WSM

WORKSHOP MANUAL

KUBOTA EXCAVATOR

U10-5

Kubota

TO THE READER

This workshop manual provides safety information for service activity, general information such as specifications and dimensions of the machine, mechanisms and structure descriptions of the machine, and service procedures.

Safety
This section contains safety service descriptions and safety label information.

General
This section contains general instructions, tightening torques, general machine information and special tools.

Maintenance
This section contains information for the recommended oil and general maintenance procedures.

Each section basically consists of mechanism and servicing.

Mechanism
Mechanism part contains information and explanations for the structure, functions, and specifications of the machine or component parts. This part should be comprehended before proceeding with troubleshooting, disassembling, assembling, and servicing works.

Servicing
Servicing part contains information and procedures for maintenance, troubleshooting and repair works. The reader should follow these instructions in order to satisfy any servicing work safely, correctly and quickly.

In this WSM, service specifications and service limits are defined as followings.

Service specifications:
Specification which corresponds to new machine's ex-factory. It is based on quality standard, drawings, or actual measurements conducted by Kubota. This value is used to determine whether there is a problem with the machine in the event of a troubleshooting. However, it is necessary to consider degradation due to wear, based on the operating time of the machine, application or maintenance condition.

Service limits:
Service limit is a value corresponding to the recommended performance limit by taking long term-use wear into account. When the service limit is reached, the machine is required to have proper repair, overhaul or replacement in order to keep safe and adequate performance.

All of the illustrations, photographs, specifications, and other information in this manual were created based on the latest model at the time of publication.
The parts names used in this manual are unified into names representing the functions of the parts. Therefore, it does not necessarily correspond to the names used in other materials (parts list, operators manual etc.) and the name on the label / identification plates on the product.
Kubota reserves the right to change all information at any time without notice.

April 2021

SUPPLEMENTARY INFORMATION

For the engine servicing information, refer to the following engine WSM.

■ NOTE

- **The PDF No. may be changed by revision.**

Manuals related to the engine (D722-E4-BH-5EU)

Manual	Title	PDF No.
WSM	SM-E4 SERIES	9Y311-0038△

Applicable workshop manual

Manual	Title	PDF No.
WSM	K008-3 U10-3	97899-6073△ (English) 97899-6087△ (French) 97899-6088△ (German) 97899-6089△ (Italian) 97899-6090△ (Spanish)

This workshop manual mainly covers for the sections which are changed from U10-3. Refer to the current workshop manual of *K008-3* and *U10-3* for other information.

CONTENTS

1. SAFETY

2. GENERAL

5. HYDRAULIC SYSTEM

6. ELECTRICAL SYSTEM

7. APPENDICES

ABBREVIATIONS

Abbreviations	Definitions	Abbreviations	Definitions
A/C	Air Conditioning	ID	Inner Diameter
AC	Alternating Current	ISO	International Standards Organization
ACC	Accessory	J/C	Joint Connector
AFS	Air Flow Sensor	JIS	Japanese Industry Standard
AI	Auto Idle	LCD	Liquid Crystal Display
API	American Petroleum Institute	LED	Light Emitting Diode
Approx.	Approximately	LH	Left Hand side
AS	Auto Stop	LSD	Limited Slip Differential
ASSY.	Assembly	MAX	Maximum
ASTM	American Society for Testing and Materials	MIL	Military Standards
AUX	Auxiliary	MIN	Minimum
C/V	Control Valve	NC	Normally Closed
CAB	Cabin	NO	Normally Opened
CAN	Controller Area Network	OD	Outer Diameter
CCV	Closed Crankcase Ventilation	P/V	Pilot Valve
CECE	Committee for European Construction Equipment	P/L	Pressure Limiter
CNP	Canopy	RH	Right Hand side
CRS	Common Rail System	RMS	Root Mean Square
DIN	Deutsches Institut für Normung (German Institute for Standards)	ROPS	Roll Over Protective Structure
DOC	Diesel Oxidation Catalysts	SAE	Society of Automotive Engineers
DM	Diagnostic Manual	SBF	Slow Blow Fuse
DPF	Diesel Particulate Filters	SCV	Suction Control Valve
DTC	Diagnostic Trouble Code	SI	Système Internationale (International system of units)
ECU	Electronic Control Unit	S/J	Swivel Joint
EGR	Exhaust Gas Recirculation	SOL	Solenoid
EN	Europäische Norm (European standard)	spec.	Specification
Eng	Engine	SW	Switch
FOPS	Falling Object Protective Structure	TEMP.	Temperature
GND	Ground	TPSS	Two Pattern Selection System
HST	Hydraulic Static Transmission	WSM	Work Shop Manual
IAT	Intake Air Temperature	W/H	Wire Harness

1. SAFETY

SAFETY RULES

1. Basic safety instructions

- The EC Use of Work Equipment Directive (2009/104/EC) from 16/09/2009 applies to the operation of the aforementioned excavator.
- The information in these operating instructions applies for maintenance and repairs.
- National rules and regulations apply where applicable.

