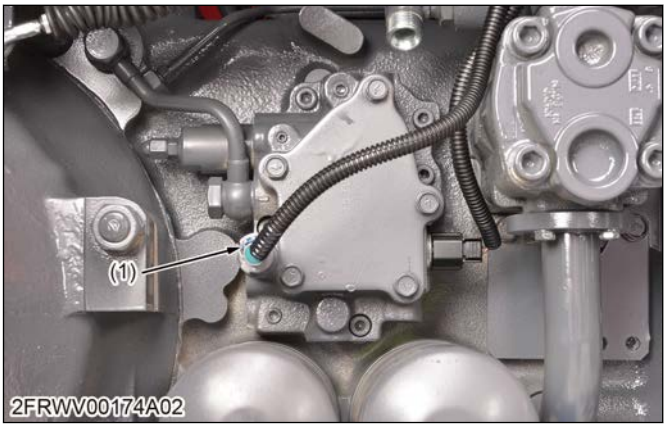
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 1 – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 6.12.1.2 Checking 2WD clutch pressure switch

1. Check the 2WD clutch pressure switch is activated or not by using tester mode "**TST-1**".



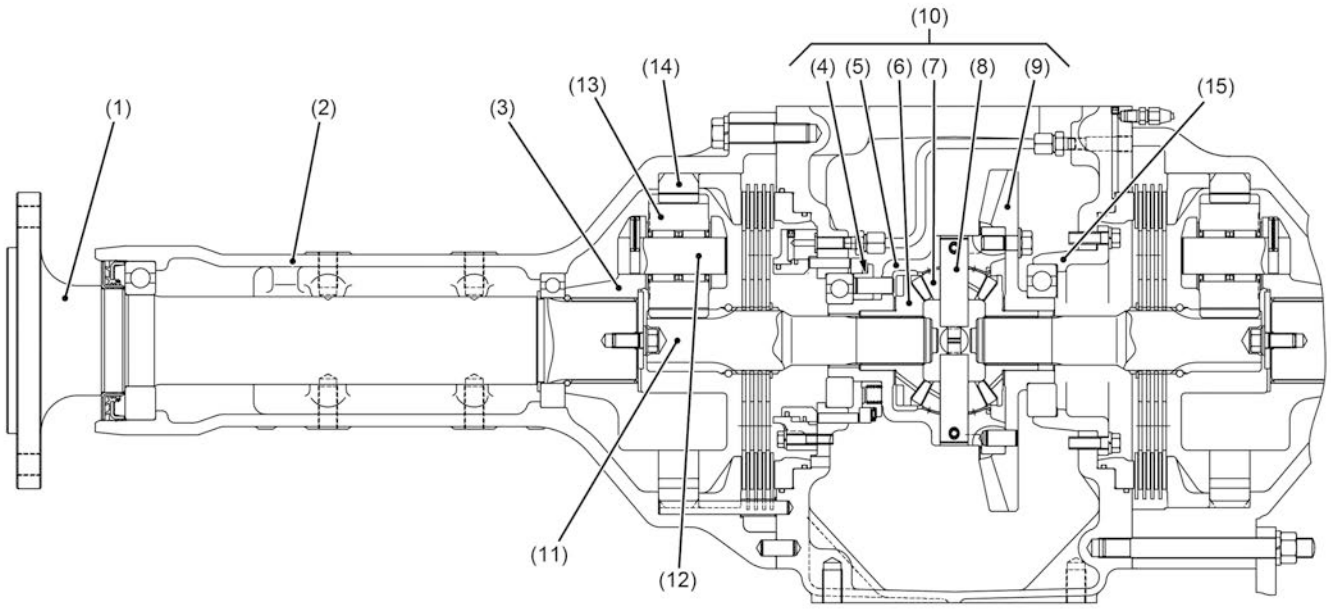

(1) 2WD clutch pressure switch

2. If any signal from 2WD clutch pressure switch is not found by tester mode "**TST-1**" although the connector voltage is OK, 2WD clutch pressure switch is damaged.

# 5. REAR AXLE

# MECHANISM

## 1. Features of rear axle




2FRWV00003A01

(1) Rear axle
(2) Rear axle case
(3) Planetary gear support
(4) Differential lock shifter
(5) Differential case
(6) Differential side gear
(7) Differential pinion gear
(8) Differential pinion shaft
(9) 35T bevel gear
(10) Differential gear
(11) Brake shaft (12T gear)
(12) Planetary gear pin
(13) 27T planetary gear
(14) 66T internal gear
(15) Differential bearing support

The rear axles are the final mechanism which transmit power from the transmission to the rear wheels. Direction of power transmitted is changed at a right angle by the differential gear (10) and, at the same time, speed is reduced. It is further reduced by the planetary gear to drive the rear axles.
The rear axles (1) are semi-floating type with the ball bearing between the rear axle (1) and rear axle case (2), which support the rear wheel load as well as transmitting power to the rear wheel. They withstand all the forces caused by tire rotation and side skidding.

# SERVICING

## 1. Troubleshooting for rear axle

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Excessive or unusual noise at all time | 1. Improper backlash between planetary gear and internal gear | Replace | 5-22 |
| | 2. Bearing worn | Replace | 5-22<br>5-22 |
| | 3. Insufficient or improper type of transmission fluid used | Replace | 2-13 |

# 2. Servicing specifications for rear axle

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Internal gear to planetary gear | Backlash | 0.2 to 0.4 mm<br>0.008 to 0.01 in. | 0.5 mm<br>0.02 in. |
| Thrust collar | Thickness | 1.55 to 1.65 mm<br>0.0611 to 0.0649 in. | 1.2 mm<br>0.047 in. |
| Planetary gear shaft | O.D. | 29.989 to 30.000 mm<br>1.1807 to 1.1811 in. | — |
| Planetary gear | I.D. | 42.009 to 42.025 mm<br>1.6539 to 1.6545 in. | — |
| Needle | O.D. | 5.994 to 6.000 mm<br>0.2360 to 0.2362 in. | — |
| Planetary gear to planetary gear shaft | Clearance | 0.0090 to 0.048 mm<br>0.00036 to 0.0018 in. | 0.3 mm<br>0.01 in. |

# 3. Tightening torques for rear axle

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to 2-15, 2-15.)

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Rear wheel mounting nut | 343.2 to 393.3 | 35.0 to 40.1 | 253.2 to 290.0 |
| Trailer brake return pipe joint bolt (Trailer brake valve side) | 63.7 to 73.5 | 6.50 to 7.49 | 47.0 to 54.2 |
| Trailer brake return pipe joint bolt (Transmission case side) | 75 to 85 | 7.7 to 8.6 | 56 to 62 |
| Trailer brake pipe 1 joint bolt (Trailer brake valve side) | 53.9 to 63.7 | 5.50 to 6.49 | 39.8 to 46.9 |
| Trailer brake pipe 1 flare nut | 49.0 to 68.6 | 5.00 to 5.99 | 36.2 to 50.5 |
| Trailer brake pipe 2 joint bolt | 53.9 to 63.7 | 5.50 to 6.49 | 39.8 to 46.9 |
| Trailer brake pipe 2 flare nut | 49.0 to 68.6 | 5.00 to 5.99 | 36.2 to 50.5 |
| Trailer brake actuating pipe | 15.7 to 23.5 | 1.60 to 2.39 | 11.6 to 17.3 |
| Trailer brake actuating pipe joint (Trailer brake valve side) | 35 to 40 | 3.6 to 4.0 | 26 to 29 |
| Trailer brake actuating pipe connector (Transmission case side) | 9.80 to 14.7 | 1.00 to 1.49 | 7.23 to 10.8 |
| ROPS under frame mounting screw (M16, 9T) | 259.9 to 304.0 | 26.5 to 31.0 | 191.7 to 224.2 |
| Stabilizer bracket mounting screw (M16, 9T) | 259.9 to 304.0 | 26.5 to 31.0 | 191.7 to 224.2 |
| Rear axle case mounting bolt and nut (M16, 9T) | 260.0 to 304.1 | 26.52 to 31.00 | 191.8 to 224.2 |
| Cabin mounting bolt and nut (M14, 7T) | 124 to 147 | 12.6 to 15.0 | 91.2 to 108 |
| Rear axle case mounting screw and nut (M16, 9T) | 260.0 to 304.1 | 26.52 to 31.00 | 191.8 to 224.2 |
| Retainer mounting screw | 89.3 to 103 | 9.11 to 10.5 | 65.9 to 75.9 |

RELATED PAGE

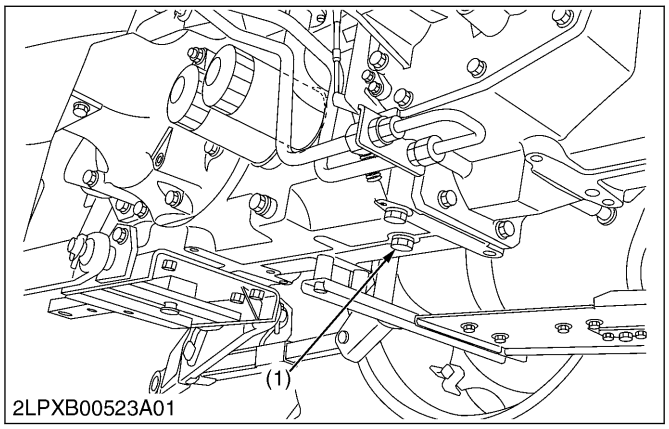
1. General use screws, bolts and nuts on page 2-15

# 4. Disassembling and assembling

## 4.1 Preparation

### 4.1.1 Draining transmission fluid

1. Place oil pan underneath the transmission case.
2. Remove the drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1).

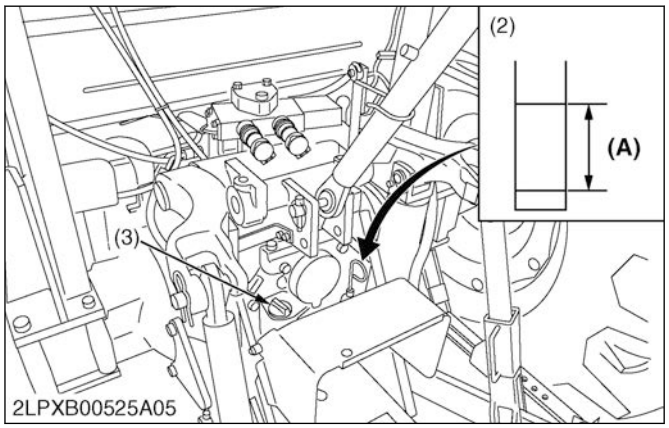



(1) Drain plug

**(When reassembling)**

**■ IMPORTANT**

- **For an enhanced ownership experience, we strongly recommend KUBOTA SUPER UDT. Use of other oil may damage the transmission or hydraulic system.**
- **Do not mix different brands of fluid together.**

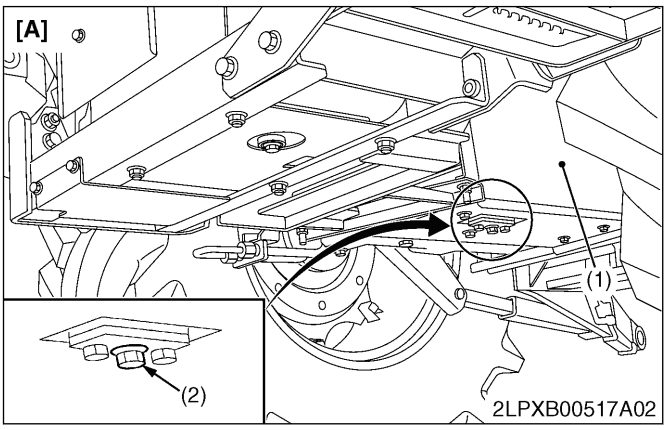


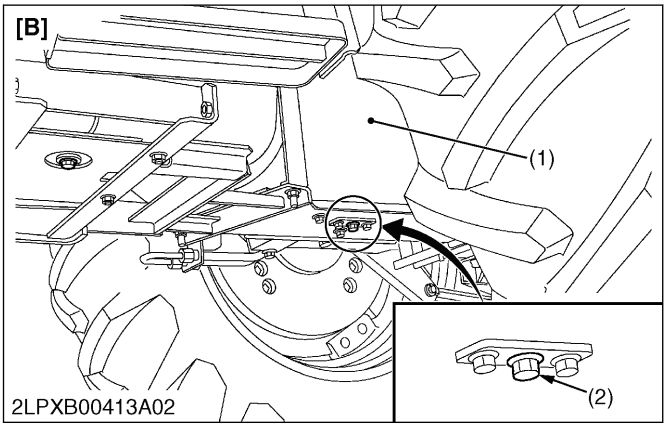

(2) Dipstick
(3) Filling port
(A) Oil level is acceptable within this range.

- Fill up from filling port (3) after removing the filling plug up to the upper notch on the dipstick (2).
- After operating the engine for a few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

| | | |
|---|---|---|
| Transmission fluid | Capacity | 60.0 L<br>16 U.S.gals<br>13 Imp.gals |

### 4.1.2 Draining fuel




(1) Fuel tank
(2) Drain plug
[A] ROPS model
[B] Cabin model

1. Place oil pans under the fuel tank (1).
2. Remove the drain plug (2) at the bottom of fuel tank (1).
3. Drain the fuel.
4. Reinstall the drain plug (2) on the fuel tank (1).

**(When reassembling)**

- Be sure to fix the seal washer is in the original position on the drain plug (2).

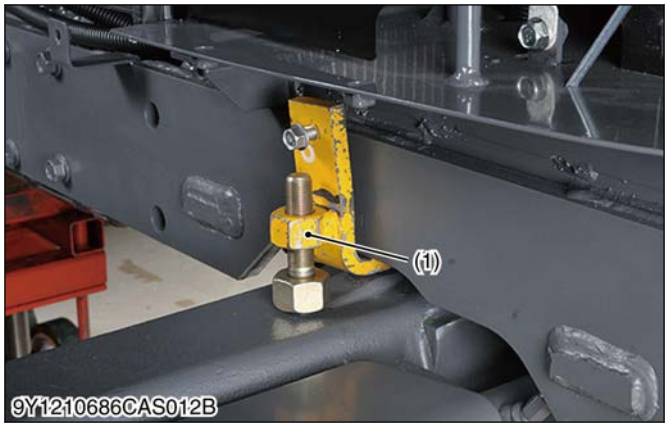
| | | |
|---|---|---|
| Fuel tank | Capacity | 105 L<br>27.7 U.S.gals<br>23.1 Imp.gals |

# 4.2 Separating rear axle

## 4.2.1 ROPS model

### 4.2.1.1 Installing front axle rocking restrictor

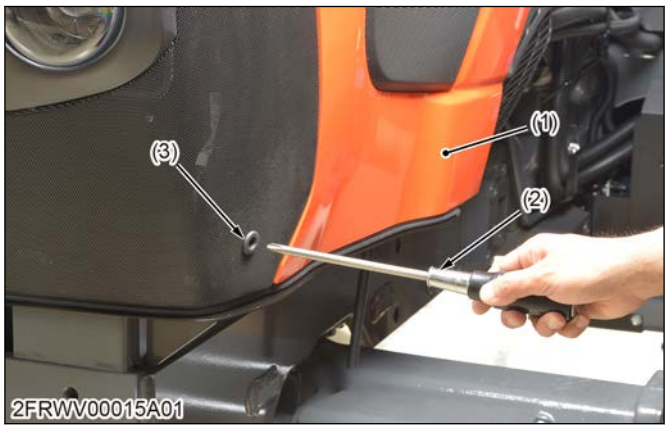
1. Chock the wheels and set the front axle rocking restrictor (1) to the front axle frame on both sides.




(1) Front axle rocking restrictor

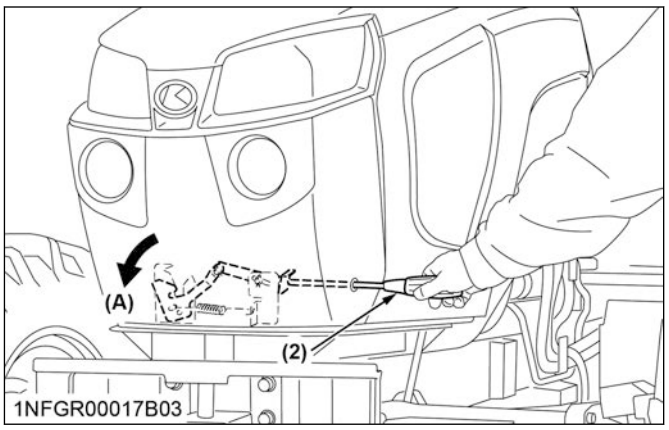
### 4.2.1.2 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).




(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).



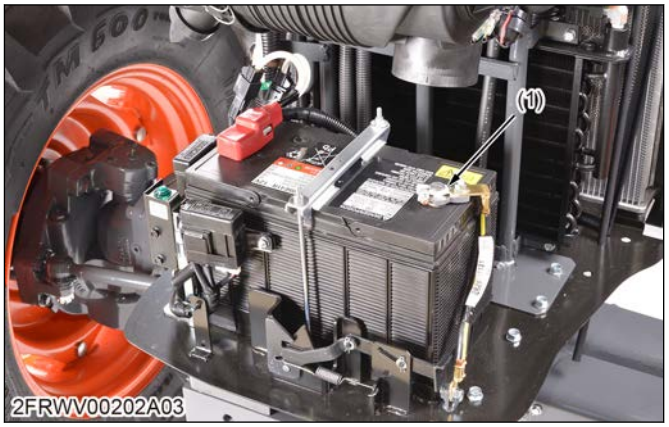

(2) Screwdriver (A) Unlock position

### 4.2.1.3 Disconnecting battery cable

**IMPORTANT**

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

1. Disconnect the negative cable terminal (1) from the battery negative terminal.

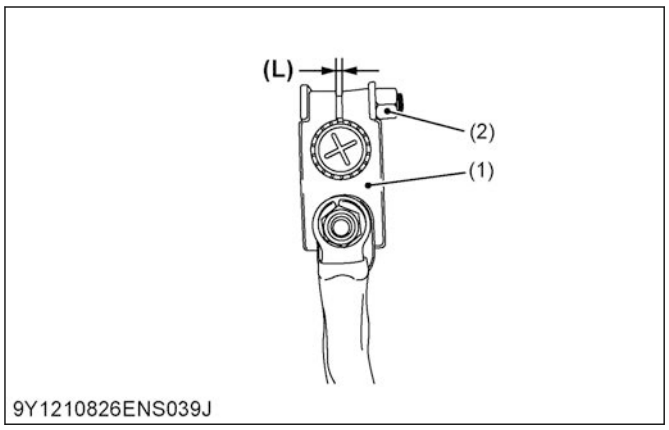



(1) Negative cable terminal

**(When reassembling)**

**IMPORTANT**

- **Tighten the battery cable terminal nut (2) so that the clearance (L) is within the following chart.**




(1) Negative cable terminal
(2) Battery cable terminal nut
(L) Clearance between the battery cable terminal

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

## 4.2.1.4 Removing ROPS upper frame and rear wheel

1. Support the ROPS upper frame with nylon sling and hoist.
2. Remove the damper (2).
3. Remove both side lynch pins (3).
4. Remove both side ROPS upper frame set bolts
5. Remove the ROPS upper frame (1).


(1) ROPS upper frame
(2) Damper
(3) Lynch pin

6. Set the disassembling stand under the transmission case.
7. Remove the rear wheel (R.H.) (4).


(4) Rear wheel (R.H.)

**(When reassembling)**

- Be sure to set the disassembling stand under the rear axle case after removing the rear wheel.
- Tighten the rear wheel mounting nut to the specified tightening torque.

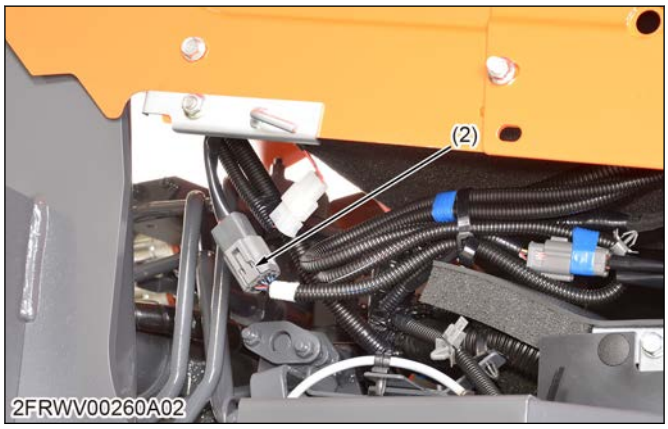
| | | |
|---|---|---|
| Tightening torque | Rear wheel mounting nut | 343.2 to 393.3 N·m<br>35.0 to 40.1 kgf·m<br>253.2 to 290.0 lbf·ft |

## 4.2.1.5 Removing auxiliary control wire

1. Disconnect the auxiliary control wires (1).


(1) Auxiliary control wire

2. Disconnect the PTO clutch switch connector (2).

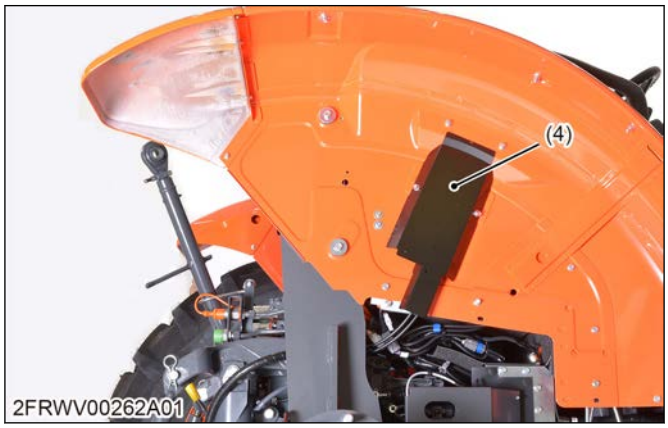



(2) PTO switch connector

3. Remove the auxiliary control lever cover (3).

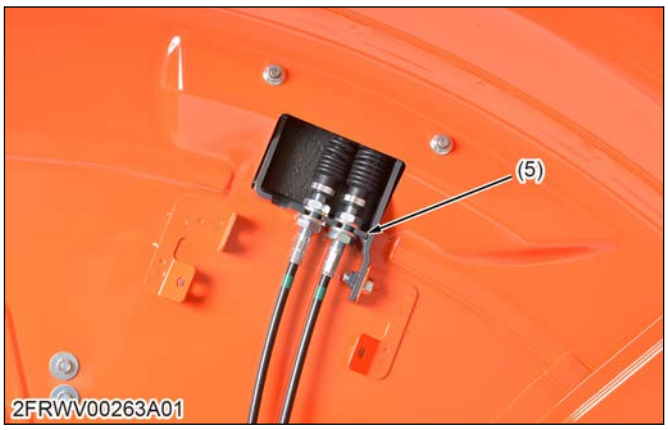

(3) Auxiliary control lever cover

4. Remove the cover (4).




(4) Cover

5. Remove the auxiliary control lever bracket (5) with auxiliary control wires.



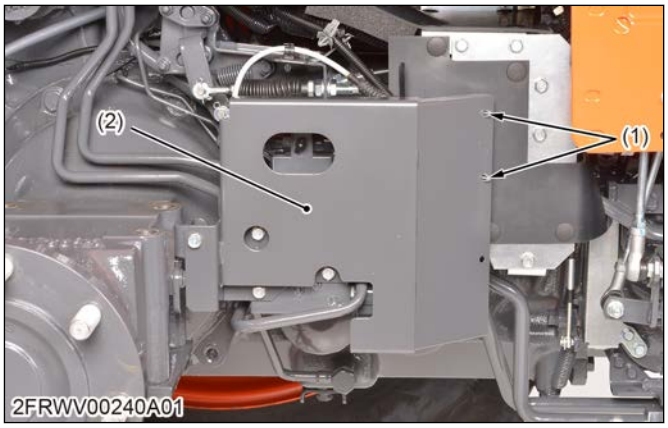

(5) Auxiliary control lever bracket

**(When reassembling)**

- Be sure to adjust the auxiliary control wires (1).

## 4.2.1.6 Removing trailer brake valve

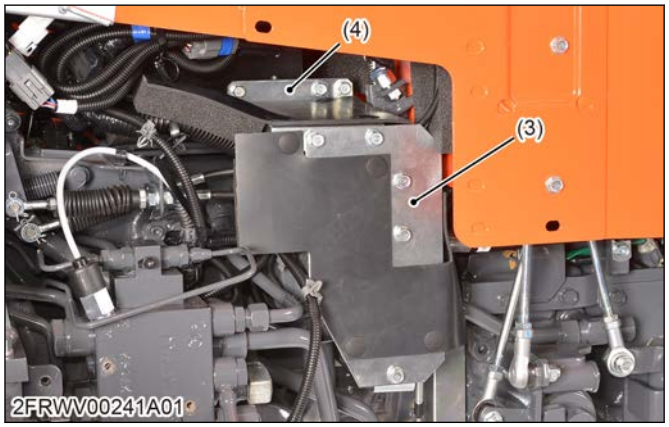
1. Disconnect the clamps (1) and remove the trailer brake valve cover (2).




(1) Clamp (2) Trailer brake valve cover

2. Remove the cover 1 (3).

3. Remove the cover 2 retaining nut (5) and cover 2 (4).



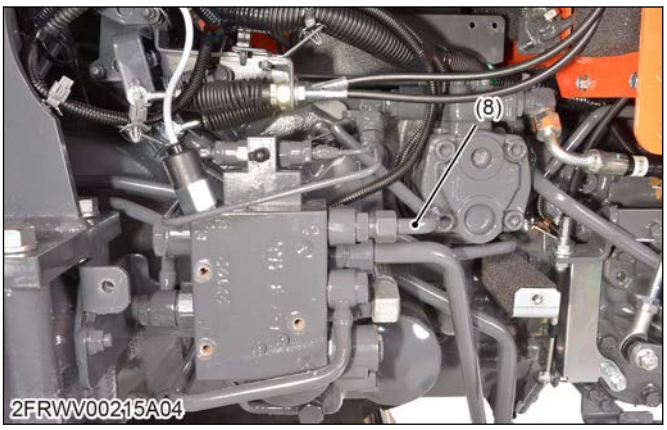


(3) Cover 1
(4) Cover 2
(5) Retaining nut

4. Disconnect the trailer brake pressure switch (6) and solenoid valve connector (7).

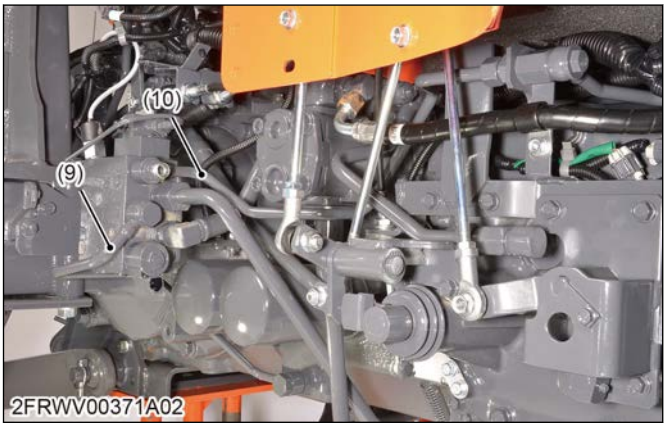

(6) Trailer brake pressure switch (7) Solenoid valve connector

5. Remove the solenoid valve delivery pipe (8).



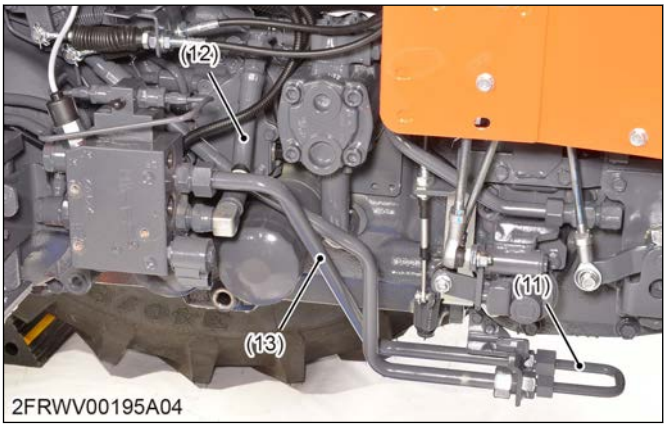

(8) Solenoid valve delivery pipe

6. Remove the trailer brake return pipe (9).
7. Remove the oil cooler return pipe (10).




(9) Trailer brake return pipe (10) Oil cooler return pipe

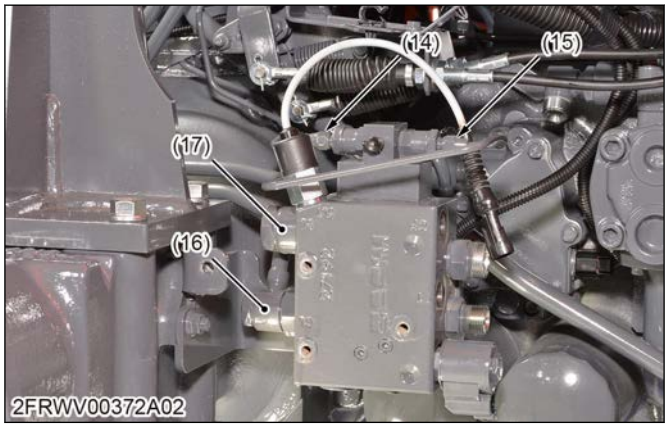
8. Remove the U pipe (11) and 3-point hitch delivery pipe 1 (13).
9. Remove the delivery hose (12).

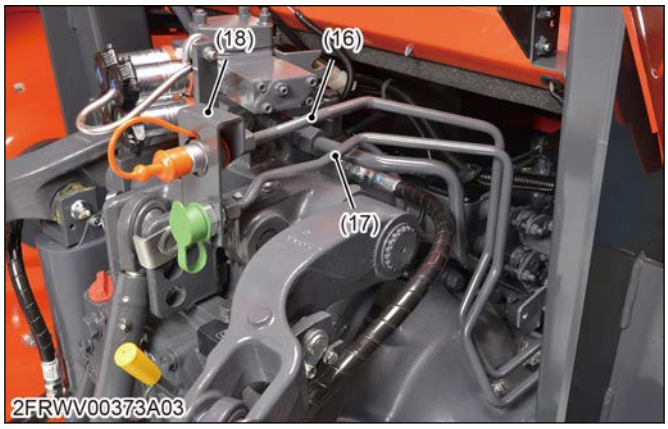



(11) U pipe
(12) Delivery hose
(13) 3-point hitch delivery pipe 1

10. Remove the trailer brake actuating pipe (R.H.) (15) and trailer brake actuating pipe (L.H.) (14).

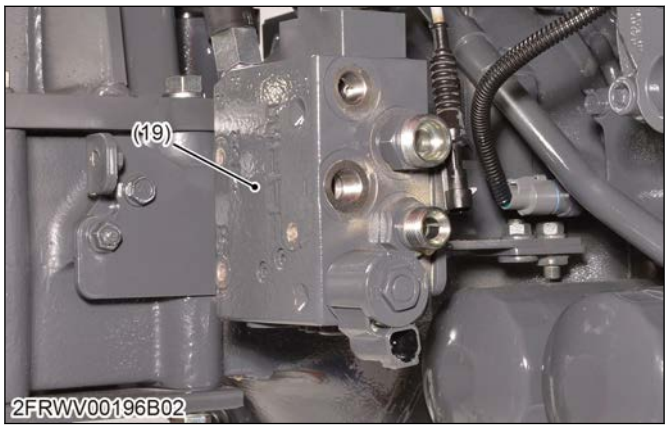
11. Remove the trailer brake pipe 1 (16) and trailer brake pipe 2 (17) together with top link holder bracket (18).




(14) Trailer brake actuating pipe (L.H.)
(15) Trailer brake actuating pipe (R.H.)
(16) Trailer brake pipe 1
(17) Trailer brake pipe 2
(18) Top link holder bracket

12. Remove the trailer brake valve (19).

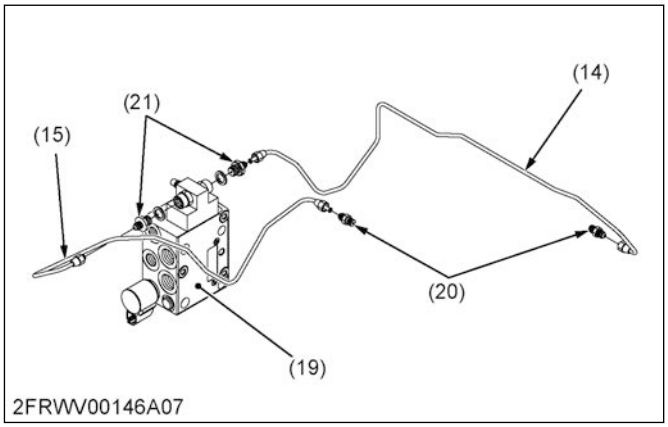



(19) Trailer brake valve

**(When reassembling)**

**■ IMPORTANT**

- **After assembling the trailer brake valve, be sure to bleed the air from the brake system.**
- Tighten the trailer brake return pipe (9), trailer brake pipes (16), (17) to the specified tightening torque.
- If the trailer brake actuating pipe connector (20) was removed, wrap the seal tape to the transmission case side of connector (20).
- If the trailer brake actuating pipe joint (21) was removed, replace the gasket with new one.
- Tighten the trailer brake actuating pipe joint (21) and trailer brake actuating pipe connector (20) to the specified tightening torque.

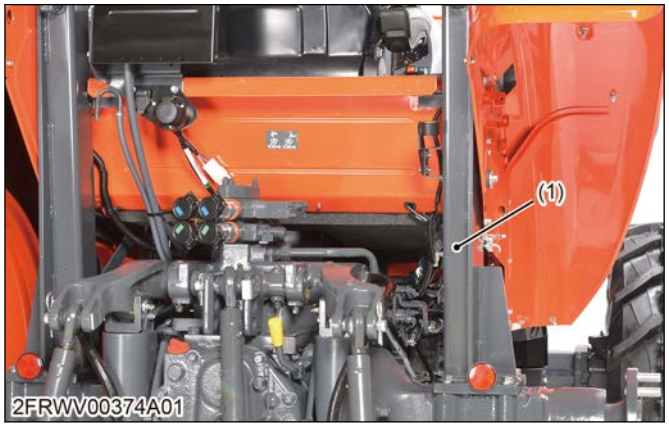



(14) Trailer brake actuating pipe (L.H.)
(15) Trailer brake actuating pipe (R.H.)
(19) Trailer brake valve
(20) Trailer brake actuating pipe connector
(21) Trailer brake actuating pipe joint

| | | |
|---|---|---|
| Tightening torque | Trailer brake return pipe joint bolt (Trailer brake valve side) | 63.7 to 73.5 N·m<br>6.50 to 7.49 kgf·m<br>47.0 to 54.2 lbf·ft |
| | Trailer brake return pipe joint bolt (Transmission case side) | 75 to 85 N·m<br>7.7 to 8.6 kgf·m<br>56 to 62 lbf·ft |
| | Trailer brake pipe 1 joint bolt (Trailer brake valve side) | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 1 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake pipe 2 joint bolt | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 2 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake actuating pipe | 15.7 to 23.5 N·m<br>1.60 to 2.39 kgf·m<br>11.6 to 17.3 lbf·ft |
| | Trailer brake actuating pipe joint (Trailer brake valve side) | 35 to 40 N·m<br>3.6 to 4.0 kgf·m<br>26 to 29 lbf·ft |
| | Trailer brake actuating pipe connector (Transmission case side) | 9.80 to 14.7 N·m<br>1.00 to 1.49 kgf·m<br>7.23 to 10.8 lbf·ft |

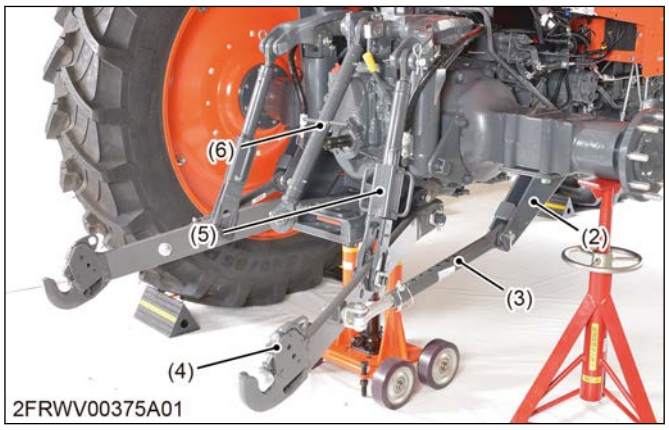
## 4.2.1.7 Removing ROPS frame and 3-point link

1. Loosen the ROPS frame (1) mounting screws. (Do not remove screws.)
2. Remove the ROPS frame (1).




(1) ROPS frame

3. Remove the top link (6).
4. Remove the stabilizer (3).
5. Remove the lift rod (5) and lower link (4).
6. Remove the stabilizer bracket (2).




(2) Stabilizer bracket
(3) Stabilizer
(4) Lower link
(5) Lift rod
(6) Top link

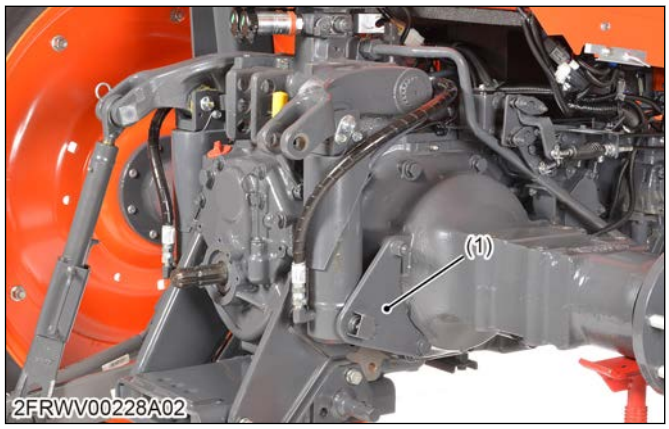
**(When reassembling)**

- To assemble the ROPS, fix the upper frame with bolt temporarily, then tighten the ROPS frame screws evenly to the specified tightening torque.
- Tighten the stabilizer bracket mounting screw (M16, 9T) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | ROPS frame mounting screw (M16, 9T) | 259.9 to 304.0 N·m<br>26.5 to 31.0 kgf·m<br>191.7 to 224.2 lbf·ft |
| | Stabilizer bracket mounting screw (M16, 9T) | 259.9 to 304.0 N·m<br>26.5 to 31.0 kgf·m<br>191.7 to 224.2 lbf·ft |

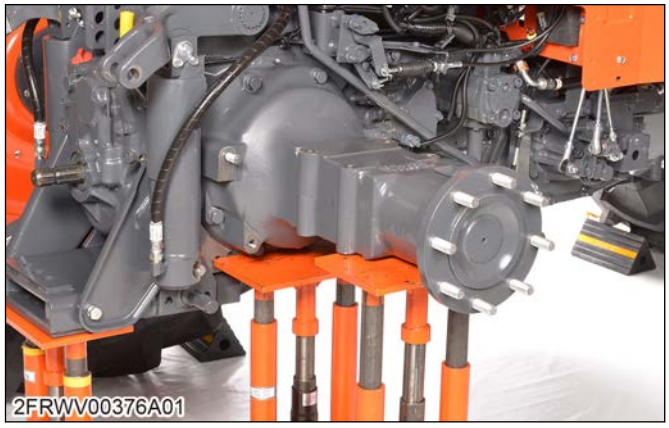
## 4.2.1.8 Removing rear axle case assembly

1. Remove the cylinder support (1).




(1) Cylinder support

2. Set the disassembling stands under the rear axle case.
3. Remove the rear axle case mounting bolts and nuts.
4. Separate the rear axle case from transmission case.




**(When reassembling)**

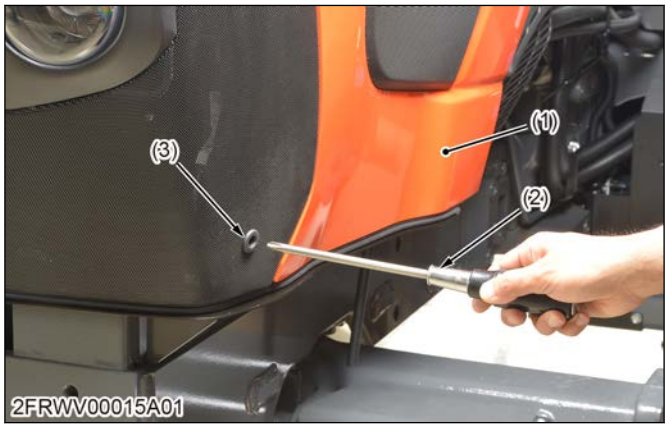
- Apply liquid gaskets (Three Bond 1206C or its equivalents) to joint face.
- Temporally tighten all bolt and nut for rear axle case assembly.
- After temporally tighten all bolt and nut, firstly tighten the nut of most forward. And then, tighten the bolt of most rearward.
- Tighten the rear axle case mounting bolts and nuts (M16, 9T) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Rear axle case mounting bolt and nut (M16, 9T) | 260.0 to 304.1 N·m<br>26.52 to 31.00 kgf·m<br>191.8 to 224.2 lbf·ft |

## 4.2.2 Cabin model

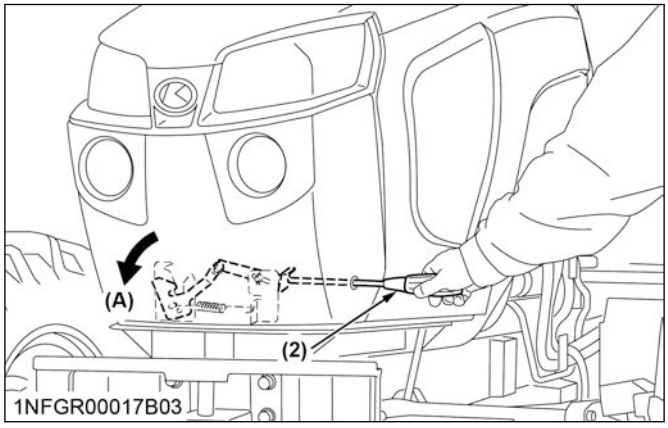
### 4.2.2.1 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).




(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).



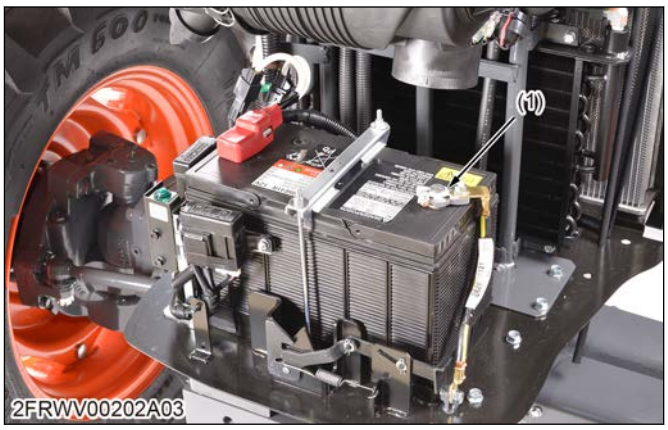

(2) Screwdriver
(A) Unlock position

### 4.2.2.2 Disconnecting battery cable

**IMPORTANT**

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

1. Disconnect the negative cable terminal (1) from the battery negative terminal.

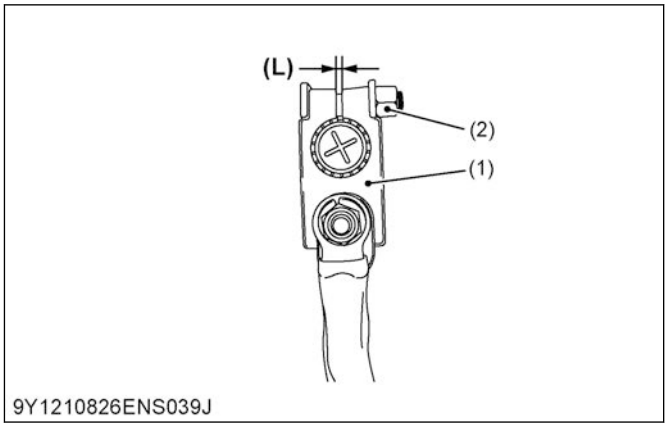



(1) Negative cable terminal

**(When reassembling)**

**IMPORTANT**

- **Tighten the battery cable terminal nut (2) so that the clearance (L) is within the following chart.**

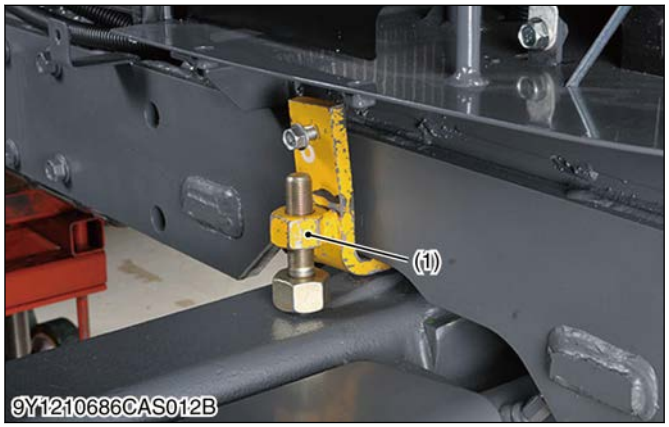



(1) Negative cable terminal
(2) Battery cable terminal nut
(L) Clearance between the battery cable terminal

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

### 4.2.2.3 Installing front axle rocking restrictor

1. Chock the wheels and set the front axle rocking restrictor (1) to the front axle frame on both sides.




(1) Front axle rocking restrictor

### 4.2.2.4 Removing rear wheel

1. Set the disassemble stand under the transmission.
2. Remove the rear wheel (1).


(1) Rear wheel

3. Set the disassembling stand under the rear axle case.

**(When assembling)**

- Tighten the rear wheel mounting nut to the specified tightening torque.

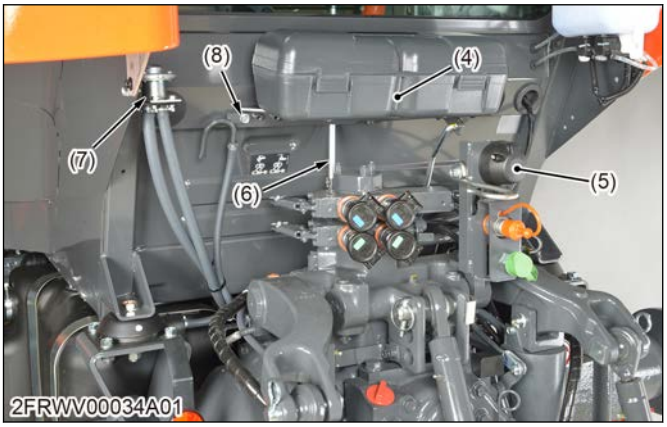
| | | |
|---|---|---|
| Tightening torque | Rear wheel mounting nut | 344 to 402 N·m<br>35.0 to 41.0 kgf·m<br>254 to 296 lbf·ft |

### 4.2.2.5 Removing outer parts (Cabin model)

1. Disconnect the grounding cable (2).
2. Disconnect the auxiliary control valve wires (1).
3. Remove the PTO linkage (3).


(1) Grounding cable
(2) Auxiliary control valve wire
(3) PTO linkage

4. Remove the tool box (4).
5. Remove the trailer coupler (5) mounting screws.
6. Remove the 3-point hitch lowering speed linkage (6).
7. Remove the transmission case breather pipe mounting bolt (8).
8. Remove the fuel vapor valve (7) mounting bolts.




(4) Tool box
(5) Trailer coupler
(6) 3-point hitch lowering speed linkage
(7) Fuel vapor valve
(8) Transmission case breather pipe mounting bolt

**(When assembling)**

- Clear the slack of the breather hoses.
- Adjust the length of the auxiliary control valve wires.

### 4.2.2.6 Disconnecting position control cable and draft control cable

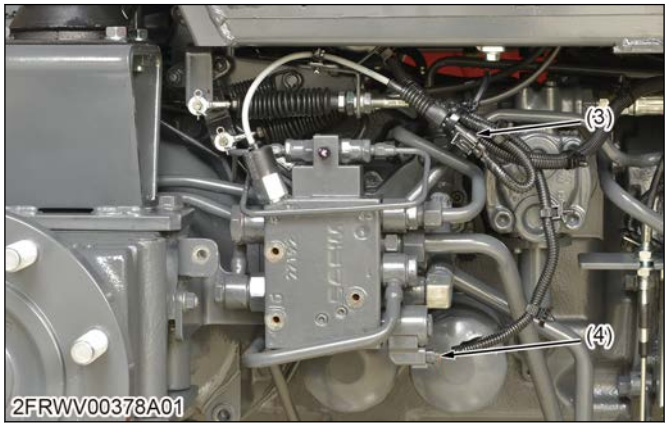
**■ NOTE**

- **Before disconnecting the draft control cable and position control cable, make the mark to identify the position control lever and draft control lever.**
- **The outside of control cable is for draft control lever.**
- **The inside of control cable is for position control lever.**

1. Disconnect the clamps (1).
2. Remove the trailer brake valve cover (2).

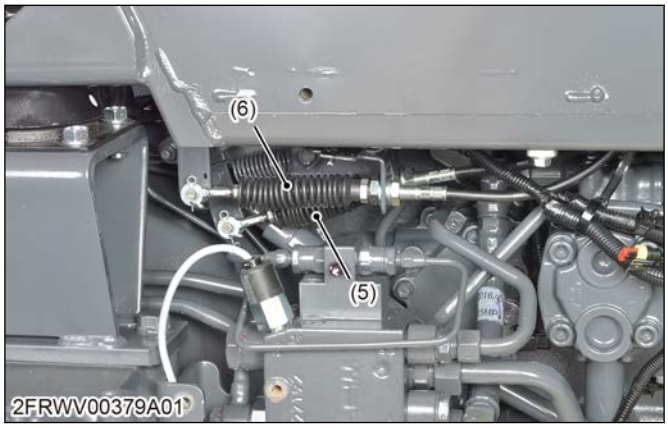

(1) Clamp (2) Trailer brake valve cover

3. Disconnect the trailer brake pressure switch connector (3).
4. Disconnect the solenoid valve connector (4).




(3) Trailer brake pressure switch connector (4) Solenoid valve connector

5. Loosen the draft control cable mounting nuts and disconnect the draft control cable (6).
6. Loosen the position control cable mounting nuts and disconnect the position control cable (5).




(5) Position control cable (6) Draft control cable

**(When assembling)**

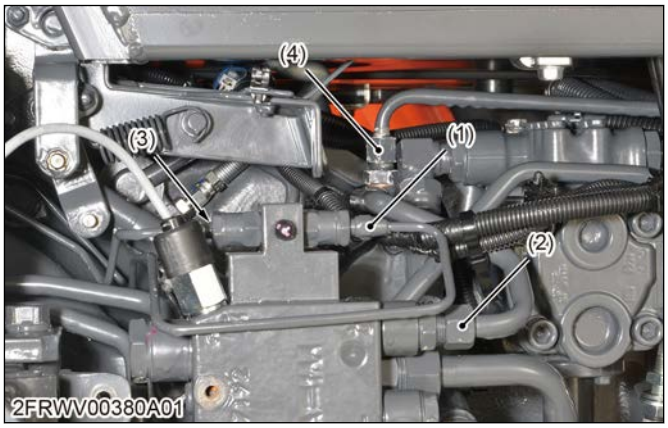
- The position of draft and position control cable are as follows.

  **Draft control cable:**
  Tractor outside

  **Position control cable:**
  Tractor inside
- Be sure to adjust the draft and position control cable.

## 4.2.2.7 Removing trailer brake valve

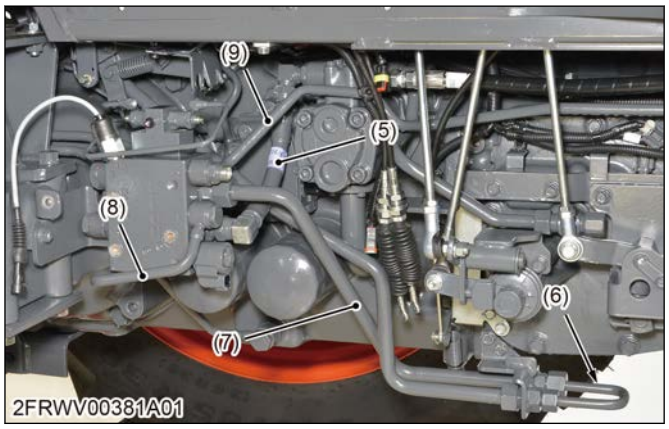
1. Remove the trailer brake actuating pipe (R.H.) (1) and trailer brake actuating pipe (L.H.) (3).
2. Disconnect the dual speed delivery pipe (4).
3. Remove the solenoid valve delivery pipe (2).




(1) Trailer brake actuating pipe (R.H.)
(2) Solenoid valve delivery pipe
(3) Trailer brake actuating pipe (L.H.)
(4) Dual speed delivery pipe

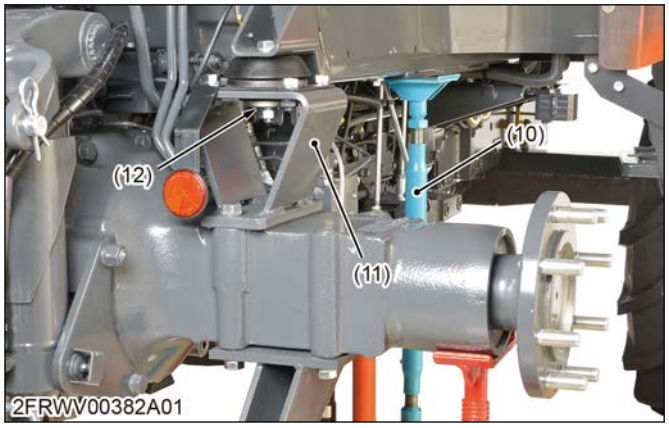
4. Remove the trailer brake return pipe (8).
5. Remove the oil cooler return pipe (9).
6. Remove the U pipe (6) and 3-point hitch delivery pipe 1 (7).

7. Remove the delivery hose (5).



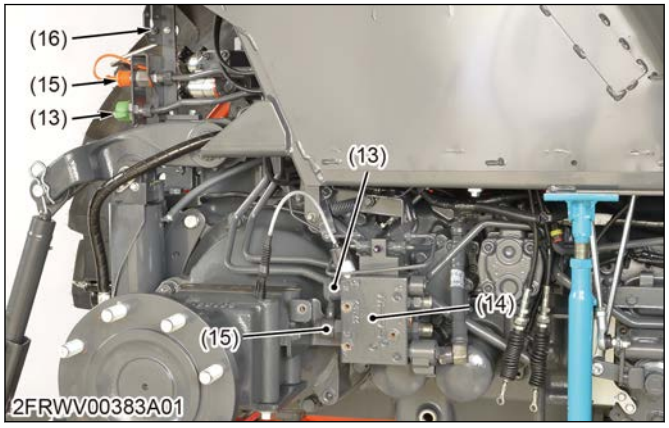

(5) Delivery hose
(6) U pipe
(7) 3-point hitch delivery pipe 1
(8) Trailer brake return pipe
(9) Oil cooler return pipe

8. Set the cab support pole (10) under the cab frame.
9. Remove the cabin mounting bolt and nut (12).
10. Remove the bracket (11).




(10) Cab support pole
(11) Bracket
(12) Cabin mounting bolt and nut

11. Remove the trailer brake pipe 1 (15) and trailer brake pipe 2 (13) together with top link holder (16).
12. Remove the trailer brake valve (14).



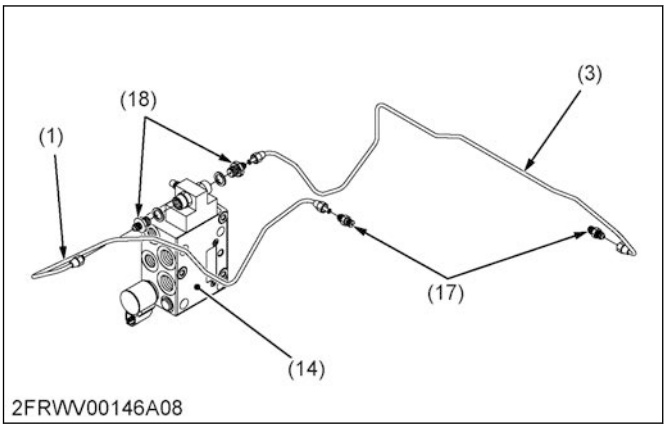

(13) Trailer brake pipe 2
(14) Trailer brake valve
(15) Trailer brake pipe 1
(16) Top link holder

**(When reassembling)**

**■ IMPORTANT**

- **After assembling the trailer brake valve, be sure to bleed the air from the brake system.**

- Tighten the trailer brake return pipe (8), trailer brake pipes (13), (15) to the specified tightening torque.
- If the trailer brake actuating pipe connector (17) was removed, wrap the seal tape to the transmission case side of connector (17).
- If the trailer brake actuating pipe joint (18) was removed, replace the gasket witch new one.
- Tighten the trailer brake actuating pipe joint (18) and trailer brake actuating pipe connector (17) to the specified tightening torque.




(1) Trailer brake actuating pipe (R.H.)
(3) Trailer brake actuating pipe (L.H.)
(14) Trailer brake valve
(17) Trailer brake actuating pipe connector
(18) Trailer brake actuating pipe joint

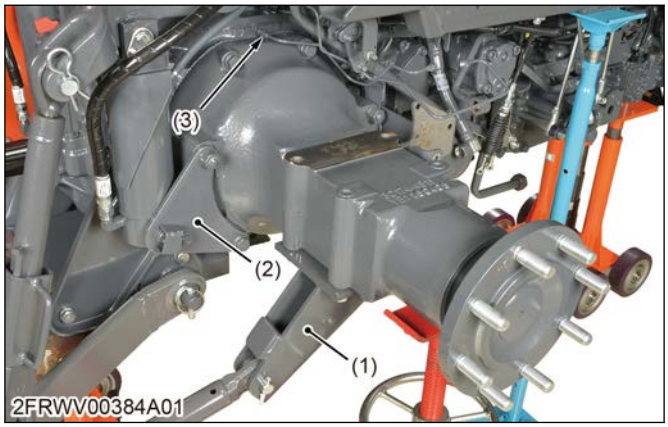
| | | |
|---|---|---|
| Tightening torque | Trailer brake return pipe joint bolt (Trailer brake valve side) | 63.7 to 73.5 N·m<br>6.50 to 7.49 kgf·m<br>47.0 to 54.2 lbf·ft |
| | Trailer brake return pipe joint bolt (Transmission case side) | 75 to 85 N·m<br>7.7 to 8.6 kgf·m<br>56 to 62 lbf·ft |
| | Trailer brake pipe 1 joint bolt (Trailer brake valve side) | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 1 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake pipe 2 joint bolt | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 2 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake actuating pipe | 15.7 to 23.5 N·m<br>1.60 to 2.39 kgf·m<br>11.6 to 17.3 lbf·ft |
| | Trailer brake actuating pipe joint (Trailer brake valve side) | 35 to 40 N·m<br>3.6 to 4.0 kgf·m<br>26 to 29 lbf·ft |
| | Trailer brake actuating pipe connector (Transmission case side) | 9.80 to 14.7 N·m<br>1.00 to 1.49 kgf·m<br>7.23 to 10.8 lbf·ft |

## 4.2.2.8 Removing rear axle case assembly

**■ IMPORTANT**

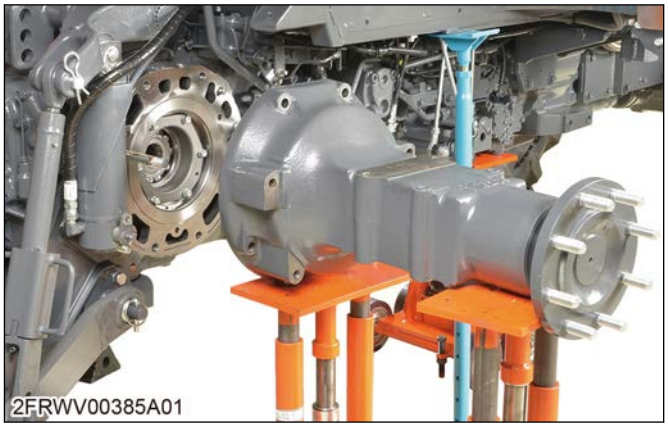
- **Be sure to support the rear axle and make sure the balance for support position.**

1. Remove the trailer brake actuating pipe (R.H.) (3).
2. Remove the stabilizer and bracket (1).
3. Remove the cylinder support (2).




(1) Bracket
(2) Cylinder support
(3) Trailer brake actuating pipe (R.H.)

4. Set the disassembling stands under the rear axle case.
5. Remove the rear axle case mounting bolts and nuts.
6. Separate the rear axle case from transmission case.




**(When reassembling)**

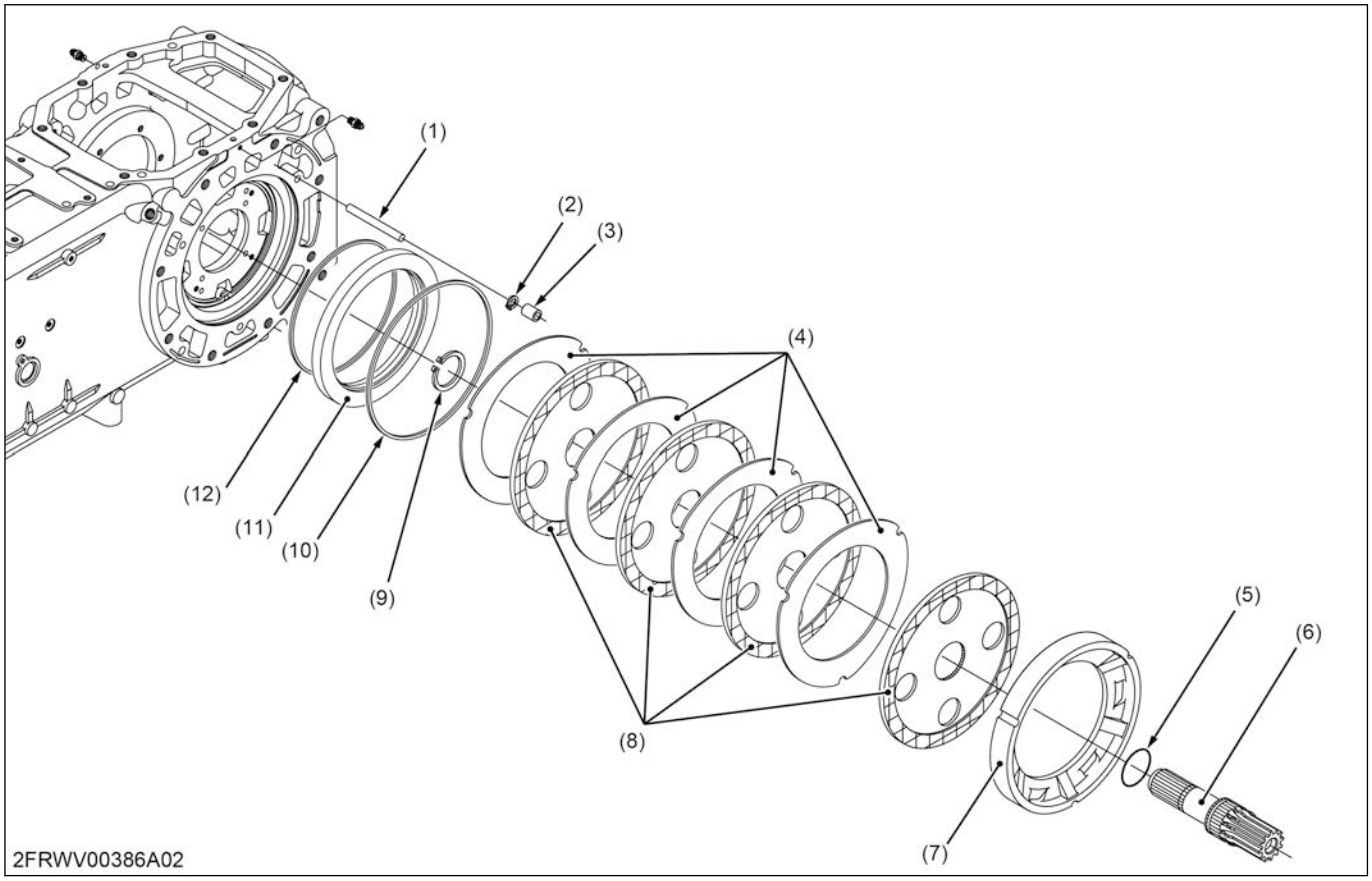
- Apply liquid gaskets (Three Bond 1206C or its equivalents) to the joint face.
- Temporally tighten all bolt and nut for rear axle case assembly.
- After temporally tighten all bolt and nut, firstly tighten the nut of most forward.
  And then, tighten the bolt of most rearward.
- Tighten the to the cabin mounting bolt and nut (M14, 7T) and the rear axle case mounting screw and nut (M16, 9T) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Cabin mounting bolt and nut (M14, 7T) | 124 to 147 N·m<br>12.6 to 15.0 kgf·m<br>91.2 to 108 lbf·ft |
| | Rear axle case mounting screw and nut (M16, 9T) | 260.0 to 304.1 N·m<br>26.52 to 31.00 kgf·m<br>191.8 to 224.2 lbf·ft |

# 4.3 Disassembling rear axle

## 4.3.1 Brake section

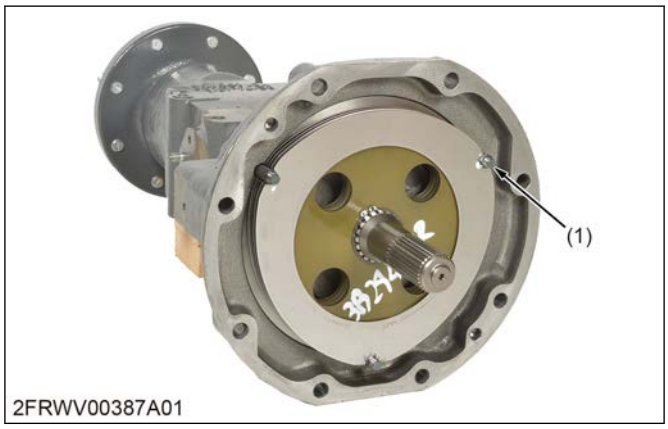
### 4.3.1.1 Disassembling brake shaft, brake disc, steel plate and brake plate

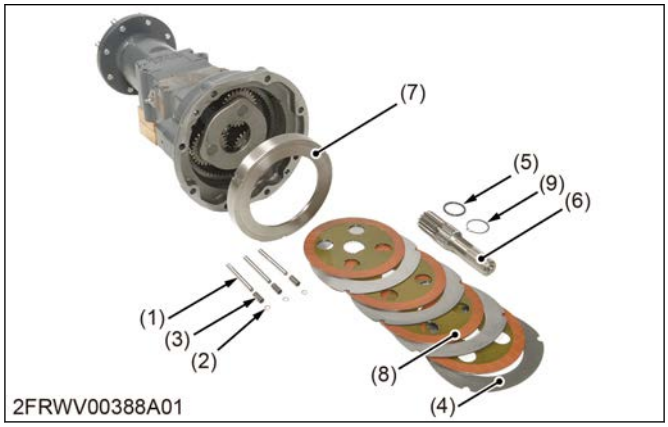



(1) Pin
(2) External circlip
(3) Collar
(4) Steel plate
(5) O-ring
(6) Brake shaft
(7) Brake plate
(8) Brake disc
(9) External circlip
(10) Brake seal 1
(11) Brake piston
(12) Brake seal 2

1. Remove the external circlip (2).
2. Remove the pin (1) and collar (3).
3. Remove the brake shaft (6) with brake discs (8) and steel plates (4).
4. Remove the external circlip (9).

5. Remove the brake plate (7).

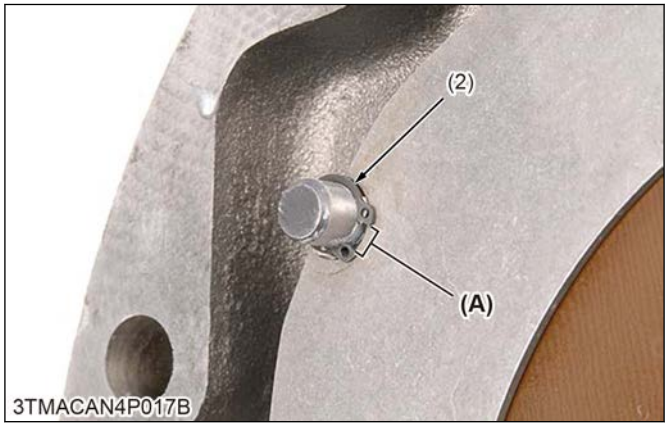



(1) Pin
(2) External circlip
(3) Collar
(4) Steel plate
(5) O-ring
(6) Brake shaft
(7) Brake plate
(8) Brake disc
(9) External circlip

**(When reassembling)**

- Place the brake discs (8) so that the holes align to next holes.
- The pin (1) does not have groove for external circlip (2).
- Face the external circlip (2) gap (A) to brake shaft (6).

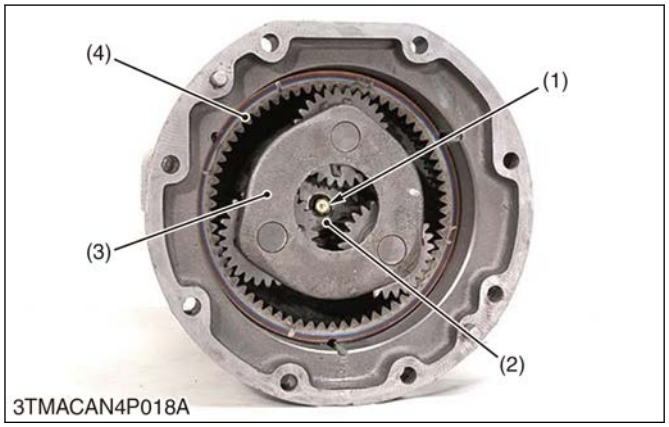



(2) External circlip
(A) Gap

## 4.3.2 Rear axle case

### 4.3.2.1 Disassembling planetary gear support

1. Remove the retainer mounting screw (1).
2. Carefully remove the planetary gear support (3).
3. Remove the internal gear (4).




(1) Retainer mounting screw
(2) Retainer plate
(3) Planetary gear support
(4) Internal gear

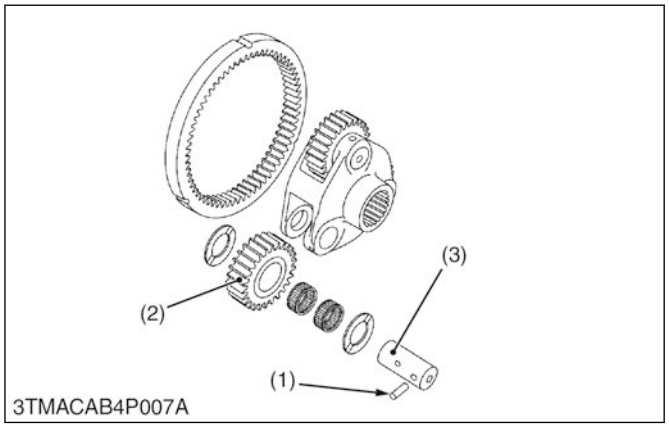
**(When reassembling)**

- Be sure to insert the retainer plate (2).
- Tighten the retainer mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Retainer mounting screw | 89.3 to 103 N·m<br>9.11 to 10.5 kgf·m<br>65.9 to 75.9 lbf·ft |

### 4.3.2.2 Disassembling planetary gear

1. Tap out roll pin (1) into the planetary gear shaft (3).

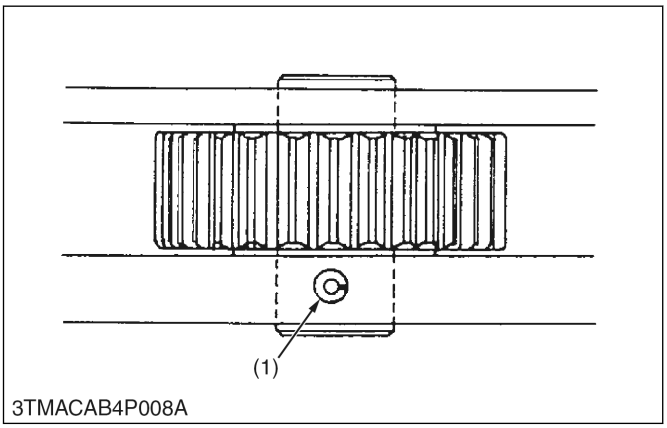



(1) Roll pin
(2) Planetary gear
(3) Planetary gear shaft

2. Draw out the planetary gear shaft (3), and remove the planetary gear (2).
3. Tap out the roll pin from the planetary gear shaft.

**(When reassembling)**

- Apply transmission fluid to the inner surface of planetary gear (2).
- Set the roll pin (1) as shown in the figure.

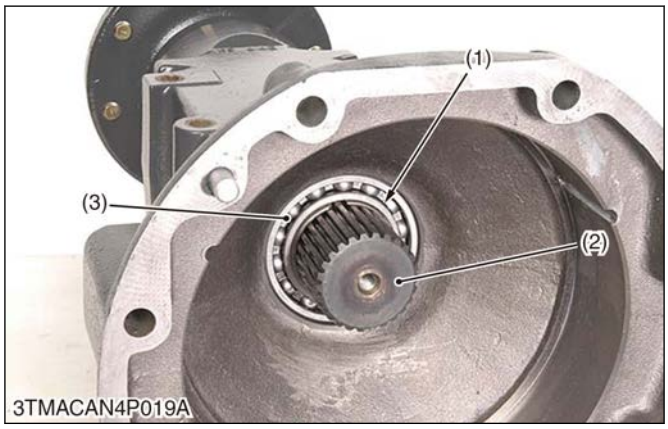


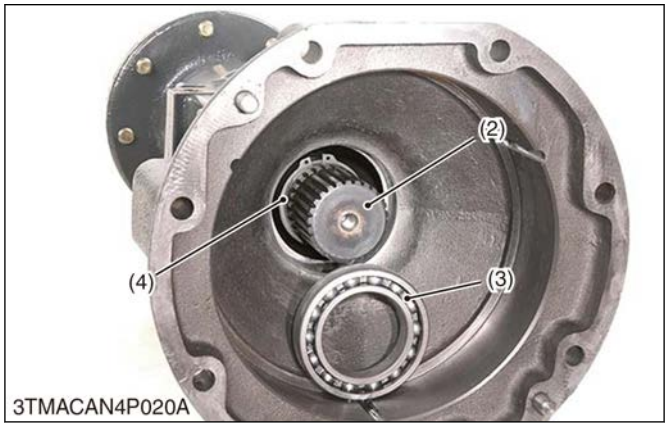

(1) Roll pin

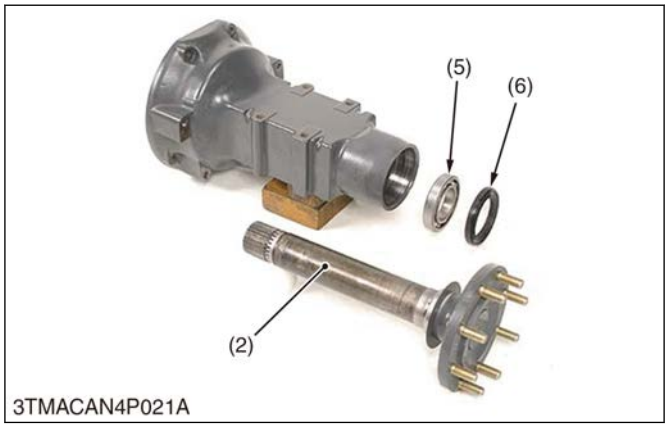
### 4.3.2.3 Removing rear axle

1. Remove external circlip (1).
2. Tap out rear axle (2) half way.
3. Remove ball bearing (3) and external circlip (4) from rear axle.
4. Tap out rear axle (2).

5. Tap out ball bearing (5) and oil seal (6) together.



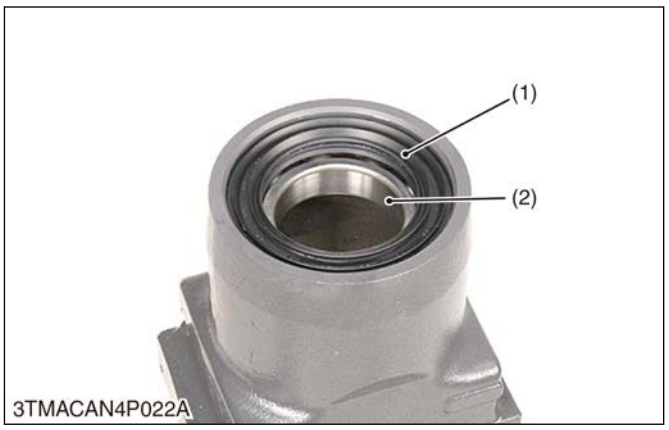




(1) External circlip
(2) Rear axle
(3) Ball bearing
(4) External circlip
(5) Ball bearing
(6) Oil seal

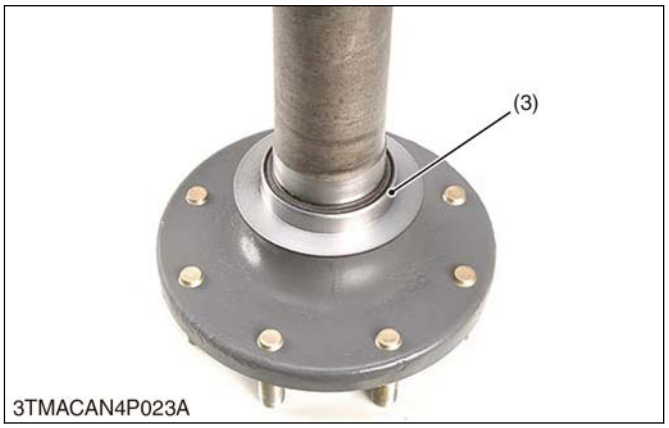
## 4.3.2.4 Assembling procedure for rear axle

1. Assemble the ball bearing (2) to the rear axle case.
2. Assemble the oil seal 1 (1), face the seal lip to outside.



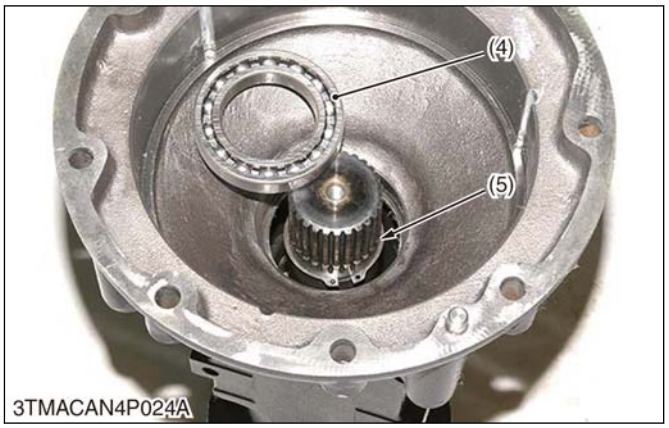

(1) Oil seal 1
(2) Ball bearing

3. Assemble the oil seal 2 (3) to the rear axle.




(3) Oil seal 2

4. Assemble the rear axle to rear axle case.
   - Apply transmission fluid to the oil seal when insert the rear axle to rear axle case.
5. Assemble the external circlip (5) then tap in the ball bearing (4) to the rear axle shaft.

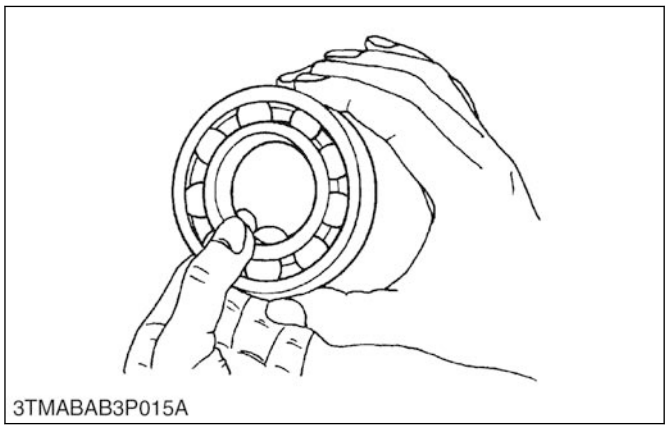



(4) Ball bearing
(5) External circlip

# 5. Servicing

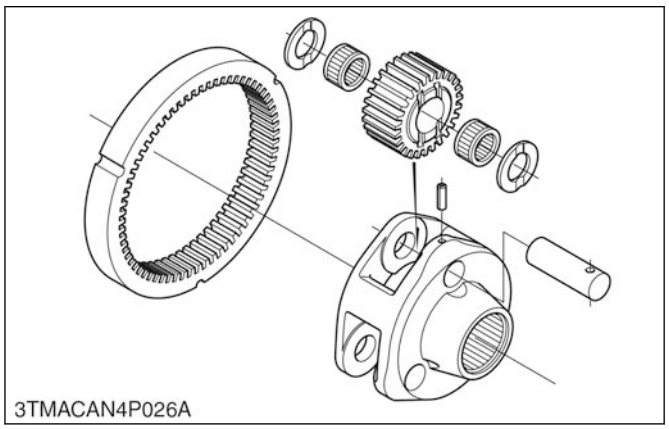
## 5.1 Bearing

### 5.1.1 Checking ball bearing


3TMABAB3P015A

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

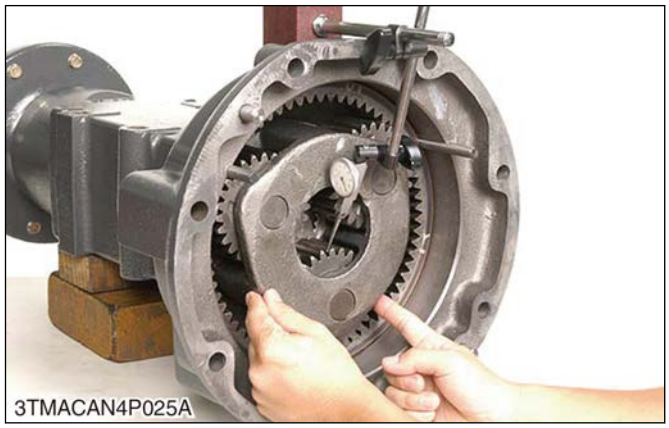
### 5.1.2 Checking needle bearing


3TMACAN4P026A

1. Check the needle bearing for abrasion, color change or other damage.
2. If there is any problem, replace it.

## 5.2 Planetary gear

### 5.2.1 Checking backlash between internal gear and planetary gear


3TMACAN4P025A

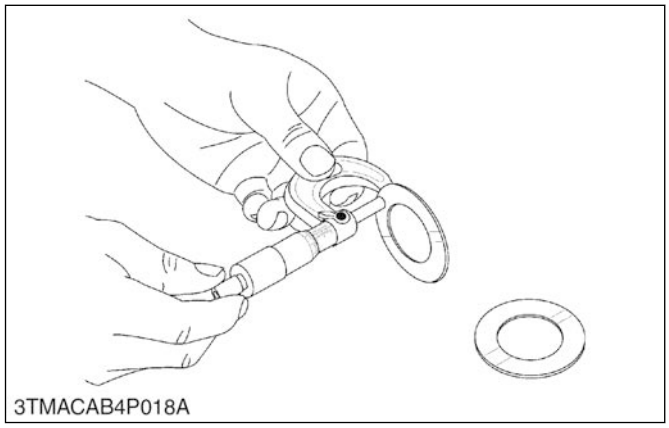
1. Set a dial indicator (lever type) on the tooth of the planetary gear.
2. Hold the planetary gear support and move only the planetary gear to measure the backlash.

| | | |
|---|---|---|
| Backlash between internal gear and planetary gear | Factory specification | 0.2 to 0.4 mm<br>0.008 to 0.01 in. |
| | Allowable limit | 0.5 mm<br>0.02 in. |

3. If the measured value exceeds the allowable limit, check the planetary gear and planetary shaft.

### 5.2.2 Measuring thrust collar thickness

Tools required
- Micrometer

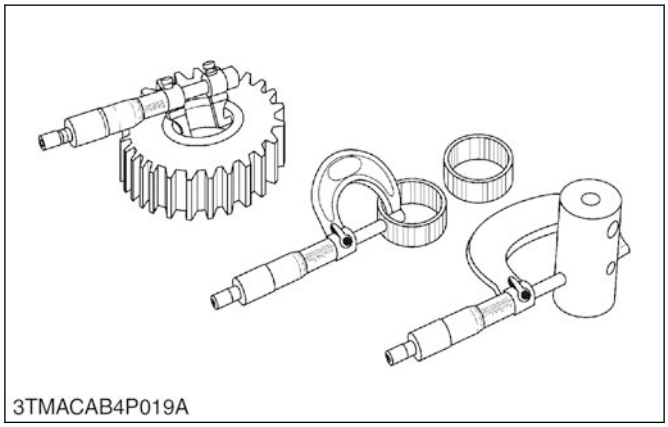

3TMACAB4P018A

1. Measure the thickness of the thrust collar.

| | | |
|---|---|---|
| Thrust collar thickness | Factory specification | 1.55 to 1.65 mm<br>0.0611 to 0.0649 in. |
| | Allowable limit | 1.2 mm<br>0.047 in. |

2. If the measured value is less than the allowable limit, replace it.

## 5.2.3 Measuring clearance between planetary gear and planetary gear shaft


3TMACAB4P019A

1. Measure planetary gear shaft O.D. (rubbing surface).

| | | |
|---|---|---|
| Planetary gear shaft O.D. | Factory specification | 29.989 to 30.000 mm<br>1.1807 to 1.1811 in. |

2. Measure planetary gear I.D. (rubbing surface).

| | | |
|---|---|---|
| Planetary gear I.D. | Factory specification | 42.009 to 42.025 mm<br>1.6539 to 1.6545 in. |

3. Measure O.D. of two needles installed diagonally in needle bearing.

| | | |
|---|---|---|
| Needle O.D. | Factory specification | 5.994 to 6.000 mm<br>0.2360 to 0.2362 in. |

4. Calculate clearance.
   (Clearance = Planetary gear I.D. − {(2 × Needle O.D.) + Planetary gear shaft O.D.}).
5. If clearance exceeds allowable limit, replace them.

| | | |
|---|---|---|
| Clearance between planetary gear and planetary gear shaft | Factory specification | 0.0090 to 0.048 mm<br>0.00036 to 0.0018 in. |
| | Allowable limit | 0.3 mm<br>0.01 in. |

# 6. BRAKES

# MECHANISM

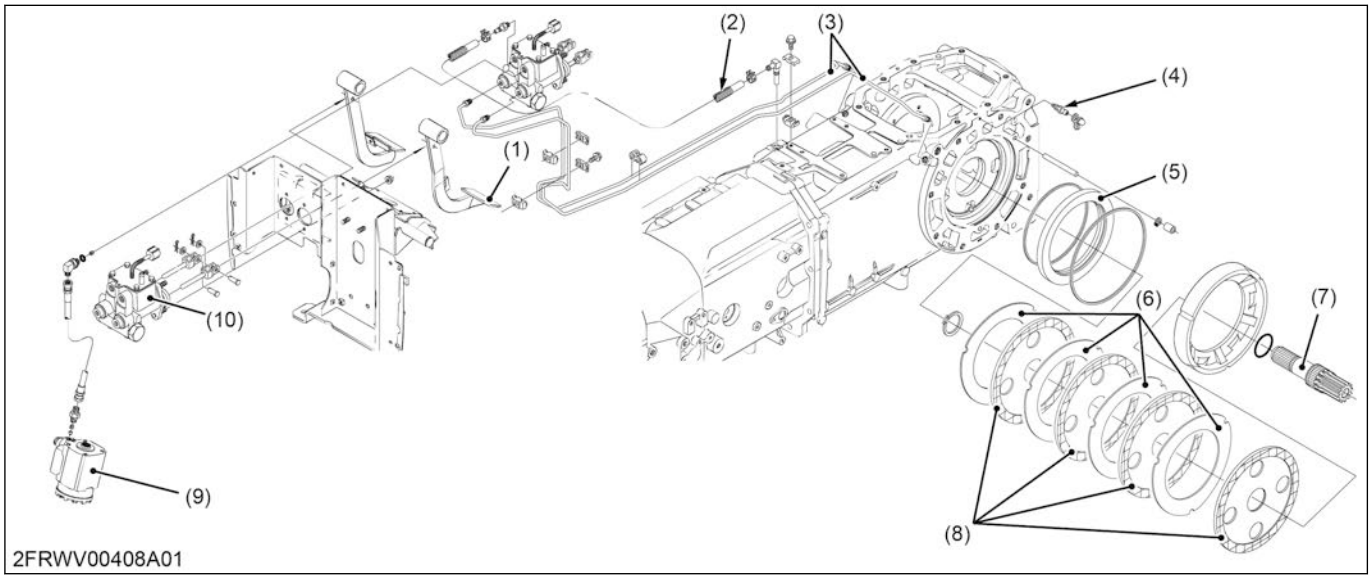
## 1. Traveling brake

### 1.1 Structure of traveling brake

**■ NOTE**

- **Refer to "BRAKES" section in the Workshop Manual of *Tractor mechanism* (Code No. *9Y021-18200*).**

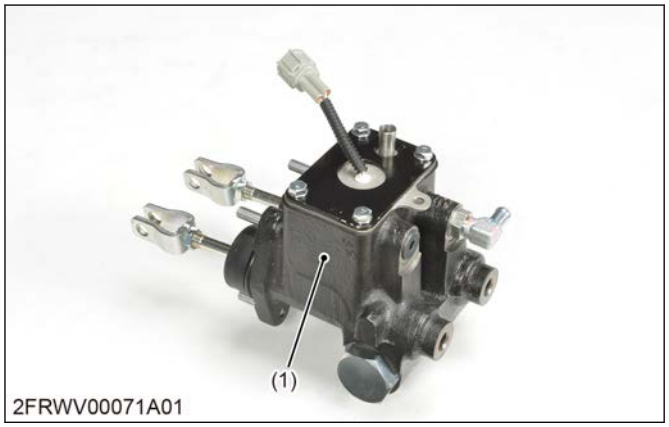
The traveling brake is a hydraulic wet disk type, which consists of the master cylinder (10), brake pipe (3), brake piston (5) and others. This type provides high and stable braking effect and requires almost no adjustment.
The master cylinder (10) is one piece type which including equalizer, oil reservoir and oil amount detecting function..
While the machine operates in 2WD traveling mode, oil flow pushes the dish springs and 4WD clutch is disengaged. When both brake pedals are depressed at the same time, 2-brake switches energize the 2WD solenoid valve to switch into 4WD traveling mode. Therefore brake force applies to all 4-wheels and greater breaking effect is obtained.
The brake oil provided forcibly, the oil after through the power steering controller (9), oil line separate for oil cooler and master cylinder (10). The master cylinder (10) saves oil and surplus oil return to the clutch housing case through the return hose (2).
This system makes free maintenance for brake oil level check. In addition, the master cylinder (10) have oil amount detecting function and prevent shortage of brake oil.

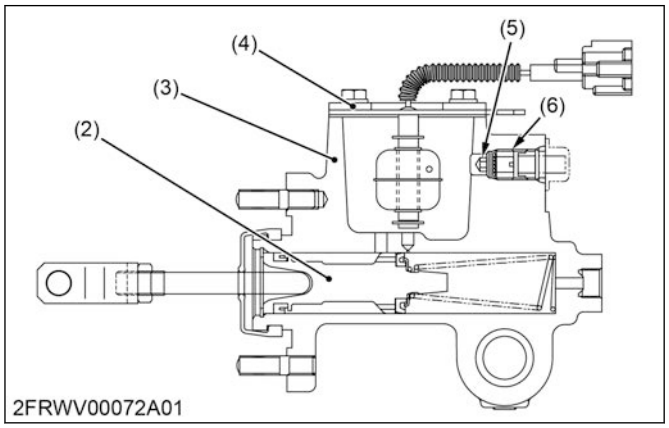


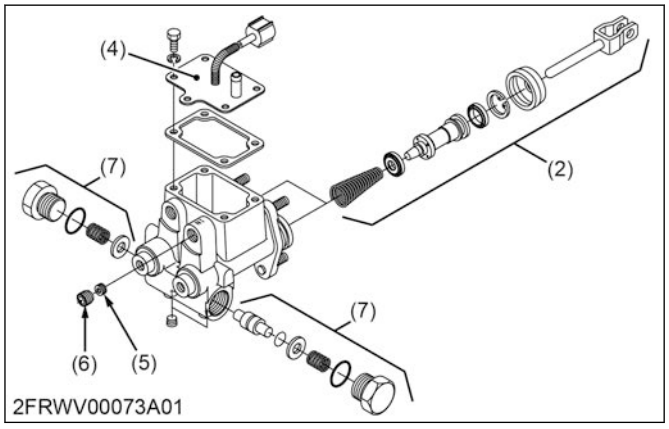

(1) Brake pedal
(2) Return hose
(3) Brake pipe
(4) Bleeder
(5) Brake piston
(6) Brake plate
(7) Brake shaft
(8) Brake disk
(9) Power steering controller
(10) Master cylinder

## 1.2 Function of master cylinder assembly

The master cylinder is one piece type which including oil tank (3), master cylinder (2) and equalizer (7).
Tank cover (4) has the oil level check function. If the oil level in the tank (3) becomes low, the float fitted to the tank cover (4) moves down. If the oil level becomes lower than prescribed level, the connection between the terminals is disconnected.
The function for each parts, refer to "BRAKES" section in the Workshop Manual of *Tractor mechanism* (Code No. *9Y021-18200*).



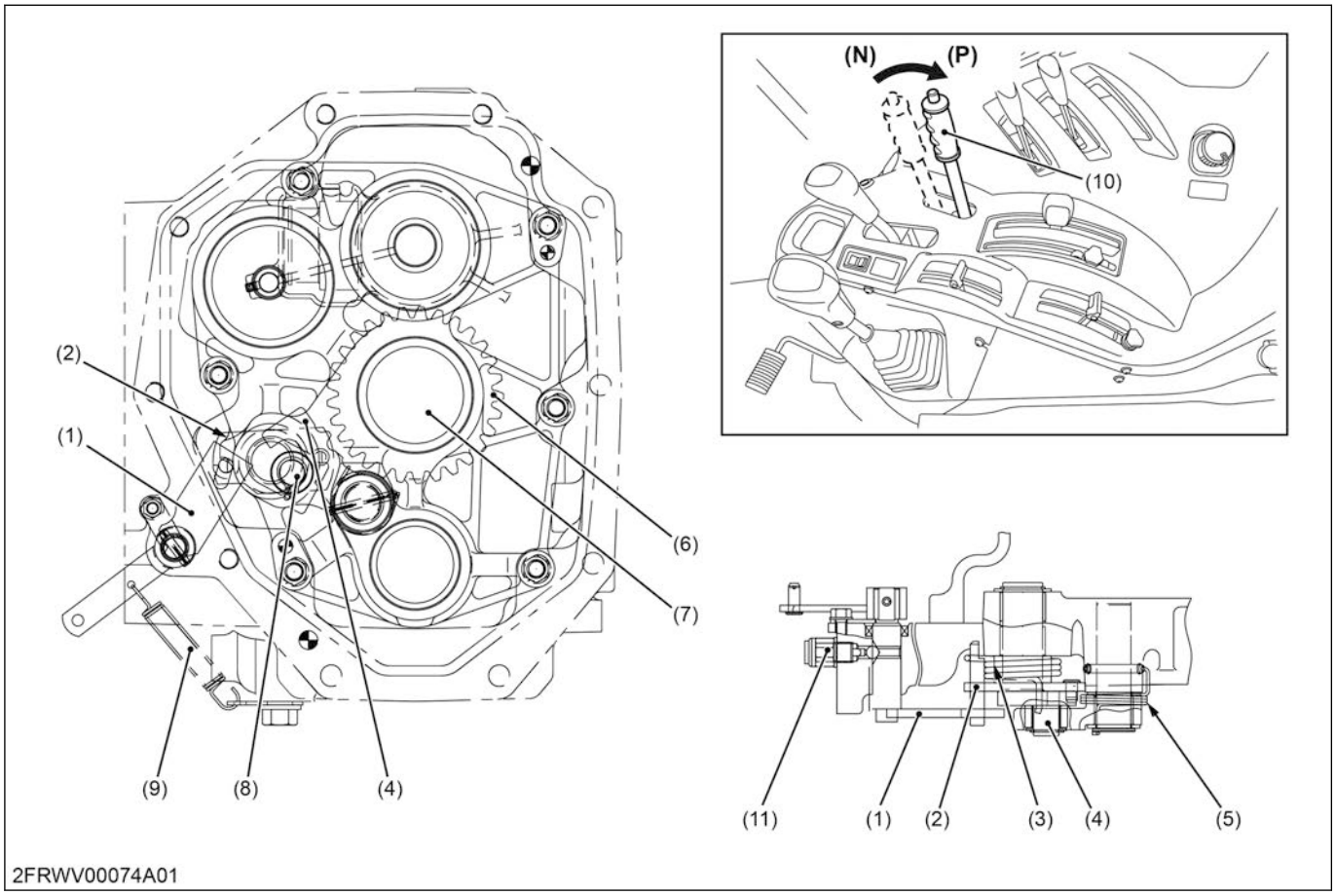




(1) Master cylinder assembly
(2) Master cylinder
(3) Tank
(4) Tank cover
(5) Orifice
(6) Filter
(7) Equalizer

# 2. Parking brake

## 2.1 Structure of gear locked parking brake

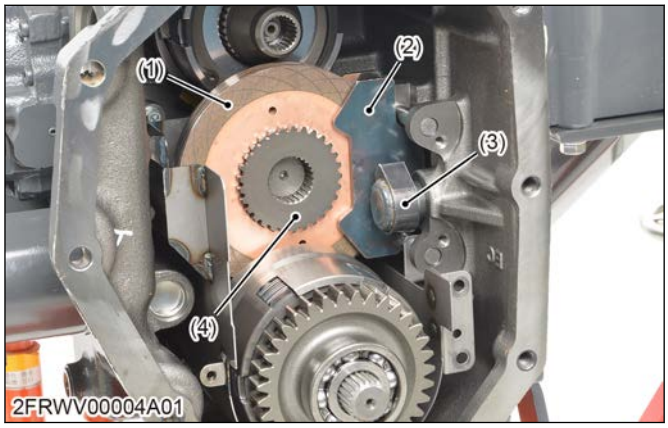


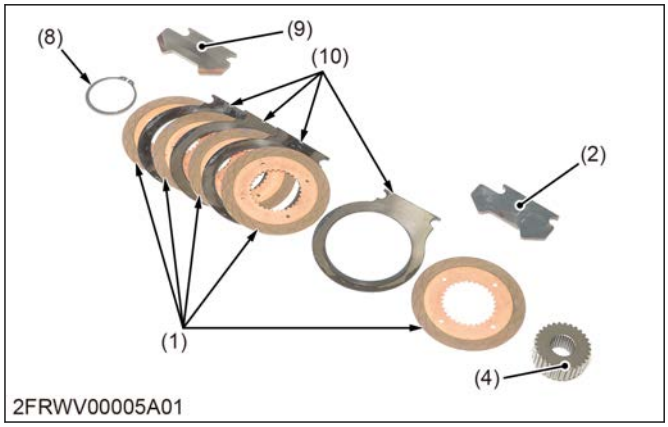

(1) Parking lever
(2) Parking lever cam
(3) Spring
(4) Parking brake gear lever
(5) Spring
(6) Parking brake gear
(7) Counter shaft
(8) Parking collar
(9) Spring
(10) Parking gear lock lever
(11) Switch (Parking brake)
(P) At parking brake "ON"
(N) At parking brake "OFF" (Neutral position)

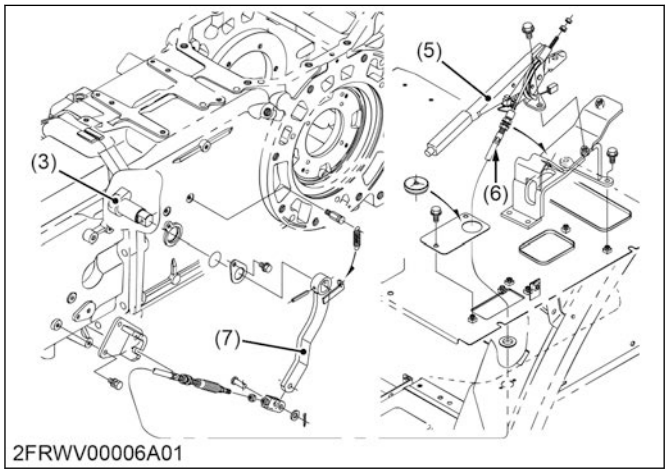
The parking brake is gear lock type.
When the parking gear lock lever (10) is in **ON** position (P), the parking lever (1) pushes down the parking lever cam (2).
The parking collar pushes the parking brake gear lever (4) to engage and lock the parking brake gear (6) on the counter shaft (7).
When the parking gear lock lever (10) is in **OFF** position (N), parking brake gear lever (4), parking lever cam (2) and parking lever (1) are returned by return springs (3), (5) and (9).

# 3. Secondary brake

## 3.1 Structure of secondary brake




(1) Brake disk
(2) Brake pad 1
(3) Secondary brake cam
(4) Secondary brake hub
(5) Secondary brake hand lever
(6) Secondary brake cable
(7) Secondary brake lever
(8) Circlip
(9) Brake pad 2
(10) Steel plate

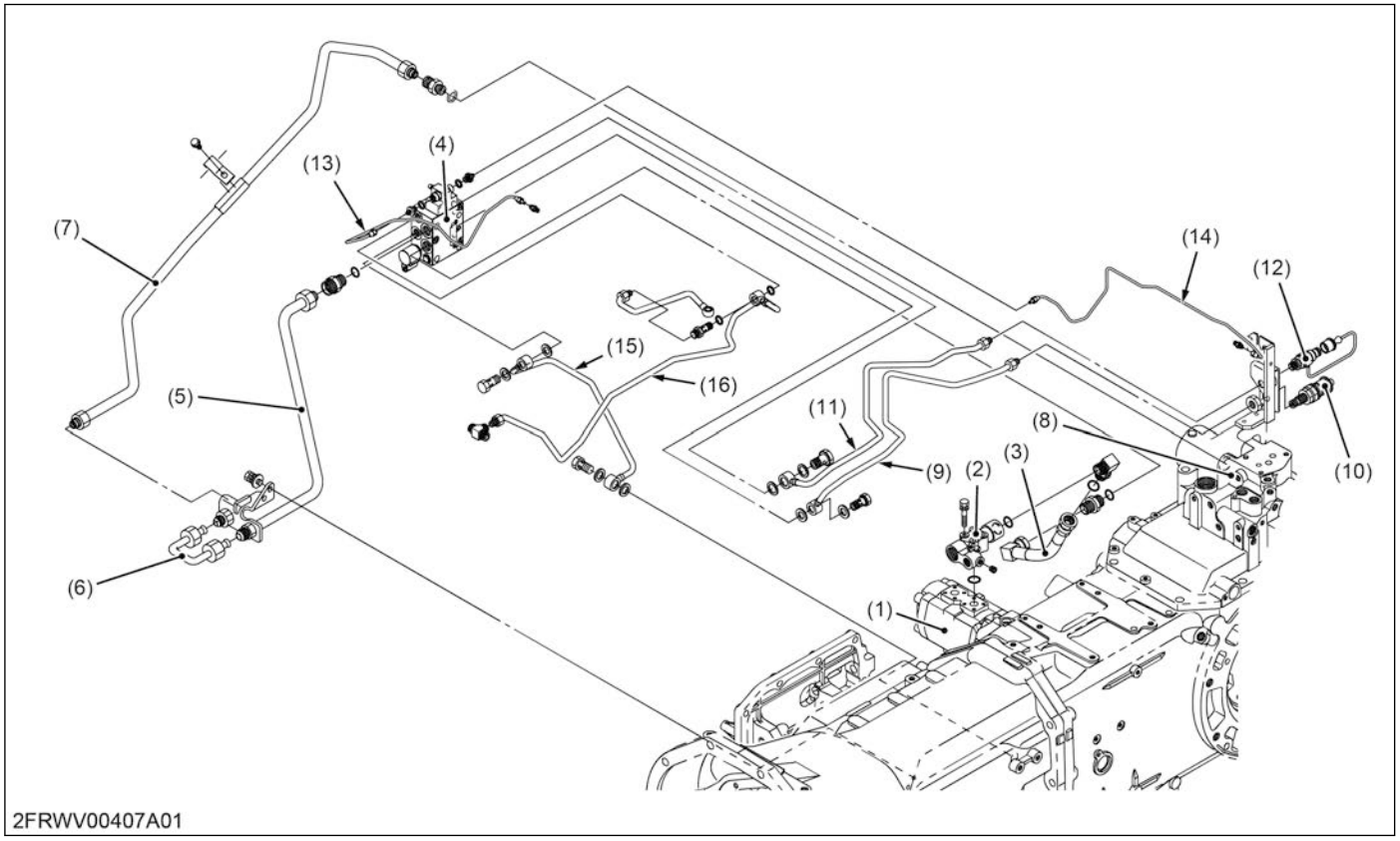
Secondary brakes are a wet disc brake, which is independent of the traveling brakes and provided on the secondary brake hub (4).
When the hand secondary brake lever is pulled, the secondary brake cam (3) is moved through the secondary brake cable (6) and pushes the brake pad 1 (2).

As the secondary brake cam (3) moves, the brake disks (1) are pressed by the brake pads (2) and (9), causing frictional force. This frictional force provides braking effect.

# 4. Hydraulic trailer brake

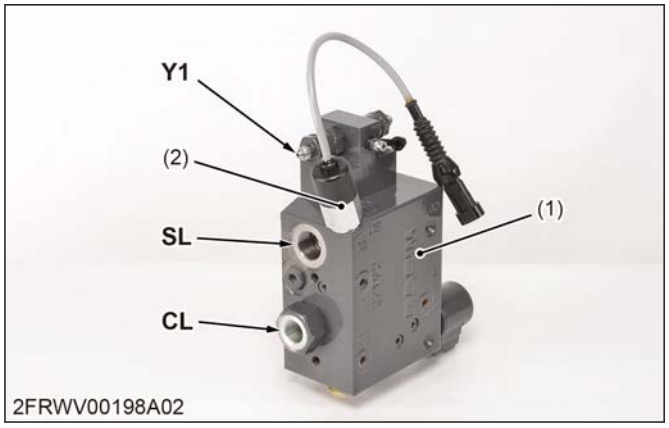
## 4.1 Structure of trailer brake

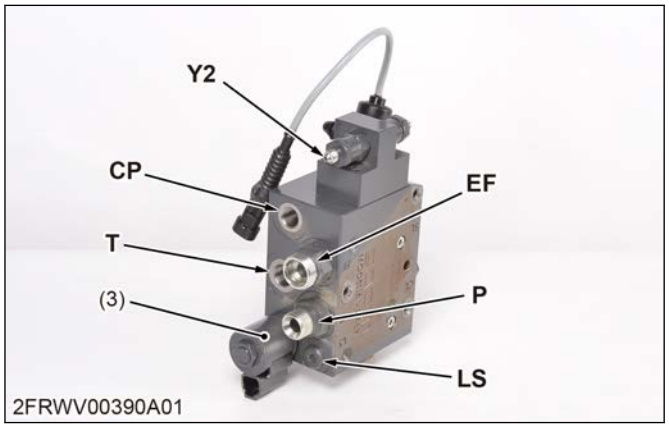
The hydraulic trailer brake valve (4) is provided in this tractor, which brings a steady braking power at work to use the heavy trailer. The oil pressure rise in the brake case is perceived to the trailer brake valve (4) through the pilot pipe (R.H.) (13) and pilot pipe (L.H.) (14). Then the trailer brake valve (4) feeds pressurized oil to the trailer through the "**CL**" line coupler (10) corresponding to the brake oil pressure in the brake case, namely amount of brake pedal operation.

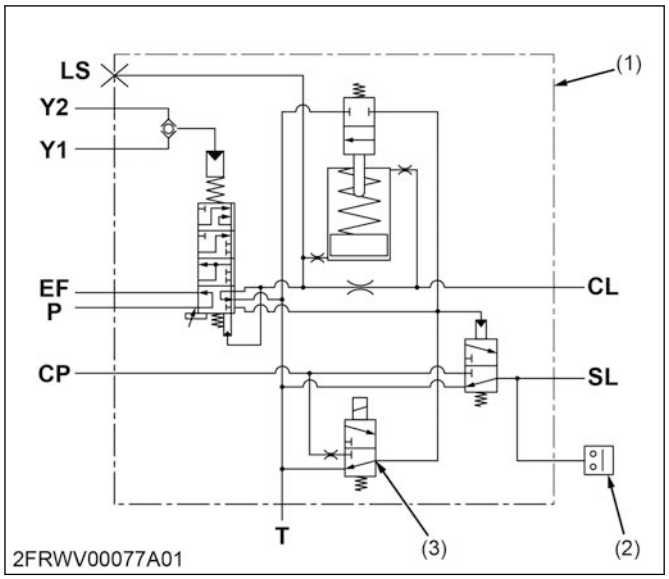



(1) Hydraulic pump
(2) Relief valve holder
(3) Trailer brake delivery hose
(4) Trailer brake valve
(5) 3-point hitch delivery pipe 1
(6) U-pipe
(7) 3-point hitch delivery pipe 2
(8) Hydraulic cylinder
(9) "**CL**" line delivery pipe
(10) "**CL**" line coupler
(11) "**SL**" line delivery pipe
(12) "**SL**" line coupler
(13) Pilot pipe (R.H.)
(14) Pilot pipe (L.H.)
(15) Trailer brake valve return pipe
(16) Oil cooler return pipe

## 4.2 Function of hydraulic trailer brake valve




(1) Hydraulic trailer brake valve
(2) Pressure switch
(3) Hydraulic trailer brake solenoid

This trailer valve (1) can supply two lines of hydraulic brake outlet, CL and SL.
If the pilot pressure is applied to Y1 or Y2 port, the pressure moves the spool. As a result, the pressure applied to P port is outputted to CL port.
In addition, the hydraulic trailer brake solenoid (3) is equipped to this valve. If this solenoid is activated, the hydraulic pressure applied to CP port moves the spool and the hydraulic pressure is outputted to SL port. To check SL port is outputted or not, pressure switch (2) is equipped.

# SERVICING

## 1. Troubleshooting for brakes

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Poor braking force | 1. Brake pedal free travel excessive | Adjust | 6-11 |
| | 2. Brake disc worn | Replace | 5-18<br>6-40 |
| | 3. Brake piston warped | Replace | 6-37<br>6-39 |
| | 4. Brake oil leakage from brake pipes, bleeder, master cylinder or equalizer | Repair or replace | — |
| | 5. Master cylinder or equalizer malfunctioning | Repair or replace | 6-25<br>6-32<br>6-33<br>6-33 |
| Uneven braking force | 1. Brake pedal free travel improper adjusted | Adjust | 6-11 |
| | 2. Brake disc worn | Replace | 5-18<br>6-40 |
| | 3. Brake piston warped | Replace | 6-37<br>6-39 |
| | 4. Brake oil leakage from brake pipes, bleeder, master cylinder or equalizer | Repair or replace | — |
| | 5. Master cylinder or equalizer malfunctioning | Repair or replace | 6-25<br>6-32<br>6-33<br>6-33 |
| Brake drags. | 1. Brake pedal free travel too small | Adjust | 6-11 |
| | 2. Master cylinder return spring weaken or broken | Replace | 6-33 |
| | 3. Master cylinder malfunctioning | Repair or replace | 6-25<br>6-32<br>6-33 |
| | 4. Brake seal failure | Replace | 6-37 |
| | 5. Brake lines clogged | Clean | — |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Brake drags. | 6. Brake pedal return spring weaken or broken | Replace | 6-34<br>6-34 |
| Spongy brake pedal | 1. Air in brake system | Bleed air | 2-56 |
| Brake oil consumed excessively. | 1. Brake seal failure | Replace | 6-37 |
| | 2. Brake oil leakage in brake lines | Repair or replace | — |
| | 3. Parking brake dose not work properly free play excessive. | Adjust | 6-16<br>6-17 |
| Parking brake drags. | 1. Parking brake dose not work properly free play too small | Adjust | 6-16<br>6-17 |

# 2. Servicing specifications for brakes

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Proper brake pedal | Free travel (Right brake pedal) | 7 to 14 mm<br>0.3 to 0.6 in.<br>on the pedal | — |
| | Free travel (Left brake pedal) | Right brake free travel (actual value)<br>+5.0 to 10 mm<br>0.20 to 0.39 in.<br>on the pedal | — |
| Secondary brake lever | Free play (Number of notches) | 3 notches | — |
| Battery cable terminal | Clearance | 1.0 to 1.5 mm<br>0.040 to 0.059 in. | — |
| Brake pedal bushing | I.D. | 25.093 to 25.148 mm<br>0.98792 to 0.99007 in. | — |
| Pedal shaft | O.D. | 24.948 to 25.000 mm<br>0.98221 to 0.98425 in. | — |
| brake pedal bushing to pedal shaft | Clearance | 0.093 to 0.20 mm<br>0.0037 to 0.0078 in. | 0.5 mm<br>0.02 in. |
| Brake plate | flatness | — | 0.3 mm<br>0.01 in. |
| Brake disc | Wear | 4.15 to 4.35 mm<br>0.164 to 0.171 in. | 3.3 mm<br>0.13 in. |
| Brake plate | Wear | 2.1 to 2.5 mm<br>0.083 to 0.098 in. | 1.5 mm<br>0.059 in. |

### Trailer brake

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Supplementary line port | Setting pressure (Without secondary brake lever and parking brake lever) | 1.50 to 3.50 MPa<br>15.3 to 35.6 kgf/cm$^2$<br>218 to 507 psi | — |
| | Setting pressure (With secondary brake lever or parking brake lever) | 0 to 100 kPa<br>0 to 1.01 kgf/cm$^2$<br>0 to 14.5 psi | — |
| Control line | Setting pressure (Without brake pedal) | 0 to 200 kPa<br>0 to 2.03 kgf/cm$^2$<br>0 to 29.0 psi | — |
| | Setting pressure (With brake pedal) | 11.5 to 15.0 MPa<br>118 to 152 kgf/cm$^2$<br>1670 to 2170 psi | — |

# 3. Tightening torques for brakes

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to 2-15, 2-15.)

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Bleeder | 6.5 to 6.8 | 0.66 to 0.70 | 4.8 to 5.0 |
| Coupler mounting nut | 88.2 to 98.0 | 9.00 to 9.99 | 65.1 to 72.2 |
| Brake pipe retaining nut | 20 to 28 | 2.1 to 2.8 | 15 to 20 |
| Lock nut | 7.8 to 9.3 | 0.80 to 0.94 | 5.8 to 6.8 |
| Steering mounting nut | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Step mounting bolt (7T, M10) | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Step mounting bolt (7T, M12) | 77.5 to 90.2 | 7.91 to 9.19 | 57.2 to 66.5 |
| Brake delivery pipe retaining nut | 23 to 27 | 2.3 to 2.8 | 17 to 20 |
| Power steering delivery hose retaining nut | 22.6 to 27.5 | 2.31 to 2.80 | 16.7 to 20.2 |
| Master cylinder mounting nut | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| DPF muffler mounting nut | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| DPF muffler bracket mounting bolt | 60.8 to 70.6 | 6.20 to 7.19 | 44.9 to 52.0 |
| SCR muffler bracket mounting bolt and nut | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Steering wheel mounting nut | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Brake shaft support mounting bolt | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Brake delivery pipe retaining nut | 20 to 28 | 2.1 to 2.8 | 15 to 20 |
| Master cylinder hose retaining nut | 23 to 27 | 2.3 to 2.8 | 17 to 20 |
| Plug | 98.1 to 117 | 10.0 to 12.0 | 72.4 to 86.7 |

RELATED PAGE

1. General use screws, bolts and nuts on page 2-15

# 4. Checking and adjusting

## 4.1 Traveling brake

### 4.1.1 Checking brake pedal free travel

**WARNING**

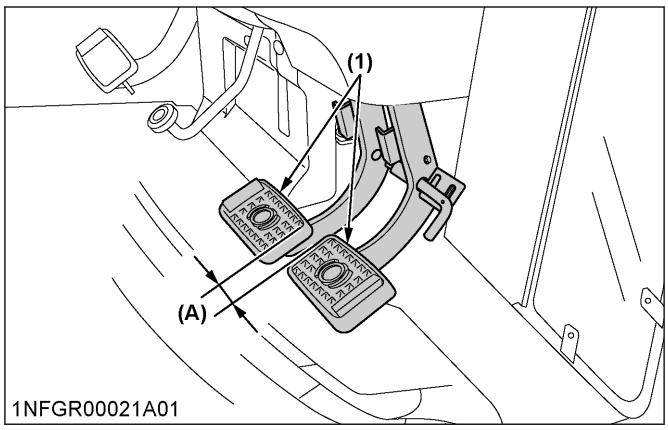
**To avoid personal injury or death:**

- **Park on flat ground, stop the engine and chock the wheels before checking the brake pedal.**
- **To prevent uneven braking, the specification must be within the recommended limit. If found out of the specifications, adjust the brakes.**

**NOTE**

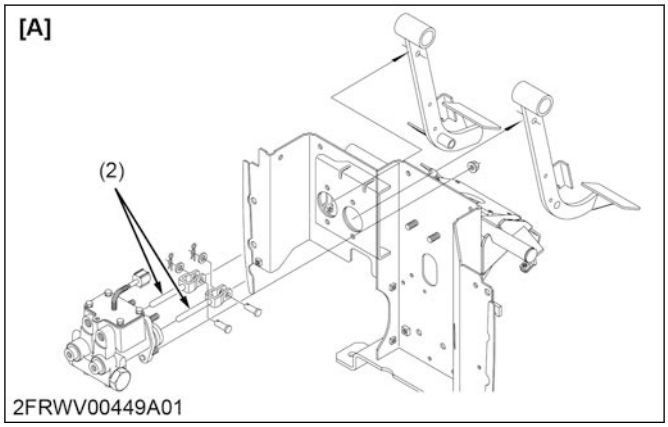
- **Brake pedals should be equal when depressed.**

1. Set the parking brake lever to parking position.
2. Slightly depress the brake pedals and measure free travel at the top of pedal stroke.




(1) Brake pedals (A) Free travel

3. If the measured value is not within the factory specifications, adjust the free travel by the push rod (2).
4. After adjustment, tighten the lock nut firmly.





(2) Push rod [B] Cabin model
[A] ROPS model

5. If the measured value is not within the factory specifications, adjust the free travel by the push rod (2).
6. After adjustment, tighten the lock nut firmly.

| | | |
|---|---|---|
| Proper brake pedal free travel (A) | Right brake pedal | 7 to 14 mm (0.3 to 0.6 in.) on the pedal |
| | Left brake pedal | Right brake free travel (actual value) +5.0 to 10 mm (0.20 to 0.39 in.) on the pedal. |
| Step on the right brake, and the trailer hydraulic brake allows some pilot oil to flow. This means that the free travel is different between the left and right brakes. | | |

### 4.1.2 Checking brake pedal stroke

**WARNING**

**To avoid personal injury or death:**

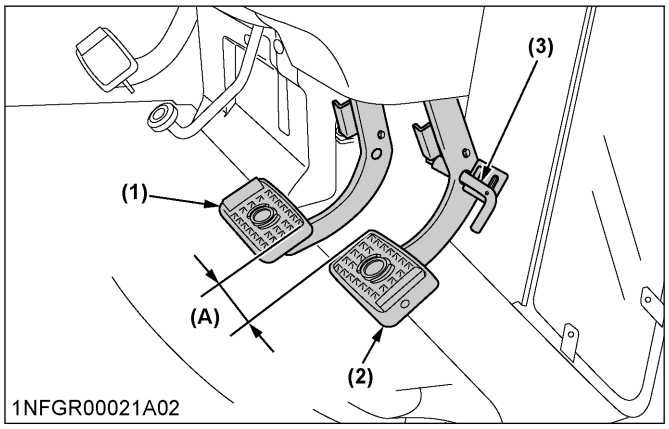
- **Stop the engine and chock the wheels before checking brake pedal.**
- **To prevent uneven braking, the specification must be within the recommended limit. If found out of the specifications, adjust the brakes.**

**NOTE**

- **Brake pedals should be equal when depressed.**

1. Disengage the brake pedal lock (3).
2. Depress the brake pedal several times.
3. Step on the right-hand pedal (2) and measure the level difference (pedal stroke) between this pedal (2) and the left-hand pedal (1).

4. Do the same for the left-hand pedal (1).




(1) Brake pedal (L.H.)
(2) Brake pedal (R.H.)
(3) Brake pedal lock
(A) Pedal stroke

5. If the pedal stroke (A) exceeds the factory specification, check the air bleeding, master cylinder, equalizer or brake case.

**(When reassembling)**

| | |
|---|---|
| Pedal stroke (A) (Each pedal) | Less than 100 mm (3.9 in.) at each pedal |

## 4.1.3 Checking equalizer working level (Anti-imbalance device)

**⚠ WARNING**

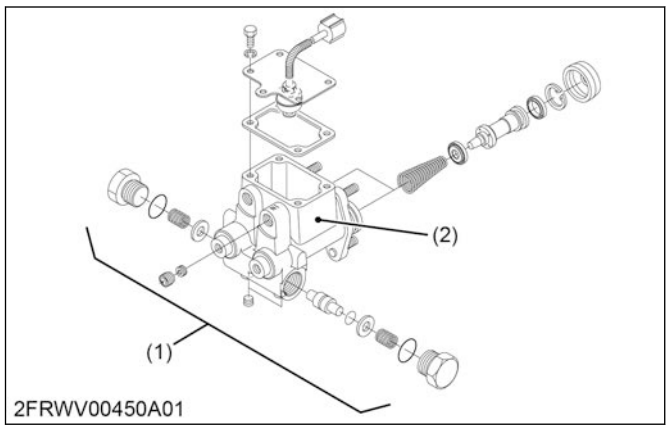
**To avoid personal injury or death:**

- **Stop the engine and chock the wheels before checking brake pedal.**
- **To prevent uneven braking, the specification must be within the recommended limit. If found out of the specifications, adjust the brakes.**

**■ NOTE**

- **Brake pedals should be equal when depressed.**

1. Gently step on both brake pedals at once.
2. Further step on the right-hand pedal (the left-hand pedal slightly raises itself) and measure the level difference between the pedals.
3. Do the same for the left-hand pedal.
4. If the measured value is not within the factory specification, check the equalizer (1).




(1) Equalizer
(2) Master cylinder

**(When reassembling)**

| | |
|---|---|
| Equalizer working level | Minimum level difference of 5 mm (0.2 in.) between both pedals. |

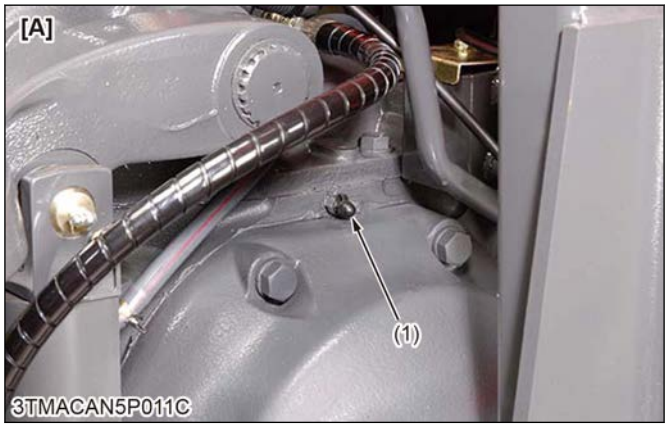
## 4.1.4 Checking traveling brake system

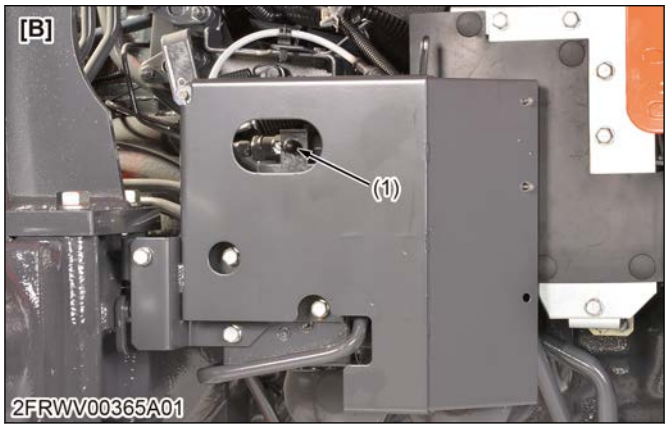
**⚠ CAUTION**

- **If the air is in the master cylinder, bleed the air from brake system completely.**

1. Remove the bleeder (1) from the transmission case or trailer brake valve.

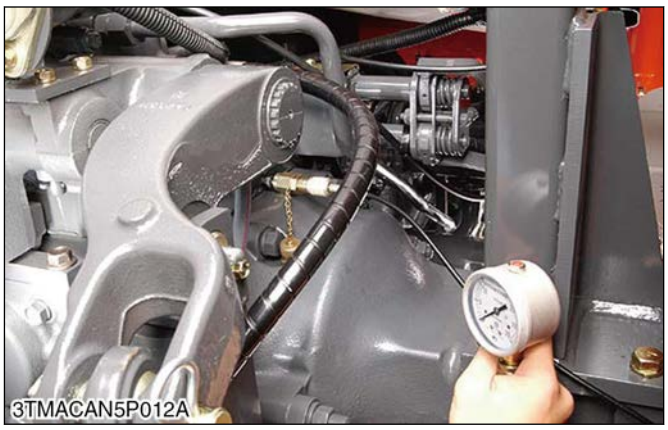
2. Set the hydraulic brake adaptor, joint (Code No. 07916-50401), cable (Code No. 07916-50331) and pressure gauge (Code No. 07916-52961).




(1) Bleeder
[A] Without trailer brake model
[B] With trailer brake model

3. Set the pedal fixing plate between the pedal and pedal stopper after depressing the brake pedal to reach the pressure between 3.0 to 3.2 MPa (30 to 33 kgf/cm$^2$, 430 to 460 psi).
4. Read the pressure P after one minute.
5. After reading the pressure P, wait another five minutes to read the pressure P and check the pressure drop.
   The pressure drop should be within P × 0.01 MPa (P × 0.1 kgf/cm$^2$, P × 1 psi).
6. If the pressure drop is too big, attach the pressure gauge to equalizer (brake pipe rear end) and master cylinder (brake pipe front end) to find out the problem area.




**(When reassembling)**

- Tighten the bleeder to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Bleeder | 6.5 to 6.8 N·m<br>0.66 to 0.70 kgf·m<br>4.8 to 5.0 lbf·ft |

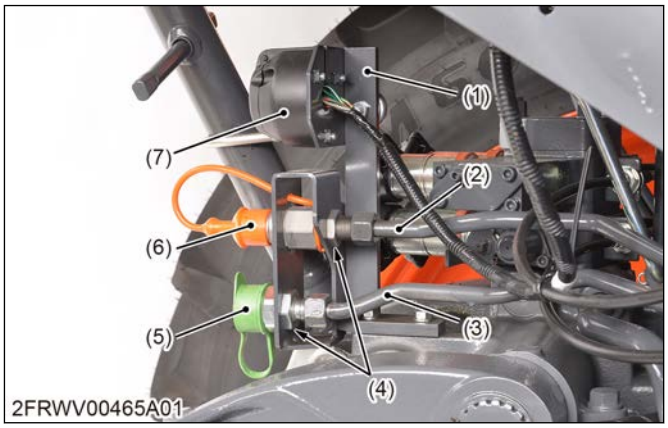
RELATED PAGE
2.25 Hydraulic brake adaptor on page 2-97

## 4.1.5 Testing trailer brake system

**CAUTION**

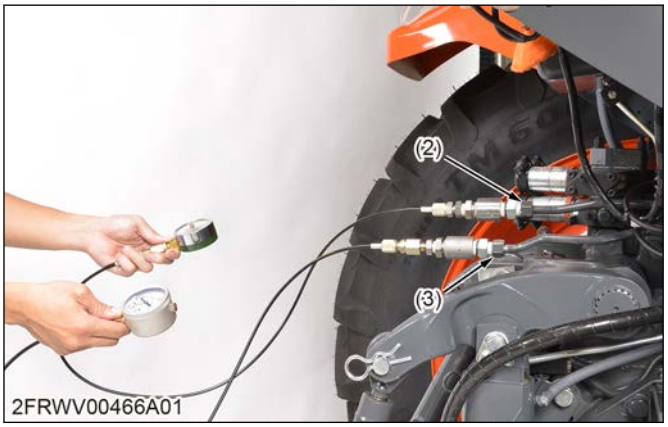
- **If the air is in the master cylinder, brake pipe and case bleed the air completely.**

1. Remove the trailer coupler (7).
2. Remove the coupler (6) from the trailer supplemental line pipe (2).
3. Remove the coupler (5) from the trailer control line pipe (3).
4. Remove the top link holder (1).




(1) Top link holder
(2) Trailer supplemental line pipe
(3) Trailer control line pipe
(4) Coupler mounting nut
(5) Coupler
(6) Coupler
(7) Trailer coupler

5. Set the trailer brake adapters and pressure gauges to trailer line pipes (2) (3).




(2) Trailer supplemental line pipe (3) Trailer control line pipe

6. Start the engine and set engine speed to rated speed.

**Condition for ROPS model**

| Engine speed | Oil temperature | Gear shift |
|---|---|---|
| 2400 $min^{-1}$ (rpm) | 40 to 60 ℃<br>104 to 140 ℉ | Neutral |

**Condition for Cabin model**

| Engine speed | Oil temperature | Gear shift |
|---|---|---|
| 2600 $min^{-1}$ (rpm) | 40 to 60 ℃<br>104 to 140 ℉ | Neutral |

7. Measure the pressure.

**(When reassembling)**

| | | | | |
|---|---|---|---|---|
| Trailer brake setting pressure | Supplementary line port setting pressure | Without secondary brake lever and parking brake lever | Factory specifications | 1.50 to 3.50 MPa<br>15.3 to 35.6 kgf/$cm^2$<br>218 to 507 psi |
| | | With secondary brake lever or parking brake lever | | 0 to 100 kPa<br>0 to 1.01 kgf/$cm^2$<br>0 to 14.5 psi |
| | Control line setting pressure | Without brake pedal | | 0 to 200 kPa<br>0 to 2.03 kgf/$cm^2$<br>0 to 29.0 psi |
| | | With brake pedal | | 11.5 to 15.0 MPa<br>118 to 152 kgf/$cm^2$<br>1670 to 2170 psi |

- Tighten the coupler mounting nuts (4) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Coupler mounting nut | 88.2 to 98.0 N·m<br>9.00 to 9.99 kgf·m<br>65.1 to 72.2 lbf·ft |

## 4.1.6 Bleeding brake system

**⚠ CAUTION**

- **Be careful to hot part such a muffler and rotating part of engine during air bleeding procedure.**

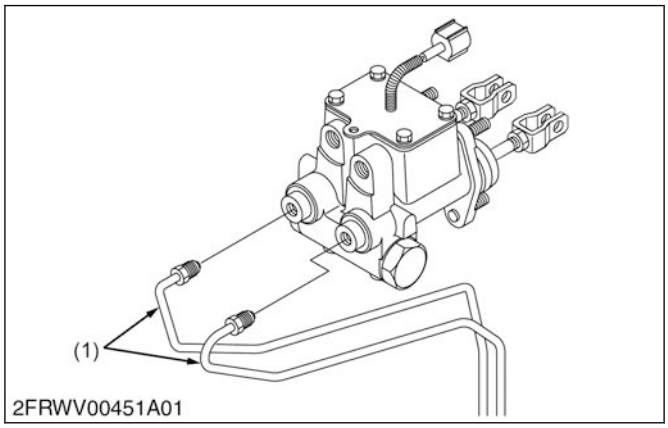
**■ IMPORTANT**

- **The shuttle lever and main gear shift lever are shift in NEUTRAL position.**
- **Set the parking brake lever to PARKING position.**
- **Fill the transmission fluid to the equalizer and master cylinder when overhauling the master cylinder assembly.**
- **If the air mixes in the brake hydraulic circuit, poor or no braking force is obtained due to compress the air even when the brake pedal is pressed.**
- **Accordingly whenever the hydraulic brake system is disassembled, be sure to bleed after reassembling.**

**NOTE**

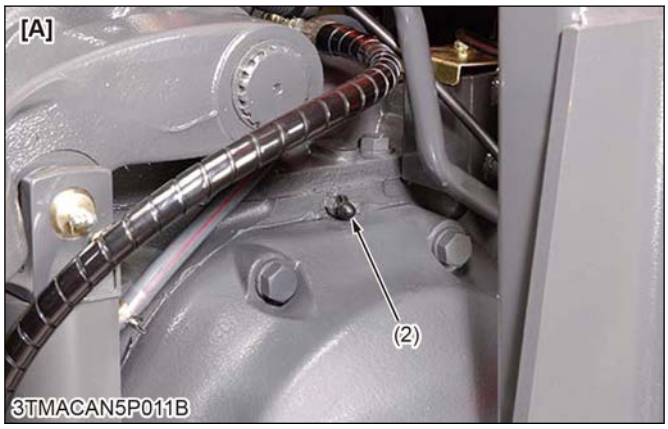
- **While bleeding, operate the engine at low speed to keep enough oil in the master cylinder assembly.**

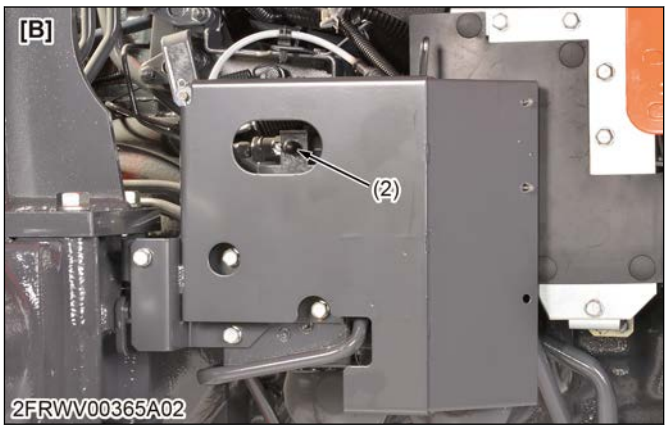
1. Disconnect the brake pipes (1) from the master cylinder.
2. Prepare the oil pan.
3. Move the brake pedals up and down by hand. At this time, when raising the pedal, close the master cylinder outlet by a fingers, and when lowering, release the fingers.
4. After bleeding the air from the master cylinder, install the brake pipes (1) to the master cylinder.



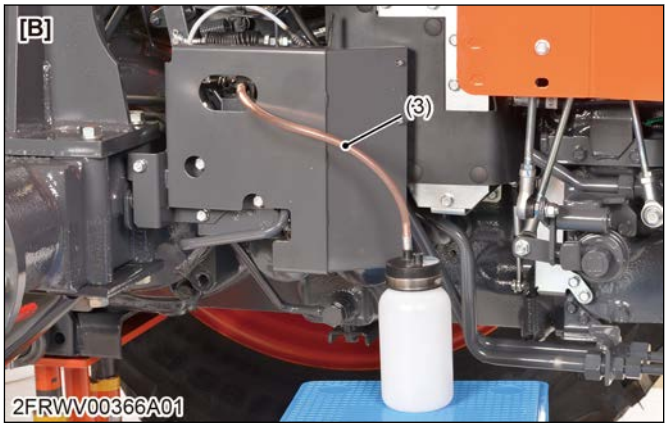

(1) Brake pipe

5. Connect the vinyl pipe (3) to the bleeder (2) for brake case or trailer brake valve.
6. Depress the brake pedals several times and foot on the brake pedals, and then loosen the bleeders (2). After loosing the bleeders (2), the brake pedals lower spontaneously. After tightening the bleeders (2), release the brake pedals. Repeat this operation until air bubble in brake oil disappears.
7. After bleeding, tighten the bleeders firmly.








(2) Bleeder
(3) Vinyl pipe
[A] Without trailer brake model
[B] With trailer brake model

**(When reassembling)**

- After bleeding, tighten the bleeders firmly.
- Tighten the brake pipe retaining nut and the bleeder to the specified tightening torque.

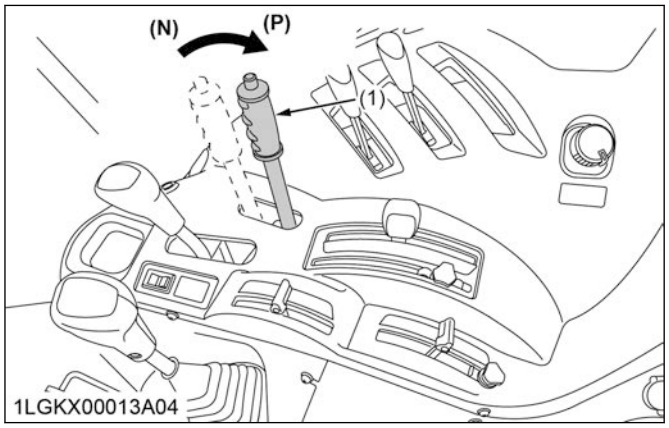
| | | |
|---|---|---|
| Tightening torque | Brake pipe retaining nut | 20 to 28 N·m<br>2.1 to 2.8 kgf·m<br>15 to 20 lbf·ft |
| | Bleeder | 6.5 to 6.8 N·m<br>0.66 to 0.70 kgf·m<br>4.8 to 5.0 lbf·ft |

RELATED PAGE
2.8 Brake air bleeder on page 2-80

## 4.2 Parking brake

### 4.2.1 Checking gear locked parking brake lever

1. Check the gear locked parking brake lever (1) shifts to (P) position.

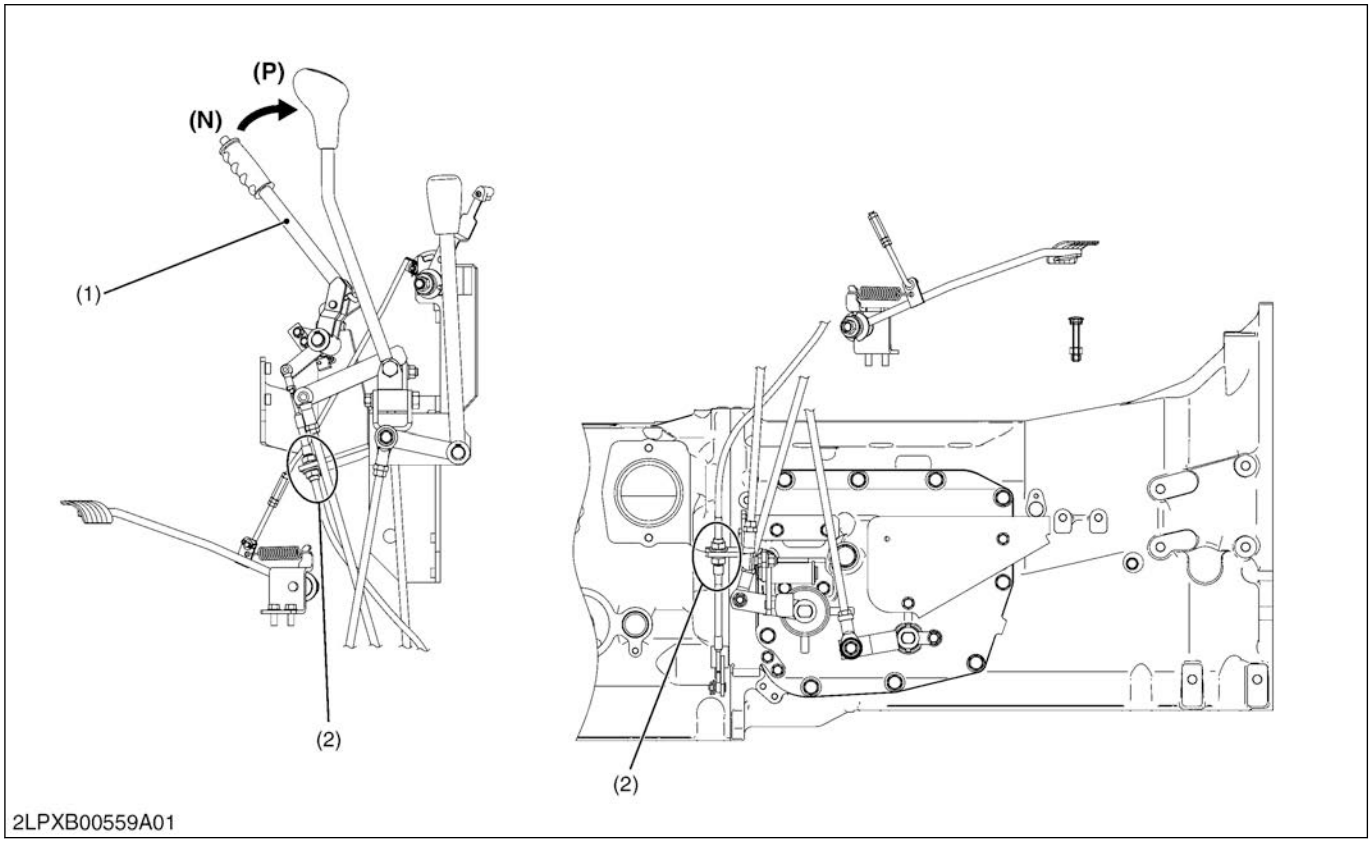


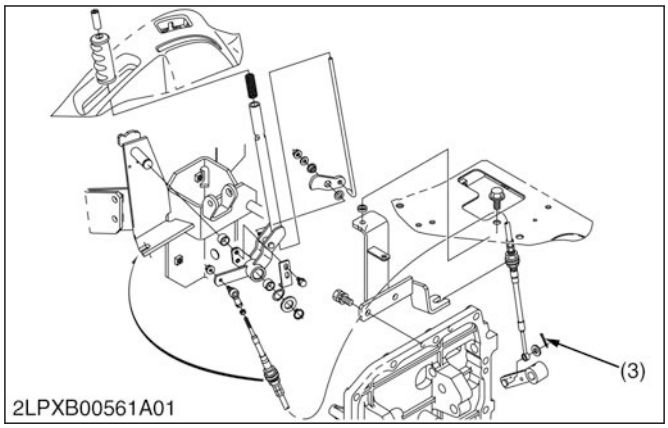

(1) Gear locked parking brake lever
(N) At parking brake "OFF" (Neutral position)
(P) At parking brake "ON"

2. If shifting is not smooth, adjust the gear locked parking brake lever (1).

RELATED PAGE
4.2.2 Adjusting gear locked parking brake lever on page 6-17

## 4.2.2 Adjusting gear locked parking brake lever




(1) Gear locked parking brake lever
(2) Gear locked lever wire retaining nut
(3) Split pin
(P): At parking brake "ON"
(N): At parking brake "OFF" (Neutral position)

1. Make sure that the gear locked parking brake lever (1) is set to "OFF" position.
2. Assemble that the retaining nuts (2) for gear locked wire should be located to the middle of wire thread.
3. Be sure that the split pin (3) should be bent to both sides.
4. Make sure that the gear locked parking brake lever (1) moves correctly.

RELATED PAGE
4.2.1 Checking gear locked parking brake lever on page 6-16

## 4.3 Secondary brake

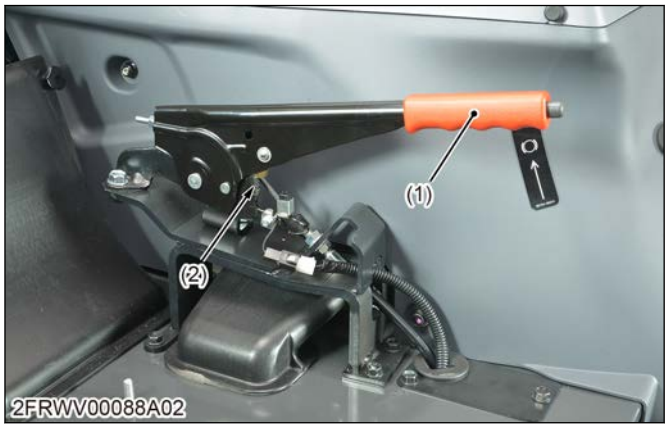
### 4.3.1 Adjusting secondary brake lever free play

**WARNING**

**To avoid personal injury or death:**

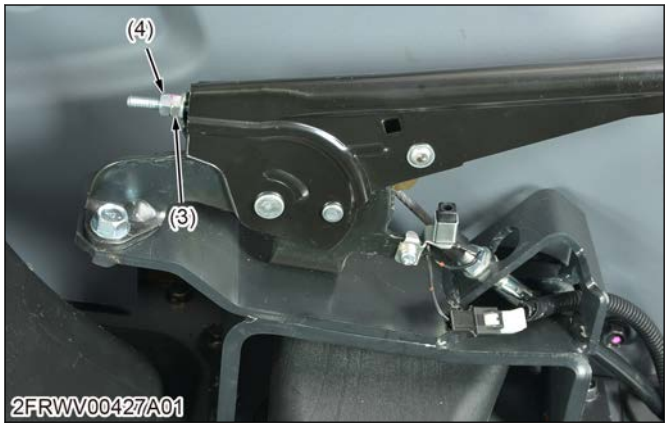
- **Park on flat ground, stop the engine and chock the wheels before checking the secondary brake.**

1. Set the secondary brake lever (1) at 3 notches (2) position.




(1) Secondary brake lever (2) Notch

2. Check if there is any free play of the secondary brake lever (1).
3. If adjustment is needed, loosen the lock nut (4) and adjust the secondary brake wire length within acceptable limits.
4. After adjusting, tighten the lock nut (4) firmly.




(3) Adjusting nut (4) Lock nut

| | | |
|---|---|---|
| Secondary brake lever free play (Number of notches) | Factory specification | 3 notches |

**(When reassembling)**

- Tighten the lock nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Lock nut | 7.8 to 9.3 N·m<br>0.80 to 0.94 kgf·m<br>5.8 to 6.8 lbf·ft |

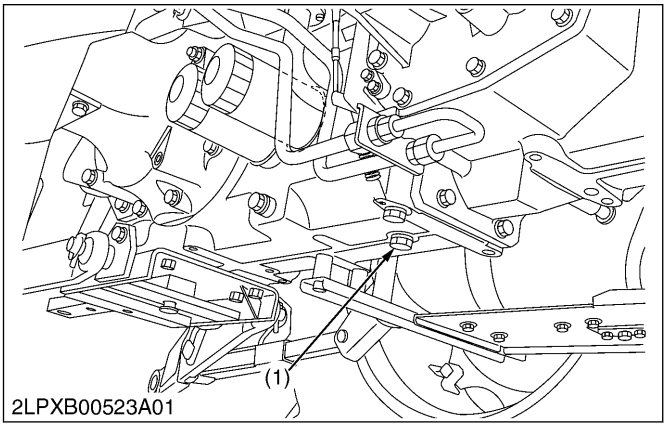
# 5. Disassembling and assembling

## 5.1 Removing master cylinder

### 5.1.1 ROPS model

#### 5.1.1.1 Draining transmission fluid

1. Place oil pan underneath the transmission case.
2. Remove the drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1).

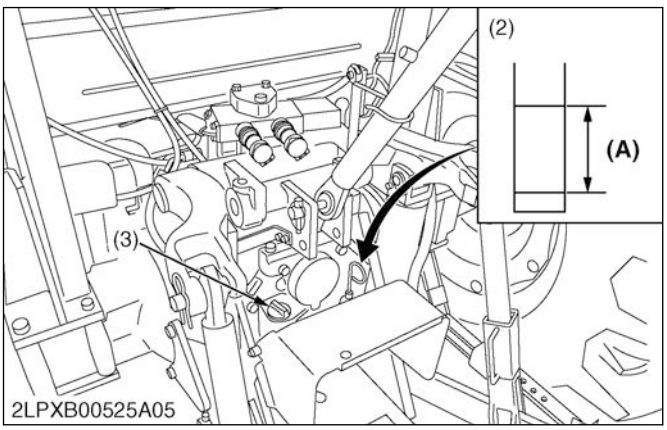



(1) Drain plug

**(When reassembling)**

**IMPORTANT**

- **For an enhanced ownership experience, we strongly recommend KUBOTA SUPER UDT. Use of other oil may damage the transmission or hydraulic system.**
- **Do not mix different brands of fluid together.**




(2) Dipstick (A) Oil level is acceptable within this range.
(3) Filling port

- Fill up from filling port (3) after removing the filling plug up to the upper notch on the dipstick (2).

- After operating the engine for a few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

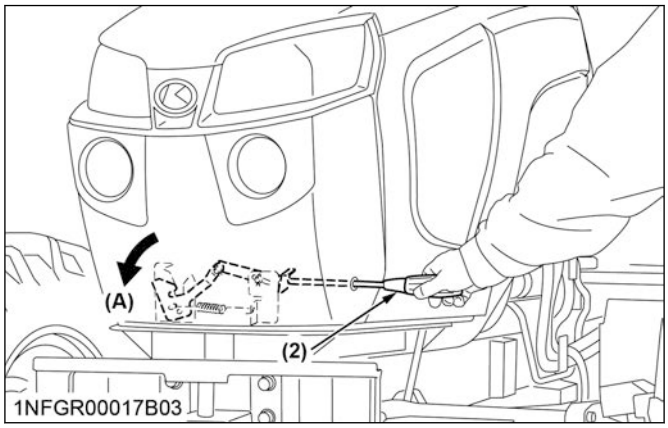
| | | |
|---|---|---|
| Transmission fluid | Capacity | 60.0 L<br>16 U.S.gals<br>13 Imp.gals |

## 5.1.1.2 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).


(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).




(2) Screwdriver
(A) Unlock position

## 5.1.1.3 Removing bonnet and cover

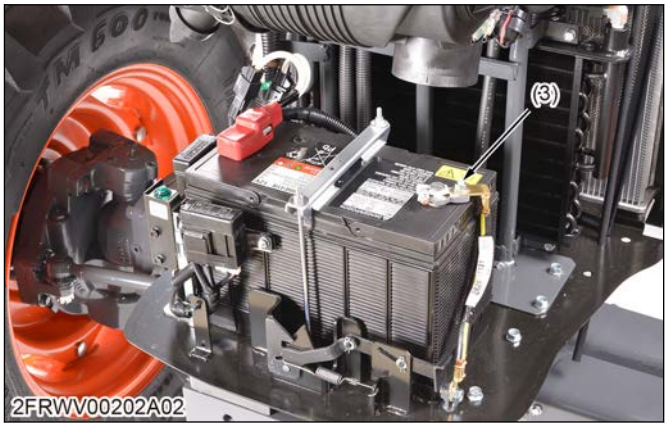
**IMPORTANT**

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

1. Remove the side bonnets (2) and the side covers (1) on both sides.

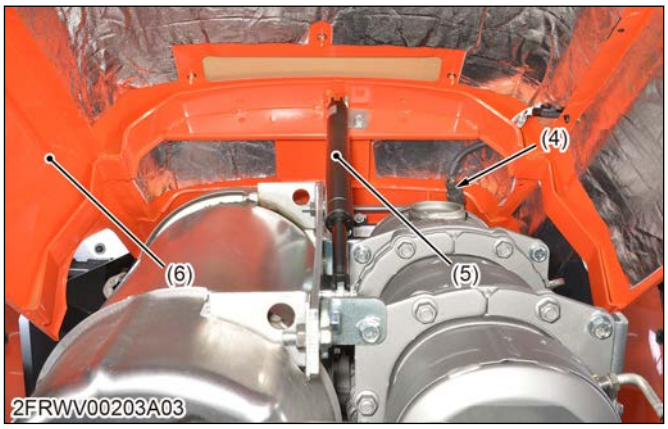

(1) Side cover
(2) Side bonnet

2. Disconnect the negative cable (3) from the battery negative terminal.




(3) Negative cable

3. Disconnect the head light connector (4).
4. Remove the bonnet damper (5).
5. Remove the bonnet (6).

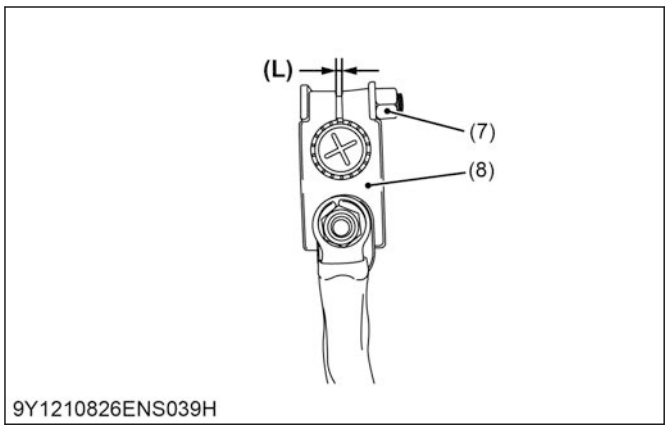



(4) Head light connector
(5) Bonnet damper
(6) Bonnet

**(When reassembling)**

**IMPORTANT**

- **Tighten the battery cable terminal nut (7) so that the clearance (L) is within the following chart.**




(7) Terminal nut
(8) Battery cable terminal
(L) Clearance between the battery cable terminal

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

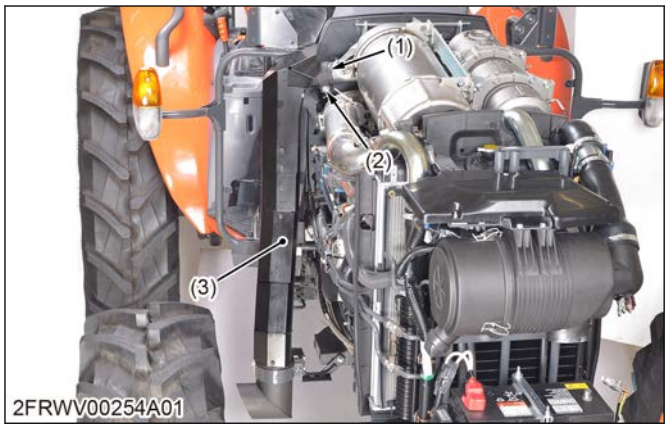
- When assembling the bonnet damper (5), be sure that the cylinder parts should be on the backward.

### 5.1.1.4 Removing muffler pipe

**CAUTION**

- **After operating the engine, muffler pipe is very hot. When removing the muffler pipe, wait a moment for cool down.**

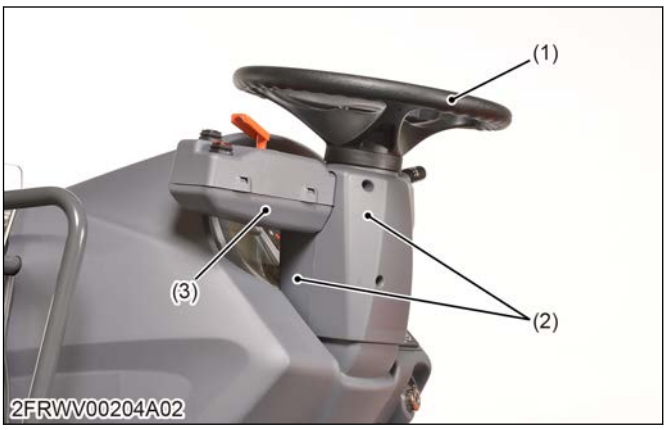
1. Remove the muffler pipe cover (3).
2. Loosen the muffler pipe fixing bolt (2) and nut
3. Remove the muffler pipe (1).




(1) Muffler pipe
(2) Muffler pipe fixing bolt
(3) Muffler pipe cover

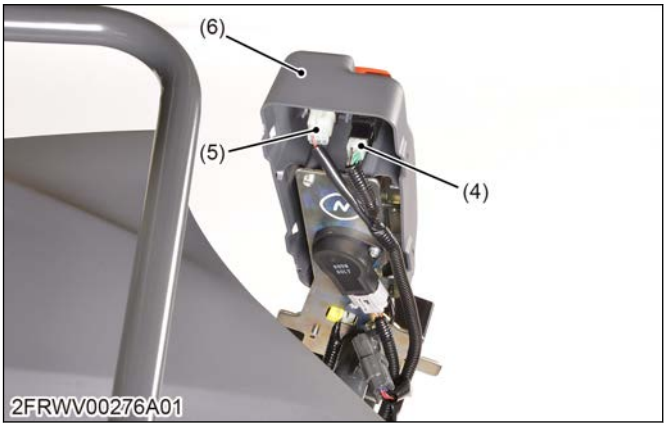
### 5.1.1.5 Removing steering and panel cover

1. Remove the steering post covers (2).
2. Remove the steering mounting nut and remove the steering (1).
3. Remove the shuttle under cover (3).




(1) Steering
(2) Steering post cover
(3) Shuttle under cover

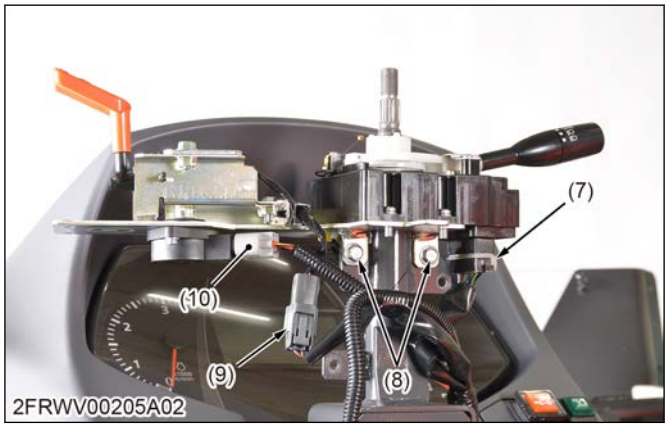
4. Disconnect the hazard switch connector (4) and auto differential lock switch connector (5).
5. Remove the shuttle upper cover (6).




(4) Hazard switch connector
(5) Auto differential lock switch connector
(6) Shuttle upper cover

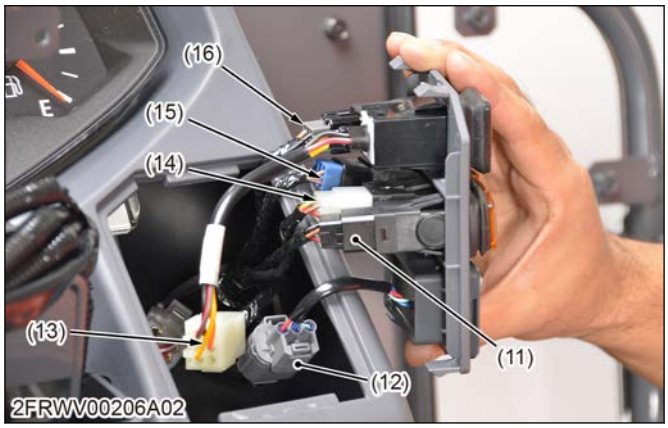
6. Disconnect the combination lever switch connector (7).
7. Disconnect the connector for shuttle lever neutral switch (9) and shuttle lever sensor connector (10).
8. Disconnect the horn connector.

9. Remove the combination lever mounting bolts (8) and then remove the combination lever switch assembly.



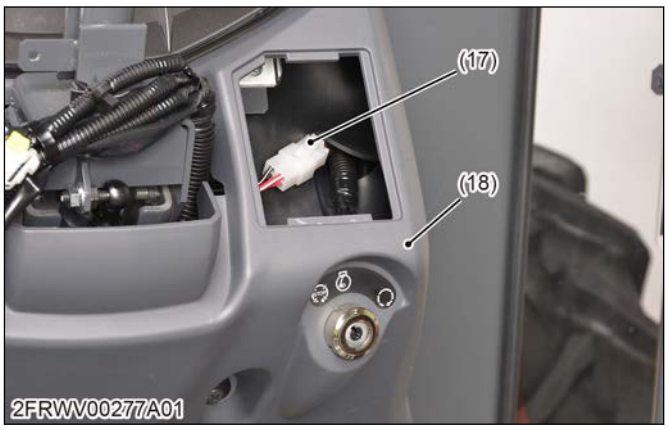

(7) Combination lever switch connector
(8) Combination lever switch mounting bolt
(9) Shuttle lever neutral switch connector
(10) Shuttle lever sensor connector

10. Disconnect the meter select switch connector (12) and 4WD switch connector (13).
11. Disconnect the connectors for parked regeneration switch (11) and DPF inhibit switch connector (14).
12. Disconnect the constant RPM management switch connector (15) and front work light switch connector (16).




(11) Parked regeneration switch
(12) Meter select switch connector
(13) 4WD switch connector
(14) DPF inhibit switch connector
(15) Constant RPM management switch connector
(16) Front work light switch connector

13. Disconnect the main switch connector (17).
14. Remove the panel cover (18).




(17) Main switch connector
(18) Panel cover

**(When reassembling)**

- Tighten the steering mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Steering mounting nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

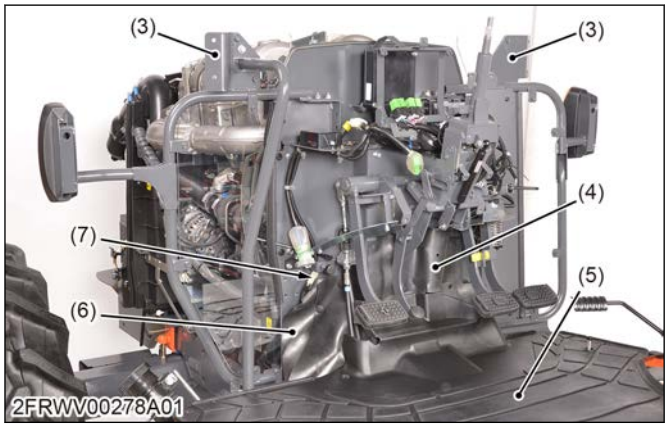
## 5.1.1.6 Removing guard and mat

1. Remove the meter panel (1).
2. Remove the insulator (2).


(1) Meter panel
(2) Insulator

3. Remove the mat (5) and insulator 1 (4) and insulator 2 (6).
4. Disconnect both side combination lamp connectors (7).

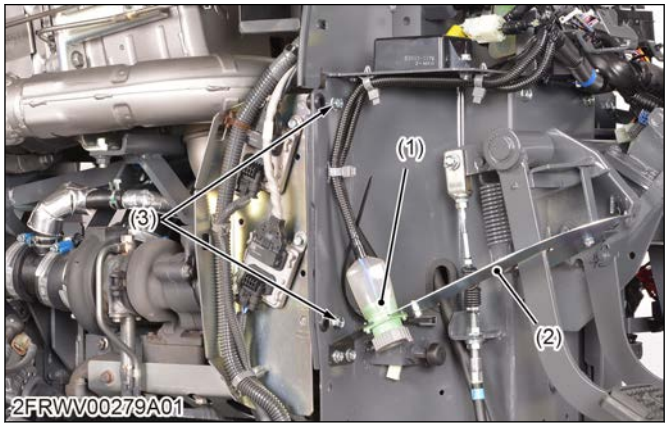
5. Remove both side guards (3).




(3) Guard
(4) Insulator 1
(5) Mat
(6) Insulator 2
(7) Combination lamp connector

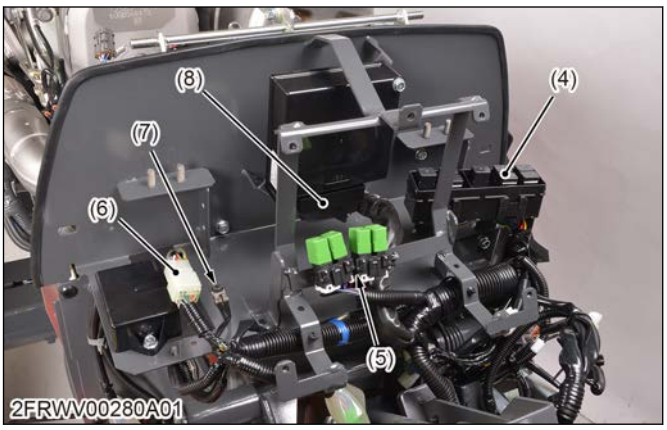
## 5.1.1.7 Removing wiring harness

1. Remove the plate (2).
2. Remove the K-OBD connector (1) mounting screws.
3. Remove the NOx sensor stay mounting bolts (3).



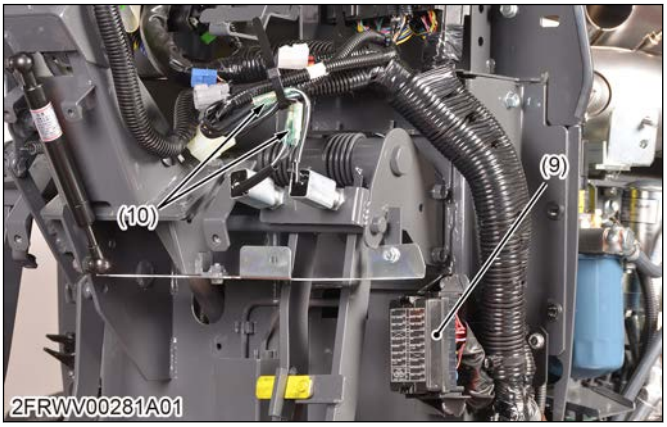

(1) K-OBD connector
(2) Plate
(3) NOx sensor stay mounting bolt

4. Disconnect the flasher unit connector (6) and grounding wire mounting screw (7).
5. Disconnect the tractor ECU connector (8), relays (5) and relay box (4).



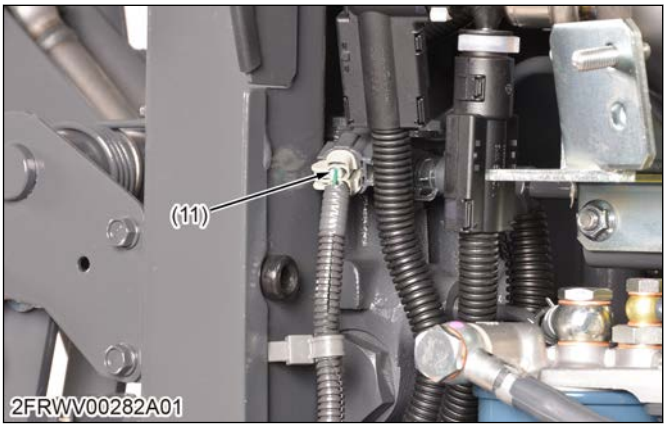

(4) Relay box
(5) Relay
(6) Flasher unit connector
(7) Grounding wire mounting screw
(8) Tractor ECU connector

6. Remove the fuse box (9).
7. Disconnect the brake switch connectors (10).




(9) Fuse box
(10) Brake switch connector

8. Disconnect the master cylinder oil level sensor connector (11).




(11) Master cylinder oil level sensor connector

9. Remove the step mounting bolts (12).
10. Disconnect the joint connectors (13).

11. Set aside the main harness to the front side.


(12) Step mounting bolt (13) Joint connector

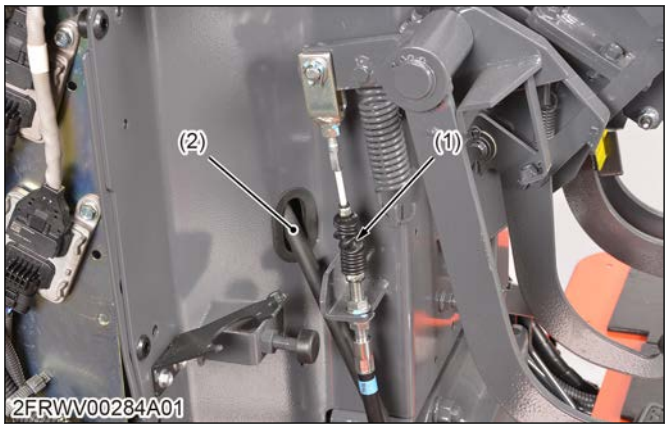
**(When reassembling)**

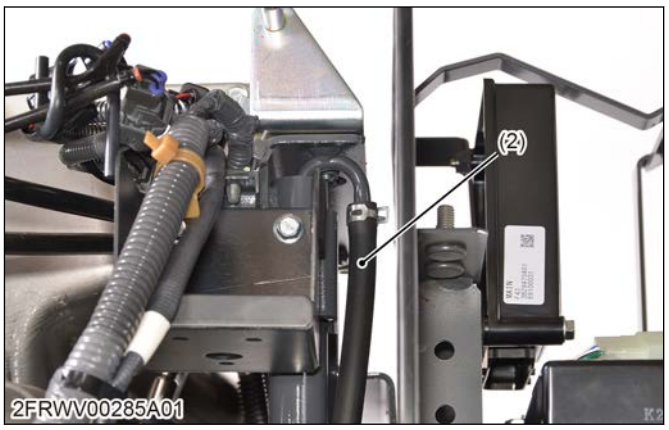
- Tighten the step mounting bolt (7T, M10) and the step mounting bolt (7T, M12) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Step mounting bolt (7T, M10) | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | Step mounting bolt (7T, M12) | 77.5 to 90.2 N·m<br>7.91 to 9.19 kgf·m<br>57.2 to 66.5 lbf·ft |

## 5.1.1.8 Disconnecting clutch cable and breather hose

1. Disconnect the clutch cable (1).
2. Remove the DEF tank breather hose (2).



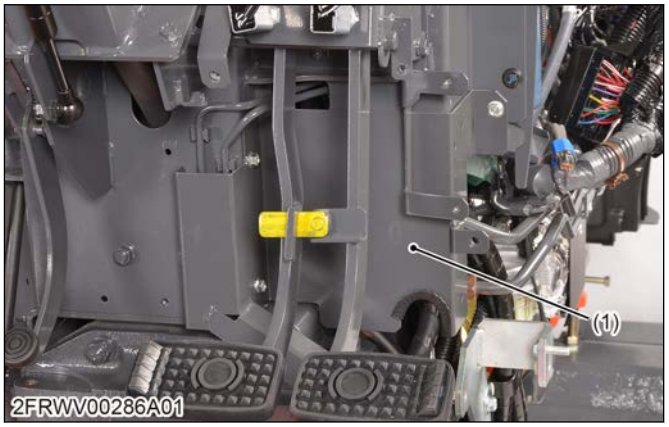

(1) Clutch cable (2) DEF tank breather hose

**(When reassembling)**

- Be sure to adjust the clutch cable for the clutch pedal free travel.

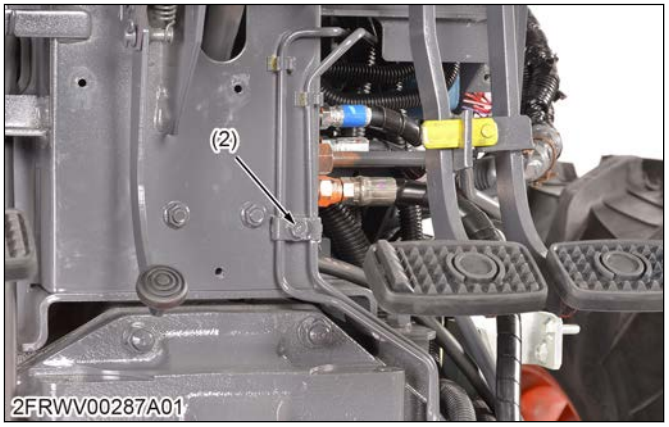
## 5.1.1.9 Disconnecting brake pipe and hose

1. Remove the steering support cover (1).




(1) Steering support cover

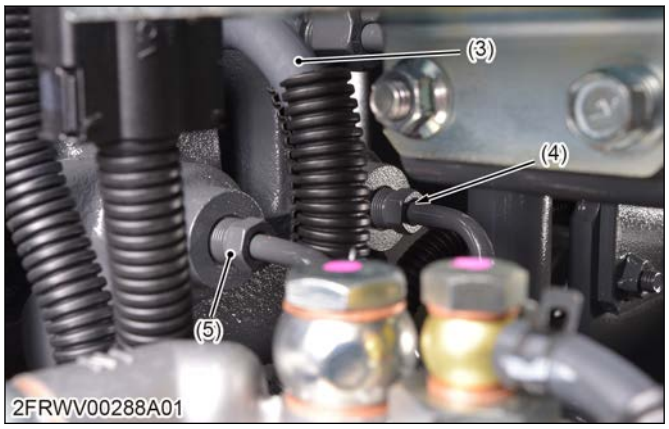
2. Remove the brake pipe clamp (2).




(2) Brake pipe clamp

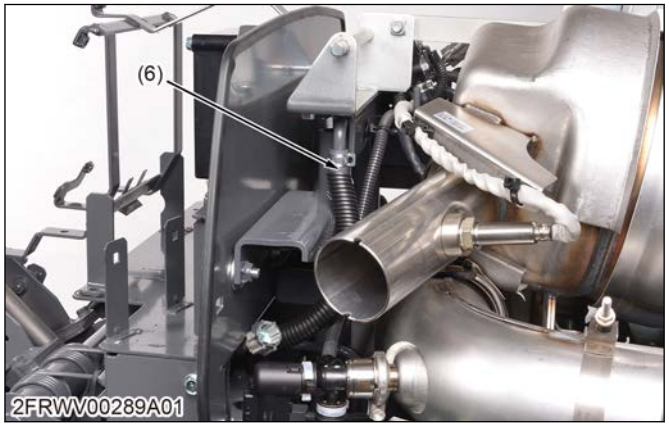
3. Disconnect the master cylinder return hose (3).
4. Disconnect the brake delivery pipe (R.H.) (5).

5. Disconnect the brake delivery pipe (L.H.) (4).




(3) Master cylinder return hose
(4) Brake delivery pipe (L.H.)
(5) Brake delivery pipe (R.H.)

6. Disconnect the breather hose (6).




(6) Breather hose

**(When reassembling)**

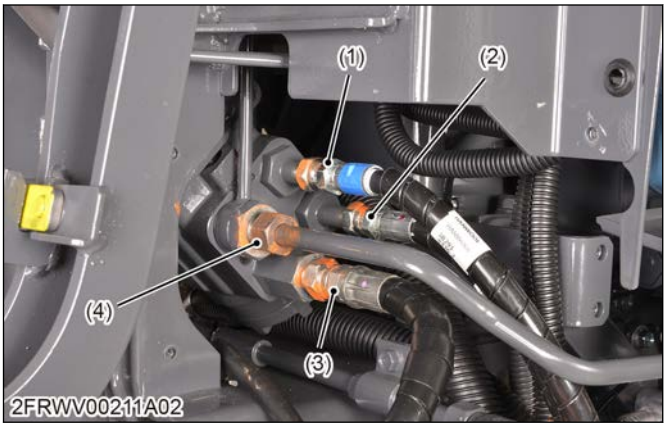
**■ IMPORTANT**

- **After assembling the brake delivery pipes, be sure to bleed the air from brake system.**
- Tighten the brake delivery pipe retaining nuts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Brake delivery pipe retaining nut | 23 to 27 N·m<br>2.3 to 2.8 kgf·m<br>17 to 20 lbf·ft |

## 5.1.1.10 Disconnecting steering controller pipe and hose

1. Disconnect the oil cooler pipe (4).
2. Disconnect the power steering delivery hose (3).
3. Disconnect the power steering delivery hose (L.H.) (1) and (R.H.) (2) from the power steering controller.




(1) Power steering delivery hose (L.H.)
(2) Power steering delivery hose (R.H.)
(3) Power steering delivery hose
(4) Oil cooler pipe

**(When reassembling)**

- Connect the power steering delivery hose (L.H.) (1) with blue tape to upper port of power steering controller.
- Tighten the power steering delivery hose (L.H.) (1) and (R.H) (2) to the specified tightening torque.

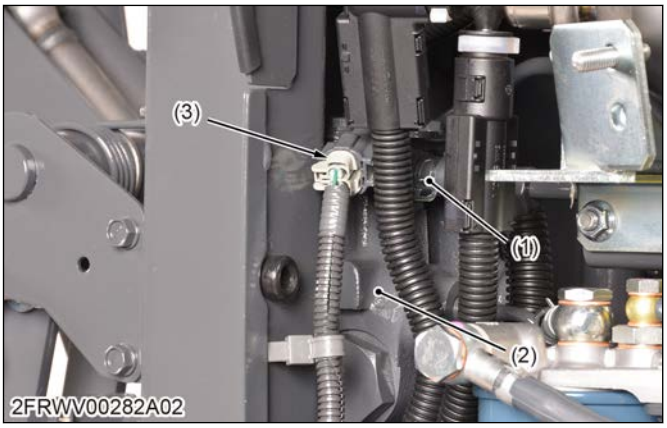
| | | |
|---|---|---|
| Tightening torque | Power steering delivery hose retaining nut | 22.6 to 27.5 N·m<br>2.31 to 2.80 kgf·m<br>16.7 to 20.2 lbf·ft |

## 5.1.1.11 Disconnecting master cylinder pipe and hose

**■ IMPORTANT**

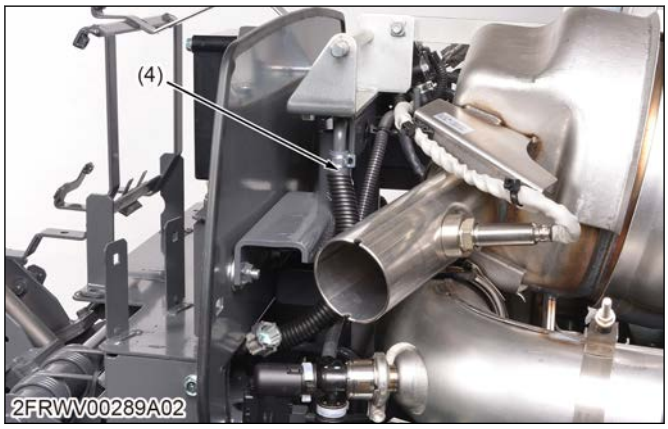
- **After assembling the master cylinder pipes, bleed the air from brake system.**

1. Disconnect the master cylinder connector (3).
2. Disconnect the master cylinder return hose (1) from the master cylinder (2).



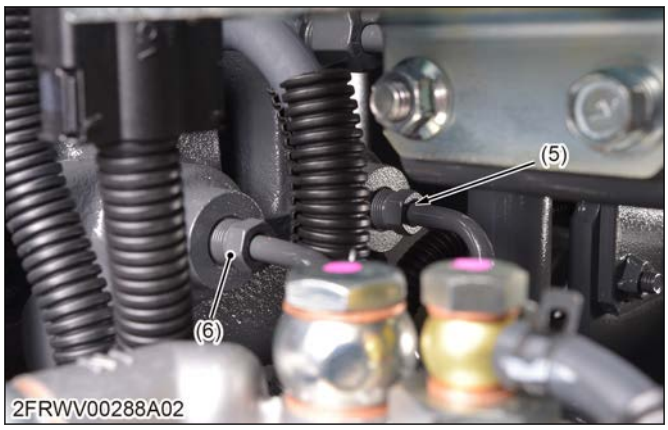

(1) Master cylinder return hose
(2) Master cylinder
(3) Master cylinder connector

3. Disconnect the master cylinder hose (4).




(4) Master cylinder hose

4. Disconnect the brake pipe (R.H.) (5) and the brake pipe (L.H.) (6) from the master cylinder (2).




(5) Brake pipe (R.H.) (6) Brake pipe (L.H.)

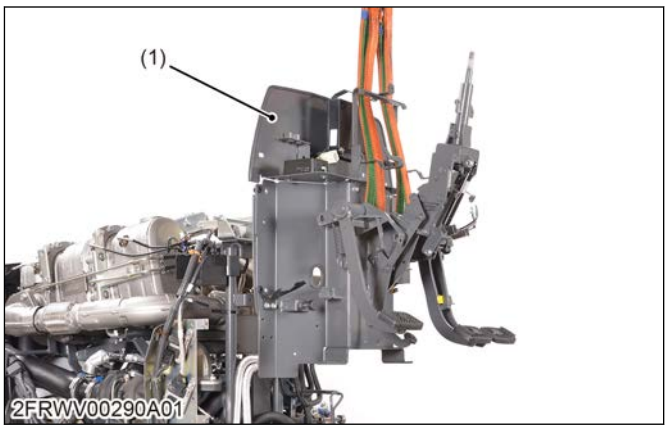
**(When reassembling)**

- Tighten the brake pipe retaining nuts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Brake pipe retaining nut | 20 to 28 N·m<br>2.1 to 2.8 kgf·m<br>15 to 20 lbf·ft |

## 5.1.1.12 Removing steering support unit

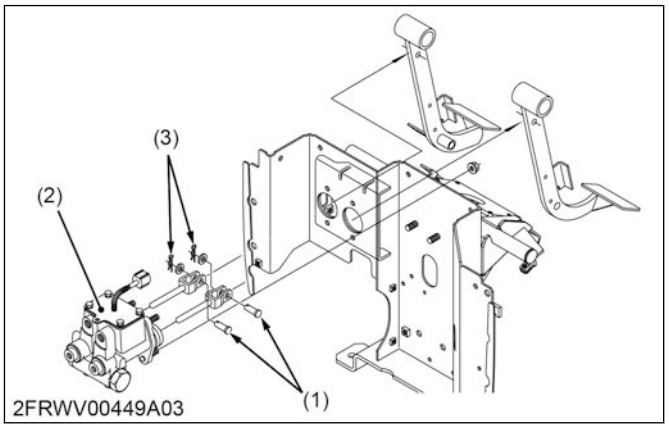
1. Set the steering support unit (1) with nylon sling and hoist.
2. Remove the steering support mounting bolts.
3. Remove the steering support unit (1).




(1) Steering support unit

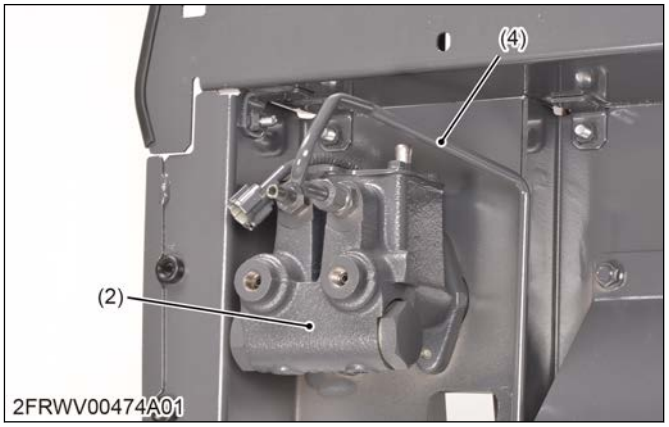
## 5.1.1.13 Removing master cylinder

1. Remove the snap pins (3) and clevis pins (1).




(1) Clevis pin (3) Snap pin
(2) Master cylinder

2. Remove the master cylinder delivery pipe (4).
3. Remove the master cylinder mounting nuts.
4. Remove the master cylinder (2).




(2) Master cylinder (4) Master cylinder delivery pipe

**(When reassembling)**

- After mounting the master cylinder (2), be sure to bleed the air.

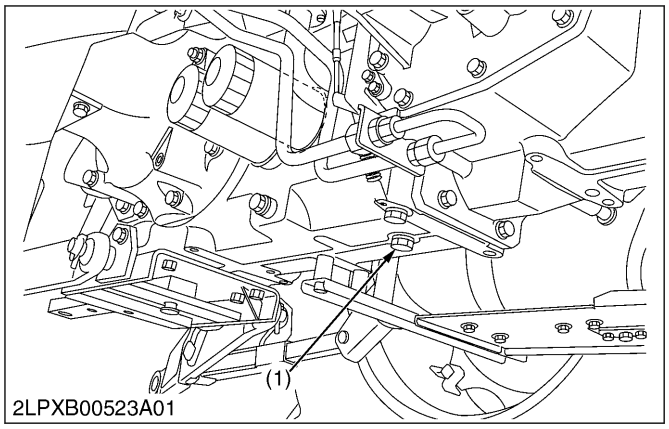
- Tighten the master cylinder mounting nuts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Master cylinder mounting nut | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 5.1.2 Cabin model

### 5.1.2.1 Draining transmission fluid

1. Place oil pan underneath the transmission case.
2. Remove the drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1).

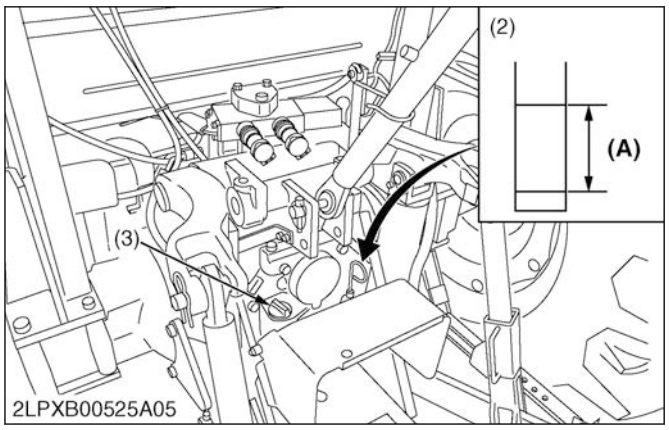



(1) Drain plug

**(When reassembling)**

**■ IMPORTANT**

- **For an enhanced ownership experience, we strongly recommend KUBOTA SUPER UDT. Use of other oil may damage the transmission or hydraulic system.**
- **Do not mix different brands of fluid together.**



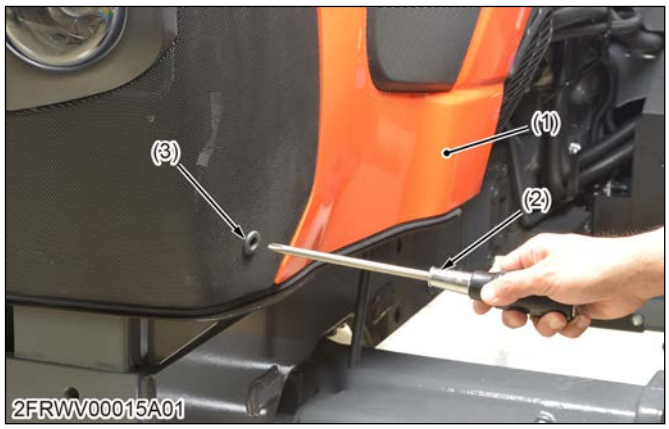

(2) Dipstick
(3) Filling port
(A) Oil level is acceptable within this range.

- Fill up from filling port (3) after removing the filling plug up to the upper notch on the dipstick (2).
- After operating the engine for a few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

| | | |
|---|---|---|
| Transmission fluid | Capacity | 60.0 L<br>16 U.S.gals<br>13 Imp.gals |

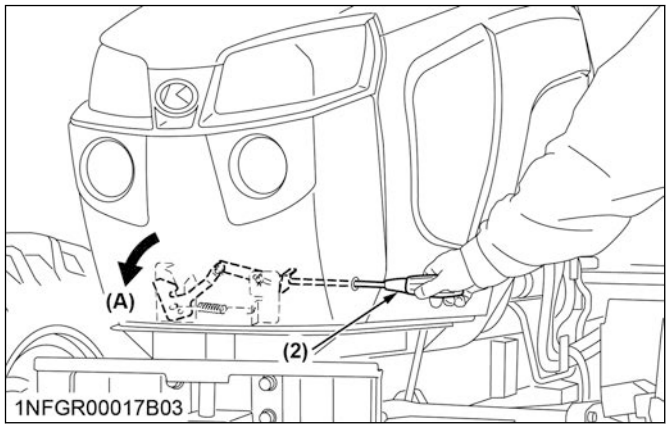
### 5.1.2.2 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).




(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).




(2) Screwdriver
(A) Unlock position

### 5.1.2.3 Removing bonnet and cover

**■ IMPORTANT**

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

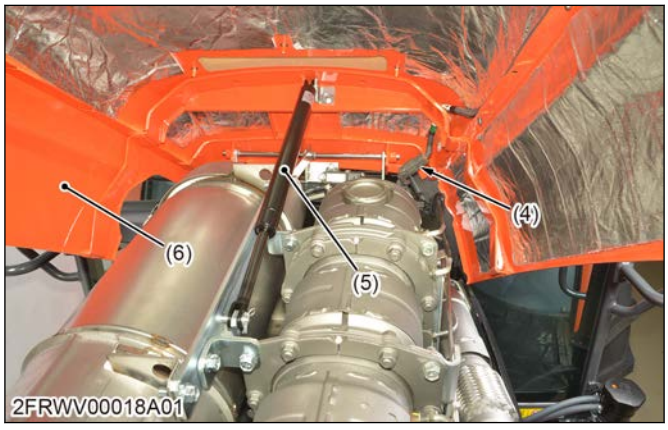
1. Remove the side bonnets (2) and the side covers (1) on both sides.


(1) Side cover
(2) Side bonnet

2. Disconnect the negative cable (3) from the battery negative terminal .


(3) Negative cable

3. Disconnect the head light connector (4).
4. Remove the bonnet damper (5).
5. Remove the bonnet (6).

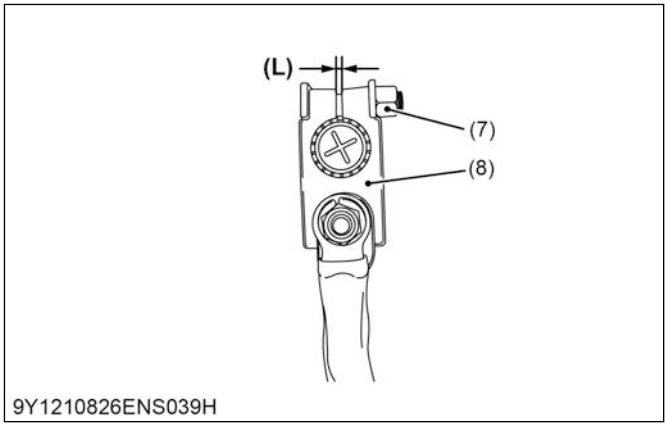



(4) Head light connector
(5) Bonnet damper
(6) Bonnet

**(When reassembling)**

**■ IMPORTANT**

- **Tighten the battery cable terminal nut (7) so that the clearance (L) is within the following chart.**




(7) Terminal nut
(8) Battery cable terminal
(L) Clearance between the battery cable terminal

- When assembling the bonnet damper (5), be sure that the cylinder parts should be on the backward.

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

## 5.1.2.4 Removing muffler pipe

**⚠ CAUTION**

- **After operating the engine, muffler pipe is very hot. When removing the muffler pipe, wait a moment for cool down.**

1. Loosen the muffler pipe clamp (1).
2. Remove the muffler pipe mounting bolts (3).
3. Remove the muffler pipe (4).
4. Remove the muffler pipe stay (2).

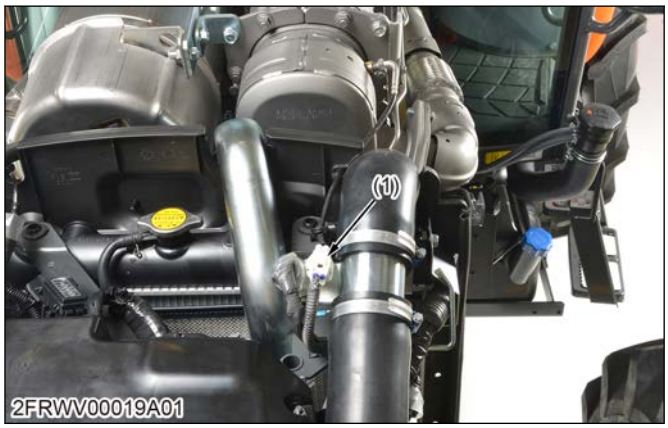

(1) Muffler pipe clamp
(2) Muffler pipe stay
(3) Muffler pipe mounting bolt
(4) Muffler pipe

**(When reassembling)**
- Firstly, tighten all bolts around muffler pipe (4).
- Be sure to tighten the muffler pipe mounting bolts (3) at first, and then tighten the muffler pipe stay (2) mounting bolts.
- Lastly, tighten the muffler pipe clamp (1).

## 5.1.2.5 Disconnecting wiring harness for DPF muffler and SCR muffler

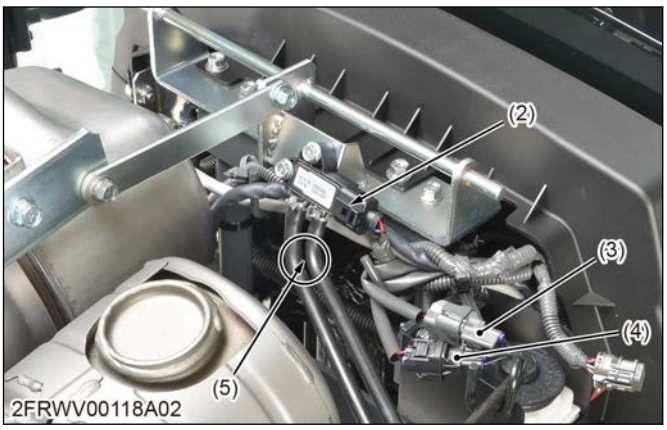
**⚠ CAUTION**
- **After operating the engine, muffler is very hot. When disconnecting the connectors, wait a moment for cool down.**

1. Disconnect the exhaust temperature sensor (T2) connector (1).



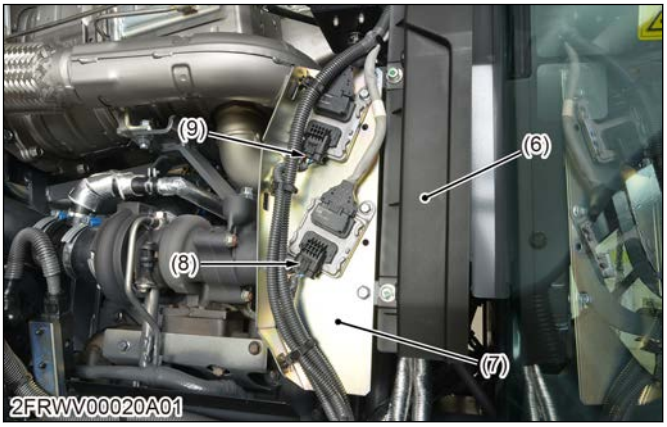

(1) Exhaust temperature sensor connector (T2)

2. Disconnect the exhaust temperature sensor (T0) connector (4) and (T1) connector (3).
3. Disconnect the differential pressure sensor connector (2).
4. Remove the differential pressure sensor hoses (5).




(2) Differential pressure sensor connector
(3) Exhaust temperature sensor (T1) connector
(4) Exhaust temperature sensor (T0) connector
(5) Differential pressure sensor hose

5. Remove the cover (L.H.) (6).
6. Disconnect the pre NOx sensor connector (8) and post NOx sensor connector (9).
7. Remove the NOx sensor mounting stay (7).

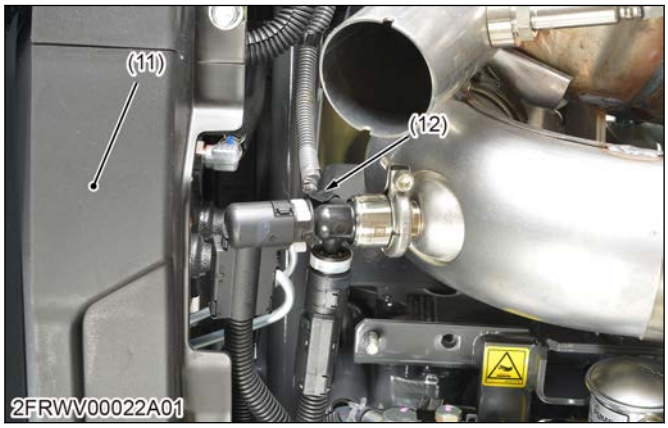



(6) Cover (L.H.)
(7) NOx sensor mounting stay
(8) Pre NOx sensor connector
(9) Post NOx sensor connector

8. Disconnect the SCR temperature sensor connector (10).

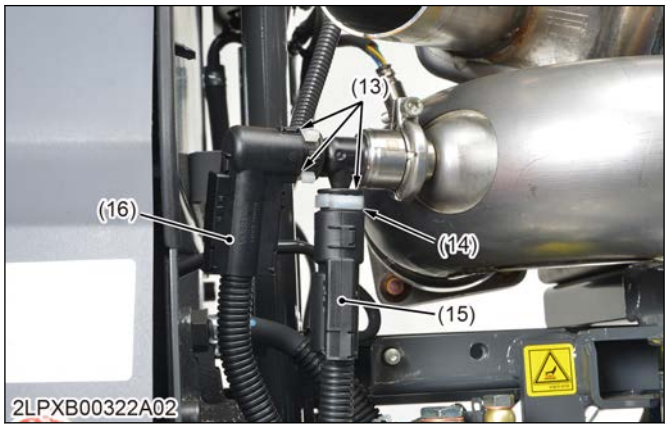

(10) SCR temperature sensor connector

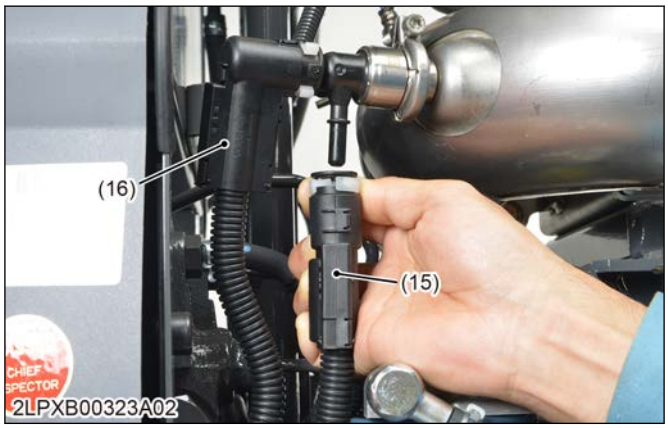
9. Remove the cover (R.H.) (11).
10. Disconnect the DEF injector connector (12).




(11) Cover (R.H.)
(12) DEF injector connector

11. Pinch the tabs (13) of white clamp (14) and pull out the DEF delivery hose (15).
12. Pinch the tabs (13) of white clamp (14) and pull out the DEF return hose (16).




(13) Tab
(14) White clamp
(15) DEF delivery hose
(16) DEF return hose

**(When reassembling)**

- Parts number of each DPF exhaust gas temperature sensor connector is different. Be sure to connect with same color of connector.
- – T0: Black
  – T1: Gray
  – T2: White
- Each SCR NOx sensor harness color is different.
  – Pre NOx sensor muffler: Black
  – Post NOx sensor: Gray

## 5.1.2.6 Removing DPF and SCR muffler

**CAUTION**

- **After operating the engine, muffler is very hot. When removing the DPF and SCR muffler, wait a moment for cool down.**

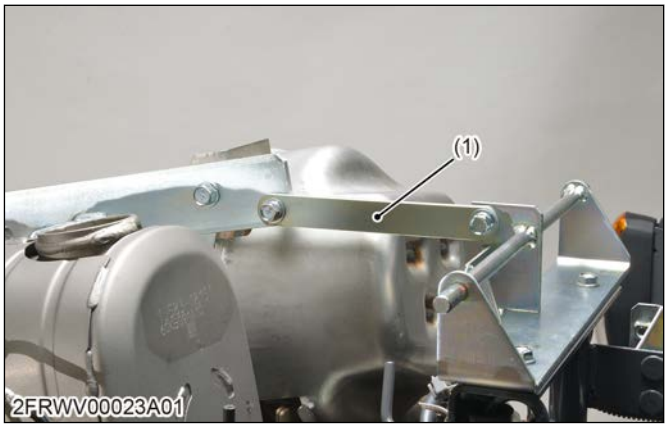
**IMPORTANT**

- **Since muffler assembly is heavy, use the hoist for safety.**

| | |
|---|---|
| DPF and SCR muffler assembly weight | About 66 kg<br>About 150 lbs |

- **Be attention for each sensor when assembling and removing. Each sensor is easy to corrupt by shock.**

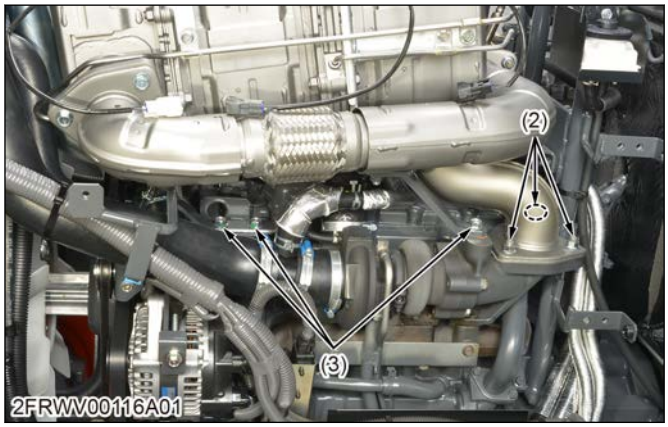
1. Prepare the hoist for removing.
2. Remove the support stay (1).




(1) Support stay

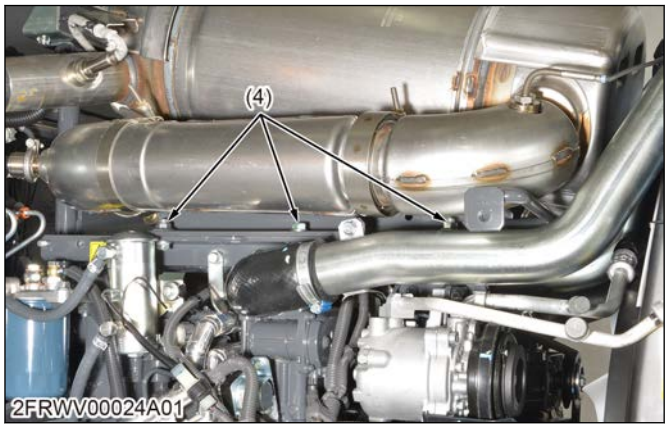
3. Remove the DPF muffler mounting nuts (2).

4. Remove the DPF muffler bracket mounting bolts (3).



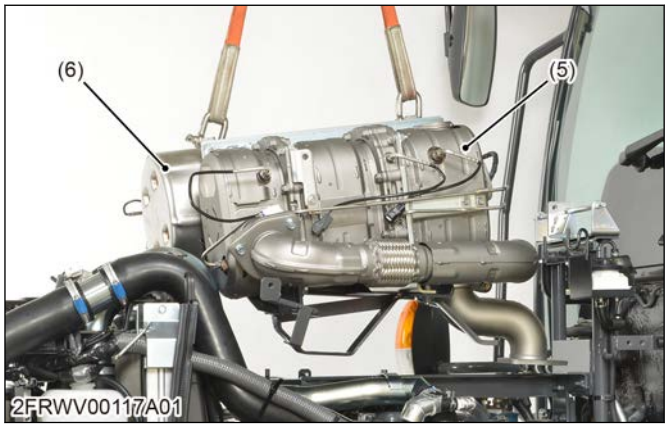

(2) DPF muffler mounting nut (3) DPF muffler bracket mounting bolt

5. Remove the SCR muffler bracket mounting bolts and nut (4).




(4) SCR muffler bracket mounting bolt and nut

6. Support the DPF muffler (5) and SCR muffler (6) assemblies with nylon sling and hoist.
7. Remove the DPF muffler (5) and SCR muffler (6) assemblies.




(5) DPF muffler (6) SCR muffler

**(When reassembling)**

- Firstly, pre-tighten all bolts and nuts around the DPF and SCR muffler assembly.
- Lastly, tighten the DPF muffler mounting nut, the DPF muffler bracket mounting bolt and the SCR muffler bracket mounting bolt and nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | DPF muffler mounting nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | DPF muffler bracket mounting bolt | 60.8 to 70.6 N·m<br>6.20 to 7.19 kgf·m<br>44.9 to 52.0 lbf·ft |
| | SCR muffler bracket mounting bolt and nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

## 5.1.2.7 Removing steering and cover

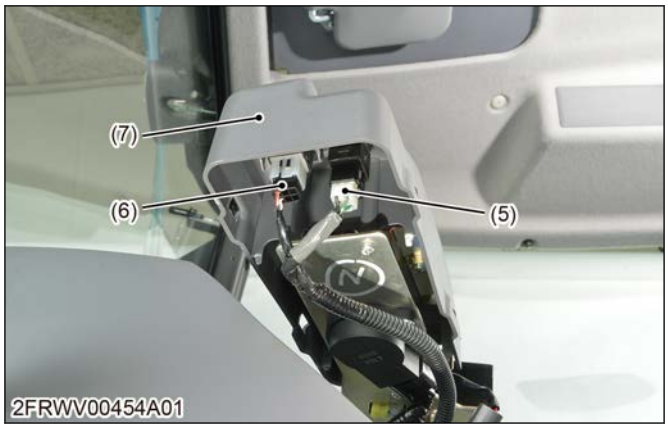
1. Remove the horn switch (3) and disconnect the horn switch connectors (2).
2. Remove the steering wheel mounting nut (1) and the steering wheel.
3. Remove the steering post covers.


(1) Steering wheel mounting nut (3) Horn switch
(2) Horn switch connector

4. Remove the shuttle under cover (4).

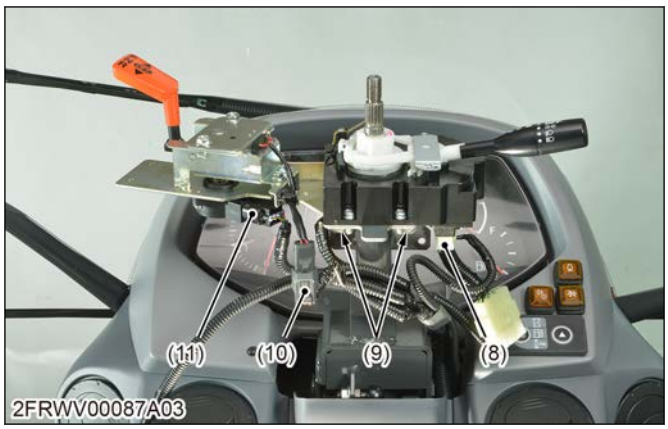

(4) Shuttle under cover

5. Disconnect the hazard switch connector (5).
6. Disconnect the auto differential lock switch connector (6).
7. Remove the shuttle upper cover (7).