2. Duties, liability and warranty

A basic prerequisite for the safe handling and problem-free operation of the excavator is the knowledge of the safety instructions and safety regulations.
These operating instructions, in particular the safety instructions, must be followed by all persons working near or with the excavator. Above and beyond this, the safety rules and regulations applicable for the site must also be observed.
Hazards occurring during the handling of the excavator:

- The excavators are manufactured according to the state of technology and the recognised safety rules. Nevertheless, danger to life and limb of the operator or a third party, or damage to the excavator or other property, can occur. The excavator(s) may only be used.
  - – → for its approved use
  - – → in a completely safe operating condition

  Malfunctions that can impair safety must be repaired immediately.

Warranty and liability
The scope, period and form of the warranty are set forth in the sales and delivery conditions of the manufacturer. The operating instructions valid at the time of delivery shall be the basis for any warranty claims arising from error s in the documentation, see the date of issue of the operating instructions. The following applies above and beyond the sales and delivery conditions: No warranty or liability shall be assumed for personnel and property damages resulting from one or more of the following reasons:

- Unapproved use of the excavator.
- Improper starting, operation and maintenance of the excavator.
- Operation of the machine with malfunctioning safety devices or improperly installed or non-operational safety and protective devices.
- Ignorance or non-observance of these operating instructions.
- Insufficiently qualified or insufficiently instructed operating personnel.
- Improperly performed repairs.
- Unauthorised engineering changes to the excavator.
- Poor surveillance of machine parts subject to wear.
- Catastrophes caused by the effect of foreign objects or an act of god.

It is the responsibility of the owner to ensure that:

- The safety rules are observed.
- Unapproved use and unauthorised operation are prevented.
- The excavator is used properly and is operated in accordance with the contractual conditions of use.

3. Approved use

The excavators specified in these operating instructions may only be used for loosening, excavating, picking up, transporting and dumping soils, rocks and other materials, as well as for work with the dozer or with a breaker. The load may be transported largely without driving the excavator. Do not exceed the maximum lifting capacity.
Approved use also includes

- Observation of all notes in these operating instructions.
- Regular servicing
- Regular safety inspections

4. Unapproved use

Any improper use – i.e. any deviation from the information in the “Approved use” section of the excavators documented in these operating instructions – is considered unapproved use. This also applies to the failure to observe the standards and guidelines listed in these operating instructions.
Hazards can occur as a result of improper use. Such improper uses include.

- Using the excavator to lift loads without the proper equipment for lifting operations.
- Using the excavator in contaminated environments.
- Using the excavator in enclosed spaces without sufficient ventilation.
- Using the excavator under conditions of extreme temperatures (extreme heat or cold).
- Using the machine during a thunderstorm or when there is a possibility of lightning.
- Using the excavator for underground work.

- Using the machine to transport people (e.g. by means of attachments).
- Using the excavator for demolition work, with the danger of falling objects (e.g. tearing down walls).
- Using the machine with a log grab.

5. Quick coupler and attachments limitations

The Kubota excavator has been thoroughly tested for proper performance with quick coupler and attachments sold or approved by Kubota.
Use with quick coupler and attachments which are not sold or approved by Kubota and which are otherwise unfit for use with the Kubota excavator may result in malfunctions or failures of the excavator, damage to other property and injury to the operator or others.
[Any malfunctions or failures of the excavator resulting from use with improper quick coupler and attachments are not covered by the warranty.]

6. Special duties of the owner

The owner of the excavator in the context of these operating instructions is any person or company that uses the excavator itself or on whose order it is used. In special cases (e.g. leasing, rental), the owner is the person who must perform the duties arising from operation according to the conditions of the contract between owner and user of the excavator.
The owner must ensure that the excavator is only used properly and that any danger to the life and health of the user or others who are in the proximity of the user are eliminated. Furthermore, observance of the safety rules and regulations as well as the operating, maintenance and repair regulations must be ensured. The owner must make sure that all operators and users have read and understood these operating instructions.
The operator must provide persons who work with or on the excavator with suitable personal protective equipment (PPE) and those persons must use that equipment where applicable, for example: suitable working clothes, safety shoes, safety helmets, eye protection, ear protection and breathing masks. The owner/employer bears the main responsibility for the PPE, which is specified by the safety rules for particular types of activity.
Waste such as old oil, fuel, hydraulic fluid, coolant and batteries comes under the category of toxic waste and can be a hazard to the environment, people and animals.
Disposal must be undertaken in an appropriate way, according to legally prescribed pollution control and safety regulations.
If you have questions about the proper disposal or storage of refuse and toxic waste, contact your Kubota dealer or a local waste management contractor.

7. Noise emission and vibration

The values specified in these operating instructions were identified during the test cycle on an identical machine and are valid for a machine with the standard equipment. The determined values are specified in the Technical Data.

7.1 Noise emission

The noise levels were determined using the method for determining the guaranteed sound pressure level ISO 4871 based on directive 2000/14/EC, Appendix VI.
The noise levels indicated are not applicable for the determination of additional workplace noise emissions. The actual noise levels may need to be determined directly at the workplaces, subject to actually existing conditions (other noise sources, special operating conditions, sound reflections).
Depending on the actual noise emissions, the owner must provide the operator with the necessary personal protective equipment (ear protection).

⚠ CAUTION

- **Noises at a noise level of more than 85 dB (A) can cause hearing damage.**
- **At a noise level of 80 dB (A) and up, the use of ear protection is recommended.**
- **At a noise level of 85 dB (A) and up, the operator must wear ear protection.**

7.2 Vibrations

The vibrations on the machine have been determined using an identical machine.
The vibration stress on the operator over a longer period of time must be determined by the owner at the operating site, in compliance with directive 2002/44/EC in order to consider individual magnitudes of influence.

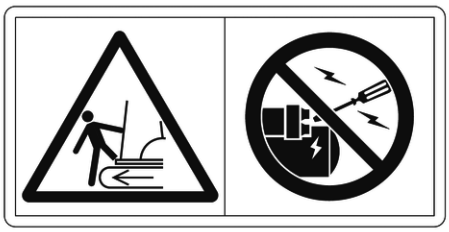
8. Safety labels on the machine

Care of safety labels

- Keep safety labels clean and free from interfering objects.
- Clean safety labels with soap and water and dry with a soft, clean cloth.
- Replace damaged or missing safety labels with new ones from your Kubota dealer.
- If a component with glued-on safety labels is replaced with a new part, make sure that the new labels are affixed to the same location as the replaced component.
- Safety labels should be stuck only on clean and dry surfaces. Press any air bubbles into the outer edge of the sticker.

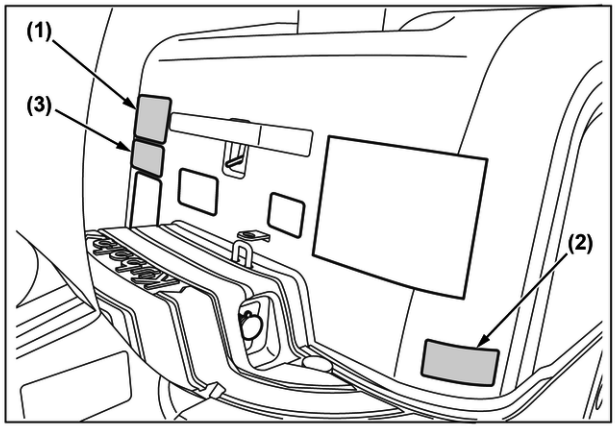
The positioning of the safety labels is illustrated in the following figures.