(5) Hazard switch connector
(6) Auto differential lock switch connector
(7) Shuttle upper cover

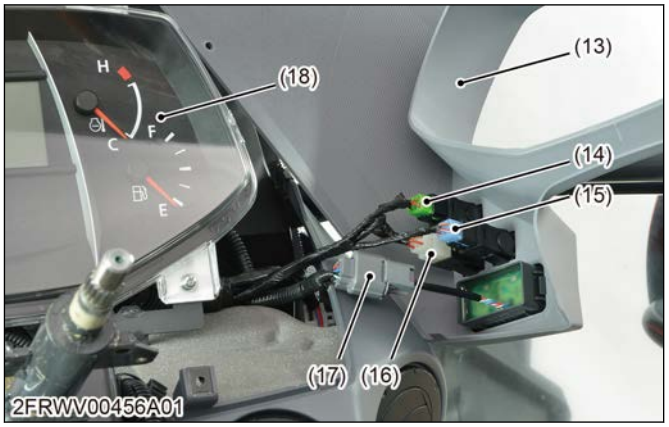
8. Disconnect the combination lever switch connector (8).
9. Disconnect the shuttle lever neutral switch connector (10) and shuttle lever sensor connector (11).
10. Remove the combination lever mounting bolts (9) and disconnect the horn switch connector (12).
11. Remove the combination lever switch assembly.





(8) Combination lever switch connector
(9) Combination lever switch mounting bolt
(10) Shuttle lever neutral switch connector
(11) Shuttle lever sensor connector
(12) Horn switch connector

12. Remove the panel cover (13).
13. Disconnect the panel change switch connector (17).
14. Disconnect the connectors for parked regeneration switch (15), DPF inhibit switch (16) and constant RPM management switch (14).
15. Remove the meter panel (18).




(13) Panel cover
(14) Constant RPM management switch connector
(15) Parked regeneration switch connector
(16) DPF inhibit switch connector
(17) Panel change switch connector
(18) Meter panel

16. Remove the steering shaft cover (19).
17. Remove the air outlets (21).
18. Disconnect the main switch connector.

19. Remove the panel under cover (R.H.) (20) and (L.H.) (22).


(19) Steering shaft cover
(20) Panel under cover (R.H.)
(21) Air outlet
(22) Panel under cover (L.H.)

**(When reassembling)**

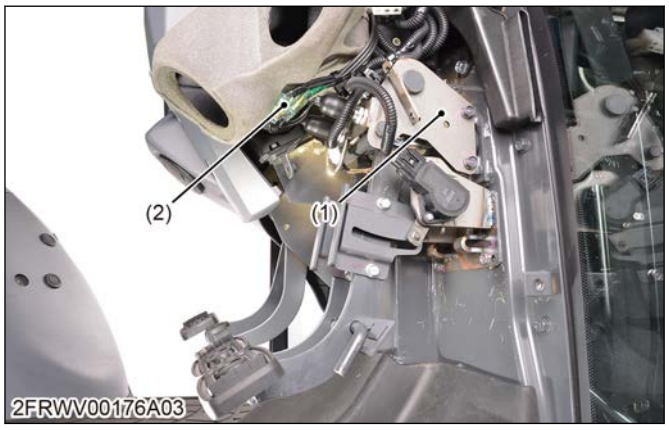
- Tighten the steering wheel mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Steering wheel mounting nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

RELATED PAGE
2.2 Steering wheel puller on page 2-79

## 5.1.2.8 Removing master cylinder

1. Disconnect the 1P connectors (2) for brake switch.
2. Remove the brake shaft support (1).




(1) Brake shaft support
(2) 1P connector for brake switch

3. Remove the snap pins (3) and clevis pins from the brake pedals.


(3) Snap pin

4. Remove the master cylinder mounting nuts.
5. Remove the master cylinder assembly.

**(When reassembling)**

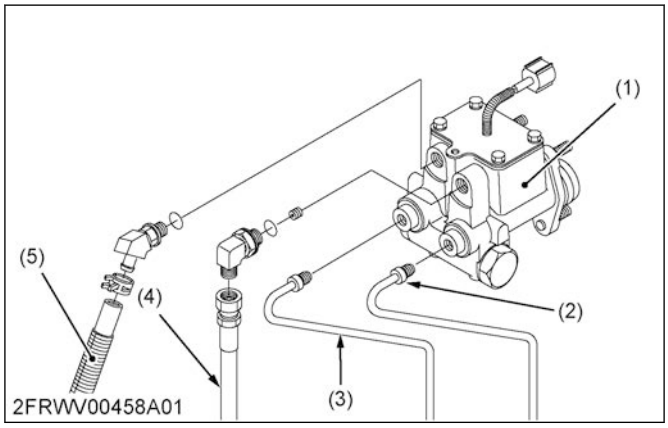
- After mounting the master cylinder assembly, be sure to bleed the air from brake system.
- Tighten the brake shaft support mounting bolts to the specified tightening torque.
- Tighten the master cylinder mounting nuts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Brake shaft support mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |
| | Master cylinder mounting nut | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 5.1.2.9 Removing master cylinder

1. Disconnect the master cylinder delivery hose (4) and master cylinder return hose (5) from the master cylinder (1).
2. Disconnect the brake delivery pipe (R.H.) (3) and (L.H.) (2).

3. Remove the master cylinder (1).




(1) Master cylinder
(2) Brake delivery pipe (L.H.)
(3) Brake delivery pipe (R.H.)
(4) Master cylinder delivery hose
(5) Master cylinder return hose

**(When reassembling)**

**■ IMPORTANT**

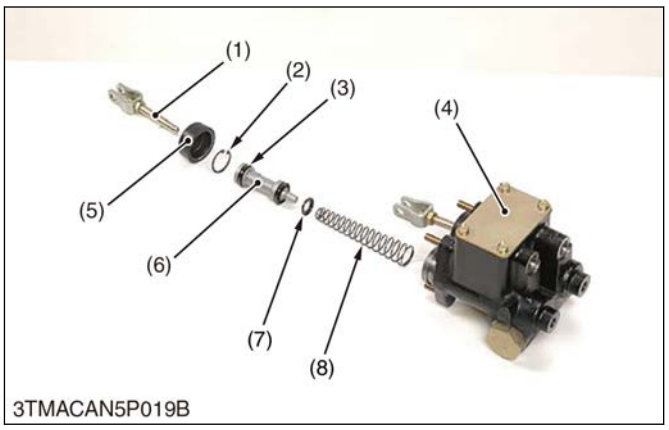
- **After assembling the master cylinder pipes, be sure to bleed the air from brake system.**

| | | |
|---|---|---|
| Tightening torque | Master cylinder mounting nut | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |
| | Brake delivery pipe retaining nut | 20 to 28 N·m<br>2.1 to 2.8 kgf·m<br>15 to 20 lbf·ft |
| | Master cylinder delivery hose retaining nut | 23 to 27 N·m<br>2.3 to 2.8 kgf·m<br>17 to 20 lbf·ft |

# 5.2 Master cylinder

## 5.2.1 Disassembling master cylinder

1. Drain the brake oil from the master cylinder assembly (4).
2. Remove the push rod (1) and boot (5) from the master cylinder.
3. Remove the internal circlip (2), and pull out the piston (6) and return spring (8).



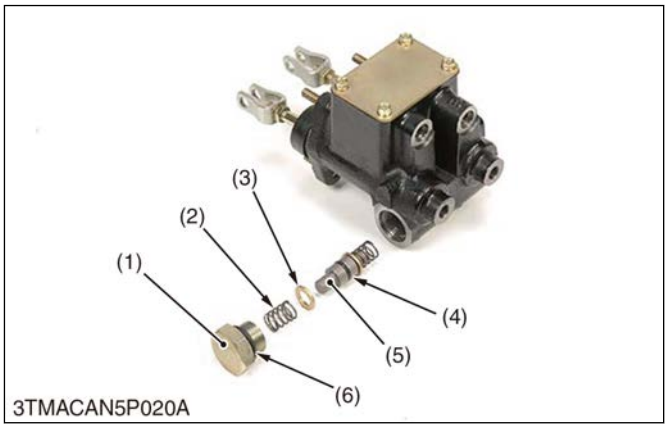

(1) Push rod
(2) Internal circlip
(3) Secondary cylinder cup
(4) Master cylinder assembly
(5) Boot
(6) Piston
(7) Primary cylinder cup
(8) Return spring

**(When reassembling)**

- Install the outlet valve, noting its direction.
- Install the piston not to damage the cylinder cup lip.

## 5.2.2 Removing equalizer

1. Drain the brake oil from the equalizer.
2. Secure the equalizer in a vise, remove both the plug (1) to pull out the piston (5).




(1) Plug
(2) Spring
(3) Washer
(4) O-ring
(5) Piston
(6) O-ring

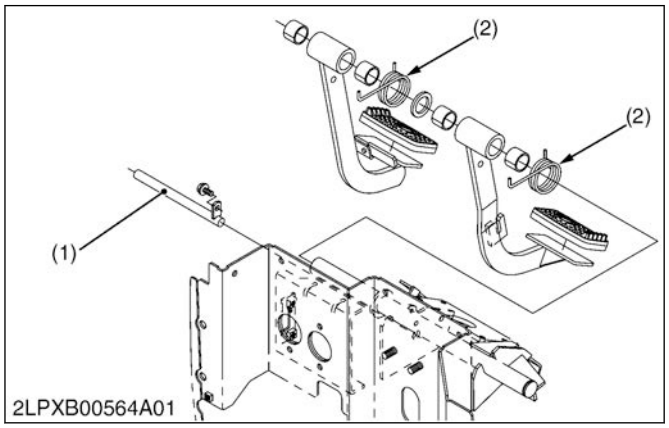
**(When reassembling)**

- Install the piston and plug, noting the O-ring.
- Tighten the plug to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Plug | 98.1 to 117 N·m<br>10.0 to 12.0 kgf·m<br>72.4 to 86.7 lbf·ft |

# 5.3 Brake pedal

## 5.3.1 Removing brake pedal (ROPS model)




(1) Brake pedal shaft (2) Spring

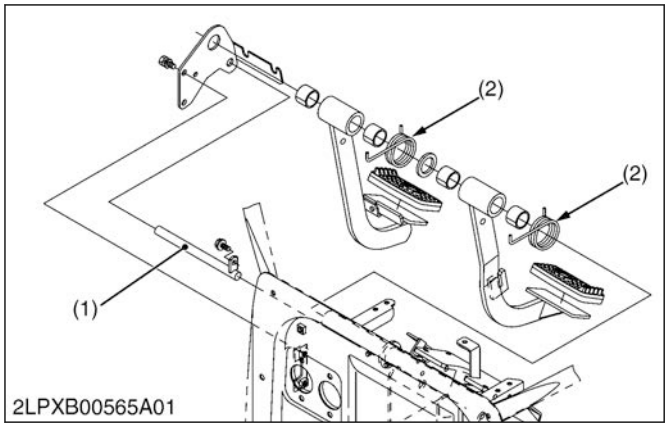
1. Remove the springs (2).
2. Remove the brake pedal shaft (1) mounting screw.
3. Draw out the brake pedal shaft (1) and brake pedals.

**(When reassembling)**

**■ IMPORTANT**

- **After reassembling the brake pedal, be sure to adjust the brake pedal free travel.**
- Apply grease to the brake pedal shaft.

## 5.3.2 Removing brake pedal (Cabin model)




(1) Brake pedal shaft (2) Spring

1. Remove the springs (2).
2. Remove the brake pedal shaft (1) mounting screw.
3. Draw out the brake pedal shaft (1) and brake pedals.

**(When reassembling)**

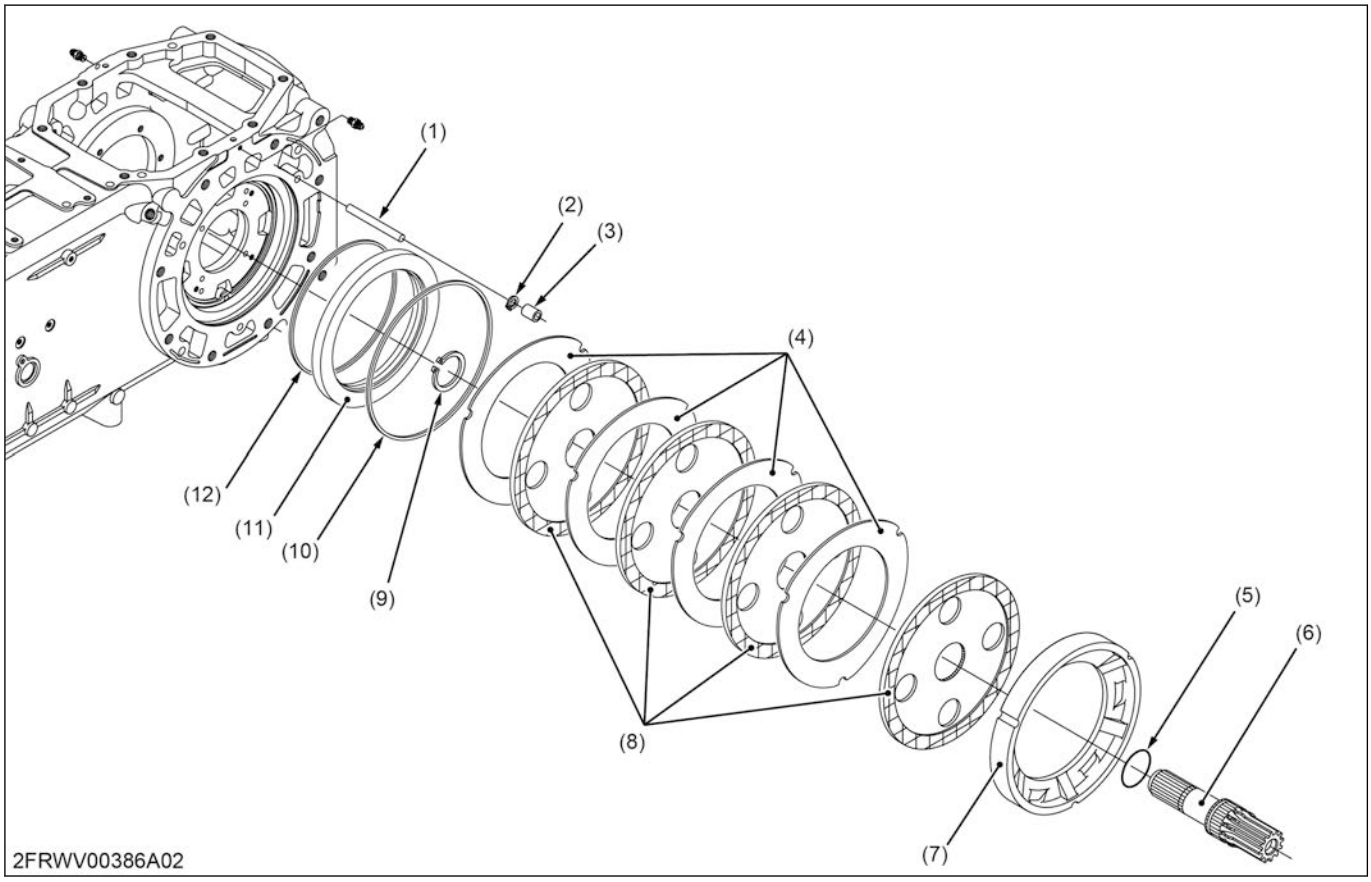
**■ IMPORTANT**

- **After reassembling the brake pedal, be sure to adjust the brake pedal free travel.**
- Apply grease to the brake pedal shaft.

# 5.4 Brake disk and plate

- Separating rear axle case from transmission case.

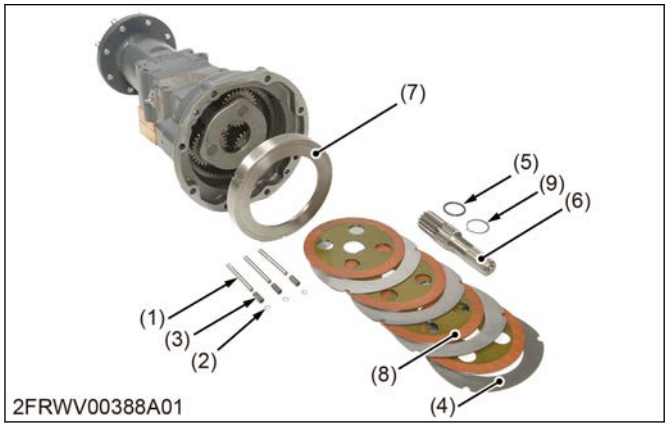
## 5.4.1 Disassembling brake shaft, brake disc, steel plate and brake plate




(1) Pin
(2) External circlip
(3) Collar
(4) Steel plate
(5) O-ring
(6) Brake shaft
(7) Brake plate
(8) Brake disc
(9) External circlip
(10) Brake seal 1
(11) Brake piston
(12) Brake seal 2

1. Remove the external circlip (2).
2. Remove the pin (1) and collar (3).
3. Remove the brake shaft (6) with brake discs (8) and steel plates (4).
4. Remove the external circlip (9).

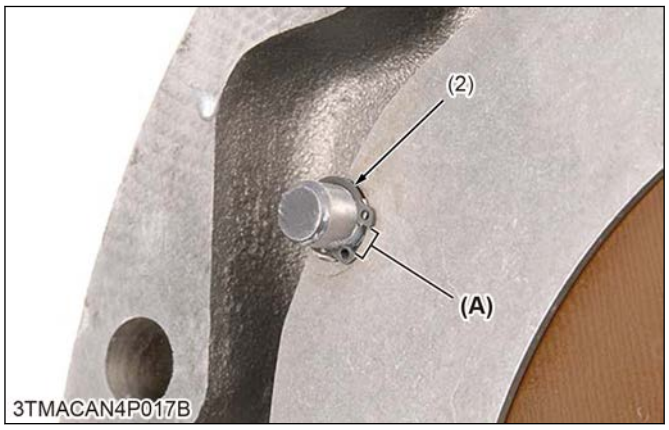
5. Remove the brake plate (7).


(1) Pin
(2) External circlip
(3) Collar
(4) Steel plate
(5) O-ring
(6) Brake shaft
(7) Brake plate
(8) Brake disc
(9) External circlip

**(When reassembling)**

- Place the brake discs (8) so that the holes align to next holes.
- The pin (1) does not have groove for external circlip (2).
- Face the external circlip (2) gap (A) to brake shaft (6).



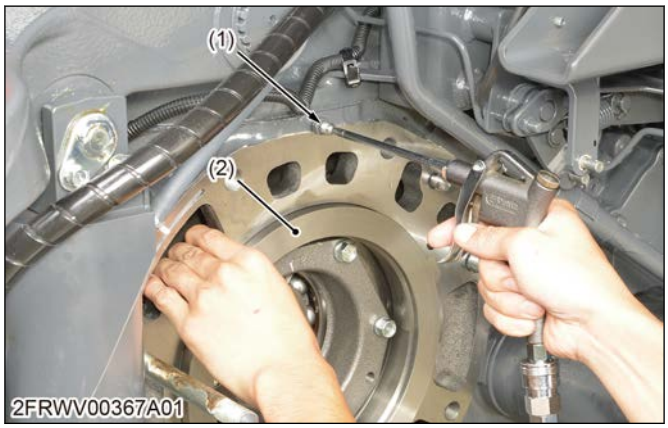

(2) External circlip
(A) Gap

## 5.5 Brake piston

- Separating rear axle case from transmission case.

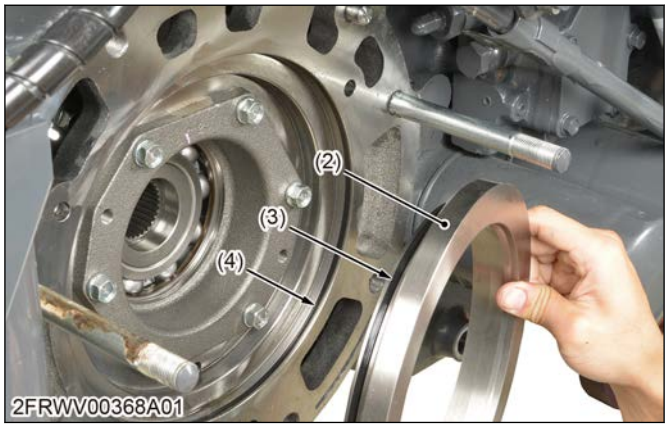
### 5.5.1 Removing brake piston

1. Hold sectary the piston (2) by hand.
2. Slowly inject an air from bleeder (1).




(1) Bleeder (2) Brake piston

3. Remove the brake piston (2) with compressed air.
4. Remove the brake seal 1 (3) and brake seal 2 (4).




(3) Brake seal 1 (4) Brake seal 2

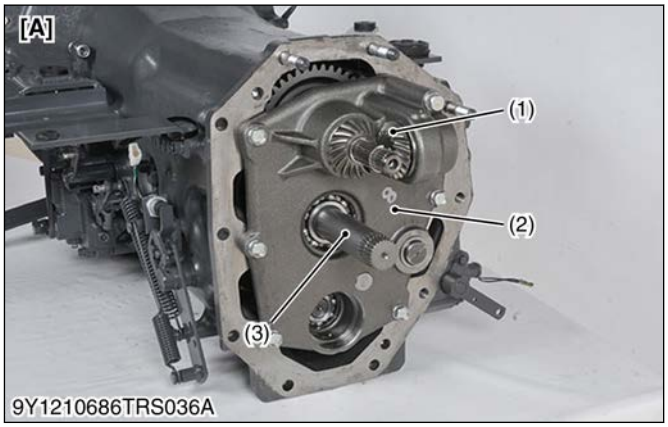
**(When reassembling)**

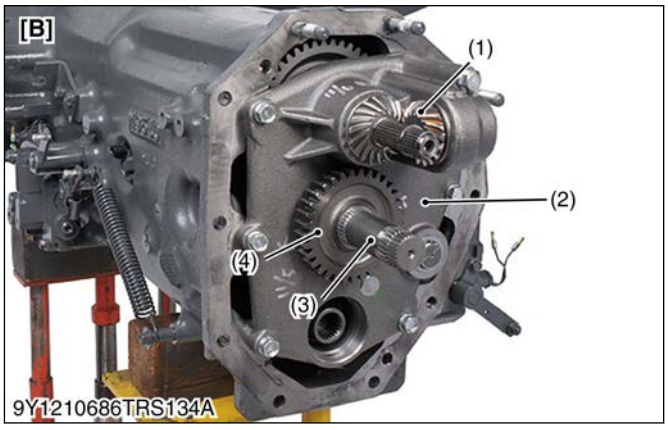
- Replace the brake seal 1 (3) and 2 (4) with new one.
- Install the brake seal (1) and (2) so as not to twist.
- Be careful not to enter the foreign matter into the seal groove of inside brake case.
- When installing the brake piston (2), apply transmission fluid to the brake seals.
- When installing the brake piston (2), tap it in evenly and lightly using a soft hammer.

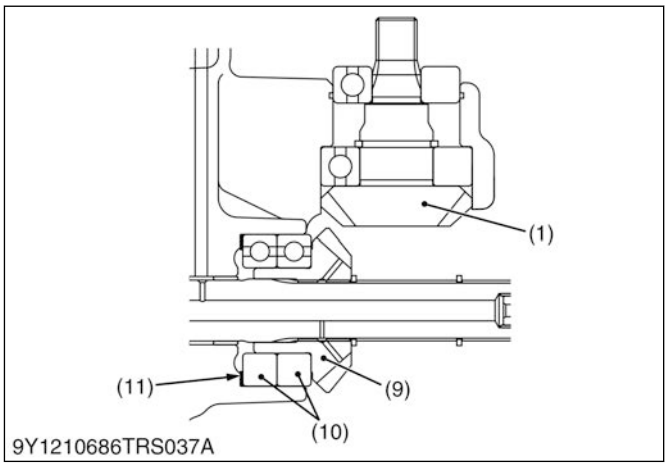
## 5.6 Parking brake gear

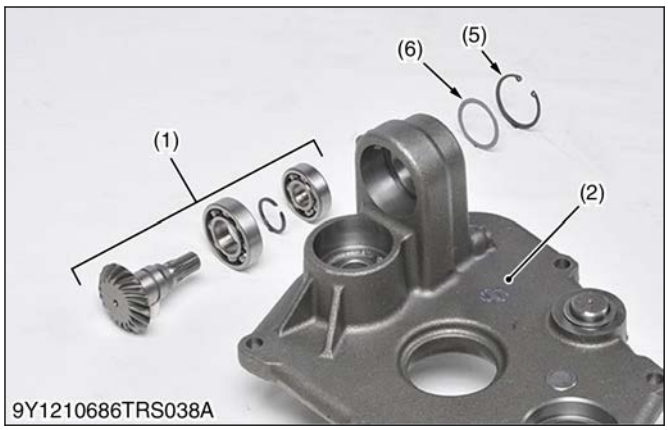
- Separating transmission case and clutch housing case.

### 5.6.1 Removing PTO propeller shaft, bearing holder and pump gear



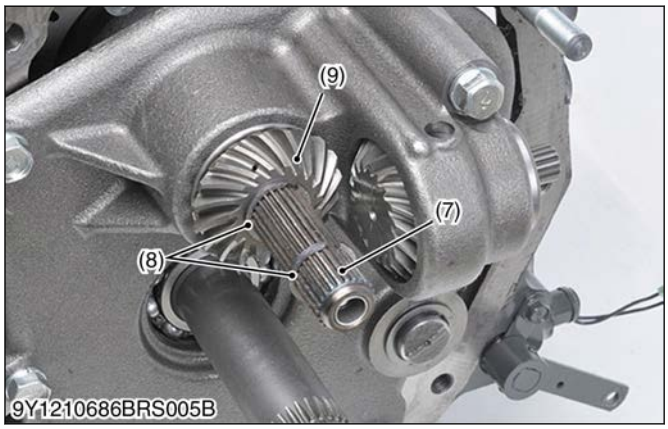



(1) 18T spiral bevel gear assembly
(2) Bearing holder
(3) 3rd shaft
(4) 33T gear
(5) Internal circlip
(6) Shim 1
(9) 19T spiral bevel gear
(10) Bearing
(11) Shim 2
[A] F18/R18 speed transmission model
[B] F36/R36 speed transmission model

1. Remove the internal circlip (5), shim 1 (6) and slide the 18T spiral bevel gear assembly (1).


(5) Internal circlip
(6) Shim 1

2. Tap out the PTO propeller shaft (7) frontward and then remove the external circlip (8), 19T spiral bevel gear (9), bearing (10) and shim 2 (11).

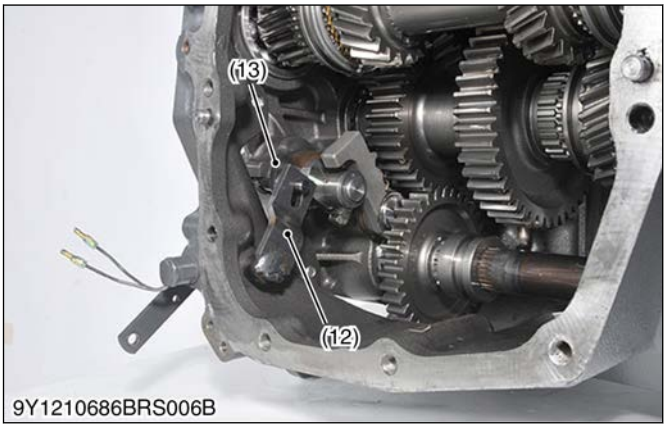



(7) PTO propeller shaft
(8) External circlip
(9) 19T spiral bevel gear

3. Remove the external circlip and 33T gear (4). (F36/R36 speed transmission model)
4. Remove the bearing holder mounting screws, and draw out the bearing holder (2).
5. If the 3rd shaft (3) comes out with bearing holder, tap in the 3rd shaft (3) during drawing out the bearing holder (2).

**(When reassembling)**

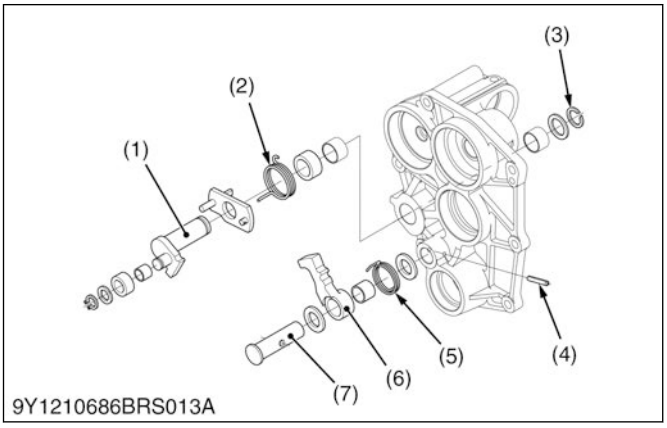
- Check the backlash between 18T spiral bevel gear (1) and 19T spiral bevel gear (9).
- Be sure to fix the parking brake arm (13) and parking cam lever (12).




(12) Parking cam lever
(13) Parking brake arm

RELATED PAGE
6.9.1 Checking backlash between 18T bevel gear and 19T bevel gear on page 4-122

## 5.6.2 Removing parking brake gear



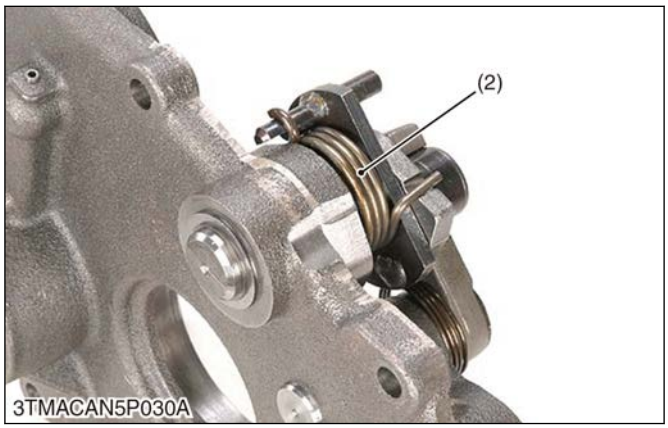

(1) Parking cam shaft
(2) Parking cam spring
(3) External circlip
(4) Roll pin
(5) Parking gear spring
(6) Parking gear
(7) Parking gear pin

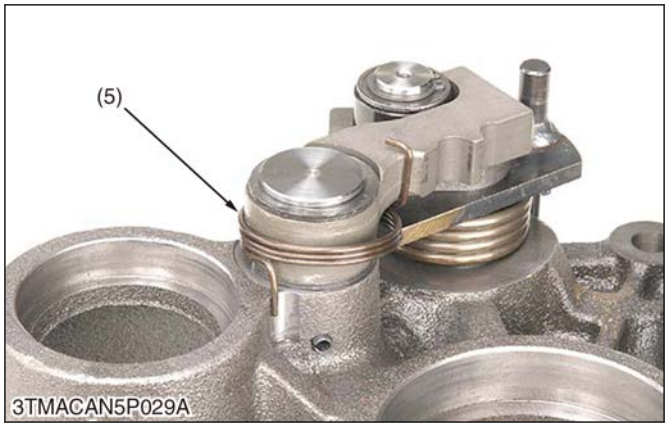
1. Remove the external circlip (3).
2. Draw out the parking cam shaft (1).
3. Remove the roll pin (4).

4. Remove the parking gear pin (7) and parking gear (6).

**(When reassembling)**

- Be sure to hook the springs (2), (5) as shown in the photo.



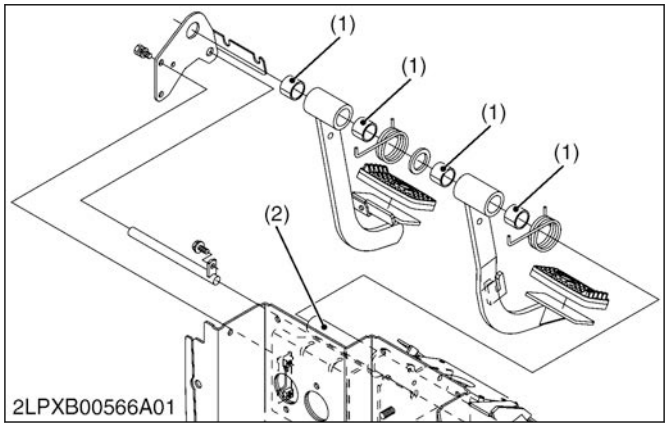




(2) Parking cam spring (5) Parking gear spring

# 6. Servicing

## 6.1 Brake pedal

### 6.1.1 Checking brake pedal bushing




(1) Brake pedal bushing (2) Brake pedal shaft

1. Measure the brake pedal bushing I.D. with inside micrometer.

| | | |
|---|---|---|
| Brake pedal bushing I.D. | Factory specification | 25.093 to 25.148 mm<br>0.98792 to 0.99007 in. |

2. Measure the pedal shaft O.D. with outside micrometer and calculate the clearance.

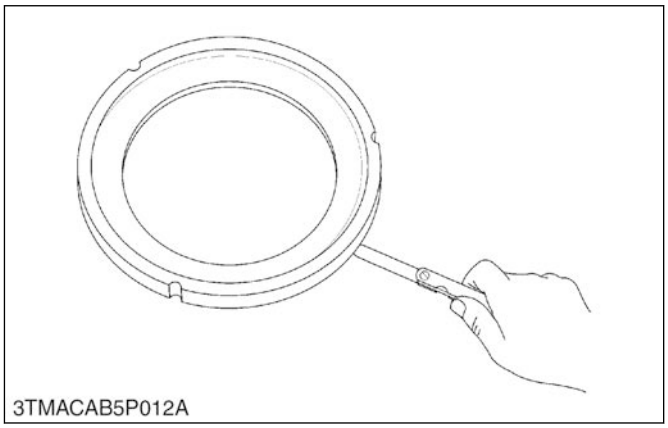
| | | |
|---|---|---|
| Pedal shaft O.D. | Factory specification | 24.948 to 25.000 mm<br>0.98221 to 0.98425 in. |

| | | |
|---|---|---|
| Clearance between brake pedal bushing and pedal shaft | Factory specification | 0.093 to 0.20 mm<br>0.0037 to 0.0078 in. |
| | Allowable limit | 0.5 mm<br>0.02 in. |

3. If the clearance exceeds the allowable limit, replace it.

## 6.2 Traveling brake

### 6.2.1 Checking brake plate flatness

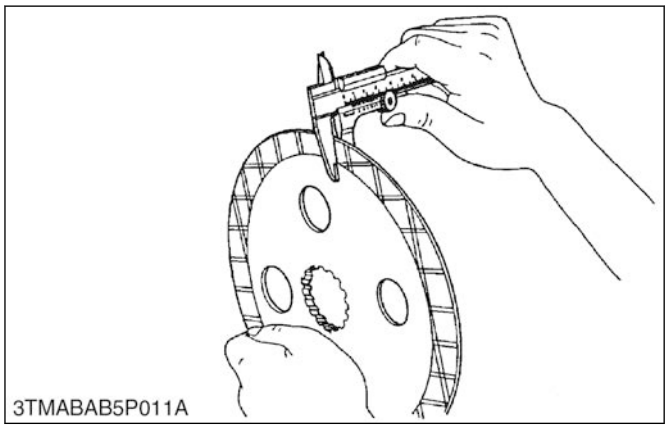



1. Place the brake plate on the surface plate.
2. Measure the flatness of brake plate with a feeler gauge at four points on a diagonal line.

| | | |
|---|---|---|
| Brake plate flatness | Allowable limit | 0.3 mm<br>0.01 in. |

3. If the measured value exceeds the allowable limit, replace it.

## 6.2.2 Checking brake disk wear




1. Measure the brake disk thickness with vernier calipers.

| | | |
|---|---|---|
| Brake disk wear | Factory specification | 4.15 to 4.35 mm<br>0.164 to 0.171 in. |
| | Allowable limit | 3.3 mm<br>0.13 in. |

2. If the measured value is less than the allowable limit, replace it.

## 6.2.3 Checking brake plate wear


1. Measure the brake plate thickness with vernier calipers.

| | | |
|---|---|---|
| Brake plate wear | Factory specification | 2.1 to 2.5 mm<br>0.083 to 0.098 in. |
| | Allowable limit | 1.5 mm<br>0.059 in. |

2. If the measured value is less than the allowable limit, replace it.

# 7. FRONT AXLE

# MECHANISM

## 1. Structure

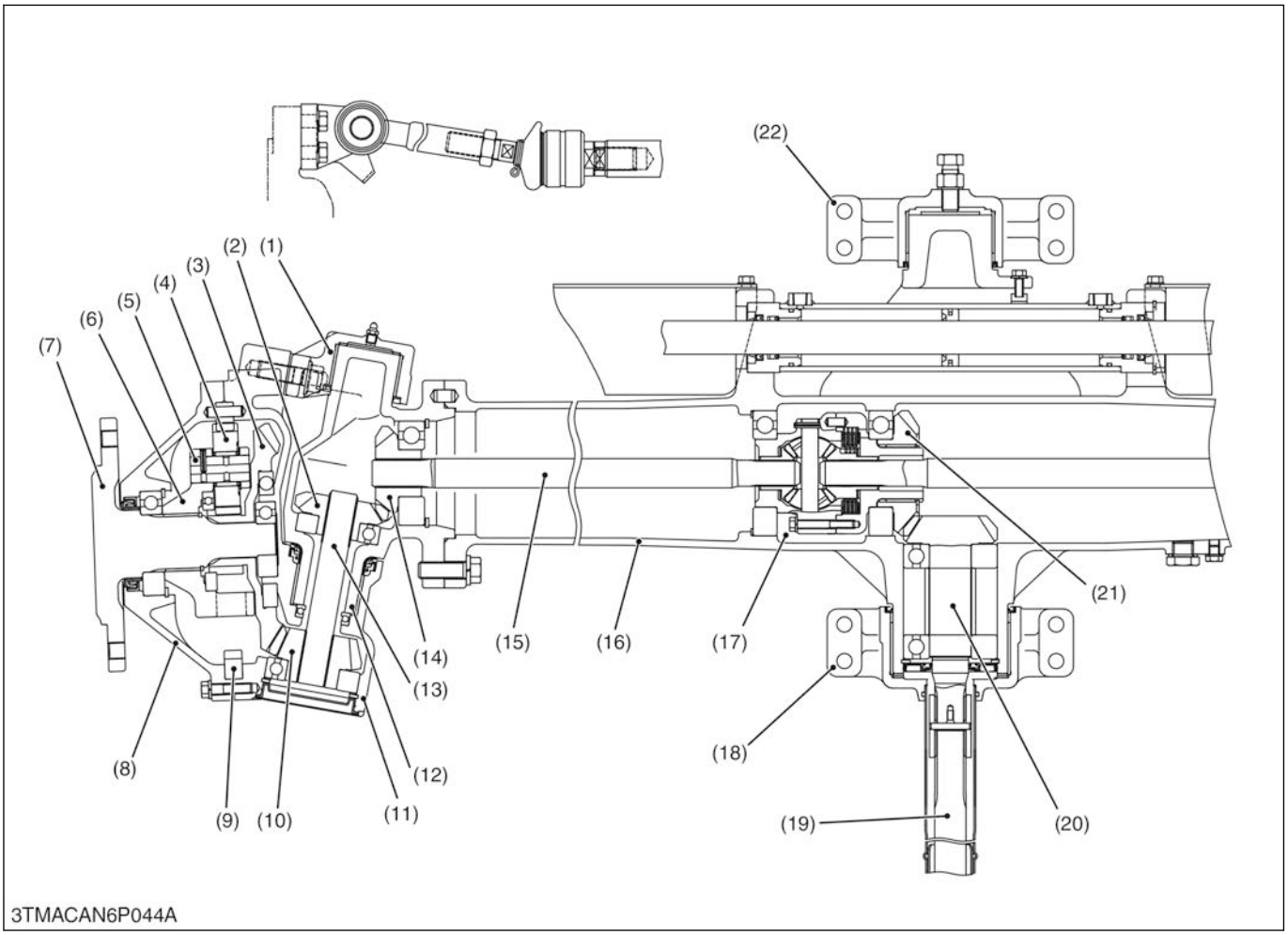
The front axle supports the front of tractor and facilitates steering.
The four-wheel drive axle has powered front wheels.

**NOTE**

- **Refer to "Front axle" section in the Workshop Manual of *Tractor mechanism* (Code No. *9Y021-18200*).**

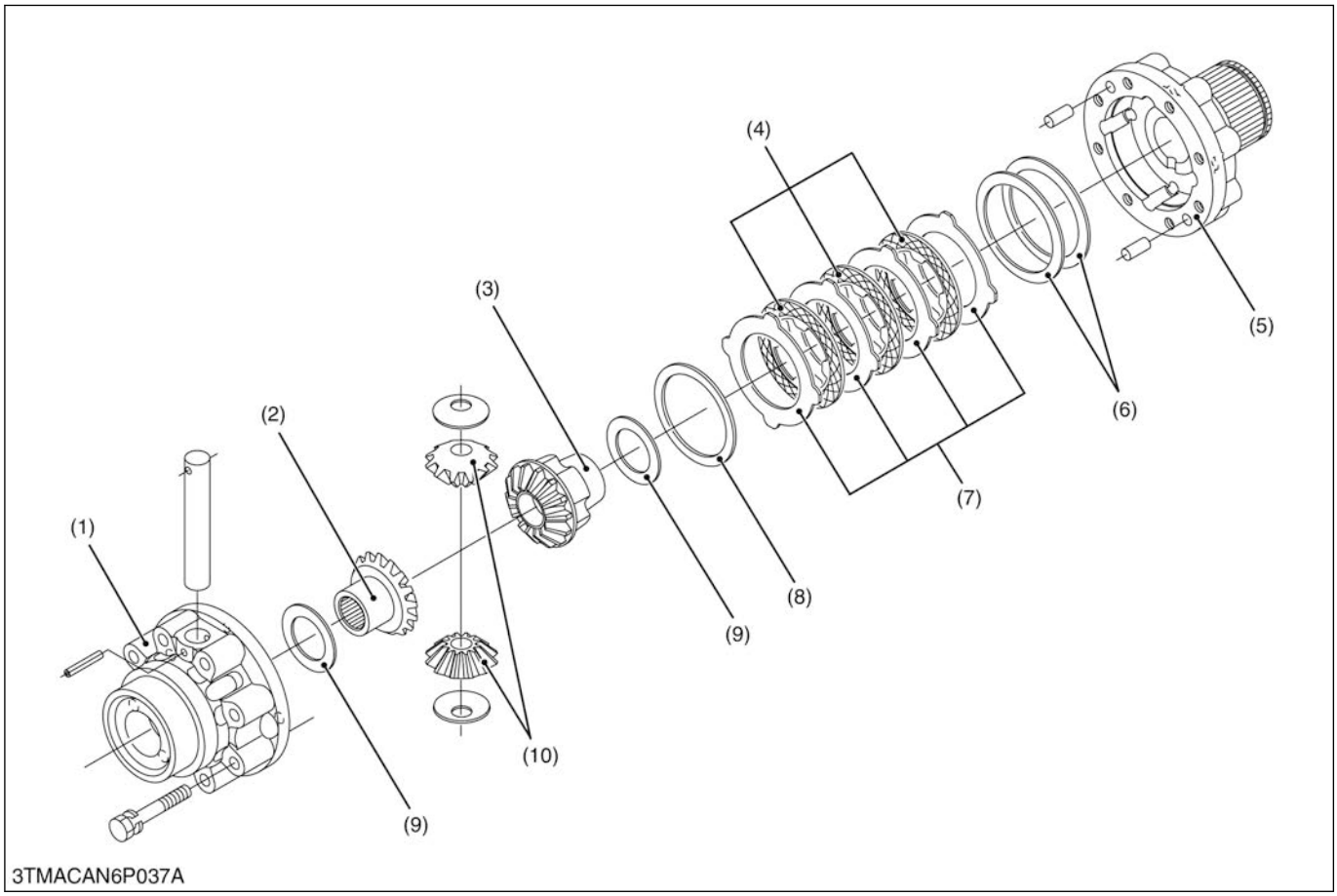
RELATED PAGE
1.1 Structure of 4 wheel drive on page 7-2

# 1.1 Structure of 4 wheel drive




(1) Front axle case support
(2) 18T bevel gear
(3) 41T bevel gear
(4) 23T planetary gear
(5) Planetary gear pin
(6) Planetary gear support
(7) Front axle
(8) Front axle case cover
(9) 62T internal gear
(10) 15T bevel gear
(11) Front axle case
(12) Bevel gear case
(13) Bevel gear shaft
(14) 17T bevel gear
(15) Differential yoke shaft
(16) Front differential case
(17) Differential gear assembly (LSD)
(18) Bracket (Rear)
(19) Propeller shaft
(20) 17T bevel pinion shaft
(21) 23T bevel gear
(22) Bracket (Front)

## 1.2 Function of Limited Slip Differential (LSD)




(1) Differential case
(2) Side gear
(3) Side gear (LSD)
(4) Friction disk
(5) Case cover
(6) Belleville washer (Cupped spring washer)
(7) Steel plate
(8) Adjustment shim (LSD)
(9) Adjustment shim (Side gear)
(10) Pinion gear

In addition to conventional components, this differential gear system has friction disks (4) on one side of a side gear (LSD) (3), steel plates (7) on the differential gear case cover (5), belleville washer (cupped spring washer) (6), and an adjustment shim (LSD) (8).
The steel plates (7) and the friction disks (4) are coupled and pressed against each other with the belleville washer (cupped spring washer) (6), which assembles the side gear (LSD) (3) and the differential case (1) into one.
Therefore, this differential gear system is always differential lock condition under normal conditions.
When a tractor is driving straight ahead, the differential gear is in differential lock condition and the right and left wheels rotate at the same speed, allowing stable operating in a straight line.
When the tractor takes a turn, the right and left wheels are forced to rotate in different speeds, and the difference in rotation makes the right and left side gears rotate in different speeds.
At this point, if a torque higher than a specified load level is applied the belleville washer (cupped spring washer) (6), the spring operates and the steel plate is released from the friction disk.
As a result, the right and left side gears rotate differently just as usual differential gear, allowing smooth cornering.
A load specified on the spring is adjusted by changing thickness of the adjustment shim (LSD) (8).

# SERVICING

## 1. Troubleshooting for front axle

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Front wheels wander to right or left. | 1. Tire pressure is uneven. | Adjust tire pressure. | — |
| | 2. Toe-in adjustment is improper. (Improper alignment) | Adjust toe-in. | 7-9 |
| | 3. Front axle bracket (front, rear) bushing is excessively worn. | Replace bushing. | 7-16<br>7-24 |
| | 4. Front axle rocking force is too small. | Adjust front axle rocking force. | 7-10 |
| | 5. Front wheel sway is excessive. | Replace wheel hub. | 7-9 |
| | 6. Tie-rod end is loose. | Tighten tie-rod end nut. | 8-33 |
| | 7. Aeration of the hydraulic fluid is in power steering circuit | Bleed air from power steering circuit. | — |
| Front wheels can not be driven. [4WD type] | 1. Propeller shaft is damaged. | Replace propeller shaft | 3-62 |
| | 2. Front wheel drive gears in transmission is damaged. | Replace front wheel drive gears. | — |
| | 3. Front differential gear is damaged. | Replace front differential gear. | 7-17<br>7-19 |
| | 4. Coupling is displaced. | Reassemble coupling. | 3-62 |
| Noise [4WD type] | 1. Gear backlash is excessive. | Adjust gear backlash or replace gear. | — |
| | 2. Oil is insufficient. | Fill oil to proper level. | 2-13<br>2-40<br>2-40 |
| | 3. Bearing is damaged. | Replace bearing. | 5-22<br>5-22 |
| | 4. Gears are damaged. | Replace gears. | — |

# 2. Servicing specifications for front axle

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Toe-in (b–a) | | 2.0 to 8.0 mm<br>0.079 to 0.31 in. | — |
| Front wheel (Face runout of wheel at bead) | Axial sway | Less than<br>5.0 mm<br>0.20 in. | — |
| Bevel gear case to stopper | Clearance | Below<br>0.5 mm<br>0.02 in. | — |
| Front wheel hub | Turning torque | 3.0 to 4.9 N·m<br>0.30 to 0.50 kgf·m<br>2.2 to 3.6 lbf·ft | — |
| Front axle middle boss to bracket bushing | Clearance | 0.050 to 0.15 mm<br>0.0020 to 0.0059 in. | 0.35 mm<br>0.014 in. |
| Front axle middle boss | O.D. | 39.938 to 40.000 mm<br>1.5724 to 1.5748 in. | — |
| Bracket bushing | I.D. | 40.050 to 40.088 mm<br>1.5768 to 1.5782 in. | — |
| Knuckle shaft | O.D. | 37.975 to 38.000 mm<br>1.49508 to 1.49606 in. | — |
| Bushing | I.D. | 38.020 to 38.100 mm<br>1.49685 to 1.50000 in. | — |
| Knuckle shaft (kingpin) to bushing | Clearance | 0.0200 to 0.125 mm<br>0.000788 to 0.00492 in. | 0.35 mm<br>0.014 in. |
| Bevel gear to bevel pinion shaft | Backlash | 0.20 to 0.30 mm<br>0.0079 to 0.011 in. | 0.4 mm<br>0.02 in. |
| Differential side gear boss | O.D. | 31.959 to 31.975 mm<br>1.2583 to 1.2588 in. | — |
| Differential case bore | I.D. | 32.025 to 32.050 mm<br>1.2609 to 1.2618 in. | — |
| Differential case to differential side gear | Clearance | 0.050 to 0.091 mm<br>0.0020 to 0.0035 in. | 0.35 mm<br>0.014 in. |
| Differential pinion shaft | O.D. | 15.966 to 15.984 mm<br>0.62859 to 0.62929 in. | — |
| Differential pinion gear | I.D. | 16.000 to 16.018 mm<br>0.62993 to 0.63062 in. | — |
| Differential pinion shaft to pinion gear | Clearance | 0.016 to 0.052 mm<br>0.00063 to 0.0020 in. | 0.25 mm<br>0.0098 in. |
| Pinion gear to differential side gear | Backlash | 0.1 to 0.3 mm<br>0.004 to 0.01 in. | 0.4 mm<br>0.02 in. |
| Pinion gear to LSD side gear | Backlash | 0.1 to 0.3 mm<br>0.004 to 0.01 in. | 0.4 mm<br>0.02 in. |
| LSD disk | Slip torque | 54 to 67 N·m<br>5.5 to 6.9 kgf·m<br>40 to 49 lbf·ft | — |
| Rear differential case boss | O.D. | 109.965 to 110.000 mm<br>4.32933 to 4.33070 in. | — |
| Front differential case boss | O.D. | 79.965 to 80.000 mm<br>3.1483 to 3.1496 in. | — |
| Bearing retainer | O.D. | 59.97 to 60.00 mm<br>2.361 to 2.362 in. | — |

(Continued)

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Bevel gear case | O.D. | 59.97 to 60.00 mm<br>2.361 to 2.362 in. | — |
| Bevel gear in bevel gear case | Backlash | 0.20 to 0.30 mm<br>0.0079 to 0.011 in. | 0.4 mm<br>0.02 in. |
| Bevel gear in front wheel case | Backlash | 0.20 to 0.30 mm<br>0.0079 to 0.011 in. | 0.4 mm<br>0.02 in. |
| Internal gear to planetary gear | Backlash | 0.10 to 0.30 mm<br>0.0040 to 0.011 in. | 0.5 mm<br>0.02 in. |
| Planetary gear | I.D. | 33.009 to 33.025 mm<br>1.2993 to 1.3001 in. | — |
| Shaft | O.D. | 24.991 to 25.000 mm<br>0.98390 to 0.98425 in. | — |
| Needle bearing | O.D. | 3.994 to 4.000 mm<br>0.1573 to 0.1574 in. | — |
| Planetary gear to shaft | Clearance | 0.0090 to 0.046 mm<br>0.00036 to 0.0018 in. | 0.3 mm<br>0.01 in. |
| Thrust collar | Thickness | 0.75 to 0.85 mm<br>0.030 to 0.033 in. | 0.5 mm<br>0.02 in. |

# 3. Tightening torques for front axle

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to 2-15, 2-15.)

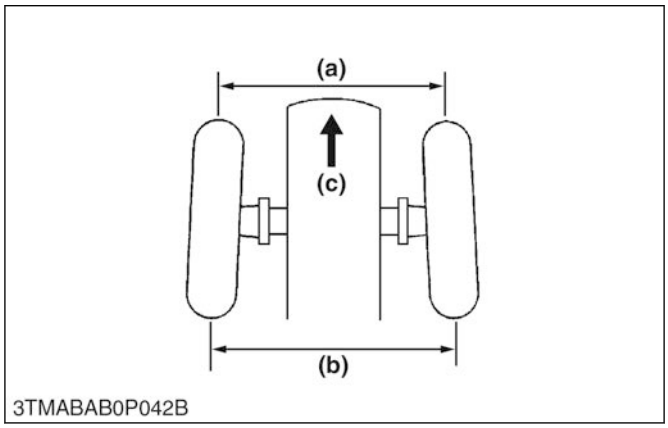
| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Front axle rocking force adjusting screw | 20 to 29 | 2.0 to 3.0 | 15 to 21 |
| Tie-rod end lock nut | 167 to 196 | 17.0 to 20.0 | 123 to 144 |
| Front axle rocking force adjusting lock nut | 98.1 to 147 | 10.0 to 15.0 | 72.4 to 108 |
| Power steering hose retaining nut | 23 to 27 | 2.3 to 2.8 | 17 to 20 |
| Front wheel mounting nut (M14) | 167 to 196 | 17.0 to 20.0 | 123 to 144 |
| Front wheel mounting nut (M16) | 260 to 304 | 26.5 to 31.0 | 192 to 224 |
| Bracket mounting nut | 124 to 147 | 12.6 to 15.0 | 91.2 to 108 |
| Bracket mounting screw | 167 to 196 | 17.0 to 20.0 | 123 to 144 |
| Tie-rod end slotted nut | 157 to 176 | 16.0 to 18.0 | 116 to 130 |
| Tie-rod joint lock nut | 167 to 196 | 17.0 to 20.0 | 123 to 144 |
| Bevel gear case mounting screw (M16, 9T) | 260 to 304 | 26.5 to 31.0 | 192 to 224 |
| Front wheel case support mounting screw (M16, 9T) | 260 to 304 | 26.5 to 31.0 | 192 to 224 |
| Front wheel case cover mounting screw | 48 to 55 | 4.9 to 5.7 | 36 to 41 |
| Front wheel mounting stud bolt (M16) | 131 to 152 | 13.3 to 15.5 | 96.2 to 112 |
| Differential case cover mounting screw (M8, 9T) | 30 to 34 | 3.0 to 3.5 | 22 to 25 |

# 4. Checking, disassembling and servicing

## 4.1 Checking and adjusting

### 4.1.1 Checking toe-in

1. Park tractor on a flat place.
2. Turn steering wheel so that front wheels are in the straight ahead position.
3. Lower the implement, lock the park brake and stop the engine.
4. Measure distance (a) between tire beads at front of tire, hub height.
5. Measure distance (b) between tire beads at rear of tire, hub height.




(a) Wheel-to-wheel distance at front
(b) Wheel-to-wheel distance at rear
(c) "FRONT"

6. Front distance should be shorter than rear distance.
7. If not, adjust tie-rod length.

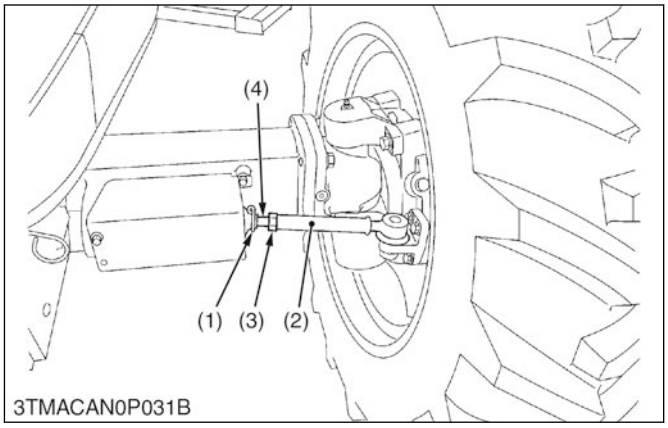
| | | |
|---|---|---|
| Toe-in (b–a) | Factory specification | 2.0 to 8.0 mm<br>0.079 to 0.31 in. |

### 4.1.2 Adjusting toe-in

1. Remove the cylinder covers.
2. Remove the snap ring (1).
3. Loosen the tie-rod end lock nut (3).
4. Turn the rod end (4) to adjust until the proper toe-in value is obtained.
5. Retighten the tie-rod end lock nut (3).
6. Tighten the front axle rocking force adjusting screw and the tie-rod end lock nut to the specified tightening torque.

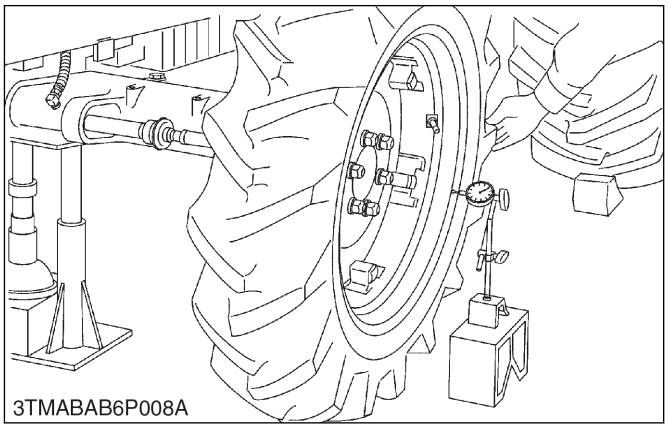
| | | |
|---|---|---|
| Tightening torque | Front axle rocking force adjusting screw | 20 to 29 N·m<br>2.0 to 3.0 kgf·m<br>15 to 21 lbf·ft |
| | Tie-rod end lock nut | 167 to 196 N·m<br>17.0 to 20.0 kgf·m<br>123 to 144 lbf·ft |

7. Install the tie-rod joint with the snap ring (1) on the rod end.




(1) Snap ring
(2) Tie-rod end
(3) Tie-rod end lock nut
(4) Tie-rod end

### 4.1.3 Checking axial sway of front wheel

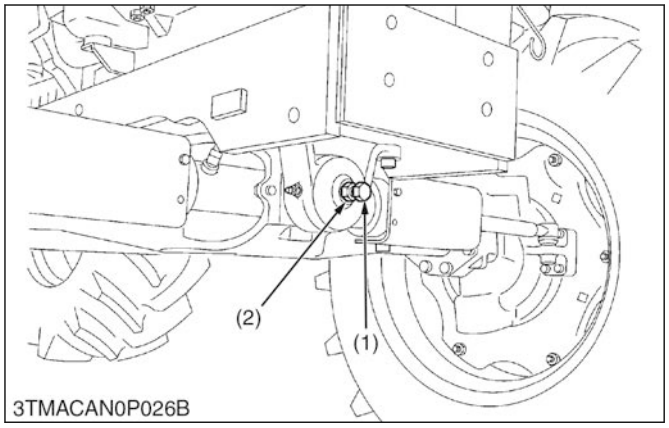



1. Jack up the front side of tractor.
2. Set a dial gauge on the outside of rim.
3. Turn the wheel slowly and read the runout of rim.
4. If the measured value exceeds the factory specifications, check the bearing, rim and front wheel hub.

| | | |
|---|---|---|
| Axial sway of front wheel (Face run-out of wheel at bead) | Factory specification | Less than<br>5.0 mm<br>0.20 in. |

## 4.1.4 Adjusting front axle pivot

1. Jack up the tractor body, and then loosen the front axle rocking force adjusting lock nut (2).
2. Screw in the adjusting screw (1) until seated, and then tighten the adjusting screw (1) with an additional 1/6 turn.
3. Retighten the lock nut (2).




(1) Adjusting screw (2) Lock nut

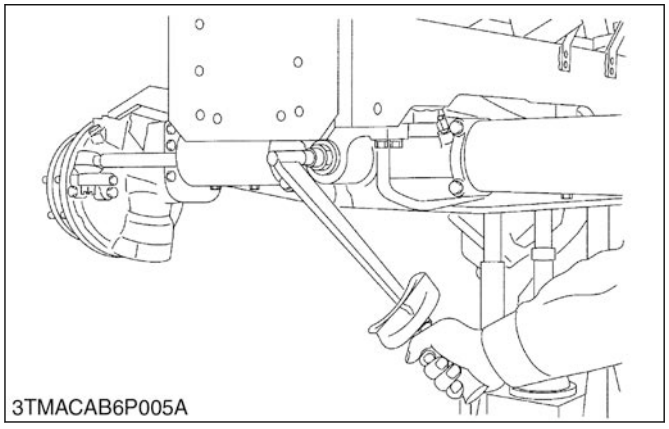
**(When reassembling)**

- Tighten the lock nut (2) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Front axle rocking force adjusting lock nut | 98.1 to 147 N·m<br>10.0 to 15.0 kgf·m<br>72.4 to 108 lbf·ft |

**(Reference)**

- Tighten the front axle rocking force adjusting screw and front axle rocking force adjusting lock nut to the specified tightening torque.

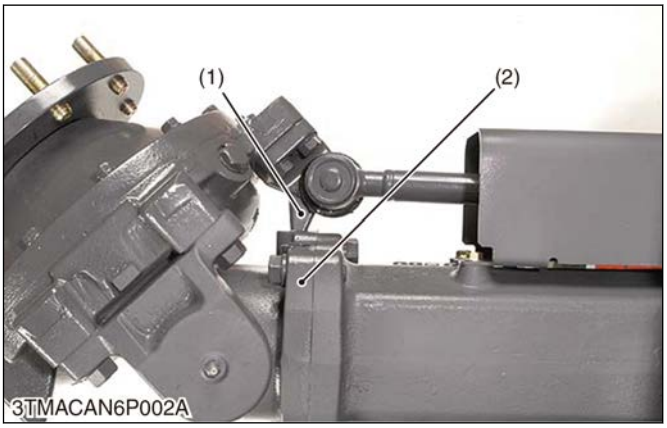



| | | |
|---|---|---|
| Tightening torque | Front axle rocking force adjusting screw | 20 to 29 N·m<br>2.0 to 3.0 kgf·m<br>15 to 21 lbf·ft |
| | Front axle rocking force adjusting lock nut | 98.1 to 147 N·m<br>10.0 to 15.0 kgf·m<br>72.4 to 108 lbf·ft |

## 4.1.5 Adjusting between bevel gear case and stopper (4WD model)

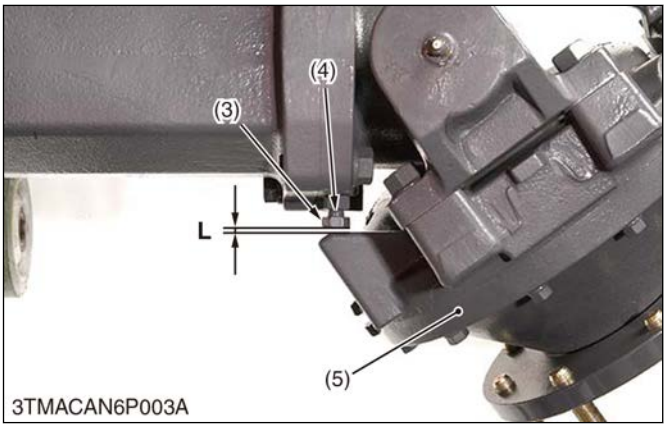
1. Inflate the tires to the specified pressure.
2. Steer the wheels to the extreme right until the knuckle arm (1) contacts with the bevel gear case (2).
3. If the knuckle arm (1) cannot be contacted with the bevel gear case (2), shorten the length of stopper (3).
4. Keeping the knuckle arm (1) contact with the bevel gear case (2), adjust the clearance to the factory specification as shown in the table.

| | | |
|---|---|---|
| Clearance between bevel gear case and stopper (L) | Factory specification | Below<br>0.5 mm<br>0.02 in. |




(1) Knuckle arm (2) Bevel gear case

5. After adjustment, secure the stopper with the lock nut (4).




(3) Stopper L: Clearance
(4) Lock nut
(5) Front gear case

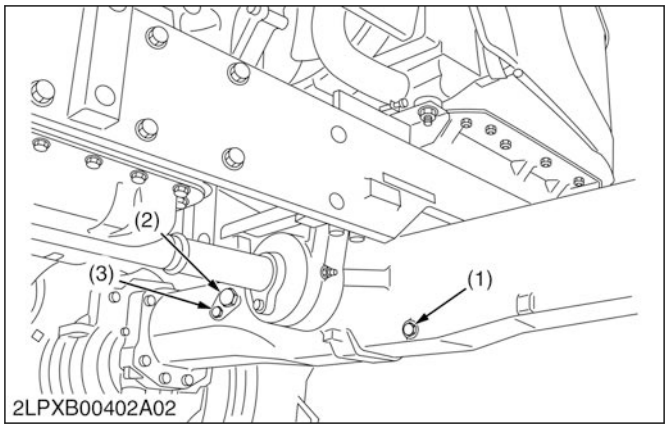
6. For adjusting the left steering angle, perform the same procedure as mentioned in right steering angle.

# 4.2 Disassembling and assembling

## 4.2.1 Separating front axle

### 4.2.1.1 Separating front axle (4WD model)

#### 4.2.1.1.1 Draining front differential case oil (4WD model)



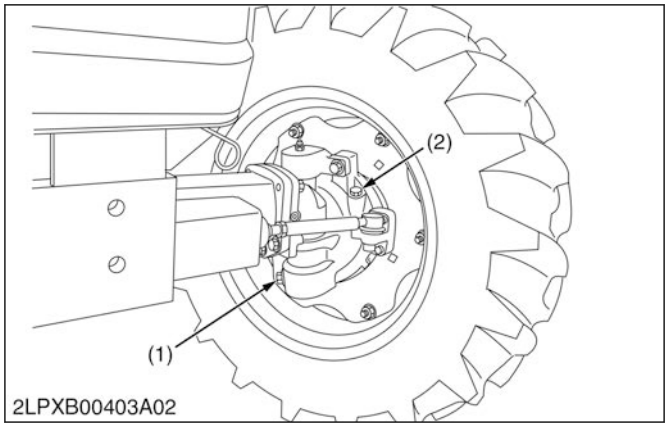

(1) Drain plug
(2) Filling port
(3) Check plug

1. To drain the used oil, remove the drain and filling plug at the front differential case and drain the oil completely into the oil pan.
2. After draining reinstall the drain plug (1).
3. Remove the oil level check plug (3).
4. Fill with the new oil up to the lower rim of filling port (2).

| | | |
|---|---|---|
| Front differential case oil | Capacity | 6.0 L<br>6.3 U.S.qts<br>5.3 Imp.qts |

5. After filling, reinstall the filling plug and check plugs.

#### 4.2.1.1.2 Draining front axle gear case oil (4WD model)




(1) Drain plug
(2) Filling plug

1. To drain the used oil, remove the right and left drain plugs (1) and filling plugs (2) at the front axle gear case and drain the oil completely into the oil pan.
2. After draining reinstall the drain plugs.
3. Fill with the new oil up to the filling plug port.

| | | |
|---|---|---|
| Front axle gear case oil | Capacity | 3.5 L<br>3.7 U.S.qts<br>3.1 Imp.qts |

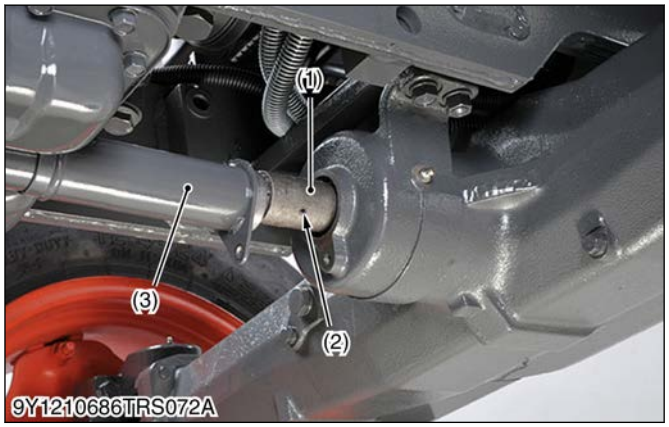
- After filling, reinstall the filling plugs (2).

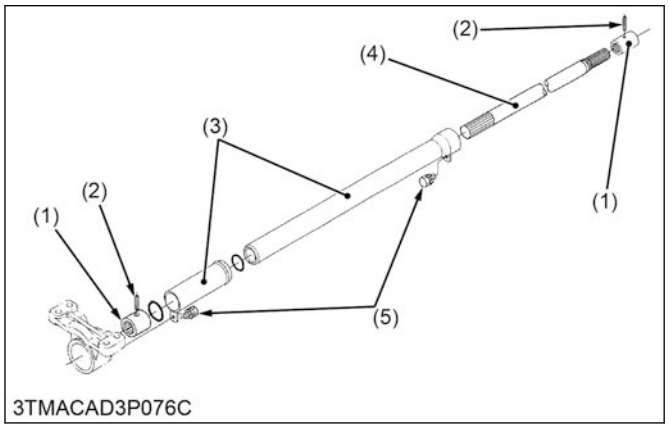
RELATED PAGE
LUBRICANTS, FUEL AND COOLANT on page 2-13

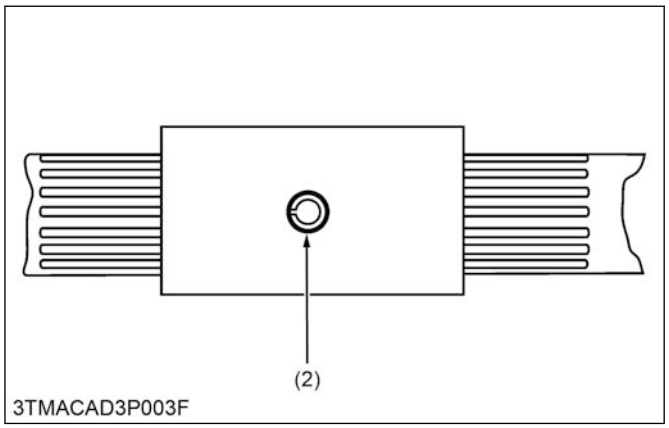
#### 4.2.1.1.3 Removing propeller shaft

1. Slide the propeller shaft covers (3) after removing the screws (5).
2. Tap out the roll pins (2).

3. Slide the couplings (1) and remove the propeller shaft (4).



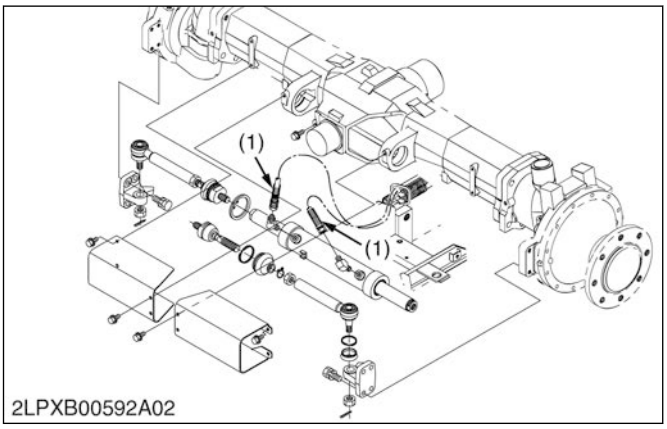




(1) Coupling
(2) Roll pin
(3) Propeller shaft cover
(4) Propeller shaft
(5) Screw

**(When reassembling)**
- Apply the grease to the splines of couplings (1).
- Tap in the roll pins (2) as shown in the figure.

## 4.2.1.1.4 Removing front wheel and power steering hoses (4WD model)

1. Check the front axle and engine are securely mounted on the disassembly stand.
2. Remove the front wheel.
3. Lift the front axle and remove the front wheels.
4. Disconnect the power steering hoses (1).



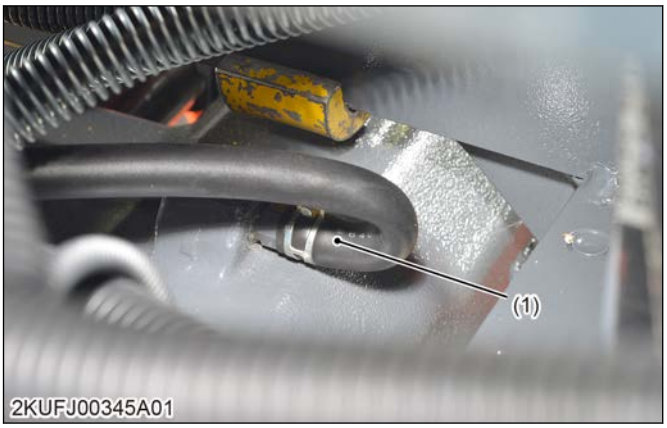

(1) Power steering hose

**(When reassembling)**
- Tighten the power steering hose retaining nut and the front wheel mounting nut (M16) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Power steering hose retaining nut | 23 to 27 N·m<br>2.3 to 2.8 kgf·m<br>17 to 20 lbf·ft |
| | Front wheel mounting nut (M16) | 260 to 304 N·m<br>26.5 to 31.0 kgf·m<br>192 to 224 lbf·ft |

## 4.2.1.1.5 Removing front axle (4WD model)

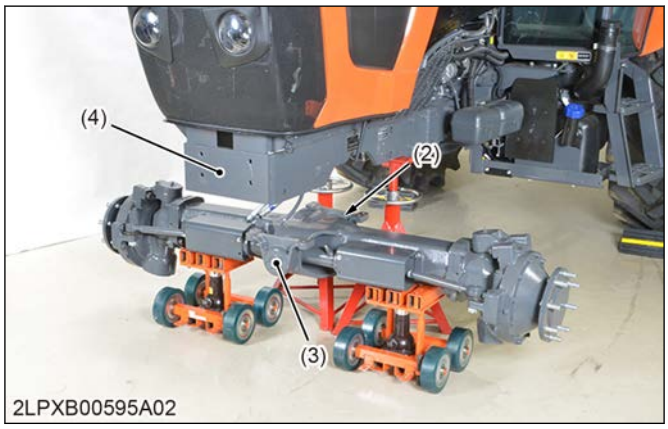
1. Place a disassembling stand under the front axle case and support it with a jack.
2. Disconnect the breather hose (1).




(1) Breather hose

3. Remove the bracket (front) (3) mounting screws and nuts.
4. Remove the bracket (rear) (2) mounting screws and nuts.

5. Separate the front axle from front axle frame.




(2) Rear bracket
(3) Front bracket
(4) Front axle frame

**(When reassembling)**

**IMPORTANT**

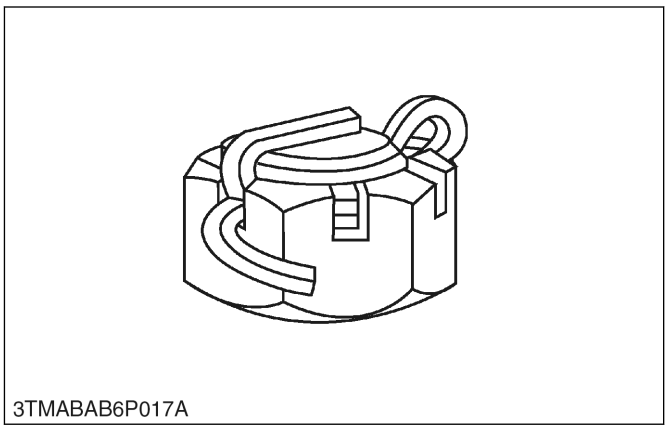
- **Adjust the front axle pivot.**
- Tighten the bracket mounting nut and the bracket mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Bracket mounting nut | 124 to 147 N·m<br>12.6 to 15.0 kgf·m<br>91.2 to 108 lbf·ft |
| | Bracket mounting screw | 167 to 196 N·m<br>17.0 to 20.0 kgf·m<br>123 to 144 lbf·ft |

## 4.2.2 Disassembling front axle

## 4.2.2.1 Disassembling front axle (4WD model)

### 4.2.2.1.1 Removing tie-rod (4WD model)


1. Remove the cotter pin and remove the tie-rod end slotted nuts.
2. Remove the tie-rod with a tie-rod end lifter (Code No. 07909-39051).

**(When reassembling)**

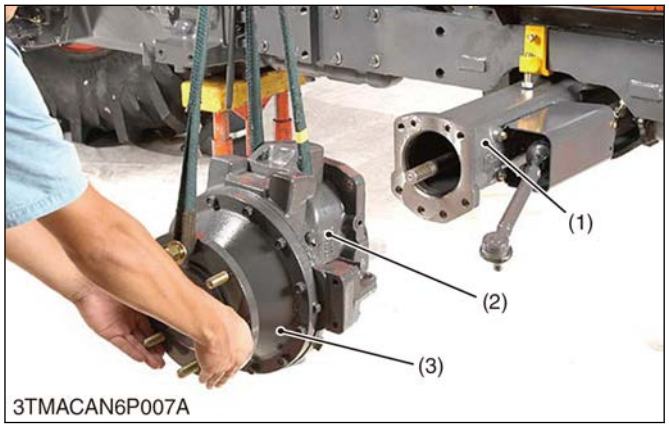
- Replace cotter pin with a new one.
- Bend the cotter pin as shown in the figure.
- Tighten the tie-rod end slotted nut, the tie-rod joint lock nut and the knuckle arm mounting screw to the specified tightening torques.

| | | |
|---|---|---|
| Tightening torque | Tie-rod end slotted nut | 157 to 176 N·m<br>16.0 to 18.0 kgf·m<br>116 to 130 lbf·ft |
| | Tie-rod joint lock nut | 167 to 196 N·m<br>17.0 to 20.0 kgf·m<br>123 to 144 lbf·ft |
| | Knuckle arm mounting screw (M12, 9T) | 103 to 117 N·m<br>10.5 to 11.9 kgf·m<br>76.0 to 86.2 lbf·ft |

RELATED PAGE
2.1 Tie-rod end lifter on page 2-79

## 4.2.2.1.2 Separating front differential case from bevel gear case (4WD model)

1. Remove the bevel gear case (2) and the front wheel case (3) as a unit from the front differential case (1).




(1) Front differential case
(2) Bevel gear case
(3) Front wheel case

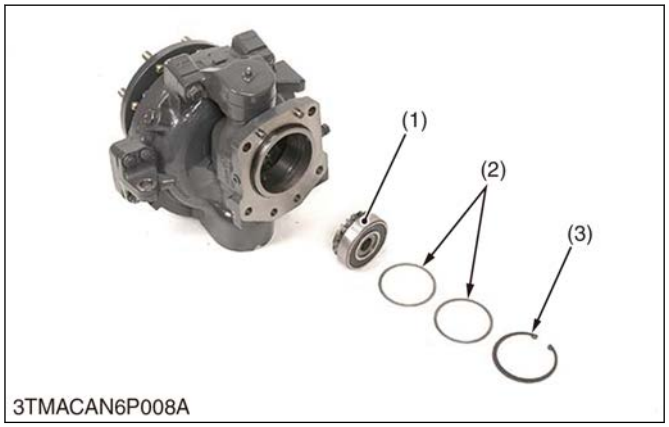
**(When reassembling)**

- Apply grease to the O-ring.
- Install the bevel gear case to the front differential case, noting the O-ring.
- Tighten the bevel gear case mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Bevel gear case mounting screw (M16, 9T) | 260 to 304 N·m<br>26.5 to 31.0 kgf·m<br>192 to 224 lbf·ft |

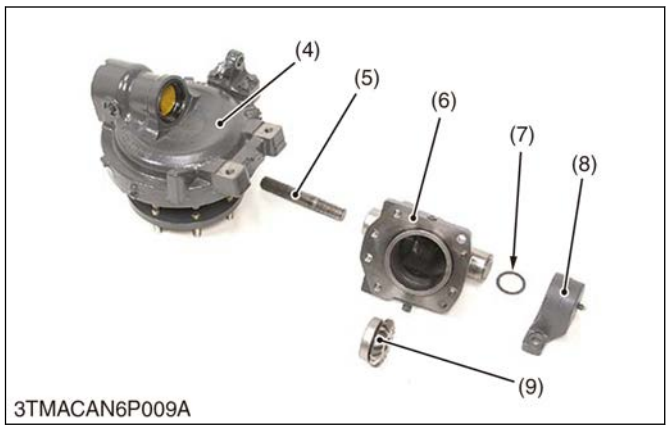
## 4.2.2.1.3 Disassembling bevel gear case (4WD model)

1. Remove the internal circlip (3) and shim (2).
2. Remove the 17T bevel gear (1) with bearing.




(1) 17T bevel gear
(2) Shim
(3) Internal circlip

3. Remove the front wheel case support (8).
4. Remove the 18T bevel gear (9) and bevel gear shaft (5).




(4) Front wheel case
(5) Bevel gear shaft
(6) Bevel gear case
(7) Collar
(8) Front wheel case support
(9) 18T bevel gear

**(When reassembling)**

**NOTE**

- **Apply grease to the front wheel case support DX bushing and front wheel case DX bushing.**
- **Install the oil seal to the front wheel case support so that its lip faces to the outward.**
- **Apply gear oil to the bearing.**
- **Tighten the front wheel case support mounting screw to the specified tightening torque.**

| | | |
|---|---|---|
| Tightening torque | Front wheel case support mounting screw (M16, 9T) | 260 to 304 N·m<br>26.5 to 31.0 kgf·m<br>192 to 224 bf·ft |

## 4.2.2.1.4 Removing front wheel case cover (4WD model)


1. Remove the front wheel case cover mounting bolts.
2. Remove the front wheel case cover from the front wheel case.

**(When reassembling)**

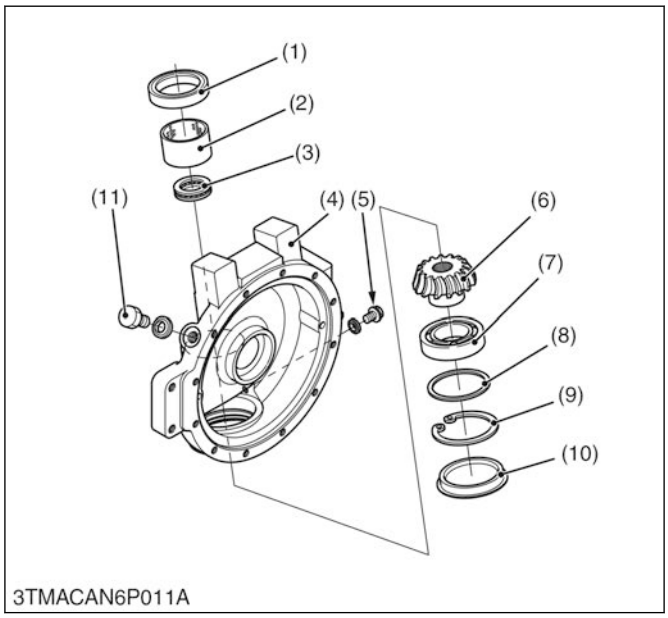
- Apply transmission fluid to the O-ring.
- If the O-ring is damaged, replace it to a new one.

- Tighten the front wheel case cover mounting bolt to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Front wheel case cover mounting screw | 48.1 to 55.9 N·m<br>4.9 to 5.7 kgf·m<br>35.4 to 41.2 lbf·ft |

## 4.2.2.1.5 Disassembling front wheel case (4WD model)

1. Remove the cap (10) which is installed in the bottom of front wheel case.
2. Remove the internal circlip (9) and remove the adjusting shims (8).
3. Tap the bevel gear to downward, and remove the 15T bevel gear (6) with bearing (7).




(1) Oil seal
(2) DX bushing
(3) Thrust ball bearing
(4) Front wheel case
(5) Plug
(6) 15T bevel gear
(7) Ball bearing
(8) Shim
(9) Internal circlip
(10) Cap
(11) Plug

**(When reassembling)**

- Apply grease to the front wheel case DX bushing (2).
- Apply grease to the oil seal.
- Replace the cap (10) with new one.
- Apply transmission fluid to the cap.

## 4.2.2.1.6 Removing bevel gear (4WD model)

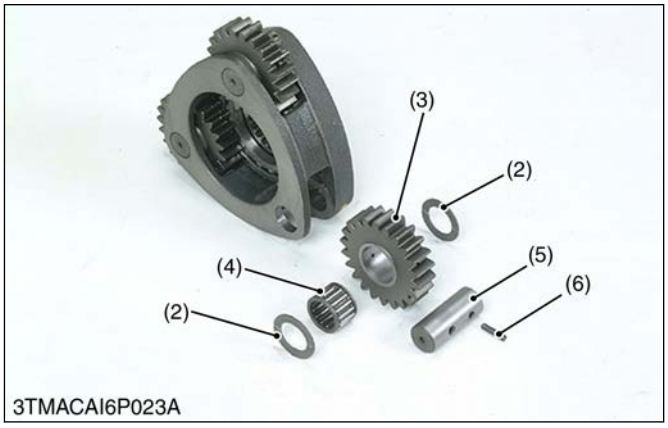
1. Remove the bevel gear and bearing with a puller.


## 4.2.2.1.7 Disassembling planetary gear (4WD model)

1. Remove the external circlip (1).

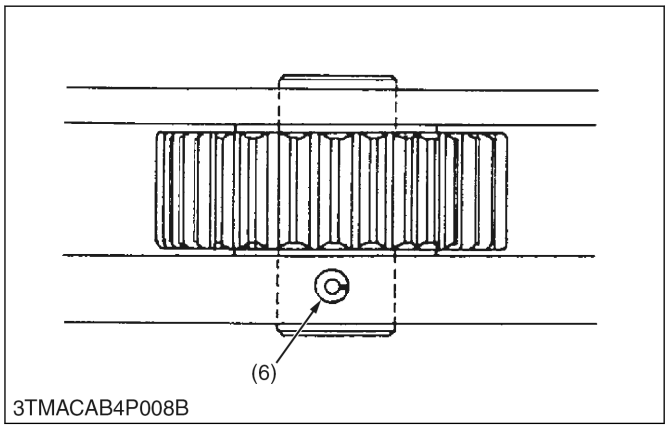

(1) External circlip

2. Remove the planetary gear support assembly.
3. Tap the roll pin (6) into the planetary gear shaft (5).
4. Draw out the planetary gear shaft (5), and remove the planetary gear (3).
5. Remove the roll pin (6) from the planetary gear shaft (5).




(2) Thrust collar
(3) Planetary gear
(4) Needle bearing
(5) Planetary gear shaft
(6) Roll pin

**(When reassembling)**
- Apply transmission fluid to the needle bearing (4).
- Tap in the roll pin (6) in the direction as shown figure.

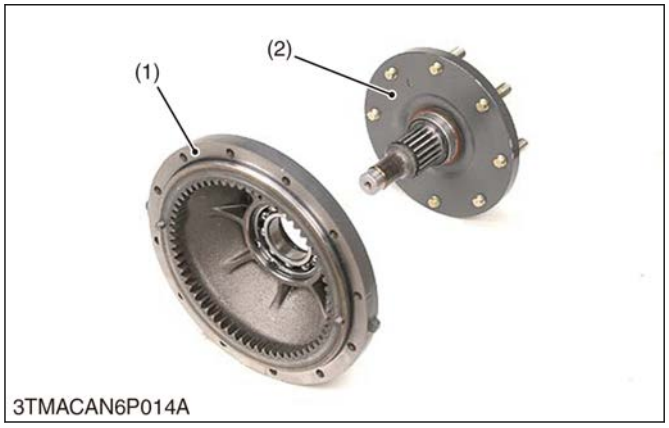



(6) Roll pin

- Replace the external circlip (1) with new one.

## 4.2.2.1.8 Removing front axle (4WD model)

1. Tap out the front axle (2) from front wheel case cover (1).



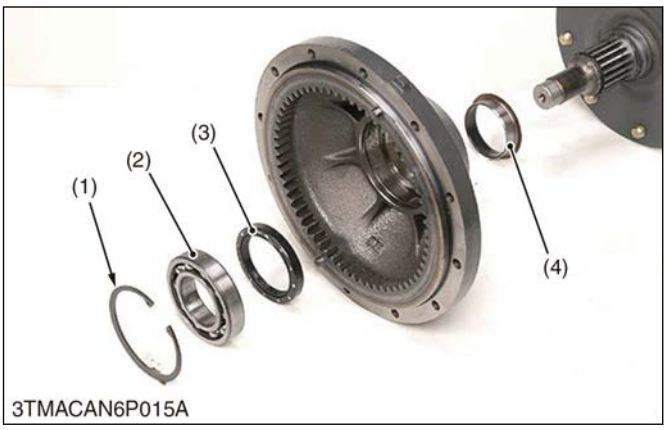

(1) Front wheel case cover (2) Front axle

**(When reassembling)**
- Apply grease to the front axle oil seal.
- Tighten the front wheel mounting stud bolt (M16) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Front wheel mounting stud bolt (M16) | 131 to 152 N·m<br>13.3 to 15.5 kgf·m<br>96.2 to 112 lbf·ft |

## 4.2.2.1.9 Removing front axle oil seal (4WD model)

1. Remove the internal circlip (1) and tap out the bearing (2).
2. Remove the oil seal 1 (3) and the oil seal 2 (4).



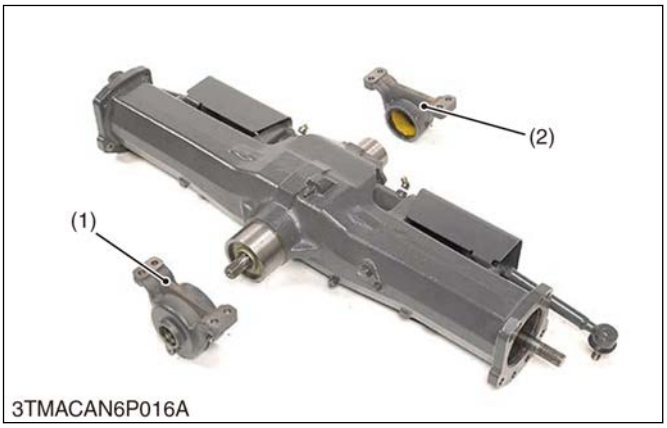

(1) Internal circlip (4) Oil seal
(2) Bearing
(3) Oil seal

**(When reassembling)**
- Since the oil seal (parts number: 3A161-48250) consists of the oil seal 1 (3) and the oil seal 2 (4), install the oil seal 1 (3) outward to the front wheel case cover so that its lip faces to the outward.

## 4.2.3 Removing differential gear and bevel pinion shaft (4WD model)

## 4.2.3.1 Removing bevel pinion shaft (4WD model)

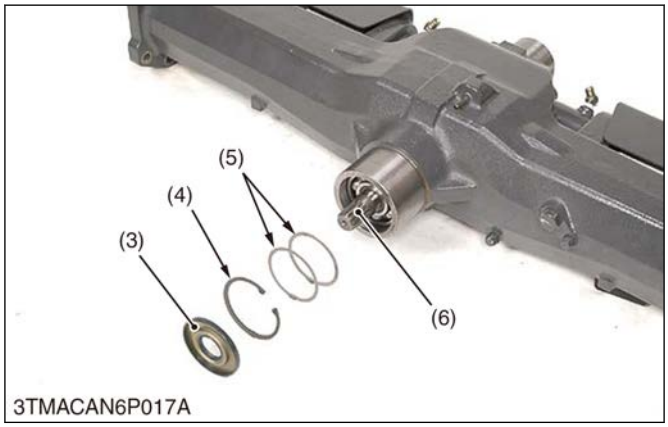
1. Remove the front bracket (2) and rear bracket (1).

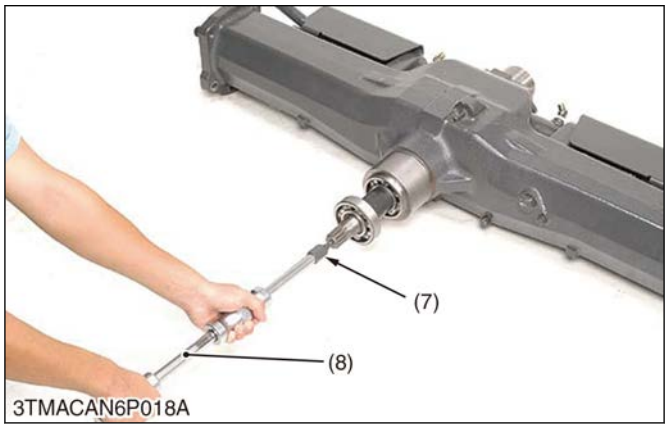



(1) Rear bracket (2) Front bracket

2. Remove the oil seal (3), internal circlip (4) and shim (5).

3. Pull out the bevel pinion shaft (6) with a sliding hammer (8).




(3) Oil seal
(4) Internal circlip
(5) Shim
(6) Bevel pinion shaft
(7) Adaptor for slide hummer
(8) Sliding hammer

**(Reference)**

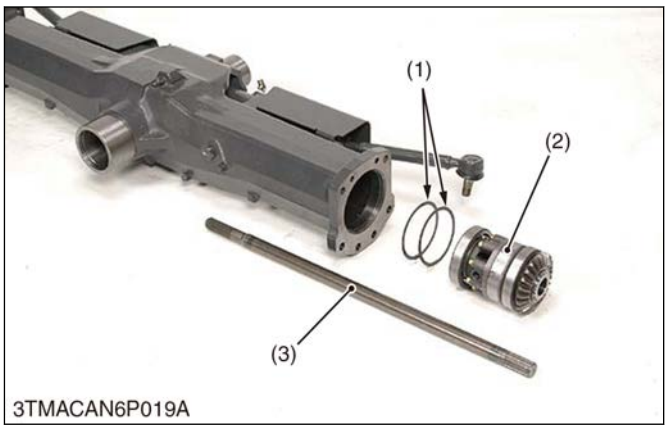
**Adaptor for slide hammer:**
M6 pitch 1.0 mm

**(When reassembling)**
- Replace oil seal (3) with new one.
- Install the oil seal (3) to the front axle case so that its lip faces to the inward.
- Apply grease to the DX bushing for bracket (1), (2).

RELATED PAGE
2.13 Sliding hammer on page 2-82
2.14 Adaptor (M6) for sliding hammer on page 2-83

### 4.2.3.2 Disassembling differential gear (LSD) assembly (4WD model)

1. Remove both yoke shaft.
2. Remove the differential gear (LSD) assembly (2) and shim (1) to right hand side.

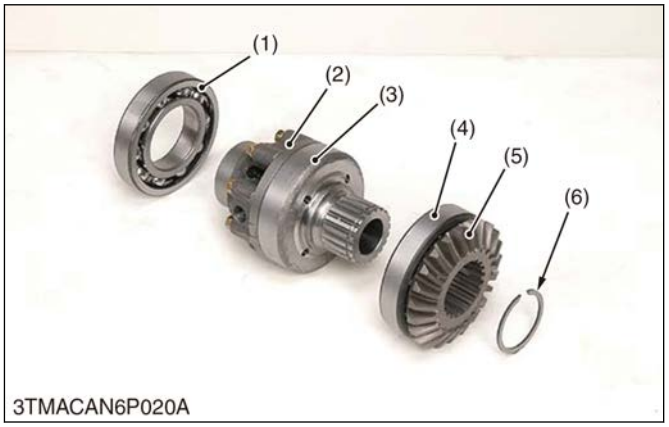



(1) Shim
(2) Differential gear (LSD) assembly
(3) Yoke shaft (R.H.)

## 4.2.4 Disassembling differential gear (LSD) (4WD model)

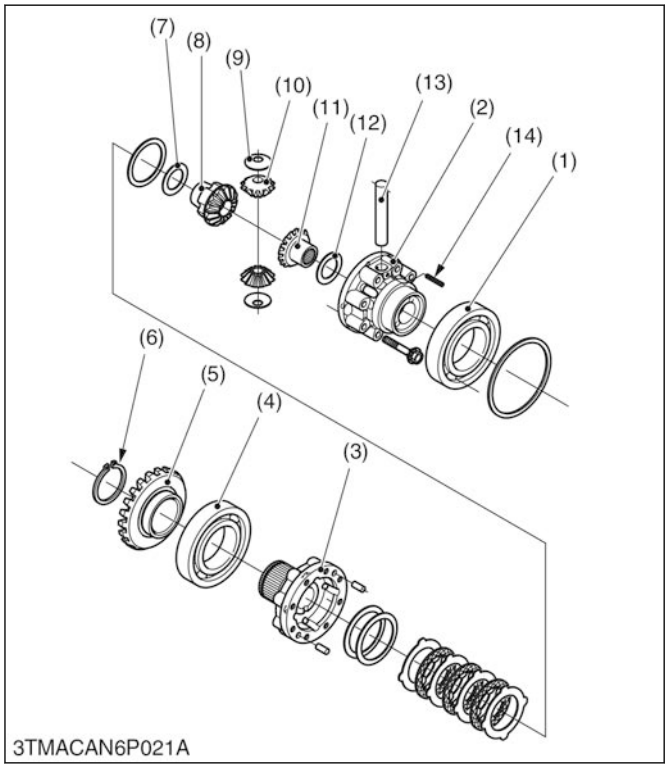
### 4.2.4.1 Removing spiral bevel gear (4WD model)

1. Remove the external circlip (6) and the 23T spiral bevel gear (5) with bearing (4).
2. Remove the bearing (1).
3. Remove the differential case cover mounting screws and remove the differential case cover (3).




(1) Bearing
(2) Differential case
(3) Differential case cover
(4) Bearing
(5) 23T spiral bevel gear
(6) External circlip

4. Remove the roll pin (14) and the differential pinion shaft (13) and pinion gears (10), differential side gear (11) and shim.




(1) Bearing
(2) Differential case
(3) Differential case cover
(4) Bearing
(5) 23T spiral bevel gear
(6) External circlip
(7) Shim
(8) LSD side gear
(9) Pinion washer
(10) Differential pinion gear
(11) Differential side gear
(12) Shim
(13) Differential pinion shaft
(14) Roll pin

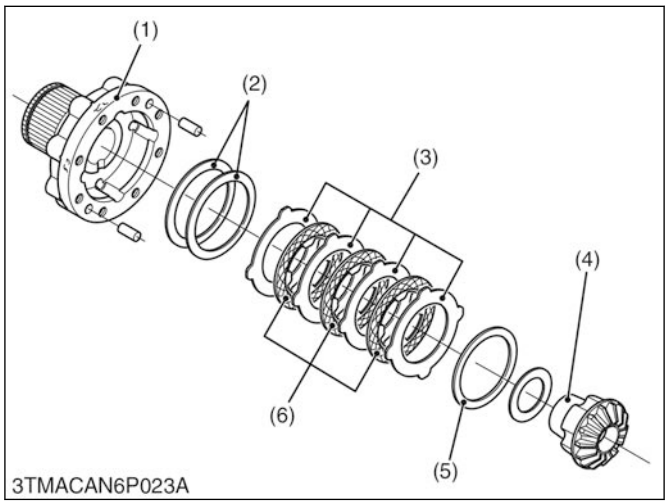
**(When reassembling)**

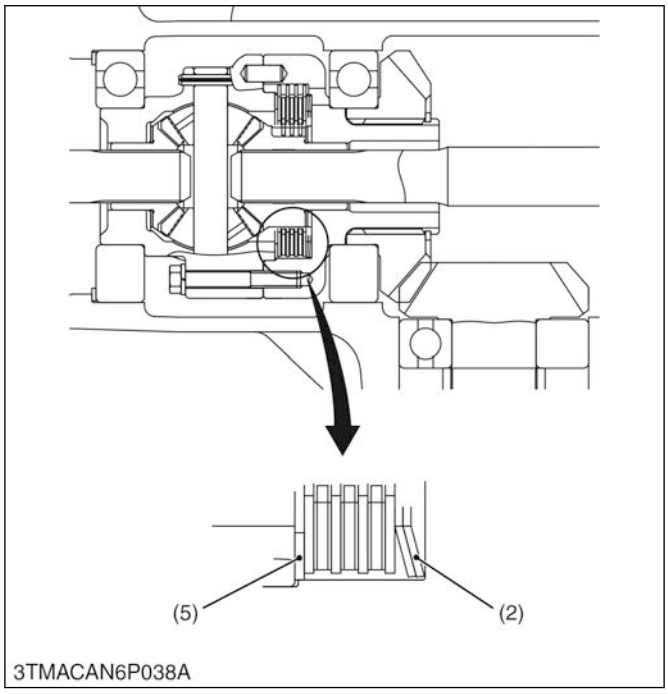
- Replace the external circlip (6) with new one.
- Check the differential pinion gears (10), pinion shaft (13) for excessive wear. If these parts are damaged or excessively worn, replace both parts with new ones.
- Apply molybdenum disulfide (Three Bond 1901 or its equivalents) to inner circumferential surface of differential pinions, side gear and shim.
- Install the parts to their original position.
- Face the roll pin (14) as shown in the photo.
- Tighten the differential case cover mounting screw (M8, 9T) to the specified tightening torque.


| | | |
|---|---|---|
| Tightening torque | Differential case cover mounting screw (M8, 9T) | 30 to 34 N·m<br>3.0 to 3.5 kgf·m<br>22 to 25 lbf·ft |

### 4.2.4.2 Removing LSD disk and steel plate (4WD model)

1. Remove the LSD side gear (4), LSD shim (5), steel plates (3), LSD disks (6) and belleville washers (cupped spring washer) (2).




(1) Differential case cover
(2) Belleville washer (Cupped spring washer)
(3) Steel plate
(4) LSD side gear
(5) LSD shim
(6) LSD disk

**(When reassembling)**

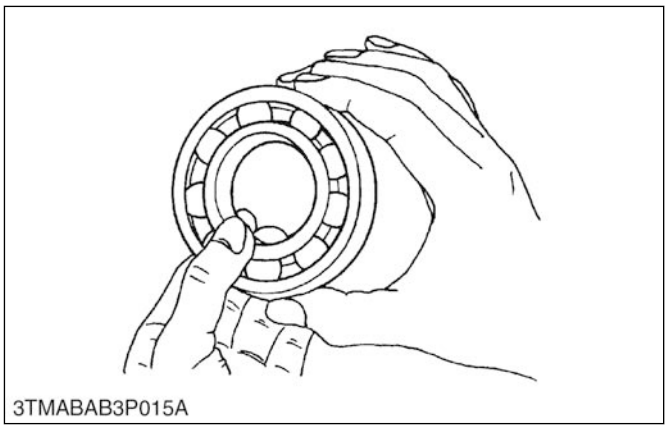
- Apply transmission fluid to the LSD disks.
- Apply molybdenum disulfide (Three Bond 1901 or its equivalents) to side gear and shim.
- Assemble the belleville washers (cupped spring washer) as shown in the figure.
- Check the slip torque of LSD after assembling.

RELATED PAGE
4.3.1.7 Checking slip torque of LSD disk on page 7-22

## 4.3 Servicing

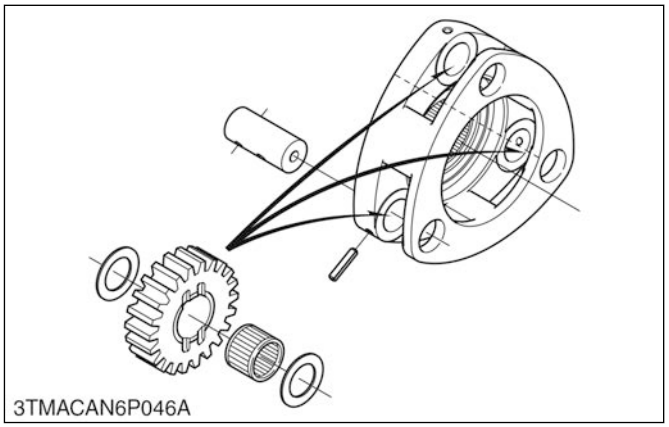
### 4.3.1 Servicing front axle (4WD model)

#### 4.3.1.1 Checking ball 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, turn the outer race to check rotation.
3. If there is any problem, replace it.

#### 4.3.1.2 Checking needle bearing

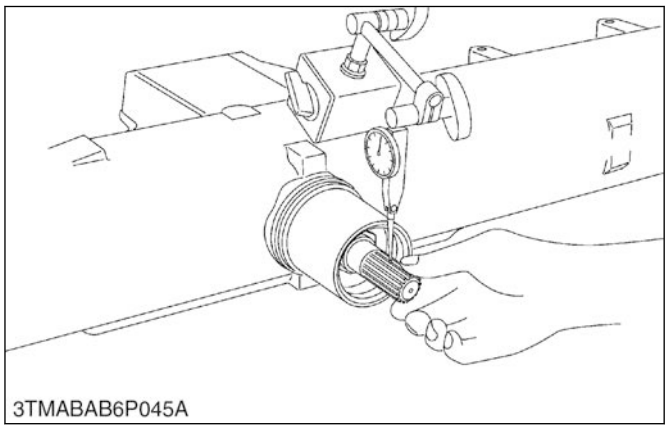



1. Check the needle bearing for wear, color, change or other damage.
2. If there is any doubt as to the condition of a needle bearing, replace it.

## 4.3.1.3 Checking backlash and tooth contact between bevel pinion shaft and bevel gear

**■ IMPORTANT**

- **Adjust the tooth contact with shims (3) and (4) so that the spiral bevel pinion shaft may not contact with the differential case.**

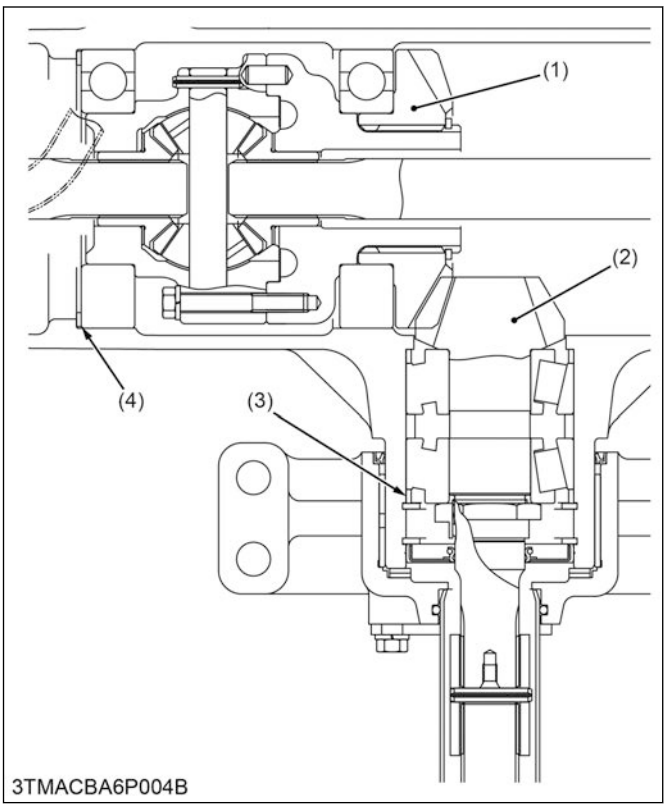



1. Set a dial indicator (lever type) with its finger on the tooth surface.
2. Measure the backlash by fixing the bevel pinion shaft (2) and moving the bevel gear (1) by hand.
3. Calculate the backlash from the ratio of the shaft diameter to the gear diameter.

| | |
|---|---|
| Backlash | Play × 2.0 |

| | | |
|---|---|---|
| Backlash between bevel gear and bevel pinion shaft | Factory specification | 0.20 to 0.30 mm<br>0.0079 to 0.011 in. |
| | Allowable limit | 0.4 mm<br>0.016 in. |

4. If the backlash exceeds the allowable limit, adjust the backlash with the shim (4).



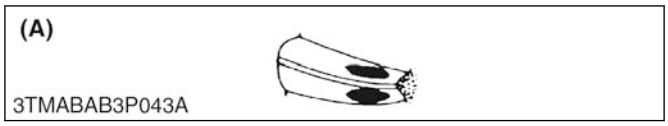

(1) Bevel gear
(2) Bevel pinion shaft
(3) Collar
(4) Shim

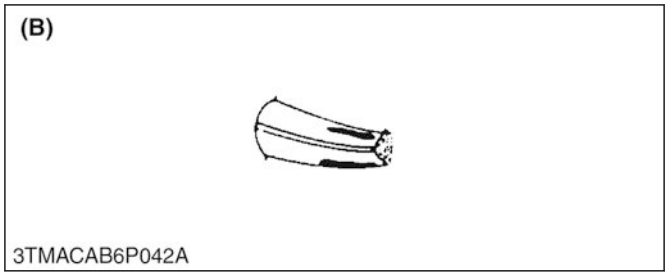
**(Reference)**

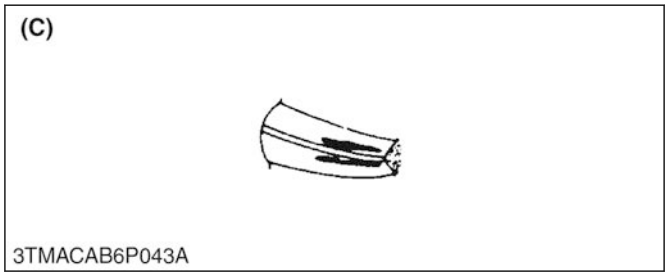
| | | |
|---|---|---|
| Thickness of adjusting collar (3) | 5.8 mm<br>0.229 in. | Code No. 3C011-43010 |
| | 5.9 mm<br>0.233 in. | Code No. 3C011-43020 |
| | 6.0 mm<br>0.237 in. | Code No. 3C011-43030 |
| | 6.1 mm<br>0.241 in. | Code No. 3C011-43040 |
| | 6.2 mm<br>0.245 in. | Code No. 3C011-43050 |
| | 6.4 mm<br>0.252 in. | Code No. 3C011-43070 |
| Thickness of adjusting shim (4) | 0.7 mm<br>0.028 in. | Code No. 3A151-32180 |
| | 0.8 mm<br>0.032 in. | Code No. 3A151-32130 |
| | 1.0 mm<br>0.039 in. | Code No. 3A151-32140 |
| | 1.2 mm<br>0.047 in. | Code No. 3A151-32150 |
| | 1.4 mm<br>0.055 in. | Code No. 3A151-32160 |
| | 2.3 mm<br>0.091 in. | Code No. 3A151-32170 |

| | |
|---|---|
| Change of backlash per 0.1 mm (0.004 in.) shim | Approximately 0.05 mm 0.002 in. |

5. Adjust the backlash properly by repeating the above procedures.
6. Apply red lead lightly over several teeth at three positions equally spaced on the bevel gear (1).
7. Turn the bevel pinion shaft (2), against the periphery of the bevel gear.
8. Check the tooth contact.
9. If not proper, adjust according to the instructions shown in the figure.




(A) Proper contact:
More than 35% red lead contact area on the gear tooth surface.
The center of tooth contact at 1/3 of the entire width from the small end.

(B) Deep contact:
Decrease the shims.

(C) Shallow contact:
Increase the shims.

## 4.3.1.4 Checking clearance between differential case and differential side gear


1. Measure the differential side gear boss O.D.

| | | |
|---|---|---|
| Differential side gear boss O.D. | Factory specification | 31.959 to 31.975 mm 1.2583 to 1.2588 in. |

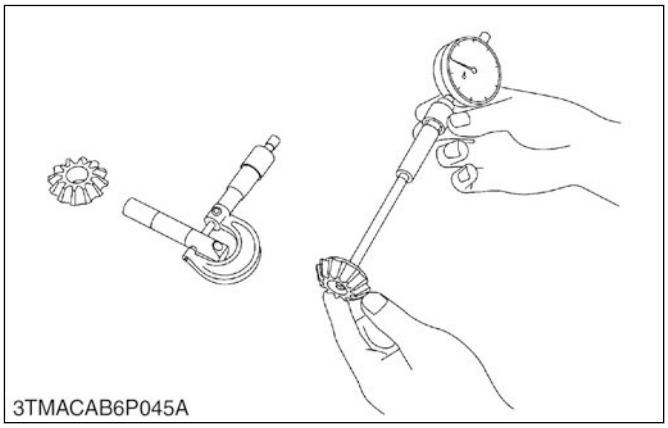
2. Measure the differential case bore I.D. and calculate the clearance.

| | | |
|---|---|---|
| Differential case bore I.D. | Factory specification | 32.025 to 32.050 mm 1.2609 to 1.2618 in. |

| | | |
|---|---|---|
| Clearance between differential case and differential side gear | Factory specification | 0.050 to 0.091 mm 0.0020 to 0.0035 in. |
| | Allowable limit | 0.35 mm 0.014 in. |

3. If the clearance exceeds the allowable limit, replace it.

## 4.3.1.5 Checking clearance between differential pinion shaft and pinion gear




1. Measure the differential pinion shaft O.D.

| | | |
|---|---|---|
| Differential pinion shaft O.D. | Factory specification | 15.966 to 15.984 mm 0.62859 to 0.62929 in. |

2. Measure the differential pinion gear I.D. and calculate the clearance.

| | | |
|---|---|---|
| Differential pinion gear I.D. | Factory specification | 16.000 to 16.018 mm<br>0.62993 to 0.63062 in. |

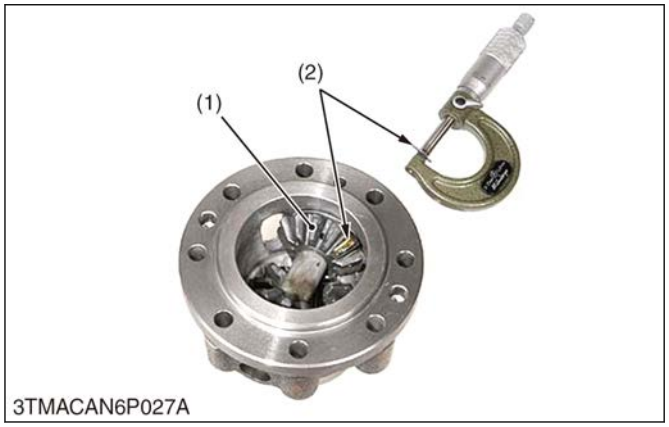
| | | |
|---|---|---|
| Clearance between differential pinion shaft and pinion gear | Factory specification | 0.016 to 0.052 mm<br>0.00063 to 0.0020 in. |
| | Allowable limit | 0.25 mm<br>0.0098 in. |

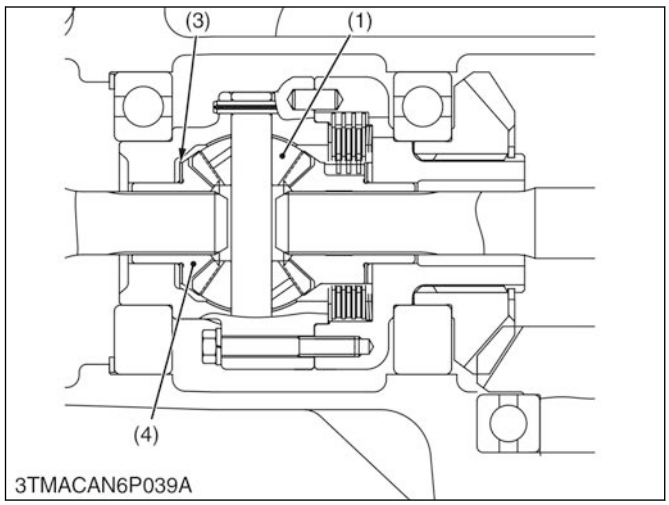
3. If the clearance exceeds the allowable limit, replace.

## 4.3.1.6 Checking backlash between differential pinion and differential side gear

1. Hold the plastigauge (wire of solder) (2) on the pinion gear (1) with grease.
2. Turn the pinion gear (1) to mesh the plastigauge (wire of solder) (2).
3. Measure the thickness of plastigauge (wire of solder) (2).

| | | |
|---|---|---|
| Backlash between pinion gear and differential side gear | Factory specification | 0.1 to 0.3 mm<br>0.004 to 0.01 in. |
| | Allowable limit | 0.4 mm<br>0.02 in. |




(1) Pinion gear
(2) Plastigauge (Wire of solder)

(1) Pinion gear
(3) Shim
(4) Side gear

**(Reference)**

| | |
|---|---|
| Thickness of adjusting shim | 0.8 mm<br>0.032 in. |
| | 1.0 mm<br>0.039 in. |
| | 1.2 mm<br>0.047 in. |
| | Standard size of shim<br>1.0 mm<br>0.039 in. |

4. If the backlash exceeds the allowable limit, adjust with shim (3).
5. Adjust the backlash properly by repeating above procedure.

## 4.3.1.7 Checking slip torque of LSD disk

**■ IMPORTANT**

- **When measuring the slip torque for LSD, apply ample lubricant to the LSD disk.**
- **Turn the LSD side gear using a jig clockwise and counterclockwise each direction several times to mesh the LSD disk and steel plate.**


3TMACAN6P029A

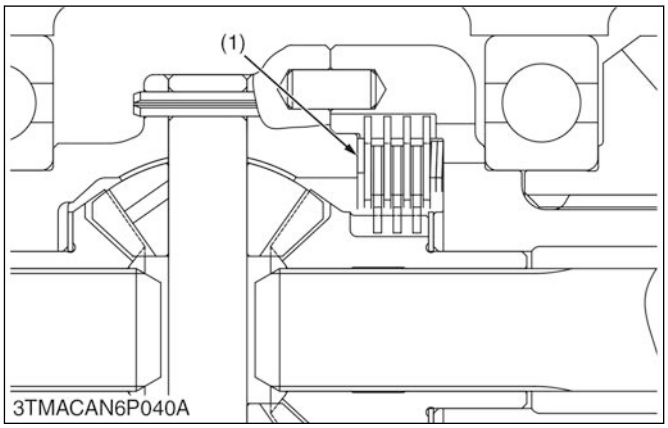

3TMACAN6P030A


3TMACAN6P031A


3TMACAN6P032A

1. Set the differential assembly on the vice securely.
2. Check the LSD slip torque using a jig as shown in the photo.

| | | |
|---|---|---|
| LSD slip torque | Factory specification | 54 to 67 N·m<br>5.5 to 6.9 kgf·m<br>40 to 49 lbf·ft |




(1) Shim

**(Reference)**

- Jig in the photo: Spline from yoke shafts welded with box wrench.

| | | |
|---|---|---|
| Thickness of adjusting shim | 0.1 mm<br>0.004 in. | Code No.<br>35533-43010 |
| | 0.2 mm<br>0.008 in. | Code No.<br>35533-43020 |
| | 0.4 mm<br>0.016 in. | Code No.<br>35533-43030 |
| | 0.8 mm<br>0.032 in. | Code No.<br>35533-43040 |
| | 1.0 mm<br>0.039 in. | Code No.<br>35533-43050 |
| | 1.2 mm<br>0.047 in. | Code No.<br>35533-43060 |

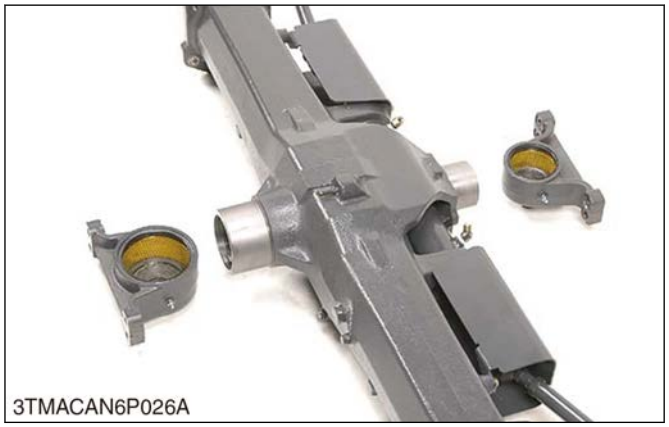
| | | |
|---|---|---|
| Thickness of steel plate | Factory specification | 1.32 to 1.48 mm<br>0.0520 to 0.0582 in. |
| Thickness of LSD disk | | 2.55 to 2.65 mm<br>0.101 to 0.104 in. |

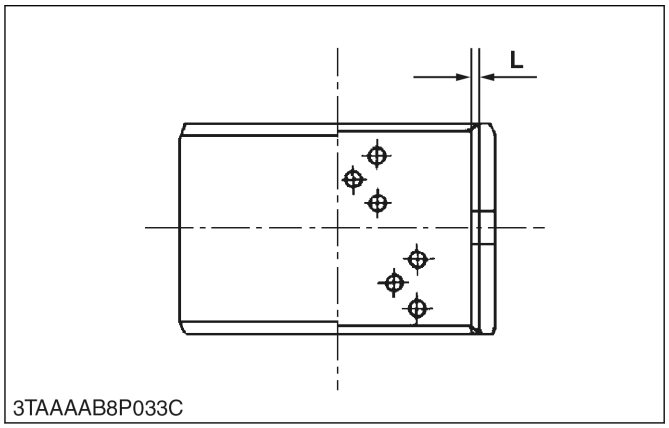
| | |
|---|---|
| Change of slip torque per 0.1 mm (0.004 in.) shim | Approximately<br>5 to 6 N·m<br>0.5 to 0.7 kgf·m<br>4 to 5 lbf·ft |

3. If the LSD slip torque is not within the factory specification, adjust with LSD shim (1).

RELATED PAGE
2.15 LSD adaptor on page 2-83

## 4.3.1.8 Checking front bracket and rear bracket bushing


3TMACAN6P026A



3TAAAAB8P033C

1. Inspect the DX bushings for signs of wear or damage visually. (The DX bushing tends to show concentrated wear.)

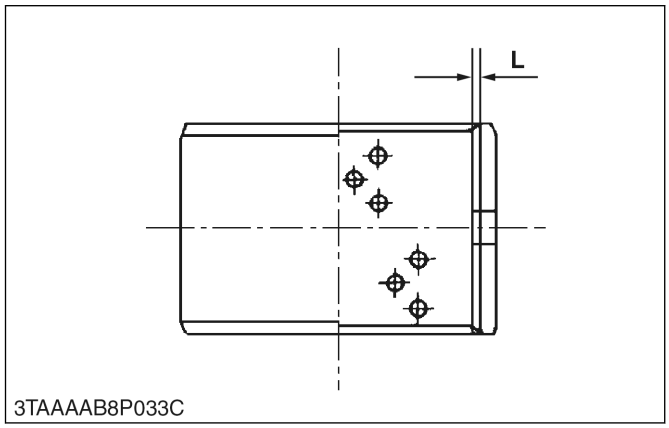
| | | |
|---|---|---|
| Front bracket and rear bracket bushing | Alloy thickness (L) | 0.57 mm<br>0.022 in. |

| | | |
|---|---|---|
| Rear differential case boss O.D. | Factory specification | 109.965 to 110.000 mm<br>4.32933 to 4.33070 in. |
| Front differential case boss O.D. | | 79.965 to 80.000 mm<br>3.1483 to 3.1496 in. |

2. If the DX bushing is worn beyond the alloy thickness (L), replace it.

## 4.3.1.9 Checking bearing retainer and front wheel case support bushing


3TMACAN6P033A



3TAAAAB8P033C

1. Visually inspect the DX bushings for signs of wear or damage. (The DX bushing tends to show concentrated wear.)

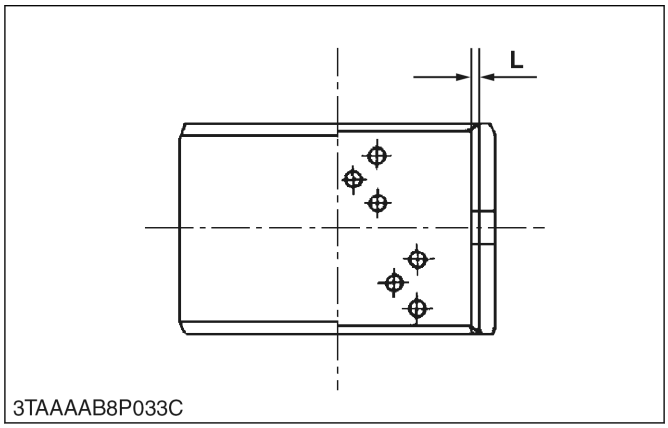
| | | |
|---|---|---|
| Front wheel case support bushing | Alloy thickness (L) | 0.57 mm<br>0.022 in. |

| | | |
|---|---|---|
| Bearing retainer O.D. | Factory specification | 59.97 to 60.00 mm<br>2.361 to 2.362 in. |

2. If the DX bushing is worn beyond the alloy thickness (L), replace it.

## 4.3.1.10 Checking bevel gear case and front wheel case bushing


3TMACAN6P034A



3TAAAAB8P033C

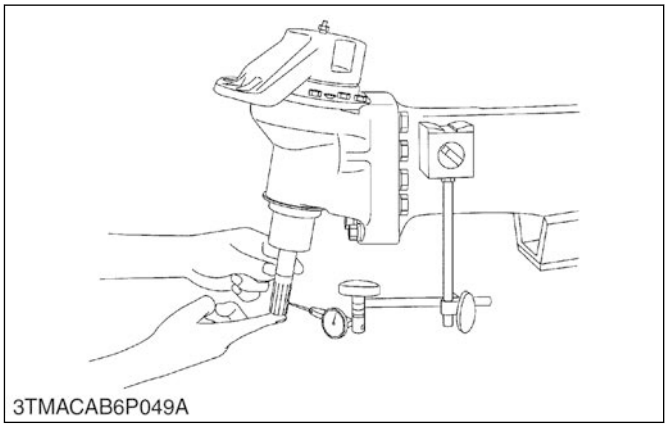
1. Visually inspect the DX bushings for signs of wear or damage. (The DX bushing tends to show concentrated wear.)

| | | |
|---|---|---|
| Front wheel case bushing | Alloy thickness (L) | 0.57 mm<br>0.0224 in. |

| | | |
|---|---|---|
| Bevel gear case O.D. | Factory specification | 54.97 to 55.00 mm<br>2.1642 to 2.1653 in. |

2. If the DX bushing is worn beyond the alloy thickness (L), replace it.

## 4.3.1.11 Checking backlash of bevel gear in bevel gear case

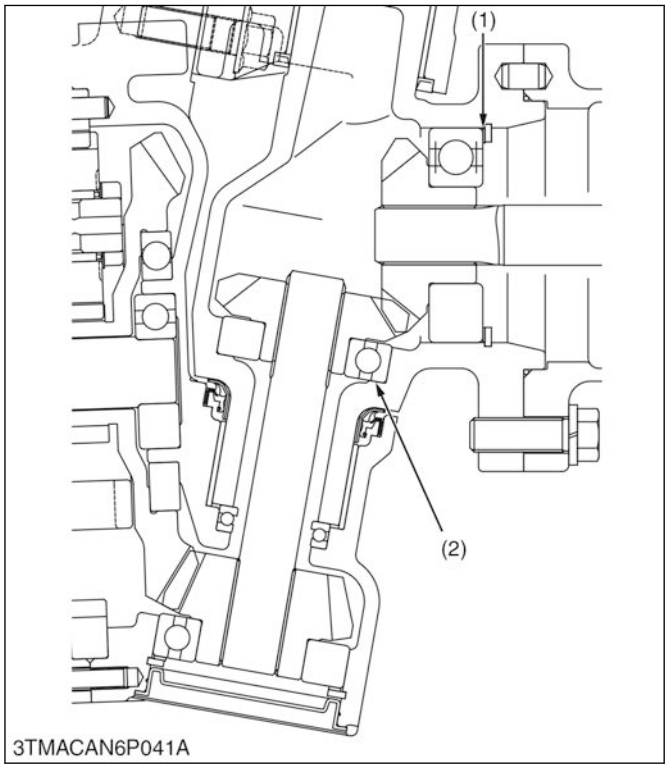

3TMACAB6P049A

1. Set a dial indicator (Lever type) on the shaft (Kingpin).
2. Move the shaft (Kingpin) by hand and measure the circumferential play of the shaft.

3. Calculate the backlash from the ratio of the shaft diameter to the gear diameter.

| | |
|---|---|
| Backlash | Play × 2 |

| | | |
|---|---|---|
| Backlash of bevel gear in bevel gear case | Factory specification | 0.20 to 0.30 mm<br>0.0079 to 0.011 in. |
| | Allowable limit | 0.4 mm<br>0.016 in. |




(1) Shim (2) Shim

**(Reference)**

| | | |
|---|---|---|
| Thickness of adjusting shim (1) | 0.4 mm<br>0.016 in. | Code No. 3A021-44021 |
| | 0.6 mm<br>0.024 in. | Code No. 3A021-44031 |
| | 0.8 mm<br>0.032 in. | Code No. 3A021-44041 |
| | 1.0 mm<br>0.039 in. | Code No. 3A021-44051 |
| | 1.2 mm<br>0.047 in. | Code No. 3A021-44061 |
| Thickness of adjusting shim (2) | 0.1 mm<br>0.004 in. | Code No. 35533-43011 |
| | 0.2 mm<br>0.008 in. | Code No. 35533-43021 |
| | 0.4 mm<br>0.016 in. | Code No. 35533-43031 |

4. If the backlash exceeds the allowable limit, adjust with the shims (1) and (2).

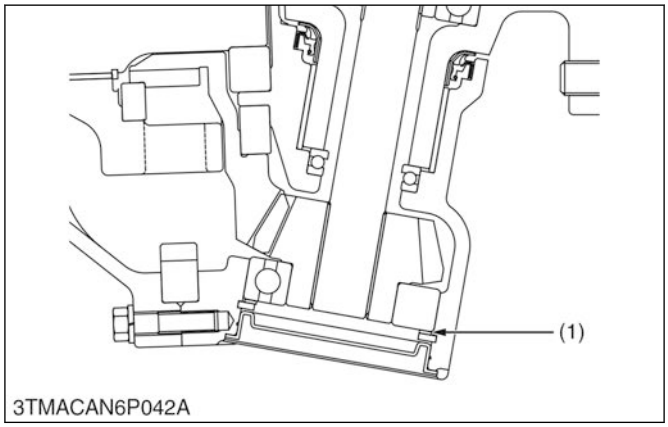
## 4.3.1.12 Checking backlash of bevel gear in front wheel case


1. Set a dial indicator (Lever type) on the shaft (Kingpin).
2. Move the shaft (Kingpin) by hand and measure the circumferential play of the shaft.
3. Calculate the backlash from the ratio of the shaft diameter to the gear diameter.

| | |
|---|---|
| Backlash | Play × 2 |

| | | |
|---|---|---|
| Backlash of bevel gear in front wheel case | Factory specification | 0.20 to 0.30 mm<br>0.0079 to 0.011 in. |
| | Allowable limit | 0.4 mm<br>0.02 in. |

4. If the backlash exceeds the allowable limit, adjust with the shims (1).

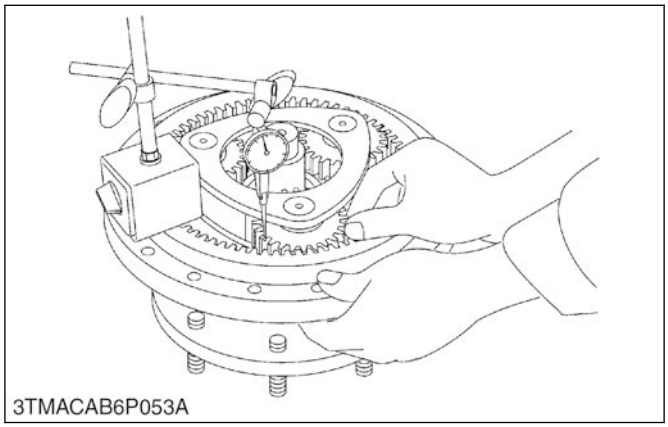



(1) Shim

**(Reference)**

| | | |
|---|---|---|
| Thickness of adjusting shim (1) | 0.1 mm<br>0.004 in. | Code No 35533-44080 |
| | 0.2 mm<br>0.008 in. | Code No 35533-44090 |
| | 0.4 mm<br>0.016 in. | Code No 35533-44100 |
| | 0.8 mm<br>0.032 in. | Code No 35533-44110 |
| | 1.0 mm<br>0.039 in. | Code No 35533-44120 |
| | 1.2 mm<br>0.047 in. | Code No 35533-44130 |
| | Standard size of shim (1)<br>2.0 mm<br>0.079 in. | |

## 4.3.1.13 Checking backlash between internal gear and planetary gear

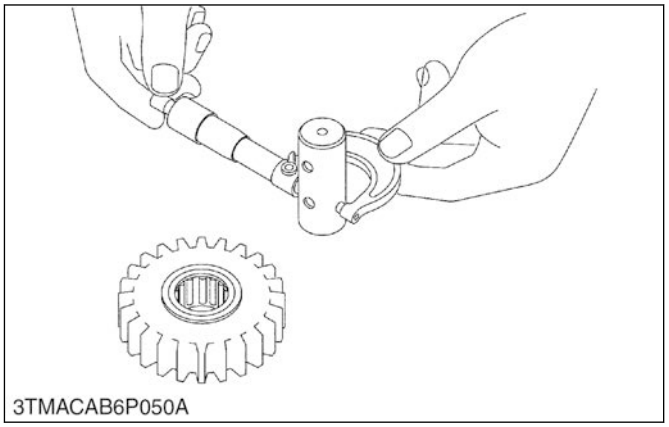



1. Set a dial indicator (lever type) on the tooth of the planetary gear.
2. Hold the planetary gear support and move only the planetary gear.

| | | |
|---|---|---|
| Backlash between internal gear and planetary gear | Factory specification | 0.10 to 0.30 mm<br>0.0040 to 0.011 in. |
| | Allowable limit | 0.5 mm<br>0.02 in. |

3. If the measurement exceeds the allowable limit, check the planetary gear and planetary shaft.

## 4.3.1.14 Checking clearance between planetary gear and shaft




1. Measure the planetary gear I.D. and the planetary gear shaft O.D. (rubbing surface).

| | | |
|---|---|---|
| Planetary gear I.D. | Factory specification | 33.009 to 33.025 mm<br>1.2993 to 1.3001 in. |
| Shaft O.D. | | 24.991 to 25.000 mm<br>0.98390 to 0.98425 in. |

2. Measure the O.D. of two needles installed diagonally in the needle bearing.

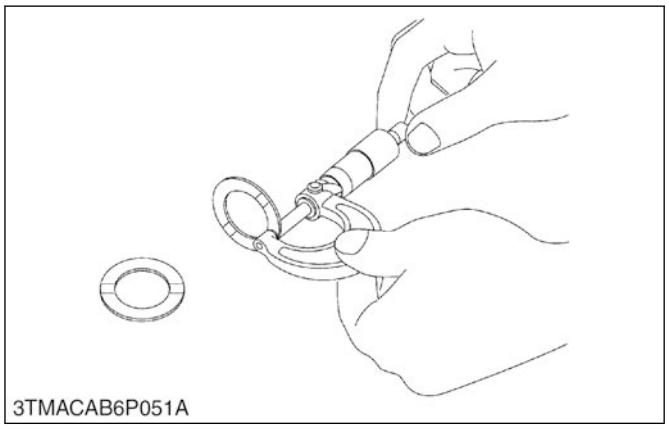
| | | |
|---|---|---|
| Needle bearing O.D. | Factory specification | 3.994 to 4.000 mm<br>0.1573 to 0.1574 in. |

3. Calculate the clearance.

| | | |
|---|---|---|
| Clearance between planetary gear and shaft | Factory specification | 0.0090 to 0.046 mm<br>0.00036 to 0.0018 in. |
| | Allowable limit | 0.3 mm<br>0.01 in. |

4. If the clearance exceeds the allowable limit, replace them.

## 4.3.1.15 Checking thrust collar thickness




1. Measure the thickness of the thrust collar.

| | | |
|---|---|---|
| Thrust collar thickness | Factory specification | 0.75 to 0.85 mm<br>0.030 to 0.033 in. |
| | Allowable limit | 0.5 mm<br>0.02 in. |

2. If the measurement is less than the allowable limit, replace it.

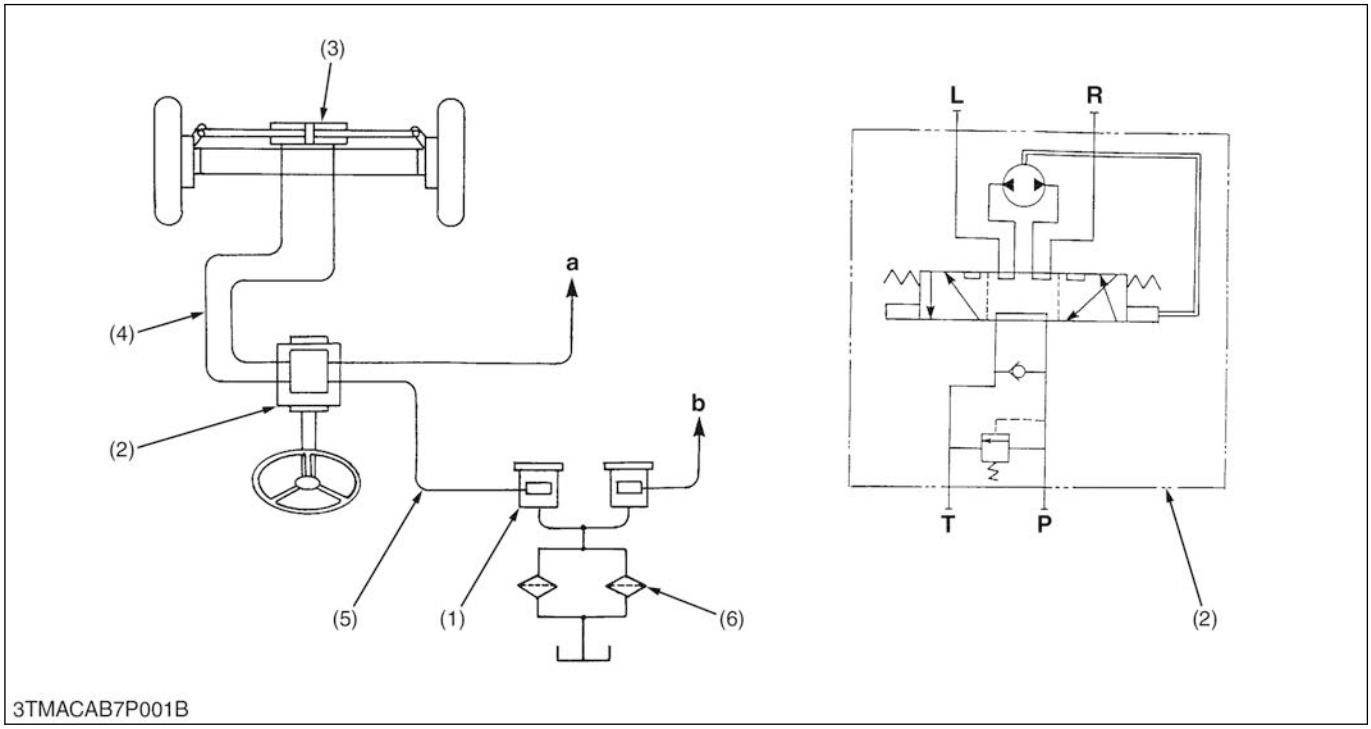
# 8. STEERING

# MECHANISM

## 1. Mechanism of steering

**NOTE**

- **Refer to "Steering" section in the Workshop Manual of *Tractor mechanism* (Code No. *9Y021-18200*).**



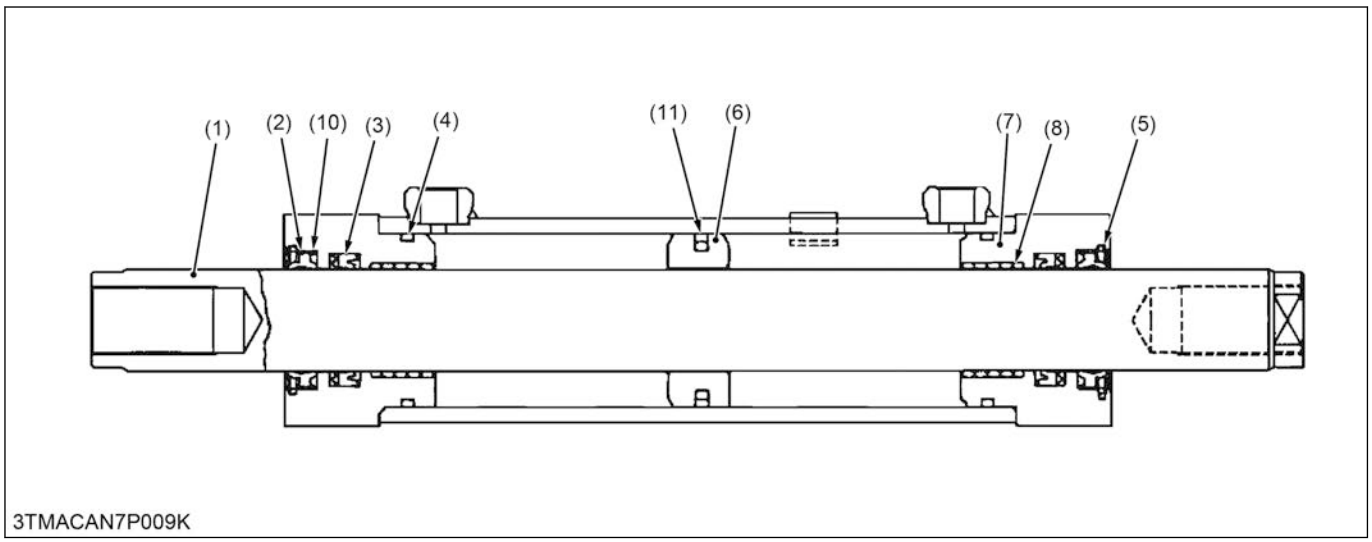

(1) Hydraulic pump
(2) Steering controller
(3) Steering cylinder
(4) Power steering hose
(5) Power steering pipe
(6) Magnet filter
a: To oil cooler, brake master cylinder and PTO clutch pack
b: To 3-point hydraulic system

All models are provided with a full hydrostatic power steering. Generally power steering is divided into 4 types : booster type, integral type, semi-integral type and full hydrostatic type.
In the full hydrostatic power steering, the steering controller is connected to the steering cylinder with only the hydraulic piping. This steering is actuated by oil pressure. Accordingly, it does not have mechanical transmitting parts such as steering gear, pitman arm, drag link, etc. Therefore, it is simple in construction.
This steering system consists of the hydraulic pump (1), steering controller (2), steering cylinder (3), magnet filter (6), etc.
The full hydrostatic power steering systems are divided into two types: non-load reaction type and load reaction type.
They are distinguished by whether the cylinder port is blocked or not with the controller in neutral. In these models, load reaction type is used.
With the load reaction type power steering, the steering wheel returns almost to the straight forward position as with an automobile when the operator releases his hands from the steering wheel.

**(Reference)**
With the non-load reaction type power steering, the steering wheel keep their position when the operator releases his hands from the steering wheel.
Vibration at the wheels is not transmitted to the steering wheel.

# 2. Feature of steering cylinder

The steering cylinder is single piston both rod double-acting type. This steering cylinder is installed parallel to the front axle and connected to tie-rods.
The tie-rods connected to both knuckle arm guarantees equal steering movement to both front wheels.
The steering cylinder provides force in both directions. Depending upon the direction the steering wheel is turned, the pressure oil enters at one end of the cylinder to extend, or the other end to retract it, thereby turning front wheel of the tractor.




(1) Rod
(2) Scraper seal
(3) Oil seal
(4) O-ring
(5) Circlip
(6) Piston
(7) Guide
(8) Bushing
(10) Backup ring
(11) Piston seal

# SERVICING

## 1. Troubleshooting for steering

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Tractor cannot be steered | 1. Joint shaft in the power steering controller is improperly assembled | Reassemble the steering joint and the steering controller. | — |
| | 2. Power steering pipe or power steering hose is damaged. | Replace the power steering pipe or power steering hose. | 3-59<br>8-30 |
| Steering is hard. | 1. Oil is improper | Change with specified oil | 2-39 |
| | 2. Hydraulic pump is damaged. | Replace the hydraulic pump. Bleed air from the power steering oil circuit. | 4-74 |
| | 3. Relief valve is damaged. | Replace the relief valve. Bleed air from the power steering oil circuit. | 8-8 |
| | 4. Steering controller is damaged. (Spool and sleeve) | Repair or replace the steering controller. Bleed air from the power steering oil circuit. | 8-31<br>8-32 |
| | 5. Oil leaks due to damaged oil seal. | Replace the oil seal. Bleed air from the power steering oil circuit. | 8-32 |
| Steering force fluctuates | 1. Steering controller is damaged. | Replace the steering controller. | 3-47<br>11-62<br>8-31<br>8-32 |
| | 2. Air is sucked in the pump due to leaking or missing of oil. | Fill the transmission fluid to the proper level. | 2-39 |
| | 3. Air is sucked in the pump from the suction pipe | Check the oil rings. Replace the oil rings and the suction pipe. Bleed air from the power steering hydraulic circuit. | — |
| Steering is hard especially in the beginning of steering | 1. Power steering controller is damaged. | Repair or replace the power steering controller. Bleed air from the power steering hydraulic circuit. | 8-31<br>8-32 |
| Steering wheel turns spontaneously when released. | 1. Power steering controller is damaged. | Repair or replace the power steering controller. Bleed air from the power steering hydraulic circuit. | 8-31<br>8-32 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Front wheels wander to right and left. | 1. Power steering controller is damaged. | Repair or replace the power steering controller. Bleed air from the power steering hydraulic circuit. | 8-31<br>8-32 |
| | 2. Air is sucked in the pump due to lack of oil | Fill the transmission fluid to the proper level. | 2-39 |
| | 3. Air is sucked in the pump from the suction pipe. | Check the oil rings. Replace the oil rings and the suction pipe. Bleed the air from the power steering hydraulic circuit. | — |
| | 4. Air bleeding is Insufficient. | Bleed the air from the power steering hydraulic circuit. | 8-8 |
| | 5. Cylinder is damaged. | Repair or replace the cylinder. Bleed the air from the power steering hydraulic circuit. | 8-33<br>8-35 |
| Wheels are turned to a direction opposite to steering direction. | 1. Power steering delivery hoses are connected in reverse. | Connect delivery hoses to cylinder ports properly. Bleed the air from the power steering hydraulic circuit. | — |
| Steering wheel turns idle in manual steering. | 1. Air bleeding is insufficient. | Bleed the air from the power steering hydraulic circuit. | 8-8 |
| | 2. Air is sucked in the pump due to lack of oil | Fill the transmission fluid to the proper level. | 2-39 |
| Noise occurs. | 1. Air is sucked in the pump due to lack of oil | Fill the transmission fluid to the proper level. | 2-39 |
| | 2. Air is sucked in the pump from the suction pipe | Check the oil rings. Replace the oil rings and the suction pipe. Bleed the air from the power steering hydraulic circuit. | — |
| | 3. Hydraulic pipe is deformed. | 1. Replace hydraulic pipe. Bleed the air from the power steering hydraulic circuit.<br>2. Check the O-ring. Replace the O-ring and the suction pipe. Bleed the air from the power steering hydraulic circuit. | 3-59<br>8-30 |
| Oil temperature increases rapidly. | 1. Relief valve is damaged. | Check the relief valve operating pressure. Replace the power steering controller.<br>• Bleed the air from the power steering hydraulic circuit. Check the relief valve operating pressure. Check the oil temperature. | 8-8 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Front wheels vibrate. | 1. Mechanical connection parts or wheel bearings are worn | Check the mechanical connection parts and the wheel bearings. Replace the damaged parts. Check and adjust the toe-in. | — |

# 2. Servicing specifications for steering

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Relief valve operating pressure | At engine idling speed | Above<br>15.0 MPa<br>153 kgf/cm$^2$<br>2180 psi | — |
| | At engine maximum speed | Below<br>18.6 MPa<br>190 kgf/cm$^2$<br>2700 psi | — |
| Clearance "L" | | 1.0 to 1.5 mm<br>0.040 to 0.059 in. | — |
| Toe-in | 4WD | 2.0 to 8.0 mm<br>0.079 to 031 in. | — |
| Steering cylinder tube I.D. | | 55.000 to 55.074 mm<br>2.1654 to 2.1682 in. | 55.100 mm<br>2.1693 in. |
| Clearance between cylinder rod and bushing | | 0.010 to 0.14 mm<br>0.00040 to 0.0055 in. | 0.250 mm<br>0.00984 in. |

# 3. Tightening torques for steering

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to 2-15, 2-15.)

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Steering handle mounting nut | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Power steering hose retaining nut | 22.6 to 27.5 | 2.31 to 2.80 | 16.7 to 20.2 |
| Power steering controller joint shaft mounting bolt | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Master cylinder hose retaining nut | 22.6 to 27.5 | 2.31 to 2.80 | 16.7 to 20.2 |
| Power steering controller mounting bolt | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Gerotor assembly mounting screw (5/16') | 26 to 28 | 2.6 to 2.9 | 19 to 20 |
| Tie-rod end slotted nut | 156.8 to 176.4 | 15.99 to 17.98 | 115.7 to 130.1 |
| Tie-rod joint lock nut | 167 to 196 | 17.0 to 20.0 | 123 to 144 |
| Cylinder clamp nut | 35 to 39 | 3.5 to 4.0 | 26 to 28 |
| Cylinder clamp lock nut | 40 to 45 | 4.0 to 4.6 | 29 to 33 |
| Cylinder cover mounting screw | 49 to 55 | 4.9 to 5.7 | 36 to 41 |
| Power steering delivery hose | 23 to 27 | 2.3 to 2.8 | 17 to 20 |
| Hose joint | 30 to 34 | 3.0 to 3.5 | 22 to 25 |
| Tie-rod joint | 167 to 196 | 17.1 to 19.9 | 124 to 144 |
| Cylinder guide assembly | 290 to 330 | 29.6 to 33.6 | 214 to 243 |

# 4. Checking and adjusting

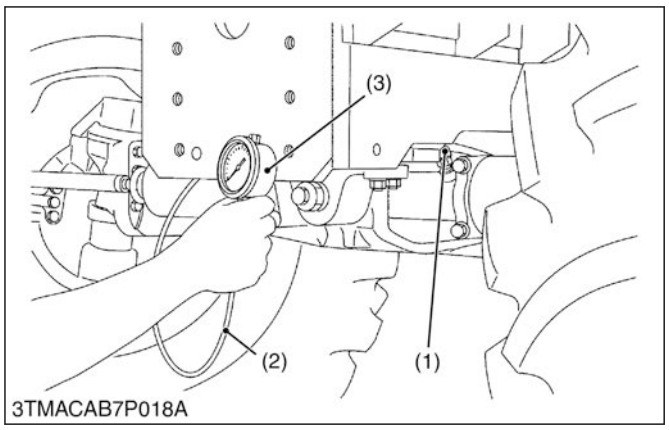
## 4.1 Steering controller

### 4.1.1 Measuring relief valve setting pressure

1. Disconnect the delivery hose from steering cylinder and set a pressure gauge (3) between them using power steering adaptor (1) and cable (2).

**■ NOTE**

- **Use a pressure gauge with over 19.6 MPa (200 kgf/cm$^2$, 2800 psi) capacity.**




(1) Power steering adaptor
(2) Cable
(3) Pressure gauge

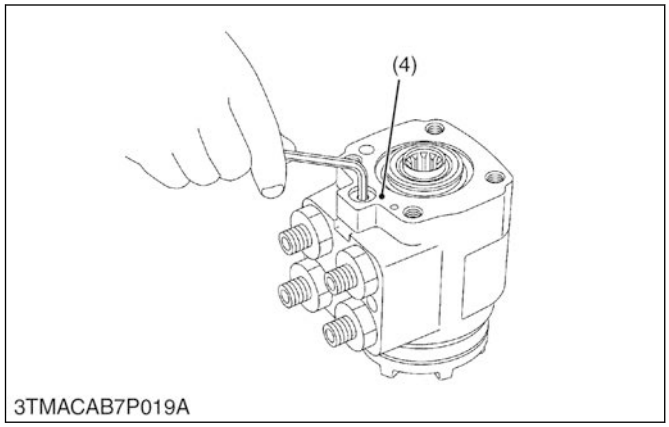
2. Start the engine and fully turn the steering wheel to the left or right.

| | | |
|---|---|---|
| Condition | Oil temperature | 50 to 60 ℃<br>122 to 140 ℉ |

3. Read the pressure when the relief valve operates at both idling and maximum engine speed.

| | | | |
|---|---|---|---|
| Relief valve setting pressure | At idling engine speed | Factory specification | Above<br>15.0 MPa<br>153 kgf/cm$^2$<br>2180 psi |
| | At maximum engine speed | | Below<br>18.6 MPa<br>190 kgf/cm$^2$<br>2700 psi |

4. If the measured value is not within the factory specifications, adjust the relief pressure by the adjusting plug (4).




(4) Adjusting plug for relief valve

**(Reference)**

| | | |
|---|---|---|
| Change of pressure by turning adjusting plug | Number of rotations of adjusting plug | Change of pressure |
| | 1 rotation | Approximately<br>2.9 MPa<br>30 kgf/cm$^2$<br>430 psi |

**(Air bleeding)**

**■ IMPORTANT**

- **Start the engine, then turn the steering wheel slowly in both directions all the way alternately a few times, and stop the engine.**

RELATED PAGE
2.10 Pressure gauge 50 on page 2-81
2.11 Power steering adaptor on page 2-81

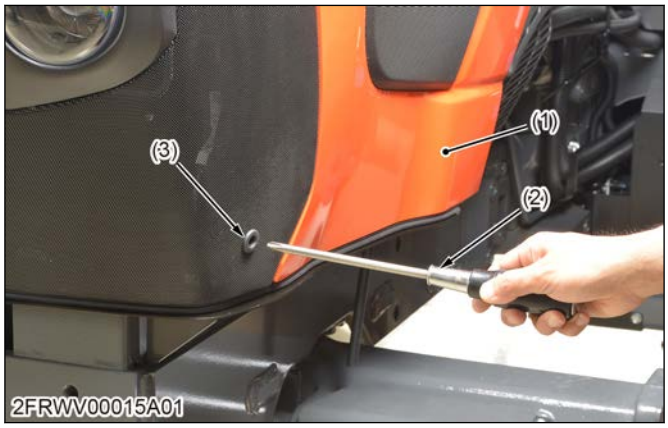
# 5. Disassembling and assembling

## 5.1 Removing steering controller

### 5.1.1 ROPS model

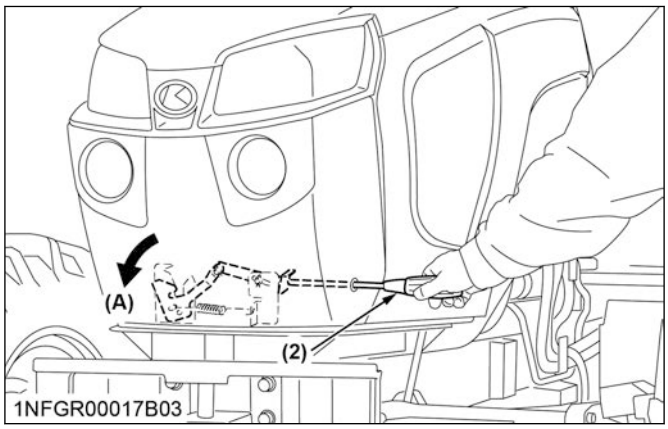
#### 5.1.1.1 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).




(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).




(2) Screwdriver
(A) Unlock position

#### 5.1.1.2 Removing bonnet and cover

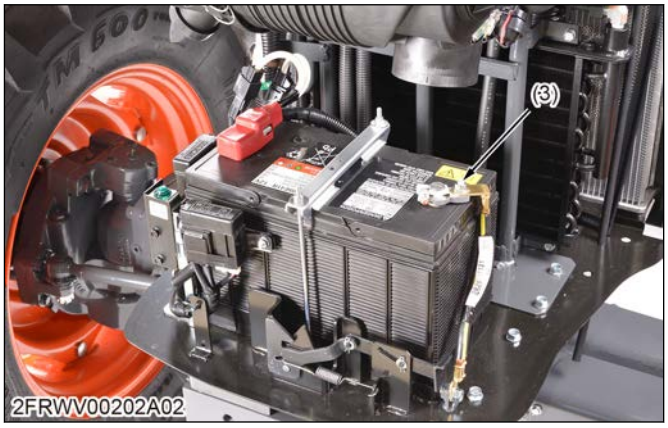
**IMPORTANT**

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

1. Remove the side bonnets (2) and the side covers (1) on both sides.

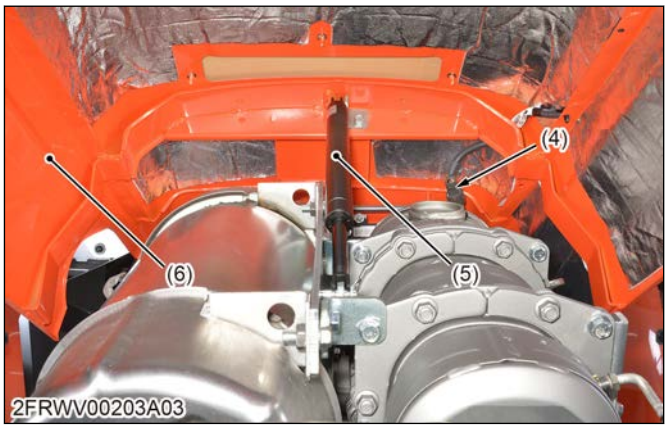

(1) Side cover
(2) Side bonnet

2. Disconnect the negative cable (3) from the battery negative terminal.




(3) Negative cable

3. Disconnect the head light connector (4).
4. Remove the bonnet damper (5).
5. Remove the bonnet (6).

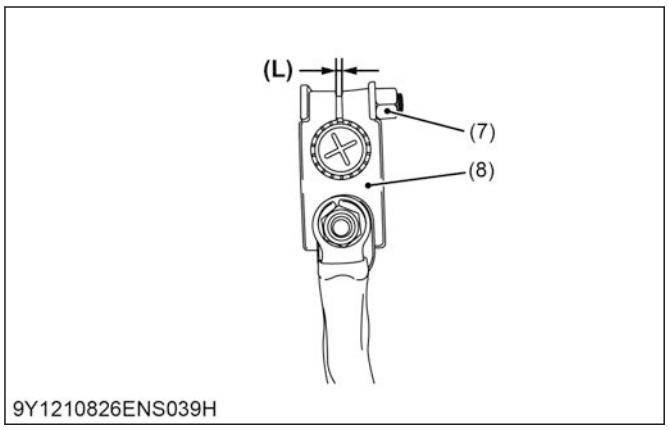



(4) Head light connector
(5) Bonnet damper
(6) Bonnet

**(When reassembling)**

**IMPORTANT**

- **Tighten the battery cable terminal nut (7) so that the clearance (L) is within the following chart.**




(7) Terminal nut
(8) Battery cable terminal
(L) Clearance between the battery cable terminal

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

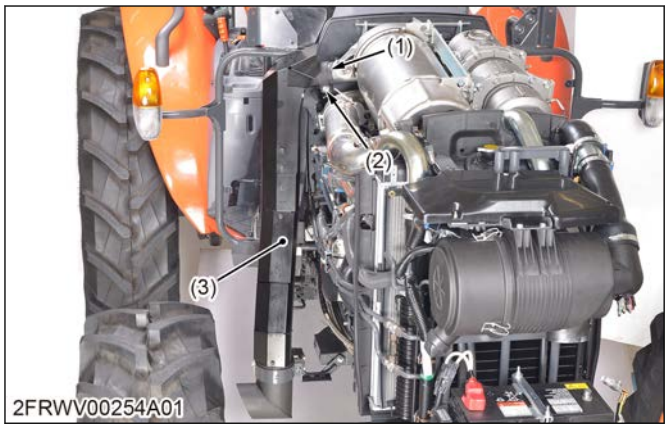
- When assembling the bonnet damper (5), be sure that the cylinder parts should be on the backward.

### 5.1.1.3 Removing muffler pipe

**CAUTION**

- **After operating the engine, muffler pipe is very hot. When removing the muffler pipe, wait a moment for cool down.**

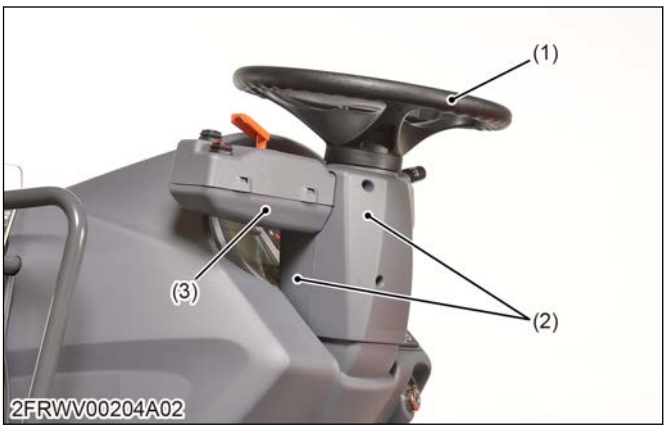
1. Remove the muffler pipe cover (3).
2. Loosen the muffler pipe fixing bolt (2) and nut
3. Remove the muffler pipe (1).




(1) Muffler pipe
(2) Muffler pipe fixing bolt
(3) Muffler pipe cover

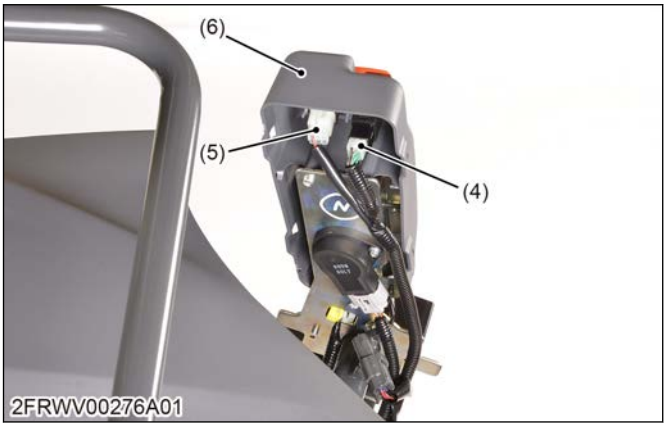
### 5.1.1.4 Removing steering and panel cover

1. Remove the steering post covers (2).
2. Remove the steering mounting nut and remove the steering (1).
3. Remove the shuttle under cover (3).




(1) Steering
(2) Steering post cover
(3) Shuttle under cover

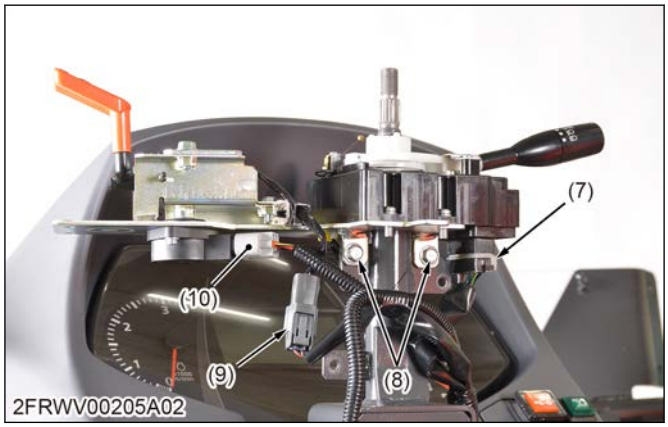
4. Disconnect the hazard switch connector (4) and auto differential lock switch connector (5).
5. Remove the shuttle upper cover (6).




(4) Hazard switch connector
(5) Auto differential lock switch connector
(6) Shuttle upper cover

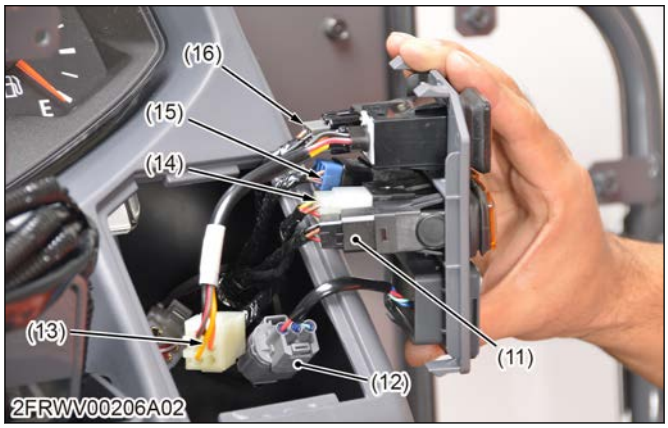
6. Disconnect the combination lever switch connector (7).
7. Disconnect the connector for shuttle lever neutral switch (9) and shuttle lever sensor connector (10).
8. Disconnect the horn connector.

9. Remove the combination lever mounting bolts (8) and then remove the combination lever switch assembly.



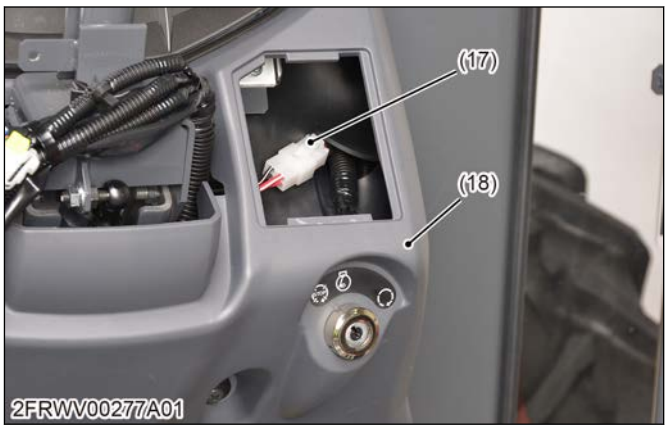

(7) Combination lever switch connector
(8) Combination lever switch mounting bolt
(9) Shuttle lever neutral switch connector
(10) Shuttle lever sensor connector

10. Disconnect the meter select switch connector (12) and 4WD switch connector (13).
11. Disconnect the connectors for parked regeneration switch (11) and DPF inhibit switch connector (14).
12. Disconnect the constant RPM management switch connector (15) and front work light switch connector (16).




(11) Parked regeneration switch
(12) Meter select switch connector
(13) 4WD switch connector
(14) DPF inhibit switch connector
(15) Constant RPM management switch connector
(16) Front work light switch connector

13. Disconnect the main switch connector (17).
14. Remove the panel cover (18).




(17) Main switch connector
(18) Panel cover

**(When reassembling)**

- Tighten the steering mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Steering mounting nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

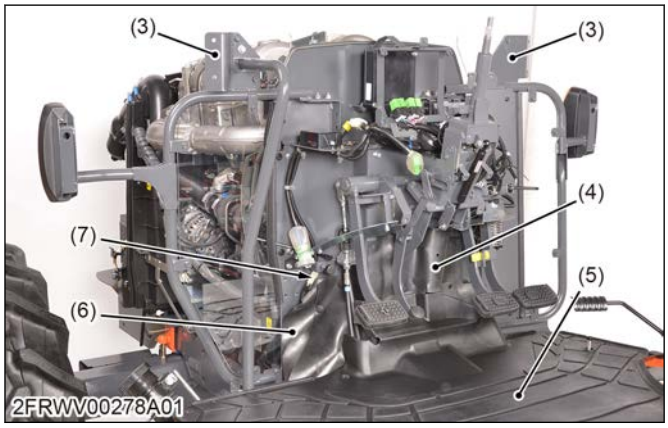
## 5.1.1.5 Removing guard and mat

1. Remove the meter panel (1).
2. Remove the insulator (2).


(1) Meter panel
(2) Insulator

3. Remove the mat (5) and insulator 1 (4) and insulator 2 (6).
4. Disconnect both side combination lamp connectors (7).

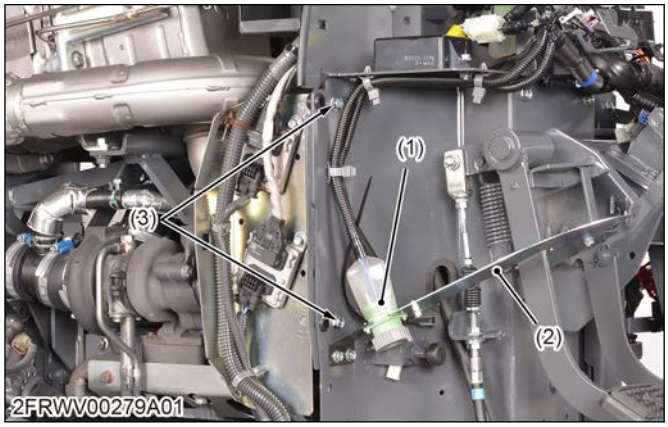
5. Remove both side guards (3).




(3) Guard
(4) Insulator 1
(5) Mat
(6) Insulator 2
(7) Combination lamp connector

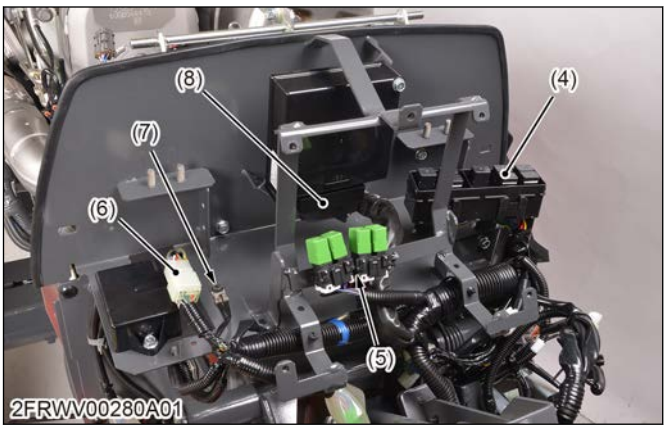
## 5.1.1.6 Removing wiring harness

1. Remove the plate (2).
2. Remove the K-OBD connector (1) mounting screws.
3. Remove the NOx sensor stay mounting bolts (3).



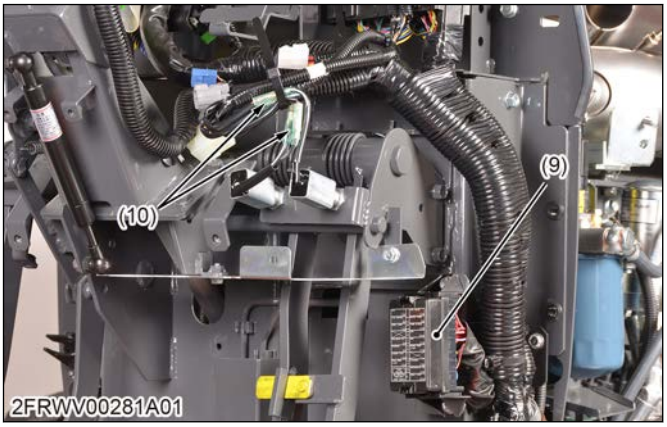

(1) K-OBD connector
(2) Plate
(3) NOx sensor stay mounting bolt

4. Disconnect the flasher unit connector (6) and grounding wire mounting screw (7).
5. Disconnect the tractor ECU connector (8), relays (5) and relay box (4).



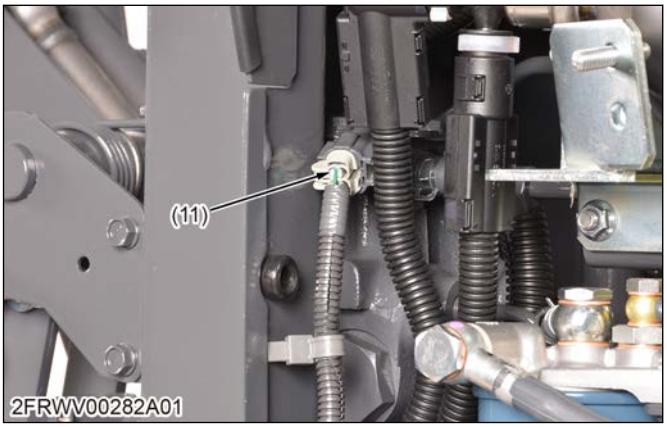

(4) Relay box
(5) Relay
(6) Flasher unit connector
(7) Grounding wire mounting screw
(8) Tractor ECU connector

6. Remove the fuse box (9).
7. Disconnect the brake switch connectors (10).




(9) Fuse box
(10) Brake switch connector

8. Disconnect the master cylinder oil level sensor connector (11).




(11) Master cylinder oil level sensor connector

9. Remove the step mounting bolts (12).
10. Disconnect the joint connectors (13).

11. Set aside the main harness to the front side.


(12) Step mounting bolt (13) Joint connector

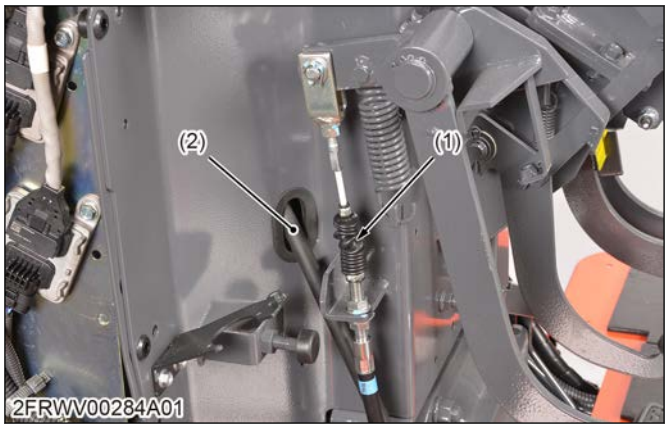
**(When reassembling)**

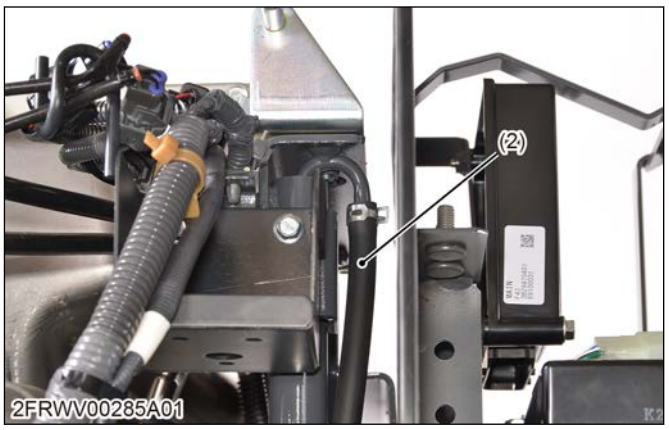
- Tighten the step mounting bolt (7T, M10) and the step mounting bolt (7T, M12) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Step mounting bolt (7T, M10) | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | Step mounting bolt (7T, M12) | 77.5 to 90.2 N·m<br>7.91 to 9.19 kgf·m<br>57.2 to 66.5 lbf·ft |

## 5.1.1.7 Disconnecting clutch cable and breather hose

1. Disconnect the clutch cable (1).
2. Remove the DEF tank breather hose (2).



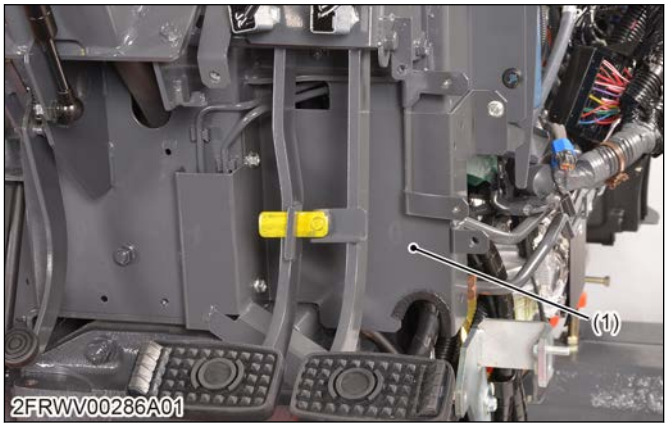

(1) Clutch cable (2) DEF tank breather hose

**(When reassembling)**

- Be sure to adjust the clutch cable for the clutch pedal free travel.

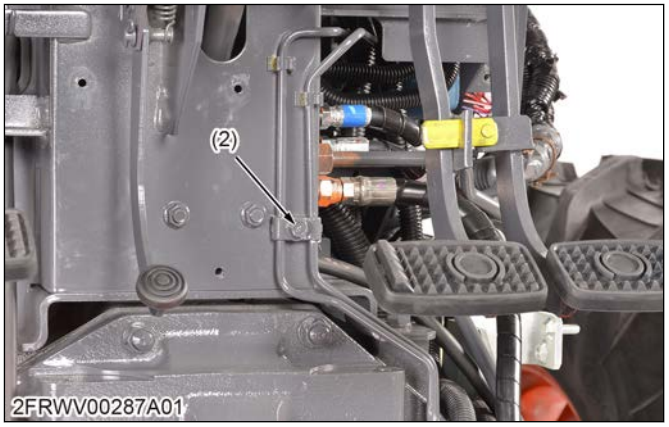
## 5.1.1.8 Disconnecting brake pipe and hose

1. Remove the steering support cover (1).




(1) Steering support cover

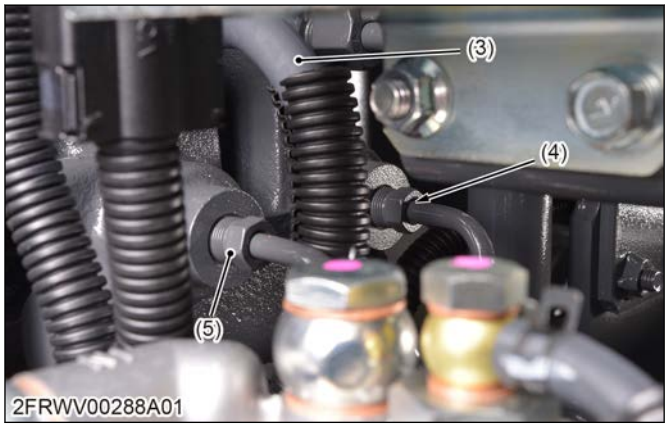
2. Remove the brake pipe clamp (2).




(2) Brake pipe clamp

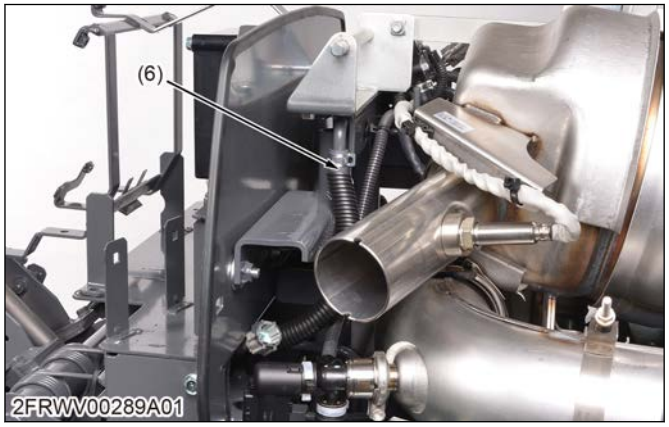
3. Disconnect the master cylinder return hose (3).
4. Disconnect the brake delivery pipe (R.H.) (5).

5. Disconnect the brake delivery pipe (L.H.) (4).




(3) Master cylinder return hose
(4) Brake delivery pipe (L.H.)
(5) Brake delivery pipe (R.H.)

6. Disconnect the breather hose (6).




(6) Breather hose

**(When reassembling)**

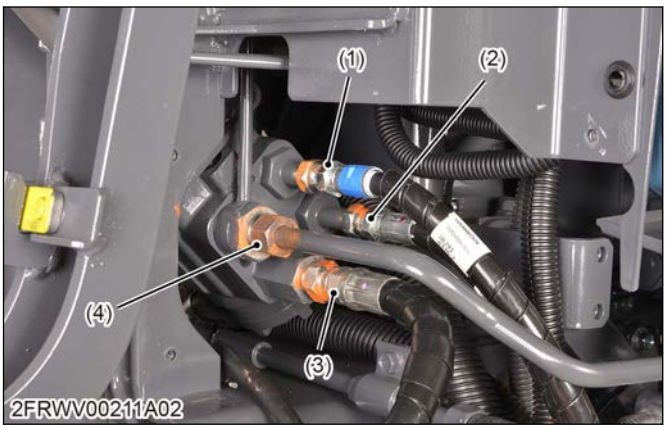
**■ IMPORTANT**

- **After assembling the brake delivery pipes, be sure to bleed the air from brake system.**
- Tighten the brake delivery pipe retaining nuts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Brake delivery pipe retaining nut | 23 to 27 N·m<br>2.3 to 2.8 kgf·m<br>17 to 20 lbf·ft |

## 5.1.1.9 Disconnecting steering controller pipe and hose

1. Disconnect the oil cooler pipe (4).
2. Disconnect the power steering delivery hose (3).
3. Disconnect the power steering delivery hose (L.H.) (1) and (R.H.) (2) from the power steering controller.




(1) Power steering delivery hose (L.H.)
(2) Power steering delivery hose (R.H.)
(3) Power steering delivery hose
(4) Oil cooler pipe

**(When reassembling)**

- Connect the power steering delivery hose (L.H.) (1) with blue tape to upper port of power steering controller.
- Tighten the power steering delivery hose (L.H.) (1) and (R.H) (2) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Power steering delivery hose retaining nut | 22.6 to 27.5 N·m<br>2.31 to 2.80 kgf·m<br>16.7 to 20.2 lbf·ft |

## 5.1.1.10 Removing steering support unit

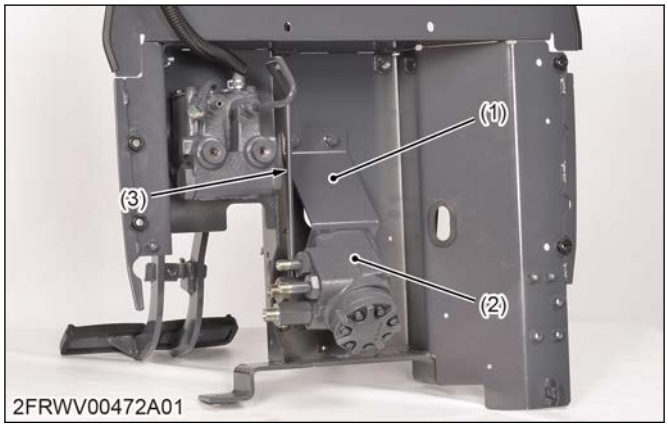
1. Set the steering support unit (1) with nylon sling and hoist.
2. Remove the steering support mounting bolts.
3. Remove the steering support unit (1).


(1) Steering support unit

## 5.1.1.11 Removing steering controller

1. Remove the master cylinder delivery pipe (3).
2. Remove the steering controller holder (1).

3. Remove the steering controller (2).




(1) Steering controller holder
(2) Steering controller
(3) Master cylinder delivery pipe

**(When reassembling)**

- Tighten the steering controller mounting bolts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Steering controller mounting bolt | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

## 5.1.2 Cabin model

## 5.1.2.1 Separating cabin from tractor

## 5.1.2.1.1 Draining coolant

**⚠ WARNING**

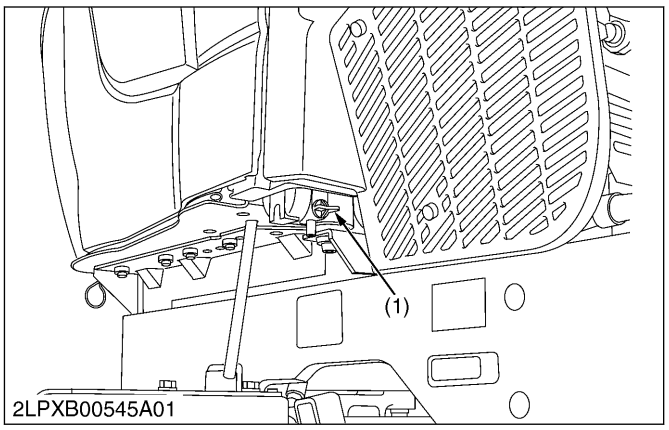
**To avoid personal injury:**

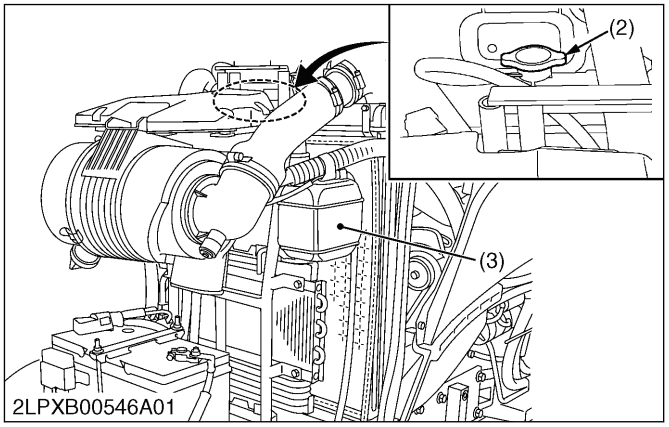
- **Do not remove radiator cap while coolant is hot. When cool, slowly rotate cap to the first stop and allow sufficient time for excess pressure to escape before removing the cap completely.**

**■ IMPORTANT**

- **Do not start engine without coolant.**
- **Use clean, fresh soft water and anti-freeze to fill the radiator and recovery tank.**
- **When mixing the anti-freeze with water, the anti-freeze mixing ratio is 50%.**
- **Tighten radiator cap securely. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**

1. Stop the engine and let the engine cool down.
2. To drain the coolant, open the radiator drain plug (1), remove the drain plug and remove radiator cap (2). The radiator cap must be removed to completely drain the coolant.




(1) Drain plug
(2) Radiator cap
(3) Recovery tank

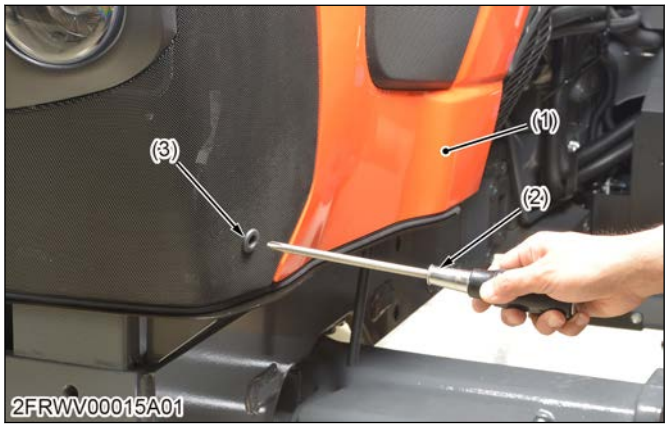
3. After all coolant is drained, reinstall the drain plug (1).
4. Fill with coolant up to the "**FULL**" mark of recovery tank (3).

| | |
|---|---|
| Coolant capacity | 10 L<br>10.6 U.S.qts<br>8.8 Imp.qts |

5. Start and operate the engine for a few minutes.
6. Stop the engine, remove the key and let cool.
7. Check coolant level of recovery tank (3) and add coolant if necessary.
8. Properly dispose of used coolant.

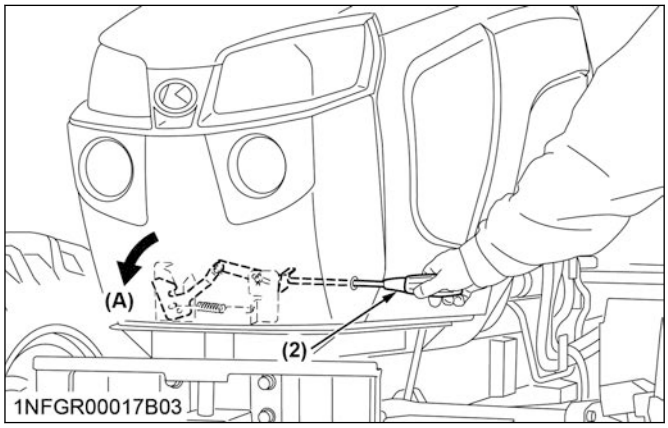
## 5.1.2.1.2 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).




(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).




(2) Screwdriver
(A) Unlock position

## 5.1.2.1.3 Removing bonnet and cover

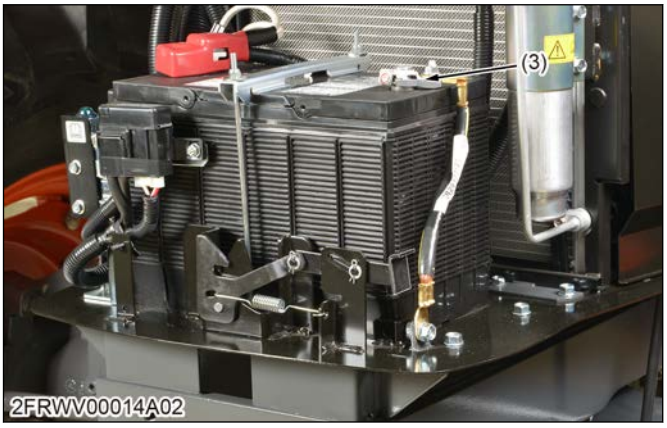
**■ IMPORTANT**

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

1. Remove the side bonnets (2) and the side covers (1) on both sides.

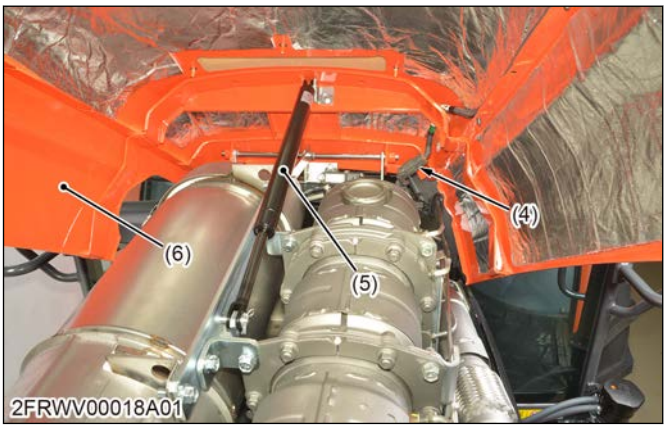

(1) Side cover
(2) Side bonnet

2. Disconnect the negative cable (3) from the battery negative terminal .




(3) Negative cable

3. Disconnect the head light connector (4).
4. Remove the bonnet damper (5).
5. Remove the bonnet (6).

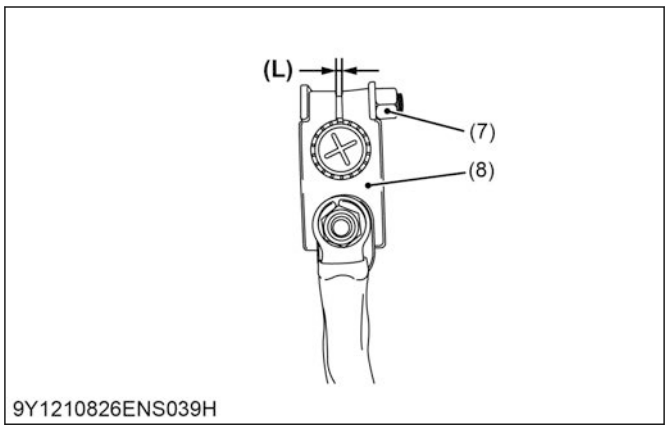



(4) Head light connector
(5) Bonnet damper
(6) Bonnet

**(When reassembling)**

**■ IMPORTANT**

- **Tighten the battery cable terminal nut (7) so that the clearance (L) is within the following chart.**




(7) Terminal nut
(8) Battery cable terminal
(L) Clearance between the battery cable terminal

- When assembling the bonnet damper (5), be sure that the cylinder parts should be on the backward.

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

## 5.1.2.1.4 Removing muffler pipe

**CAUTION**

- **After operating the engine, muffler pipe is very hot. When removing the muffler pipe, wait a moment for cool down.**

1. Loosen the muffler pipe clamp (1).
2. Remove the muffler pipe mounting bolts (3).
3. Remove the muffler pipe (4).
4. Remove the muffler pipe stay (2).


(1) Muffler pipe clamp
(2) Muffler pipe stay
(3) Muffler pipe mounting bolt
(4) Muffler pipe

**(When reassembling)**

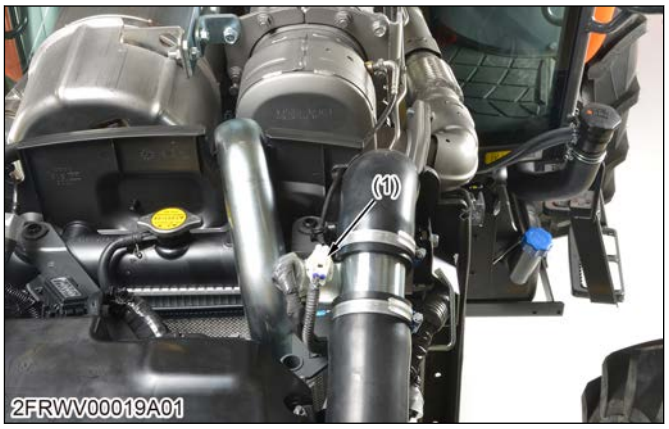
- Firstly, tighten all bolts around muffler pipe (4).
- Be sure to tighten the muffler pipe mounting bolts (3) at first, and then tighten the muffler pipe stay (2) mounting bolts.
- Lastly, tighten the muffler pipe clamp (1).

## 5.1.2.1.5 Disconnecting wiring harness for DPF muffler and SCR muffler

**CAUTION**

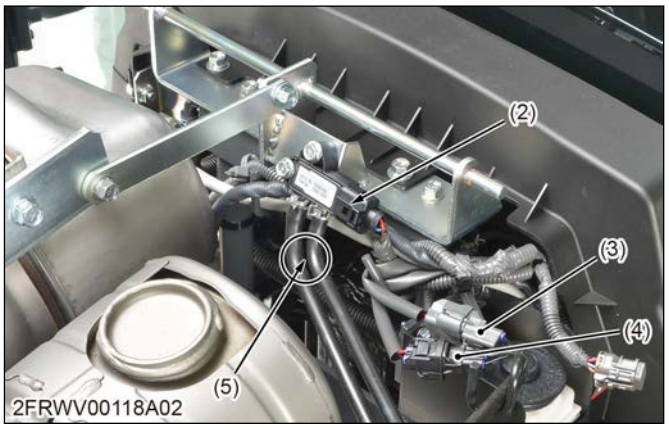
- **After operating the engine, muffler is very hot. When disconnecting the connectors, wait a moment for cool down.**

1. Disconnect the exhaust temperature sensor (T2) connector (1).




(1) Exhaust temperature sensor connector (T2)

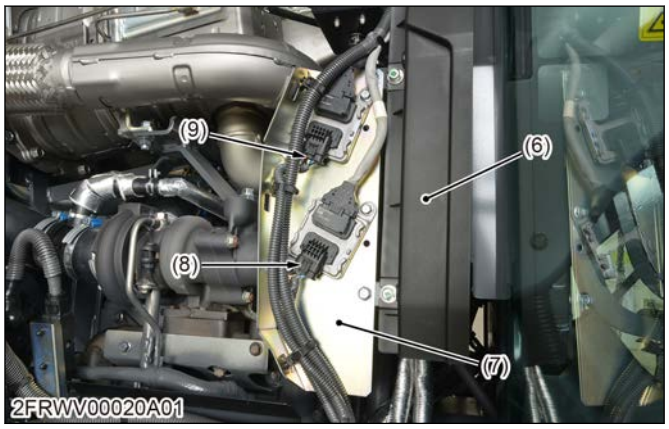
2. Disconnect the exhaust temperature sensor (T0) connector (4) and (T1) connector (3).
3. Disconnect the differential pressure sensor connector (2).
4. Remove the differential pressure sensor hoses (5).




(2) Differential pressure sensor connector
(3) Exhaust temperature sensor (T1) connector
(4) Exhaust temperature sensor (T0) connector
(5) Differential pressure sensor hose

5. Remove the cover (L.H.) (6).
6. Disconnect the pre NOx sensor connector (8) and post NOx sensor connector (9).

7. Remove the NOx sensor mounting stay (7).

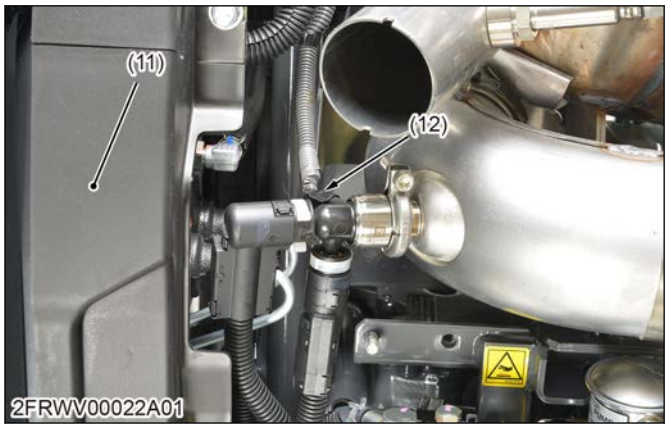



(6) Cover (L.H.)
(7) NOx sensor mounting stay
(8) Pre NOx sensor connector
(9) Post NOx sensor connector

8. Disconnect the SCR temperature sensor connector (10).

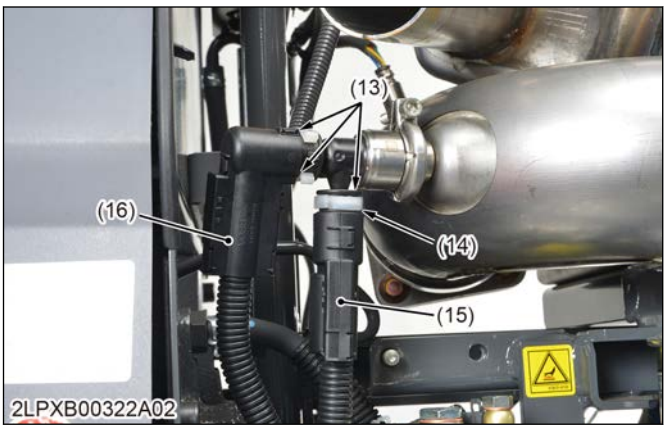

(10) SCR temperature sensor connector

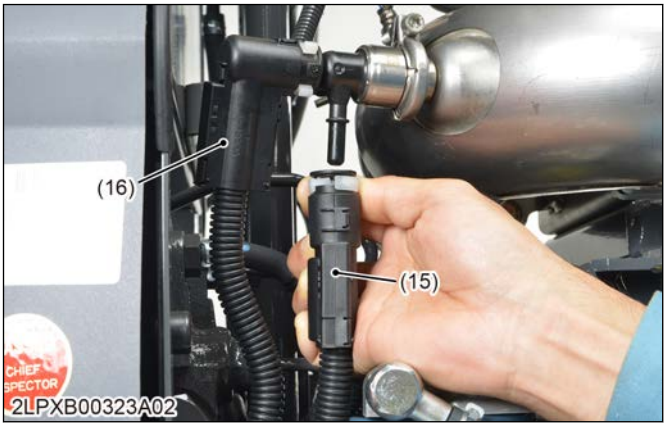
9. Remove the cover (R.H.) (11).
10. Disconnect the DEF injector connector (12).




(11) Cover (R.H.)
(12) DEF injector connector

11. Pinch the tabs (13) of white clamp (14) and pull out the DEF delivery hose (15).
12. Pinch the tabs (13) of white clamp (14) and pull out the DEF return hose (16).




(13) Tab
(14) White clamp
(15) DEF delivery hose
(16) DEF return hose

**(When reassembling)**

- Parts number of each DPF exhaust gas temperature sensor connector is different. Be sure to connect with same color of connector.
- – T0: Black
  – T1: Gray
  – T2: White
- Each SCR NOx sensor harness color is different.
  – Pre NOx sensor muffler: Black
  – Post NOx sensor: Gray

## 5.1.2.1.6 Removing DPF and SCR muffler

**⚠ CAUTION**

- **After operating the engine, muffler is very hot. When removing the DPF and SCR muffler, wait a moment for cool down.**

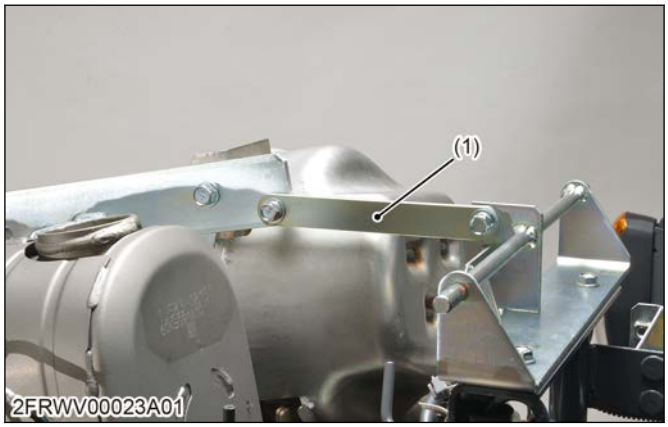
**■ IMPORTANT**

- **Since muffler assembly is heavy, use the hoist for safety.**

| | |
|---|---|
| DPF and SCR muffler assembly weight | About 66 kg<br>About 150 lbs |

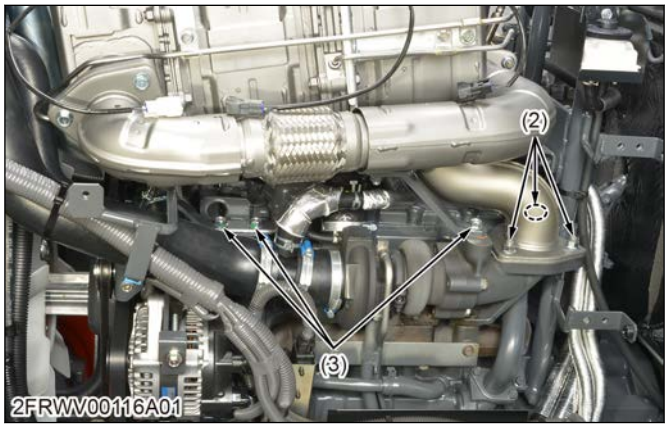
- **Be attention for each sensor when assembling and removing. Each sensor is easy to corrupt by shock.**

1. Prepare the hoist for removing.
2. Remove the support stay (1).



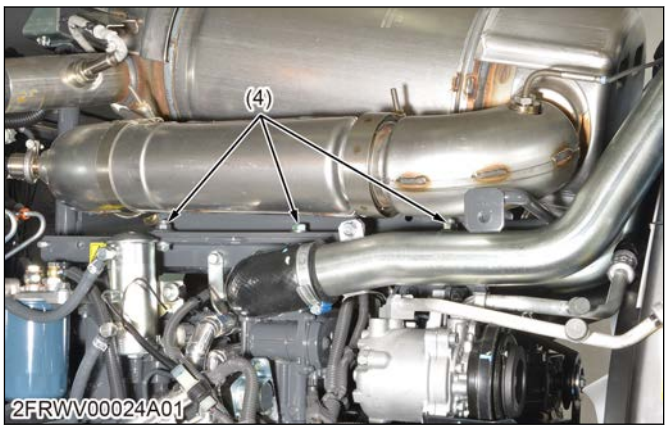

(1) Support stay

3. Remove the DPF muffler mounting nuts (2).
4. Remove the DPF muffler bracket mounting bolts (3).



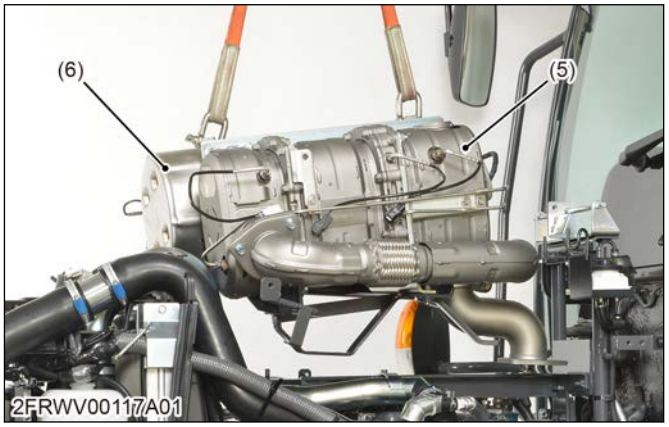

(2) DPF muffler mounting nut
(3) DPF muffler bracket mounting bolt

5. Remove the SCR muffler bracket mounting bolts and nut (4).




(4) SCR muffler bracket mounting bolt and nut

6. Support the DPF muffler (5) and SCR muffler (6) assemblies with nylon sling and hoist.
7. Remove the DPF muffler (5) and SCR muffler (6) assemblies.




(5) DPF muffler
(6) SCR muffler

**(When reassembling)**

- Firstly, pre-tighten all bolts and nuts around the DPF and SCR muffler assembly.
- Lastly, tighten the DPF muffler mounting nut, the DPF muffler bracket mounting bolt and the SCR muffler bracket mounting bolt and nut to the specified tightening torque.

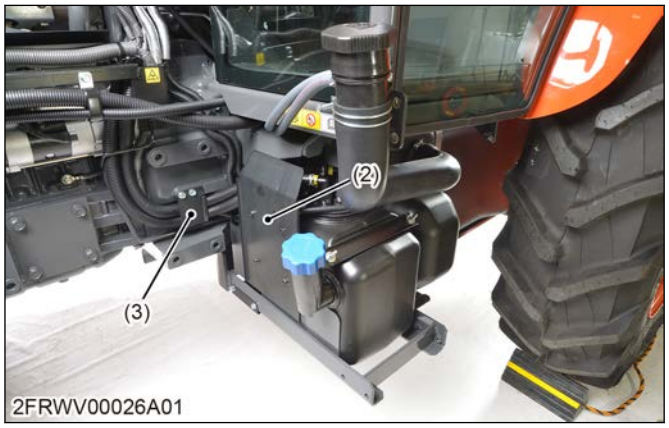
| | | |
|---|---|---|
| Tightening torque | DPF muffler mounting nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | DPF muffler bracket mounting bolt | 60.8 to 70.6 N·m<br>6.20 to 7.19 kgf·m<br>44.9 to 52.0 lbf·ft |
| | SCR muffler bracket mounting bolt and nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

## 5.1.2.1.7 Removing DEF tank

1. Remove the auxiliary step (1).

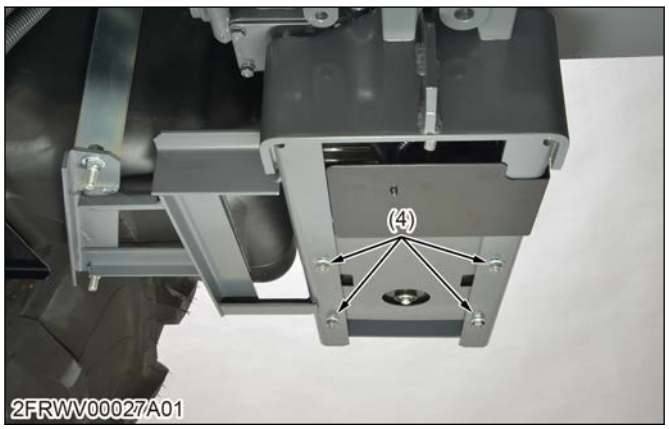

(1) Auxiliary step

2. Remove the DEF tank protection plate (2).
3. Remove the hose clamp (3).



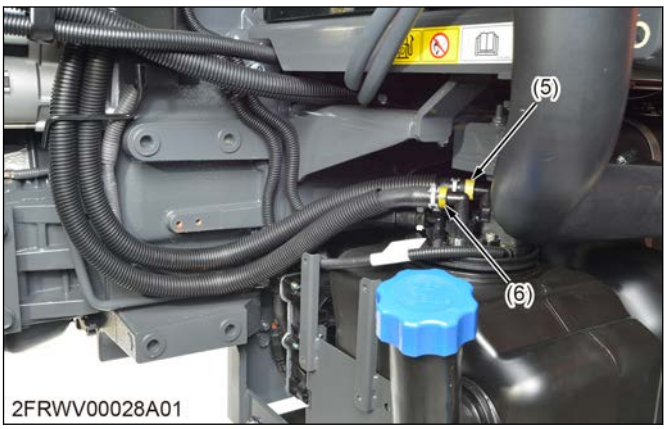

(2) DEF tank protection plate (3) Hose clamp

4. Remove the DEF tank mounting nuts (4).




(4) DEF tank mounting nut

5. Disconnect the coolant return hose (6) and coolant hose (5).




(5) Coolant hose (6) Coolant return hose

6. Disconnect the DEF suction hose (8) and DEF return hose (7).
7. Disconnect the DEF tank header unit connector (9).

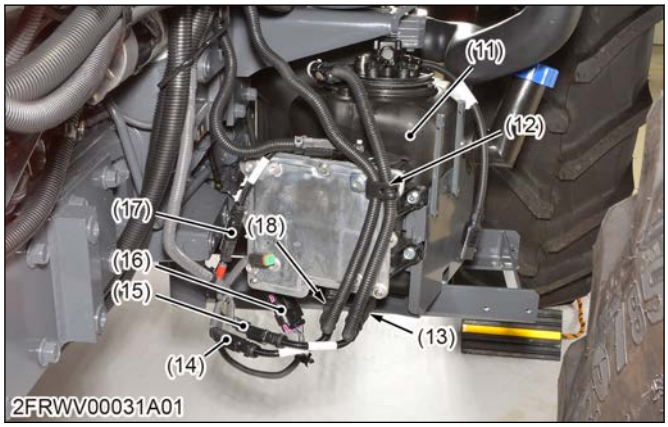

(7) DEF return hose
(8) DEF suction hose
(9) DEF tank header unit connector

8. Disconnect the DEF tank breather hose (10).


(10) DEF tank breather hose

9. Remove the clamp (12).
10. Disconnect the DEF suction hose (13) and DEF suction hose electric heater connector (14).
11. Disconnect the DEF delivery hose (18) and DEF delivery hose electric heater connector (15).
12. Disconnect the DEF pump connector (16).

13. Disconnect the DEF return hose electric heater connector (17).




(11) DEF tank
(12) Clamp
(13) DEF suction hose
(14) DEF suction hose electric heater connector
(15) DEF delivery hose electric heater connector
(16) DEF pump connector
(17) DEF return hose electric heater connector
(18) DEF delivery hose

14. Remove the DEF tank.


**(When reassembling)**

- Connect the DEF return hose (7) to backward of DEF tank unit.
- Connect the DEF suction hose (13) to forward of DEF tank unit.
- Connect the DEF delivery hose (18) to backward of DEF pump.
- Connect the DEF suction hose (13) to forward of DEF pump.

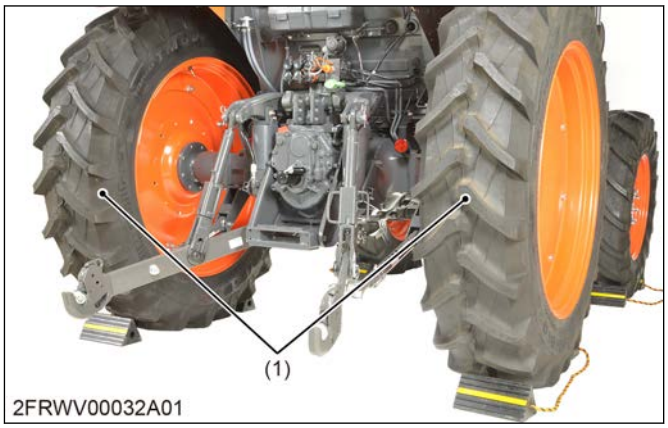
## 5.1.2.1.8 Installing front axle rocking restrictor

1. Chock the wheels and set the front axle rocking restrictor (1) to the front axle frame on both sides.


(1) Front axle rocking restrictor

## 5.1.2.1.9 Removing rear wheels

1. Place the disassembling stand under the transmission case.
2. Remove the rear wheels (1).




(1) Rear wheel

3. Place the disassembling stand under the rear axle case on both sides.

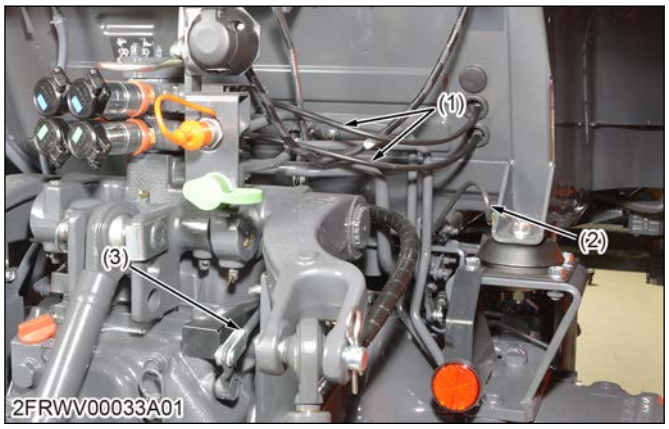
**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Rear wheel mounting nut | 260 to 304 N·m<br>26.5 to 31.0 kgf·m<br>191.8 to 224.2 lbf·ft |

## 5.1.2.1.10 Removing outer parts (Cabin model)

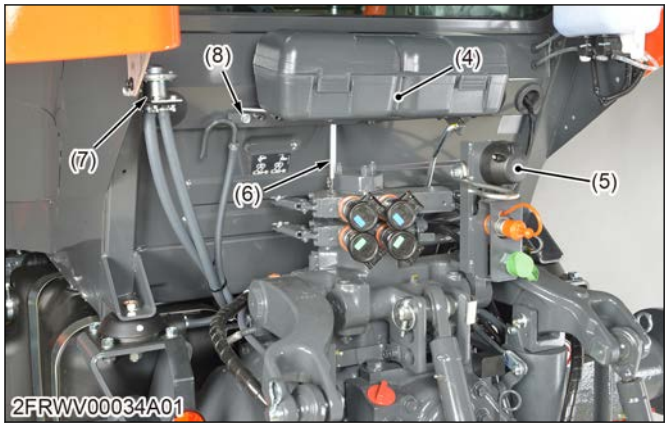
1. Disconnect the grounding cable (2).
2. Disconnect the auxiliary control valve wires (1).

3. Remove the PTO linkage (3).




(1) Grounding cable
(2) Auxiliary control valve wire
(3) PTO linkage

4. Remove the tool box (4).
5. Remove the trailer coupler (5) mounting screws.
6. Remove the 3-point hitch lowering speed linkage (6).
7. Remove the transmission case breather pipe mounting bolt (8).
8. Remove the fuel vapor valve (7) mounting bolts.

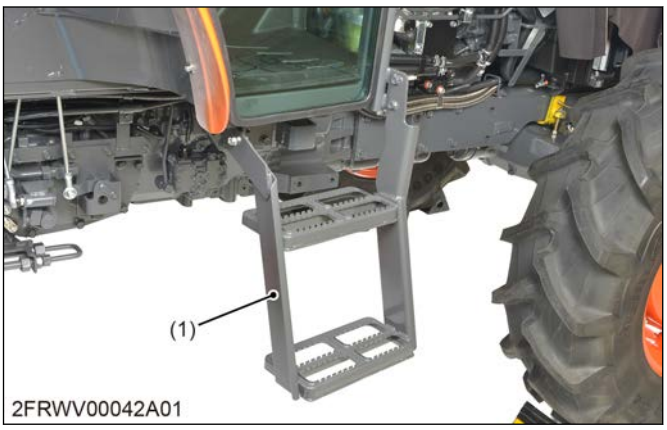



(4) Tool box
(5) Trailer coupler
(6) 3-point hitch lowering speed linkage
(7) Fuel vapor valve
(8) Transmission case breather pipe mounting bolt

**(When assembling)**
- Clear the slack of the breather hoses.
- Adjust the length of the auxiliary control valve wires.

## 5.1.2.1.11 Removing auxiliary step

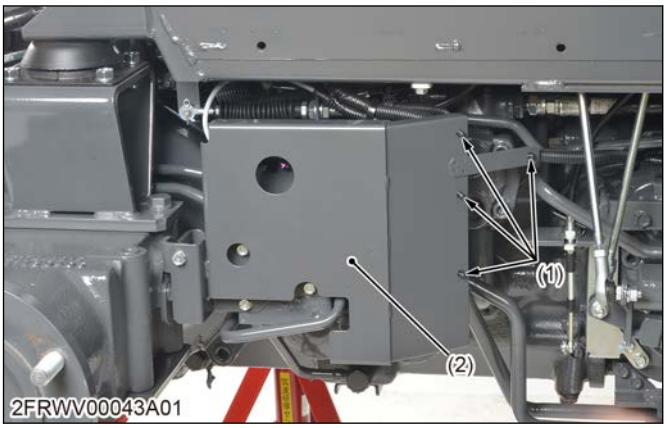
1. Remove the auxiliary step (1).




(1) Auxiliary step

## 5.1.2.1.12 Disconnecting draft control wire and position control wire

1. Disconnect the harness clamps (1) from the trailer brake valve protection cover (2).
2. Remove the trailer brake valve protection cover (2).



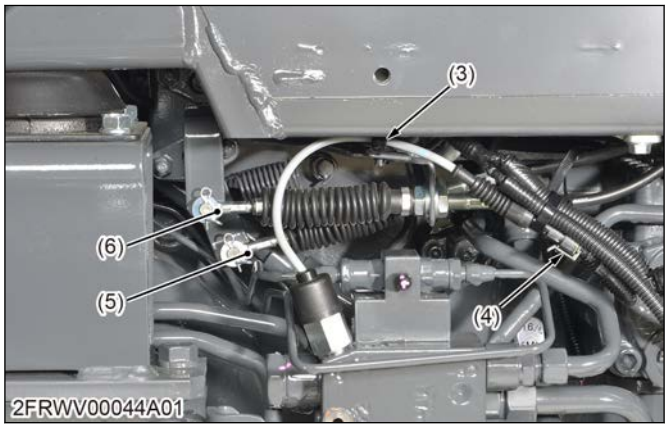

(1) Harness clamp
(2) Trailer brake valve protection cover

3. Disconnect the trailer brake pressure switch connector (4) and the trailer brake pressure switch cable from the clamp (3).

4. Disconnect the draft control wire (6) and position control wire (5).

**■ NOTE**

- **Before disconnecting the draft control wire and position control wire, make the mark to identify the position of the wires.**




(3) Clamp
(4) Trailer brake pressure switch connector
(5) Position control wire
(6) Draft control wire

**(When reassembling)**

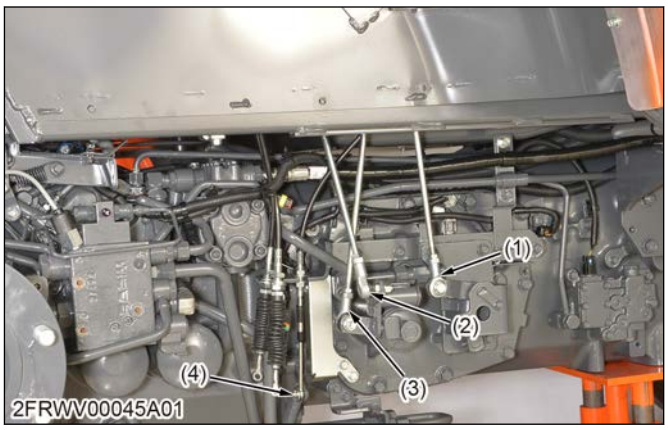
- The position of draft and position control wires are as follows.

  **Draft control lever:**
  Tractor outside

  **Position control lever:**
  Tractor inside
- Adjust the draft and position control wire.

## 5.1.2.1.13 Removing gear shift linkage and parking brake

1. Disconnect the range shift lever rod (1).
2. Disconnect the main shift lever rod 1 (2).
3. Disconnect the main shift lever rod 2 (3).
4. Disconnect the parking brake wire (4).




(1) Range shift lever rod
(2) Main shift lever rod 1
(3) Main shift lever rod 2
(4) Parking brake wire

**(When reassembling)**

- Adjust the main shift lever rod 1 and 2.
- Adjust the range shift lever rod.
- Adjust the parking brake wire.

## 5.1.2.1.14 Disconnecting steering shaft

1. Remove the universal joint mounting bolt (2).
2. Disconnect the steering shaft (1) from the steering controller.


(1) Steering shaft
(2) Universal joint mounting bolt

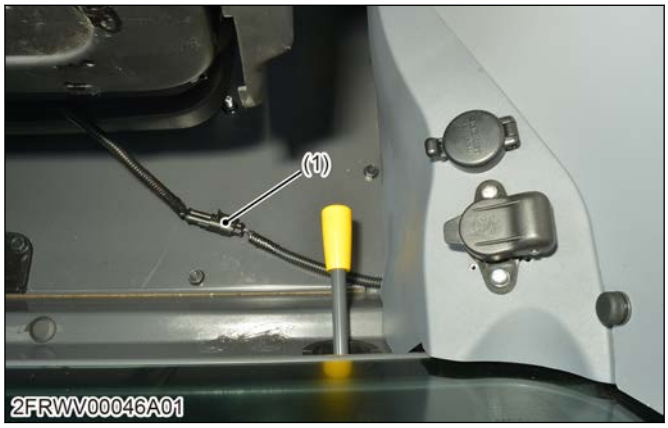
**(When reassembling)**

- Tighten the universal joint mounting bolt (2) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Universal joint mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 5.1.2.1.15 Removing seat

1. Disconnect the seat switch connector (1).




(1) Seat switch connector

2. Remove the seat (2) with the seat suspension mounting bracket.


(2) Seat

**(When reassembling)**

- Tighten the seat suspension mounting bolt to the specified tightening torque.

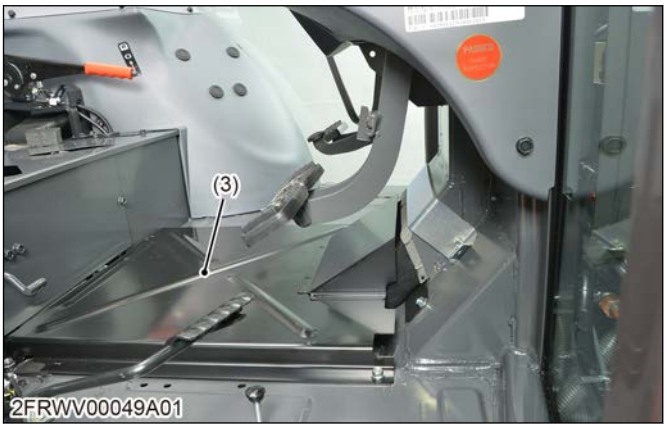
| | | |
|---|---|---|
| Tightening torque | Seat suspension mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 5.1.2.1.16 Removing floor mat and air conditioner duct

1. Remove the floor mat (1) and sponges (2).


(1) Floor mat (2) Sponge

2. Remove the access plate (3).




(3) Access plate

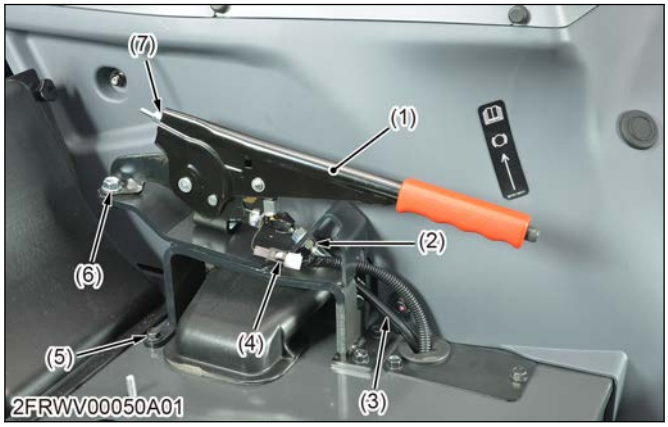
3. Disconnect the joint connectors (4).


(4) Joint connector

## 5.1.2.1.17 Removing secondary brake

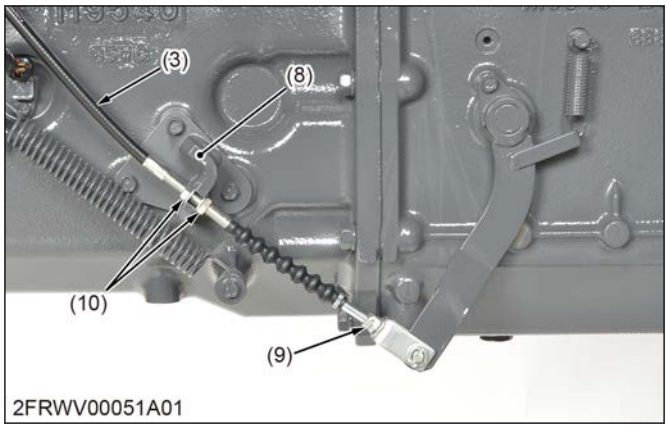
1. Disconnect the secondary brake switch connector (4).
2. Remove the secondary brake cable adjusting nuts (7).
3. Loosen the secondary brake cable mounting nuts (2) and disconnect the secondary brake cable (3).

4. Remove the secondary brake lever mounting bolts (6).
5. Remove the secondary brake lever bracket mounting bolts (5).




(1) Secondary brake lever
(2) Secondary brake cable mounting nut
(3) Secondary brake cable
(4) Secondary brake switch connector
(5) Secondary brake bracket mounting bolt
(6) Secondary brake lever mounting bolt
(7) Secondary brake cable adjusting nut

6. Loosen the secondary brake cable mounting nut 1 (10) and disconnect the secondary brake cable (3).
7. Remove the cable stay (8).




(3) Secondary brake cable
(8) Cable stay
(9) Secondary brake cable adjusting nut 1
(10) Secondary brake cable mounting nut 1

**(When assembling)**

- Be sure that the split pin of joint pin is bent to both sides.
- Be sure to adjust the free play of the secondary brake cable.

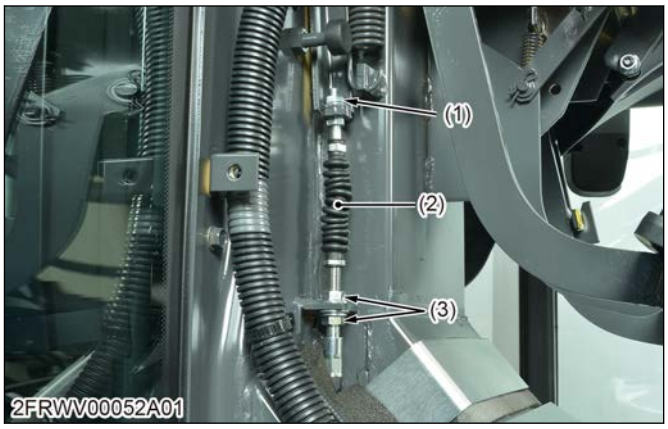
| | | |
|---|---|---|
| Secondary brake lever free play (Number of notches) | Factory specification | 4 notches |

- Tighten the secondary brake cable mounting nuts (2) and adjusting nuts (7) to the specified tightening torque.
- Tighten the secondary brake lever mounting bolts (6) and secondary brake bracket mounting bolts (5) to the specified tightening torque.
- Tighten the secondary brake cable adjusting nut 1 (9) and mounting nuts 1 (10) to the specified tightening torque.
- Tighten the cable stay (8) mounting bolts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Secondary brake cable mounting nut | 20 to 25 N·m<br>2.1 to 2.5 kgf·m<br>15 to 18 lbf·ft |
| | Secondary brake cable adjusting nut | 7.8 to 9.3 N·m<br>0.80 to 0.94 kgf·m<br>5.8 to 6.8 lbf·ft |
| | Secondary brake lever mounting bolt | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | Secondary brake bracket mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |
| | Secondary brake cable adjusting nut 1 | 17.1 to 20.6 N·m<br>1.75 to 2.10 kgf·m<br>12.7 to 15.1 lbf·ft |
| | Secondary brake cable mounting nuts 1 | 20 to 25 N·m<br>2.1 to 2.5 kgf·m<br>15 to 18 lbf·ft |
| | Cable stay mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 5.1.2.1.18 Disconnecting clutch cable

1. Loosen the clutch cable mounting nuts 2 (3).
2. Remove the clutch cable mounting nut 1 (1) and disconnect the clutch cable (2).




(1) Clutch cable mounting nut 1
(2) Clutch cable
(3) Clutch cable mounting nut 2

3. Loosen the clutch cable mounting nuts 3 (4).

4. Disconnect the clutch cable (2).


(2) Clutch cable (4) Clutch cable mounting nut 3

**(When reassembling)**

- Be sure to adjust the clutch cable for the clutch pedal free travel.
- Tighten the clutch cable mounting nut 1, 2 and 3 to the specified torque.

| | | |
|---|---|---|
| Tightening torque | Clutch cable mounting nut 1 | 17.7 to 20.6 N·m<br>18.1 to 2.10 kgf·m<br>13.1 to 15.1 lbf·ft |
| | Clutch cable mounting nut 2 | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |
| | Clutch cable mounting nut 3 | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 5.1.2.1.19 Disconnecting wire harness inside cabin

1. Remove the cover (1).

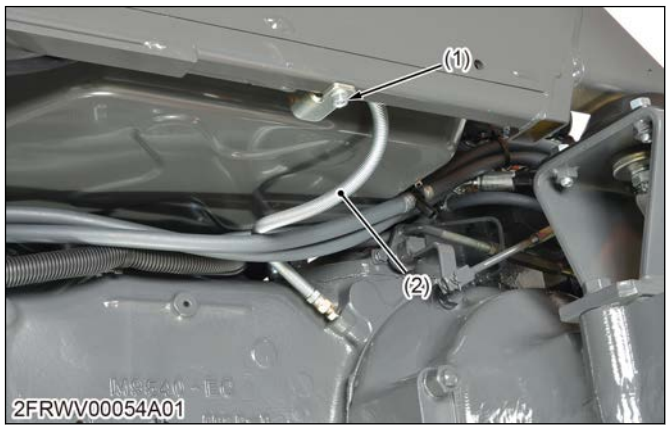

(1) Cover

2. Disconnect the joint connectors (2).
3. Pull out the main harness to the out side of cabin.


(2) Joint connector

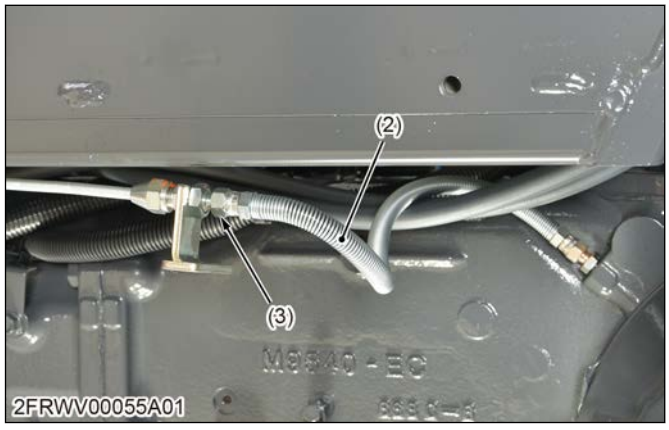
## 5.1.2.1.20 Disconnecting brake hose

1. Remove the brake pipe stay mounting bolts (1) on both sides.




(1) Brake pipe stay mounting bolt (2) Brake hose

2. Loosen the brake hose mounting nuts (3) on both sides.
3. Disconnect the brake hose (2) on both sides.




(2) Brake hose (3) Brake hose mounting nut

**(When reassembling)**

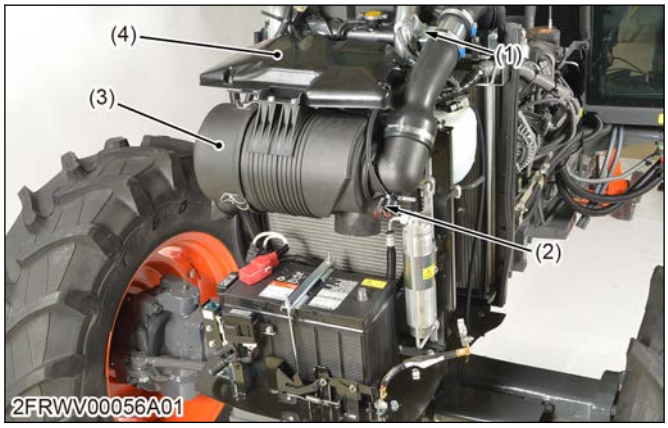
- Tighten the brake hose mounting nuts to the specified torque.

- After connecting the brake hoses, bleed the air from hydraulic brake lines.

| | | |
|---|---|---|
| Tightening torque | Brake hose mounting nut | 13.7 to 15.7 N·m<br>1.40 to 1.60 kgf·m<br>10.1 to 11.5 lbf·ft |

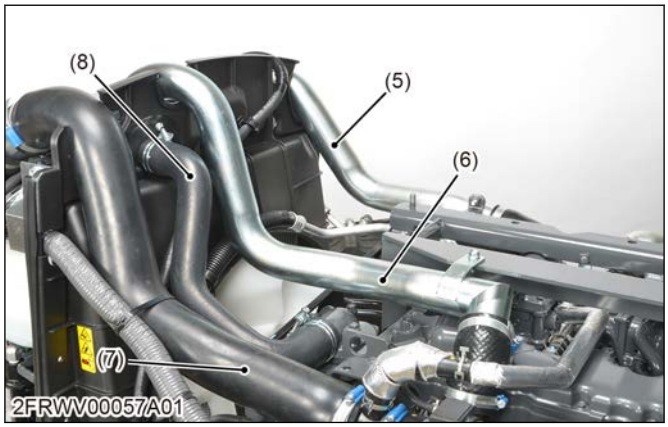
## 5.1.2.1.21 Removing air cleaner hose and pipe

1. Disconnect the air flow sensor connector (1) and air cleaner switch connector (2).
2. Remove the engine ECU and ACU cover (4).
3. Remove the air cleaner (3).




(1) Air flow sensor connector
(2) Air cleaner switch connector
(3) Air cleaner
(4) Cover

4. Disconnect the air inlet hose (7).
5. Loosen the bands and disconnect the inter cooler inlet pipe (6).
6. Loosen the bands and disconnect the inter cooler outlet pipe (5).
7. Loosen the hose bands and disconnect the coolant hose (8).




(5) Inter cooler outlet pipe
(6) Inter cooler inlet pipe
(7) Air inlet hose
(8) Coolant hose

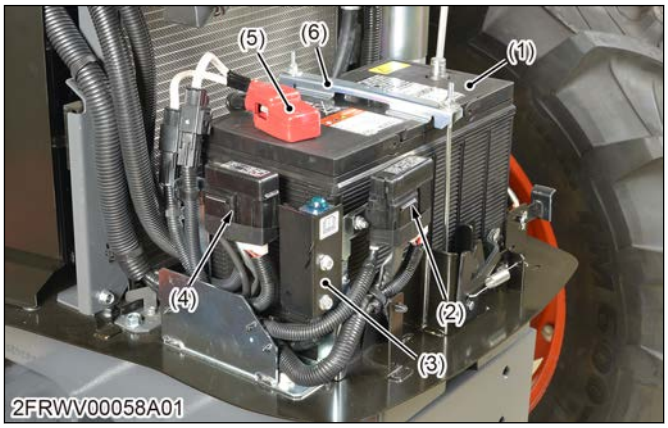
**(When assembling)**

- Be sure the bands of air inlet hose are connected securely.
- Be sure the bands of inter cooler hoses are connected securely.

| | | |
|---|---|---|
| Tightening torque | Hose band (Inlet air, inter cooler) | 4.0 to 5.0 N·m<br>0.41 to 0.50 kgf·m<br>3.0 to 3.6 lbf·ft |

## 5.1.2.1.22 Removing battery

1. Disconnect the positive cable (5) from the battery positive terminal.
2. Disconnect the slow blow fuse box 1 (2) and slow blow fuse box 2 (4).
3. Disconnect the ACU operating lamp (3).
4. Remove the battery stay (6) and battery (1).

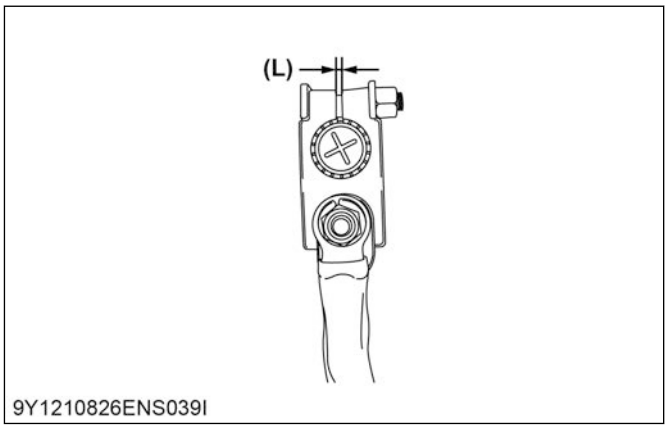



(1) Battery
(2) Slow blow fuse box 1
(3) ACU operating lamp
(4) Slow blow fuse box 2
(5) Positive cable
(6) Battery stay

**(When reassembling)**

**■ IMPORTANT**

- **Tighten the battery cable terminal nut so that the clearance (L) is within the following chart.**




(L) Clearance between the battery cable terminal

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

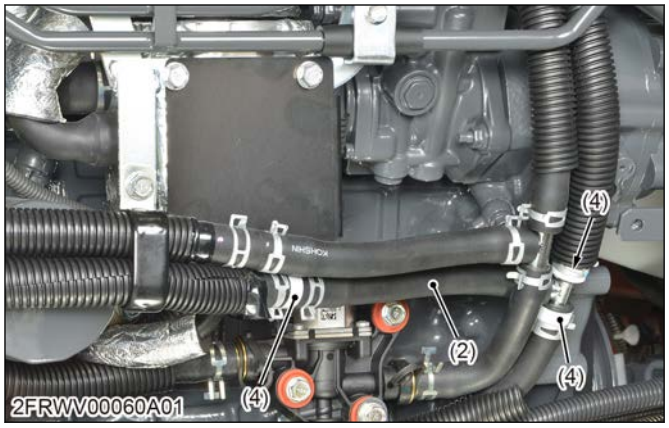
## 5.1.2.1.23 Disconnecting heater hose

1. Remove the heater hose clamps (3).
2. Disconnect the heater hose (1).
3. Disconnect the heater return hose (2).


(1) Heater hose
(2) Heater return hose
(3) Heater hose clamp

**(When reassembling)**

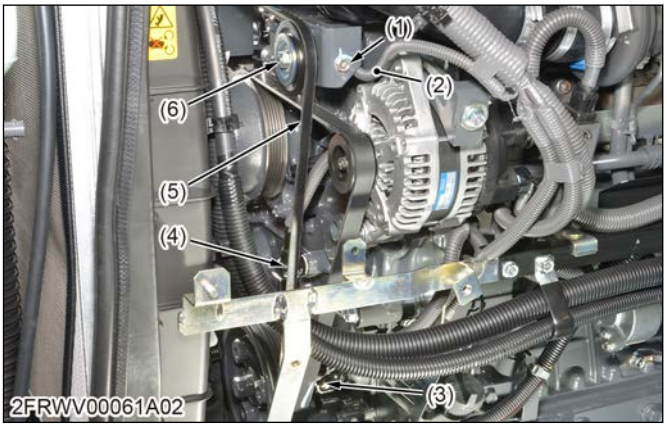
- The heater return hose (2) with white tape (4) should be connected to the hose which has also white tape (4).




(2) Heater return hose
(4) White tape

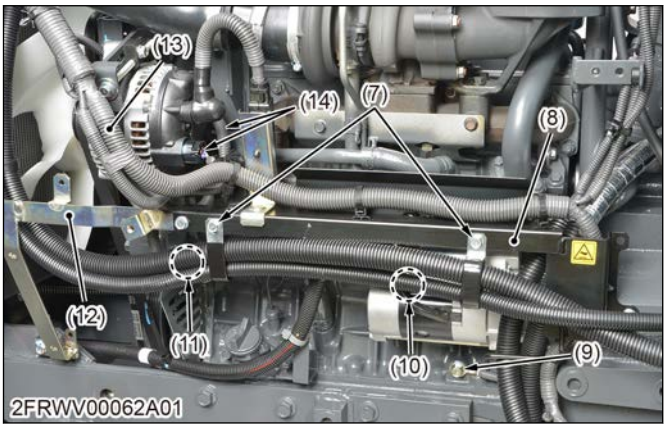
## 5.1.2.1.24 Removing compressor and condenser

1. Loosen the air conditioner belt tension pulley mounting nut (6).
2. Loosen the air conditioner belt adjusting bolt (1).
3. Remove the air conditioner belt (5).
4. Disconnect the coolant temperature sensor connector (2).
5. Disconnect the camshaft position sensor connector (4).
6. Disconnect the crankshaft position sensor connector (3).




(1) Air conditioner belt adjusting bolt
(2) Coolant temperature sensor connector
(3) Crankshaft position sensor connector
(4) Camshaft position sensor connector
(5) Air conditioner belt
(6) Tension pulley mounting nut

7. Remove the high and low pressure hose clamps (7).
8. Disconnect the starter motor connectors (10) and oil switch connector (11).
9. Disconnect the grounding wire (9).
10. Disconnect the alternator connectors (14).
11. Remove the stay 1 (8) and stay 2 (12).
12. Set aside the engine harness (13) to the front side.




(7) High and low pressure hose clamp
(8) Stay 1
(9) Grounding wire
(10) Starter motor connector
(11) Oil switch
(12) Stay 2
(13) Engine harness
(14) Alternator connectors

13. Remove the high and low pressure hose clamp (16).
14. Remove the condenser stopper bolt (17).

15. Loosen the condenser wing nut (15).


(15) Condenser wing nut
(16) High and low pressure hose clamp
(17) Condenser stopper bolt

16. Disconnect the compressor 1P connector (20).
17. Remove the grounding wire mounting screw (18).
18. Remove the compressor (19) with stay.


(18) Ground wire mounting screw
(19) Compressor
(20) Compressor 1P connector

19. Jack up the front axle and turn the front tires to the left side.
20. Slide the condenser with the reviver to the left side.
21. Remove the compressor (19), the condenser with the receiver and air-conditioner hose as a unit.


**(When reassembling)**

- After reassembling the compressor, be sure to adjust the air conditioner belt tension.
- Tighten the alternator terminal nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Alternator terminal nut | 9.80 to11.3 N·m<br>1.00 to 1.15kgf·m<br>7.23 to 8.33 lbf·ft |

## 5.1.2.1.25 Removing cabin from tractor

1. Set the cabin dismounting tool (1) to the cabin.


(1) Cabin dismounting tool

2. Remove the cabin mounting bolts and nuts (2).



(2) Cabin mounting bolt and nut

3. Remove the cabin from tractor body.


2FRWV00069A01

**(When reassembling)**

**■ NOTE**

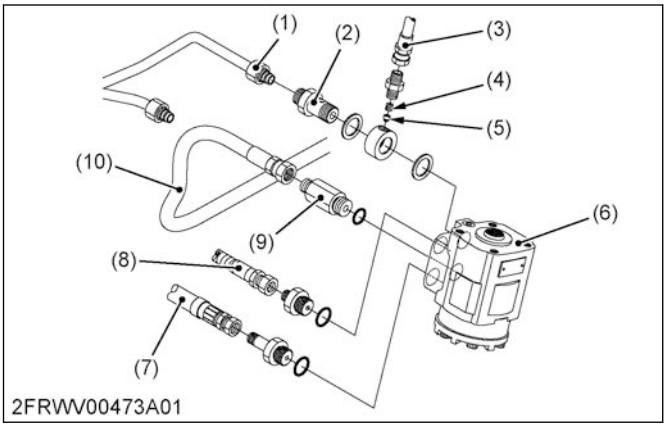
- **Lift the cabin while making sure it does not catch on anything.**
- **Tighten the cabin mounting bolts and nuts to the specified tightening torque.**

| | | |
|---|---|---|
| Tightening torque | Cabin mounting bolt and nut | 124 to 147 N·m<br>12.6 to 15.0 kgf·m<br>91.2 to 108 lbf·ft |

RELATED PAGE
2.26 Tools for dismounting cabin on page 2-98

## 5.1.2.2 Disconnecting steering controller pipe and hose

1. Disconnect the oil cooler pipe (1).
2. Disconnect the power steering delivery hose (10).
3. Disconnect the power steering delivery hose (L.H.) (8) and (R.H.) (7) from the power steering controller (6).
4. Disconnect the master cylinder delivery hose (3).



2FRWV00473A01

(1) Oil cooler pipe
(2) Joint
(3) Master cylinder delivery hose
(4) Orifice
(5) Filter
(6) Steering controller
(7) Power steering delivery hose (R.H.)
(8) Power steering delivery hose (L.H.)
(9) Joint pipe
(10) Power steering delivery hose

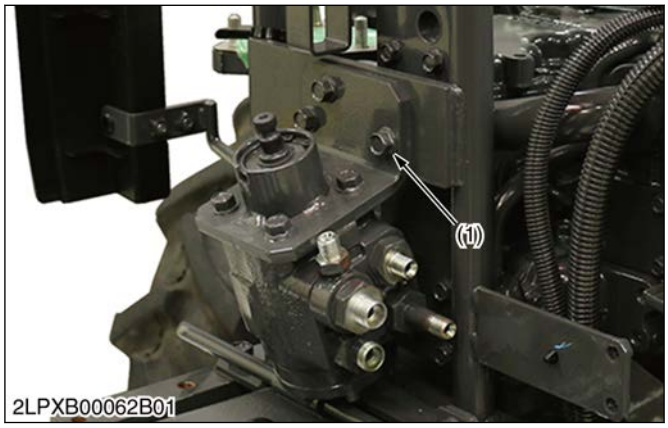
**(When reassembling)**

- Connect the power steering delivery hose (L.H.) (8) with blue tape to upper port of power steering controller.
- Tighten the joint (2) and joint pipe (9) to the specified tightening torque.
- Tighten the power steering delivery hose retaining nut (L.H.) (8) and (R.H) (7) to the specified tightening torque.
- Tighten the power steering delivery hose (10) retaining nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Joint | 88.0 to 98.0 N·m<br>8.98 to 9.99 kgf·m<br>64.9 to 72.2 lbf·ft |
| | Power steering delivery hose (R.H.) | 22.6 to 27.5 N·m<br>2.31 to 2.80 kgf·m<br>16.7 to 20.2 lbf·ft |
| | Power steering delivery hose (L.H.) | 22.6 to 27.5 N·m<br>2.31 to 2.80 kgf·m<br>16.7 to 20.2 lbf·ft |
| | Joint pipe | 70.6 to 86.2 N·m<br>7.20 to 8.78 kgf·m<br>52.1 to 63.5 lbf·ft |
| | Power steering delivery hose retaining nut | 45.1 to 53.0 N·m<br>4.60 to 5.40 kgf·m<br>33.3 to 39.0 lbf·ft |

### 5.1.2.3 Removing power steering controller

1. After removing the cabin, remove the power steering controller holder mounting bolt (1).




(1) Power steering controller holder mounting bolt

2. Remove the power steering controller with holder.

**(When reassembling)**

- Tighten the power steering controller mounting bolt to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Power steering controller mounting bolt | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

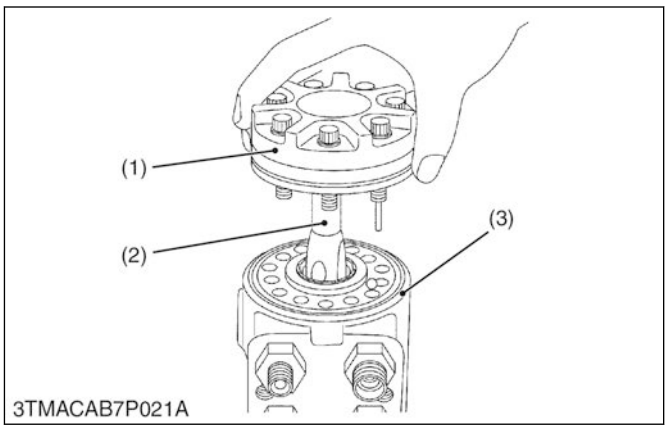
## 5.2 Steering controller

### 5.2.1 Removing gerotor

**■ IMPORTANT**

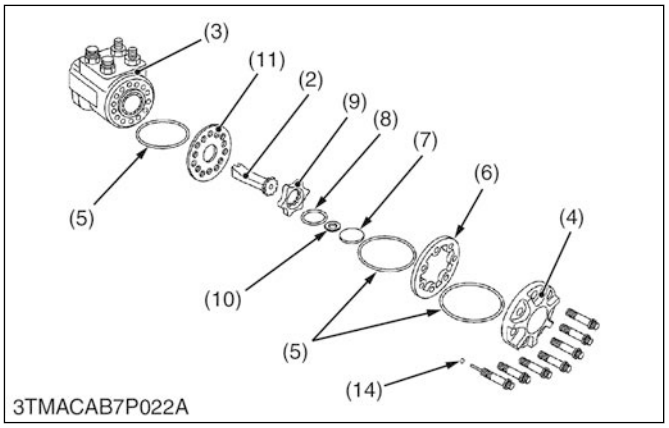
- **Use KUBOTA UDT fluid.**
- **Do not use the mixture of different brands of oil.**
- **Before disassembling the power steering system hydraulic components, check the performance of hydraulic pump and power steering using a flowmeter.**
  **Do not disassemble the power steering needlessly.**
- **After removing or disassembling the power steering hydraulic components, be sure to bleed air.**
- **If disassembly of power steering is needed, perform disassembly carefully following the instructions given below.**
- **Do not brush or grind with sandpaper.**
- **Use KUBOTA UDT fluid for cleaning and compressed air for blowing off.**
- **Check each part for wear and damage.**
  **If seriously damage, replace parts as sub-assembly or assembly.**
- **Replace O-rings and seals with new ones.**
- **Bleed the air of power steering line.**

1. Secure the housing (3) in a vise and remove gerotor mounting screws and gerotor assembly (1).




(1) Gerotor assembly
(2) Driven shaft
(3) Housing

2. Remove the distributor plate (11) and driven shaft (2).



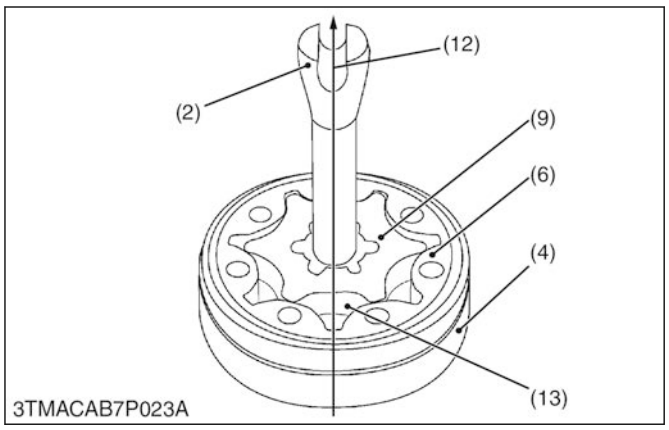

(2) Driven shaft
(3) Housing
(4) End cap
(5) O-ring
(6) Stator
(7) Spacer
(8) O-ring
(9) Rotor
(10) Spacer ring
(11) Distributor plate
(14) Ball

3. Remove the rotor (9), O-ring (5) between the distributor plate and stator (6).
4. Remove the spacer ring (10) and spacer (7).
5. Remove the O-ring (8) from the rotor (9).

**(When reassembling)**

**■ IMPORTANT**

- **Be sure to align the direction of the drive shaft pin groove (12) with the rotor tooth bottom (13).**




(2) Driven shaft
(4) End cap
(6) Stator
(9) Rotor
(12) Direction pin groove
(13) Rotor tooth bottom

- Fit an O-ring into the groove of the end cap (4), and insert 2 or 3 bolts.
- Fit an O-ring into the groove of the stator (6), and put it on the end cap, with the O-ring upward.
- Apply clean transmission fluid (specified fluid) to the rotor (9), fit an O-ring (8) into the groove of the rotor and put the spacer on it. Keeping the spacer on the rotor, fit it into the stator (6) with the spline beveled side upward.
- After putting the spacer into the rotor (9), insert the splines of driven shaft (2) into the rotor (9), aligning the direction of drive shaft pin groove (12) with the rotor tooth bottom (13).
- Fit an O-ring into the groove of the housing (3).
  Fit the pin groove of the driven shaft (2) to the dowel pin inside the housing.

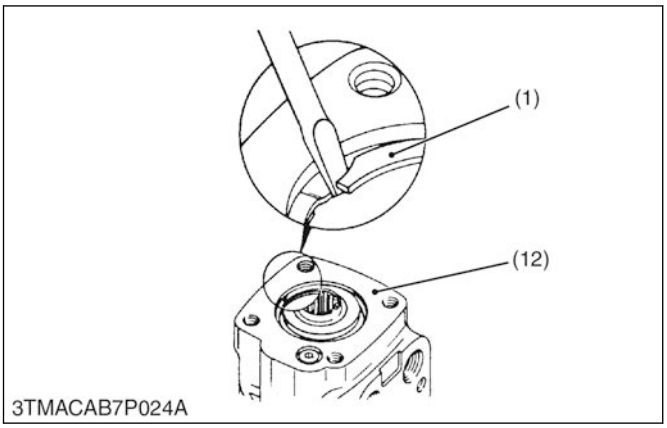
| | | |
|---|---|---|
| Tightening torque | Gerotor assembly mounting screw (5/16') | 26 to 28 N·m<br>2.6 to 2.9 kgf·m<br>19 to 20 lbf·ft |

## 5.2.2 Removing grand seal, needle bearing, sleeve and spoool

**■ IMPORTANT**

- **Use KUBOTA UDT fluid.**
- **Do not use the mixture of different brands of oil.**
- **Before disassembling the power steering system hydraulic components, check the performance of hydraulic pump and power steering using a flowmeter.**
  **Do not disassemble the power steering needlessly.**
- **After removing or disassembling the power steering hydraulic components, be sure to bleed air.**
- **If disassembly of power steering is needed, perform disassembly carefully following the instructions given below.**
- **Do not brush or grind with sandpaper.**
- **Use KUBOTA UDT fluid for cleaning and compressed air for blowing off.**
- **Check each part for wear and damage.**
  **If seriously damage, replace parts as sub-assembly or assembly.**
- **Replace O-rings and seals with new ones.**
- **Bleed the air of power steering line.**

1. Remove the retaining ring (1) with a screw driver.



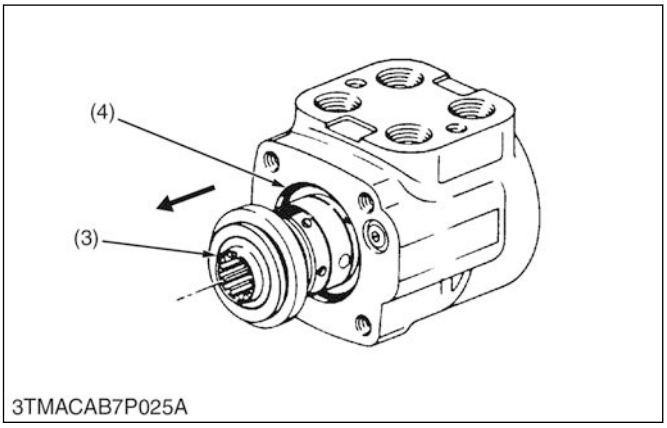

(1) Retaining ring
(12) Housing

2. Hold the control valve unit vertically and spool and sleeve.
3. Align the cross pin parallel to flat side of housing (flow priority valve mounting side).

**■ NOTE**

- **The cross pin is visible through open end of spool**

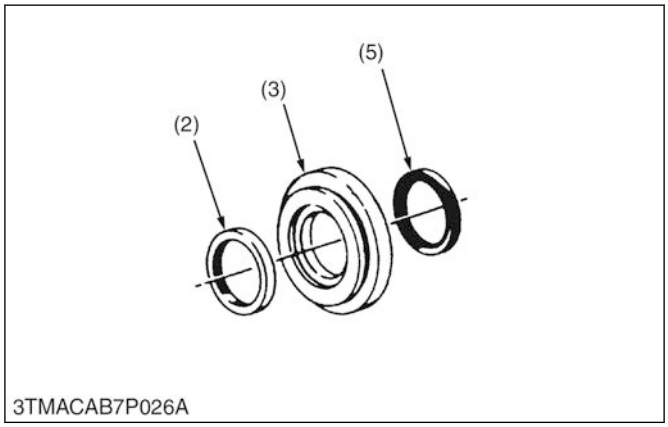
4. Don't allow the cross pin to be caught. If the cross pin is caught in the groove of the housing, adjust its position with a fingertip.
5. Push the spool and sleeve to the arrow direction and remove the seal grand bushing (3) with dust seal (2) and quad ring seal (5).




(3) Seal grand bushing
(4) O-ring

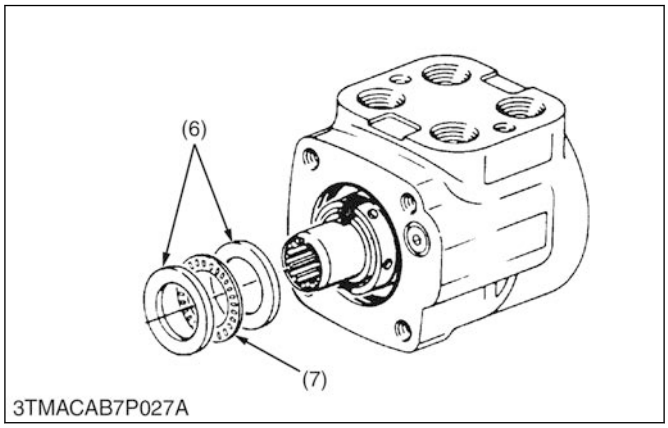
6. Remove the O-ring (4) from the housing (12).
7. Remove the dust seal (2) from the seal grand bushing (3).

8. Remove the quad ring seal (5) from the seal grand bushing (3).




(2) Dust seal
(3) Seal grand bushing
(5) Quad ring seal

9. Remove the bearing races (6) and needle bearing (7) from valve assembly.

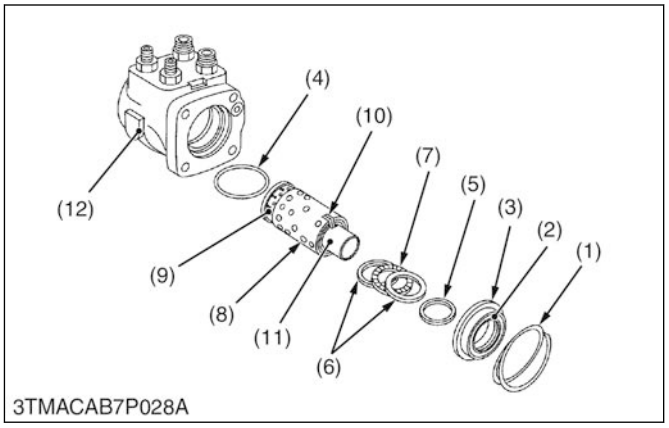



(6) Bearing race
(7) Needle bearing

10. Draw out the sleeve (9) and spool (11) assembly from the gerotor side, with the port surface of the housing downward.

**■ IMPORTANT**

- **As the clearance between the housing and sleeve is very narrow, do not draw out the sleeve forcibly.**




(1) Retaining ring
(2) Dust seal
(3) Seal grand bushing
(4) O-ring
(5) Quad ring seal
(6) Bearing race
(7) Needle bearing
(8) Pin
(9) Sleeve
(10) Centering spring
(11) Spool
(12) Housing

11. Don't allow the dowel pin to be caught in the groove of the housing (12). If the dowel pin is caught in the groove of the housing (12), adjust its position with a fingertip and draw out the sleeve (9) and spool assembly slowly.

**(When reassembling)**

**■ NOTE**

- **The sleeve (9), spool (11) and housing (12) should not be inclined each other.**
- **If the pin is caught in the housing grooves, adjust its position with a fingertip.**

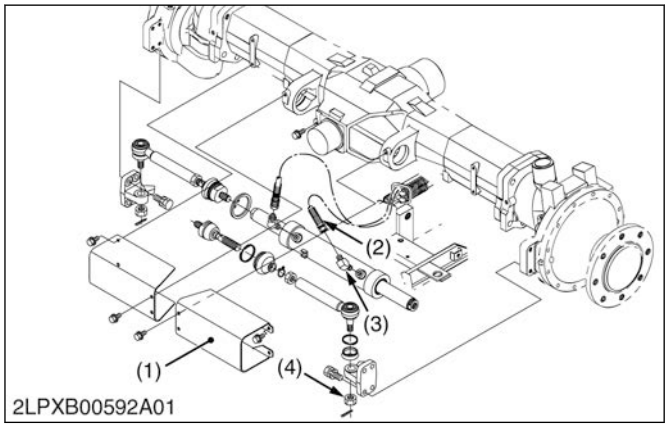
- Replace O-ring with new one.
- Apply transmission oil to the dust seal, quad ring seal and O-ring.
- Apply transmission oil to the bearing races and needle bearing.
- Apply clean transmission oil to the assembly when fitting the sleeve (9) and spool (11) assembly into the housing (12).
- Insert the sleeve (9) and spool (11) assembly into the housing (12) while turning it slowly.

## 5.3 Removing power steering cylinder

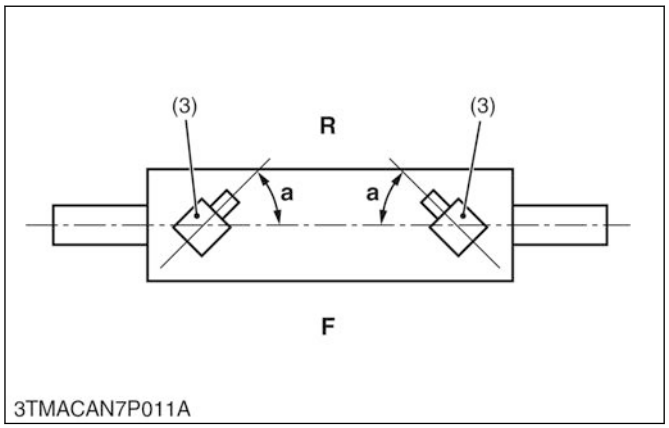
### 5.3.1 Removing tie-rod end (4WD model)

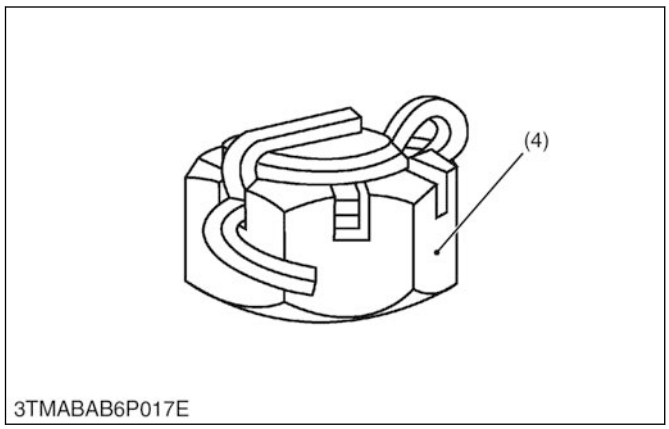
1. Remove both cylinder cover (1).
2. Disconnect both power steering delivery hoses (2) from cylinder.
3. Remove both hose joints (3) from steering cylinder.
4. Pull out the cotter pin and remove the tie-rod end slotted nuts (4).

5. Remove the tie-rod with a tie-rod end lifter (Code No. 07909-39051).








(1) Cylinder cover
(2) Power steering delivery hose
(3) Hose joint
(4) Slotted nut
F: Front
R: Rear
a: 0.79 rad (45°)

**(When reassembling)**

- Apply teflon tape to joint and set the joint as shown in the figure.
- Connect the power steering delivery hose with blue tape to the right hand side.
- Replace cotter pin with a new one.
- After tightening the tie-rod end slotted nut to the specified torque, install a cotter pin as shown in the figure.
- After assembling the power steering cylinder and tie-rod, check the toe-in and adjust it if necessary.
- Tighten the power steering delivery hose retaining nut and the hose joint to the specified tightening torque.

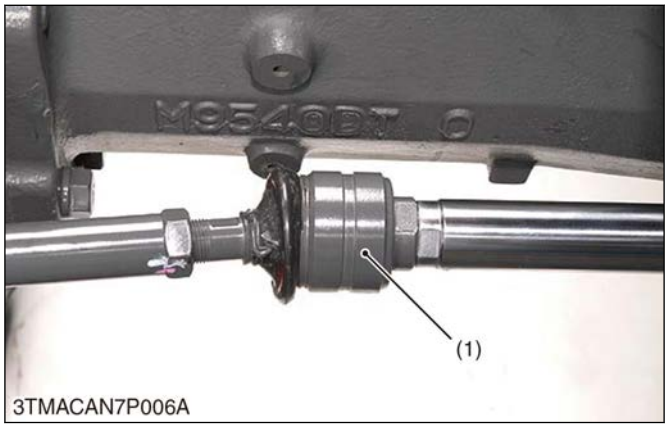
| | | |
|---|---|---|
| Tightening torque | Power steering delivery hose | 23 to 27 N·m<br>2.4 to 2.7 kgf·m<br>17 to 19 lbf·ft |
| | Tie-rod end slotted nut | 156.8 to 176.4 N·m<br>15.99 to 17.98 kgf·m<br>115.7 to 130.1 lbf·ft |
| | Hose joint | 30 to 34 N·m<br>3.1 to 3.4 kgf·m<br>23 to 25 lbf·ft |

| | | |
|---|---|---|
| Toe-in | Factory specification | 2.0 to 8.0 mm<br>0.079 to 031 in. |

RELATED PAGE
2.1 Tie-rod end lifter on page 2-79

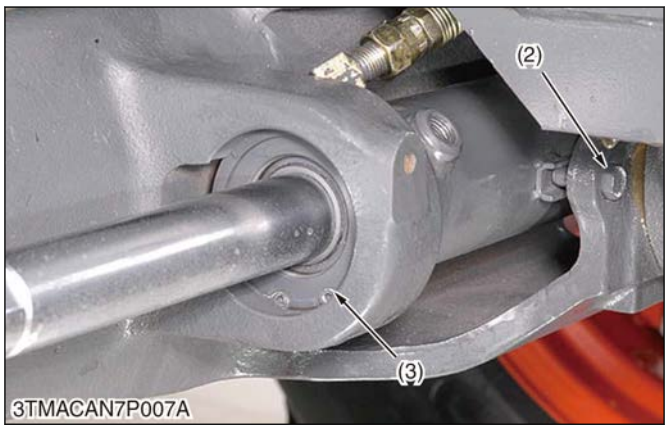
### 5.3.2 Removing steering cylinder (4WD model)

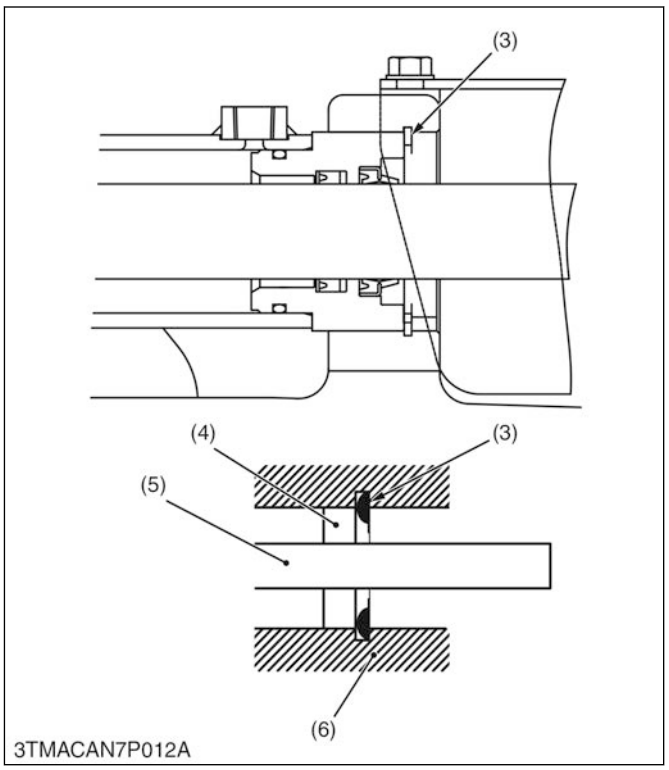
1. Remove both tie-rod joint (1).




(1) Tie-rod joint

2. Remove the internal circlip (3) and set screw (2).




(2) Set screw
(3) Internal circlip
(4) Dust seal
(5) Cylinder rod
(6) Front axle case

3. Draw out the steering cylinder to the right.

**(When reassembling)**

- Apply liquid lock (Three Bond 1372 or its equivalents) to the tie-rod joint.
- When reassembling internal circlip (3), the sharp edge should face to outward as shown in the figure.
- Tighten the tie-rod joint to the specified tightening torque.

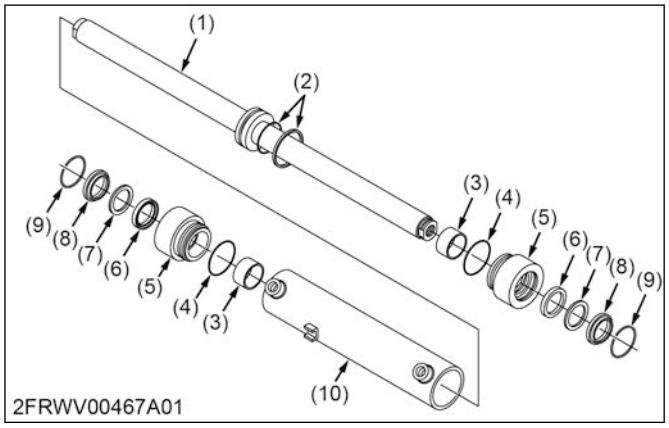
| | | |
|---|---|---|
| Tightening torque | Tie-rod joint | 167 to 196 N·m<br>17.1 to 19.9 kgf·m<br>124 to 144 lbf·ft |

## 5.4 Disassembling steering cylinder

### 5.4.1 Disassembling steering cylinder guide and rod (4WD model)

1. Remove the cylinder guides (5).

2. Draw out the cylinder rod (1).




(1) Cylinder rod
(2) Piston seal
(3) Bushing
(4) O-ring
(5) Cylinder guide
(6) Rod seal
(7) Backup ring
(8) Dust seal
(9) Internal circlip
(10) Cylinder tube

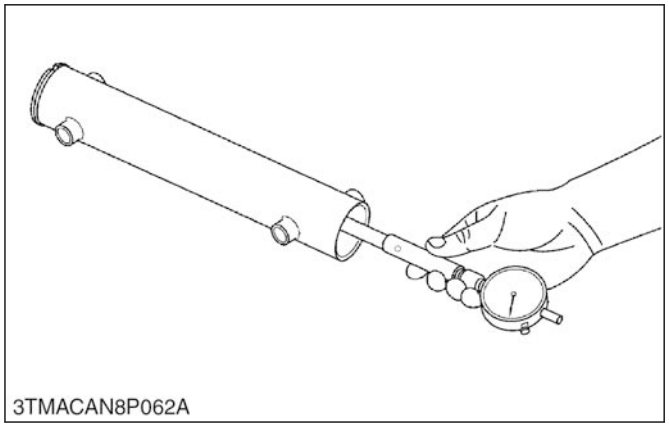
**(When reassembling)**

- Apply transmission fluid to the piston seals (2), O-ring (4), rod seal (6), backup ring (7), dust seal (8) and inside of cylinder tube (10).

RELATED PAGE
2.21 Hydraulic cylinder piston sealing tool on page 2-90

# 6. Servicing

## 6.1 Checking steering cylinder I.D.

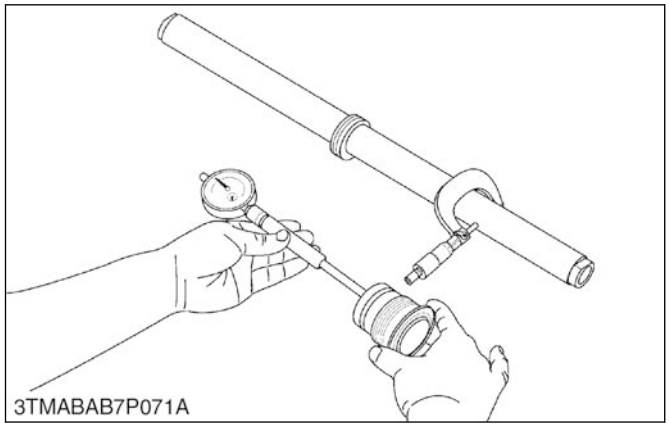



1. Measure the steering cylinder I.D. with a cylinder gauge.

| | | |
|---|---|---|
| Steering cylinder I.D. | Factory specification | 55.000 to 55.074 mm<br>2.1654 to 2.1682 in. |
| | Allowable limit | 55.100 mm<br>2.1693 in. |

2. If the cylinder I.D. exceeds the allowable limit, replace the cylinder tube.

## 6.2 Checking clearance between rod and bushing




1. Measure the rod O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge.
3. Calculate the clearance between rod and bushing.

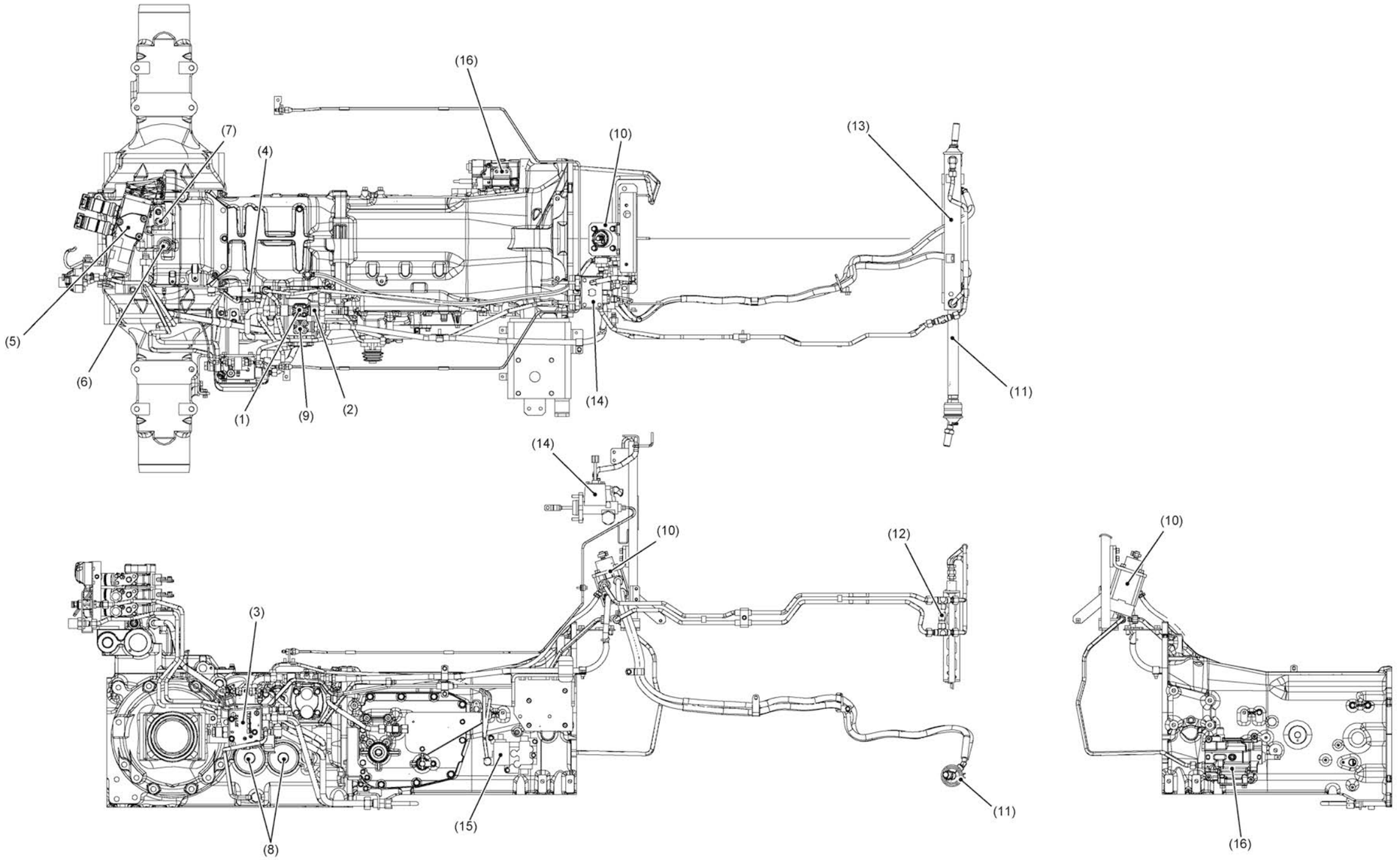
| | | |
|---|---|---|
| Clearance between rod and bushing | Factory specification | 0.010 to 0.14 mm<br>0.00040 to 0.0055 in. |
| | Allowable limit | 0.250 mm<br>0.00984 in. |

4. If the clearance exceeds the allowable limit, replace as a unit.

# 9. HYDRAULIC SYSTEM

# MECHANISM

## 1. Hydraulic system structure




(1) Hydraulic pump (3-point hitch)
(2) Relief valve (3-point lifting linkage)
(3) Trailer brake valve (If equipped)
(4) Solenoid valve assembly (PTO, 4WD, differential lock)
(5) Auxiliary control valve
(6) Cylinder safety valve
(7) Lowering speed adjusting valve
(8) Oil filter
(9) Hydraulic pump (Power steering, shuttle and solenoid valve)
(10) Power steering controller
(11) Power steering cylinder
(12) Oil cooler check valve
(13) Oil cooler
(14) Brake master cylinder
(15) Hi-Lo dual speed solenoid valve
(16) Shuttle valve

# 2. Outline of hydraulic system

The hydraulic system of the M5 series tractor consists of a 3-point hitch, auxiliary hydraulic control for implements, power steering, PTO clutch, shuttle clutch, dual speed clutch (DS transmission model), 4WD clutch (DS transmission model), rear differential lock (DS transmission model) and hydraulic brakes shown above.

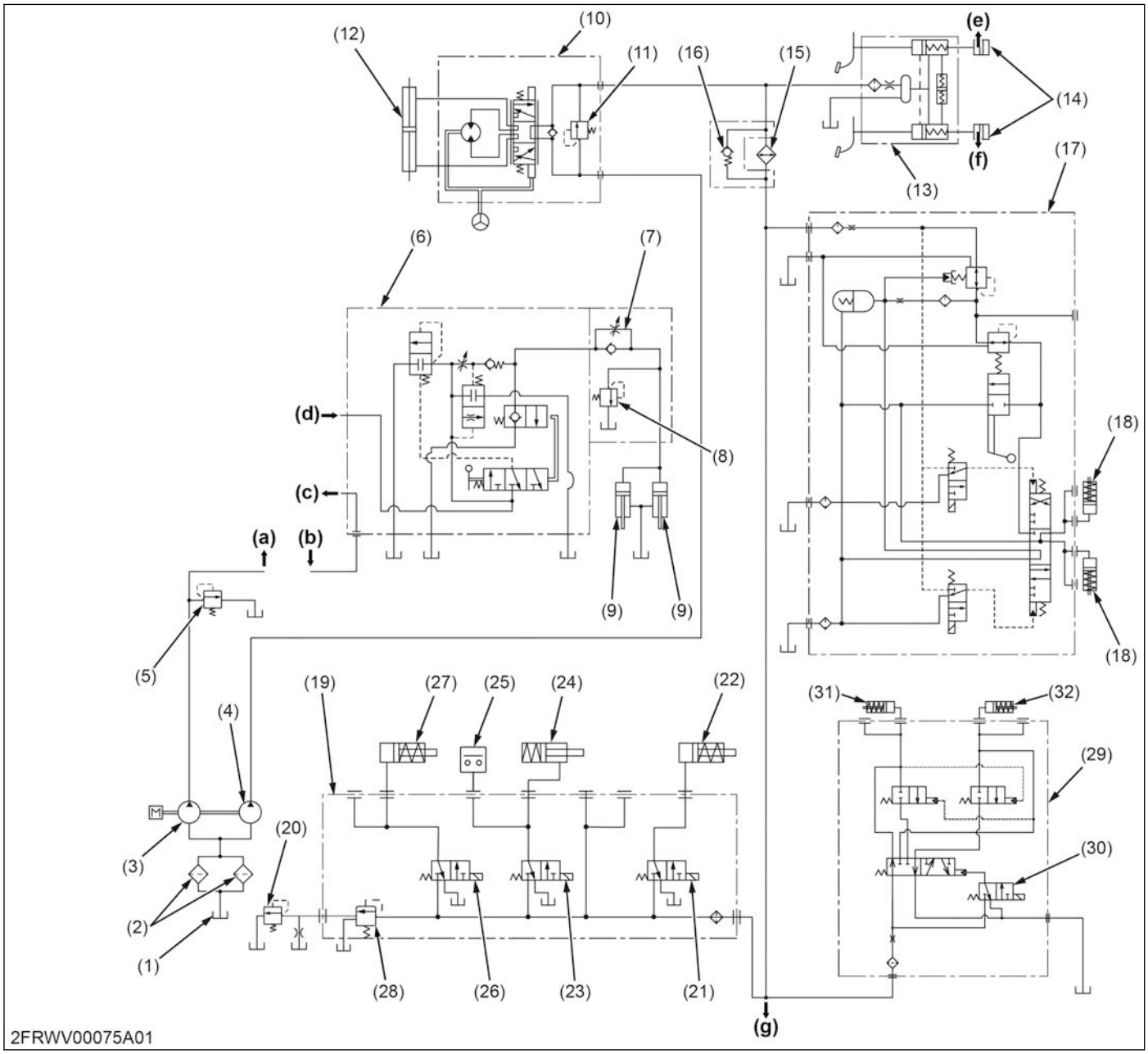
This system has the following functions.

1. Raise and lower implements connected to the 3-point hitch with external hydraulic cylinders. The hydraulic lift includes position control and draft control (mixed) control.
2. Draw hydraulic power from auxiliary control valve to operate implement hydraulic cylinders.
   - Implements with double acting cylinders can easily receive, hydraulic power drawn from the quick coupler.
   - Flow control valve permits simultaneous operation of implements powered by hydraulic pressure along with operation of 3-point hitch.
   - Oil flow from 3-point hitch pump can be connected with oil flow from auxiliary control valve.
   - Total oil flow is 60.0 L/min. (15.8 U.S.gals/min., 13.2 Imp.gals/min.). (ROPS model)
     Total oil flow is 64.9 L/min. (17.1 U.S.gals/min., 14.3 Imp.gals/min.). (Cabin model)
   - Operating pressure is 19.6 MPa (200 kgf/cm$^2$, 2847 psi).
   - Maximum of 3 auxiliary control valves or 2 valves with a flow control valve.
3. Hydraulic oil flow for power steering is 23.8 L/min. (6.29 U.S.gals/min., 5.24 Imp.gals/min.). (ROPS model)
   Hydraulic oil flow for power steering is 25.7 L/min. (6.79 U.S.gals/min., 5.65 Imp.gals/min.). (Cabin model)
4. Operation of power steering through the steering controller.
5. Hydraulic oil flow for shuttle, PTO, 4WD, rear differential lock and dual speed is 23 L/min. (6.1 U.S.gals/min., 5.1 Imp.gals/min.).
6. Operation of PTO clutch, shuttle clutch, dual speed clutch, 4WD clutch, differential lock and Bi-speed turn clutch.
7. Operation of hydraulic brakes.
8. Operation of auxiliary control valve, refer to "Hydraulic system" section in the Workshop Manual of *Tractor mechanism* (Code No. *9Y021-18200*).

# 3. Hydraulic circuit

## 3.1 Total hydraulic circuit

### 3.1.1 F36/R36 speed transmission model

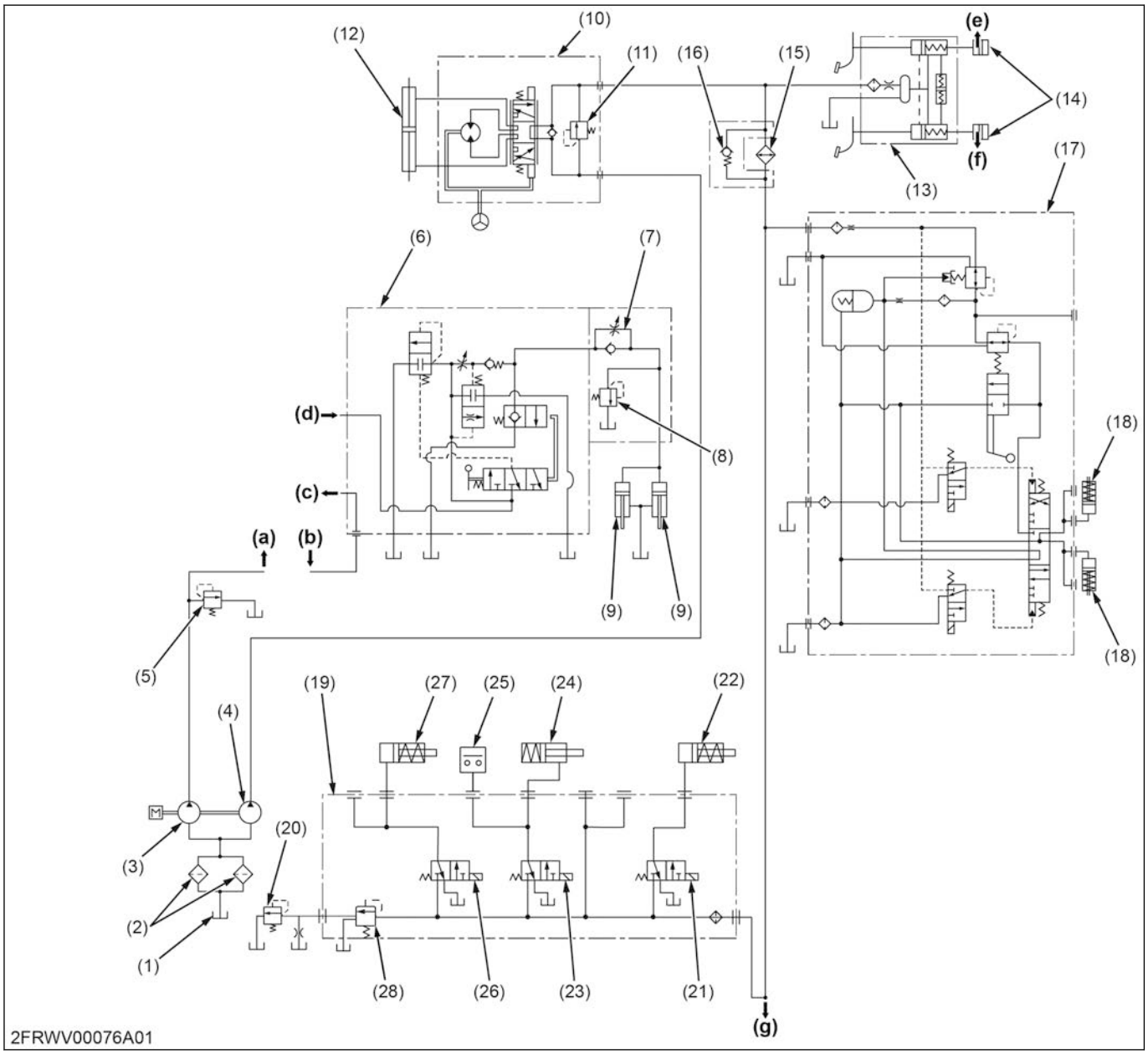



(1) Oil tank (Transmission case)
(2) Hydraulic oil filter cartridge
(3) Hydraulic pump (3-point hitch)
(4) Hydraulic pump (Power steering and system line)
(5) Relief valve (3-point hitch)
(6) Control valve (3-point hitch)
(7) Lowering speed adjusting valve
(8) Cylinder safety valve
(9) Exterior hydraulic cylinder
(10) Power steering controller
(11) Power steering controller relief valve
(12) Steering cylinder
(13) Brake master cylinder
(14) Brake piston
(15) Oil cooler
(16) Oil cooler check valve
(17) Shuttle valve
(18) Shuttle clutch pack
(19) Solenoid valve assembly
(20) Relief valve (Lubricating line)
(21) Solenoid valve (Rear differential lock)
(22) Rear differential lock piston
(23) Solenoid valve (2WD)
(24) 2WD clutch pack
(25) 2WD pressure switch
(26) Solenoid valve (PTO)
(27) PTO clutch pack
(28) Solenoid valve relief valve
(29) Dual speed valve
(30) Solenoid valve (Dual speed)
(31) Clutch pack (Hi)
(32) Clutch pack (Lo)
(a) To trailer brake valve (If equipped)
(b) Freon trailer brake valve (If equipped)
(c) To auxiliary control valve
(d) From auxiliary control valve
(e) To trailer brake valve (If equipped)
(f) To trailer brake valve (If equipped)
(g) To trailer brake valve (If equipped)

### Operating pressure

| | |
|---|---|
| (5) | 19.4 to 19.8 MPa (198 to 201 kgf/cm$^2$, 2820 to 2870 psi) |
| (8) | 23.1 to 24.5 MPa (235 to 250 kgf/cm$^2$, 3350 to 3550 psi) |
| (11) | 14.7 to 15.4 MPa (150 to 157 kgf/cm$^2$, 2140 to 2230 psi) |
| (16) | Approx. 0.8 MPa (8 kgf/cm$^2$, 100 psi) |
| (28) | 2.16 MPa (22.0 kgf/cm$^2$, 313 psi) |

## 3.1.2 F18/R18 speed transmission model



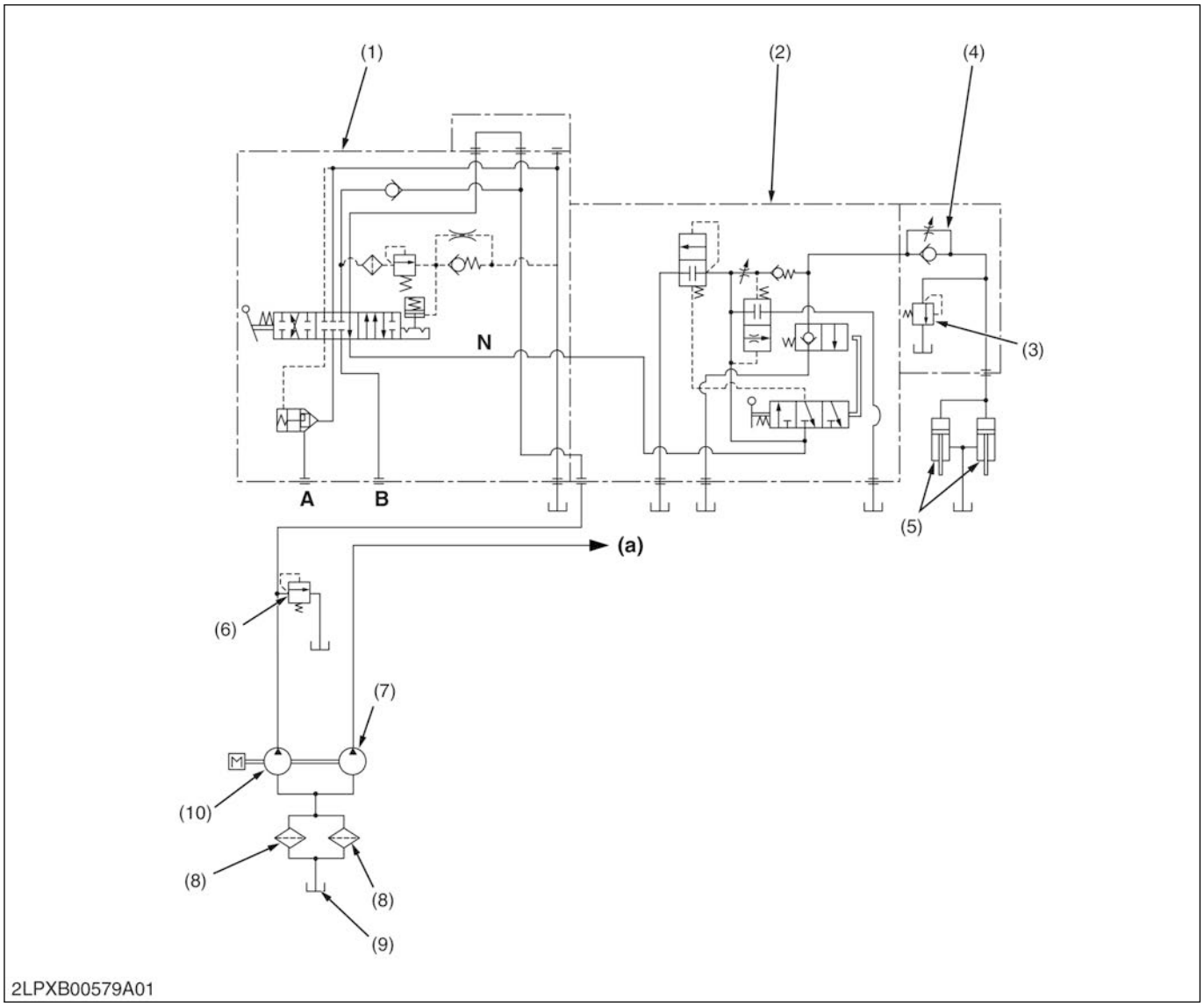

(1) Oil tank (Transmission case)
(2) Hydraulic oil filter cartridge
(3) Hydraulic pump (3-point hitch)
(4) Hydraulic pump (Power steering and system line)
(5) Relief valve (3-point hitch)
(6) Control valve (3-point hitch)
(7) Lowering speed adjusting valve
(8) Cylinder safety valve
(9) Exterior hydraulic cylinder
(10) Power steering controller
(11) Power steering controller relief valve
(12) Steering cylinder
(13) Brake master cylinder
(14) Brake piston
(15) Oil cooler
(16) Oil cooler check valve
(17) Shuttle valve
(18) Shuttle clutch pack
(19) Solenoid valve assembly
(20) Relief valve (Lubricating line)
(21) Solenoid valve (Rear differential lock)
(22) Rear differential lock piston
(23) Solenoid valve (2WD)
(24) 2WD clutch pack
(25) 2WD pressure switch
(26) Solenoid valve (PTO)
(27) PTO clutch pack
(28) Solenoid valve relief valve
(a) To trailer brake valve (If equipped)
(b) Freon trailer brake valve (If equipped)
(c) To auxiliary control valve
(d) From auxiliary control valve
(e) To trailer brake valve (If equipped)
(f) To trailer brake valve (If equipped)
(g) To trailer brake valve (If equipped)

### Operating pressure

| | |
|---|---|
| (5) | 19.4 to 19.8 MPa (198 to 201 kgf/cm$^2$, 2820 to 2870 psi) |
| (8) | 23.1 to 24.5 MPa (235 to 250 kgf/cm$^2$, 3350 to 3550 psi) |
| (11) | 14.7 to 15.4 MPa (150 to 157 kgf/cm$^2$, 2140 to 2230 psi) |
| (16) | Approx. 0.8 MPa (8 kgf/cm$^2$, 100 psi) |
| (28) | 2.16 MPa (22.0 kgf/cm$^2$, 313 psi) |

# 3.2 3 point hydraulic system

## 3.2.1 Outline of three point hitch hydraulic circuit diagram

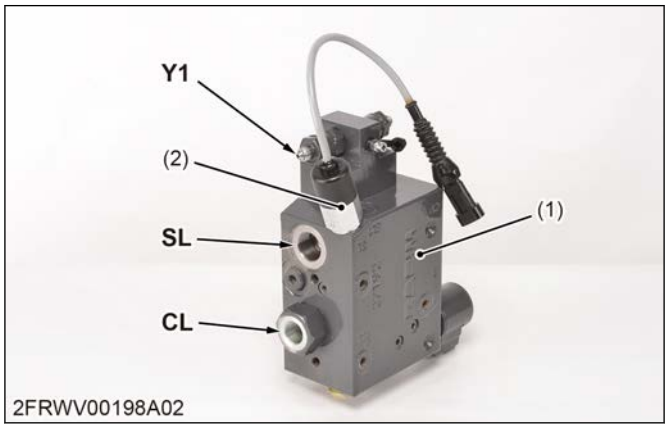


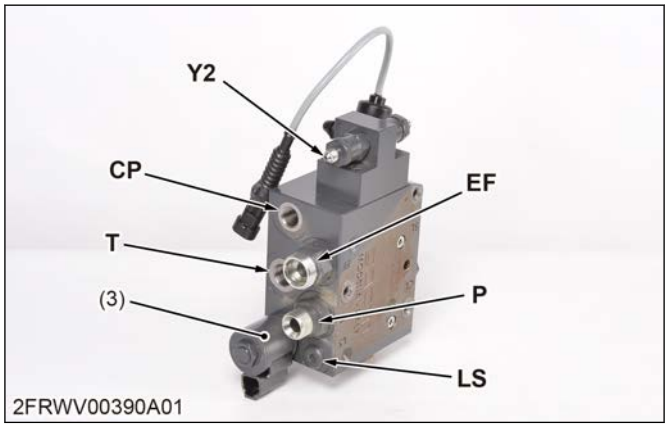

(1) Auxiliary control valve (SCD)
(2) Control valve
(3) Cylinder safety valve
(4) Lowering speed adjusting valve
(5) Hydraulic cylinder (Exterior)
(6) Relief valve
(7) Hydraulic pump (for power steering and system line)
(8) Hydraulic oil filter cartridge
(9) Oil tank (Transmission case)
(10) Hydraulic pump (for 3-point hitch)
(a) To power steering controller
A: To implement cylinder
B: To implement cylinder
N: N port

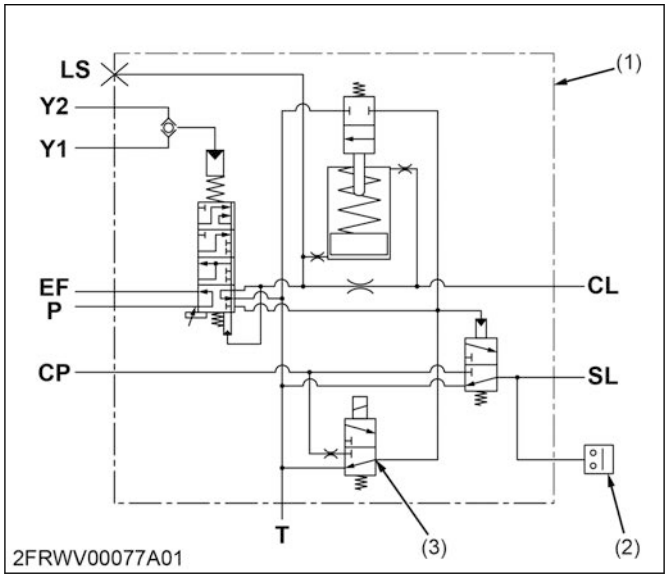
1. When the engine is started, the hydraulic pump (10) is rotated to draw oil from transmission case (9) through the suction pipe.
   Supplied oil is filtered by the hydraulic oil filter cartridge (8).
2. Filtered oil is forced out by the hydraulic pump to the auxiliary control valve (1).
3. With the auxiliary control valve (1) in neutral position, oil is channeled from "N" port to the control valve (2).
4. The hydraulic system has a relief valve (6) which restricts the maximum pressure in the circuit.
   The hydraulic cylinders (5) have a cylinder safety valve (3) to relieve shock pressure due to heavy implement bounce.
5. The control valve (2) is actuated by the mechanical linkage for "Position control" or "Draft control" or both "Mix control" (combination the position control and the draft control).

# 4. Hydraulic trailer brake valve

## 4.1 Function of hydraulic trailer brake valve



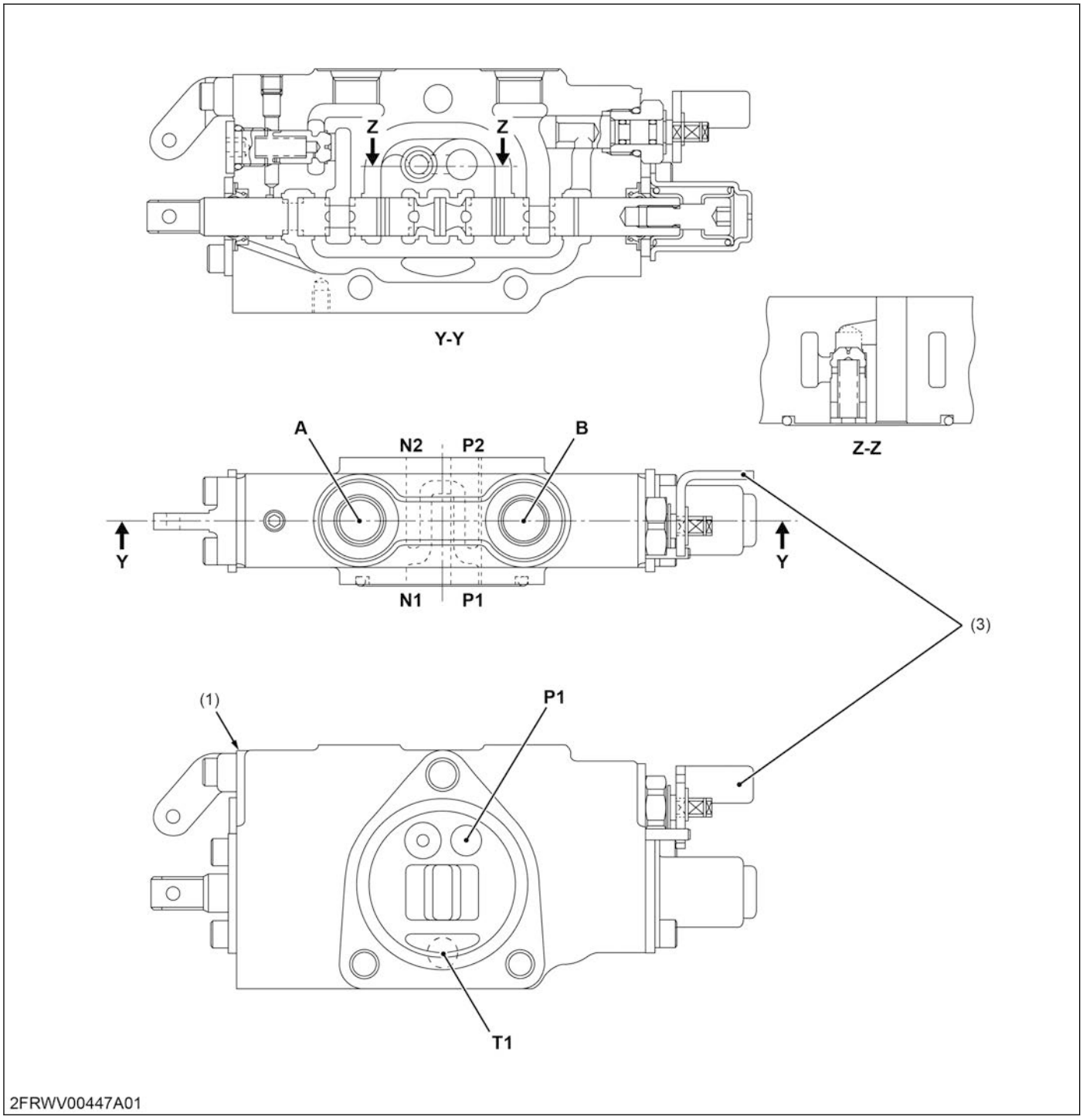

(1) Hydraulic trailer brake valve
(2) Pressure switch
(3) Hydraulic trailer brake solenoid

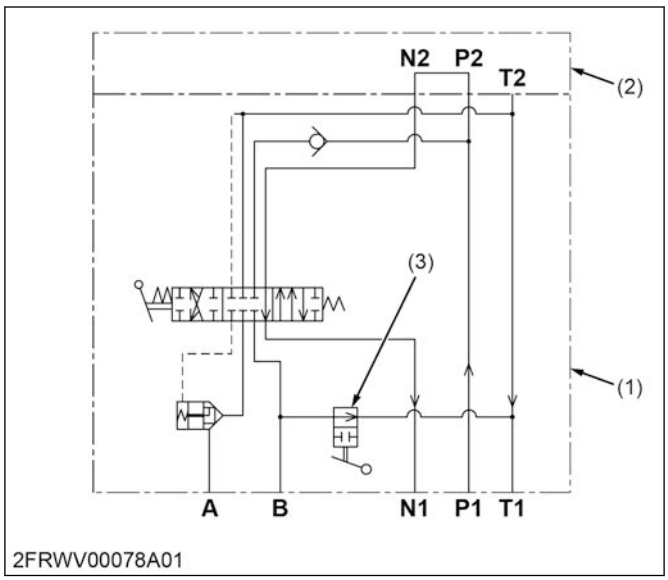
This trailer valve (1) can supply two lines of hydraulic brake outlet, CL and SL.
If the pilot pressure is applied to Y1 or Y2 port, the pressure moves the spool. As a result, the pressure applied to P port is outputted to CL port.

In addition, the hydraulic trailer brake solenoid (3) is equipped to this valve. If this solenoid is activated, the hydraulic pressure applied to CP port moves the spool and the hydraulic pressure is outputted to SL port. To check SL port is outputted or not, pressure switch (2) is equipped.

# 5. Auxiliary control valve

## 5.1 Structure of S/D valve

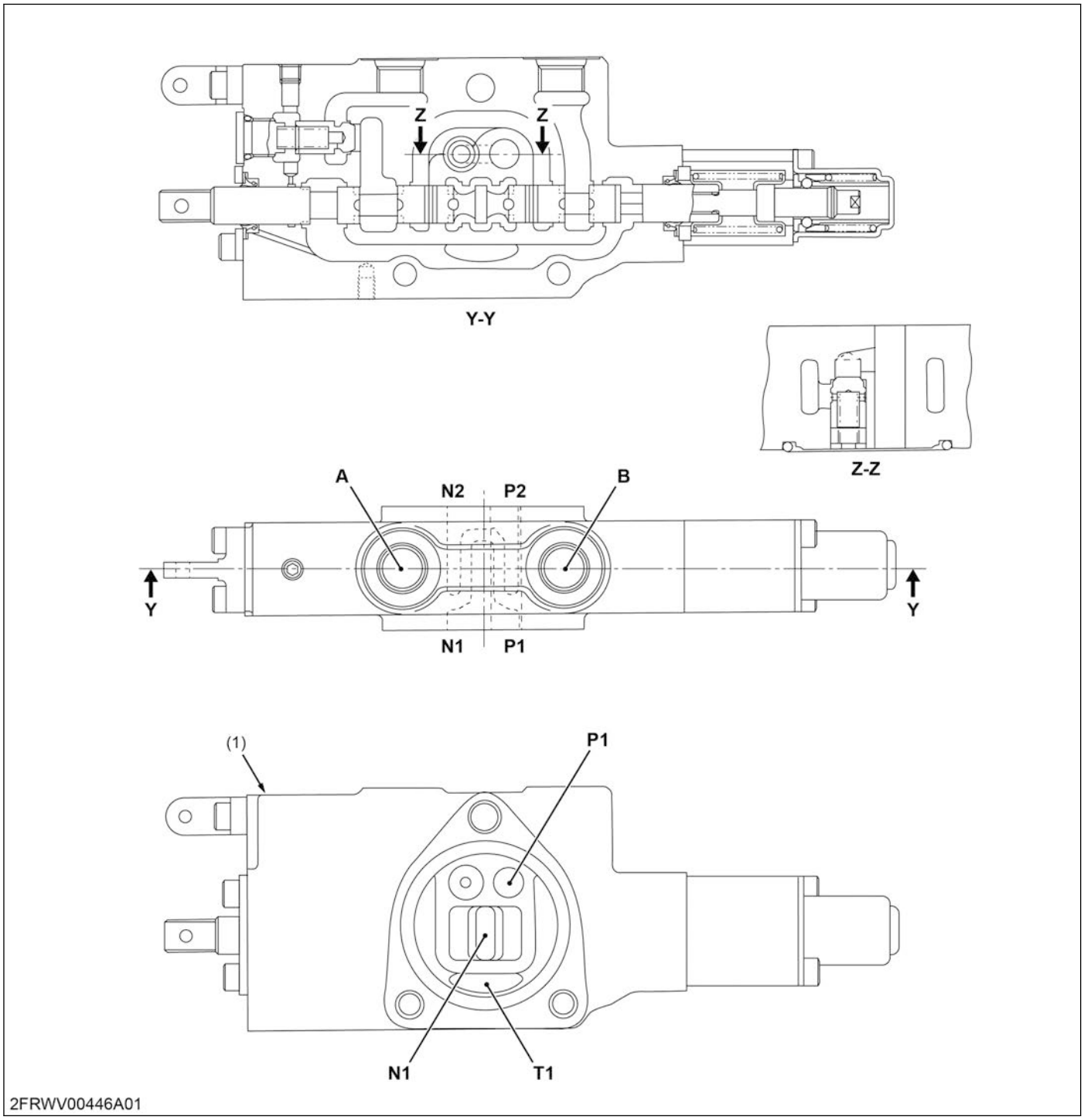


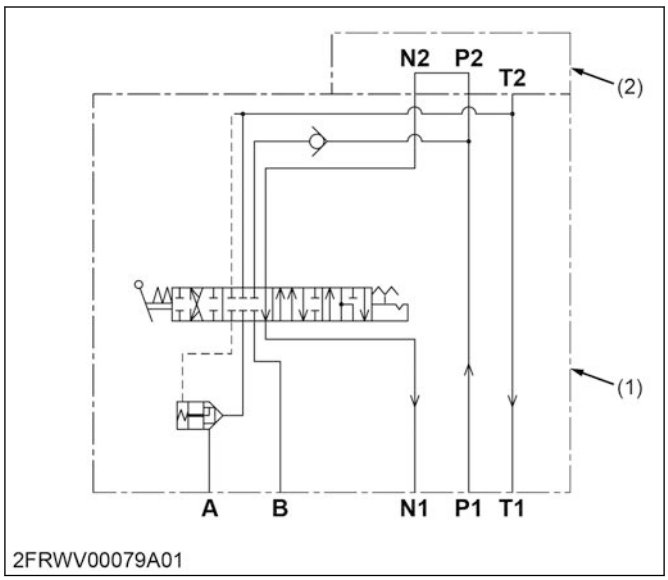



(1) S/D valve (2) Auxiliary control valve cover (3) S/D switching knob

S/D valve (1) is a valve can switch single or double acting by using S/D switching knob (3).

## 5.2 Structure of floating detent valve

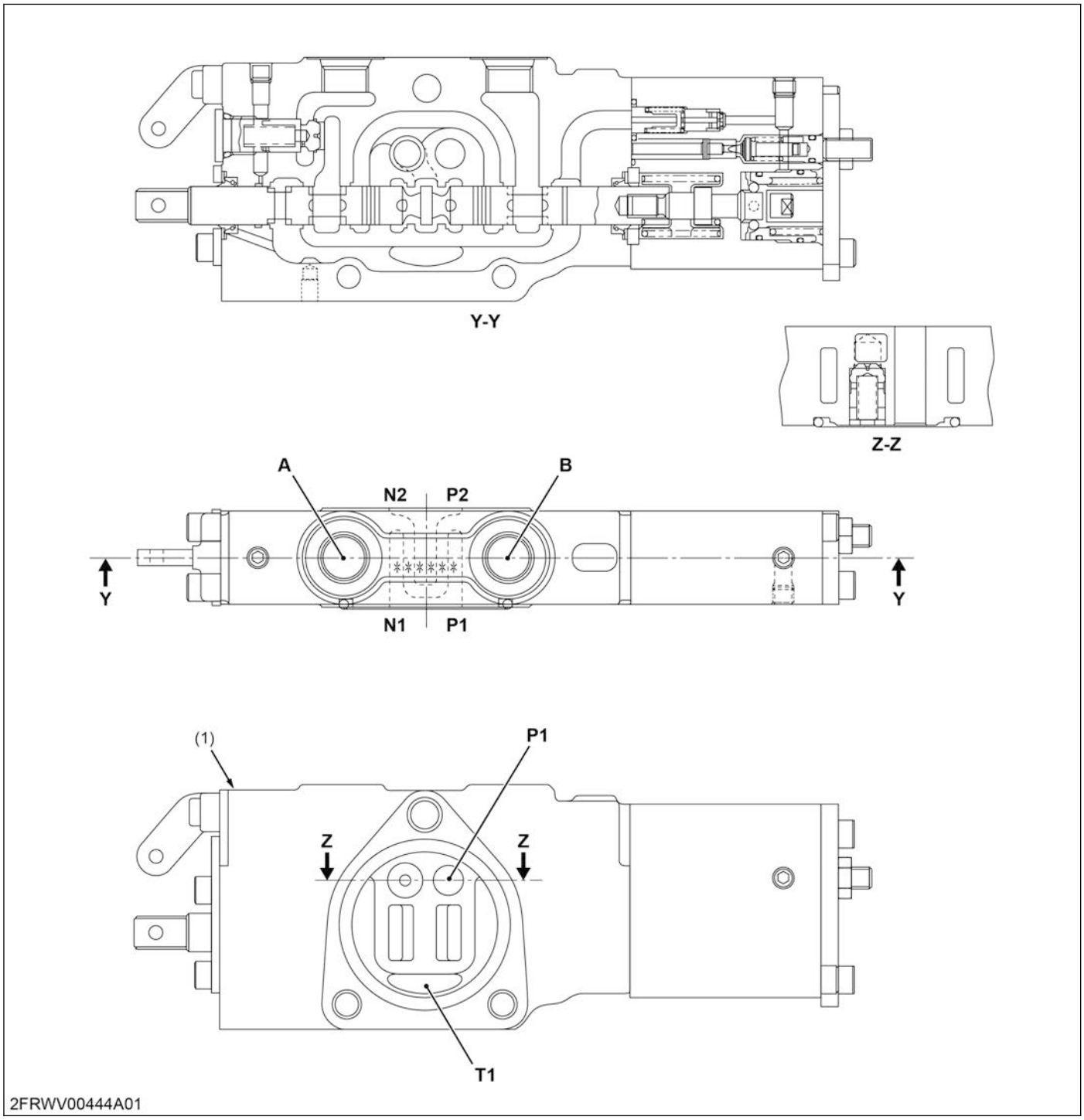


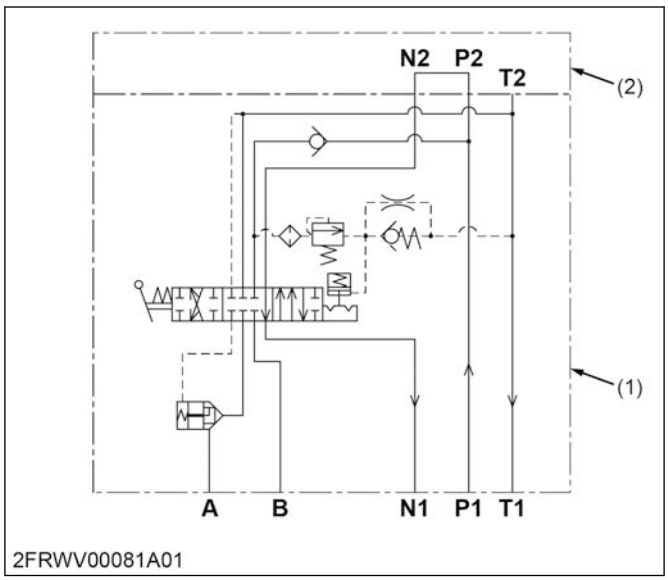



(1) Floating detent valve (2) Auxiliary control valve cover

In addition to normal S/D valve, this valve has floating detent function. When spool is in floating detent position, both output port A and B are connected to T1 and T2 port and spool stays this position until operator releases the spool.

## 5.3 Structure of self canceling detent valve

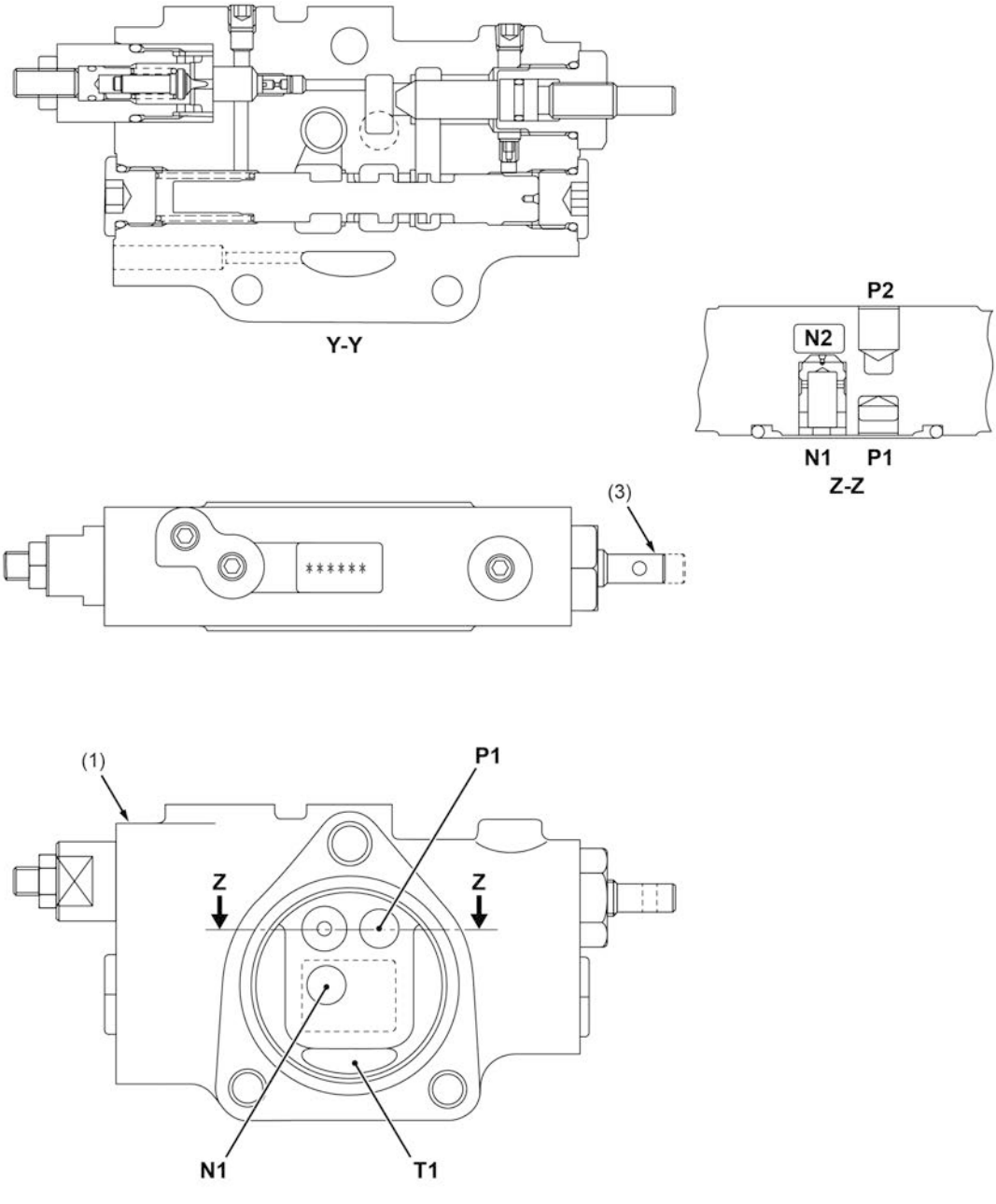


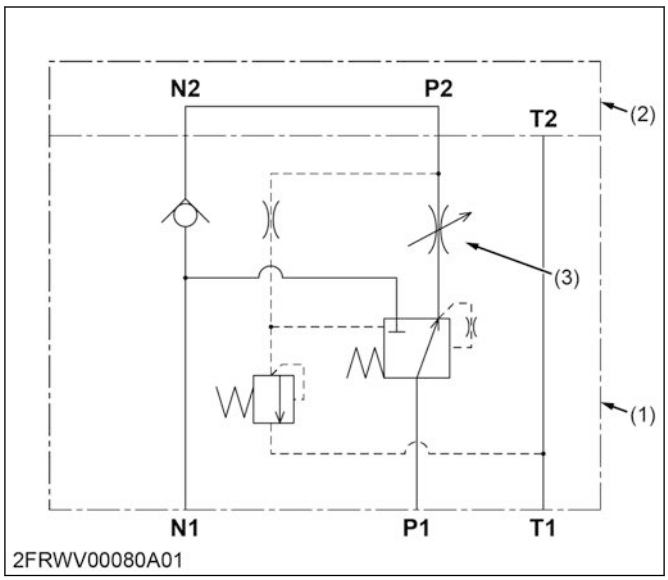



(1) Self canceling detent valve (2) Auxiliary control valve cover

In addition to normal S/D valve, this valve has detent function. When the lever is operated either direction, by operation little bit more the lever becomes detent position and keeps the position. If the cylinder connected to this valve reaches to the end, the valve returns to **Neutral** position automatically. Operator can also return the valve to **Neutral** position manually.

## 5.4 Structure of flow control valve



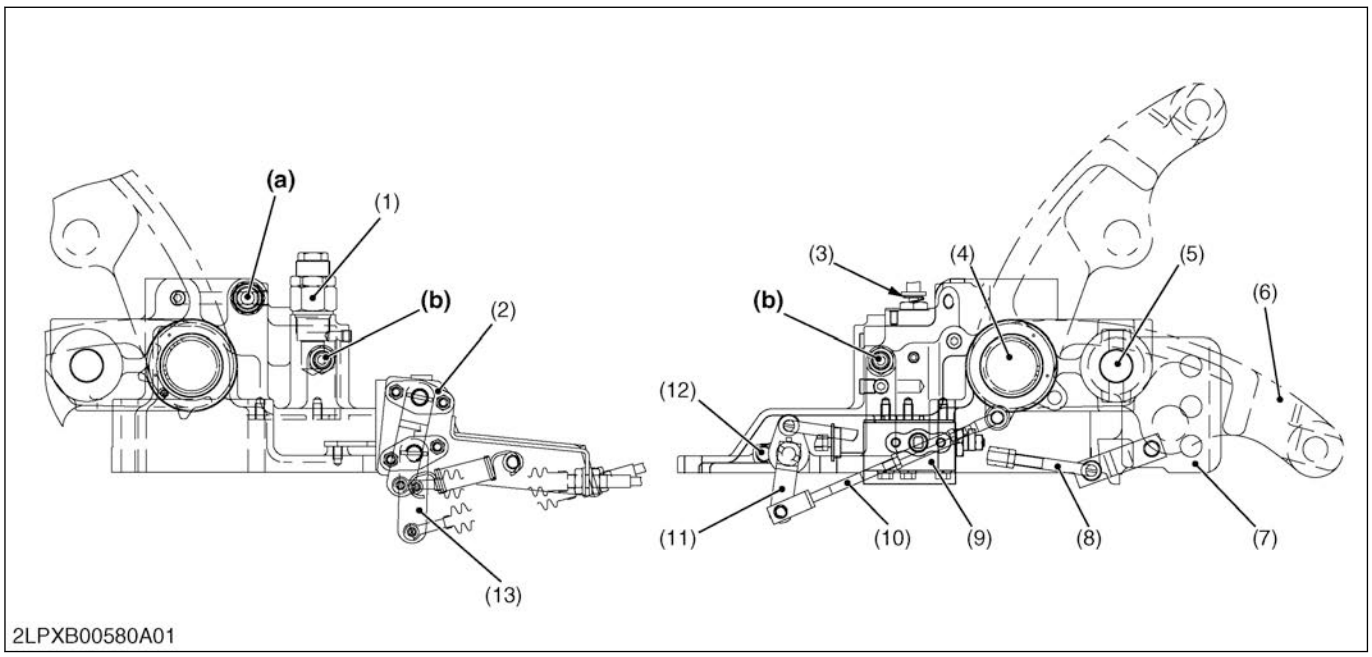



(1) Flow control valve (2) Auxiliary control valve cover (3) Flow control knob

By attaching this valve to the bottom of the other auxiliary valve, the flow amount of oil can be controlled by the flow control knob (3).

# 6. Three point hitch hydraulic system

## 6.1 Structure of hydraulic block




(1) Cylinder safety valve
(2) Draft control linkage
(3) Lowering speed adjusting valve
(4) Hydraulic arm shaft
(5) Torsion bar
(6) Lift arm
(7) Top link bracket
(8) Draft rod
(9) Control valve
(10) Position feedback rod
(11) Position feedback link
(12) Draft feedback link
(13) Position control linkage
(a) From hydraulic pump
(b) To or from hydraulic cylinder

The hydraulic block is equipped with cylinder safety valve (1), lowering speed adjusting valve (3), check valve, control valve, lift arm (6), lift arm shaft, torsion bar (5), position feedback rod (10) and draft rod (8) etc.
The hydraulic outlet port (b) is located in the hydraulic block to take power from the tractor to operate the hydraulic cylinders of the 3-point linkage.

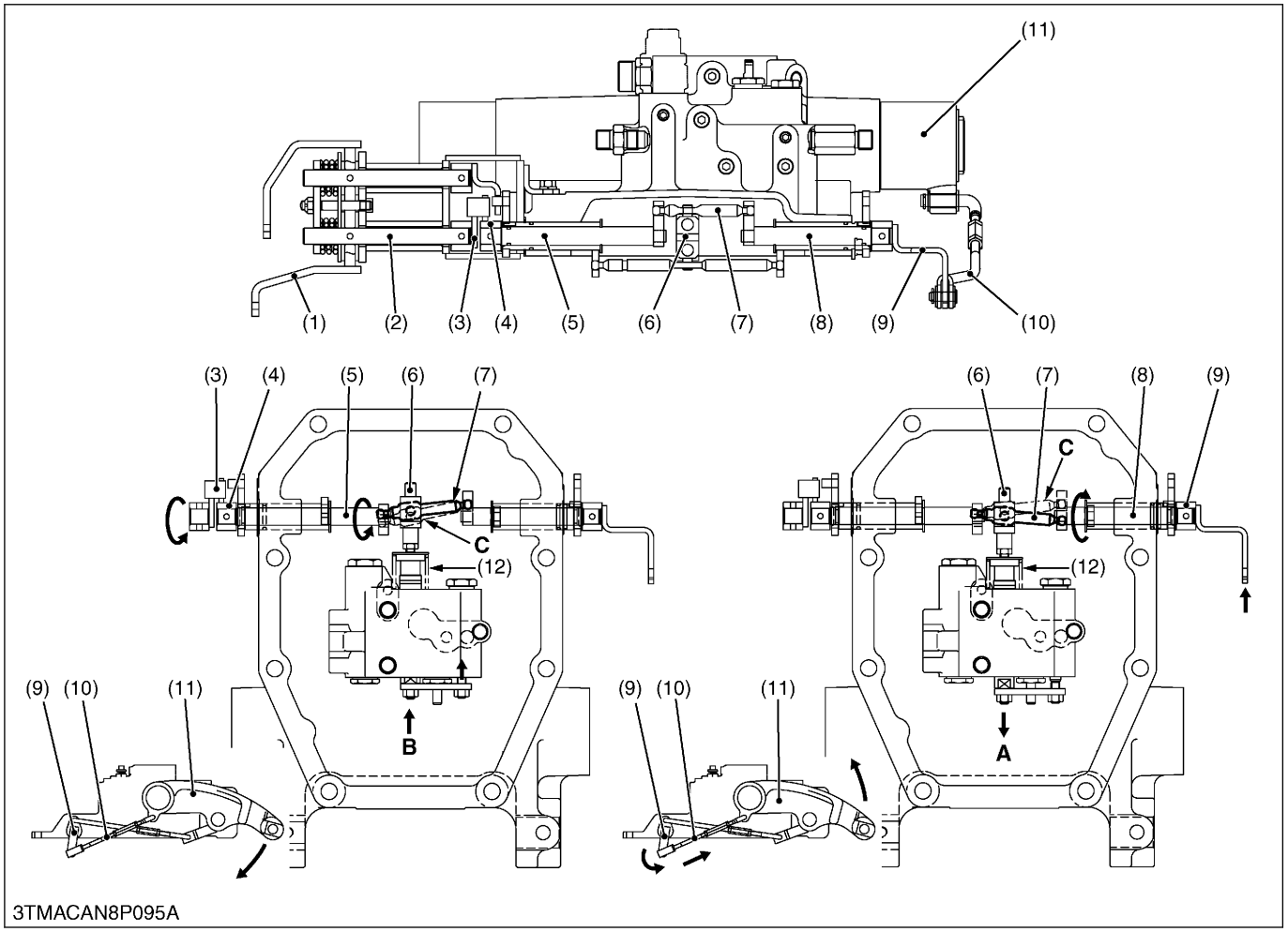
1. To operate the control valve, refer to "Hydraulic system / Position control valve - Type 7" in the Workshop Manual of *Tractor mechanism* (Code No. *9Y021-18200*).
2. To operate the cylinder safety valve (surge relief valve) operation, refer to "Hydraulic system / Cylinder safety valve (Surge relief valve)" in the Workshop Manual of *Tractor mechanism* (Code No. *9Y021-18200*).

# 6.2 Linkage mechanism

## 6.2.1 Function of position control

Position control is a hydraulic mechanism to raise or lower the implement attached to the tractor in proportion to the movement of the position control lever. The implement can be positioned at any height by moving the position control lever. Fine position adjustment is also easy.

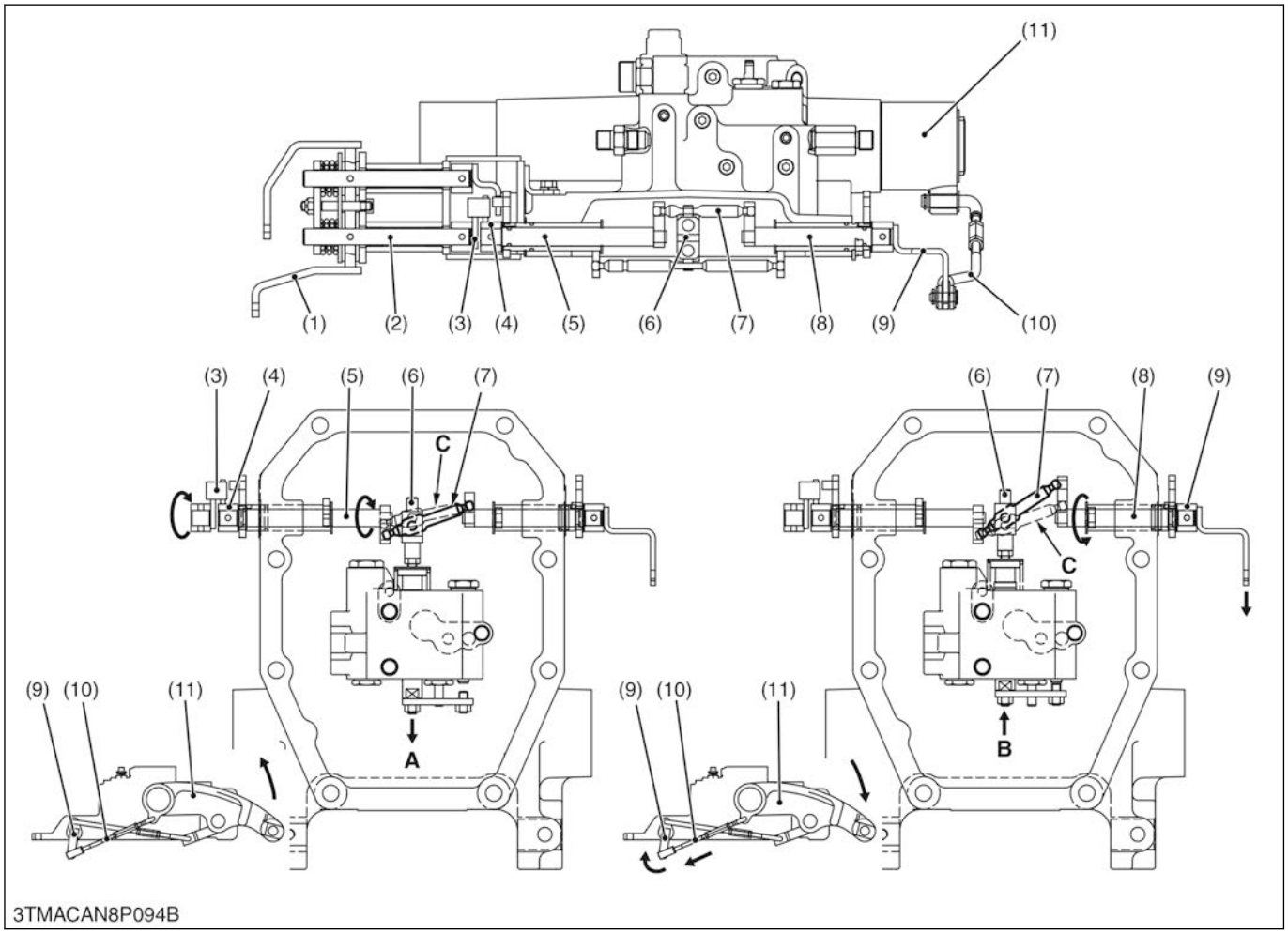
**Lift**




(1) Position control lever
(2) Position lever shaft 1
(3) Position link 1
(4) Position link 2
(5) Position lever shaft 2
(6) Spool
(7) Spool drive lever (position)
(8) Position feedback shaft
(9) Position feedback lever
(10) Position feedback rod
(11) Lift arm
A: **LIFT**
B: **DOWN**
C: Neutral position

1. When the position control lever (1) is moved to the **LIFT** position, the position lever shaft 1 (2) and position link 1 (3) rotates and press down the position link 2 (4). The position lever shaft 2 (5) rotates and pushes the spool (6) by the spool drive lever (7), opening the **LIFT** circuit.
2. When the lift arm (11) moves upward, position feedback shaft (8) rotates via position feedback rod (10) and pulls the spool (6) by the spool drive lever (7).
   The lift arm stops when the spool (6) returns to the neutral position "C".

**Down**




(1) Position control lever
(2) Position lever shaft 1
(3) Position link 1
(4) Position link 2
(5) Position lever shaft 2
(6) Spool
(7) Spool drive lever (position)
(8) Position feedback shaft
(9) Position feedback lever
(10) Position feedback rod
(11) Lift arm
A: **LIFT**
B: **DOWN**
C: Neutral position

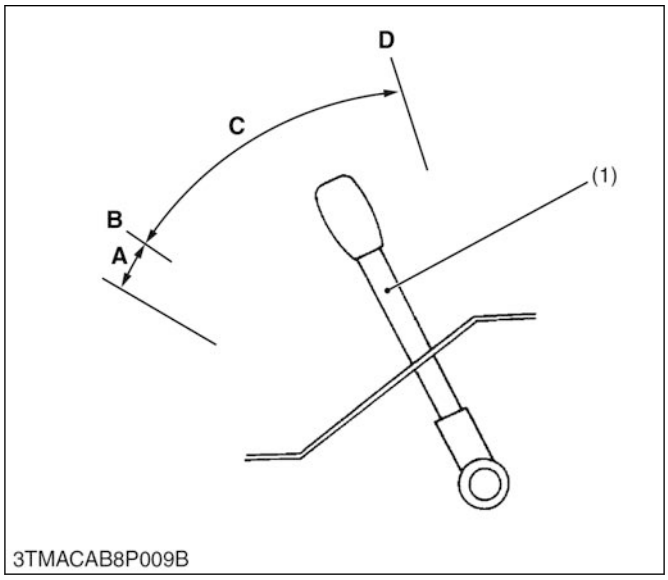
1. When the position control lever (1) is moved to the **DOWN** position, the position link 2 (4) is free.
   The spool (6) of control valve moves by spool spring to opening the **DOWN** circuit.
2. When the lift arm (11) moves downward, feedback shaft (8) rotates via position feedback rod (10) and push the spool (6) by the spool drive lever (7).
   The lift arm stops when the spool returns to the neutral position "C".

## 6.2.2 Draft control

Draft control is a system which keeps a constant traction load, and is suited for the work which needs heavy traction load such as plowing.
The implement is automatically raised when its traction load is increased, and lowers when the traction load is decreased. By keeping a constant load level, it prevents the tractor from slipping and being loaded excessively.
The setting traction load can be adjusted by changing the position of the draft control lever.
The draft control system uses the same control valve as the position control system. The traction load applied to the tractor is sensed and is fed back to the control valve by means of the other linkage mechanism.

### 6.2.2.1 Feature of draft control

Draft control is a system which keeps a constant traction load, and is suited for the work which needs heavy traction load such as plowing.




(1) Draft control lever
A Floating range
B Deep
C Draft control range
D Shallow

With draft control, operation is as described below according to the position of the draft control lever.

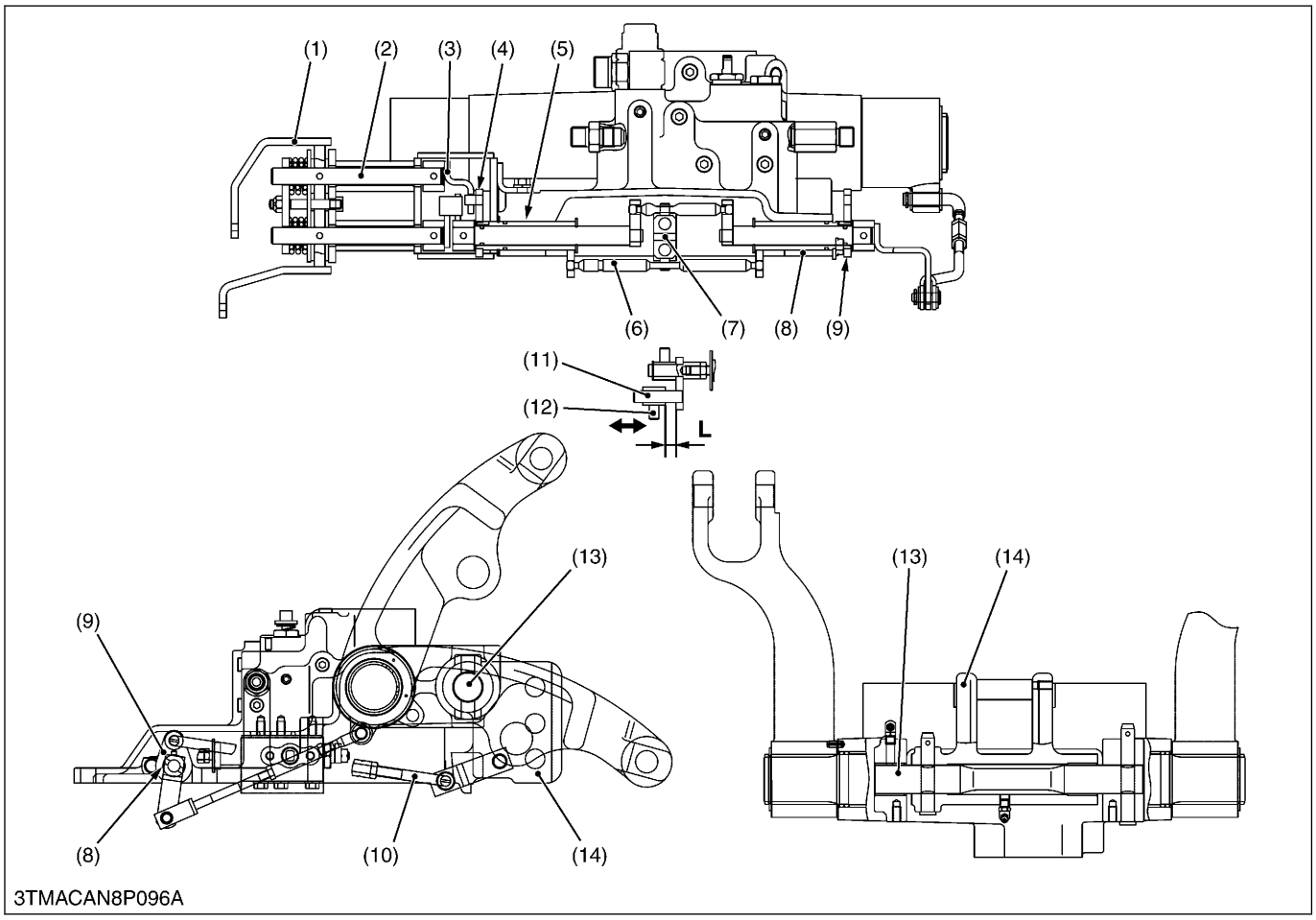
1. When the draft control lever is set in the floating range (A), the implement lowers to the ground.
2. When the draft control lever is set in the draft control range (C), work is performed as follows.
   - As the traction load applied to the tractor from the implement increases, the implement is raised.
   - As the traction load decreases, the implement lowers to the position at which it matches the setting traction load.
3. When the implement is raised as described in 2 above, the force to raise the implement is applied to the rear wheels so that the ground pressure of the wheels is momentarily increased to prevent slippage.

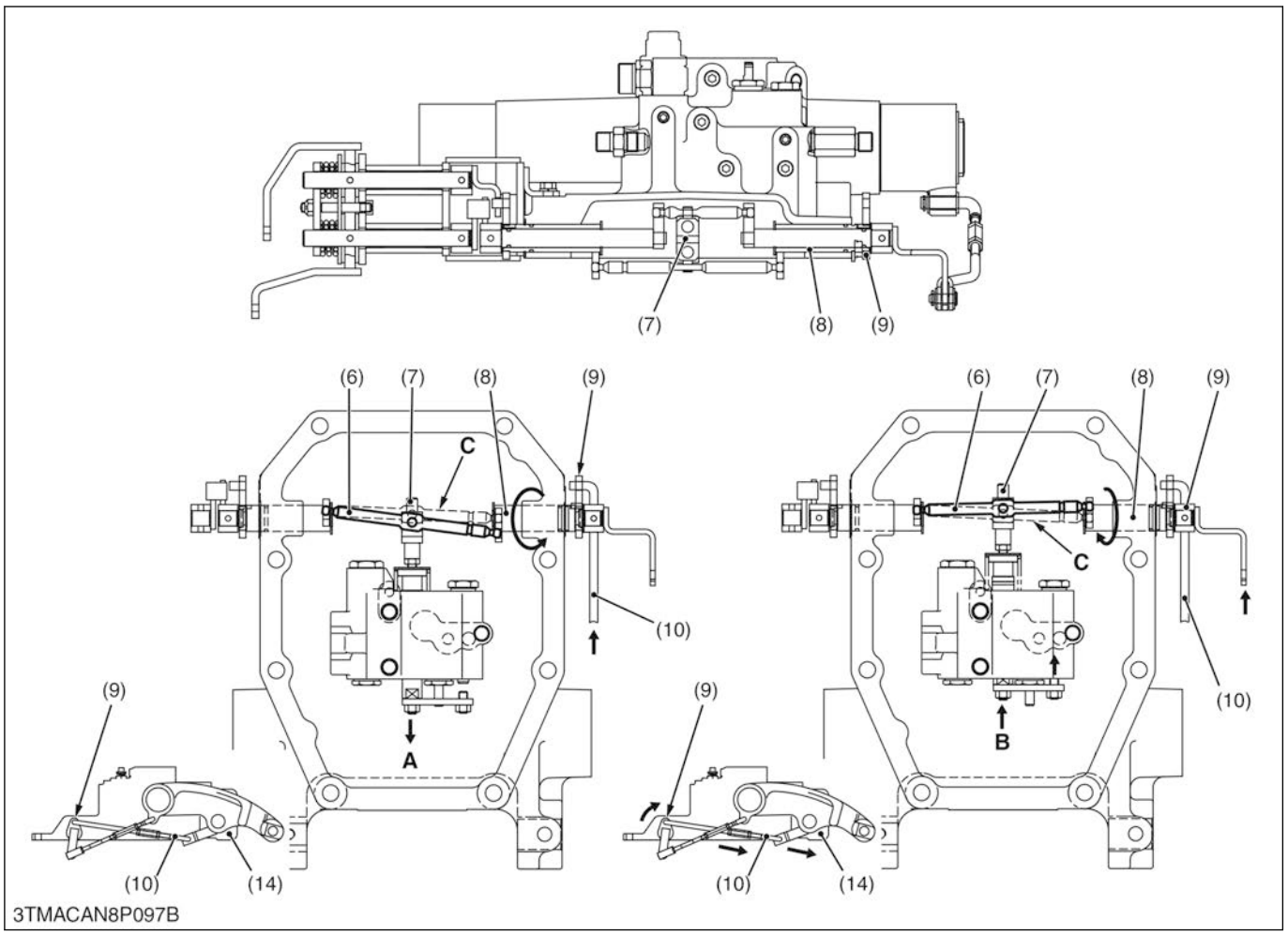
**(Reference)**

- When the draft control is used, the position control lever should be set at "FLOATING" range.
- If the position control lever is set at working range, both control systems operate performing mixed control system.

RELATED PAGE
6.2.3 Feature of mixed control on page 9-24

## 6.2.2.2 Function of draft control



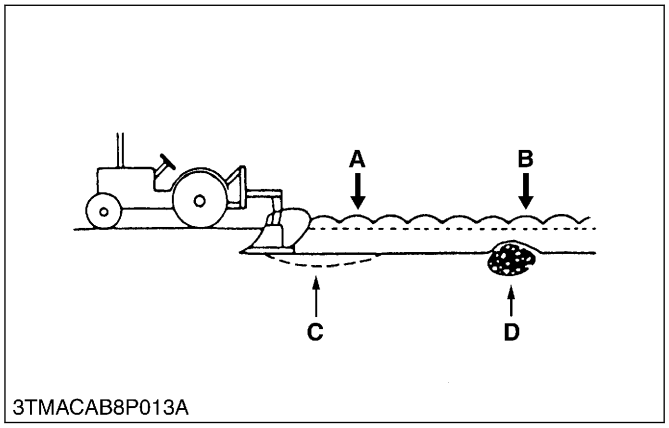



(1) Draft control lever
(2) Draft lever shaft
(3) Draft lever
(4) Draft link
(5) Draft link shaft
(6) Spool drive lever (Draft)
(7) Spool
(8) Draft feedback link shaft
(9) Draft feedback lever
(10) Draft feedback rod
(11) Spool shaft
(12) Spool link
(13) Torsion bar
(14) Top link holder
L: Clearance
A: **LIFT**
B: **DOWN**
C: Neutral position

1. The traction load applied to the tractor from the implement act as a torsional force to the torsion bar (13) via the top link and top link holder (14). When the torsion bar (13) is twisted, its displacement is transmitted to the draft feedback link shaft (8) to rotate via the draft feedback rod (10) and draft feedback lever (9). The draft feedback link shaft (8) rotates. The end of the spool drive lever (6) is connected to the draft feedback link shaft (8) and the other end is fixed with the draft link shaft (5), pulling out or pushing in the spool (7) by the rotation of the draft link shaft (5).
   The angle of the draft link shaft (5) is controlled by the draft control lever (1).
   The angle of the draft link shaft (5) slides the spool link (12) on the spool shaft (11). This sliding motion changes clearance (L) and draft sensibility.
2. When the traction load increases, the torsion bar is twisted, and its displacement is transmitted to the draft feedback link shaft (8) via the draft feedback rod (10) and draft feedback lever (9). The draft feedback link shaft (8) rotates.
   The draft feedback link shaft (8) pushes the spool (7) in via the spool drive lever (6) and the **LIFT** circuit is activated.
   As the implement is raised and the traction load decreases, the torsion bar is restored to return the spool (7) to neutral point "C".
3. When the traction load decreases, the torsion bar is restored and its displacement is transmitted to the draft feedback link shaft (8) via the draft feedback rod (10) and draft feedback lever (9). As the draft feedback link shaft (8) rotates, the spool drive lever (6) pulls the spool (7) to form the **DOWN** circuit.
   As the implement lowers and the traction load increases, the torsion bar is twisted to return the spool (7) to neutral position "C".

### 6.2.3 Feature of mixed control

Mixed control is a system combining position control with draft control.

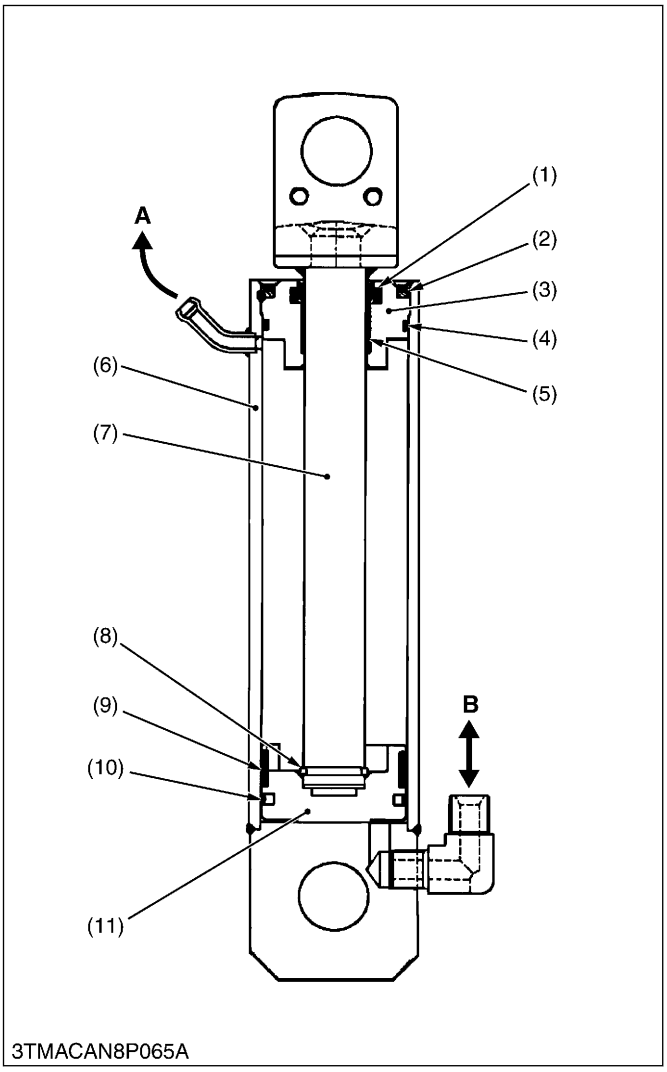



3TMACAB8P013A

A: Position controlled
B: Draft controlled
C: Not deep even in soft soil
D: Shallow where resistance occurs

When traction load increases, the draft control functions to raise the lift arms (implement). When traction load reduces, the lift arms (implement) lower to the height set by the position control only, when traction load increases, slippage or engine stop may occur unless the implement is raised.
With the draft control only, plowing depth cannot be kept constant if soil hardness changes greatly.
The mixed control serves to eliminate such disadvantages.

## 6.3 Feature of hydraulic cylinder




3TMACAN8P065A

(1) Dust seal
(2) Circlip
(3) Head
(4) O-ring
(5) Bushing
(6) Cylinder tube
(7) Rod
(8) Circlip
(9) Wear ring
(10) Seal
(11) Piston
A: To transmission case
B: To or from position control valve

The external type hydraulic cylinders are used for three point linkage system. This hydraulic cylinder is single acting type, and it is installed directly between hydraulic lift arm and lower link.
The main components of the hydraulic cylinder are shown in the figure.

# SERVICING

## 1. Troubleshooting for hydraulic system

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| When operator does not hear the relief valve operation sound, the implement does not rise. | 1. Parts of control linkage improperly are assembled or damaged | Repair or replace the parts. Adjust the control linkage. | 9-55<br>9-56<br>9-56<br>9-56<br>9-57<br>9-58<br>9-34 |
| | 2. Control valve is damaged. (unload valve, spool, check valve, poppet valve) | Repair or replace the control valve. | 9-58<br>9-59<br>9-60<br>9-60 |
| | 3. Control valve is broken | Replace the control valve. | 9-58<br>9-59<br>9-60<br>9-60 |
| | 4. Control valve is improperly adjusted. | Adjust the dimensions of the adjusting screw and the spool joint. | 9-58<br>9-59<br>9-60<br>9-60 |
| | 5. Relief valve spring is damaged. | Replace the relief valve spring. | 9-63 |
| | 6. Cylinder is damaged. | Replace | 9-60<br>9-61<br>9-62 |
| | 7. Safety valve is damaged. | Replace the safety valve. | 9-63 |
| When operator hears relief valve operation sound, implement does not rise. | 1. Transmission fluid is improper or transmission fluid level is insufficient. | Change the transmission fluid or fill the transmission fluid to the proper level. | 2-39 |
| | 2. Oil filter is clogged | Replace the oil filter. | 2-35 |
| | 3. Relief valve operating pressure is too low. | Check and adjust the relief valve operating pressure. | 9-32 |
| | 4. Relief valve spring is weak or damaged. | Replace the relief valve spring. Check and adjust the relief valve operating pressure. | 9-32 |
| | 5. Hydraulic pump is damaged. | Repair or replace the hydraulic pump. | 4-74<br>9-43 |
| Implement does not reach the maximum height | 1. Position feedback rod length is improperly adjusted | Adjust the position feedback rod length. | 9-34 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Implement does not reach the maximum height | 2. Draft rod length is improperly adjusted. | Adjust the draft rod length. | 9-34 |
| Implement does not lower | 1. Control valve is damaged. | Repair or replace the control valve. | 9-58<br>9-59<br>9-60<br>9-60 |
| | 2. Spool of the control valve is damaged. | Replace the control valve. | 9-58<br>9-60 |
| | 3. Lowering speed adjusting valve is closed. | Open the lowering speed adjusting valve. | 9-64<br>9-65 |
| Implement drops by its weight. | 1. Hydraulic cylinder is worn or damaged. | Disassemble the hydraulic cylinder. Repair the hydraulic cylinder. Replace the hydraulic cylinder. | 9-60<br>9-61<br>9-62 |
| | 2. Safety valve is damaged. | Replace the safety valve. | 9-63 |
| | 3. Lowering speed adjusting valve is damaged. | Replace the lowering speed adjusting valve. | 9-64<br>9-65 |
| | 4. Control valve is damaged. (check valve seat surface, check valve O-ring, poppet valve seat surface and poppet valve O-ring is damaged.) | Replace the control valve. | 9-58<br>9-59<br>9-60<br>9-60 |
| Implement hunts. (Moves up and down.) | 1. Poppet valve or poppet seat surface of the control valve is damaged. | Replace the control valve. | 9-58<br>9-60 |
| | 2. Check valve or check valve seat surface of the control valve is damaged. | Replace the control valve. | 9-58<br>9-60 |
| | 3. Control valve O-ring is worn or damaged. | Replace the control valve O-ring. | 9-58 |
| Draft control does not operate properly. | 1. Draft control linkage is improperly adjusted. | Adjust the draft rod length. Adjust the draft control lever wire length. | 9-34 |
| | 2. Torsion bar is weak or broken. | Replace the top link bracket. Adjust the draft rod length. When the adjusted top link length is short, adjust the top link length to the proper length. When heavy implement is attached to the tractor, check the implement limitations. | 9-63 |

# 2. Servicing specifications for hydraulic system

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Power steering pump delivery | Hydraulic pump delivery at no pressure (ROPS model) | Above<br>23.8 L/min.<br>6.29 U.S.gals/min.<br>5.24 Imp.gals/min. | — |
| | Hydraulic pump delivery at rated pressure (ROPS model) | 23.3 L/min.<br>6.16 U.S.gals/min.<br>5.13 Imp.gals/min. | 19.6 L/min.<br>5.18 U.S.gals/min.<br>4.31 Imp.gals/min. |
| | Hydraulic pump delivery at no pressure (Cabin model) | Above<br>25.7 L/min.<br>6.79 U.S.gals/min.<br>5.65 Imp.gals/min. | — |
| | Hydraulic pump delivery at rated pressure (Cabin model) | 25.2 L/min.<br>6.66 U.S.gals/min.<br>5.54 Imp.gals/min. | 21.1 L/min<br>5.57 U.S.gals/min.<br>4.64 Imp.gals/min. |
| Three point pump delivery | Hydraulic pump delivery at no pressure (ROPS model) | Above<br>58.1 L/min.<br>15.3 U.S.gals/min.<br>12.8 Imp.gals/min. | — |
| | Hydraulic pump delivery at rated pressure (ROPS model) | 56.9 L/min.<br>15.0 U.S.gals/min.<br>12.5 Imp.gals/min. | 47.8 L/min.<br>12.6 U.S.gals/min.<br>10.5 Imp.gals/min. |
| | Hydraulic pump delivery at no pressure (Cabin model) | Above<br>62.9 L/min.<br>16.6 U.S.gals/min.<br>13.8 Imp.gals/min. | — |
| | Hydraulic pump delivery at rated pressure (Cabin model) | 61.7 L/min.<br>16.3 U.S.gals/min.<br>13.6 Imp.gals/min. | 51.8 L/min.<br>13.7 U.S.gals/min.<br>11.4 Imp.gals/min. |
| Relief valve | Operating pressure | 19.7 to 20.5 MPa<br>200 to 210 kgf/cm$^2$<br>2850 to 2980 psi | — |
| Safety valve | Operating pressure | 23.1 to 24.5 MPa<br>235 to 250 kgf/cm$^2$<br>3350 to 3550 psi | — |
| Position control lever | Floating range | 10 to 30 mm<br>0.40 to 1.1 in. | — |
| Cylinder | Free play | 5 to 8 mm<br>0.2 to 0.3 in. | — |
| Draft Lever | Free range | Less than<br>25 mm<br>0.98 in. | — |
| | Floating range | More than<br>15 mm<br>0.59 in. | — |
| Position and draft control lever | Operating force | 20 to 39 N<br>2.0 to 4.0 kgf<br>4.4 to 8.8 lbf | — |
| Auxiliary valve lever pin center to valve control wire end | Clearance | 0 to 3.0 mm<br>0 to 0.12 in. | — |
| Control lever to stopper plate | Clearance | 0 to 1.0 mm<br>0 to 0.039 in. | — |

(Continued)

## 9. HYDRAULIC SYSTEM

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Oil cooler check valve | Operating pressure | Approximately<br>0.8 MPa<br>8 kgf/cm$^2$<br>100 psi | — |
| Spring retainer to spool joint 3 | Length | 22.5 to 23.0 mm<br>0.886 to 0.905 in. | — |

# 3. Tightening torques for hydraulic system

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to 2-15, 2-15.)

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Rear wheel mounting nut | 344 to 402 | 35.0 to 41.0 | 254 to 296 |
| Relief valve assembly | 35 to 39 | 3.5 to 4.0 | 26 to 28 |
| Safety valve assembly | 40 to 49 | 4.0 to 5.0 | 29 to 36 |
| Housing cover mounting screw | 40 to 44 | 4.0 to 4.5 | 29 to 32 |
| 3-point hitch delivery pipe nut | 108 to 117 | 11.0 to 12.0 | 79.6 to 86.7 |
| Cylinder hose retaining nut | 46 to 53 | 4.6 to 5.4 | 34 to 39 |
| Top cover mounting screw (M14, 9T) | 167 to 196 | 17.0 to 20.0 | 123 to 144 |
| Top cover mounting nut (M14, 7T) | 124 to 147 | 12.6 to 15.0 | 91.2 to 108 |
| Auxiliary control valve mounting bolt (7T, M8) | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Auxiliary control valve mounting bolt (7T, M10) | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Control valve mounting screw | 20 to 23 | 2.0 to 2.4 | 15 to 17 |
| Seat plug 1 | 40 to 58 | 4.0 to 6.0 | 29 to 43 |
| Seat plug 2 | 40 to 58 | 4.0 to 6.0 | 29 to 43 |
| Seat plug 3 | 40 to 58 | 4.0 to 6.0 | 29 to 43 |
| Lock nut | 16 to 19 | 1.6 to 2.0 | 12 to 14 |
| Seat plug 4 | 30 to 49 | 3.0 to 5.0 | 22 to 36 |
| Safety valve lock nut | 59 to 78 | 6.0 to 8.0 | 44 to 57 |
| Lowering speed adjusting valve assembly | 35 to 39 | 3.5 to 4.0 | 26 to 28 |
| Return pipe joint bolt: trailer brake valve side | 75 to 85 | 7.7 to 8.7 | 56 to 63 |
| Return pipe joint bolt: transmission case side | 63.7 to 73.5 | 6.5 to 7.5 | 47 to 54 |
| Delivery hose 1 retaining nut | 57.6 to 70.4 | 5.9 to 7.2 | 43 to 52 |
| Delivery pipe 2 retaining nut: trailer brake valve side | 57.6 to 70.4 | 5.9 to 7.2 | 43 to 52 |
| Pilot pipe retaining nut (L.H. and R.H.) | 15.7 to 23.5 | 1.6 to 2.4 | 12 to 17 |
| Trailer control pipe joint bolt and trailer supplementary pipe joint bolt | 49.0 to 68.6 | 5.0 to 7.0 | 36 to 51 |

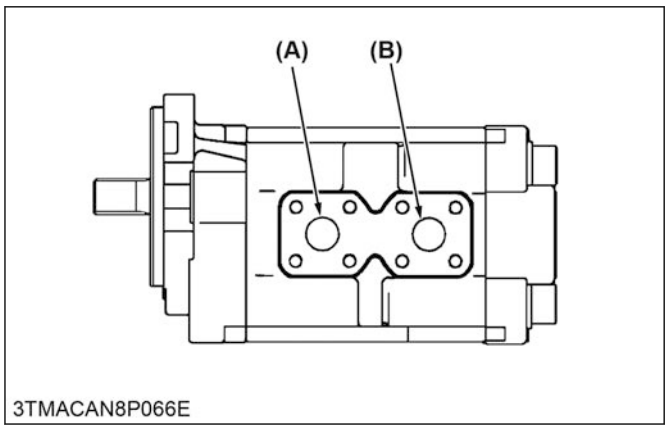
# 4. Checking and adjusting

## 4.1 Hydraulic pump

### 4.1.1 Checking hydraulic flow test (3-point hitch hydraulic system)

**IMPORTANT**

- **When using a flowmeter, use the flowmeter instructions.**
- **Do not close the flowmeter loading valve completely, before testing, because it has no relief valve.**
- **Set the main shift lever and shuttle lever in Neutral position.**
- **Set the parking brake lever in parked position.**




(A) 3-point hydraulic port (B) Power steering port

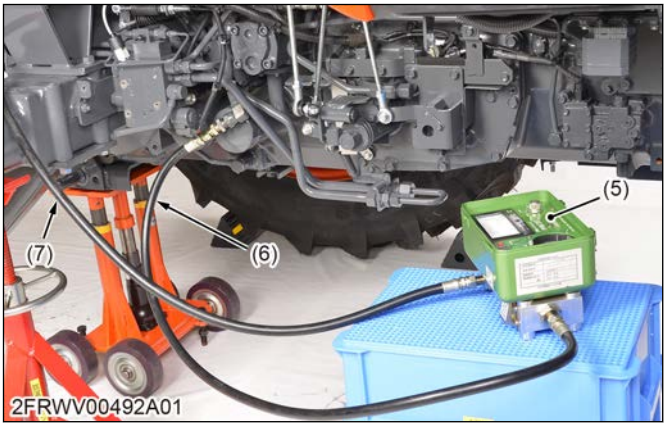
1. Place the disassembling stand under the transmission case.
2. Remove the right rear wheel.
3. Place the disassembling stand under the right rear axle case.
4. Disconnect the clamps (1) and then remove the trailer brake valve cover (2).


(1) Clamp (2) Trailer brake valve cover

5. Disconnect the delivery hose (4) from the hydraulic pump (3).


(3) Hydraulic pump (4) Delivery hose

6. Connect the hydraulic test hose (6) to the adapter and flowmeter inlet port.
7. Connect the other hydraulic test hose (7) to the flowmeter outlet port, and insert the hydraulic test hose other end to transmission oil filling port.
8. Open the flowmeter loading valve completely. (Turn counterclockwise.)




(5) Flowmeter (7) Hydraulic test hose
(6) Hydraulic test hose

9. Start the engine and set the engine speed at 2000 to 2200 $min^{-1}$ (rpm).
10. Slowly close the loading valve to generator pressure approximately 9.81 MPa (100 $kgf/cm^2$, 1420 psi). Hold in this condition until the oil temperature reaches approx. 55 ℃ (131 ℉).
11. Open the loading valve completely.

12. Set the engine speed. (Refer to the following "Condition".)

**Condition for ROPS model**

| Engine speed | Rated pressure | Oil temperature |
|---|---|---|
| Approximately 2400 $min^{-1}$ (rpm) | 20.5 MPa<br>210 $kgf/cm^2$<br>2980 psi | 50 to 60 ℃<br>122 to 140 ℉ |

[Three point pump delivery]

**Condition for Cabin model**

| Engine speed | Rated pressure | Oil temperature |
|---|---|---|
| Approximately 2600 $min^{-1}$ (rpm) | 20.5 MPa<br>210 $kgf/cm^2$<br>2980 psi | 50 to 60 ℃<br>122 to 140 ℉ |

[Three point pump delivery]

13. Measure the hydraulic pump oil delivery at rated pressure.
If the hydraulic pump oil delivery does not reach the allowable limit, check the hydraulic pump suction line, the oil filter or the hydraulic pump.
**[Three point pump delivery]**

**[ROPS model]**

| | | |
|---|---|---|
| Hydraulic pump oil delivery rate at no pressure | Factory specification | Above<br>58.1 L/min.<br>15.3 U.S.gals/min.<br>12.8 Imp.gals/min. |
| Hydraulic pump oil delivery rate at rated pressure | Factory specification | 56.9 L/min.<br>15.0 U.S.gals/min.<br>12.5 Imp.gals/min. |
| | Allowable limit | 47.8 L/min.<br>12.6 U.S.gals/min.<br>10.5 Imp.gals/min. |

**[Cabin model]**

| | | |
|---|---|---|
| Hydraulic pump oil delivery rate at no pressure | Factory specification | Above<br>63.0 L/min.<br>16.6 U.S.gals/min.<br>13.9 Imp.gals/min. |
| Hydraulic pump oil delivery rate at rated pressure | Factory specification | 61.7 L/min.<br>16.3 U.S.gals/min.<br>13.6 Imp.gals/min. |
| | Allowable limit | 51.8 L/min.<br>13.7 U.S.gals/min.<br>11.4 Imp.gals/min. |

14. Open the loading valve completely and stop the engine.

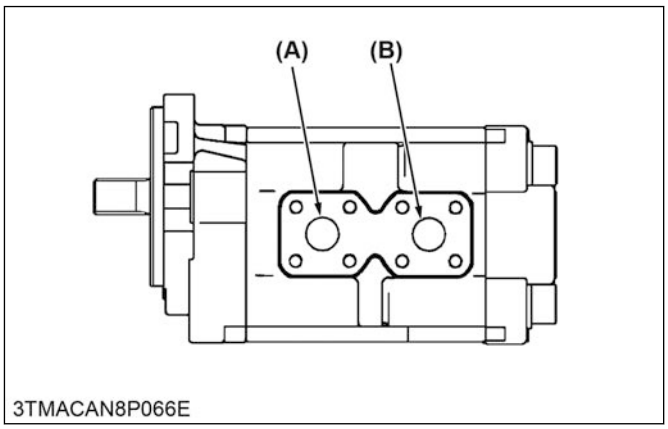
RELATED PAGE

2.4 Flow meter on page 2-79
2.5 Adaptor set for flow meter on page 2-80

## 4.1.2 Checking hydraulic flow test (Power steering hydraulic system)

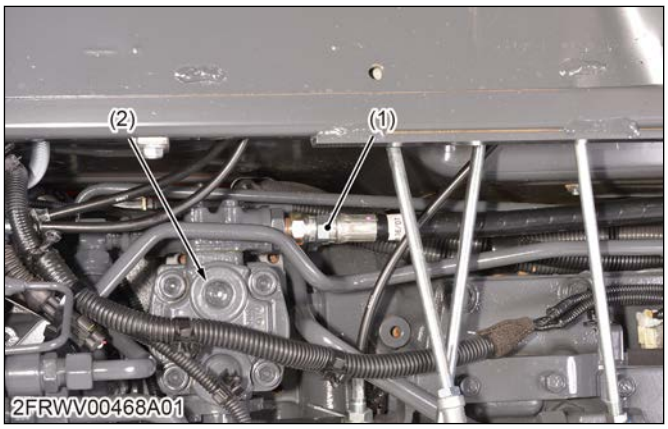
**IMPORTANT**

- **When using a flowmeter, use the flowmeter instructions.**
- **Do not close the flowmeter loading valve completely, before testing, because it has no relief valve.**
- **Set the main shift lever and shuttle lever in Neutral position.**
- **Set the parking brake lever in parked position.**




(A) 3-point hydraulic port (B) Power steering port

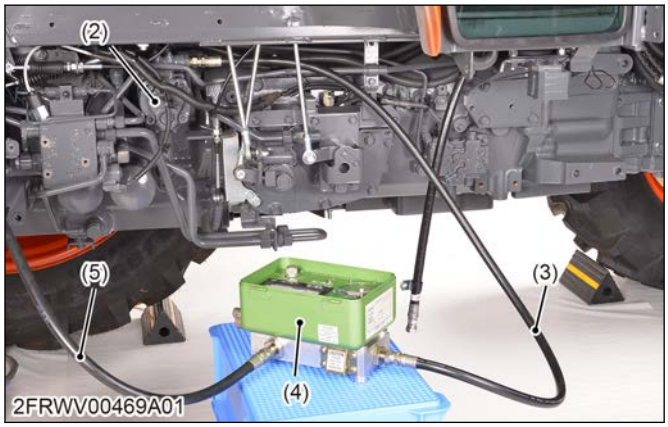
1. Place the disassembling stand under the transmission case.
2. Remove the right rear wheel.
3. Place the disassembling stand under the right rear axle case.
4. Disconnect the power steering delivery hose (1) from the hydraulic pump (2).




(1) Power steering delivery hose (2) Hydraulic pump

5. Connect the hydraulic test hose (3) to the hydraulic pump (2) and flowmeter inlet port.

6. Connect the other hydraulic test hose (5) to the flowmeter outlet port, and insert the hydraulic test hose other end to transmission oil filling port.




(2) Hydraulic pump
(3) Hydraulic test hose
(4) Flowmeter
(5) Hydraulic test hose

7. Open the flowmeter loading valve completely. (Turn counterclockwise.)
8. Start the engine and set the engine speed at 2000 to 2200 $min^{-1}$ (rpm).
9. Slowly close the loading valve to generator pressure approximately 9.81 MPa (100 $kgf/cm^2$, 1420 psi). Hold in this condition until the oil temperature reaches approx. 55 ℃ (131 ℉).
10. Open the loading valve completely.
11. Set the engine speed. (Refer to the following "Condition".)

**Condition for ROPS model**

| Engine speed | Rated pressure | Oil temperature |
|---|---|---|
| Approximately 2400 $min^{-1}$ (rpm) | 20.5 MPa<br>210 $kgf/cm^2$<br>2980 psi | 50 to 60 ℃<br>122 to 140 ℉ |

[Three point pump delivery]

**Condition for Cabin model**

| Engine speed | Rated pressure | Oil temperature |
|---|---|---|
| Approximately 2600 $min^{-1}$ (rpm) | 20.5 MPa<br>210 $kgf/cm^2$<br>2980 psi | 50 to 60 ℃<br>122 to 140 ℉ |

[Three point pump delivery]

12. Measure the hydraulic pump oil delivery at rated pressure.
    If the hydraulic pump oil delivery does not reach the allowable limit, check the hydraulic pump suction line, the oil filter or the hydraulic pump.

**[Three point pump delivery]**

**[ROPS model]**

| | | |
|---|---|---|
| Hydraulic pump oil delivery rate at no pressure | Factory specification | Above<br>23.1 L/min.<br>6.10 U.S.gals/min.<br>5.08 Imp.gals/min. |
| Hydraulic pump oil delivery rate at rated pressure | Factory specification | 22.6 L/min.<br>5.97 U.S.gals/min.<br>4.97 Imp.gals/min. |
| | Allowable limit | 19.0 L/min.<br>5.02 U.S.gals/min.<br>4.18 Imp.gals/min. |

**[Cabin model]**

| | | |
|---|---|---|
| Hydraulic pump oil delivery rate at no pressure | Factory specification | Above<br>24.9 L/min.<br>6.58 U.S.gals/min.<br>5.48 Imp.gals/min. |
| Hydraulic pump oil delivery rate at rated pressure | Factory specification | 24.4 L/min.<br>6.45 U.S.gals/min.<br>5.37 Imp.gals/min. |
| | Allowable limit | 20.5 L/min.<br>5.42 U.S.gals/min.<br>4.51 Imp.gals/min. |

13. Open the loading valve completely and stop the engine.

RELATED PAGE
2.4 Flow meter on page 2-79
2.5 Adaptor set for flow meter on page 2-80

## 4.2 Relief and safety valve

### 4.2.1 Checking relief valve setting pressure with pressure tester

1. Set the relief valve setting pressure adaptor G (Code No. 07916-52751) to the half male of the quick coupler and then set a pressure gauge (Code No. 07916-50322), cable (Code No. 07916-50331).
2. Start the engine, and set the engine speed. (Refer to the following "Condition".)

**Condition for ROPS model**

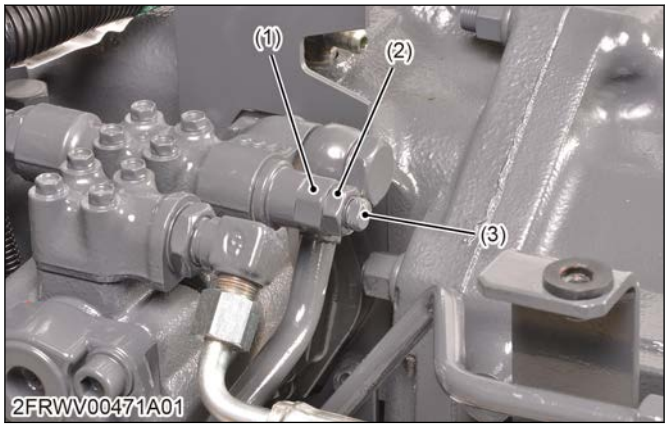
| Engine speed | Oil temperature |
|---|---|
| Approx. 2400 $min^{-1}$ (rpm) | 45 to 55 ℃<br>113 to 131 ℉ |

**Condition for Cabin model**

| Engine speed | Oil temperature |
|---|---|
| Approx. 2600 $min^{-1}$ (rpm) | 45 to 55 ℃<br>113 to 131 ℉ |

3. Set the auxiliary control valve operation lever to the **UP** position and read the pressure gauge when the relief valve is actuated.


4. If the pressure is not within the factory specification, adjust the relief valve adjuster (3).




(1) Relief valve
(2) Lock nut
(3) Adjuster

| | | |
|---|---|---|
| Relief valve operating pressure | Factory specification | 19.7 to 20.5 MPa<br>200 to 210 kgf/cm$^2$<br>2850 to 2980 psi |

**(When reassembling)**

- Tighten the relief valve assembly and lock nut to the specified tightening torque.

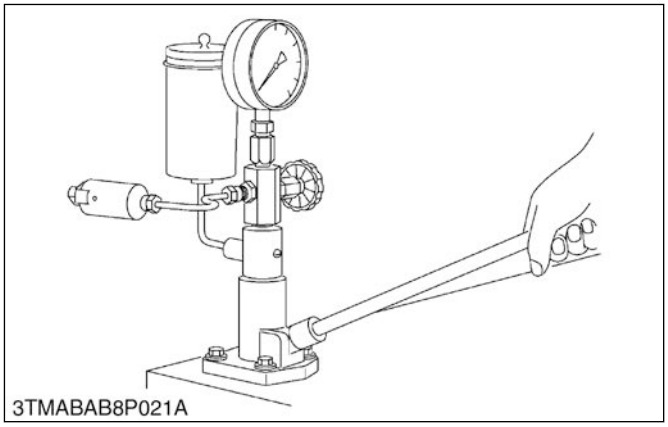
| | | |
|---|---|---|
| Tightening torque | Relief valve assembly | 35 to 39 N·m<br>3.5 to 4.0 kgf·m<br>26 to 28 lbf·ft |
| | Relief valve lock nut | 19.6 to 23.6 N·m<br>2.00 to 2.40 kgf·m<br>14.5to 17.4 lbf·ft |

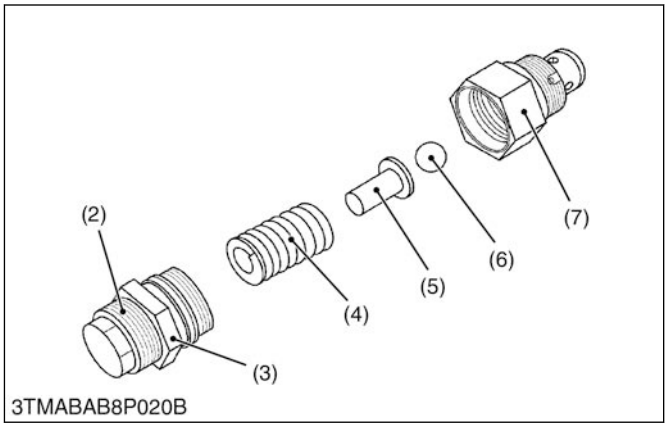
RELATED PAGE
2.9 Relief valve setting pressure adaptor G on page 2-81

## 4.2.2 Checking safety valve setting pressure using injection nozzle tester

**NOTE**

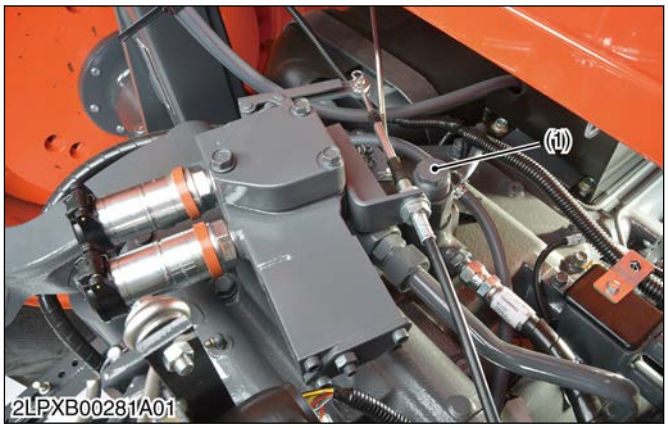
- **Use specified transmission fluid to test the operating pressure of the cylinder safety valve.**




(2) Adjusting screw
(3) Lock nut
(4) Spring
(5) Seat
(6) Ball
(7) Housing

1. Remove the safety valve assembly (1).




(1) Safety valve assembly

2. Set the safety valve to an injection nozzle tester with a safety valve setting adaptor.
3. Measure the operating pressure of the safety valve.

4. If the operating pressure is not within the factory specifications, adjust by turning the adjusting screw (2).

| | | |
|---|---|---|
| Safety valve operating pressure | Factory specification | 23.1 to 24.5 MPa<br>235 to 250 kgf/cm$^2$<br>3350 to 3550 psi |

5. After adjustment, tighten the lock nut (3) firmly.

**(When reassembling)**

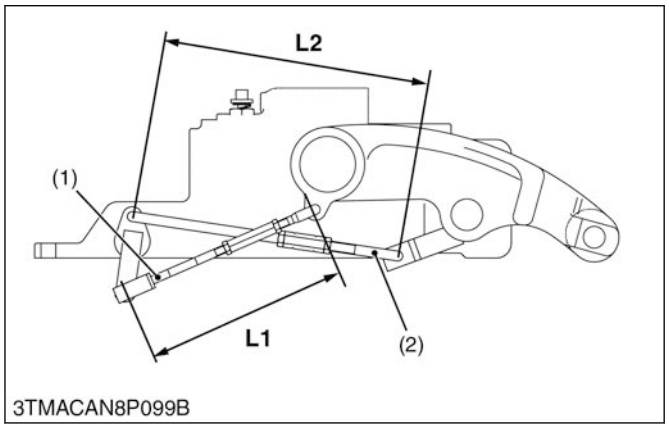
- Install the safety valve to the hydraulic cylinder block, being careful not to damage the O-ring and apply transmission fluid.
- Tighten the safety valve assembly to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Safety valve assembly | 40 to 49 N·m<br>4.0 to 5.0 kgf·m<br>29 to 36 lbf·ft |

RELATED PAGE
2.22 Cylinder safety valve setting pressure adaptor on page 2-91
LUBRICANTS, FUEL AND COOLANT on page 2-13

# 4.3 Position and draft control linkage

## 4.3.1 Adjusting position feedback rod length and draft rod length




(1) Position feedback rod
(2) Draft rod
L1: Position feedback rod length
L2: Draft rod length

1. Adjust the position feedback rod length "L1" and the draft rod length "L2" to the reference value shown in the table.

| | | |
|---|---|---|
| Position feedback rod length "L1" | Reference value | Approximately<br>210 mm<br>8.27 in. |
| Draft rod length "L2" | | Approximately<br>272 mm<br>10.7 in. |

## 4.3.2 Adjusting position control lever floating range

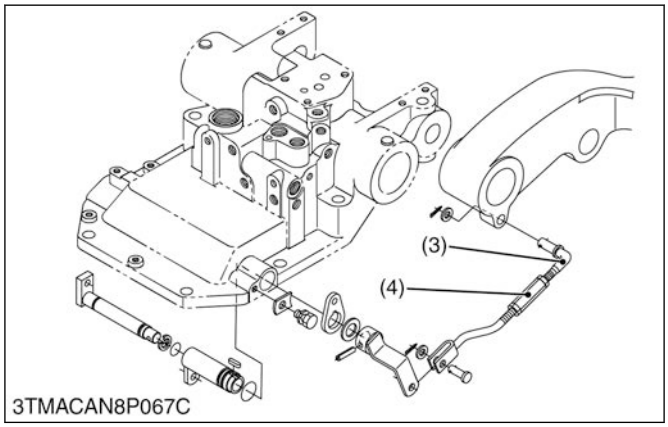
1. Attach approx. 490 N (50 kgf, 110 lbf) of weight to the end of the lower links.
2. Set the position control lever (2) and the draft control lever (1) to the lowest position.



(1) Draft control lever
(2) Position control lever
[A] ROPS model
[B] Cabin model

3. Start the engine, and after warming-up, set the engine speed at 1000 min$^{-1}$ (rpm).
4. Move the position control lever (2) to the uppermost position. (Contact the position control lever to the position control lever guide.)
5. Lengthen the position feedback rod (3) until the relief valve begins to be operated.

6. From the relief valve operating position, turn the turnbuckle (4) 1 turn to shorten the position feedback rod (3).




(3) Position feedback rod (4) Turnbuckle

7. Tighten the turnbuckle nut.
8. Move the position control lever (2) to the lowest position to check the cylinder goes to the lowest position.
9. Set the position control lever (2) to the lowest position, and then slowly shift the position control lever and the lift arm to the upper position until the lift arm begins to operate. Check the guide end of the floating range (L) and the position control lever.



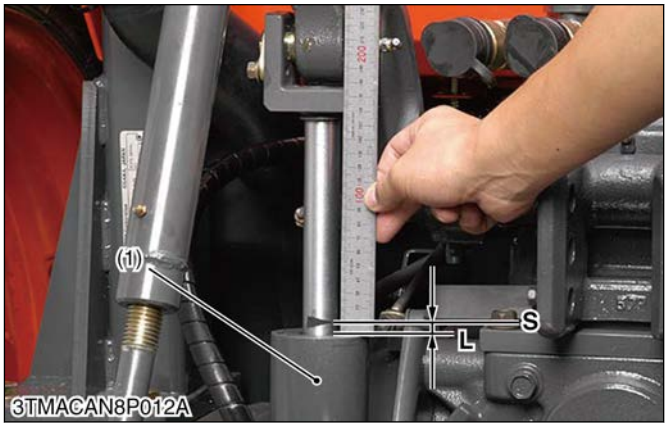
[A] ROPS model (L) Floating range
[B] Cabin model

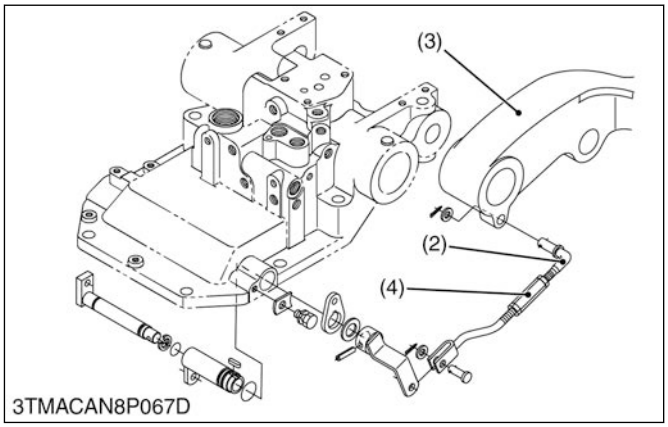
10. If the floating range (L) is not the factory specification, readjust it with the above procedure.

| | | |
|---|---|---|
| Floating range (L) | Factory specification | 10 to 30 mm<br>0.40 to 1.1 in. |

## 4.3.3 Adjusting cylinder free play

1. Move the position control lever and the draft control lever all the way down.
2. Start the engine and set the engine speed at the maximum speed.
3. Move the position control lever to the uppermost position.
4. Raise the lift arm (3) to the top dead center by hand, and mark hydraulic cylinder (1) with the mark "S".
5. Measure the cylinder free play "L" from the mark "S" to the cylinder body end.
6. If the cylinder free play is not the factory specifications, adjust it with the position feedback rod (2).

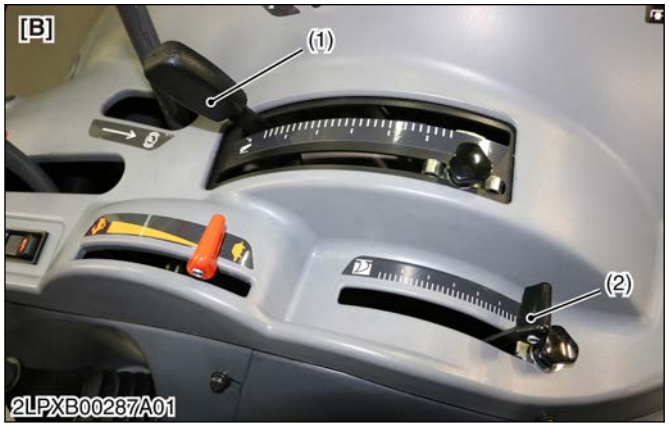


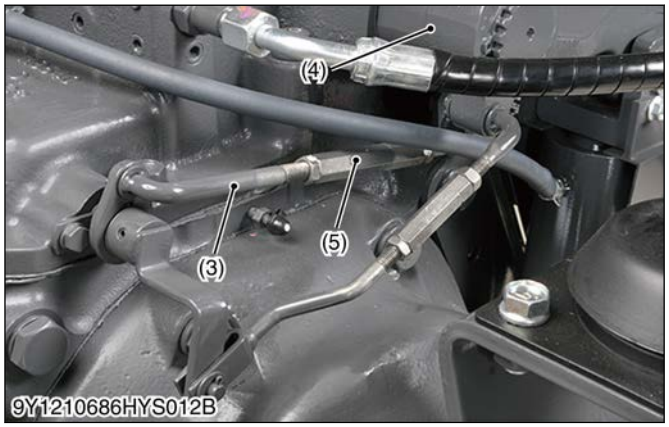



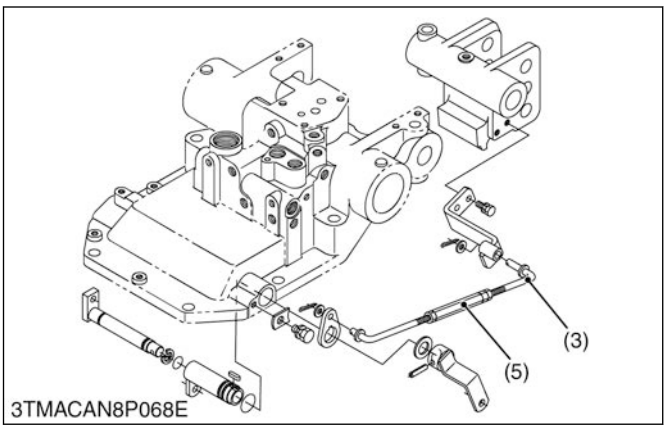

(1) Hydraulic cylinder L: Cylinder free play
(2) Position feedback rod S: Mark
(3) Lift arm
(4) Turnbuckle

| | | |
|---|---|---|
| Cylinder free play "L" | Factory specification | 5 to 8 mm<br>0.2 to 0.3 in. |

## 4.3.4 Adjusting draft control

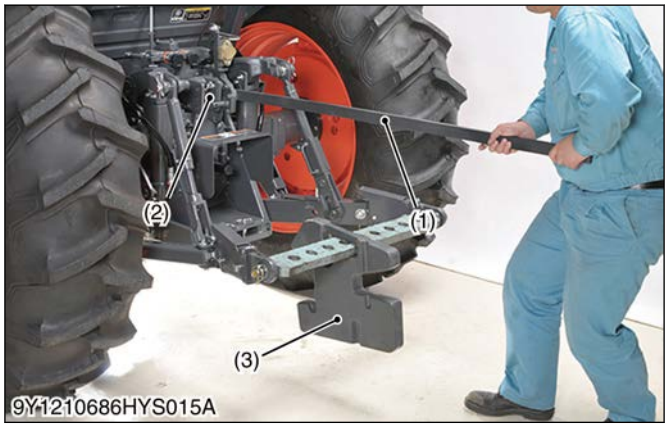




(1) Position control lever
(2) Draft control lever
(3) Draft rod
(4) Lift arm
(5) Turnbuckle
[A] ROPS model
[B] Cabin model

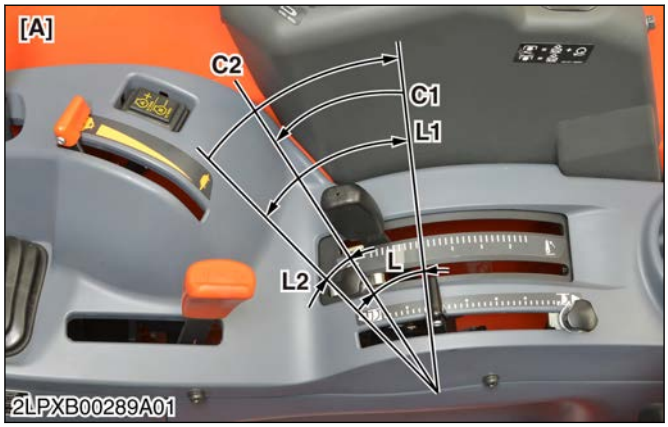
1. Install approx. 490 N (50 kgf, 110 lbf) weight to the end of the lower links.
2. Start the engine and set the speed at 1000 $min^{-1}$ (rpm).
3. Move the position control lever (1) and draft control lever (2) all the way down.
4. Move the draft control lever (2) to uppermost position then lengthen the draft rod (3) and check the point where the lift arms begin to rise.
5. When the lift arms (4) begin to rise, turn the turnbuckle (5) 2 turns to shorten the draft rod (3).
6. Move the position control lever (1) and draft control lever (2) to uppermost position to make sure the relief does not operate.
7. If the relief valve operate, adjust the draft rod (3).
8. Tighten the lock nuts securely.

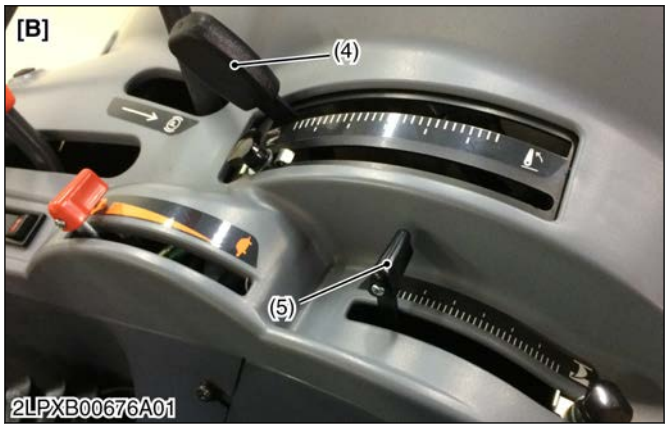
RELATED PAGE
2.20 Draft control test bar on page 2-90

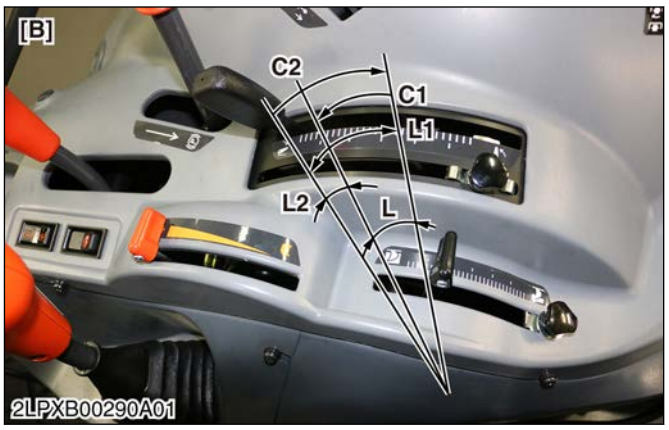
## 4.3.5 Adjusting draft lever free range








(1) Test bar
(2) Top link bracket
(3) Weight
(4) Position control lever
(5) Draft control lever
C1: Begin to rise the lift arm
C2: Begin to down the lift arm
L: Free range
L1: Distance for begin to rise the lift arm
L2: Distance for begin to down the lift arm
[A] ROPS model
[B] Cabin model

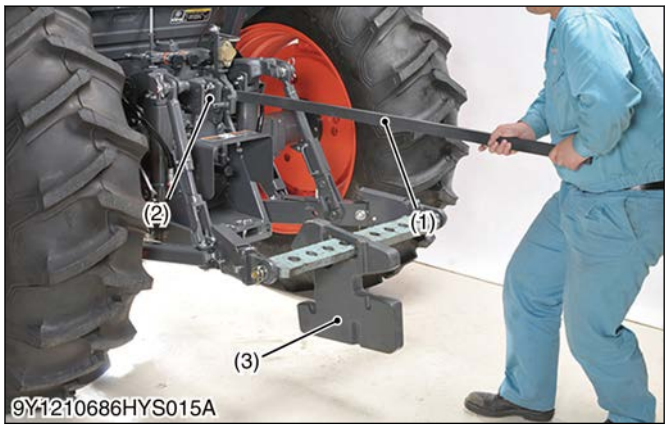
1. Install approx. 490 N (50 kgf, 110 lbf) weight to the end of the lower links.
2. Attach the test bar (1) to the top link bracket (2).
3. Start the engine and set the engine speed at maximum speed.
4. Move the draft and position control lever (5), (4) all the way down.
5. Press the test bar (1) downward until the top link bracket (2) comes in contact with the tractor body.
6. Slowly shift the draft control lever (5) upward until the lift arms begin to rise "C1". Then slowly shift the draft control lever (5) downward until the lift arms begin to lower "C2". Calculate the free range "L" of the draft control lever (5) on the lever guide.

| | | |
|---|---|---|
| Free range L1 – L2 | Factory specification | Less than 25 mm 0.98 in. |

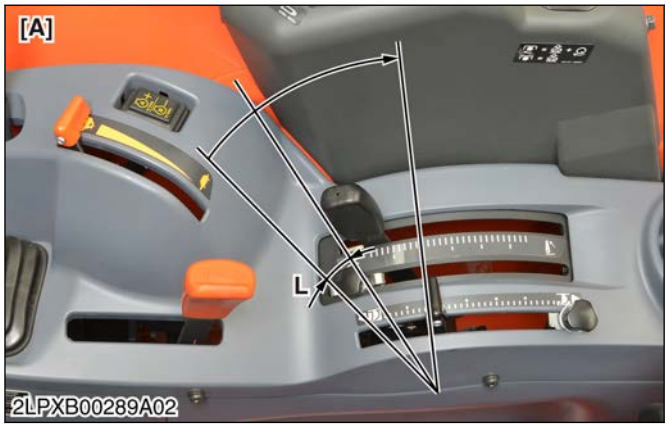
RELATED PAGE

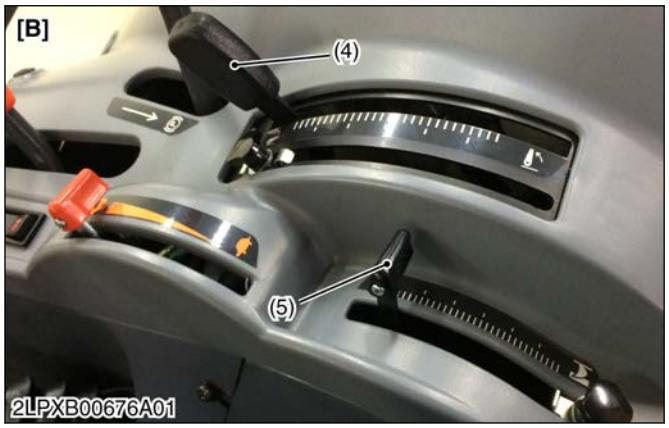
2.20 Draft control test bar on page 2-90

## 4.3.6 Adjusting draft lever floating range









(1) Test bar
(2) Top link bracket
(3) Weight
(4) Position control lever
(5) Draft control lever
L: Floating range
[A] ROPS model
[B] Cabin model

1. Install approx. 490 N (50 kgf, 110 lbf) weight to the end of the lower links.
2. Attach the test bar (1) to the top link bracket (2).
3. Start the engine and set the speed at maximum speed.
4. Move the draft control lever (5) and the position control lever (4) all the way down.
5. Press the test bar (1) downward until the top link bracket (2) comes in contact with the top cover.
6. Slowly shift the draft control lever (5) upward to mid way of the lift arm guide. At this time, the lift arm should rise. Then slowly shift the draft control lever (5) downward until the lift arms begin to lower, measure the floating range "L" of the draft control lever (5) from the end of the lever guide.
7. If floating range (L) is not within the factory specification, adjust the draft control rod length.

| | | |
|---|---|---|
| Floating range "L" | Factory specification | More than<br>15 mm<br>0.59 in. |

RELATED PAGE
2.20 Draft control test bar on page 2-90

### 4.3.7 Adjusting position control lever operating force and draft control lever operating force

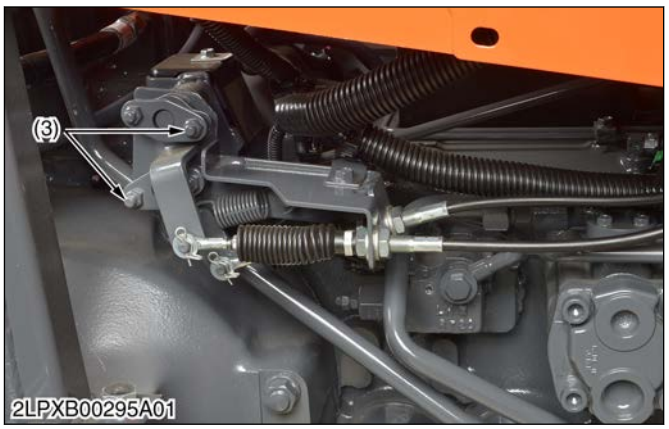
1. Check the position control lever operating force and the draft control lever operating force.





(1) Position control lever
(2) Draft control lever
[A] ROPS model
[B] Cabin model

2. If the position control lever operating force and the draft control lever operating force is not the factory specification, adjust it with tightening nuts (3).




(3) Nut

| | | |
|---|---|---|
| Operating force for position and draft control lever | Factory specification | 20 to 39 N<br>2.0 to 4.0 kgf<br>4.4 to 8.8 lbf |

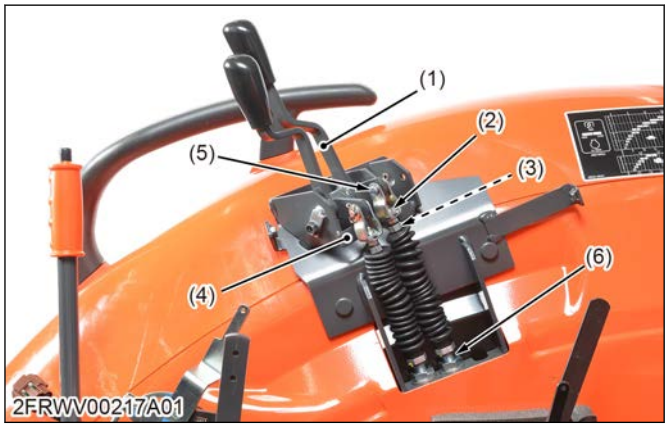
## 4.4 Auxiliary control valve linkage

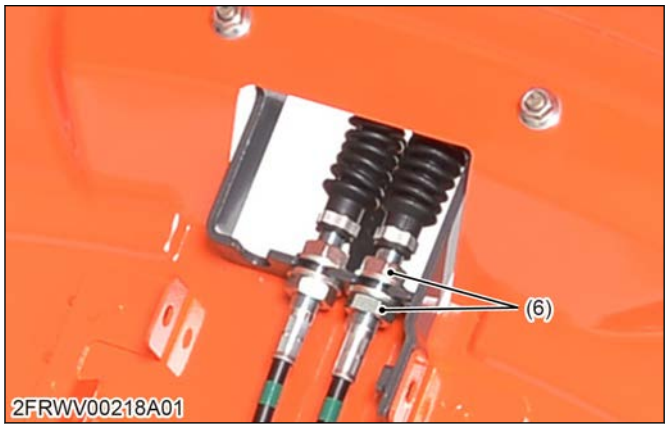
### 4.4.1 ROPS model

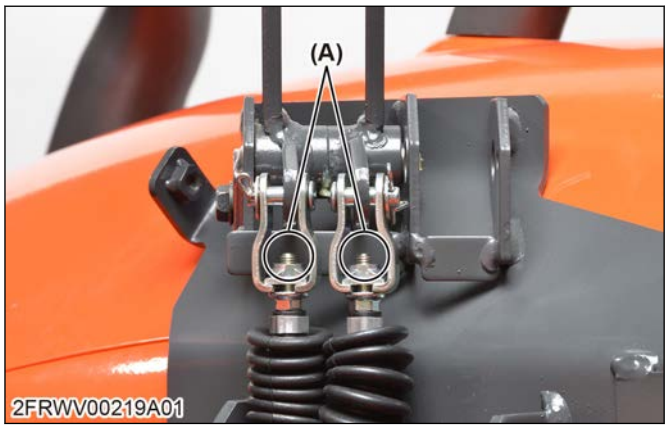
#### 4.4.1.1 Adjusting auxiliary control valve wire length (ROPS model - lever side)

1. Screw the wire (3) into the nut placed in the rod end (4).
2. Move the control lever (1) forward and tighten the wire with the lock nuts (2) to contact the control lever (1) and the stopper (5).

3. Tighten the wire (3) with the retaining nut (6) at the center of its thread.



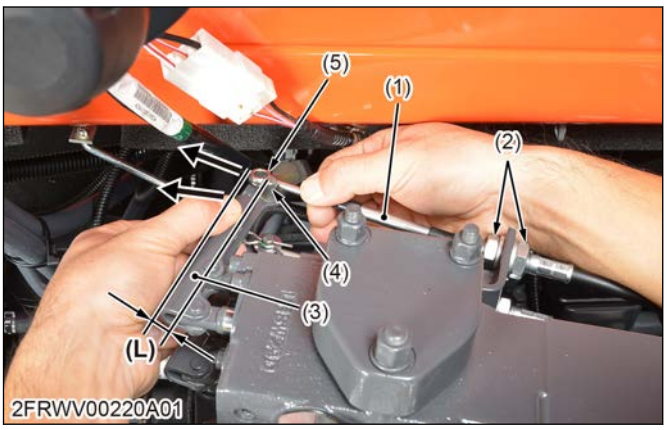




(1) Control lever
(2) Lock nut
(3) Wire
(4) Rod end
(5) Stopper
(6) Retaining nut
(A) Screw the wire into the nut placed in the rod end.

## 4.4.1.2 Adjusting auxiliary control valve wire length (ROPS model - valve side)

1. Pull the auxiliary valve lever (3) to a full engage position.
2. Pull the wire (1) fully, and tighten the wire with the retaining nuts (2) so that the clearance (L) between wire end (5) and valve lever pin (4) is 0 to 3.0 mm (0 to 0.12 in.) as shown in the photo.

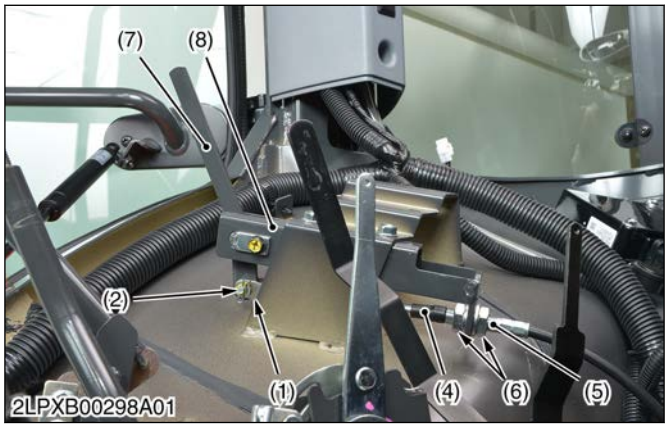


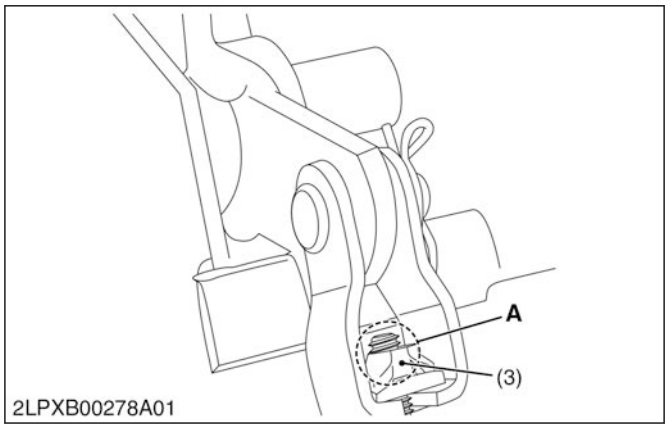

(1) Wire
(2) Retaining nut
(3) Auxiliary valve lever
(4) Lever pin
(5) Wire end
(L) Clearance between wire end and valve lever pin

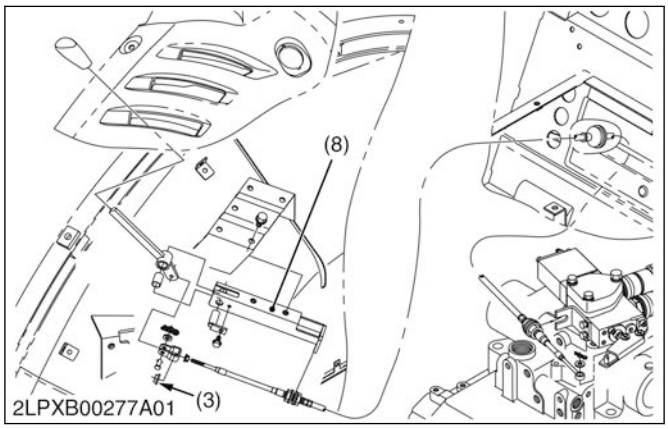
| | | |
|---|---|---|
| Clearance between wire end and valve lever pin (L) | Factory specification | 0 to 3.0 mm<br>0 to 0.12 in. |

## 4.4.2 Cabin model

### 4.4.2.1 Adjusting wire length of auxiliary control valve (lever side - Cabin model)



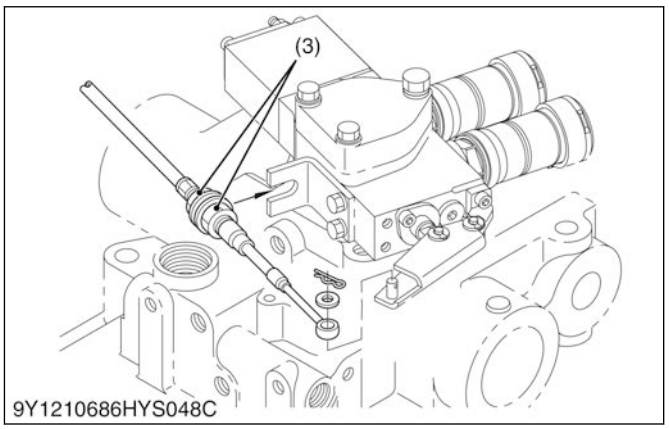

(1) Rod end
(2) Pin
(3) Lock nut
(4) Wire
(5) Thread
(6) Retaining nut (Lever side)
(7) Control lever
(8) Wire position mounting bracket
A: Screw in the wire to the rod end fully.

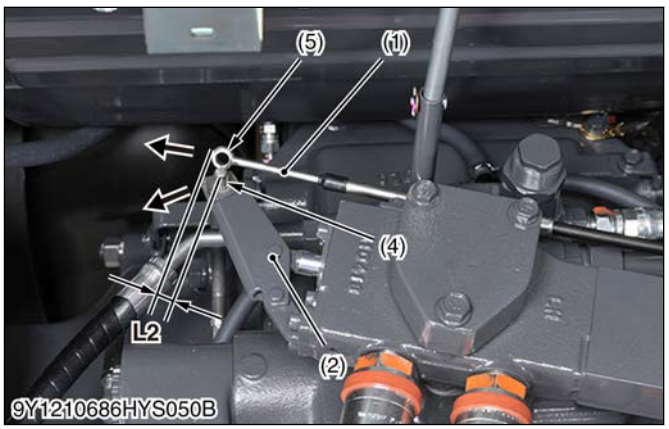
**(Lever Side)**

1. Screw in the wire (4) to the rod end (1) fully.
2. Shift the control lever (7) forward and fix the wire with lock nut (3) or the retaining nut (6) to be a clearance (L1) between the control lever (7) and the stopper plate of wire position mounting bracket (8).

| | | |
|---|---|---|
| Clearance between control lever and stopper plate (L1) | Factory specification | 0 to 1.0 mm<br>0 to 0.039 in. |

### 4.4.2.2 Adjusting wire length of auxiliary control valve (valve side - Cabin model)




(1) Wire
(2) Auxiliary valve lever
(3) Retaining nut (Valve side)
(4) Lever pin
(5) Wire end

**(Valve Side)**

1. Pull the auxiliary valve lever (2) to a full engage position.
2. Pull out and push the wire (1), and fix the wire with retaining nuts (3) to be a clearance (L2) between wire end (5) and valve lever pin (4) as shown in the photo.

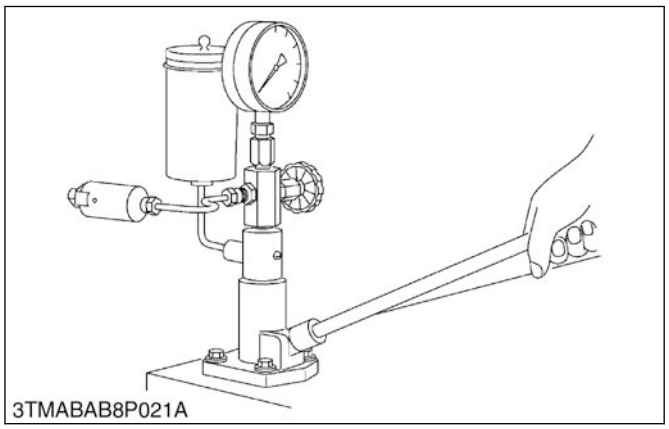
| | | |
|---|---|---|
| Clearance between wire end and valve lever pin (L2) | Reference value | 0 to 5.0 mm<br>0 to 0.19 in. |

## 4.5 Oil cooler check valve

### 4.5.1 Checking operating pressure of oil cooler check valve

**NOTE**

- **Use specified transmission fluid to test the operating pressure of the oil cooler check valve (1).**


(1) Oil cooler check valve

1. Attach the oil cooler check valve to a injection nozzle tester with a relief valve adaptor.
2. Measure the operating pressure of the oil cooler check valve (1).
3. If the pressure is not within the factory specifications, replace relief valve with the new one.

| | | |
|---|---|---|
| Oil cooler check valve operating pressure | Factory specification | Approximately<br>0.8 MPa<br>8 kgf/cm$^2$<br>100 psi |

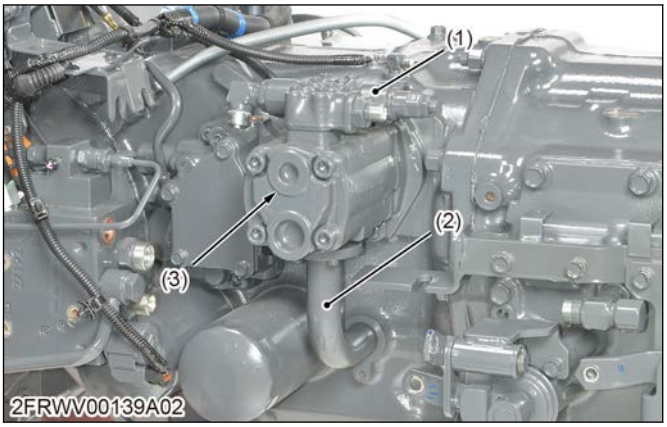
RELATED PAGE
2.23 Oil cooler relief valve setting pressure adaptor on page 2-94

# 5. Disassembling and assembling

## 5.1 Hydraulic pump

### 5.1.1 Removing hydraulic pump

1. Remove the relief valve folder and pump flange (1).
2. Remove the suction pipe (2).
3. Remove the hydraulic pump (3).



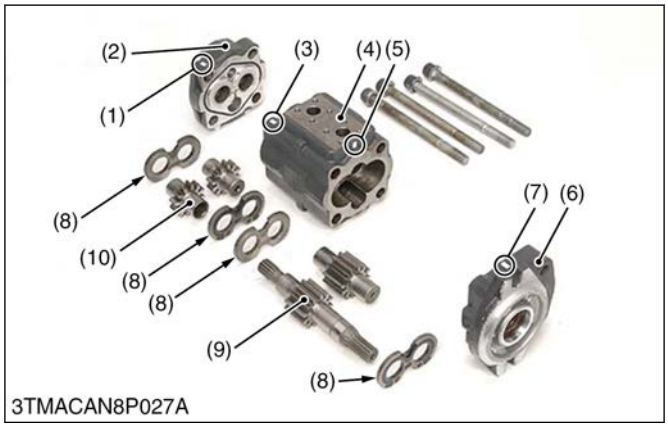

(1) Pump flange
(2) Suction pipe
(3) Hydraulic pump

**(When reassembling)**

- Replace the O-ring with new one.
- Apply the transmission oil to the O-ring.
- Tighten the relief valve folder and pump flange (1) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Pump flange mounting bolt | 9.80 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.23 to 8.33 lbf·ft |
| | Relief valve folder mounting bolt | 9.80 to 11.3 N·m<br>1.00 to 1.15 kgf·m<br>7.23 to 8.33 lbf·ft |

### 5.1.2 Disassembling hydraulic pump

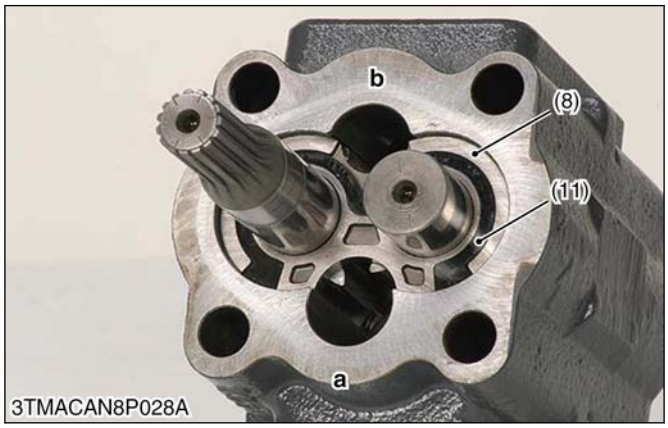



(1) Parting mark
(2) Housing cover
(3) Parting mark
(4) Housing
(5) Parting mark
(6) Flange
(7) Parting mark
(8) Backup plate
(9) Gear (Three point system)
(10) Gear (Power steering)

1. Put the parting marks (1), (3), (5), (7) on the flange (6), housing (4) and housing cover (2).
2. Remove the housing cover mounting screw and separate the flange (6) and housing cover (2) from the housing (4).
3. Remove the backup plate (8).
4. Remove the gears (9), (10).