(1) Part No. RB456-5739-△



(2) Part No. RD579-5736-△

(3) Part No. RD548-5738-△



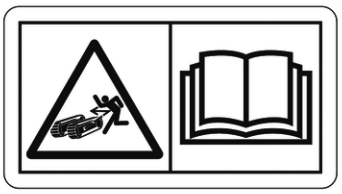
2GNHT00054A01enUS

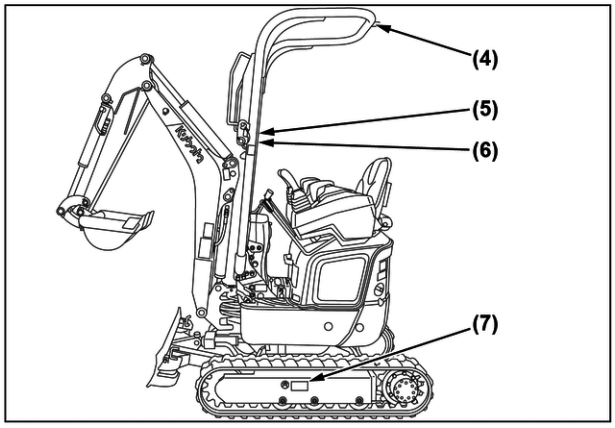
(4) Part No. RB419-5796-△

(5) Part No. RA058-5723-△

(6) Part No. RB579-5755-△

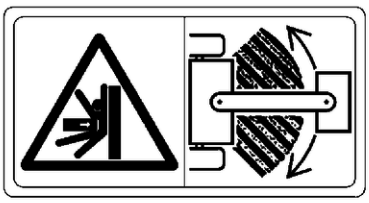
(7) Part No. RB456-5795-△



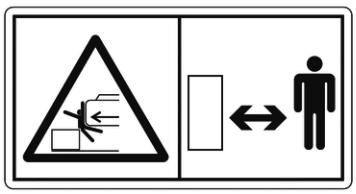


2GNHT00055A01enUS

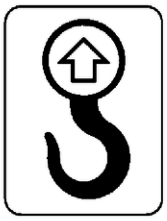
(8) Part No. RB456-5722-△



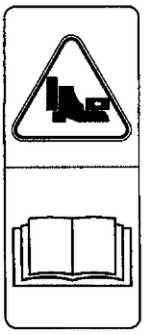
(9) Part No. RA028-5728-△



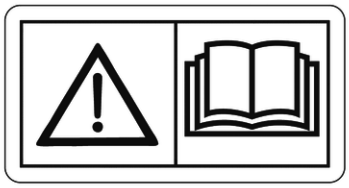
(10) Part No. R2491-5796-△

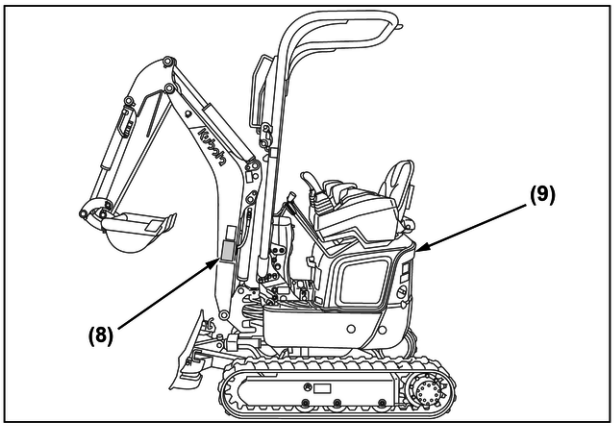