**(When reassembling)**

- When installing the backup plate (8) with seal element (11), don't reassemble them to the each original position. Seal element on the backup plate (8) does not face to the gear side.




(8) Backup plate
(11) Seal element
a: Inlet
b: Outlet

- Don't damage the seal elements and O-rings.
- After reassembling, check the smooth rotation of the hydraulic pump (for example, mount arm an approximately 100 mm (3.94 in.) long to the drive gear and rotate its arm slowly for smooth rotation).
- Tighten the housing cover mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Housing cover mounting screw | 40 to 44 N·m<br>4.0 to 4.5 kgf·m<br>29 to 32 lbf·ft |

## 5.2 Removing top cover (3-point hitch hydraulic block)

### 5.2.1 ROPS model

#### 5.2.1.1 Removing rear wheel and 3-point linkage

1. Set the disassembling stand under the transmission case.
2. Remove the rear wheel (R.H.) (1).
3. Remove the top link (4).
4. Remove the lower links (2) and lift rods (3).


(1) Rear wheel (R.H.)
(2) Lowe link
(3) Lift rod
(4) Top link

**(When reassembling)**

- Tighten the rear wheel mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Rear wheel mounting nut | 343.2 to 393.3 N·m<br>35.0 to 40.1 kgf·m<br>253.2 to 290.0 lbf·ft |

## 5.2.1.2 Disconnecting auxiliary control wire

1. Disconnect the auxiliary control wires (1).


(1) Auxiliary control wire

**(When reassembling)**

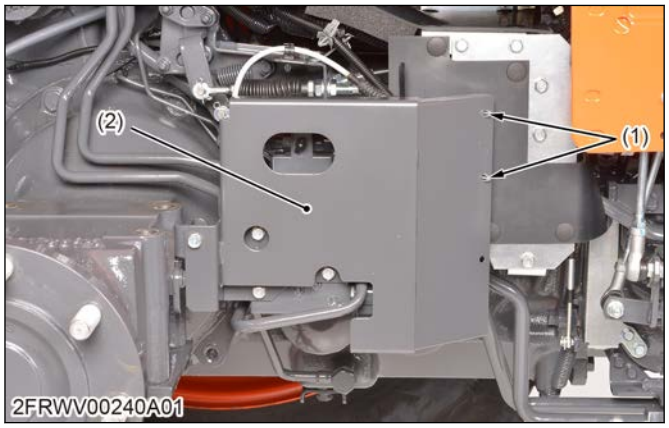
- Be sure to adjust the auxiliary control wires (1).

## 5.2.1.3 Disconnecting position control wire and draft control wire

**NOTE**

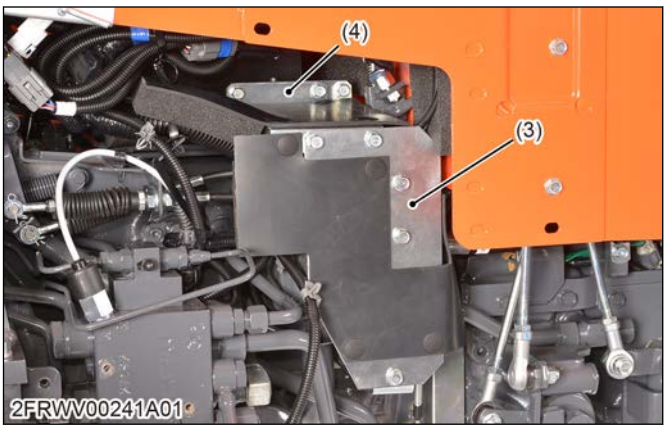
- **Before disconnecting the draft control wire and position control wire, make the parting mark on the their adjustable portion to identify their original length.**
- **The outside control wire is the draft control lever wire.**
- **The inside control wire is the position control lever wire.**

1. Disconnect the clamps (1) and remove the trailer brake valve cover (2).




(1) Clamp (2) Trailer brake valve cover

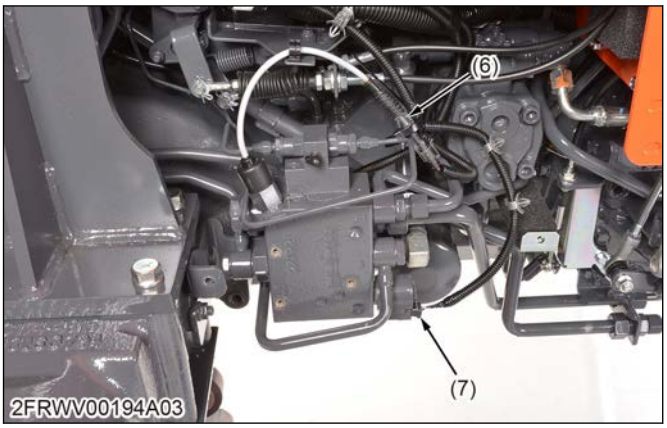
2. Remove the cover 1 (3).
3. Remove the cover 2 retaining nut (5) and cover 2 (4).





(3) Cover 1 (5) Retaining nut
(4) Cover 2

4. Disconnect the trailer brake pressure switch (6) and solenoid valve connector (7).




(6) Trailer brake pressure switch (7) Solenoid valve connector

5. Disconnect the draft control wire (8) and position control wire (9).


(8) Draft control wire
(9) Position control wire

**(When assembling)**

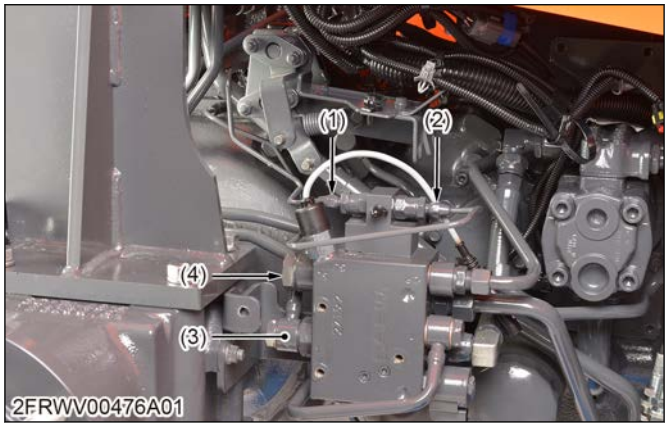
- The position of draft and position control cable are as follows.

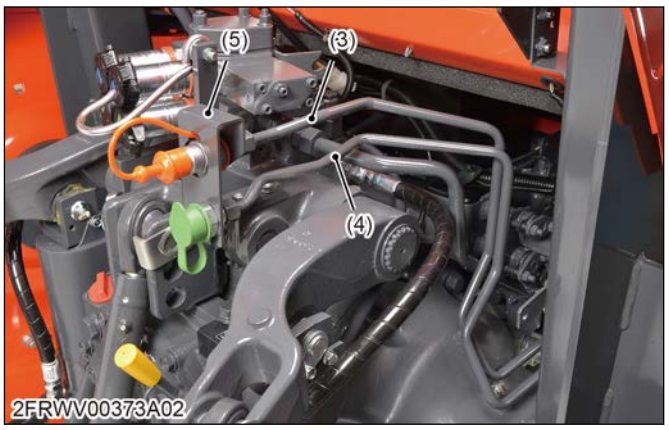
  **Draft control cable:**
  Tractor outside

  **Position control cable:**
  Tractor inside
- Be sure to adjust the draft and position control cable.

## 5.2.1.4 Removing trailer brake valve

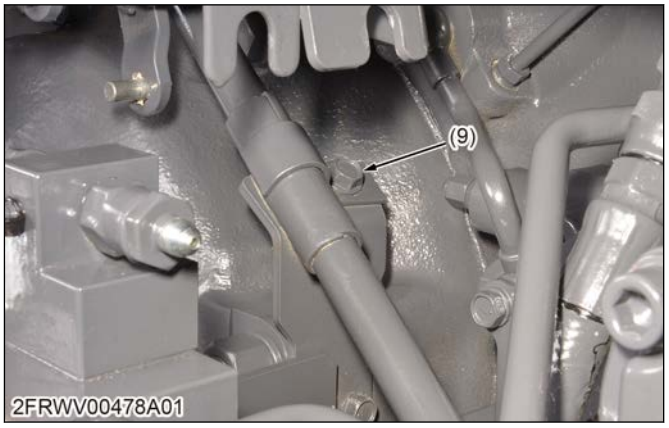
1. Remove the trailer brake actuating pipe (R.H.) (2) and trailer brake actuating pipe (L.H.) (1).
2. Remove the trailer brake pipe 1 (3) and trailer brake pipe 2 (4) together with top link holder bracket (5).




(1) Trailer brake actuating pipe (L.H.)
(2) Trailer brake actuating pipe (R.H.)
(3) Trailer brake pipe 1
(4) Trailer brake pipe 2
(5) Top link holder bracket

3. Remove the U pipe (7) and 3-point hitch delivery pipe 1 (8).
4. Remove the 3-point hitch delivery pipe 2 mounting bolt (9).
5. Remove the 3-point hitch delivery pipe 2 (6).

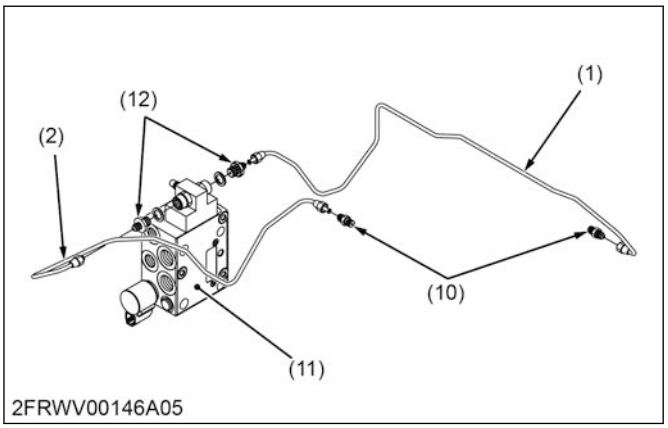

(6) 3-point hitch delivery pipe 2
(7) U pipe
(8) 3-point hitch delivery pipe 1
(9) 3-point hitch delivery pipe 2 mounting bolt

**(When reassembling)**

**■ IMPORTANT**

- **After assembling the pipes, be sure to bleed the air from the brake system.**

- If the trailer brake actuating pipe connector (10) was removed, wrap the seal tape to the transmission case side of connector (10).
- If the trailer brake actuating pipe joint (12) was removed, replace the gasket with new one.
- Tighten the trailer brake actuating pipe joint (12) and trailer brake actuating pipe connector (10) to the specified tightening torque.




(1) Trailer brake actuating pipe (L.H.)
(2) Trailer brake actuating pipe (R.H.)
(10) Trailer brake actuating pipe connector
(11) Trailer brake valve
(12) Trailer brake actuating pipe joint

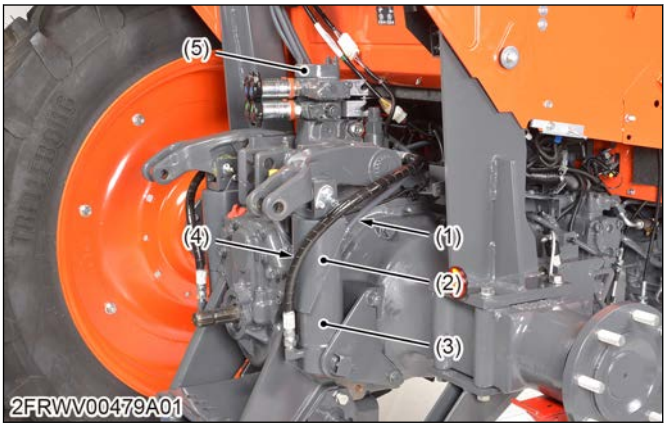
| | | |
|---|---|---|
| Tightening torque | Trailer brake return pipe joint bolt (Trailer brake valve side) | 63.7 to 73.5 N·m<br>6.50 to 7.49 kgf·m<br>47.0 to 54.2 lbf·ft |
| | Trailer brake return pipe joint bolt (Transmission case side) | 75 to 85 N·m<br>7.7 to 8.6 kgf·m<br>56 to 62 lbf·ft |
| | Trailer brake pipe 1 joint bolt (Trailer brake valve side) | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 1 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake pipe 2 joint bolt | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 2 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake actuating pipe | 15.7 to 23.5 N·m<br>1.60 to 2.39 kgf·m<br>11.6 to 17.3 lbf·ft |
| | Trailer brake actuating pipe joint (Trailer brake valve side) | 35 to 40 N·m<br>3.6 to 4.0 kgf·m<br>26 to 29 lbf·ft |
| | Trailer brake actuating pipe connector (Transmission case side) | 9.80 to 14.7 N·m<br>1.00 to 1.49 kgf·m<br>7.23 to 10.8 lbf·ft |

## 5.2.1.5 Removing auxiliary control valve and hydraulic cylinder

**NOTE**

- **Do not damage the grease fittings when removing the hydraulic cylinder pin.**

1. Remove the auxiliary control valves (5).
2. Disconnect the hydraulic cylinder delivery hoses (4).
3. Disconnect the breather hoses (1).
4. Remove the hydraulic cylinder cover (2).
5. Remove the hydraulic cylinder pins, and then remove the hydraulic cylinder (3).




(1) Breather hose
(2) Hydraulic cylinder cover
(3) Hydraulic cylinder
(4) Hydraulic cylinder delivery hose
(5) Auxiliary control valve

6. Remove the lowering speed adjustment rod (6).


(6) Lowering speed adjustment rod

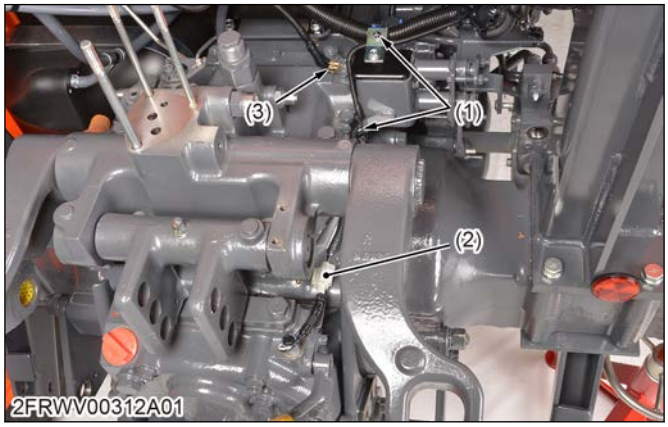
**(When reassembling)**

- Apply grease to the grease fittings.
- Do not damage the grease fittings when reassembling the hydraulic cylinder.
- Install the O-rings for auxiliary control valve.
- Tighten the 3-point hitch delivery pipe retaining nut and the cylinder hose retaining nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | 3-point hitch delivery pipe retaining nut | 108 to 117 N·m<br>11.0 to 12.0 kgf·m<br>79.6 to 86.7 lbf·ft |
| | Hydraulic cylinder delivery hose retaining nut | 46 to 53 N·m<br>4.6 to 5.4 kgf·m<br>34 to 39 lbf·ft |

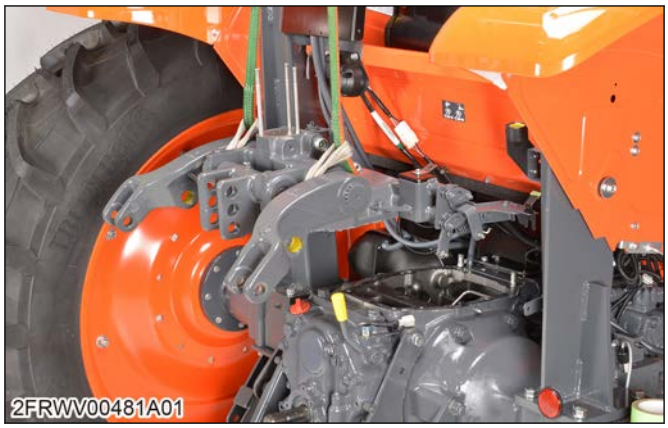
## 5.2.1.6 Removing top cover

1. Disconnect the clamps (1) and PTO speed detect switch connector (2).
2. Remove the grounding cable mounting bolt (3).




(1) Clamp
(2) PTO speed detect switch connector
(3) Grounding cable mounting bolt

3. Remove the top cover mounting bolts and nuts.
4. Remove the top cover assembly from the transmission case by using a hoist.




**(When reassembling)**

**■ NOTE**

- **After reassembling the top cover assembly to the tractor,check and adjust the position control lever operating force and the draft control operating force.**
- **Check and adjust the position feedback rod length and the draft rod length.**
- **Since the top cover mounting bolt has two different length, assemble them to the original position.**
- Apply liquid gasket (Three Bond 1206C or its equivalents) to the joint face of the transmission case and the top cover.
- Tighten the top cover mounting bolts and nuts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Top cover mounting screw (M14, 9T) | 167 to 196 N·m<br>17.0 to 20.0 kgf·m<br>123 to 144 lbf·ft |
| | Top cover mounting nut (M14, 7T) | 124 to 147 N·m<br>12.6 to 15.0 kgf·m<br>91.2 to 108 lbf·ft |

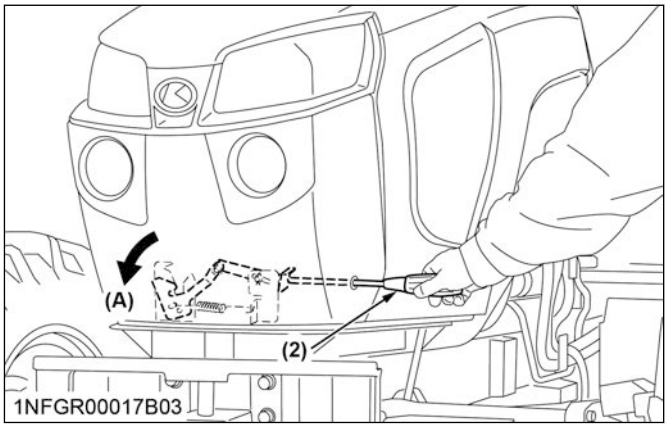
## 5.2.2 Cabin model

## 5.2.2.1 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).


(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).



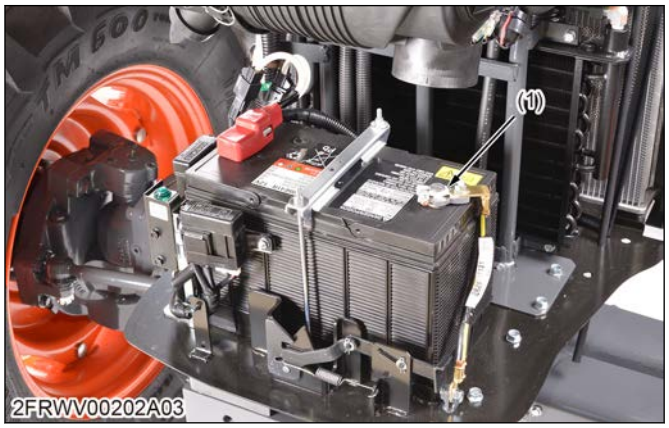

(2) Screwdriver
(A) Unlock position

## 5.2.2.2 Disconnecting battery cable

**■ IMPORTANT**

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

1. Disconnect the negative cable terminal (1) from the battery negative terminal.

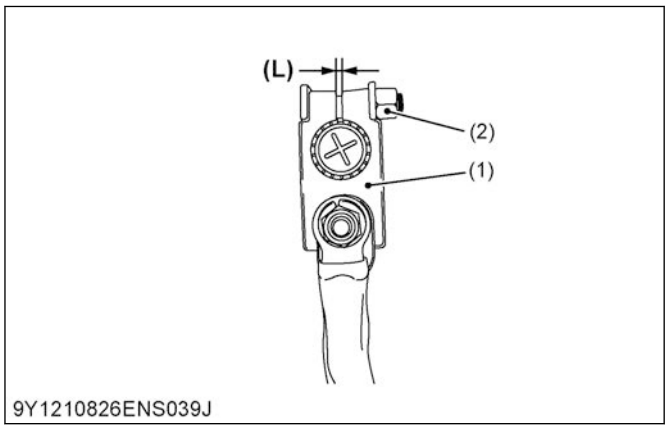



(1) Negative cable terminal

**(When reassembling)**

**■ IMPORTANT**

- **Tighten the battery cable terminal nut (2) so that the clearance (L) is within the following chart.**

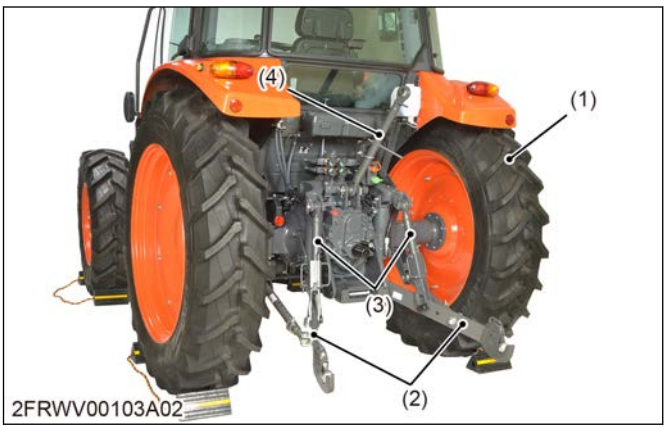



(1) Negative cable terminal
(2) Battery cable terminal nut
(L) Clearance between the battery cable terminal

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

## 5.2.2.3 Removing rear wheel and 3-point linkage

1. Set the disassembling stand under the transmission case.
2. Remove the rear wheel (R.H.) (1).
3. Remove the top link (4).
4. Remove the lower links (2) and lift rods (3).




(1) Rear wheel (R.H.)
(2) Lowe link
(3) Lift rod
(4) Top link

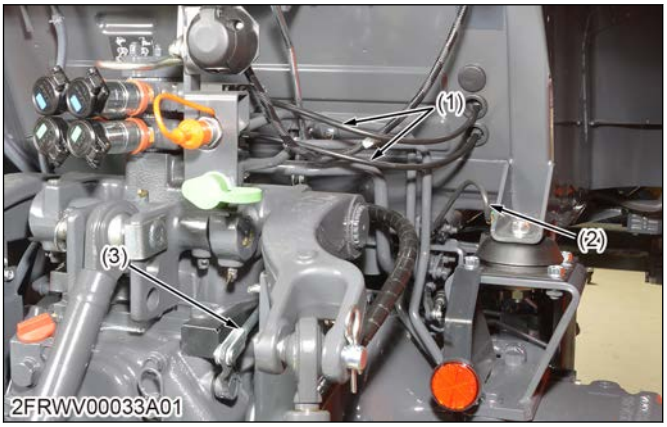
**(When reassembling)**

- Tighten the rear wheel mounting nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Rear wheel mounting nut | 343.2 to 393.3 N·m<br>35.0 to 40.1 kgf·m<br>253.2 to 290.0 lbf·ft |

## 5.2.2.4 Removing outer parts (Cabin model)

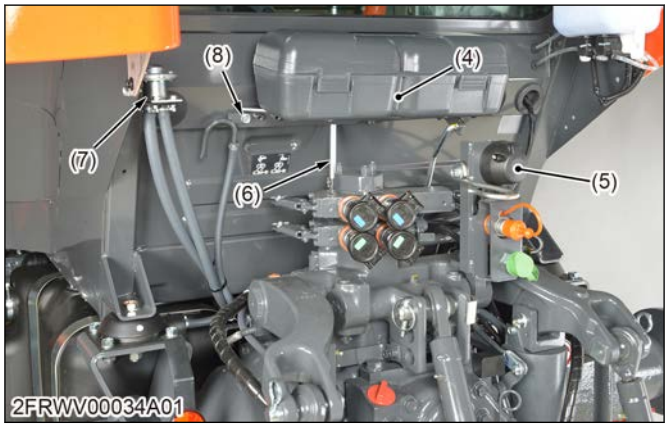
1. Disconnect the grounding cable (2).
2. Disconnect the auxiliary control valve wires (1).
3. Remove the PTO linkage (3).




(1) Grounding cable
(2) Auxiliary control valve wire
(3) PTO linkage

4. Remove the tool box (4).
5. Remove the trailer coupler (5) mounting screws.
6. Remove the 3-point hitch lowering speed linkage (6).
7. Remove the transmission case breather pipe mounting bolt (8).

8. Remove the fuel vapor valve (7) mounting bolts.




(4) Tool box
(5) Trailer coupler
(6) 3-point hitch lowering speed linkage
(7) Fuel vapor valve
(8) Transmission case breather pipe mounting bolt

**(When assembling)**
- Clear the slack of the breather hoses.
- Adjust the length of the auxiliary control valve wires.

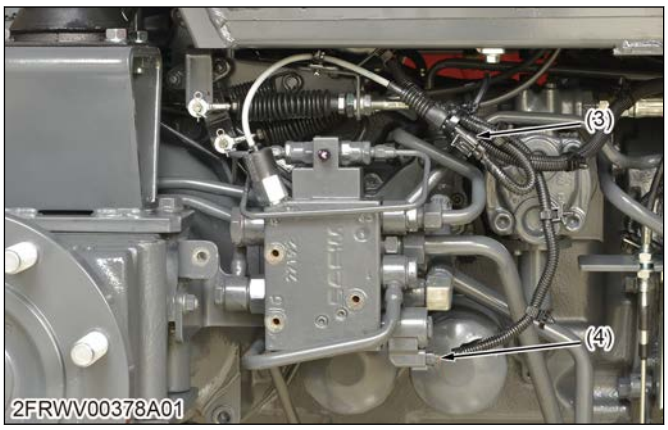
## 5.2.2.5 Disconnecting position control cable and draft control cable

**NOTE**
- **Before disconnecting the draft control cable and position control cable, make the mark to identify the position control lever and draft control lever.**
- **The outside of control cable is for draft control lever.**
- **The inside of control cable is for position control lever.**

1. Disconnect the clamps (1).
2. Remove the trailer brake valve cover (2).

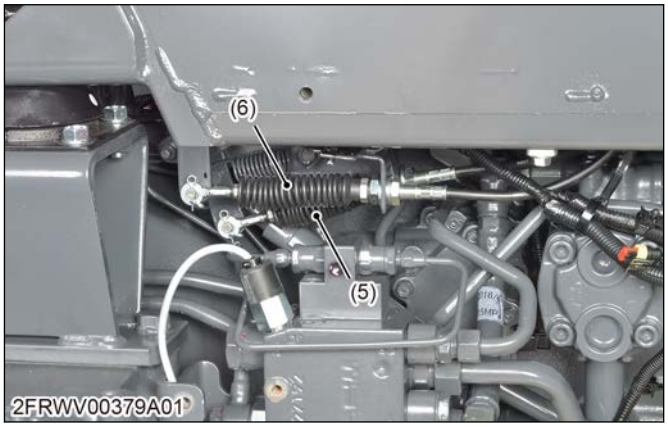

(1) Clamp
(2) Trailer brake valve cover

3. Disconnect the trailer brake pressure switch connector (3).
4. Disconnect the solenoid valve connector (4).




(3) Trailer brake pressure switch connector
(4) Solenoid valve connector

5. Loosen the draft control cable mounting nuts and disconnect the draft control cable (6).
6. Loosen the position control cable mounting nuts and disconnect the position control cable (5).




(5) Position control cable
(6) Draft control cable

**(When assembling)**
- The position of draft and position control cable are as follows.

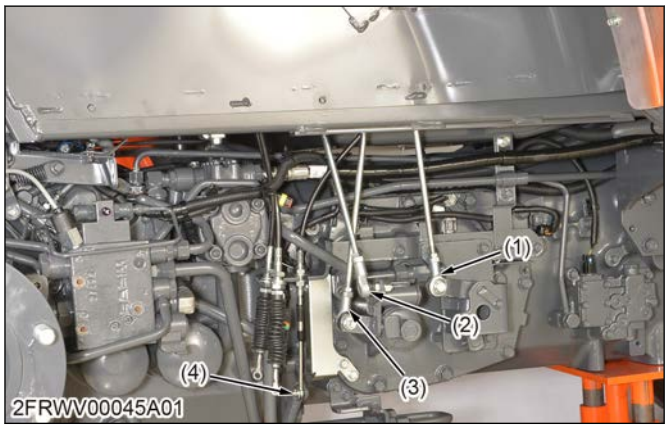
  **Draft control cable:**
  Tractor outside

  **Position control cable:**
  Tractor inside
- Be sure to adjust the draft and position control cable.

## 5.2.2.6 Removing gear shift linkage and parking brake

1. Disconnect the range shift lever rod (1).
2. Disconnect the main shift lever rod 1 (2).
3. Disconnect the main shift lever rod 2 (3).

4. Disconnect the parking brake wire (4).




(1) Range shift lever rod
(2) Main shift lever rod 1
(3) Main shift lever rod 2
(4) Parking brake wire

**(When reassembling)**

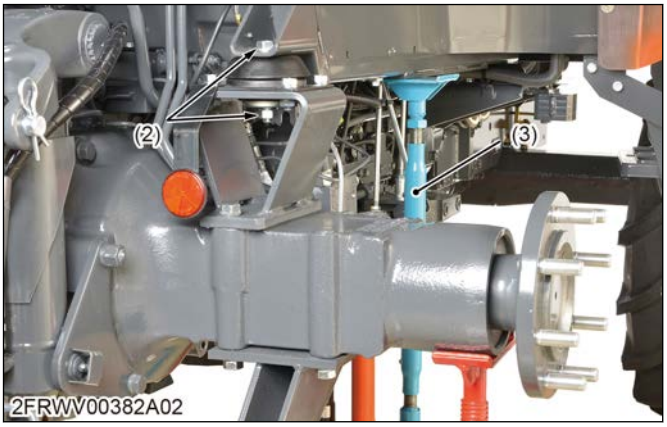
- Adjust the main shift lever rod 1 and 2.
- Adjust the range shift lever rod.
- Adjust the parking brake wire.

## 5.2.2.7 Removing cabin mounting bolt and nut

1. Set the cabin dismounting tool (1) to the cabin.


(1) Cabin dismounting tool

2. Set the cabin support pole (3) under the cabin frame.
3. Remove the cabin mounting bolts and nuts (2).


(2) Cabin mounting bolt and nut (3) Cabin support pole

**(When reassembling)**

**NOTE**

- **Lift the cabin while making sure it does not catch on anything.**
- Tighten the cabin mounting bolt and nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Cabin mounting bolt and nut | 124 to 147 N·m<br>12.6 to 15.0 kgf·m<br>91.2 to 108 lbf·ft |

## 5.2.2.8 Removing cabin bracket

**NOTE**

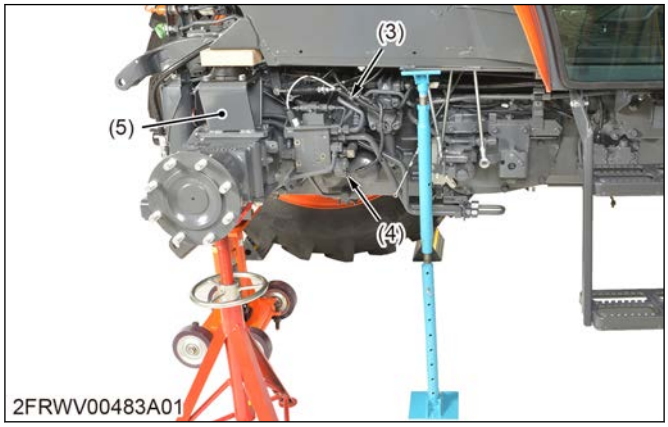
- **Before disconnecting the draft control cable and position control cable, make the mark to identify the position control lever and draft control lever.**
- **The outside of control cable is for draft control lever.**
- **The inside of control cable is for position control lever.**

1. Lift the cabin and then wooden blocks between the cabin frame and the tractor.
2. Disconnect the clamps (1).

3. Remove the trailer brake valve cover (2).


(1) Clamp (2) Trailer brake valve cover

4. Disconnect the trailer brake pressure switch connector (3).
5. Disconnect the solenoid valve connector (4).
6. Remove the cabin bracket (5).



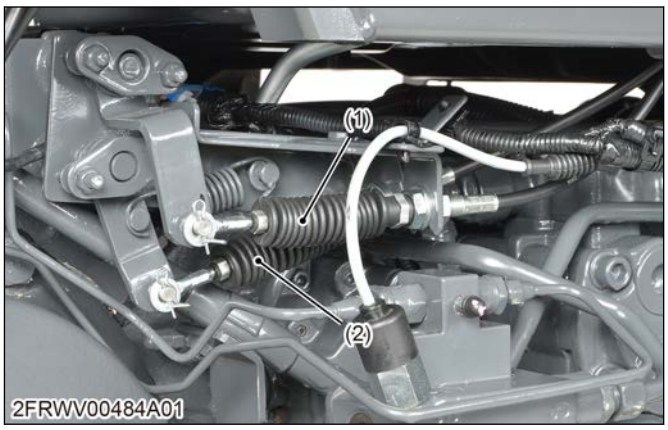

(3) Trailer brake pressure switch connector (5) Cabin bracket
(4) Solenoid valve connector

## 5.2.2.9 Disconnecting position control cable and draft control cable

**■ NOTE**

- **Before disconnecting the draft control cable and position control cable, make the mark to identify the position control lever and draft control lever.**
- **The outside of control cable is for draft control lever.**
- **The inside of control cable is for position control lever.**

1. Loosen the draft control cable mounting nuts and disconnect the draft control cable (1).
2. Loosen the position control cable mounting nuts and disconnect the position control cable (2).




(1) Draft control cable (2) Position control cable

**(When assembling)**

- The position of draft and position control cable are as follows.

  **Draft control cable:**
  Tractor outside

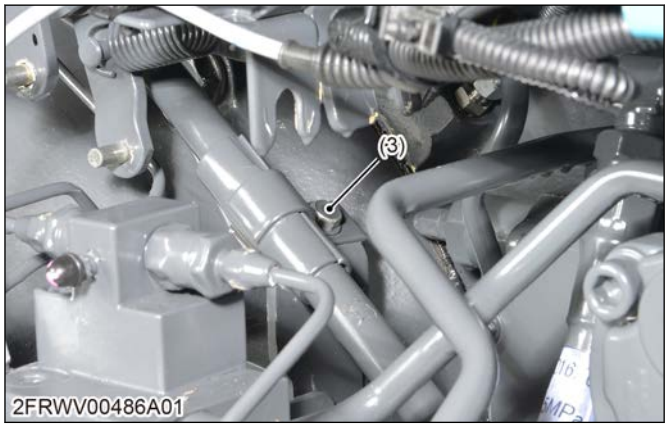
  **Position control cable:**
  Tractor inside
- Be sure to adjust the draft and position control cable.

## 5.2.2.10 Removing trailer brake pipe

1. Remove the trailer brake pipe 1 (2) and trailer brake pipe 2 (1) together with top link holder bracket.

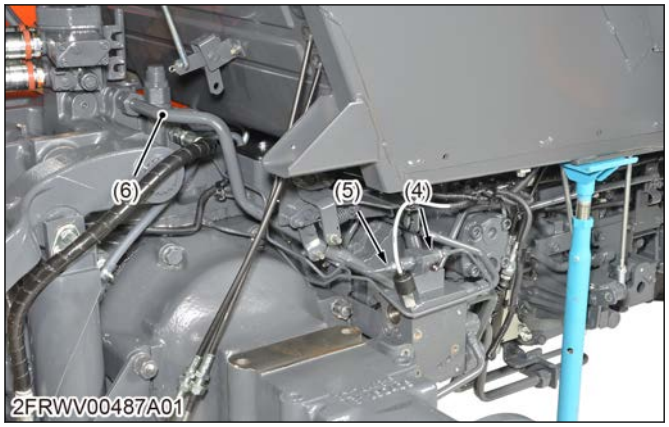

(1) Trailer brake pipe 2 (2) Trailer brake pipe 1

2. Remove the 3-point hitch delivery pipe 2 mounting bolt (3).




(3) 3-point hitch delivery pipe 2 mounting bolt

3. Remove the trailer brake actuating pipe (R.H.) (4) and trailer brake actuating pipe (L.H.) (5).
4. Remove the 3-point hitch delivery pipe 2 (6).



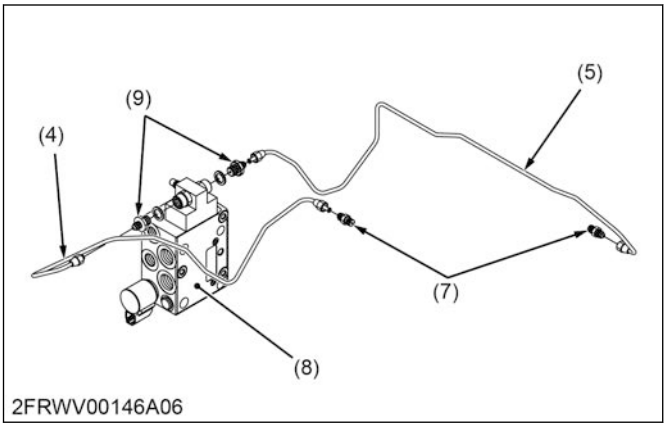

(4) Trailer brake actuating pipe (R.H.)
(5) Trailer brake actuating pipe (L.H.)
(6) 3-point hitch delivery pipe 2

**(When reassembling)**

**■ IMPORTANT**

- **After assembling the pipes, be sure to bleed the air from the brake system.**

- If the trailer brake actuating pipe connector (7) was removed, wrap the seal tape to the transmission case side of connector (7).
- If the trailer brake actuating pipe joint (9) was removed, replace the gasket with new one.
- Tighten the trailer brake actuating pipe joint (9) and trailer brake actuating pipe connector (7) to the specified tightening torque.



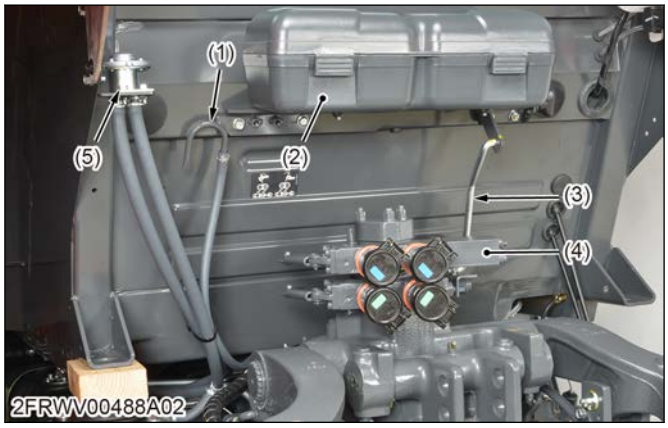

(4) Trailer brake actuating pipe (R.H.)
(5) Trailer brake actuating pipe (L.H.)
(7) Trailer brake actuating pipe connector
(8) Trailer brake valve
(9) Trailer brake actuating pipe joint

| | | |
|---|---|---|
| Tightening torque | Trailer brake return pipe joint bolt (Trailer brake valve side) | 63.7 to 73.5 N·m<br>6.50 to 7.49 kgf·m<br>47.0 to 54.2 lbf·ft |
| | Trailer brake return pipe joint bolt (Transmission case side) | 75 to 85 N·m<br>7.7 to 8.6 kgf·m<br>56 to 62 lbf·ft |
| | Trailer brake pipe 1 joint bolt (Trailer brake valve side) | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 1 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake pipe 2 joint bolt | 53.9 to 63.7 N·m<br>5.50 to 6.49 kgf·m<br>39.8 to 46.9 lbf·ft |
| | Trailer brake pipe 2 flare nut | 49.0 to 68.6 N·m<br>5.00 to 5.99 kgf·m<br>36.2 to 50.5 lbf·ft |
| | Trailer brake actuating pipe | 15.7 to 23.5 N·m<br>1.60 to 2.39 kgf·m<br>11.6 to 17.3 lbf·ft |
| | Trailer brake actuating pipe joint (Trailer brake valve side) | 35 to 40 N·m<br>3.6 to 4.0 kgf·m<br>26 to 29 lbf·ft |
| | Trailer brake actuating pipe connector (Transmission case side) | 9.80 to 14.7 N·m<br>1.00 to 1.49 kgf·m<br>7.23 to 10.8 lbf·ft |

## 5.2.2.11 Removing auxiliary control valve

1. Remove the tool box (2).
2. Remove the fuel tank breather hoses (5) and transmission case breather hose (1).
3. Remove the PTO speed shifting linkage rod (3).

4. Remove the auxiliary control valves (4).




(1) Transmission case breather hose
(2) Tool box
(3) PTO speed shifting linkage rod
(4) Auxiliary control valve
(5) Fuel tank breather hose

**(When reassembling)**
- Be sure to fit the O-rings for auxiliary control valve.
- Be sure to adjust the auxiliary control valve wire.
- Tighten the auxiliary control valve mounting bolt to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Auxiliary control valve mounting bolt (7T, M8) | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |
| | Auxiliary control valve mounting bolt (7T, M10) | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

## 5.2.2.12 Removing hydraulic cylinder

**■ NOTE**
- **Be careful not to damage the grease fitting when removing the hydraulic cylinder pin.**

1. Remove the hydraulic cylinder delivery hoses (2) on both sides.
2. Remove the hydraulic cylinder breather hoses (3) on both sides.
3. Remove the hydraulic cylinder covers on both sides.
4. Remove the hydraulic cylinders (1) on both sides.

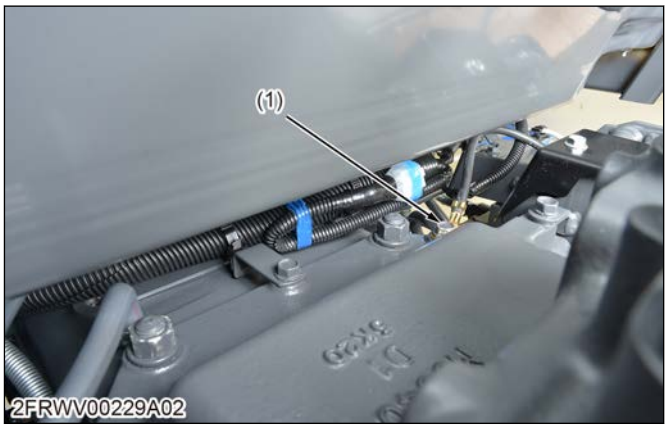

(1) Hydraulic cylinder
(2) Hydraulic cylinder delivery hose
(3) Hydraulic cylinder breather hose

**(When reassembling)**
- Apply grease to the grease fitting.
- Be careful not to damage the grease fitting when reassembling the hydraulic cylinder.
- Tighten the hydraulic cylinder delivery hoses (2) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Hydraulic cylinder delivery hose retaining nut | 46 to 53 N·m<br>4.6 to 5.4 kgf·m<br>34 to 39 lbf·ft |

## 5.2.2.13 Disconnecting connector for transmission case

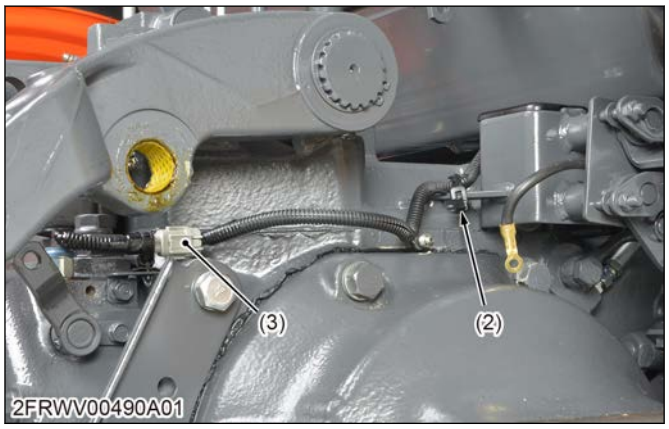
1. Remove the grounding cable mounting bolt (1).




(1) Grounding cable mounting bolt

2. Remove the switch cover and disconnect the PTO speed detect switch connector (3).

3. Remove the clamp (2).




(2) Clamp
(3) PTO speed detect switch connector

## 5.2.2.14 Removing top cover

1. Remove the top cover mounting bolts and nuts.
2. Remove the top cover assembly from the transmission case by using a hoist.


**(When reassembling)**

**■ NOTE**

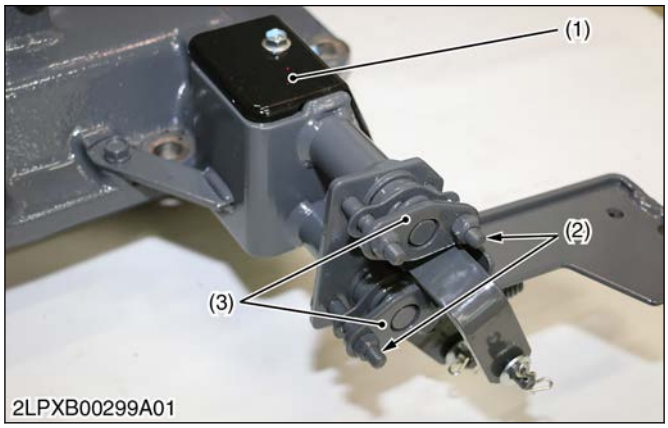
- **After reassembling the top cover assembly to the tractor,check and adjust the position control lever operating force and the draft control operating force.**
- **Check and adjust the position feedback rod length and the draft rod length.**
- **Since the top cover mounting bolt has two different length, assemble them to the original position.**

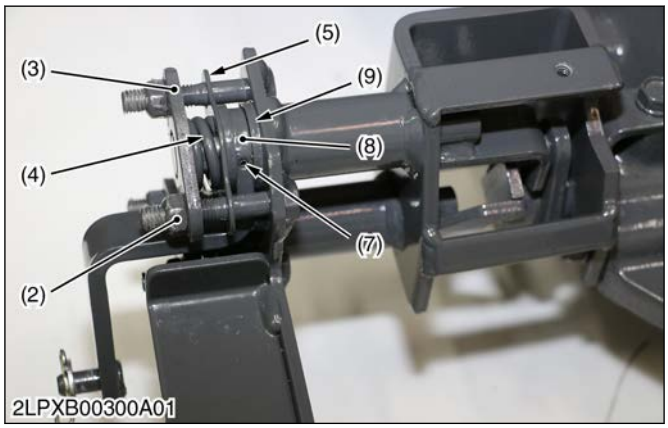
- Apply liquid gasket (Three Bond 1206C or its equivalents) to the joint face of the transmission case and the top cover
- Tighten the top cover mounting bolts and nuts to the specified tightening torque.

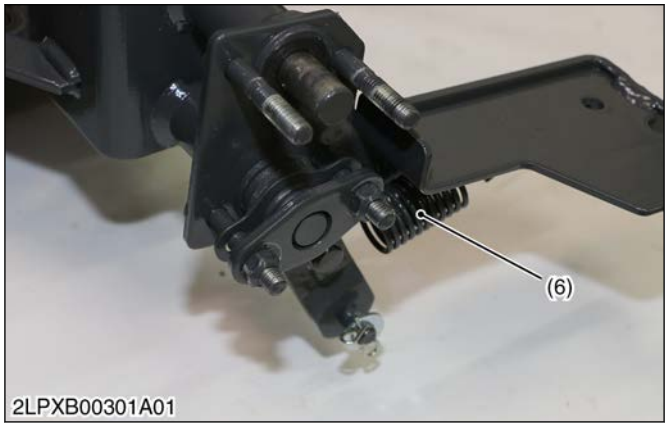
| | | |
|---|---|---|
| Tightening torque | Top cover mounting screw (M14, 9T) | 167 to 196 N·m<br>17.0 to 20.0 kgf·m<br>123 to 144 lbf·ft |
| | Top cover mounting nut (M14, 7T) | 124 to 147 N·m<br>12.6 to 15.0 kgf·m<br>91.2 to 108 lbf·ft |

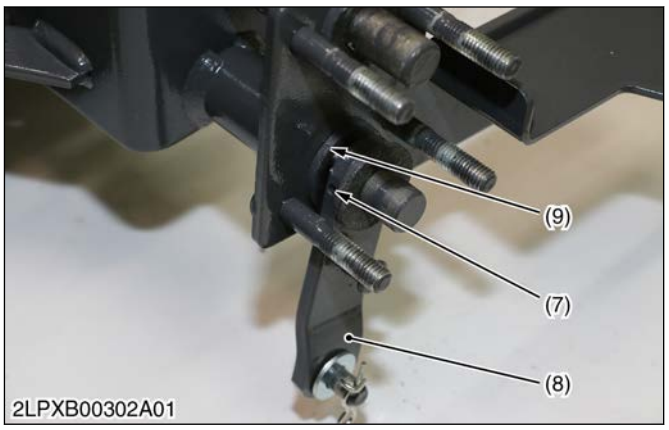
# 5.3 Hydraulic linkage

## 5.3.1 Removing position linkage and draft linkage




(1) Link cover
(2) Position and draft linkage nut
(3) Plate 1
(4) Spring 1
(5) Plate 2
(6) Spring 2
(7) Roll pin
(8) Position and draft lever
(9) Friction plate

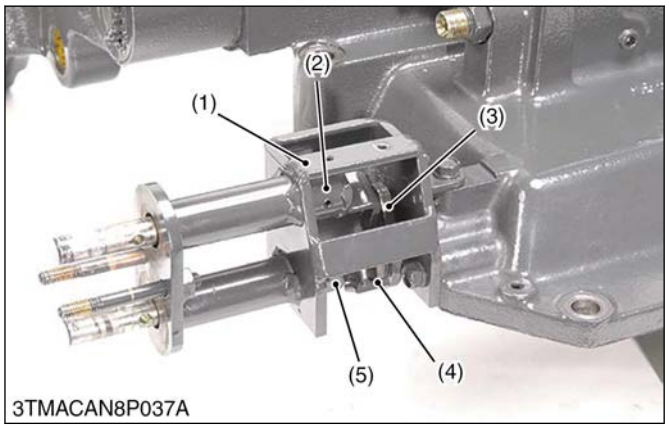
1. Remove the link cover (1).
2. Remove the nuts (2) for position and draft linkage.
3. Draw out the plate 1 (3), spring 1 (4) and plate 2 (5) for position and draft linkage.
4. Remove the spring 2 (6).
5. Tap out the roll pin (7) and remove the position and draft lever (8) and friction plate (9).

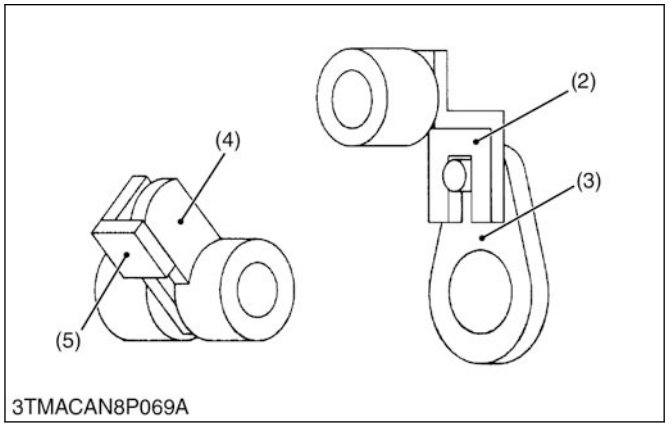
**(When reassembling)**

**■ NOTE**

- **After assembling the linkage, adjust operating force of the position and draft levers and length of the position and draft rods.**

## 5.3.2 Removing linkage bracket



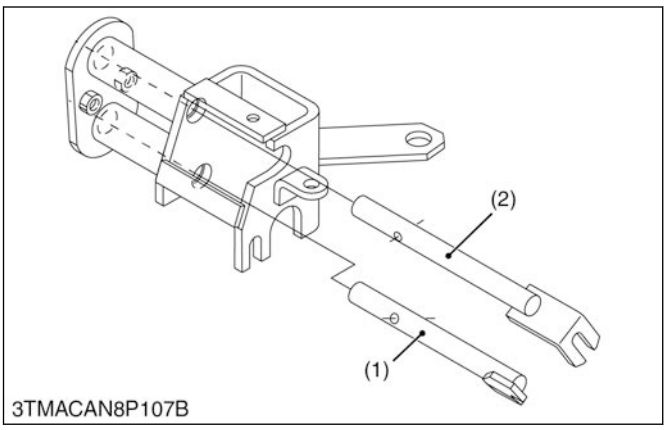

(1) Bracket
(2) Draft link cam 2
(3) Draft lever 3
(4) Position lever 3
(5) Position lever 2

1. Remove the bracket (1).

**(When reassembling)**
- Be sure to assemble the position lever 2 (5) and 3 (4) as shown in figure.
- Be sure to assemble the draft link cam 2 (2) and draft lever 3 (3) as shown in figure.

## 5.3.3 Removing draft lever rod and position lever rod

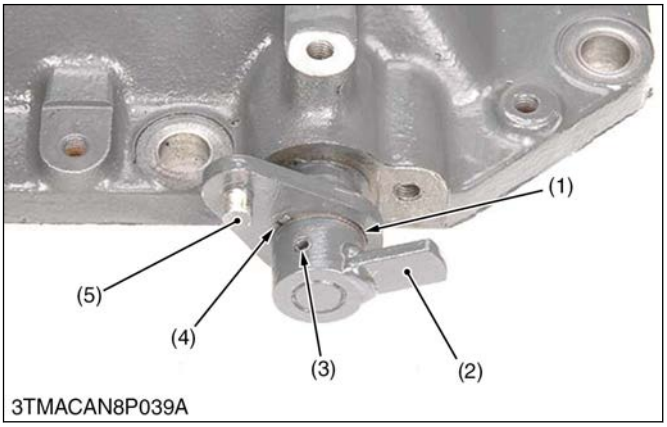
1. Draw out the position lever rod (1) and draft lever rod (2).

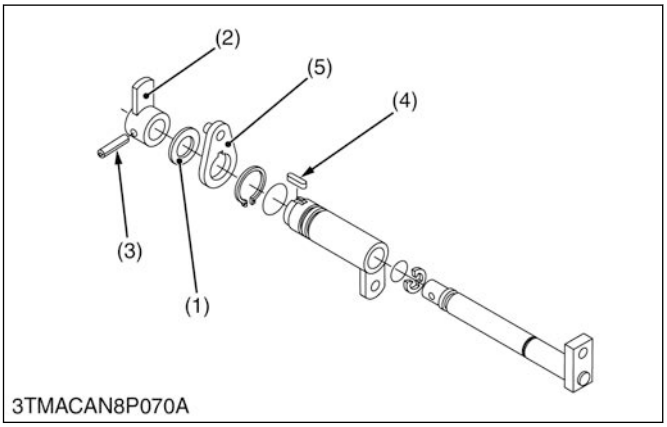



(1) Position lever rod
(2) Draft lever rod

**(When reassembling)**
- Apply grease to the bushes.

## 5.3.4 Removing draft lever 3 and position lever 3

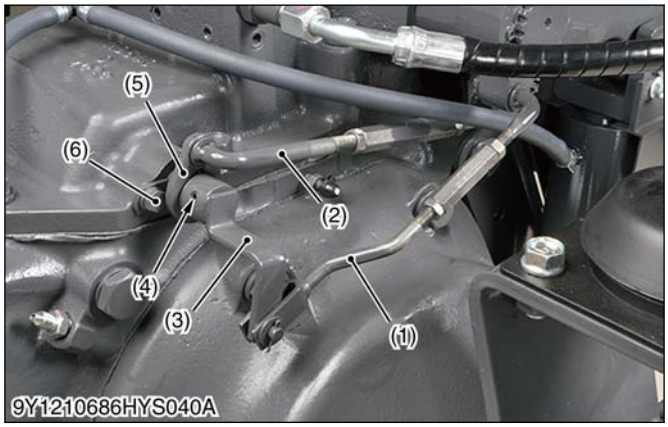


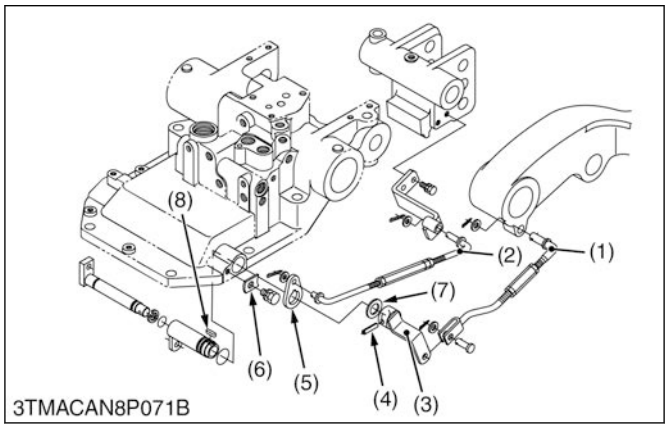




(1) Washer
(2) Position lever 3
(3) Roll pin
(4) Key
(5) Draft lever 3

1. Tap out the roll pin (3).
2. Remove the position lever 3 (2), washer (1), draft lever 3 (5) and key (4).

## 5.3.5 Removing position feedback rod and draft rod




(1) Position feedback rod
(2) Draft rod
(3) Position feedback lever
(4) Roll pin
(5) Draft feedback lever
(6) Stopper
(7) Washer
(8) Key

1. Tap out the roll pin (4), and remove the position feedback rod (1) with the position feedback lever (3) and the washer (7).
2. Remove the draft rod (2) with the draft feedback lever (5) and the key (8).
3. Remove the stopper (6).

**(When reassembling)**

- Adjust the position feedback rod length and the draft rod length to the reference value.

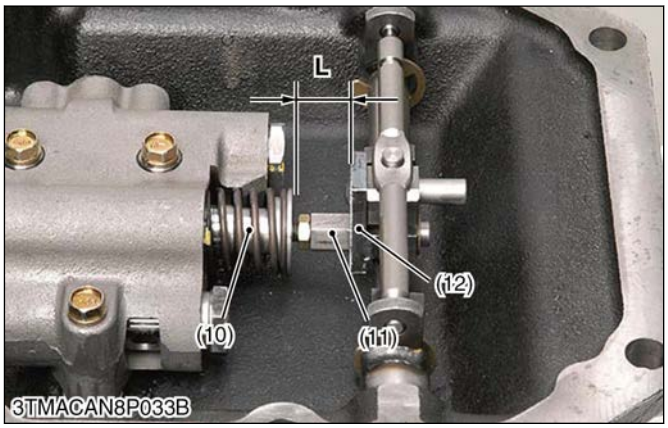
| | | |
|---|---|---|
| Position feedback rod length | Reference value | 210 mm<br>8.3 in. |
| Draft rod length | | 272 mm<br>10.7 in. |

## 5.3.6 Removing draft spool lever and position spool lever

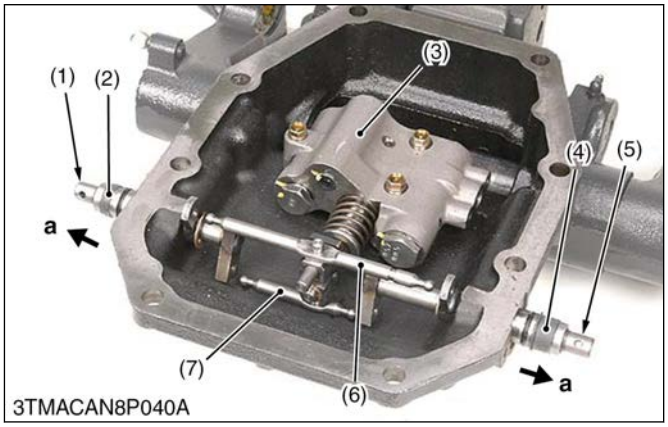
**■ NOTE**

- **Do not disassemble the spool joint 1 (11) from the spool (10) unless necessary.**
  **If the spool joint is disassembled due to unavoidable reasons, record the installation length "L" between the spool joint 3 (12) and spring retainer (as shown in the figure).**
  **When reassembling, be sure to make to a former length.**

| | | |
|---|---|---|
| Length "L" | Factory specification | 22.5 to 23.0 mm<br>0.886 to 0.905 in. |




(10) Spool
(11) Spool joint 1
(12) Spool joint 3

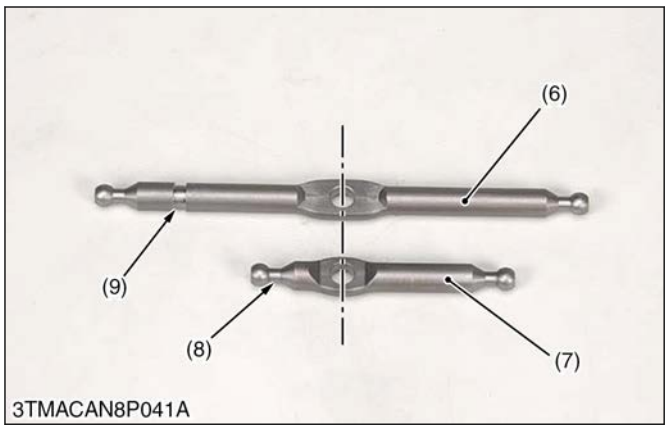



(1) Position feedback shaft
(2) Draft feedback shaft
(3) Control valve
(4) Draft shaft
(5) Position shaft
(6) Draft spool lever
(7) Position spool lever
a: Push out direction

1. Push out the draft feedback shaft (2) and position feedback shaft (1).
2. Push out the draft shaft (4) and position shaft (5).
3. Remove the draft spool lever (6).
4. Remove the control valve (3).
5. Remove the position spool lever (7).

**(When reassembling)**

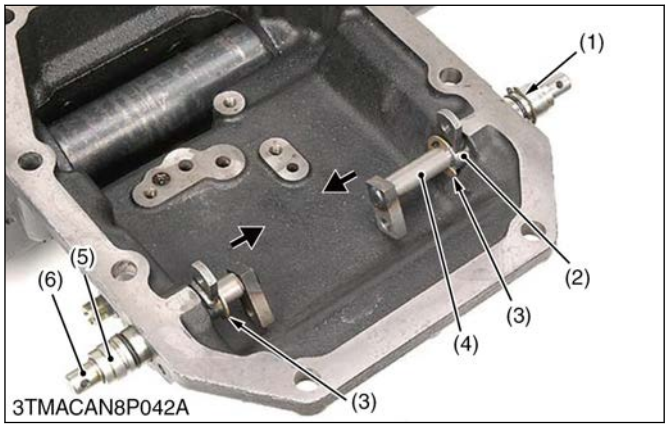
- Fix the groove (9) side on the draft spool lever (6) and the shorter side (8) on the position spool lever (7) facing to the hydraulic operating lever side.
- Be sure to fix the O-rings to the control valve and apply grease to them.




(6) Draft spool lever
(7) Position spool lever
(8) Shorter side
(9) Groove

### 5.3.7 Removing position and draft control shaft and position and draft feedback shaft

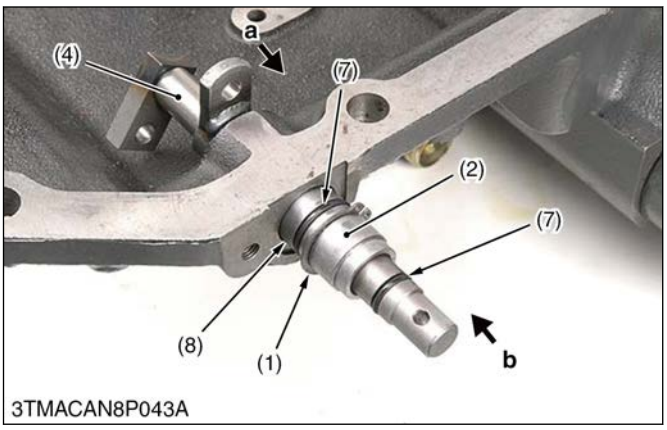
1. Remove the position and draft feedback rod and.
2. Remove the external circlip (1). Draw out the position and draft control shaft (4) and (2).
3. Remove the E-shaped stopper (3).
4. Remove the position feedback shaft (6) from draft feedback shaft (5) and remove the position control shaft (4) from draft control shaft (2).




(1) External circlip
(2) Draft control shaft
(3) E-shaped stopper
(4) Position control shaft
(5) Draft feedback shaft
(6) Position feedback shaft

**(When reassembling)**

1. Remove the O-ring (7) from position control shaft.
2. Insert the position control shaft and draft control shaft to the body until both the O-ring grooves come out.
3. Apply grease to the O-ring then assemble the O-ring from outside.
4. Fix the external circlip the draft control shaft then push back the position control shaft with draft control shaft.
5. Fix the E-shaped stopper (3).
6. The feedback side is same as control side.



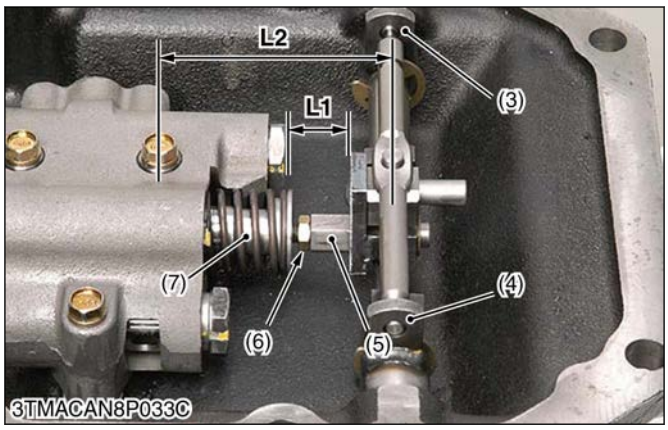

(1) External circlip
(2) Draft control shaft
(4) Position control shaft
(7) O-ring
(8) Chamfer
a: To fix O-rings
b: To assemble shafts

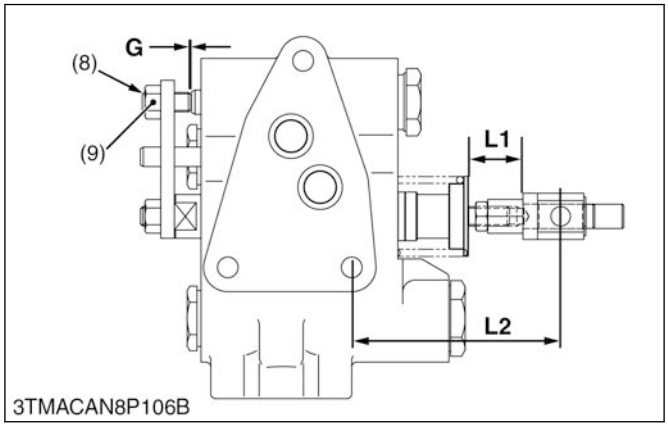
## 5.4 Control valve

### 5.4.1 Removing control valve

**NOTE**

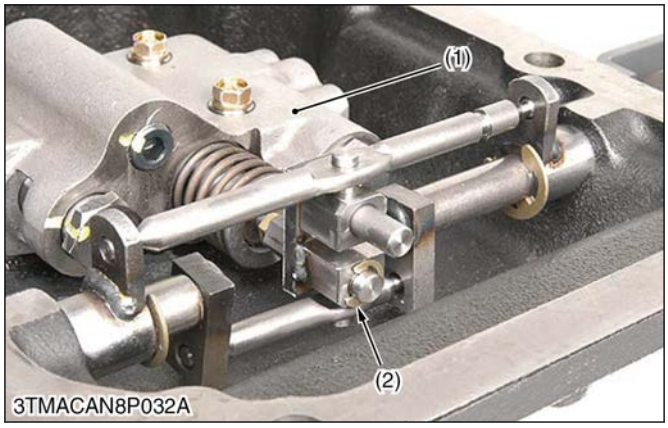
- **Do not disassemble the spool joint (5) from the spool (7) unless necessary.**
  **If disassembled due to unavoidable reasons, record the installation length "L1" between the spool joint (5) and spring retainer. (as shown figure).**
  **When reassembling, be sure to make a former length.**
- **Do not loosen the adjusting bolt (8) unless necessary.**




(3) Position link lever
(4) Draft link lever
(5) Spool joint
(6) Lock nut
(7) Spool
(8) Adjusting bolt
(9) Lock nut
G: Gap

1. Remove the E-shaped stopper (2).
2. Remove the control valve mounting screws.
3. Remove the control valve (1).

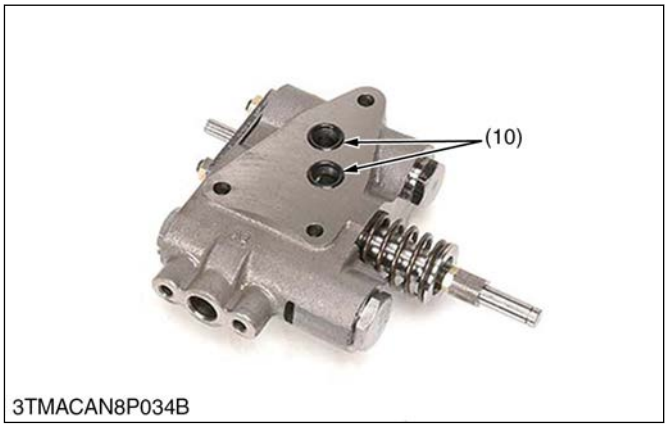



(1) Control valve
(2) E-shaped stopper

**(When reassembling)**

- Be sure to fit the O-rings (10).

1. Set the length L1 to the reference value or recorded value.
2. Set the length L2 to the factory specification (neutral state), with operate the draft link lever (4) and position link lever (3).
3. Check the gap (G) between the lowering poppet and adjusting bolt (8).
4. If the gap (G) is not within the reference value, recheck the length (L2) at the neutral state of spool. If necessary to adjust the gap (G), loosen the lock nut (9) and adjust by the adjusting bolt (8).




(10) O-ring

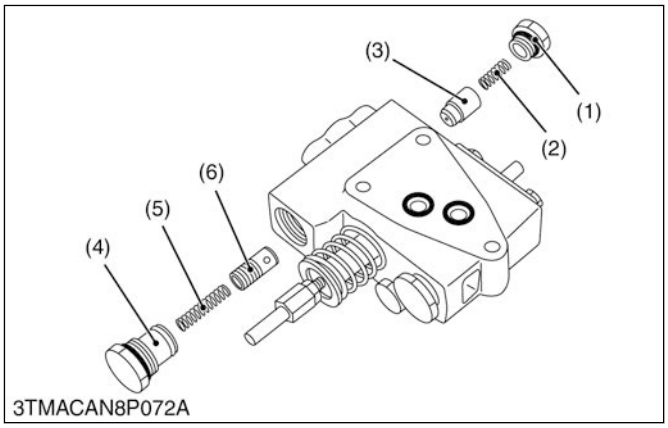
| | | |
|---|---|---|
| Tightening torque | Control valve mounting screw | 20 to 23 N·m<br>2.0 to 2.4 kgf·m<br>15 to 17 lbf·ft |

| | | |
|---|---|---|
| Length (L1) | Factory specification | 22.5 to 23.0 mm<br>0.886 to 0.905 in. |

| | | |
|---|---|---|
| Length (L2) | Reference value | 85.8 to 86.2 mm<br>3.38 to 3.39 in. |

| | | |
|---|---|---|
| Gap (G) | Reference value | 0.2 to 0.3 mm<br>0.008 to 0.01 in. |

## 5.4.2 Removing plug and unload valve




(1) Seat plug 1
(2) Spring
(3) Unload poppet 1
(4) Seat plug 2
(5) Spring
(6) Unload poppet 2

1. Secure the control valve with a vise.
2. Remove the seat plug 1 (1) for unload poppet 1 (3).
3. Draw out the spring (2) for unload poppet 1 (3).
4. Remove the seat plug 2 (4) for unload poppet 2 (6).

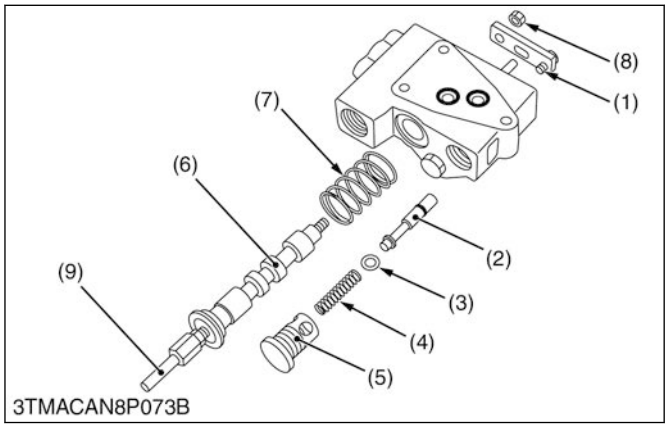
5. Draw out the spring (5) and unload poppet 2 (6).

**(When reassembling)**
- Install the plug, noting O-ring.
- Tighten the seat plug 1 and the seat plug 2 to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Seat plug 1 | 40 to 58 N·m<br>4.0 to 6.0 kgf·m<br>29 to 43 lbf·ft |
| | Seat plug 2 | 40 to 58 N·m<br>4.0 to 6.0 kgf·m<br>29 to 43 lbf·ft |

### 5.4.3 Removing spool and poppet valve

**■ IMPORTANT**
- **Do not change the adjuster (1) adjustment.**
- **Do not disassemble the spool joint 1 (9) from the spool (6) unless necessary.**



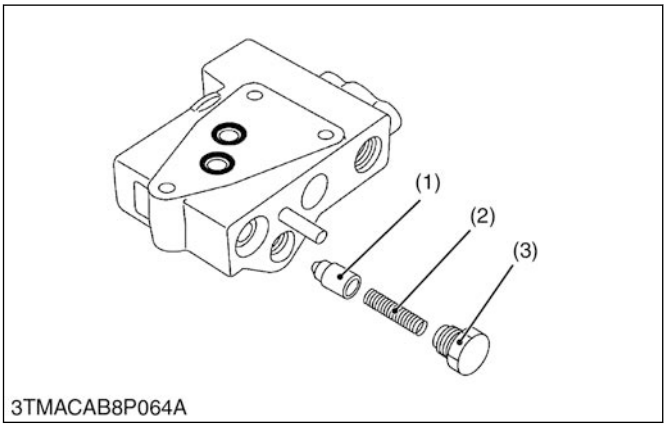

(1) Adjuster
(2) Poppet valve
(3) Collar
(4) Spring
(5) Seat plug 3
(6) Spool
(7) Spring
(8) Lock nut
(9) Spool joint 1

1. Remove the lock nut (8) for spool (6).
2. Draw out the spool (6).
3. Remove the seat plug 3 (5) for poppet valve (2).
4. Draw out the spring (4), collar (3) and poppet valve (2).

**(When reassembling)**
- Install the poppet valve, noting O-ring and backup ring.
- Tighten the seat plug 3 and the lock nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Seat plug 3 | 40 to 58 N·m<br>4.0 to 6.0 kgf·m<br>29 to 43 lbf·ft |
| | Lock nut | 16 to 19 N·m<br>1.6 to 2.0 kgf·m<br>12 to 14 lbf·ft |

### 5.4.4 Removing check valve




(1) Check valve
(2) Spring
(3) Seat plug 4

1. Remove the seat plug 4 (3).
2. Draw out the spring (2) and check valve (1).

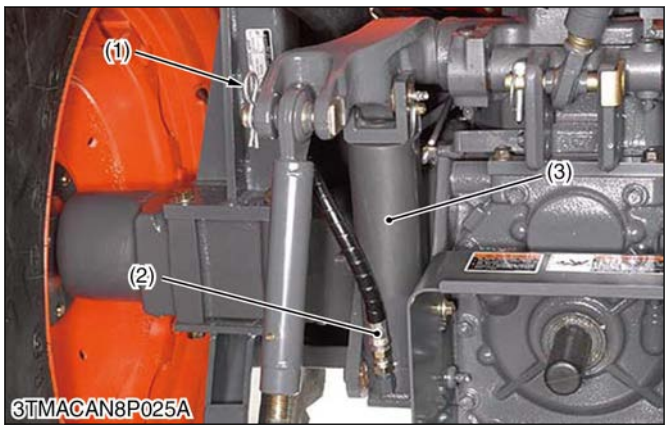
**(When reassembling)**
- Install the plug, noting O-ring.
- Tighten the seat plug 4 to the specified tightening torque.

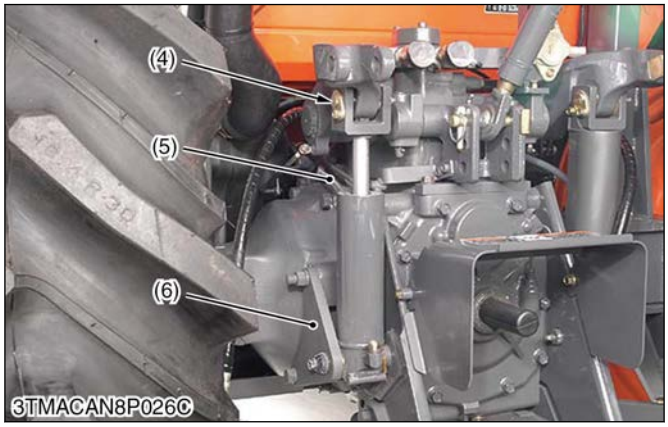
| | | |
|---|---|---|
| Tightening torque | Seat plug 4 | 30 to 49 N·m<br>3.0 to 5.0 kgf·m<br>22 to 36 lbf·ft |

## 5.5 Hydraulic cylinder

### 5.5.1 Removing hydraulic cylinder

**■ NOTE**
- **Be careful not to damage the grease fittings when removing the hydraulic cylinder.**




(1) Lift rod pin
(2) Hydraulic hose
(3) Hydraulic cylinder cover
(4) Cylinder pin (Upper)
(5) Breather hose
(6) Cylinder pin (Lower)

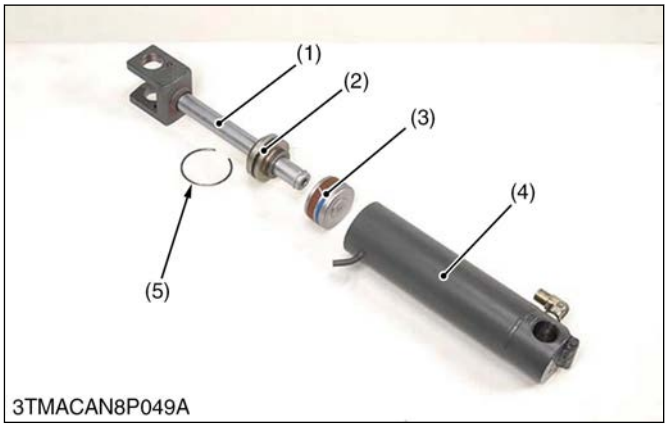
1. Remove the lift rod pin (1).
2. Disconnect the hydraulic hose (2) from hydraulic cylinder.
3. Remove the hydraulic cylinder cover (3).
4. Remove the cylinder pin (upper) (4).
5. Disconnect the breather hose (5) from hydraulic cylinder.
6. Remove the cylinder pin (lower) (6).
7. Remove the hydraulic cylinder.

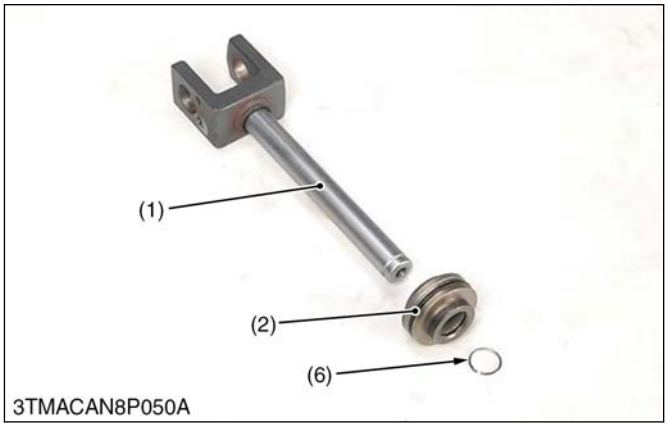
**(When reassembling)**

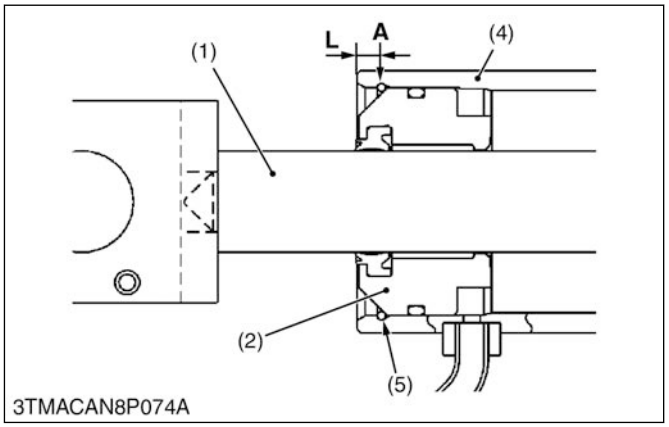
- Apply grease to the grease fittings.
- Don't damage the grease fittings when reassembling the hydraulic cylinder.
- Tighten the cylinder hose retaining nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Cylinder hose retaining nut | 46 to 53 N·m<br>4.6 to 5.4 kgf·m<br>34 to 39 lbf·ft |

## 5.5.2 Disassembling hydraulic cylinder




(1) Rod
(2) Head
(3) Piston
(4) Cylinder tube
(5) Internal circlip
(6) External circlip
A: Position for drilling
L: 6.0 mm (0.24 in.)

1. Remove the liquid gasket from the head (2).
2. Slightly tap-in the head (2) to inside, and remove the internal circlip (5) by using the small screwdriver.

3. If the internal circlip (5) cannot be removed by above-mentioned procedure, remove it by the following procedure.
   a. Carefully clamp the cylinder tube (4) in a vise.
   b. Drill approximately 2.5 mm (0.098 in.) diameter hole on the cylinder tube (position A) just over the internal circlip (5) as shown in the figure.
   c. Use a small screwdriver and remove the internal circlip (5). Simultaneously support this action by pushing from the outside of the cylinder tube with another small screwdriver or similar tool.
4. Remove the rod (1) and head (2).
5. Inject the compressed air through the oil inlet port of the cylinder tube (4), and remove the piston (3).
6. Remove the external circlip (6), and remove the head (2).

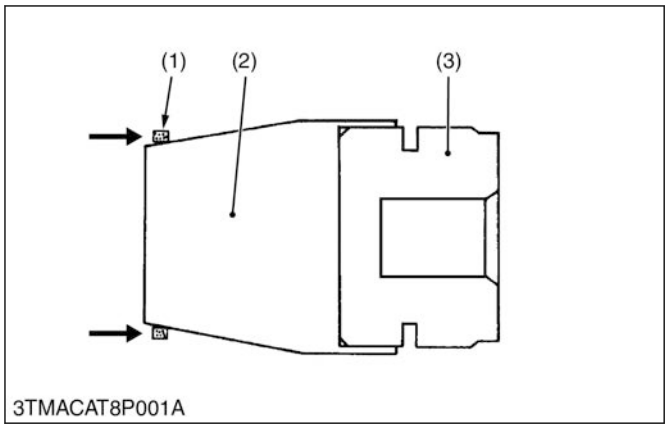
**(When reassembling)**

- Apply transmission fluid to the piston (3), head (2) and cylinder tube (4).
- Don't damage the O-ring, backup ring and seal.
- Apply liquid gasket (Three Bond 1206C or its equivalent) to the top of head (2), while pressing the head (2) against internal circlip (5).
- After reassembling the cylinder, close the drilled hole by liquid gasket.

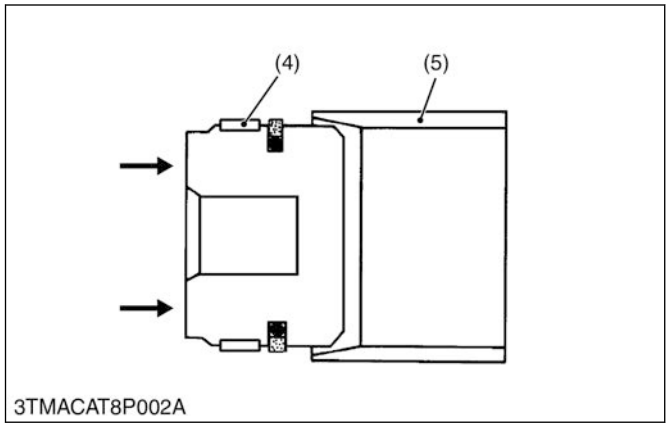
## 5.5.3 Installing piston seal

**■ NOTE**

- **Do not turn (roll) the piston seal as you install it.**



3TMACAT8P001A



3TMACAT8P002A

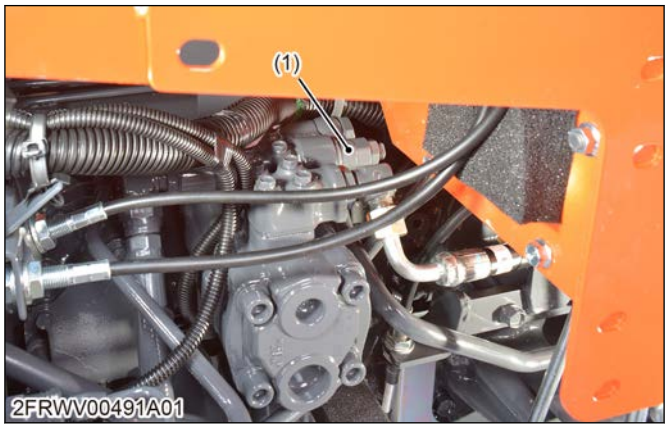
(1) Piston seal
(2) Slide jig
(3) Piston
(4) Bearing ring
(5) Correcting jig

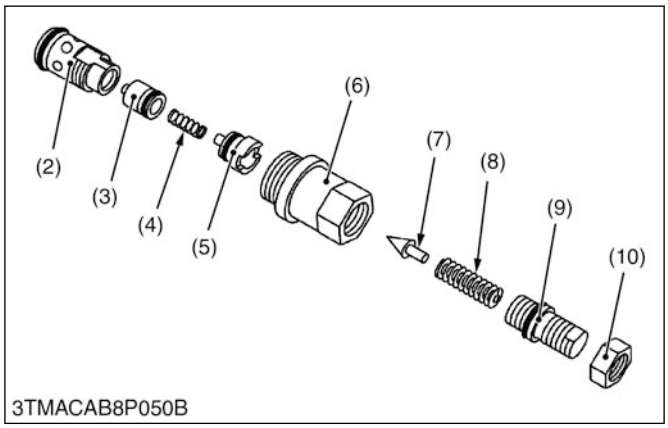
1. Place the slide jig (2) on the piston (3).
2. Install the piston seal (1) to the piston using the slide jig.
3. Compress the piston seal to the correct size by installing the piston into the correcting jig (5).

RELATED PAGE
2.21 Hydraulic cylinder piston sealing tool on page 2-90

# 5.6 Relief valve

## 5.6.1 Disassembling relief valve




(1) Relief valve assembly
(2) Valve seat
(3) Main valve
(4) Spring
(5) Valve seat
(6) Valve body
(7) Pilot valve
(8) Spring
(9) Adjuster
(10) Lock nut

1. Remove the relief valve assembly (1).
2. Secure the relief valve assembly (1) in a vise.
3. Loosen the lock nut (10).
4. Remove the adjuster (9), and remove the spring (8) and the pilot valve (7).
5. Remove the valve seat (2), and draw out the valve seat (5), the spring (4) and the main valve (3).

**(When reassembling)**

**■ IMPORTANT**

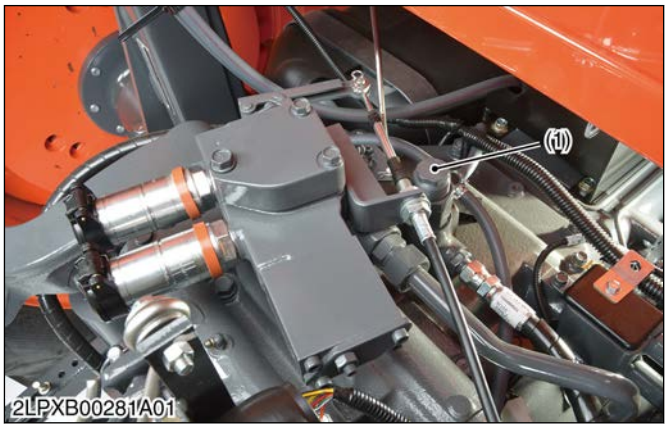
- **After disassembling and assembling the relief valve assembly, be sure to adjust the relief valve setting pressure.**

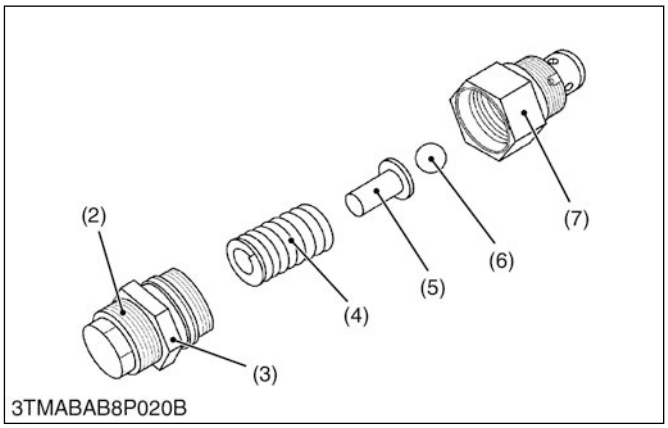
- Be careful not to damage the O-ring.
- Tighten the relief valve assembly to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Relief valve assembly | 35 to 39 N·m<br>3.5 to 4.0 kgf·m<br>26 to 28 lbf·ft |

# 5.7 Safety valve

## 5.7.1 Disassembling safety valve




(1) Safety valve assembly
(2) Adjust screw
(3) Lock nut
(4) Spring
(5) Seat
(6) Ball
(7) Housing

1. Remove the safety valve assembly (1).
2. Secure the safety valve assembly in a vise.
3. Loosen the lock nut (3), and remove the adjust screw (2).
4. Draw out the spring (4), seat (5) and ball (6).

**(When reassembling)**

- Install the safety valve to the hydraulic cylinder block. Don't damage the O-ring.
- Tighten the safety valve assembly and the safety valve lock nut to the specified tightening torque.

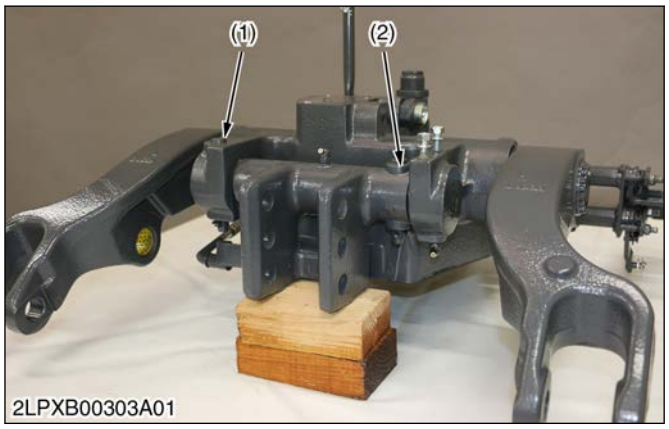
| | | |
|---|---|---|
| Tightening torque | Safety valve assembly | 40 to 49 N·m<br>4.0 to 5.0 kgf·m<br>29 to 36 lbf·ft |
| | Safety valve lock nut | 59 to 78 N·m<br>6.0 to 8.0 kgf·m<br>44 to 57 lbf·ft |

# 5.8 Top link bracket

## 5.8.1 Disassembling top link bracket

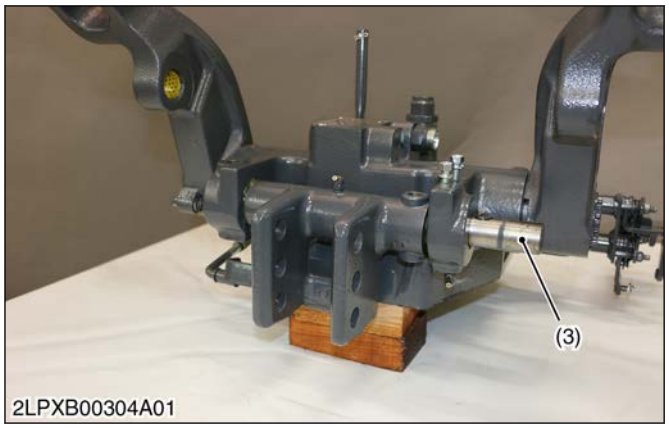
1. Remove the position and draft rod.
2. Remove the cotter pin.

3. Remove the clevis pins (1) and (2).




(1) Clevis pin (2) Clevis pin

4. Draw out the torsion bar (3).



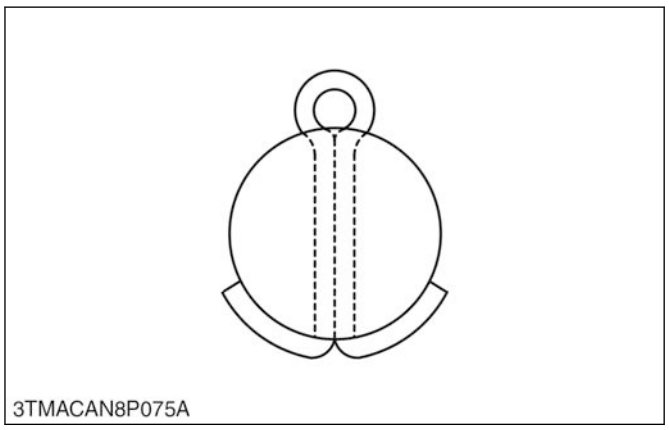

(3) Torsion bar

**(When reassembling)**

**■ NOTE**

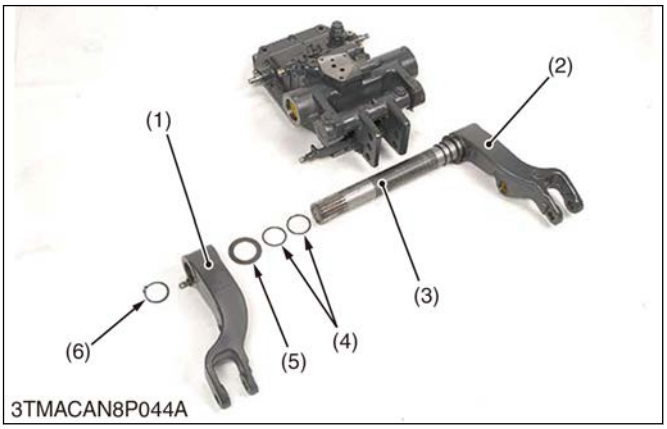
- **After assembling the top link bracket, adjust the position feedback rod and the draft rod.**
- **Apply grease to the grease fittings.**

- Apply grease to the torsion bar bushing.
- Replace the cotter pin with new one, and assemble as shown in the figure.




# 5.9 Lift arm and lift arm shaft

## 5.9.1 Removing lift arm and lift arm shaft

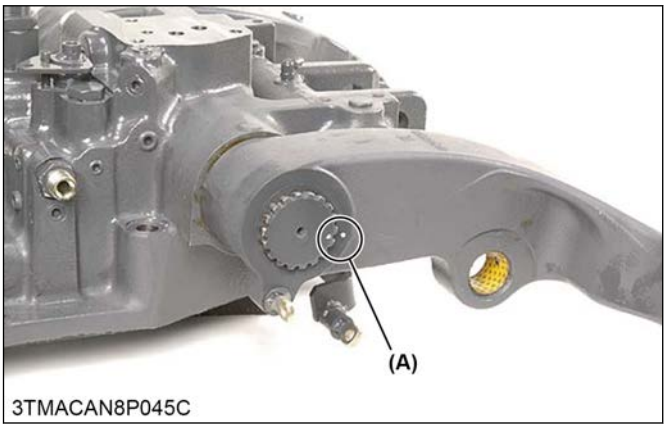



(1) Lift arm (L.H.)
(2) Lift arm (R.H.)
(3) Lift arm shaft
(4) O-ring
(5) Collar
(6) External circlip

1. Remove the external circlip (6).
2. Remove the lift arm (R.H.) (2).
3. Draw out the lift arm shaft (3) and lift arm (L.H.) (1) as a unit.
4. Remove the collar (5) and O-rings (4).

**(When reassembling)**

- Align the alignment marks (A) of the lift arm shaft and lift arms.




(A) Alignment mark

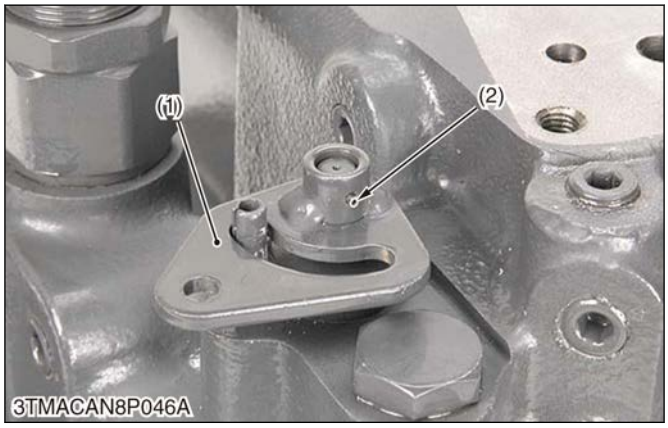
- Apply grease to the right and left bushings of lift arm support and O-rings.
- Don't damage the O-rings.

# 5.10 Lowering speed adjusting valve

## 5.10.1 Removing lowering speed adjusting valve (ROPS model)

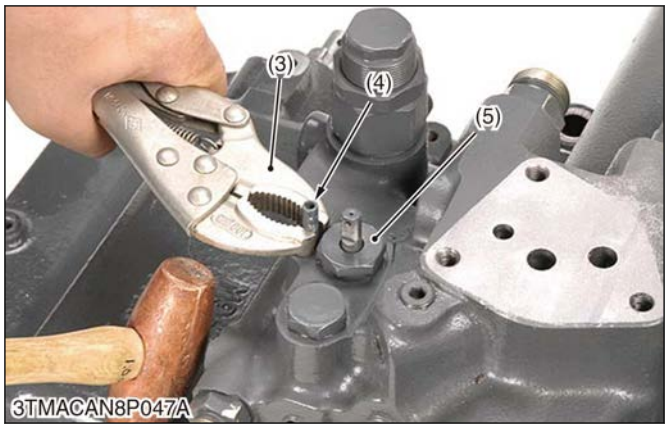
1. Tap out the roll pin (2).

2. Remove the plate (1).



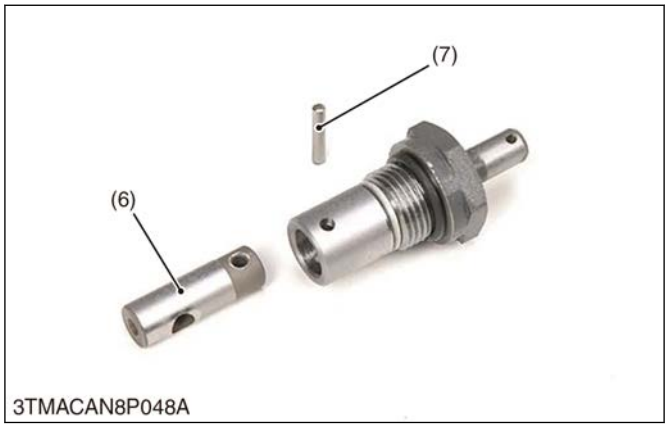

(1) Plate
(2) Roll pin

3. Tap out the roll pin (4) using a vice grip pliers (3).




(3) Vice grip pliers
(4) Roll pin
(5) Lowering speed adjusting valve assembly

4. Remove the lowering speed adjusting valve assembly (5).




(6) Valve
(7) Pin

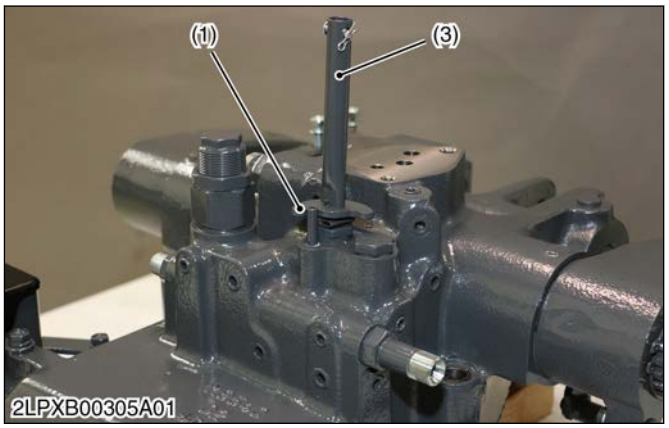
**(When reassembling)**

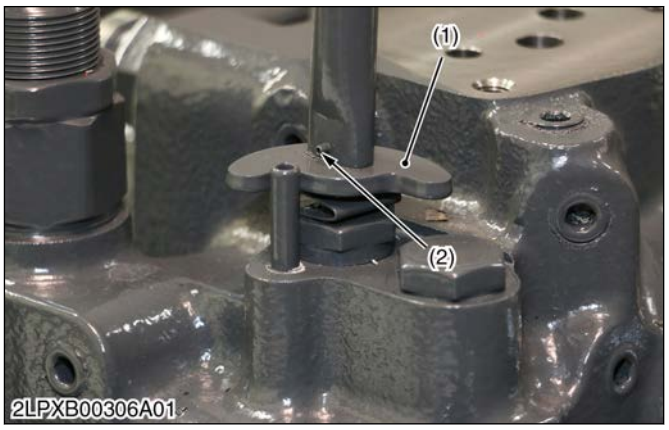
- Check the lowering speed adjusting valve turns smoothly.
- Tighten the lowering speed adjusting valve assembly to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Lowering speed adjusting valve assembly | 35 to 39 N·m<br>3.5 to 4.0 kgf·m<br>26 to 28 lbf·ft |

## 5.10.2 Removing lowering speed adjusting valve (Cabin model)

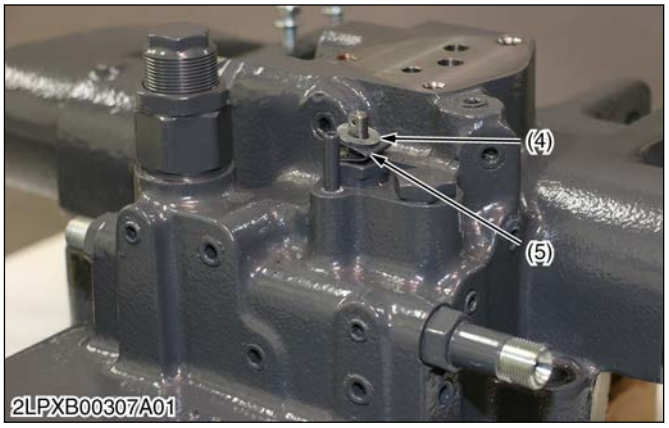
1. Tap out the roll pin 1 (2).
2. Remove the shaft (3) and plate 1 (1).



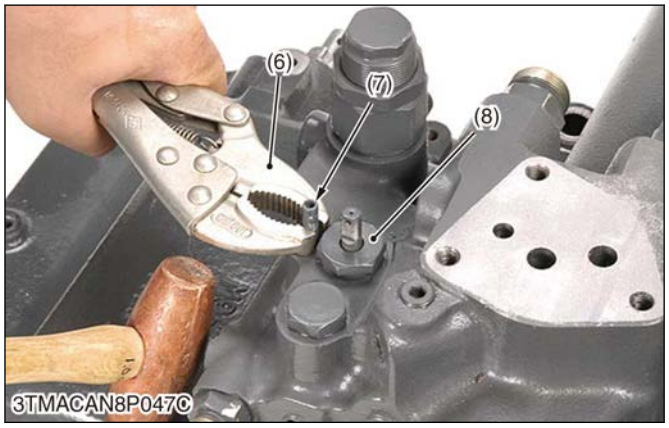

(1) Plate 1
(2) Roll pin 1
(3) Shaft

3. Remove the washer (4) and spring plate (5).



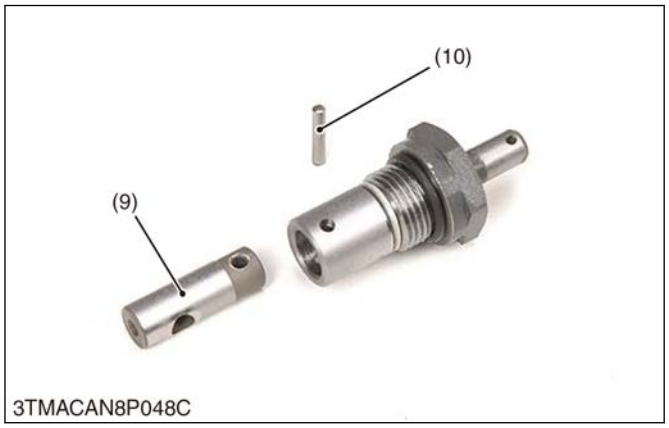

(4) Washer
(5) Spring plate

4. Tap out the roll pin 2 (7) using a vice grip pliers (6).




(6) Vice grip pliers
(7) Roll pin 2
(8) Lowering speed adjusting valve assembly

5. Remove the lowering speed adjusting valve assembly (8).




(9) Valve
(10) Pin

**(When reassembling)**

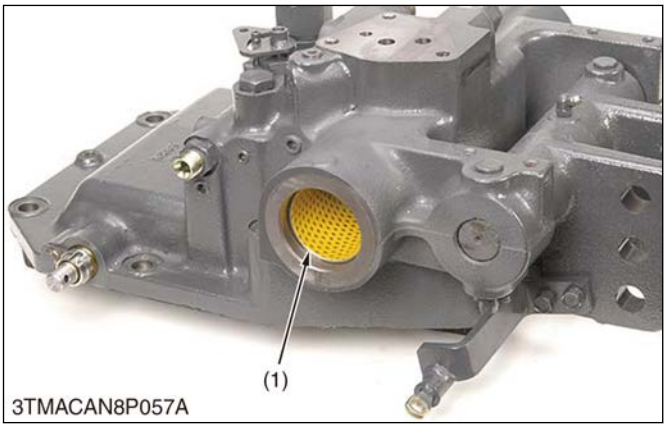
- Check the lowering speed adjusting valve turns smoothly.

| | | |
|---|---|---|
| Tightening torque | Lowering speed adjusting valve assembly | 35 to 39 N·m<br>3.5 to 4.0 kgf·m<br>26 to 28 lbf·ft |

# 6. Servicing

## 6.1 Lift arm and top link bracket

### 6.1.1 Checking lift arm support bushing





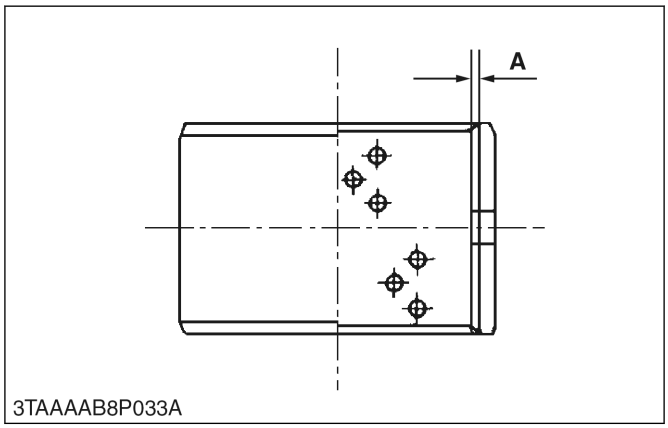
(1) Lift arm support bushing
(2) Lift arm bushing

1. Visually inspect the DX bushings for signs of wear or damage.

**■ NOTE**
- **DX bushing tends to show concentrated wear.**

**(Reference)**

| | | |
|---|---|---|
| Lift arm support and lift arm bushing | Alloy thickness "A" | 0.57 mm 0.022 in. |

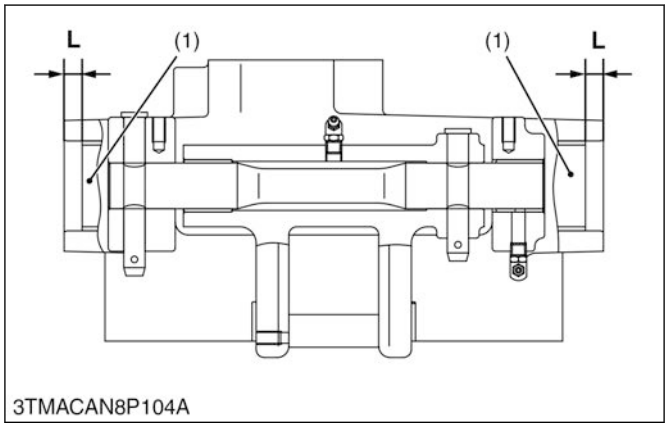



A: Alloy thickness

2. If the DX bushing is worn beyond the alloy portion "A", replace it.

**(When installing)**
- Use a press-fitting tool.
- Apply transmission fluid to the lift arm support liner boss.
- Lift arm support bushing's seam face to rear and hole face to front and upper.
- Lift arm bushing's seam face to front and lower and hole face to rear.

| | | |
|---|---|---|
| Press-fit location of bushing "L" | Factory specification | 11.0 mm 0.433 in. |

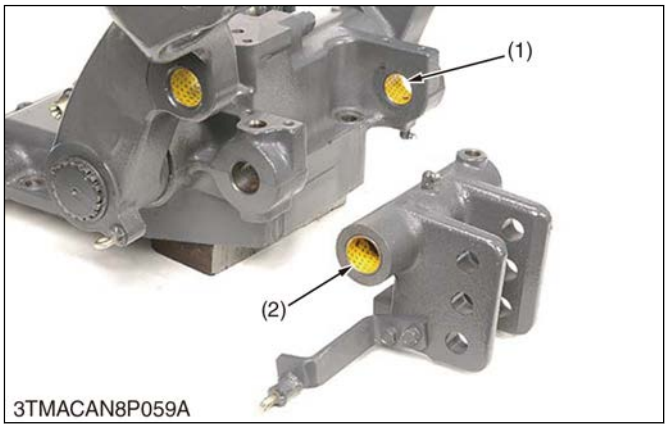



(1) Lift arm support bushing L: Press-fit location

RELATED PAGE

2.19 Hydraulic arm shaft bushing press-fitting tool on page 2-90

## 6.1.2 Checking torsion bar and top link bracket



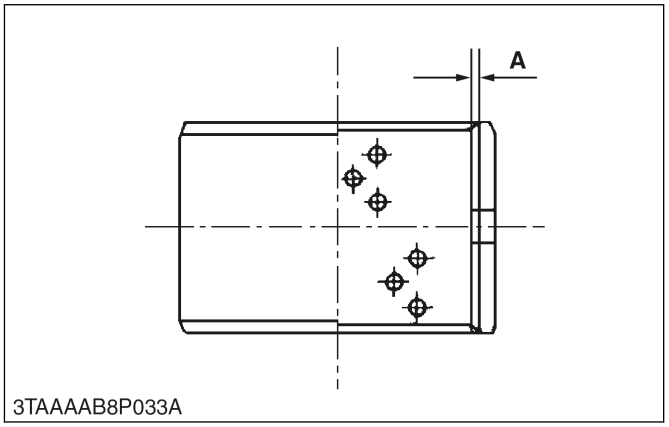

(1) Torsion bar bushing (2) Top link bracket bushing

1. Visually inspect the DX bushings for signs of wear or damage.

**■ NOTE**
- **DX bushing tends to show concentrated wear.**

**(Reference)**

| | | |
|---|---|---|
| Lift arm bushing | Alloy thickness "A" | 0.57 mm 0.022 in. |




A: Alloy thickness

2. If the DX bushing is worn beyond the alloy portion "A", replace it.

**(When installing)**
- Apply transmission fluid to the bushing press in position.
- Top link bracket bushing's seam face to rear.
- Torsion bar bushing's hole face to lower to align with grease gallery.

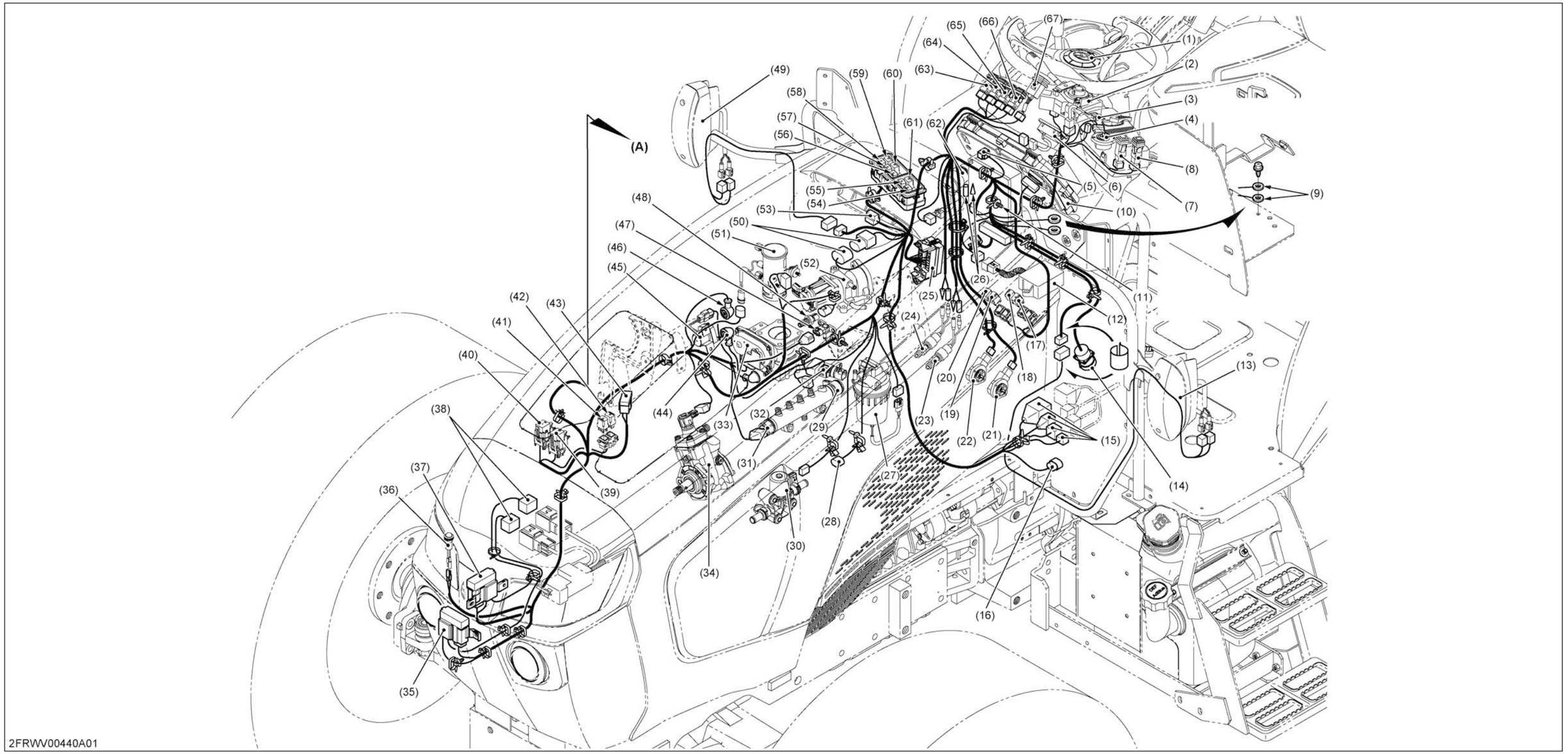
# 10. ELECTRICAL SYSTEM

# MECHANISM

# 1. Location of electrical components

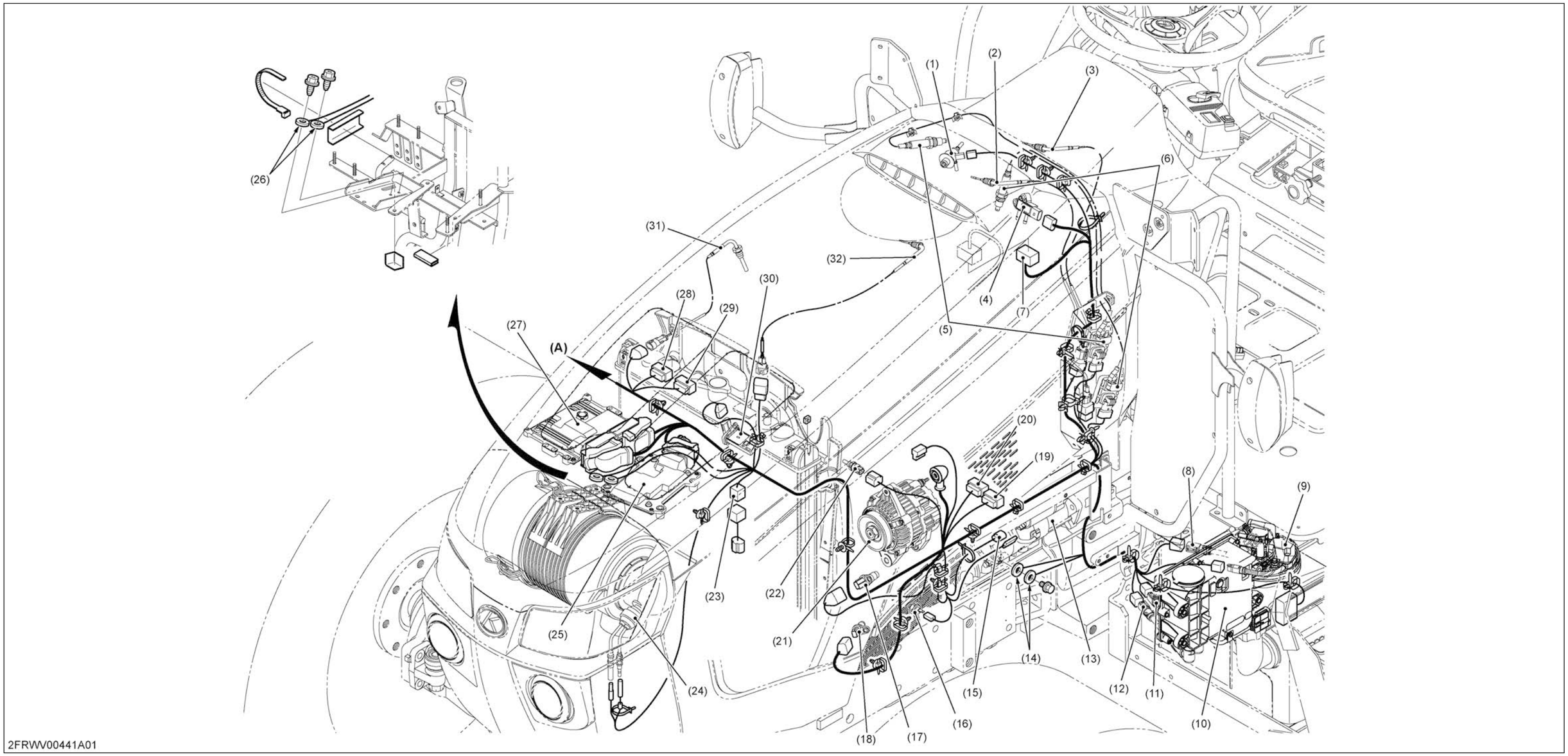
## 1.1 ROPS model

### 1.1.1 Electrical component location on main harness 1



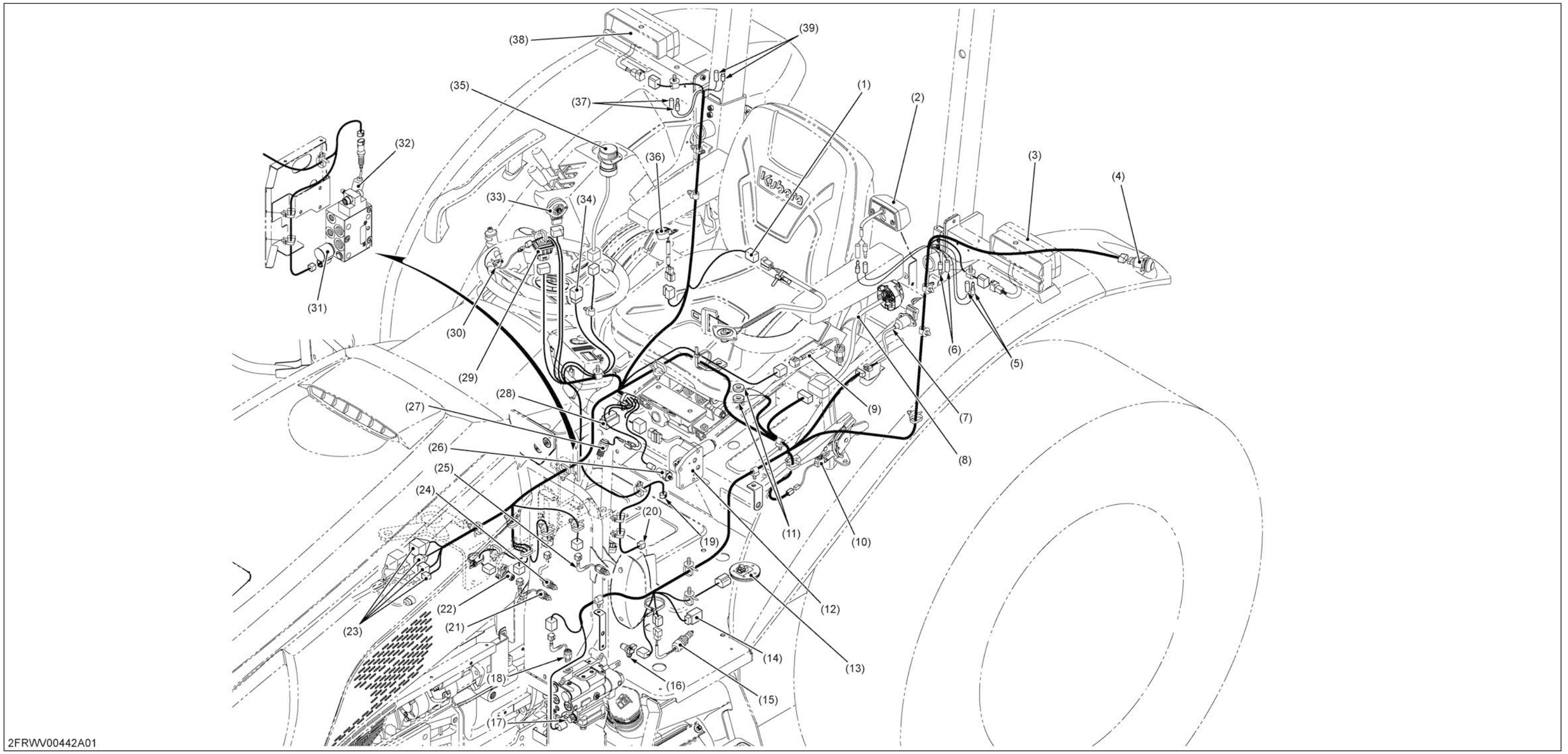

(1) Horn switch
(2) Combination switch
(3) Shuttle switch
(4) Shuttle sensor
(5) Diode
(6) Meter select switch
(7) Auto differential lock switch
(8) Hazard light switch
(9) Grounding
(10) Meter panel
(11) Tractor ECU
(12) Flasher unit
(13) Front combination lamp (L.H.)
(14) K-OBD connector
(15) Connectors to body harness
(16) Connector to front PTO valve
(17) PTO relay
(18) Front PTO relay
(19) T/B gear lock parking relay
(20) T/B secondary brake relay
(21) Brake sensor (L.H.)
(22) Brake sensor (R.H.)
(23) Brake switch (L.H.)
(24) Brake switch (R.H.)
(25) Fuse box 1
(26) Connector to air trailer display lamp
(27) Sedimenter
(28) Connector to PCV heater
(29) Pressure reducing valve
(30) Coolant valve
(31) Rail pressure sensor
(32) Connector to injector harness
(33) Intake throttle valve
(34) Supply pump
(35) Slow blow fuse box 2
(36) ACU operating lamp
(37) Slow blow fuse box 1
(38) Connectors to battery
(39) Starter relay
(40) Intake air heater relay
(41) CRS relay 1
(42) CRS relay 2
(43) CRS fuse box
(44) Intake air heater cable
(45) Intake air heater relay
(46) Connector to intake air heater
(47) Boost pressure sensor
(48) Coolant temperature sensor
(49) Front Combination Lamp (R.H.)
(50) Check connector
(51) Feed pump
(52) EGR valve
(53) Connector to front loader
(54) PTO neutral relay
(55) Head light relay
(56) PTO safety relay
(57) DEF heater control relay
(58) Auxiliary power relay
(59) Work light relay
(60) Neutral relay
(61) Stop lamp relay
(62) Main switch
(63) Front work lamp switch
(64) Constant RPM management switch
(65) DPF INHIBIT switch
(66) Parked regeneration switch
(67) 4WD switch
(A) To main harness 2

## 1.1.2 Electrical component location on main harness 2




(1) DEF injector
(2) Exhaust temperature sensor (T1)
(3) Exhaust temperature sensor (T0)
(4) Differential pressure sensor
(5) Pre NOx sensor
(6) Post NOx sensor
(7) Connector to lighting harness
(8) DEF return hose heater
(9) DEF tank unit
(10) DEF pump unit
(11) DEF delivery hose heater
(12) DEF suction hose heater
(13) Starter motor
(14) Grounding
(15) Connector
(16) Engine oil pressure switch
(17) Camshaft position sensor
(18) Crankshaft position sensor
(19) J/C 3
(20) J/C 4
(21) Alternator
(22) Coolant temperature sensor
(23) Diagmaster connector
(24) Air cleaner switch
(25) ACU
(26) Grounding
(27) Engine ECU
(28) J/C 1
(29) J/C 2
(30) Air flow sensor
(31) SCR temperature sensor
(32) Exhaust temperature sensor(T2)
(A) To main harness 1

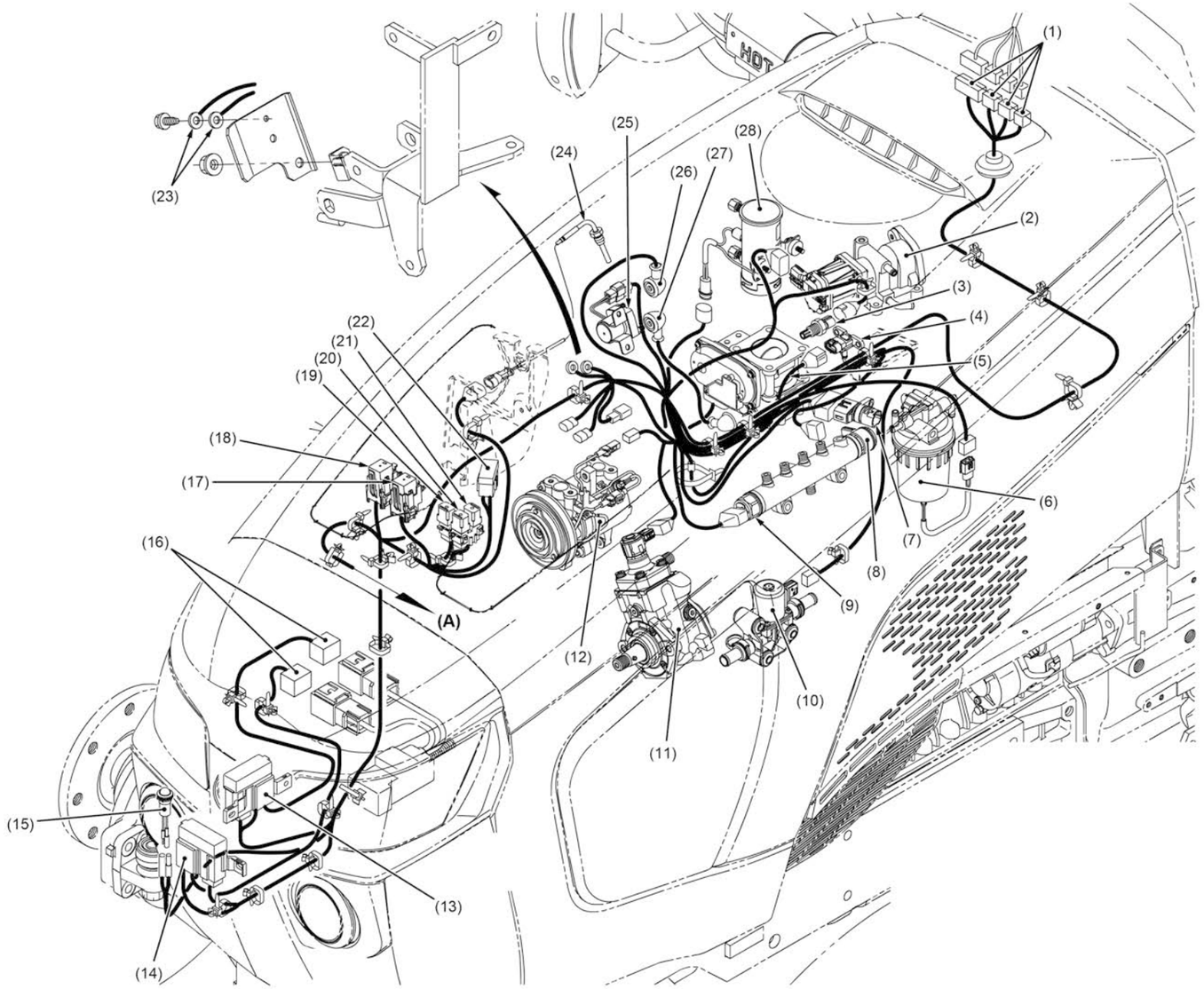
## 1.1.3 Electrical component location on body harness




(1) Connectors to seat switch
(2) License lamp
(3) Rear combination lamp (L.H.)
(4) External PTO Switch
(5) Connector to hazard lamp
(6) Connector to work light
(7) Auxiliary electric outlet
(8) Trailer connector
(9) PTO speed select switch
(10) Secondary brake switch
(11) Grounding
(12) Solenoid valve
(13) Fuel level sensor
(14) Diode
(15) Diode
(16) Traveling speed sensor
(17) Shuttle solenoid
(18) Shuttle valve spool neutral switch
(19) Connector to T/B pressure switch
(20) Connector to T/B solenoid
(21) Main gear shift (6th) switch
(22) Shuttle rotation sensor
(23) Connectors to main harness
(24) Range gear shift (Hi) switch
(25) Gear lock parking detect switch
(26) 2WD pressure switch
(27) Differential lock pedal switch
(28) J/C 5
(29) RPM dual memory switch
(30) Gear lock parking lever switch
(31) Trailer brake solenoid
(32) Trailer brake pressure switch
(33) Throttle sensor
(34) Connector to PTO switch
(35) PTO switch
(36) Buzzer
(37) Connector to work light
(38) Rear combination lamp (R.H.)
(39) Connector to hazard lamp

## 1.2 Cabin model

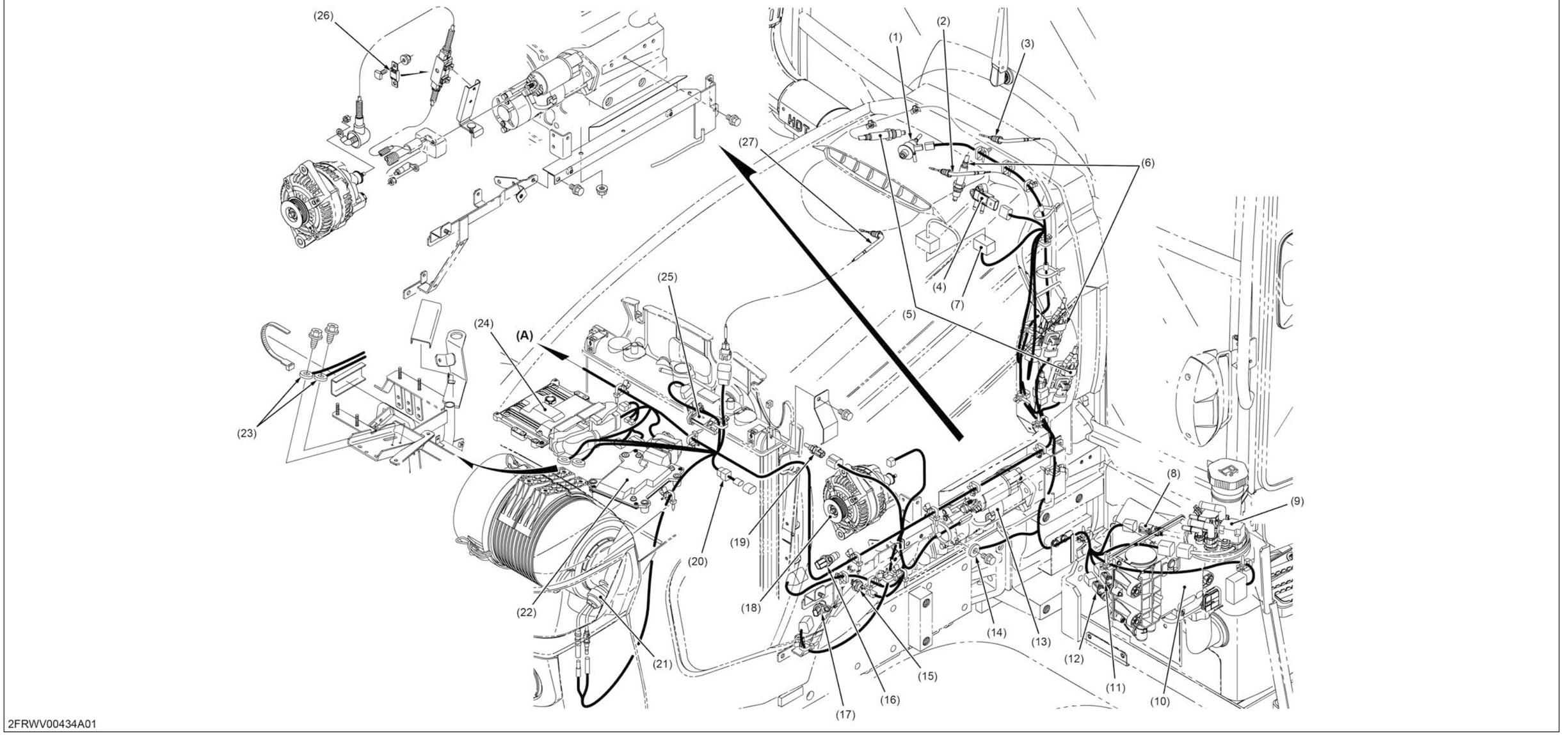
### 1.2.1 Electrical component location on engine harness 1




2FRWV00433A01

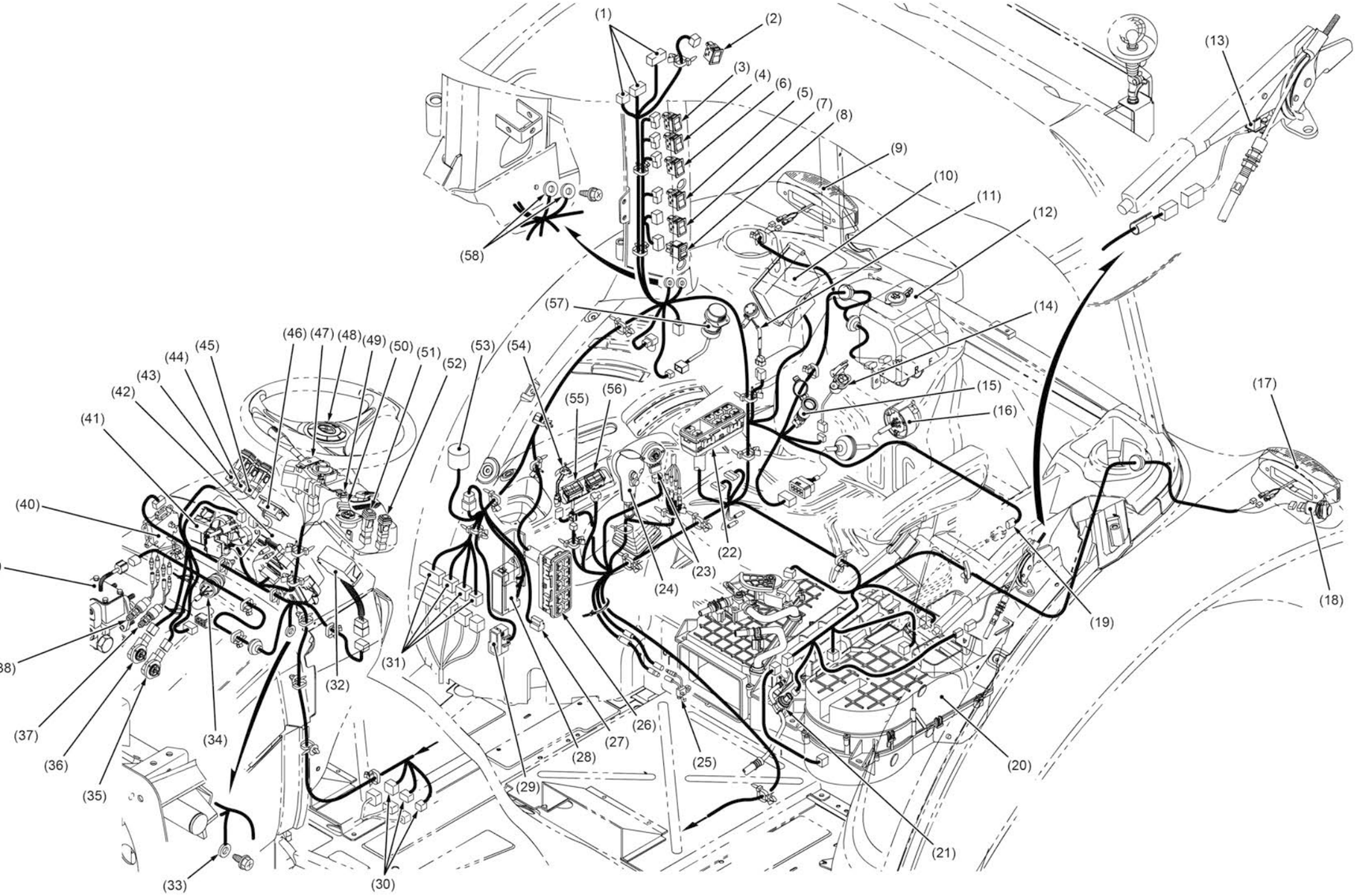
(1) Connectors to main harness
(2) EGR valve
(3) Intake air temperature sensor
(4) Boost pressure sensor
(5) Intake throttle valve
(6) Sedimenter
(7) Connector to injector harness
(8) Pressure reducing valve
(9) Rail pressure sensor
(10) Coolant valve
(11) Supply pump
(12) Compressor
(13) Slow blow fuse box 2
(14) Slow blow fuse box 1
(15) ACU operating lamp
(16) Connectors to battery
(17) Starter relay
(18) ACU relay
(19) DEF heater control relay
(20) CRS relay 2
(21) CRS relay 1
(22) Fuse box
(23) Grounding
(24) SCR temperature sensor
(25) Intake air heater relay
(26) Connector to intake air heater relay
(27) Intake air heater cable
(28) Feed pump
(A) To engine harness 2

## 1.2.2 Electrical component location on engine harness 2




(1) DEF injector
(2) Exhaust temperature sensor (T1)
(3) Exhaust temperature sensor (T0)
(4) Differential pressure sensor
(5) Pre NOx sensor
(6) Post NOx sensor
(7) Connector to lighting harness
(8) DEF return hose heater
(9) DEF tank unit
(10) DEF pump unit
(11) DEF delivery hose heater
(12) DEF suction hose heater
(13) Starter motor
(14) Grounding
(15) Engine oil pressure switch
(16) Camshaft position sensor
(17) Crankshaft position sensor
(18) Alternator
(19) Coolant temperature sensor
(20) Diagmaster connector
(21) Air cleaner switch
(22) ACU
(23) Grounding
(24) Engine ECU
(25) Air flow sensor
(26) Slow blow fuse
(27) Exhaust temperature sensor (T2)
(A) To engine harness 2

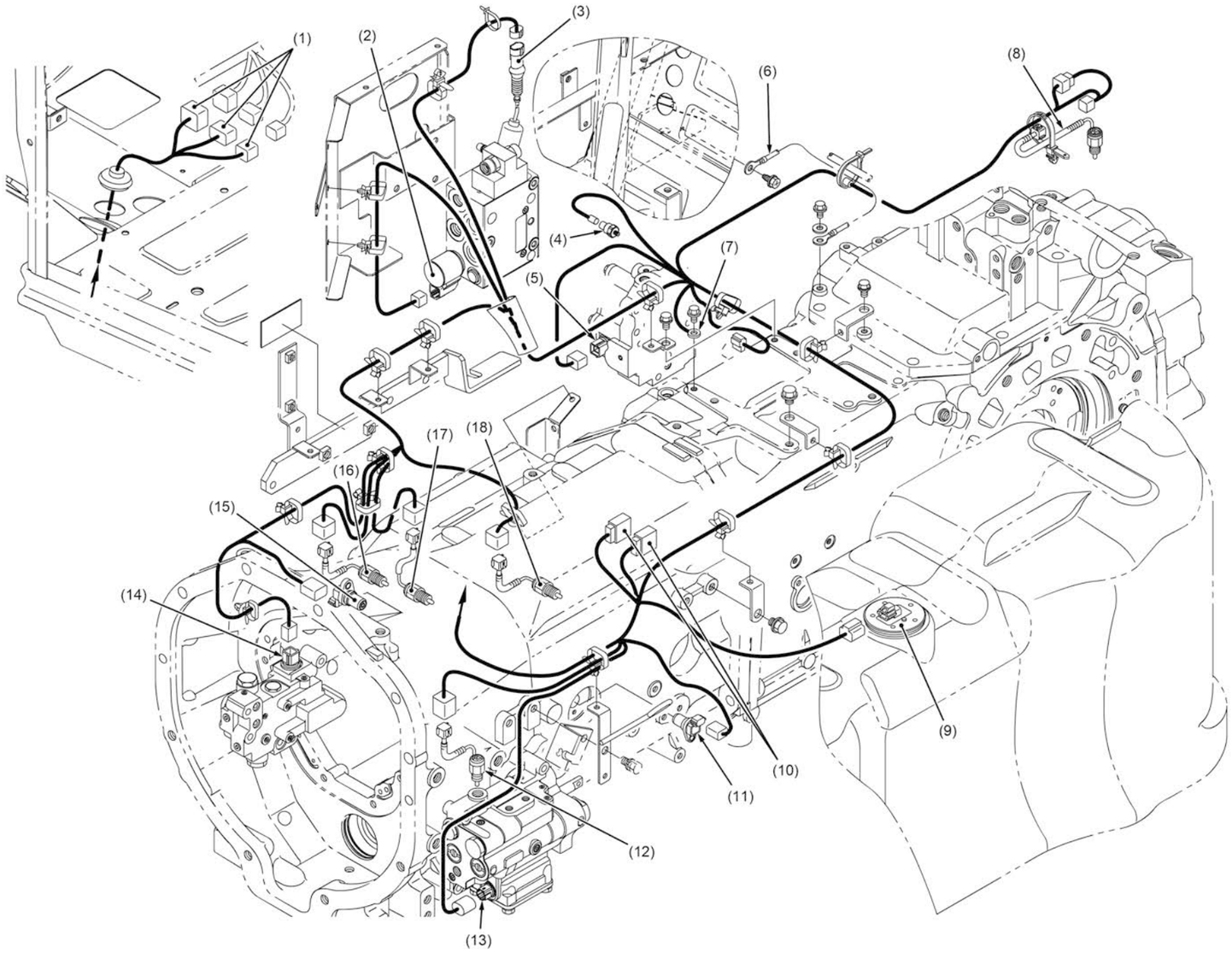
### 1.2.3 Electrical component location on main harness




2FRWV00435A01

(1) Connectors to cabin harness
(2) Defogger switch (If equipped)
(3) Front work lamp switch
(4) Beacon switch
(5) Front work lamp switch (If equipped)
(6) Rear work lamp switch
(7) Rear wiper switch (If equipped)
(8) Front wiper switch
(9) Rear combination lamp (R.H.)
(10) Tractor ECU
(11) Buzzer
(12) Washer tank
(13) Secondary brake switch
(14) Auxiliary electric outlet
(15) Cigar socket
(16) Trailer connector
(17) Rear combination lamp (L.H.)
(18) External PTO switch
(19) Connectors to seat switch
(20) Air conditioner unit
(21) Pressure switch
(22) Relay box 1
(23) Throttle sensor
(24) Main gear shift lever switch
(25) Differential lock pedal switch
(26) Relay box 2
(27) Connector to front loader
(28) Fuse box 1
(29) Fuse box 2
(30) Connectors to body harness
(31) Connectors to engine harness
(32) Flasher unit
(33) Grounding
(34) Main switch
(35) Brake sensor (L.H.)
(36) Brake sensor (R.H.)
(37) Brake switch (L.H.)
(38) Brake switch (R.H.)
(39) Master cylinder
(40) Mode motor
(41) Wiper motor
(42) Meter panel
(43) Constant RPM management switch
(44) DPF INHIBIT switch
(45) Parked regeneration switch
(46) Meter select switch
(47) Combination switch
(48) Horn switch
(49) Shuttle switch
(50) Shuttle sensor
(51) Auto differential lock switch
(52) Hazard light switch
(53) K-OBD connector
(54) Gear lock parking lever switch
(55) RPM dual memory switch
(56) 4WD switch
(57) PTO switch
(58) Grounding

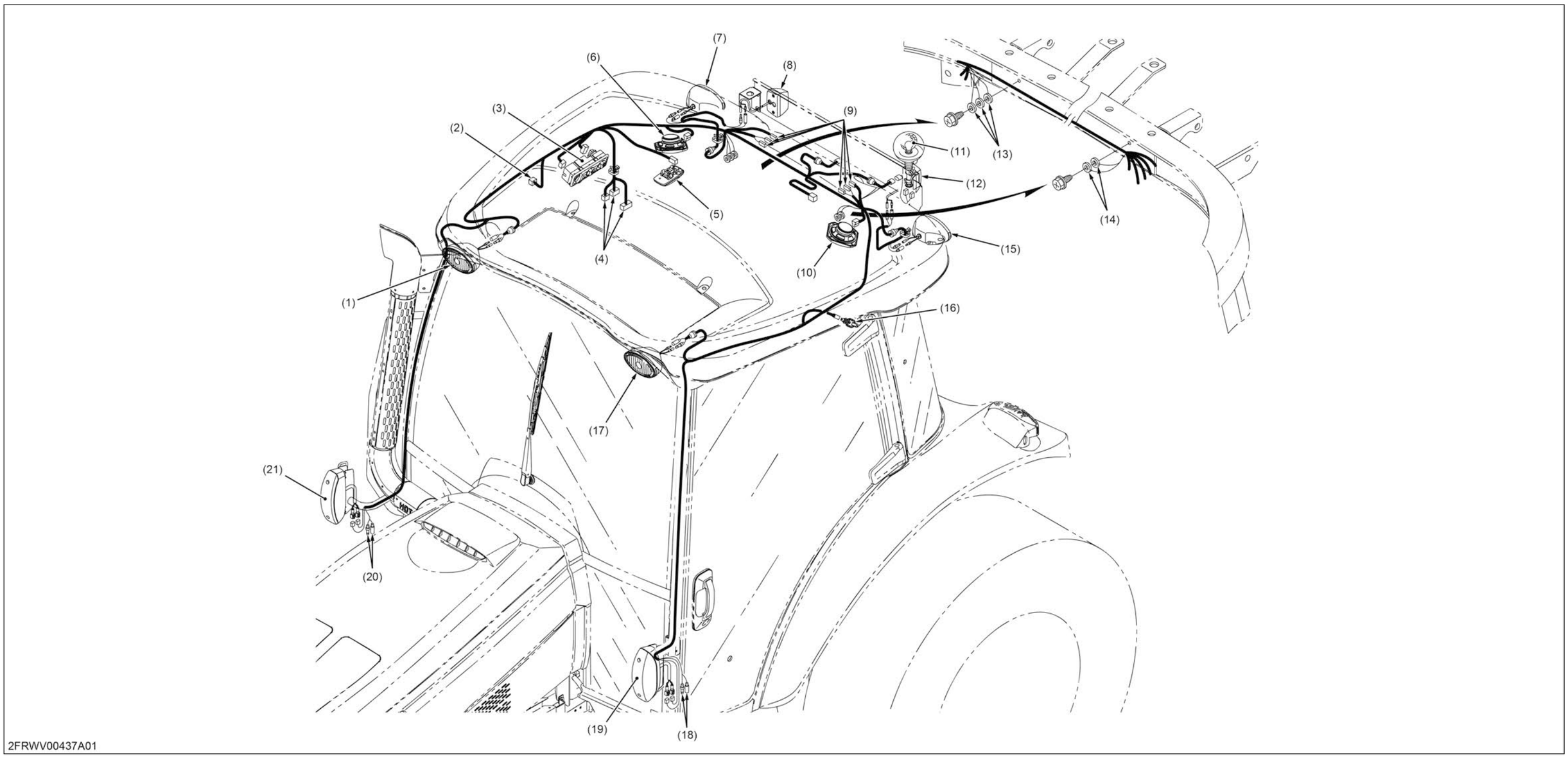
## 1.2.4 Electrical component location on body harness




2FRWV00436A01

(1) Connectors to main harness
(2) Trailer brake solenoid
(3) Trailer brake pressure switch
(4) 2WD pressure switch
(5) Solenoid valve
(6) Grounding cable
(7) Grounding
(8) PTO speed select switch
(9) Fuel level sensor
(10) Diode
(11) Traveling speed sensor
(12) Shuttle valve spool neutral switch
(13) Shuttle solenoid
(14) Dual speed solenoid
(15) Shuttle rotation sensor
(16) Range gear shift (Hi) switch
(17) Main gear shift (6th) switch
(18) Gear lock parking detect switch

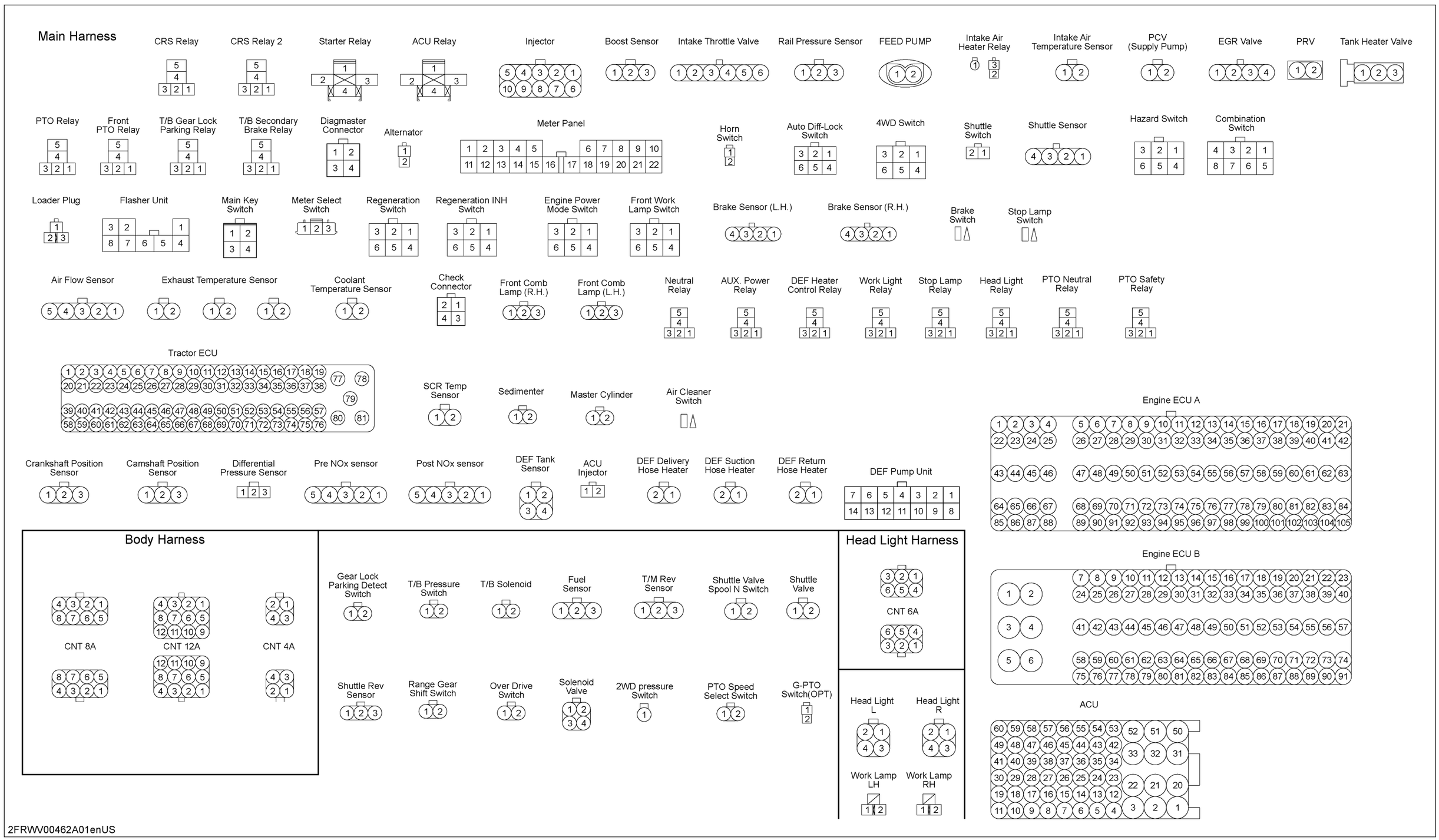
### 1.2.5 Electrical component location on cabin harness




(1) Front work light (R.H.)
(2) Connectors to radio unit
(3) A/C control panel
(4) Connectors to main harness
(5) Room lamp
(6) Speaker (R.H.)
(7) Rear work light (R.H.)
(8) License lamp (R.H.)
(9) Connectors to defogger
(10) Speaker (L.H.)
(11) Beacon lamp (If equipped)
(12) License lamp (L.H.)
(13) Grounding
(14) Grounding
(15) Rear work light (L.H.)
(16) Door switch
(17) Front work light (L.H.)
(18) Connectors to work light (L.H.)
(19) Front combination lamp (L.H.)
(20) Connectors to work light (R.H.)
(21) Front combination lamp (R.H.)

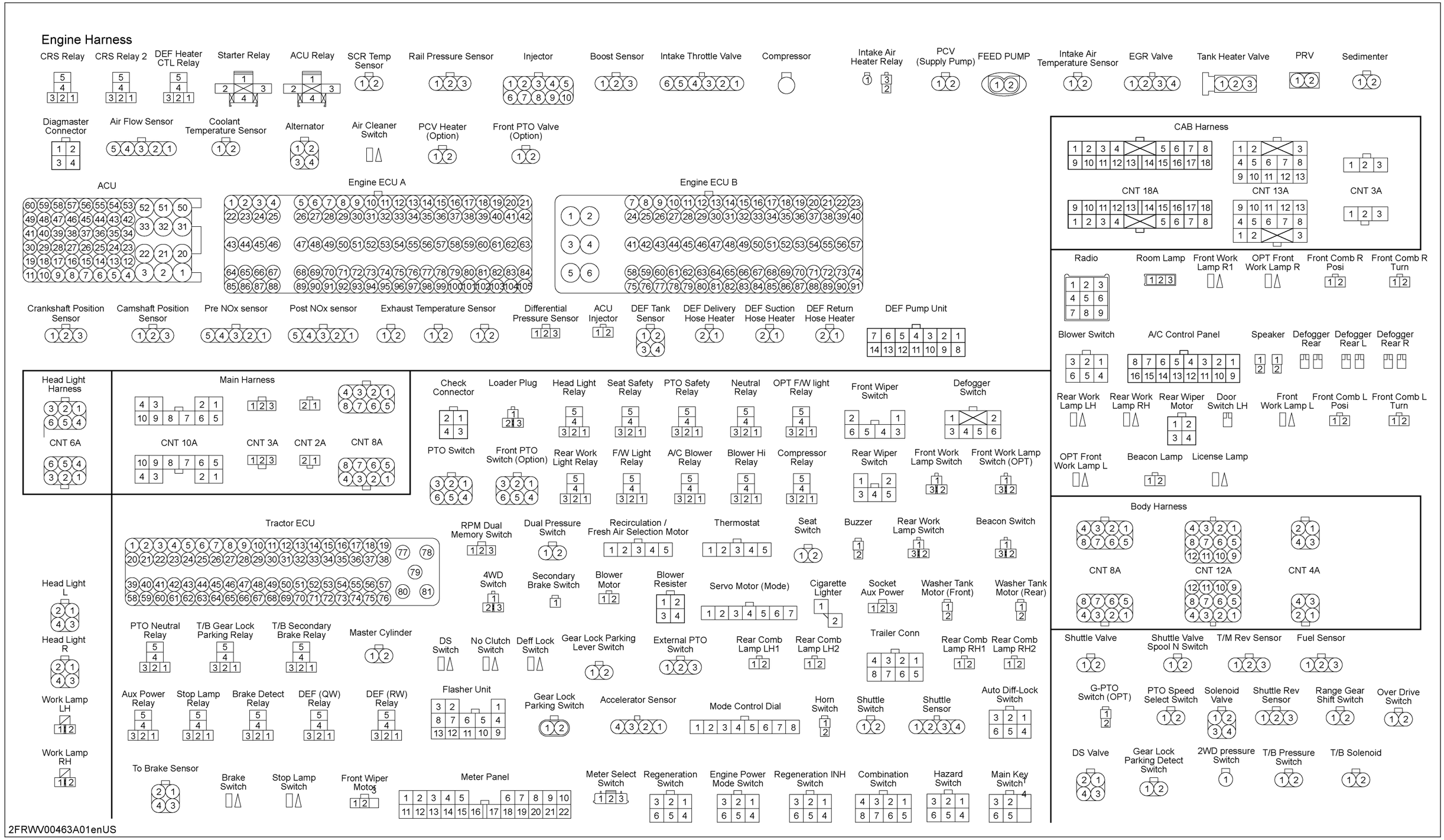
# 2. Connector

## 2.1 Connectors (ROPS model)




2FRWV00462A01enUS

## 2.2 Connectors (Cabin model)

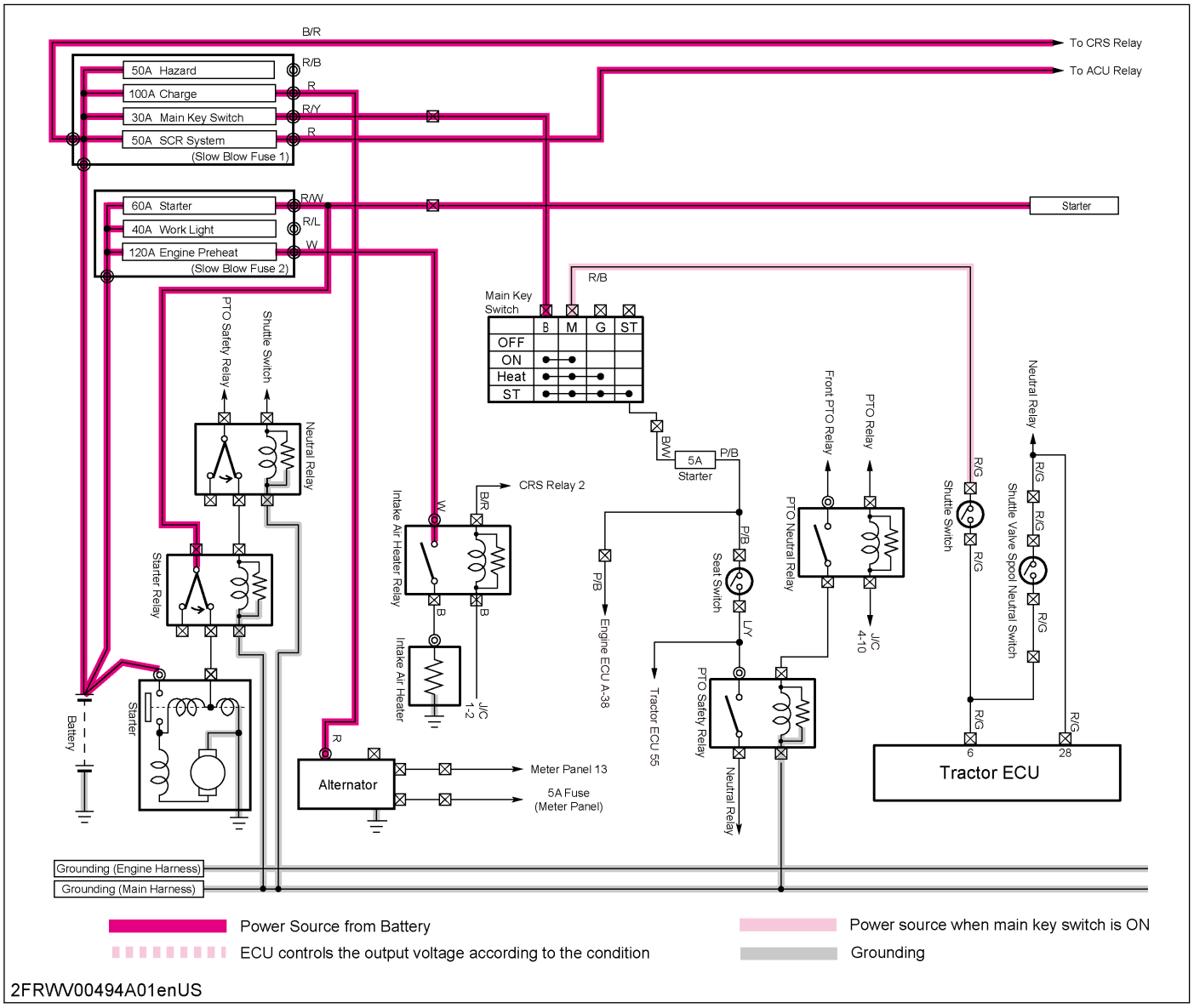



2FRWW00463A01enUS

# 3. Engine starting system and stopping system

## 3.1 System outline and electrical circuit

### 3.1.1 Electrical circuit of starting system (ROPS model)



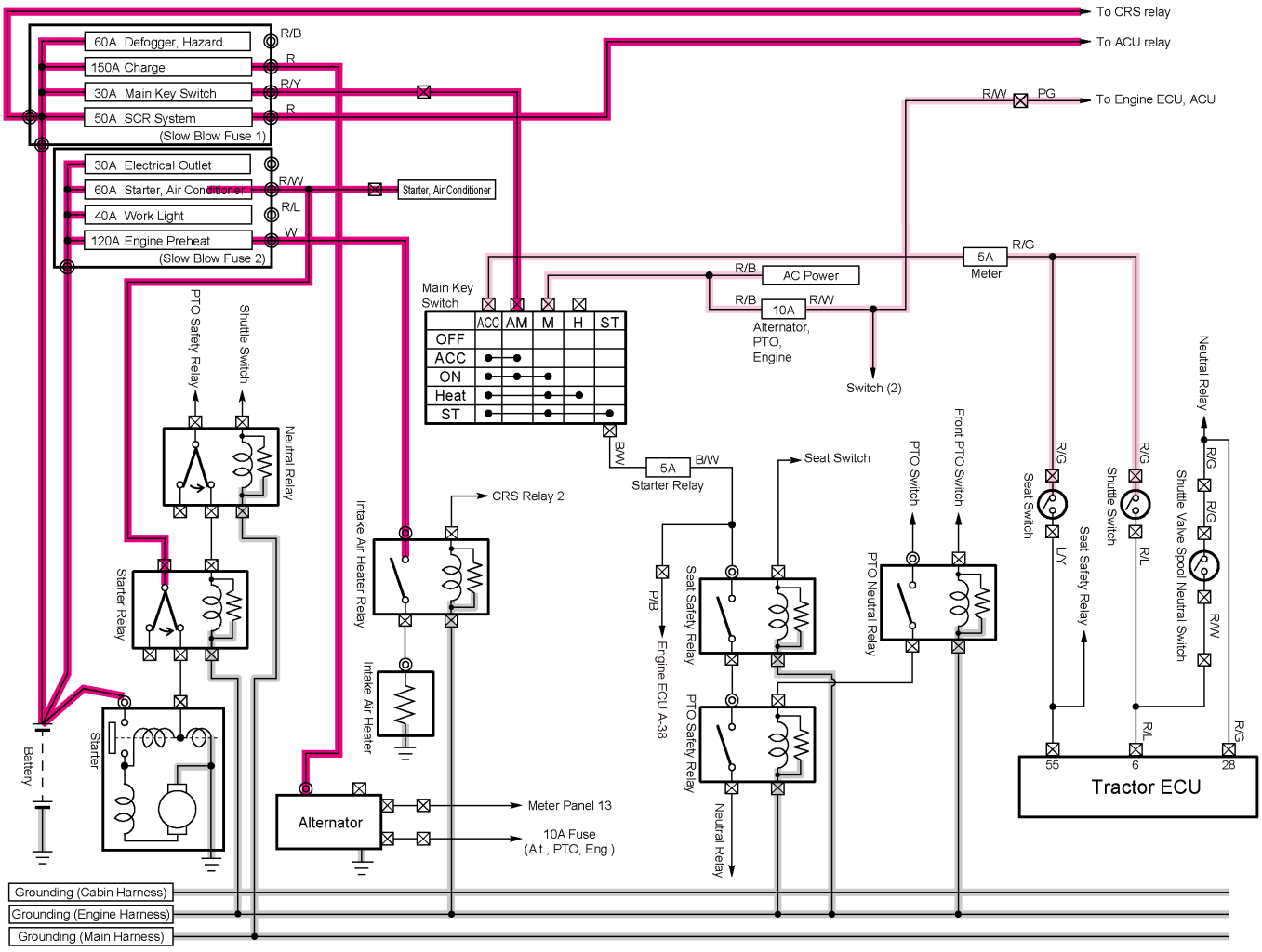

2FRWV00494A01enUS

There are four key positions, **OFF**, **ON**, **GLOW** and **START** on the main key switch.
When the main key switch is set **ON**, terminal of the main key switch is connected to terminal M.
When the main key switch is set to **START** under the condition that explained below, terminal G of the main key switch is connected to terminal M and terminal ST. Consequently, battery current flows to related engine starting circuit shown in the figure and actuates the starter motor.

- Shuttle lever is in **Neutral** position
- PTO switch is in **Neutral** position
- Seat is occupied

When the main switch is released after starting the engine, the main switch returns to **ON** automatically. This stops the starter.

## 3.1.2 Electrical circuit of starting system (Cabin model)




2FRWV00495A01enUS

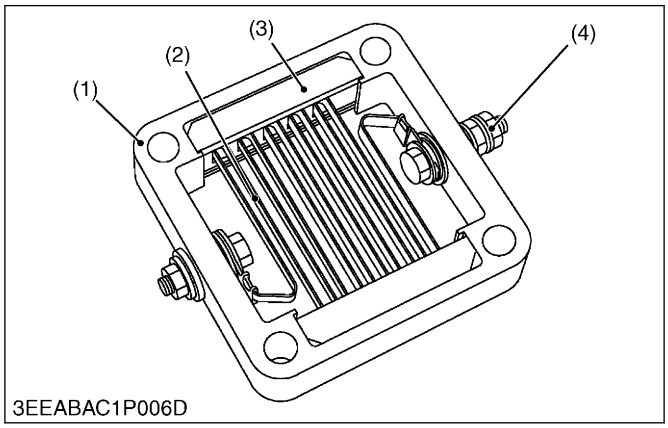
There are five key positions, **OFF**, **ACC**, **ON**, **GLOW** and **START** on the main key switch.
When the main switch is set to **ACC** (Accessory), the radio, windshields wipers (front and rear), work lights (front and rear), cigar lighter and blower fan can be used.
When the main key switch is set **ON**, terminal AM of the main key switch is connected to terminal ACC and terminal M.
When the main key switch is set to **START** under the condition that explained below, terminal G of the main key switch is connected to terminal M and terminal ST. Consequently, battery current flows to related engine starting circuit shown in the figure and actuates the starter motor.

- Shuttle lever is in **Neutral** position
- PTO switch is in **Neutral** position
- Seat is occupied

When the main switch is released after starting the engine, the main switch returns to **ON** automatically. This stops the starter.

# 3.2 Components

## 3.2.1 Intake air heater

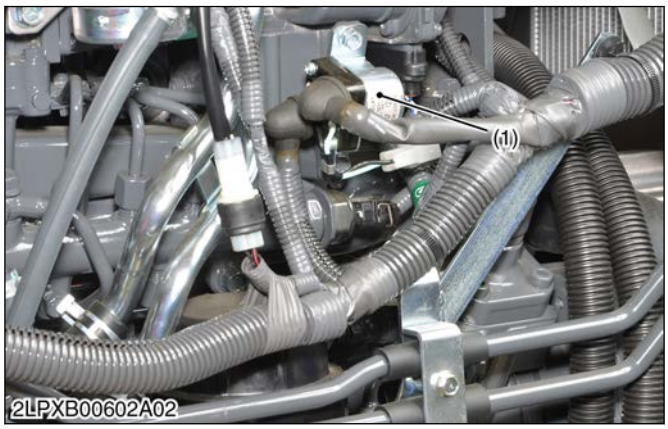


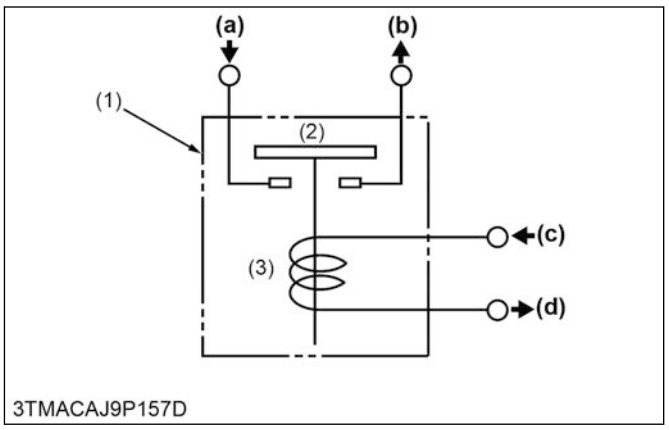

(1) Body
(2) PTC element
(3) Insulator
(4) Main terminal

The intake air heater is introduced in order to further improve the starting performance in cold regions. The intake air heater is mounted on the air inlet manifold, while the conventional glow plug on the cylinder head. This means that a multi-valve design can be implemented and that the starting performance and serviceability are enhanced.

**[Structure]**
The battery's positive terminal is connected with the main terminal. When the key switch is set to the **ON** position, the current starts flowing in this routes as indicated with the arrow marks: main terminal → PTC element → ground (body).
The preheating time and after heating time are controlled by CPU that is in the meter panel.

## 3.2.2 Intake air heater relay



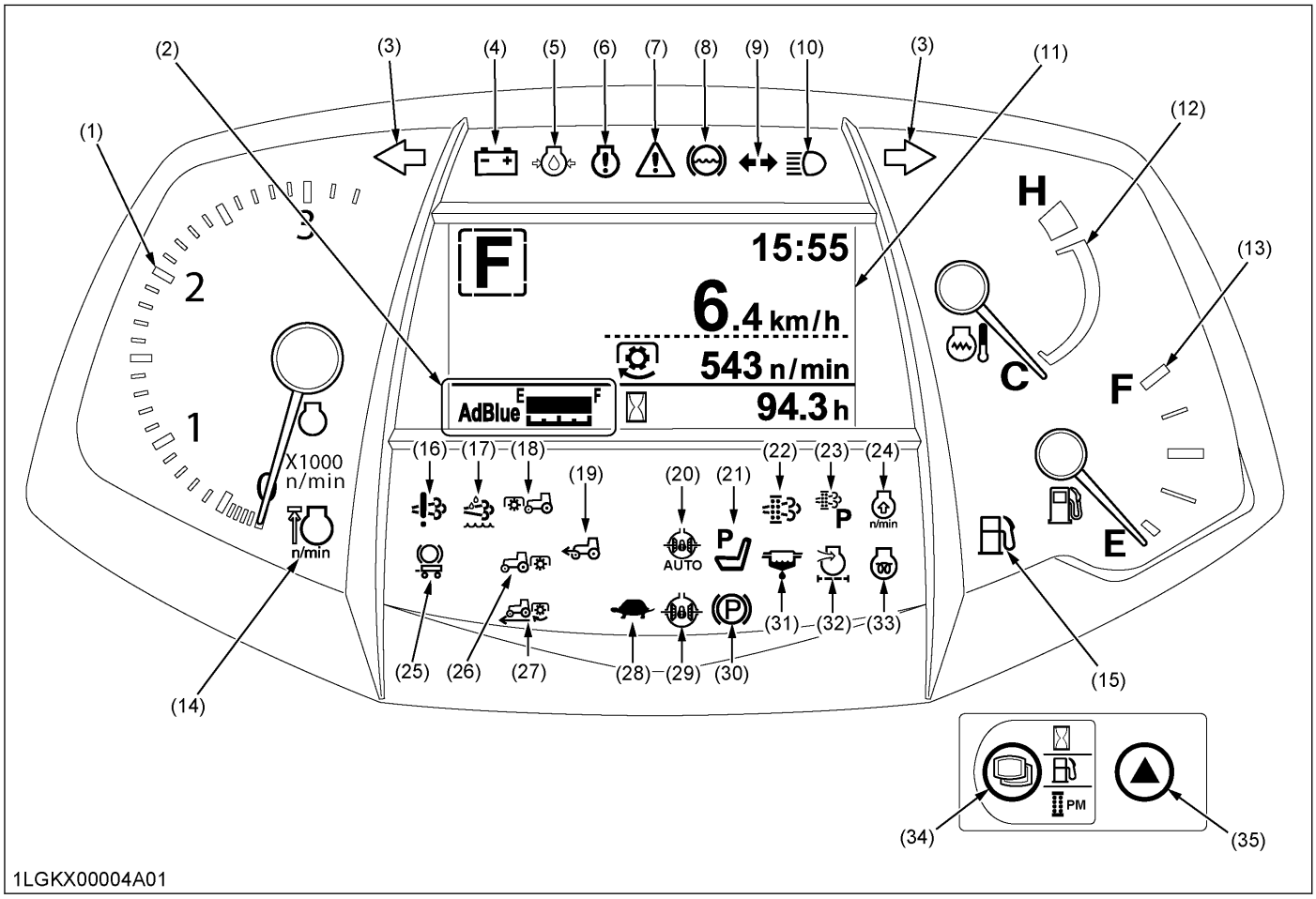

(1) Heater relay
(2) Relay contact
(3) Relay coil
(a) From battery
(b) To air heater
(c) From ECU (CRS)
(d) To ground

In some cases, the intake air heater relay (1) is mounted on air heating system to prevent the contact of the main switch burning out when the main switch is switched.
Current from the ECU (CRS) flows only the air heater relay coil (3), and the relay contact (2) is pulled to ON position by electromagnetic force.
Therefore, current from the battery flows directly to the air heater.

# 4. Instrument panel

## 4.1 Indication items of meter panel

### 4.1.1 Instrument panel

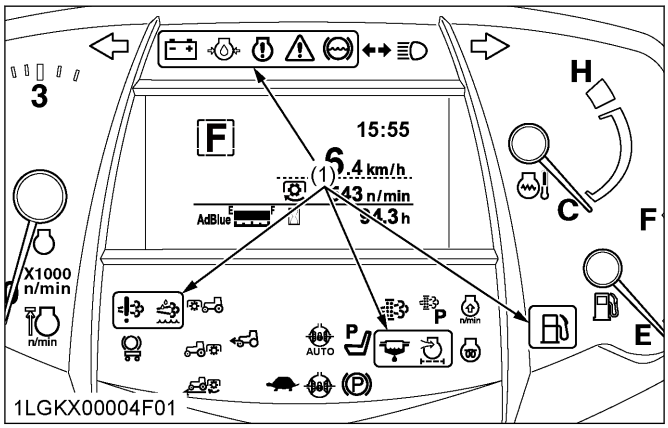



1LGKX00004A01

(1) Tachometer
(2) DEF/AdBlue® gauge
(3) Hazard and turn signal indicator
(4) Electrical charge warning indicator
(5) Engine oil pressure warning indicator
(6) Engine warning indicator
(7) Master system warning indicator
(8) Brake oil level warning indicator
(9) Trailer indicator
(10) High beam indicator
(11) Liquid crystal display (LCD)
(12) Coolant temperature gauge
(13) Fuel gauge
(14) Rev-limiter indicator
(15) Fuel level indicator
(16) DEF/AdBlue® system warning indicator
(17) DEF/AdBlue® warning indicator
(18) Front PTO indicator (if equipped)
(19) 4WD indicator
(20) Auto differential lock indicator
(21) Parking brake OPC indicator
(22) Regeneration indicator
(23) Parked regeneration indicator
(24) Engine rpm increase indicator
(25) Hydraulic trailer brake pressure warning indicator
(26) Rear PTO indicator
(27) Ground PTO indicator (if equipped)
(28) Dual speed shift indicator
(29) Differential lock indicator
(30) Parking brake warning indicator
(31) Water separator indicator
(32) Air cleaner indicator
(33) Heater indicator
(34) Mode selector switch
(35) Select switch

## 4.1.2 Function of Easy Checker™

If the indicators on the Easy Checker™ come on during operation, immediately stop the engine and find the cause as follows.
Never operate the tractor while an Easy Checker™ indicator is on.




(1) Easy Checker™

**Engine warning**
This indicator serves the following 2 functions. If the indicator lights up, pinpoint the cause and take proper measures.

1. Error with the engine control system
   If during operation the water temperature gauge reads an acceptable level but the indicator on the Easy Checker™ comes on, stop the engine and then restart it.

   **■ IMPORTANT**
   - **If the warning indicator lights up, the following phenomena may appear depending on the engine's trouble spot.**
     - **The engine stops unexpectedly.**
     - **The engine fails to start or gets interrupted just after starting.**
     - **The engine output is not enough.**
     - **The engine output is enough, but the warning indicator stays on.**

     **If the engine output is not enough, immediately interrupt the operation and move the tractor to a safe place and stop the engine.**

2. Engine overheat
   If the water temperature gauge reads an unusual level and the indicator on the Easy Checker™ comes on, the engine may have overheated. Check the tractor by reading the troubleshooting section of this manual.

**Engine oil pressure**
If the oil pressure in the engine drops below the prescribed level, the indicator on the Easy Checker™ will come on.
If this should happen during operation, and it does not go off when the engine is accelerated to more than 1000 rpm, check the engine oil level.

**DEF/AdBlue® system warning**
If trouble should occur in the DEF/AdBlue® system, the indicator on the Easy Checker™ will light up.
If this should happen during operation, check the DEF/AdBlue® system.

**Fuel level**
If the fuel in the tank drops below the prescribed level (less than 16 L), the indicator on the Easy Checker™ will come on.
If this should happen during operation, refuel as soon as possible.

**■ IMPORTANT**
- **When the fuel indicator lights up, refuel the tank as soon as possible. If the tractor runs out of fuel and stalls, the engine and its components may be damaged.**

**Water separator**
If water or impurities collect in the water separator, the indicator on the Easy Checker™ will light up.
If this should happen during operation, drain the water from the water separator as soon as possible.

**DEF/AdBlue® level**
If the DEF/AdBlue® in the tank drops below the prescribed level, or if a poor-quality product is added, the indicator on the Easy Checker™ will light up.
If this should happen during operation, refill or replace with DEF/AdBlue® as soon as possible.

**Air cleaner**
If the air cleaner is clogged, the indicator on the Easy Checker™ will come on.
If this should happen during operation, clean the air cleaner element.

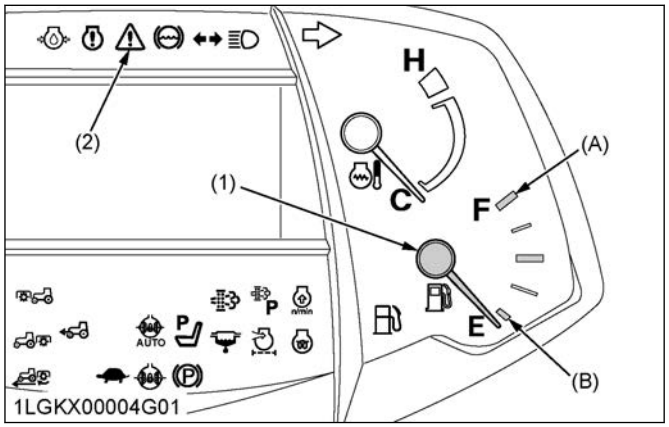
**Brake oil level**
If a fault occurs in the tractor braking system, the warning indicator in the Easy Checker™ will light up.
If this should happen during operation, stop the engine and check the transmission oil level.

**Electrical charge**
If the alternator is not charging the battery, the indicator on the Easy Checker™ will come on.
If this should happen during operation, check the electrical charging system.

**⚠ Master system warning**
If trouble should occur at the engine, transmission or other control parts, the indicator flashes as a warning.

## 4.1.3 Function of fuel gauge

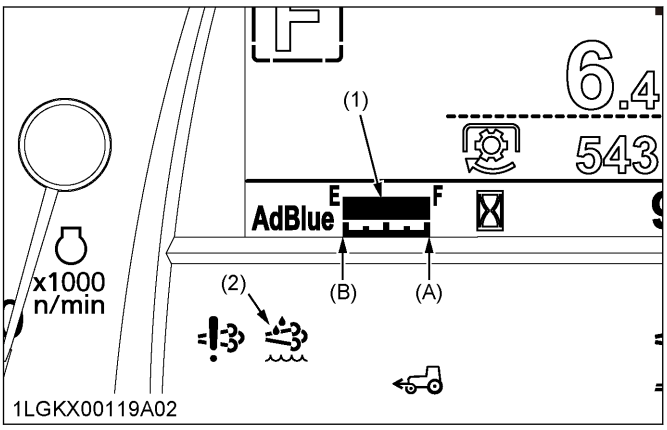
When the key switch is on, the fuel gauge indicates the fuel level.
Be careful not to empty the fuel tank. Otherwise air may enter the fuel system.
Should this happen, the system should be bled.
If the engine runs out of fuel and stalls, the master system warning indicator lights up. When the indicator appears, turn the key switch to **OFF** and then to **ON** again in order to turn off the indicator.




(1) Fuel gauge
(2) Master system warning indicator
(A) FULL
(B) EMPTY

## 4.1.4 DEF/AdBlue® gauge

The DEF/AdBlue® level in the DEF/AdBlue® tank is indicated with LCD blocks.
If DEF/AdBlue® level drops too low, the engine output is restricted. With this in mind, be careful not to empty the tank.
When the fluid level in the tank has dropped below 15%, the DEF/AdBlue® warning indicator on the instrument panel lights up and stays on.
Immediately add DEF/AdBlue® to the specified level.

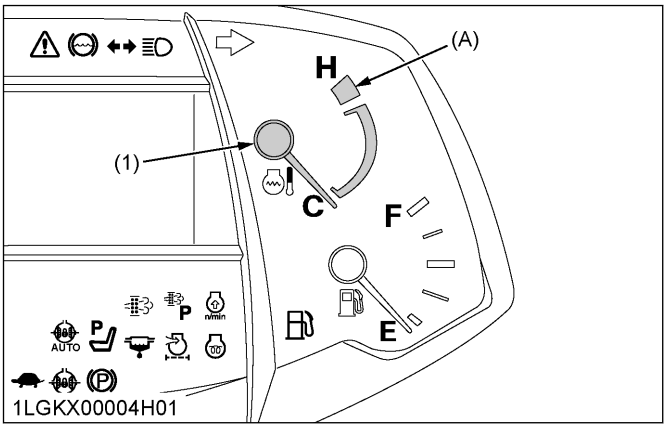



(1) DEF/AdBlue® gauge
(2) DEF/AdBlue® warning indicator
(A) FULL
(B) EMPTY

## 4.1.5 Function of coolant temperature gauge

**⚠ WARNING**
**To avoid personal injury or death:**
- **Do not remove radiator cap until coolant temperature is well below its boiling point. Then, loosen the cap slightly to the first stop to relieve any pressure before removing the cap completely.**

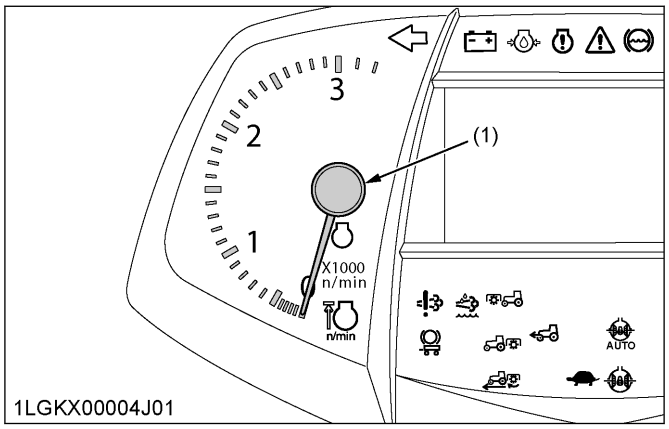
1. With the key switch at **ON**, this gauge indicates the temperature of the coolant. "**C**" is for cold and "**H**" is for hot.
2. If the indicator reaches the red zone position, the engine coolant is overheated. Check the tractor by reading the troubleshooting section of this manual.




(1) Coolant temperature gauge
(A) RED ZONE

## 4.1.6 Tachometer

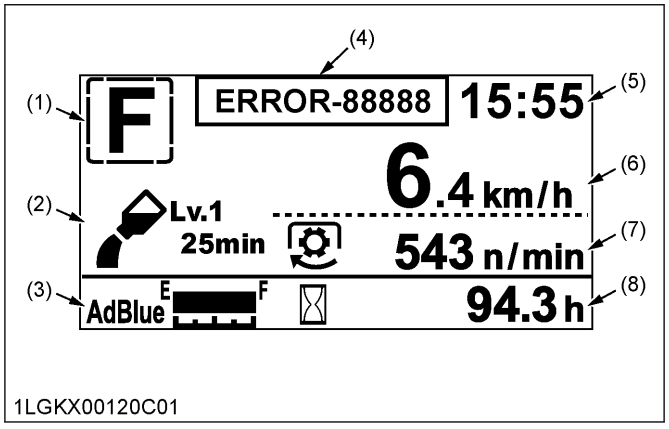
The tachometer indicates the engine speed on the dial.




(1) Engine revolution

## 4.1.7 LCD monitor

This display provides the operator with a variety of information necessary to operate the tractor. Further, part of the display can be modified by the operator as required.




| No. | Description | | Reference page |
|---|---|---|---|
| (1) | F | Forward operation is selected with the shuttle lever. | — |
| | R | Reverse operation is selected with the shuttle lever. | — |
| | N | The shuttle lever is at neutral position. | — |
| | P | The parking brake lever is at parking position. | — |
| | P | Travel when the parking brake lever is locked. | — |
| | Blinking | Clutch-off switch is pushed. Clutch is disengaged. | — |
| | No display | Shuttle lever system trouble. | — |
| (2) | | DEF/AdBlue® low level icon indicator | — |
| | | DEF/AdBlue® poor quality icon indicator | |
| | | DEF/AdBlue® freeze icon indicator | |
| | | SCR system trouble | |
| | | Low temperature regulation indicator | — |
| | n/min | Engine over-speed limiting indicator | — |
| (3) | **DEF/AdBlue® gauge**<br>Displays the fluid level in the DEF/AdBlue tank. | | 10-18 |
| (4) | **Trouble display**<br>A trouble-spot-pinpointing error code and the related control unit are displayed. | | 10-22 |
| (5) | **Clock** | | 10-89 |
| (6) | **Travel speed** | | 10-89 |
| (7) | **PTO speed** | | 10-90 |
| (8) | **Performance monitor**<br>Various information can be selected by the operator. | | 10-21 |

**NOTE**

- **Errors may occur in the fuel consumption display depending on the conditions of use. Use the displayed data only as an approximate**

**guide. In particular, do not use the total fuel consumption display mode in place of the fuel gauge.**

- **The travel speed displayed when the wheels slip under traction is different from the actual one.**
- **In cold weather, the LCD monitor response will normally be slower and the visibility be less than in warmer weather.**

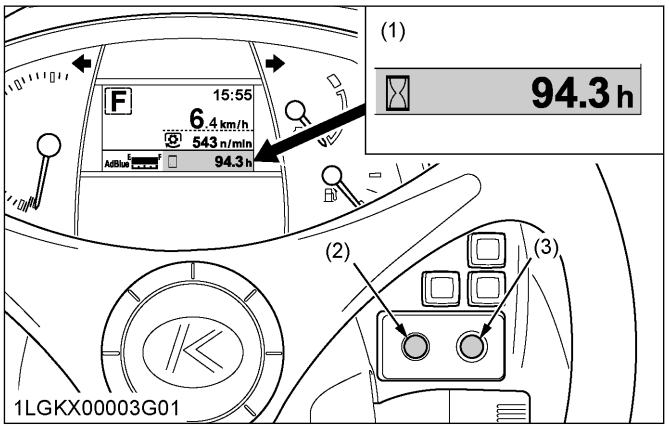
## 4.1.7.1 Performance monitor

**Display change**

Use the mode selector switch and select switch to choose one of the items shown in the following table to be displayed on screen.

**Priority display**

1. When the RPM dual memory setting is **ON**, the engine rpm A or B is displayed on the screen.
   When selecting any other information such as Hour meter or PM buildup, the item will displayed for approximately 5 seconds before resuming the engine rpm A or B display.
2. Turn **OFF** the RPM dual memory setting to display any other information continuously.




(1) Performance monitor (2) Mode selector switch (3) Select switch

**List of types of information displayed on the performance monitor**

| Selected screen (mode) | Display | Remarks | | Reference page |
|---|---|---|---|---|
| 1/4 | | Elapsed time (hour meter) | • The hour meter indicates in 6 digits the hours the tractor has been used; the last digit indicates 1/10 of an hour. | — |
| | TRIP | Trip meter | • The total operating hours, counted from the previous re-setting, is displayed. | — |
| 2/4 | | Instantaneous fuel consumption | • The Instantaneous fuel consumption is measured per hour. | — |
| | Av. | Average fuel consumption | • The Average fuel consumption is measured per hour from the previous resetting. | — |
| | | Total fuel consumption | • The total fuel consumption, measured from the previous resetting, is displayed. | — |
| 3/4 | PM | PM buildup (percentage) | • The PM buildup inside the DPF muffler is displayed.<br>• Regeneration is needed when the 100% level has been reached.<br>• The more the bar is extended to the right, the more PM has built up. | — |
| | | PM buildup (graph) | | |
| 4/4 | A n/min | Memory A rpm | • Engine RPM dual memory A rpm is displayed. | — |
| | B n/min | Memory B rpm | • Engine RPM dual memory B rpm is displayed. | — |

**■ NOTE**

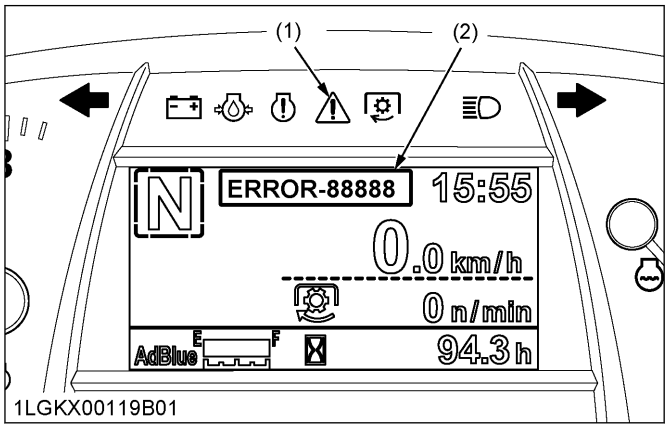
- **Hold down the mode selector switch for 2 seconds or longer to reset the Trip meter, Average fuel consumption and Total fuel consumption displays to “0.0”.**

## 4.1.7.2 ERROR mode of LCD monitor

**■ IMPORTANT**

- **This error codes are the error which corresponds to the Tractor ECU. DTC codes are not displayed on the meter panel.**

If something is wrong with the power train, the master system warning indicator starts blinking and the error code shown below is displayed on the liquid crystal display, indicating the location of the trouble.




(1) Master system warning indicator (2) Error code

1. When the error code is displayed, do the decided procedures.
2. After doing the procedure, there is no error code on the meter panel.

| Error code | Trouble content | Detail | System action |
|---|---|---|---|
| ERROR-1 | Throttle sensor (main) trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | Engine idling |
| ERROR-2 | Throttle sensor (sub) trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | |
| ERROR-3 | Throttle sensor main / sub phase | Sum of sensor voltage < 3.85 V or 6.14 V ≦ sum of sensor voltage | |
| ERROR-4 | Shuttle sensor (main) trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | Cannot drive |
| ERROR-5 | Shuttle sensor (sub) trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | |
| ERROR-6 | Shuttle sensor main / sub phase shifting trouble | Sum of sensor voltage < 3.85 V or 6.14 V ≦ sum of sensor voltage | |
| ERROR-7 | Shuttle sensor signal trouble | Although shuttle lever sensor is F/R position, shuttle lever neutral switch is **ON**. | |
| ERROR-8 | Gear lock parking signal trouble | Although gear lock brake switch is **OFF** position, gear lock detect switch is **ON**. | − |
| ERROR-10 | Front PTO solenoid trouble | Open circuit or short circuit | Unavailable front PTO |
| ERROR-11 | PTO solenoid trouble | Open circuit or short circuit | Unavailable PTO |
| ERROR-13 | Bi-speed solenoid trouble | Open circuit or short circuit | Unavailable Bi-speed |
| ERROR-14 | Shuttle forward solenoid trouble | Open circuit or short circuit | Cannot drive |
| ERROR-15 | Shuttle reverse solenoid trouble | Open circuit or short circuit | |
| ERROR-16 | 2WD solenoid trouble | Open circuit or short circuit | Only 4WD is available. |
| ERROR-17 | Differential lock solenoid trouble | Open circuit or short circuit | Unavailable differential lock |
| ERROR-18 | Front PTO switch trouble | 2 positions are in ON at the same time | Unavailable front PTO |
| ERROR-20 | PTO switch trouble | 2 positions are in ON at the same time | Unavailable PTO |
| ERROR-21 | Range gear shift (Hi) switch trouble | Switch status and estimate shift is different | Engine maximum speed is limited. |
| ERROR-22 | Main gear shift (6th) switch trouble | Switch status and estimate shift is different | |
| ERROR-23 | Shuttle rotation sensor trouble | Pulse is not detected when driving at H6 shift. | |
| ERROR-24 | Traveling speed sensor trouble | Pulse is not detected when driving at H6 shift. | |
| ERROR-33 | Brake sensor (L.H.) trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | Only 4WD is available<br>Unavailable auto differential lock |
| ERROR-34 | Brake sensor (R.H.) trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | |
| ERROR-35 | Brake (L.H.) signal trouble | Brake (left) sensor signal does not match brake switch condition | |
| ERROR-36 | Brake (R.H.) signal trouble | Brake (right) sensor signal does not match brake switch condition | |

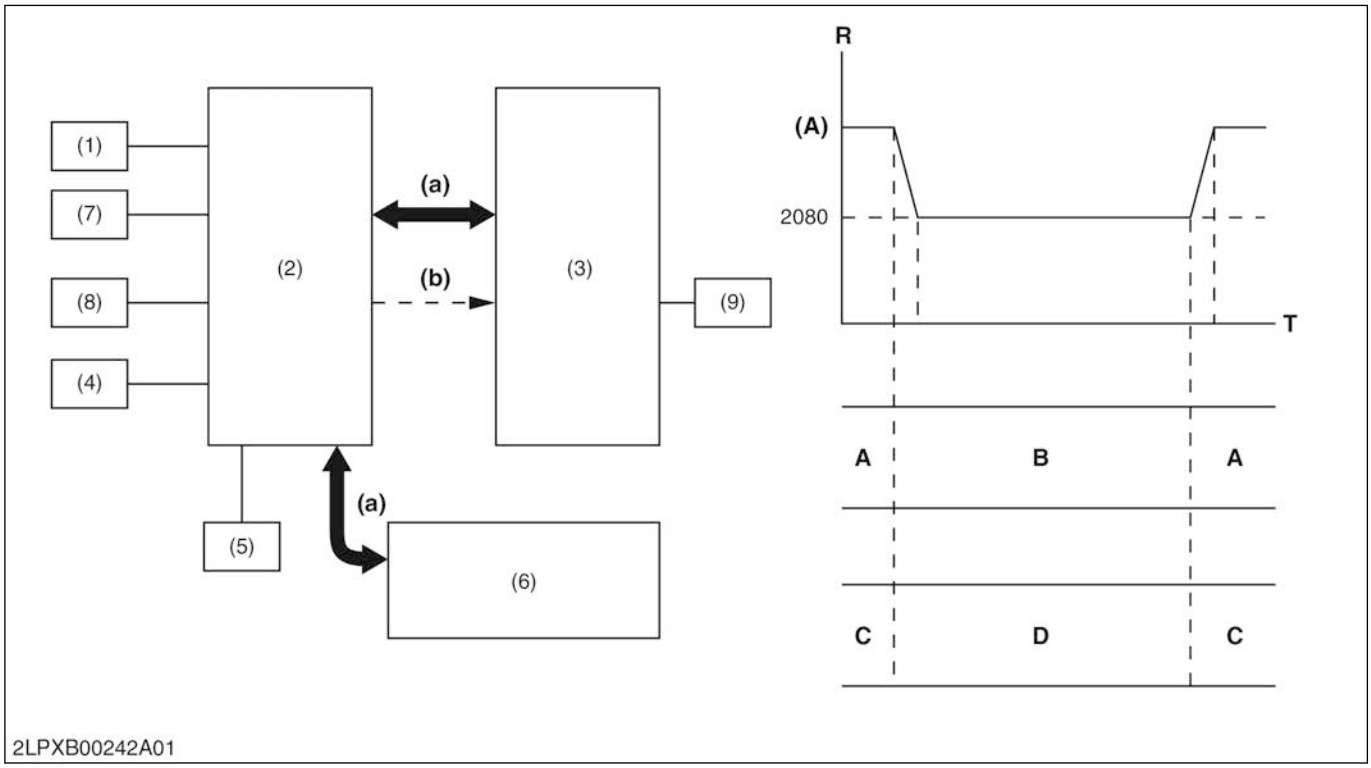
(Continued)

| Error code | Trouble content | Detail | System action |
|---|---|---|---|
| ERROR-37 | 2WD pressure switch trouble | Switch contradiction (4WD switch is **OFF** when tractor is in 2WD mode or 4WD switch is **ON** when tractor is in 4WD mode) | Unavailable 2WD |
| ERROR-ENG (ERROR-41) | Engine communication trouble | Communication breakdown more than 5 seconds | Engine loss of control |
| ERROR-ACU (ERROR-42) | ACU communication trouble | Communication breakdown more than 5 seconds | ACU loss of control |
| ERROR-ECU (ERROR-43) | ECU communication trouble or meter communication trouble | Communication breakdown more than 5 seconds | Undisplay meter panel |
| ERROR-60 | Analog reference supply voltage +5 V trouble | Short circuit of sensor voltage | Engine idling and cannot drive |
| ERROR-63 | Acceleration and engine adjustment trouble | Calibration had done incorrectly | Engine idling |
| ERROR-NET | Communication trouble | Miss connection of CAN harness or short circuit | Loss of various control |

# 5. Advanced controls

## 5.1 ECO 40 km/h function

### 5.1.1 Structure of ECO 40 km/h function




(1) Main gear shift (6th) switch
(2) Tractor ECU
(3) Engine ECU
(4) Range gear shift (High) switch
(5) Throttle sensor
(6) Meter ECU
(7) Shuttle rotation sensor
(8) Traveling speed sensor
(9) Crankshaft position sensor
(A) Rated speed
A: 5th-high
B: 6th-high
C: OFF
D: ON
R: Engine rotation speed : $min^{-1}$ (rpm)
T: Time
(a) CAN communication
(b) Send signal (Engine limit)

**Travel Speed Limiter (ECO 40 km/h)**

With the 6-speed main gear shift type, the highest travel speed is reachable when the engine rpm is at around the middle level with the maximum travel speed range. This provides for a fuel-efficient operate while traveling along roads, pulling a trailer, etc.. Step on the foot throttle, and the engine rpm rises proportionally and the travel speed goes up accordingly. But the engine speed is limited to 2080 $min^{-1}$ (rpm) or so, and it does not increase even if the foot throttle is increased. When the main gear shift lever is set to the High-6th position, the Rev-Limiter indicator illuminates.

This figure is "Travel Speed Limiter" mechanism.

This mechanism is controlled by the Tractor ECU, the range gear shift (Hi) switch, the main gear shift (6th) switch, the shuttle rotation sensor, the traveling speed sensor, the throttle sensor, the meter ECU, the crankshaft position sensor and the engine ECU. The tractor ECU checks in condition of 6th (main gear shift) and high (range gear shift). The range gear shift (Hi) switch and range gear shift (6th) switch are normal open type. When main gear shift (6th) is changed from 5th position to 6th position, the switch opens. After that, when the tractor exceeds 40 km/h, the tractor ECU communicates the engine ECU to be limited the engine rpm (2080 $min^{-1}$ (rpm)).

When the tractor becomes out of condition, this feature releases.

Even if one of each sensor is gone wrong, the tractor never exceed 40 km/h in any condition. This is fail safe function.

| Model | Maximum traveling speeds |
|---|---|
| F18/R18 speed transmission model | 38.8 km/h (24.1 mph) |
| F36/R36 speed transmission model | 39.2 km/h (24.4 mph) |

**Condition**

**Main gear shift:**
6th

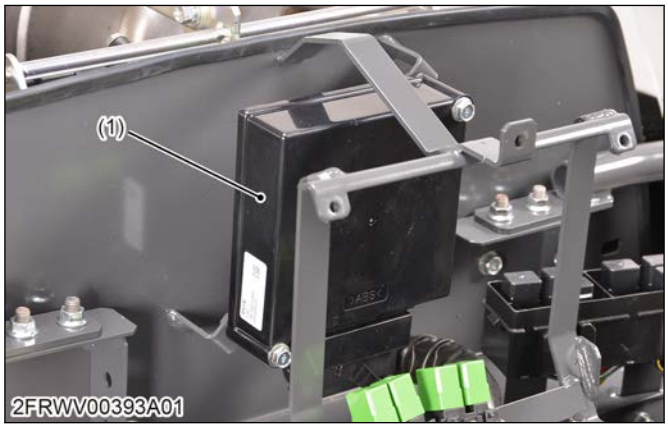
**Range range gear shift:**
High

**Engine revolution limitation:**
2080 $min^{-1}$ (rpm)

## 5.1.2 Components

### 5.1.2.1 Function of tractor ECU

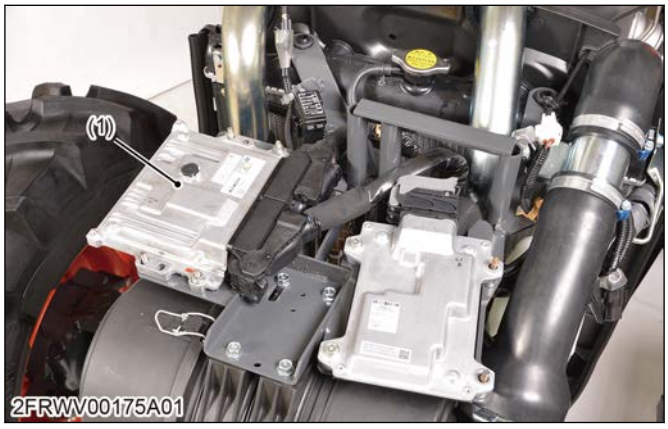
The tractor ECU (1) receives the input signals from the switches and sensors around the tractor and calculates the output signal.