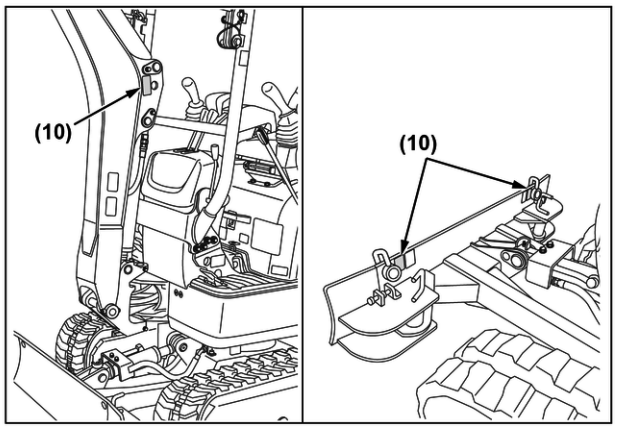
(11) Part No. RA118-5776-△

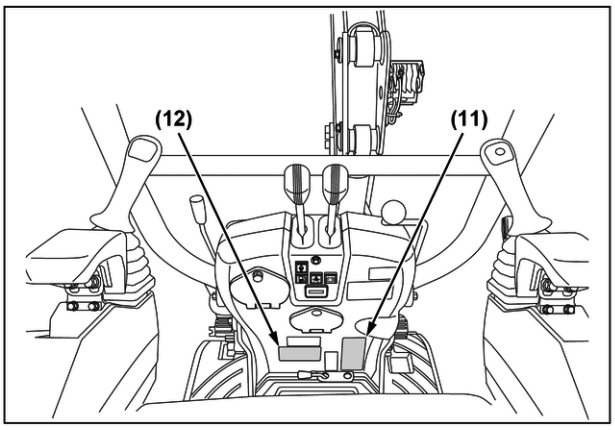


(12) Part No. 69198-5784-△





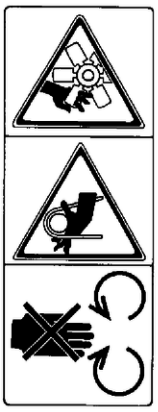




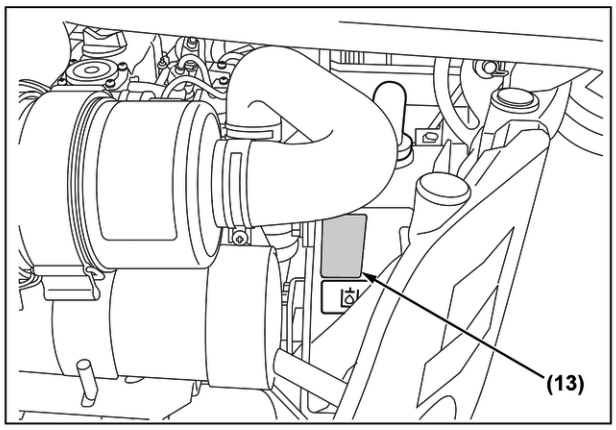
2SBJL00033A01enUS

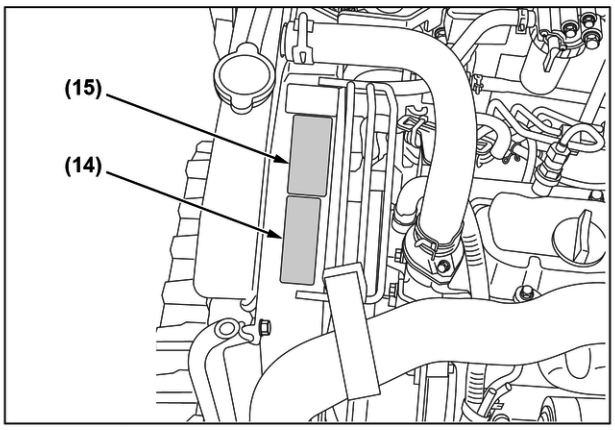
(13) Part No. RD579-5738-△

(14) Part No. 6C090-4958-△



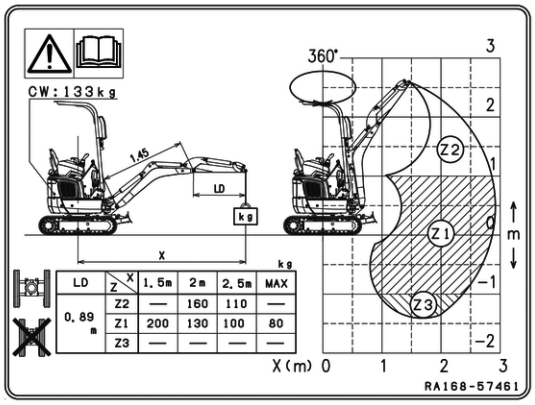
(15) Part No. RA058-5722-△





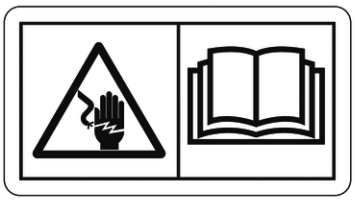
2GNHT00057A01enUS

(16) Part No. RA168-5746-△



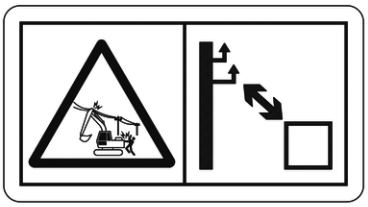
LD	Z \ X	1.5m	2m	2.5m	MAX
0.89 m	Z2	—	160	110	—
	Z1	200	130	100	80
	Z3	—	—	—	—

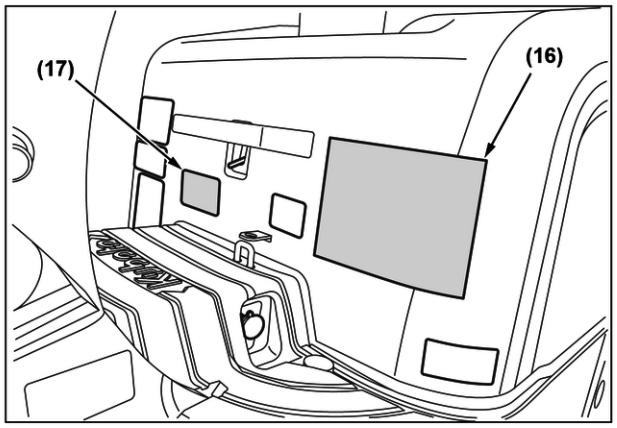
(17) Part No. RB456-5786-△

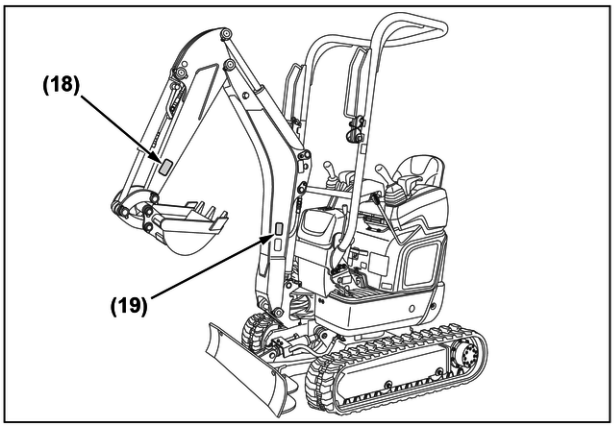


(18) Part No. RB456-5789-△

(19) Part No. RB456-5788-△

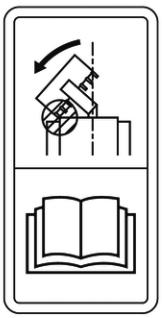




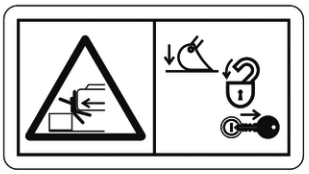


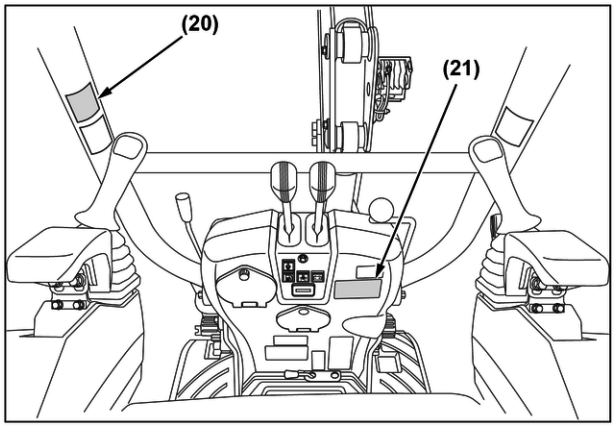
2SBJL00034A01enUS

(20) Part No. RD839-5739-△



(21) Part No. RB456-5783-△





2GNHT00059A01enUS

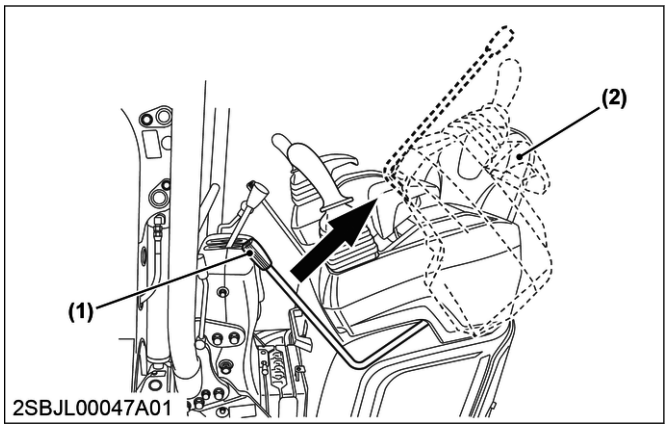
9. Safety devices

Before starting the machine, all safety devices must be installed properly and operational. Manipulating the safety devices is prohibited.
Protective devices may only be removed once

- the excavator is standing still and the engine is stopped.
- and secured against restarting (starter switch in **[STOP]** position and key removed).

9.1 Locking the controls

9.1.1 Locking the control lever



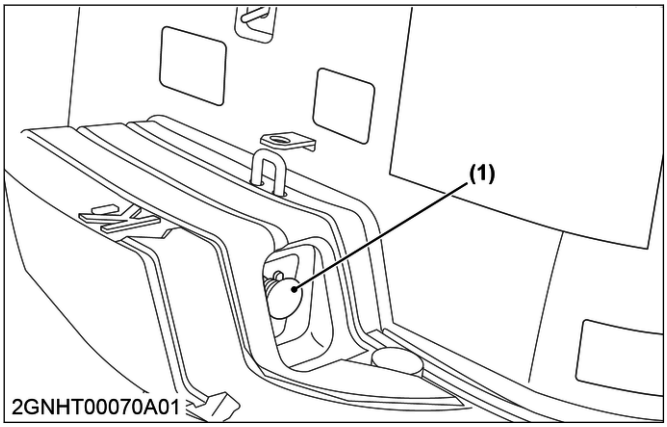
(1) Lever lock (2) Control console

If the left or the right control console is raised completely with the lever lock, then the hydraulic functions of the following controls will be locked:

Function	
AUX control pedal	●
Swing control pedal	●
Travel control lever RH	●
Travel control lever LH	●
Blade control lever	●
Pilot control lever RH	●
Pilot control lever LH	●

- To unlock the hydraulic functions, lower the control console completely using the lever lock.