(1) Tractor ECU

### 5.1.2.2 Function of engine ECU

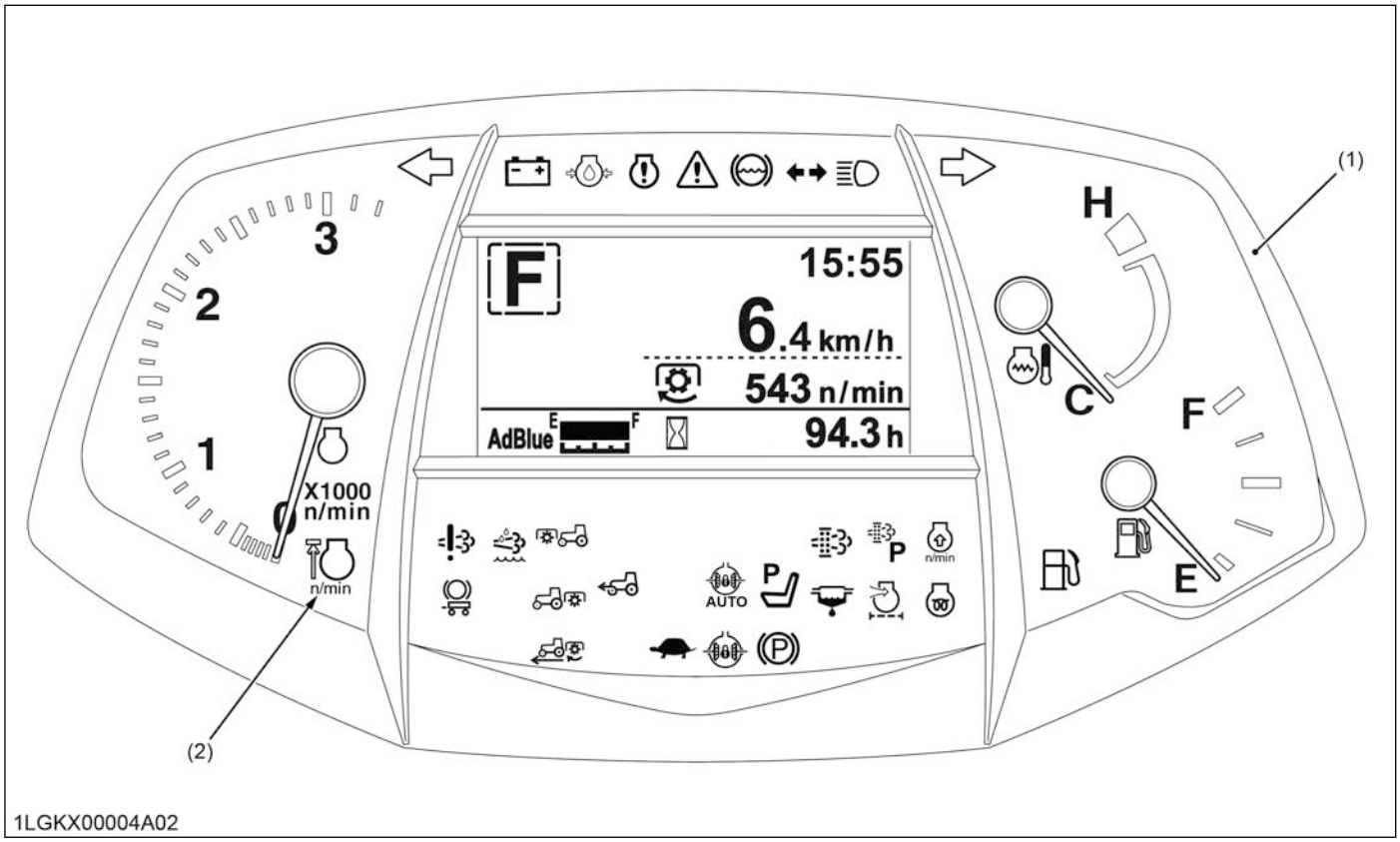



(1) Engine ECU

The engine ECU (1) receives the input signals from the switches and sensors around the engine and calculates the output signal.

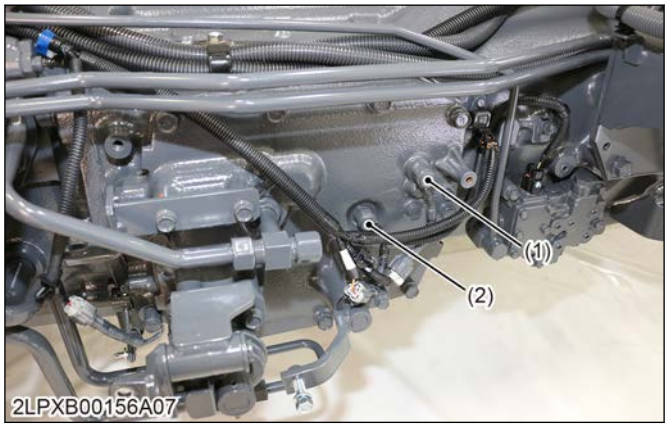
### 5.1.2.3 Rev-limiter indicator on meter panel

The meter panel (1) displays the tractor operating condition. When the main and range gear shift lever is set to the H-6 position, the Rev-limiter indicator (2) illuminates.




(1) Meter panel (2) Rev-limiter indicator

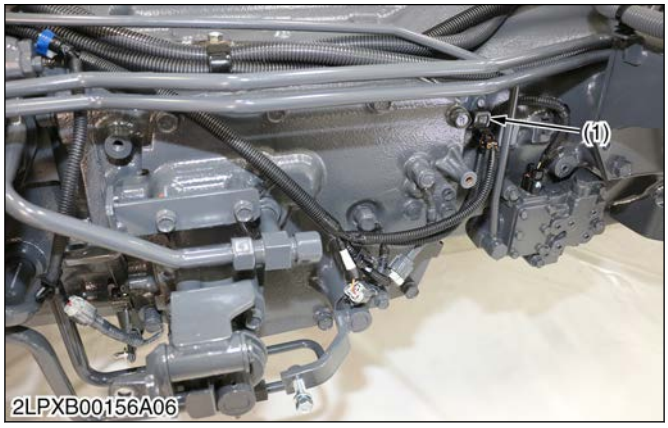
### 5.1.2.4 Range gear shift switch (Hi) and main gear shift switch (6th)




(1) Main gear shift switch (6th) (2) Range gear shift switch (Hi)

The range gear shift switch (Hi) (2) checks whether range gear shift is high. The main gear shift switch (6th) (1) checks whether main gear shift is 6th position.
Both switches are normal open type.

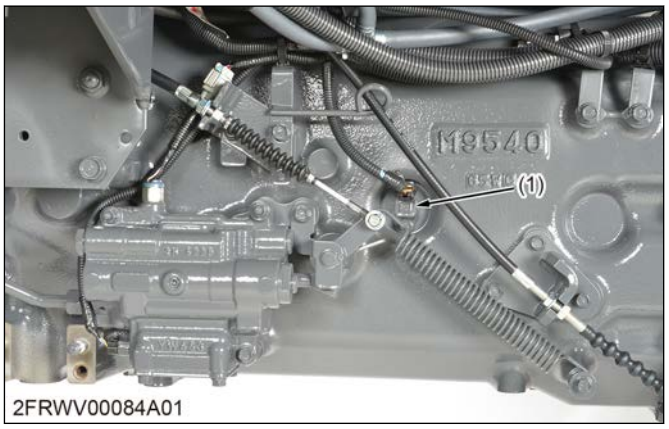
### 5.1.2.5 Shuttle rotation sensor




(1) Shuttle rotation sensor

The value of shuttle rotation sensor (1) is used for calculating of shuttle rotation speed. The value of this sensor is used for estimating the gear shift range (H6).

### 5.1.2.6 Traveling speed sensor




(1) Traveling speed sensor

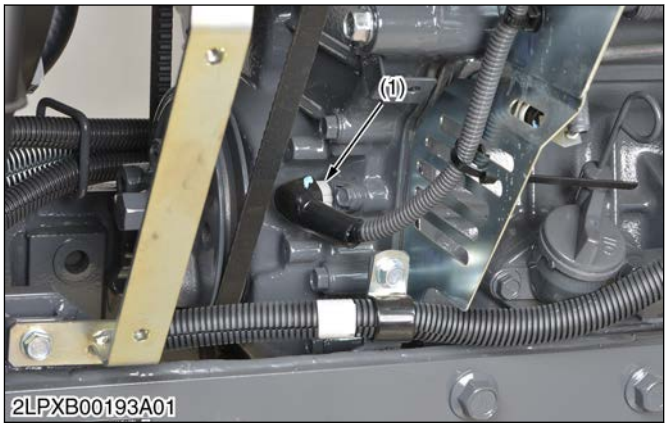
The value of traveling speed sensor (1) is used for calculating of traveling speed. The value of this sensor is used for estimating the gear shift range (H6).

### 5.1.2.7 Throttle sensor


(1) Throttle sensor

The throttle sensor (1) detects the position of foot throttle pedal and hand throttle lever. The value of this sensor is sent to tractor ECU.

### 5.1.2.8 Crankshaft position sensor

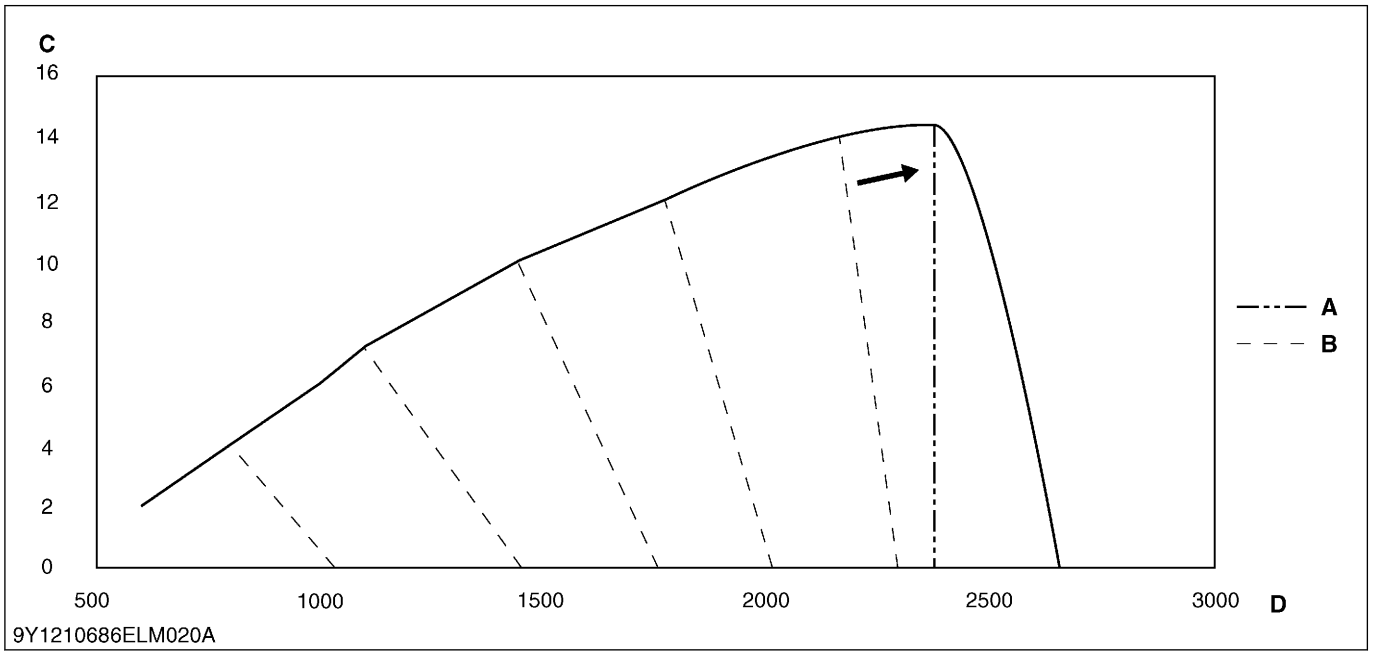



(1) Crankshaft position sensor

The value of crankshaft position sensor (1) is used for calculating of engine rotation speed. The value of this sensor is sent to engine ECU.

# 5.2 Constant RPM management switch with indicator (Work cruise)

## 5.2.1 Structure of constant RPM management switch with indicator (Work cruise)




A: Work cruise ON B: Work cruise OFF C: kW D: $min^{-1}$ (rpm)

**Constant RPM Management Control**
Constant RPM Management can be turned "ON" or "OFF" by operating the switch. Pressing the switch turns the control "ON" and pressing the switch again turns it "OFF".

**When constant RPM management is "ON"**
Fluctuations in the engine speed due to load fluctuations are reduced and the travel speed and PTO speed are kept nearly constant, allowing stable work. When constant RPM management is "ON", the switch's indicator light up.

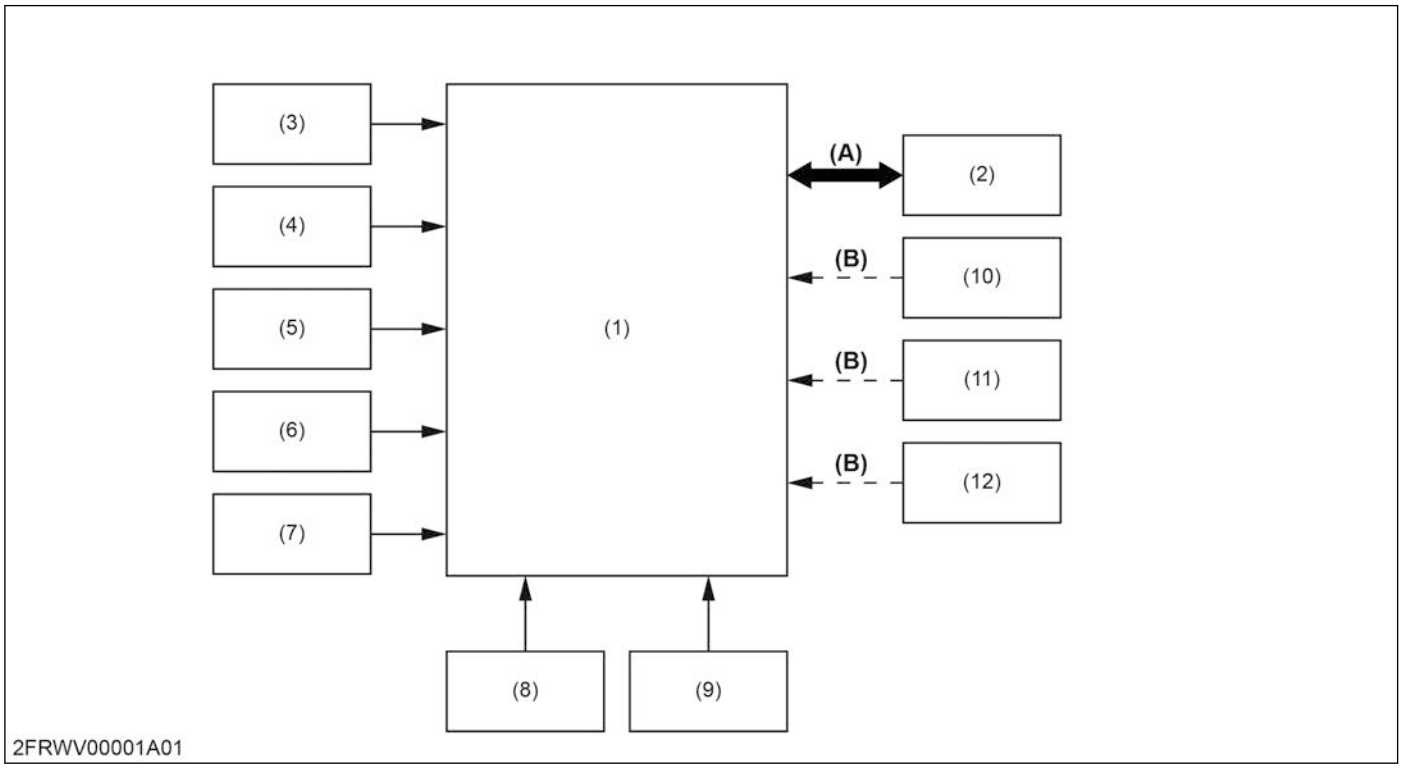
**When constant RPM management is "OFF"**
As in a conventional engine, the engine speed increases or decreases according to changes in the load. The operator judges the size of the load from the engine speed and engine sound, and can adjust the travel speed or plowing depth to prevent overload on the tractor.

## 5.2.2 Constant RPM management mechanism

The engine keeps same engine RPM.
When the tractor charges load or doesn't charge load the engine ECU starts to control fuel of the injector. During using the constant RPM management function, the engine tries to increase to inject fuel quantity by controlling the engine ECU.

# 5.3 Electronic hydraulic shuttle

## 5.3.1 Structure of electronic hydraulic shuttle




(1) Tractor ECU
(2) Meter panel
(3) Shuttle sensor
(4) Shuttle switch
(5) Secondary brake switch
(6) Gear lock parking lever switch
(7) Clutch off switch
(8) Gear lock parking detect switch
(9) Shuttle valve spool neutral switch
(10) Shuttle F solenoid
(11) Shuttle R solenoid
(12) Buzzer
(A) CAN communication
(B) Send signal

**Outline of electronic hydraulic shuttle control**
This tractor is equipped with electronic hydraulic shuttle function to ease the shuttle shift operation.
If the operator shifts the shuttle shift lever to "**F**" or "**R**" position, shuttle sensor (3) detects the lever operation and sends the signal to tractor ECU (1). And the tractor ECU (1) sends the signal to shuttle F solenoid (10) or shuttle R solenoid (11) according to the signal from shuttle sensor (3). If shuttle F solenoid (10) or shuttle R solenoid (11) is activated, the oil is sent to corresponding shuttle clutch pack and shuttle clutch is engaged.

**Double engagement prevention control**
In case while gear lock parking brake lever is in "**ON**" position the shuttle lever is operated either "**F**" or "**R**" position, double engagement prevention control is also equipped. If tractor detect this condition via gear lock parking lever switch (6) or gear lock parking detect switch (8), tractor ECU (1) stops sending signal to shuttle solenoids and sounds the buzzer (12). If the tractor ECU (1) identifies shuttle lever is "**N**" condition or gear lock parking brake is released, tractor recovers to normal condition.

**No clutch shift control**
While clutch off switch (7) is pressed, tractor ECU (1) does not send any signal to shuttle solenoids.

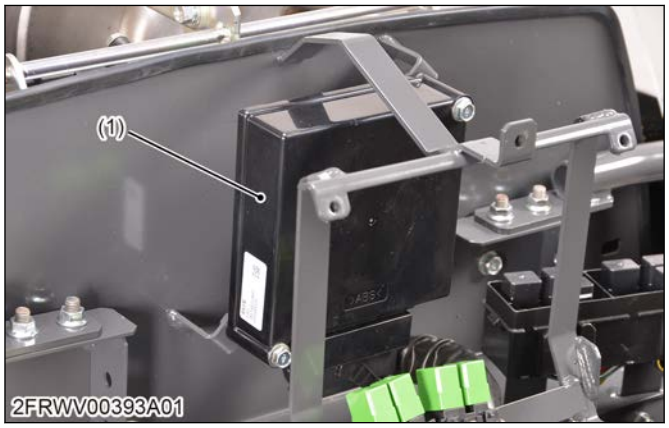
**Secondary brake drag control**
If shuttle lever is operated to "**F**" or "**R**" position while secondary brake is applied, tractor ECU (1) sounds the buzzer (12) but keeps sending the signal shuttle solenoids.

**Fail safe function**
If tractor ECU (1) detects any failure of related switches or sensors, error indication is displayed on meter panel and electronic hydraulic shuttle control is restricted.

## 5.3.2 Components

### 5.3.2.1 Function of tractor ECU

The tractor ECU (1) receives the input signals from the switches and sensors around the tractor and calculates the output signal.

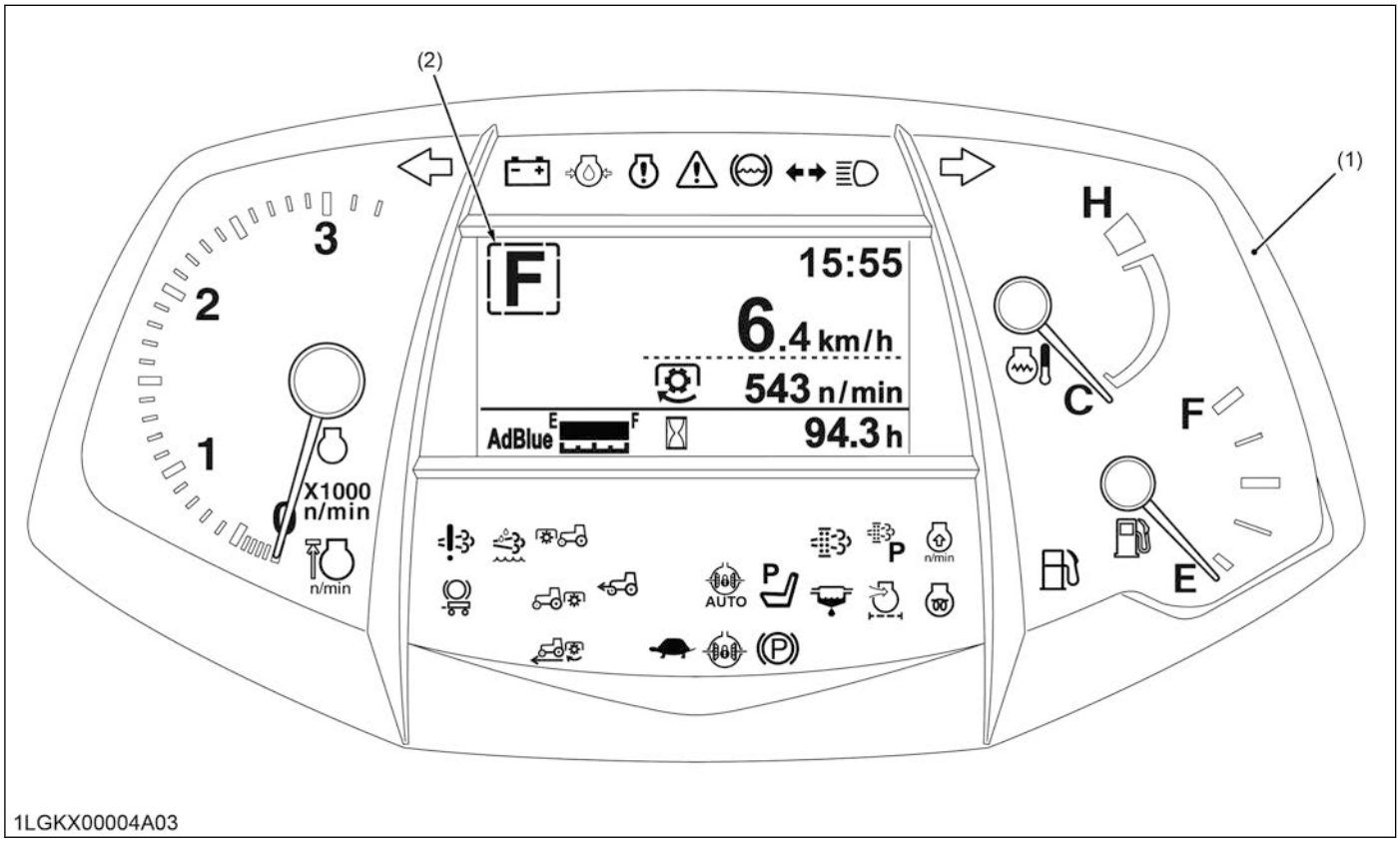




(1) Tractor ECU

### 5.3.2.2 Shuttle shift indicator on meter panel

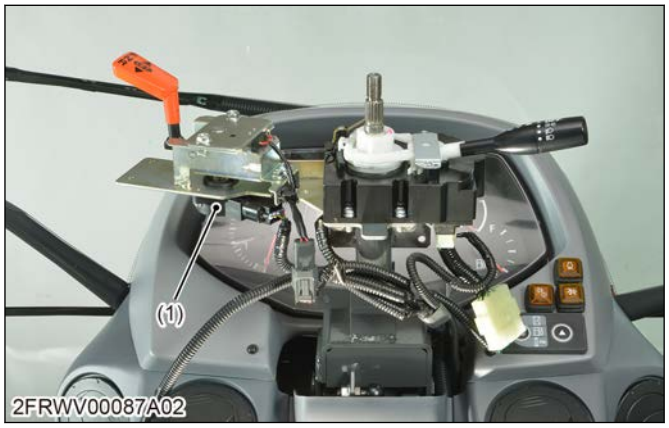
The meter panel (1) displays the tractor operating condition. When the shuttle lever or gear lock parking lever is operated, shuttle shift indicator (2) shows current position.




(1) Meter panel (2) Shuttle shift indicator

### 5.3.2.3 Function of shuttle sensor

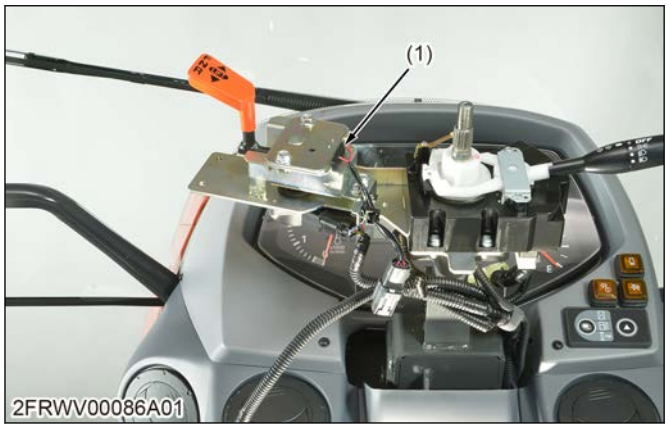
The value of shuttle sensor (1) is used for detecting shuttle lever position.




(1) Shuttle sensor

### 5.3.2.4 Function of shuttle switch

The shuttle switch (1) detects the shuttle lever is in **N** position or not.




(1) Shuttle switch

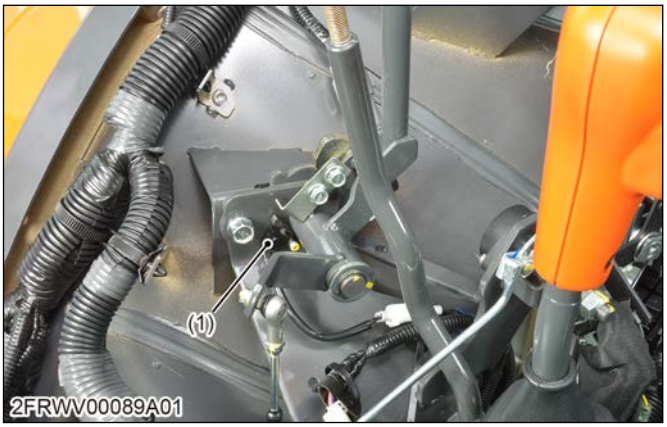
### 5.3.2.5 Function of secondary brake switch

The secondary brake switch (1) detects secondary brake is applied or not.


(1) Secondary brake switch

### 5.3.2.6 Function of gear lock parking lever switch

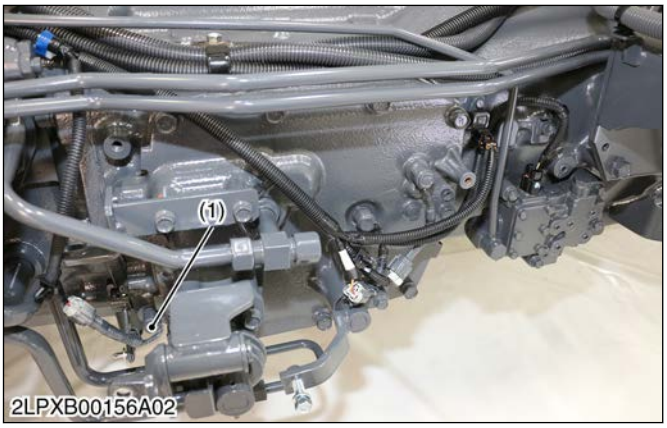
The gear lock parking lever switch (1) detects the position of gear lock parking lever.




(1) Gear lock parking lever switch

### 5.3.2.7 Function of gear lock parking detect switch

The gear lock parking detect switch (1) detects the position of gear lock parking arm.

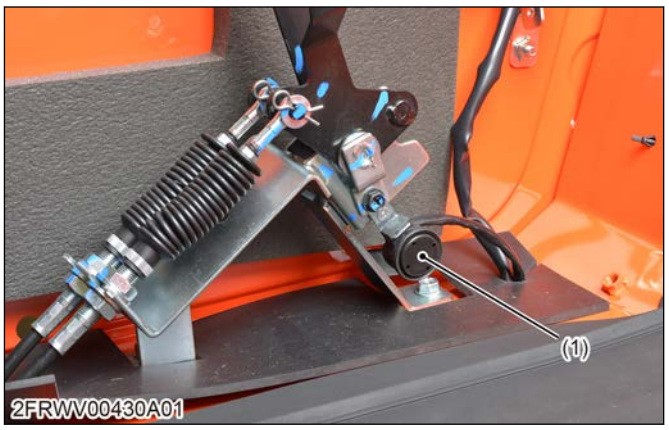



(1) Gear lock parking detect switch

### 5.3.2.8 Function of clutch off switch

The clutch off switch (1) is the switch to disengage the hydraulic clutch to ease the main gear shifting. While pressing, this switch is **ON**.


(1) Clutch off switch




(1) Buzzer

## 5.3.2.9 Function of shuttle valve spool neutral switch

The shuttle valve spool neutral switch (1) detects the shuttle valve spool is in N or not.

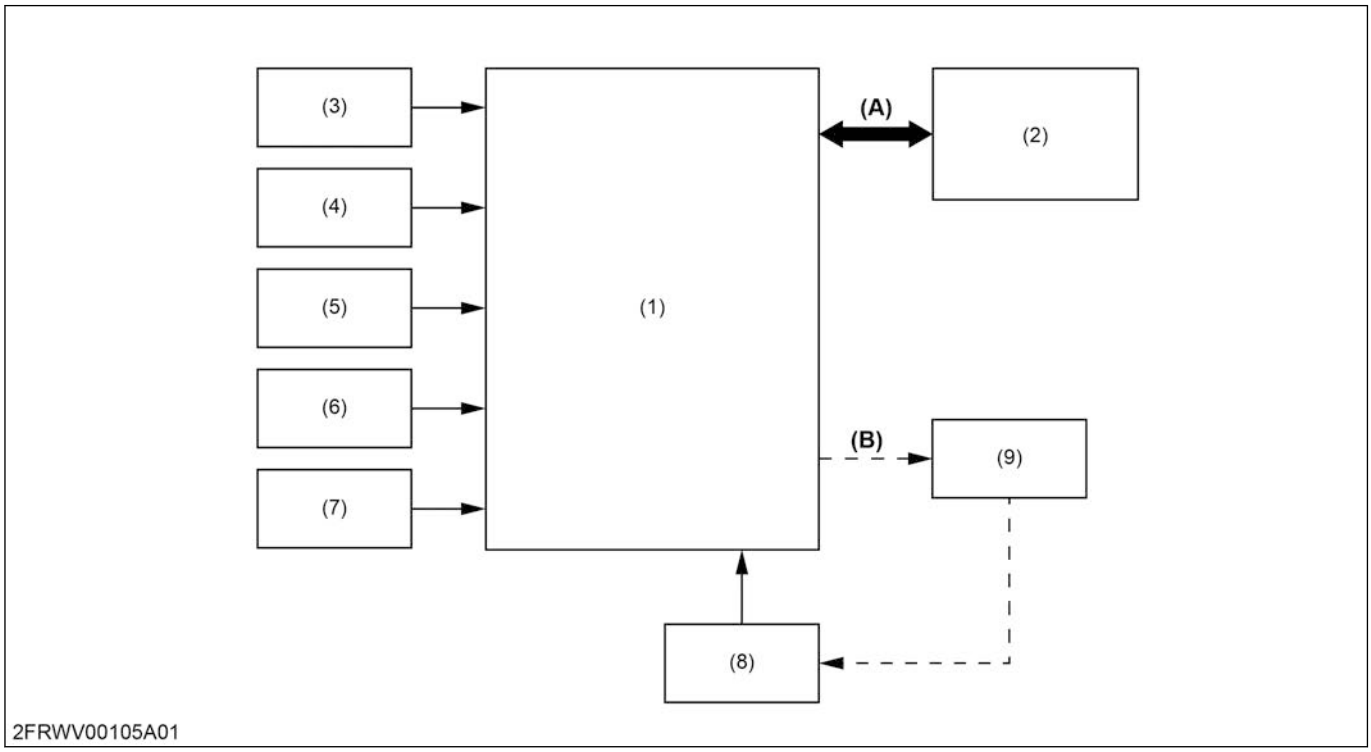

(1) Shuttle valve spool neutral switch

## 5.3.2.10 Function of buzzer

The buzzer (1) warns the operator as necessary.

# 5.4 4WD control

## 5.4.1 Structure of 4WD control




(1) Tractor ECU
(2) Meter panel
(3) 4WD switch
(4) Brake switch (R.H.)
(5) Brake switch (L.H.)
(6) Brake sensor (R.H.)
(7) Brake sensor (L.H.)
(8) 2WD pressure switch
(9) 2WD solenoid
(A) CAN communication
(B) Send signal (2WD solenoid activation)

**Outline of 4WD control**

When 4WD switch is in 4WD position, 2WD solenoid is not activated and the oil from the hydraulic pump does not flow into 2WD clutch. In this condition, tractor is in 4WD mode.
If 4WD switch is pressed to 2WD position, tractor is changed to 2WD mode. In this mode 2WD solenoid is activated and the oil flows into 2WD clutch. Tractor becomes 2WD mode.

**Control table**

| 4WD switch | Tractor mode | Brake switch (R.H.) | Brake switch (L.H.) | Secondary brake switch | 2WD solenoid | 4WD indicator on meter panel |
|---|---|---|---|---|---|---|
| OFF | 2WD | OFF | ON | OFF | ON | OFF |
| | | ON | OFF | OFF | ON | OFF |
| | | ON | ON | - | OFF | OFF |
| | | - | - | ON | OFF | OFF |
| ON | 4WD | - | - | - | OFF | ON |

In 2WD mode, even either brake pedal is depressed tractor keeps 2WD condition. But when both brake pedals are depressed, tractor ECU stops activating 2WD solenoid and tractor changed into 4WD mode to assure braking force.
In case of failure of brake switches, brake sensors are equipped.

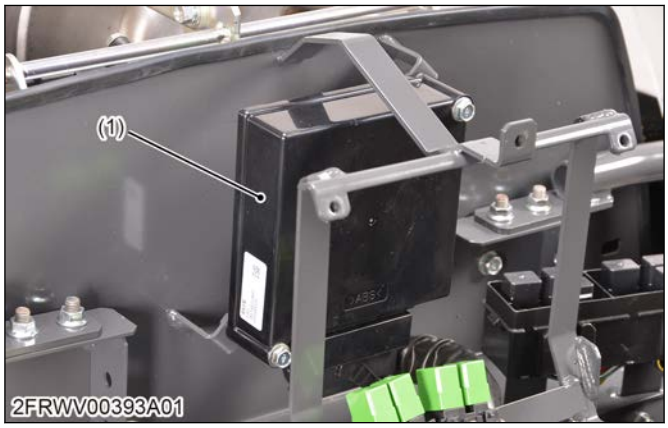
**Fail safe function**

If tractor ECU (1) detects any failure of related switches or sensors, error indication is displayed on meter panel (2) 2WD mode is restricted.
And the 4WD indicator on meter panel (2) blinks and warn the operator.

## 5.4.2 Components

### 5.4.2.1 Function of tractor ECU

The tractor ECU (1) receives the input signals from the switches and sensors around the tractor and calculates the output signal.

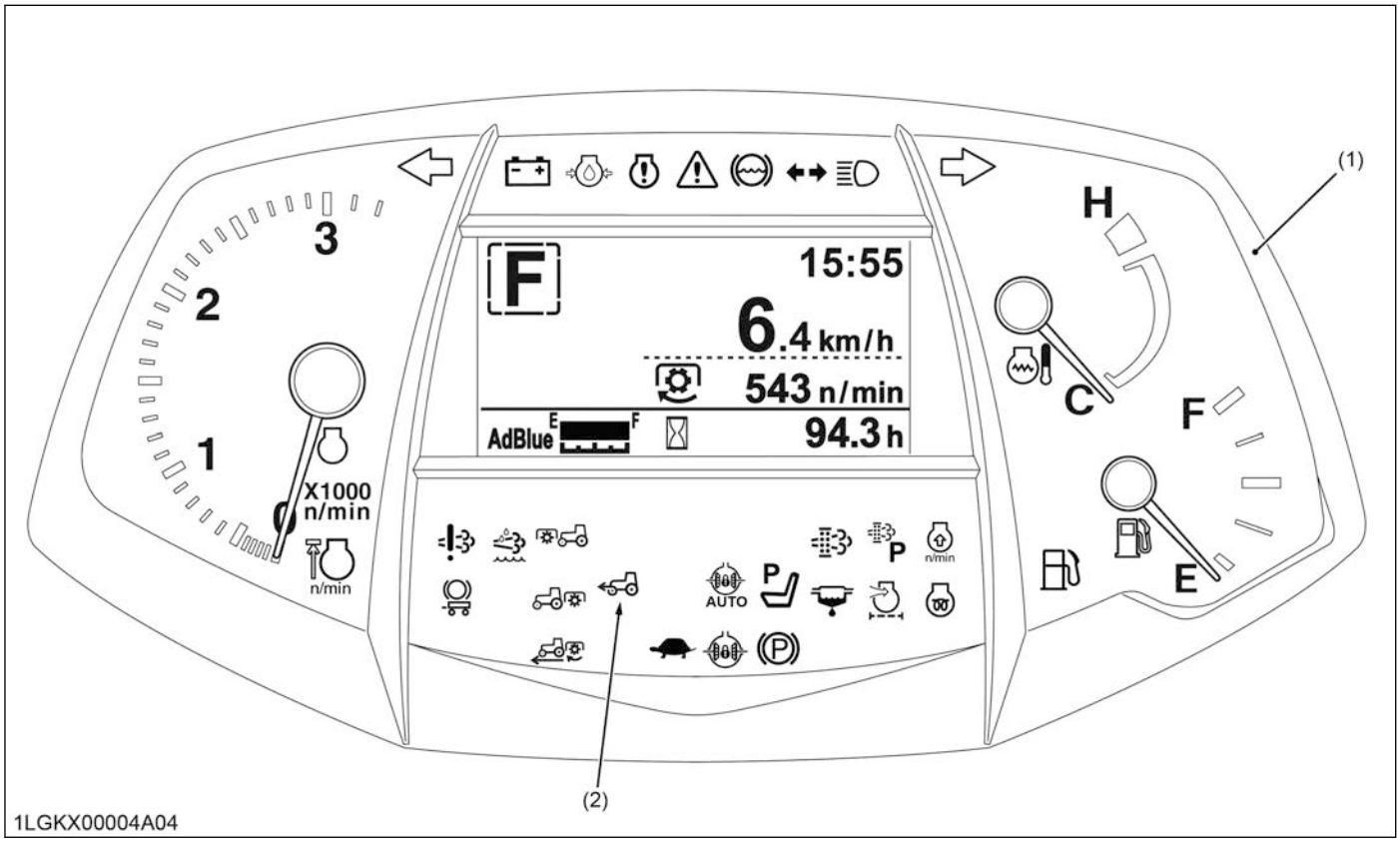




(1) Tractor ECU

## 5.4.2.2 4WD indicator on meter panel

The meter ECU (1) displays the tractor operating condition. When the tractor is in 4WD mode, 4WD indicator (2) appears on LCD.




(1) Meter panel (2) 4WD indicator

### 5.4.2.3 Function of 4WD switch

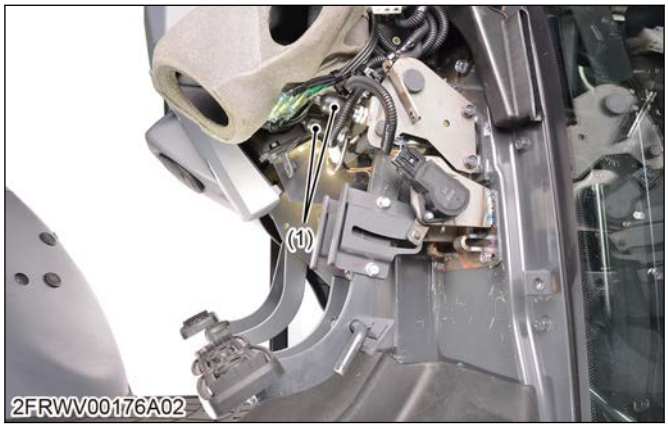
The 4WD switch (1) is the switch to choose 2WD mode or 4WD mode.



(1) 4WD switch

### 5.4.2.4 Function of brake switch

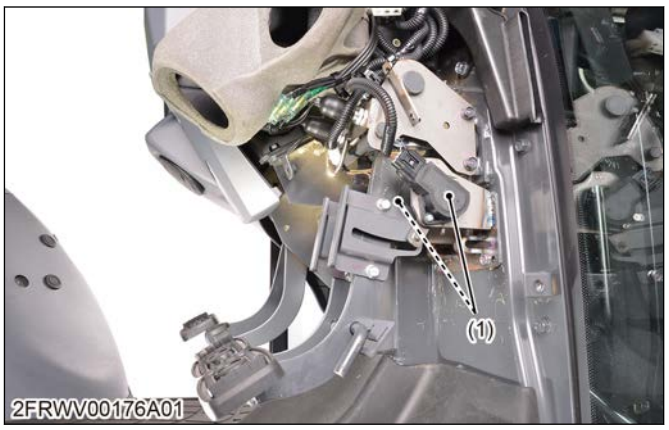
The brake switch (1) detects brake pedal is depressed or not.




(1) Brake switch

### 5.4.2.5 Function of brake sensor

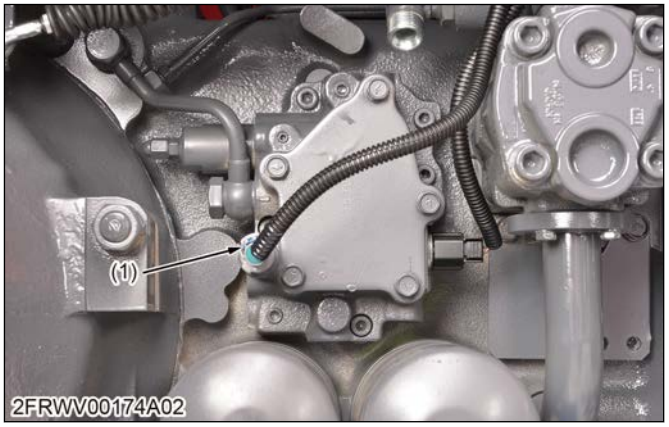
The brake sensor (1) detects the position of the brake pedal.




(1) Brake sensor

### 5.4.2.6 Function of 2WD clutch pressure switch

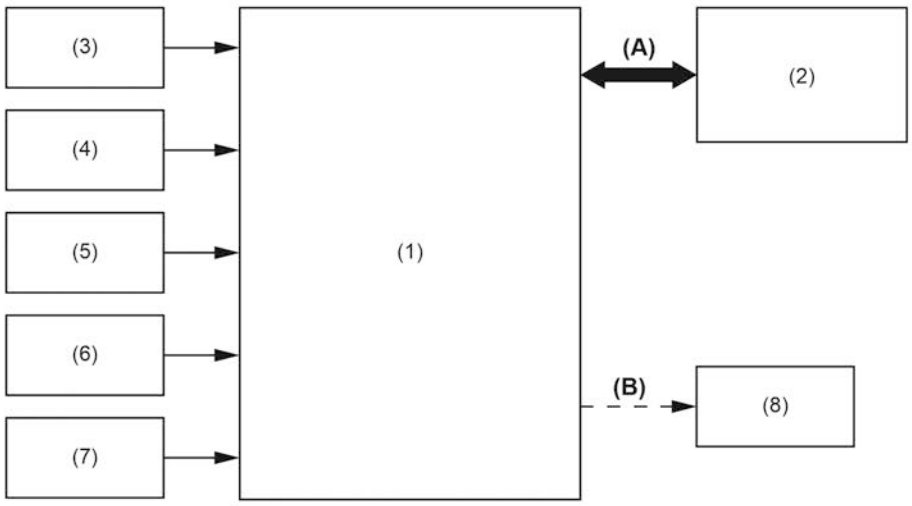
The 2WD clutch pressure switch (1) checks the hydraulic pressure applied to 2WD clutch. If the pressure exceed the prescribed level, the switch turns **ON**.




(1) 2WD clutch pressure switch

# 5.5 Auto differential lock control

## 5.5.1 Structure of auto differential lock control




2FRWV00002A01

(1) Tractor ECU
(2) Meter panel
(3) Differential lock switch
(4) Auto differential lock switch
(5) Brake switch (R.H.)
(6) Brake switch (L.H.)
(7) Traveling speed sensor
(8) Differential lock solenoid
(A) CAN communication
(B) Send signal (differential lock activation)

**Outline of auto differential lock control**

Auto differential lock is adopted to improve operability.

In manual differential lock mode (normal mode), when operator depress the differential lock pedal the differential lock switch is turned **ON**. Tractor ECU (1) detects this signal, sends differential lock activation signal to differential lock solenoid (8) and rear differential gear is locked. When the differential lock pedal is released, rear differential lock is released as well.

When auto differential lock switch (4) is pressed, the indicator on meter panel lights up and auto differential lock mode is activated. In this mode, tractor ECU (1) keeps sending differential lock activation signal all the time. Tractor ECU (1) has condition to activate auto differential lock mode. If tractor ECU (1) does not satisfy one of these, tractor ECU (1) does not activate the mode although the auto differential lock switch (4) is pressed.

**Condition**

| Traveling speed | Brake switch | Differential lock switch |
|---|---|---|
| 0.5 km/h to 15 km/h | Off | Off |

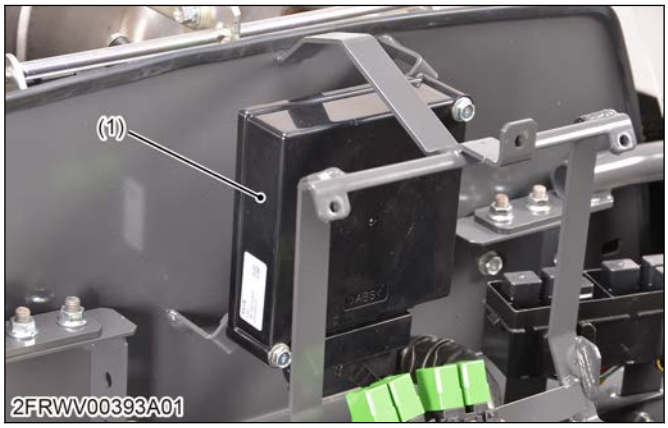
**Fail safe function**

If tractor ECU (1) detects any failure of related switches or sensors, error indication is displayed on meter panel (2) and auto differential lock mode is restricted.

## 5.5.2 Components

### 5.5.2.1 Function of tractor ECU

The tractor ECU (1) receives the input signals from the switches and sensors around the tractor and calculates the output signal.

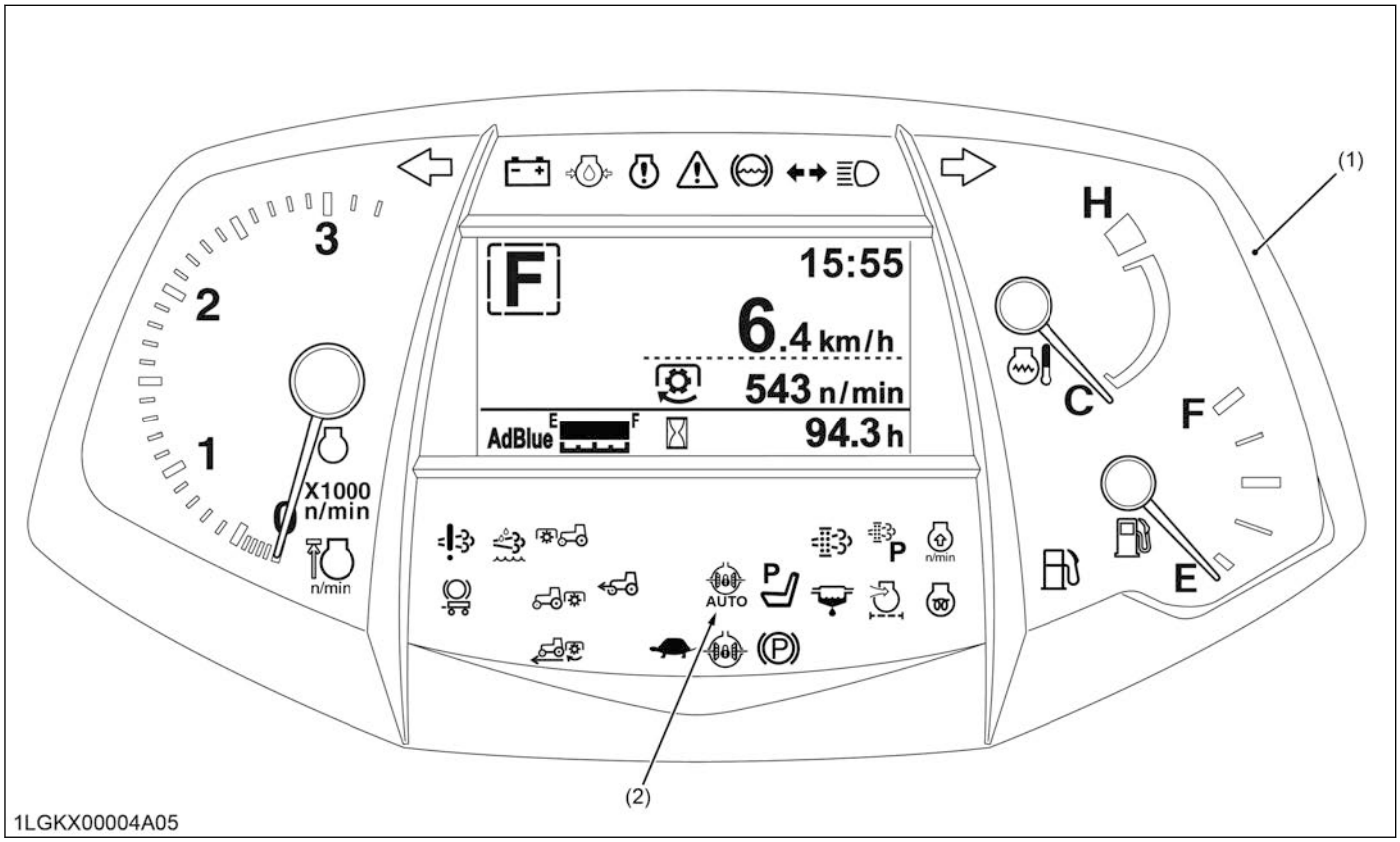




(1) Tractor ECU

## 5.5.2.2 Auto differential lock indicator on meter panel

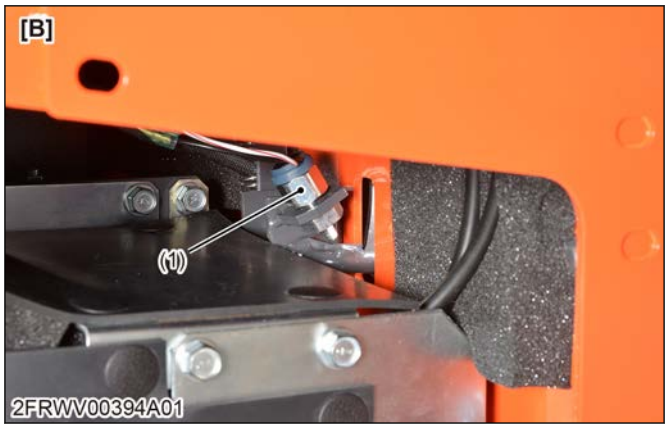
The meter panel (1) displays the tractor operating condition. When the tractor is in auto differential lock mode, the auto differential lock indicator (2) appears on LCD.




(1) Meter panel (2) Auto differential lock indicator

### 5.5.2.3 Function of differential lock switch

The differential lock switch (1) detects the operation of differential lock pedal.


(1) Differential lock switch
[A] Cabin model
[B] ROPS model

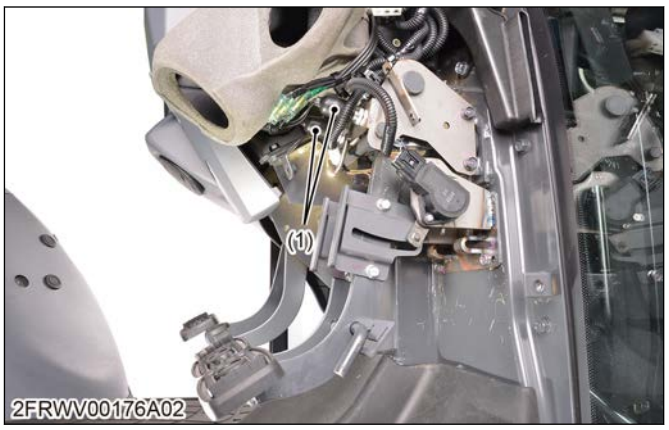
### 5.5.2.4 Function of auto differential lock switch

The auto differential lock switch (1) is the switch to activate auto differential lock mode.


(1) Auto differential lock switch

### 5.5.2.5 Function of brake switch

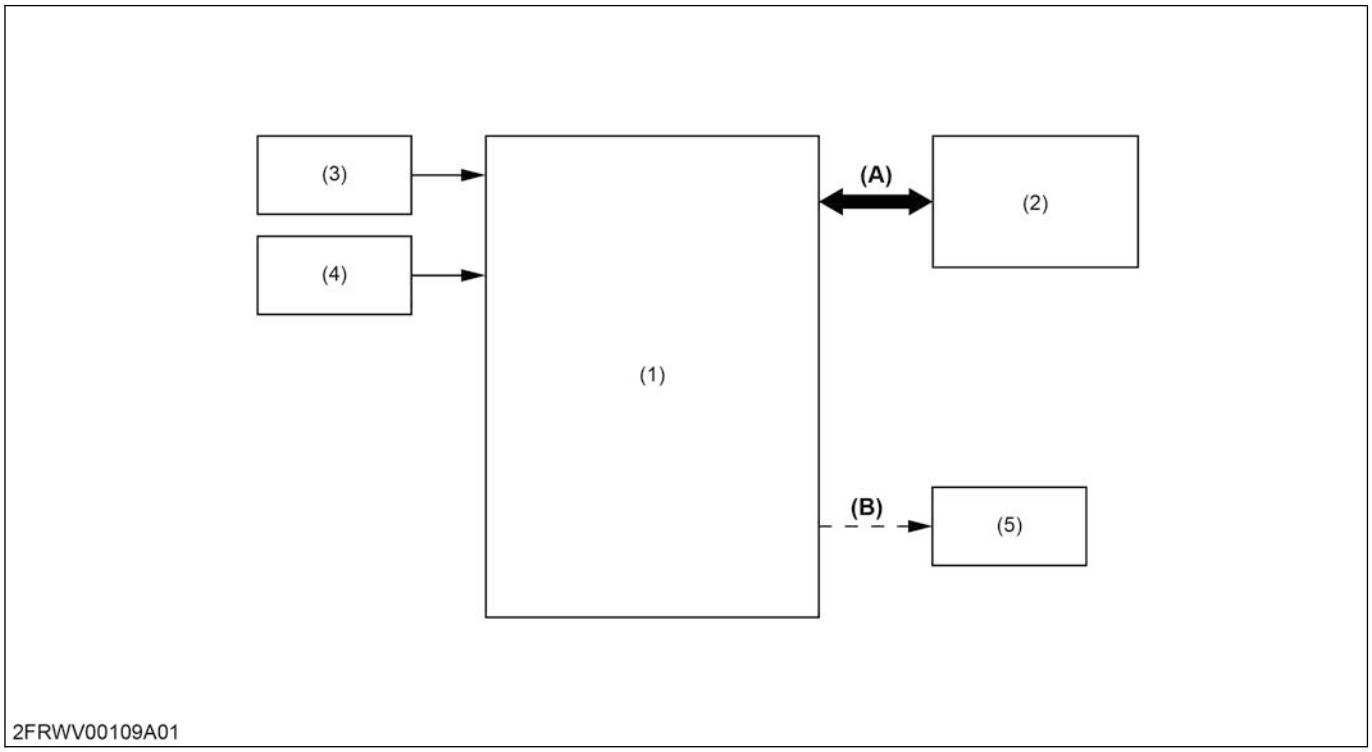
The brake switch (1) detects brake pedal is depressed or not.




(1) Brake switch

# 5.6 Gear lock parking brake OPC

## 5.6.1 Gear lock parking brake OPC




(1) Tractor ECU
(2) Meter panel
(3) Gear lock parking detect switch
(4) Seat switch
(5) Buzzer
(A) CAN communication
(B) Send signal

**Outline of gear lock parking brake operator presence control (OPC)**

Gear lock parking brake OPC is a control warns when the operator leave the seat while the gear lock parking brake is not applied.

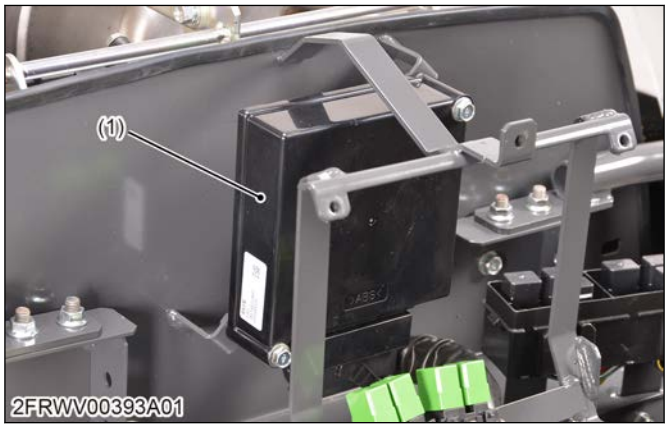
If tractor ECU detect both gear lock parking detect switch (3) and seat switch (4) are **OFF** for one second, gear lock parking brake OPC is activated. To warn the operator, indication appears on meter panel and the buzzer sound continuously.

If tractor ECU detects either gear lock parking detect switch (3) or seat switch (4) is turning **ON**, the gear lock parking brake OPC is released.

## 5.6.2 Components

### 5.6.2.1 Function of tractor ECU

The tractor ECU (1) receives the input signals from the switches and sensors around the tractor and calculates the output signal.

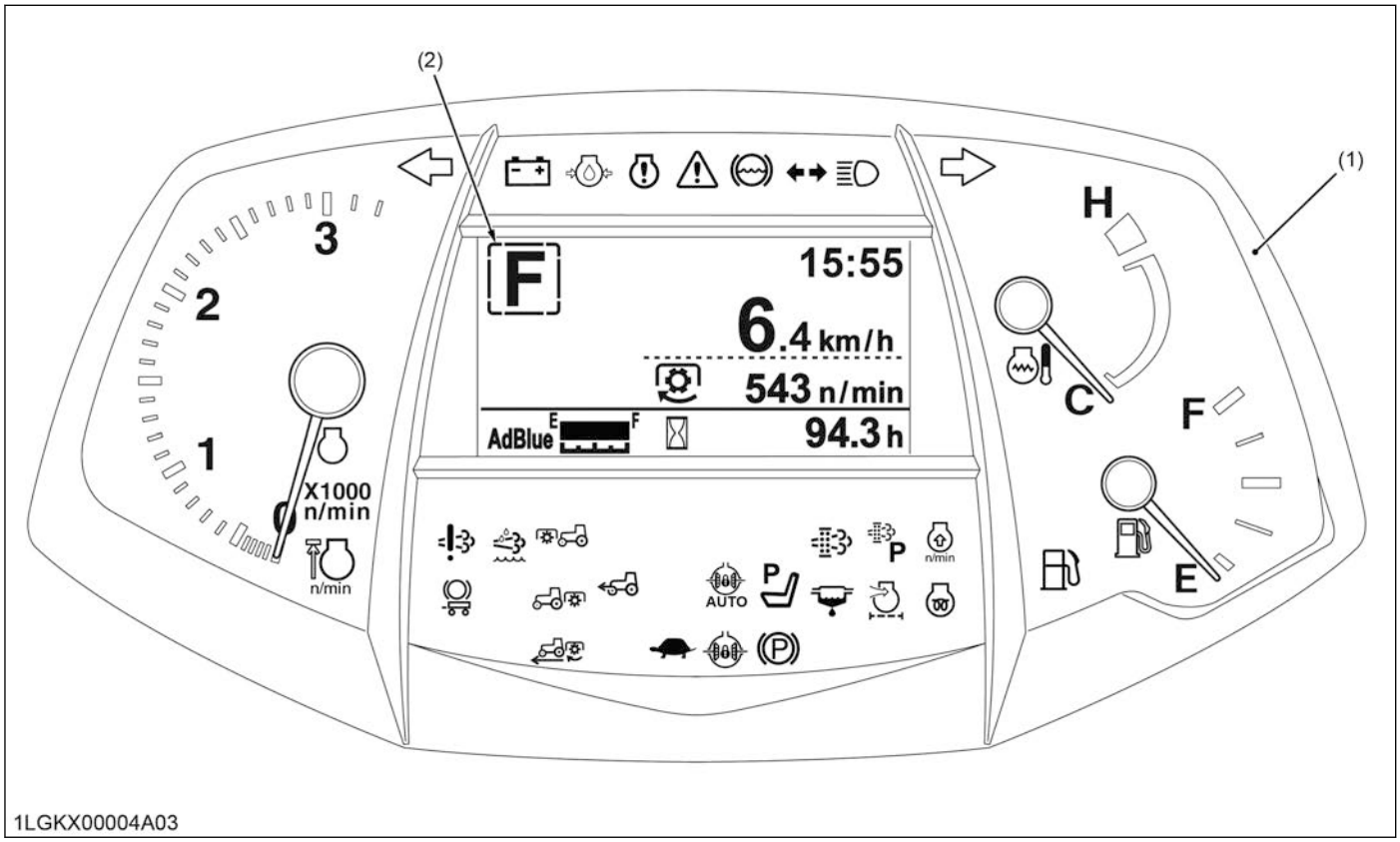




(1) Tractor ECU

## 5.6.2.2 Shuttle shift indicator on meter panel

The meter panel (1) displays the tractor operating condition. When the shuttle lever or gear lock parking lever is operated, shuttle shift indicator (2) shows current position.

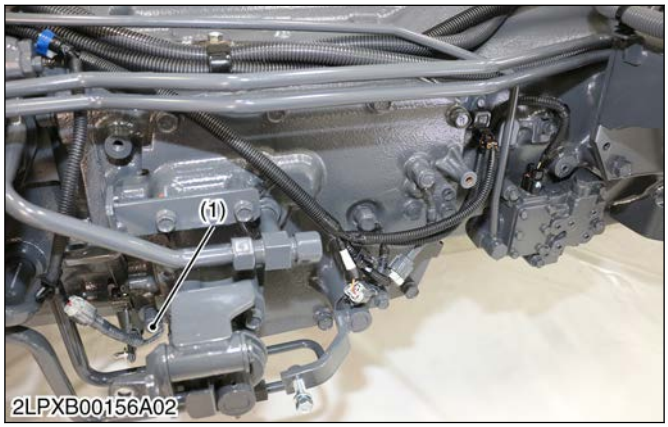



1LGKX00004A03

(1) Meter panel (2) Shuttle shift indicator

### 5.6.2.3 Function of gear lock parking detect switch

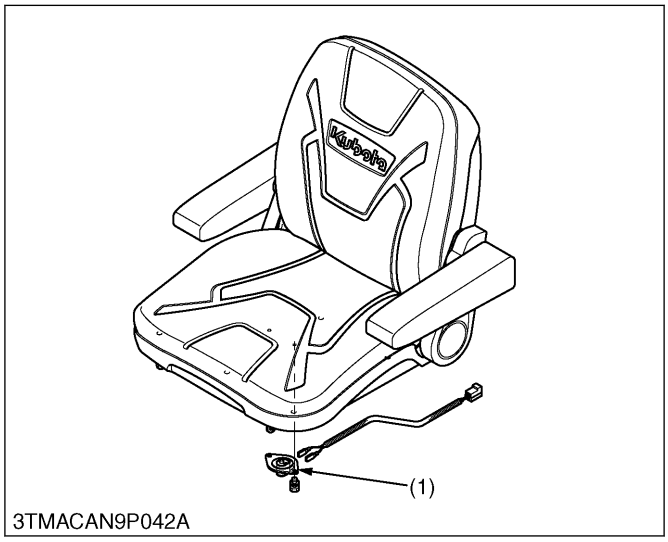
The gear lock parking detect switch (1) detects the position of gear lock parking arm.




(1) Gear lock parking detect switch

### 5.6.2.4 Function of seat switch

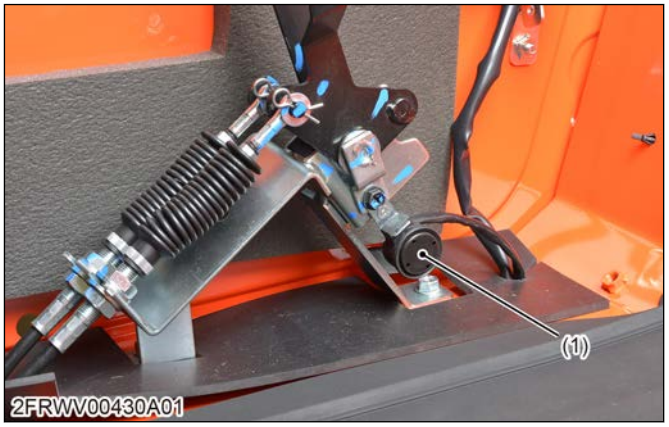
The seat switch (1) is a built-in switch of the seat and detects the seat is occupied by operator or not.




(1) Seat switch

### 5.6.2.5 Function of buzzer

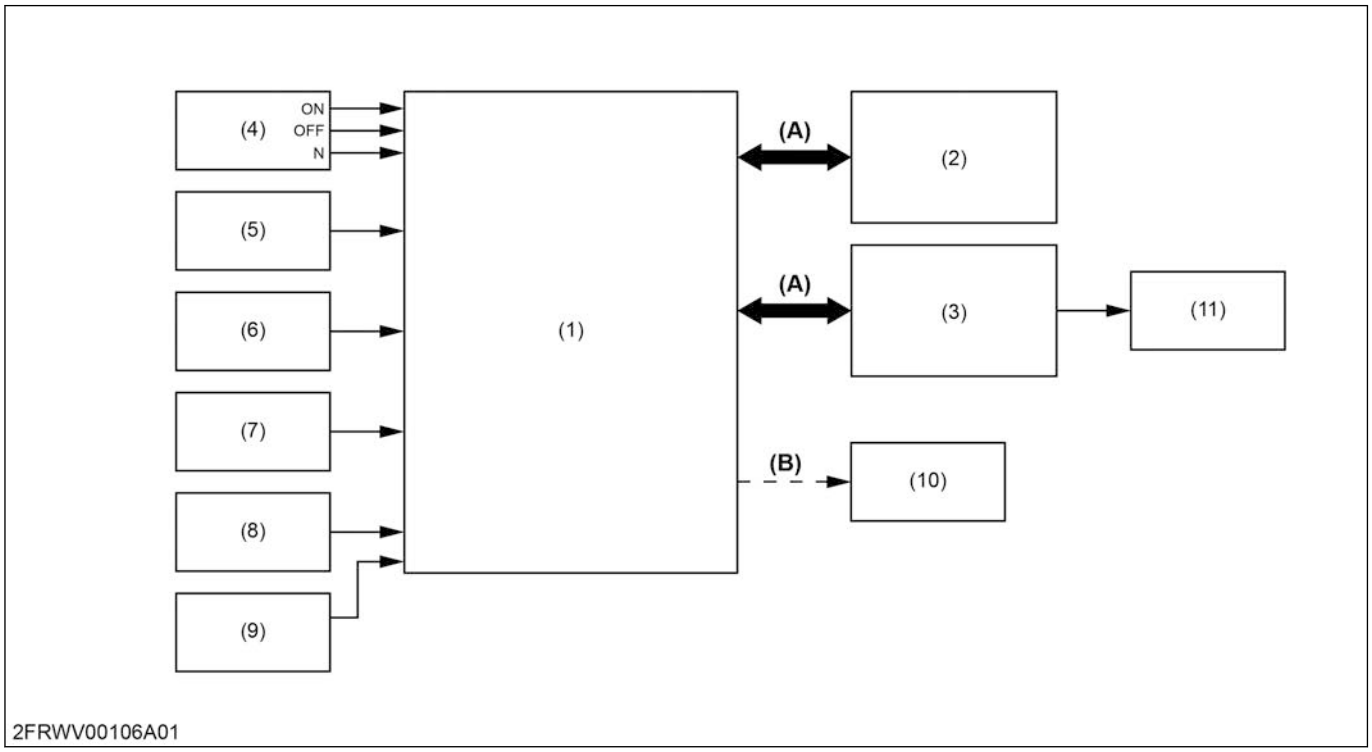
The buzzer (1) warns the operator as necessary.


(1) Buzzer

# 5.7 PTO control

## 5.7.1 Structure of PTO control




(1) Tractor ECU
(2) Meter panel
(3) Engine ECU
(4) PTO switch
(5) External PTO switch
(6) Gear lock parking detect switch
(7) Seat switch
(8) Shuttle sensor
(9) Traveling speed sensor
(10) PTO solenoid
(11) PTO indication lamp
(A) CAN communication
(B) Send signal (PTO solenoid activation)

**Engine start restriction**
When operator tries to start the engine, if PTO switch (4) or external PTO switch (5) is not N position, meter panel (2) indicates "**PTO N**" on LCD.

**PTO operation**
PTO switch (4) is turned **ON** while seat switch (7) is **ON**, tractor ECU (1) send the signal to PTO solenoid (10) and PTO starts rotating. If PTO switch (4) is turned **ON** while seat switch (7) is **OFF**, tractor ECU (1) does not send the signal to PTO solenoid (10).
PTO output is stopped when PTO switch (4) is turned to **OFF** or external PTO switch (5) is turned **OFF**.

**PTO operator presence control (OPC)**
While shuttle sensor (8) is detecting N or traveling speed sensor (9) is detecting tractor stopping tractor ECU (1) detects PTO rotating and seat switch is **OFF**, tractor ECU (1) stops the PTO rotation.

**External PTO switch operation**

**Control table**

| External PTO switch | Gear lock parking detect switch | PTO output |
|---|---|---|
| ON | OFF | OFF |
| ON (Short press) | ON | ON while external PTO switch is pressed. |
| ON (Long press) | ON | ON |

If the gear lock parking detect switch (6) is turned **OFF** while PTO output is **ON**, tractor ECU (1) stops PTO rotation.

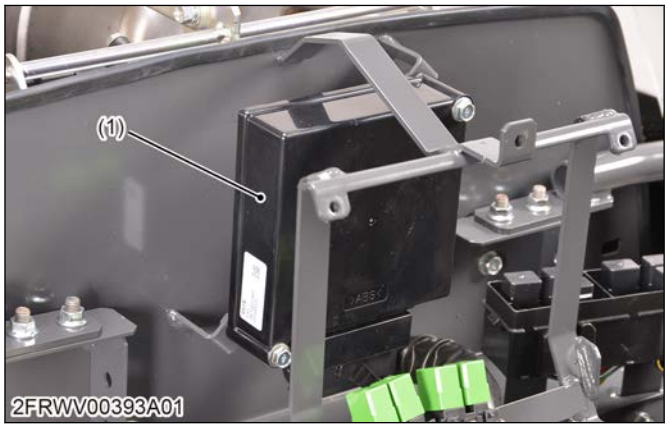
**Double pressing warning**
If external PTO switch (5) is turned **ON** while PTO switch (4) is in **ON** or **OFF**, Meter panel (2) indicates "**PTO SW BOTH**" and warns the operator.

**Fail safe function**
If tractor ECU (1) detects some failure of related switches or sensors, error indication is displayed on meter panel (2) and PTO operation is restricted.

## 5.7.2 Components

### 5.7.2.1 Function of tractor ECU

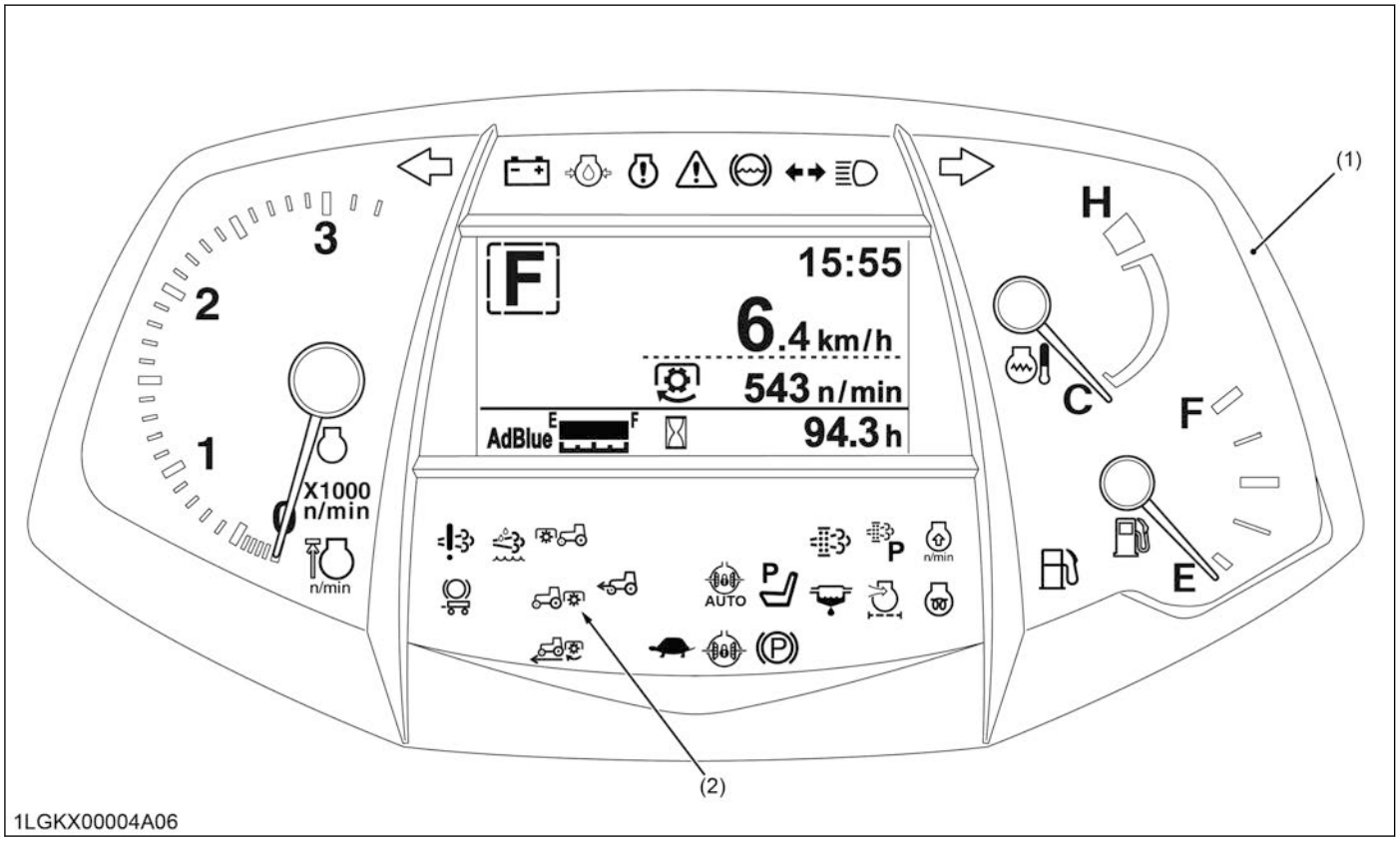
The tractor ECU (1) receives the input signals from the switches and sensors around the tractor and calculates the output signal.





(1) Tractor ECU

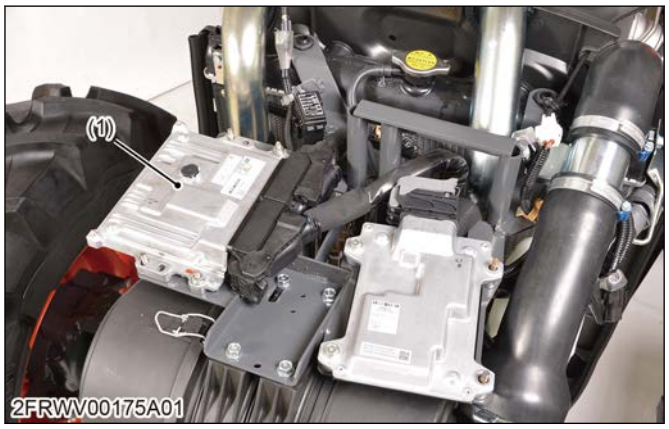
## 5.7.2.2 PTO indicator on meter panel




(1) Meter panel (2) PTO indicator

The meter panel (1) displays the tractor operating condition. When the PTO is operating, the PTO indicator (2) appears on LCD.

### 5.7.2.3 Function of engine ECU




(1) Engine ECU

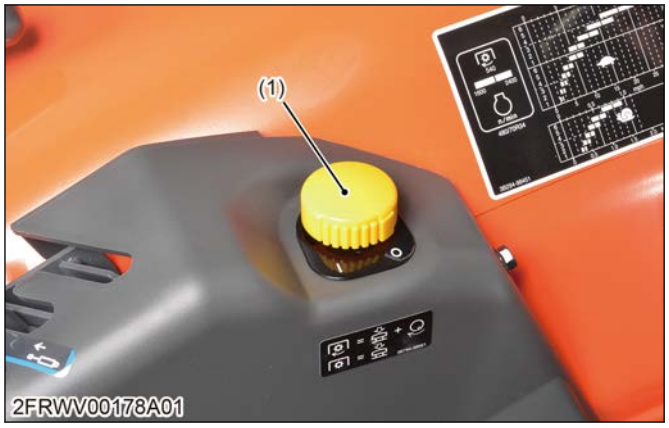
The engine ECU (1) receives the input signals from the switches and sensors around the engine and calculates the output signal.

### 5.7.2.4 Function of PTO switch

PTO switch is a switch to engage PTO.
This switch has three position. There are **N**, **OFF** and **ON**.

- When the switch is not operated, the switch is in **N** position.
- When the switch is pressed, the switch becomes **OFF** position.
- When the switch is pressed and turned counterclockwise, the switch becomes **ON** position.

The switch gets back to **N** position by itself when the switch is released.




(1) PTO switch

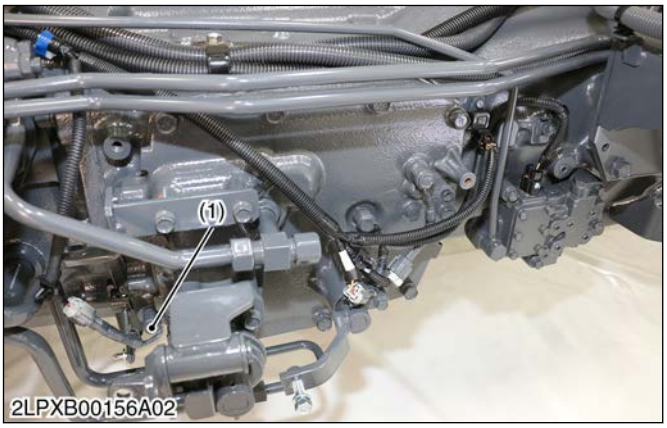
### 5.7.2.5 Function of external PTO switch

External PTO switch is a switch to engage PTO without occupying the seat.
This switch is momentary type. Only while pushing the switch, the switch is in **ON** position. Normally the switch is in **OFF** position.


(1) External PTO switch

### 5.7.2.6 Function of gear lock parking detect switch

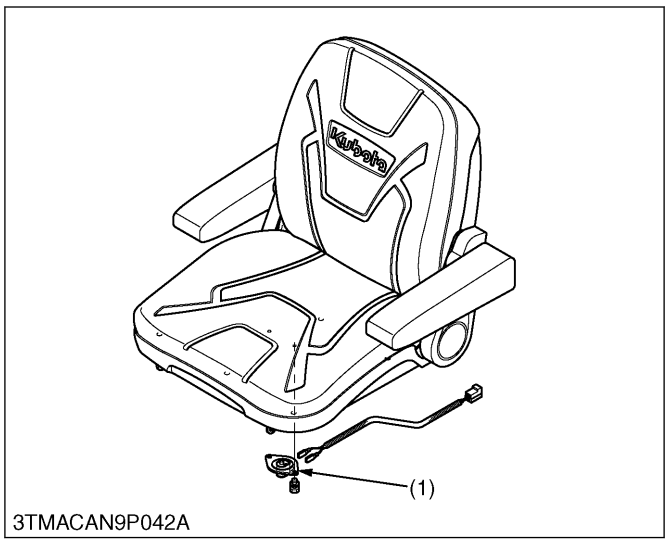
The gear lock parking detect switch (1) detects the position of gear lock parking arm.




(1) Gear lock parking detect switch

### 5.7.2.7 Function of seat switch

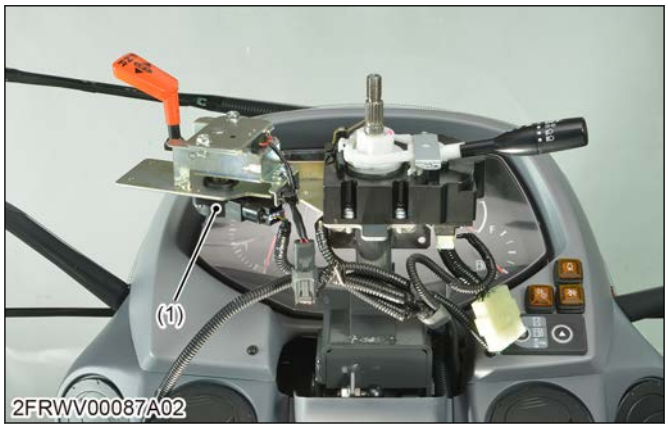
The seat switch (1) is a built-in switch of the seat and detects the seat is occupied by operator or not.




(1) Seat switch

### 5.7.2.8 Function of shuttle sensor

The value of shuttle sensor (1) is used for detecting shuttle lever position.




(1) Shuttle sensor

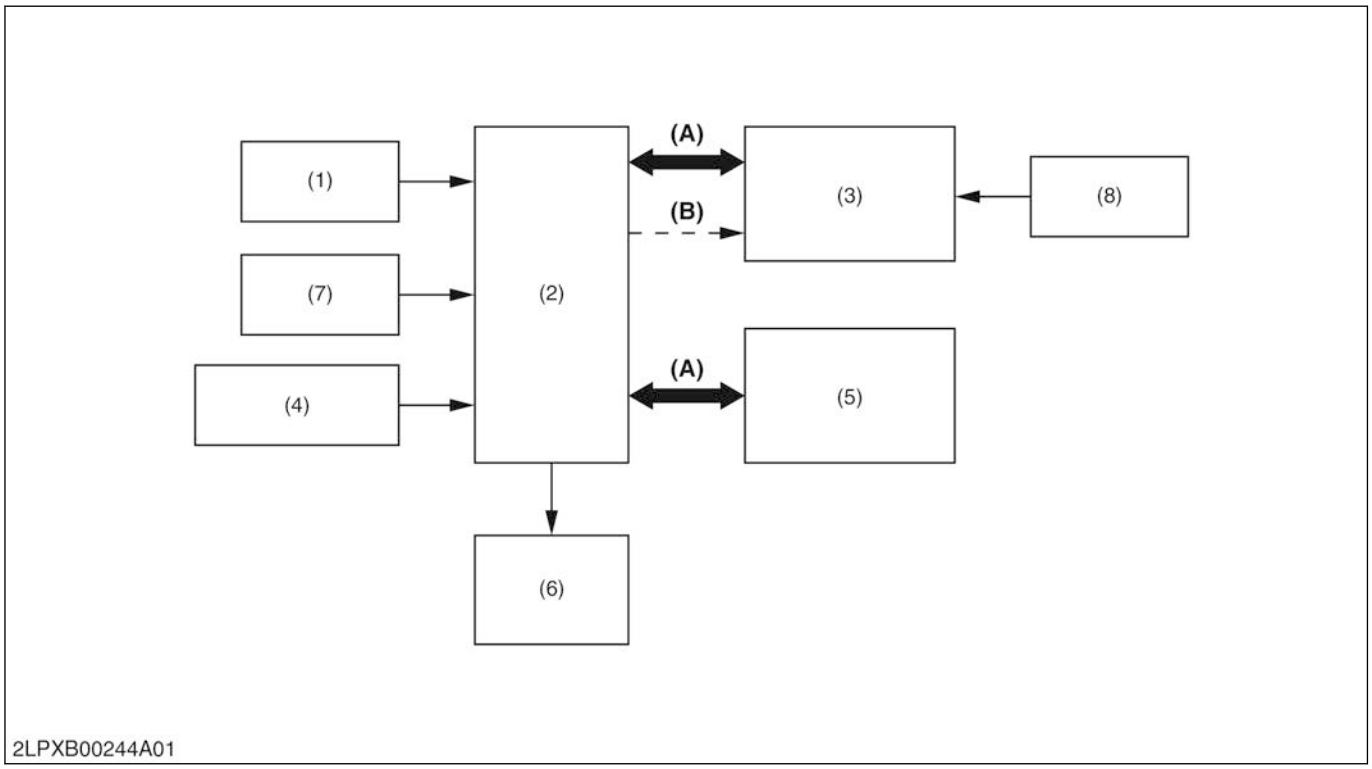
### 5.7.2.9 Traveling speed sensor


(1) Traveling speed sensor

The value of traveling speed sensor (1) is used for calculating of traveling speed. The value of this sensor is used for estimating the gear shift range (H6).

# 5.8 PTO speed limiter (If equipped 540 Economy)

## 5.8.1 Function of PTO speed limiter




(1) PTO switch
(2) Tractor ECU
(3) Engine ECU
(4) PTO speed select switch
(5) Meter panel
(6) PTO solenoid
(7) Throttle sensor
(8) Crankshaft position sensor
(A) CAN communication
(B) Send signal (Engine limit)

Move the PTO gear shift lever to "540E".turn on the PTO clutch control switch, and the rev-limiter indicator lights up on the meter panel.
If the PTO clutch control switch is turned on with the engine rpm higher than the PTO 540E limit level, the PTO clutch indicator on the meter panel starts blinking and the PTO is disabled. After a while, the engine rpm automatically drops below the PTO 540E limit level and the PTO starts functioning. At the same time, the flashing PTO clutch indicator stays **ON**.

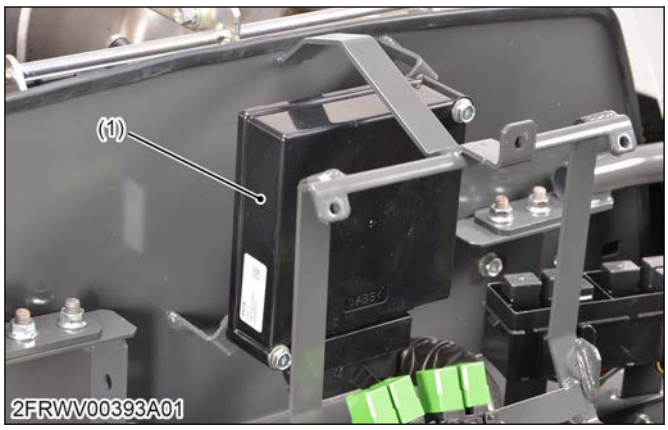
| PTO | Limitation PTO/Engine speed $min^{-1}$ (rpm) |
|---|---|
| 540E | 630/2057 |

**NOTE**
- **If the PTO clutch control switch is turned OFF but the engine rpm fails to rise with the throttle, return the engine rpm to a lower level. This enables acceleration again.**

## 5.8.2 Components

### 5.8.2.1 Function of tractor ECU

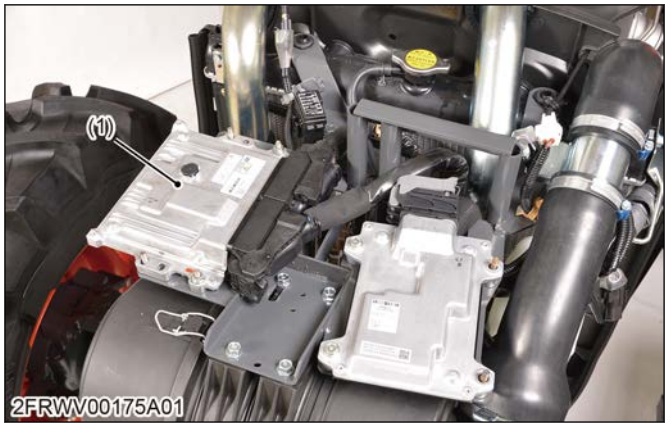
The tractor ECU (1) receives the input signals from the switches and sensors around the tractor and calculates the output signal.





(1) Tractor ECU

## 5.8.2.2 Function of engine ECU

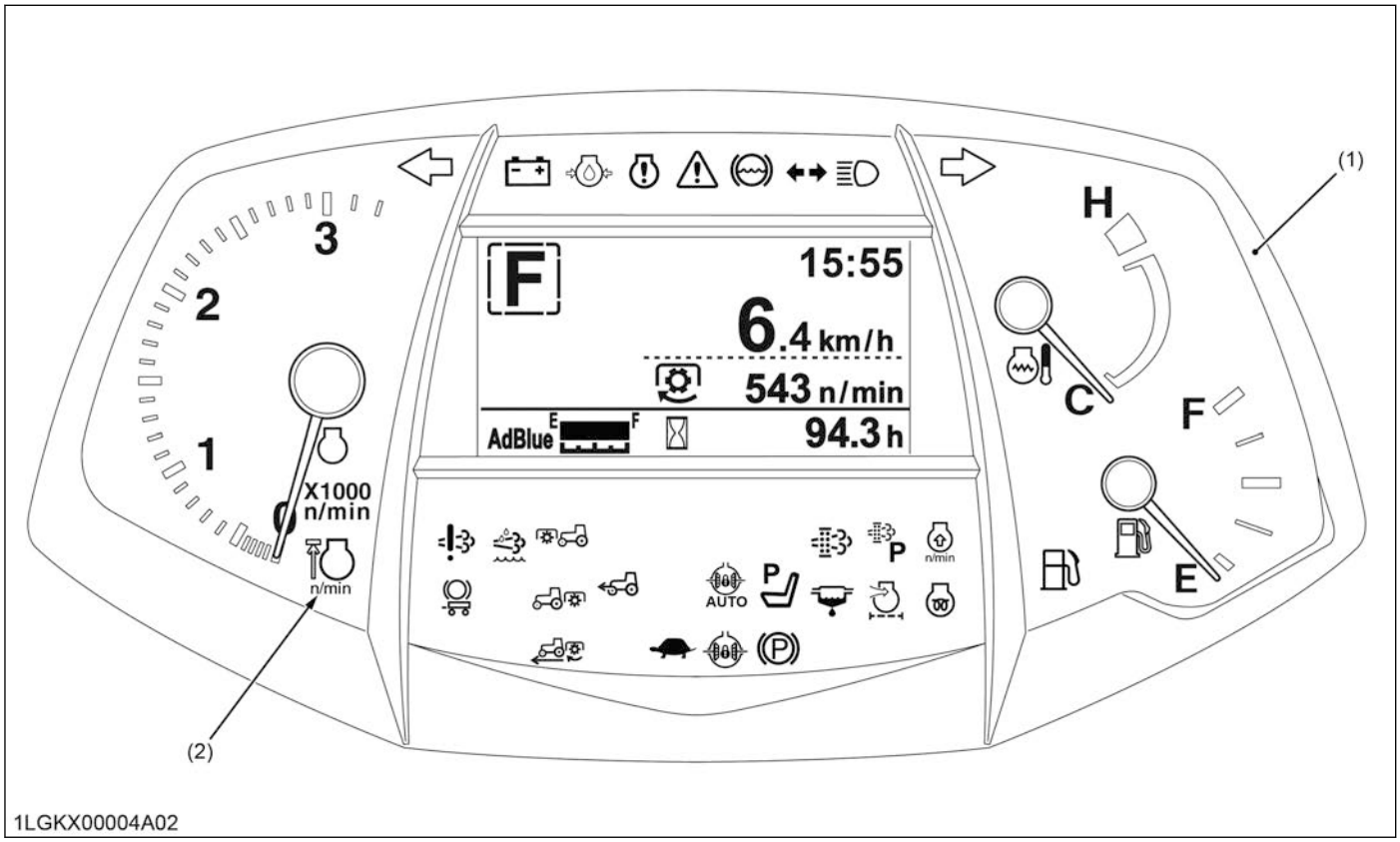



(1) Engine ECU

The engine ECU (1) receives the input signals from the switches and sensors around the engine and calculates the output signal.

### 5.8.2.3 Rev-limiter indicator on meter panel

The meter panel (1) displays the tractor operating condition. When the main and range gear shift lever is set to the H-6 position, the Rev-limiter indicator (2) illuminates.



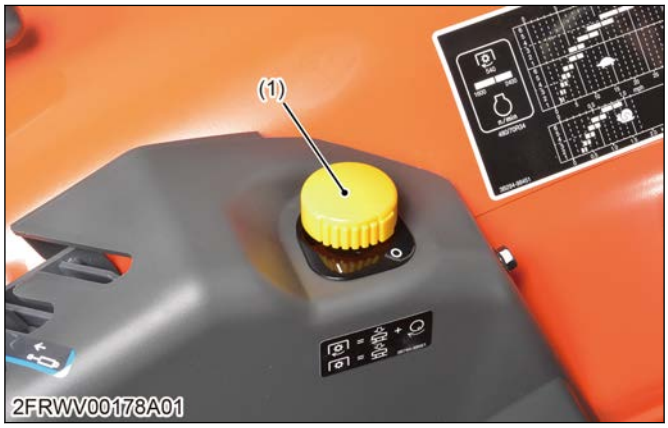

(1) Meter panel (2) Rev-limiter indicator

### 5.8.2.4 Function of PTO switch

PTO switch is a switch to engage PTO.
This switch has three position. There are **N**, **OFF** and **ON**.

- When the switch is not operated, the switch is in **N** position.
- When the switch is pressed, the switch becomes **OFF** position.
- When the switch is pressed and turned counterclockwise, the switch becomes **ON** position.

The switch gets back to **N** position by itself when the switch is released.




(1) PTO switch

### 5.8.2.5 PTO speed select switch


(1) PTO speed select switch

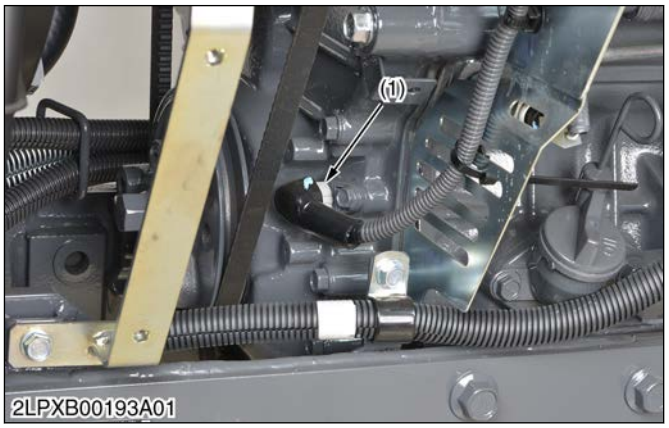
PTO speed select switch (1) checks whether PTO gear shift lever is 540 Economy position.
This switch is normal close type.

### 5.8.2.6 Throttle sensor


(1) Throttle sensor

The throttle sensor (1) detects the position of foot throttle pedal and hand throttle lever. The value of this sensor is sent to tractor ECU.

### 5.8.2.7 Crankshaft position sensor




(1) Crankshaft position sensor

The value of crankshaft position sensor (1) is used for calculating of engine rotation speed. The value of this sensor is sent to engine ECU.

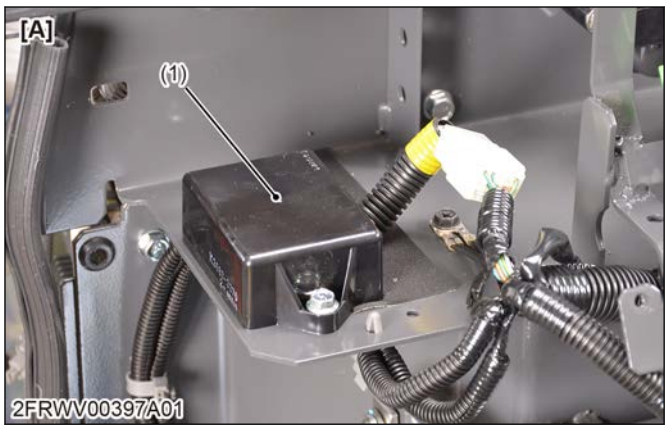
# 6. Lighting system

## 6.1 Components

### 6.1.1 Function of flasher unit

The function of flasher unit is as follows.

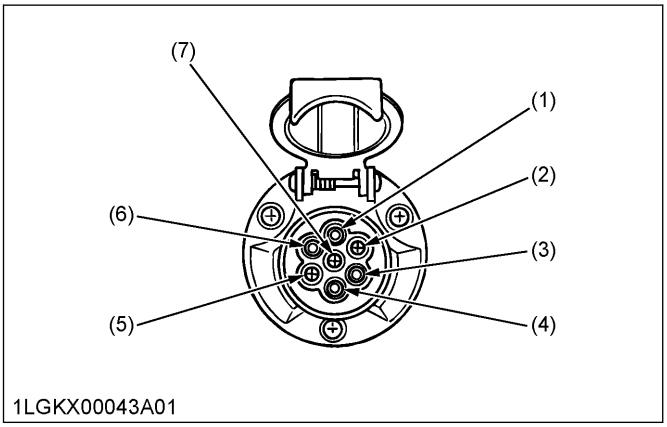
1. The flasher unit blinks the turn signal light and hazard indicator light when the hazard switch is turned on.
2. Then flasher unit blinks the turn signal light when the turn signal lever is turned clockwise or counterclockwise.
3. The flasher unit lights the position light when the light switch is turned on (Lo or Hi).
4. The flasher unit lights the position light when the position light switch is turned on.





(1) Flasher unit
[A] ROPS model
[B] Cabin model

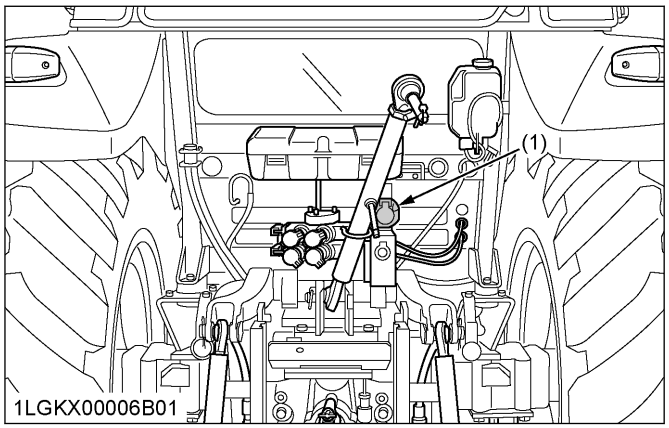
### Function of each terminal in trailer electrical outlet




| Terminal | Function |
|---|---|
| (1) | Turn signal light (L.H) |
| (2) | — |
| (3) | Ground |
| (4) | Turn signal light (R.H.) |
| (5) | Tail light<br>Side marker light<br>Parking light |
| (6) | Brake stop light |
| (7) | Registration plate light |

# 7. Trailer electrical outlet

A trailer electrical outlet is supplied for use with trailer or implement.




(1) Trailer electrical outlet

# SERVICING

## 1. Troubleshooting for electrical system

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| All electrical equipment do not operate | 1. Battery discharged or damaged | Recharge or replace | 10-93 |
| | 2. Battery positive cable disconnected or improperly connected | Repair or replace | 10-93 |
| | 3. Battery negative cable disconnected or improperly connected | Repair or replace | 10-93 |
| | 4. Slow blow fuse blown | Replace | 2-59<br>2-60 |
| Fuse blown frequently | 1. Short-circuited | Repair or replace | — |

**Battery**

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Battery discharges too quickly | 1. Battery damaged | Replace | 10-93 |
| | 2. Alternator damaged | Repair or replace | 10-109<br>10-109<br>10-109 |
| | 3. Wiring harness disconnected or improperly connected (between battery positive terminal and alternator B terminal) | Repair or replace | — |
| | 4. Cooling fan belt slipping | Adjust tension | 2-29 |

**Starting system**

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Starter motor does not operate | 1. Battery discharged or damaged | Recharge or replace | 10-93 |
| | 2. Slow blow fuse blown | Replace | 2-59<br>2-60 |
| | 3. Starter relay damaged | Replace | 10-164<br>10-165<br>10-165 |
| | 4. PTO switch damaged | Repair or replace | 10-106<br>10-106 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Starter motor does not operate | 5. Wiring harness disconnected or improperly connected | Repair or replace | — |
| | 6. Starter motor damaged | Repair or replace | 10-179 |
| | 7. Main switch damaged | Replace | 10-99<br>10-100<br>10-100<br>10-100<br>10-101<br>10-101<br>10-101<br>10-102<br>10-102<br>10-102 |

**Air heater**

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Air heater does not heat | 1. Slow blow fuse blown | Replace | 2-59<br>2-60 |
| | 2. Air heater relay damaged | Replace | 10-163<br>10-164 |
| | 3. Air heater damaged | Replace | 2-47 |

**Lighting system**

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Head light does not light | 1. Fuse blown | Replace | 2-57<br>2-57 |
| | 2. Bulb blown | Replace | 2-60 |
| | 3. Wiring harness disconnected or improperly connected | Repair or replace | — |
| Illumination light does not light | 1. Fuse blown | Replace | 2-57<br>2-57 |
| | 2. Meter panel damaged | Replace | 10-110 |
| | 3. Wiring harness disconnected or improperly connected | Repair or replace | — |
| Tail light does not light | 1. Fuse blown | Replace | 2-57<br>2-57 |
| | 2. Wiring harness disconnected or improperly connected | Repair or replace | — |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Hazard light does not light | 1. Fuse blown | Replace | 2-57<br>2-57 |
| | 2. Bulb blown | Replace | 2-60<br>2-60 |
| | 3. Flasher unit damaged | Replace | 10-173<br>10-173 |
| | 4. Hazard switch damaged | Replace | 10-172<br>10-173 |
| | 5. Turn signal switch damaged | Replace | 10-170<br>10-171<br>10-171<br>10-172 |
| Hazard and turn signal indicator lamp does not light | 1. Meter panel damaged | Replace | 10-110 |
| | 2. Wiring harness disconnected or improperly connected | Repair or replace | — |
| Hazard and turn signal light does not go ON and OFF | 1. Flasher unit damaged | Replace | 10-173<br>10-173 |
| Work light does not light | 1. Fuse blown | Replace | 2-57<br>2-57 |
| | 2. Bulb blown | Replace | 2-60<br>2-60 |
| | 3. Wiring harness disconnected or improperly connected | Repair or replace | — |
| Brake light does not light | 1. Fuse blown | Replace | 2-57<br>2-57 |
| | 2. Bulb blown | Replace | 2-60<br>2-60 |

**Horn**

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Horn does not sound when horn button is pushes | 1. Horn switch damaged | Replace | — |
| | 2. Horn damaged | Replace | — |
| | 3. Wiring harness disconnected or improperly connected (between combination switch terminal H terminal and horn) | Repair or replace | — |

**Easy Checker™**

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Engine oil pressure lamp lights up when engine is operating | 1. Engine oil pressure too low | Repair | 3-42 |
| | 2. Engine oil insufficient | Fill | 2-24 |
| | 3. Engine oil pressure switch damaged | Replace | 3-42 |
| | 4. Short circuit between engine oil pressure switch lead and chassis | Repair | - |
| | 5. Circuit in meter panel damaged | Replace | 10-110 |
| Engine oil pressure lamp does not light when main switch is turned ON and engine is not operating | 1. Meter panel damaged | Replace | 10-110 |
| | 2. Engine oil pressure switch damaged | Replace | 3-42 |
| | 3. Wiring harness disconnected or improperly connected (between meter panel and engine oil pressure switch) | Repair or replace | — |
| | 4. Circuit in meter panel damaged | Replace | 10-110 |
| Charge lamp does not go OFF when engine is operating | 1. Alternator damaged | Repair or replace | 10-109<br>10-109<br>10-109 |
| | 2. Short circuit between alternator terminal L and chassis | Repair | — |
| | 3. Circuit in meter panel damaged | Replace | 10-110 |
| Charge lamp does not light when main switch is turned ON | 1. Wiring harness disconnected or improperly connected (between meter panel and alternator) | Repair or replace | — |
| | 2. Circuit in meter panel damaged | Replace | 10-110 |
| PTO lamp lights up when PTO switch is OFF position | 1. PTO switch is damaged | Replace | 10-106<br>10-106 |
| PTO lamp does not light up when PTO switch is ON position | 1. PTO switch is damaged | Replace | 10-106<br>10-106 |
| | 2. Meter panel damaged | Replace | 10-110 |
| Fuel level indicator lamp lights up | 1. Fuel insufficient | Fill | 2-13 |
| | 2. Fuel level sensor damaged | Replace | 10-157<br>10-158 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Fuel level indicator lamp lights up | 3. Short circuit between fuel unit lead and chassis | Repair | — |
| | 4. Circuit in meter panel damaged | Replace | 10-110 |
| Fuel level indicator lamp does not light when fuel tank is empty | 1. Fuel level sensor damaged | Replace | 10-157<br>10-158 |
| | 2. Wiring harness disconnected or improperly connected (between meter panel and fuel unit) | Repair or replace | — |
| | 3. Circuit in meter panel damaged | Replace | 10-110 |
| Coolant temperature indicator does not light when water temperature gauge points to H (Red zone) | 1. Fuse blown | Replace | 2-57<br>2-57 |
| | 2. Coolant temperature sensor is damaged | Replace | 10-148<br>10-148 |
| | 3. Wiring harness disconnected or improperly connected (between panel and coolant temperature sensor) | Repair or replace | — |
| | 4. Circuit in meter panel is damaged | Replace | 10-110 |
| 4WD indicator lamp lights up when 4WD is not engaged | 1. 4WD switch is damaged | Replace | 10-129<br>10-130<br>10-130<br>10-131 |
| 4WD indicator lamp does not light when 4WD is engaged | 1. 4WD switch is damaged | Replace | 10-129<br>10-130<br>10-130<br>10-131 |
| Air cleaner clogged lamp lights up | 1. Air cleaner clogged | Clean or replace | 2-29<br>10-162<br>10-162 |

**4WD**

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Front wheel does not drive when 4WD switch is turned ON | 1. 4WD switch or wiring harness is damaged | Replace | 10-129<br>10-130<br>10-130<br>10-131 |
| Front wheel drive not be canceled | 1. 4WD switch or wiring harness is damaged | Repair or replace | 10-129<br>10-130<br>10-130<br>10-131 |

### Gauges

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Fuel gauge does not function | 1. Fuel level sensor damaged | Replace | 10-157<br>10-158 |
| | 2. Wiring harness disconnected or improperly connected (between meter panel and fuel unit) | Repair or replace | — |
| | 3. Circuit in meter panel damaged | Replace | 10-110 |
| Coolant temperature gauge does not function | 1. Coolant temperature gauge damaged | Replace | 11-82 |
| | 2. Coolant temperature sensor damaged | Replace | 10-148<br>10-148 |
| | 3. Wiring harness disconnected or improperly connected (between meter panel and coolant temperature sensor) | Repair or replace | — |
| | 4. Circuit in meter panel damaged | Replace | 10-110 |

### LCD monitor

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Nothing is displayed in LCD | 1. Battery discharged or damaged (Battery voltage is below 10 V) | Recharge or replace | 10-93 |
| | 2. Slow blow fuse blown | Replace | 2-59<br>2-60 |
| | 3. Meter panel connector disconnect | Connect | 10-110 |
| | 4. Meter panel damaged | Replace | 10-110 |
| Indication on LCD does not change when pushing the display select switch | 1. Display select switch damaged | Replace | 10-176<br>10-177 |
| | 2. Wiring harness disconnected | Repair | — |
| Traveling speed is not indicating | 1. Wiring harness disconnected | Repair | — |
| | 2. Traveling speed sensor damaged | Replace | 10-133<br>10-133 |
| PTO speed in not indicating | 1. Wiring harness disconnected | Repair | — |

# 2. Servicing specifications for electrical system

### Starter motor

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Commutator | O.D. | 32.0 mm<br>1.26 in. | 31.4 mm<br>1.24 in. |
| Mica | Undercut | 0.50 to 0.80 mm<br>0.020 to 0.031 in. | 0.2 mm<br>0.0079 in. |
| Brush | Length | 18.0 mm<br>0.709 in. | 11.0 mm<br>0.433 in. |

### Air heater

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Air heater | Resistance | Approx. 0.3 Ω | — |

### Alternator

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Brush | Length | 18.5 mm<br>0.728 in. | 5.0 mm<br>0.20 in. |
| Slip ring | O.D. | 22.7 mm<br>0.894 in. | 22.1 mm<br>0.870 in. |

### Fuel level sensor

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Float at uppermost position | Resistance | 3.0 to 5.0 Ω | — |
| Float at lowermost position | Resistance | 107.5 to 112 Ω | — |

### Coolant temperature sensor

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Coolant temperature at 120 ℃ (248 ℉) | Resistance | Approx. 117 Ω | — |
| Coolant temperature at 100 ℃ (212 ℉) | Resistance | Approx. 189 Ω | — |
| Coolant temperature at 80 ℃ (176 ℉) | Resistance | Approx. 290 to 354 Ω | — |
| Coolant temperature at 50 ℃ (122 ℉) | Resistance | Approx. 808 Ω | — |
| Coolant temperature at 20 ℃ (68 ℉) | Resistance | Approx. 2.21 to 2.69 kΩ | — |

### Flasher unit

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Flasher blinking | Times | 85 to 95 times / minute | — |

### Solenoid valve

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| PTO solenoid valve<br>2WD solenoid valve<br>Rear differential lock solenoid valve | Resistance | 10 to 12 Ω | — |

### Dual speed solenoid valve (F36/R36 speed transmission model)

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Dual speed solenoid valve | Resistance | 10 to 12 Ω | — |

# 3. Tightening torques for electrical system

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to 2-15, 2-15.)

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Air cleaner switch | 1.0 to 1.9 | 0.10 to 0.20 | 0.73 to 1.44 |
| B terminal nut | 9.8 to 11 | 1.0 to 1.2 | 7.3 to 8.6 |
| Pulley nut (Alternator) | 58.4 to 78.9 | 5.95 to 8.05 | 43.1 to 58.2 |

# 4. Checking and adjusting

## 4.1 Checking, setting and adjusting by using instrument panel

It is possible to do the following programs by using instrument panel.

Tester function and self diagnosis

- Checking sensors output voltage easily.
  Verifying the sensor signal by comparing with the data memorized in ECU.

Error information

- Check or clear the error information.

Setting

- Setting the tractor model, block heater.

Adjusting

- Inputting the various data to ECU.

## 4.1.1 Mode and item selection

### 4.1.1.1 Selecting mode and item

**WARNING**

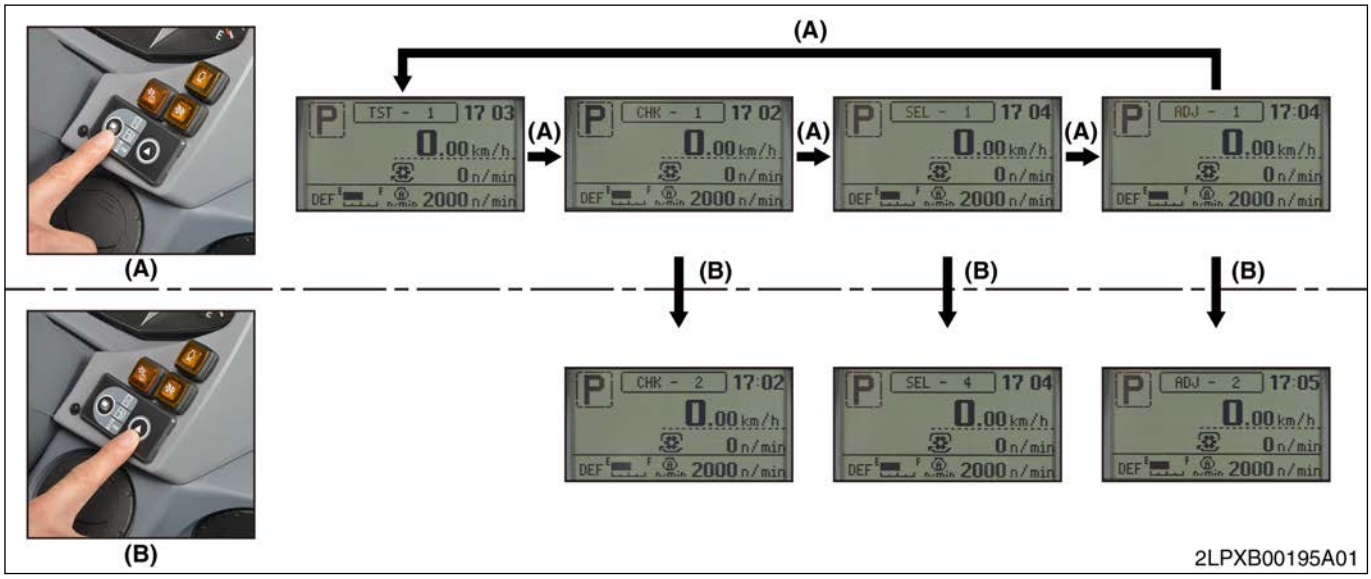
- **To perform the testing of the electronic instrument panel, operator must be seated on the tractor.**
- **When performing this testing, be sure to set shuttle lever, range and main gear shift levers to neutral and apply parking brake.**

Set the Shuttle lever position to Neutral.


(1) Mode selector switch (2) Select switch

1. Turn the main key switch **ON** while pressing both the mode selector switch (1) and the select switch (2). Master system warning indicator lights up.
2. Release both the switches (1), (2) once.
3. Press and hold both the switches (1), (2) again while master system warning indicator is lighting. "**SW-OFF**" is blinking on the top of LCD.
4. Release both the switches (1), (2). "**Item Number**" is indicated on the LCD ("**TST-1**" is displayed on the top of LCD.)

5. Press the mode selector switch (1) to change the "**Mode**". Press the select switch (2) to change the "**Item Number**".




(A) Press the mode selector switch (1).
(B) Press the select switch (2).

The mode displayed on LCD is changed.

| Mode | Item number | Mode name | Item name |
|---|---|---|---|
| TEST | "**TST-1**" | Tester function<br>Self diagnosis | Checking the each sensor value<br>Checking the each switch condition |
| CHK | "**CHK-1**" | Error Information | Checking the error code history |
| | "**CHK-2**" | | Clearing the error code history |
| SEL | "**SEL-1**" | Setting | Setting the tractor specification |
| | "**SEL-4**" | | Setting the block heater |
| | "**SEL-5**" | | Setting the front PTO |
| | "**SEL-6**" | | Setting the trailer brake |
| ADJ | "**ADJ-1**" | Calibration | Adjusting the throttle sensor |
| | "**ADJ-2**" | | Adjusting the shuttle sensor |
| | "**ADJ-4**" | | Adjusting the brake sensor |

6. The desired "**Item Number**" is displayed, press and hold the select switch (2).
Desired mode is selected.

## 4.1.2 Mode “TST”

### 4.1.2.1 Checking the each sensor value and switch condition TST-1

Select the item number “**TST-1**”.


(1) Mode selector switch (2) Select switch

Sensor data is displayed in 4 column on the LCD.
“**TST-1**” mode has two kind of function. One is “**checking the each sensor value**”, and the other one is “**checking the each switch condition**”.

1. Press the mode selector switch (1) for “**checking the each sensor value**”.
   The sensor value displayed on LCD is changed.

| Sensor number | Sensor name | Unit | Remark |
|---|---|---|---|
| T1 | Accelerator sensor (Main) | Voltage | |
| T2 | Accelerator sensor (Sub) | Voltage | |
| T3 | Engine revolution | n/min | |
| T4 | Shuttle revolution | n/min | |
| T5 | Engine coolant temperature | Celcius degree | |
| T6 | Fuel level sensor voltage | Voltage | |
| T7 | Battery voltage | Voltage | |
| T8 | PTO revolution | n/min | |
| T9 | PM sedimentation quantity 1 | Gram | DPF regeneration request trigger 1 |
| T10 | PM sedimentation quantity 2 | Gram | DPF regeneration request trigger 2 |
| T11 | Fuel quantity after regeneration | L | DPF regeneration request trigger 3 |
| T12 | Shuttle sensor (Main) | Voltage | |
| T13 | Shuttle sensor (Sub) | Voltage | |
| T21 | Brake sensor (L.H.) | Voltage | |
| T22 | Brake sensor (R.H.) | Voltage | |

2. Check the following switch conditions by operating the each switch.
   Buzzer should be sounded when the switch position is changed.

| Switch name | Reference |
|---|---|
| Shuttle switch | Buzzer beeps when shuttle neutral switch is changed to Neutral from other position. |
| Range gear shift (Hi) switch | Buzzer beeps when range shift lever is changed to H range from other position. |
| Main gear shift (6th) switch | Buzzer beeps when main shift lever is changed to 6 shift from other position. |
| Dual speed switch | Buzzer beeps when dual speed button is changed to Lo shift from Hi shift. |
| Constant RPM management switch | Buzzer beeps when constant RPM management switch is pressed. |
| 4WD switch | Buzzer beeps when 4WD switch is ON (4WD mode). |
| Brake switch (L.H.) | Buzzer beeps when left brake pedal is depressed. |
| Brake switch (R.H.) | Buzzer beeps when right brake pedal is depressed. |
| DPF INHIBIT switch | Buzzer beeps when DPF INHIBIT switch is pressed. |
| Parked regeneration switch | Buzzer beeps when parked regeneration switch is pressed. |
| PTO switch | Buzzer beeps when PTO switch is turned ON. |
| | Buzzer beeps when PTO switch is turned to neutral. |
| | Buzzer beeps when PTO switch is turned OFF. |
| PTO speed detect switch | Buzzer beeps when PTO gear shift lever is changed to 540 position from other position. |
| External PTO switch | Buzzer beeps when PTO external switch is pressed. |
| Front PTO switch | Buzzer beeps when front PTO switch is turned ON. |
| | Buzzer beeps when front PTO switch is turned to neutral. |
| | Buzzer beeps when front PTO switch is turned OFF. |
| Seat switch | Buzzer beeps when the operator sits the seat. |
| Alternator L terminal | Buzzer beeps when the coupler is connected to the alternator at engine stop condition. |
| Engine oil pressure switch | Buzzer beeps when the engine oil switch turns ON. |
| Gear lock parking lever switch | Buzzer beeps 2 times when parking gear lock lever is changed to locked position from other position. |
| Gear lock parking detect switch | Buzzer beeps 2 times when parking gear lock lever is changed to locked position from other position. |
| Trailer signal | Buzzer beeps when the trailer coupler is connected and trailer signal is ON. |
| Differential lock pedal switch | Buzzer beeps when differential lock pedal is pressed. |
| Auto differential lock switch | Buzzer beeps when auto differential lock switch is pressed. |
| RPM dual memory switch | Buzzer beeps when RPM dual memory switch is pressed either side. |
| Low beam switch - Head Light | Buzzer beeps when Low beam is turned ON. |
| High beam switch - Head Light | Buzzer beeps when High beam is turned ON. |
| Clutch off switch | Buzzer beeps when clutch off switch is pressed. |
| Secondary brake switch | Buzzer beeps when the secondary brake is applied. |
| Air cleaner switch | Buzzer beeps when the air cleaner is clogged. |
| Ground PTO switch | Buzzer beeps when the ground PTO lever is turned to ON position. |

(Continued)

| Switch name | Reference |
|---|---|
| Brake oil warning switch | Buzzer beeps when the brake oil level is turned to appropriate level from empty level. |
| 2WD clutch pressure switch | Buzzer beeps when the tractor changed to 2WD mode from 4WD mode. |

## 4.1.3 Mode “CHK”

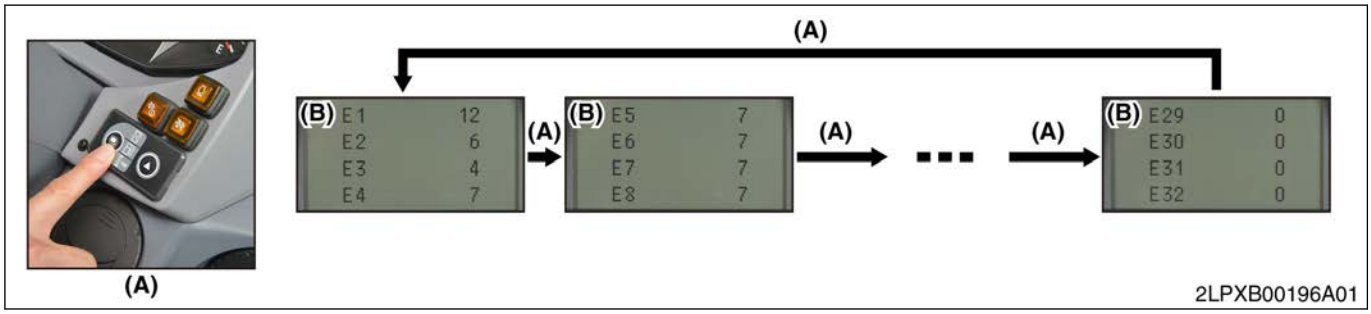
### 4.1.3.1 Checking the error history “CHK-1”

Select the item number “**CHK-1**”.


(1) Mode selector switch (2) Select switch

Error history is displayed in 4 column on the LCD and ECU memorizes total 32 error history at the maximum.

1. Press the mode selector switch (1) for "checking the other error history".




(A) Push the mode selector switch (1). (B) Sample

Latest error history is displayed from E1 on the LCD.
After pressing the mode selector switch (1) while E32 is displayed on the LCD, the latest error history (E1) is displayed again on the LCD.
The error history displayed on LCD is changed.

| Error code | Trouble content | Detail | System action |
|---|---|---|---|
| ERROR-1 | Acceleration sensor (main) trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | Engine idling |
| ERROR-2 | Acceleration sensor (sub) trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | |
| ERROR-3 | Acceleration sensor main / sub phase | Sum of sensor voltage < 3.85 V or 6.14 V ≦ sum of sensor voltage | |
| ERROR-4 | Shuttle lever sensor (main) trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | Cannot drive |
| ERROR-5 | Shuttle lever sensor (sub) trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | |
| ERROR-6 | Shuttle sensor main / sub phase shifting trouble | Sum of sensor voltage < 3.85 V or 6.14 V ≦ sum of sensor voltage | |
| ERROR-7 | Shuttle sensor signal trouble | Although shuttle lever sensor is F/R position, shuttle lever neutral switch is **ON**. | |
| ERROR-8 | Gear lock signal trouble | Although gear lock brake switch is **OFF** position, gear lock detect switch is **ON**. | − |
| ERROR-10 | Front PTO solenoid trouble | Open circuit or short circuit | Unavailable front PTO |
| ERROR-11 | PTO solenoid trouble | Open circuit or short circuit | Unavailable PTO |
| ERROR-13 | Bi-speed solenoid trouble | Open circuit or short circuit | Unavailable Bi-speed |
| ERROR-14 | Shuttle forward solenoid trouble | Open circuit or short circuit | Cannot drive |
| ERROR-15 | Shuttle reverse solenoid trouble | Open circuit or short circuit | |
| ERROR-16 | 2WD solenoid trouble | Open circuit or short circuit | Only 4WD is available |
| ERROR-17 | Diff-lock solenoid trouble | Open circuit or short circuit | Unavailable differential lock |
| ERROR-18 | Front PTO switch trouble | 2 positions are in ON at the same time | Unavailable front PTO |
| ERROR-20 | PTO switch trouble | 2 positions are in ON at the same time | Unavailable PTO |

(Continued)

| Error code | Trouble content | Detail | System action |
|---|---|---|---|
| ERROR-21 | Range gear shift (Hi) switch trouble | Switch status and estimate shift is different | Engine maximum speed is limited. |
| ERROR-22 | Main gear shift (6th) switch trouble | Switch status and estimate shift is different | |
| ERROR-23 | Shuttle rotating sensor trouble | Pulse is not detected when driving at H6 shift. | |
| ERROR-24 | Machine speed sensor trouble | Pulse is not detected when driving at H6 shift. | |
| ERROR-33 | Brake (left) sensor trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | Only 4WD is available<br>Unavailable auto differential lock |
| ERROR-34 | Brake (right) sensor trouble | Sensor voltage ≦ 0.2 V or 4.9 V ≦ sensor voltage | |
| ERROR-35 | Brake (left) signal trouble | Brake (left) sensor signal does not match brake switch condition | |
| ERROR-36 | Brake (right) signal trouble | Brake (right) sensor signal does not match brake switch condition | |
| ERROR-37 | 2WD pressure switch trouble | Switch contradiction (4WD switch is **OFF** when tractor is in 2WD mode or 4WD switch is **b** when tractor is in 4WD mode) | Unavailable 2WD |
| ERROR-ENG (ERROR-41) | Engine communication trouble | Communication breakdown more than 5 seconds | Engine loss of control |
| ERROR-ACU (ERROR-42) | ACU communication trouble | Communication breakdown more than 5 seconds | ACU loss of control |
| ERROR-ECU (ERROR-43) | ECU communication trouble or meter communication trouble | Communication breakdown more than 5 seconds | Undisplay meter panel |
| ERROR-60 | Analog reference supply voltage +5 V trouble | Short circuit of sensor voltage | Engine idling and cannot drive |
| ERROR-63 | Acceleration and engine adjustment trouble | Calibration had done incorrectly | Engine idling |
| ERROR-NET | Communication trouble | Miss connection of CAN harness or short circuit | Loss of various control |

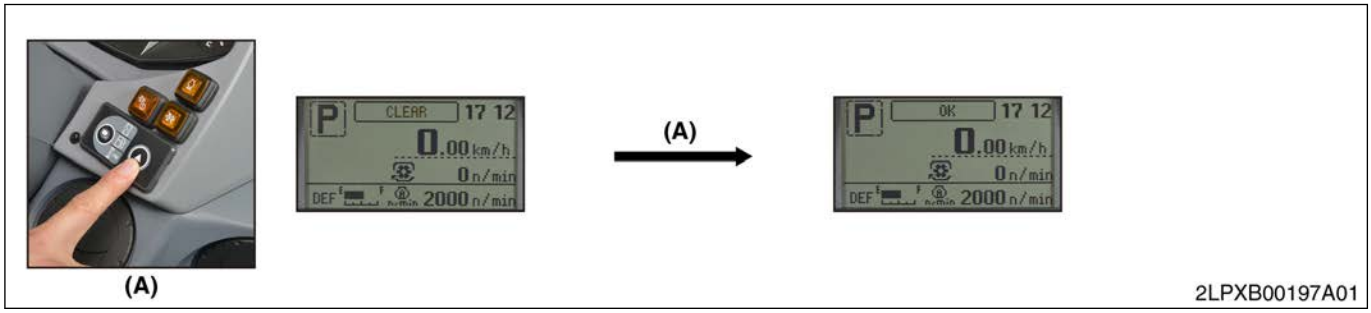
## 4.1.3.2 Clearing error history “CHK-2”

Select the item number “**CHK-2**”.


(1) Mode selector switch (2) Select switch

After selecting the “**CHK-2**”, “**CLEAR**” is displayed on the LCD.

1. Press and hold the select switch (2) for 2 seconds to clear the error history.




(A) Press and hold the select switch (2).

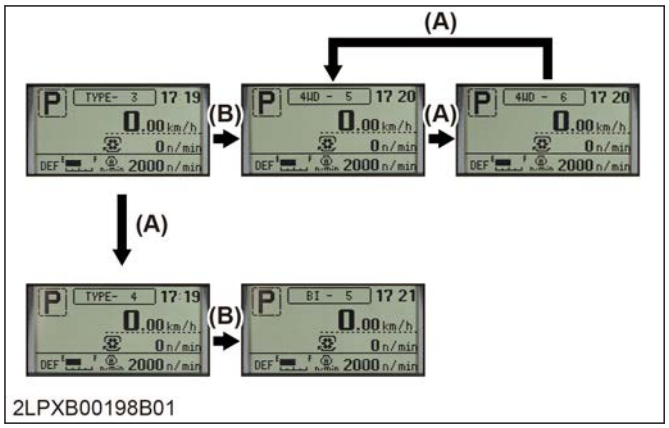
When "clearing the error history" is completed, buzzer beeps and “**OK**” is displayed on the LCD.

## 4.1.4 Mode “SEL”

### 4.1.4.1 Selecting tractor model “SEL-1”

Select the item number “**SEL-1**”.


(1) Mode selector switch (2) Select switch




(A) Push the select switch (2).
(B) Press and hold the select switch (2).
(C) Push the mode selector switch (1).

Tractor type is blinking as “**TYPE-***” on the LCD.

1. Press and hold the select switch (2) in accordance with the following table to select the tractor type “**TYPE-***”.
   a. Press the select switch (2) to select the tractor type “**TYPE-***”.

| Tractor type "TYPE-*" | Destination | Front axle type "@@@" | Front axle type | Gear shift type "#" | Gear shift |
|---|---|---|---|---|---|
| 3 | European model | 4WD | Mechanical 4 wheel drive | 5 | Main shift:6, Range shift:3 |
| | | | | 6 | Main shift:6, Range shift:3, Dual Speed |
| 4 | Main shift:6, Range shift:3, Dual Speed | BI | Bi Speed | 5 | Main shift:6, Range shift:3 |

After selecting the tractor type, buzzer beeps 2 times and tractor model “**@@@ - #**” is blinking on the LCD.

2. Press and hold the select switch (2) in accordance with the above table to select the tractor model “**@@@ - #**”.
   a. Press the mode selector switch (1) to select the front axle type “**@@@**”.
   b. Press the select switch (2) to select the gear shift type “**#**”.

   After selecting the tractor model “**@@@ - #**”, buzzer beeps and “**OK**” is displayed on the LCD.

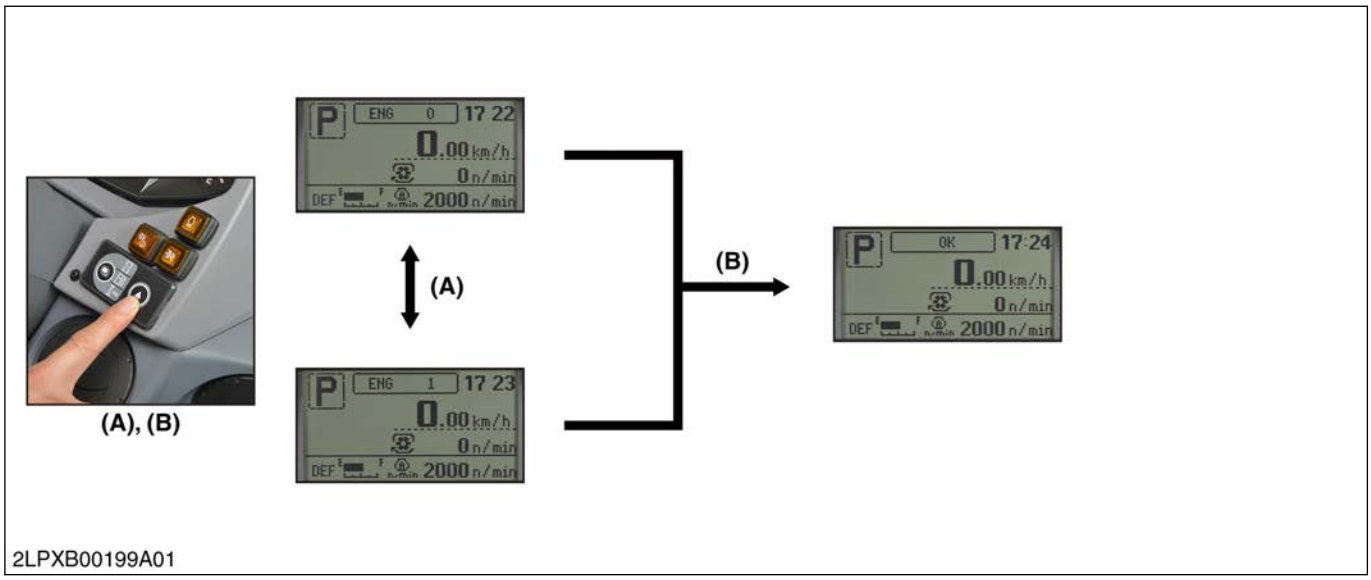
## 4.1.4.2 Selecting block heater “SEL-4”

Select the item number “**SEL-4**”.


(1) Mode selector switch (2) Select switch

Block heater setting is blinking as “**ENG @**” on the LCD.

1. Press and hold the select switch (2) in accordance with the following table to select the block heater setting “**@**”.
   a. Press the select switch (2) to select the block heater setting “**@**”.




(A) Press the select switch (2). (B) Press and hold the select switch (2).

**LCD display of block heater setting**

| Block Heater Setting“@” | Specifications |
|---|---|
| 0 | without block heater |
| 1 | with block heater |

After selecting the block heater setting “**@**”, buzzer beeps and “**OK**” is displayed on the LCD.

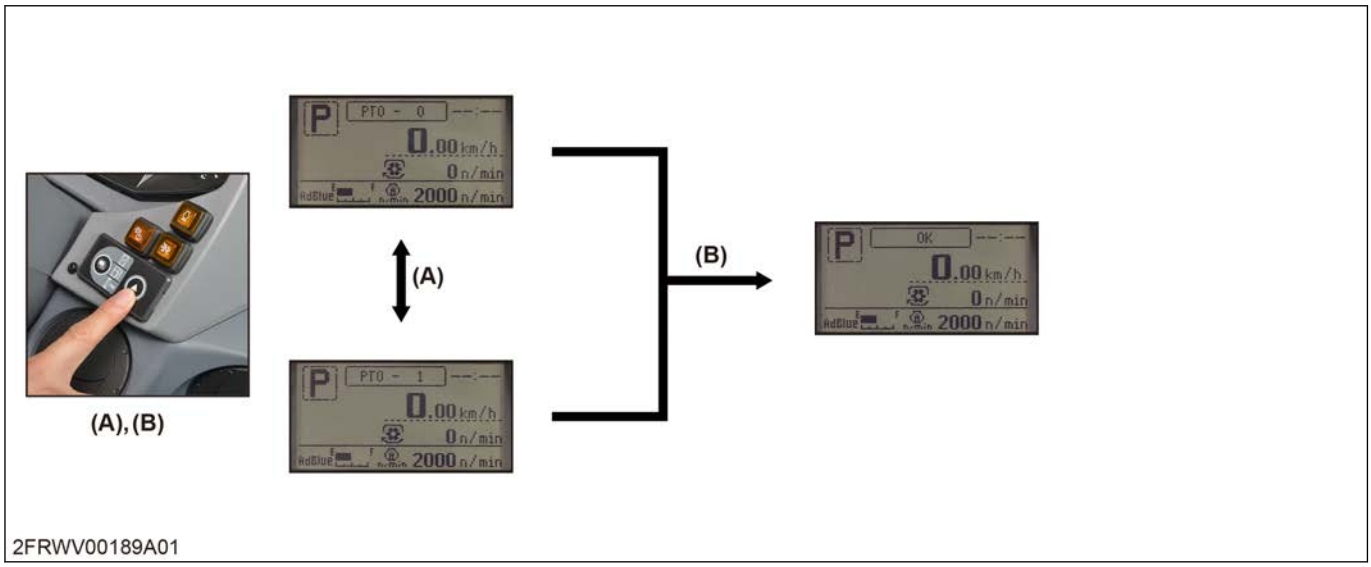
## 4.1.4.3 Selecting front PTO “SEL-5”

Select the item number “**SEL-5**”.


(1) Mode selector switch (2) Select switch

Front PTO setting is blinking as "**PTO @**" on the LCD.

1. Press and hold the select switch (2) in accordance with the following table to select the front PTO setting "**@**".
   a. Press the select switch (2) to select the front PTO setting "**@**".




(A) Press the select switch (2). (B) Press and hold the select switch (2).

**LCD display of front PTO setting**

| Front PTO Setting"@" | Specifications |
|---|---|
| 0 | without front PTO |
| 1 | with front PTO |

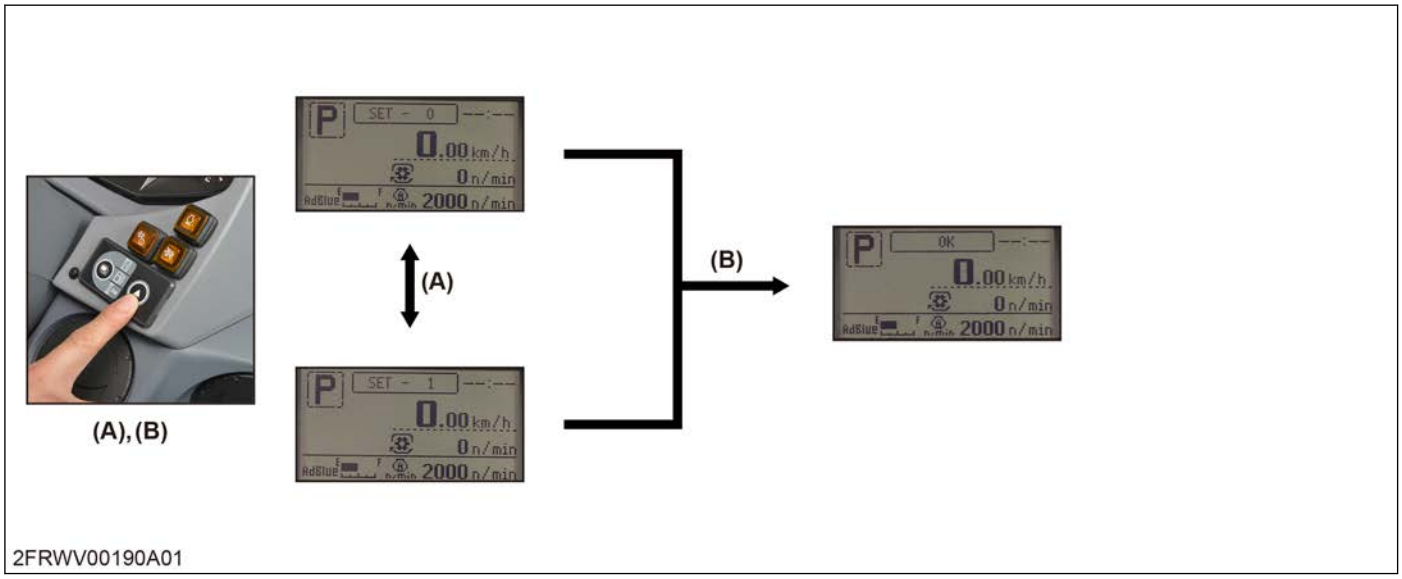
After selecting the front PTO setting "**@**", buzzer beeps and "**OK**" is displayed on the LCD.

## 4.1.4.4 Selecting trailer brake "SEL-6"

Select the item number "**SEL-6**".


Trailer brake setting is blinking as "**SET @**" on the LCD.

1. Press and hold the select switch (2) in accordance with the following table to select the trailer brake setting "**@**".
   a. Press the select switch (2) to select the trailer brake setting "**@**".




(A) Press the select switch (2).

(B) Press and hold the select switch (2).

### LCD display of trailer brake setting

| Trailer brake Setting"@" | Specifications |
|---|---|
| 0 | without trailer brake |
| 1 | with trailer brake |

After selecting the trailer brake setting "**@**", buzzer beeps and "**OK**" is displayed on the LCD.

## 4.1.5 Mode “ADJ”

### 4.1.5.1 Adjusting throttle sensor “ADJ-1”

**■ IMPORTANT**
- **Apply parking lock securely. If not, tractor may move.**

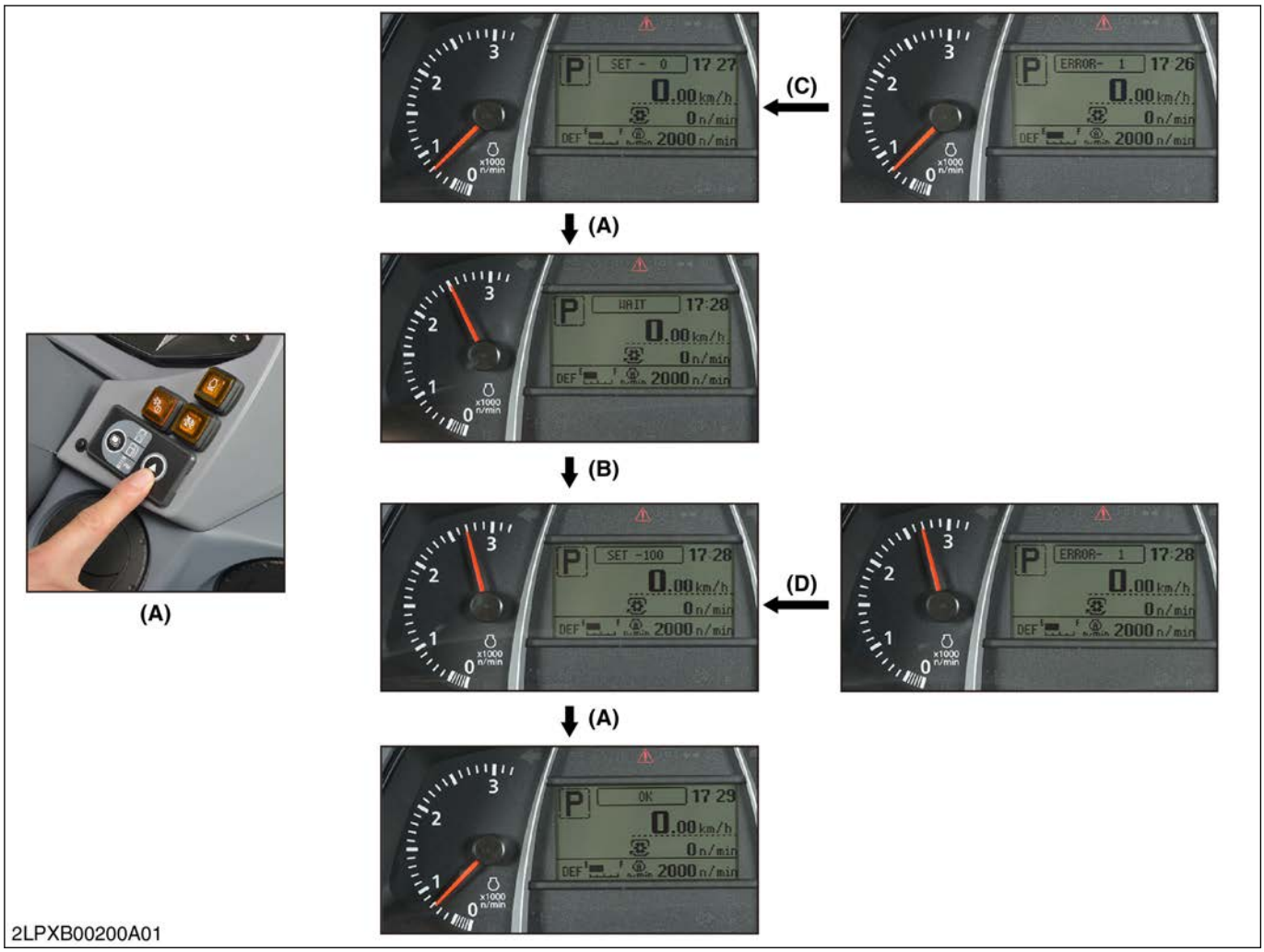
**■ NOTE**
- **Before adjusting the throttle sensor, warm up the engine.**
- **Start the engine and set the foot throttle and hand throttle lever to idling position.**
- **Set the main gear shift lever to neutral position.**

Select the item number “**ADJ-1**”.


(1) Mode selector switch (2) Select switch

“**SET-0**” is displayed on the LCD.

1. Press the select switch (2) to memorize the idling position of throttle lever to ECU.




(A) Press the select switch (2).
(B) Automatically process
(C) Set the foot throttle and hand throttle lever to idling position.
(D) Set the hand throttle lever to maximum position.

If buzzer beeps intermittent and "**ERROR-1**" is displayed on the LCD, set the foot throttle and hand throttle lever to idling position.
   a. Engine revolution automatically increases up to 90% and "**WAIT**" is displayed on the LCD.
   b. Engine revolution automatically increases furthermore up to 100% and "**ERROR-1**" is displayed on the LCD.
2. Set the hand throttle lever to maximum position.
   If buzzer beeps intermittent and "**ERROR-1**" is displayed on the LCD, set the hand throttle lever to maximum position.
   "**SET-100**" is displayed on the LCD.
3. Press the select switch (2) to memorize the maximum position of throttle lever to ECU.
   If the adjustment is incorrect, "**NG**" is displayed on the LCD, adjust this procedure again.
   Buzzer beeps and "**OK**" is displayed on the LCD.
4. Stop the engine.

## 4.1.5.2 Adjusting shuttle lever sensor "ADJ-2"

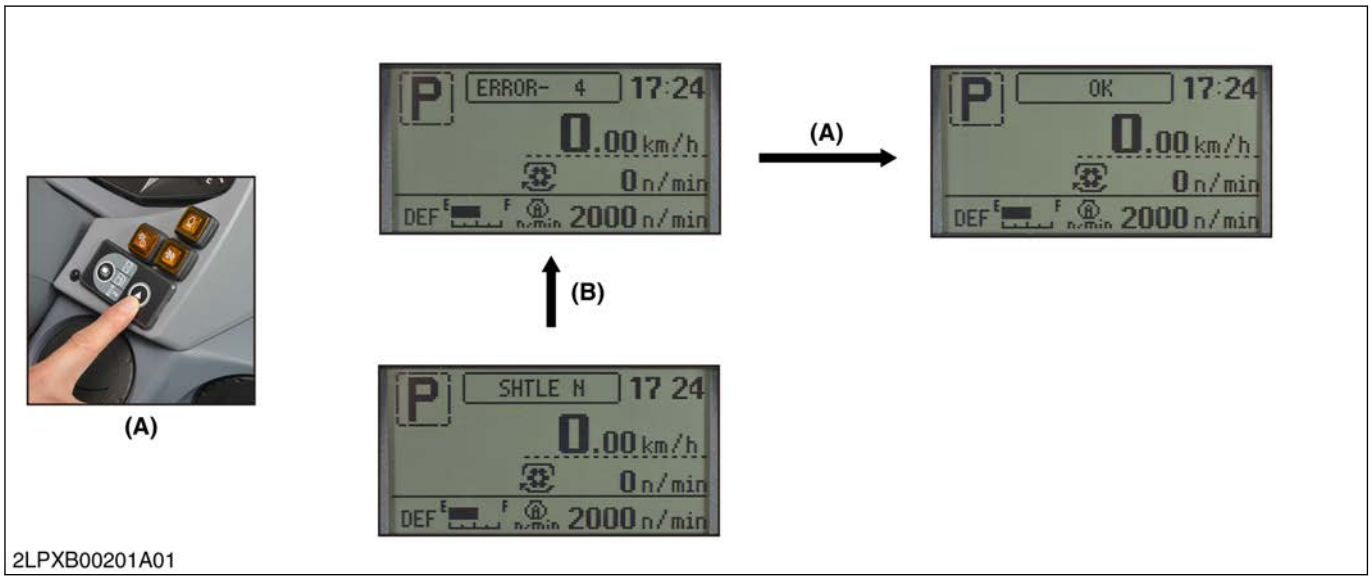
**■ NOTE**
- **Set the shuttle lever to neutral position.**

Select the item number “**ADJ-2**”.


(1) Mode selector switch (2) Select switch

“**SHUTTLE N**” is displayed on the LCD.

1. Press and hold the select switch (2) to memorize the neutral position of shuttle lever to ECU.




(A) Press and hold the select switch (2). (B) Set the shuttle lever to neutral position.

If buzzer beeps intermittent and “**ERROR-4**” is displayed on the LCD, set the shuttle lever to neutral position.
If the adjustment is incorrect, “**NG**” is displayed on the LCD, adjust this procedure again.
Buzzer beeps and “**OK**” is displayed on the LCD.

2. Stop the engine.

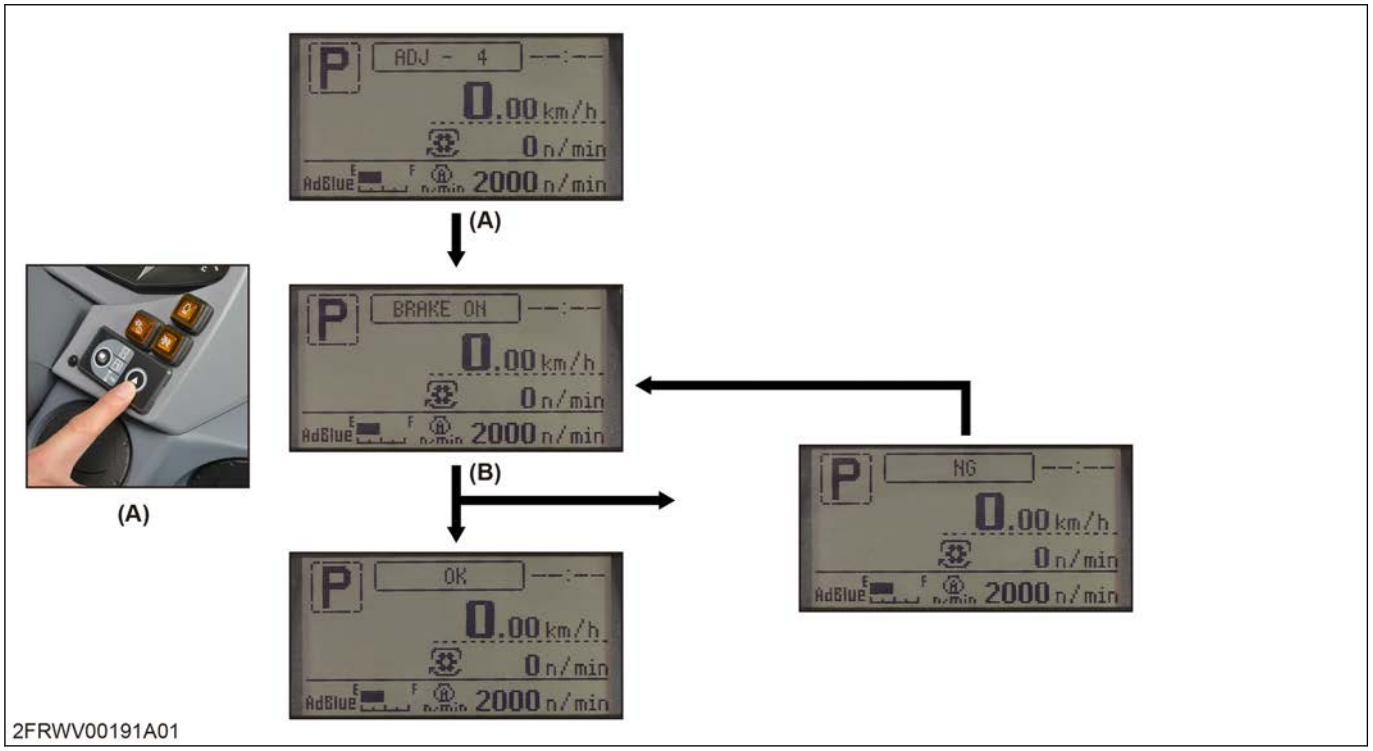
## 4.1.5.3 Adjusting brake sensor “ADJ-4”

**■ NOTE**

- **Be sure to interlock the right and left brake pedals and release both pedals.**


(1) Mode selector switch (2) Select switch

1. Select the item number "**ADJ-4**".




- "**BRAKE ON**" is displayed on the LCD.
- If any error codes are indicated on meter panel, refer the table below and check the tractor condition.

**Error codes**

| Error code number | Detail of error code |
|---|---|
| ERROR-33 | Initial condition of brake sensor (L.H.) is out of range |
| ERROR-34 | Initial condition of brake sensor (R.H.) is out of range |
| ERROR-35 | Brake switch (L.H.) is already **ON** |
| ERROR-36 | Brake switch (R.H.) is already **ON** |

2. After you make sure that “**BRAKE ON**” is displayed, depress both brake pedals very slowly together.
   - “**OK**” is displayed on meter panel.
   - If “**NG**” and any error codes are indicated on meter panel, refer to the table explaining the cause below and try again after confirming “**BRAKE ON**” is displayed again on meter panel.

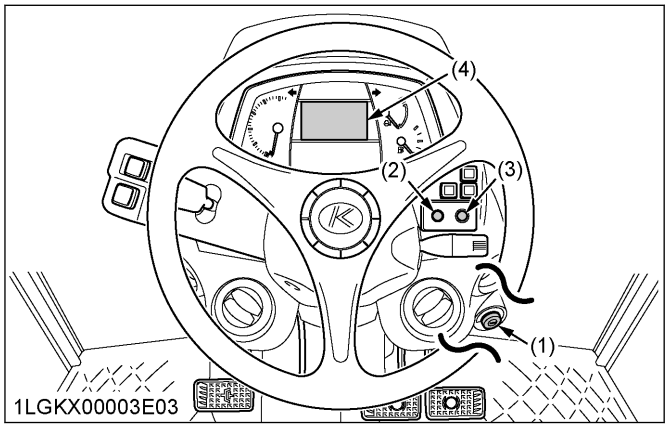
**Error codes**

| Error code number | Detail of error code |
|---|---|
| STEP-1 | Left brake pedal is depressed too quickly |
| STEP-2 | Brake switch (L.H.) turned **ON** out of the range |
| STEP-3 | Brake switch (L.H.) did not turned **ON** |
| STEP-4 | Brake switch (L.H.) turned **ON** in shallow position |
| STEP-5 | Right brake pedal is depressed too quickly |
| STEP-6 | Brake switch (R.H.) turned **ON** out of the range |
| STEP-7 | Brake switch (R.H.) did not turned **ON** |
| STEP-8 | Brake switch (R.H.) turned **ON** in shallow position |

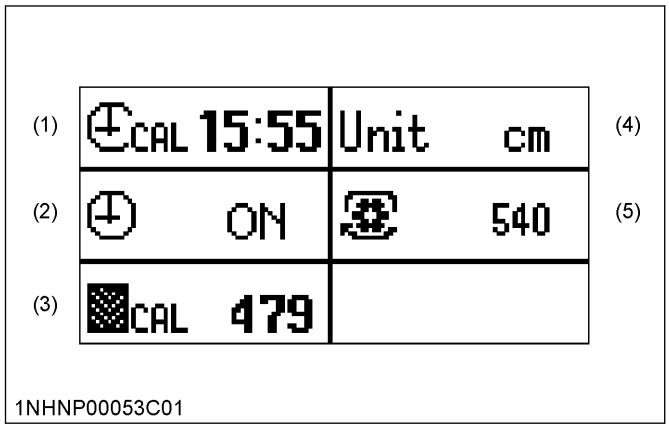
3. Turn the main key switch to **OFF** position.

## 4.1.6 Various setting mode

While pressing the mode selector switch, turn the key switch to **ON** position.
The various setting mode screen appears on the LCD monitor. The various setting mode can set 5 items.
Turn the key switch to **OFF** position to finish setting.



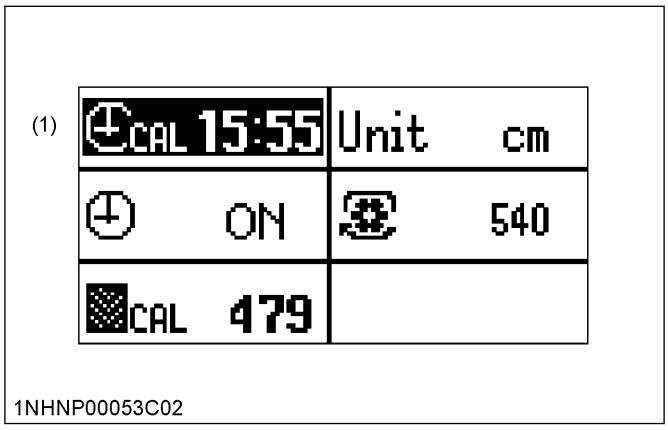

(1) Key switch
(2) Mode selector switch
(3) Select switch
(4) LCD monitor



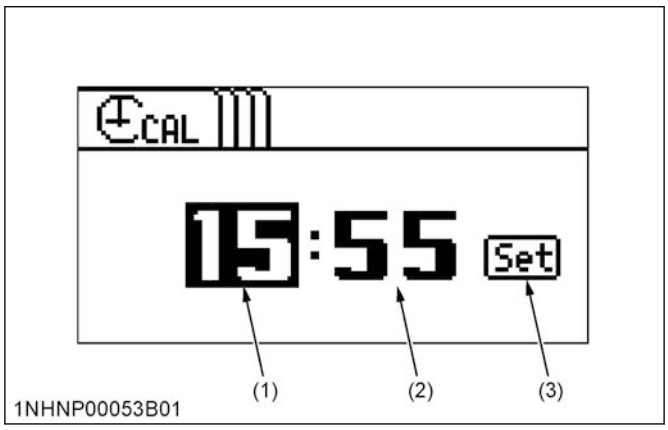

(1) Clock setting
(2) Clock ON/OFF setting
(3) Tire circumference setting
(4) Unit setting
(5) PTO speed display setting

### 4.1.6.1 Clock setting

1. Press the mode selector switch to choose clock setting.
   Then press the Select switch, and the clock setting screen appears.




(1) Clock setting

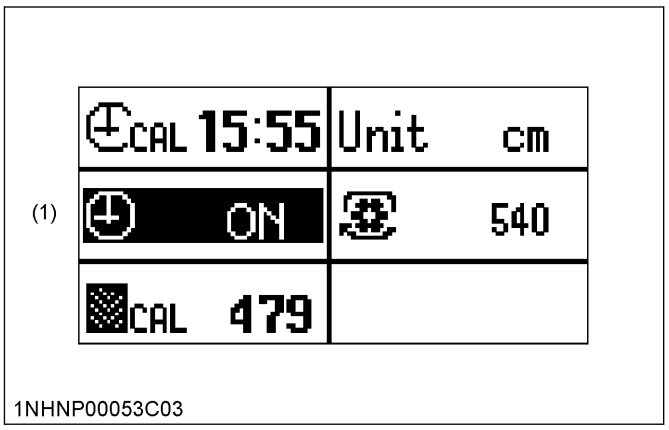



(1) Hour
(2) Minute
(3) Set switch

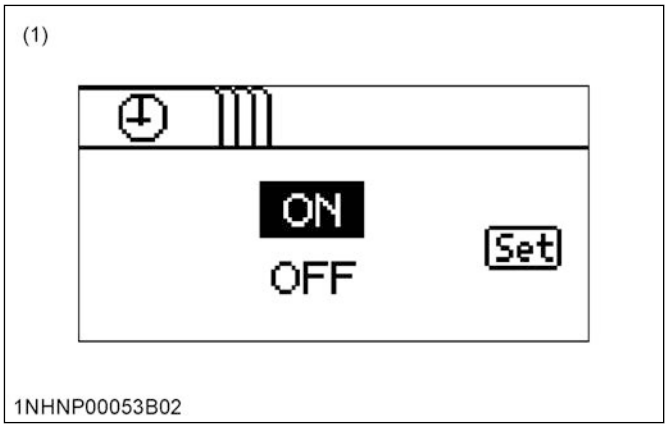
2. Setting the "Hour" of the clock:
   a. Press the mode selector switch to choose the "Hour" (highlighted).
   b. To put the clock forward, press the select switch.
3. Setting the "Minute" of the clock:
   a. Press the mode selector switch to choose the "Minute" (highlighted).
   b. Carry out the "Minute" setting in the same way as the "Hour" setting.
4. Press the mode selector switch.
5. To complete the setting, select “**Set**” with the Select switch.
   The various setting mode screen appears again.

### 4.1.6.2 Setting the clock display ON/OFF

1. Press the mode selector switch to choose "Clock ON/OFF setting".
   Then press the select switch, and the clock ON/OFF setting screen appears.




(1) Clock ON/OFF setting



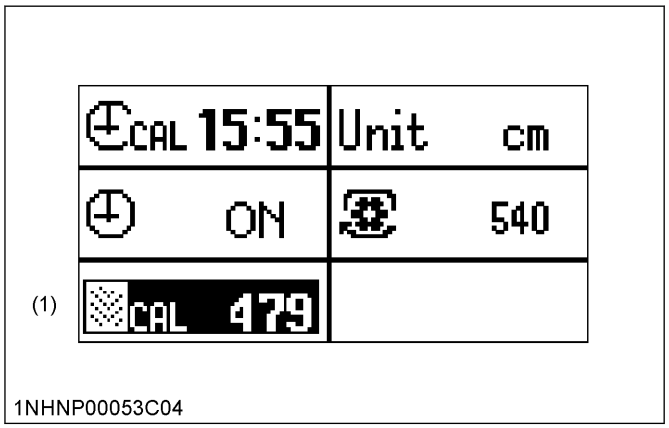

(1) Clock ON/OFF setting screen

2. Press the select switch and select **ON** or **OFF**.
3. Press the mode selector switch.
4. To complete the setting, select “**Set**” with the select switch.
   The various setting mode screen appears again.

### 4.1.6.3 Setting the tire circumference

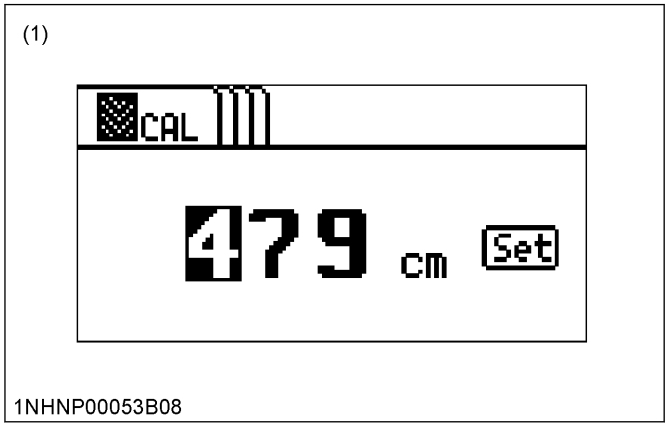
When optional different-diameter tires are fitted on the machine, the travel speed display mode must be changed. Otherwise, the travel speed will not be correctly displayed. Such mode switching is also needed when the original tires are back on the machine.

1. Press the mode selector switch to choose "Tire circumference".
   Then press the select switch, and the tire circumference setting screen appears.




1NHNP00053C04

(1) Tire circumference




1NHNP00053B08

(1) Tire circumference screen

2. According to the following table, enter the tire circumference value.
   a. Press the mode selector switch to select a digit.
   b. To put the number forward, press the select switch.
      The numeral changes from 0 to 9 at each push of the switch.

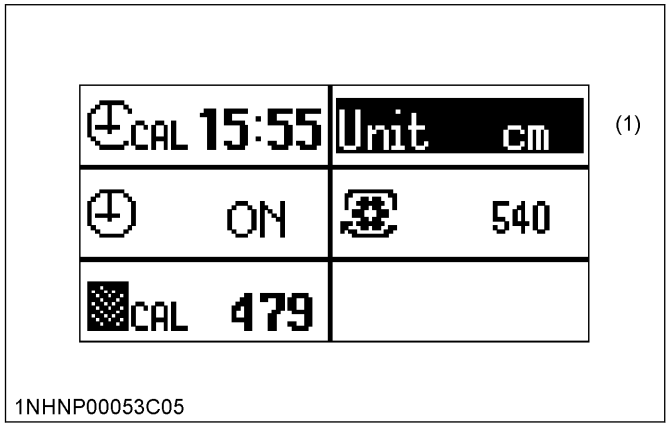
**Tire circumference table (reference)**

| Rear tire size | Entry (cm) |
|---|---|
| 420/85R30 | 455 |
| 460/85R30 | 467 |
| 340/85R38 | 469 |
| 420/85R34 | 474 |
| 480/70R30 | 442 |
| 480/70R34 | 479 |
| 300/85R42 | 471 |
| 23.1-26 | 474 |
| 440/80R34 | 475 |

3. Press the mode selector switch.
4. To complete the setting, select “**Set**” with the select switch.
   The various setting mode screen appears again.

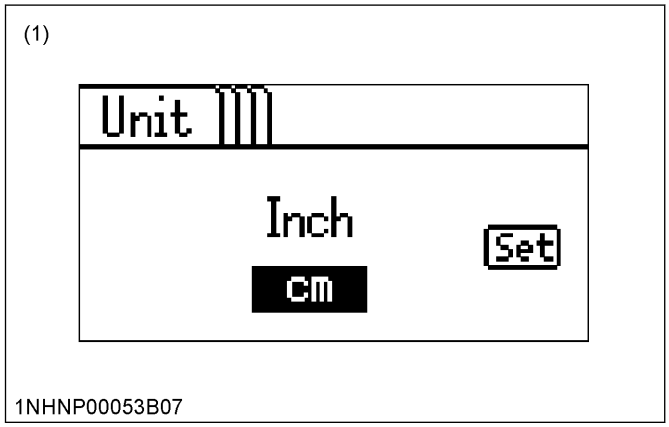
### 4.1.6.4 Setting the unit

1. Press the mode selector switch to choose "Unit setting". Then press the select switch, and the unit setting screen appears.




1NHNP00053C05

(1) Unit setting




1NHNP00053B07

(1) Unit setting screen

2. Press the select switch to select “**Inch**” or “**cm**”.
3. Press the mode selector switch.
4. To complete the setting, select “**Set**” with the select switch.
   The various setting mode screen appears again.

### 4.1.6.5 Setting the PTO speed display

**540/540E min$^{-1}$ (rpm) model**
The PTO speed display mode has been factory-set at "540/540E". Do not attempt to change the setting. Otherwise the correct PTO speed will not be displayed on the LCD monitor.

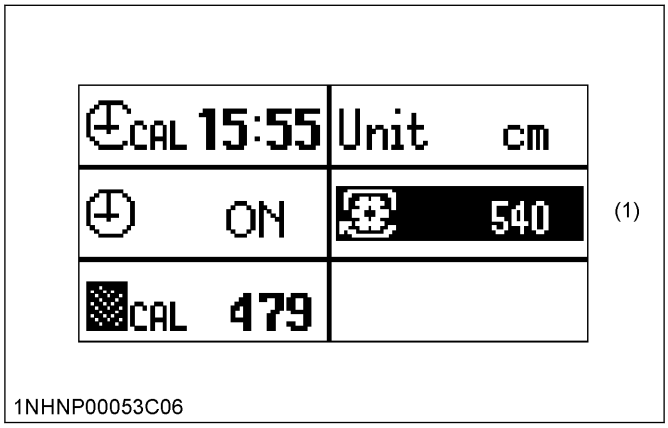
**540/1000 min$^{-1}$ (rpm) model**
The PTO speed display mode has been factory-set at "540/1000". Do not attempt to change the setting.

Otherwise the correct PTO speed will not be displayed on the LCD monitor.

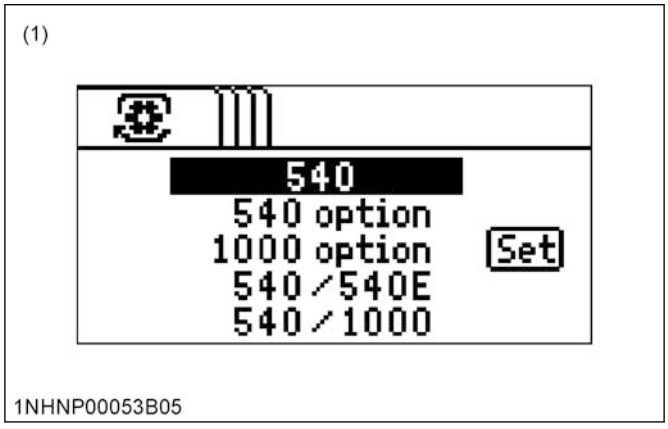
**Interchangeable PTO 540/1000 min$^{-1}$ (rpm) model**
Whenever the PTO speed is changed to the other speed, it is necessary to switch the PTO speed display mode. Otherwise the PTO speed will not be correctly displayed on the LCD monitor. When the PTO speed is changed from 540 min$^{-1}$ (rpm) to 1000 min$^{-1}$ (rpm) or from 1000 min$^{-1}$ (rpm) to 540 min$^{-1}$ (rpm), it is necessary to switch the PTO speed display mode.

**NOTE**
- **The current setting can be checked in the following procedure.**

1. Press the mode selector switch to choose "PTO speed display setting".
   Then press the select switch, and the PTO speed display setting screen appears.




(1) PTO speed display setting




(1) PTO speed display setting screen

2. According to the following table, press the select switch and select the PTO speed.

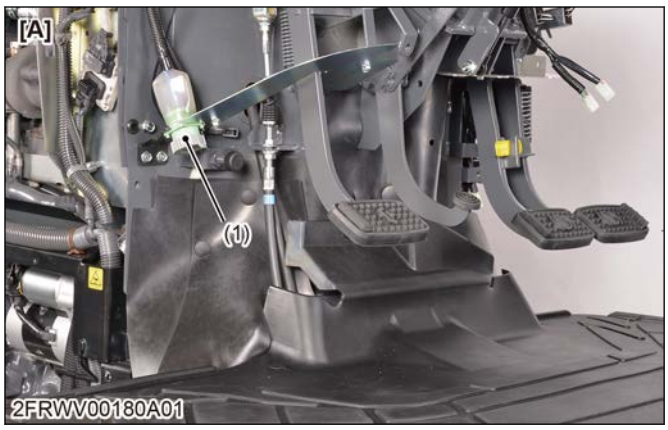
| Model | Select the PTO speed [min$^{-1}$ (rpm)] |
|---|---|
| Standard | Not select |
| With interchangeable PTO shaft | 540 option |
| | 1000 option |
| With PTO gear shift lever | 540/540E |
| | 540/1000 |

3. Press the mode selector switch.
4. To complete the setting, select "**Set**" with the select switch.
   The various setting mode screen appears again.

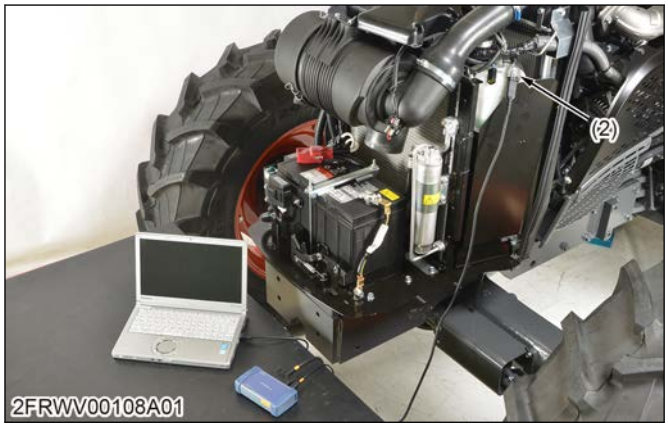
# 4.2 Checking, setting and adjusting by using diagnostic tool

## 4.2.1 Connection port of diagnostic tool

Please see below to know the position of diagnostic tool.





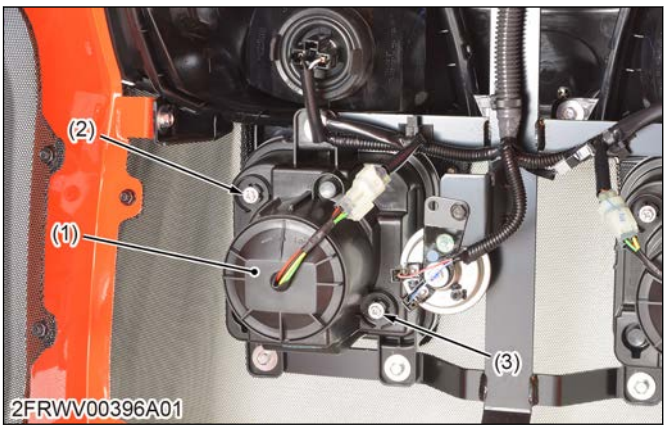



(1) Connection port of tractor diagnostic tool
(2) Connection port of engine diagnostic tool
[A] ROPS model
[B] Cabin model

## 4.3 Adjusting lighting system

### 4.3.1 Adjusting head light

Please see below to adjust the head light axis.




(1) Head light
(2) Adjusting screw (Horizontal side)
(3) Adjusting screw (Vertical side)

| Adjusting screw | Tighten | Loosen |
|---|---|---|
| Horizontal side (2) | Move left | Move right |
| Vertical side (3) | Move upper | Move lower |

## 4.4 Battery, fuses, grounding and connector

**CAUTION**

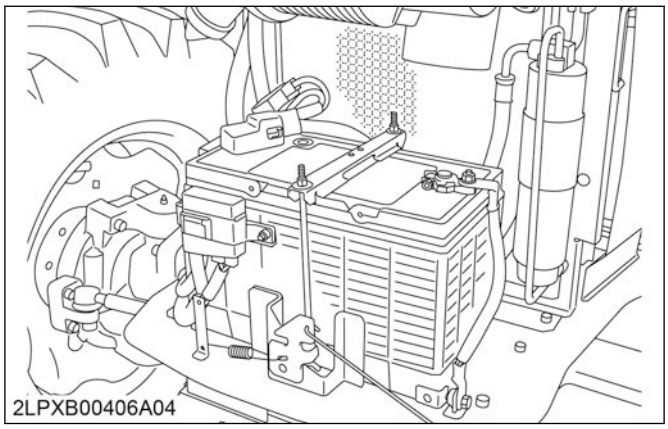
- **To avoid accidental short circuit, be sure to attach the positive cable to the positive terminal before the negative cable is attached to the negative terminal.**
- **Never remove the battery cap while the engine is operating.**
- **Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water immediately.**
- **Keep open sparks and flames away from the battery at all times. Hydrogen gas mixed with oxygen becomes very explosive.**

**IMPORTANT**

- **If the machine is to be operated for a short time without battery (using a slave battery for starting), use additional current (lights) while engine is operating and insulate terminal of battery. If this advice is disregarded, damage to alternator and regulator may result.**

## 4.4.1 Battery

### 4.4.1.1 Checking battery voltage

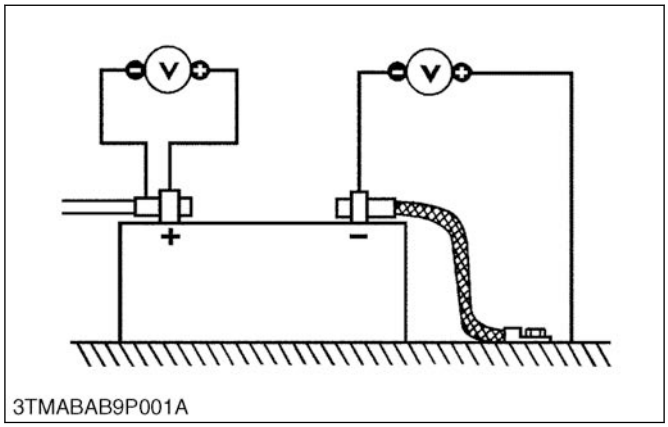



1. Stop the engine and turn the main switch **OFF**.
2. Connect the COM (−) lead of the voltmeter to the battery's negative terminal post and the (+) lead to the positive terminal post, and measure the battery voltage.
3. If the battery voltage is less than the factory specification, recharge the battery.

| | | |
|---|---|---|
| Battery voltage | Factory specification | More than 12 V |

### 4.4.1.2 Checking battery terminal connection

1. Turn the key switch **ON**, and turn on the head light.
2. Check 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.




| | | |
|---|---|---|
| Potential difference | Factory specification | Less than 0.1 V |

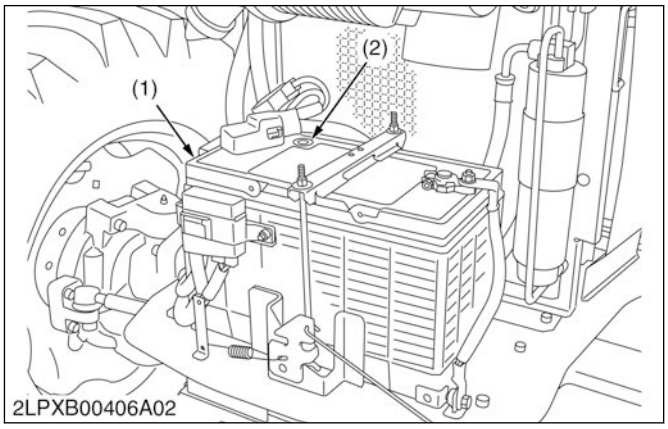
3. If the measurement exceeds the factory specification, clean the battery terminal posts and cable clamps, and tighten them firmly.

### 4.4.1.3 Checking battery condition indicator

**IMPORTANT**

- **The factory installed battery is of non-refillable type. If the indicator turns white, do not charge the battery but replace it with new one.**

1. Check the battery condition by reading the indicator (2).



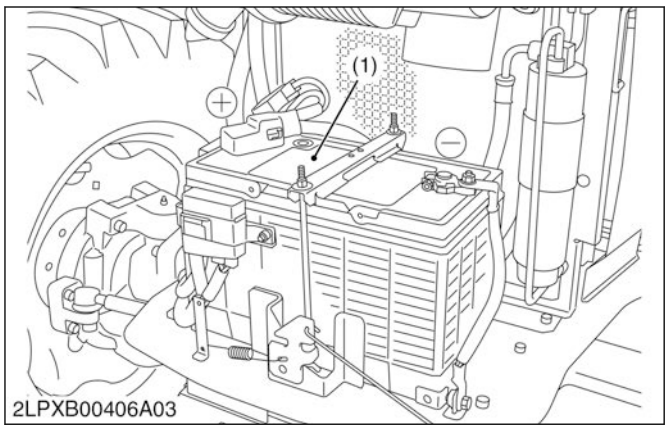

(1) Battery (2) Indicator

| State of indicator display | |
|---|---|
| Green | Specific gravity of electrolyte and quality of electrolyte are both in good condition. |
| Black | Needs charging battery. |
| White | Needs replacing battery. |

### 4.4.1.4 Battery charging

**WARNING**

- **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.**
- **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.**




(1) Battery

1. To slow charge the battery (1), connect the battery positive terminal to the charge positive terminal and the negative terminal to the negative, then recharge in the standard fashion.
2. A boost charge is only for emergencies. It will partially charge 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.
3. The battery is charge if the indicator display turns green from black.
4. When exchanging an old battery for a new one, use battery of equal specification shown in table.

**Table**

| Battery type | Volts | Capacity at 5H.R. |
|---|---|---|
| GP31 (105E41R) | 12 V | 80 A.H. |

| Reserve capacity | Cold Cranking Amps | Normal charging rate |
|---|---|---|
| 160 min. | 900 | 11 A |

## 4.4.1.5 Directions for storage of battery

1. When storing the tractor for long periods of time, remove the battery from tractor, adjust the electrolyte to the proper level and store in a dry place out of direct sunlight.
2. To prevent battery self-discharge while the tractor is stored, recharge the battery once every 3 months in hot seasons and once every 6 months in cold seasons.

**(Reference)**

**Self-discharge rate**

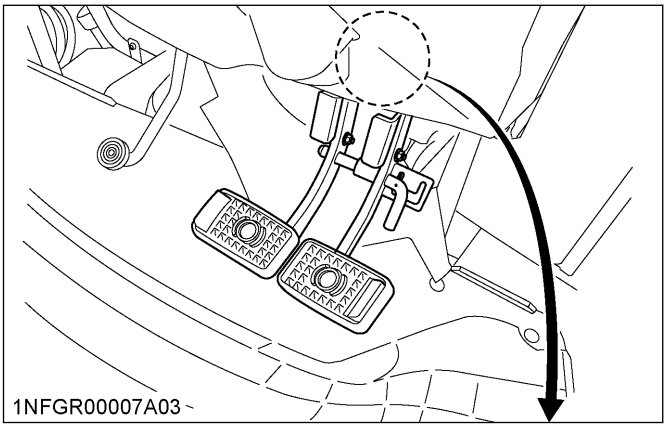
| Temperature | Self-discharge rate |
|---|---|
| 30 ℃ (86 ℉) | Approx. 1.0% per day |
| 20 ℃ (68 ℉) | Approx. 0.5% per day |
| 10 ℃ (50 ℉) | Approx. 0.25% per day |

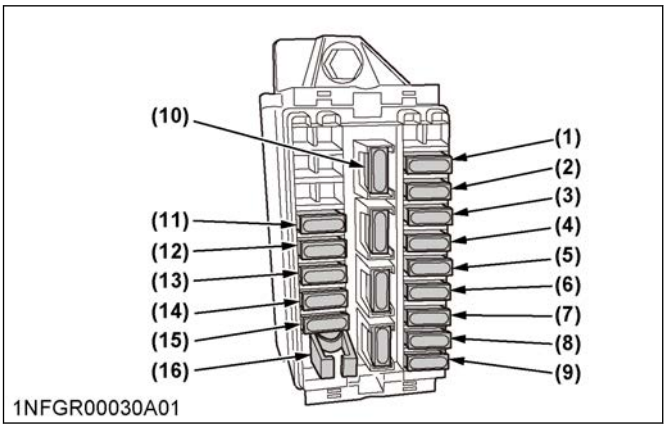
## 4.4.2 Fuse

## 4.4.2.1 Checking fuse (ROPS model)

**■ IMPORTANT**

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



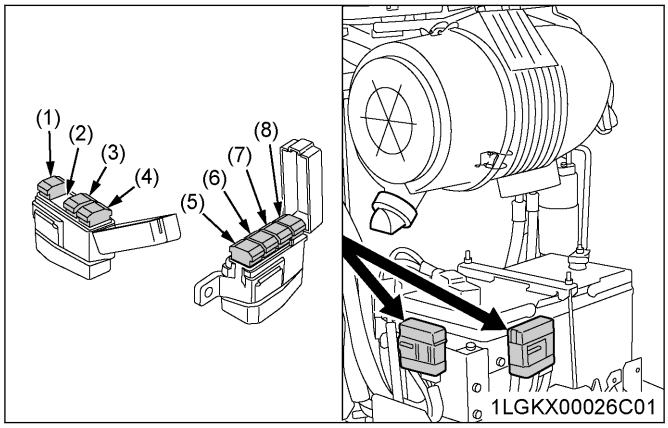
| Fuse No. | Capacity | Protected circuit |
|---|---|---|
| (1) | 15 A | Work light |
| (2) | 5 A | Meter (Backup) |
| (3) | 5 A | ECU (Backup) |
| (4) | 10 A | Turn signal, stop lamp |
| (5) | 15 A | Auxiliary power |
| (6) | 5 A | Meter panel |
| (7) | 20 A | Headlight |
| (8) | 15 A | Flasher |
| (9) | 5 A | Starter relay |
| (10) | | Spare fuse |
| (11) | 25 A | AUX socket |
| (12) | 10 A | Horn |
| (13) | 5 A | PTO, engine |
| (14) | 5 A | Transmission control |
| (15) | 15 A | ECU |
| (16) | | Fuse puller |

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

## 4.4.2.2 Checking slow blow fuse (ROPS model)

**■ NOTE**

- **The slow blow fuse are intended to protect the electrical cabling. If any of them has blown out, be sure to pinpoint the cause. Never use any substitute, use only a KUBOTA genuine part.**

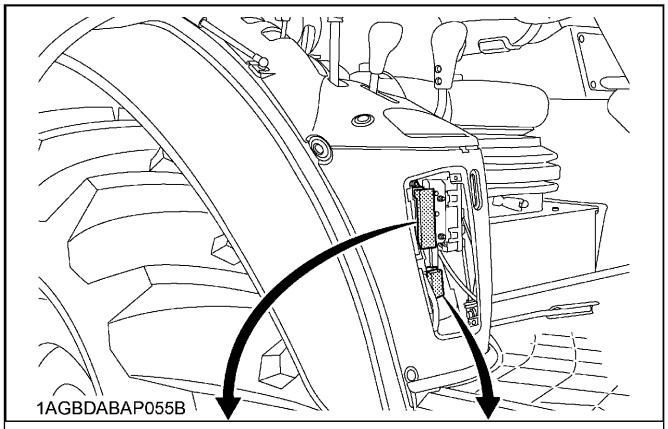


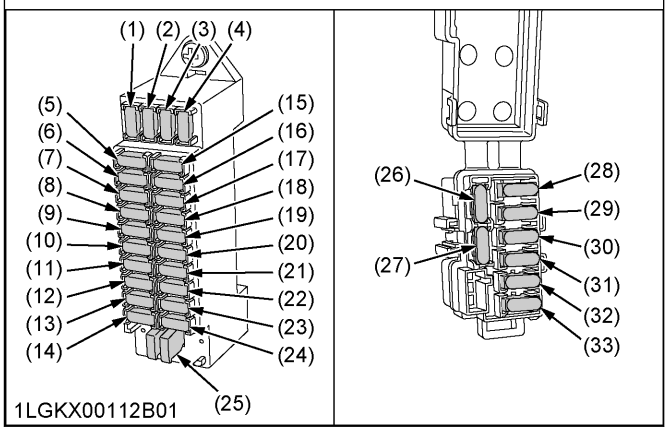

| Fuse No. | Capacity | Protected circuit | Type |
|---|---|---|---|
| (1) | 30 A | Main key switch | Bolt fixed |
| (2) | — | — | — |
| (2) | 50 A | SCR system | Non bolt fixed |
| (4) | 60 A | Hazard | |
| (6) | 120 A | Engine preheat | Bolt fixed |
| (6) | 40 A | Work light | |
| (7) | 30 A | Electrical outlet | Non bolt fixed |
| (8) | 60 A | Starter | |

## 4.4.2.3 Checking fuse 1 (Cabin model)

**■ IMPORTANT**

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



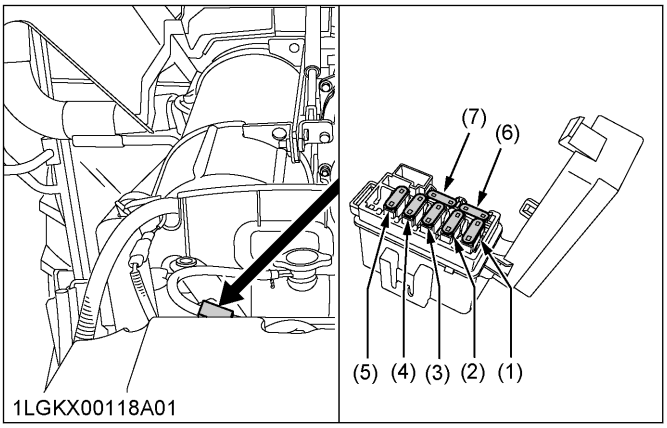
| Fuse No. | Capacity | Protected circuit |
|---|---|---|
| (1) | 5 A | Spare fuse |
| (2) | 10 A | Spare fuse |
| (3) | 15 A | Spare fuse |
| (4) | 20 A | Spare fuse |
| (5) | 15 A | Work light (Rear) |
| (6) | 15 A | Work light (Front) |
| (7) | 15 A | Cigarette lighter |
| (8) | 30 A | Air conditioner (Fan motor) |
| (9) | 10 A | Air conditioner (Compressor) |
| (10) | 20 A | Work light (Front side) |
| (11) | 5 A | Transmission control |
| (12) | 15 A | Loader plug |
| (13) | 15 A | ECU |
| (14) | 5 A | Starter relay |
| (15) | 5 A | Radio |
| (16) | 5 A | Air conditioner (Control) |
| (17) | 15 A | Wiper |
| (18) | 10 A | Alternator, PTO, engine |
| (19) | 5 A | Meter |
| (20) | 10 A | Turn signal |
| (21) | 10 A | Back up (Meter) |
| (22) | 20 A | Head light |
| (23) | 20 A | Flasher (Hazard) |
| (24) | 5 A | Back up (ECU) |
| (25) | Fuse puller | |
| (26) | 15 A | Spare fuse |
| (27) | 20 A | Spare fuse |
| (28) | 20 A | Quarter window defogger |
| (29) | 20 A | Rear window defogger |
| (30) | 15 A | Work light (Option) |
| (31) | 15 A | Stop lamp |
| (32) | 10 A | OBD |
| (33) | 10 A | Trailer brake valve |

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

## 4.4.2.4 Checking fuse 2 (Cabin model)

**IMPORTANT**

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




| Fuse No. | Capacity | Protected circuit |
|---|---|---|
| (1) | 30 A | CRS system fuel pump |
| (2) | 20 A | SCR system |
| (3) | 30 A | SCR heater system |
| (4) | 10 A | NOx sensor, SCR tank sensor |
| (5) | 10 A | EGR valve air flow sensor |
| (6) | 10 A | Spare fuse |
| (7) | 30 A | Spare fuse |

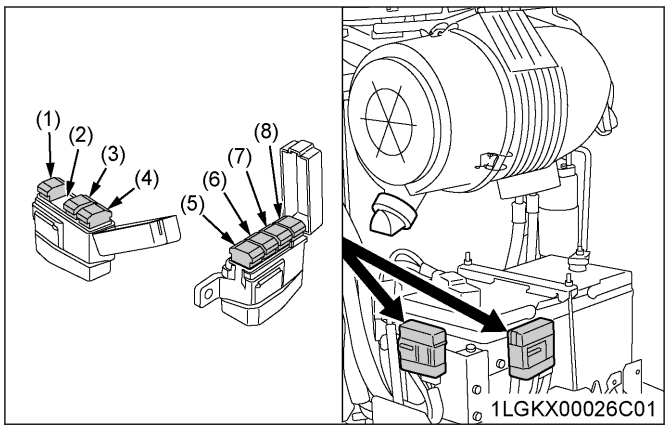
1. The tractor electrical system is protected from potential damage by fuses.
2. A blown fuse indicates that there is an overload or short somewhere in the electrical system.
3. If any of the fuses should blow, replace with a new one of the same capacity.

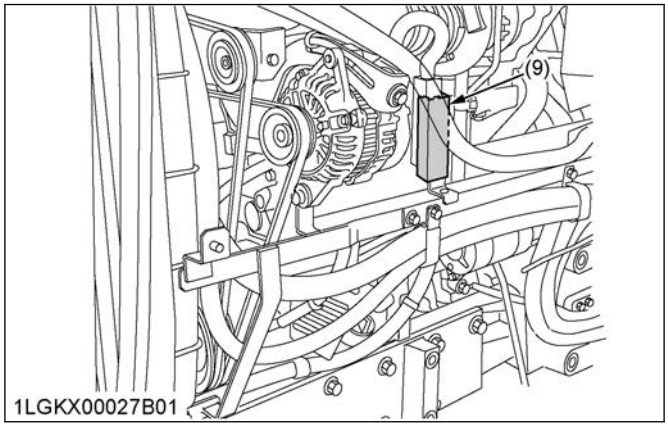
## 4.4.2.5 Checking slow blow fuses (Cabin model)

The slow blow fuses are intended to protect the electrical cabling.

**NOTE**

- **The slow blow fuse are intended to protect the electrical cabling. If any of them has blown out, be sure to pinpoint the cause. Never use any substitute, use only a KUBOTA genuine part.**



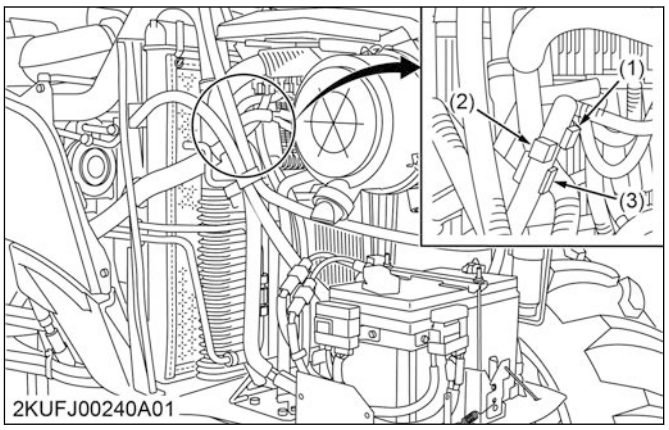




| Fuse No. | Capacity | Protected circuit | Type |
|---|---|---|---|
| (1) | 30 A | Main key switch | Bolt fixed |
| (2) | — | — | — |
| (3) | 50 A | SCR system | Non bolt fixed |
| (4) | 60 A | Defogger, hazard | |
| (5) | 120 A | Engine preheat | Bolt fixed |
| (6) | 40 A | Work light | |
| (7) | 30 A | Electrical outlet | Non bolt fixed |
| (8) | 60 A | Starter, air conditioner | |
| (9) | 150 A | Charge | |

## 4.4.2.6 Checking oil separator fuse

**■ IMPORTANT**

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




**Oil separator fuse (If equipped)**

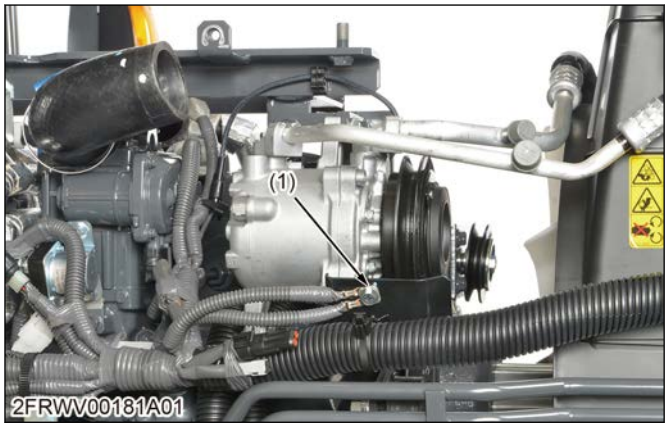
| Fuse No. | Capacity | Protected circuit |
|---|---|---|
| (1) | 15 A | Heater (Oil separator, out 1) |
| (2) | 15 A | Heater (Oil separator, in) |
| (3) | 15 A | Heater (Oil separator, out 2) |

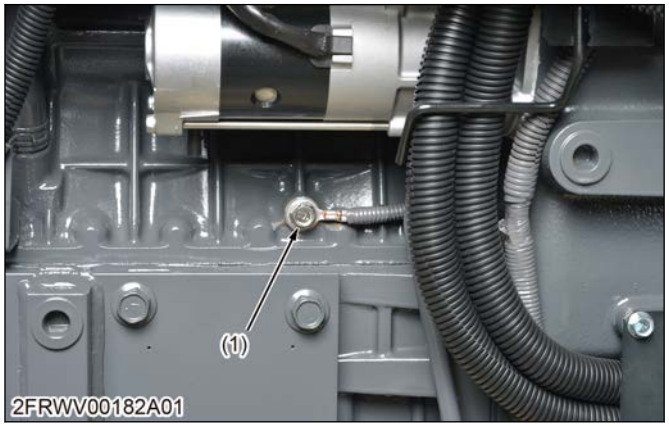
1. The tractor electrical system is protected from potential damage by fuses.
2. A blown fuse indicates that there is an overload or short somewhere in the electrical system.
3. If any of the fuses should blow, replace with a new one of the same capacity.

## 4.4.3 Checking grounding wires

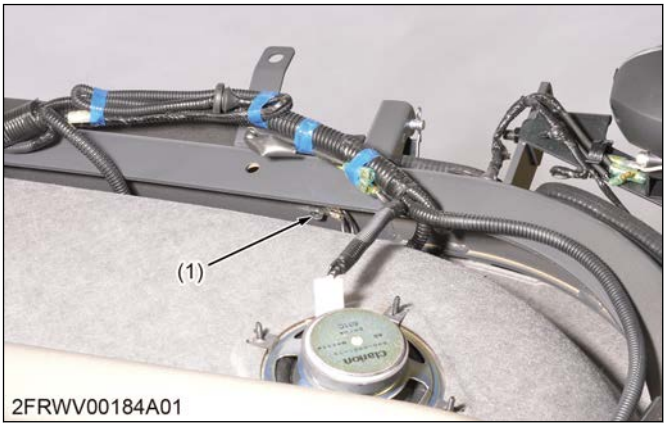
### 4.4.3.1 Checking grounding wire

**Cabin model**



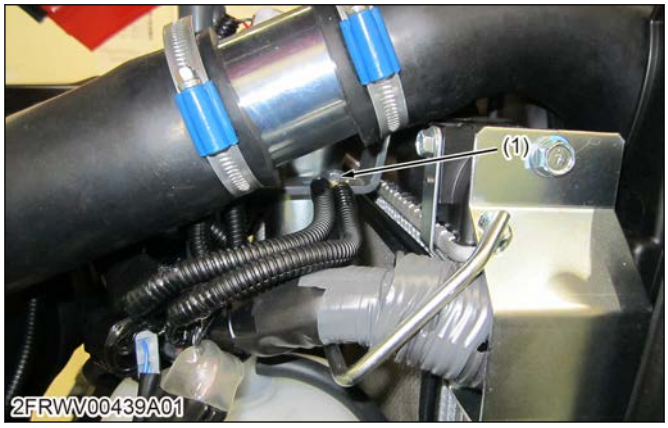


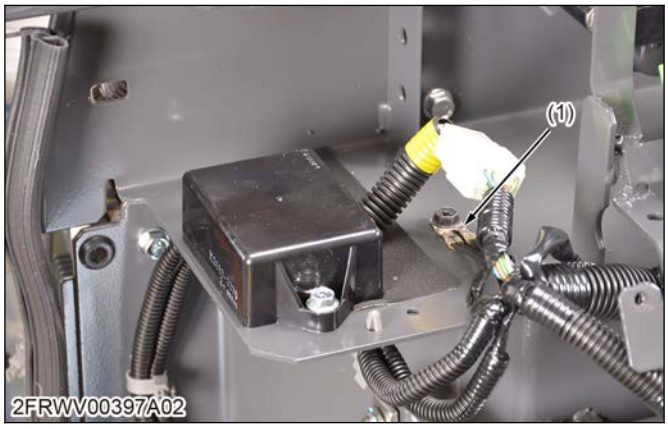


(1) Grounding wire

**ROPS model**






(1) Grounding wire

1. Check the whether the grounding wire (1) is connected securely to the tractor chassis.
2. If the grounding wire is broken or disconnected, replace it.

### 4.4.4 Connector

### 4.4.4.1 Checking connector

1. When inspect the circuit line, check the related connectors.
2. Disconnect the connectors and check their terminals for contamination and deformation.
3. Check to see that cable does not broken or terminals are not shelled off.
4. If any damaged parts are found, repair or replace them.

**(When reassembling)**

**IMPORTANT**

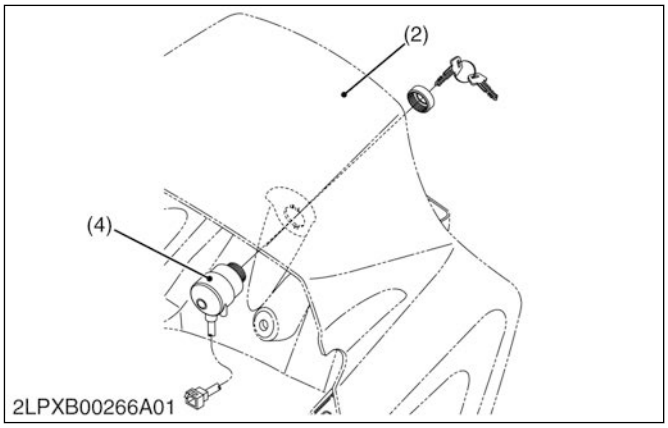
- **Connect connector surely after checked.**

## 4.5 Starting system

### 4.5.1 Main switch

### 4.5.1.1 ROPS model

### 4.5.1.1.1 Preparing for checking main switch (ROPS model)



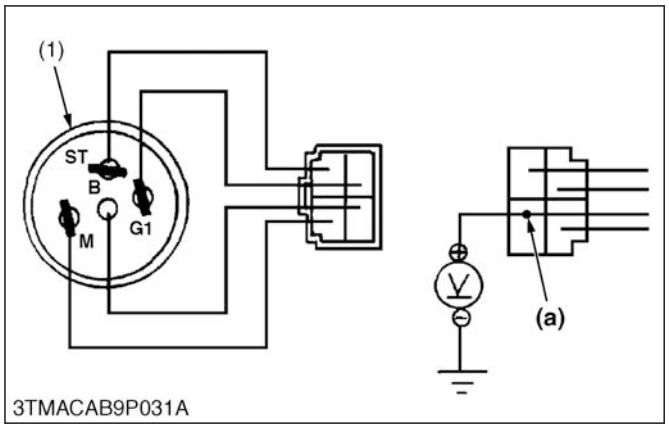

(2) Panel cover (4) Main switch

1. Remove the steering handle (1), panel cover (2) and steering post cover (3).


(1) Steering handle
(2) Panel cover
(3) Steering post cover

2. Disconnect the 4P connector for main switch (4).
3. Remove the main switch (4).

### 4.5.1.1.2 Checking connector voltage for main switch (ROPS model)

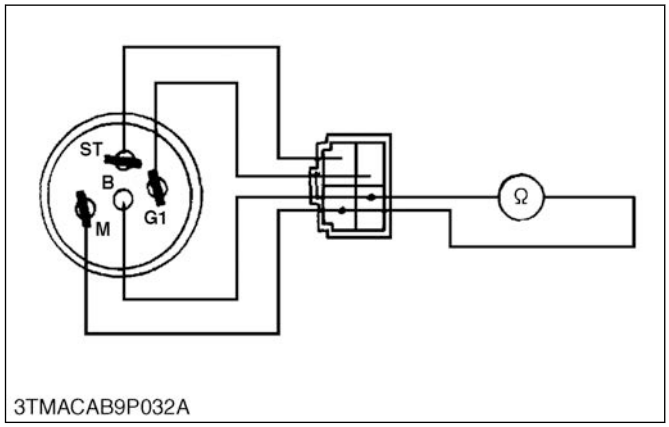



(1) Main switch
(a) From battery positive terminal (Wire harness side)

1. Measure the voltage with a voltmeter across the connector terminal B and chassis.
2. If the voltage differs from the battery voltage, the wiring harness is damaged.

| | | |
|---|---|---|
| Voltage | Connector terminal B — Chassis | Approximately battery voltage |

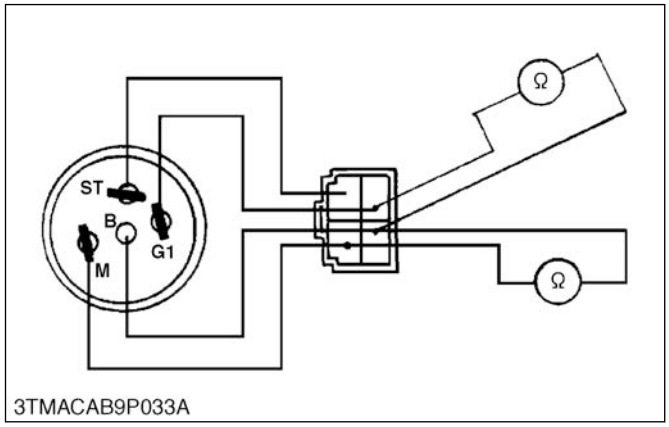
### 4.5.1.1.3 Checking main switch at ON position (ROPS model)




1. Turn the main switch to **ON** position.
2. Measure the resistance with an ohmmeter across the terminal B and the terminal M.
3. If 0 ohm is not indicated, the B - M contacts of the main switch are damaged.

| | | |
|---|---|---|
| Resistance | Terminal B - Terminal M | 0 Ω |

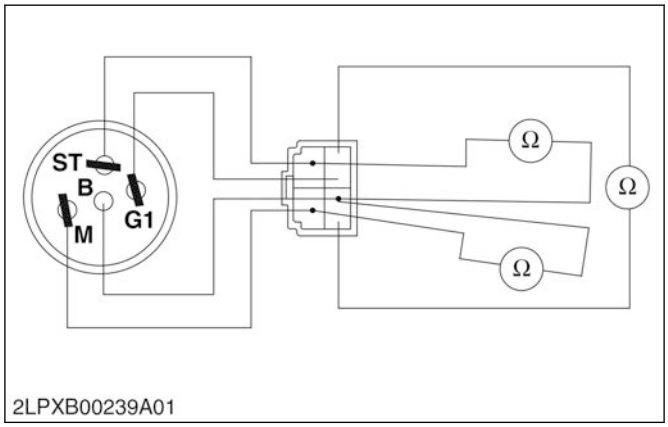
### 4.5.1.1.4 Checking main switch at PREHEAT position (ROPS model)




1. Turn and hold the main switch at the **PREHEAT** position.
2. Measure the resistances with an ohmmeter across the terminal B and the terminal G1, and across terminal B and terminal M.
3. If 0 ohm is not indicated, these contacts of the main switch are damaged.

| | | |
|---|---|---|
| Resistance | Terminal B — Terminal G1 | 0 Ω |
| | Terminal B — Terminal M | 0 Ω |

### 4.5.1.1.5 Checking main switch at START position (ROPS model)

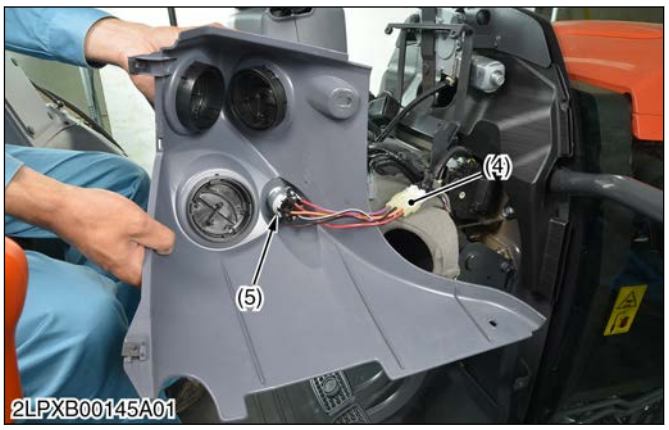



1. Turn and hold the main switch at the **START** position.
2. Measure the resistances with an ohmmeter across the terminal B and the terminal ST, across terminal B and the terminal M, and across terminal B and terminal G1.
3. If 0 ohm is not indicated, these contacts of the main switch are damaged.

| | | |
|---|---|---|
| Resistance | Terminal B - Terminal ST | 0 Ω |
| | Terminal B - Terminal M | 0 Ω |
| | Terminal B - Terminal G1 | 0 Ω |

## 4.5.1.2 Cabin model

### 4.5.1.2.1 Preparing for checking main switch (Cabin model)

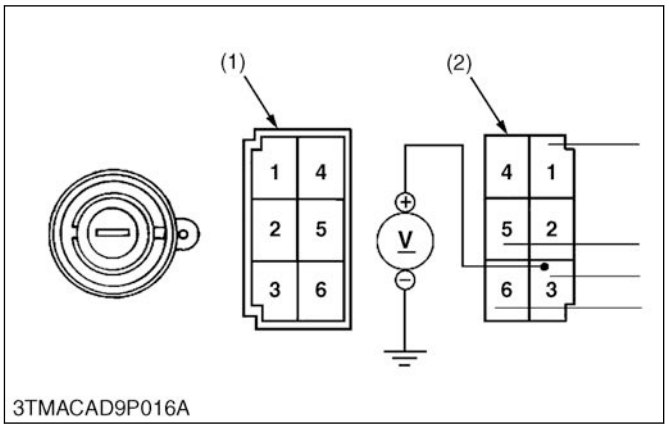

(2) Air outlet
(3) Panel under cover R.H.
(4) 6P connector
(5) Main switch

1. Remove the panel cover (1).


(1) Panel cover

2. Remove the air outlets (2).
3. Remove the panel under cover R.H. (3) and disconnect the 6P connector (4) for main switch (5).
4. Perform the following check.

### 4.5.1.2.2 Checking connector voltage for main switch (Cabin model)

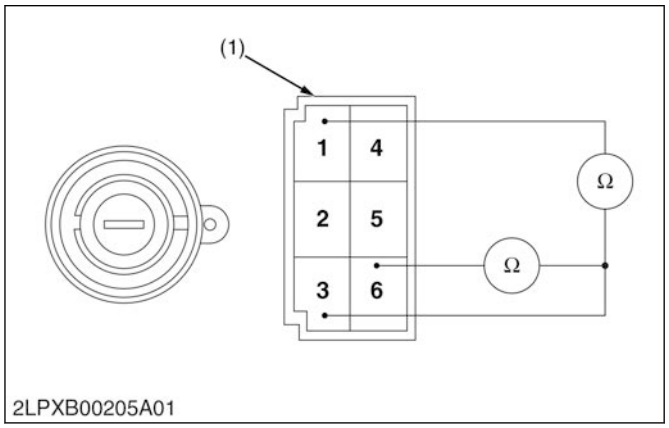



(1) Main switch
(2) Main switch connector (Wire harness side)

1. Measure the voltage with a voltmeter across the connector terminal 3 and chassis.
2. If the voltage differs from the battery voltage, the wiring harness is damaged.

| | | |
|---|---|---|
| Voltage | Connector terminal 3 - Chassis | Approximately battery voltage |

## 4.5.1.2.3 Checking for main switch at ON position (Cabin model)

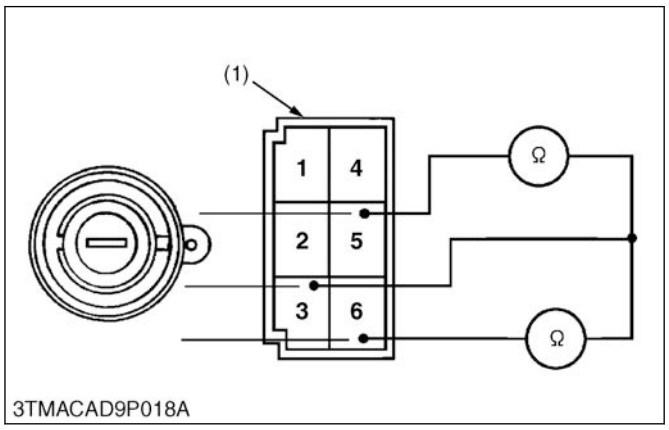



(1) Main switch connector

1. Turn the main switch to **ON** position.
2. Measure the resistance with an ohmmeter across the terminal 3 and the terminal 1 and the terminal 6.
3. If 0 ohm is not indicated, these contacts of the main switch are damaged.

| | | |
|---|---|---|
| Resistance | Terminal 3 - Terminal 1 | 0 Ω |
| | Terminal 3 - Terminal 6 | 0 Ω |

## 4.5.1.2.4 Checking main switch at START position (Cabin model)

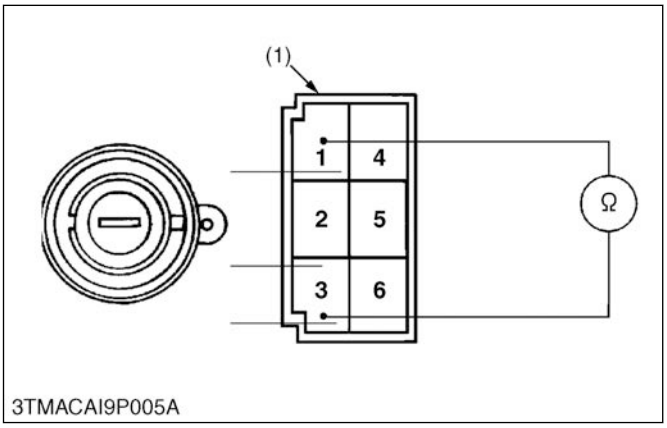



(1) Main switch connector

1. Turn and hold the main switch at the **START** position.
2. Measure the resistances with an ohmmeter across the terminal 5 and across terminal 3 and the terminal 6.
3. If 0 ohm is not indicated, these contacts of the main switch are damaged.

| | | |
|---|---|---|
| Resistance | Terminal 3 - Terminal 5 | 0 Ω |
| | Terminal 3 - Terminal 6 | 0 Ω |

## 4.5.1.2.5 Checking main switch at ACC position (Cabin model)




(1) Main switch connector

1. Turn the main switch key at the **ACC** position.
2. Measure the resistances with an ohmmeter across the terminal 3 and the terminal 1.
3. If 0 ohm is not indicated, these contacts of the main switch are damaged.

| | | |
|---|---|---|
| Resistance | Terminal 3 - Terminal 1 | 0 Ω |

## 4.5.2 Starter motor

### 4.5.2.1 Checking starter motor terminal B voltage

1. Measure the voltage with a voltmeter across the terminal B (1) and chassis.


(1) Terminal B (2) Starter motor

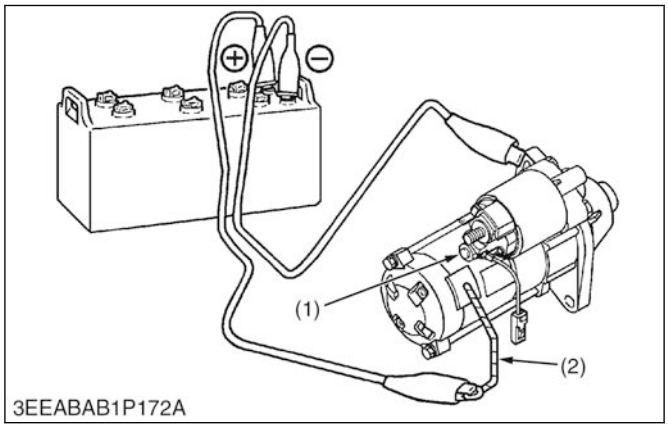
| | | |
|---|---|---|
| Voltage | Factory specification | Approximately battery voltage |

2. If the voltage differs from the battery voltage, the battery positive cable or the battery negative cable is damaged.

### 4.5.2.2 Testing starter motor

**CAUTION**

- **Secure the starter to prevent it from jumping up and down while testing the motor.**



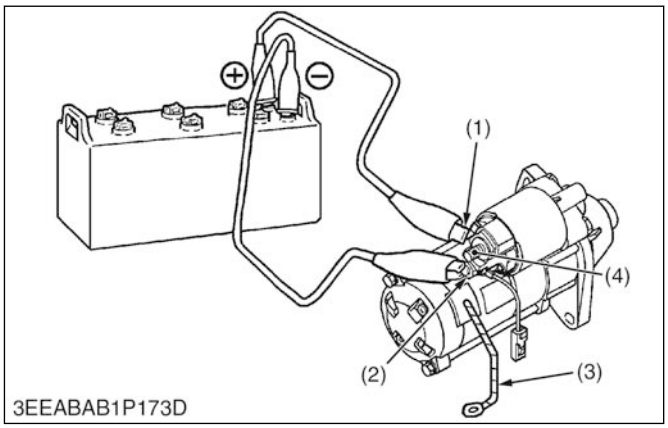

(1) Terminal C (2) Connecting lead

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter terminal C (1).
3. Remove the starter from the engine.
4. Disconnect the connecting lead (2) from the starter terminal C (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 operate, check the motor.

### 4.5.2.3 Testing magnet switch

**NOTE**

- **This test should be done for a short time, about 3 to 5 seconds.**

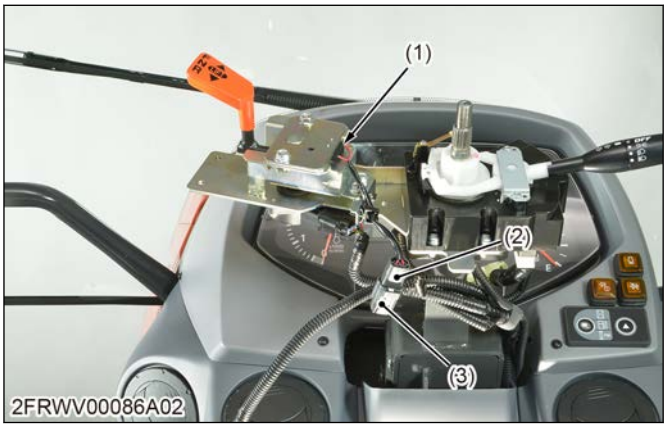


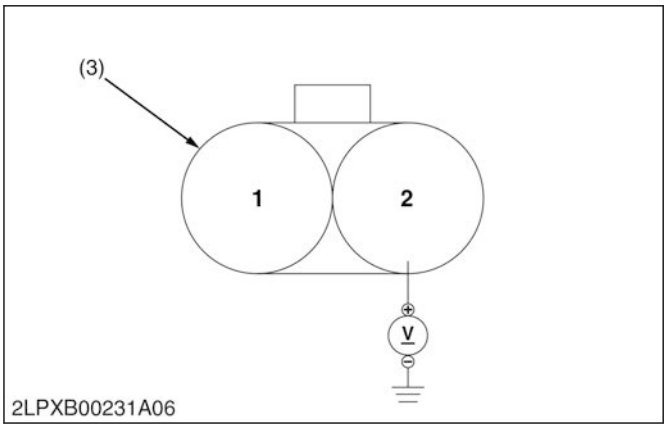

(1) Terminal S (3) Connecting lead
(2) Terminal C (4) Terminal B

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter terminal B (4).
3. Remove the starter from the engine.
4. Disconnect the connecting lead (3) from the starter terminal C (2).
5. Connect a jumper lead from the starter terminal S (1) to the battery positive terminal post.
6. Connect a jumper lead momentarily between the starter terminal C (2) and the battery negative terminal post.
7. If the pinion gear does not pop out, check the magnetic switch.

## 4.5.3 Shuttle switch

### 4.5.3.1 Checking connector voltage for shuttle lever neutral switch



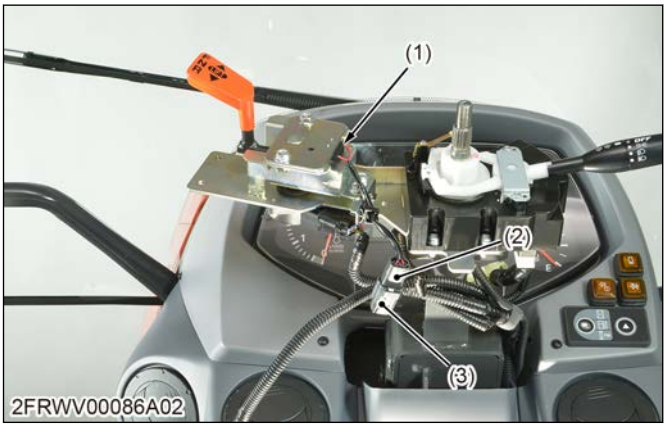



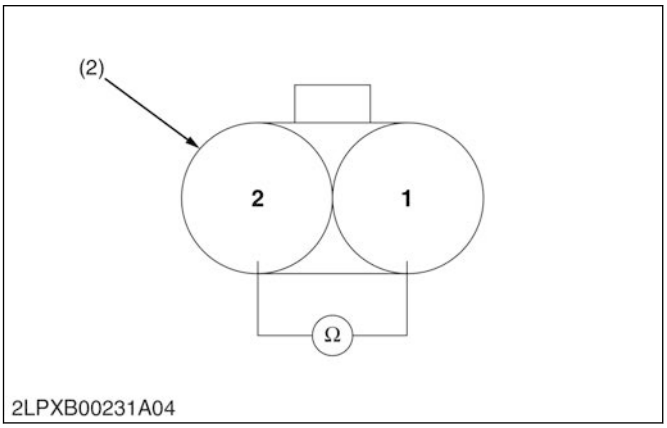

(1) Shuttle switch
(2) Connector (Switch side)
(3) Connector (Wire harness side)

1. Remove the steering handle and steering post cover.
2. Disconnect the connector, and turn the main key switch **ON** position.
3. Measure the voltage with a voltmeter across the terminals shown in the table below.
4. If the reference value is not indicated as shown in the table below, check the relating electric circuit.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 2 – Chassis | Approximately battery voltage |

### 4.5.3.2 Checking shuttle lever neutral switch




(1) Shuttle switch
(2) Connector (Switch side)
(3) Connector (Wire harness side)

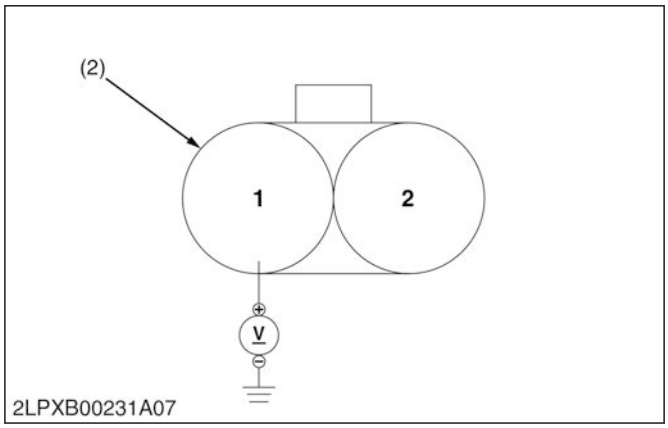
1. Check the continuity across the terminals shown in the table below.

| Position | Terminal 1 – 2 |
|---|---|
| Switch **OFF**(Shuttle lever is **Neutral** position) | Continuity |
| Switch **ON**(Shuttle lever is **Forward** or **Reverse** position) | Infinity |

2. If the continuity specified value is not indicated, shuttle lever neutral switch is damaged.

## 4.5.4 Shuttle valve spool neutral switch

### 4.5.4.1 Checking connector voltage for shuttle valve spool neutral switch

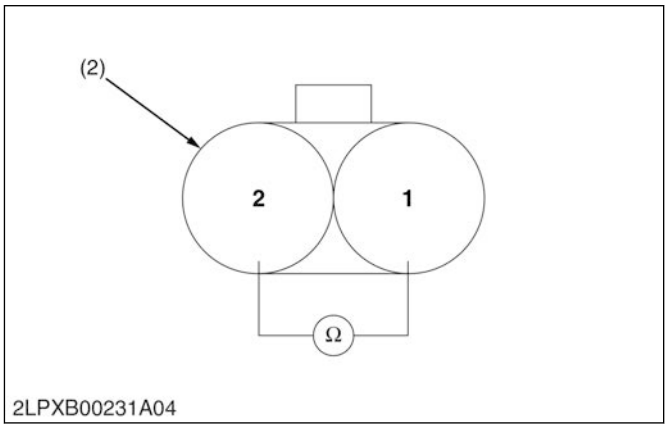

(1) Shuttle valve spool neutral switch
(2) Connector (Wire harness side)

1. Set the shuttle lever to **Neutral** position.
2. Disconnect the connector, and turn the main key switch **ON** position.
3. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 1 – Chassis | Approximately battery voltage |

4. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.5.4.2 Checking shuttle valve spool neutral switch


(1) Shuttle valve spool neutral switch
(2) Connector (Switch side)

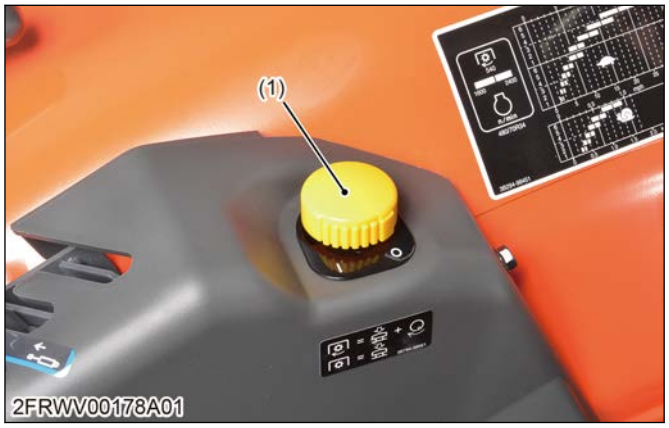
1. Remove the shuttle valve spool neutral switch (1).
2. Check the continuity across the terminals shown in the table below.

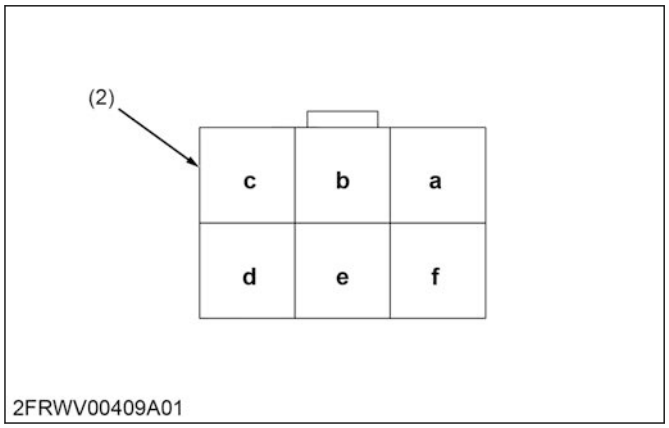
| Position | Terminal 1 – 2 |
|---|---|
| Switch is **Released**. | Continuity (0 Ω) |
| Switch is **Pressed**. | Infinity |

3. If the continuity specified value is not indicated, shuttle valve spool neutral switch is damaged.

## 4.5.5 PTO switch

### 4.5.5.1 Checking connector voltage for PTO switch



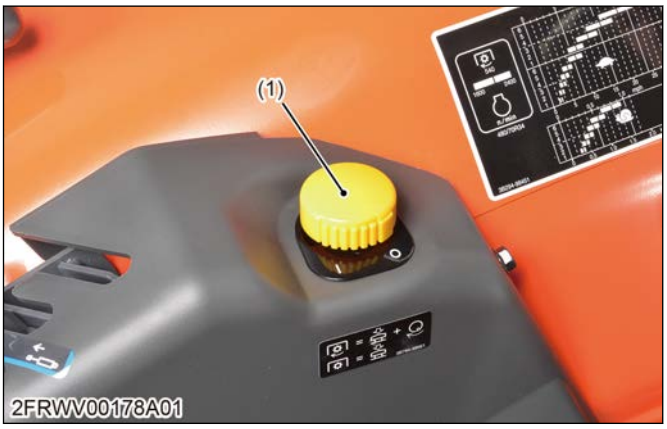

(1) PTO switch
(2) Connector (Wire harness side)

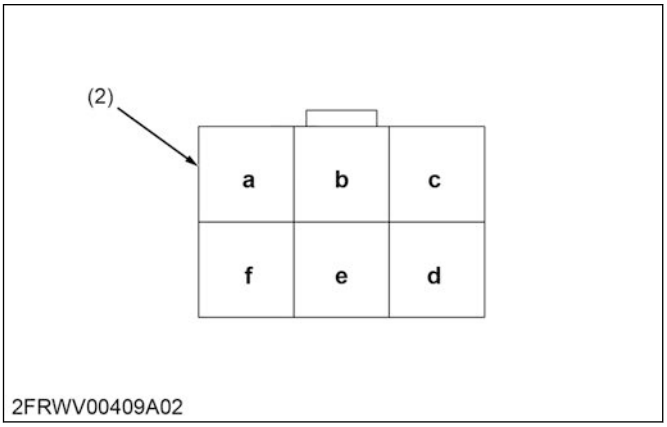
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal a – Chassis<br>Terminal e - Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table above, check the relating electric circuit.

### 4.5.5.2 Checking PTO switch




(1) PTO switch
(2) Connector (Switch side)

1. Check the continuity across the terminals shown in the table below.

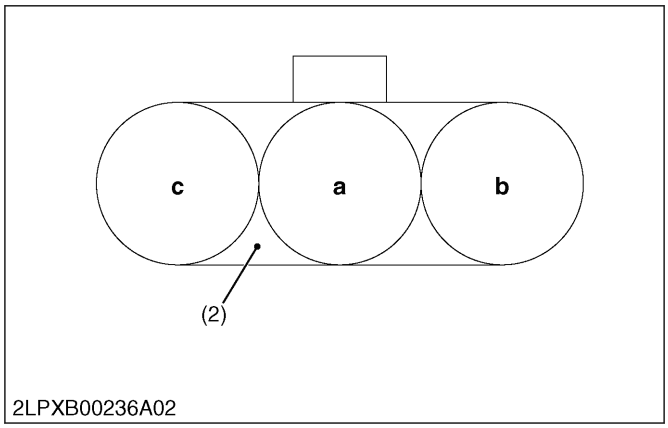
| Position | | Terminal | | | | | |
|---|---|---|---|---|---|---|---|
| | | a | b | c | d | e | f |
| PTO switch | N | ● | ● | | | | |
| | OFF | ● | | ● | ● | ● | |
| | ON | ● | | | | | ● |

2FRWV00398A01enUS

2. If the continuity specified above is not indicated, PTO switch is damaged.

## 4.5.6 External PTO switch

### 4.5.6.1 Checking connector voltage for external PTO switch

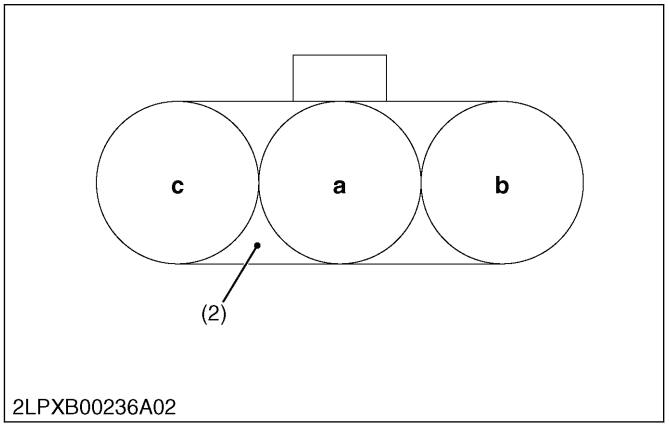




(1) External PTO switch (2) Connector (Wire harness side)

1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.
3. If the reference value is not indicated as shown in the table above, check the relating electric circuit.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal c - Chassis | Approximately battery voltage |

### 4.5.6.2 Checking external PTO switch


(1) External PTO switch (2) Connector (Switch side)

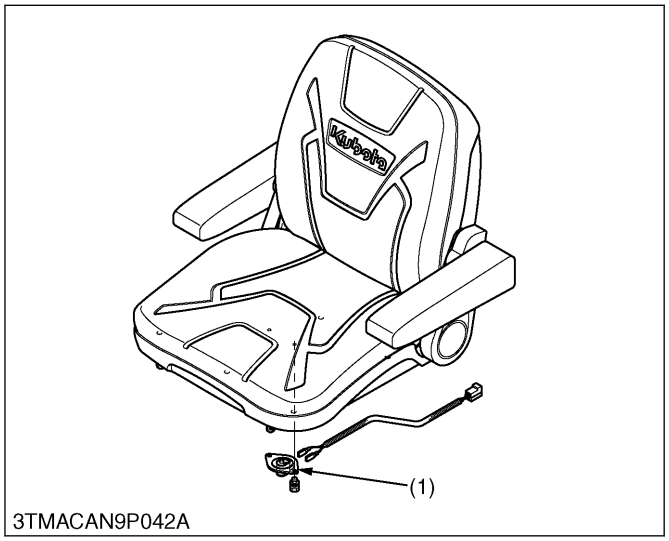
1. Check the continuity across the terminals shown in the table below.

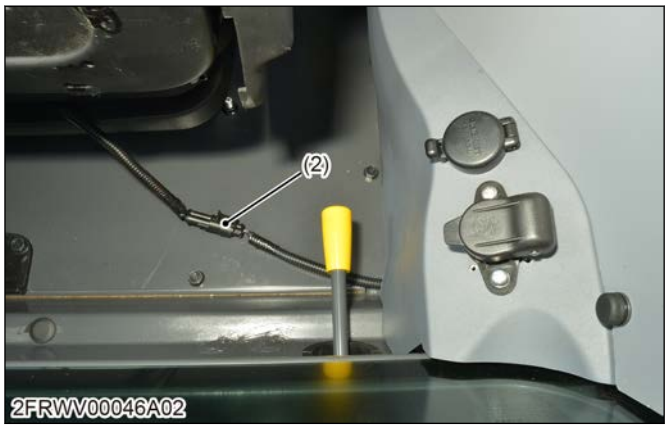
| Position | Terminal a – b |
|---|---|
| Switch is **Released**. | Infinity |
| Switch is **Pressed**. | Continuity (0 Ω) |

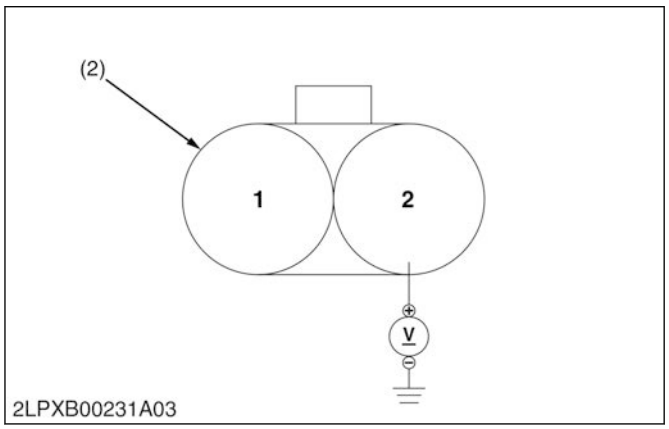
2. If the continuity specified above is not indicated, external PTO switch is damaged.

### 4.5.7 Seat switch

#### 4.5.7.1 Checking connector voltage for seat switch




(1) Seat switch (2) Connector(Wire harness side)

1. Turn the main key switch to **OFF** position.
2. Disconnect the connector(2) to the seat switch (1).
3. Turn the main key switch to **ON** position.
4. Measure the voltage with a voltmeter across the terminals shown in the table below.
5. If the reference value is not indicated as shown in the table below, check the relating electric circuit.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 2 – Chassis | Approximately battery voltage |

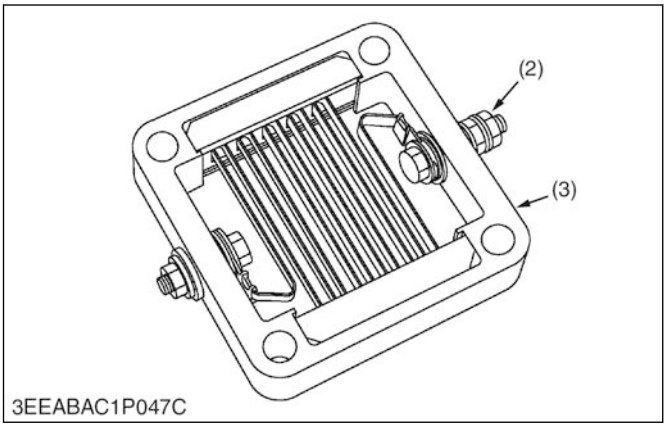
## 4.6 Intake air heater

### 4.6.1 Checking intake air heater

1. Disconnect the lead (1) from the intake air heater.


(1) Power supply lead

2. Measure the resistance between positive terminal (2) and intake air heater body (3).
3. If the resistance value is at 0 Ω (ground short), replace the intake air heater. If the resistance value is infinity, the heat coil is disconnected. Replace the intake air heater.

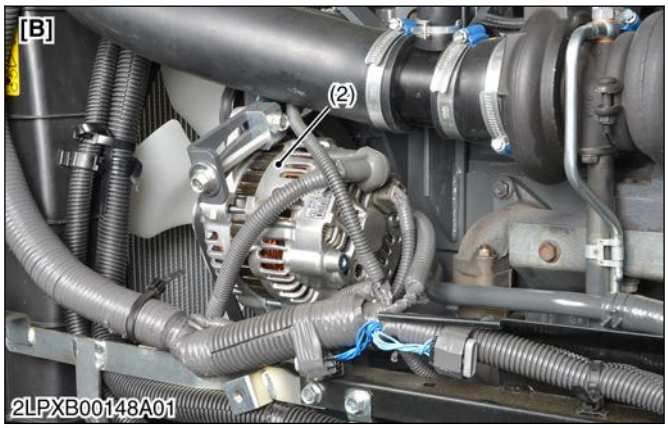



(2) Positive terminal (3) Intake air heater body

| | | |
|---|---|---|
| Resistance of the heater coil | Factory specification | Approximately 0.3 Ω (At cold occasion) |

# 4.7 Alternator

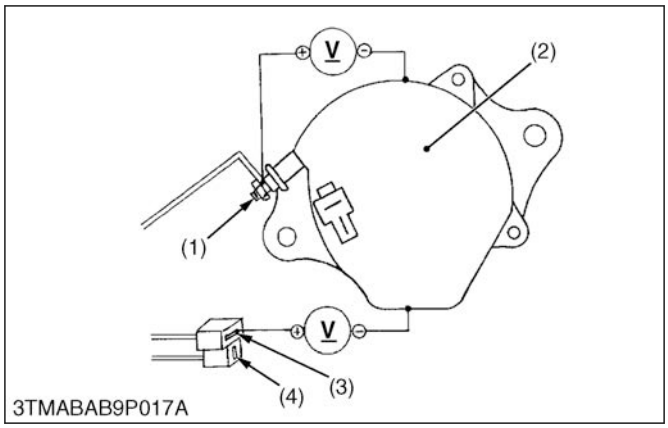
## 4.7.1 Preparing for checking alternator


(1) Alternator (60 A)
(2) Alternator (80 A)
[A] ROPS model
[B] Cabin model

1. Disconnect the 2P connector from alternator after turning the main key switch "**OFF**".
2. Perform the following procedure.

## 4.7.2 Measuring connector voltage




(1) Terminal B
(2) Alternator
(3) Terminal IG
(4) Terminal L

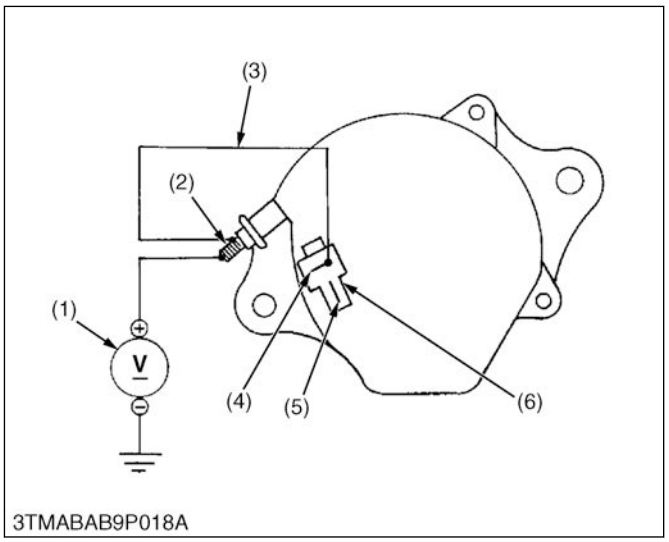
1. Turn "**OFF**" the main switch. Measure the voltage between the terminal B (1) and the chassis.

| | | |
|---|---|---|
| Voltage (Main switch at "**OFF**") | Terminal B – Chassis | Approximately battery voltage |

2. Turn "**ON**" the main switch. Measure the voltage between the terminal IG (3) and the chassis.

| | | |
|---|---|---|
| Voltage (Main switch at "**ON**") | Terminal IG – Chassis | Approximately battery voltage |

## 4.7.3 Testing at no load




(1) Voltmeter
(2) Terminal B
(3) Jumper lead
(4) Terminal IG
(5) Terminal L
(6) 2P connector

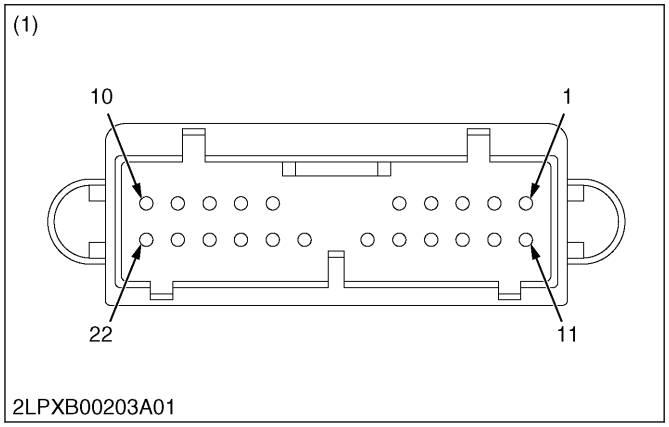
1. Connect the 2P connector (6) to previous positions of the alternator after turning "**OFF**" the main switch.
2. Connect the jumper lead (3) between terminal IG (4) and terminal B (2).
3. Start the engine and then set at idling speed.
4. Disconnect the negative cable from the battery.
5. Measure the voltage between the terminal B (2) and the chassis.
6. If the measurement is less than the factory specifications, disassemble the alternator and check the IC regulator.
   **(Reference)**
   - Once the engine has started, the alternator temperature rises quickly up to an ambient temperature of 70 to 90 ℃ (158 to 194 ℉). As the temperature goes higher than 50 ℃ (122 ℉), the alternator voltage slowly drops; at higher than 100 ℃ (212 ℉), it drops by about 1 V.

| | | |
|---|---|---|
| Voltage | Factory specification | More than 14 V |

# 4.8 ECU

## 4.8.1 Meter ECU

### 4.8.1.1 Terminal position of meter ECU



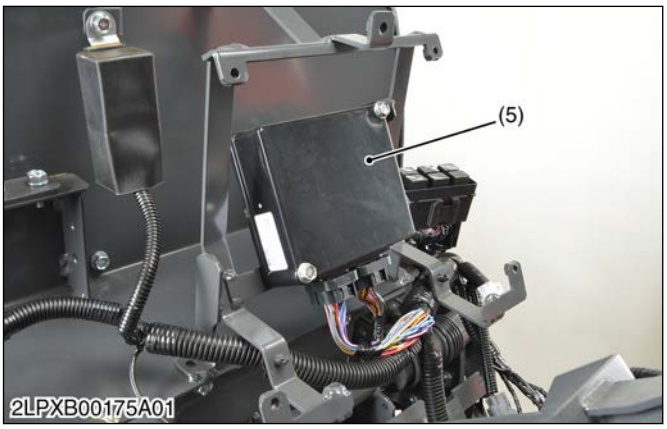

(1) Meter ECU connector

| No. | Terminal name |
|---|---|
| 1 | CAN (L) |
| 2 | CAN (H) |
| 3 | NC |
| 4 | NC |
| 5 | NC |
| 6 | NC |
| 7 | NC |
| 8 | Turning signal (Right) |
| 9 | Turning signal (Left) |
| 10 | GND |
| 11 | Head light (Hi beam) |
| 12 | Engine oil pressure switch |
| 13 | Alternator L terminal |
| 14 | Air cleaner switch |
| 15 | Brake master cylinder |
| 16 | Trailer connecting signal |
| 17 | Head light (Lo beam) |
| 18 | Fuel level sensor |
| 19 | Mode selector switch |
| 20 | Select switch |
| 21 | IGN |
| 22 | +B |

## 4.8.2 Tractor ECU

### 4.8.2.1 Preparing for checking tractor ECU (ROPS model)

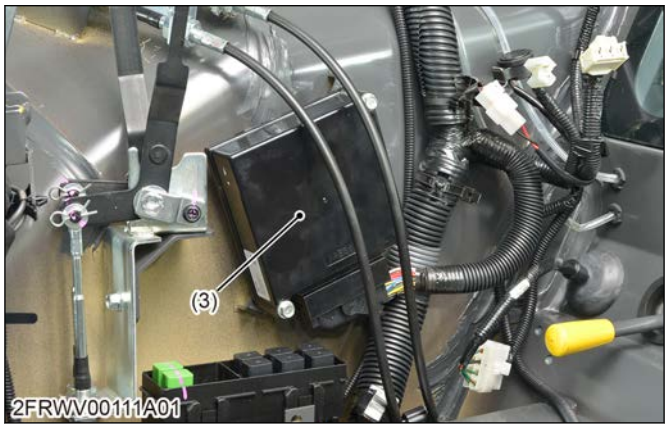





(1) Steering handle
(2) Steering handle cover
(3) Meter panel cover
(4) Meter panel
(5) Tractor ECU

1. Remove the steering handle (1).
2. Remove the steering handle cover (2).
3. Remove the meter panel cover (3).
4. Remove the meter panel (4).

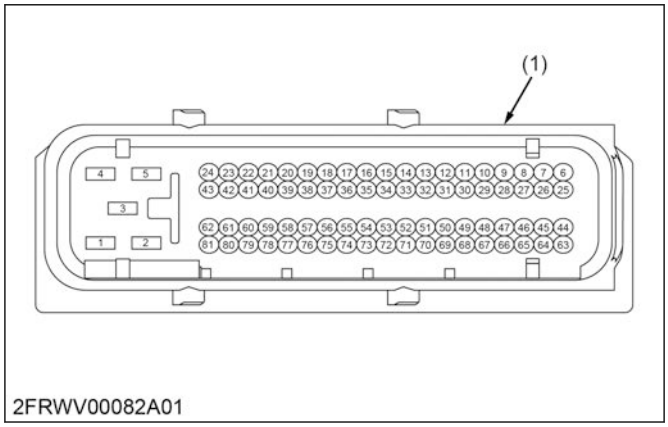
## 4.8.2.2 Preparing for checking tractor ECU (Cabin model)


(1) Lever grip
(2) Cover
(3) Tractor ECU

1. Remove the lever grips (1).
2. Disconnect the connector for PTO switch, 4WD switch and RPM dual memory switch.
3. Remove the cover (2).

## 4.8.2.3 Terminal position of tractor ECU




(1) Tractor ECU

| Terminal | Signal name |
|---|---|
| 1 | +B |
| 2 | Differential lock solenoid |
| 3 | 2WD solenoid |
| 4 | +B |
| 5 | GND |
| 6 | Shuttle switch |
| 7 | Gear lock parking lever switch |
| 8 | PTO switch (OFF 1) |
| 9 | Ground PTO switch |
| 10 | 2WD pressure switch |
| 11 | 4WD switch |
| 12 | — |
| 13 | Brake sensor (L.H.) |
| 14 | Throttle sensor (Sub) |
| 15 | Throttle sensor (Main) |
| 16 | CAN (L) |
| 17 | — |
| 18 | — |
| 19 | DPF INHIBIT switch |
| 20 | — |
| 21 | — |
| 22 | +5 V (Sensor use) |
| 23 | Front PTO relay |
| 24 | PTO solenoid |
| 25 | Clutch off switch |
| 26 | Gear lock parking detect switch |
| 27 | PTO speed select switch |
| 28 | Shuttle valve spool neutral switch |
| 29 | — |
| 30 | Brake switch (L.H.) |
| 31 | — |
| 32 | Brake sensor (R.H.) |
| 33 | Shuttle sensor (Sub) |
| 34 | Shuttle sensor (Main) |
| 35 | CAN (H) |
| 36 | Shuttle rotation sensor |
| 37 | Traveling speed sensor |
| 38 | Parked regeneration switch |
| 39 | Buzzer |
| 40 | — |

(Continued)

| Terminal | Signal name |
|---|---|
| 41 | GND (Sensor use) |
| 42 | — |
| 43 | Shuttle solenoid (Backward) |
| 44 | Secondary brake switch |
| 45 | Differential lock pedal switch |
| 46 | Front PTO switch (OFF 1) |
| 47 | Front PTO switch (ON) |
| 48 | T/B pressure switch |
| 49 | Auto differential lock switch |
| 50 | RPM dual memory switch (B) |
| 51 | — |
| 52 | — |
| 53 | — |
| 54 | — |
| 55 | Seat switch |
| 56 | External PTO switch |
| 57 | — |
| 58 | — |
| 59 | — |
| 60 | RXD (RS-232C) |
| 61 | — |
| 62 | Shuttle solenoid (forward) |
| 63 | PTO switch (N) |
| 64 | — |
| 65 | Front PTO switch (OFF 2) |
| 66 | Front PTO switch (N) |
| 67 | Dual speed switch |
| 68 | Range gear shift (Hi) switch |
| 69 | Main gear shift (6th) switch |
| 70 | Parked regeneration switch |
| 71 | DPF INHIBIT switch |
| 72 | Constant RPM management switch |
| 73 | RPM dual memory switch (A) |
| 74 | PTO switch (ON) |
| 75 | PTO switch (OFF 2) |
| 76 | Brake switch (R.H.) |
| 77 | — |
| 78 | — |
| 79 | TXD (RS-232C) |
| 80 | — |

(Continued)

| Terminal | Signal name |
|---|---|
| 81 | — |

## 4.8.3 Engine ECU

### 4.8.3.1 Terminal position of engine ECU

**[A]**

| A85 | A86 | A87 | A88 |
|---|---|---|---|
| PCV-LO | PCV-HI | | |
| A64 | A65 | A66 | A67 |
| COM1 | TWV3 | PRV+ | PRV- |
| A43 | A44 | A45 | A46 |
| COM1 | TWV1 | | |
| A22 | A23 | A24 | A25 |
| COM2 | TWV2 | OUTE1 | |
| A1 | A2 | A3 | A4 |
| COM2 | TWV4 | SWV6 | SWV5 |

| A89 | A90 | A91 | A92 | A93 | A94 | A95 | A96 | A97 | A98 | A99 | A100 | A101 | A102 | A103 | A104 | A105 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A-GND2 | | A-GND5 | A-GND12 | A-GND6 | INJ-SLD | A-GND3 | A-GND4 | A-GND-A | | INJ-SLD | A-GND7 | OUTE5 |
| A68 | A69 | A70 | A71 | A72 | A73 | A74 | A75 | A76 | A77 | A78 | A79 | A80 | A81 | A82 | A83 | A84 |
| | | | | ADE5 | ADE4 | ADE2 | ADV5 | ADE1 | | ADE13 | ADE3 | ADE11 | | | | OUTE6 |
| A47 | A48 | A49 | A50 | A51 | A52 | A53 | A54 | A55 | A56 | A57 | A58 | A59 | A60 | A61 | A62 | A63 |
| NE-VCC | | ADE6 | ADE9 | ADE8 | ADE7 | ADV6 | ADV7 | | | A-VCC1 | A-VCC12 | G-VCC | | A-VCC2 | OUTV4 | |
| A26 | A27 | A28 | A29 | A30 | A31 | A32 | A33 | A34 | A35 | A36 | A37 | A38 | A39 | A40 | A41 | A42 |
| NE-SLD | G-GND | | A-GND3 | A-GND3 | A-GND3 | A-GND1 | A-GND | | | | | SWV2 | | A-VCC4 | OUTV2 | |
| A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | A18 | A19 | A20 | A21 |
| NE(MRE) | G | | | SWE1 | | | | | | | | | | | | |

**[B]**

| B5 | B6 | B75 | B76 | B77 | B78 | B79 | B80 | B81 | B82 | B83 | B84 | B85 | B86 | B87 | B88 | B89 | B90 | B91 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| +B | +B | | CAN2H | CAN1H | SWV7 | | | | | | | | | OUTV1 | BATT | SOUT5 | | SOUT7 |
| | | B58 | B59 | B60 | B61 | B62 | B63 | B64 | B65 | B66 | B67 | B68 | B69 | B70 | B71 | B72 | B73 | B74 |
| | | | CAN2L | CAN1L | SWV3 | | | | SWV10 | SWV12 | | | | OUTV1 | | | | |
| B3 | B4 | B41 | B42 | B43 | B44 | B45 | B46 | B47 | B48 | B49 | B50 | B51 | B52 | B53 | B54 | B55 | B56 | B57 |
| +B | GND | SWV1 | SWV4 | SWV14 | | | A-VCC11 | | | A-VCC10 | | A-VCC10 | | SWV8 | SOUT2 | | SOUT4 | SOUT6 |
| | | B24 | B25 | B26 | B27 | B28 | B29 | B30 | B31 | B32 | B33 | B34 | B35 | B36 | B37 | B38 | B39 | B40 |
| | | | | | VS | SWV9 | A-GND12 | CAN-SLD | | A-GND13 | | A-GND3 | | | POUT1 | | | SOUT3 |
| B1 | B2 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | B18 | B19 | B20 | B21 | B22 | B23 |
| GND | GND | SWV23 | SWV11 | | | | ADV1 | | | ADV2 | | ADV3 | | | SWV13 | OUTV3 | SOUT1 | OUTV5 |

2LPXB00204A01

[A] Engine ECU connector A [B] Engine ECU connector B

## Connector A

| No. | Pin symbol | Signal name |
|---|---|---|
| A1 | COM2 | Common 2 |
| A2 | TWV4 | Injection #2 |
| A3 | SWV6 | Water level SW |
| A4 | SWV5 | Clog SW |
| A5 | NE (MRE) | Crankshaft |
| A6 | G | Camshaft angle |
| A7 | — | — |
| A8 | — | — |
| A9 | SWE1 | CAN-SEL-SW |
| A10 | — | — |
| A11 | — | — |
| A12 | — | — |
| A13 | — | — |
| A14 | — | — |
| A15 | — | — |
| A16 | — | — |
| A17 | — | — |
| A18 | — | — |
| A19 | — | — |
| A20 | — | — |
| A21 | — | — |
| A22 | COM2 | Common 2 |
| A23 | TWV2 | Injection #3 |
| A24 | OUTE1 | Feed pump |
| A25 | — | — |
| A26 | NE-GND | Crankshaft GND |
| A27 | G-GND | Camshaft angle GND |
| A28 | — | — |
| A29 | A-GND3 | Exhaust gas temperature 3 GND |
| A30 | A-GND3 | Exhaust gas temperature 2 GND |
| A31 | A-GND3 | Exhaust gas temperature 1 GND |
| A32 | A-GND1 | Option temperature sensor GND |
| A33 | A-GND | Option temperature sensor GND |
| A34 | — | — |
| A35 | — | — |
| A36 | — | — |
| A37 | — | — |
| A38 | SWV2 | ST-SW |
| A39 | — | — |

(Continued)

| No. | Pin symbol | Signal name |
|---|---|---|
| A40 | A-VCC4 | External barometric pressure sensor battery |
| A41 | OUTV2 | Exhaust air valve (Suction) |
| A42 | — | — |
| A43 | COM1 | Common 1 |
| A44 | TWV1 | Injection #1 |
| A45 | — | — |
| A46 | — | — |
| A47 | NE-VCC | Crankshaft power |
| A48 | — | — |
| A49 | ADE6 | External barometric pressure sensor |
| A50 | ADE9 | Exhaust gas temperature 3 (T2) |
| A51 | ADE8 | Exhaust gas temperature 2 (T1) |
| A52 | ADE7 | Exhaust gas temperature 1 (T0) |
| A53 | ADE6 | Option |
| A54 | ADE7 | Option |
| A55 | — | — |
| A56 | — | — |
| A57 | A-VCC1 | Rail pressure sensor power |
| A58 | A-VCC12 | Differential pressure sensor power |
| A59 | G-VCC | Camshaft angle power |
| A60 | — | — |
| A61 | A-VCC2 | Boost sensor power |
| A62 | OUTV4 | Intake air valve (Hold) |
| A63 | — | — |
| A64 | COM1 | Common 1 |
| A65 | TWV3 | Injection #4 |
| A66 | PRV+ | PRV+ |
| A67 | PRV- | PRV- |
| A68 | — | — |
| A69 | — | — |
| A70 | — | — |
| A71 | — | — |
| A72 | ADE5 | Coolant temp sensor (Water temp) |
| A73 | ADE4 | EXT air temp sensor |
| A74 | ADE2 | Fuel temp sensor |
| A75 | ADE5 | Intake air temperature sensor |
| A76 | ADE1 | Rail pressure sensor |
| A77 | — | — |
| A78 | ADE13 | Differential pressure sensor |
| A79 | ADE3 | Boost sensor |

(Continued)

| No. | Pin symbol | Signal name |
|---|---|---|
| A80 | ADE11 | Mass air flow sensor |
| A81 | — | — |
| A82 | — | — |
| A83 | — | — |
| A84 | OUTE6 | Intake air throttle - |
| A85 | PCV-LO | PCV- |
| A86 | PCV-HI | PCV+ |
| A87 | — | — |
| A88 | — | — |
| A89 | — | — |
| A90 | — | — |
| A91 | — | — |
| A92 | — | — |
| A93 | A-GND2 | Water temp GND |
| A94 | — | — |
| A95 | A-GND5 | PFUEL temp GND |
| A96 | A-GND12 | Intake air temperature (Built-in mass air flow sensor) |
| A97 | A-GND6 | Rail pressure sensor GND |
| A98 | INJ-SLD | Shield |
| A99 | A-GND3 | Differential pressure sensor GND |
| A100 | A-GND4 | Boost sensor GND |
| A101 | A-GND-A | Mass air flow sensor GND |
| A102 | — | — |
| A103 | INJ-SLD | Shield |
| A104 | A-GND7 | External barometric pressure sensor GND |
| A105 | OUTE5 | Intake air throttle + |

### Connector B

| No. | Pin symbol | Signal name |
|---|---|---|
| B1 | GND | ECU GND |
| B2 | GND | ECU GND |
| B3 | +B | ECU power |
| B4 | GND | ECU GND |
| B5 | +B | ECU power |
| B6 | +B | ECU power |
| B7 | SWV23 | External barometric pressure sensor SW |
| B8 | SWV11 | OP1-SW |
| B9 | — | — |
| B10 | — | — |
| B11 | — | — |
| B12 | ADV1 | Throttle sensor 1 |
| B13 | — | — |
| B14 | — | — |
| B15 | ADV2 | Throttle sensor 2 |
| B16 | — | — |
| B17 | ADV3 | Intake air throttle valve position sensor |
| B18 | — | — |
| B19 | — | — |
| B20 | SWV13 | OP2-SW |
| B21 | OUTV3 | STA-REL |
| B22 | SOUT1 | ENGINE-WARNING-LAMP |
| B23 | OUTV5 | Heater RLY |
| B24 | — | — |
| B25 | — | — |
| B26 | — | — |
| B27 | VS | Traveling speed sensor |
| B28 | SWV9 | Parked regeneration SW |
| B29 | A-GND12 | Throttle sensor 1 GND |
| B30 | CAN-SLD | CAN-SLD |
| B31 | — | — |
| B32 | A-GND13 | Throttle sensor 2 GND |
| B33 | — | — |
| B34 | A-GND3 | Intake air throttle valve position sensor GND |
| B35 | — | — |
| B36 | — | — |
| B37 | POUT1 | TAC |
| B38 | — | — |
| B39 | — | — |

(Continued)

| No. | Pin symbol | Signal name |
|---|---|---|
| B40 | SOUT3 | Parked regeneration display |
| B41 | SWV1 | IG-SW |
| B42 | SWV4 | Rated speed select SW |
| B43 | SWV14 | Inhibit-SW |
| B44 | — | — |
| B45 | — | — |
| B46 | A-VCC11 | Throttle sensor 2 power |
| B47 | — | — |
| B48 | — | — |
| B49 | A-VCC10 | Throttle sensor 1 power |
| B50 | — | — |
| B51 | A-VCC10 | Intake air throttle sensor power |
| B52 | — | — |
| B53 | SWV8 | OIL-SW |
| B54 | SOUT2 | ENG-STOP-LAMP |
| B55 | — | — |
| B56 | SOUT4 | Heater lamp |
| B57 | SOUT6 | OIL-LAMP |
| B58 | — | — |
| B59 | CAN2L | CAN2 |
| B60 | CAN1L | CAN1 |
| B61 | SWV3 | STOP-SW |
| B62 | — | — |
| B63 | — | — |
| B64 | — | — |
| B65 | SWV10 | BG-mode SW |
| B66 | SWV12 | Parking SW |
| B67 | — | — |
| B68 | — | — |
| B69 | — | — |
| B70 | OUTV1 | Main relay |
| B71 | — | — |
| B72 | — | — |
| B73 | — | — |
| B74 | — | — |
| B75 | — | — |
| B76 | CAN2H | CAN2 |
| B77 | CAN1H | CAN1 |
| B78 | SWV7 | Neutral SW |
| B79 | — | — |

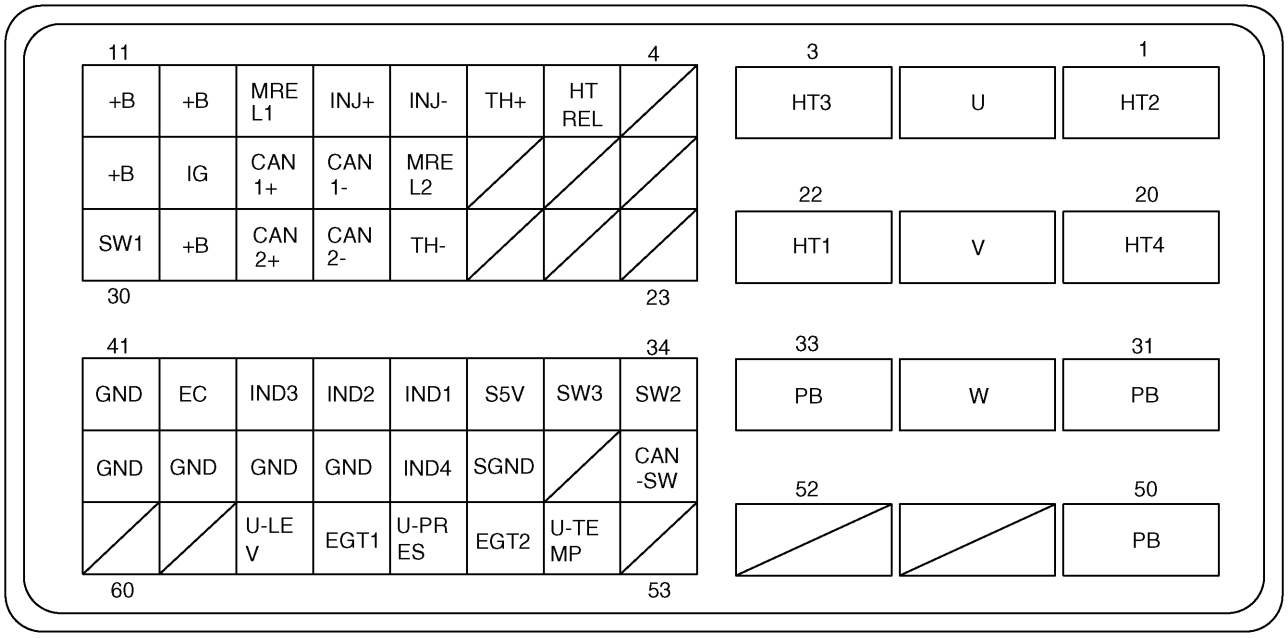
(Continued)

| No. | Pin symbol | Signal name |
|---|---|---|
| B80 | — | — |
| B81 | — | — |
| B82 | — | — |
| B83 | — | — |
| B84 | — | — |
| B85 | — | — |
| B86 | — | — |
| B87 | OUTV1 | Main relay |
| B88 | BATT | RAM backup power |
| B89 | SOUT5 | Overheat lamp |
| B90 | — | — |
| B91 | SOUT7 | Regeneration lamp |

## 4.8.4 ACU

### 4.8.4.1 Terminal position of ACU

(1)




2LPXB00422A01

(1) ACU connector

| No. | Pin symbol | Signal name |
|---|---|---|
| 1 | HT2 | Delivery line heater |
| 2 | U | Urea pump (U-phase) |
| 3 | HT3 | Return line heater |
| 4 | — | — |
| 5 | HTREL | Heater relay |
| 6 | TH+ | Coolant valve (+) |
| 7 | INJ- | Urea injector (-) |
| 8 | INJ+ | Urea injector (+) |
| 9 | MREL1 | Main relay |
| 10 | +B | Battery |
| 11 | +B | Battery |
| 12 | — | — |
| 13 | — | — |
| 14 | — | — |
| 15 | MREL2 | Main relay |
| 16 | CAN1- | CAN1-LO |
| 17 | CAN1+ | CAN1-HI |
| 18 | IG | Ignition switch |
| 19 | +B | Battery |
| 20 | HT4 | Enclosure heater |
| 21 | V | Urea pump (V-phase) |
| 22 | HT1 | Suction line heater |
| 23 | — | — |
| 24 | — | — |
| 25 | — | — |
| 26 | TH- | Coolant valve (-) |
| 27 | CAN2- | CAN2-LO |
| 28 | CAN2+ | CAN2-HI |
| 29 | +B | Battery |
| 30 | SW0 | Spare switch (Open/GND) |
| 31 | PB | Battery (for heaters) |
| 32 | W | Urea pump (W-phase) |
| 33 | PB | Battery (for heaters) |
| 34 | SW1 | Spare switch (Open/GND) |
| 35 | SW2 | Spare switch (Open/GND) |
| 36 | S5V | Sensor power supply 5 V |
| 37 | IND1 | Indicator lamp 1 |
| 38 | IND2 | Indicator lamp 2 |
| 39 | IND3 | Indicator lamp 3 |
| 40 | EC | Case ground |

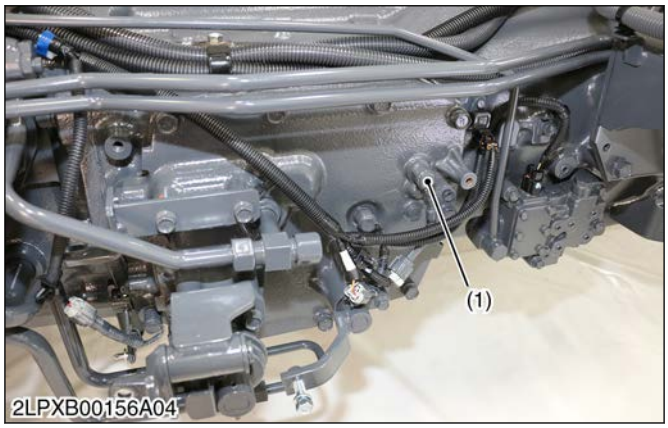
(Continued)

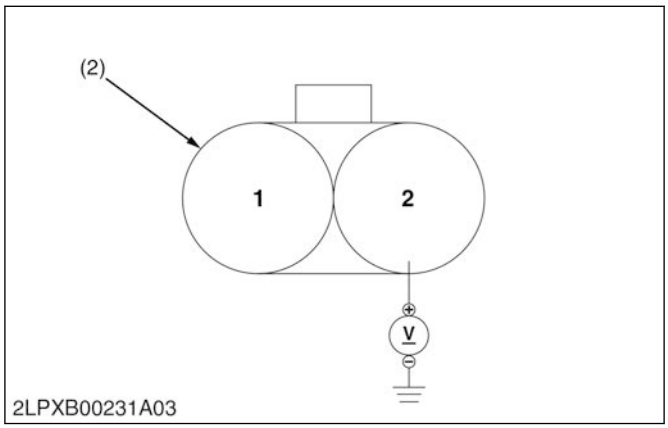
| No. | Pin symbol | Signal name |
|---|---|---|
| 41 | GND | Ground |
| 42 | CAN_SW | CAN switch (+B/Open) |
| 43 | — | — |
| 44 | SGND | Sensor ground |
| 45 | IND4 | Indicator lamp 4 |
| 46 | GND | Ground |
| 47 | GND | Ground |
| 48 | GND | Ground |
| 49 | GND | Ground |
| 50 | PB | Battery (for heaters) |
| 51 | — | — |
| 52 | — | — |
| 53 | — | — |
| 54 | U-TEMP | Urea temperature sensor (Not used) |
| 55 | EGT2 | Post SCR temperature sensor (Not used) |
| 56 | U-PRES | Urea pressure sensor |
| 57 | EGT1 | Pre SCR temperature sensor |
| 58 | U-LEV | Urea level sensor (Not used) |
| 59 | — | — |
| 60 | — | — |

# 4.9 Traveling switch and sensor

## 4.9.1 Main gear shift (6th) switch

### 4.9.1.1 Checking connector voltage for main gear shift (6th) switch



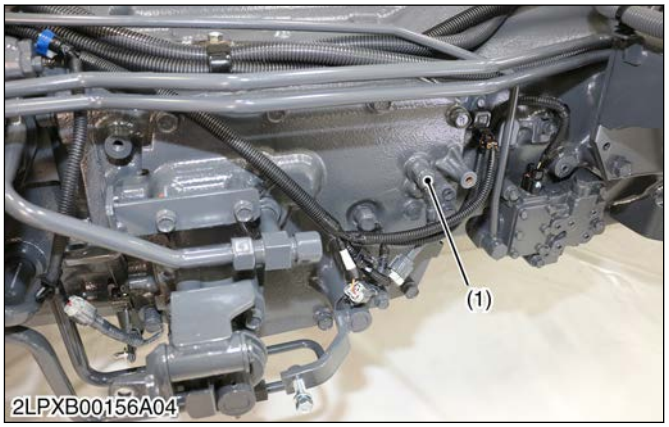

(1) Main gear shift (6th) switch (2) Connector (Wire harness side)

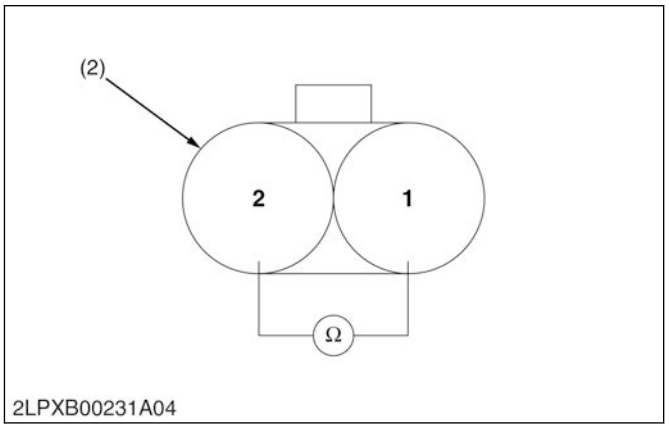
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 2 – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.9.1.2 Checking main gear shift (6th) switch




(1) Main gear shift (6th) switch (2) Connector (Switch side)

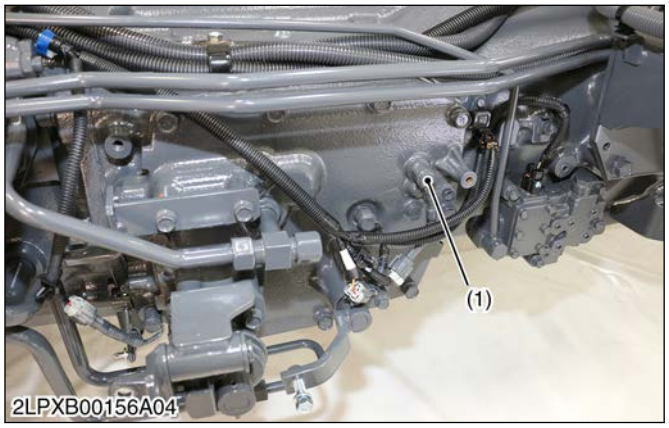
1. Check the continuity across the terminals shown in the table below.

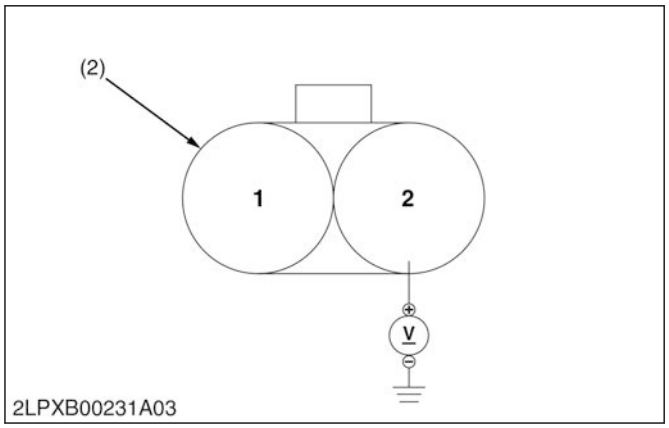
| Position | Terminal 1 – 2 |
|---|---|
| Switch **OFF**(Main gear shift lever is **6th** position) | Infinity |
| Switch **ON**(Main gear shift lever is **Except 6th** position) | Continuity (0 Ω) |

2. If the continuity specified value is not indicated, main gear shift (6th) switch is damaged.

## 4.9.2 Range gear shift (High) switch

### 4.9.2.1 Checking connector voltage for range gear shift (High) switch



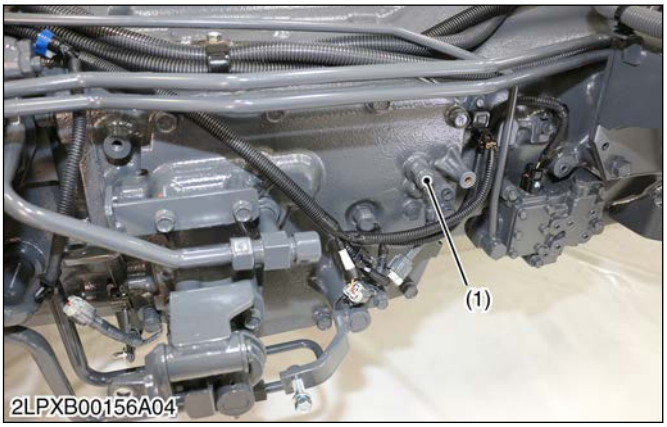

(1) Range gear shift (Hi) switch (2) Connector (Wire harness side)

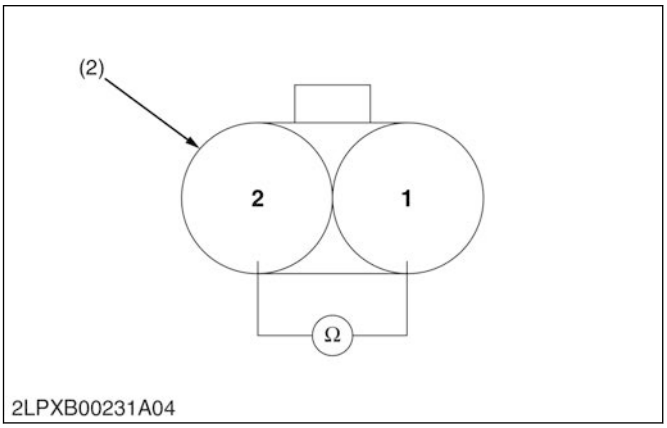
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 2 – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.9.2.2 Checking range gear shift (High) switch




(1) Range gear shift (Hi) switch (2) Connector (Switch side)

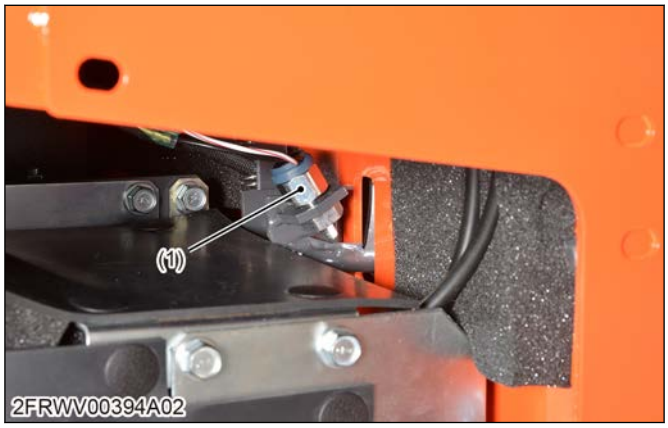
1. Check the continuity across the terminals shown in the table below.

| Position | Terminal 1 – 2 |
|---|---|
| Switch **OFF** (Range gear shift lever is **L** position) | Infinity |
| Switch **ON** (Range gear shift lever is **H** position) | Continuity (0 Ω) |

2. If the continuity specified value is not indicated, range gear shift (High) switch is damaged.

## 4.9.3 Rear differential lock switch

### 4.9.3.1 Checking connector voltage for rear differential lock switch (ROPS model)



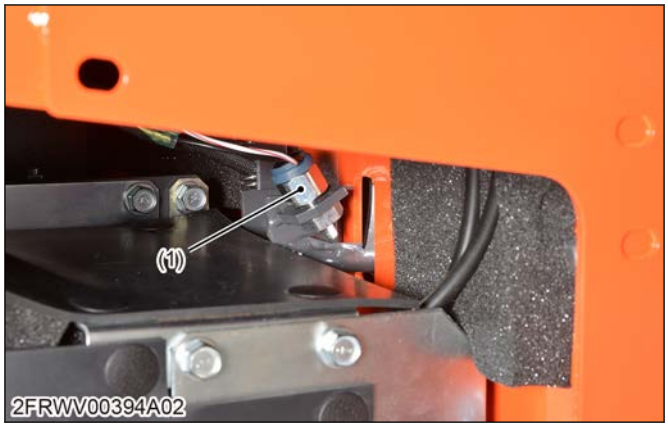

(1) Rear differential lock switch

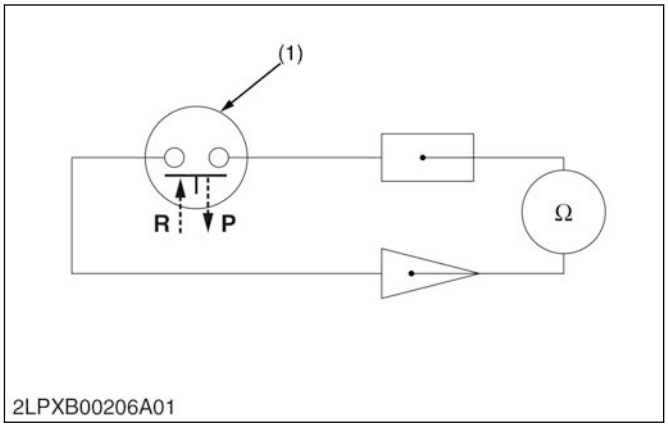
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main key switch at ON | Red/White lead - Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.9.3.2 Checking rear differential lock switch (ROPS model)




(1) Rear differential lock switch R: Released
P: Pushed

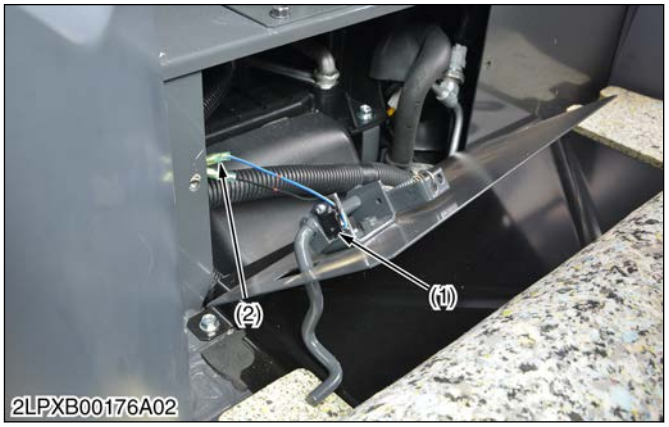
1. Check the continuity with an ohmmeter across the switch terminals.
2. If it does not conduct or any value is indicated when the switch is released (differential lock pedal is pushed), the switch is damaged.

| | | | |
|---|---|---|---|
| Resistance (Across switch terminals) | Reference value | When switch is released "R". | 0 Ω |

3. If infinity is not indicated when the switch is pushed (differential lock pedal is released), the switch is damaged.

| | | | |
|---|---|---|---|
| Resistance (Across switch terminals) | Reference value | When switch is pushed "P". | Infinity |

### 4.9.3.3 Checking connector voltage for rear differential lock switch (Cabin model)




(1) Rear differential lock switch (2) Rear differential lock switch connector

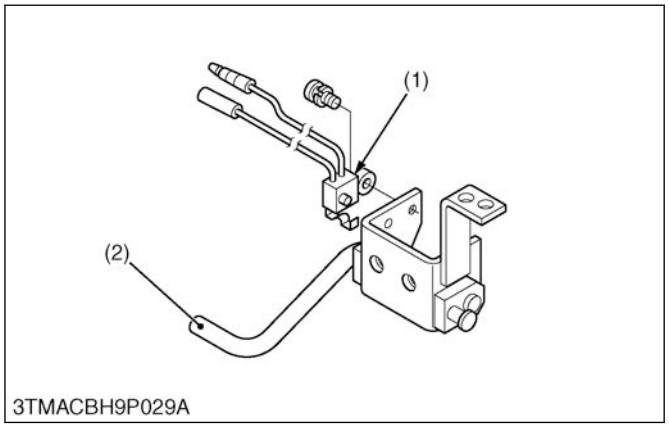
1. Disconnect the connector, and turn the main key switch “**ON**” position.

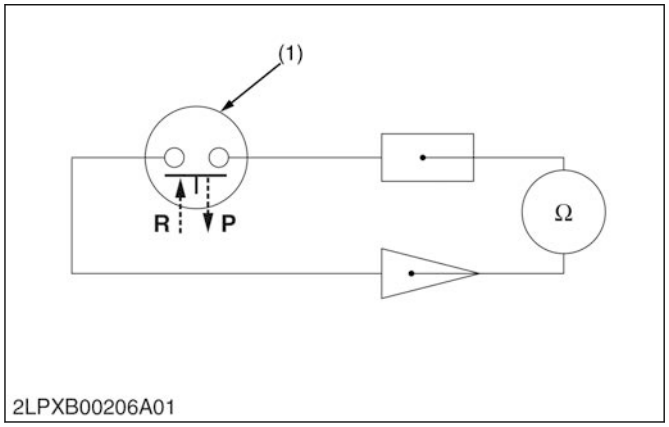
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main key switch at "**ON**" | Red/White lead - Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.9.3.4 Checking rear differential lock switch (Cabin model)


(1) Rear differential lock switch
(2) Rear differential lock pedal
P: Pushed
R: Released

1. Check the continuity with an ohmmeter across the switch terminals.
2. If it does not conduct or any value is indicated when the switch is released (differential lock pedal is pushed), the switch is damaged.

| | | | |
|---|---|---|---|
| Resistance (Across switch terminals) | Reference value | When switch is released "R". | 0 Ω |

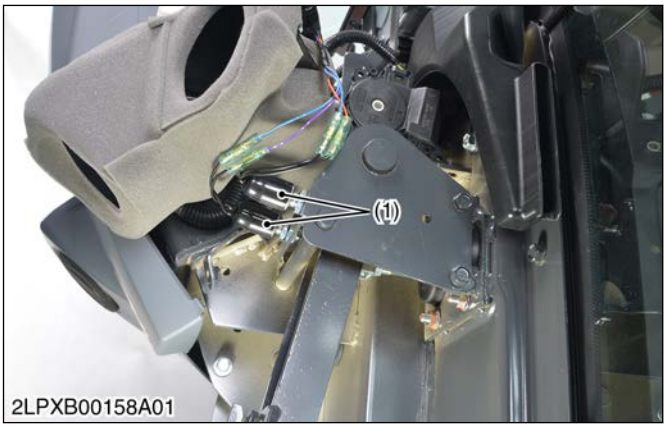
3. If infinity is not indicated when the switch is pushed (differential lock pedal is released), the switch is damaged.

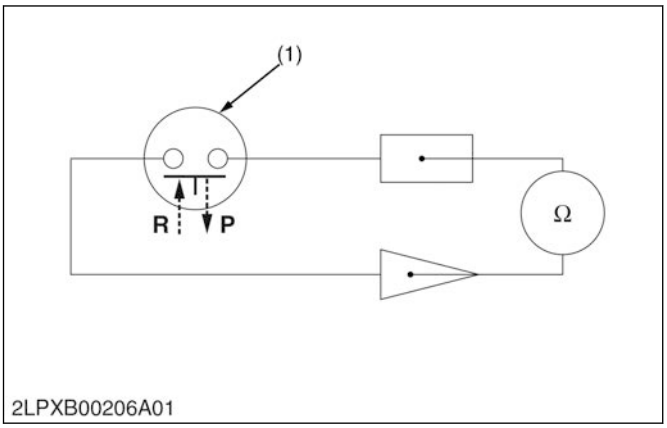
| | | | |
|---|---|---|---|
| Resistance (Across switch terminals) | Reference value | When switch is pushed "P". | Infinity |

## 4.9.4 Foot brake switch

### 4.9.4.1 Checking foot brake switch wire

1. Disconnect the leads from the foot brake switch (1).



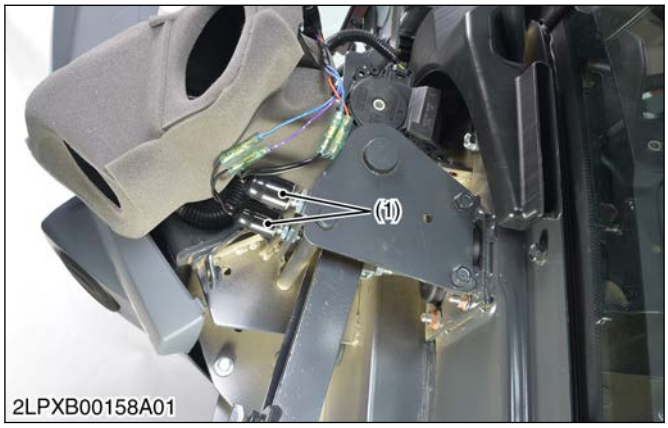



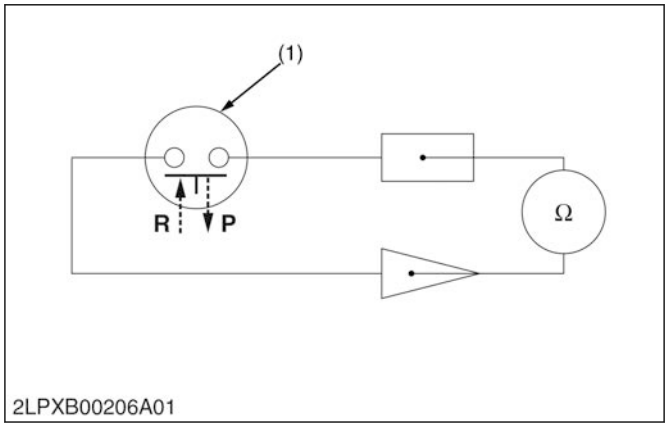

(1) Foot brake switch
P: Pushed
R: Released

2. Connect the wiring harness lead terminals to each other and turn the main switch **ON**.
3. If the stop lights do not light, the fuse, wiring harness or bulb is damaged.

### 4.9.4.2 Checking foot brake switch

1. Remove the foot brake switch (1).




(1) Foot brake switch R: Released
P: Pushed

2. Check the continuity with an ohmmeter across the switch terminals.
3. If it does not conduct or any value is indicated when the switch is released, the switch is damaged.

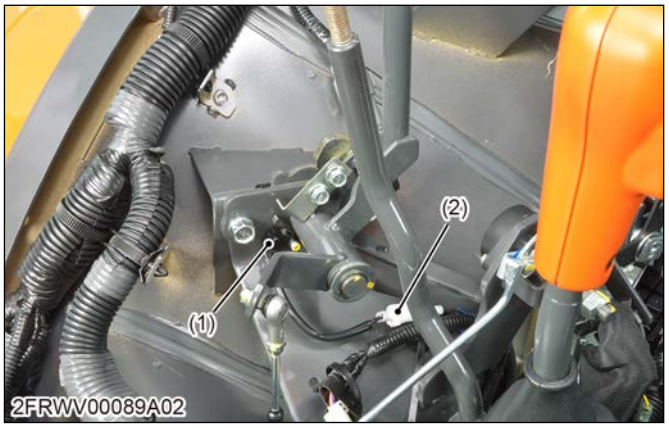
| | | | |
|---|---|---|---|
| Resistance (Across switch terminals) | Reference value | When switch is released "R". | 0 Ω |

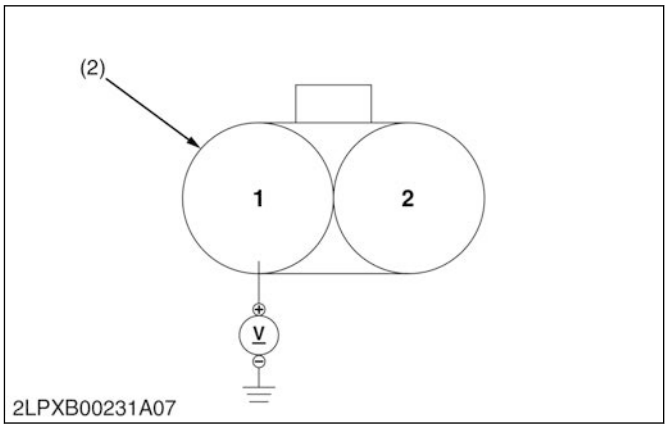
4. If infinity is not indicated when the switch is pushed, the switch is damaged.

| | | | |
|---|---|---|---|
| Resistance (Across switch terminals) | Reference value | When switch is pushed "P". | Infinity |

## 4.9.5 Parking lock lever switch

### 4.9.5.1 Checking connector voltage for parking lock lever switch



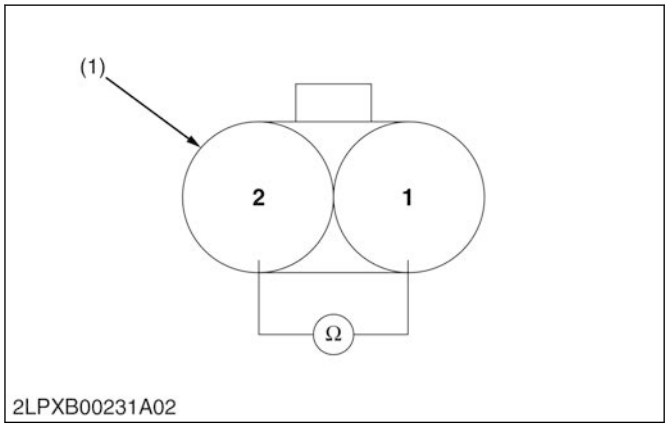

(1) Parking lock lever switch (2) Connector (Wire harness side)

1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 1 – chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.9.5.2 Checking parking lock lever switch




(1) Connector (Switch side)

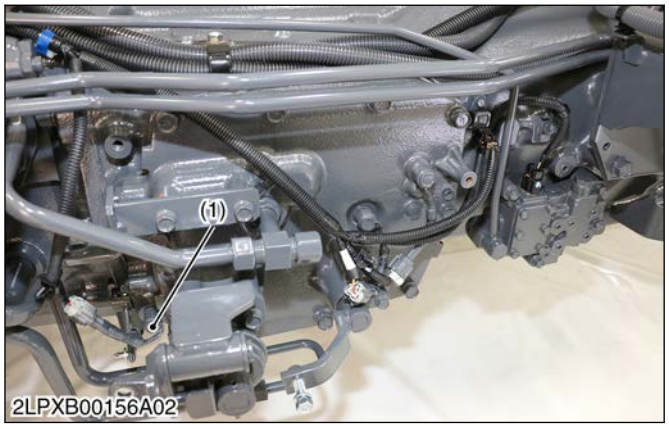
1. Check the continuity across the terminals shown in the table below.

| Position | Terminal 1 – 2 |
|---|---|
| Switch **ON** (Parking lock lever is released position) | Continuity (0 Ω) |
| Switch **OFF** (Parking lock lever is parked position) | Infinity |

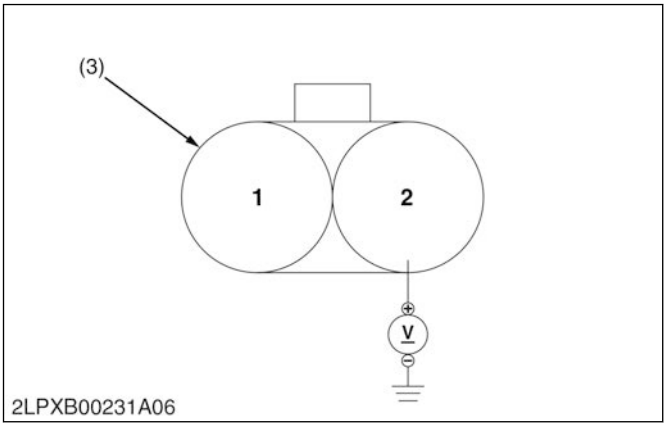
2. If the continuity specified value is not indicated, parking lock lever switch is damaged.

## 4.9.6 Gear lock parking brake switch

## 4.9.6.1 Checking connector voltage for gear lock parking brake switch







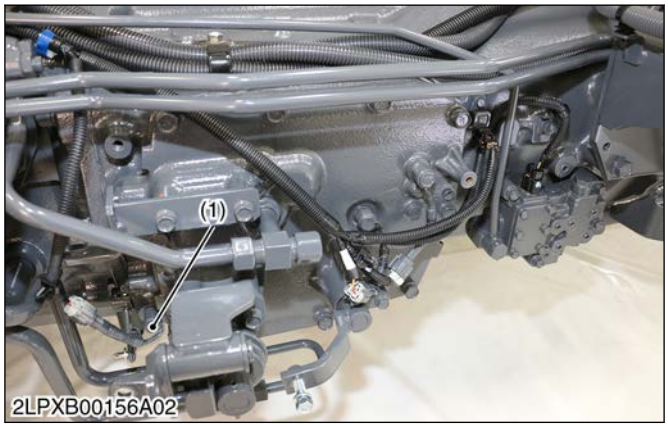

(1) Gear lock parking brake switch
(2) Gear lock parking brake lever
(3) Gear lock parking brake switch connector (Wire harness side)
(A) Parked position

1. Remove the steering handle and steering post cover.
2. Disconnect the connector, and turn the main key switch "**ON**" position.
3. Measure the voltage with a voltmeter across the terminals shown in the table below.

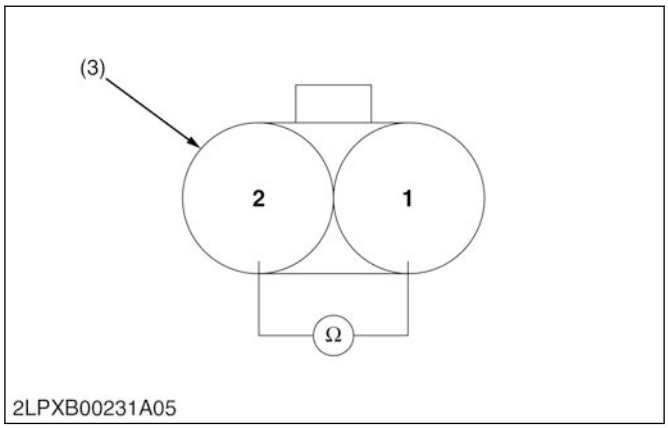
| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 2 – Chassis | Approximately battery voltage |

4. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.9.6.2 Checking gear lock parking brake switch







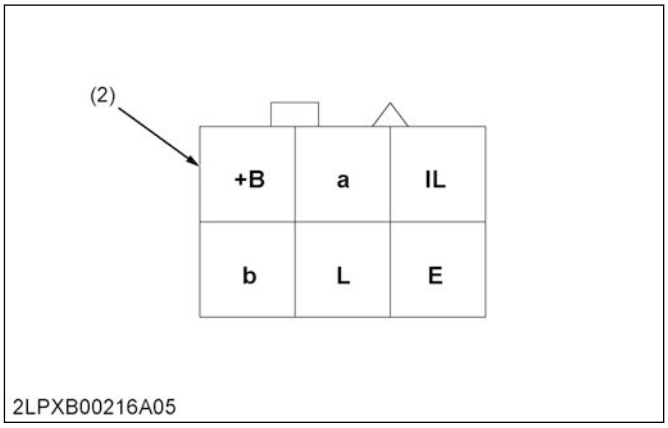

(1) Gear lock parking brake switch
(2) Gear lock parking brake lever
(3) Gear lock parking brake switch (Switch side)
(A) Parked position

1. Remove the cover for gear lock parking brake switch.
2. Disconnect the connector of gear lock parking brake switch (1).
3. Measure the resistance value between terminal 1 and terminal 2 when the gear lock parking brake lever is parked / released position.
4. If the continuity specified below is not indicated, the switch is damaged.

| | | | |
|---|---|---|---|
| Resistance (Across switch terminal) | Reference value | When switch is pushed "P" (Parking gear lock lever is parked position). | 0 Ω |
| | | When switch is released "R"(Parking gear lock lever is released position). | Infinity |

## 4.9.7 4WD switch

## 4.9.7.1 Checking connector voltage for 4WD switch (ROPS model)

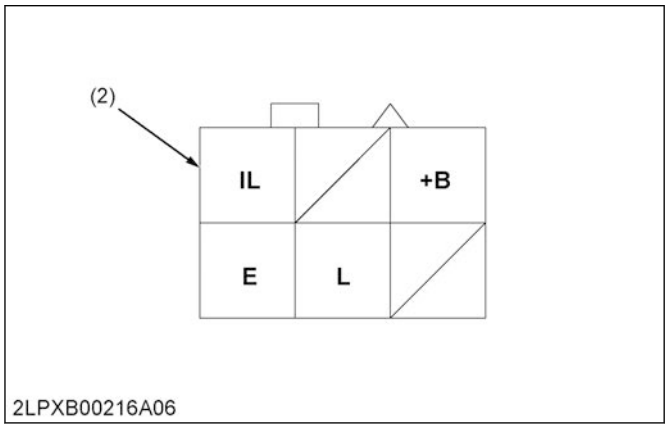

(1) 4WD switch
(2) Connector (Wire harness side)

1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal L – Chassis | Approximately battery voltage |

3. If the reference value is not indicated, check the relating electric circuit.

## 4.9.7.2 Checking 4WD switch (ROPS model)

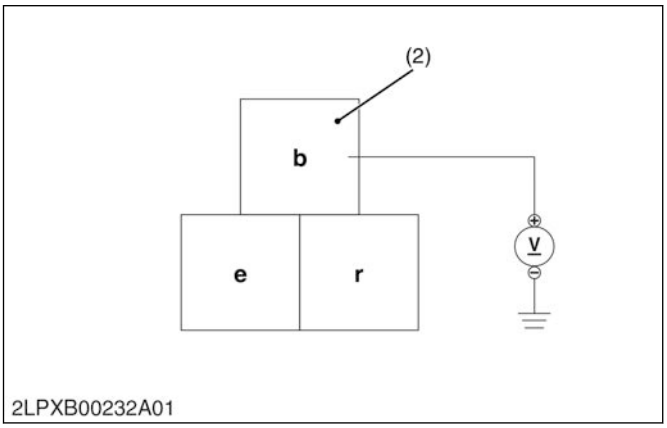

(1) 4WD switch (2) Connector (Switch side)

1. Check the continuity across the terminals shown in the table below.

| | | |
|---|---|---|
| Resistance (Switch at **OFF**) | Terminal +B – Terminal L | Infinity |
| Resistance (Switch at **ON**) | Terminal +B – Terminal L | 0 Ω |
| Resistance (Bulb) | Terminal IL – Terminal E | Approximately 6.5 Ω |

2. If the continuity specified below is not indicated, 4WD switch is damaged.

## 4.9.7.3 Checking connector voltage for 4WD switch

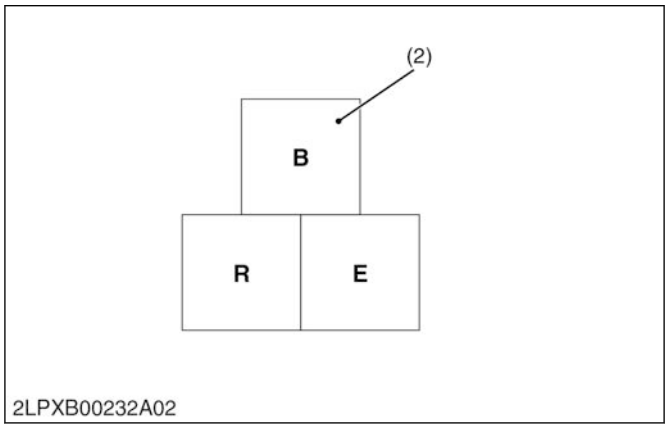




(1) 4WD switch (2) Connector (Wire harness side)

1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.
3. If the reference value is not indicated as shown in the table below, check the relating electric circuit.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal b – Chassis | Approximately battery voltage |

## 4.9.7.4 Checking 4WD switch (Cabin model)


(1) 4WD switch
(2) Connector (Switch side)

1. Check the continuity across the terminals shown in the table below.

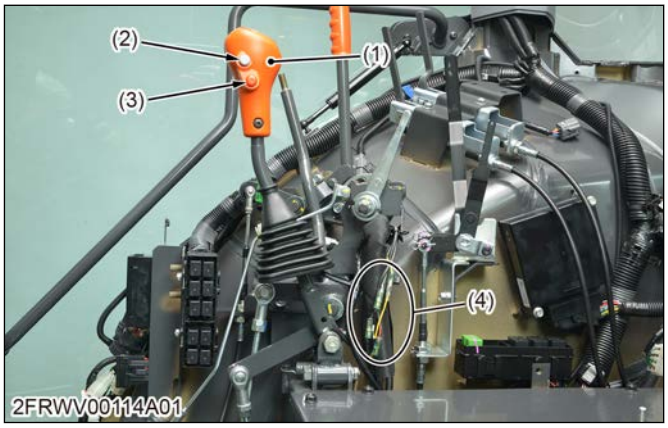
| Position | | Terminal | | |
|---|---|---|---|---|
| | | B | R | E |
| 4WD switch | OFF | | ● | ● |
| | ON | ● | ● | ● |

2LPXB00234A01

2. If the continuity specified below is not indicated, 4WD switch is damaged.

## 4.9.8 Main shift lever switch

### 4.9.8.1 Checking connector voltage for main shift lever switch



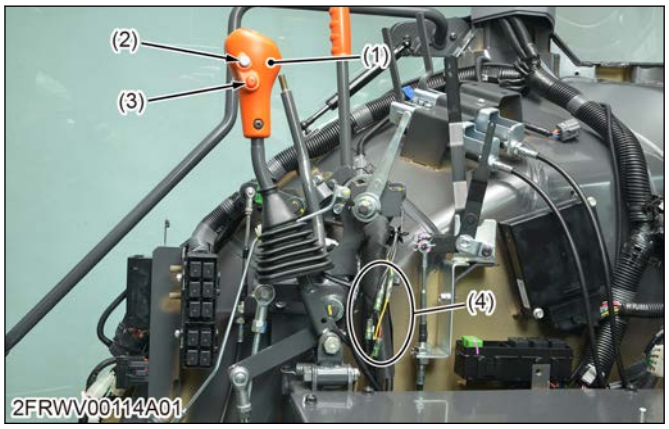

(1) Main shift lever switch
(2) Clutch off switch
(3) DS(dual speed) switch
(4) Connector

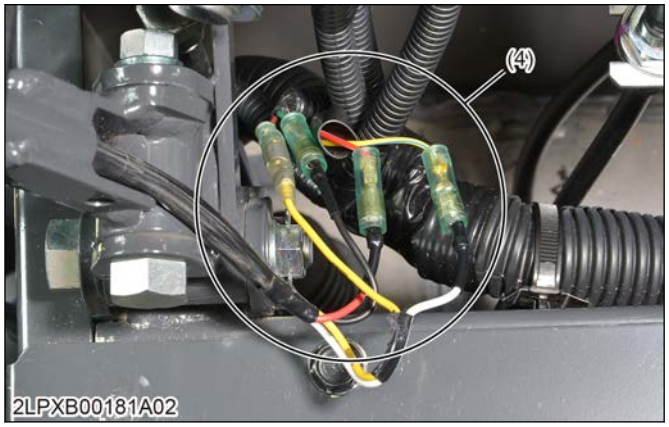
1. Disconnect the connector (4), and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

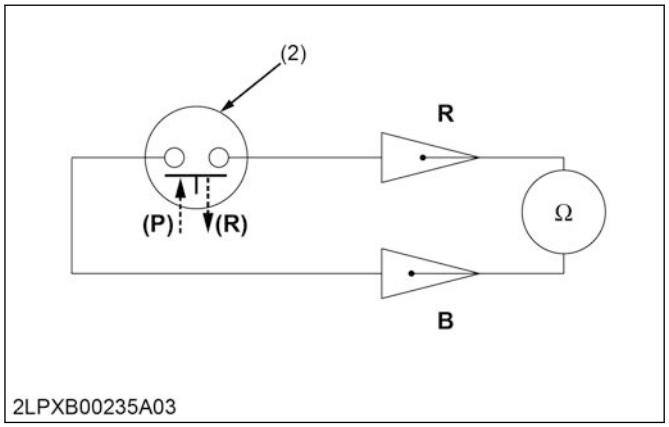
| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Red / White lead – Chassis | Approximately battery voltage |
| | | White lead – Chassis | |

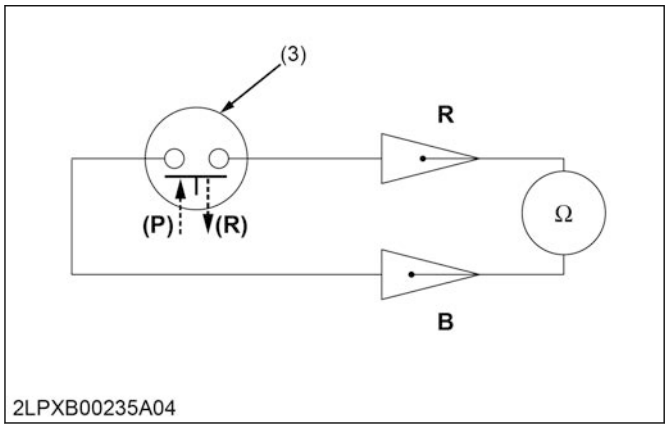
3. If the reference value is not indicated as shown in the table below, check the relating electric circuit.

## 4.9.8.2 Checking main shift lever switch




(1) Clutch off switch
(2) DS(dual speed) switch
(3) Main shift lever switch
(4) Connector

1. Check the continuity across the terminals shown in following sub-steps.
   a. Check the continuity across the terminals for clutch off switch shown in the table below.
      If the continuity specified below is not indicated, clutch off switch is damaged.

**Clutch off switch**

| Switch | Position | Terminal (Wire harness color) | |
|---|---|---|---|
| | | Red | Black |
| Clutch off switch | OFF (Release) | Infinity | |
| | ON (Push) | Continuity | |

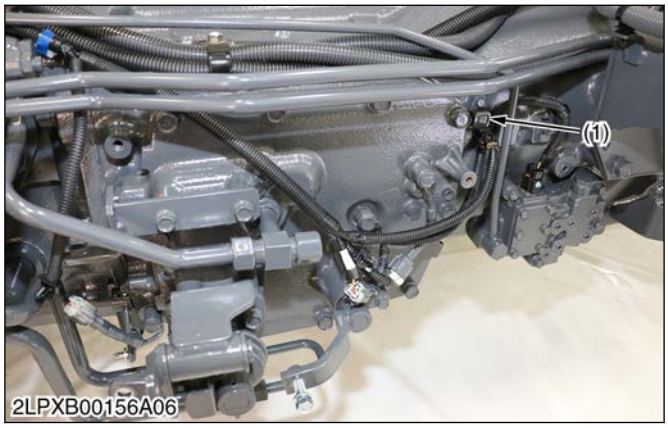
   b. Check the continuity across the terminals for dual speed shift switch shown in the table below.
      If the continuity specified below is not indicated, dual speed switch is damaged.

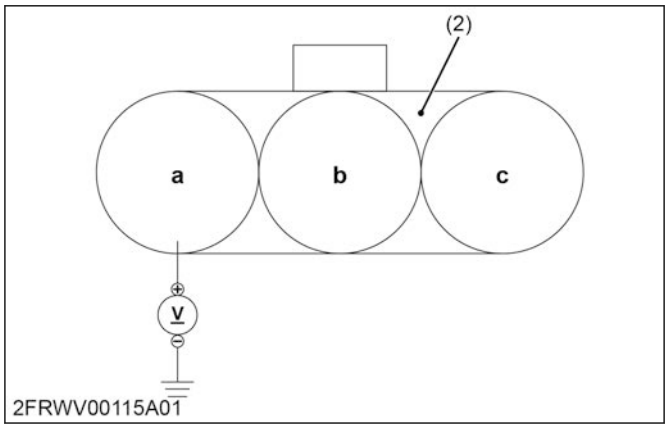
**Dual speed shift switch**

| Switch | Position | Terminal (Wire harness color) | |
|---|---|---|---|
| | | White | Yellow |
| Dual speed shift switch | OFF (Release) | Infinity | |
| | ON (Push) | Continuity | |

## 4.9.9 Traveling speed sensor

### 4.9.9.1 Checking connector voltage for traveling speed sensor




(1) Traveling speed sensor
(2) Connector (Wire harness side)

1. Disconnect the connector and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal a – Chassis | Approximately battery voltage |
| | | Terminal b – Chassis | Approximately 5 voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.9.9.2 Checking traveling speed sensor

**■ NOTE**

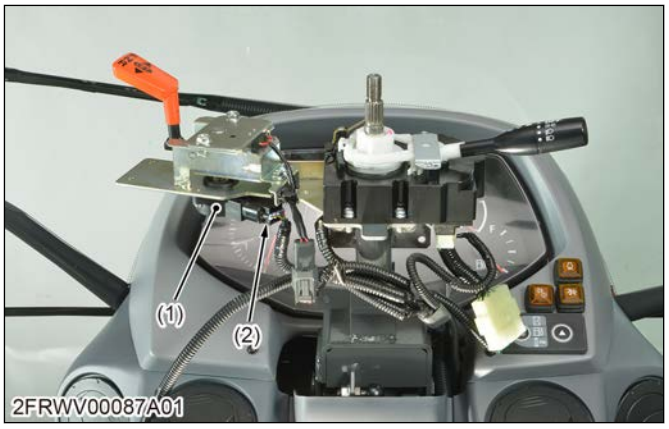
- **The traveling speed sensor cannot be checked by circuit tester.**

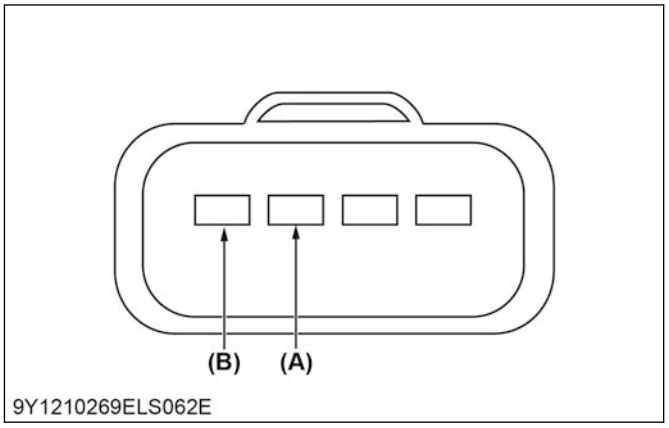

(1) Traveling speed sensor

1. Check traveling speed display on the LCD.
2. If traveling speed is not displayed on the LCD although connector voltage is OK, the traveling speed sensor is damaged.

## 4.9.10 Shuttle lever sensor

### 4.9.10.1 Checking connector voltage for shuttle lever sensor



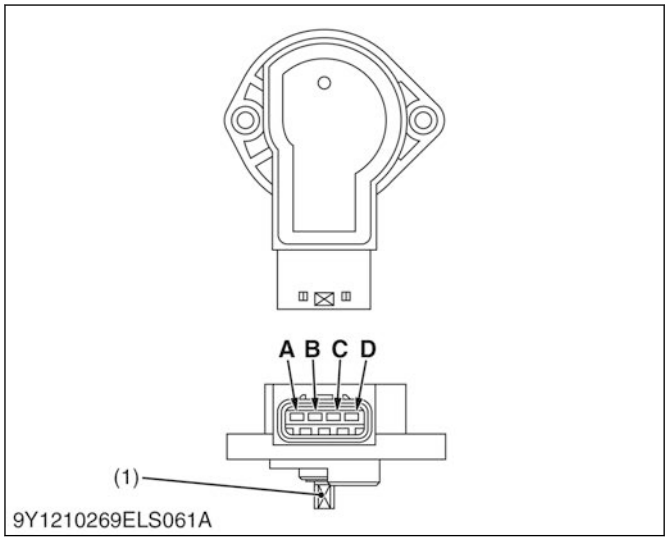

(1) Shuttle sensor
(2) Connector (Wire harness side)
(A) Terminal A
(B) Terminal B

1. Remove the steering handle and steering post cover.
2. Disconnect the shuttle lever sensor connector.
3. Turn the main key switch **ON**.

4. Check the voltage between terminal A (+) and terminal B (−) of the wire harness side.
5. If the measurement is not indicated as shown in the table below, check the relating electric circuit.

| | | |
|---|---|---|
| Voltage | Terminal A – Terminal B | 5 V |

### 4.9.10.2 Checking shuttle lever sensor resistance




(1) Sensor shaft
A: Terminal A
B: Terminal B
C: Terminal C
D: Terminal D

**(Reference)**

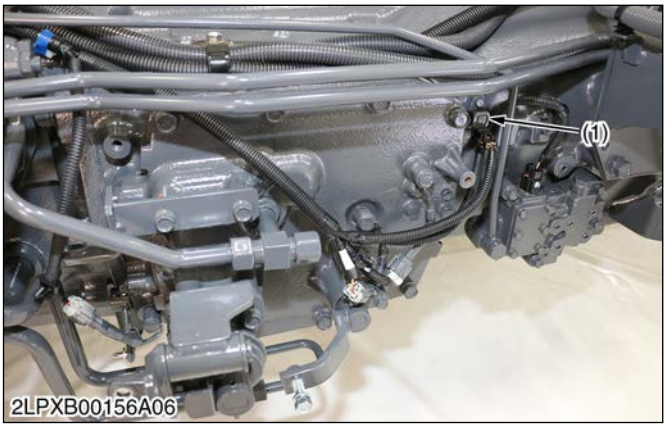
- The change of resistance can be checked easily with analog tester.

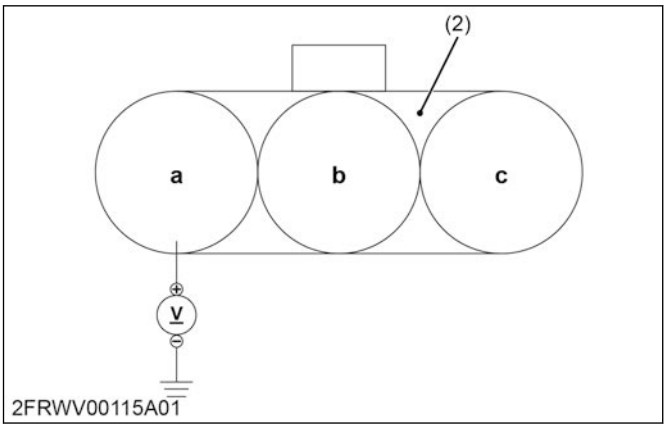
1. Measure the resistance between the following terminals.
   a. Measure the resistance between terminal A and D while slowly turning the sensor shaft (1).
   b. Measure the resistance between terminal B and D while slowly turning the sensor shaft (1).
2. Replace the sensor if the resistance value is out of specification shown in the table below.

| | | |
|---|---|---|
| Resistance | Terminal A – Terminal D | 0 to 1 kΩ |
| | Terminal B – Terminal D | 0 to 1 kΩ |

## 4.9.11 Shuttle rotation sensor

### 4.9.11.1 Checking connector voltage for shuttle rotation sensor




(1) Shuttle rotation sensor
(2) Connector (Wire harness side)

1. Disconnect the connector and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.
3. If the reference value is not indicated as shown in the table below, check the relating electric circuit.

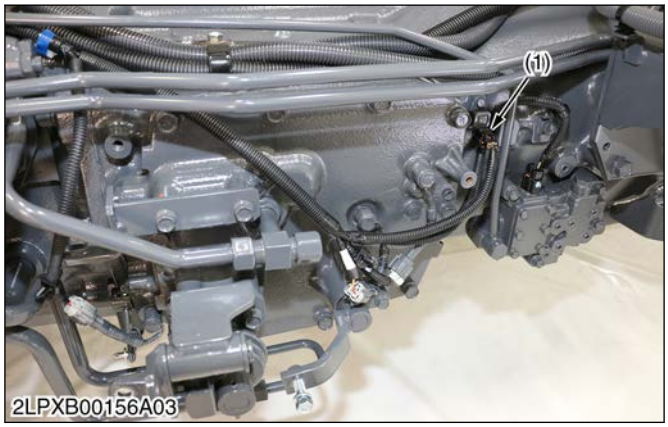
| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal a – Chassis | Approximately battery voltage |

### 4.9.11.2 Checking shuttle rotation sensor

**NOTE**

- **The shuttle rotation sensor cannot be checked by circuit tester.**

1. Check the number of shuttle rotation by using tester mode "**TST-1**".

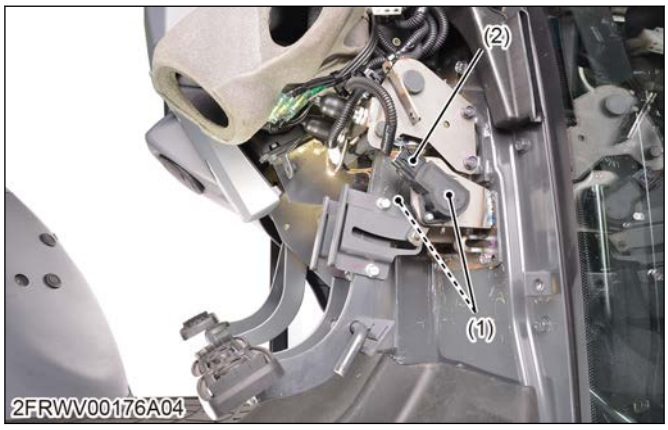


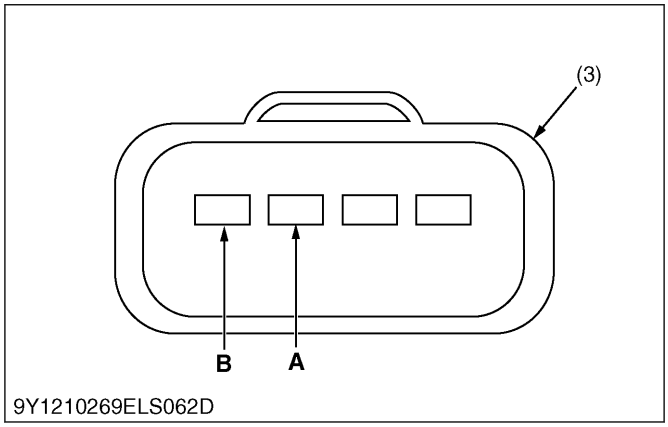

(1) Shuttle rotation sensor

2. If the number of shuttle rotation is not displayed correctly although connector voltage is OK, the shuttle rotation sensor is damaged.

## 4.9.12 Brake sensor

### 4.9.12.1 Checking connector voltage for brake sensor



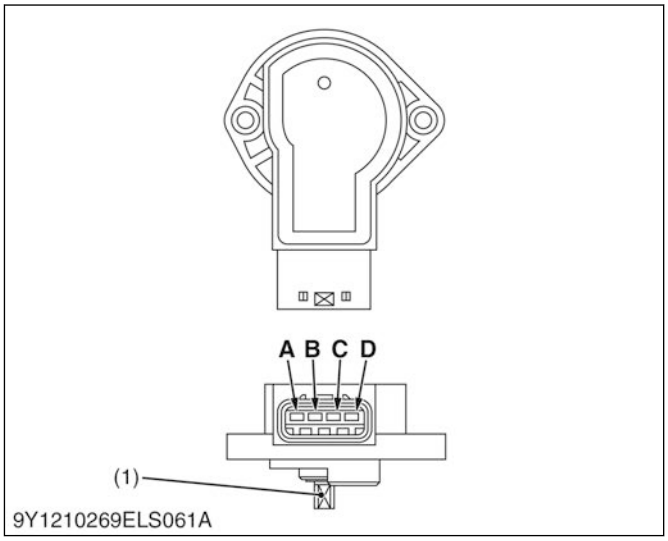




(1) Brake sensor
(2) Brake sensor connector
(3) Connector (Wire harness side)
A: Terminal A
B: Terminal B

1. Disconnect the brake sensor connector.
2. Turn the main key switch **ON**.
3. Check the voltage between terminal A (+) and terminal B (−) of the wire harness side.
4. If the measurement is not indicated as shown in the table below, check the relating electric circuit.

| | | |
|---|---|---|
| Voltage | Terminal A –Terminal B | 5 V |

### 4.9.12.2 Checking brake sensor resistance




(1) Sensor shaft
A: Terminal A
B: Terminal B
C: Terminal C
D: Terminal D

**(Reference)**

- The change of resistance can be checked easily with analog tester.

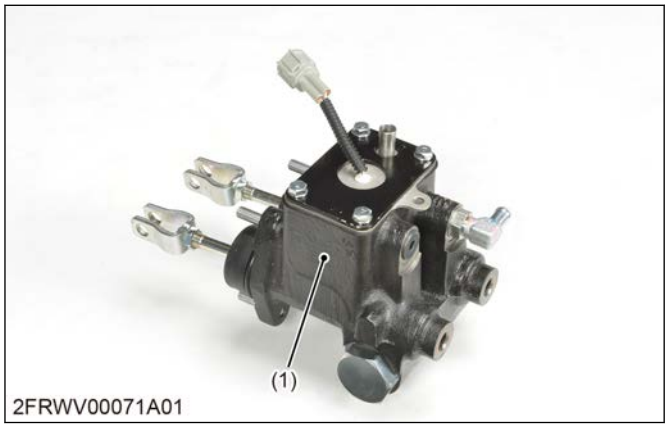
1. Measure the resistance between the following terminals.
   a. Measure the resistance between terminal A and D while slowly turning the sensor shaft (1).
   b. Measure the resistance between terminal B and D while slowly turning the sensor shaft (1).

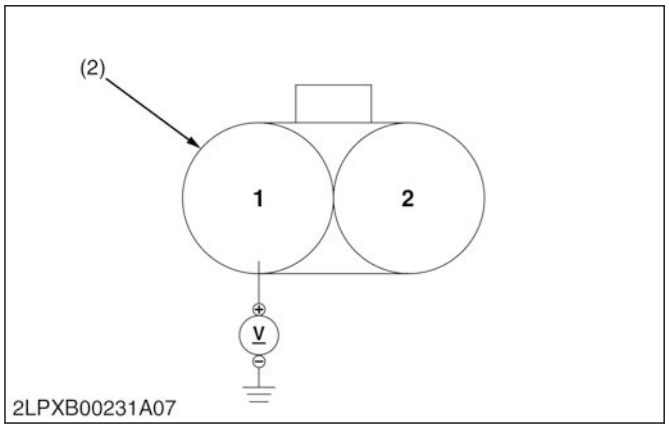
   Replace the sensor if the resistance value is out of specification shown in the table below.

| | | |
|---|---|---|
| Resistance | Terminal A – Terminal D | 0 to 1 kΩ |
| | Terminal B – Terminal D | 0 to 1 kΩ |

## 4.9.13 Master cylinder

### 4.9.13.1 Checking connector voltage for master cylinder




(1) Master cylinder
(2) master cylinder connector (Wire harness side)

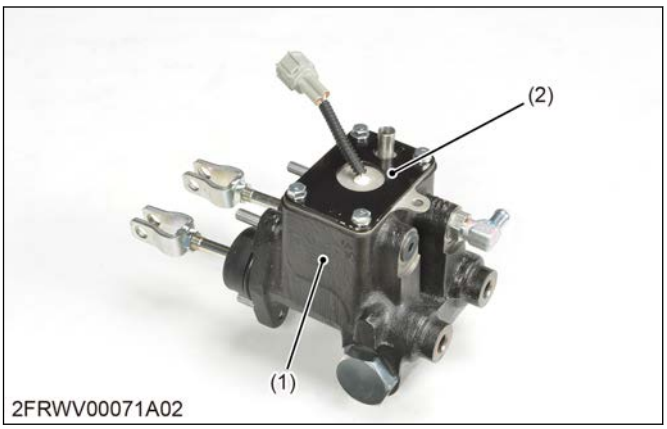
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

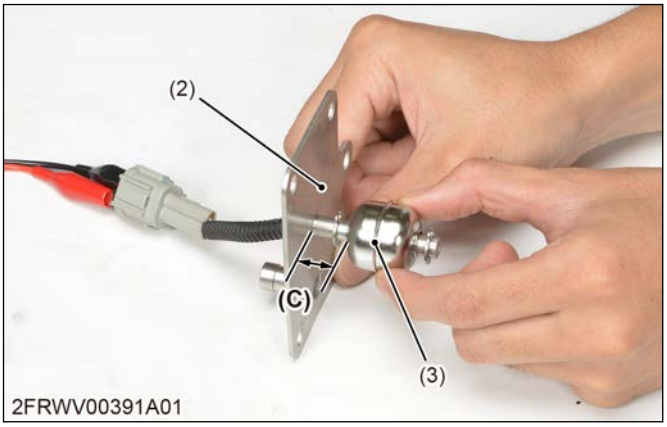
| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 1 – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.9.13.2 Checking master cylinder

1. Check the continuity across the terminals while moving the float (3) position.



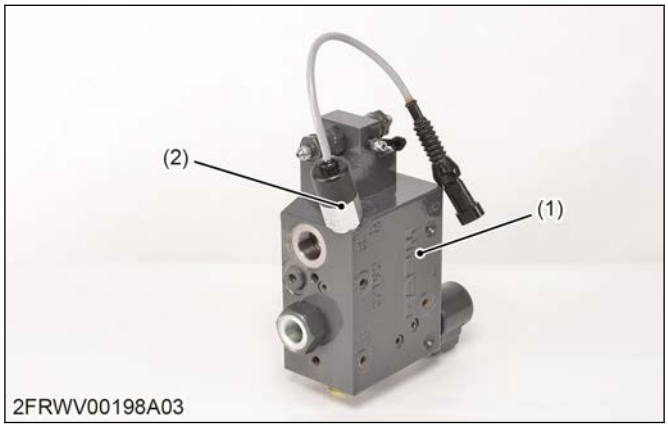

(1) Master cylinder
(2) Level sensor
(3) Float

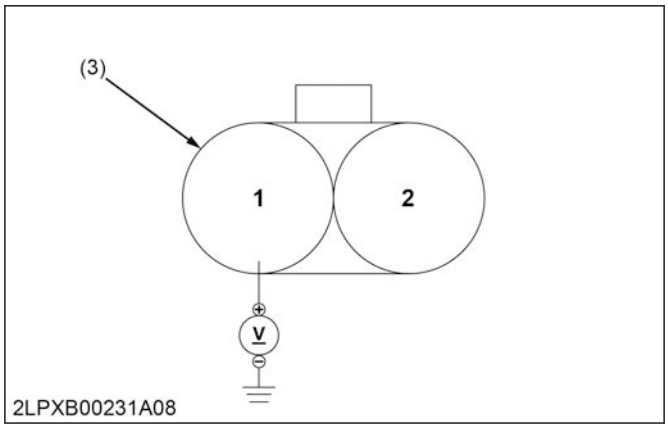
| Float position | Terminals |
|---|---|
| Upper position<br>(C) is less than 17 to 21 mm | Continuity |
| Lower position<br>(C) is bigger than 17 to 21 mm | Infinity |

2. If the continuity specified below is not indicated, level sensor of master cylinder is damaged.

## 4.9.14 Trailer brake pressure switch

### 4.9.14.1 Checking connector voltage for trailer brake pressure switch



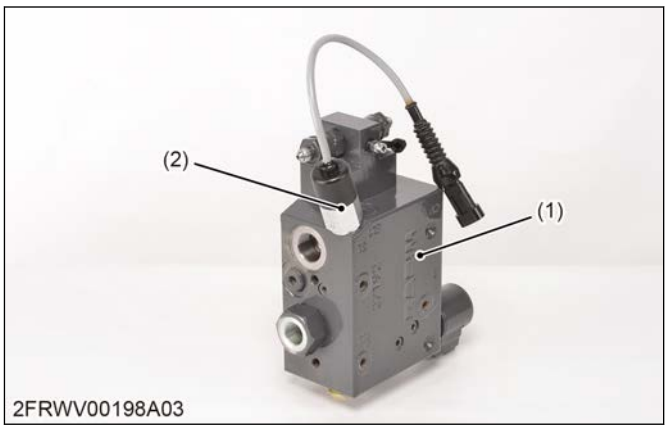

(1) Trailer brake valve
(2) Trailer brake pressure switch
(3) Trailer brake pressure switch connector (Wire harness side)

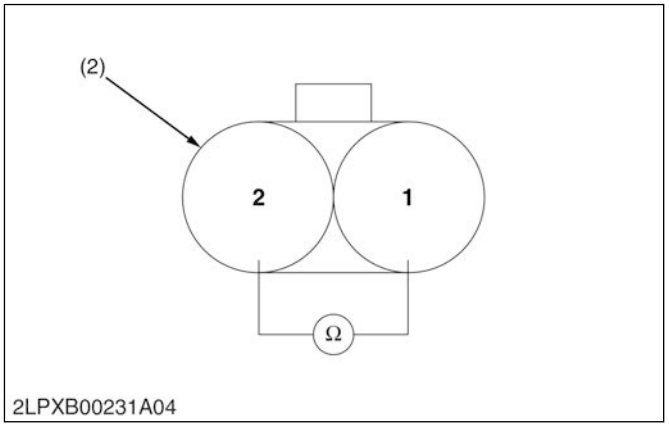
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.
3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 1 – Chassis | Approximately battery voltage |

### 4.9.14.2 Checking trailer brake pressure switch

Be sure to set the main gear shift lever to “**Neutral**” position.




(1) Trailer brake valve
(2) Trailer brake pressure switch

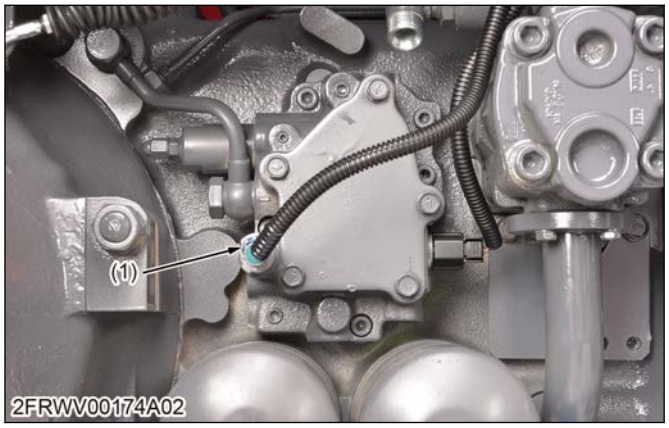
1. Disconnect the connector oft the trailer brake pressure switch.
2. Start the engine.
3. Check the continuity across the terminals shown in the table below.

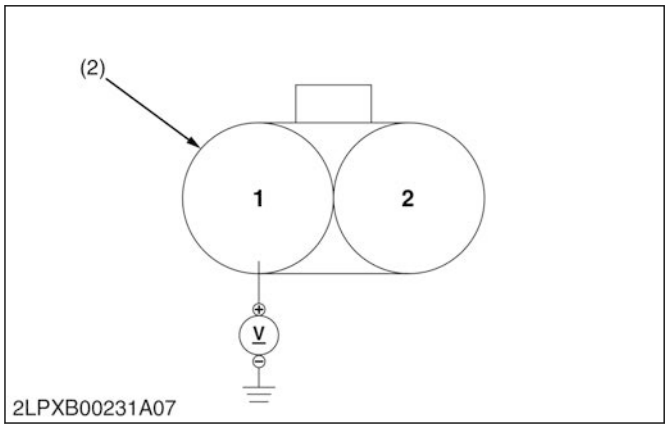
| Condition | Terminal 1 – 2 |
|---|---|
| Gear lock parking brake and secondary brake is released | Infinity |
| Gear lock parking brake or secondary brake is applied | Continuity |

4. If the continuity specified value is not indicated, trailer brake switch is damaged or trailer brake is not working properly.

## 4.9.15 2WD clutch pressure switch

### 4.9.15.1 Checking connector voltage 2WD clutch pressure switch




(1) 2WD clutch pressure switch (2) 2WD clutch pressure switch connector (Wire harness side)

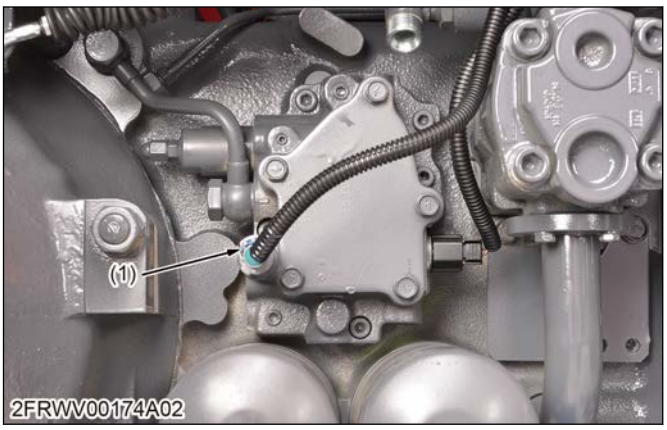
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 1 – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.9.15.2 Checking 2WD clutch pressure switch

1. Check the 2WD clutch pressure switch is activated or not by using tester mode "**TST-1**".




(1) 2WD clutch pressure switch

2. If any signal from 2WD clutch pressure switch is not found by tester mode "**TST-1**" although the connector voltage is OK, 2WD clutch pressure switch is damaged.

## 4.9.16 Secondary brake switch

### 4.9.16.1 Checking connector voltage for secondary brake switch

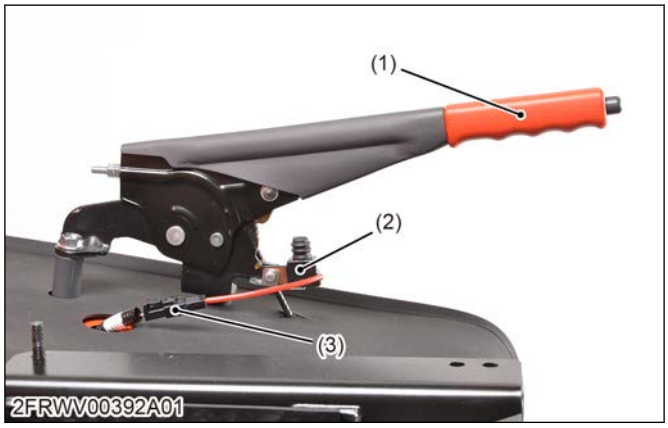

(1) Secondary brake switch (2) Secondary brake switch connector (Wire harness side)

1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 1 – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.9.16.2 Checking secondary brake switch




(1) Secondary brake lever
(2) Secondary brake switch
(3) Connector (Switch side)

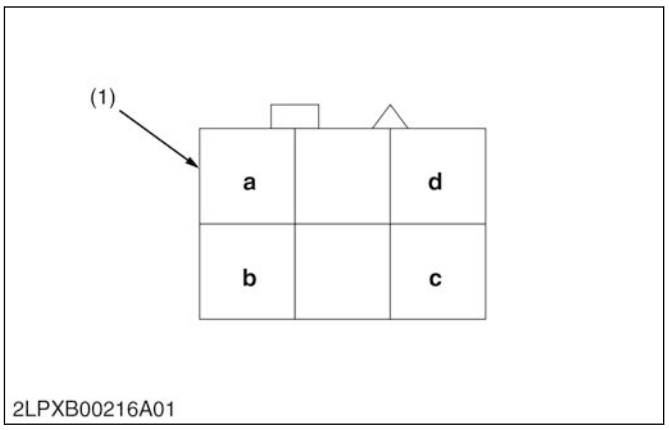
1. Check the continuity across the terminal and chassis shown in the table below.

| Position | Terminal 1 - chassis |
|---|---|
| Secondary brake is applied (switch is released) | Continuity |
| Secondary brake is released (switch is pressed) | Infinity |

2. If the continuity specified above is not indicated, secondary brake switch is damaged.

## 4.9.17 Auto differential lock switch

## 4.9.17.1 Checking connector voltage for auto differential lock switch

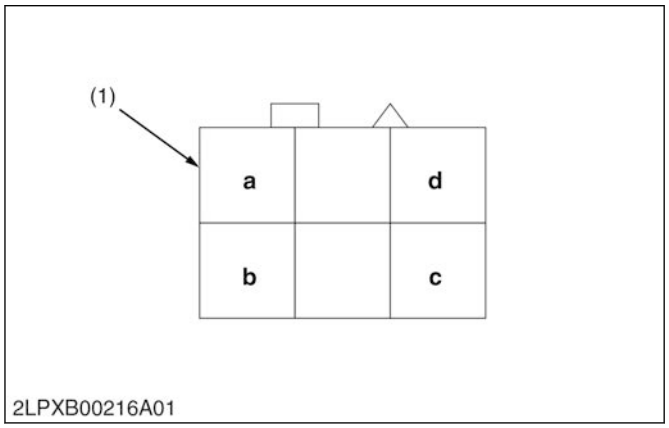




(1) Auto differential lock switch
(2) Connector (Wire harness side)

1. Disconnect the auto differential lock switch connector.
2. Turn the main key switch **ON** position.
3. Measure the voltage with a voltmeter across the terminals shown in the table below.
4. If the reference value is not indicated as shown in the table, check the related electric circuit.

| | | |
|---|---|---|
| Voltage | Terminal d – Chassis | 12 V |

### 4.9.17.2 Checking auto differential lock switch


(1) Auto differential lock switch (2) Connector (Switch side)

1. Check the continuity across the terminals shown in the table below.

| Continuity check | Switch is **ON** | Terminal c – Terminal d | Continuity |
|---|---|---|---|

2. If the continuity specified value is not indicated, the auto differential lock switch is damaged.

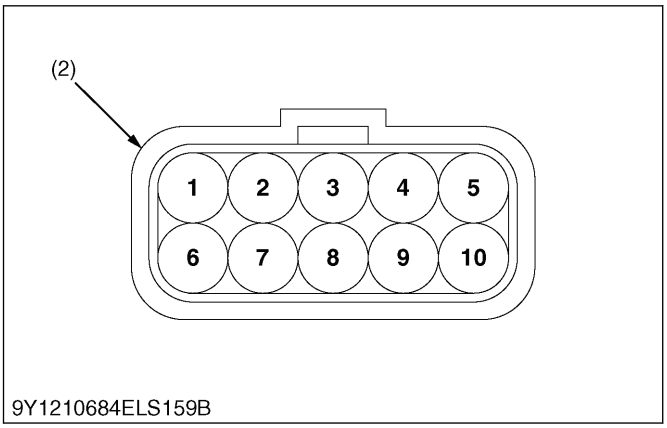
## 4.10 Engine control system

**IMPORTANT**

- **On the Diagmaster Software, you can check and measure the resistance and voltage of the engine sensors and switches. When you measure the value of the engine sensors, use the Diagmaster Software.**
- **Refer to Diagnosis Manual "*9Y120-03140*" in detail points.**

### 4.10.1 Injector

#### 4.10.1.1 Checking connector voltage for injector


(1) Injector (2) Connector (Harness side)

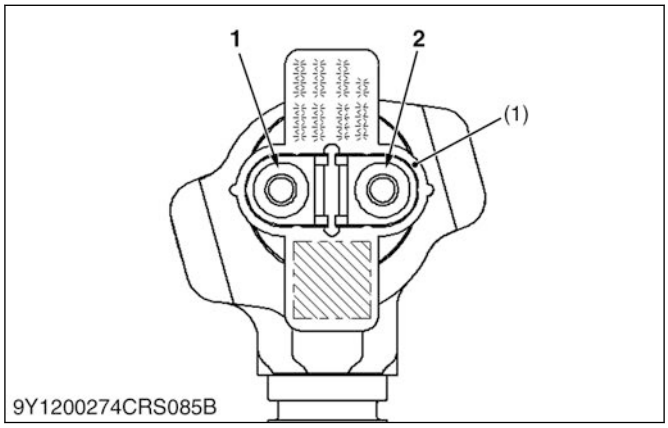
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 6 – chassis | Approximately 2.5 V |
| | | Terminal 7 – chassis | |
| | | Terminal 8 – chassis | |
| | | Terminal 9 – chassis | |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.1.2 Checking injector resistance

1. Measure the resistance with an ohmmeter across the terminals shown in the table below.




(1) Injector terminal

| | | |
|---|---|---|
| Resistance | Terminal 1 – 2 | 0.4 to 0.7 Ω |

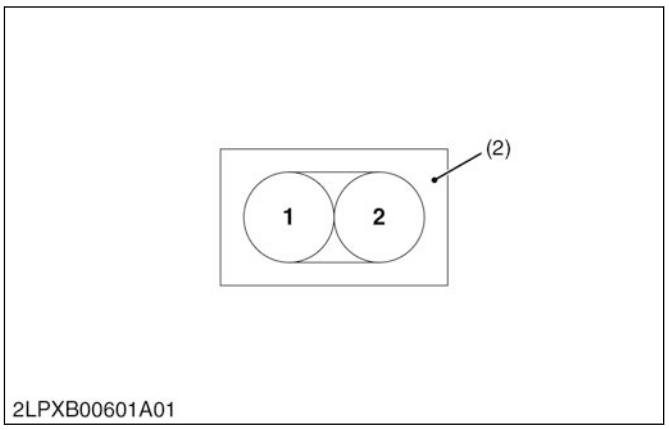
2. If the measured value is not indicated, the injector is damaged.

## 4.10.2 Pre-stroke control valve (PCV)

### 4.10.2.1 Checking connector voltage for pre-stroke control valve (PCV)

**■ IMPORTANT**

- **When replacing the supply pump, be sure to do supply pump difference learning. (Refer to the "Diagnosis Manual" (*9Y120-03140*))**


(1) PCV (pre-stroke control valve) connector
(2) Connector (Harness side)

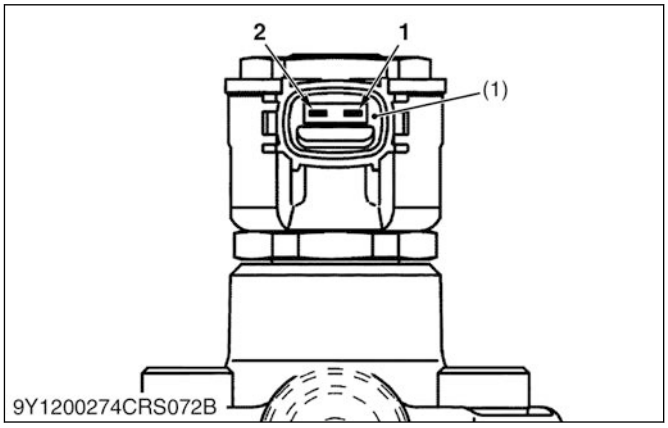
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 1 – chassis | Approximately 2.5 V |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.2.2 Checking pre-stroke control valve (PCV) resistance

1. Measure the resistance with an ohmmeter across the terminals shown in the table below.




(1) Connector (PCV side)

| | | | |
|---|---|---|---|
| Resistance | At 20 ℃ (68 ℉) | Terminal 1 – 2 | Approximately 0.47 Ω |

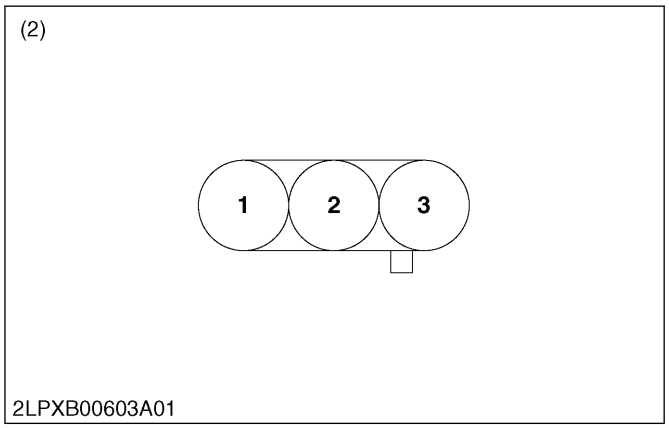
2. If the measured value is not indicated, the PCV is damaged.

## 4.10.3 Rail pressure sensor

### 4.10.3.1 Checking connector voltage for rail pressure sensor

**NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is damaged if the relating electric circuit is normal.**


(1) Rail pressure sensor connector (2) Connector (Harness side)

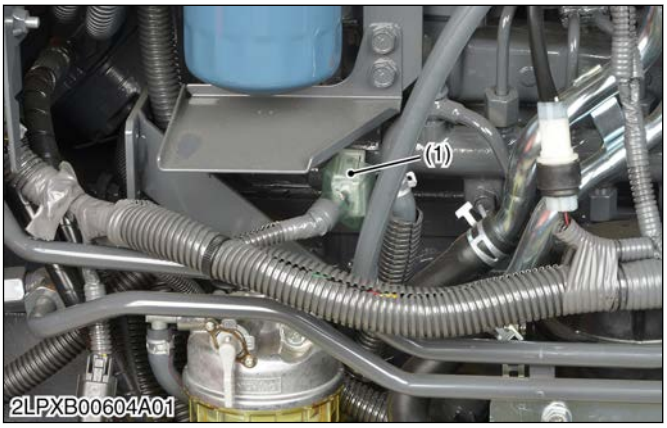
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

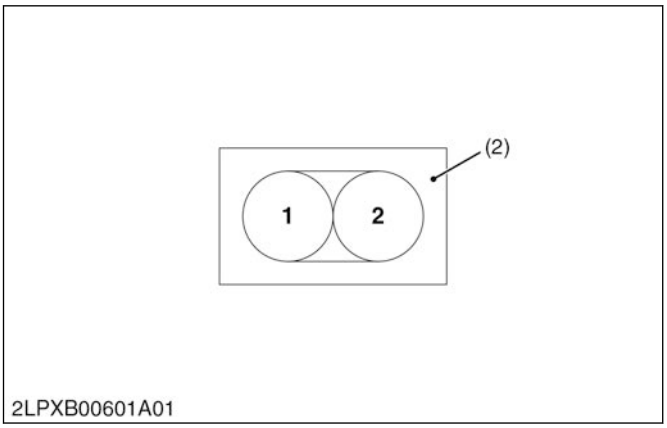
| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 1 – chassis | Approximately 5 V |
| | | Terminal 2 – chassis | |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.10.4 Pressure reducing valve (PRV)

### 4.10.4.1 Checking connector voltage for pressure reducing valve (PRV)




(1) Pressure reducing valve (PRV) connector (2) Connector (Harness side)

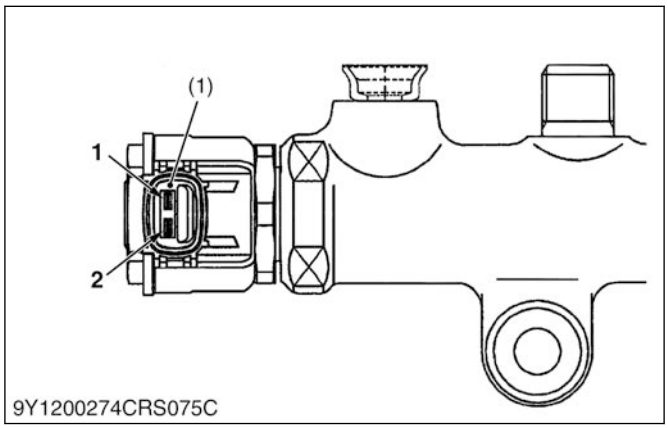
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 1 – chassis | Approximately 2.5 V |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.4.2 Checking pressure reducing valve (PRV) resistance

1. Measure the resistance with an insulation resistance tester (megohmmeter tester) across the terminals shown in the table below.



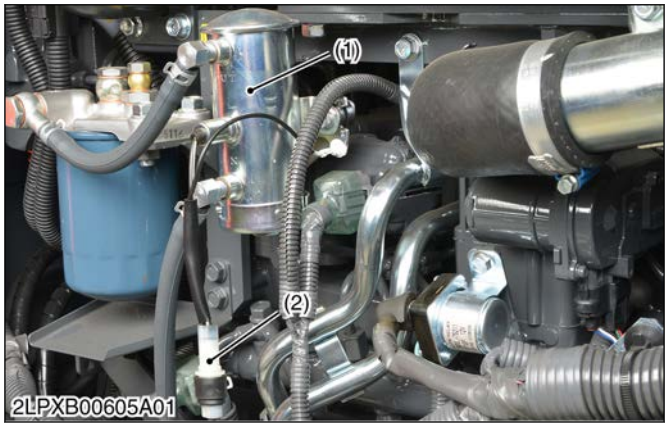

(1) Connector (PRV side)

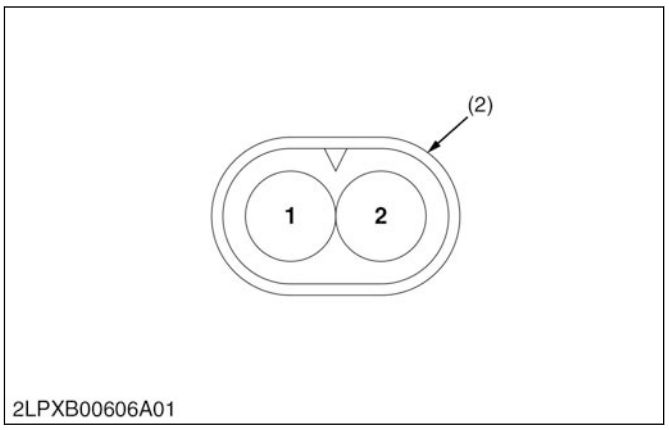
| | | |
|---|---|---|
| Resistance | Terminal 1 – chassis | 10 MΩ or higher (between terminal and body, 500 V) |
| | Terminal 2 – chassis | |

2. If the measured value is not indicated, the PRV is damaged.

## 4.10.5 Fuel pump

### 4.10.5.1 Checking connector voltage for fuel pump



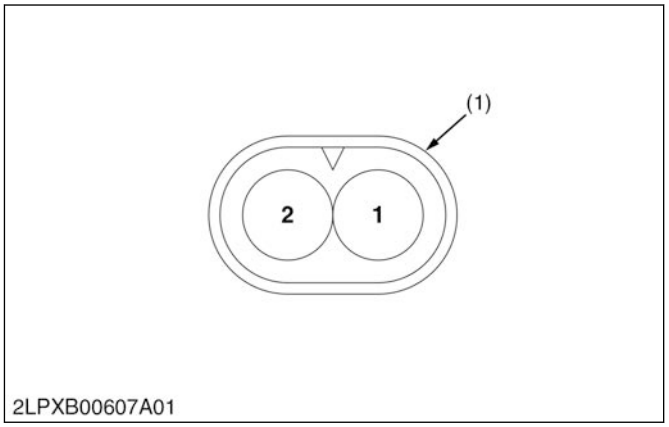

(1) Fuel pump (2) Connector (Harness side)

1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 1 – chassis | Approximately 5 V |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.5.2 Testing pump actuation

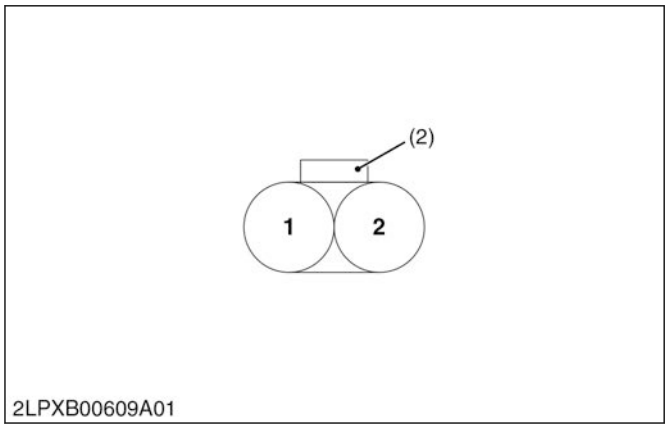



(1) Connector (Pump side)

1. Connect a jumper lead from the terminal 1 to the battery positive terminal post.
2. Connect a jumper lead from the terminal 2 to the battery negative terminal post.
3. If the pump does not work, pump is damaged.

## 4.10.6 Sedimenter

### 4.10.6.1 Checking connector voltage for sedimenter


(1) Sedimenter (2) Connector (Harness side)

1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 1 – chassis | Approximately battery voltage |

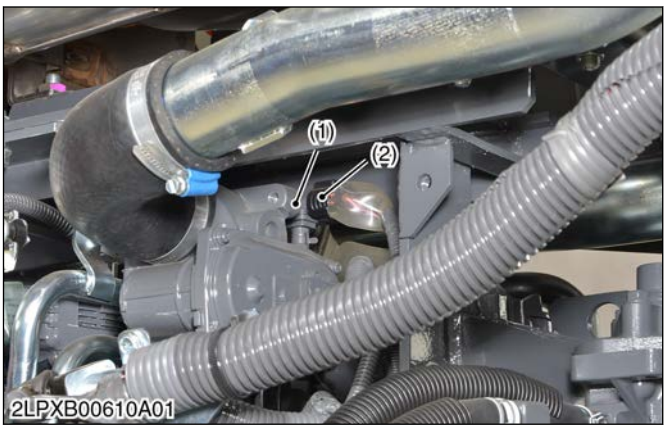
3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

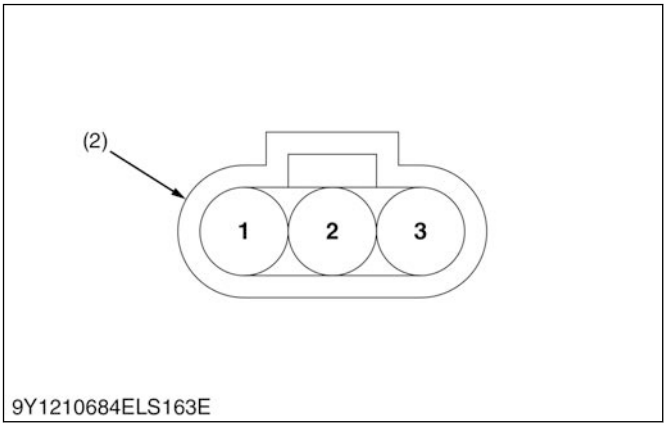
## 4.10.7 Boost sensor

### 4.10.7.1 Checking connector voltage for boost sensor

**NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is damaged if the relating electric circuit is normal.**




(1) Boost sensor (2) Connector (Harness side)

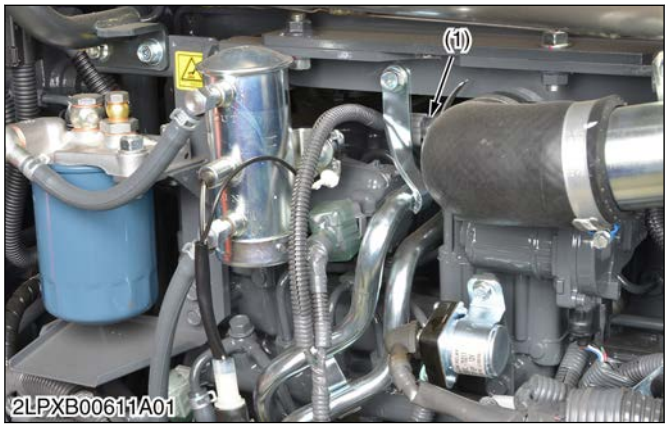
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

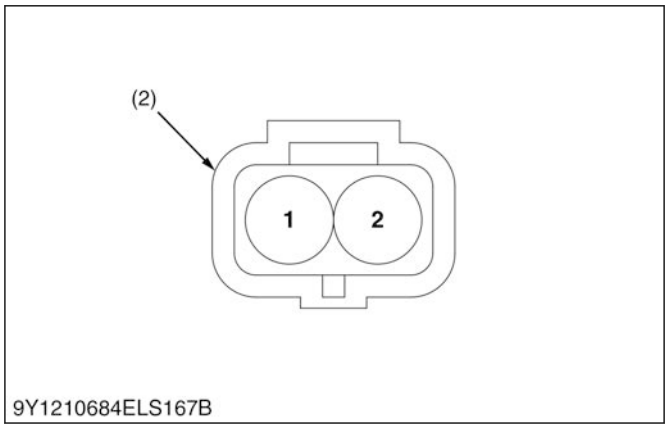
| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 3 – chassis | Approximately 5 V |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.10.8 Intake air temperature sensor

### 4.10.8.1 Checking connector voltage for intake air temperature sensor




(1) Intake air temperature sensor connector
(2) Connector (Wire harness side)

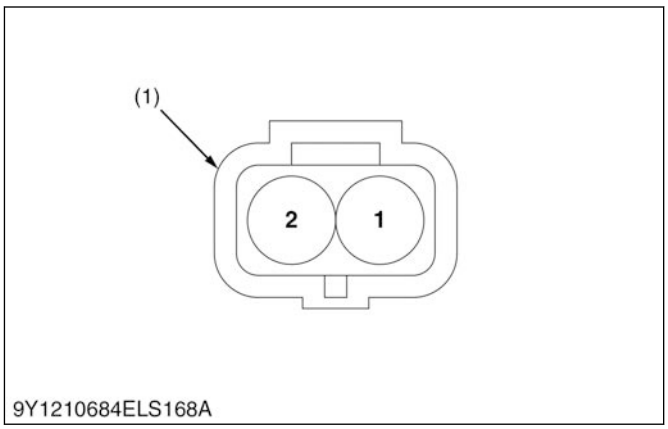
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 2 – chassis | Approximately 5 V |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.8.2 Checking resistance for intake air temperature sensor

1. Measure the resistance with an ohmmeter across the terminals shown in the table below.




(1) Connector (Sensor side)

| | | | |
|---|---|---|---|
| Resistance | At 20 ℃ (68 ℉) | Terminal 1 – 2 | Approx. 2.4 kΩ |
| | At 60 ℃ (140 ℉) | | Approx. 0.58 kΩ |
| | At 100 ℃ (212 ℉) | | Approx. 0.18 kΩ |

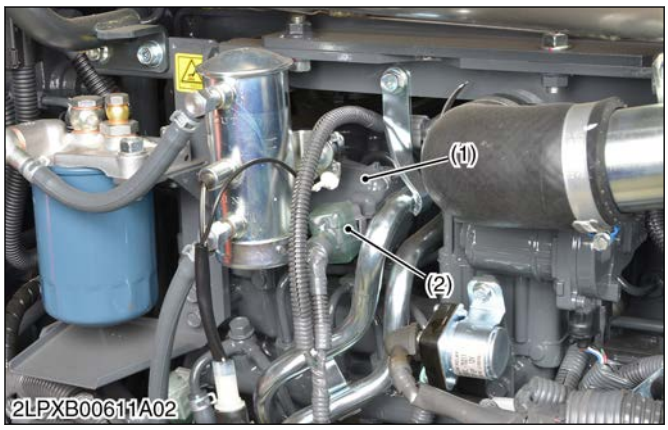
2. If the reference value is not indicated, the intake air temperature sensor is damaged.

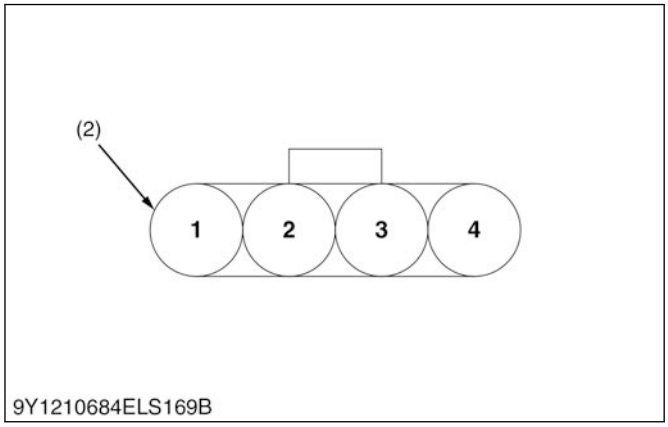
## 4.10.9 EGR valve

### 4.10.9.1 Checking connector voltage for EGR valve

**NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is damaged if the relating electric circuit is normal.**




(1) EGR valve (2) Connector (Harness side)

1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 1 – Chassis | Approximately battery voltage |

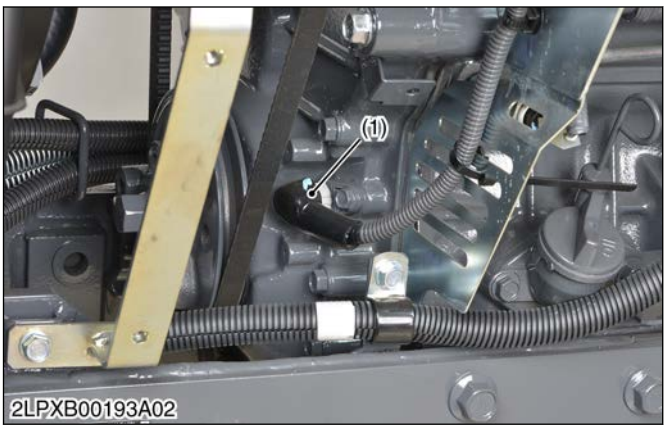
3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

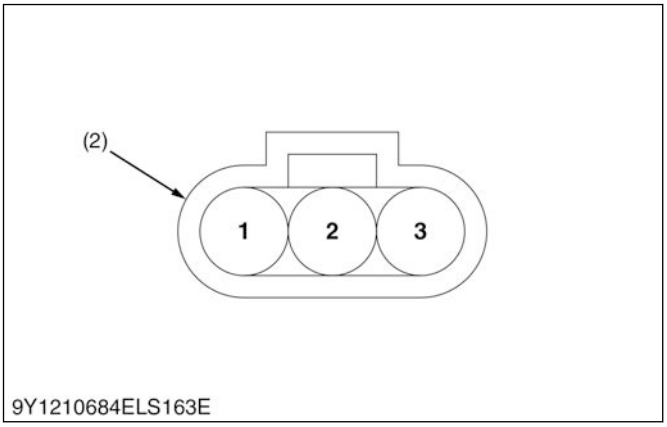
## 4.10.10 Crankshaft position sensor

### 4.10.10.1 Checking connector voltage for crankshaft position sensor

**NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is damaged if the relating electric circuit is normal.**




(1) Crankshaft position sensor connector (2) Connector (Harness side)

1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 3 – Chassis | Approximately 5 V |
| | | Terminal 1 – Chassis | |

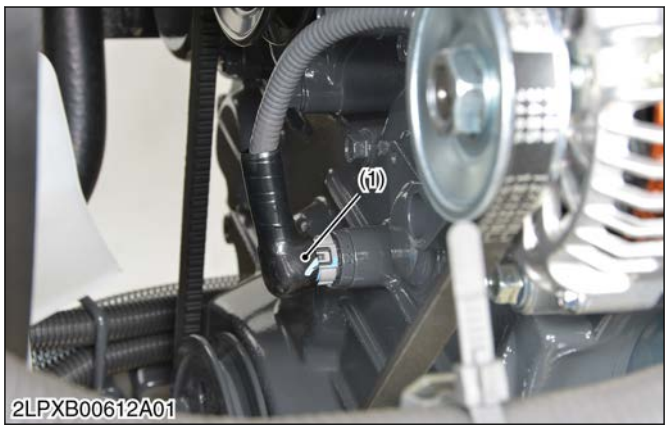
3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

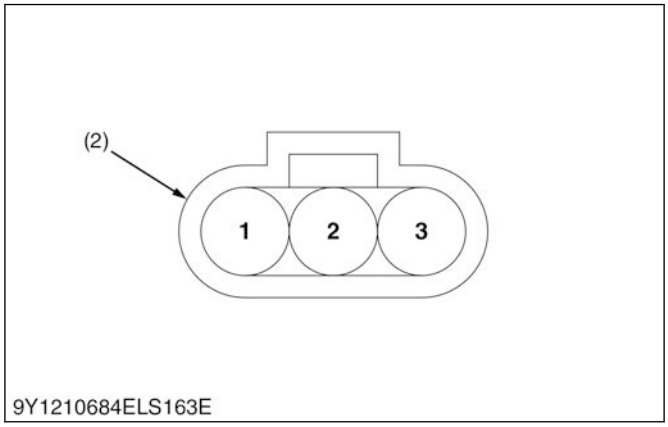
## 4.10.11 Camshaft position sensor

### 4.10.11.1 Checking connector voltage for camshaft position sensor

**NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is damaged if the relating electric circuit is normal.**




(1) Camshaft position sensor connector (2) Connector (Harness side)

1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 3 – Chassis | Approximately 5 V |
| | | Terminal 1 – Chassis | |

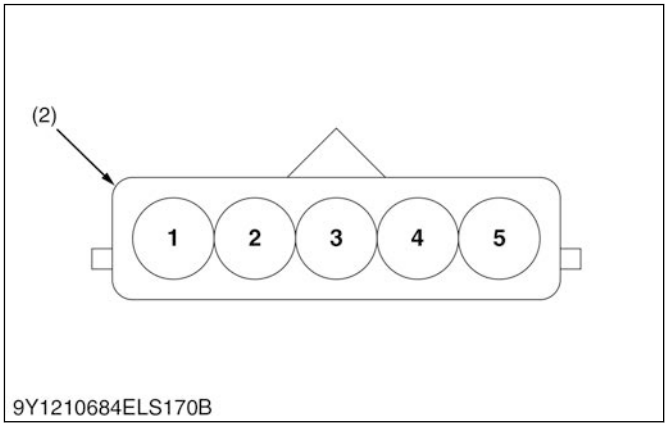
3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.10.12 Air flow sensor

### 4.10.12.1 Checking connector voltage for air flow sensor

**NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is damaged if the relating electric circuit is normal.**


(1) Air flow sensor (2) Connector (Harness side)

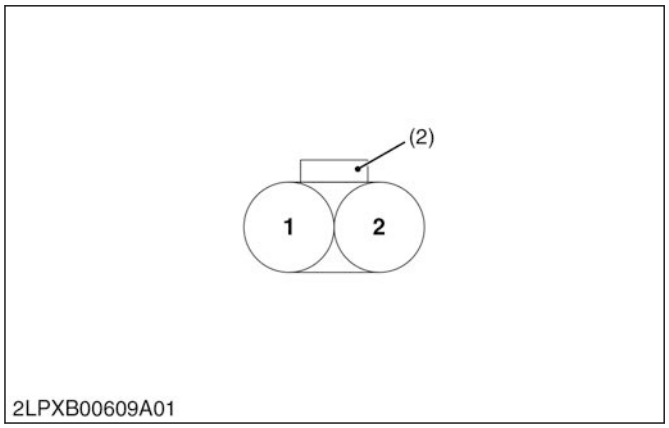
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 1 – Chassis | Approximately battery voltage |
| | | Terminal 4 – Chassis | Approximately 5 V |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.10.13 Coolant temperature sensor

### 4.10.13.1 Checking connector voltage for coolant temperature sensor


(1) Coolant temperature sensor (2) Connector (Harness side)

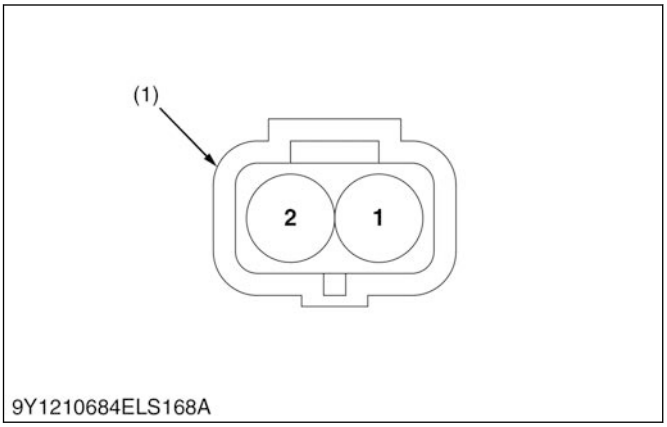
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 2 – chassis | Approximately 5 V |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.13.2 Checking resistance for coolant temperature sensor

1. Measure the resistance with an ohmmeter across the terminals shown in the table below.



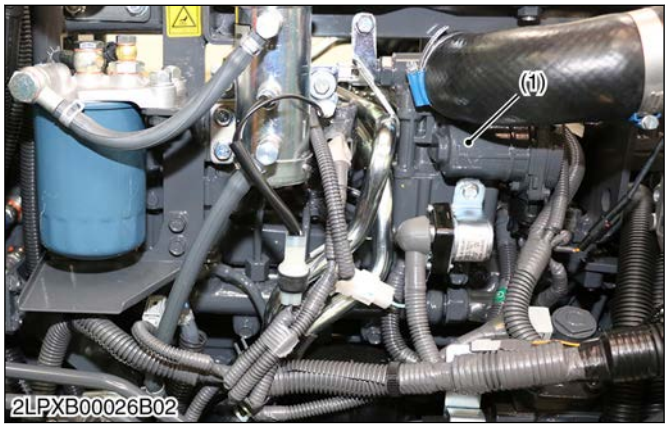

(1) Connector (Sensor side)

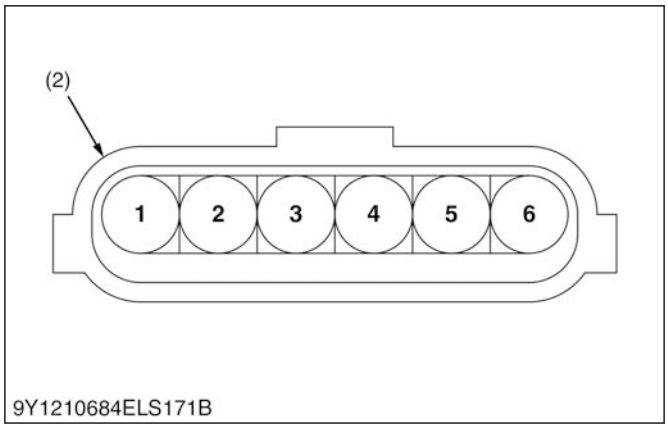
| | | | |
|---|---|---|---|
| Resistance | At 20 ℃ (68 ℉) | Terminal 1 – 2 | Approximately 2.5 kΩ |
| | At 40 ℃ (104 ℉) | | Approximately 1.2 kΩ |
| | At 60 ℃ (140 ℉) | | Approximately 0.58 kΩ |
| | At 80 ℃ (176 ℉) | | Approximately 0.32 kΩ |
| | At 100 ℃ (212 ℉) | | Approximately 0.18 kΩ |

2. If the reference value is not indicated, the coolant temperature sensor is damaged.

## 4.10.14 Intake throttle valve

### 4.10.14.1 Checking connector voltage for intake throttle valve



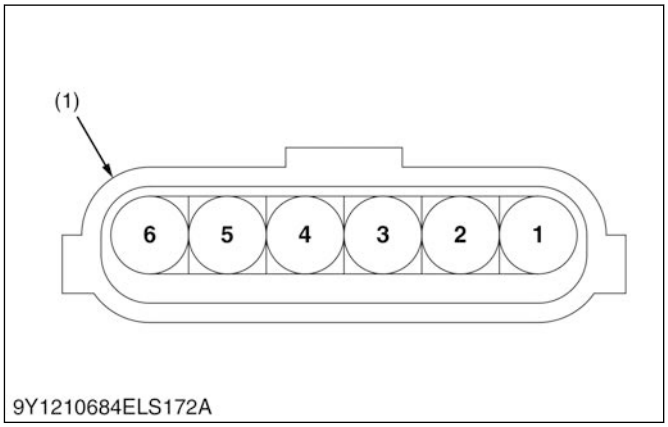

(1) Intake throttle valve (2) Connector (Harness side)

1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 2 – Chassis | Approximately 5 V |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.14.2 Checking motor resistance




(1) Connector (Sensor side)

1. Turn the main key switch **OFF** and disconnect the throttle valve connector.
2. Measure the resistance with an ohmmeter across the terminal 5 and 6.

| Item | Condition | Terminal | Resistance |
|---|---|---|---|
| DC motor | — | Terminal 5 – 6 | Approximately 12 Ω |

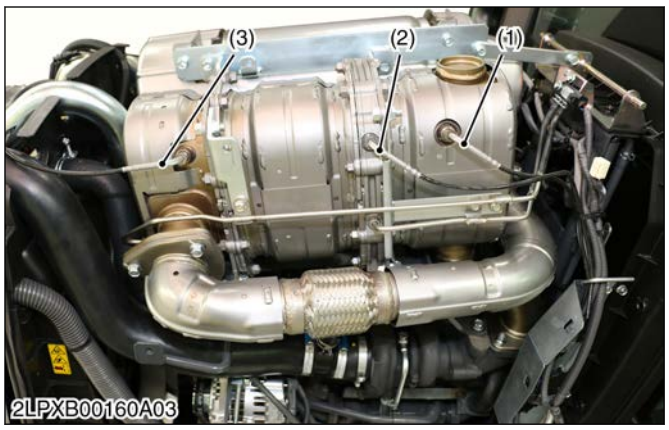
3. If the reference value is not indicated as shown in the table, DC motor is damaged.

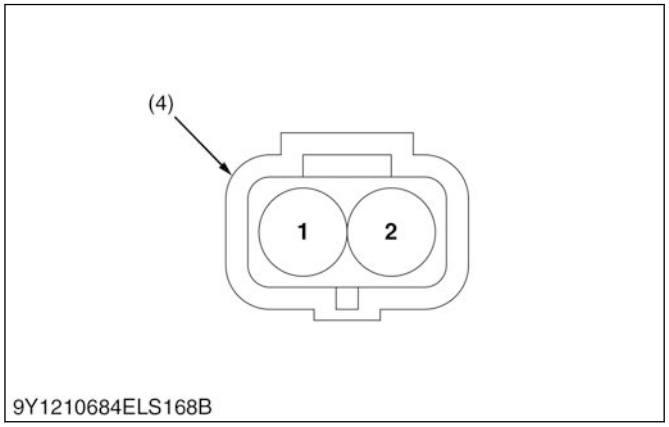
## 4.10.15 Exhaust temperature sensor

### 4.10.15.1 Checking connector voltage for exhaust temperature sensor

**NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is damaged if the relating electric circuit is normal.**




(1) Exhaust temperature sensor T0
(2) Exhaust temperature sensor T1
(3) Exhaust temperature sensor T2
(4) Connector (Harness side)

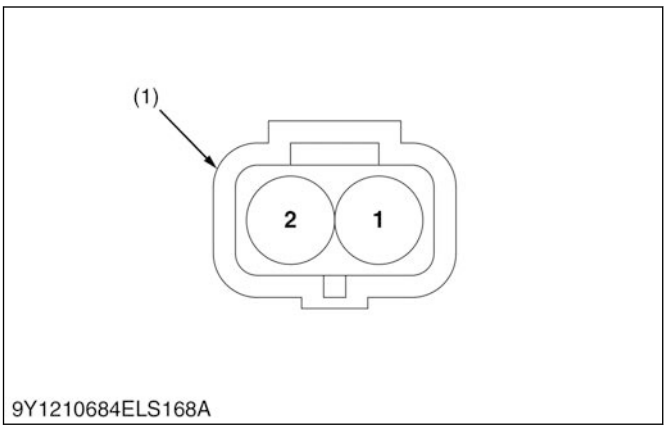
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 2 – Chassis | Approximately 5 V |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.15.2 Checking sensor resistance for exhaust temperature sensor (reference)

1. Measure the resistance with an ohmmeter across the terminals shown in the table below.




(1) Connector (Sensor side)

| | | |
|---|---|---|
| Resistance | At 200 ℃ (140 ℉) | Approximately 4.00 kΩ |
| | At 650 ℃ (212 ℉) | Approximately 0.164 kΩ |

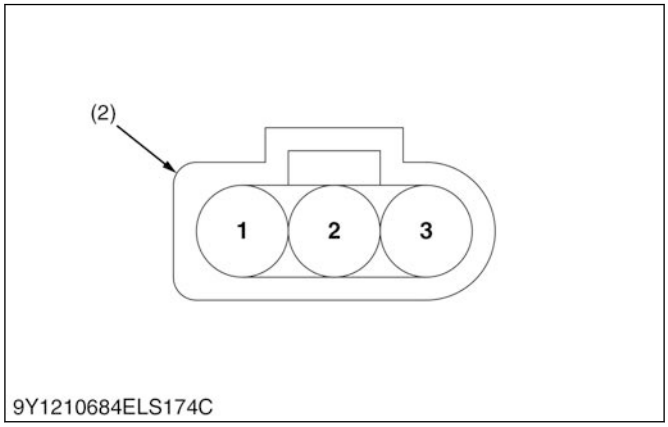
2. If the reference value is not indicated, the exhaust temperature sensor is damaged.

## 4.10.16 Differential pressure sensor

### 4.10.16.1 Checking connector voltage for differential pressure sensor

**NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is damaged if the relating electric circuit is normal.**


(1) Differential pressure sensor (2) Connector (Harness side)

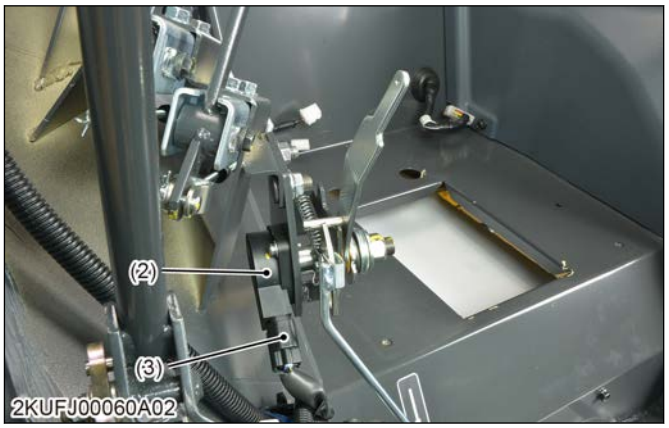
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

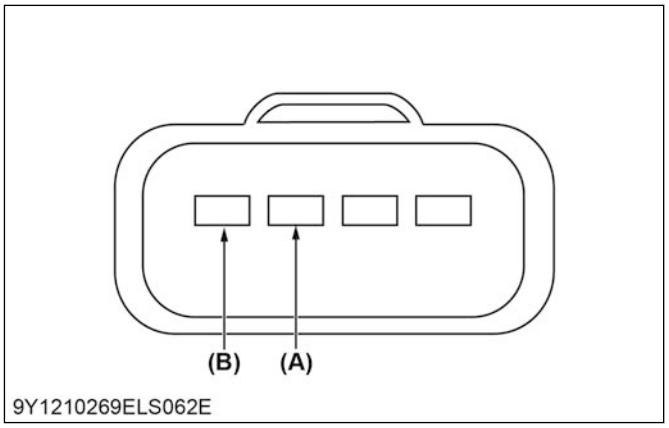
| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 1 – Chassis | Approximately 5 V |
| | | Terminal 3 – Chassis | |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.10.17 Throttle sensor

### 4.10.17.1 Checking connector voltage for throttle sensor

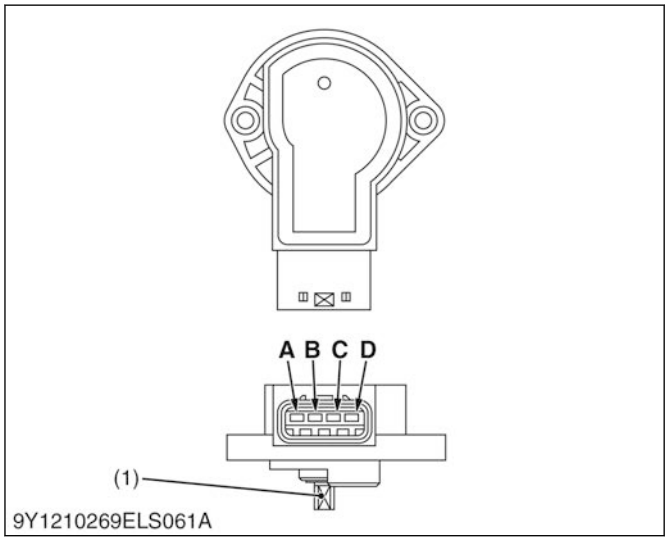




(1) Hand throttle lever
(2) Throttle sensor
(3) Throttle sensor connector
(A) Terminal A
(B) Terminal B

1. Remove the hand throttle lever grip and the throttle sensor connector (3).
2. Turn the main key switch **ON**.
3. Check the voltage between terminal A (+) and terminal B (−) of the wire harness side.
4. If the measurement is not indicated as shown in the table below, check the relating electric circuit.

| | | |
|---|---|---|
| Voltage | Terminal A – Terminal B | 5 V |

## 4.10.17.2 Checking throttle sensor resistance




(1) Sensor shaft
A: Terminal A
B: Terminal B
C: Terminal C
D: Terminal D

**(Reference)**

- The change of resistance can be checked easily with analog tester.

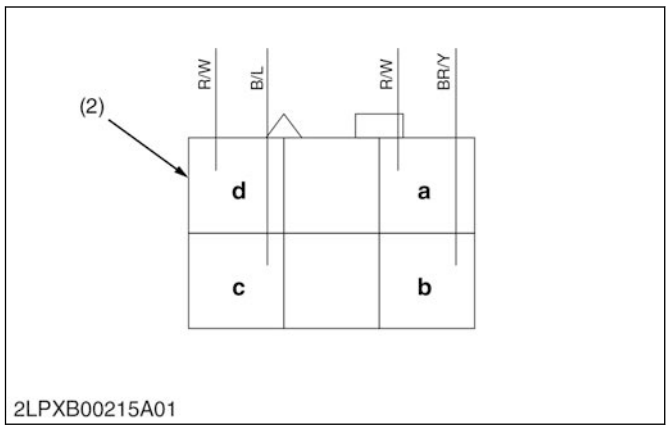
1. Measure the resistance between the following terminals.
   a. Measure the resistance between terminal A and D while slowly turning the sensor shaft (1).
   b. Measure the resistance between terminal B and D while slowly turning the sensor shaft (1).

   Replace the sensor if the resistance value is out of specification shown in the table below.

| | | |
|---|---|---|
| Resistance | Terminal A – Terminal D | 0 to 1 kΩ |
| | Terminal B – Terminal D | 0 to 1 kΩ |

## 4.10.18 Parked regeneration switch

## 4.10.18.1 Checking connector voltage for parked regeneration switch

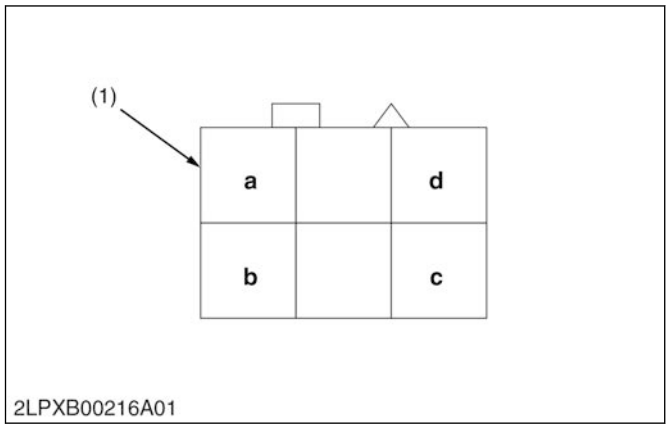

(1) Parked regeneration switch (2) Connector (Harness side)

1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal a – Chassis | Approximately battery voltage |
| | | Terminal d – Chassis | |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.10.18.2 Checking parked regeneration switch




(1) Connector (Switch side)

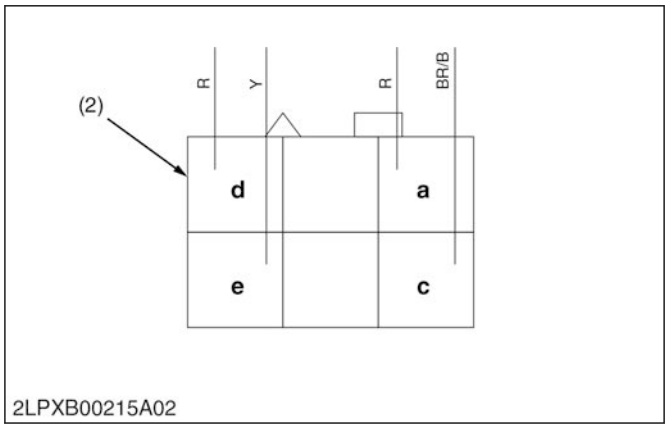
1. Press the parked regeneration switch **ON**.
2. Check the continuity across the terminals shown in the table below.

| | | |
|---|---|---|
| Continuity check | Terminal a – b | Continuity |
| | Terminal c – d | |

3. If the continuity specified value is not indicated, the parked regeneration switch is damaged.

## 4.10.19 DPF INHIBIT switch

### 4.10.19.1 Checking connector voltage for DPF INHIBIT switch

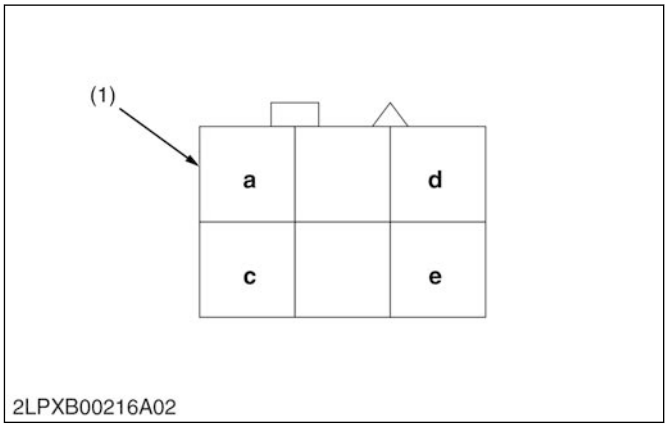

(1) DPF INHIBIT switch (2) Connector (Harness side)

1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal a – Chassis | Approximately battery voltage |
| | | Terminal d – Chassis | |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.19.2 Checking DPF INHIBIT switch




(1) Connector (Switch side)

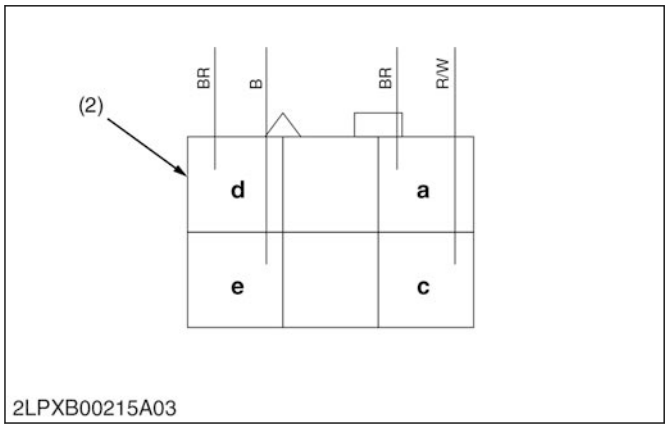
1. Press the DPF INHIBIT switch **ON**.
2. Check the continuity across the terminals shown in the table below.

| | | |
|---|---|---|
| Continuity check | Terminal a – c | Continuity |
| | Terminal d – e | |

3. If the continuity specified value is not indicated, the DPF INHIBIT switch is damaged.

## 4.10.20 Constant RPM management switch

### 4.10.20.1 Checking connector voltage for constant RPM management switch

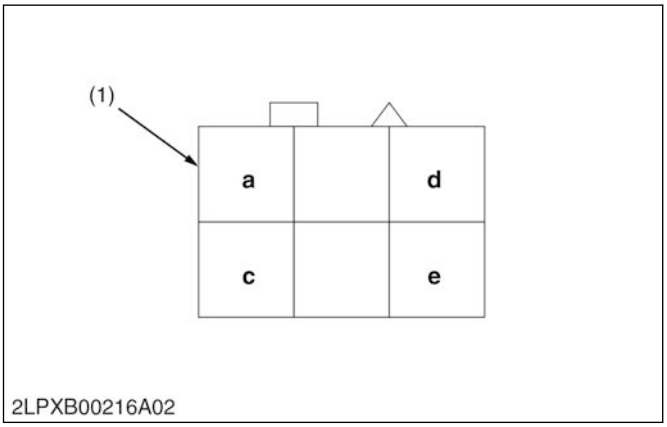

(1) Constant RPM management switch (2) Connector (Harness side)

1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal a – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.20.2 Checking constant RPM management switch




(1) Connector (Switch side)

1. Press the constant RPM management switch **ON**.
2. Check the continuity across the terminals shown in the table below.

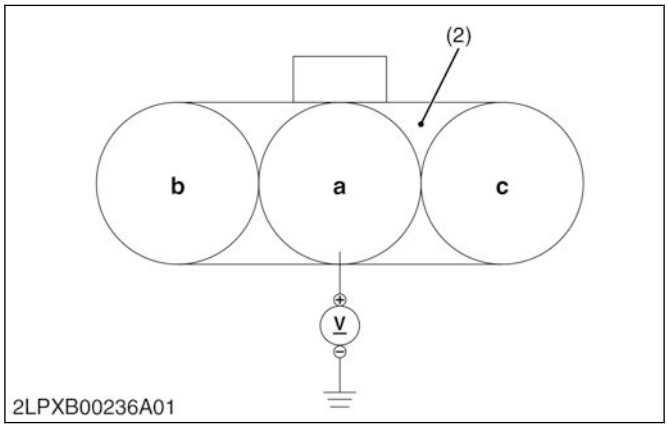
| | | |
|---|---|---|
| Continuity check | Terminal a – c | Continuity |
| | Terminal d – e | |

3. If the continuity specified value is not indicated, the constant RPM management switch is damaged.

## 4.10.21 RPM dual memory switch (ROPS model)

### 4.10.21.1 Checking connector voltage for RPM dual memory switch (ROPS model)






(1) RPM dual memory switch
(2) Connector (Wire harness side)

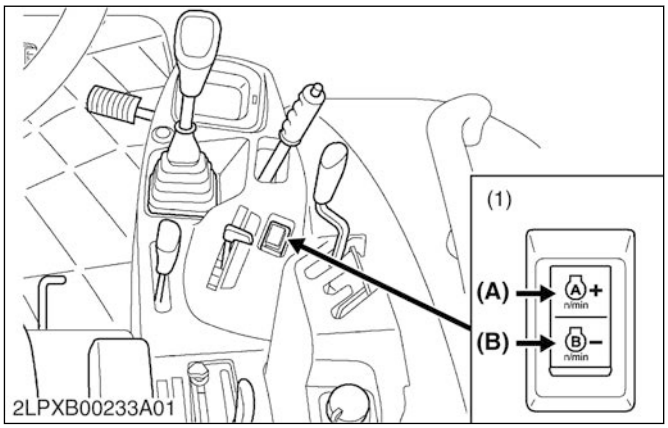
1. Disconnect the connector and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

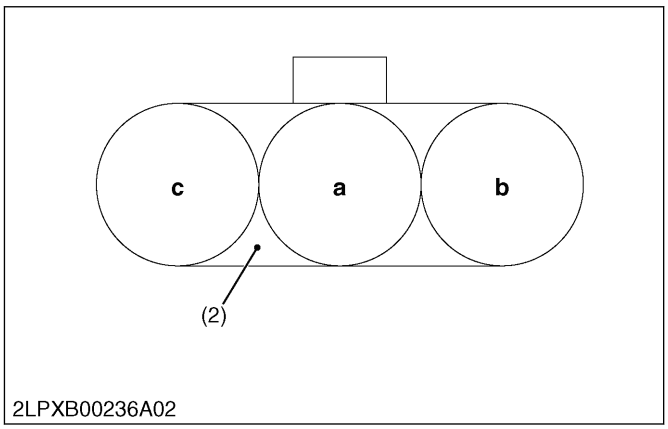
| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal a – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.21.2 Checking RPM dual memory switch (ROPS model)






(1) RPM dual memory switch
(2) Connector (Switch side)
(A) Switch A
(B) Switch B

1. Check the continuity across the terminals shown in the table below.

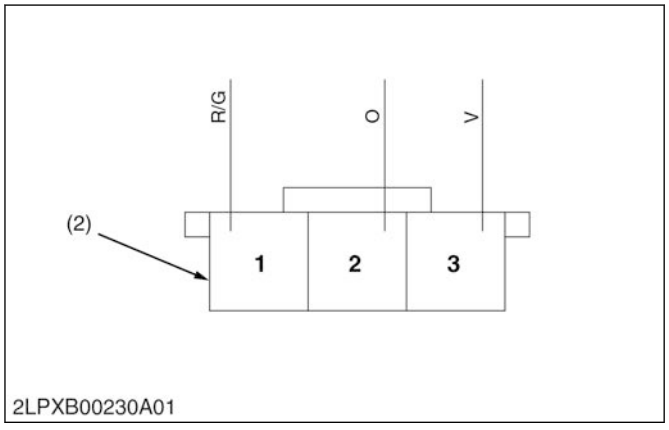
| Position | | Terminal | | |
|---|---|---|---|---|
| | | a | b | c |
| RPM dual memory switch | Switch A **(A)** "press" | ● | ● | |
| | OFF | | | |
| | Switch B **(B)** "press" | ● | | ● |

2LPXB00237A01

2. If the continuity specified value is not indicated, the switch is damaged.

## 4.10.22 RPM dual memory switch (Cabin model)

### 4.10.22.1 Checking connector voltage for RPM dual memory switch (Cabin model)

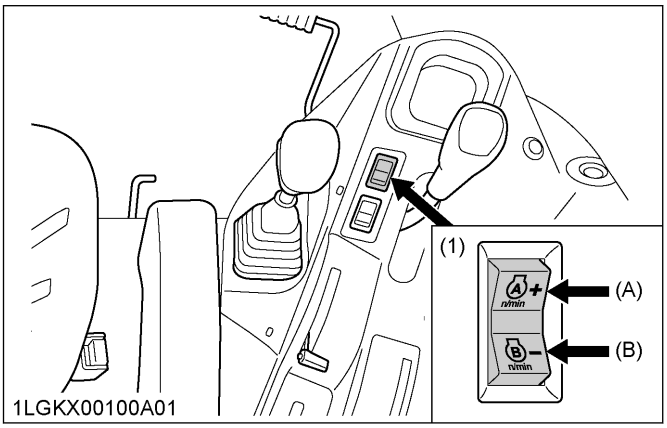

(1) RPM dual memory switch (2) Connector (Harness side)

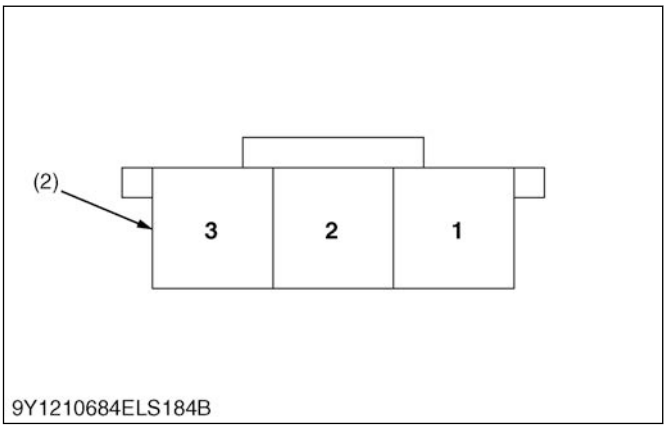
1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 1 – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.22.2 Checking RPM dual memory switch (Cabin model)


(1) RPM dual memory switch (A) Switch A
(2) Connector (Switch side) (B) Switch B

1. Check the continuity across the terminals shown in the table below.

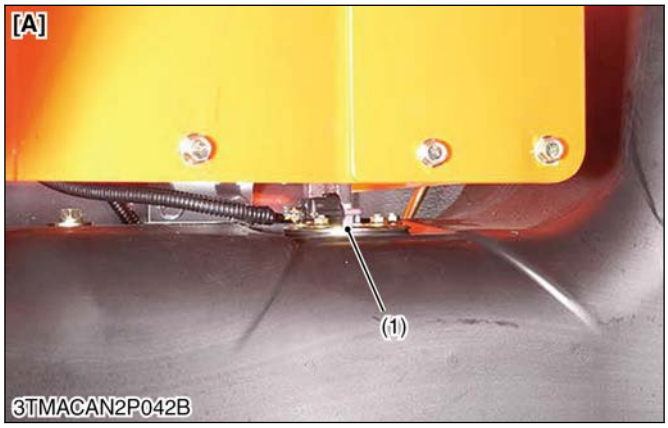
| Position | | Terminal | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| RPM dual memory switch | Switch A **(A)** "press" | ● | | ● |
| | OFF | | | |
| | Switch B **(B)** "press" | ● | ● | |

2LPXB00539A01

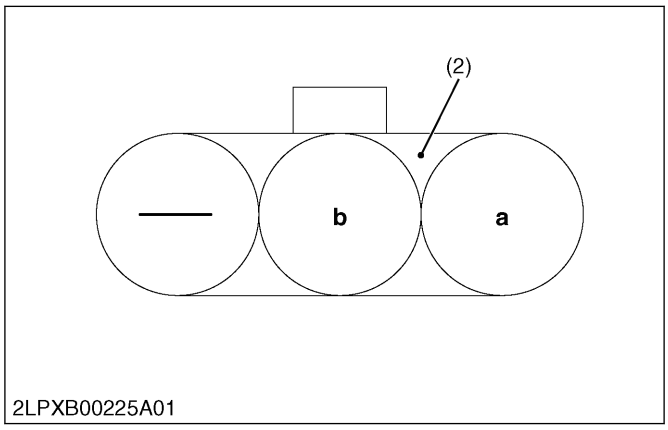
2. If the continuity specified value is not indicated, the RPM dual memory switch is damaged.

## 4.10.23 Fuel level sensor

### 4.10.23.1 Checking connector voltage for fuel level sensor







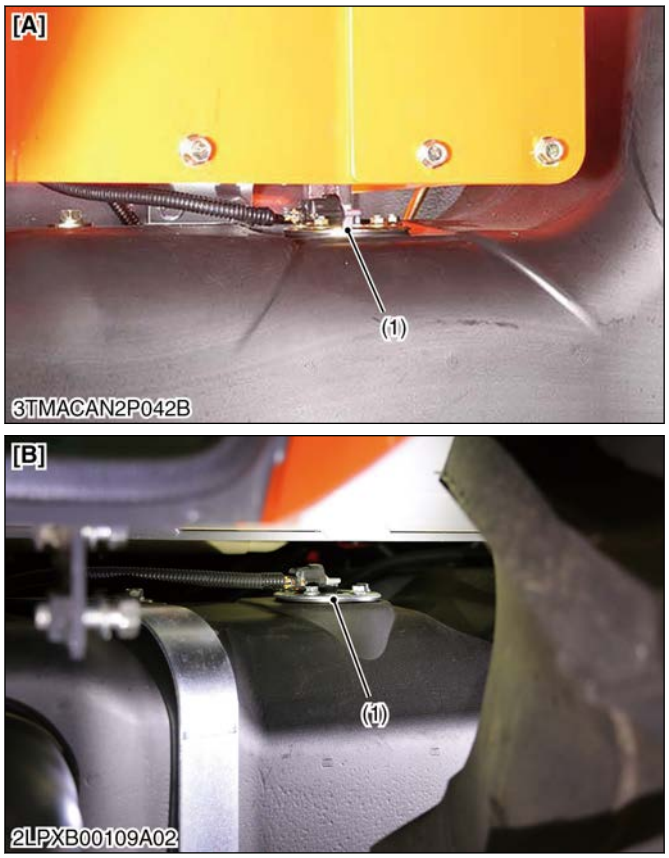

(1) Fuel unit
(2) Connector (Wire harness side)
[A] ROPS model
[B] Cabin model
a: Terminal a
b: Terminal b

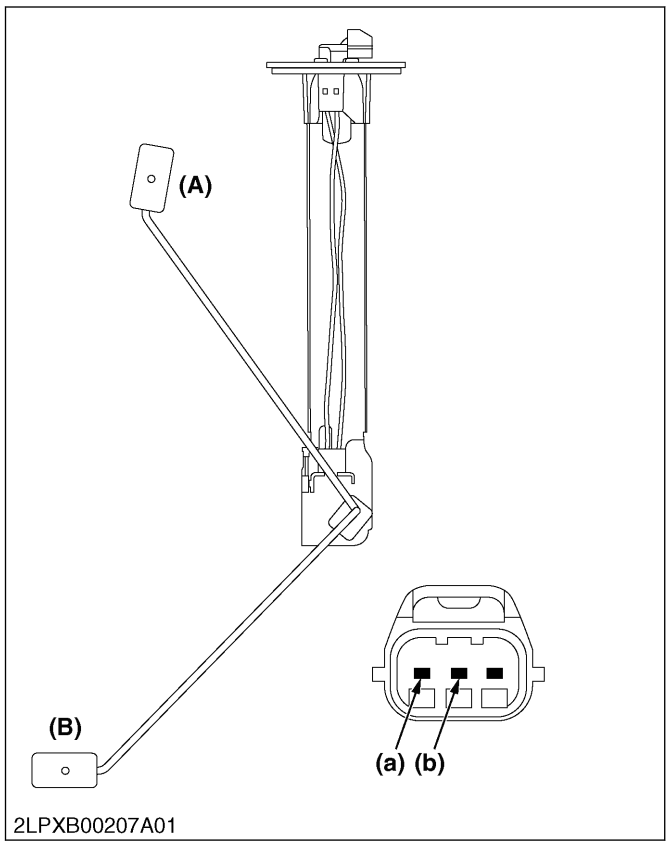
1. Disconnect the connector and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal a - Chassis | Approximately battery voltage |

3. If the measurement is not indicated as shown in the table, check the relating electric circuit.

## 4.10.23.2 Checking fuel level sensor




(1) Fuel unit
[A] ROPS model
[B] Cabin model
(A) Float at uppermost position
(B) Float at lowermost position
(a) Terminal a
(b) Terminal b

1. Remove the fuel level sensor from the fuel tank.
2. Measure the resistance with an ohmmeter across the terminal a and terminal b.
3. If the measurement is not satisfied the value of the following table, the sensor is damaged.

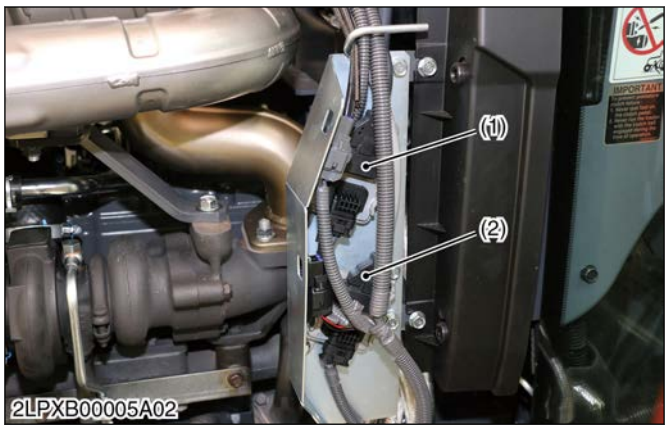
| | | | |
|---|---|---|---|
| Resistance (Sensor terminal (a) – Terminal (b)) | Factory specification | Float at uppermost position | 3.0 to 5.0 Ω |
| | | Float at lowermost position | 107.5 to 112.5 Ω |

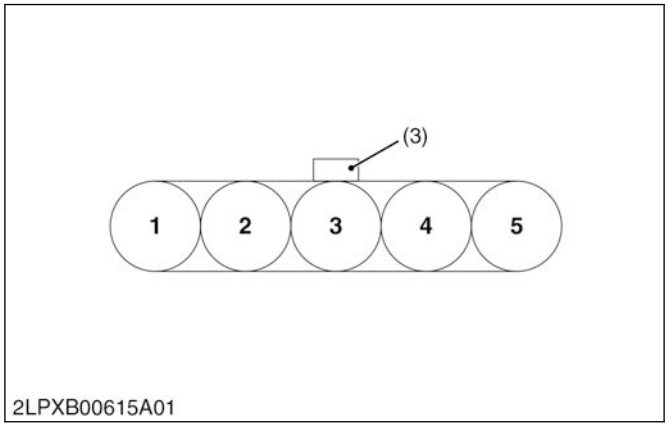
## 4.10.24 NOx sensor

## 4.10.24.1 Checking connector voltage for NOx sensor

**■ NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is damaged if the relating electric circuit is normal.**




(1) Pre NOx sensor
(2) Post NOx sensor
(3) Connector (Harness side)

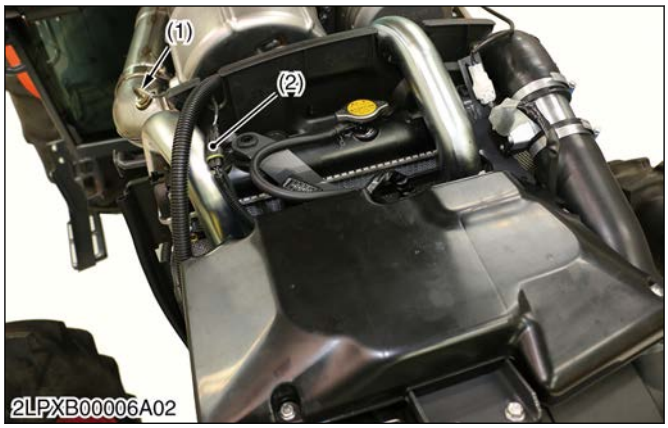
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

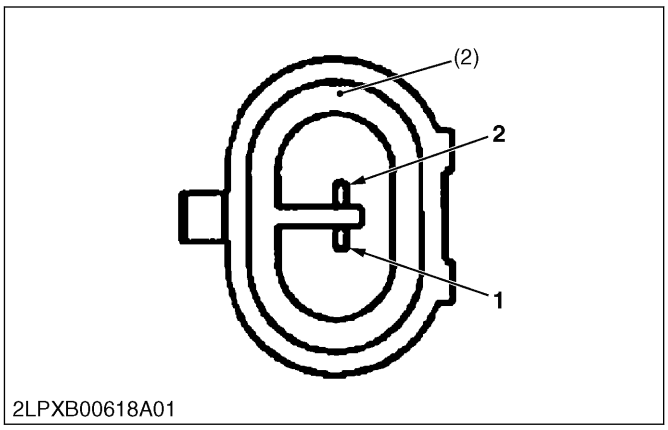
| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 5 – chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.10.25 SCR temperature sensor

### 4.10.25.1 Checking connector voltage for SCR temperature sensor




(1) SCR temperature sensor
(2) Connector (Harness side)

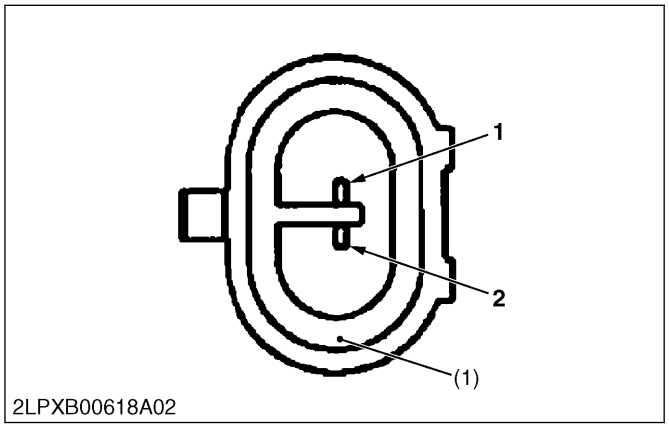
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 1 – chassis | Approximately 5 V |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.10.25.2 Checking resistance for SCR temperature sensor

1. Measure the resistance with an ohmmeter across the terminals shown in the table below.




(1) Connector (Sensor side)

| | | | |
|---|---|---|---|
| Resistance | At 0 ℃ (32 ℉) | Terminal 1 – 2 | Approximately 201 Ω |
| | At 25 ℃ (77 ℉) | | Approximately 220 Ω |
| | At 100 ℃ (212 ℉) | | Approximately 276 Ω |
| | At 200 ℃ (392 ℉) | | Approximately 349 Ω |
| | At 300 ℃ (572 ℉) | | Approximately 420 Ω |
| | At 400 ℃ (752 ℉) | | Approximately 488 Ω |
| | At 500 ℃ (932 ℉) | | Approximately 554 Ω |

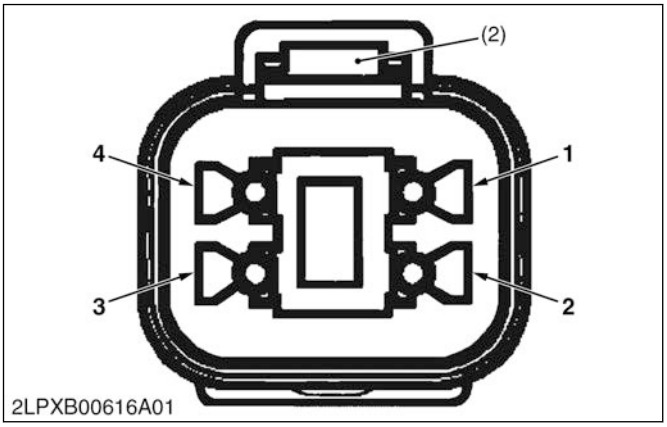
2. If the reference value is not indicated, the SCR temperature sensor is damaged.

## 4.10.26 DEF tank unit

## 4.10.26.1 Checking connector voltage for DEF tank unit

**■ NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is damaged if the relating electric circuit is normal.**


(1) DEF tank unit (2) Connector (Harness side)

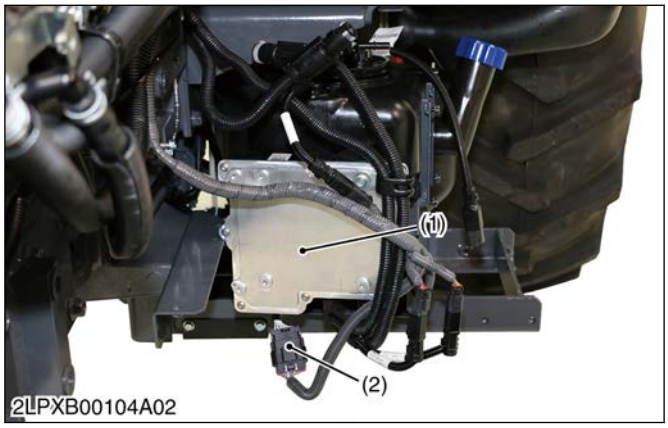
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

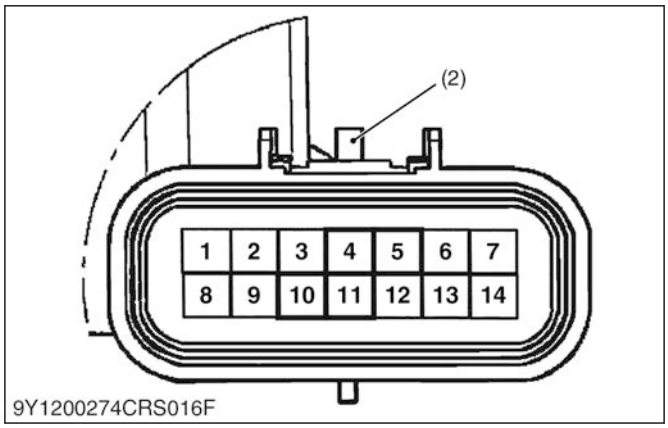
| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 1 – chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.10.27 DEF pump unit

### 4.10.27.1 Checking connector voltage for DEF pump unit




(1) DEF pump unit (2) Connector (Harness side)

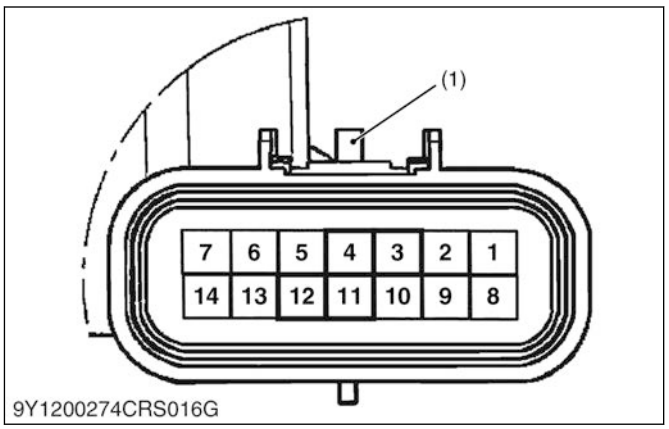
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 5 – chassis | Approximately 5 V |
| | | Terminal 7 – chassis | |
| | | Terminal 14 – chassis | |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.10.27.2 Checking resistance for DEF pump unit

1. Measure the resistance with an ohmmeter across the terminals shown in the table below.



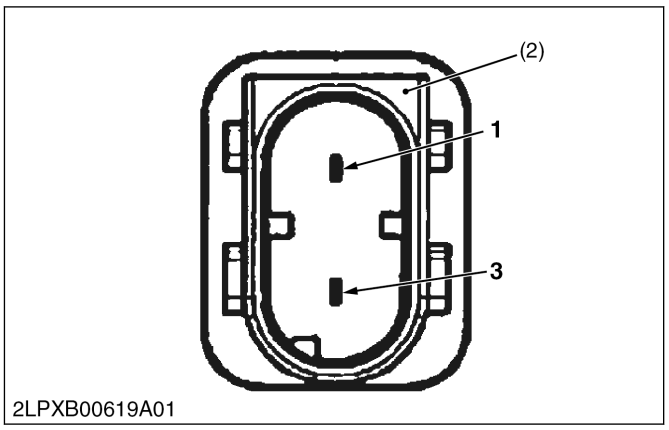

(1) Connector (Sensor side)

| | | |
|---|---|---|
| Resistance | Terminal 3 - chassis | Approximately 1.5 kΩ or higher |
| | Terminal 4 - chassis | |
| | Terminal 11 - chassis | |

2. If the reference value is not indicated, the DEF pump unit is damaged.

## 4.10.28 DEF tank heater coolant valve

### 4.10.28.1 Checking connector voltage for DEF tank heater coolant valve


(1) DEF tank heater coolant valve (2) Connector (Harness side)

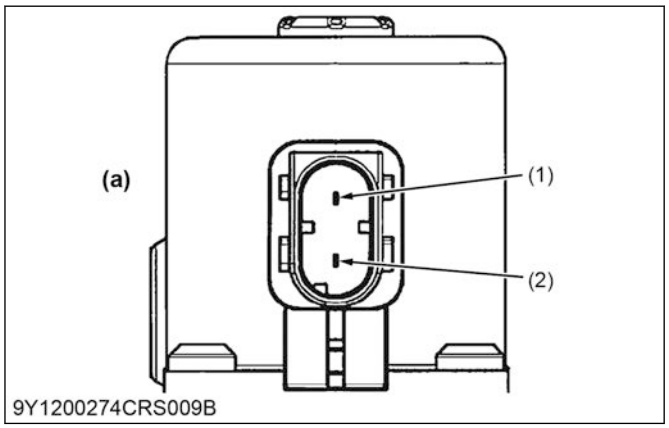
1. Disconnect the connector, and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 3 – chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.10.28.2 Checking DEF tank heater coolant valve

1. Measure the resistance with an ohmmeter across the terminals shown in the table below.




(1) Connector (Sensor side)

| | | |
|---|---|---|
| Resistance | Terminal 1 - Terminal 3 | Approximately 9 to 13 Ω at room temperature |

2. If the reference value is not indicated, the DEF tank heater coolant valve is damaged.

## 4.10.29 Air cleaner switch

**NOTE**

- **Firstly check the connector voltage, secondly check the other wires continuity, then finally check the switch continuity.**

## 4.10.29.1 Checking connector voltage for air cleaner switch


(1) Air cleaner switch

1. Disconnect the lead from the switch and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.
3. If the reference value is not indicated as shown in the table below, check the relating electric circuit.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Red/Black lead – Chassis | Approx. battery voltage |

## 4.10.29.2 Checking air cleaner switch

1. Check the continuity across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Switch continuity | In normal state | Across the leads | No continuity |
| | At pressure over approx. 6.35 kPa (0.0648 kgf/cm$^2$, 0.921 psi) | Across the leads | Continuity |


(1) Air cleaner switch

2. If the continuity specified below is not indicated, the switch is damaged.

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Air cleaner switch | 1.0 to 1.9 N·m<br>0.10 to 0.20 kgf·m<br>0.73 to 1.44 lbf·ft |

## 4.10.30 Engine oil pressure switch

### 4.10.30.1 Checking connector voltage for engine oil pressure switch

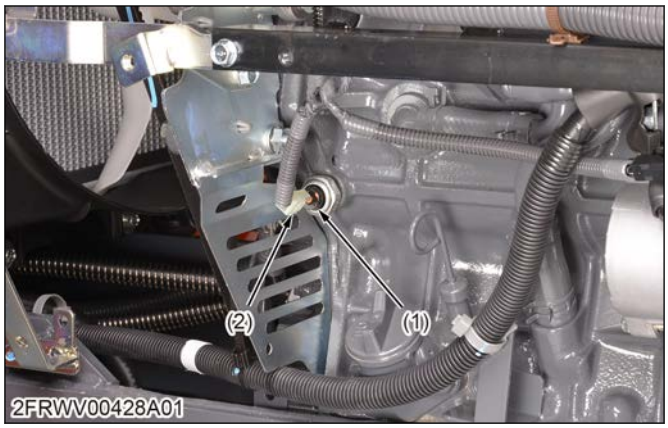

(1) Engine oil pressure switch (2) Connector (Harness side)

1. Disconnect the lead from the switch and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.
3. If the reference value is not indicated as shown in the table below, check the relating electric circuit.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal – Chassis | Approx. battery voltage |

### 4.10.30.2 Checking engine oil pressure switch

1. Check the continuity across the terminals shown in the table below.




(1) Engine oil pressure switch (2) Connector (Harness side)

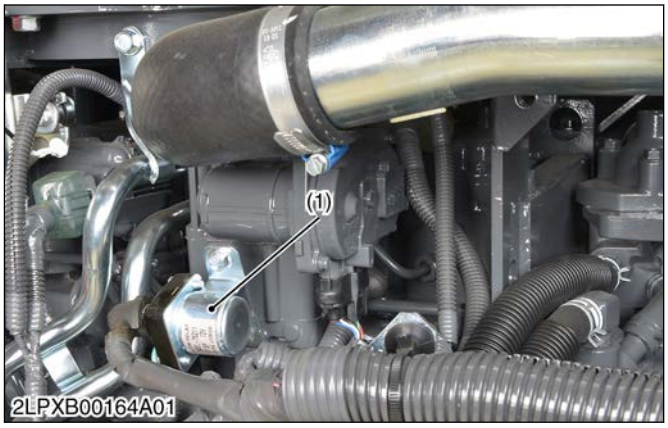
2. If the continuity specified below is not indicated, the switch is damaged.