9.2 Locking the swivel frame



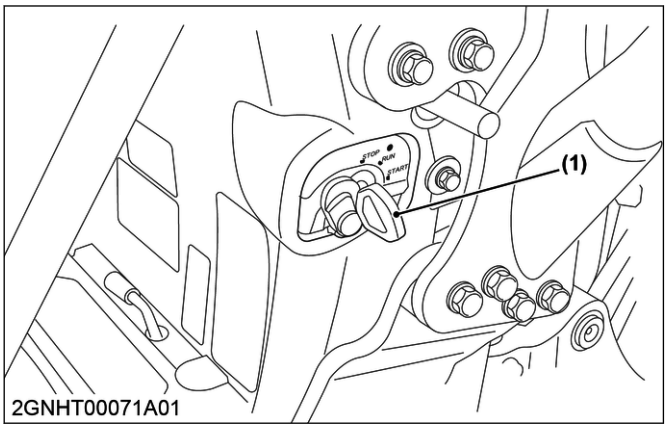
(1) Swivel frame lock

The swivel frame lock serves to secure the swivel frame against unintentional rotations, e.g. during transport.
If the swivel frame lock is in the bottom position, the swivel frame and the track frame are interlocked.

■ NOTE

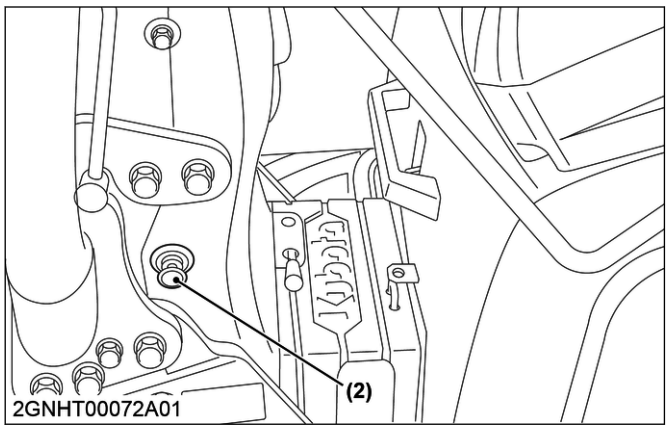
- **Before locking the swivel frame, the swivel frame and track frame must be aligned parallel to one another.**

9.3 Engine emergency stop



(1) Starter switch

The engine turns off when the starter switch is switched to the **[STOP]** position.
If the engine cannot be turned off, please operate the engine emergency stop knob in order to turn off the engine.



(2) Knob

To stop the engine:
- Pull the knob until the engine stops.

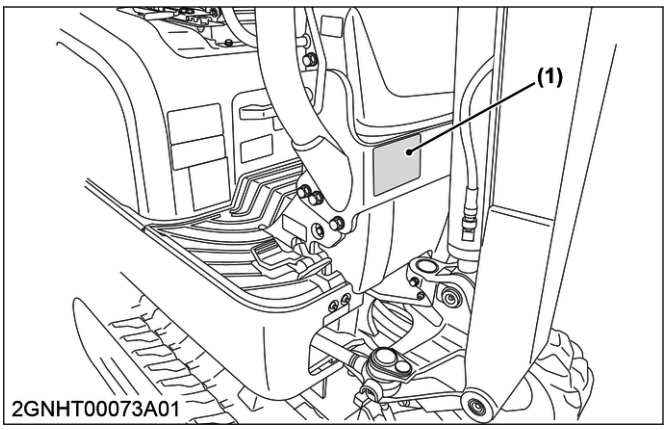
After the engine has stopped, push in the knob.