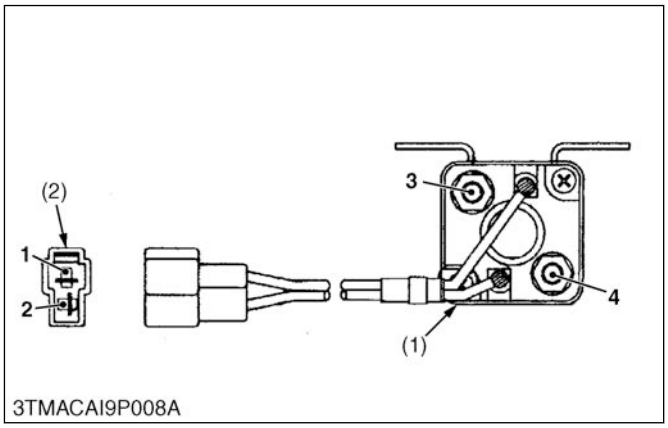
| | | | |
|---|---|---|---|
| Switch continuity | In normal state | Terminal – Body | Continuity |
| | At pressure over approx. 49 kPa (0.50 kgf/cm$^2$, 7.1 psi) | Terminal – Body | No continuity |

## 4.11 Relays

### 4.11.1 Intake air heater relay

### 4.11.1.1 Checking connector voltage for intake air heater relay




(1) Air heater relay (2) 2P connector

1. Turn **OFF** the main switch.
2. Measure the voltage with a voltmeter across the terminal 4 (white color lead) and chassis.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **OFF** | Terminal 4 (White color lead) – Chassis | Approximately battery voltage |

3. If the voltage differs from battery voltage, check the relating electric circuit.

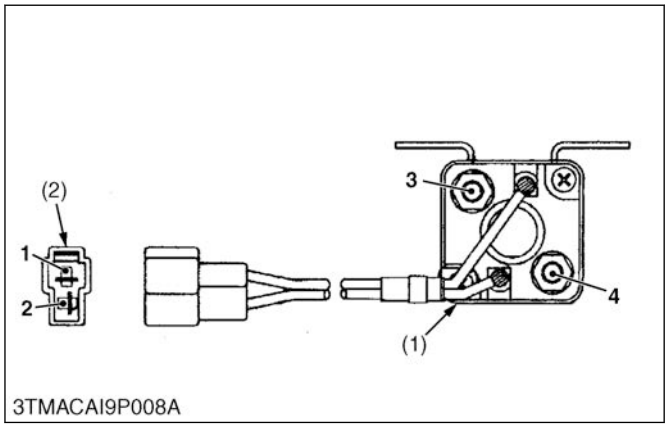
4. Disconnect the connector (2), turn the main key switch to the **PREHEAT** position, and measure the voltage with a voltmeter across the terminal 1 and the chassis.

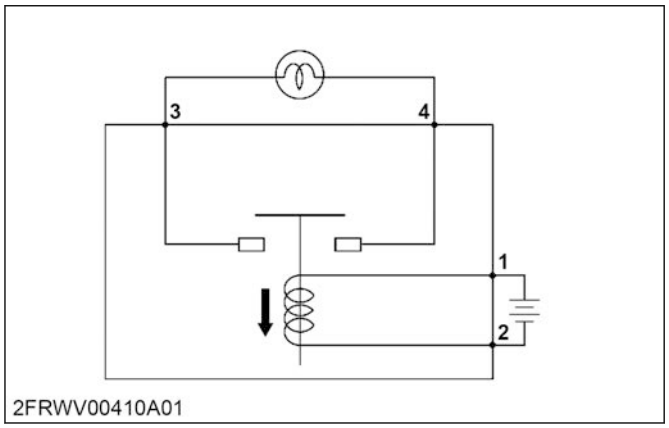
| | | | |
|---|---|---|---|
| Voltage | Main switch at **PREHEAT** | Terminal 1 – Chassis | Approximately battery voltage |

5. If the voltage differs from the battery voltage, the wiring harness or slow blow fuse is damaged.

### 4.11.1.2 Checking function for intake air heater relay

1. Remove the intake air heater relay.
2. Apply battery voltage across the 1 and 2 terminals, check continuity across 3 terminal and 4 terminal as shown in figure.



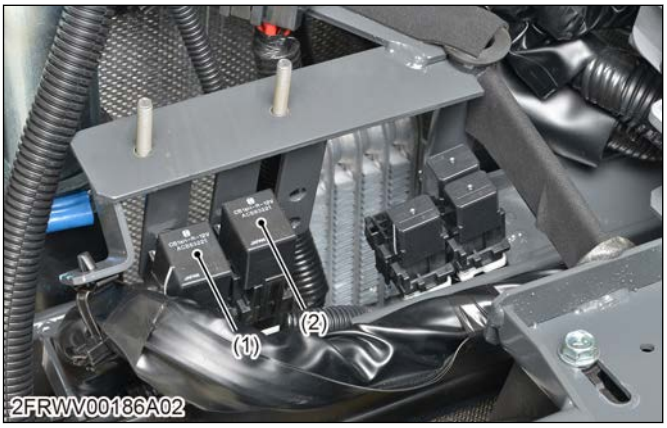



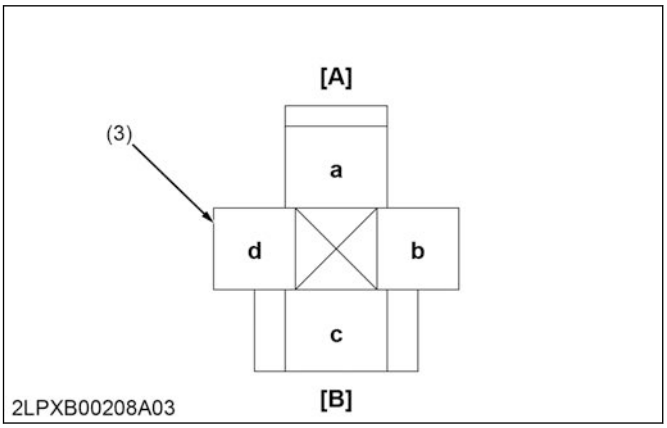

(1) Intake air heater relay (2) Relay connector

3. If continuity is not established across 3 terminal and 4 terminal, intake air heater relay is damaged.

## 4.11.2 CB type relay

### 4.11.2.1 Checking connector voltage for CB type relay (Cabin model)



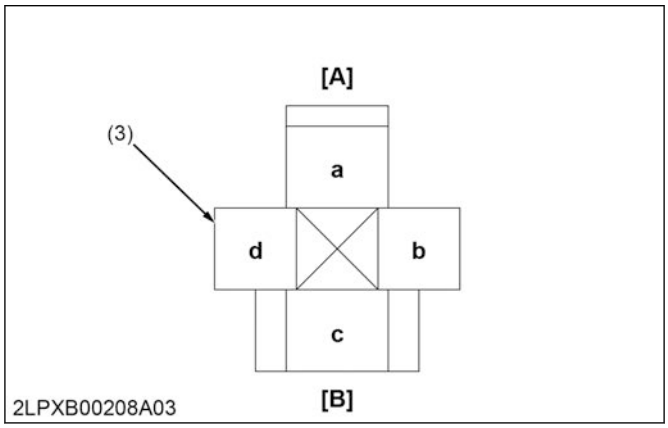

(1) ACU relay (2) Starter relay (3) Connector (Wire harness side)

1. Measure the voltage with a voltmeter across the battery terminal and chassis as table below.

| | | | |
|---|---|---|---|
| (1) | ACU relay (Main switch at **OFF** position) | Terminal c - Chassis<br>Terminal d - Chassis | Approximately battery voltage |
| (2) | Starter relay (Main switch at **OFF** position) | Terminal c - Chassis | Approximately battery voltage |

2. If the voltage differs from the battery voltage, the wiring harness or fuse is damaged.

## 4.11.2.2 Checking connector voltage for CB type relay (ROPS model)

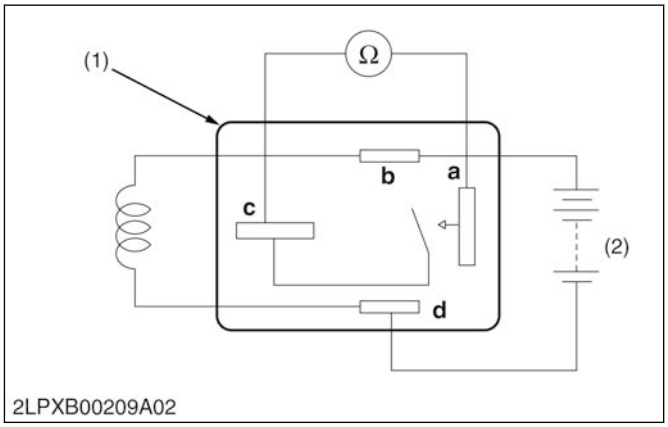

(1) ACU relay
(2) Starter relay
(3) Connector (Wire harness side)
[A] Front side
[B] Rear side

1. Measure the voltage with a voltmeter across the battery terminal and chassis as table below.

| | | | |
|---|---|---|---|
| (1) | ACU relay (Main switch at **OFF** position) | Terminal b - Chassis<br>Terminal c - Chassis | Approximately battery voltage |
| (2) | Starter relay (Main switch at **OFF** position) | Terminal a - Chassis | Approximately battery voltage |

2. If the voltage differs from the battery voltage, the wiring harness or fuse is damaged.

## 4.11.2.3 Checking function for CB type relay

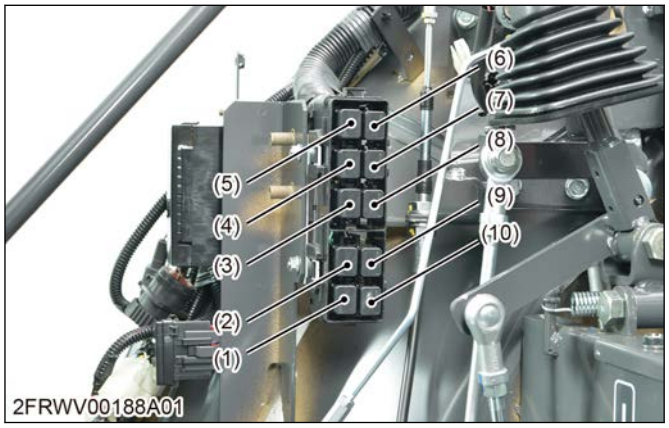


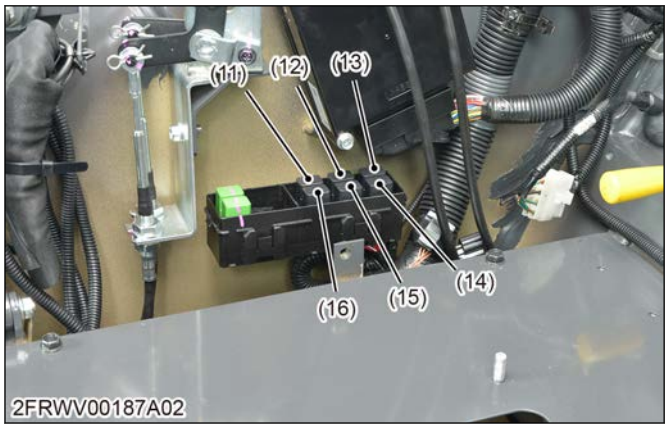

(1) Connector (Relay side)
(2) Battery

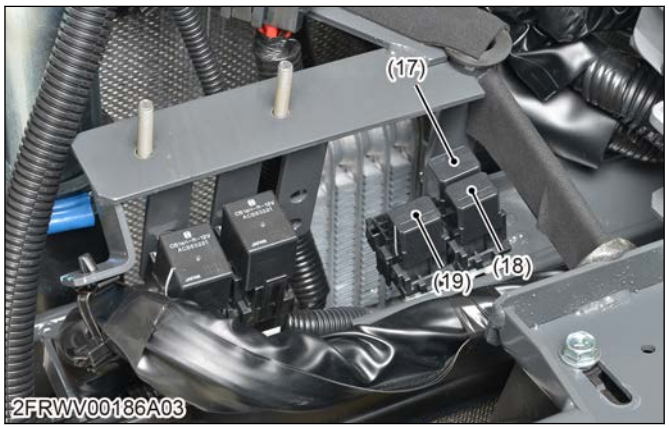
1. Apply battery voltage across the terminals b and d, and check for continuity across the terminals a and c.
2. If continuity is not established across terminals a and c, replace it.

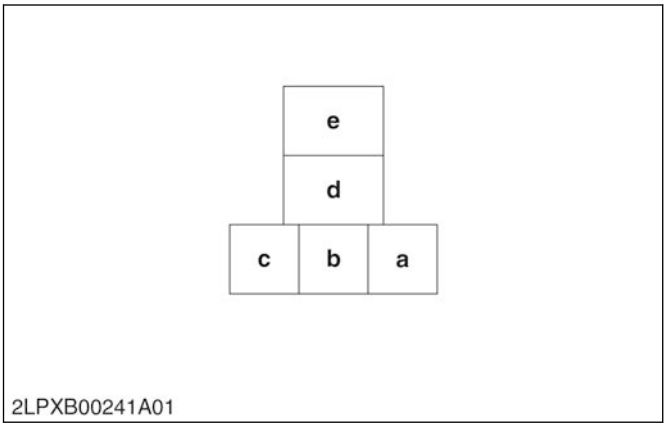
## 4.11.3 CM type relay

### 4.11.3.1 Checking connector voltage for CM type relay (Cabin model)




(1) PTO safety relay
(2) Head light relay
(3) Air conditioner blower high relay
(4) Rear work light relay
(5) Air conditioner blower relay
(6) Air conditioner compressor relay
(7) Front work light relay
(8) Option front work light relay
(9) Neutral relay
(10) Seat safety relay
(11) DEF (QW) relay
(12) Brake detect relay
(13) Stop lamp relay
(14) Auxiliary power relay
(15) PTO neutral relay
(16) DEF (RW) relay
(17) CRS relay
(18) CRS relay 2
(19) DEF Heater control relay

1. Measure the battery voltage with a voltmeter across the battery positive terminal and the battery negative terminal.

2. Measure the relay connector voltage with a voltmeter across the connector terminals and the chassis as shown in the following table.

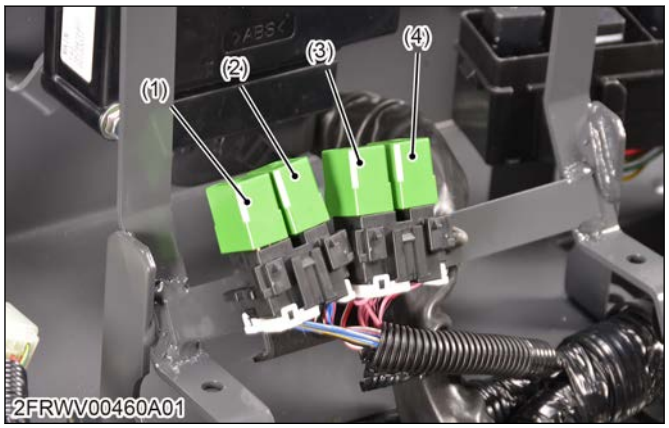
| | | | |
|---|---|---|---|
| (1) | PTO safety relay | — | — |
| (2) | Head light relay (main switch at "**OFF**" position) | Terminal d – Chassis | Approximately battery voltage |
| (3) | Air conditioner blower high relay (main switch at "**ON**" position) | Terminal c – Chassis | Approximately battery voltage |
| (4) | Rear work light relay | — | — |
| (5) | Air conditioner blower relay (main switch at "**OFF**" position) | Terminal c – Chassis<br>Terminal d – Chassis | Approximately battery voltage |
| (6) | Air conditioner compressor relay | Terminal c – Chassis<br>Terminal d – Chassis | Approximately battery voltage |
| (7) | Front work light relay (main switch at "**OFF**" position) | Terminal d – Chassis | Approximately battery voltage |
| (8) | Option front work light relay (main switch at "**OFF**" position) | Terminal d – Chassis | Approximately battery voltage |
| (9) | Neutral relay | — | — |
| (10) | Seat safety relay (main switch at "**START**" position | Terminal d – Chassis | Approximately battery voltage |
| (11) | DEF (QW) relay (main switch at "**ON**" position) | Terminal e – Chassis | Approximately battery voltage |
| (12) | Brake detect relay | — | — |
| (13) | Stop lamp relay (main switch at "**ON**" position) | Terminal e – Chassis | Approximately battery voltage |
| (14) | Auxiliary power relay | Terminal c – Chassis<br>Terminal d – Chassis | Approximately battery voltage |
| (15) | PTO neutral relay | — | — |
| (16) | DEF (RW) relay (main switch at "**ON**" position) | Terminal c – Chassis<br>Terminal e – Chassis | Approximately battery voltage |
| (17) | CRS relay (main switch at "**OFF**" position) | Terminal c – Chassis<br>Terminal e – Chassis | Approximately battery voltage |
| (18) | CRS relay 2 (main switch at "**ON**" position) | Terminal d – Chassis | Approximately battery voltage |

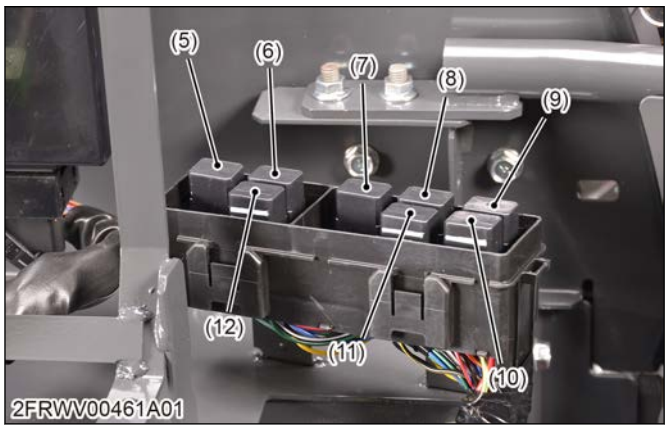
(Continued)

| | | | |
|---|---|---|---|
| (19) | DEF heater control relay (main switch at "**OFF**" position) | Terminal c – Chassis | Approximately battery voltage |

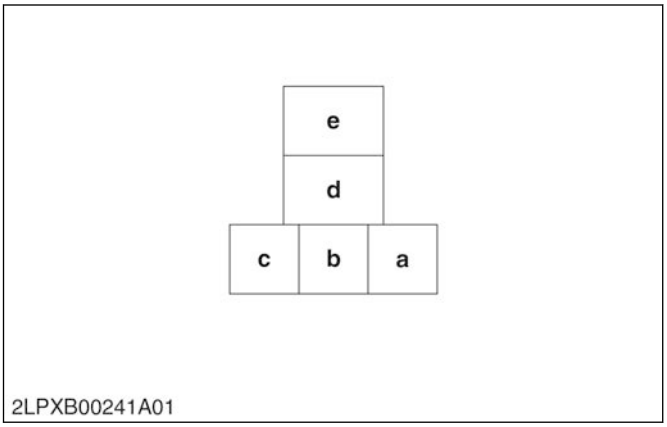
3. If the measured voltage differs from the battery voltage, the wiring harness or fuse is damaged.

## 4.11.3.2 Checking connector voltage for CM type relay (ROPS model)








(1) PTO neutral relay
(2) PTO relay
(3) T/B secondary brake relay
(4) T/B gear lock parking relay
(5) Brake detect relay
(6) Head light relay
(7) PTO safety relay
(8) DEF Heater control relay
(9) Auxiliary power relay
(10) Work light relay
(11) Neutral relay
(12) Stop lamp relay
(13) CRS relay 2
(14) CRS relay 1

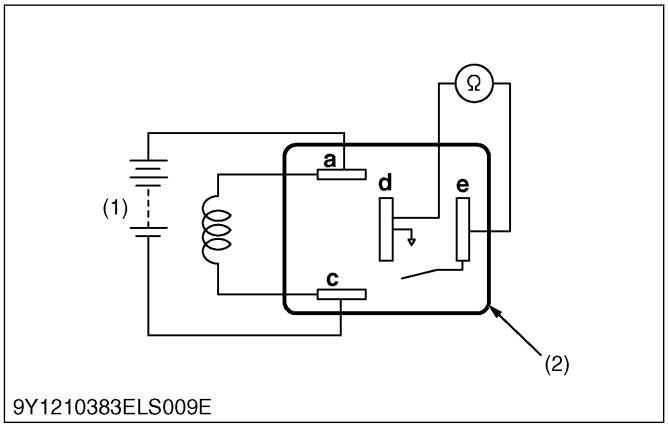
1. Measure the battery voltage with a voltmeter across the battery positive terminal and the battery negative terminal.

2. Measure the relay connector voltage with a voltmeter across the connector terminals and the chassis as shown in the following table.

| | | | |
|---|---|---|---|
| (1) | PTO neutral relay (Main switch at **ON** position) | Terminal c – Chassis | Approximately battery voltage |
| (2) | PTO relay (Main switch at **ON** position) | Terminal c – Chassis<br>Terminal e – Chassis | Approximately battery voltage |
| (3) | T/B secondary brake relay (Main switch at **ON** position) | Terminal c – Chassis<br>Terminal e – Chassis | Approximately battery voltage |
| (4) | T/B gear lock parking relay (Main switch at **ON** position) | Terminal c – Chassis | Approximately battery voltage |
| (5) | Brake detect relay (Main switch at **ON** position and each brake pedal is pressed) | Terminal c – Chassis<br>Terminal e – Chassis | Approximately battery voltage |
| (6) | Head light relay | Terminal d – Chassis | Approximately battery voltage |
| (7) | PTO safety relay (Main switch at **START** position | Terminal e – Chassis | Approximately battery voltage |
| (8) | DEF heater control relay (Main switch at **ON** position) | Terminal c – Chassis | Approximately battery voltage |
| (9) | Auxiliary power relay | Terminal e – Chassis | Approximately battery voltage |
| (10) | Work light relay | Terminal d – Chassis | Approximately battery voltage |
| (11) | Neutral relay (Main switch at **START** position | Terminal e – Chassis | Approximately battery voltage |
| (12) | Stop lamp relay | Terminal e – Chassis | Approximately battery voltage |
| (13) | CRS relay 2 (Main switch at **ON** position) | Terminal c – Chassis<br>Terminal d – Chassis | Approximately battery voltage |
| (14) | CRS relay 1 | Terminal c – Chassis<br>Terminal e – Chassis | Approximately battery voltage |

3. If the measured voltage differs from the battery voltage, the wiring harness, fuse or related electrical circuit is damaged.

## 4.11.3.3 Checking relay continuity

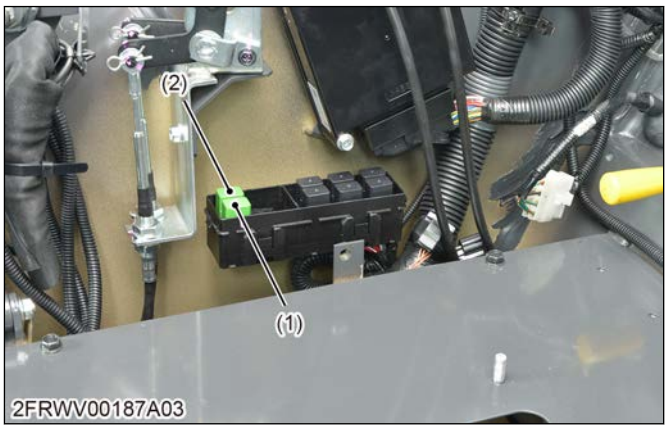


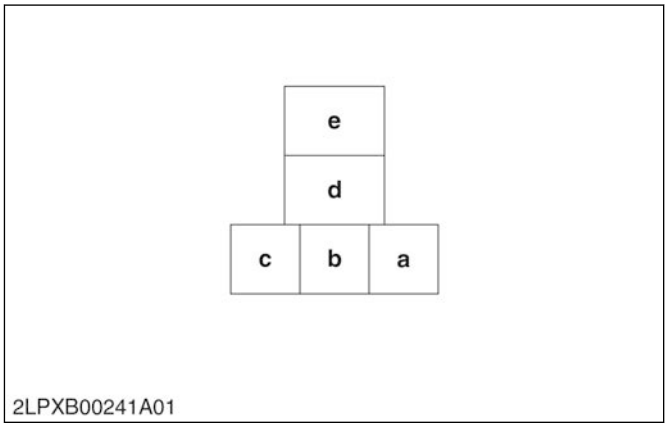

(1) Battery (2) Connector (Relay side)

1. Apply battery voltage across the terminal a and the terminal c, and check for continuity across the terminal d and the terminal e.
2. If continuity is not established across the terminal d and the terminal e, replace it.

## 4.11.4 CM type 5 pin relay

## 4.11.4.1 Checking connector voltage for CM type 5 pin relay (Cabin model)




(1) T/B gear lock parking relay (2) T/B secondary brake relay

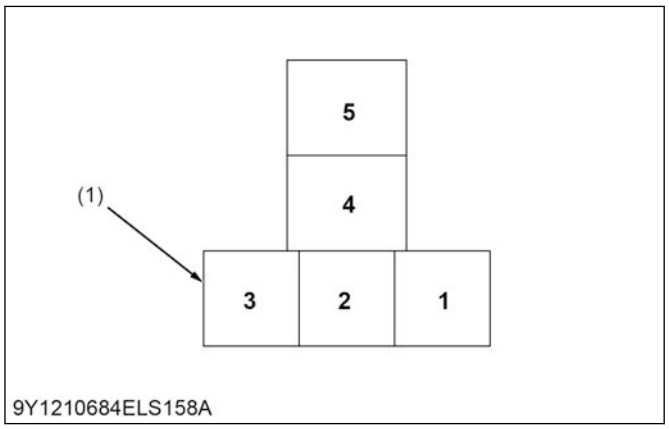
1. Measure the battery voltage with a voltmeter across the battery positive terminal and the battery negative terminal.

2. Measure the relay connector voltage with a voltmeter across the connector terminals and the chassis as shown in the following table.

| | | | |
|---|---|---|---|
| (1) | T/B gear lock parking relay (main switch at "**ON**" position) | Terminal b – Chassis | Approximately battery voltage |
| (2) | T/B secondary brake relay (main switch at "**ON**" position) | Terminal a – Chassis | Approximately battery voltage |

3. If the measured voltage differs from the battery voltage, the wiring harness or fuse is damaged.

### 4.11.4.2 Checking relay continuity



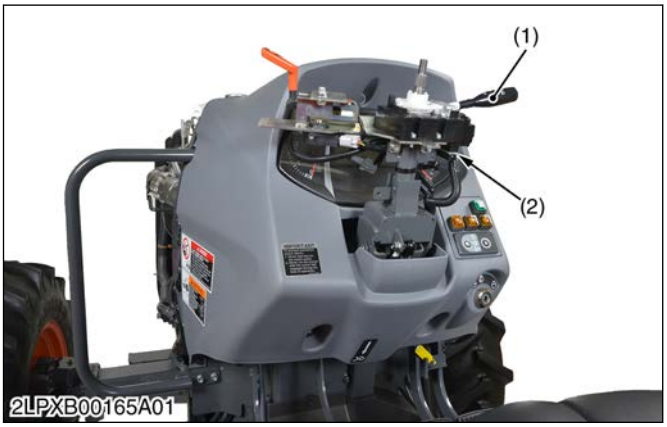

(1) Relay

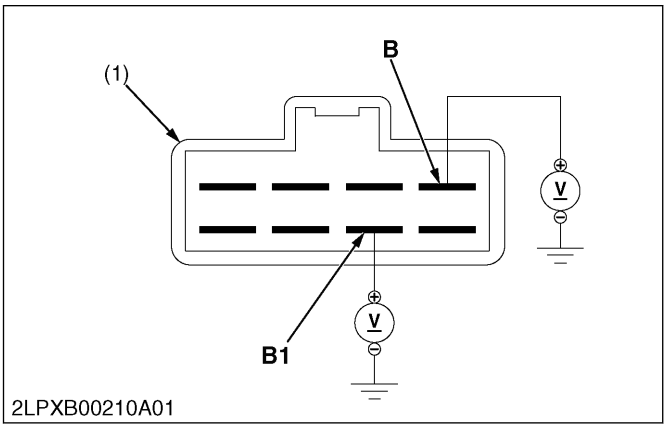
1. Check the continuity across the terminal 2 and the terminal 5.
2. If there is no continuity across the terminal 2 and the terminal 5, the relay is damaged.
3. Apply battery voltage across the terminal 1 and the terminal 3, and check the continuity across the terminal 4 and the terminal 5.
4. If continuity is not established across the terminal 4 and the terminal 5, the relay is damaged.

## 4.12 Lighting switches and flasher unit

### 4.12.1 Combination switch and lever (ROPS model)

### 4.12.1.1 Checking connector voltage for combination switch (ROPS model)



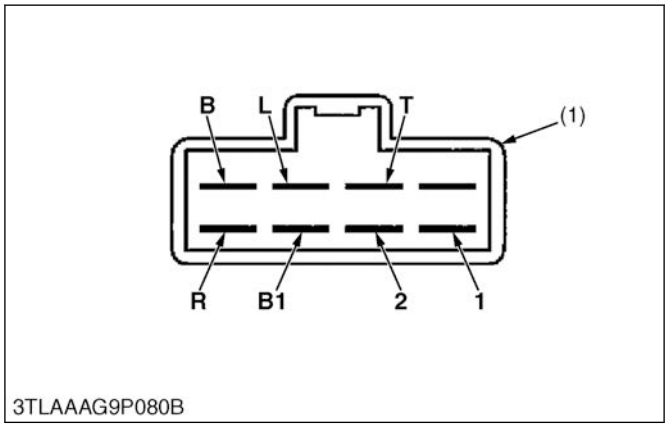

(1) Combination switch (2) Combination switch connector (Wire harness side)

1. Remove the steering post cover.
2. Disconnect the combination switch connector (2).
3. Measure the voltage across the connector B terminal to chassis and the B1 terminal to chassis when the main switch is "ON/OFF" position.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** position | B Terminal – Chassis | Approximately battery voltage |
| | Main switch at **OFF** position | B1 Terminal - Chassis | |

4. If the voltage differs from the battery voltage, the relating wiring harness is damaged.

## 4.12.1.2 Checking combination switch (ROPS model)




(1) Combination switch

1. Measure the resistance across seven terminal referring to the table below.

**Light switch**

| Lighting lever position | B1 | T | 1 | 2 | Resistance |
|---|---|---|---|---|---|
| OFF | | | | | 0 Ω |
| Lo | ● | ● | ● | | |
| Hi | ● | ● | | ● | |

2LPXB00375A01

**Turn signal switch**

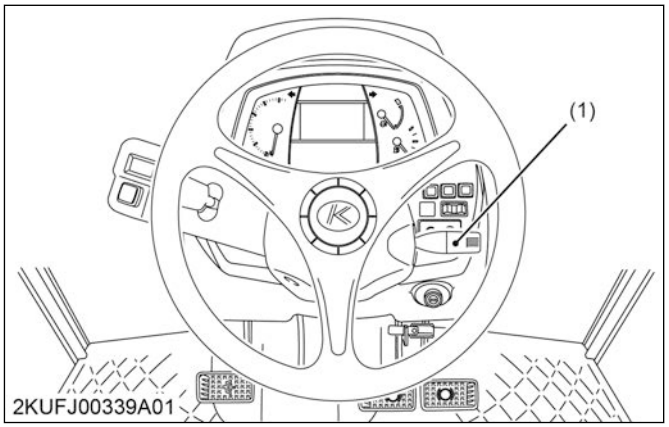
| Turn signal lever position | B | L | R | Resistance |
|---|---|---|---|---|
| Left | ● | ● | | 0 Ω |
| OFF | | | | |
| Right | ● | | ● | |

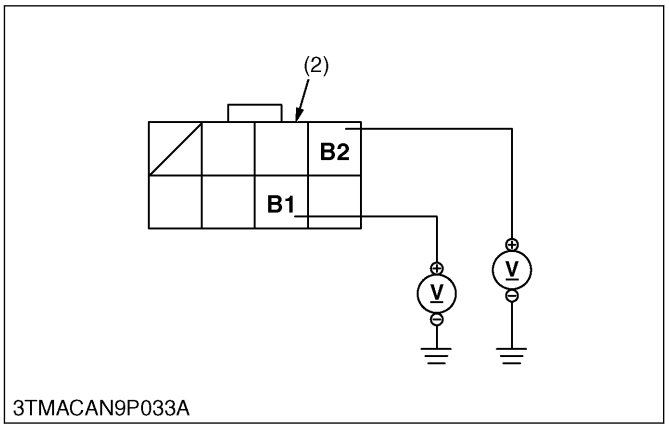
2LPXB00376A01

2. If the continuity specified value is not indicated, the switch is damaged.

## 4.12.2 Combination switch and lever (Cabin model)

### 4.12.2.1 Checking connector voltage for combination switch (Cabin model)



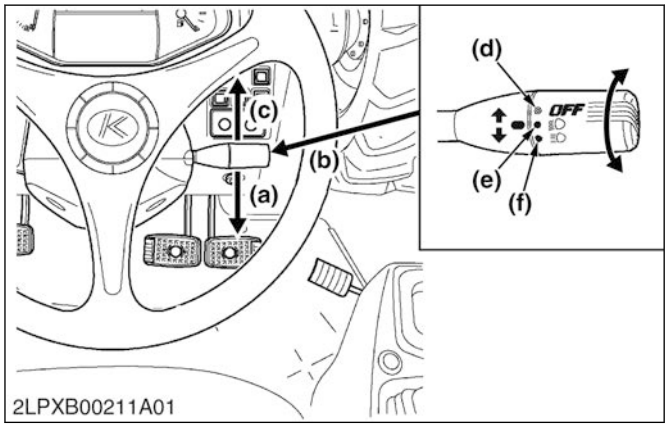

(1) Combination switch
(2) Combination switch connector (Wire harness side)

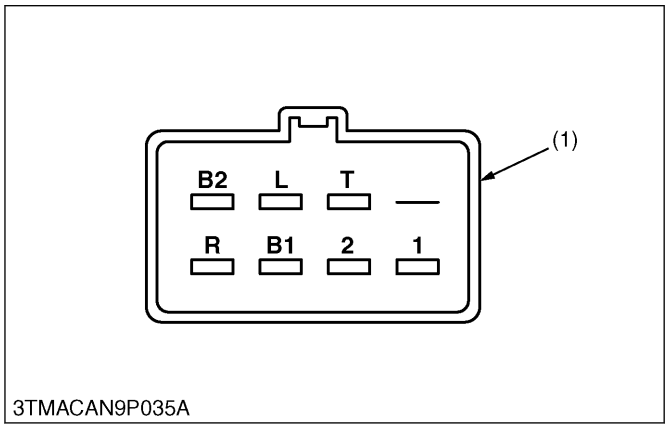
1. Remove the steering post cover.
2. Disconnect the combination switch connector (2).
3. Measure the voltage across the connector B2 terminal to chassis and the B1 terminal to chassis when the main switch is **ON/OFF** position.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **OFF** | Terminal B1 – Chassis | Approximately battery voltage |
| | Main switch at **ON** | Terminal B2 – Chassis | |

4. If the voltage differs from the battery voltage, the relating wiring harness is damaged.

## 4.12.2.2 Checking combination switch (Cabin model)




(1) Lever combination switch connector (Switch side)
(a) Right turn
(b) OFF
(c) Left turn
(d) "**OFF**"
(e) Head light (Lo)
(f) Head light (Hi)

1. Measure the resistance across seven terminal referring to the table below.

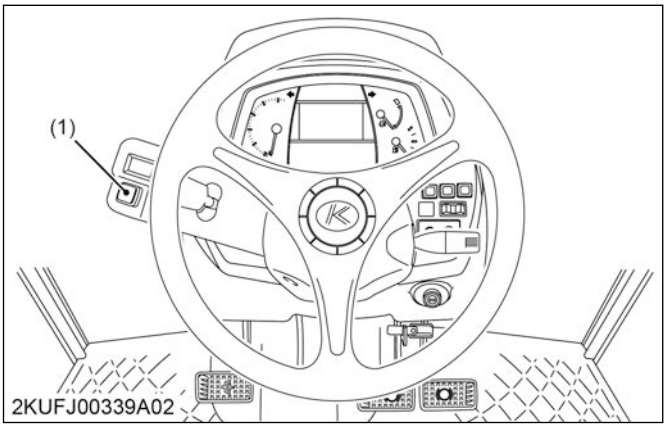
| | | Terminal | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Continuity | Position | **B1** | **T** | **1** | **2** | **B2** | **R** | **L** |
| Turn signal switch | R.H. **(a)** | | | | | ● | ● | |
| | OFF **(b)** | | | | | | | |
| | L.H. **(c)** | | | | | ● | | ● |
| Light switch | OFF **(d)** | | | | | | | |
| | Lo **(e)** | ● | ● | ● | | | | |
| | Hi **(f)** | ● | ● | | ● | | | |

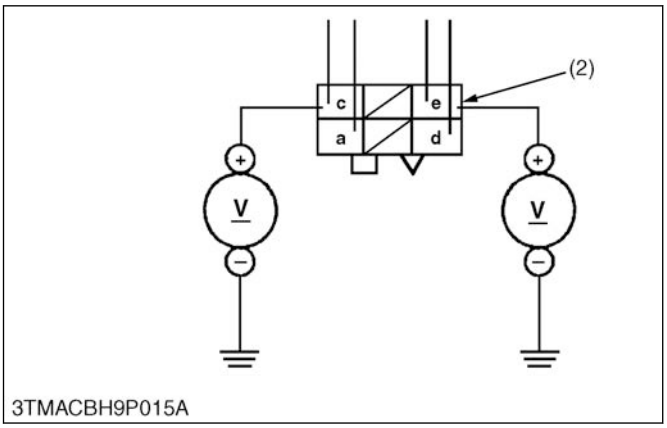
2LPXB00540A01

2. If the continuity specified below is not indicated, the switch is faulty.

## 4.12.3 Hazard switch

### 4.12.3.1 Checking connector voltage for hazard switch



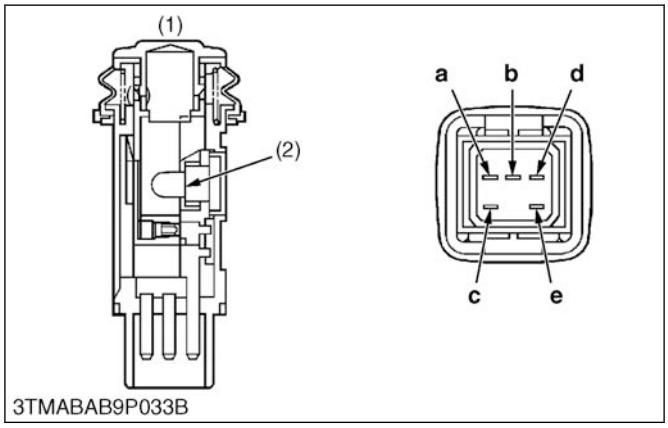




(1) Hazard switch
(2) 6P connector (Wire harness side)

1. Disconnect the connector for hazard switch.
2. Measure the voltage with a voltmeter across the terminal a and chassis.
3. If the voltage differ from the battery voltage, the wiring harness is damaged.

| | | |
|---|---|---|
| Voltage | Terminal a – Chassis | Approximately battery voltage |

## 4.12.3.2 Checking hazard switch




(1) Hazard switch (2) Bulb

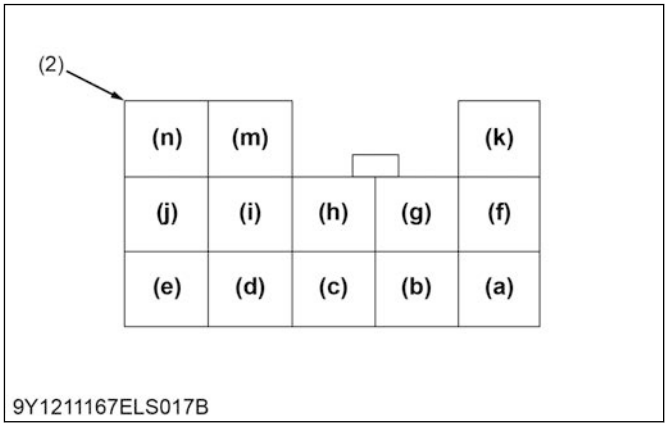
1. Measure the resistance with ohmmeter across the terminal a and terminal c, and across the terminal d and terminal e.
2. If the measurement is not following table, the hazard switch or the bulb are damaged.

| | | |
|---|---|---|
| Resistance (Switch at **OFF**) | Terminal a – Terminal c | Infinity |
| Resistance (Switch at **ON**) | Terminal a – Terminal c | 0 Ω |
| Resistance (Bulb) | Terminal d – Terminal e | Approximately 13 Ω |

## 4.12.4 Flasher unit

## 4.12.4.1 Checking connector voltage for flasher unit






(1) Flasher unit
(2) Flasher unit connector (Wire harness side)
[A] ROPS model
[B] Cabin model

1. Disconnect the connector from the flasher unit.
2. Check the wiring harness connector as shown in the table.
3. If the measured value is different, the wiring harness or relating circuit is damaged.

| | | | |
|---|---|---|---|
| Voltage | Main key switch at OFF | Terminal (h) - Chassis | Approximately battery voltage |
| | Main key switch at ON | Terminal (g) - Chassis | |

| | | |
|---|---|---|
| Resistance | Terminal (m) - Chassis | 0 Ω |

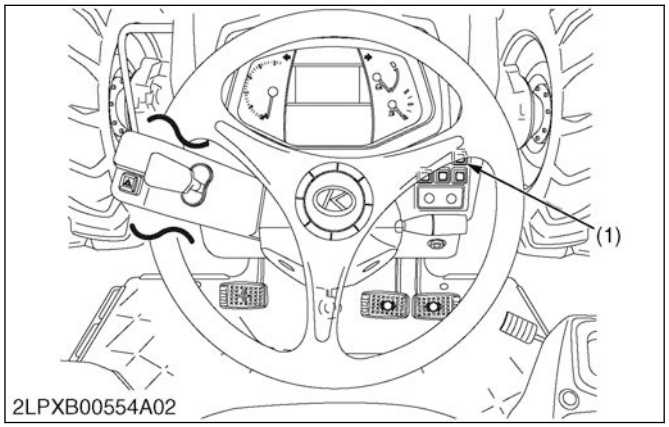
## 4.12.4.2 Checking flasher unit actuation

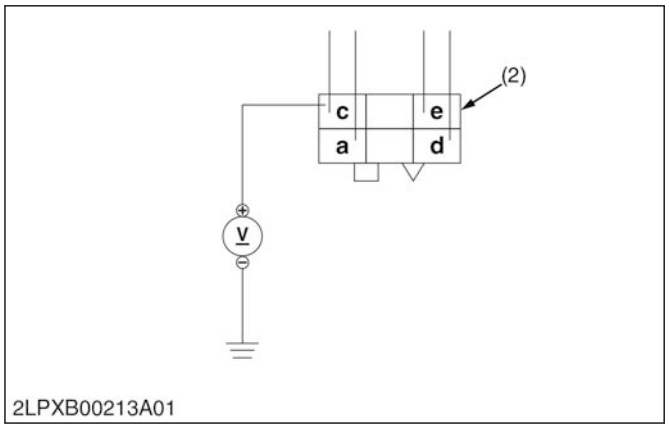
1. Check that the lights are switched according to the switch operation.
2. If any problem is found although the connector is OK, the flasher unit is damaged.
3. Count the number of blinking.
4. If the factory specification is not indicated, replace the flasher unit.

| | | |
|---|---|---|
| Blink (Times of blinking light) | Factory specification | 85 to 95 times/minute |

## 4.12.5 Front work light switch (ROPS model)

### 4.12.5.1 Checking connector voltage for front work light switch (ROPS model)



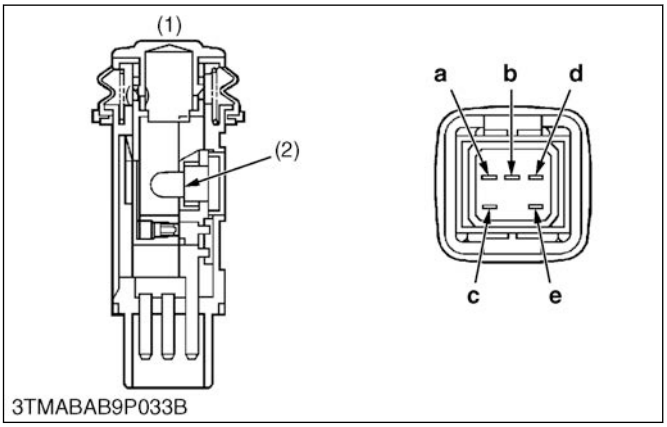

(1) Front work light switch (2) 6P connector (Wire harness side)

1. Turn the main switch to **ON** position.
2. Measure the voltage with a voltmeter across the terminal a and chassis.

| | | |
|---|---|---|
| Voltage | Terminal c – Chassis | Approximately battery voltage |

3. If the voltage differ from the battery voltage, the wiring harness or fuse is damaged.

### 4.12.5.2 Checking front work light switch (ROPS model)




(1) Front work light switch (2) Bulb

1. Measure the resistance with ohmmeter across the terminal a and terminal c, and across the terminal d and terminal e.
2. If the measurement is not satisfied in the following table, the switch or the bulb is damaged.

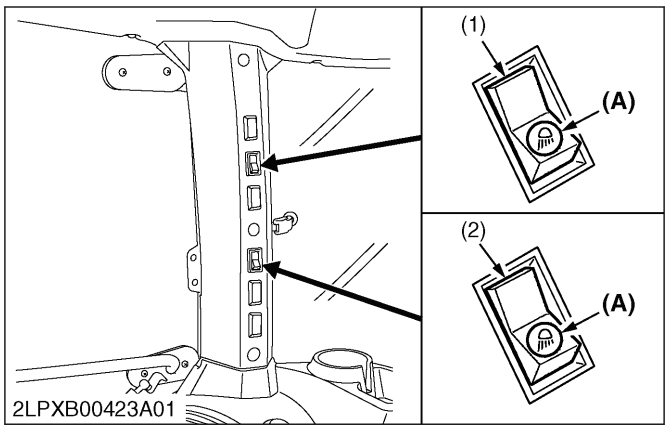
| | | |
|---|---|---|
| Resistance (Switch at **OFF**) | Terminal a – Terminal c | Infinity |
| Resistance (Switch at **ON**) | Terminal a – Terminal c | 0 Ω |
| Resistance (Bulb) | Terminal d – Terminal e | Approximately 13 Ω |

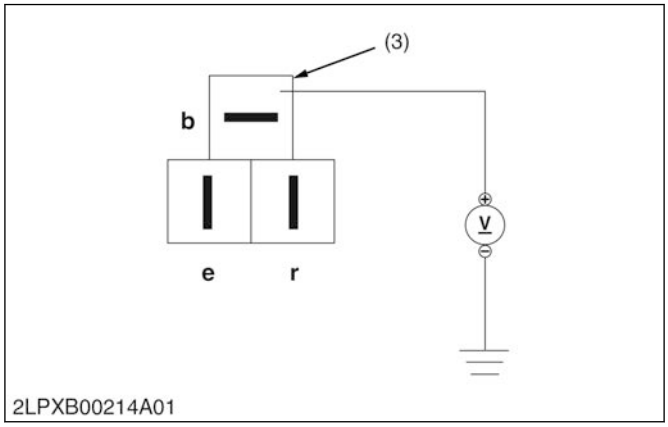
## 4.12.6 Front / Rear work light (Cabin model)

### 4.12.6.1 Checking connector voltage for work light switch (Cabin model)

**NOTE**

- **The terminal b of 3P connector for front work light switch is white/black color wire, for rear light switch is white/blue color wire.**



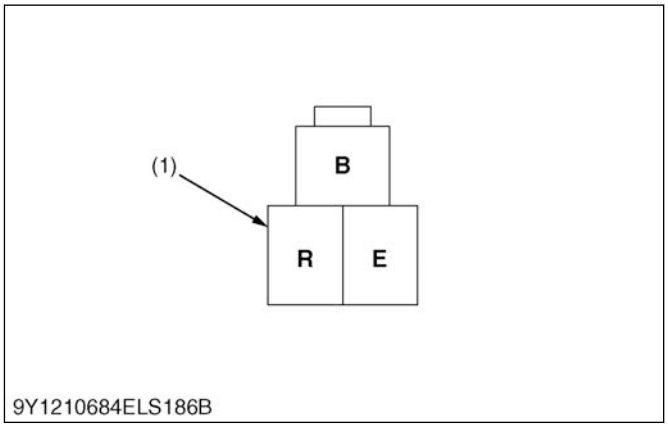

(1) Work light switch (Front)
(2) Work light switch (Rear)
(3) 3P connector (Wire harness side)
(A) Indicator for work lights

1. Turn the main switch to "**ON**" position.
2. Measure the voltage with a voltmeter across the terminal b and chassis.

| | | |
|---|---|---|
| Voltage | Terminal b – Chassis | Approximately battery voltage |

3. If the voltage differ from the battery voltage, the wiring harness or fuse is faulty.

## 4.12.6.2 Checking work light switch (Cabin model)




(1) Work light switch (Switch side)

1. Check the continuity across the terminals shown table below.
2. If the continuity specified below is not indicated, the switch is damaged.

| Position | | Terminal | | |
|---|---|---|---|---|
| | | B | R | E |
| Work light switch | OFF | | ● | ● |
| | ON | ● | ● | ● |

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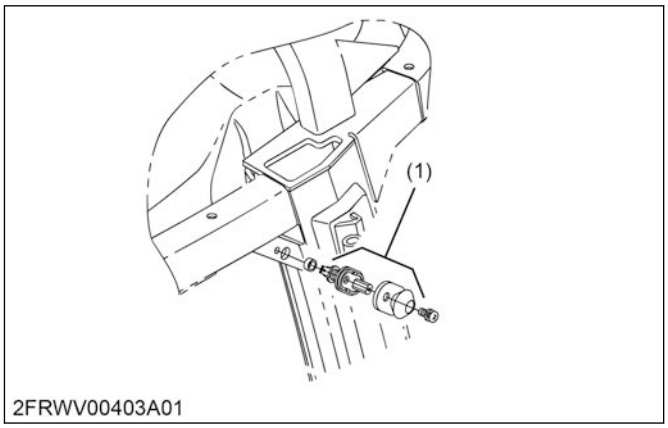
## 4.12.7 Door switch

**NOTE**

- **Firstly check the connector voltage, secondly check the other wires continuity, then finally check the switch continuity.**

## 4.12.7.1 Checking connector voltage for door switch




(1) Door switch

1. Disconnect the connector, and turn the room lamp switch **DOOR** position.

2. Measure the voltage with a voltmeter across the terminals shown in the table below.
3. If the reference value is not indicated as shown in the table below, check the relating electric circuit.

| | | | |
|---|---|---|---|
| Voltage | Room lamp switch at **DOOR** | Black/Red lead – Chassis | Approx. battery voltage |

### 4.12.7.2 Checking door switch continuity

1. Check the continuity across the terminals shown in the table below.
2. If the continuity specified below is not indicated, the switch is damaged.

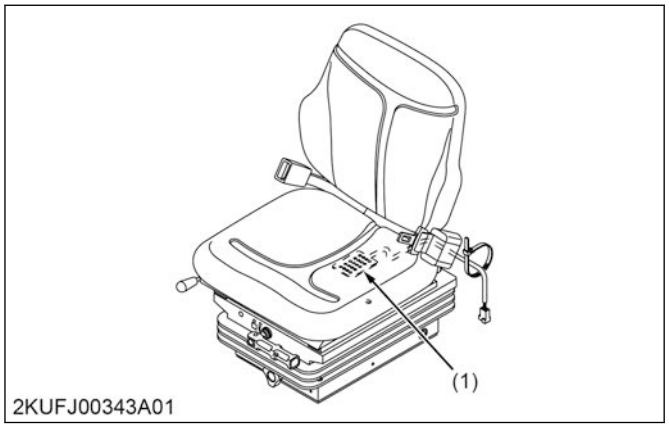
| | | | |
|---|---|---|---|
| Continuity check | Switch **Pushed** | Terminal – Body | No continuity |
| | Switch **Released** | Terminal – Body | Continuity |

## 4.13 Operator presence control (OPC) system

### 4.13.1 Checking OPC system

**⚠ WARNING**

- **Disconnect the implement drive universal joint from the PTO shaft, if the implement has mounted.**



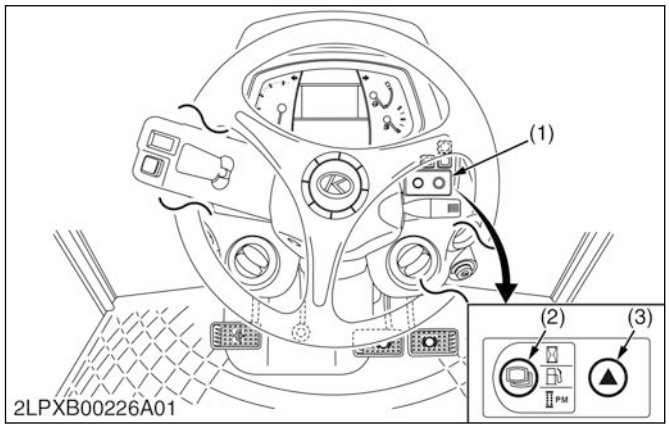

(1) Seat switch

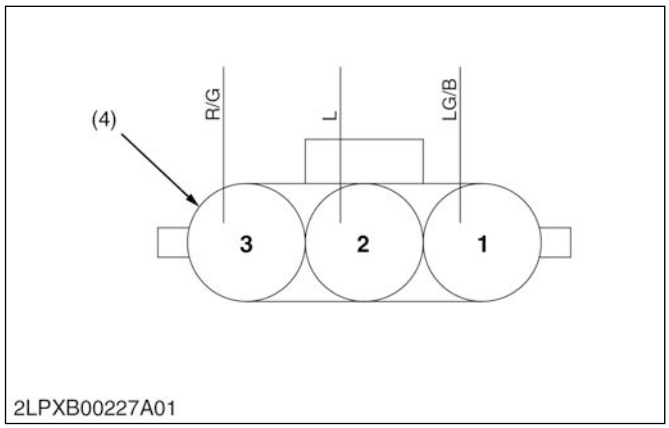
1. Sit on the seat.
2. Operate the engine.
3. Shift the PTO clutch control switch to **ON**.
   Make sure the warning buzzer does not whistle.
4. Stand up from the seat.
   The warning buzzer start beeping after one second when operator stands up from the seat. It continues beeps for 10 seconds.

## 4.14 Others

### 4.14.1 Display select switch

#### 4.14.1.1 Checking connector voltage for display select switch



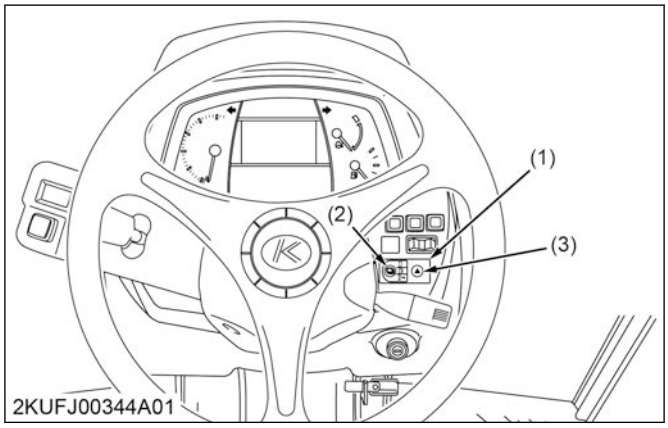

(1) Display select switch
(2) Mode selector switch
(3) Select switch
(4) Connector (Wire harness side)

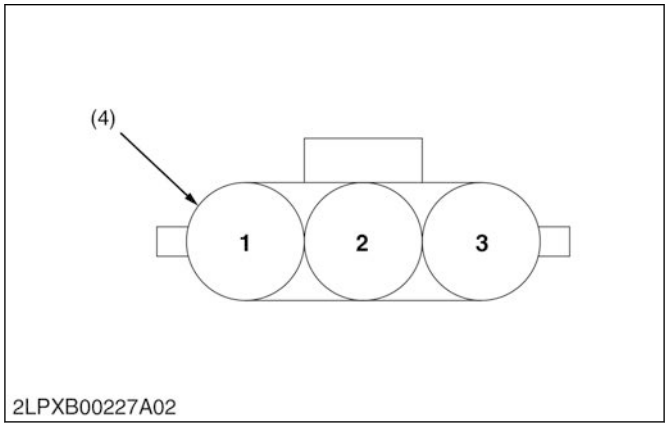
1. Disconnect the connector and turn the main key switch "**ON**" position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at "**ON**" | Terminal 3 – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

### 4.14.1.2 Checking display select switch




(1) Display select switch
(2) Mode selector switch
(3) Select switch
(4) Connector (Switch side)

1. Check the continuity across the terminals shown in the table below.

| Position | | Terminal | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| Display select switch | Mode selector switch (2) “ON” | ● | | ● |
| | OFF | | | |
| | Select switch (3) “ON” | | ● | ● |

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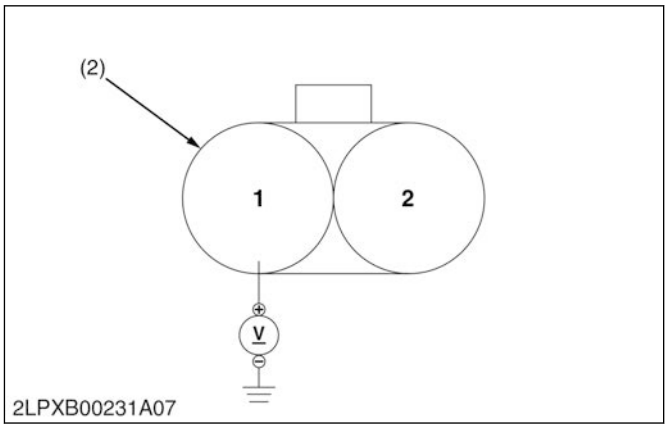
2. If the continuity specified value is not indicated, the switch is damaged.

## 4.14.2 PTO speed select switch

### 4.14.2.1 Checking connector voltage for PTO speed select switch

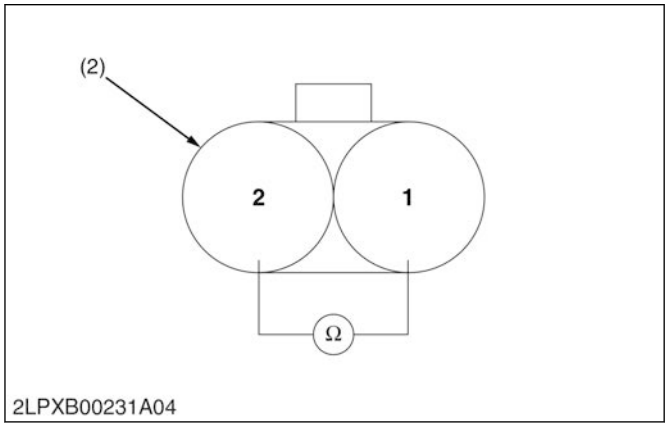

(1) PTO speed select switch
(2) PTO speed select switch connector (Wire harness side)

1. Disconnect the connector, and turn the main key switch **ON** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.

| | | | |
|---|---|---|---|
| Voltage | Main switch at **ON** | Terminal 1 – Chassis | Approximately battery voltage |

3. If the reference value is not indicated as shown in the table, check the relating electric circuit.

## 4.14.2.2 Checking PTO speed select switch


(1) PTO speed select switch
(2) PTO speed select switch connector (Switch side)

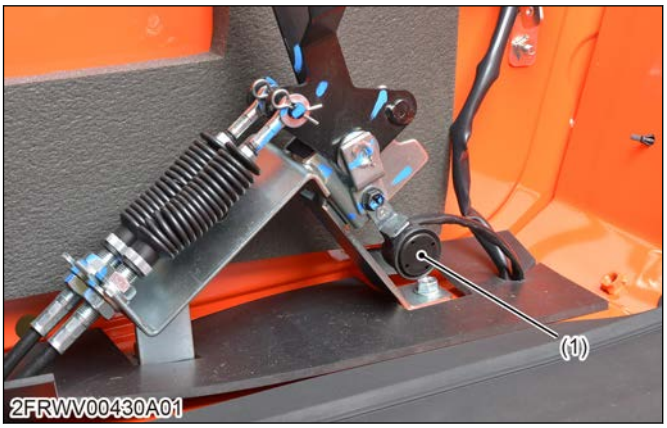
1. Check the continuity across the terminals shown in the table below.

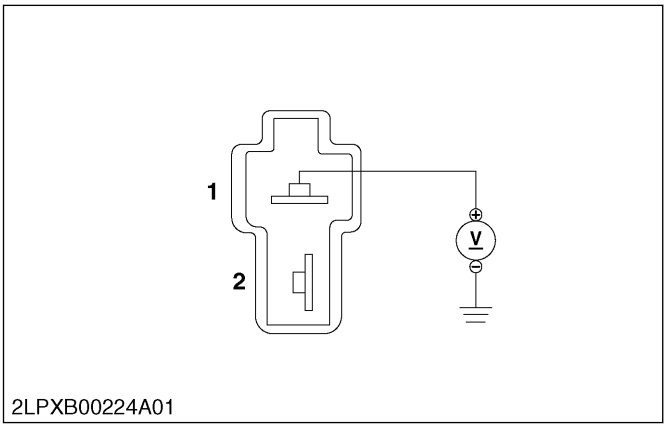
| Position | Terminal 1 – 2 |
|---|---|
| Switch is **Released** (PTO speed select lever is **540** position). | Continuity (0 Ω) |
| Switch is **Pressed** (PTO speed select lever is **540E** position). | Infinity |

2. If the continuity specified value is not indicated, PTO speed select switch is damaged.

## 4.14.3 Buzzer

### 4.14.3.1 Checking connector voltage for buzzer

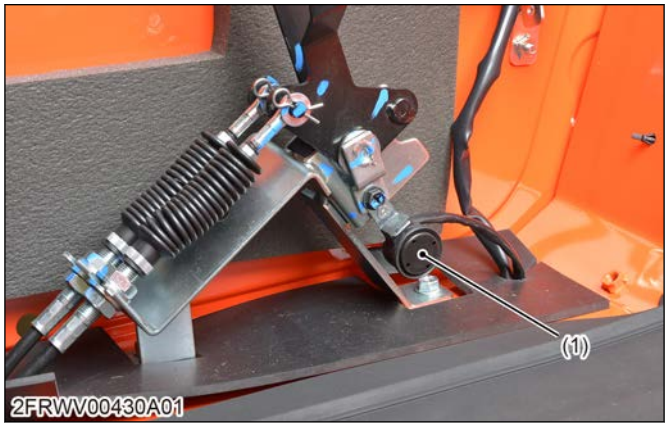

(1) Buzzer

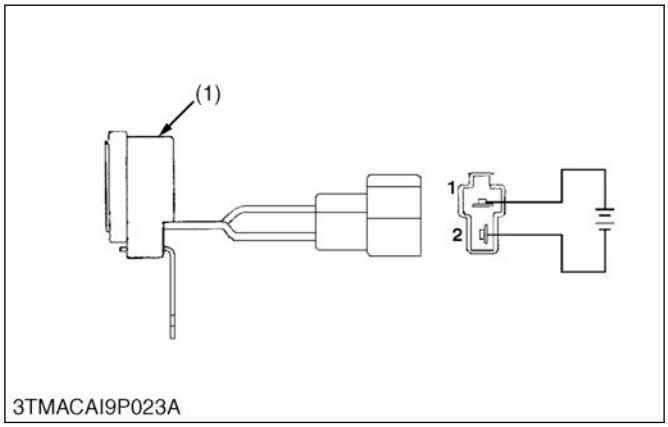
1. Disconnect the buzzer connector.
2. Turn the main switch to **ON** position.
3. Measure the voltage with a voltmeter across the terminal 1 and chassis.

| | | |
|---|---|---|
| Voltage | Terminal 1 - Chassis | Approximately battery voltage |

4. If the voltage differ from the battery voltage, the relating wiring harness is damaged.

### 4.14.3.2 Checking buzzer


(1) Buzzer

1. Remove the buzzer (1).
2. Connect the jumper lead across the battery positive terminal and terminal 1 of connector.
3. Connect the jumper lead across the battery negative terminal and terminal 2 of connector.
4. If the buzzer does not whistle, replace it.

# 5. Disassembling and assembling

## 5.1 Starter motor

### 5.1.1 Disassembling starter motor

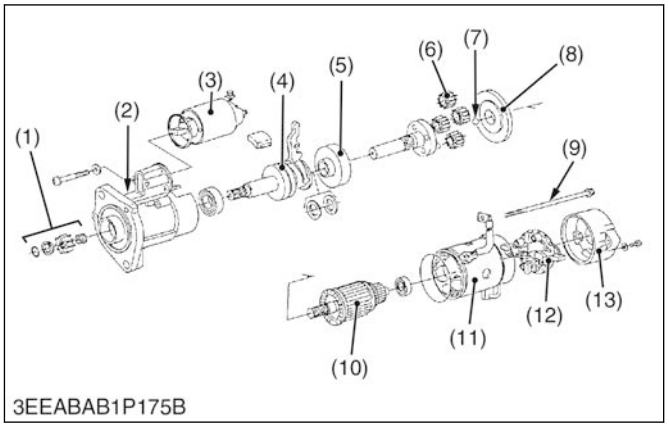
**IMPORTANT**

- **Before disconnecting the yoke, put tally marks on the yoke and the front bracket.**
- **Take note of the positions of the set of packings and the setup bolt.**
- **Apply grease to the gears, bearings, shaft's sliding part and ball.**

**NOTE**

- **Do not damage to the brush and commutator.**

1. Disconnect the solenoid switch (3).




(1) Gear
(2) Front bracket
(3) Solenoid switch
(4) Overrunning clutch
(5) Internal gear
(6) Planetary gear
(7) Ball
(8) Set of packings
(9) Through screws
(10) Armature
(11) Yoke
(12) Brush holder
(13) Rear end frame

2. Remove the 2 through screws (9) and the 2 brush holder lock screws. Remove the rear end frame (13) and the brush holder (12). Disconnect the armature (10) and the yoke (11). Remove also the ball (7) from the tip of the armature.
3. Remove the set of packings (8), the 4 planetary gears and another packing.
4. Remove the shaft assembly. Take note of the position of the lever.

**(When reassembling)**

- Apply grease to the parts indicated in the figure.

| | | |
|---|---|---|
| Tightening torque | B terminal nut | 9.8 to 11 N·m<br>1.0 to 1.2 kgf·m<br>7.3 to 8.6 lbf·ft |

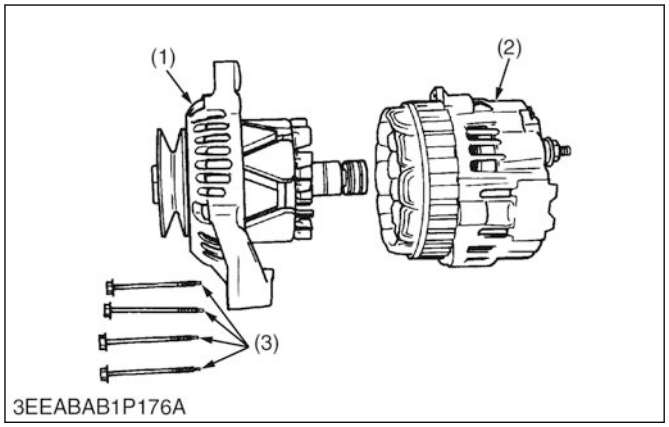
# 5.2 Alternator

## 5.2.1 Disassembling front bracket

**■ IMPORTANT**

- **Put a tally line on the front bracket and the rear bracket for reassembling them later.**

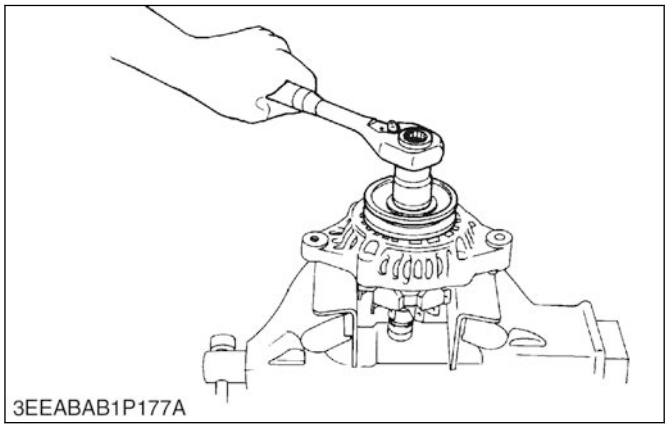
1. Remove the 4 screws (3).




(1) Front bracket
(2) Rear bracket
(3) Screw

2. Separate the front bracket (1) and the rear bracket (2) from each other.

## 5.2.2 Disassembling pulley

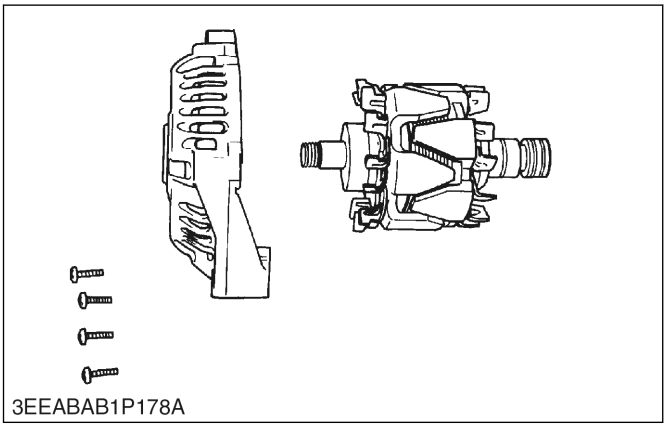



1. Hold the rotor (base of the claw) in a vise.
2. Loosen the lock nut using a M24 box wrench.

**(When reassembling)**

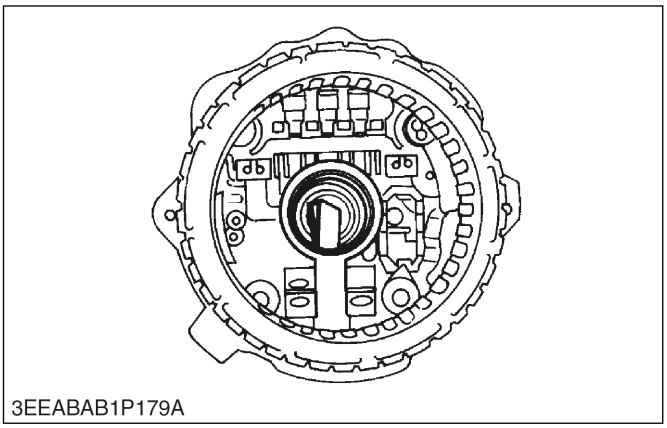
| | | |
|---|---|---|
| Tightening torque | Pulley nut | 58.4 to 78.9 N·m<br>5.95 to 8.05 kgf·m<br>43.1 to 58.2 lbf·ft |

## 5.2.3 Disassembling rotor



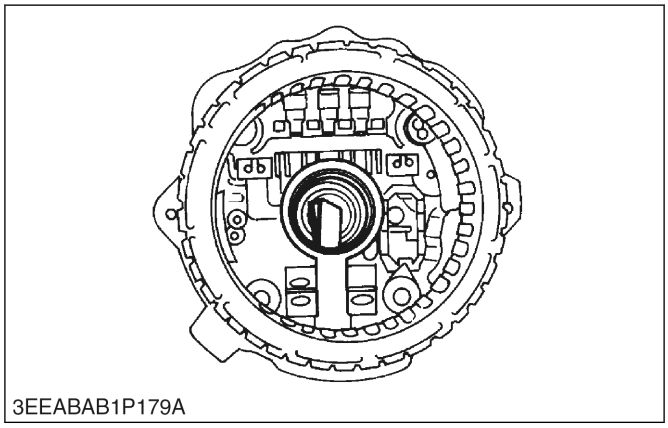

1. Remove the 4 screws of the bearing retainer.
2. Temporarily install the nut on the pulley screw.
3. Remove the rotor.

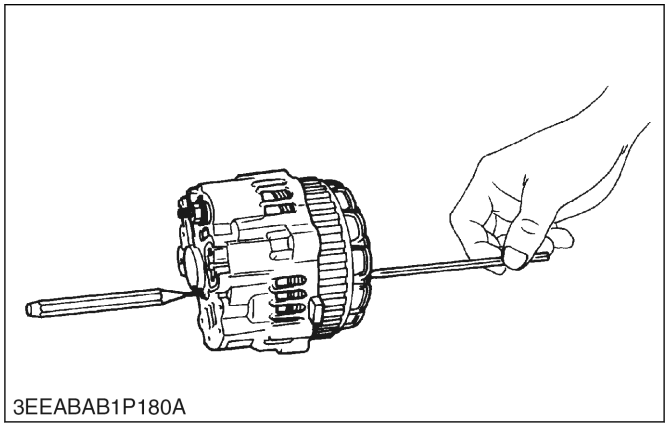
## 5.2.4 Disassembling brush

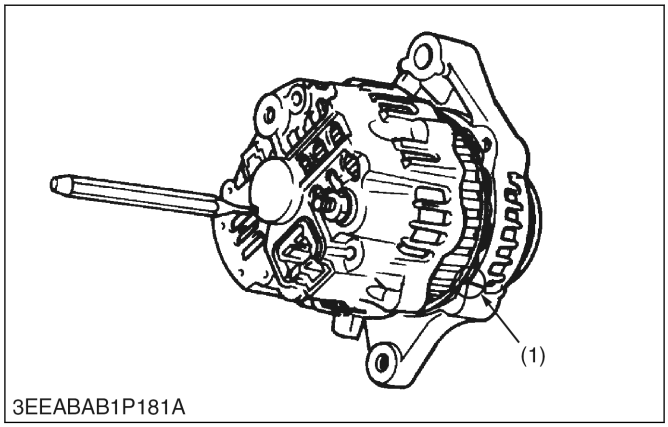



1. Remove the brush holder.
2. When the brush holder is removed, the 2 brushes are found and stretched out of the shaft hole.

## 5.2.5 Reassembling brush


3EEABAB1P179A


3EEABAB1P180A



3EEABAB1P181A

(1) Marking

1. Fit the brush with its sliding face in the clockwise direction when viewed from front.

**IMPORTANT**

- **Be sure to keep the 2 brushes deep in the brush holder. Otherwise the rotor and the rear section can not be fitted into the position.**
- **Use a hex. wrench to push the brushes into place.**

| | |
|---|---|
| Hex. wrench | 4 mm |

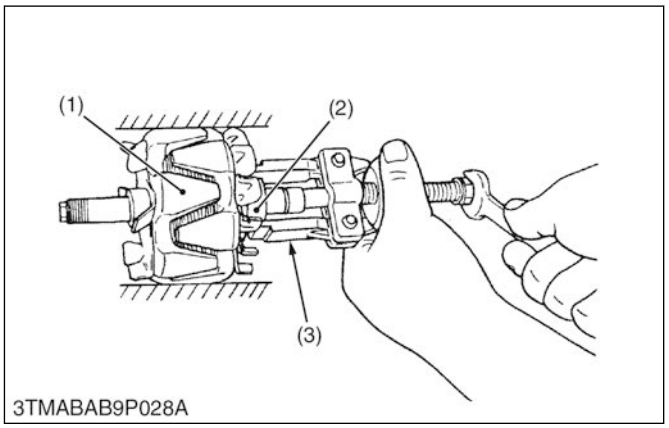
- **Using a pin-pointed punch, keep the brushes from popping out.**

| | |
|---|---|
| Pin-pointed punch | 2 mm<br>0.08 in. |

2. Match the tally line of the front section with that of the rear section.
3. Tighten the 4 screws.
4. Draw out the pin-pointed punch out of the brush holder.

## 5.2.6 Disassembling bearing at slip ring side

1. Lightly secure the rotor (1) with a vise to prevent damage.



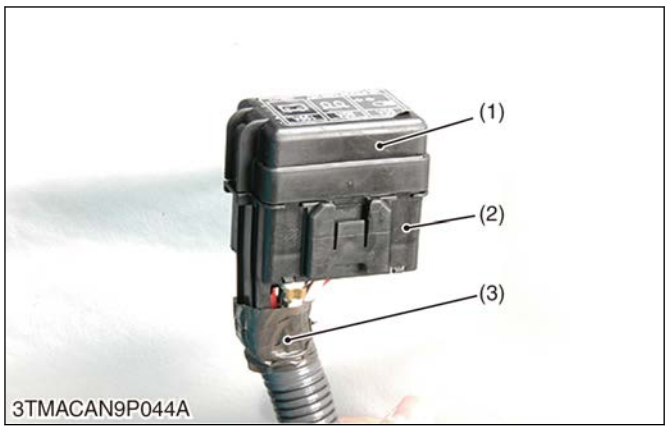
3TMABAB9P028A

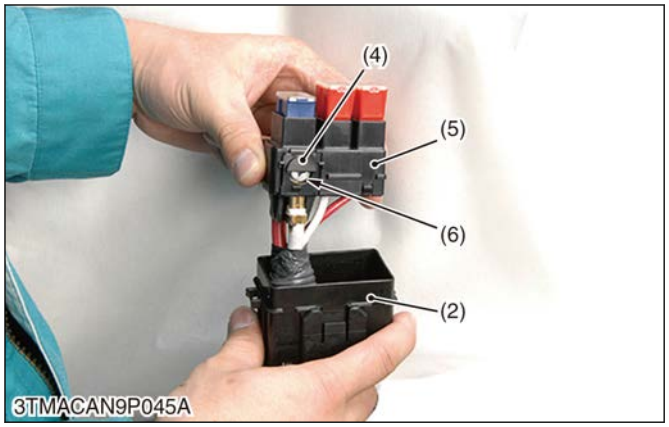
(1) Rotor
(2) Bearing
(3) Puller

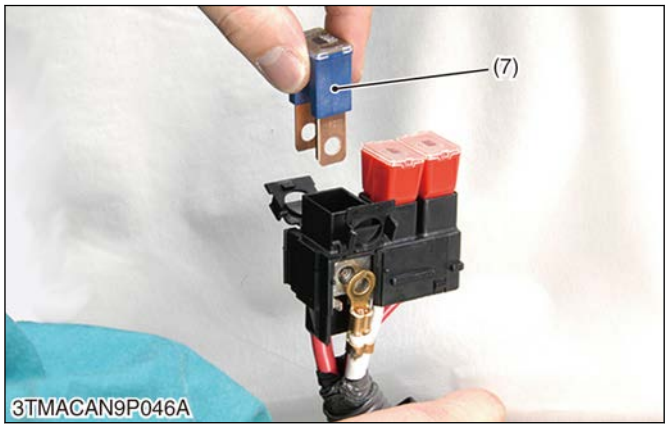
2. Remove the bearing (2) with a puller (3).

## 5.3 Fuse (Slow blow 100 A) for Cabin model

### 5.3.1 Removing fuse




(1) Top cover
(2) Fuse box
(3) Protect tape
(4) Cover
(5) Fuse stay
(6) Screw
(7) Fuse (100 A)

**[Replacing procedure for 100 A]**

1. Remove the battery negative cable.
2. Remove the top cover (1) and protect tape (3).
3. Draw out the fuse stay (5) from the fuse box (2).
4. Open the cover (4) and remove the screw (6) to draw out the fuse (100 A) (7).

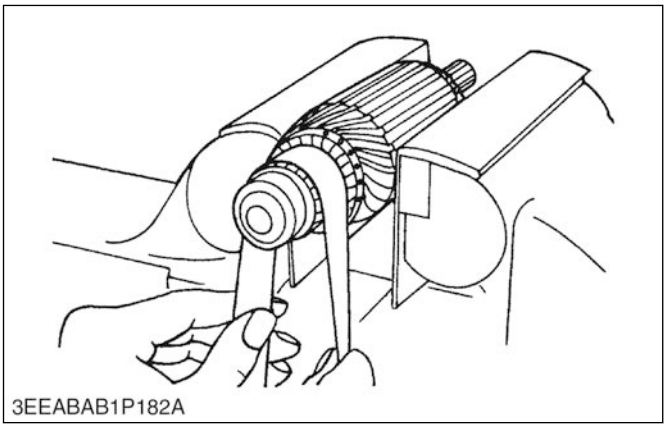
**(When reassembling)**

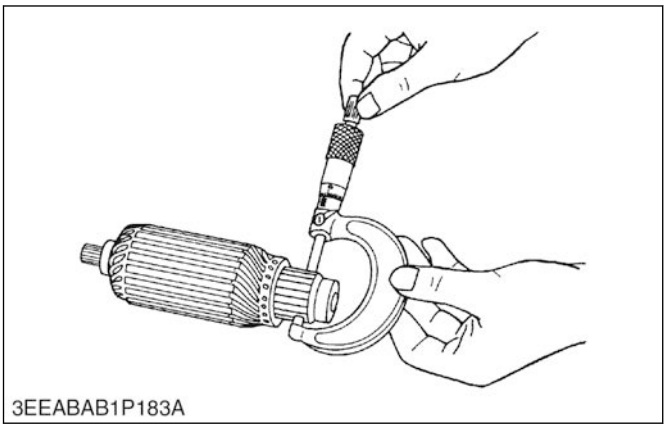
- Be sure to apply the nylon tape.

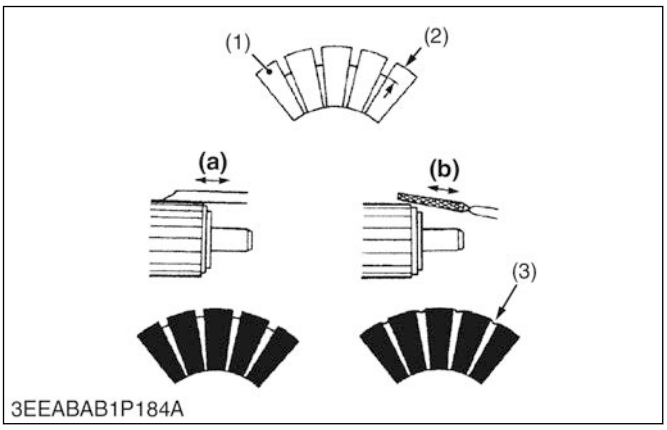
# 6. Servicing

## 6.1 Starter

### 6.1.1 Checking mica undercut of starter commutator




(1) Segment
(2) Depth of mica
(3) Mica
(a) Good
(b) Bad

1. Check the contact face of the commutator for wear.
2. If it is slightly worn, grind the commutator with emery paper.

3. Measure the commutator O.D. with an outside micrometer at several points.

| | | |
|---|---|---|
| Commutator O.D. | Factory specification | 32 mm<br>1.2598 in. |
| | Allowable limit | 31.4 mm<br>1.24 in. |

4. If the minimum O.D. is less than the allowable limit, replace the armature. 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.

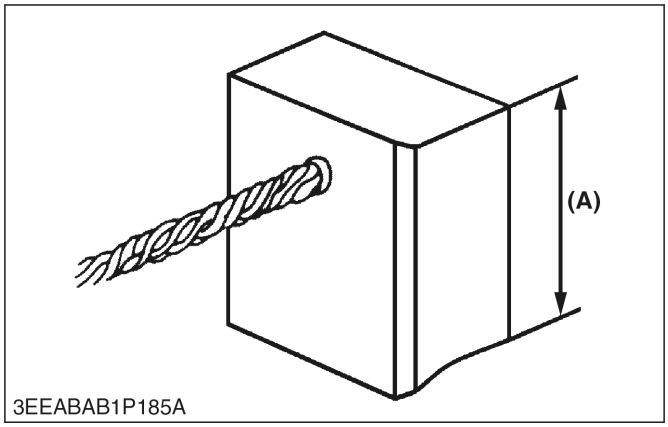
| | | |
|---|---|---|
| Mica undercut | Factory specification | 0.50 to 0.80 mm<br>0.0197 to 0.0315 in. |
| | Allowable limit | 0.20 mm<br>0.0079 in. |

6. If the undercut is less than the allowable limit, correct it with a saw blade and chamfer the segment edges.

## 6.1.2 Measuring brush wear

If the contact face of the brush is dirty or dusty, clean it with emery paper.

1. Measure the brush length (A) with vernier calipers.
2. If the length is less than the allowable limit, replace the yoke assembly and brush holder.

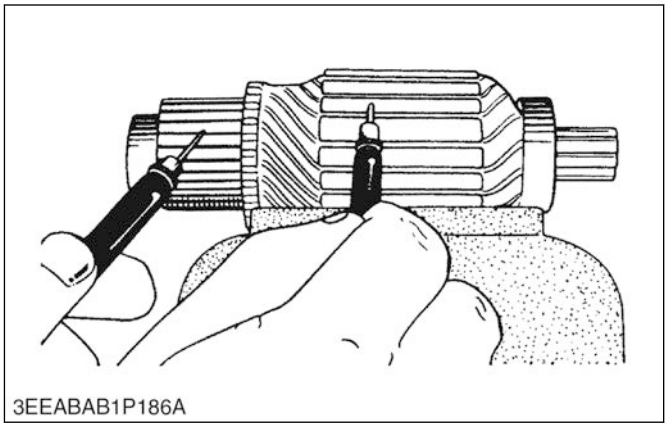



(A) Brush length

| | | |
|---|---|---|
| Brush length (A) | Factory specification | 18.0 mm<br>0.709 in. |
| | Allowable limit | 11.0 mm<br>0.433 in. |

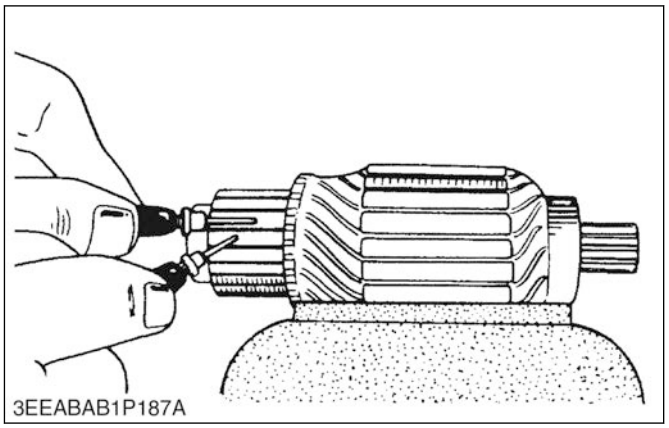
## 6.1.3 Checking armature coil

1. Check the continuity across the commutator and armature coil core with an ohmmeter.




| | | |
|---|---|---|
| Resistance | Commutator – Armature coil core | Infinity |

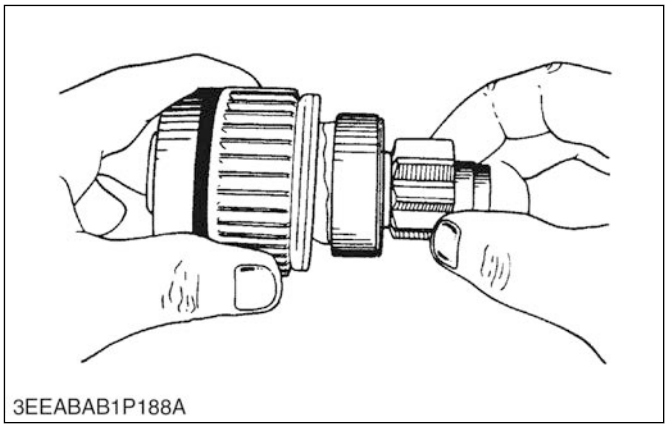
2. If it conducts, replace the armature.
3. Check the continuity across the segments of the commutator with an ohmmeter.




| | | |
|---|---|---|
| Resistance | Commutator segment | 0 Ω |

4. If it does not conduct, replace the armature.

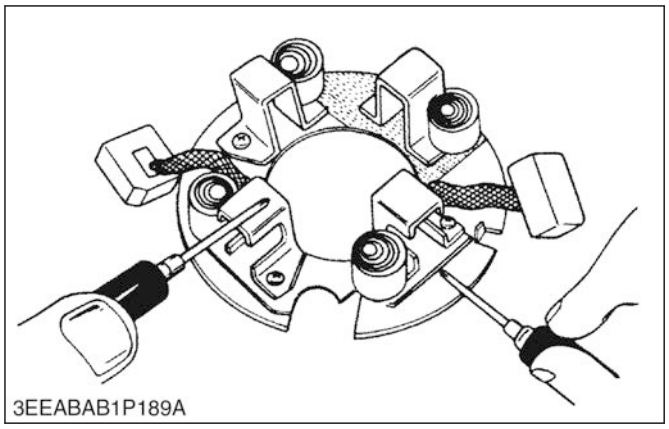
## 6.1.4 Checking overrunning clutch




1. Inspect the pinion for wear or damage.

2. If there is any problem, 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 both directions, replace the overrunning clutch assembly.

### 6.1.5 Checking brush holder

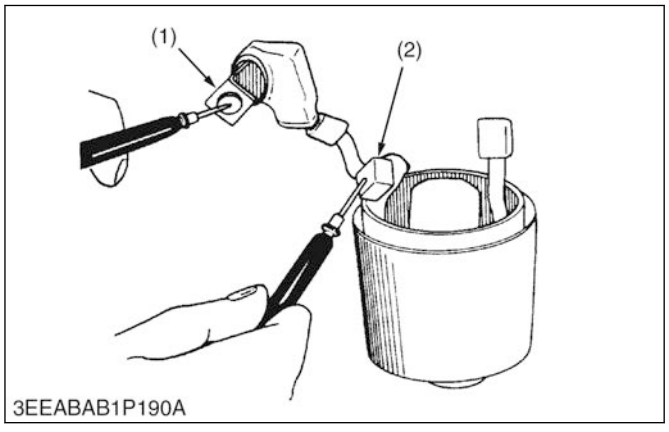

3EEABAB1P189A

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

| | | |
|---|---|---|
| Resistance | Brush holder – Holder support | Infinity |

### 6.1.6 Checking 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.

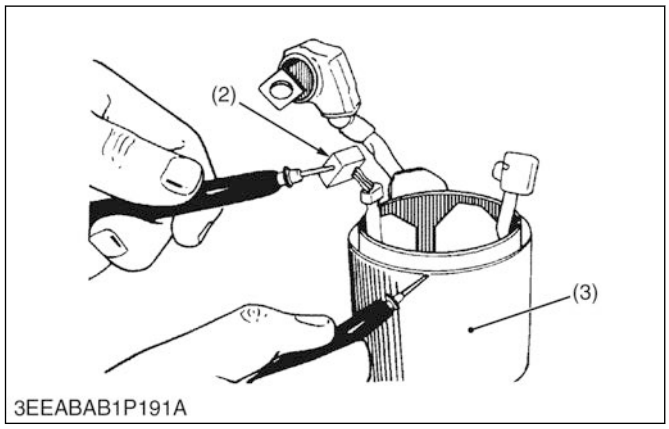


3EEABAB1P190A

(1) Lead (2) Brush

| | | |
|---|---|---|
| Resistance | Lead (1) – Brush (2) | 0 Ω |

3. Check the continuity across the brush (2) and yoke (3) with an ohmmeter.
4. If it conducts, replace the yoke assembly.



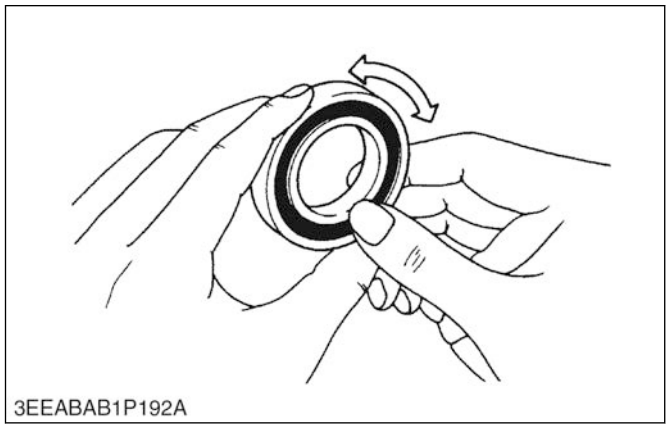
3EEABAB1P191A

(2) Brush (3) Yoke

| | | |
|---|---|---|
| Resistance | Brush (2) – Yoke (3) | Infinity |

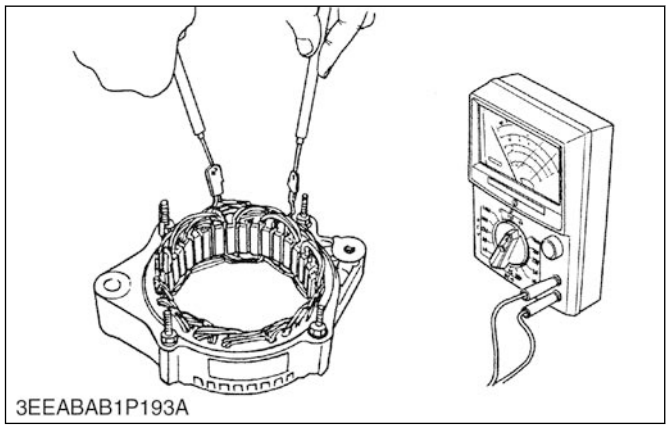
## 6.2 Alternator

### 6.2.1 Checking bearing


3EEABAB1P192A

1. Check the bearing for smooth rotation.
2. If it does not rotate smoothly, replace it.

### 6.2.2 Checking stator

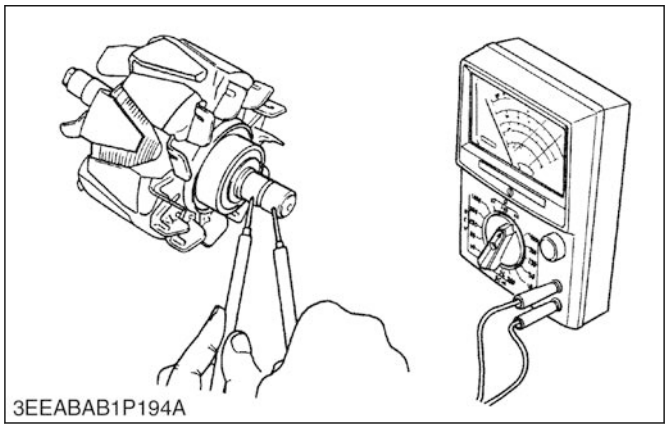

3EEABAB1P193A

1. Measure the resistance across each lead of the stator coil with an ohmmeter.
2. If the measurement is not within factory specification, replace it.

| | | |
|---|---|---|
| Resistance | Factory specification | Less than 1.0 Ω |

3. Check the continuity across each stator coil lead and core with an ohmmeter.
4. If infinity is not indicated, replace it.

## 6.2.3 Checking rotor

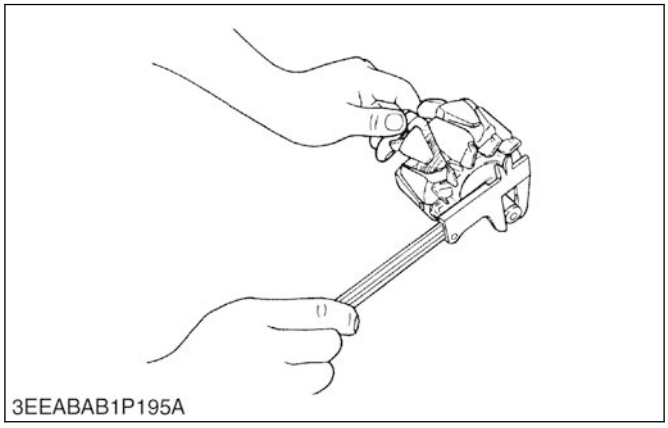

3EEABAB1P194A

1. Measure the resistance across the slip rings with an ohmmeter.
2. If the resistance is not the factory specification, replace it.

| | | |
|---|---|---|
| Resistance | Factory specification | 2.8 to 3.3 Ω |

3. Check the continuity across the slip ring and core with an ohmmeter.
4. If infinity is not indicated, replace it.

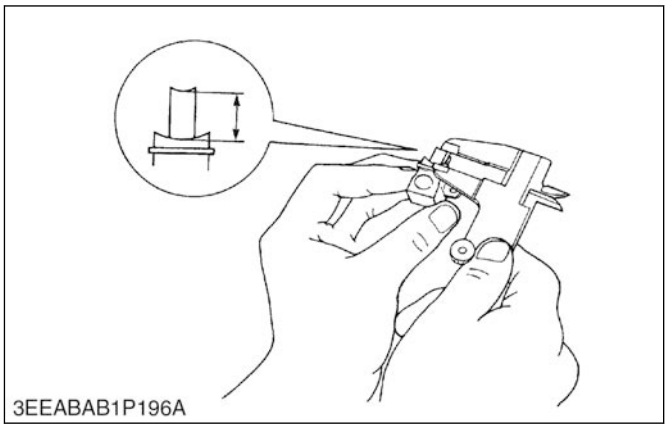
## 6.2.4 Checking slip ring


3EEABAB1P195A

1. Check the slip ring for score.
2. If scored, correct with an emery paper or on a lathe.
3. Measure the O.D. of slip ring with vernier calipers.
4. If the measurement is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Slip ring O.D. | Factory specification | 22.7 mm<br>0.894 in. |
| | Allowable limit | 22.1 mm<br>0.870 in. |

## 6.2.5 Checking brush wear

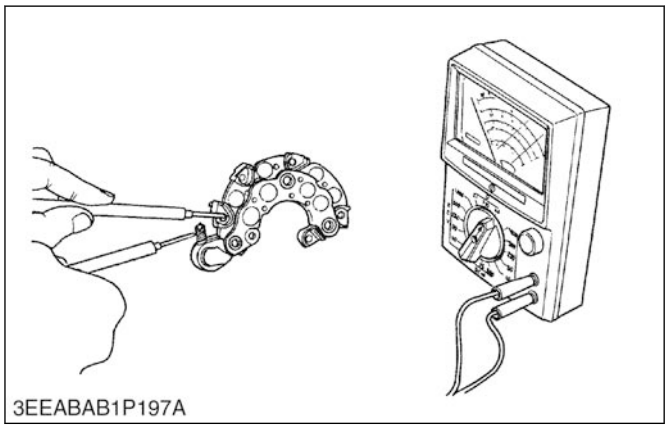

3EEABAB1P196A

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

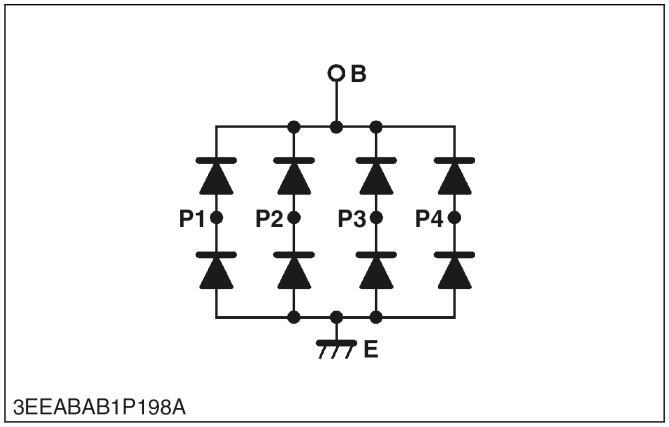
| | | |
|---|---|---|
| Brush length | Factory specification | 18.5 mm<br>0.728 in. |
| | Allowable limit | 5.0 mm<br>0.20 in. |

3. Make sure that the brush moves smoothly.
4. If the brush is damaged, replace it.

## 6.2.6 Checking rectifier



3EEABAB1P197A




3EEABAB1P198A

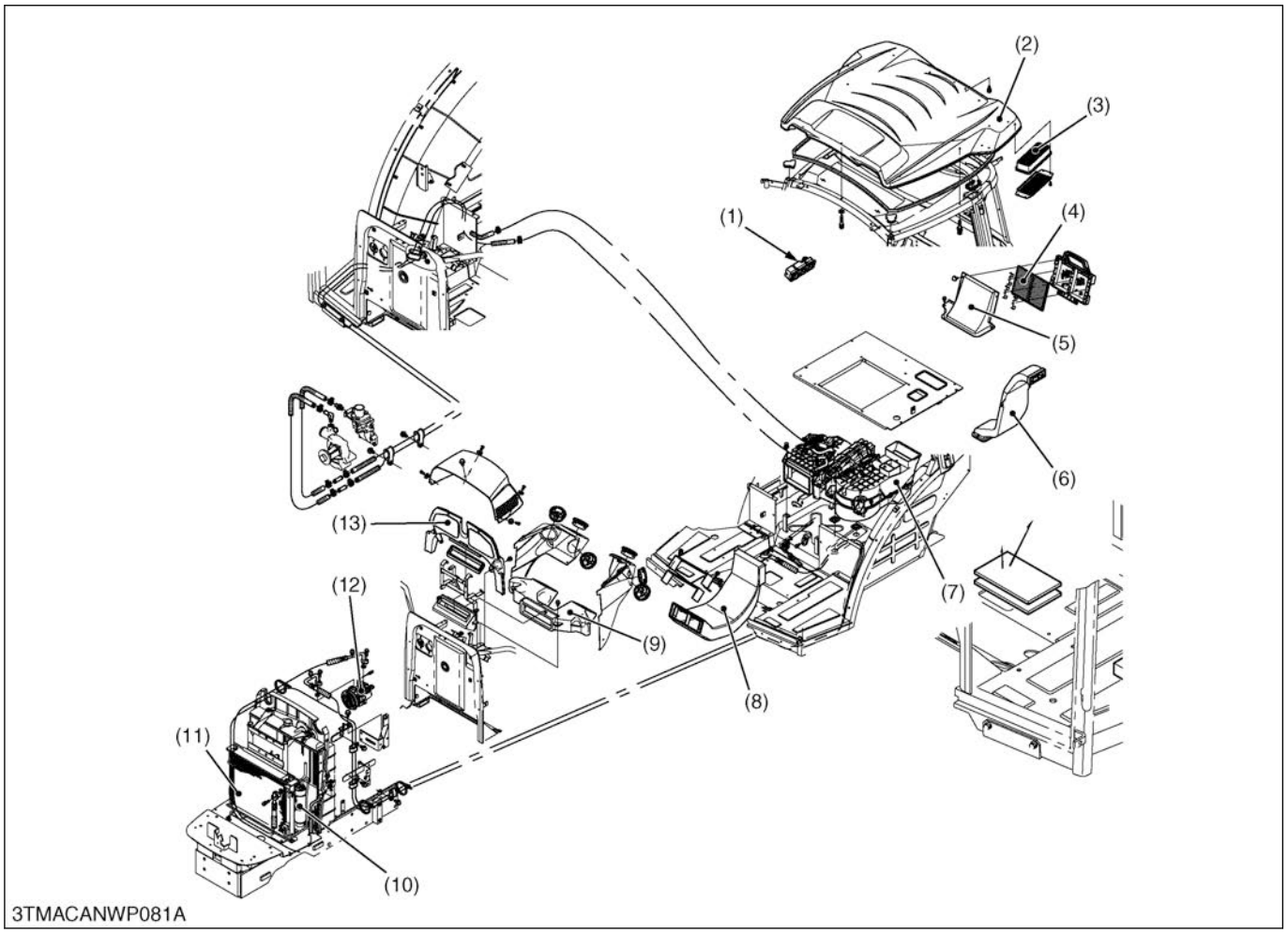
1. Check the continuity across each diode of rectifier with an ohmmeter.
2. If the diode in the rectifier conducts in one direction and does not conduct in the reverse direction, the rectifier is normal.

# 11. CABIN

# MECHANISM

## 1. Air condiitioning system

### 1.1 Structure of air conditioning system

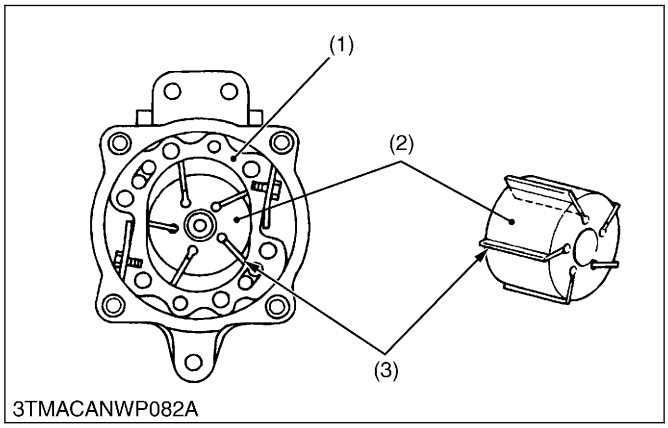



(1) Control panel
(2) Outer roof
(3) Fresh air filter
(4) Inner air filter
(5) Inner air duct
(6) Fresh air duct
(7) Air conditioner unit
(8) Front duct
(9) Dashboard blow port
(10) Receiver
(11) Condenser
(12) Compressor
(13) Defroster blow port

This cabin is equipped with the inner air circulation/outside air inhalation type large capacity thin air conditioner.
The inner air inhaled from the inner air filter (4) provided behind the seats goes through the inner air duct (5) and goes into the air conditioner unit (7). The fresh air inhaled from the fresh air filter (3) goes through the center pillar on the left and goes into the air conditioner unit (7) via the fresh air duct (6).
The inner air and fresh air inhaled into the air conditioner unit (7) is cooled and dehumidified in the cooling section of the air conditioner unit (7). The comfortable air, warmed moderately with the heater, comes from the air duct with low humidity.
The six dashboard air outlets allow opening and closing, and adjusting direction of winds. The defroster air outlet is opened and closed by moving the mode dial on the control panel (1).

| | | |
|---|---|---|
| Capacity (Cooling) | Factory specification | 3.5 kW |
| Capacity (Warming) | | 5.2 kW |
| Kinds of refrigerant (Charge amount) | | R134a<br>0.95 to 1.05 kg<br>2.10 to 2.31 lbs |
| Pressure sensor (Low) | | 0.196 MPa<br>2.00 kgf/cm$^2$<br>28.4 psi |
| Pressure sensor (High) | | 3.14 MPa<br>32.0 kgf/cm$^2$<br>455 psi |

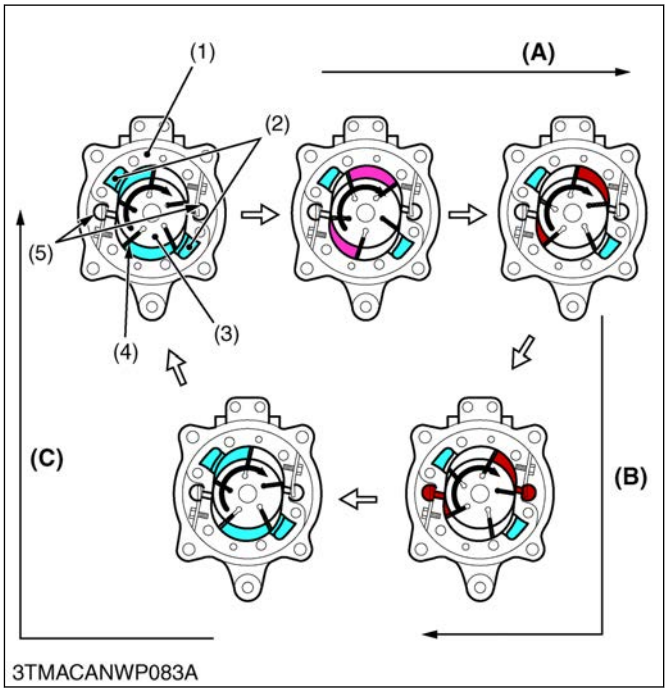
## 1.2 Structure of compressor




(1) Cylinder
(2) Rotor
(3) Vane

The vane type compressor installed on this cabin consists of a cylinder (1) with an oval cross section and a rotor (2) with five vanes (3). The vane type compressor is provided with both two suction ports and two discharge ports.
The five vanes (3) mounted on the rotor (2), rotating along the inner wall of the cylinder (1), keeps air-tightness using the centrifugal force of the rotor (2) and the back pressure of the vanes (3) that grow in proportion to the rotating speed of the rotor (2).
As a result, the volumes of the five cylinder chambers separated with the cylinder (1) and the five vanes (3) change.
For each rotation of the rotor (2), each of the cylinder chambers performs two cycles of inhalation, compression, and discharge.

### 1.2.1 Operation of compressor




(1) Cylinder
(2) Suction port
(3) Rotor
(4) Vane
(5) Discharge port
(A) Compression process
(B) Discharge process
(C) Suction process

In proportion to the rotation of the rotor (3), a volume of a cylinder chamber separated with the cylinder (1) and the vanes (4) increases. The cylinder chamber inhales refrigerant gas from the suction port (2).
As the rotor (3) rotates further, a volume of the cylinder chamber separated with the cylinder (1) and the vanes (4) decreases, and the refrigerant gas is compressed. As the rotor (3) rotates even further, the refrigerant gas is highly compressed and then presses the discharge valve to open. The refrigerant gas is discharged from the discharge port (5).

### 1.2.2 Property of compressor oil

The compressor oil dissolves in the refrigerant, circulates through the air-conditioning cycle, and functions to lubricate the compressor. But the conventional compressor oil for R12 does not dissolve in R134a, so it does not circulate through the cycle, and the lifespan of the compressor is considerably shortened.
It is still essential to ensure that the correct refrigerant oil is used. R12 systems were lubricated with mineral oil, which is totally unsuitable for R134a systems. The letter require PAG oil, which mixes very well with the refrigerant and provides ideal lubrication throughout the system.

| Quantity (Total) | Brand Name |
|---|---|
| 110 to 120 cc<br>0.117 to 0.126 U.S.qts<br>0.0968 to 0.105 Imp.qts | ND-OIL 8 <PAG*>oil |

* PAG: Polyalkyleneglycol (Synthetic oil)

## 1.3 Feature of air conditioner unit

**■ NOTE**

- **As for the mechanism and function of each component part, refer to "CABIN" section in the Workshop Manual of *Tractor mechanism* (Code No. *9Y021-18200*).**



(1) Heater core
(2) Evaporator
(3) Air conditioner unit
(4) Expansion valve
(5) Blower

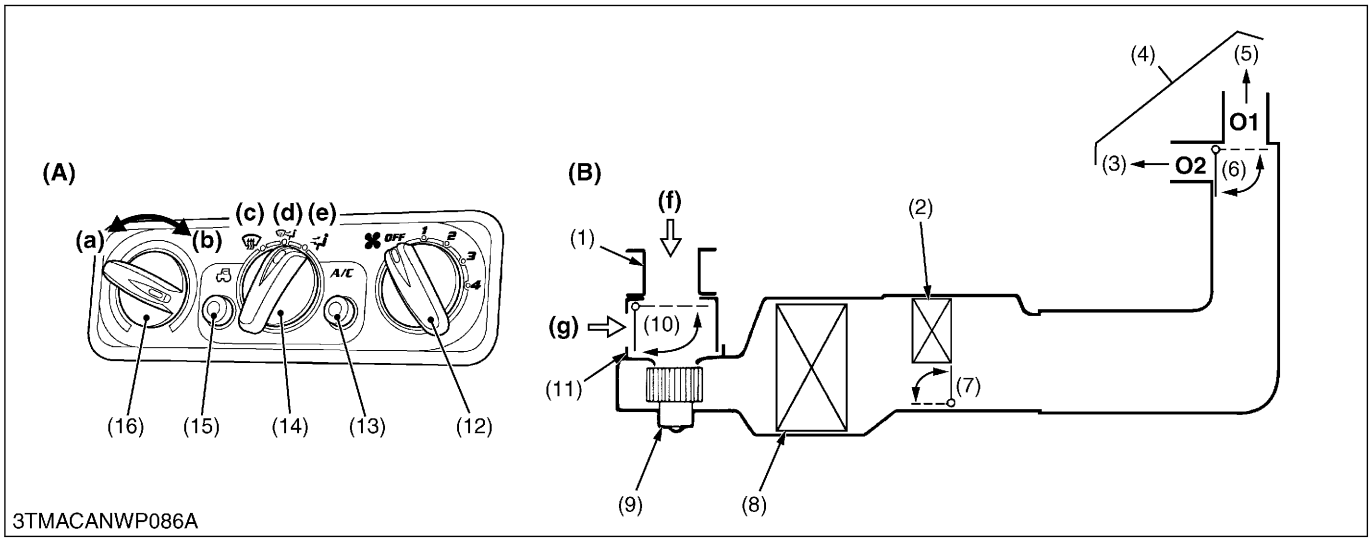
The air conditioner unit (3) consists of evaporator (2), expansion valve (4), heater core (1), blower (5) etc.

### 1.3.1 Feature of A/C blower


(1) Blower motor
(2) Blower fan
(3) Resistor

The blower is incorporated in the left-hand space of the air conditioner unit. It blows cool or warm fresh air via the dashboard and defroster blow ports into the cabin.
The speed of the blower motor (1) can be adjusted in 4 steps by the resistor (3).
The blower fan (2) is centrifugal type. The air being sucked in parallel with the rotary shaft is blown in the centrifugal direction; in other words, perpendicular to the rotary shaft.

# 1.4 System control of air conditioner




(1) Fresh air inlet port
(2) Heater
(3) Dashboard
(4) Defroster and dashboard
(5) Defroster
(6) D3:
Air outlet door (Mode door)
(7) D2:
Temperature door (Air mixed door)
(8) Evaporator
(9) Blower
(10) D1:
Air intake door
(11) Recirculated air inlet port
(12) Blower switch
(13) Air conditioner switch (with indicator)
(14) Mode dial
(15) Recirculation/fresh air selection switch (with indicator)
(16) Temperature control dial
(A) Control panel
(B) Block diagram of air flow passage
(a) Cool
(b) Warm
(c) Air is blown from only the defroster air outlet.
(d) Air is blown from dashboard and defroster air outlets.
(e) Air is blown from only the dashboard air outlets.
(f) Fresh air
(g) Recirculated air
O1: Defroster air outlet
O2: Dashboard air outlets

**Recirculation / Fresh air selection switch**

- **Recirculation (Indicator: On)**
  By pushing the recirculation / fresh air selection switch (15) to "Recirculation" position (indicator: On), door D1 (10) shuts the fresh air inlet port (1). Air inside the cabin is recirculated.
- **Fresh air (Indicator: Off)**
  By pushing the recirculation / fresh air selection switch (15) to "Fresh air" position (indicator: Off), door D1 (10) opens the fresh air inlet port (1). Outside air comes into cabin.

**Temperature control dial**

- **Cool**
  By moving the temperature control dial (16) to "Cool" position (a), door D2 (7) moves to close water valve and opens side passage. The air flows toward door D3 (6) through the side passage.
- **Warm**
  By moving the temperature control dial (16) to "Warm" position (b), door D2 (7) moves to open water valve and closes side passage. The air flows toward door D3 (6) through the heater (2).

**Mode dial**

- **Defroster**
  By moving the mode dial (14) to (c) position, the door D3 (6) is moved to set up the air passage to outlet O1. Air comes out from outlet O1.
- **Defroster + Dashboard**
  By moving the mode dial (14) to (d) position, the door D3 (6) is moved to establish the air passages to outlets O1 and O2. Air comes out from both outlets.
- **Dashboard**
  By moving the mode dial (14) to (e) position, the door D3 (6) is moved to set up the air passage to outlet O2. Air comes out from outlet O2.

**Blower switch**

Air volume can be changed in four steps. At the “**4**” position, the largest air volume is obtained.

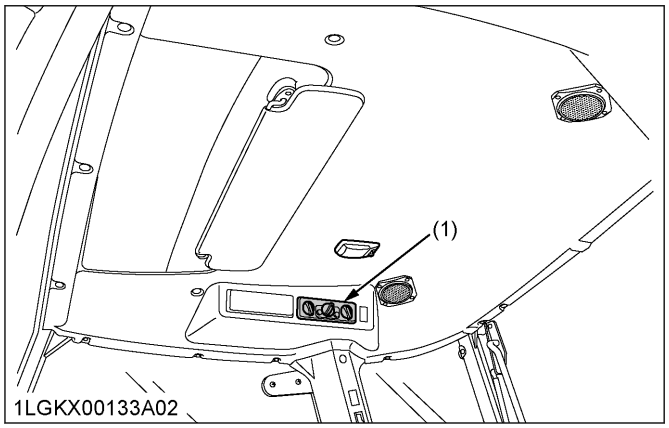
**Air conditioner switch**

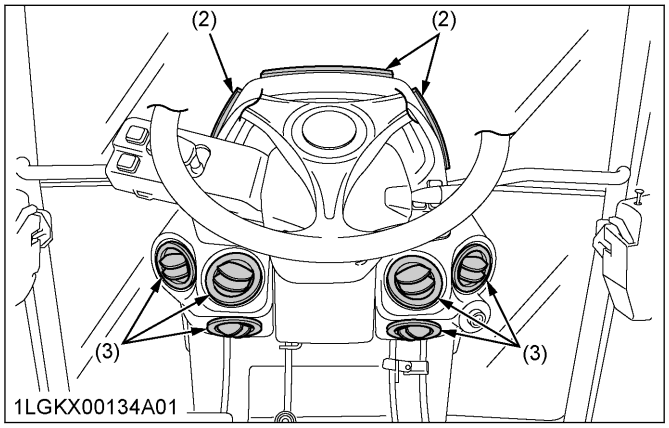
By pushing this switch, the air conditioner activates. An indicator will light up when the switch is set to "On". By pushing this switch again,the air conditioner turns off, in which case the indicator light will be off.

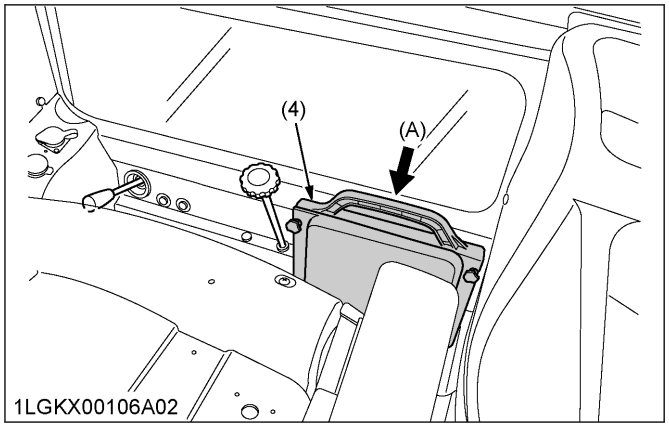
# 1.5 Air flow

## 1.5.1 Air flow

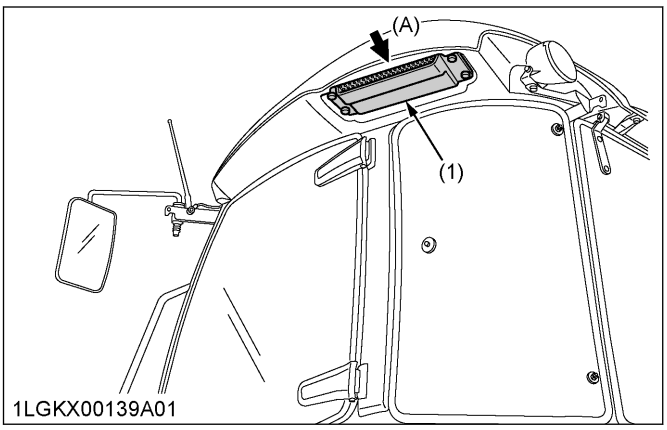
Air in the cabin and fresh air introduced into the cabin flows as follows. Adjust the air ports to obtain the desired condition.




(1) Control panel
(2) Defroster air outlets
(3) Dashboard air outlets
(4) Inner air filter
(A) Inner air recirculation




(1) Fresh air filter
(A) Fresh air inlet

**IMPORTANT**

- **Do not pour water directly into the fresh air port while washing the vehicle.**

## 1.5.2 Air control vent

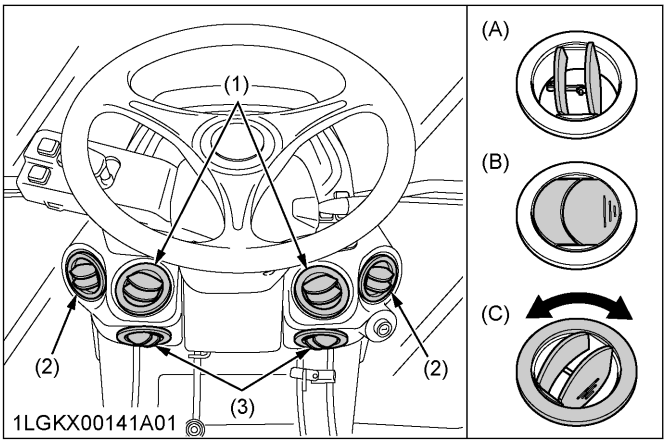
**CAUTION**

**To avoid personal injury:**

- **If the window fails to defrost in extreme conditions or becomes cloudy when dehumidifying the cabin, wipe off moisture with a soft cloth.**
- **Do not block all the air outlets of the air conditioner. A problem could occur.**

**Dashboard air outlet**

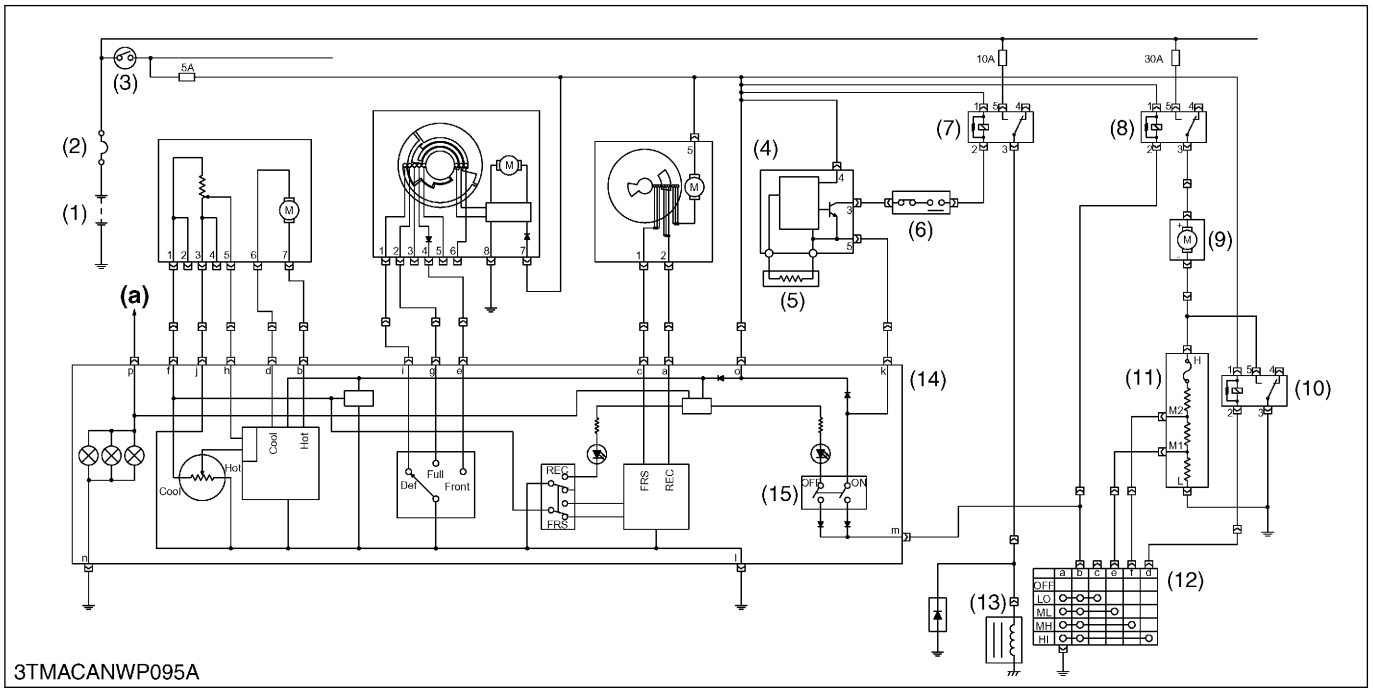
The dashboard air outlets can be independently adjusted as required.




(1) Face area air outlets
(2) Back area air outlets
(3) Feet area air outlets
(A) Open
(B) Shut
(C) Turn

# 1.6 Electrical system

## 1.6.1 Electrical circuit of air conditioner

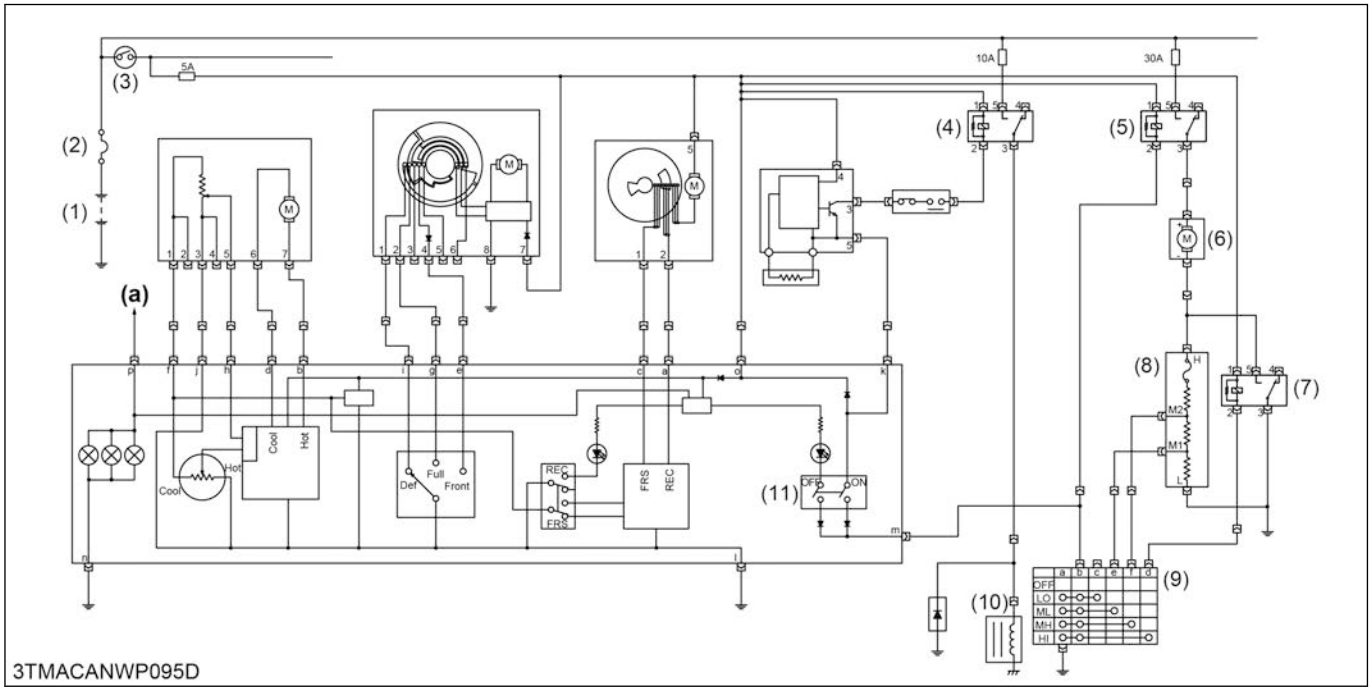


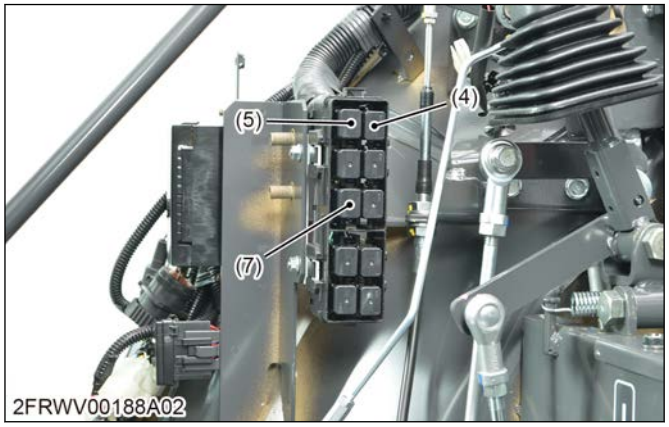

(1) Battery
(2) Slow blow fuse
(3) Main switch
(4) Thermo amplifier
(5) Frost thermistor
(6) Dual pressure switch
(7) Compressor relay
(8) Blower relay
(9) Blower motor
(10) Blower high relay
(11) Blower motor resistor
(12) Blower switch
(13) Compressor magnet clutch
(14) A/C control panel
(15) A/C switch
(a) To light switch

The process of magnetic clutch being engaged is shown below.
Main switch (3) **ON** → A/C switch (15) **ON** → Blower switch (12) **ON** (Low, Medium low, Medium high or high) → Compressor relay (7) **ON** → Thermo amplifier (4) **ON** (the thermostat temperature is more than 3 ℃ (37.4 ℉)) → Dual pressure switch (6) **ON** (if refrigerant pressure is between 0.21 MPa (2.1 kgf/cm$^2$, 30 psi) and 2.6 MPa (27 kgf/cm$^2$, 380 psi)) → Magnetic clutch of compressor will be engaged.

## 1.6.2 Blower relay and compressor relay

The blower relay (5), the blower high relay (7) and the compressor relay (4) are installed under the main gear shift lever cover. When the blower fan is adjusted for the air flow rate, the blower relay (5) and the blower high relay (7) are activated by a signal from the blower switch (9) on the control panel.
Among the air conditioner components, the battery current flows to the blower motor (6) and the magnetic clutch. If all battery current passes through the main switch (3), the current would be too large for the main switch (3) to burn out the contact of the main switch(3). If an operator forget to turn off the switch of the blower motor (6), it will cause battery discharging.
To improve these trouble, the blower relay (5), the blower high relay (7) and the compressor relay (4) are provided. The blower motor resistor (8) is provided at the electrical circuit between the blower motor (6) and the blower switch (9). Three resistance are installed in the blower motor resistor (8). When an operator selects the blower switch (9) to low position, the battery current flows through the blower motor, two resistance in the blower motor resistor (8) and the blower switch (8) to the ground. As a result, the blower motor (6) rotates at low speed. When an operator selects the blower switch (9) to high position, the battery current flows through the blower motor (6) and the blower high relay (7) to the ground. As a result, the blower motor (6) rotates at high speed. By applying these relays, the battery current flowing to the main switch decreases because a small current is required to actuate the relay. This reduces the possibility of burning out the contact of the main switch. When the main switch (3) is opened, the relay contact will open at the same time. This stops the battery current in the air conditioner circuit flowing to the ground. As a result, the battery does not discharge.

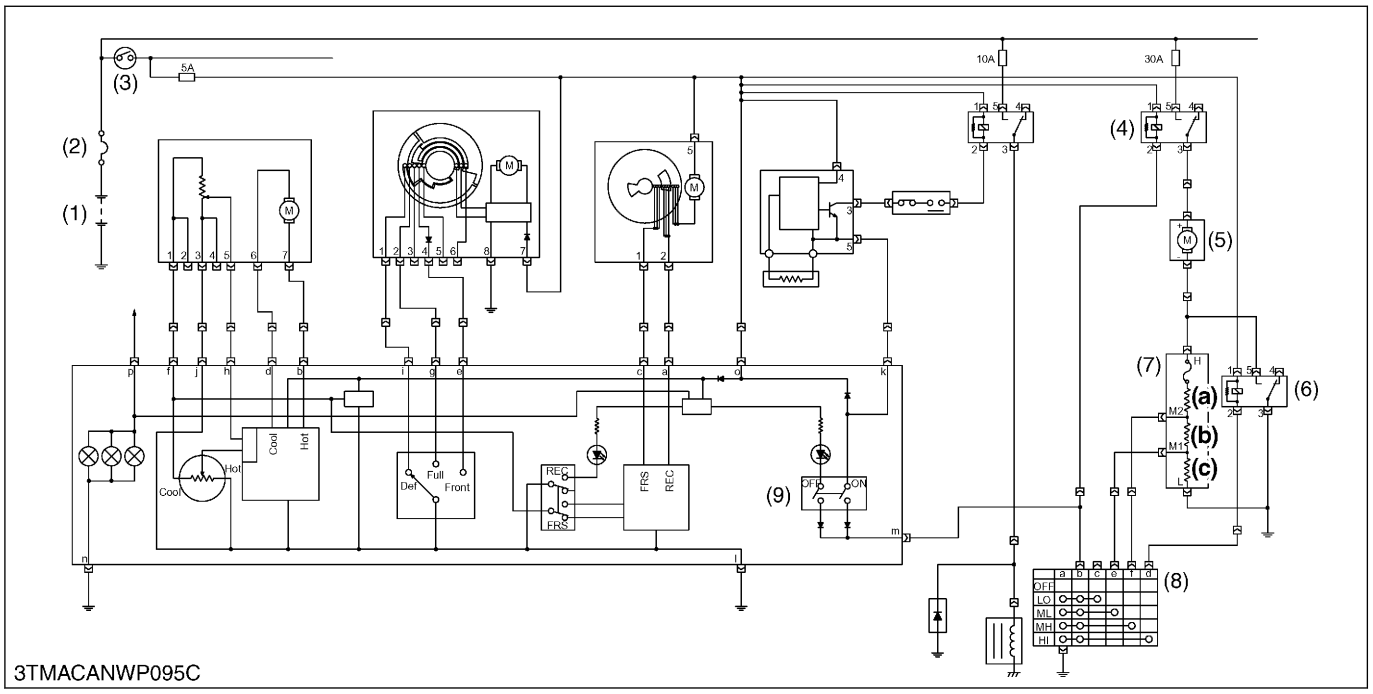



(1) Battery
(2) Slow blow fuse
(3) Main switch
(4) Compressor relay
(5) Blower relay
(6) Blower motor
(7) Blower high relay
(8) Blower resistor
(9) Blower switch
(10) Compressor magnet clutch
(11) A/C switch
(a) To light switch

## 1.6.3 Blower relay

### 1.6.3.1 Adjustment of air volume by blower relay and blower switch




(1) Battery
(2) Slow blow fuse
(3) Main switch
(4) Blower relay
(5) Blower motor
(6) Blower high relay
(7) Blower motor resistor
(8) Blower switch
(9) A/C switch
(a) Resistor M2
(b) Resistor M1
(c) Resistor L

When the main switch (3) and blower switch (8) is turned on, the current flows from battery (1) to blower relay coil and blower relay (4) is turned on. Since the blower relay (4) is turned on, the current (1) flows from the battery to the blower switch (8) through the blower motor (5). The air volume is adjusted by selecting the position of the blower switch (8) as follows.

**1. When selecting blower switch to "1 (LO)" position, air volume is adjusted to low level.**
Battery (1) → Slow blow fuse (2) → Main switch (3) → Fuse → Blower relay (4) → Blower motor (5) →Resistor M2 (a), Resistor M1 (b) and Resistor L (c) of blower motor resistor (7)→ Ground.

**2. When selecting blower switch to "2 (ML)" position, air volume is adjusted to medium low level.**
Battery (1) → Slow blow fuse (2) → Main switch (3) → Fuse → Blower relay (4) → Blower motor (5) → Resistor M2 (a) and Resistor M1 (b) of blower motor resistor (7) → Blower switch (8) → Ground.

**3. When selecting blower switch to "3 (MH)" position, air volume is adjusted to medium high level.**
Battery (1) → Slow blow fuse (2) → Main Switch (3) → Fuse → Blower relay (4) → Blower motor (5) → Resistor M2 (a) of blower motor resistor (7) → Blower switch (8) → Ground.

**4. When selecting blower switch to "4 (HI)" position, air volume is adjusted to high level.**
Battery (1) → Slow blow fuse (2) → Main switch (3) → Fuse → Blower relay (4) → Blower motor (5) → Blower high relay (6) → Blower switch (8) → Ground.

# SERVICING

## 1. Troubleshooting for cabin

**Compressor**

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Noisy (Compressor ON) | 1. Bearing of compressor worn or damaged | Replace | 11-64 |
| | 2. Valves in compressor damaged | Replace | 11-64 |
| | 3. Belt slipping | Adjust or replace | 2-32 |
| | 4. Compressor bracket mounting screws loosen | Tighten | 2-32 |
| | 5. Piping resonant | Tighten or add clamp | 11-64 |
| Noisy (Compressor OFF) | 1. Blower damaged | Repair or replace | 11-38 |
| | 2. Bearings of magnetic clutch, idle pulley or crank pulley worn or damaged | Replace | 11-33 |

**Air conditioning system**

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Does not cool (No air flow) | 1. Fuse blown | Replace | 2-57 |
| | 2. A/C compressor relay damaged | Replace | 10-166 |
| | 3. A/C blower motor damaged | Replace | 11-38 |
| | 4. A/C blower switch damaged | Replace | 11-34<br>11-34 |
| | 5. Wiring harness disconnected or improperly connected | Repair | — |
| Does not cool (Compressor does not rotate) | 1. Fuse blown | Replace | 2-57 |
| | 2. Magnetic clutch damaged | Repair or replace | 11-33 |
| | 3. A/C switch damaged | Replace | 11-35 |
| | 4. Pressure switch damaged | Replace | 11-39<br>11-40 |
| | 5. Belt slipping | Adjust or replace | 2-32 |
| Does not cool (Others) | 1. Insufficient refrigerant | Check with manifold gauge | 11-25 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Does not cool (Others) | 2. Expansion valve damaged | Replace | — |
| | 3. Compressor damaged | Replace | 11-64 |
| Insufficient cooling (Insufficient air flow) | 1. Air filter clogged | Clean or replace | 2-33<br>2-33 |
| | 2. Evaporator frosted | Clean or replace thermo switch | — |
| | 3. A/C blower motor damaged | Replace | 11-38 |
| | 4. A/C blower resistor damaged | Replace | 11-37 |
| Insufficient cooling (Many bubbles in sight glass) | 1. Insufficient refrigerant | Check with manifold gauge | 11-25 |
| | 2. Gas leaking from some place in refrigerating cycle | Repair and charge refrigerant | 11-31<br>11-31 |
| | 3. Air mixed in | Check with manifold gauge | 11-26 |
| Insufficient cooling (No bubbles in sight glass) | 1. Too much refrigerant | Check with manifold gauge | 11-32 |
| Insufficient cooling (Compressor does not rotate properly) | 1. Belt slipping | Adjust or replace | 2-32 |
| | 2. Magnetic clutch damaged | Repair or replace | 11-33 |
| | 3. Compressor damaged | Replace | 11-64 |
| Insufficient cooling (Others) | 1. Thermostat damaged | Replace | — |
| | 2. Water valve damaged | Replace | — |
| | 3. Condenser fin clogged with dust | Clean | — |
| | 4. Expansion valve damaged | Replace | — |
| Insufficient heating | 1. Water valve damaged | Replace | — |
| | 2. Temperature motor damaged | Check and repair | 11-38 |
| | 3. Insufficient coolant | Fill | 2-13 |
| Too low air flow rate (Blower motor does not operate) | 1. Blower fan switch damaged | Check and repair | 11-34 |
| | 2. A/C compressor relay damaged | Replace | 10-166 |
| | 3. Brush in poor contact | Replace | — |
| | 4. Fuse blown out | Replace | 2-57 |
| | 5. Wrong wiring or loose connections | Check and repair | — |
| Too low air flow rate (Flow rate does not change in 4 steps) | 1. Blower resistor damaged | Replace | 11-37 |
| | 2. Relay damaged | Replace | 10-166 |
| | 3. Blower fan switch damaged | Replace | 11-34 |
| Too low air flow rate (Others) | 1. Blower is not tightened enough | Check and repair | 11-38 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Too low air flow rate (Others) | 2. Blower deformed | Replace | 11-38 |
| | 3. Blower in contact with casing | Check and repair | — |
| | 4. Obstacle at or near suction port | Check and repair | — |
| | 5. Evaporator frosted | Clean or replace | — |
| | 6. Filter clogged | Clean or replace | 2-33<br>2-33 |
| | 7. Blow duct clogged or missing | Check and repair | — |
| Insufficient cooling (Compressor magnetic clutch does not work) | 1. Low battery voltage | Charge | 10-93 |
| | 2. Rotor in contact with stator | Replace | 11-66 |
| | 3. Wrong wiring or loose connections | Check and repair | — |
| | 4. Relay damaged | Replace | 10-166 |
| | 5. Coil shortage | Replace | 11-67 |
| | 6. Ground malfunction | Check and Repair | 10-98 |
| | 7. Coil burst out | Replace | 11-67 |
| Insufficient cooling (Hi-pressure level is too high) | 1. Refrigerant overcharged | Check with manifold gauge | 11-32 |
| | 2. Condenser clogged with dust and dirt | Clean | — |
| | 3. Air mixed | Check with manifold gauge | 11-26 |
| Insufficient cooling (Hi-pressure level is too low) | 1. Refrigerant too short | Check with manifold gauge | 11-32 |
| | 2. Compressor discharge valve damaged | Replace | — |
| | 3. Compressor gasket damaged | Replace | — |
| | 4. Low-pressure hose in trouble (Cracked or clogged) | Replace | 11-74 |
| Insufficient cooling (Low-pressure level is too high) | 1. Refrigerant overcharged | Check with manifold gauge | 11-32 |
| | 2. Heat-sensitive tube in poor contact | Check and repair | 11-27 |
| | 3. Expansion valve too open | Replace | 11-27 |
| Insufficient cooling (Low-pressure level is too low) | 1. Refrigerant too short | Check with manifold gauge | 11-32 |
| | 2. Gas leak at heat-sensitive tube | Replace | 11-27 |
| | 3. Evaporator frosted | Clean or replace | — |
| | 4. Low-pressure hose in trouble (Cracked or clogged) | Replace | 11-74 |
| | 5. Expansion valve clogged | Replace | — |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Insufficient cooling (Both Hi-pressure and low-pressure level is too high) | 1. Refrigerant overcharged | Check with manifold gauge | 11-32 |
| Insufficient cooling (Both Hi-pressure and low-pressure level is too low) | 1. Refrigerant too short | Check with manifold gauge | 11-32 |
| Temperature cannot be controlled (Temperature motor and / or temperature control dial malfunction) | 1. Temperature motor damaged | Replace | 11-38 |
| | 2. Temperature control dial damaged | Replace | 11-36 |
| | 3. Controller wiring harness disconnected | Repair or replace | 11-34 |
| Temperature cannot be controlled (Mode motor and/or mode switch malfunction) | 1. Mode motor damaged | Replace | — |
| | 2. Mode switch damaged | Replace | 11-39 |
| | 3. Wiring harness controller disconnected | Repair or replace | 11-34 |
| Temperature cannot be controlled (Heater hoses laid is bad) | 1. Heater hose caught | Repair | 11-79 |
| | 2. Heater hose twisted or bent | Repair or replace | 11-79 |

**Windshield wiper**

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Windshield wiper does not operate | 1. Fuse blown (Short-circuit, burnt component inside motor or other part for operation) | Correct cause and replace | 2-57 |
| | 2. Wiper motor damaged (Broken armature, worn motor brush or seized motor shaft) | Replace | 11-42<br>11-82<br>11-83 |
| | 3. Wiper switch damaged | Replace | 11-41<br>11-41<br>11-42<br>11-43 |
| | 4. Foreign material interrupts movement of link mechanism | Repair | 11-82<br>11-83 |
| | 5. Wiper arm seized or rusted | Lubricate or replace | 11-82<br>11-83 |
| Windshield wiper operating speed is too low | 1. Wiper motor damaged (Short-circuit of motor armature, worn motor brush or seized motor shaft) | Replace | 11-42<br>11-82<br>11-83 |

(Continued)

| Symptom | Probable cause and checking procedure | Solution | Reference page |
|---|---|---|---|
| Windshield wiper operating speed is too low | 2. Low battery voltage | Recharge or replace | 10-93<br>10-93<br>10-93<br>10-93 |
| | 3. Humming occurs on motor in arm operating cycle due to seized arm shaft | Lubricate or replace | 11-82<br>11-83 |
| | 4. Wiper switch contact improper | Replace | 11-41<br>11-41<br>11-42<br>11-43 |
| Windshield wiper does not stop correctly | 1. Wiper motor damaged (Contaminated auto-return contacts or improper contact due to foreign matter) | Replace | 11-42<br>11-82<br>11-83 |

# 2. Servicing specifications for cabin

| Item | | Factory specification | Allowable limit |
|---|---|---|---|
| Refrigerating cycle (Refrigerating cycle is normal operating) | Pressure (LO pressure side) | 0.15 to 0.19 MPa<br>1.5 to 2.0 kgf/cm$^2$<br>22 to 28 psi | — |
| | Pressure (HI pressure side) | 1.3 to 1.6 MPa<br>13 to 17 kgf/cm$^2$<br>190 to 240 psi | — |
| Magnetic clutch stator coil | Resistance | 3.0 to 4.0 Ω | — |
| A/C compressor magnetic clutch | Air gap | 0.30 to 0.65 mm<br>0.012 to 0.025 in. | — |
| Blower | Resistance | (Terminal Hi - Terminal M2)<br>Approx. 0.22 Ω | — |
| | | (Terminal Hi - Terminal M1)<br>Approx. 0.69 Ω | — |
| | | (Terminal Hi - Terminal Lo)<br>Approx. 1.69 Ω | — |
| Pressure switch<br>(When pressure switch is turned OFF) | Setting pressure (LO pressure side) | Less than approx.<br>0.20 MPa<br>2.0 kgf/cm$^2$<br>28 psi | — |
| | Setting pressure (HI pressure side) | More than approx.<br>3.1 MPa<br>32 kgf/cm$^2$<br>460 psi | — |
| Front wiper | Rotating speed | 25 to 43 times/min | — |
| Rear wiper | Rotating speed | 25 to 43 times/min | — |
| Battery cable terminal | Clearance | 1.0 to 1.5 mm<br>0.040 to 0.059 in. | — |
| Secondary brake lever | Free play | 4 notches | — |
| Air conditioner drive belt | Tension | 10 to 12 mm<br>(0.40 to 0.47 in.)<br>deflection at 98 N<br>(10 kgf, 22 lbf) of force | — |

# 3. Tightening torques for cabin

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to 2-15, 2-15.)

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| DPF muffler mounting nut | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| DPF muffler bracket mounting bolt | 60.8 to 70.6 | 6.20 to 7.19 | 44.9 to 52.0 |
| SCR muffler bracket mounting bolt and nut | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Rear wheel mounting nut | 260 to 304 | 26.5 to 31.0 | 191.8 to 224.2 |
| Universal joint mounting bolt | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Seat suspension mounting bolt | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Secondary brake cable mounting nut | 20 to 25 | 2.1 to 2.5 | 15 to 18 |
| Secondary brake cable adjusting nut | 7.8 to 9.3 | 0.80 to 0.94 | 5.8 to 6.8 |
| Secondary brake lever mounting bolt | 48.1 to 55.9 | 4.91 to 5.70 | 35.5 to 41.2 |
| Secondary brake bracket mounting bolt | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Secondary brake cable adjusting nut 1 | 17.1 to 20.6 | 1.75 to 2.10 | 12.7 to 15.1 |
| Secondary brake cable mounting nuts 1 | 20 to 25 | 2.1 to 2.5 | 15 to 18 |
| Cable stay mounting bolt | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Clutch cable mounting nut 1 | 17.7 to 20.6 | 18.1 to 2.10 | 13.1 to 15.1 |
| Clutch cable mounting nut 2 | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Clutch cable mounting nut 3 | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Brake hose mounting nut | 13.7 to 15.7 | 1.40 to 1.60 | 10.1 to 11.5 |
| Hose band (Inlet air, inter cooler) | 4.0 to 5.0 | 0.41 to 0.50 | 3.0 to 3.6 |
| Alternator terminal nut | 9.80 to11.3 | 1.00 to 1.15 | 7.23 to 8.33 |
| Cabin mounting screw and nut | 124 to 147 | 12.6 to 15.0 | 91.2 to 108 |
| High pressure hose mounting screw (Compressor side) | 7.9 to 11 | 0.80 to 1.2 | 5.8 to 8.6 |
| Low pressure hose mounting screw (Compressor side) | 7.9 to 11 | 0.80 to 1.2 | 5.8 to 8.6 |
| Compressor bracket mounting screw (M8) to aluminum parts | 18 to 20 | 1.8 to 2.1 | 13 to 15 |
| Compressor bracket mounting screw (M8) to ordinariness parts | 24 to 27 | 2.4 to 2.8 | 18 to 20 |
| Compressor bracket mounting screw (M10) to ordinariness parts | 48 to 55 | 4.9 to 5.7 | 36 to 41 |
| Compressor mounting screw | 25 to 29 | 2.5 to 3.0 | 18 to 21 |
| Magnetic clutch mounting screw | 15 to 21 | 1.5 to 2.1 | 11 to 15 |
| Seat bracket mounting bolt | 23.5 to 27.5 | 2.40 to 2.80 | 17.4 to 20.2 |
| Air conditioner unit mounting screw (M8) | 9.8 to 15 | 1.0 to 1.6 | 7.3 to 11 |
| Pressure hose joint mounting screw | 7.9 to 11 | 0.80 to 1.2 | 5.8 to 8.6 |
| High pressure pipe mounting screw (Condenser side) | 7.9 to 11 | 0.80 to 1.2 | 5.8 to 8.6 |
| High pressure pipe retaining nut (Receiver side) | 12 to 14 | 1.2 to 1.5 | 8.7 to 10 |

(Continued)

| Item | N·m | kgf·m | lbf·ft |
|---|---|---|---|
| Wiper arm mounting nut (Front wiper) | 6.9 to 9.8 | 0.70 to 1.0 | 5.1 to 7.2 |
| Wiper arm mounting nut (Rear wiper) | 7.9 to 9.8 | 0.80 to 1.0 | 5.8 to 7.2 |
| Wiper motor mounting screw | 7.9 to 9.8 | 0.80 to 1.0 | 5.8 to 7.2 |

# 4. Precautions at repairing refrigerant cycle

When checking or repairing the air conditioning system, the following precautions and rules must be observed. And it is of first importance that no other personnel than a well-trained serviceman should be allow to handle the refrigerant.

**⚠ CAUTION**

- **Since direct contact of the liquid refrigerant with your skin will cause frostbite, always be careful when handling the refrigerant. Always wear goggles to protect your eyes when working around the system.**
- **The refrigerant service container has a safe strength. However, if handled incorrectly, it will explode. Therefore, always follow the instructions on the label. In particular, never heat the refrigerant container above 40 ℃ (104 ℉) or drop it from a high height.**
- **Do not steam clean on the system, especially condenser because excessively high pressure will build up in the system, resulting in explosion of the system.**
- **If you improperly connect the hose between the service valve of compressor and gauge manifold, or incorrectly handle the valves, the refrigerant service container or charging hose will explode. When connecting the hose or handling the valve, be sure to check the high pressure side or low pressure side.**
- **In case the refrigerant is charged while the compressor is operating, do not open the high pressure valve of the gauge manifold.**
- **Be careful of the toxicity of the gas. The gas is harmless and nontoxic in its original state, however it produces a toxic substance when it comes in contact with high temperature parts and decomposes.**
- **Do not heat the service can unless necessary. When it has to be heated, use warm water of 40 ℃ (104 ℉) or lower. Do not heat using boiling water.**

**■ IMPORTANT**

- **If the refrigerant, O-rings, etc. for R12 are used in the R134a air conditioner system, problems such as refrigerant leakage or cloudiness in the sight glass may occur. Therefore, in order to prevent charging of refrigerant or erroneous connections, the shapes of the piping joint as well as the shapes of the service valve and the service tools have been changed.**
- **Always keep the working place clean and dry and free from dirt and dust. Wipe off water from the line fittings with a clean cloth before disconnecting.**
- **Use only for R134a refrigerant service tool.**
- **Use for R134a refrigerant recovery and recycling machine when discharging the refrigerant.**
- **Before attaching the charging hose to the can tap valve of the refrigerant container, check each packing for clogging.**
- **When disconnecting the charging hose from the charging valve of compressor and receiver, remove it as quick as possible so that gas leakage can be minimized.**
- **Be sure to charge the specified amount of refrigerant, but not excessively. Over-charging of the refrigerant in particular may cause insufficient cooling, etc..**
- **Since the charging hose can be connected to can tap valve by hand, do not use a pliers for tightening it.**
- **Keep refrigerant containers in a cool and dark place avoiding such place which are subject to strong sunlight or high temperature.**
- **Since R134a compressor oil absorbs moisture easily, seal the refrigerant line after disconnecting the each parts.**
- **Never use old-type refrigerant R12a or compressor oil for old-type refrigerant.**
- **When replacing the condenser, evaporator and receiver, etc., fill the compressor oil to compressor according to the table below.**

**(Refrigerant)**

| | | |
|---|---|---|
| Kinds of refrigerant (Charge amount) | Factory specification | R134a<br>0.95 to 1.05 kg<br>2.10 to 2.31 lbs |

**(Compressor Oil)**

| Quantity (Total) | Brand Name |
|---|---|
| 110 to 120 cc<br>0.117 to 0.126 U.S.qts<br>0.0968 to 0.105 Imp.qts | ND-OIL 8 (PAG* oil) |

* PAG: Polyalkyleneglycol (Synthetic oil)

**(Reference)**

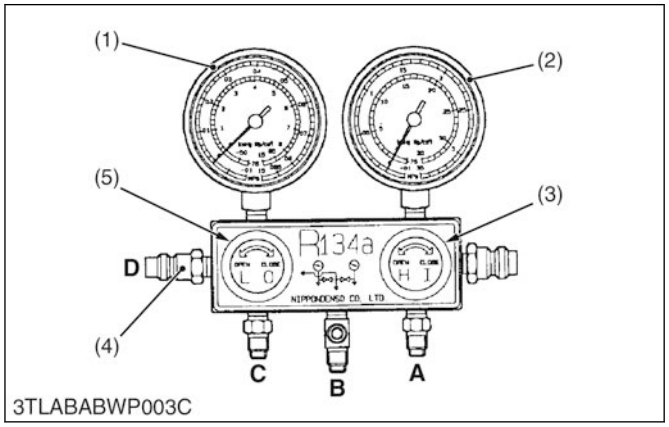
| Replacing Parts | Fill Quantity | Brand Name |
|---|---|---|
| Condenser | 45 cc<br>0.0476 U.S.qts<br>0.0396 Imp.qts | ND-OIL 8 <PAG* oil> |
| Evaporator | 40 cc<br>0.042 U.S.qts<br>0.035 Imp.qts | |
| Receiver | 10 cc<br>0.011 U.S.qts<br>0.009 Imp.qts | |
| Hose | 10 cc<br>0.011 U.S.qts<br>0.009 Imp.qts | |

* PAG: Polyalkyleneglycol (Synthetic oil)

## 4.1 Manifold gauge set

**■ NOTE**

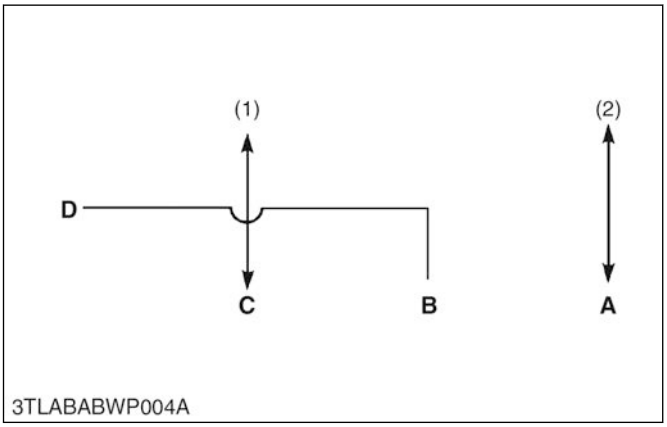
- **Schrader valve (D) must be opened.**




(1) "**LO**" pressure gauge
(2) "**HI**" pressure gauge
(3) "**HI**" pressure side valve
(4) Schrader valve
(5) "**LO**" pressure side valve

The hand valves on the manifold gauge set are used to open and close the valve. The hand valve inscribed "**LO**" is for the low pressure side valve (5) and "**HI**" is for the high pressure side valve (3). By opening or closing the high and low pressure hand valves, the following circuits are established.

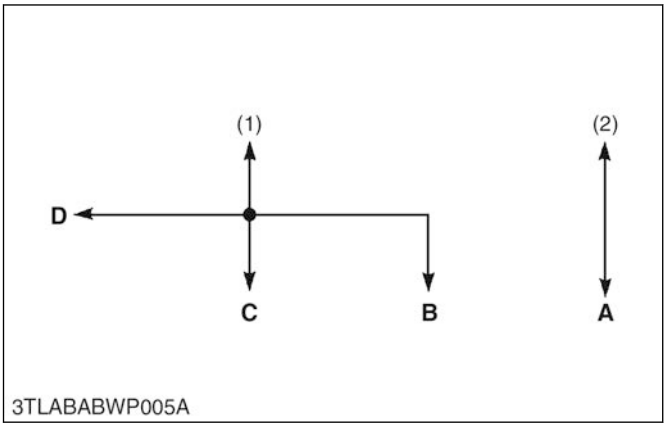
**When "LO" pressure side valve and "HI" pressure side valve are closed.**




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

Two circuits are established.
Port (C) → "**LO**" pressure gauge (1)
Port (A) → "**HI**" pressure gauge (2)

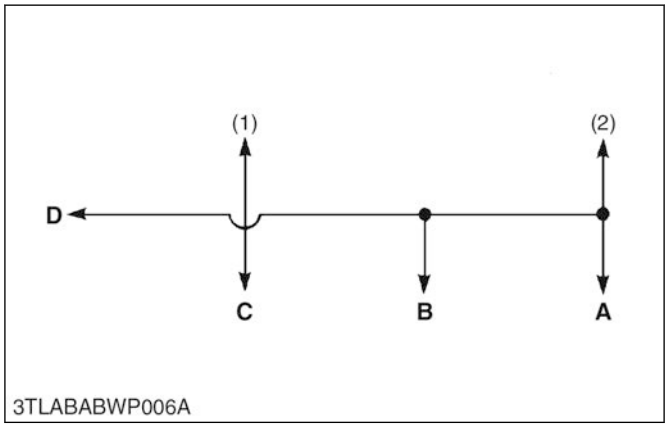
**When "LO" pressure side valve is opened and "HI" pressure side valve is closed.**




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

Two circuits are established.
Port (C) → "**LO**" pressure gauge (1)
→ Port (B)
→ Port (D) (Schrader valve must be opened.)
Port (A) → "**HI**" pressure gauge (2)

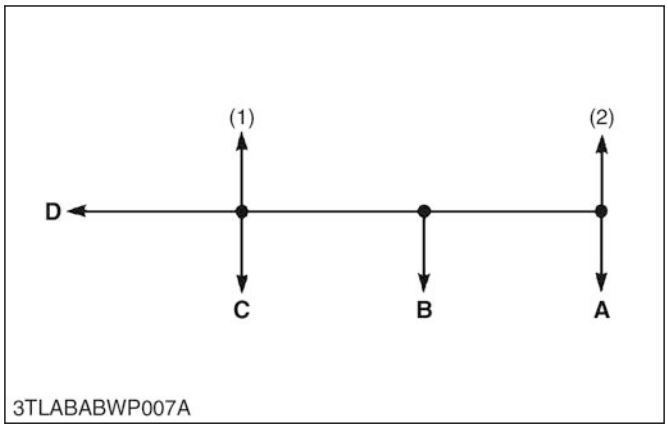
**When "LO" pressure side valve is closed and "HI" pressure side valve is opened.**




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

Two circuits are established.
Port (C) → "**LO**" pressure gauge (1)
Port (A) → "**HI**" pressure gauge (2)
→ Port (B)
→ Port (D) (Schrader valve must be opened.)

**When "LO" and "HI" pressure side valve is opened.**




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

Two circuits are established.
Port (A) → "**HI**" pressure gauge (2)
→ "**LO**" pressure gauge (1)
→ Port (B)
→ Port (C)
→ Port (D) (Schrader valve must be opened.)

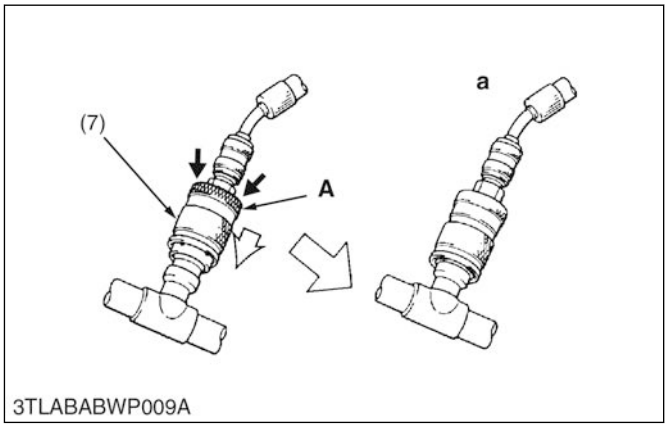
RELATED PAGE
3.1 Air conditioner service tool on page 2-106

## 4.2 Refrigerant charging hose

Refrigerant charging hose must be handled as follows.

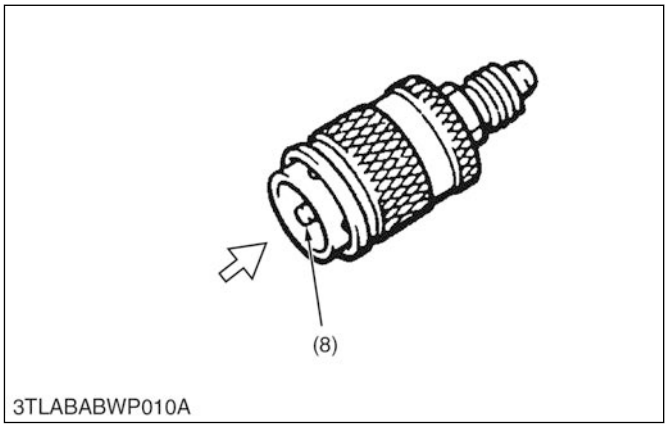
**NOTE**

- **When connecting, push carefully so that the pipe does not bend.**
- **When connecting the quick disconnect connector, push the sleeve (7) before the quick link connector can be connected to the charging valve, and move the quick sleeve to its original position and try again.**



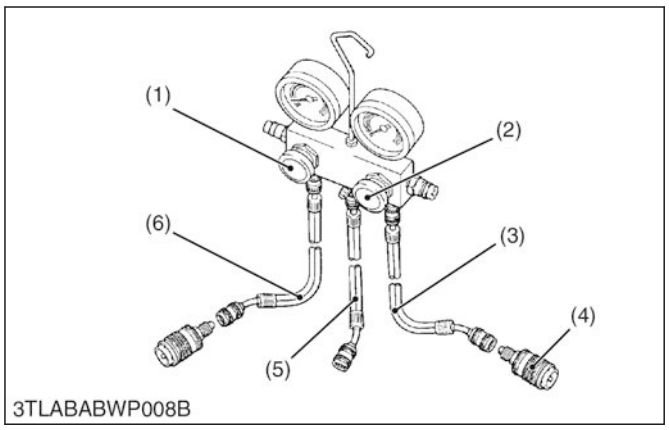

(7) Sleeve
A: Part of sleeve
a Sleeve connected to original position

- **When some refrigerant remains in the charging hose at the time of connections, it may be difficult to connect the quick link connector. In this case, perform the operation after removing any residual pressure in the hose. (Remove the residual pressure by pushing the pusher (8).)**




(8) Pusher

- **After removing the adaptor, ensure to cap the quick disconnect adaptor service valve.**



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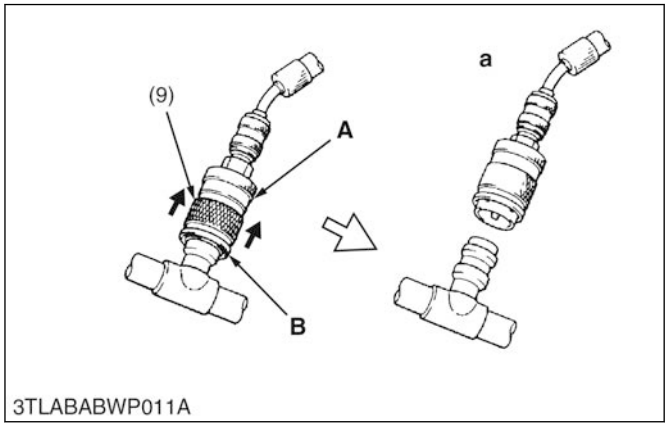

3TLABABWP011A

(1) "**LO**" pressure side valve
(2) "**HI**" pressure side valve
(3) Red hose
(4) Quick disconnect adaptor
(5) Green hose
(6) Blue hose
(9) Sleeve
A Part of sleeve
B Part of sleeve
a: Sleeve disconnected from original position

- The air conditioner manufacture recommends that the blue hose (6) is used for the "**LO**" pressure side (suction side), the green hose (5) for refrigeration side (center connecting port) and the red hose (3) for "**HI**" pressure side (discharged side).

**(When connecting)**

- Push the quick disconnect adaptor (4) into the charging valve, and push the part A until a click is heard.

**(When reassembling)**

- While holding on to part A of the quick disconnect adaptor, slide the part B up.

## 4.3 Objective of the vacuum pump adaptor

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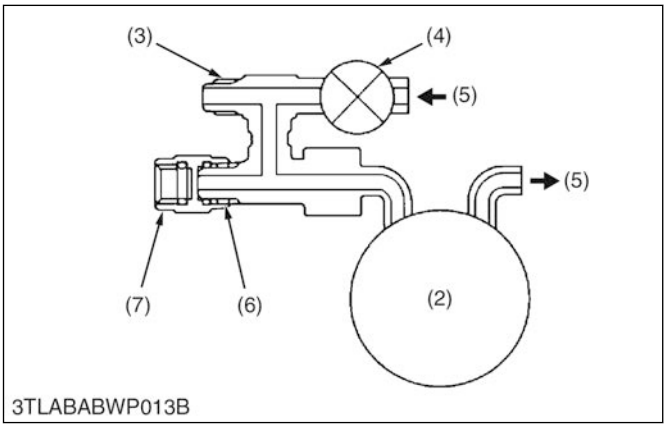


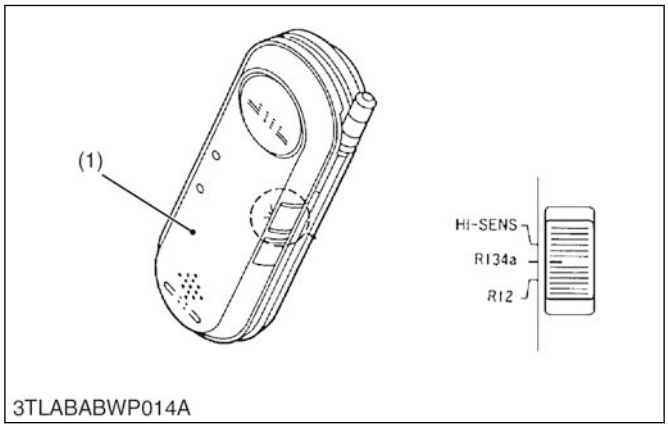
3TLABABWP013B

(1) Vacuum pump adaptor
(2) Vacuum pump
(3) Inlet (for R134a)
(4) Magnetic valve
(5) Air
(6) Inlet (for R12)
(7) Blind cap

1. After vacuum has been created in the air conditioning cycle, when the vacuum pump (2) is stopped, since there is vacuum in hoses within the gauge manifold, the vacuum pump oil flows back into the charging hose. If the refrigerant is refilled with the system still in this state, the vacuum pump oil left in the charging hose enters the air conditioner cycle together with the refrigerant. Vacuum pump adaptor (1) with a solenoid valve is used to prevent this back-flow of oil from the vacuum pump (2). The role of the solenoid valve is that when the current passes through the solenoid valve, the valve closes to keep out the outside air and allow the vacuum to build up, but when the current stops, the valve opens to allow in air and end the vacuum.
2. Attaching this adaptor to the R12 vacuum pump currently being used allows the pump to be used with both R134a and R12.

RELATED PAGE
3.3 Vacuum pump on page 2-107

## 4.4 Electric gas leak tester




(1) Electric gas leak tester

The current R12 gas leak tester has poor sensitivity for R134a and cannot be used. Therefore, a new electric gas leak tester with greater sensitivity has been designed and can be used with both R134a and R12.

**(Reference)**

Leak tester with halide torch

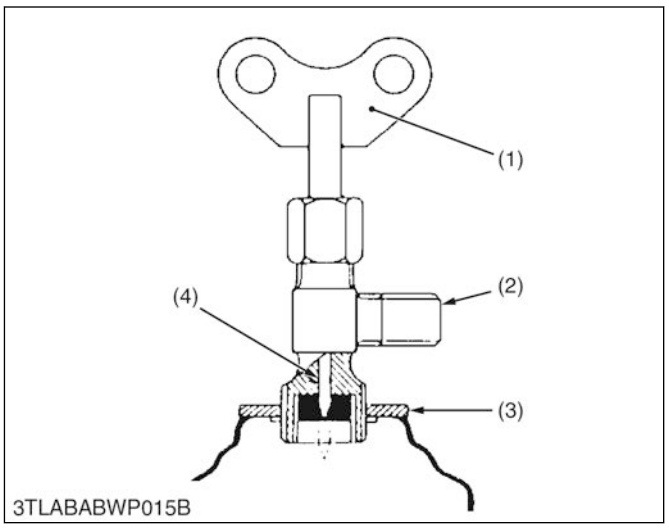
- Since the reaction with chlorine within the refrigerant is used to detect gas leaks, R134a, which contains no chlorine, cannot be detected.

RELATED PAGE
3.2 Electric gas leak tester on page 2-107

## 4.5 Operating can tap valve

The can tap valve that is used to charge the refrigerant into the air conditioning system, should be used as follows:

1. Before putting the can tap valve on the refrigerant container, turn the butterfly handle (1) counterclockwise until the valve needle is fully retracted.
2. Turn the plate nut (disk) (3) counterclockwise until it reaches its highest position, then screw down the can tap valve into the sealed tap.
3. Turn the place nut clockwise fully, and fix the center charging hose to the valve.
4. Tighten the place nut firmly by hand.
5. Turn the butterfly handle (1) clockwise, thus making a hole in the sealed tap.
6. To charge the refrigerant into the system, turn the butterfly handle (1) counterclockwise. To stop charging, turn it clockwise.

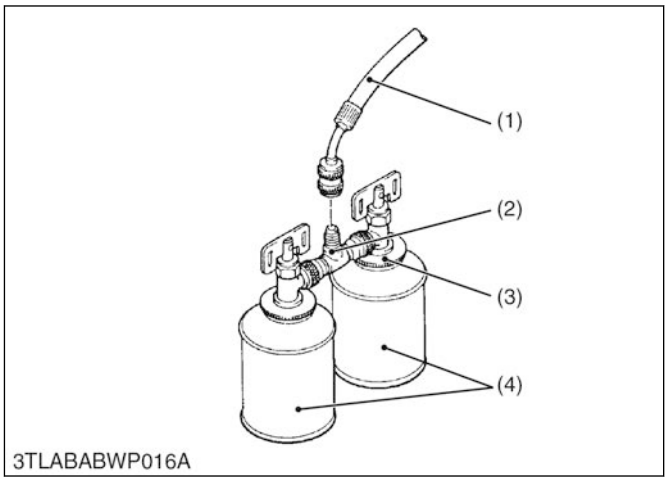



(1) Butterfly handle
(2) Connection
(3) Disk
(4) Needle

## 4.6 Installing T-joint

T-joint (2) is used to increase efficiency of gas charging using two refrigerant containers (4) at the same time.

1. Install two refrigerant container service valves to T-joint (2) sides and connect the charging hose (1) to it.




(1) Charging hose (Green)
(2) T-joint
(3) Can tap valve
(4) Refrigerant container

## 4.7 R134a refrigerant recovery and recycling machine

**IMPORTANT**

- **Use only R134a refrigerant recovery and recycling machine, and eliminate mixing R134a equipment, refrigerant and refrigerant oils with R12 systems to prevent compressor damage.**

When there is necessity of discharging the refrigerant on repairing the tractor, it should use recovery and recycling machine. (Do not release the refrigerant into the atmosphere.)

# 5. Checking and charging refrigerant cycle

## 5.1 Checking with manifold gauge

**■ IMPORTANT**

- **Since the gauge indications described in the following testing are those taken under the same condition, it should be noted that the gauge readings will differs somewhat with the ambient conditions.**

**Condition**

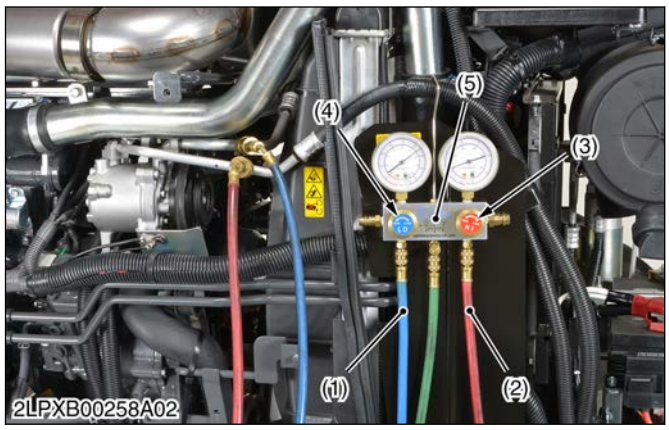
- Ambient temperature: 30 to 35 ℃ (86 to 95 ℉)
- Engine speed: Approximately 1500 $min^{-1}$ (rpm)
- Temperature control lever: Maximum cooling position
- Blower switch: HI position

### 5.1.1 Connecting manifold gauge for test preparation

**■ NOTE**

- **Be sure to drive out the air in the charging hoses at the manifold gauge connection end by using the refrigerant pressure in the refrigerating cycle.**

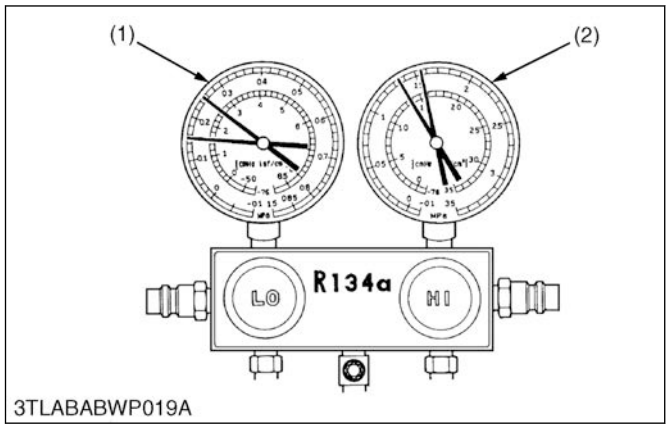
1. Close the "**HI**" pressure side valve (3) and the "**LO**" pressure side valve (4) of the manifold gauge securely.
2. Connect the charging hose (red) (2) to the "**HI**" pressure side charging valve (7) and connect the charging hose (blue) (1) to the "**LO**" pressure side charging valve (6).


(1) Charging hose (Blue)
(2) Charging hose (Red)
(3) "**HI**" pressure side valve
(4) "**LO**" pressure side valve
(5) Manifold gauge
(6) "**LO**" pressure side charging valve
(7) "**HI**" pressure side charging valve

3. Start the engine and set at approximately 1500 $min^{-1}$ (rpm).
4. Turn on the A/C switch and set the temperature control dial to maximum cooling position.
5. Set the blower switch to **HI** position.

### 5.1.2 Normal operating



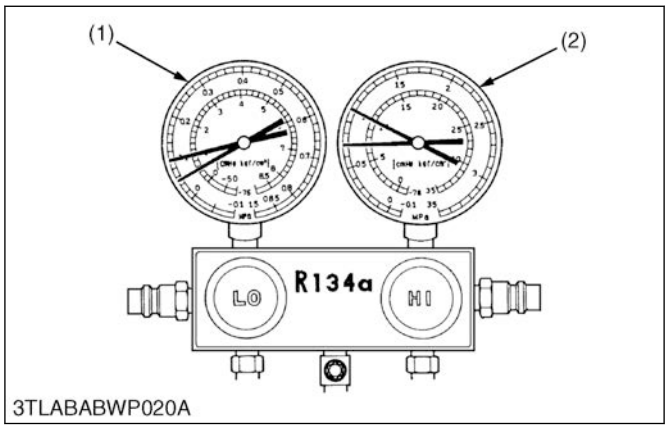

(1) "**LO**" pressure gauge
(2) "**HI**" pressure gauge

If the refrigerating cycle is operating normally, the reading value should be generally same value shown in the following table.

| | | | |
|---|---|---|---|
| Gas pressure | Factory specification | Low pressure gauge | 0.15 to 0.19 MPa<br>1.5 to 2.0 $kgf/cm^2$<br>22 to 28 psi |
| | | High pressure gauge | 1.3 to 1.6 MPa<br>13 to 17 $kgf/cm^2$<br>190 to 240 psi |

## 5.1.3 Insufficient refrigerant

### Symptoms seen in refrigerating cycle




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

- Both the pressure of "**LO**" "**HI**" pressure gauge (1)and the pressure of "**HI**" pressure gauge (2) too low.

  **"LO" pressure gauge (1):**
  0.049 to 0.098 MPa (0.50 to 1.0 kgf/cm$^2$, 7.2 to 14 psi)

  **"HI" pressure gauge (2):**
  0.69 to 0.98 MPa (7.0 to 10 kgf/cm$^2$, 100 to 140 psi)
- Bubbles seen in sight glass.
- Air discharged from air conditioner sightly cold.

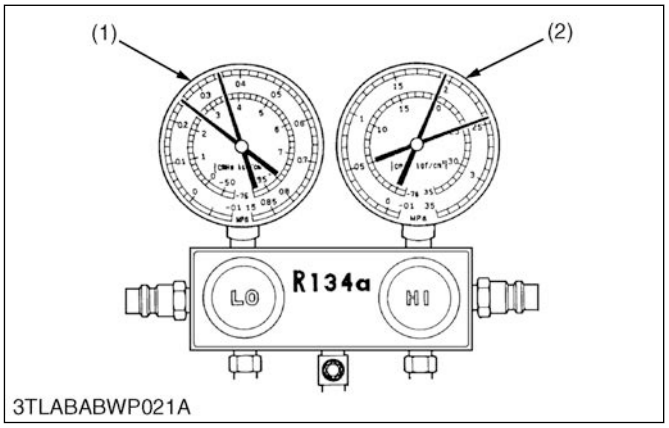
**Probable cause**
- Gas leaking from some place in refrigerant cycle.

**Solution**
- Check refrigerant leakage with electric gas leak tester and repair.
- Recharge refrigerant to the proper level.

RELATED PAGE
5.2.3 Charging refrigerant on page 11-31
4.1 Manifold gauge set on page 11-20

## 5.1.4 Excessive refrigerant or insufficient condenser cooling

### Symptoms seen in refrigerating cycle




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

- Both the pressure of "**LO**" pressure gauge (1) and the pressure of "**HI**" pressure gauge (2) too high.

  **"LO" pressure gauge (1):**
  0.20 to 0.34 MPa (2.0 to 3.5 kgf/cm$^2$, 29 to 49 psi)

  **"HI" pressure gauge (2):**
  2.0 to 2.4 MPa (20 to 25 kgf/cm$^2$, 290 to 350 psi)

**Probable cause**
- Overcharging refrigerant into cycle.
- Condenser cooling damaged.

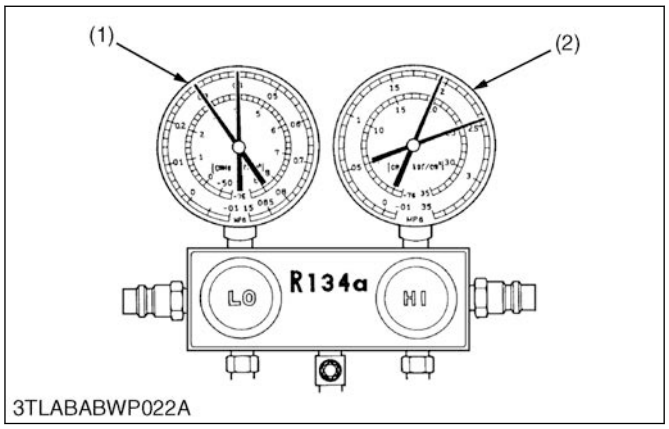
**Solution**
- Clean condenser.
- Adjust air conditioner belt to proper tension.
- If the above two items are in normal condition, check refrigerant quantity.

**NOTE**
- **If excessive refrigerant is to be discharged, loosen manifold gauge "LO" pressure side valve and vent out slowly.**

RELATED PAGE
5.2.4 Checking charging refrigerant amount on page 11-32
4.1 Manifold gauge set on page 11-20

## 5.1.5 Air entered in cycle

### Symptoms seen in refrigerating cycle




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

- Both pressure of "**LO**" pressure gauge (1) and the pressure of "**HI**" pressure gauge (2) too high.

  **"LO" pressure gauge (1):**
  0.20 to 0.34 MPa (2.0 to 3.5 kgf/cm$^2$, 29 to 49 psi)

  **"HI" pressure gauge (2):**
  2.0 to 2.4 MPa (20 to 25 kgf/cm$^2$, 290 to 350 psi)
- "**LO**" pressure gauge (1) piping not cold when touched.

**Probable cause**
- Air entered in refrigerating cycle.

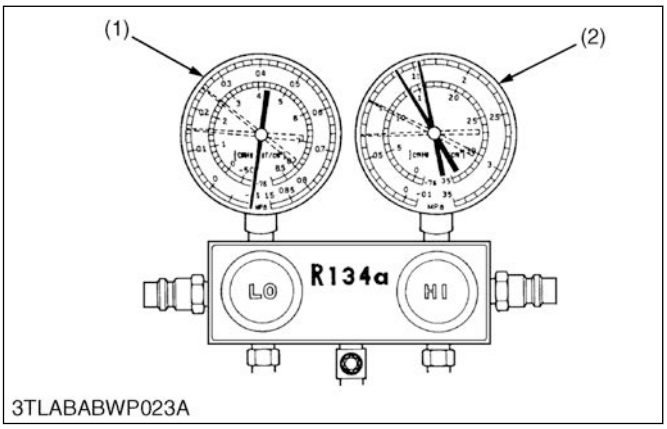
**Solution**
- Replace receiver.
- Check compressor oil contamination and quantity.
- Evacuate and recharge new refrigerant.

**NOTE**
- **The above cycle can be seen when the cycle is charged without evacuation.**

RELATED PAGE
5.2.3 Charging refrigerant on page 11-31

## 5.1.6 Moisture entered in cycle

### Symptoms seen in refrigerating cycle




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

- The air conditioner operates normally at the beginning, but over time, the pressure of "**LO**" pressure gauge (1) is vacuum and the pressure of "**HI**" pressure gauge (2) is low pressure.

  **"LO" pressure gauge (1):**
  Vacuum

  **"HI" pressure gauge (2):**
  0.69 to 0.98 MPa (7.0 to 10 kgf/cm$^2$, 100 to 140 psi)

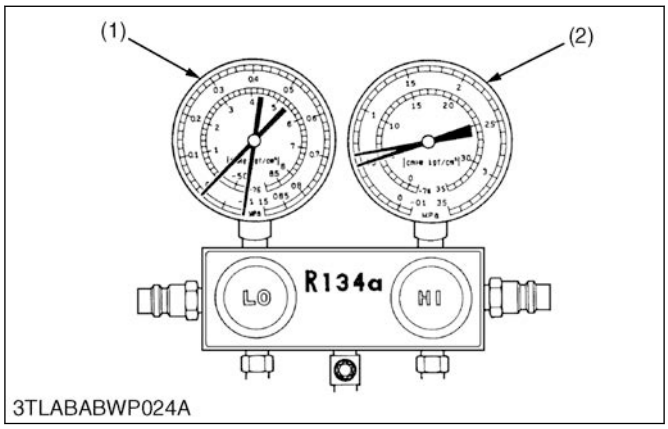
**Probable cause**
- The moisture in the refrigerating cycle freezes in the expansion valve orifice and causes temporary blocking. After a time, the ice melts and condition returns to normal.

**Solution**
- Replace receiver.
- Remove moisture in cycle by means of repeated evacuation.
- Recharge new refrigerant to the proper level.

RELATED PAGE
5.2.3 Charging refrigerant on page 11-31
5.2.2 Evacuating system on page 11-30

## 5.1.7 Refrigerant fails to circulate

**Symptoms seen in refrigerating cycle**




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

- The pressure of "**LO**" pressure gauge (1) is vacuum and the pressure of "**HI**" pressure gauge (2) is low pressure.

  **"LO" pressure gauge (1):**
  Vacuum

  **"HI" pressure gauge (2):**
  0.49 to 0.58 MPa (5.0 to 6.0 kgf/cm$^2$, 72 to 85 psi)

**Probable cause**

- Refrigerant flow obstructed by moisture or dirt in the refrigerating cycle freezing or sticking on the expansion valve orifice.

**Solution**

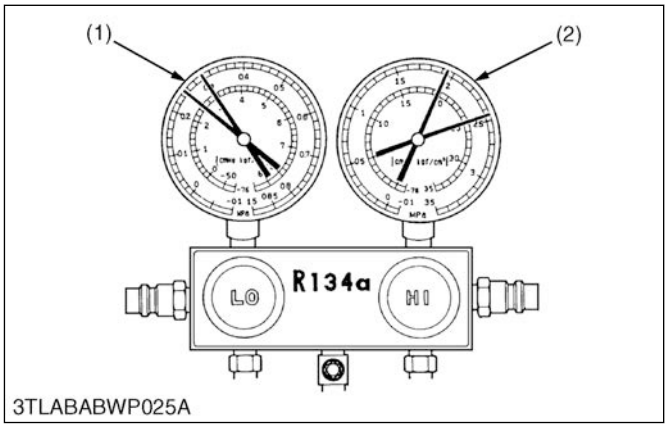
Allow to stand for same time and then resume operation to decide whether the plugging is due to moisture or dirt.

- If it is caused by moisture, correct by referring to instructions in previous.
- If it is caused by dirt, remove the expansion valve and blow out the dirt with compressed air.
- If you are unable to remove the dirt, replace the expansion valve. Replace the receiver. Evacuate and charge in proper amount of new refrigerant.
- If it is caused by gas leakage in heat sensitizing tube, replace the expansion valve.

RELATED PAGE
5.2.3 Charging refrigerant on page 11-31
5.2.2 Evacuating system on page 11-30

## 5.1.8 Expansion valve opens too far or improper installation of heat sensitizing tube

**Symptoms seen in refrigerating cycle**




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

- Both the pressure of "**LO**" pressure gauge (1) and the pressure of "**HI**" pressure gauge (2) too high.

  **"LO" pressure gauge (1):**
  0.30 to 0.39 MPa (3.0 to 4.0 kgf/cm$^2$, 43 to 56 psi)

  **"HI" pressure gauge (2):**
  2.0 to 2.4 MPa (20 to 25 kgf/cm$^2$, 290 to 350 psi)
- Frost or heavy dew on low pressure side piping.

**Probable cause**

- Expansion valve trouble or heat sensitizing tube improperly installed.
- Flow adjustment not properly done.

**Solution**

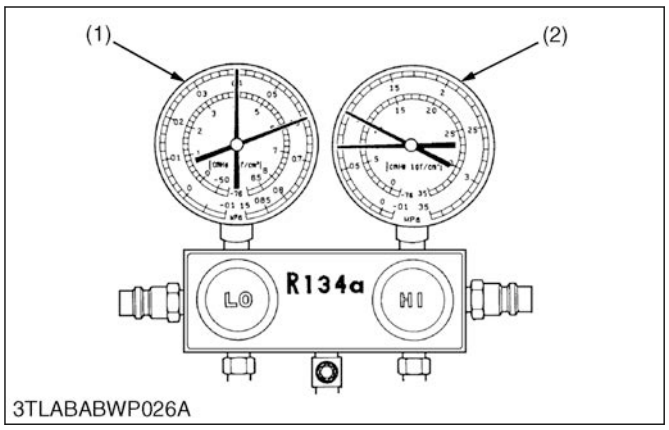
- Check installed condition of heat sensitizing tube.
- If installation of heat sensitizing tube is correct, replace the expansion valve.

## 5.1.9 Damaged compression of compressor

**Symptoms seen in refrigerating cycle**

**■ NOTE**

- **Manifold gauge indications (below figure) at damaged compressing by compressor.**




(1) "**LO**" pressure gauge (2) "**HI**" pressure gauge

**"LO" pressure gauge (1):**
0.40 to 0.58 MPa (4.0 to 6.0 kgf/cm$^2$, 57 to 85 psi)

**"HI" pressure gauge (2):**
0.69 to 0.98 MPa (7.0 to 10 kgf/cm$^2$, 100 to 140 psi)

**Probable cause**
- Leak in compressor.

**Solution**
- Replace compressor.

RELATED PAGE
6.2.2 Removing compressor assembly on page 11-62

## 5.2 Discharging, evacuating and charging

**CAUTION**
- **Since direct contact of the liquid refrigerant with your skin will cause frostbite, always be careful when handling the refrigerant. Always wear goggles to protect your eyes when working around the system.**
- **The refrigerant service container has a safe strength. However, if handled incorrectly, it will explode. Therefore, always follow the instructions on the label. In particular, never heat the refrigerant container above 40 ℃ (104 ℉) or drop it from a high height.**
- **Do not steam clean on the system, especially condenser because excessively high pressure will build up in the system, resulting in explosion of the system.**
- **If you improperly connect the hose between the service valve of compressor and gauge manifold, or incorrectly handle the valves, the refrigerant service container or charging hose will explode. When connecting the hose or handling the valve, be sure to check the high pressure side or low pressure side.**
- **In case the refrigerant is charged while the compressor is operating, do not open the high pressure valve of the gauge manifold.**
- **Be careful of the toxicity of the gas. The gas is harmless and nontoxic in its original state, however it produces a toxic substance when it comes in contact with high temperature parts and decomposes.**
- **Do not heat the service can unless necessary. When it has to be heated, use warm water of 40 ℃ (104 ℉) or lower. Do not heat using boiling water.**

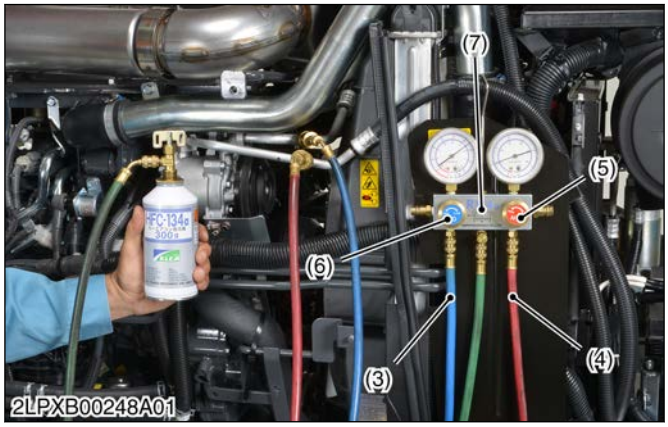
RELATED PAGE
4. Precautions at repairing refrigerant cycle on page 11-19

### 5.2.1 Discharging refrigerant

**CAUTION**
- **Protect fingers and eyes with cloth against frostbite by refrigerant when disconnecting the hose to the charging valve.**

**IMPORTANT**
- **Use only R134a refrigerant recovery and recycling machine (8). Eliminate mixing R134a equipment, refrigerant, and refrigerant oils with R12 system to prevent compressor damage.**

Prepare for the R134a refrigerant recovery and recycling machine (8).

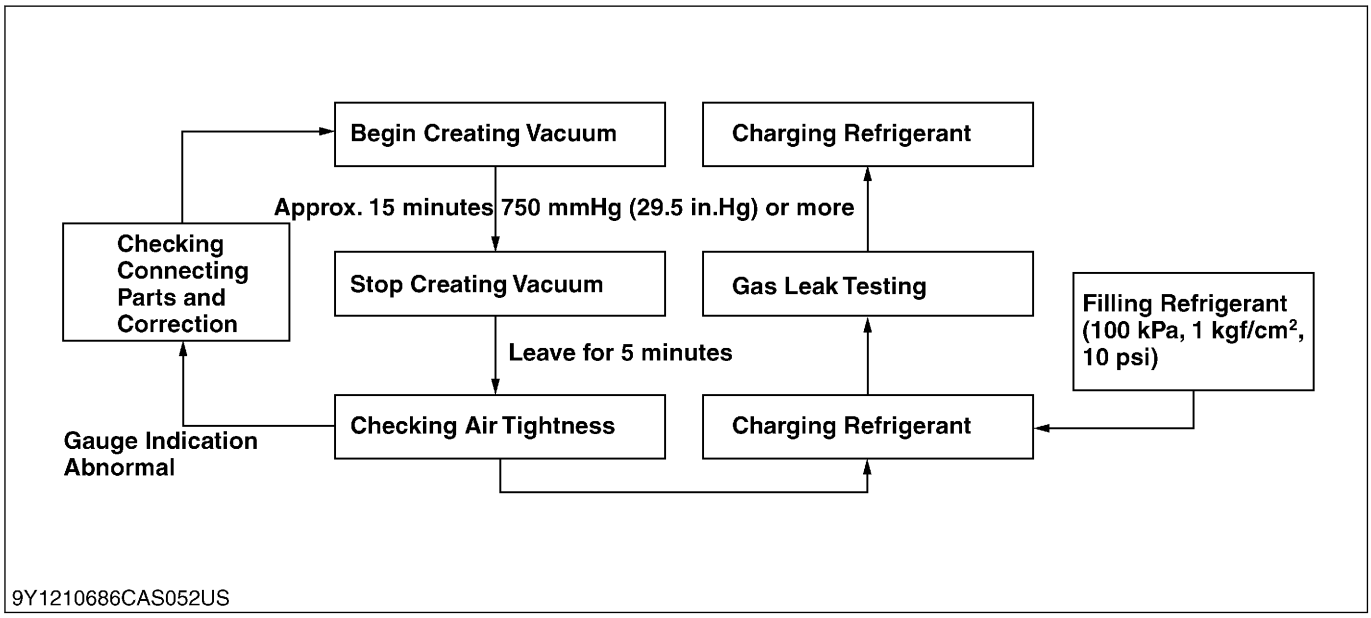



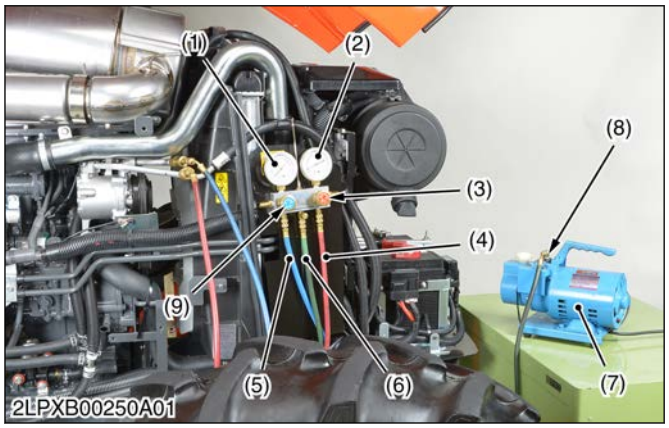


(1) "**LO**" pressure side charging valve
(2) "**HI**" pressure side charging valve
(3) Charging hose (Blue)
(4) Charging hose (Red)
(5) "**HI**" pressure side valve
(6) "**LO**" pressure side valve
(7) Manifold gauge
(8) Refrigerant recovery and recycling machine

1. Connect charging hose (blue) (3) from the refrigerant recovery and recycling machine (8) to "**LO**" pressure side charging valve (1). Connect charging hose (red) (4) to "**HI**" pressure side charging valve (2).
2. Follow the manufacturer's instructions and discharge the system.

## 5.2.2 Evacuating system




(1) "**LO**" pressure gauge
(2) "**HI**" pressure gauge
(3) "**HI**" pressure side valve
(4) Charging hose (Red)
(5) Charging hose (Blue)
(6) Charging hose (Green)
(7) Vacuum pump
(8) Vacuum pump adaptor
(9) "**LO**" pressure side valve

1. Discharge refrigerant from the system by R134a refrigerant recovery and recycling machine.
2. Connect the charging hose (red) (4) to the "**HI**" pressure side charging valve and connect the charging hose (blue) (5) to the "**LO**" pressure side charging valve.
3. Connect the center charging hose (green) (6) to a vacuum pump inlet.
4. Open both valves (3) and (9) of manifold gauge fully. Then operate the vacuum pump (7) to evacuate the refrigerant cycle. (For approximately 15 minutes.)
5. When "**LO**" pressure gauge (1) reading is more than 750 mmHg (29.5 in.Hg), stop the vacuum pump (7) and close both valves (3), (9) of manifold gauge fully.
6. Wait for over 5 minutes with the "**HI**" and "**LO**" pressure side valves (3) and (9) of gauge manifold closed, and then check that gauge indicator does not return to 0.
7. If the gauge indicator is going to approach to 0, check whether there is a leaking point and repair if it is, and then evacuate it again.

RELATED PAGE
5.2.1 Discharging refrigerant on page 11-28

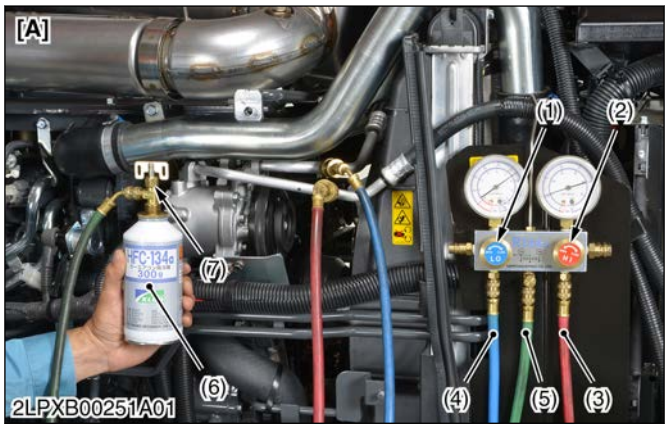
## 5.2.3 Charging refrigerant

### 5.2.3.1 Charging an empty system (Liquid)

This procedure is for charging an empty system through the "**HI**" pressure side with the refrigerant in the liquid state.

**CAUTION**

- **Never operate the engine when charging the system through the "HI" pressure side.**
- **Do not open the "LO" pressure valve when refrigerant R134a is being charged in the liquid state (refrigerant container is set upside-down).**





(1) "**LO**" pressure side valve
(2) "**HI**" pressure side valve
(3) Charging hose (Red)
(4) Charging hose (Blue)
(5) Charging hose (Green)
(6) Refrigerant container (R134a)
(7) Can tap valve
[A] Refrigerant container "Up-side"
[B] Refrigerant container "Down side"

1. Close the "**HI**" and "**LO**" pressure side valves (1) and (2) of manifold gauge after the system is evacuated completely.
2. Connect the center charging hose (green) (5) to the can tap valve (7) fitting, and then loosen the center charging hose (green) (5) at the center fitting of manifold gauge until hiss can be heard. Allow the air to escape for few seconds and tighten the nut.
3. Open the "**HI**" pressure side valve (2) fully, and keep the container upside-down to charge the refrigerant in the liquid state from the "**HI**" pressure side.
4. Charge the refrigerant in the liquid state with approximately 500 g (1.10 lbs) from the "**HI**" pressure side.

**NOTE**

- **If "LO" pressure gauge does not show a reading, the system is clogged and must be repaired.**

5. Close the "**HI**" pressure side valve (2) of manifold gauge and can tap valve of refrigerant container.

**IMPORTANT**

- **After charging the refrigerant in the liquid state with approximately 500 g (1.10 lbs) through the "HI" pressure side, be sure to recharge the refrigerant in the vapor state to specified amount through the "LO" pressure side.**

### 5.2.3.2 Charging an empty or partially charged system (Vapor)

This procedure is to charge the system through the "**LO**" pressure side with refrigerant in the vapor state. When the refrigerant container is set right side up, refrigerant will enter the system as a vapor.

**CAUTION**

- **Never open the "HI" pressure side valve of manifold gauge while the engine is operating.**

**NOTE**

- **Do not turn the refrigerant container upside-down when charging the system by operating the engine.**
- **Put refrigerant container into a pan of warm water (maximum temperature 40 ℃ (104 ℉)) to keep the vapor pressure in the container slightly higher than vapor pressure in the system.**


(1) Can tap valve
(2) "**LO**" pressure gauge
(3) "**HI**" pressure gauge
(4) "**HI**" pressure side valve
(5) "**LO**" pressure side valve

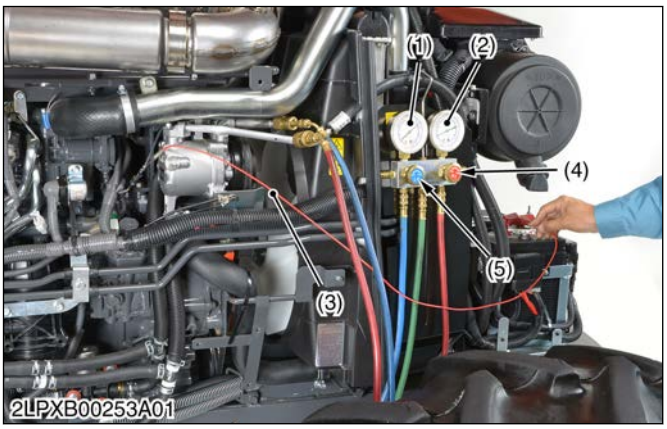
1. Check that the "**HI**" pressure side valve (4) is closed.
2. Start the engine and set an approximately 1500 $min^{-1}$ (rpm).
3. Turn on the A/C switch.
4. Set the temperature control lever to maximum cooling position and the blower switch to HI position.
5. Open the "**LO**" pressure side valve (5) of manifold gauge and the can tap valve (1) on refrigerant container and charge the refrigerant until air bubbles in the sight glass of the receiver vanish.
   **(Reference)**
   - Specified amount of refrigerant (total):
     R134a
     0.85 to 0.95 kg
     1.9 to 2.0 lbs
   - Manifold gauge indication at fully charged system (at ambient temperature: 30 ℃ (86 ℉))
     – "**HI**" pressure side:
       1.3 to 1.6 MPa
       13 to 17 $kgf/cm^2$
       190 to 240 psi
     – "**LO**" pressure side:
       0.15 to 0.19 MPa
       1.5 to 2.0 $kgf/cm^2$
       22 to 28 psi
6. After charging the specified amount of refrigerant into the system, close the "**LO**" pressure side valve (5) of manifold gauge and can tap valve (1), then stop the engine.
7. Check for gas leakage with an electric gas leak tester.

RELATED PAGE
3.2 Electric gas leak tester on page 2-107

## 5.2.4 Checking charging refrigerant amount

**NOTE**

- **Since the pressure on the following checking is the gauge indications at ambient temperature 30 ℃ (86 ℉), it should be noted that the pressure will differ somewhat with the ambient temperature.**



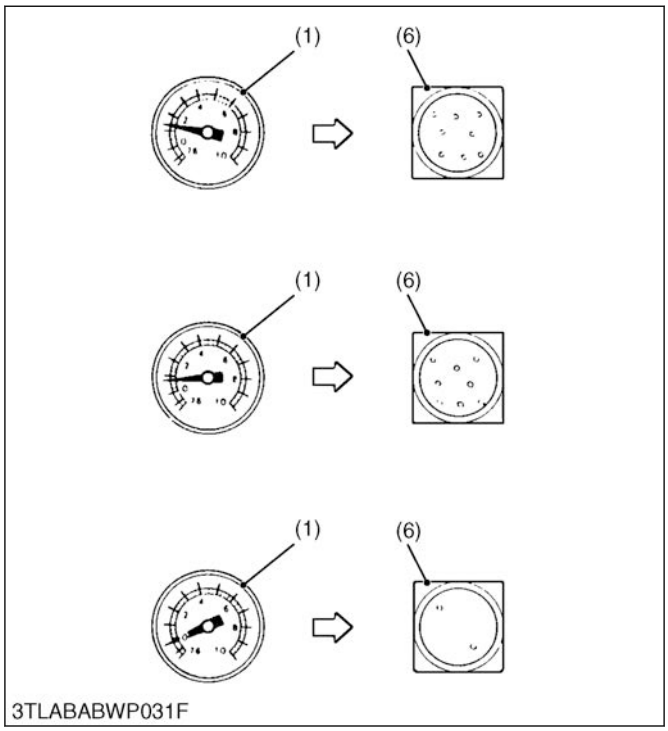


(1) "**LO**" pressure gauge
(2) "**HI**" pressure gauge
(3) To battery
(4) "**HI**" pressure side valve
(5) "**LO**" pressure side valve
(6) Sight glass

After charging the refrigerant, check for amount of charging refrigerant as follows.

1. Disconnect the 1P connector of magnetic clutch.
2. Start the engine and set a approximately 1500 $min^{-1}$ (rpm).
3. Connect the 1P connector of magnetic clutch to battery directly, and then set the blower switch to HI position.
4. Leave the system for approximately 5 minutes until the refrigerant cycle becomes stable, keeping pressure on the "**HI**" pressure side from 1.3 to 1.6 MPa (13 to 17 $kgf/cm^2$, 190 to 240 psi).

5. When the refrigerant cycle is stabilizer, turn off the blower switch and let the compressor alone to operate. Then pressure on the "**LO**" pressure side gradually drops. At this time, if pressure on the "**HI**" pressure side is kept from 1.3 to 1.6 MPa (13 to 17 kgf/cm$^2$, 190 to 240 psi), air bubbles which pass through the sight glass (6) becomes as stated below depending on refrigerant charged amount.




(1) "**LO**" pressure gauge (6) Sight glass

- **Insufficient refrigerant charge**
  Air bubbles pass continuously the sight glass when pressure on the "**LO**" pressure side is over 98 kPa (1.0 kgf/cm$^2$, 14 psi). In this case, charge the refrigerant from the "**LO**" pressure side.
- **Properly refrigerant charge**
  Air bubbles pass through the sight glass continuously when pressure on the "**LO**" pressure side is within 59 to 98 kPa (0.60 to 1.0 kgf/cm$^2$, 8.6 to 14 psi).
  If the charge refrigerant amount is proper, no air bubble is observed on the sight glass at pressure on the "**LO**" pressure side over 98 kPa (1.0 kgf/cm$^2$, 14 psi) when the blower switch is turned on. When the blower switch is turned off, bubbles pass through the sight glass in case pressure on the "**LO**" pressure side is within 59 to 98 kPa (0.60 to 1.0 kgf/cm$^2$, 8.6 to 14 psi).
- **Excessive refrigerant charge**
  Air bubbles pass through the sight glass time to time or no air bubble is observed when pressure on the "**LO**" pressure side is under 60 kPa (0.6 kgf/cm$^2$, 9 psi).
  In this case, discharge excessive refrigerant gradually from the "**LO**" pressure side.

# 6. Checking, disassembling and servicing

## 6.1 Checking and adjusting

### 6.1.1 Compressor

#### 6.1.1.1 Operation of magnetic clutch

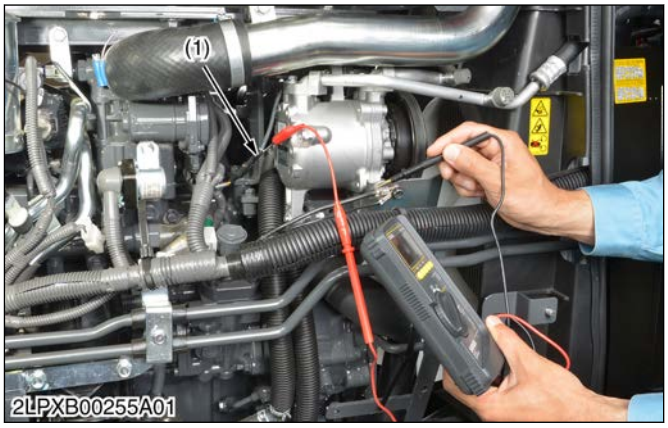
1. Turn off the A/C switch after starting the engine.
2. Check whether abrasion or abnormal noise is heard when only the magnetic clutch pulley is operating.
3. Check that the magnetic clutch (1) does not slip when the A/C switch and blower switch are turned **ON** (when the air conditioner is in operation).


(1) Magnetic clutch

4. If anything abnormal is found, repair or replace.

#### 6.1.1.2 Checking stator coil resistance

1. Measure the resistance of the stator coil with an ohmmeter across the 1P connector (1) of magnetic clutch and compressor body.




(1) 1P connector

| | | |
|---|---|---|
| Stator coil resistance | Factory specification | 3.0 to 4.0 Ω |

2. If the measured value is not within the factory specification, replace the compressor assembly.

### 6.1.1.3 Checking air gap


1. Check the air gap with feeler gauge.

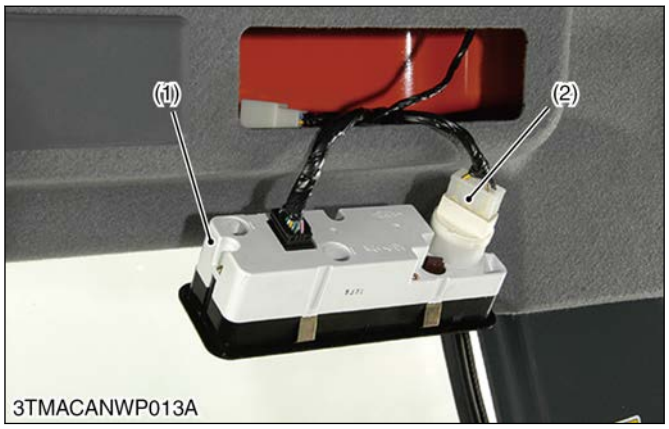
| | | |
|---|---|---|
| Air gap | Factory specification | 0.30 to 0.65 mm<br>0.012 to 0.025 in. |

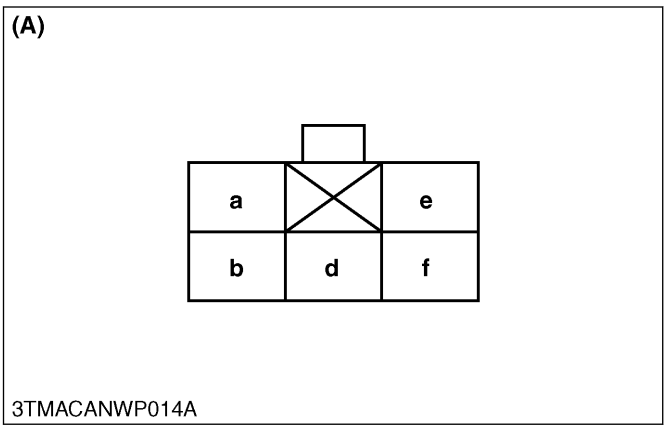
2. If the measured value is not within the factory specification, adjust it.

RELATED PAGE
6.3.1 Adjusting air gap on page 11-83

## 6.1.2 Control panel (Blower switch, A/C switch, mode control dial, temperature control dial and recirculation / fresh air selection switch)

### 6.1.2.1 Checking blower switch connector voltage



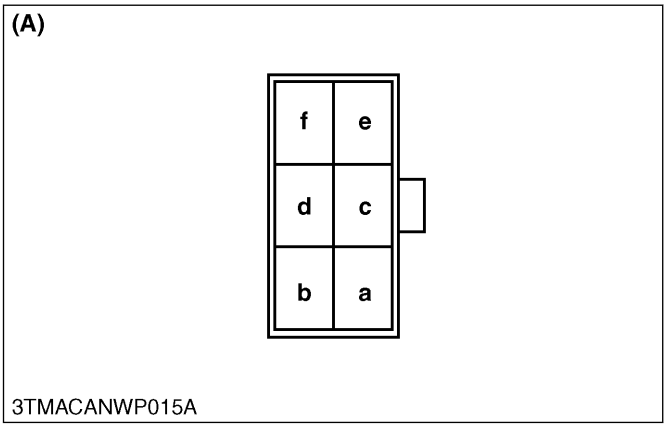

(1) Control panel
(2) 6P connector
(A) 6P connector (Wire harness side)
a, b, d, e, and f Terminal

1. Disconnect the 6P connector (2) from blower switch.
2. Turn the main switch to **ON** position.
3. Measure the voltage with a voltmeter across the connector terminal a and the connector terminal b.

| | | |
|---|---|---|
| Voltage | Terminal a — Terminal b | Approximately battery voltage |

4. If the measured voltage differs from the battery voltage, the relating wiring harness is damaged.

### 6.1.2.2 Checking blower switch




(A) 6P connector (Blower switch side)
a to f Terminal

1. Check the continuity through the terminals of the blower switch connector with an ohmmeter.

| Position | | Terminal | | | | | |
|---|---|---|---|---|---|---|---|
| | | a | b | c | d | e | f |
| A/C blower switch | OFF | | | | | | |
| | ● (Low) | ● | ● | ● | | | |
| | ● (Midium Low) | ● | ● | | | ● | |
| | ● (Midium High) | ● | ● | | | | ● |
| | ● (High) | ● | ● | | ● | | |

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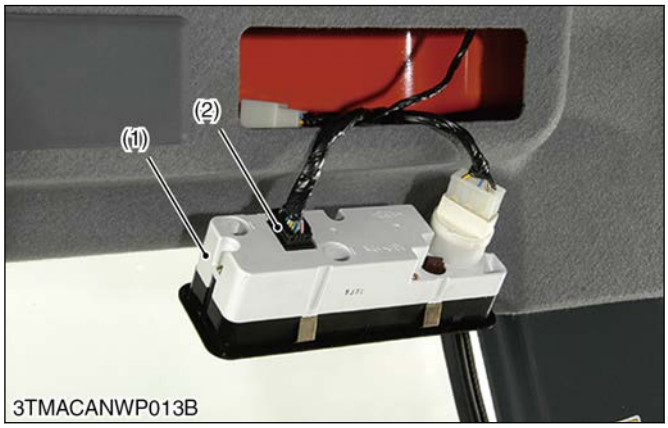
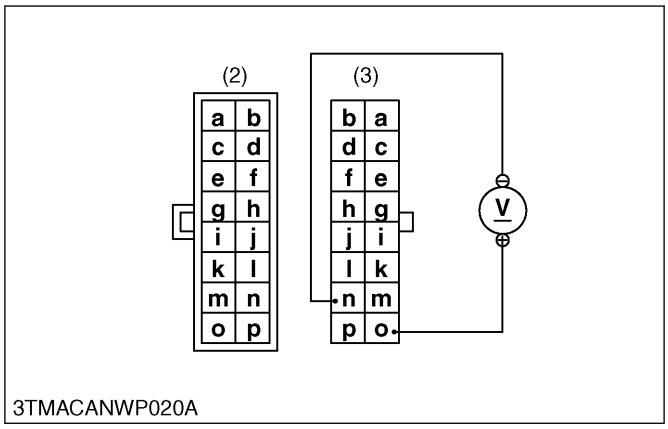
2. If the specified continuity value are not indicated, the blower switch is damaged.

## 6.1.2.3 Checking 16P connector voltage



3TMACANWP013B



3TMACANWP020A

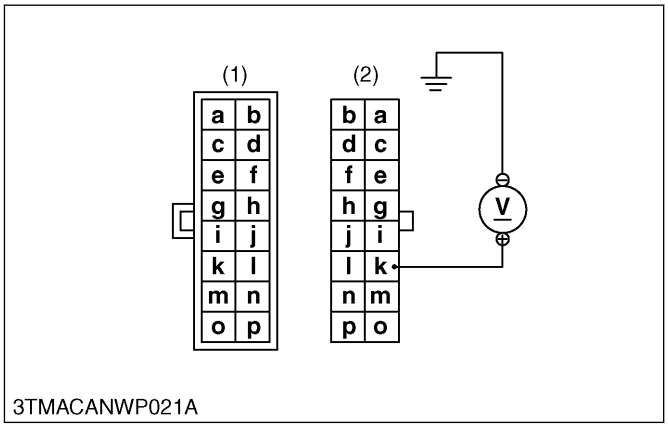
(1) Control panel
(2) 16P connector (Switch side)
(3) 16P connector (Wire harness side)
a to p: Terminal

1. Disconnect the 16P connector (2) from the control panel switch.
2. Turn the main switch to **ON** position.
3. Measure the voltage with a voltmeter across the terminal o and the terminal n.

| | | |
|---|---|---|
| Voltage | Terminal n — Terminal o | Approximately battery voltage |

4. If the measured voltage differs from the battery voltage, the relating wiring harness is damaged.

## 6.1.2.4 Checking A/C switch



3TMACANWP021A

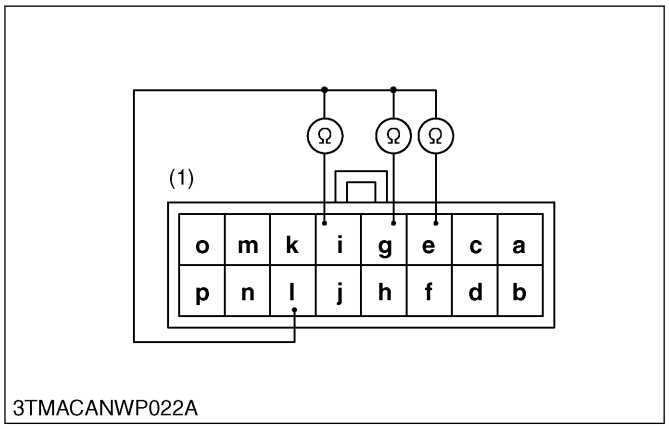
(1) 16P connector (Switch side)
(2) 16P connector (Wire harness side)
a to p: Terminal

1. Measure the voltage with a voltmeter across the terminal k and chassis.
2. Turn the main switch to **ON** position.
3. Turn the blower switch to **ON** position.
4. Measure a voltage using a circuit tester.
   a. Push the air conditioner switch to set it to **OFF** position (indicator: OFF), and then measure a voltage using a circuit tester.
   b. Push the air conditioner switch to set it at **ON** position (indicator: ON), and then measure a voltage using a circuit tester.

| | | | |
|---|---|---|---|
| Voltage | Terminal k — Chassis | A/C switch at **ON** | Approximately battery voltage |
| | | A/C switch at **OFF** | Approximately 1 V |

5. If the measured voltage does not comply with the values in the table, the control panel, wiring harness or fuse is damaged.

## 6.1.2.5 Checking mode switch




(1) 16P connector (Mode switch side)
a to p Terminal

1. Disconnect the 16P connector from control panel switch.
2. Check the continuity through the terminals of the 16P connector (1) shown in the following table with an ohmmeter.

| Position | | Terminal | | | |
|---|---|---|---|---|---|
| | | e | g | i | l |
| Mode switch | FRONT | ● | | | ● |
| | FULL | | ● | | ● |
| | DEF | | | ● | ● |

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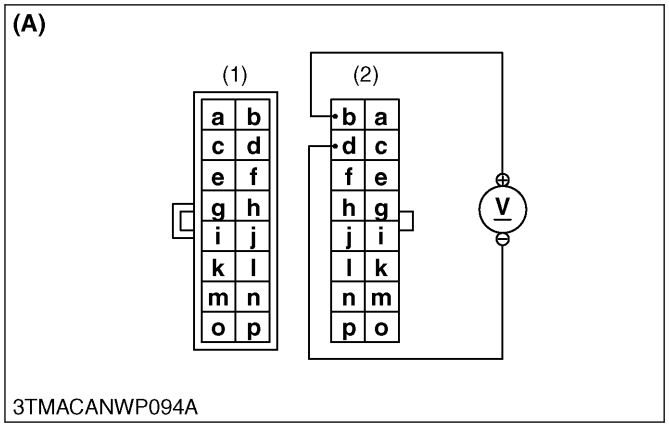
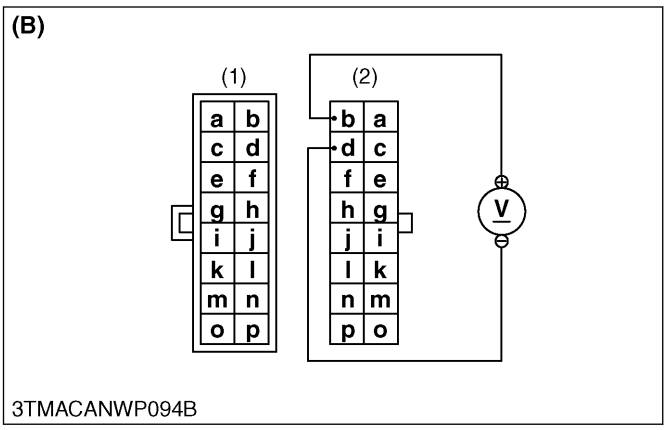
3. If the continuity is not indicated, the mode switch is damaged.

## 6.1.2.6 Checking temperature control dial

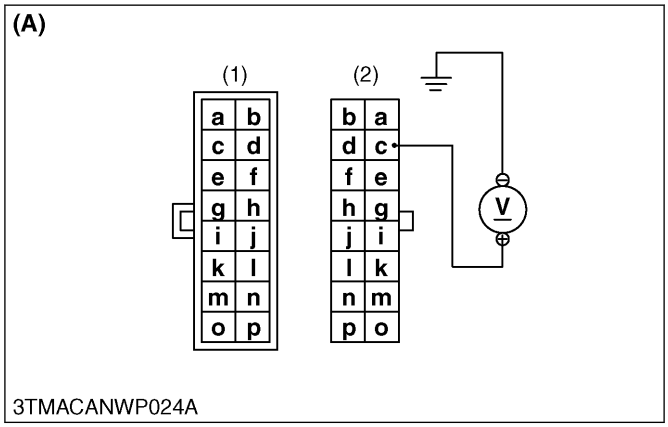


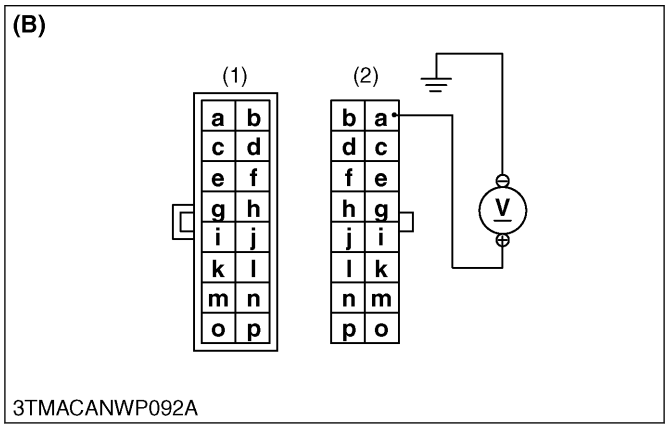




(1) 16P connector (Switch side)
(2) 16P connector (Wire harness side)
(A) **COOL** position to **WARM** position
(B) **WARM** position to **COOL** position
a to p Terminal

1. Turn the temperature control dial counterclockwise until it stops (at **COOL** position).
2. Measure the voltage with a voltmeter across the terminal b and terminal d. Make the following measurement with the terminals connected.
3. Turn the main switch to **ON** position.
4. Check that an output voltage is approximately 10 V when turning the temperature control dial clockwise until it stops (**WARM** position).
5. If the output voltage differs from approximately 10 V, the control panel, wiring harness or fuse is damaged.
6. Turn the main switch back to **OFF** position.
7. Turn the temperature control dial clockwise till it stops (**WARM** position).
8. Measure the voltage with a voltmeter across the terminal d and terminal b. Make the following measurement with the terminals connected.
9. Turn the main switch to **ON** position.
10. Check that an output voltage is approximately 10 V, when turning the temperature control dial counterclockwise until it stops (**COOL** position).
11. If the output voltage differs from approximately 10 V, the control panel, wiring harness or fuse is damaged.

## 6.1.2.7 Checking recirculation / fresh air selection switch




(1) 16P connector (Switch side)
(2) 16P connector (Wire harness side)
(A) Fresh air (Indicator: OFF)
(B) Recirculation (Indicator: ON) a to Terminal p

1. Measure the voltage with a voltmeter across the terminal c and chassis. Make the following measurement on the terminals connected.
2. Turn the main switch to **ON** position.
3. Push the recirculation/fresh air selection switch to set it at fresh air position (indicator: **OFF**), and then measure a voltage using a circuit tester.

| | | | |
|---|---|---|---|
| Voltage | Terminal c – Chassis | Recirculation / fresh air selection switch at "Fresh Air" (indicator: **OFF**) | Approximately battery voltage |

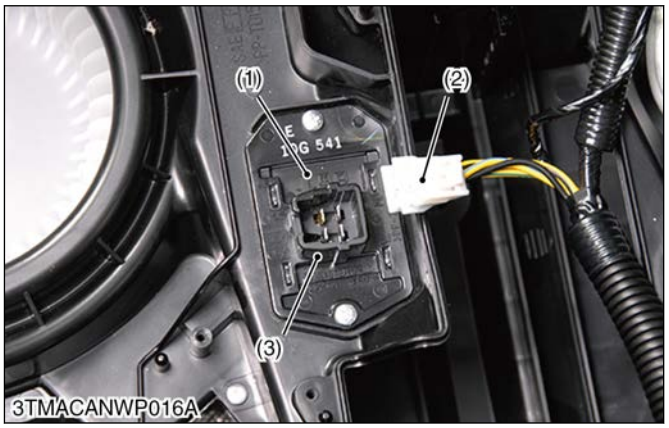
4. If a measured voltage does not comply with the values in the table, the control panel, wiring harness or fuse is damaged.
5. Turn the main switch back to **OFF** position.
6. Measure the voltage with a voltmeter across the terminal a and chassis. Make the following measurement on the terminals connected.
7. Turn the main switch to **ON** position.
8. Push the recirculation / fresh air selection switch to set it at recirculation position (indicator: **ON**), and then measure a voltage using a circuit tester.

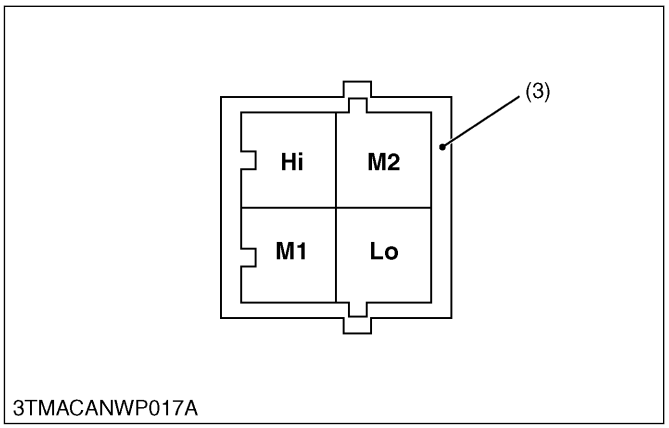
| | | | |
|---|---|---|---|
| Voltage | Terminal a – Chassis | Recirculation / fresh air selection switch at "Recirculation" (indicator: **ON**) | Approximately battery voltage |

9. If the measured voltage does not comply with the values in the table, the control panel, wiring harness or fuse is damaged.

## 6.1.3 Blower resistor

## 6.1.3.1 Checking blower resistor




(1) Blower resistor
(2) 4P connector (Wire harness side)
(3) 4P connector (Blower resistor side)
Hi, Lo, M1 and M2 Terminal

1. Disconnect the 4P connector (2) from the blower resistor (1).

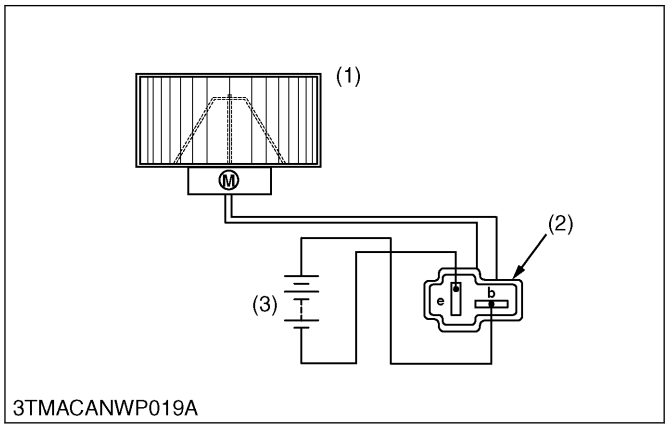
2. Measure the resistance on the terminals shown in the table.

| | | | |
|---|---|---|---|
| Resistance | Factory specification | Terminal Hi – Terminal M2 | Approximately 0.22 Ω |
| | | Terminal Hi – Terminal M1 | Approximately 0.69 Ω |
| | | Terminal Hi – Terminal Lo | Approximately 1.69 Ω |

3. If the resistance shown in the table is not indicated, replace the blower resistor.

## 6.1.4 Blower motor

### 6.1.4.1 Checking blower motor

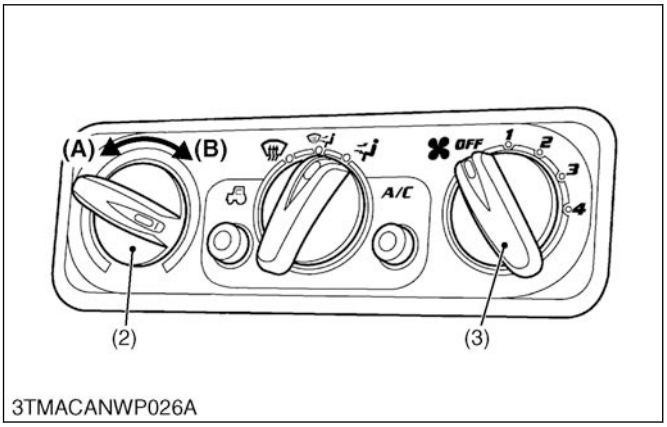




(1) Blower motor
(2) 2P connector (Blower motor side)
(3) Battery (12 V)
b: Terminal b
e: Terminal e

1. Turn the blower motor (1) by hand and check whether it turns smoothly.
2. Disconnect the 2P connector (2) of the blower motor (1) from the wire harness.
3. Connect a jumper lead to the battery positive terminal and the connector terminal b.
4. Connect a jumper lead to the battery negative terminal and the connector terminal e momentarily.
5. If the blower motor does not operate, check the motor.

## 6.1.5 Temperature motor

### 6.1.5.1 Checking temperature motor

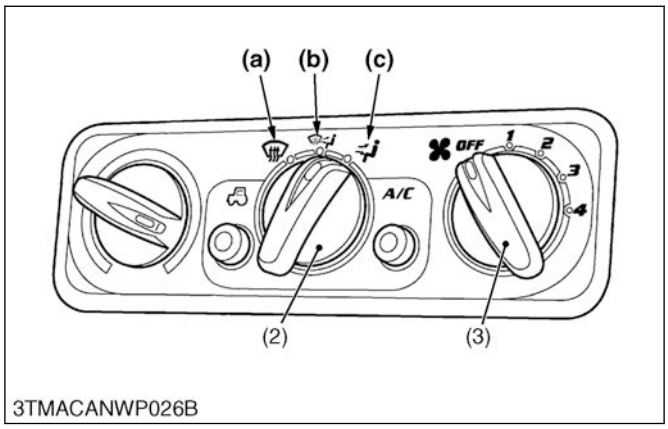

(1) Temperature motor
(2) Temperature control dial
(3) Blower switch
(A) COOL
(B) WARM

1. Make sure whether the temperature control dial (2) is damaged.
2. Turn the main switch to **ON** position.
3. Turn the blower switch (3) at **1** position.
4. Turn the temperature control dial from **COOL** position (A) to **WARM** position (B). At the time, make sure the temperature motor is operating.
5. If the temperature motor (1) does not operate, replace it.

RELATED PAGE
6.1.2.6 Checking temperature control dial on page 11-36

## 6.1.6 Mode motor

### 6.1.6.1 Checking mode motor




(2) Mode switch
(3) Blower switch
(a) Air is blown from only the defroster air outlet.
(b) Air is blown from the dashboard and defroster air outlets.
(c) Air is blown from only the dashboard air outlets.

1. Make sure whether the mode switch (2) is damaged.
2. Turn the main switch to **ON** position.
3. Turn the blower switch to **1** position.
4. Turn the mode switch to the air outlet (a), (b) and (c).
5. Make sure whether the air is blown properly from the air outlets (a),(b) and (c).

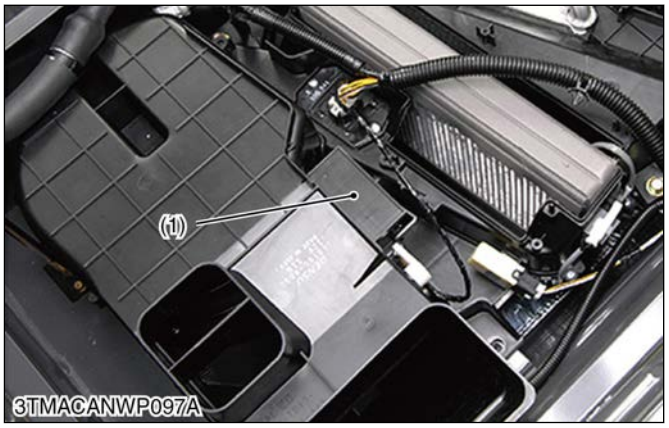

(1) Mode motor

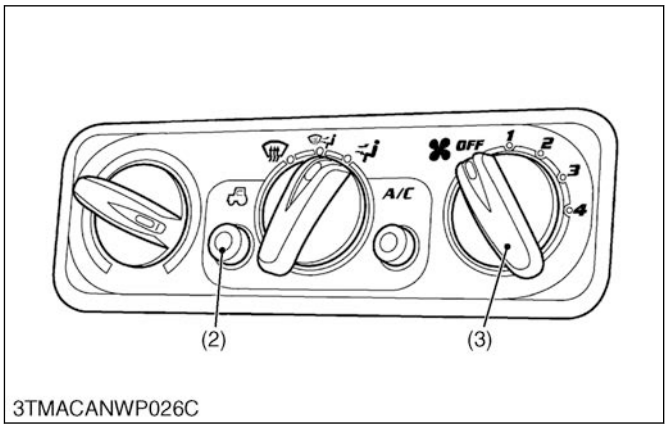
6. If the mode motor does not operate, replace it.

RELATED PAGE
6.1.2.5 Checking mode switch on page 11-36

## 6.1.7 Recirculation / fresh air motor

### 6.1.7.1 Checking recirculation/fresh air motor




(1) Recirculation/fresh air motor
(2) Recirculation/fresh air selection switch
(3) Blower switch

1. Make sure whether the recirculation/fresh air selection switch (2) is damaged.
2. Turn the main switch to **ON** position.
3. Turn the blower switch at **1** position.
4. Push the recirculation/fresh air selection switch to "Recirculation" position.
5. If the motor does not move, replace it.

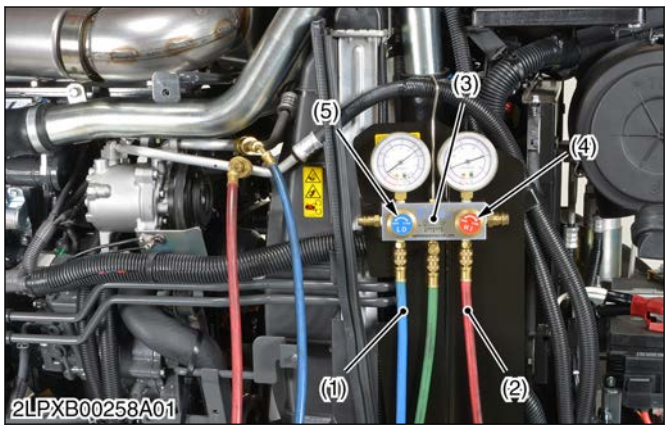
RELATED PAGE
6.1.2.4 Checking A/C switch on page 11-35

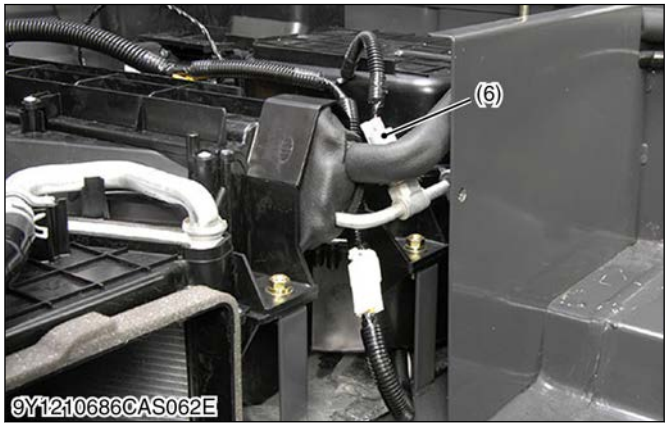
## 6.1.8 Pressure switch

### 6.1.8.1 Checking pressure switch (Hi pressure side)

**NOTE**

- **Be sure to drive out the air in the charging hoses at the manifold gauge connection end by using the refrigerant pressure in the refrigerant cycle.**




(1) Charging hose (blue)
(2) Charging hose (red)
(3) Manifold gauge
(4) "**HI**" pressure side valve
(5) "**LO**" pressure side valve
(6) 2P connector

**"HI" pressure side**

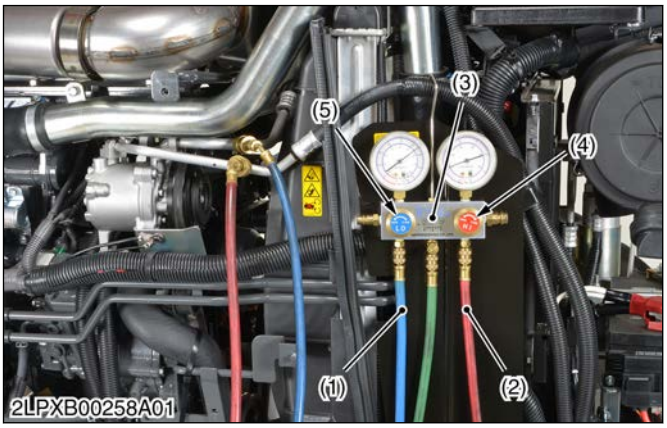
1. Connect the manifold gauge (3) to compressor as following procedure.
   a. Close the "**HI**" and "**LO**" pressure side valves (4), (5) of manifold gauge tightly.
   b. Connect the charging hoses (2), (1) (red and blue) to the respective compressor service valves.
2. Start the engine and set at approximately 1500 $min^{-1}$ (rpm). Turn on the A/C switch, then set the blower switch to HI position.
3. Raise pressure on the "**HI**" pressure side of the refrigerant cycle by covering the condenser front with a corrugated cardboard, and the pressure switch is activated and the compressor magnetic clutch is turned off. At this time, read the "**HI**" pressure gauge of the manifold gauge.

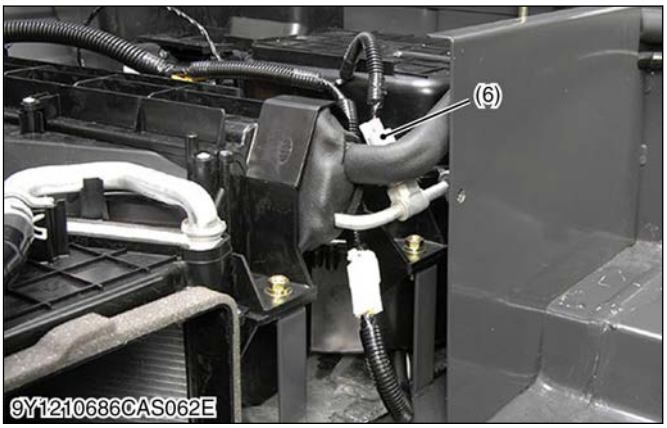
| | | | |
|---|---|---|---|
| Setting pressure | Factory specification | Pressure switch OFF | More than approximately 3.1 MPa 32 kgf/$cm^2$ 460 psi |

4. If the read pressure differs largely from the setting pressure, replace the pressure switch with a new one.

RELATED PAGE
4.1 Manifold gauge set on page 11-20

## 6.1.8.2 Checking pressure switch (Lo pressure side)




(1) Charging hose (blue)
(2) Charging hose (red)
(3) Manifold gauge
(4) "**HI**" (High pressure side) charging valve
(5) "**LO**" (Low pressure side) charging valve
(6) 2P connector

**LO pressure side**

1. Disconnect 2P connector (6) of pressure switch.
2. Measure the resistance with an ohmmeter across the connector terminals.

**(Reference)**

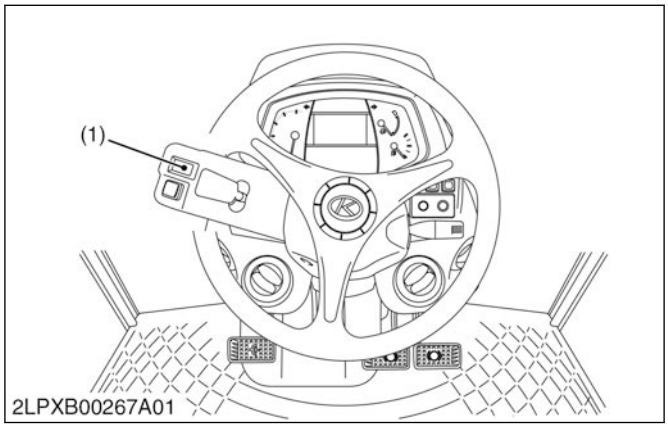
| | | | |
|---|---|---|---|
| Setting pressure | Factory specification | Pressure switch **OFF** | Less than approximately 0.20 MPa 2.0 kgf/$cm^2$ 28 psi |

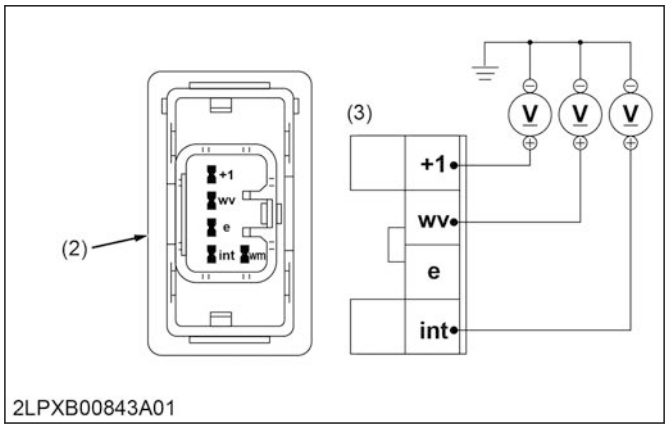
- The resistance of pressure switch is 0 ohm in normal condition, but it becomes infinity if the pressure is out of factory specification. Because the pressure switch starts to work.

3. If 0 ohm is not indicated in normal condition, there is no refrigerant in the refrigerating cycle because gas leaks or pressure switch is damaged.

## 6.1.9 Front wiper switch

### 6.1.9.1 Checking front wiper switch connector voltage



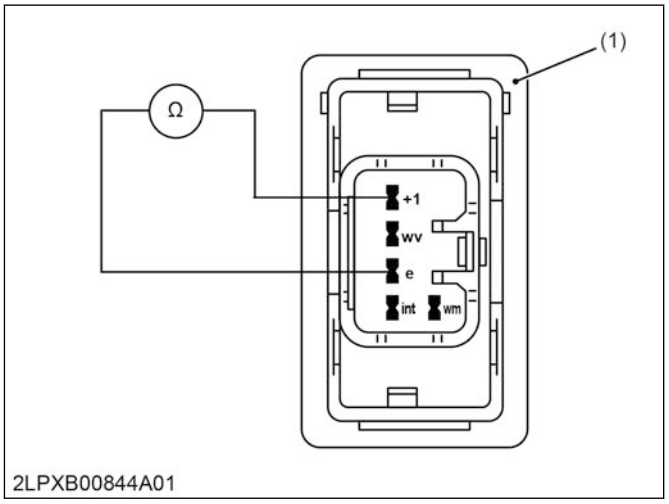

(1) Front wiper switch
(2) 6P connector (Switch side)
(3) 6P connector (Wire harness side)

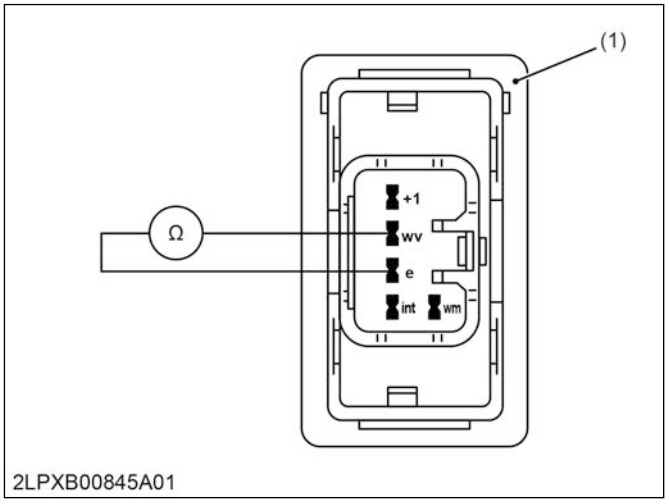
1. Disconnect the 6P connector from front wiper switch (1).
2. Turn the main switch to **ON** position.
3. Measure the voltage with a voltmeter across the connector terminal +1/wv/int at the wiring harness side and the chassis.

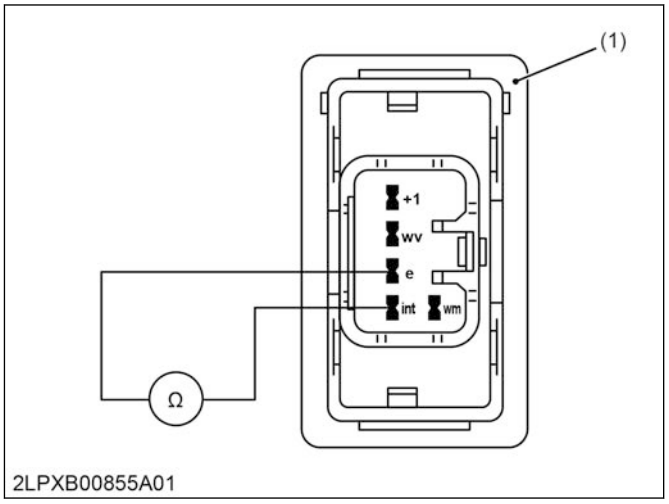
| | | |
|---|---|---|
| Voltage | Terminal +1/wv/int – Chassis | Approximately battery voltage |

4. If the measured voltage differs from the battery voltage, the wiring harness, fuse or main switch is damaged.

### 6.1.9.2 Checking front wiper switch




(1) 6P connector (Switch side)

1. Check the continuity on the terminals shown in the table with an ohmmeter.

| Position | | Terminal | | | | |
|---|---|---|---|---|---|---|
| | | int | +1 | e | wv | wm |
| Front wiper switch | WASH I | | ● | ● | ● | ● |
| | ON | | ● | ● | | |
| | OFF | | | | | |
| | INT | ● | | ● | | |
| | WASH II | ● | | ● | ● | ● |

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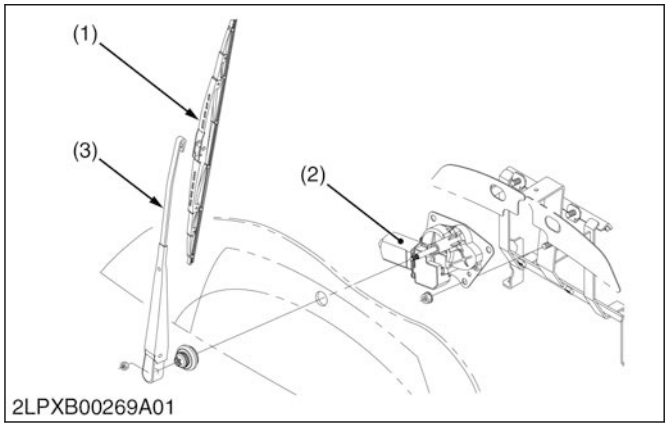
2. If the specified continuity is not indicated, the switch is damaged.

## 6.1.10 Front wiper motor

### 6.1.10.1 Checking front wiper motor




(1) Wiper blade
(2) Wiper motor
(3) Wiper arm

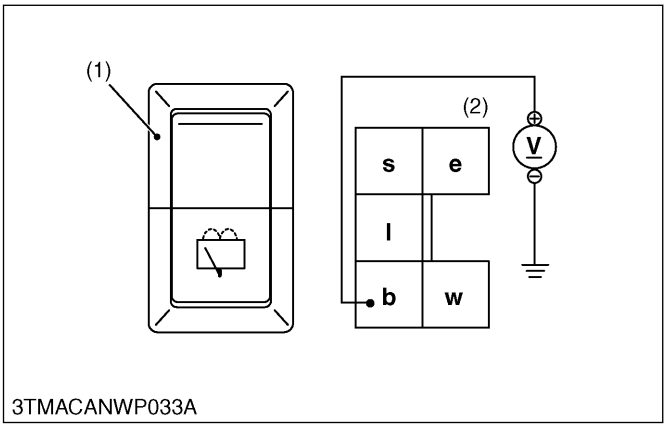
1. Raise up the front wiper arm (3).
2. Turn the main switch to **ON** position.
3. Push the front wiper switch to **ON** position.
4. Count the number of wiper arm rocking per minute.

| | | |
|---|---|---|
| Number of wiper arm swing frequency at no load | Factory specification | 25 to 43 times/minute |

5. If the counted numbers differ from the factory specification, replace the wiper motor assembly.

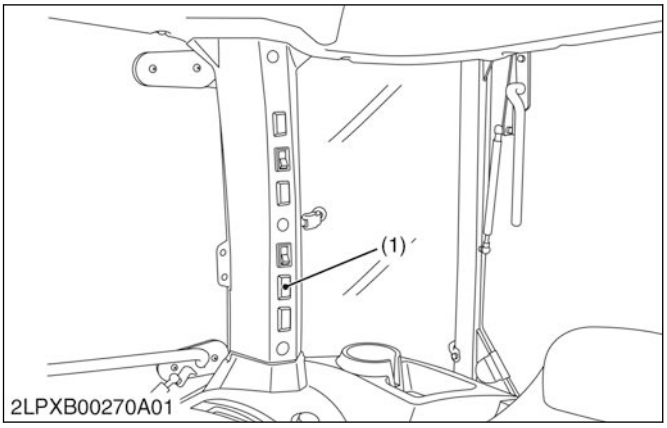
## 6.1.11 Rear wiper switch (If equipped)

### 6.1.11.1 Checking rear wiper switch connector voltage(if equipped)




(1) Rear wiper switch
(2) 5P connector (Wire harness side)
b, e, Terminal l, s and w

1. Disconnect the 5P connector from the rear wiper switch (1).



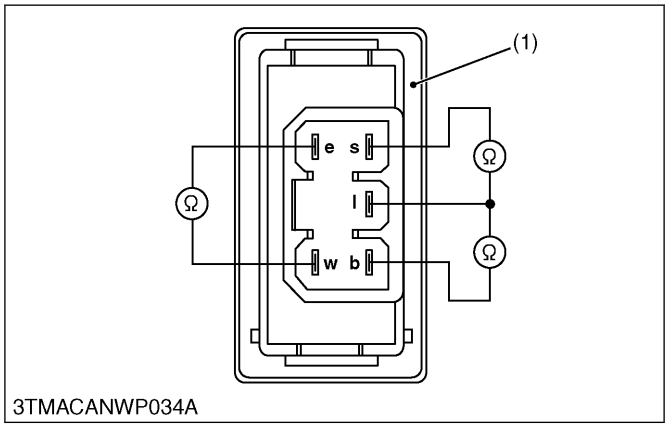

(1) Rear wiper switch

2. Turn the main switch to **ON** position.
3. Measure the voltage with a voltmeter across the connector terminal b of the wiring harness side and chassis.

| | | |
|---|---|---|
| Voltage | Terminal b – Chassis | Approximately battery voltage |

4. If the measured voltage differs from the battery voltage, the wiring harness, fuse or main switch is damaged.

### 6.1.11.2 Checking rear wiper switch (if equipped)




(1) 5P connector (Switch side) b, e, l, s and w Terminal

1. Check the continuity on the terminals as shown in the figure with an ohmmeter.

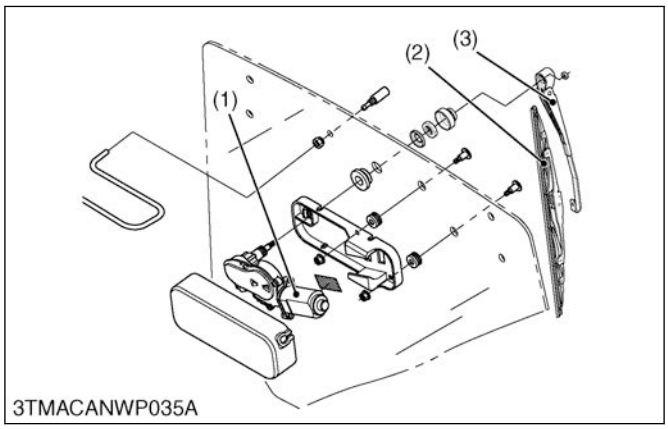
| Position | | Terminal | | | | |
|---|---|---|---|---|---|---|
| | | e | w | b | l | s |
| Rear wiper switch | WASH I | ● | ● | | ● | ● |
| | ON | | | ● | ● | |
| | OFF | | | | ● | ● |
| | WASH II | ● | ● | ● | ● | |

2LPXB00572A01

2. If the specified continuity is not indicated, the switch is damaged.

### 6.1.12 Rear wiper motor (If equipped)

### 6.1.12.1 Checking rear wiper motor (if equipped)




(1) Rear wiper motor
(2) Wiper blade
(3) Wiper arm

1. Raise up the wiper arm (3).
2. Turn the main switch to **ON** position.
3. Push the rear wiper switch to **ON** position.
4. Count the number of wiper arm rocking per minute.

| | | |
|---|---|---|
| Number of wiper arm swing frequency at no load | Factory specification | 25 to 43 times/minute |

5. If the counted numbers differ from the factory specification, replace the rear wiper motor assembly.

## 6.2 Disassembling and assembling

### 6.2.1 Separating cabin from tractor

### 6.2.1.1 Draining coolant

**⚠ WARNING**

**To avoid personal injury:**

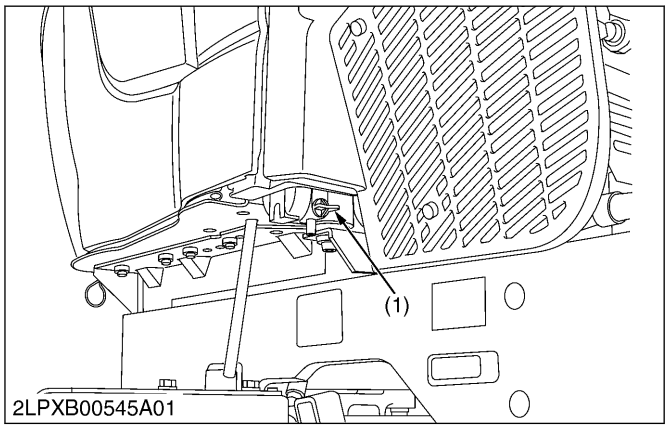
- **Do not remove radiator cap while coolant is hot. When cool, slowly rotate cap to the first stop and allow sufficient time for excess pressure to escape before removing the cap completely.**

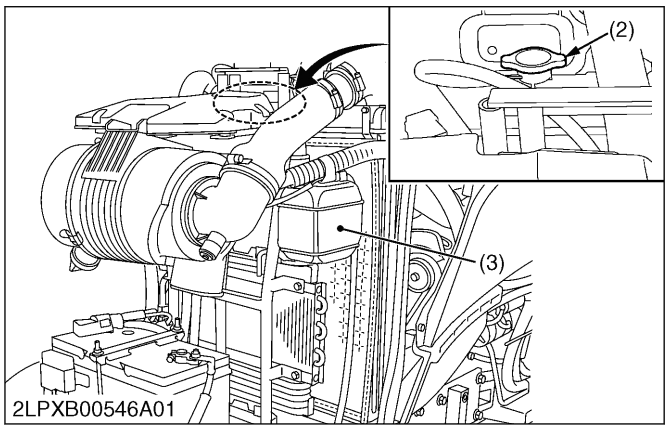
**■ IMPORTANT**

- **Do not start engine without coolant.**
- **Use clean, fresh soft water and anti-freeze to fill the radiator and recovery tank.**
- **When mixing the anti-freeze with water, the anti-freeze mixing ratio is 50%.**
- **Tighten radiator cap securely. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**

1. Stop the engine and let the engine cool down.

2. To drain the coolant, open the radiator drain plug (1), remove the drain plug and remove radiator cap (2). The radiator cap must be removed to completely drain the coolant.




(1) Drain plug
(2) Radiator cap
(3) Recovery tank

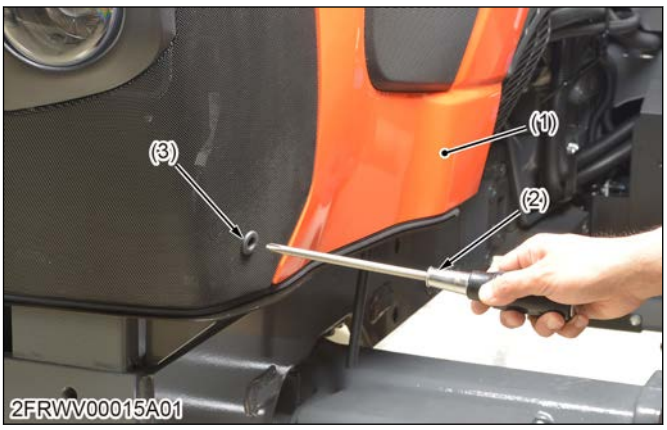
3. After all coolant is drained, reinstall the drain plug (1).
4. Fill with coolant up to the "**FULL**" mark of recovery tank (3).

| | |
|---|---|
| Coolant capacity | 10 L<br>10.6 U.S.qts<br>8.8 Imp.qts |

5. Start and operate the engine for a few minutes.
6. Stop the engine, remove the key and let cool.
7. Check coolant level of recovery tank (3) and add coolant if necessary.
8. Properly dispose of used coolant.

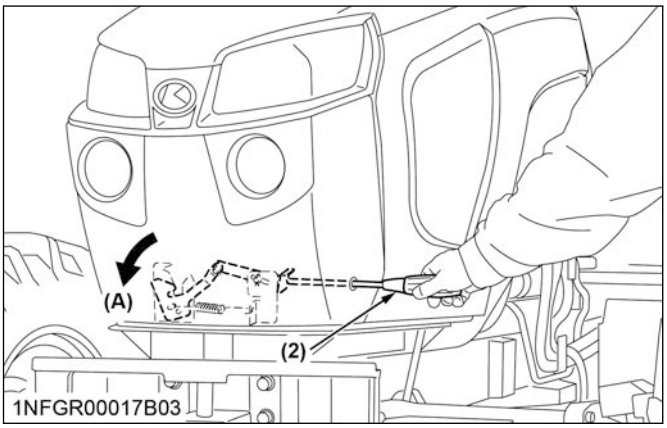
## 6.2.1.2 Opening bonnet

1. To open the bonnet (1), use a tool such as a screwdriver (2).




(1) Bonnet
(2) Screwdriver
(3) Hole

2. Insert the tool (2) into the hole (3) at the front of the bonnet (1).
3. Press the tool (2) to unlock the bonnet latch.
4. Pull the tool (2) and open the bonnet (1).




(2) Screwdriver
(A) Unlock position

## 6.2.1.3 Removing bonnet and cover

**IMPORTANT**

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

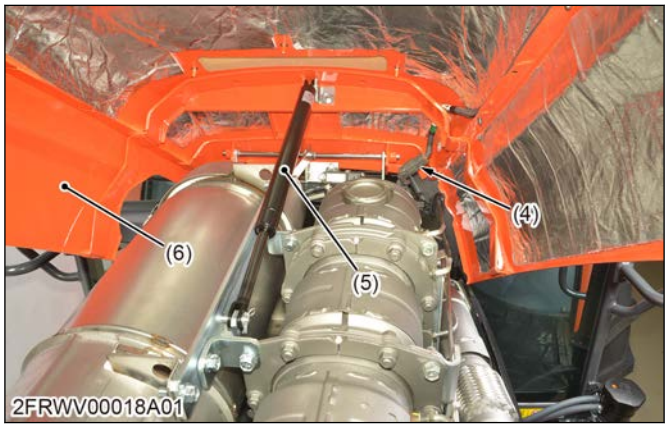
1. Remove the side bonnets (2) and the side covers (1) on both sides.


(1) Side cover
(2) Side bonnet

2. Disconnect the negative cable (3) from the battery negative terminal .


(3) Negative cable

3. Disconnect the head light connector (4).
4. Remove the bonnet damper (5).
5. Remove the bonnet (6).

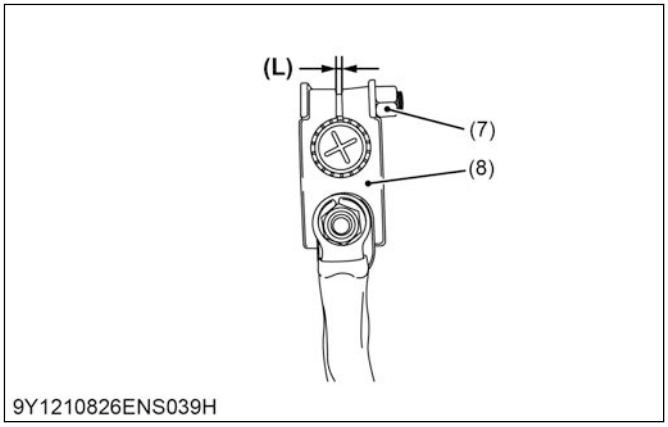



(4) Head light connector
(5) Bonnet damper
(6) Bonnet

**(When reassembling)**

**■ IMPORTANT**

- **Tighten the battery cable terminal nut (7) so that the clearance (L) is within the following chart.**




(7) Terminal nut
(8) Battery cable terminal
(L) Clearance between the battery cable terminal

- When assembling the bonnet damper (5), be sure that the cylinder parts should be on the backward.

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

## 6.2.1.4 Removing muffler pipe

**⚠ CAUTION**

- **After operating the engine, muffler pipe is very hot. When removing the muffler pipe, wait a moment for cool down.**

1. Loosen the muffler pipe clamp (1).
2. Remove the muffler pipe mounting bolts (3).
3. Remove the muffler pipe (4).
4. Remove the muffler pipe stay (2).


(1) Muffler pipe clamp
(2) Muffler pipe stay
(3) Muffler pipe mounting bolt
(4) Muffler pipe

**(When reassembling)**

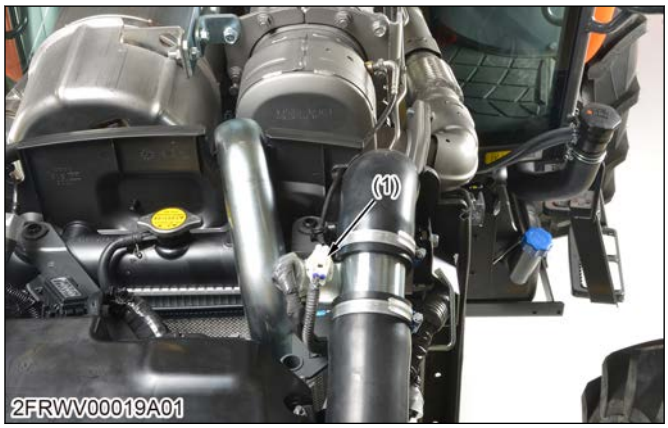
- Firstly, tighten all bolts around muffler pipe (4).
- Be sure to tighten the muffler pipe mounting bolts (3) at first, and then tighten the muffler pipe stay (2) mounting bolts.
- Lastly, tighten the muffler pipe clamp (1).

## 6.2.1.5 Disconnecting wiring harness for DPF muffler and SCR muffler

**⚠ CAUTION**

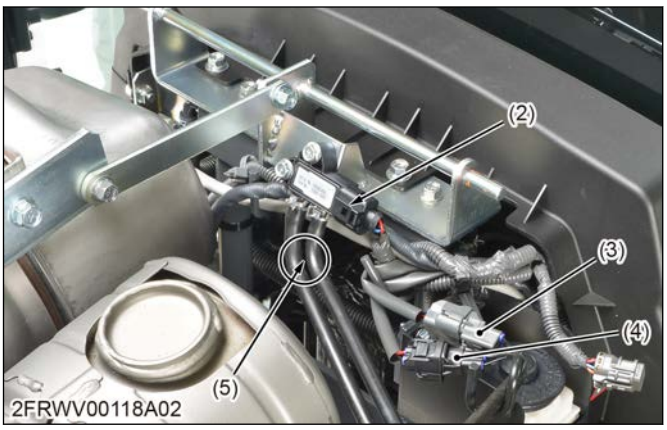
- **After operating the engine, muffler is very hot. When disconnecting the connectors, wait a moment for cool down.**

1. Disconnect the exhaust temperature sensor (T2) connector (1).



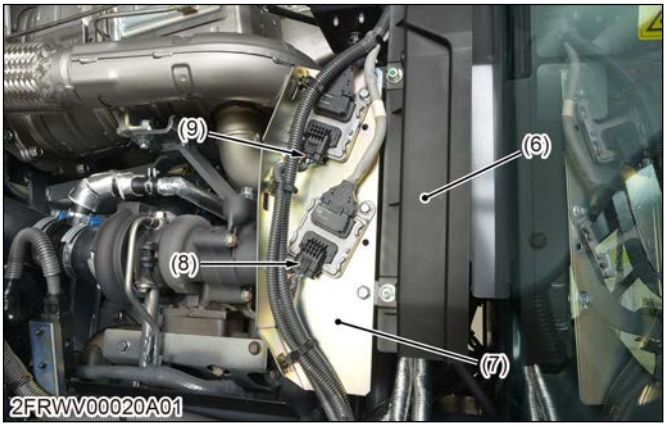

(1) Exhaust temperature sensor connector (T2)

2. Disconnect the exhaust temperature sensor (T0) connector (4) and (T1) connector (3).
3. Disconnect the differential pressure sensor connector (2).
4. Remove the differential pressure sensor hoses (5).




(2) Differential pressure sensor connector
(3) Exhaust temperature sensor (T1) connector
(4) Exhaust temperature sensor (T0) connector
(5) Differential pressure sensor hose

5. Remove the cover (L.H.) (6).
6. Disconnect the pre NOx sensor connector (8) and post NOx sensor connector (9).
7. Remove the NOx sensor mounting stay (7).

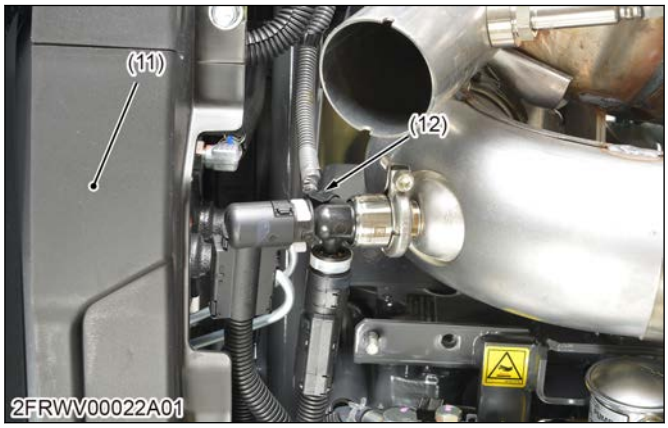



(6) Cover (L.H.)
(7) NOx sensor mounting stay
(8) Pre NOx sensor connector
(9) Post NOx sensor connector

8. Disconnect the SCR temperature sensor connector (10).

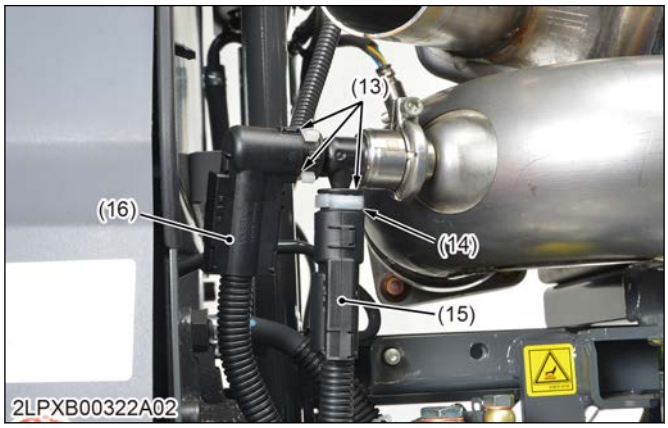

(10) SCR temperature sensor connector

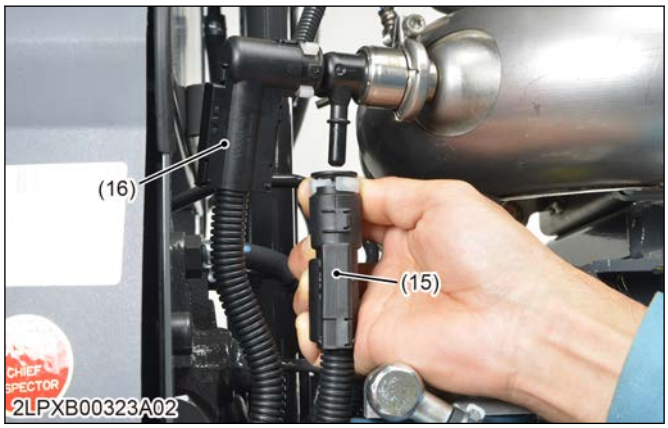
9. Remove the cover (R.H.) (11).
10. Disconnect the DEF injector connector (12).




(11) Cover (R.H.) (12) DEF injector connector

11. Pinch the tabs (13) of white clamp (14) and pull out the DEF delivery hose (15).
12. Pinch the tabs (13) of white clamp (14) and pull out the DEF return hose (16).




(13) Tab (16) DEF return hose
(14) White clamp
(15) DEF delivery hose

**(When reassembling)**

- Parts number of each DPF exhaust gas temperature sensor connector is different. Be sure to connect with same color of connector.
- – T0: Black
  – T1: Gray
  – T2: White
- Each SCR NOx sensor harness color is different.
  – Pre NOx sensor muffler: Black
  – Post NOx sensor: Gray

## 6.2.1.6 Removing DPF and SCR muffler

**CAUTION**

- **After operating the engine, muffler is very hot. When removing the DPF and SCR muffler, wait a moment for cool down.**

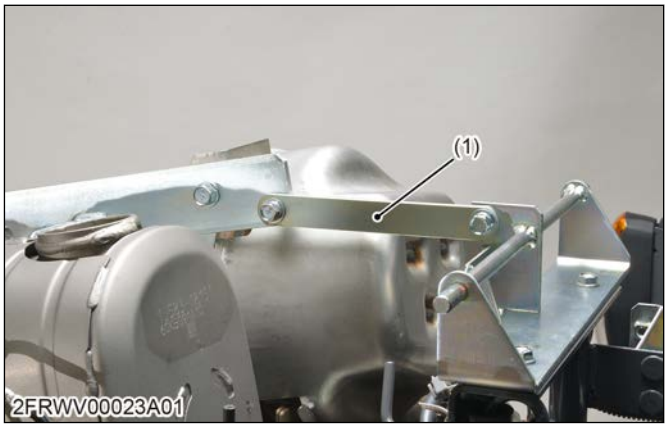
**IMPORTANT**

- **Since muffler assembly is heavy, use the hoist for safety.**

| | |
|---|---|
| DPF and SCR muffler assembly weight | About 66 kg<br>About 150 lbs |

- **Be attention for each sensor when assembling and removing. Each sensor is easy to corrupt by shock.**

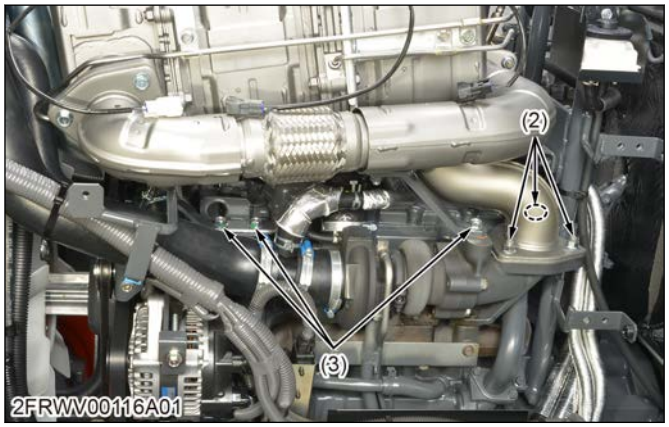
1. Prepare the hoist for removing.
2. Remove the support stay (1).




(1) Support stay

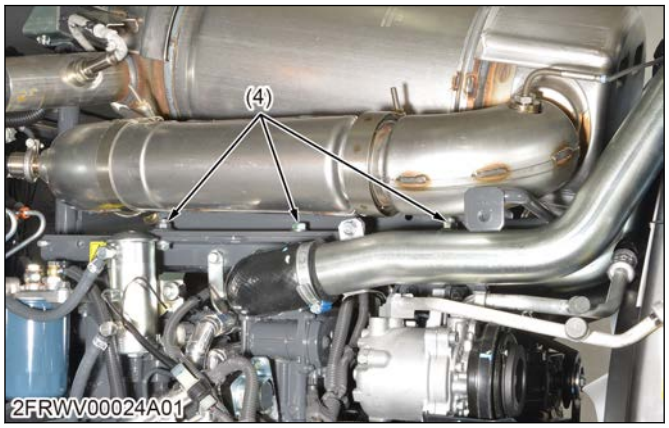
3. Remove the DPF muffler mounting nuts (2).

4. Remove the DPF muffler bracket mounting bolts (3).



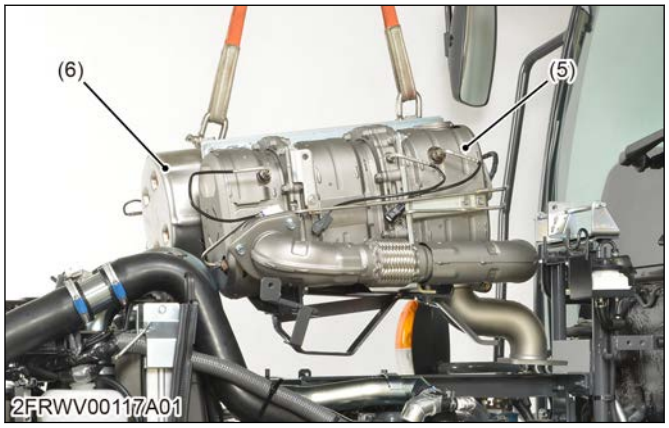

(2) DPF muffler mounting nut (3) DPF muffler bracket mounting bolt

5. Remove the SCR muffler bracket mounting bolts and nut (4).




(4) SCR muffler bracket mounting bolt and nut

6. Support the DPF muffler (5) and SCR muffler (6) assemblies with nylon sling and hoist.
7. Remove the DPF muffler (5) and SCR muffler (6) assemblies.




(5) DPF muffler (6) SCR muffler

**(When reassembling)**

- Firstly, pre-tighten all bolts and nuts around the DPF and SCR muffler assembly.
- Lastly, tighten the DPF muffler mounting nut, the DPF muffler bracket mounting bolt and the SCR muffler bracket mounting bolt and nut to the specified tightening torque.

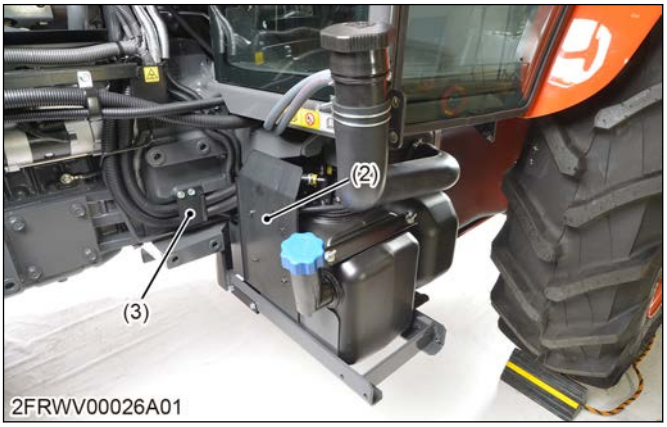
| | | |
|---|---|---|
| Tightening torque | DPF muffler mounting nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | DPF muffler bracket mounting bolt | 60.8 to 70.6 N·m<br>6.20 to 7.19 kgf·m<br>44.9 to 52.0 lbf·ft |
| | SCR muffler bracket mounting bolt and nut | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |

## 6.2.1.7 Removing DEF tank

1. Remove the auxiliary step (1).

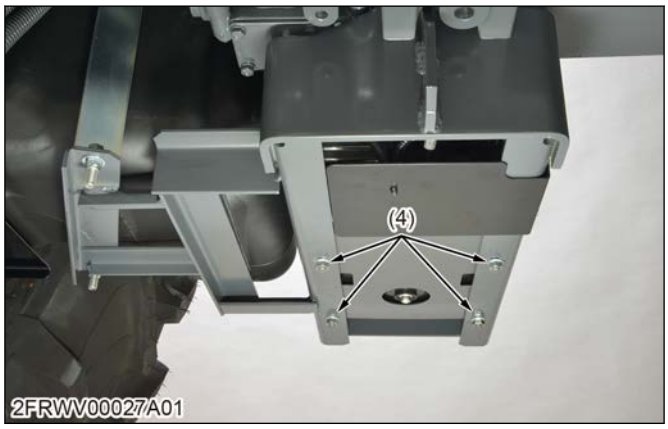

(1) Auxiliary step

2. Remove the DEF tank protection plate (2).
3. Remove the hose clamp (3).



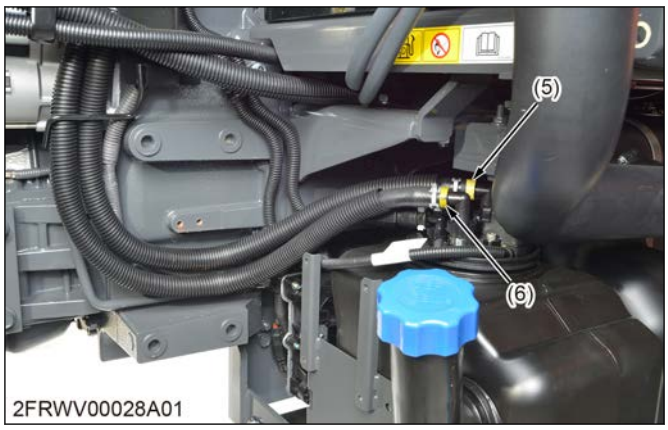

(2) DEF tank protection plate (3) Hose clamp

4. Remove the DEF tank mounting nuts (4).




(4) DEF tank mounting nut

5. Disconnect the coolant return hose (6) and coolant hose (5).




(5) Coolant hose
(6) Coolant return hose

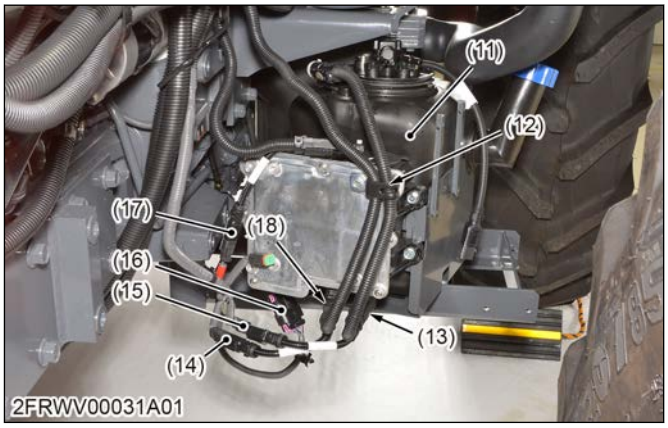
6. Disconnect the DEF suction hose (8) and DEF return hose (7).
7. Disconnect the DEF tank header unit connector (9).


(7) DEF return hose
(8) DEF suction hose
(9) DEF tank header unit connector

8. Disconnect the DEF tank breather hose (10).


(10) DEF tank breather hose

9. Remove the clamp (12).
10. Disconnect the DEF suction hose (13) and DEF suction hose electric heater connector (14).
11. Disconnect the DEF delivery hose (18) and DEF delivery hose electric heater connector (15).
12. Disconnect the DEF pump connector (16).
13. Disconnect the DEF return hose electric heater connector (17).




(11) DEF tank
(12) Clamp
(13) DEF suction hose
(14) DEF suction hose electric heater connector
(15) DEF delivery hose electric heater connector
(16) DEF pump connector
(17) DEF return hose electric heater connector
(18) DEF delivery hose

14. Remove the DEF tank.


**(When reassembling)**

- Connect the DEF return hose (7) to backward of DEF tank unit.
- Connect the DEF suction hose (13) to forward of DEF tank unit.
- Connect the DEF delivery hose (18) to backward of DEF pump.
- Connect the DEF suction hose (13) to forward of DEF pump.

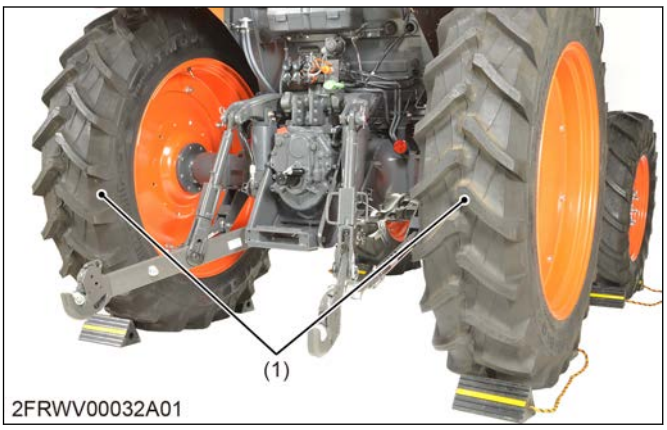
## 6.2.1.8 Installing front axle rocking restrictor

1. Chock the wheels and set the front axle rocking restrictor (1) to the front axle frame on both sides.


(1) Front axle rocking restrictor

## 6.2.1.9 Removing rear wheels

1. Place the disassembling stand under the transmission case.
2. Remove the rear wheels (1).




(1) Rear wheel

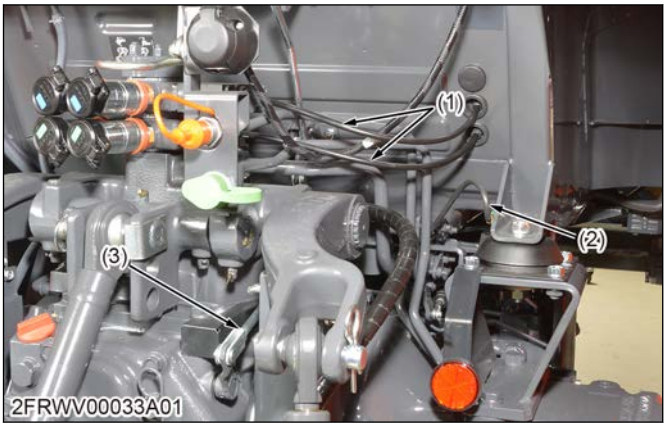
3. Place the disassembling stand under the rear axle case on both sides.

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Rear wheel mounting nut | 260 to 304 N·m<br>26.5 to 31.0 kgf·m<br>191.8 to 224.2 lbf·ft |

## 6.2.1.10 Removing outer parts (Cabin model)

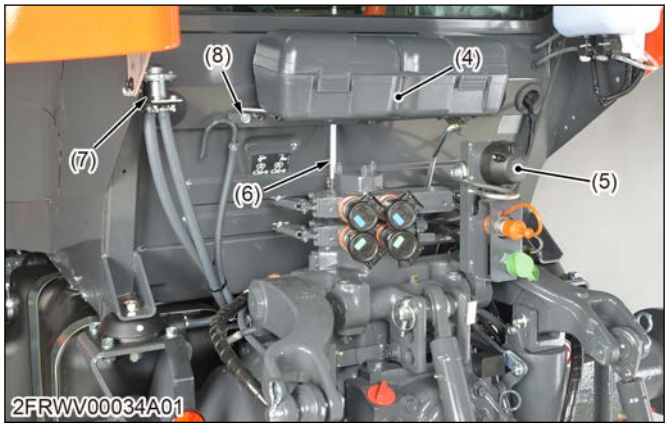
1. Disconnect the grounding cable (2).
2. Disconnect the auxiliary control valve wires (1).
3. Remove the PTO linkage (3).




(1) Grounding cable
(2) Auxiliary control valve wire
(3) PTO linkage

4. Remove the tool box (4).
5. Remove the trailer coupler (5) mounting screws.
6. Remove the 3-point hitch lowering speed linkage (6).
7. Remove the transmission case breather pipe mounting bolt (8).

8. Remove the fuel vapor valve (7) mounting bolts.

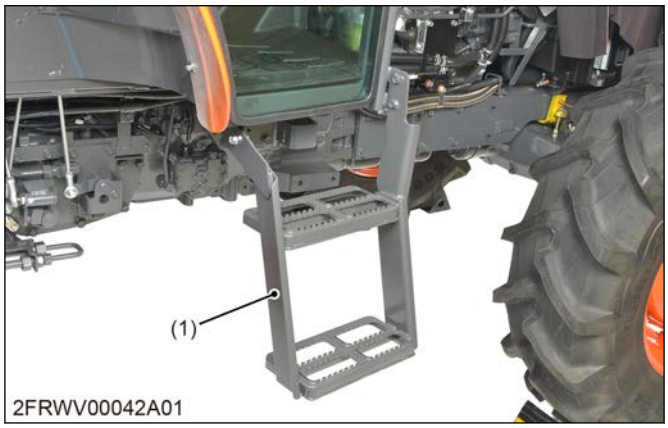



(4) Tool box
(5) Trailer coupler
(6) 3-point hitch lowering speed linkage
(7) Fuel vapor valve
(8) Transmission case breather pipe mounting bolt

**(When assembling)**
- Clear the slack of the breather hoses.
- Adjust the length of the auxiliary control valve wires.

## 6.2.1.11 Removing auxiliary step

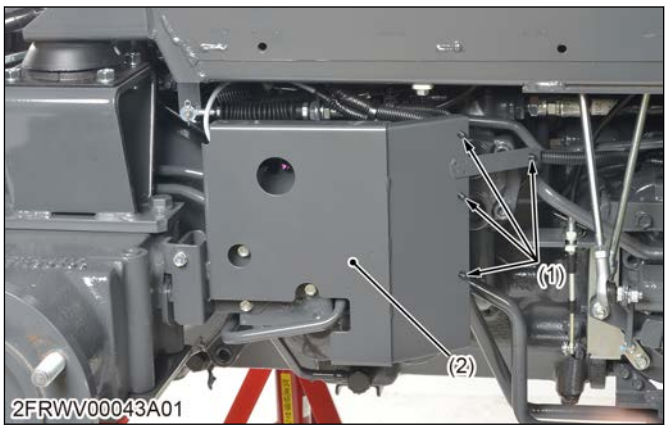
1. Remove the auxiliary step (1).




(1) Auxiliary step

## 6.2.1.12 Disconnecting draft control wire and position control wire

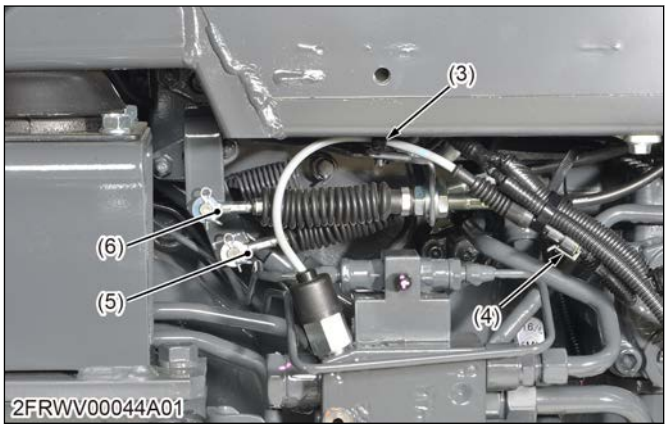
1. Disconnect the harness clamps (1) from the trailer brake valve protection cover (2).
2. Remove the trailer brake valve protection cover (2).




(1) Harness clamp
(2) Trailer brake valve protection cover

3. Disconnect the trailer brake pressure switch connector (4) and the trailer brake pressure switch cable from the clamp (3).
4. Disconnect the draft control wire (6) and position control wire (5).

**NOTE**
- **Before disconnecting the draft control wire and position control wire, make the mark to identify the position of the wires.**




(3) Clamp
(4) Trailer brake pressure switch connector
(5) Position control wire
(6) Draft control wire

**(When reassembling)**
- The position of draft and position control wires are as follows.

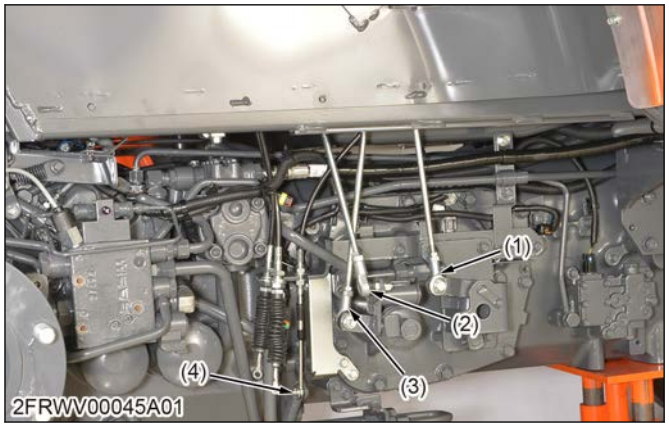
  **Draft control lever:**
  Tractor outside

  **Position control lever:**
  Tractor inside
- Adjust the draft and position control wire.

## 6.2.1.13 Removing gear shift linkage and parking brake

1. Disconnect the range shift lever rod (1).

2. Disconnect the main shift lever rod 1 (2).
3. Disconnect the main shift lever rod 2 (3).
4. Disconnect the parking brake wire (4).




(1) Range shift lever rod
(2) Main shift lever rod 1
(3) Main shift lever rod 2
(4) Parking brake wire

**(When reassembling)**
- Adjust the main shift lever rod 1 and 2.
- Adjust the range shift lever rod.
- Adjust the parking brake wire.

## 6.2.1.14 Disconnecting steering shaft

1. Remove the universal joint mounting bolt (2).
2. Disconnect the steering shaft (1) from the steering controller.

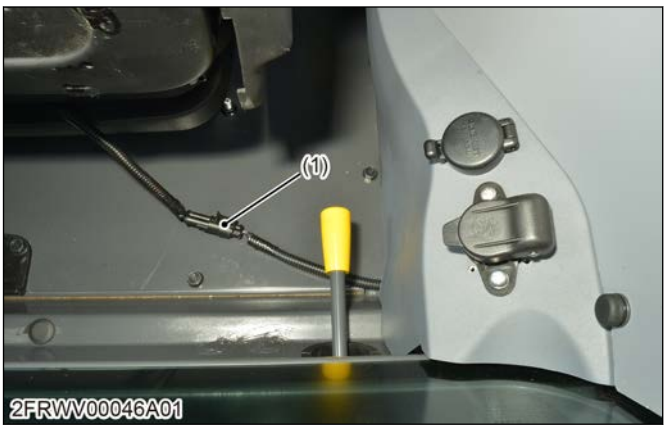

(1) Steering shaft
(2) Universal joint mounting bolt

**(When reassembling)**
- Tighten the universal joint mounting bolt (2) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Universal joint mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 6.2.1.15 Removing seat

1. Disconnect the seat switch connector (1).




(1) Seat switch connector

2. Remove the seat (2) with the seat suspension mounting bracket.

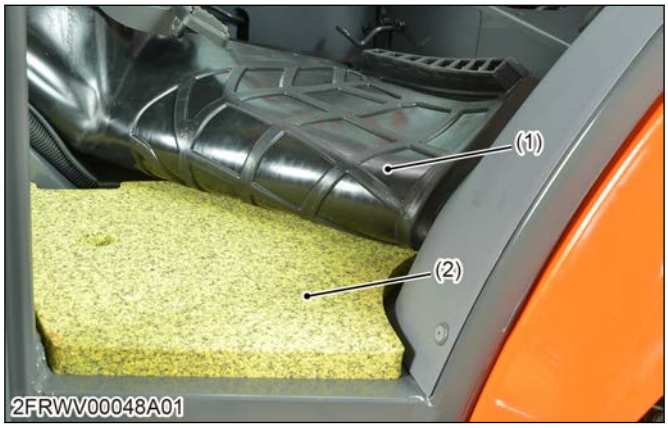

(2) Seat

**(When reassembling)**
- Tighten the seat suspension mounting bolt to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Seat suspension mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

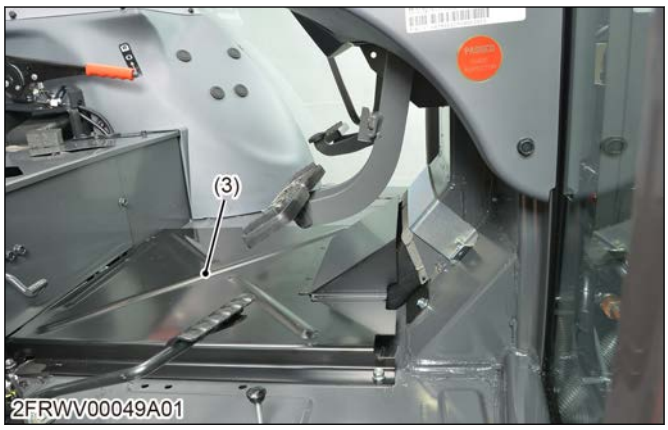
## 6.2.1.16 Removing floor mat and air conditioner duct

1. Remove the floor mat (1) and sponges (2).




(1) Floor mat (2) Sponge

2. Remove the access plate (3).

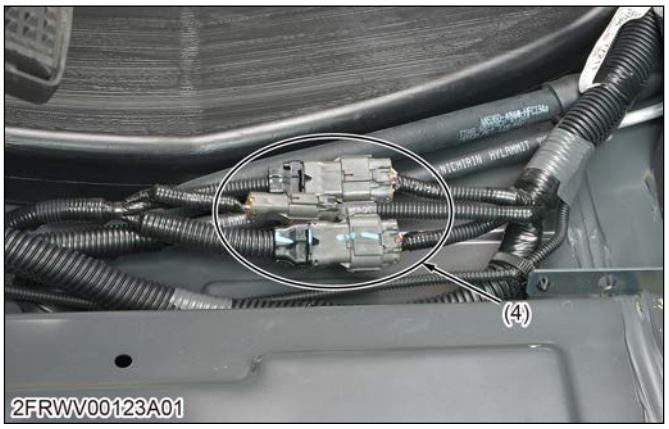



(3) Access plate

## 6.2.1.17 Removing fuel tank (Cabin model)

1. Place the oil pans under the fuel tank (1).
2. Remove the drain plug and drain the fuel.
3. After draining, reinstall the drain plug to the fuel tank (1).

3. Disconnect the joint connectors (4).




(4) Joint connector

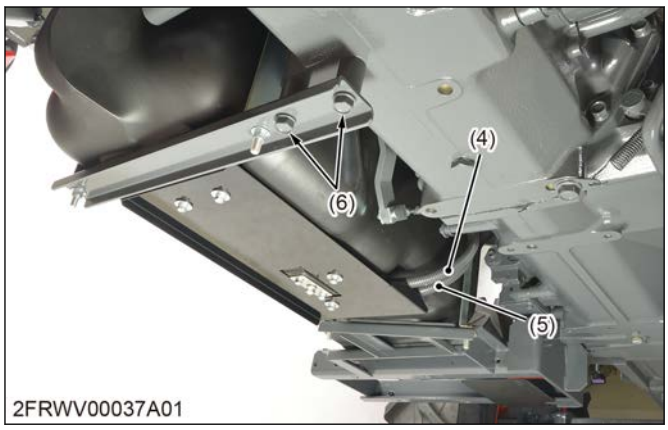
4. Place the disassembling stands under the fuel tank (1).


(1) Fuel tank

5. Remove the fuel filling port mounting bolt (2) and disconnect the fuel tank breather hoses (3).

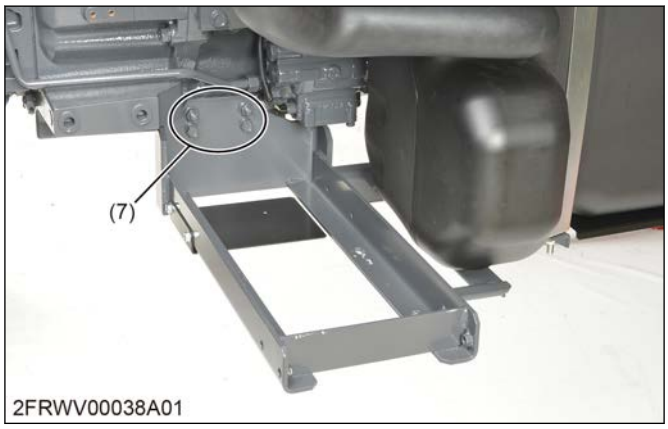

(2) Fuel filling port mounting bolt (3) Breather hose

6. Disconnect the fuel hose 1 (4) and fuel hose 2 (5) from the fuel tank.
7. Remove the fuel tank rear support mounting bolts (6).



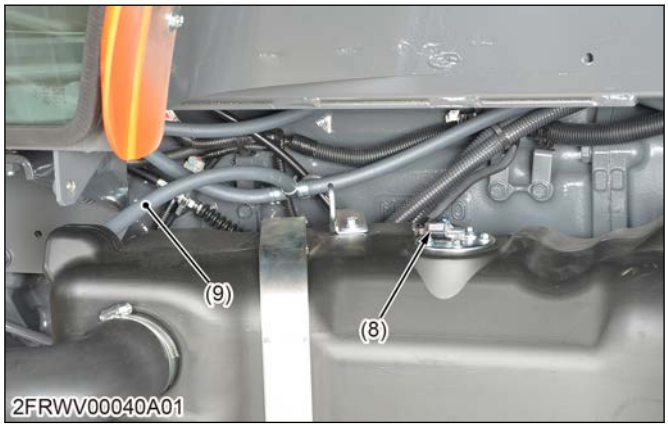

(4) Fuel hose 1
(5) Fuel hose 2
(6) Fuel tank rear support mounting bolt

8. Remove the fuel tank front support mounting bolts and nuts (7).




(7) Fuel tank front support mounting bolt

9. Lower the fuel tank together with disassembling stands.
10. Disconnect the fuel level sensor connector (8).
11. Disconnect the fuel tank breather hose (9).




(8) Fuel level sensor connector (9) Fuel tank breather hose

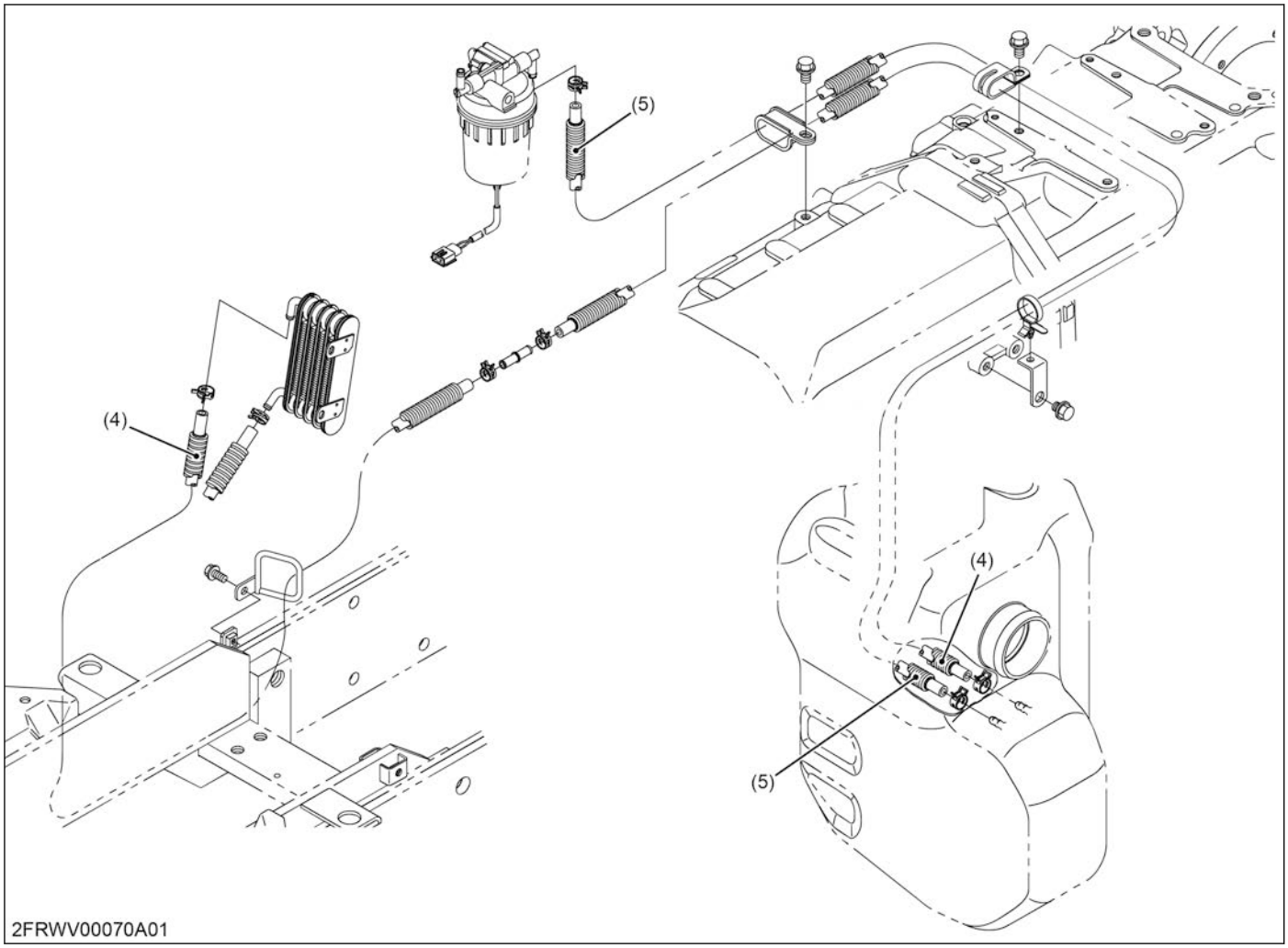
12. Disconnect the fuel tank breather hose (10).


(10) Fuel tank breather hose

13. Remove the fuel tank with stay.

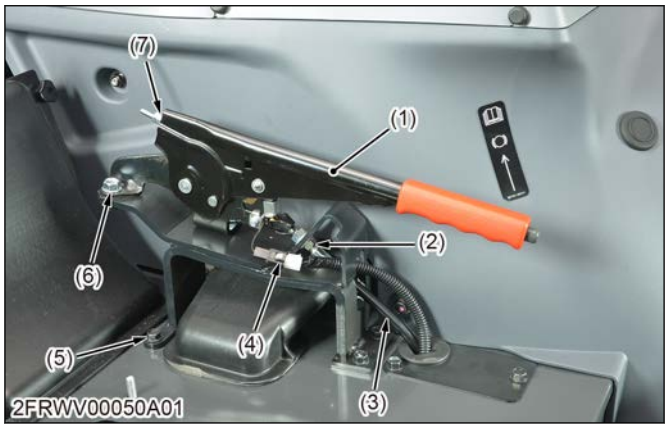

**(When assembling)**

- Clear the slack of the fuel tank breather hoses.
- Be sure that the fuel tank is fixed by tank band securely.
- Be sure that there is no contact between the fuel tank and the transmission case or the clutch housing.
- Connect the fuel hose 1 (4) with the fuel cooler.
- Connect the fuel hose 2 (5) with the fuel filter.



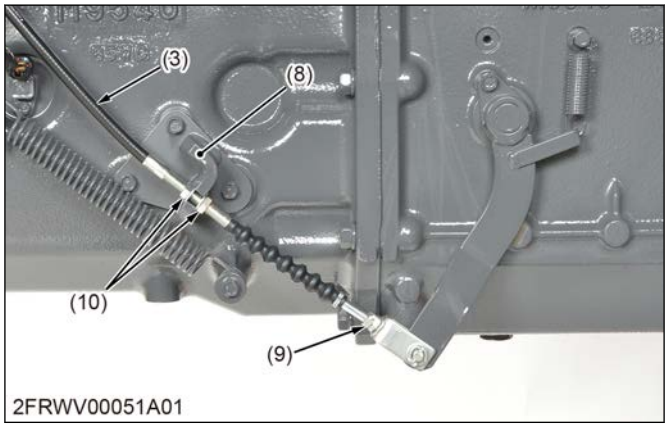
## 6.2.1.18 Removing secondary brake

1. Disconnect the secondary brake switch connector (4).
2. Remove the secondary brake cable adjusting nuts (7).
3. Loosen the secondary brake cable mounting nuts (2) and disconnect the secondary brake cable (3).
4. Remove the secondary brake lever mounting bolts (6).
5. Remove the secondary brake lever bracket mounting bolts (5).




(1) Secondary brake lever
(2) Secondary brake cable mounting nut
(3) Secondary brake cable
(4) Secondary brake switch connector
(5) Secondary brake bracket mounting bolt
(6) Secondary brake lever mounting bolt
(7) Secondary brake cable adjusting nut

6. Loosen the secondary brake cable mounting nut 1 (10) and disconnect the secondary brake cable (3).
7. Remove the cable stay (8).




(3) Secondary brake cable
(8) Cable stay
(9) Secondary brake cable adjusting nut 1
(10) Secondary brake cable mounting nut 1

**(When assembling)**

- Be sure that the split pin of joint pin is bent to both sides.
- Be sure to adjust the free play of the secondary brake cable.

| | | |
|---|---|---|
| Secondary brake lever free play (Number of notches) | Factory specification | 4 notches |

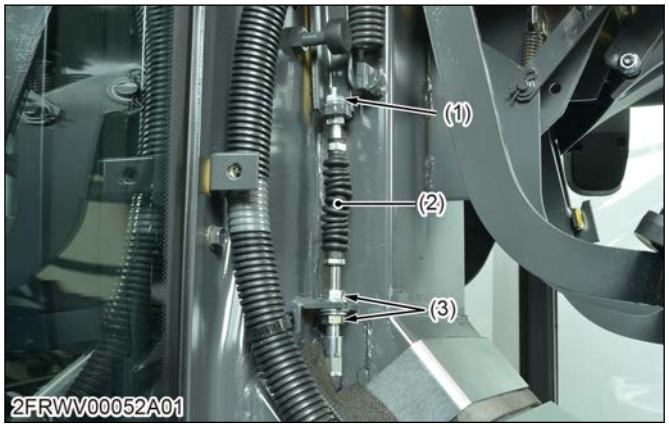
- Tighten the secondary brake cable mounting nuts (2) and adjusting nuts (7) to the specified tightening torque.
- Tighten the secondary brake lever mounting bolts (6) and secondary brake bracket mounting bolts (5) to the specified tightening torque.
- Tighten the secondary brake cable adjusting nut 1 (9) and mounting nuts 1 (10) to the specified tightening torque.
- Tighten the cable stay (8) mounting bolts to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Secondary brake cable mounting nut | 20 to 25 N·m<br>2.1 to 2.5 kgf·m<br>15 to 18 lbf·ft |
| | Secondary brake cable adjusting nut | 7.8 to 9.3 N·m<br>0.80 to 0.94 kgf·m<br>5.8 to 6.8 lbf·ft |
| | Secondary brake lever mounting bolt | 48.1 to 55.9 N·m<br>4.91 to 5.70 kgf·m<br>35.5 to 41.2 lbf·ft |
| | Secondary brake bracket mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |
| | Secondary brake cable adjusting nut 1 | 17.1 to 20.6 N·m<br>1.75 to 2.10 kgf·m<br>12.7 to 15.1 lbf·ft |
| | Secondary brake cable mounting nuts 1 | 20 to 25 N·m<br>2.1 to 2.5 kgf·m<br>15 to 18 lbf·ft |
| | Cable stay mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 6.2.1.19 Disconnecting clutch cable

1. Loosen the clutch cable mounting nuts 2 (3).

2. Remove the clutch cable mounting nut 1 (1) and disconnect the clutch cable (2).




(1) Clutch cable mounting nut 1 (3) Clutch cable mounting nut 2
(2) Clutch cable

3. Loosen the clutch cable mounting nuts 3 (4).
4. Disconnect the clutch cable (2).


(2) Clutch cable (4) Clutch cable mounting nut 3

**(When reassembling)**

- Be sure to adjust the clutch cable for the clutch pedal free travel.
- Tighten the clutch cable mounting nut 1, 2 and 3 to the specified torque.

| | | |
|---|---|---|
| Tightening torque | Clutch cable mounting nut 1 | 17.7 to 20.6 N·m<br>18.1 to 2.10 kgf·m<br>13.1 to 15.1 lbf·ft |
| | Clutch cable mounting nut 2 | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |
| | Clutch cable mounting nut 3 | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 6.2.1.20 Disconnecting wire harness inside cabin

1. Remove the cover (1).

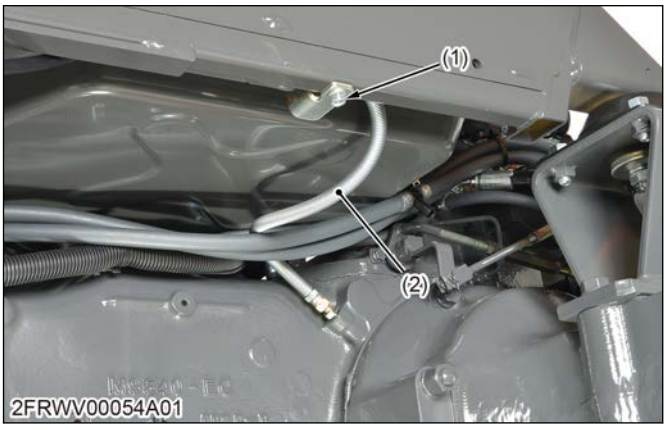

(1) Cover

2. Disconnect the joint connectors (2).
3. Pull out the main harness to the out side of cabin.


(2) Joint connector

## 6.2.1.21 Disconnecting brake hose

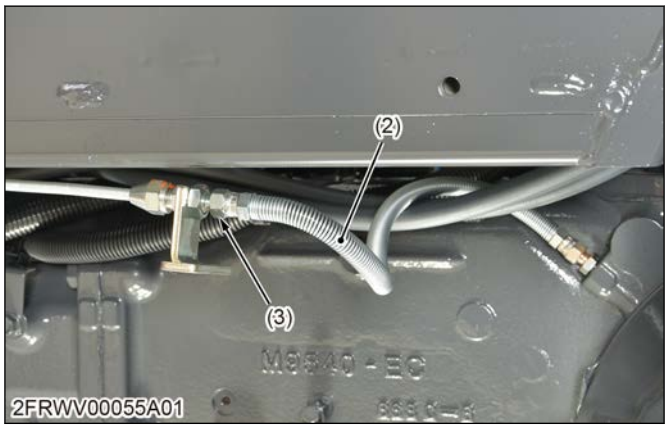
1. Remove the brake pipe stay mounting bolts (1) on both sides.




(1) Brake pipe stay mounting bolt (2) Brake hose

2. Loosen the brake hose mounting nuts (3) on both sides.

3. Disconnect the brake hose (2) on both sides.




(2) Brake hose
(3) Brake hose mounting nut

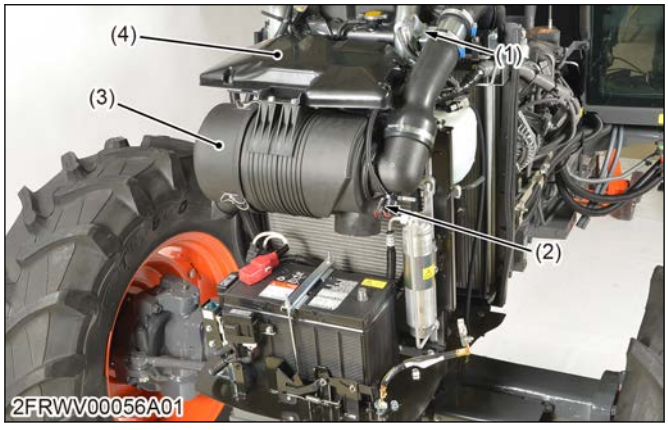
**(When reassembling)**

- Tighten the brake hose mounting nuts to the specified torque.
- After connecting the brake hoses, bleed the air from hydraulic brake lines.

| | | |
|---|---|---|
| Tightening torque | Brake hose mounting nut | 13.7 to 15.7 N·m<br>1.40 to 1.60 kgf·m<br>10.1 to 11.5 lbf·ft |

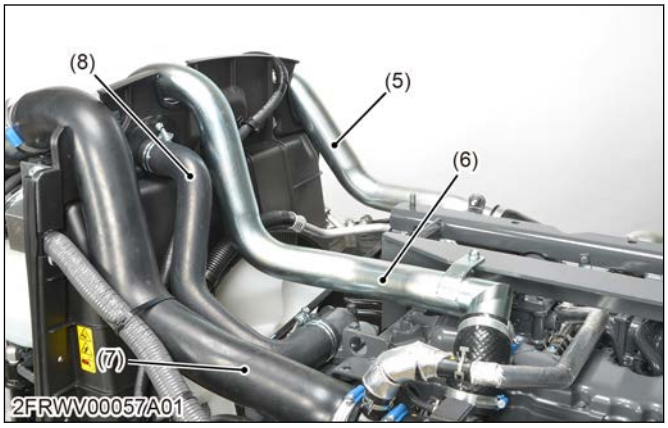
## 6.2.1.22 Removing air cleaner hose and pipe

1. Disconnect the air flow sensor connector (1) and air cleaner switch connector (2).
2. Remove the engine ECU and ACU cover (4).
3. Remove the air cleaner (3).




(1) Air flow sensor connector
(2) Air cleaner switch connector
(3) Air cleaner
(4) Cover

4. Disconnect the air inlet hose (7).
5. Loosen the bands and disconnect the inter cooler inlet pipe (6).
6. Loosen the bands and disconnect the inter cooler outlet pipe (5).
7. Loosen the hose bands and disconnect the coolant hose (8).




(5) Inter cooler outlet pipe
(6) Inter cooler inlet pipe
(7) Air inlet hose
(8) Coolant hose

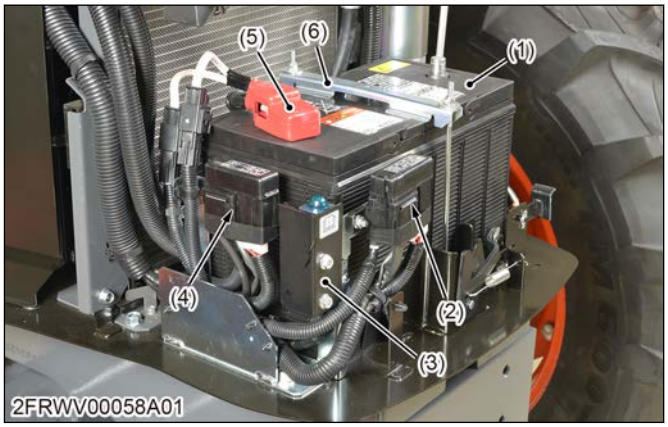
**(When assembling)**

- Be sure the bands of air inlet hose are connected securely.
- Be sure the bands of inter cooler hoses are connected securely.

| | | |
|---|---|---|
| Tightening torque | Hose band (Inlet air, inter cooler) | 4.0 to 5.0 N·m<br>0.41 to 0.50 kgf·m<br>3.0 to 3.6 lbf·ft |

## 6.2.1.23 Removing battery

1. Disconnect the positive cable (5) from the battery positive terminal.
2. Disconnect the slow blow fuse box 1 (2) and slow blow fuse box 2 (4).
3. Disconnect the ACU operating lamp (3).
4. Remove the battery stay (6) and battery (1).

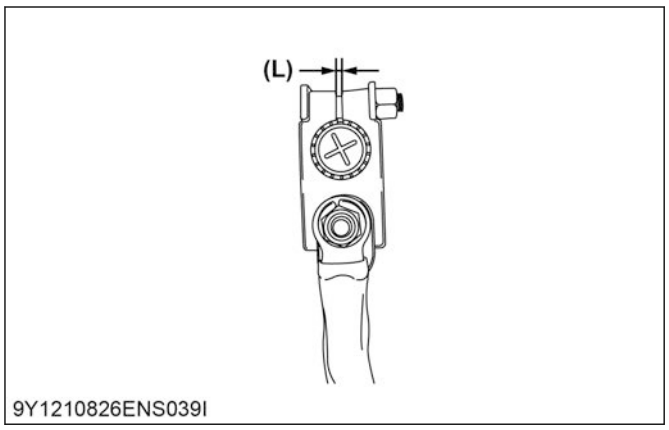



(1) Battery
(2) Slow blow fuse box 1
(3) ACU operating lamp
(4) Slow blow fuse box 2
(5) Positive cable
(6) Battery stay

**(When reassembling)**

**■ IMPORTANT**

- **Tighten the battery cable terminal nut so that the clearance (L) is within the following chart.**




(L) Clearance between the battery cable terminal

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

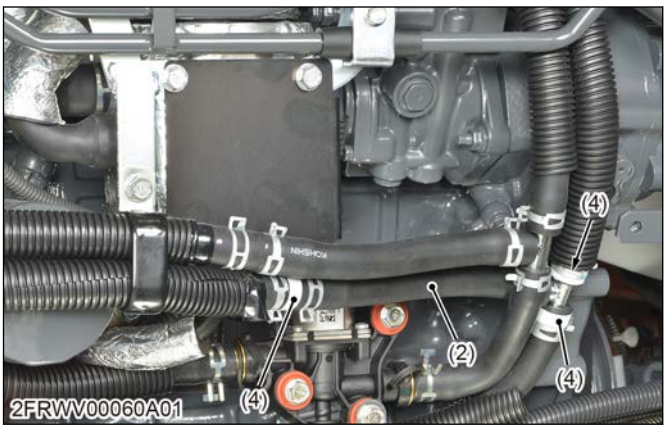
## 6.2.1.24 Disconnecting heater hose

1. Remove the heater hose clamps (3).
2. Disconnect the heater hose (1).
3. Disconnect the heater return hose (2).


(1) Heater hose
(2) Heater return hose
(3) Heater hose clamp

**(When reassembling)**

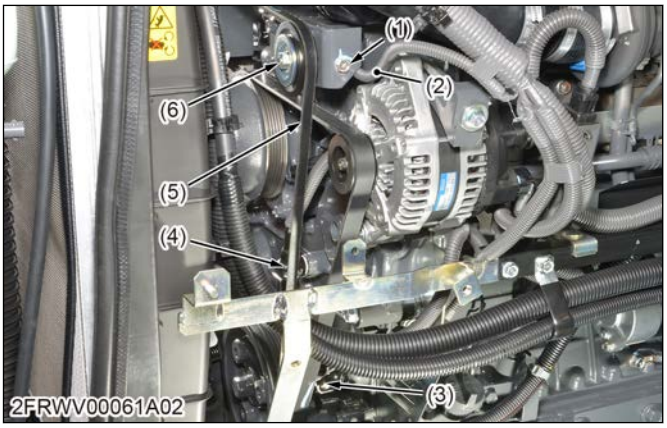
- The heater return hose (2) with white tape (4) should be connected to the hose which has also white tape (4).




(2) Heater return hose
(4) White tape

## 6.2.1.25 Removing compressor and condenser

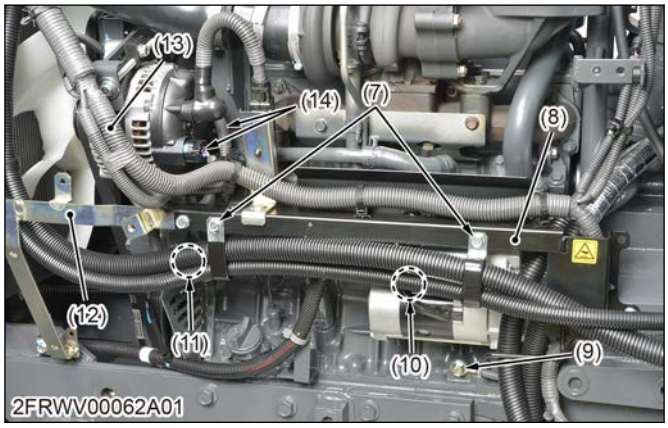
1. Loosen the air conditioner belt tension pulley mounting nut (6).
2. Loosen the air conditioner belt adjusting bolt (1).
3. Remove the air conditioner belt (5).
4. Disconnect the coolant temperature sensor connector (2).
5. Disconnect the camshaft position sensor connector (4).
6. Disconnect the crankshaft position sensor connector (3).




(1) Air conditioner belt adjusting bolt
(2) Coolant temperature sensor connector
(3) Crankshaft position sensor connector
(4) Camshaft position sensor connector
(5) Air conditioner belt
(6) Tension pulley mounting nut

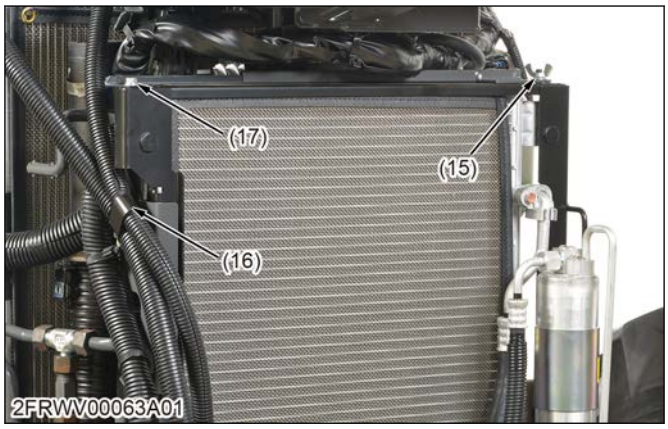
7. Remove the high and low pressure hose clamps (7).
8. Disconnect the starter motor connectors (10) and oil switch connector (11).
9. Disconnect the grounding wire (9).
10. Disconnect the alternator connectors (14).
11. Remove the stay 1 (8) and stay 2 (12).

12. Set aside the engine harness (13) to the front side.




(7) High and low pressure hose clamp
(8) Stay 1
(9) Grounding wire
(10) Starter motor connector
(11) Oil switch
(12) Stay 2
(13) Engine harness
(14) Alternator connectors

13. Remove the high and low pressure hose clamp (16).
14. Remove the condenser stopper bolt (17).
15. Loosen the condenser wing nut (15).




(15) Condenser wing nut
(16) High and low pressure hose clamp
(17) Condenser stopper bolt

16. Disconnect the compressor 1P connector (20).
17. Remove the grounding wire mounting screw (18).
18. Remove the compressor (19) with stay.


(18) Ground wire mounting screw
(19) Compressor
(20) Compressor 1P connector

19. Jack up the front axle and turn the front tires to the left side.
20. Slide the condenser with the reviver to the left side.
21. Remove the compressor (19), the condenser with the receiver and air-conditioner hose as a unit.


**(When reassembling)**

- After reassembling the compressor, be sure to adjust the air conditioner belt tension.
- Tighten the alternator terminal nut to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Alternator terminal nut | 9.80 to11.3 N·m<br>1.00 to 1.15kgf·m<br>7.23 to 8.33 lbf·ft |

## 6.2.1.26 Removing cabin from tractor

1. Set the cabin dismounting tool (1) to the cabin.


(1) Cabin dismounting tool

2. Remove the cabin mounting bolts and nuts (2).



(2) Cabin mounting bolt and nut

3. Remove the cabin from tractor body.


**(When reassembling)**

**■ NOTE**

- **Lift the cabin while making sure it does not catch on anything.**
- **Tighten the cabin mounting bolts and nuts to the specified tightening torque.**

| | | |
|---|---|---|
| Tightening torque | Cabin mounting bolt and nut | 124 to 147 N·m<br>12.6 to 15.0 kgf·m<br>91.2 to 108 lbf·ft |

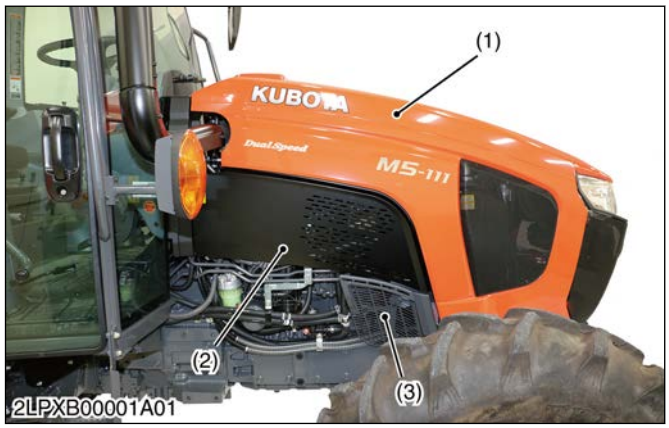
## 6.2.2 Removing compressor assembly

## 6.2.2.1 Removing bonnet and cover (Cabin model)

**■ IMPORTANT**

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

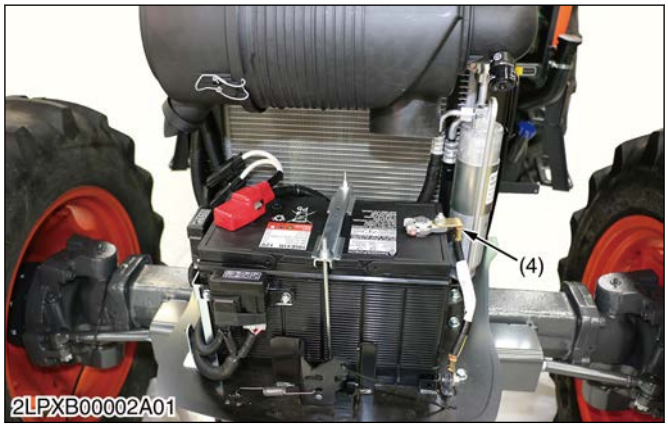
1. Open the bonnet (1).




(1) Bonnet
(2) Side bonnet
(3) Side cover

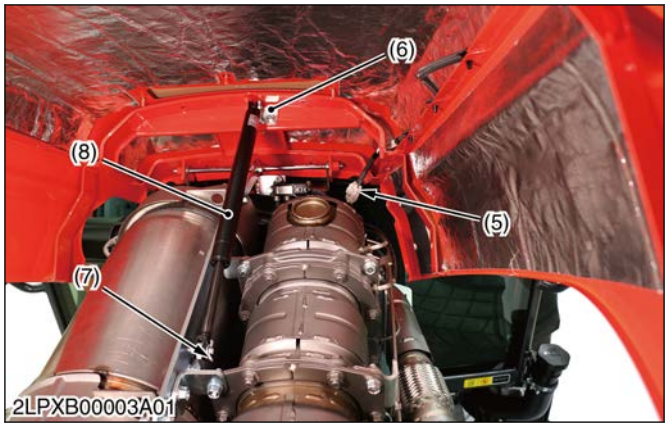
2. Remove the side bonnet (2) and the side cover (3) on both side.

3. Disconnect the negative cable (4) from the battery negative terminal .




(4) Negative cable

4. Disconnect the head light connector (5).



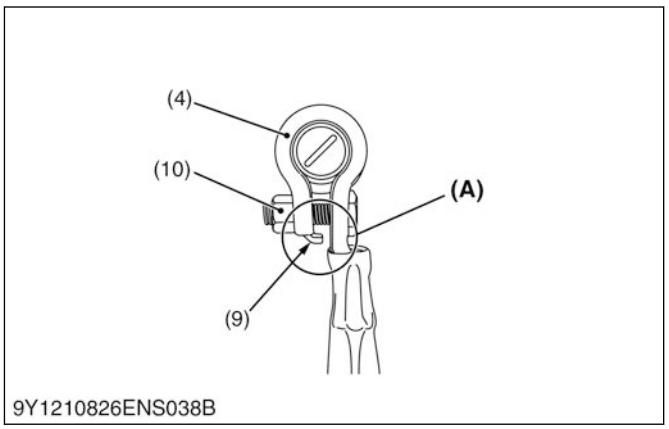

(5) Head light connector
(6) Damper stay
(7) Snap pin
(8) Bonnet damper

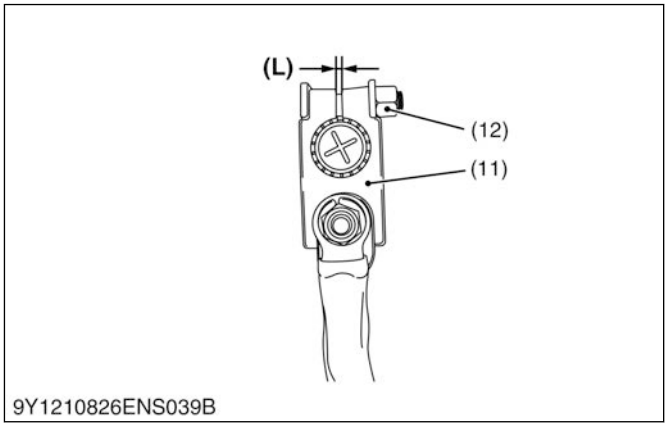
5. Remove the damper stay (6) and the snap pin (7).
6. Remove the bonnet damper (8).
7. Remove the bonnet (1).

**(When reassembling)**

**■ IMPORTANT**

- **Tighten the negative terminal nut (10) until the stopper (9) contacts to the negative cable (4).**
- **Tighten the positive terminal nut (12) so that the clearance (L) is within the following chart.**




(4) Negative cable
(9) Stopper
(10) Negative terminal nut
(11) Positive terminal
(12) Positive terminal nut
(A) The stopper contacts to the terminal.
(L) Clearance between the positive terminal

- When assembling the bonnet damper (8), be sure that the cylinder parts should be on the backward.

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

## 6.2.2.2 Discharging refrigerant

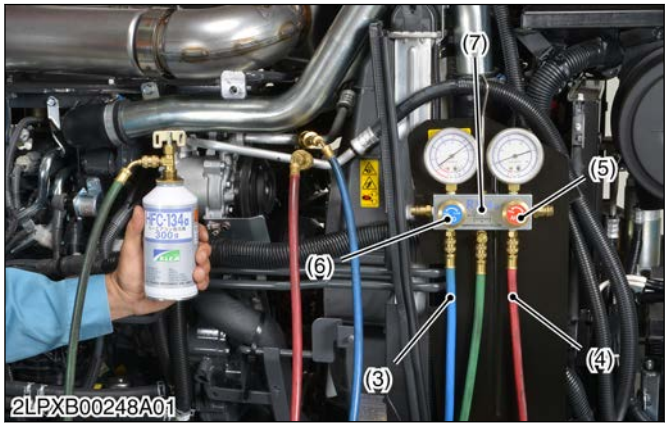
**⚠ CAUTION**

- **Protect fingers and eyes with cloth against frostbite by refrigerant when disconnecting the hose to the charging valve.**

**■ IMPORTANT**

- **Use only R134a refrigerant recovery and recycling machine (8). Eliminate mixing R134a equipment, refrigerant, and refrigerant oils with R12 system to prevent compressor damage.**

Prepare for the R134a refrigerant recovery and recycling machine (8).

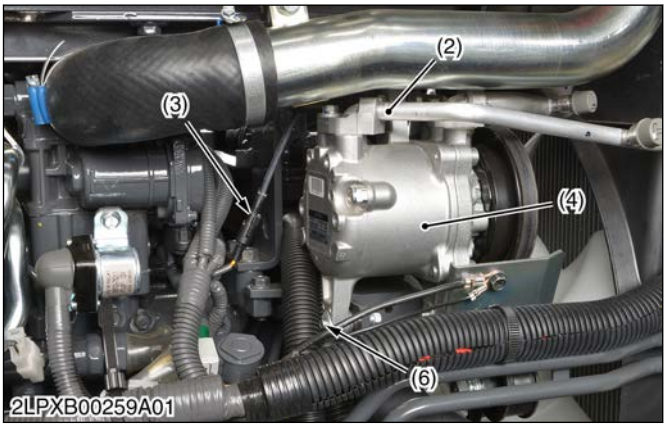



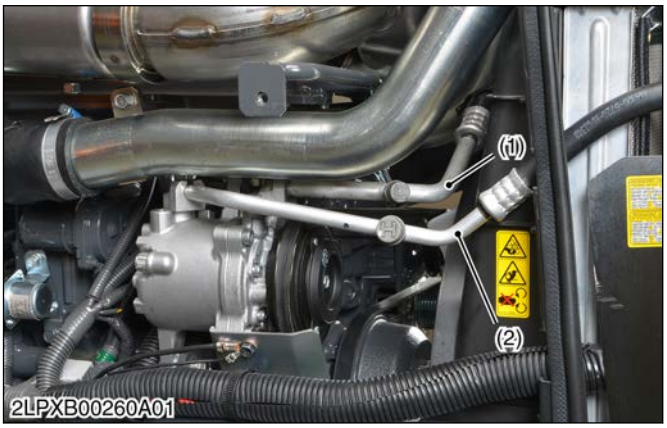


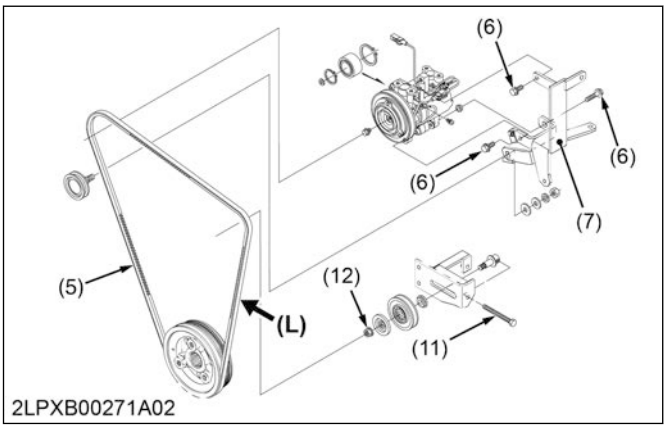
(1) "**LO**" pressure side charging valve
(2) "**HI**" pressure side charging valve
(3) Charging hose (Blue)
(4) Charging hose (Red)
(5) "**HI**" pressure side valve
(6) "**LO**" pressure side valve
(7) Manifold gauge
(8) Refrigerant recovery and recycling machine

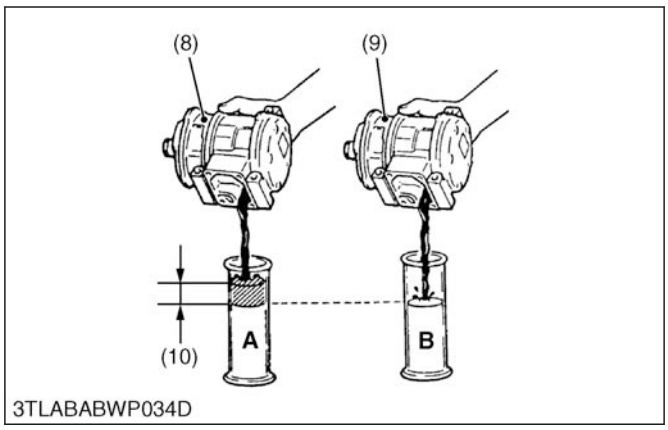
1. Connect charging hose (blue) (3) from the refrigerant recovery and recycling machine (8) to "**LO**" pressure side charging valve (1). Connect charging hose (red) (4) to "**HI**" pressure side charging valve (2).
2. Follow the manufacturer's instructions and discharge the system.

## 6.2.2.3 Removing compressor assembly from engine






(1) Low pressure hose
(2) High pressure hose
(3) 1P connector (Magnetic clutch)
(4) Compressor
(5) Air conditioner belt
(6) Compressor mounting screw
(7) Compressor stay
(8) New compressor
(9) Old compressor
(10) Remove the excess oil (A-B)
(11) Tension pulley adjusting screw
(12) Tension pulley nut
(A) Oil flow new compressor
(B) Oil flow replace compressor
(L) Deflection (10 to 12 mm (0.40 to 0.47 in.))

1. Disconnect the low pressure hose (suction) (1) and high pressure hose (discharge) (2) from the compressor, then cap the place immediately to disconnected both pressure hoses to keep the moisture out of the system.
2. Disconnect the 1P connector (3) of magnetic clutch.
3. Remove the air conditioner belt (5) and remove the compressor (4) with compressor stay (7).

**(When reassembling)**

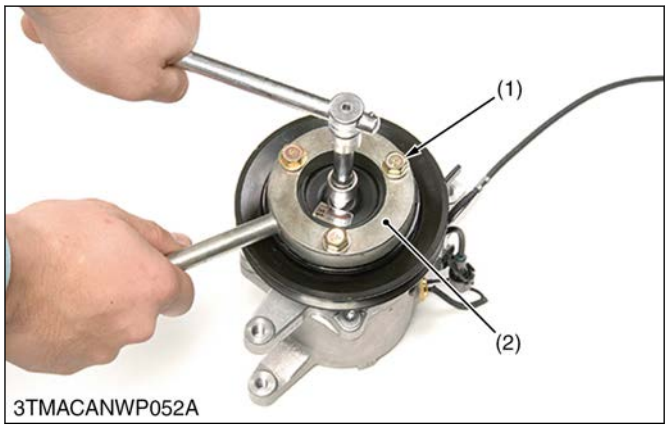
- After reassembling the compressor, be sure to adjust the air conditioner belt tension and recharge the refrigerant to the system.
- Apply compressor oil (DENSO CO. ND-OIL8 or equivalent) to the O-rings and be careful not to damage them.
- "**S**" letter is marked on the compressor for connecting the low pressure hose (suction side).
- "**D**" letter is marked on the compressor for connecting the high pressure hose (discharge side).
- When replacing the compressor with a new one, meet the oil amount with old one.
- Push on the belt between the pulleys with a finger. Deflection "L" of 10 to 12 mm (0.40 to 0.47 in.) under a 98 N (10 kgf, 22 lbf) load is appropriate.
- If tension is incorrect, loosen the tension pulley nut (12) and loosen or tighten the tension pulley adjusting screw (11) until the deflection of the belt fans within acceptable limits. And then, tighten the tension pulley nut (12).
- Tighten the high pressure hose 1 and low pressure hose mounting screw to the specified tightening torque.
- Tighten the compressor bracket mounting screw (M8) to aluminum parts to the specified tightening torque.
- Tighten the compressor bracket mounting screw (M8) to ordinariness parts to the specified tightening torque.
- Tighten the compressor bracket mounting screw (M10) to ordinariness parts to the specified tightening torque.
- Tighten the compressor mounting screws to the specified tightening torque.

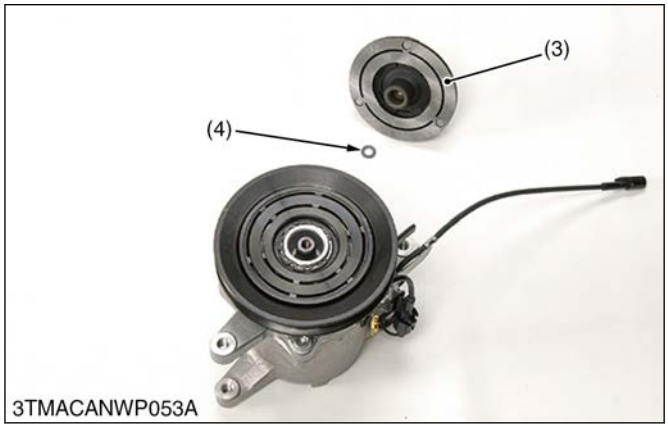
| | | |
|---|---|---|
| Tightening torque | High pressure hose 1 and low pressure hose mounting screw | 7.9 to 11 N·m<br>0.80 to 1.2 kgf·m<br>5.8 to 8.6 lbf·ft |
| | Compressor bracket mounting screw (M8) to aluminum parts | 18 to 20 N·m<br>1.8 to 2.1 kgf·m<br>13 to 15 lbf·ft |
| | Compressor bracket mounting screw (M8) to ordinariness parts | 24 to 27 N·m<br>2.4 to 2.8 kgf·m<br>18 to 20 lbf·ft |
| | Compressor bracket mounting screw (M10) to ordinariness parts | 48 to 55 N·m<br>4.9 to 5.7 kgf·m<br>36 to 41 lbf·ft |
| | Compressor mounting screws | 25 to 29 N·m<br>2.5 to 3.0 kgf·m<br>18 to 21 lbf·ft |

| | | |
|---|---|---|
| Belt tension | Factory specification | 10 to 12 mm<br>0.40 to 0.47 in. |

RELATED PAGE
5.2.3 Charging refrigerant on page 11-31

## 6.2.2.4 Disassembling hub plate




(1) Stopper bolt
(2) Stopper magnet clutch
(3) Hub plate
(4) Shim

1. Three stopper bolts (1) are set in stopper magnet clutch (2) at the position corresponding to the shape of compressor.
2. The stopper magnet clutch (2) is hung on hub plate (3).
3. Remove the magnetic clutch mounting screw.
4. Remove the hub plate (3) and air gap adjustment shim (4).

**(When reassembling)**

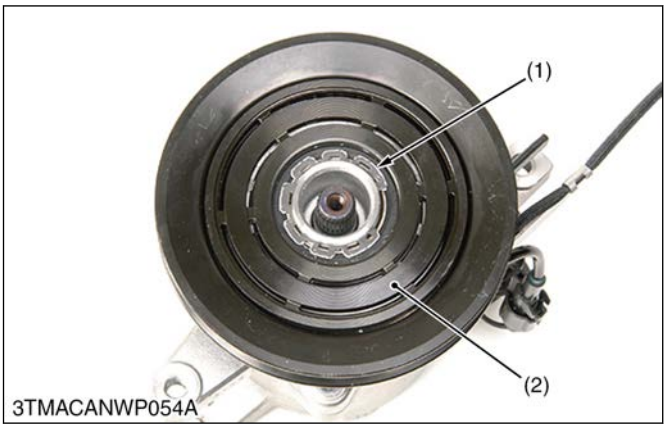
- Do not apply grease or oil on the hub plate facing.
- Do not use the magnetic clutch mounting screw again.
- Make sure to turn rotor by hand after assembling and do not contact the stator and the hub plate.
- Check and adjust the air gap before tightening the magnetic clutch mounting screw to the specified tightening torque.
- Tighten the magnetic clutch mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Magnetic clutch mounting screw | 15 to 21 N·m<br>1.5 to 2.1 kgf·m<br>11 to 15 lbf·ft |

RELATED PAGE

3.4 Magnet clutch stopper (for A/C compressor) on page 2-108
3.5 Stopper bolt (for A/C compressor) on page 2-110

## 6.2.2.5 Disassembling rotor




(1) External cir-clip
(2) Rotor

1. Remove the external cir-clip (1).
2. Remove the rotor (2).

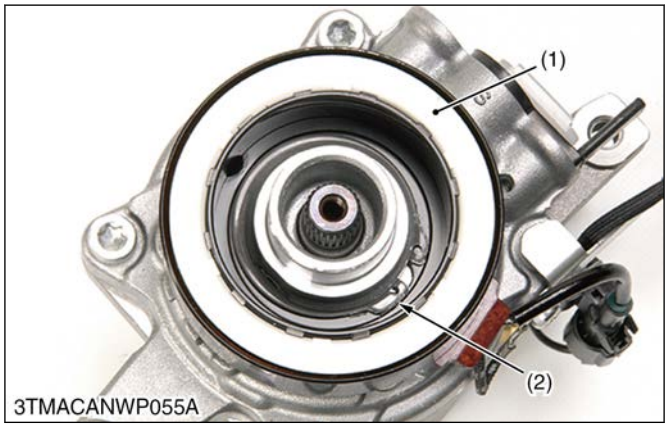
**(When reassembling)**

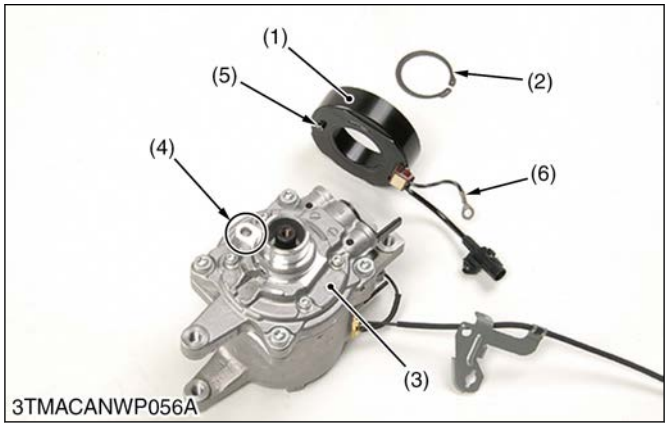
- Do not use the external cir-clip again.
- Assemble the external cir-clip for the tapered side to come outside of rotor.
- The wide portion of the expanded external cir-clip is set in boss of shaft as a minimum.

**(Reference)**

**Code No. for external cir-clip:**
T1065-87450

## 6.2.2.6 Disassembling stator




(1) Stator
(2) External cir-clip
(3) Front housing
(4) Concave part
(5) Pin
(6) Lead wire

1. Remove the lead wire (6) from the compressor body.
2. Remove the external cir-clip (2).
3. Remove the stator (1).

**(When reassembling)**
- Do not use the external cir-clip again.
- Assemble the external cir-clip for the tapered side to come outside of the front housing.
- The wide portion of the expanded external cir-clip is set in the boss of shaft as a minimum.
- Match and assemble the concave part (4) of the front housing (3) and the pin (5) of the stator.

**(Reference)**

**Code No. for external cir-clip:**
T1065-87440

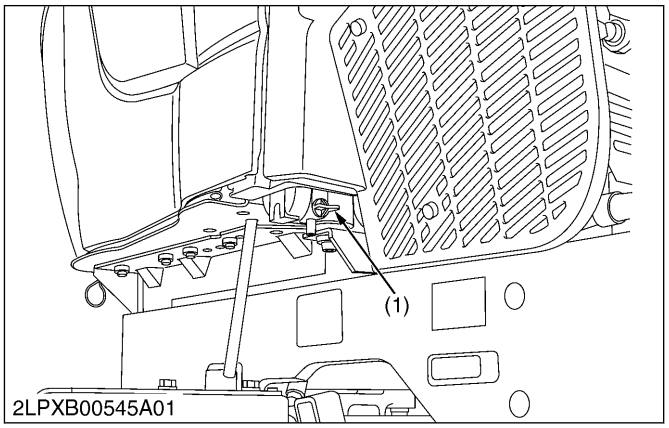
## 6.2.3 Removing air conditioner unit

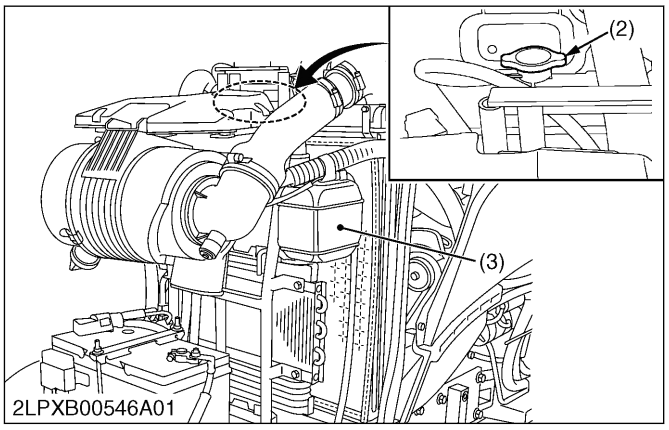
## 6.2.3.1 Draining coolant

**⚠ WARNING**
**To avoid personal injury:**
- **Do not remove radiator cap while coolant is hot. When cool, slowly rotate cap to the first stop and allow sufficient time for excess pressure to escape before removing the cap completely.**

**■ IMPORTANT**
- **Do not start engine without coolant.**
- **Use clean, fresh soft water and anti-freeze to fill the radiator and recovery tank.**
- **When mixing the anti-freeze with water, the anti-freeze mixing ratio is 50%.**
- **Tighten radiator cap securely. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**

1. Stop the engine and let the engine cool down.
2. To drain the coolant, open the radiator drain plug (1), remove the drain plug and remove radiator cap (2). The radiator cap must be removed to completely drain the coolant.




(1) Drain plug
(2) Radiator cap
(3) Recovery tank

3. After all coolant is drained, reinstall the drain plug (1).
4. Fill with coolant up to the "**FULL**" mark of recovery tank (3).

| | |
|---|---|
| Coolant capacity | 10 L<br>10.6 U.S.qts<br>8.8 Imp.qts |

5. Start and operate the engine for a few minutes.
6. Stop the engine, remove the key and let cool.

7. Check coolant level of recovery tank (3) and add coolant if necessary.
8. Properly dispose of used coolant.

### 6.2.3.2 Discharging refrigerant

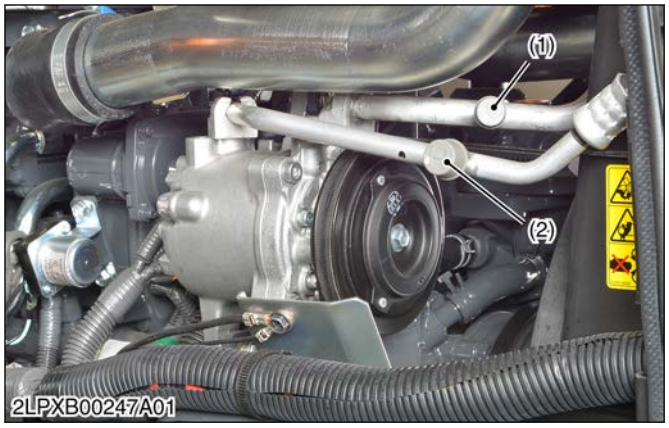
**⚠ CAUTION**

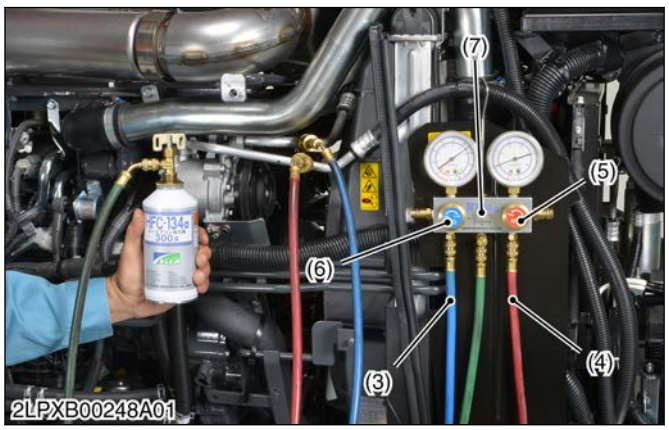
- **Protect fingers and eyes with cloth against frostbite by refrigerant when disconnecting the hose to the charging valve.**

**■ IMPORTANT**

- **Use only R134a refrigerant recovery and recycling machine (8). Eliminate mixing R134a equipment, refrigerant, and refrigerant oils with R12 system to prevent compressor damage.**

Prepare for the R134a refrigerant recovery and recycling machine (8).





(1) "**LO**" pressure side charging valve
(2) "**HI**" pressure side charging valve
(3) Charging hose (Blue)
(4) Charging hose (Red)
(5) "**HI**" pressure side valve
(6) "**LO**" pressure side valve
(7) Manifold gauge
(8) Refrigerant recovery and recycling machine

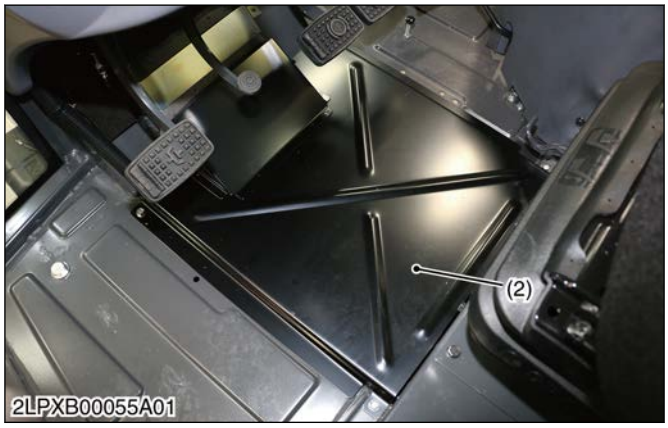
1. Connect charging hose (blue) (3) from the refrigerant recovery and recycling machine (8) to "**LO**" pressure side charging valve (1). Connect charging hose (red) (4) to "**HI**" pressure side charging valve (2).
2. Follow the manufacturer's instructions and discharge the system.

### 6.2.3.3 Removing floor mat and air conditioner duct

1. Remove the floor mat (1).


(1) Floor mat

2. Remove the access plate 1 (2).




(2) Access plate 1

3. Remove the seat under plate (3).
4. Remove the air conditioner duct (4).
5. Remove the air conditioner duct retainer plate (5).


(3) Seat under plate
(4) Air conditioner duct
(5) Air conditioner duct retainer plate

## 6.2.3.4 Removing seat

1. Disconnect the OPC wire harness connector (1).


(1) OPC wire harness connector

2. Remove the seat (2) with the seat mounting bracket.


(2) Seat

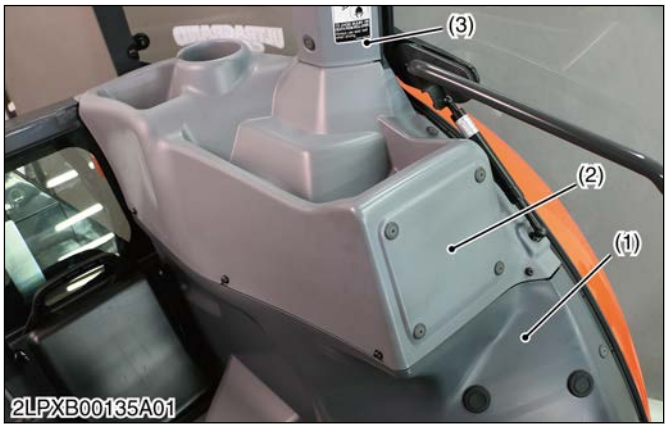
**(When reassembling)**

- Tighten the seat bracket mounting bolt to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Seat bracket mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 6.2.3.5 Removing inner cover (left side) and circulation air filter

1. Remove the left side inner cover 2 (2).
2. Remove the left side pillar cover (3).
3. Remove the left side inner cover 1 (1).




(1) Left side inner cover 1
(2) Left side inner cover 2
(3) Left side pillar cover

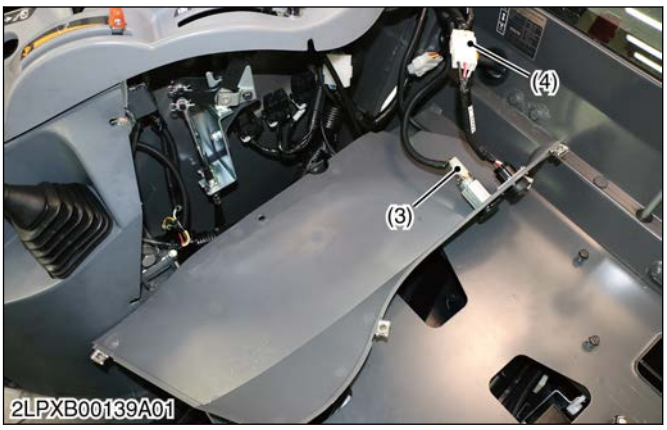
4. Remove the circulation air filter (4).


(4) Circulation air filter

5. Remove the air conditioner duct (5).


(5) Air conditioner duct

## 6.2.3.6 Removing inner cover (right side)

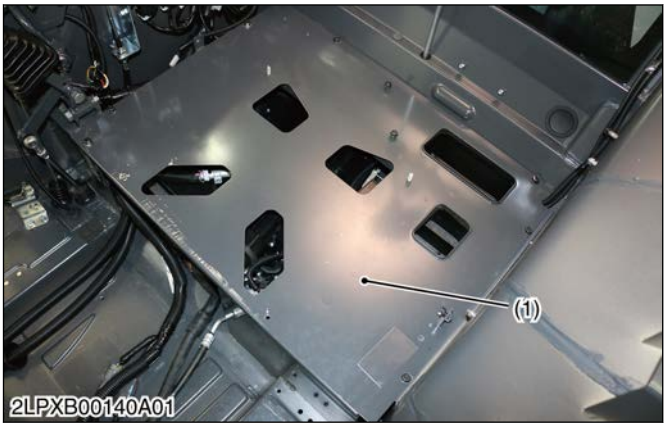




(1) Right side inner cover 1
(2) Right side inner cover 2
(3) Cigar socket connector
(4) Electrical outlet connector

1. Remove the right side inner cover 1 (1).
2. Remove the right side inner cover 2 mounting screws and open the right side inner cover 2 (2).
3. Disconnect the cigar socket connector (3).
4. Disconnect the electrical outlet connector (4).
5. Remove the right side inner cover 2 (2).

## 6.2.3.7 Removing plate

1. After removing the plate mounting bolts and nuts, remove the plate (1).

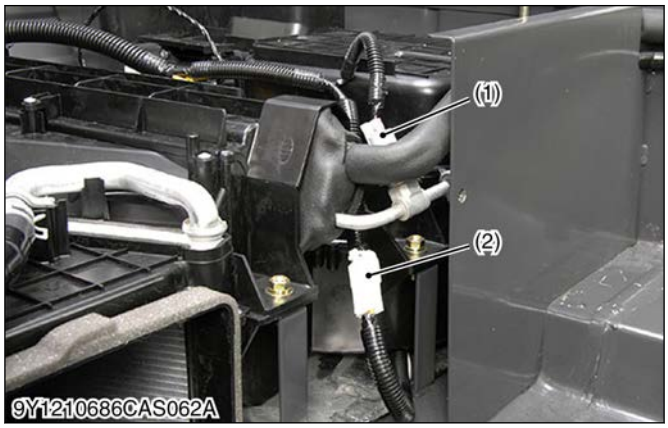




(1) Plate

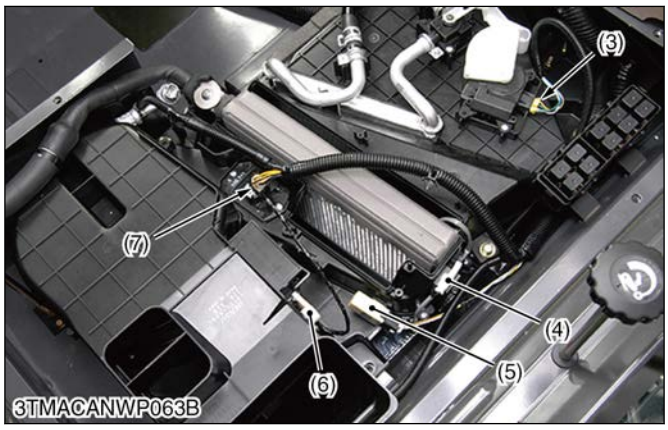
## 6.2.3.8 Disconnecting wiring harness

1. Disconnect the pressure switch 2P connector (1).
2. Disconnect the blower motor 2P connector (2).




(1) Pressure switch 2P connector (2) Blower motor 2P connector

3. Disconnect the blower resistor 4P connector (7).
4. Disconnect the recirculation/fresh air selection motor 5P connector (6).
5. Disconnect the air mix control motor 7P connector (3).
6. Disconnect the thermistor 1P connector (4).
7. Disconnect the thermostat 5P connector (5).




(3) Air mix control motor 7P connector (6) Recirculation/fresh air selection motor 5P connector
(4) Thermistor 1P connector (7) Blower resistor 4P connector
(5) Thermostat 5P connector

## 6.2.3.9 Disassembling air conditioner unit

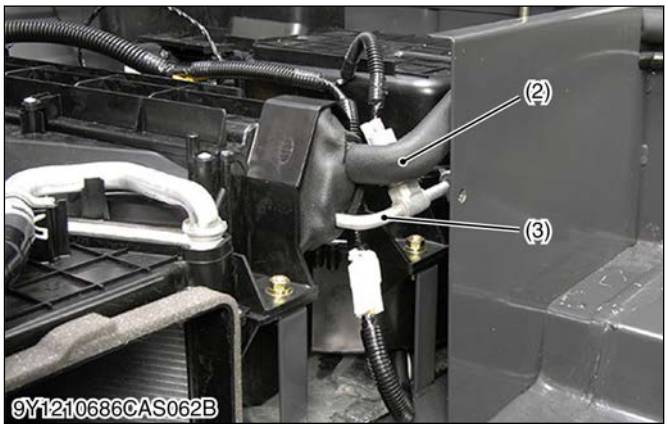
**■ NOTE**

- **Open parts are cap and moisture is prevented from going into the system at once.**

1. Disconnect the heater hoses (1).


(1) Heater hose

2. Remove the pressure hose joint mounting screws and pressure hose joints.
3. Disconnect the high pressure hose (3) and the low pressure hose (2).




(2) Low pressure hose (3) High pressure hose (Cooler hose (Liquid))

4. Remove the unit.

**(When reassembling)**

- When reconnecting the pressure hoses with the unit, apply compressor oil (DENSO OIL8 or its equivalents) to O-rings.
- Tighjten the air conditioner unit mounting screw (M8) and the pressure hose joint mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Air conditioner unit mounting screw (M8) | 9.8 to 15 N·m<br>1.0 to 1.6 kgf·m<br>7.3 to 11 lbf·ft |
| | Pressure hose joint mounting screw | 7.9 to 11 N·m<br>0.80 to 1.2 kgf·m<br>5.8 to 8.6 lbf·ft |

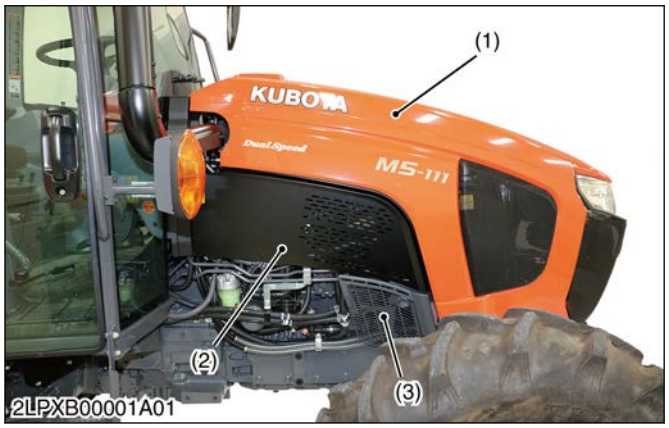
## 6.2.4 Removing air conditioner hose

### 6.2.4.1 Removing bonnet and cover (Cabin model)

**IMPORTANT**

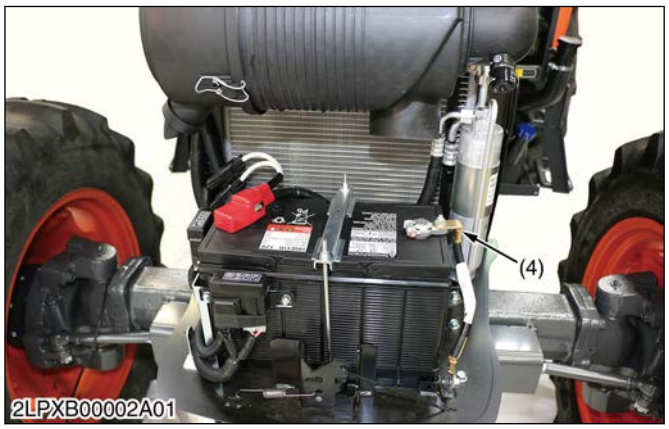
- **When disconnecting the battery cables, disconnect the negative cable first. When connecting, connect the positive cable first.**

1. Open the bonnet (1).



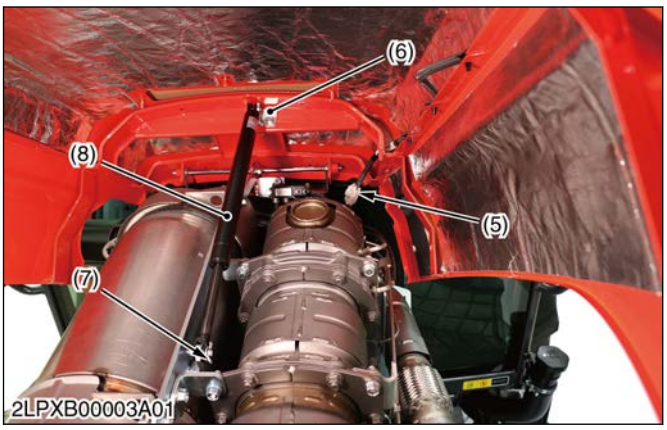

(1) Bonnet
(2) Side bonnet
(3) Side cover

2. Remove the side bonnet (2) and the side cover (3) on both side.
3. Disconnect the negative cable (4) from the battery negative terminal .




(4) Negative cable

4. Disconnect the head light connector (5).



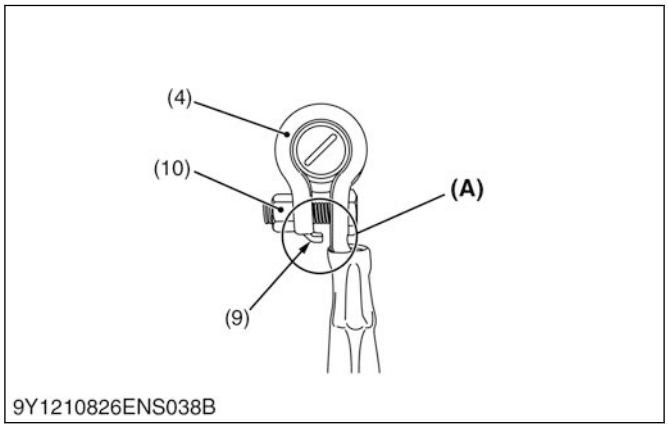

(5) Head light connector
(6) Damper stay
(7) Snap pin
(8) Bonnet damper

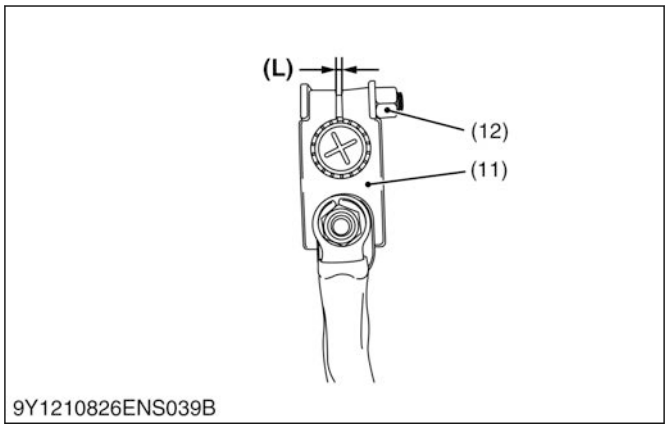
5. Remove the damper stay (6) and the snap pin (7).
6. Remove the bonnet damper (8).
7. Remove the bonnet (1).

**(When reassembling)**

**IMPORTANT**

- **Tighten the negative terminal nut (10) until the stopper (9) contacts to the negative cable (4).**
- **Tighten the positive terminal nut (12) so that the clearance (L) is within the following chart.**




(4) Negative cable
(9) Stopper
(10) Negative terminal nut
(11) Positive terminal
(12) Positive terminal nut
(A) The stopper contacts to the terminal.
(L) Clearance between the positive terminal

- When assembling the bonnet damper (8), be sure that the cylinder parts should be on the backward.

| | | |
|---|---|---|
| Clearance (L) | Factory specification | 1.0 to 1.5 mm<br>0.040 to 0.059 in. |

## 6.2.4.2 Discharging refrigerant

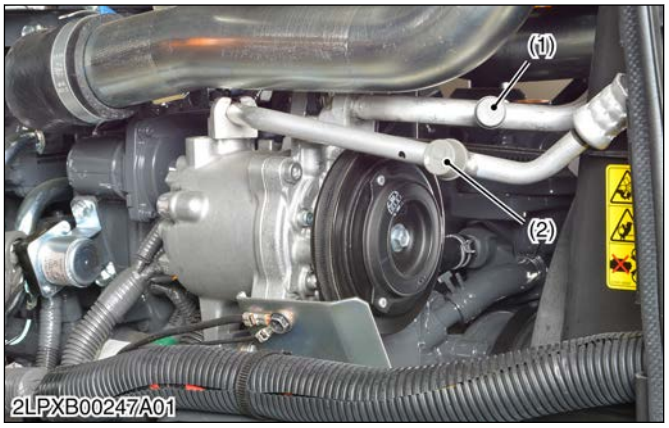
**CAUTION**

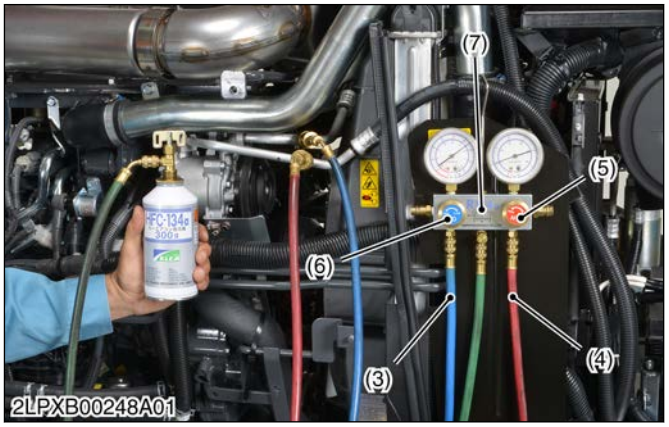
- **Protect fingers and eyes with cloth against frostbite by refrigerant when disconnecting the hose to the charging valve.**

**IMPORTANT**

- **Use only R134a refrigerant recovery and recycling machine (8). Eliminate mixing R134a equipment, refrigerant, and refrigerant oils with R12 system to prevent compressor damage.**

Prepare for the R134a refrigerant recovery and recycling machine (8).



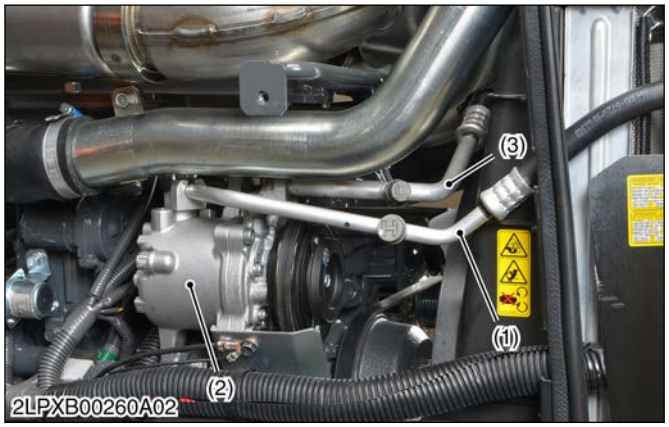



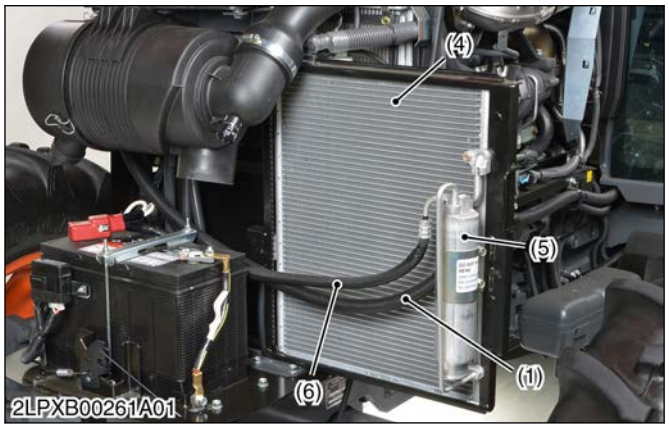


(1) "**LO**" pressure side charging valve
(2) "**HI**" pressure side charging valve
(3) Charging hose (Blue)
(4) Charging hose (Red)
(5) "**HI**" pressure side valve
(6) "**LO**" pressure side valve
(7) Manifold gauge
(8) Refrigerant recovery and recycling machine

1. Connect charging hose (blue) (3) from the refrigerant recovery and recycling machine (8) to "**LO**" pressure side charging valve (1). Connect charging hose (red) (4) to "**HI**" pressure side charging valve (2).
2. Follow the manufacturer's instructions and discharge the system.

## 6.2.4.3 Disconnecting high pressure hose 1, 2 and low pressure hose




(1) High pressure hose 1
(2) Compressor
(3) Low pressure hose
(4) Condenser
(5) Receiver
(6) High pressure hose 2

1. Disconnect the low pressure hose (3) and the high pressure hose 1 (1) from the compressor (2), and then cap the open fittings immediately to keep moisture out of the system.
2. Slide the condenser (4).
3. Disconnect the high pressure hose 1 (1) from the condenser (4) and immediately cap the place where the high pressure hose 1 (1) is disconnected keep moisture out of the system.
4. Disconnect the high pressure hose 2 (6) from the receiver (5) and immediately cap the place where the high pressure hose 2 (6) is disconnected to keep moisture out of the system.

**(When reassembling)**

- Apply compressor oil (DENSO CO. ND-OIL8 or its equivalents) to the O-rings and be careful not to damage them.
- Tighten the low pressure hose mounting screw (compressor side) and the high pressure hose 1 mounting screw (compressor side) to the specified tightening torque.
- Tighten the high pressure hose 1 mounting screw (condenser side) and the high pressure hose 2 retaining nut (receiver side) to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Low pressure hose mounting screw (compressor side) | 7.9 to 11 N·m<br>0.80 to 1.2 kgf·m<br>5.8 to 8.6 lbf·ft |
| | High pressure hose 1 mounting screw (compressor side) | 7.9 to 11 N·m<br>0.80 to 1.2 kgf·m<br>5.8 to 8.6 lbf·ft |
| | High pressure hose 1 mounting screw (condenser side) | 7.9 to 11 N·m<br>0.80 to 1.2 kgf·m<br>5.8 to 8.6 lbf·ft |
| | High pressure hose 2 retaining nut (receiver side) | 12 to 14 N·m<br>1.2 to 1.5 kgf·m<br>8.7 to 10 lbf·ft |

## 6.2.4.4 Removing seat

1. Disconnect the OPC wire harness connector (1).


(1) OPC wire harness connector

2. Remove the seat (2) with the seat mounting bracket.


(2) Seat

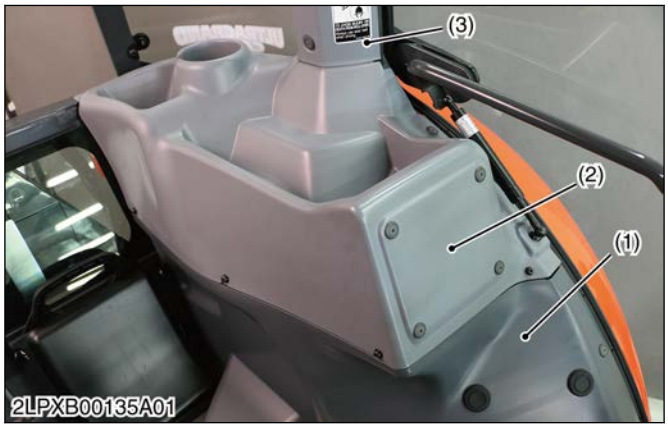
**(When reassembling)**

- Tighten the seat bracket mounting bolt to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Seat bracket mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 6.2.4.5 Removing inner cover (left side) and circulation air filter

1. Remove the left side inner cover 2 (2).
2. Remove the left side pillar cover (3).
3. Remove the left side inner cover 1 (1).




(1) Left side inner cover 1
(2) Left side inner cover 2
(3) Left side pillar cover

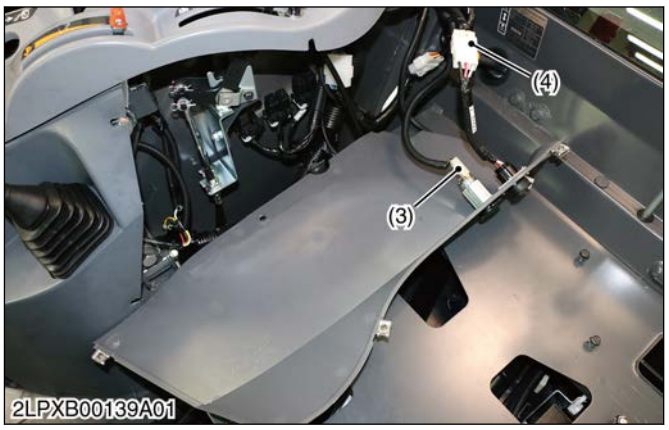
4. Remove the circulation air filter (4).


(4) Circulation air filter

5. Remove the air conditioner duct (5).


(5) Air conditioner duct

## 6.2.4.6 Removing inner cover (right side)

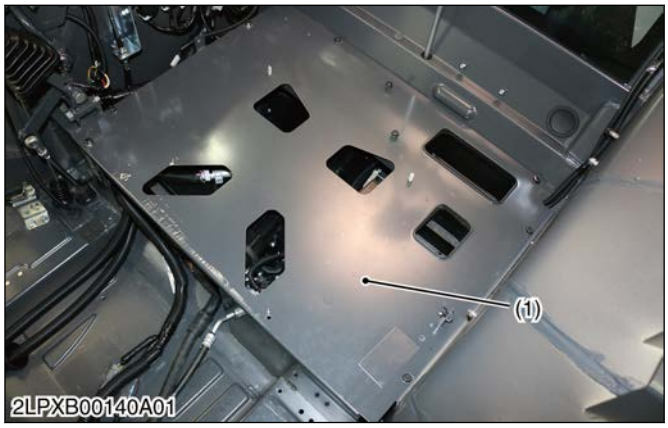




(1) Right side inner cover 1
(2) Right side inner cover 2
(3) Cigar socket connector
(4) Electrical outlet connector

1. Remove the right side inner cover 1 (1).
2. Remove the right side inner cover 2 mounting screws and open the right side inner cover 2 (2).
3. Disconnect the cigar socket connector (3).
4. Disconnect the electrical outlet connector (4).
5. Remove the right side inner cover 2 (2).

### 6.2.4.7 Removing plate

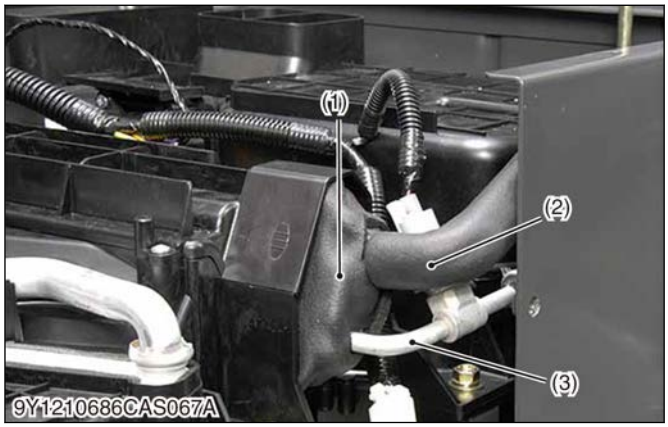
1. After removing the plate mounting bolts and nuts, remove the plate (1).





(1) Plate

### 6.2.4.8 Disconnecting high pressure hose 2 and low pressure hose




(1) Rubber
(2) Low pressure hose
(3) High pressure hose 2

1. Remove the rubber (1) and pressure hoses joint mounting screw.
2. Remove the pressure hoses joint.
3. Disconnect the high pressure hose 2 (3) and low pressure hose (2), and then immmediately cap the place where the pressure hoses (2), (3) are disconnected to keep moisture out of the system.
4. Remove the high pressure hose 2 (3) and low pressure hose (2) from the bottom of the cabin.

**(When reassembling)**
- Replace the rubber (1) with a new one.
- Apply compressor oil (DENSO CO. ND-OIL8 or its equivalents) to the O-rings and be careful not to damage them.
- Tighten the pressure hose joint mounting screw to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Pressure hose joint mounting screw | 7.9 to 11 N·m<br>0.80 to 1.2 kgf·m<br>5.8 to 8.6 lbf·ft |

## 6.2.5 Removing heater hoses

### 6.2.5.1 Draining coolant

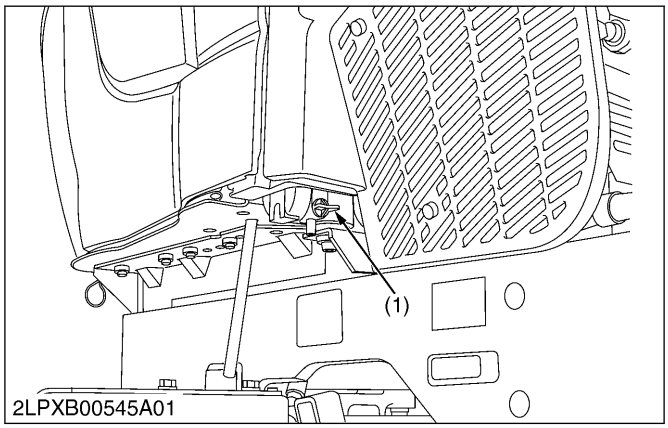
**⚠ WARNING**

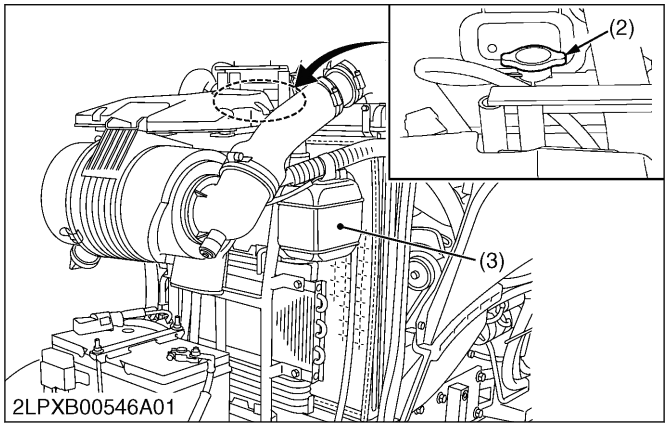
**To avoid personal injury:**
- **Do not remove radiator cap while coolant is hot. When cool, slowly rotate cap to the first stop and allow sufficient time for excess pressure to escape before removing the cap completely.**

**■ IMPORTANT**
- **Do not start engine without coolant.**
- **Use clean, fresh soft water and anti-freeze to fill the radiator and recovery tank.**
- **When mixing the anti-freeze with water, the anti-freeze mixing ratio is 50%.**
- **Tighten radiator cap securely. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**

1. Stop the engine and let the engine cool down.

2. To drain the coolant, open the radiator drain plug (1), remove the drain plug and remove radiator cap (2). The radiator cap must be removed to completely drain the coolant.




(1) Drain plug
(2) Radiator cap
(3) Recovery tank

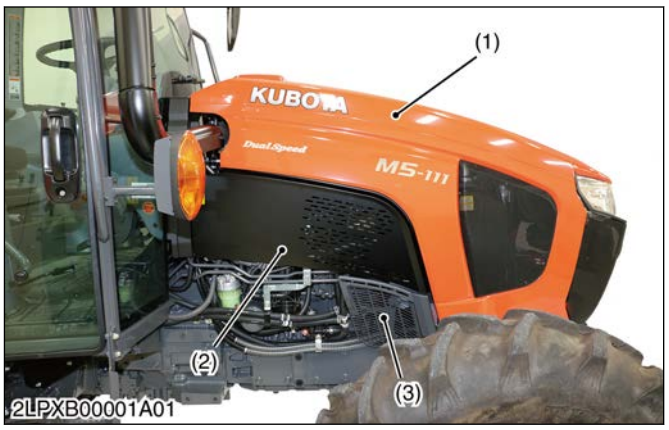
3. After all coolant is drained, reinstall the drain plug (1).
4. Fill with coolant up to the "**FULL**" mark of recovery tank (3).

| | |
|---|---|
| Coolant capacity | 10 L<br>10.6 U.S.qts<br>8.8 Imp.qts |

5. Start and operate the engine for a few minutes.
6. Stop the engine, remove the key and let cool.
7. Check coolant level of recovery tank (3) and add coolant if necessary.
8. Properly dispose of used coolant.

## 6.2.5.2 Removing side bonnet and heater hose

1. Open the bonnet (1).




(1) Bonnet
(2) Side bonnet
(3) Side cover

2. Remove the side bonnet (2) and cover (3) on right side.
3. Disconnect the heater hose (4) for air conditioner.


(4) Heater hose

## 6.2.5.3 Removing seat

1. Disconnect the OPC wire harness connector (1).


(1) OPC wire harness connector

2. Remove the seat (2) with the seat mounting bracket.


(2) Seat

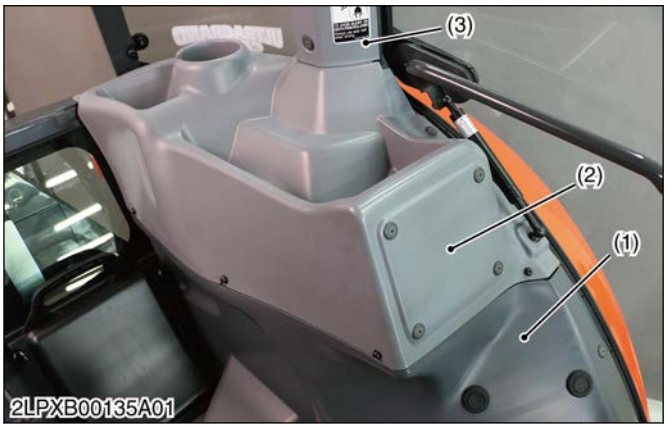
**(When reassembling)**

- Tighten the seat bracket mounting bolt to the specified tightening torque.

| | | |
|---|---|---|
| Tightening torque | Seat bracket mounting bolt | 23.5 to 27.5 N·m<br>2.40 to 2.80 kgf·m<br>17.4 to 20.2 lbf·ft |

## 6.2.5.4 Removing inner cover (left side) and circulation air filter

1. Remove the left side inner cover 2 (2).
2. Remove the left side pillar cover (3).
3. Remove the left side inner cover 1 (1).




(1) Left side inner cover 1
(2) Left side inner cover 2
(3) Left side pillar cover

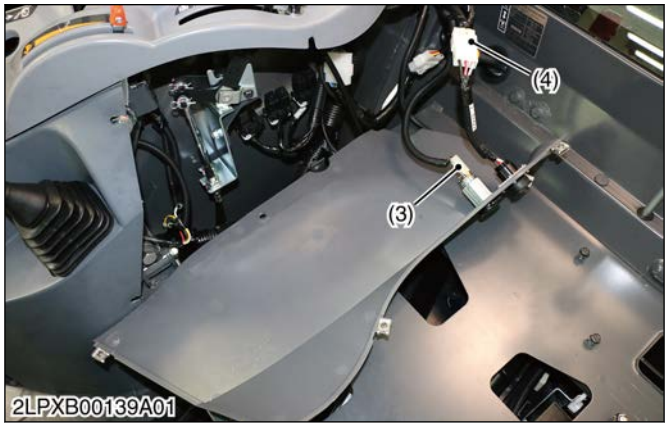
4. Remove the circulation air filter (4).


(4) Circulation air filter

5. Remove the air conditioner duct (5).


(5) Air conditioner duct

### 6.2.5.5 Removing inner cover (right side)


(1) Right side inner cover 1
(2) Right side inner cover 2
(3) Cigar socket connector
(4) Electrical outlet connector

1. Remove the right side inner cover 1 (1).
2. Remove the right side inner cover 2 mounting screws and open the right side inner cover 2 (2).
3. Disconnect the cigar socket connector (3).
4. Disconnect the electrical outlet connector (4).
5. Remove the right side inner cover 2 (2).

### 6.2.5.6 Removing heater hoses


(1) Heater hose 1
(2) Heater hose 2

1. Disconnect the heater hoses 1 (1) and 2 (2).
2. Remove the heater hoses 1 (1) and 2 (2) from the bottom of the cabin.

**(When reassembling)**

- When connecting the heater hose with air conditioner unit, hose should be put into the air conditioner unit pipe more than 30 mm (1.2 in.).
- Be sure to fix the heater hoses 1 (1) and 2 (2) to the original position.
  Note the inlet hose and outlet hoses.

## 6.2.6 Cab windshield

### 6.2.6.1 Preparation for replacing windshield

**■ NOTE**

- **Sika Tack-Ultrafast and cleaner No. 1 are made by Sika Corporation.**
- **Since these materials can not be provided by Kubota Corporation,please find the local made equivalent materials in your country and use them when you need.**

1. Prepare the following items.
   - Cutter knife: 1 piece
   - Scraper: 1 piece
   - Gun for coating: 1 piece
   - Sika Tack-Ultrafast or its equivalents
   - Sika-cleaner No. 1
   - Gummed tape

### 6.2.6.2 Replacing windshields by piano wire

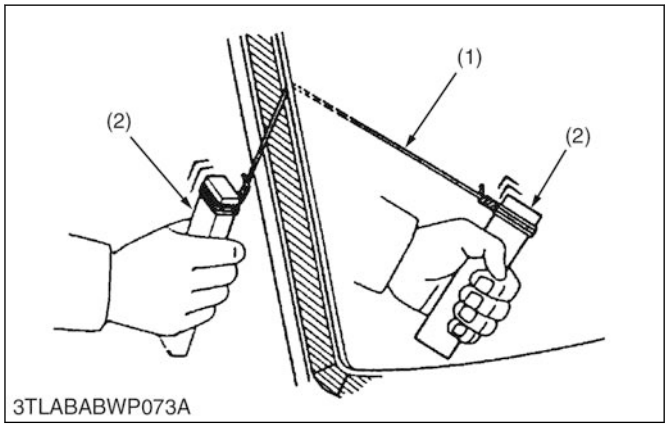
**■ NOTE**

- **Do not let the piano wire make sliding contact with the edge of glass plate forcibly.**

**[In case of using piano wire (When glass is cracked.)]**

1. Thread the piano wire from the inside of cabin.
2. Tie both ends of the wooden blocks or as shown in figure.

3. Pull the piano wire inward/outward alternately to cut the adhered part.




(1) Piano wire (2) Wooden block

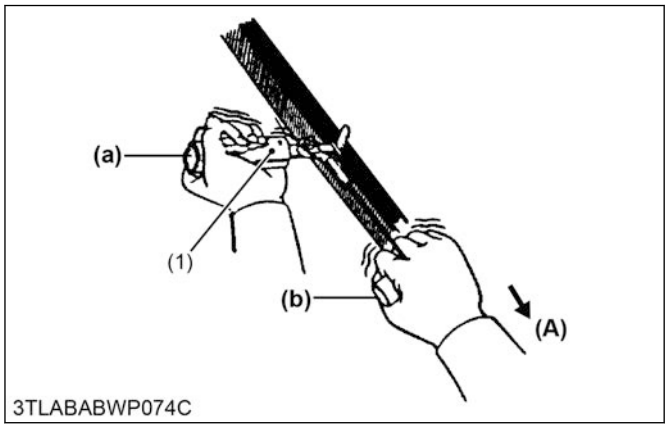
## 6.2.6.3 Replacing windshields by cutter knife

**NOTE**

- **Find a wider gap between the glass and body.**
- **Be careful of handling the cutter knife not to damage your hand.**

**[In case of using cutter knife (When glass is totally crushed finely.)]**

1. Insert the cutter knife (1) into the adhered part.
2. Keep the edge of knife blade square to the glass edge at the part (a).
3. Slide the knife blade along the glass surface and the edge.
4. Pull the part (b) in the direction parallel to the glass edge to cut them off.




(1) Cutter knife (b) Wooden block part
(A) Pulling
(a) Wooden block part

## 6.2.6.4 Removing bond

**NOTE**

- **Remove the bond completely.**

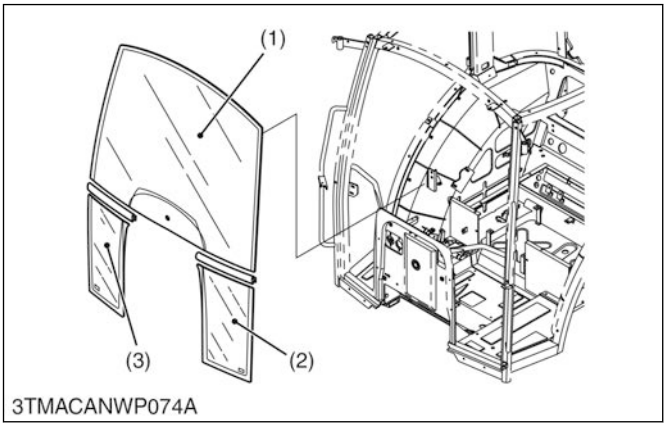
1. When the Sika Tack-Ultrafast or its equivalents attached to the cabin frame and the glass are reused, remove the bond clearly.
2. Clean the frame surface and the glass surface with Sika-cleaner No.1.

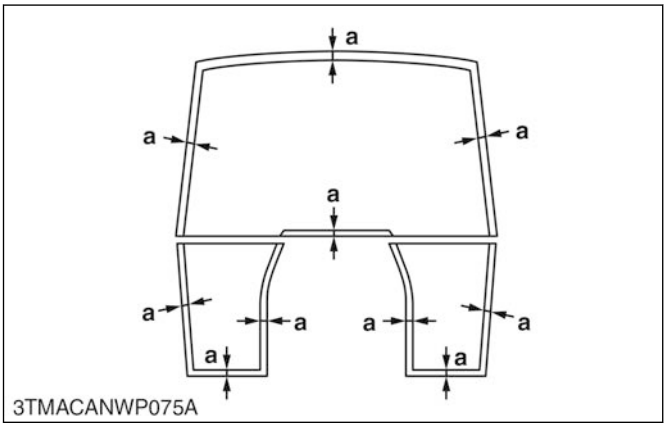
## 6.2.6.5 Cleaning cabin frame surface and glass surface

**NOTE**

- **If the glass surface is not cleaned, it may result in adhesive failure.**

1. Clean the cabin frame surface with Sika-cleaner No.1.
2. Check that the glasses are not damaged and cracked.
3. Turn over the glass and clean the glass surface with Sika-cleaner No. 1.
4. The cleaning area of the glass rear surface is indicated "a" in the figure.



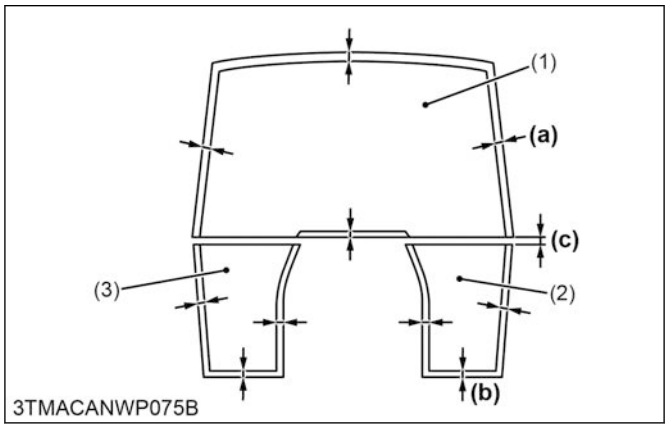

(1) Upper windshield a: 25 mm (0.98 in.)
(2) Lower windshield (Left)
(3) Lower windshield (Right)

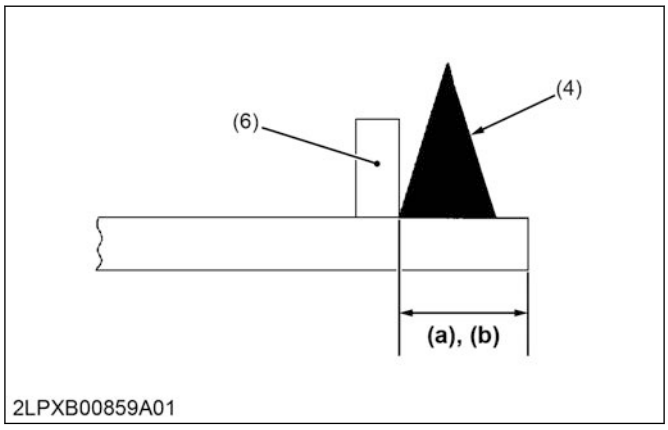
## 6.2.6.6 Applying Sika Tack-Ultrafast

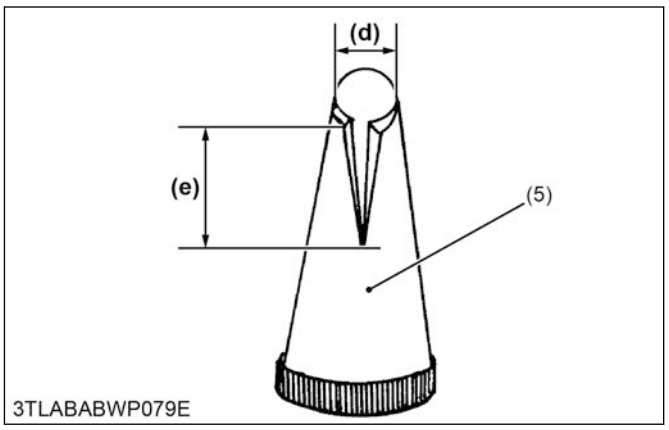
**■ NOTE**

- **Apply the Sika Tack-Ultrafast (or its equivalents) with the special shaped tip as shown in the figure.**
- **Apply it with a uniform speed to minimize unevenness.**
- **Follow the instruction manual of Sika Tack-Ultrafast.**

1. Apply a Sika Tack-Ultrafast (or its equivalents) on the glass surface as shown in figure.



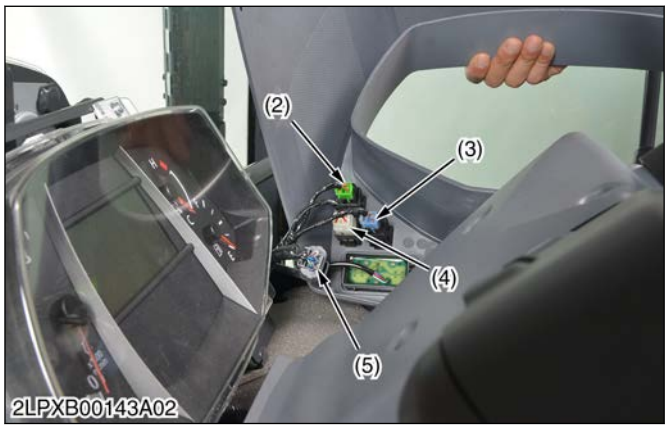



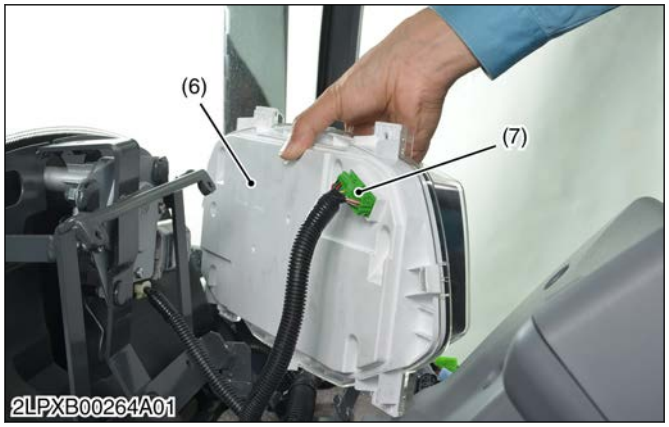

(1) Upper windshield
(2) Lower windshield (left)
(3) Lower windshield (right)
(4) Sika Tack-Ultrafast
(5) Sika Tack-Ultrafast tube tip
(6) Shield

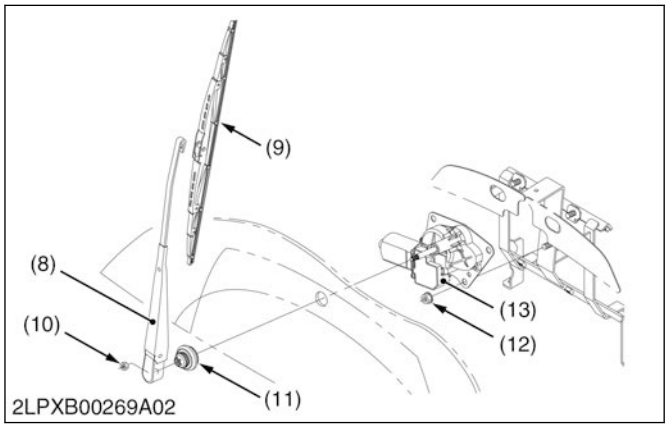
(a) 10 mm (0.39 in.)
(b) 12 mm (0.47 in.)
(c) 4.0 mm (0.16 in.)
(d) 8.0 mm dia. (0.31 in. dia.)
(e) 12 mm (0.47 in.)

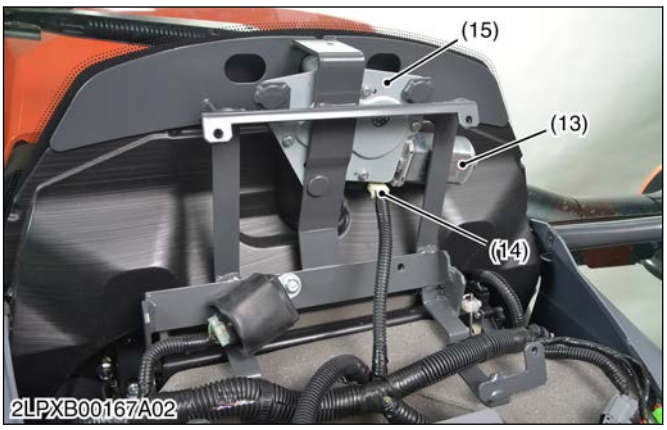
## 6.2.7 Wiper motor

### 6.2.7.1 Removing front wiper motor




(2) Constant RPM management switch connector
(3) Parked regeneration switch connector
(4) DPF INHIBIT switch connector
(5) Display switch connector
(6) Meter panel
(7) Meter panel connector
(8) Wiper arm
(9) Wiper blade
(10) Nut 1
(11) Wiper link cap
(12) Nut 2
(13) Wiper motor
(14) Wiper motor connector
(15) Wiper motor bracket

1. Remove the panel cover (1).

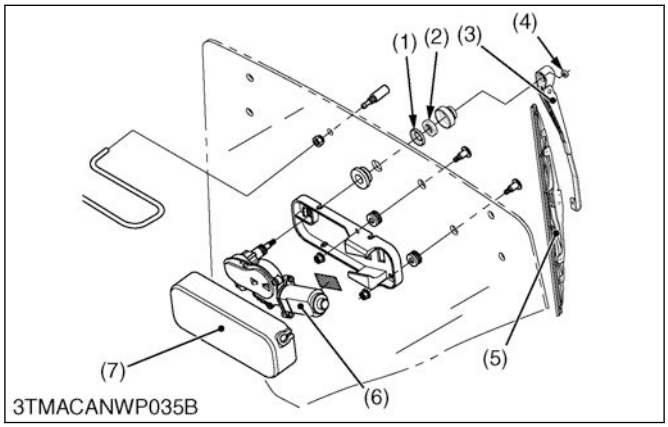

(1) Panel cover

2. Disconnect the connector (2) from constant RPM management switch.
3. Disconnect the connector (3) from parked regeneration switch.
4. Disconnect the connector (4) from DPF INHIBIT switch.
5. Disconnect the connector (5) from display switch.
6. Remove the meter panel (6).
7. Disconnect the connector (7) from meter panel (6) and remove the meter panel (6).
8. Disconnect the connector (14) from front wiper motor (13).
9. Remove the wiper arm mounting nut 1 (10) and wiper arm (8).
10. Remove the wiper link cap (11) and nut 2 (12).
11. Remove the front wiper motor bracket (15), then remove the front wiper motor (13).

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Wiper arm mounting nut | 6.9 to 9.8 N·m<br>0.70 to 1.0 kgf·m<br>5.1 to 7.2 lbf·ft |

### 6.2.7.2 Removing rear wiper motor (if equipped)




(1) Wiper link cap
(2) Nut 1
(3) Wiper arm
(4) Nut 2
(5) Wiper blade
(6) Rear wiper motor
(7) Wiper motor cover

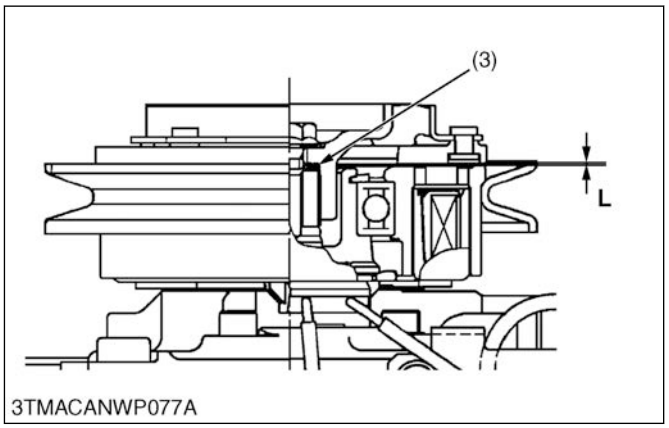
1. Remove the wiper motor cover (7).
2. Disconnect the connector from rear wiper motor (6).
3. Remove the wiper arm mounting nut 2 (4) and wiper arm (3).
4. Remove the wiper link cap (1) and nut 1 (2).
5. Remove the rear wiper motor mounting screws, then remove the rear wiper motor (6).

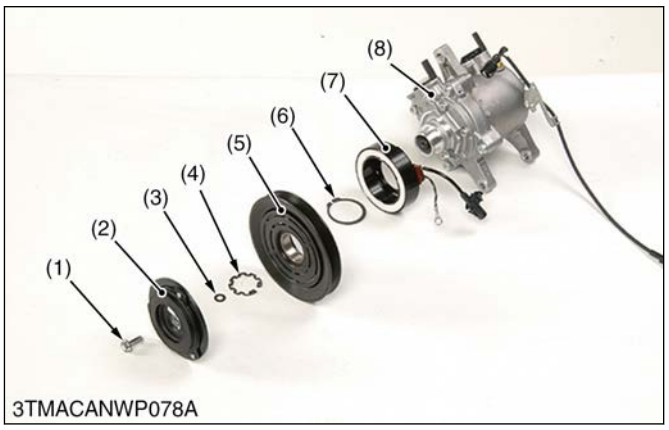
**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Wiper arm mounting nut | 7.9 to 9.8 N·m<br>0.80 to 1.0 kgf·m<br>5.8 to 7.2 lbf·ft |
| | Wiper motor mounting screw | 7.9 to 9.8 N·m<br>0.80 to 1.0 kgf·m<br>5.8 to 7.2 lbf·ft |

## 6.3 Servicing

### 6.3.1 Adjusting air gap


(1) Magnetic clutch mounting screw
(2) Hub plate
(3) Shim
(4) External snap ring
(5) Rotor
(6) External snap ring
(7) Stator
(8) Compressor body
L: Air gap

1. Measure the air gap with a feeler gauge.

2. When the measured value is out of the factory specification, adjust the air gap using the shim (3).

| | | |
|---|---|---|
| Air gap "L" | Factory specification | 0.30 to 0.65 mm<br>0.012 to 0.025 in. |

| Adjusting Shim Size | Code No. |
|---|---|
| 0.10 mm (0.0039 in.) | T1065-87340 |
| 0.15 mm (0.0059 in.) | T1065-87350 |
| 0.40 mm (0.016 in.) | T1065-87360 |
| 0.60 mm (0.024 in.) | T1065-87370 |
| 1.0 mm (0.0394 in.) | T1065-87380 |

# INDEX

## Symbols



## A

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## C

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## F

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## M

## N



## O

## P

## R

## S

## T

## U



## V



## W

# M5091/111 (ROPS) (F18/R18 SPEED TRANSMISSION MODEL)

## ELECTRIC CIRCUIT

<O○ (Horizontal)-△ (Vertical)> indicates the address.
Ex. : <14-E> : PTO Switch

J/C ○(Alphabet)-○ (Number) indicates the Joint Connector and Terminal No. .
EX. J/C 1-3 :
Joint Connector 1 - Terminal 3



Power Source from Battery
Power source when main key switch is ON
ECU controls the output voltage according to the condition
Grounding

# M5091/111 (CAB) (F36/R36 SPEED TRANSMISSION MODEL)

## ELECTRIC CIRCUIT

<O○ (Horizontal)-△ (Vertical)> indicates the address.
Ex. : <14-E> : PTO Switch

J/C ○ (Alphabet)-○ (Number) indicates the Joint Connector and Terminal No. .
EX. J/C C-3 :
Joint Connector C - Terminal 3




Power Source from Battery
Power source when main key switch is ON
ECU controls the output voltage according to the condition
Grounding



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