9.4 Prospective structure of roll-over safety bar

NOTE
- **The excavator is equipped with a protective structure that protects the operator from severe injury or death if the excavator crashes or overturns.**

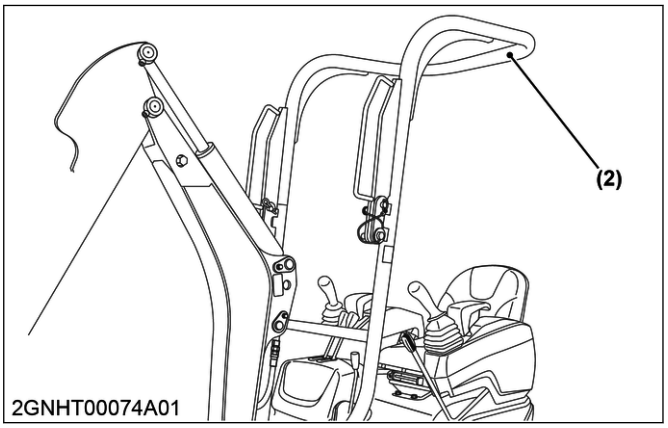
The roll-over safety bar was designed in accordance with current safety standards and tested for verification as:
- Roll-over protection
- ROPS (Roll-Over Protective Structure)

To ensure greatest protection by means of this protective structure, the following applies:
- The seat belt must be fastened while the excavator is being operated.
- Do not make any structural changes to the protective structure.
- In the event of damage, please contact your Kubota dealer (Do not repair!).
- Never operate the excavator without the protective structure.
- Never operate the machine with a higher operating weight than the maximum permissible total weight indicated on the ROPS identification plate.



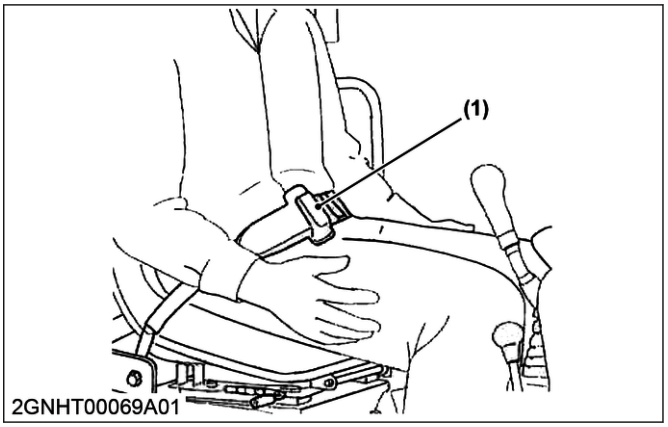
(1) ROPS identification plate

- If the roll-over safety bar is elevated and locked in that position, the operator is protected from being crushed in the event of the machine tipping over if the seat belt is tightly fastened.



(2) Roll-over safety bar

9.5 Seat belt



(1) Seat belt

If the operator with tightly fastened seat belt is on the operator's seat, then he is protected against falling off and therefore against crushing or bruising in the event of a collision or tipping over of the excavator.

DANGER

- **When operating the excavator with the roll-over safety bar swiveled upward and locked, wear the seat belt. When driving with the roll-over safety bar swiveled downward (e.g. driving through a low passageway), do not wear the seat belt.**

10. Hazards coming from the hydraulic system

If hydraulic oil gets into the eyes, rinse them immediately with clear water and subsequently seek medical aid.
Do not allow hydraulic oil to come into contact with skin or clothing. Skin parts that may have come into contact with hydraulic oil must be washed with water and soap immediately, if possible. Do this thoroughly and repeatedly, otherwise there is a risk of damage to the skin.
Immediately take off any clothes dirtied or soaked with hydraulic oil.
Persons who have inhaled hydraulic oil vapors (mist) should be taken to a doctor immediately.
If leaks have occurred in the hydraulic system, the excavator may not be placed into operation or, if in operation, operation must cease at once.
Do not use the naked hand to search for leaks; always use a piece of wood or cardboard. Protective clothing (eye protection and gloves) must be worn when seeking leaks.
Leaking hydraulic oil must be bound immediately with an oil binding agent. The contaminated oil binding agent must be stored in suitable containers and in accordance with the valid regulations.

11. Fire protection

DANGER

- **The excavator components and attachments (in particular the engine and the exhaust system) reach high temperatures even under normal working conditions. An electric installation that is damaged or not properly serviced may lead to flashovers and/or electric arcs. The following fire protection guidelines may help you ensure the maintenance and efficiency of your equipment and minimise fire hazards.**

- Remove any accumulated dirt adjacent to hot components, e.g. engine, muffler, exhaust manifold/ tubes, etc. If the machine is being used at full capacity, cleaning should be performed more frequently.
- Accumulated residues from plants and trees, or any other flammable materials, should be removed from the machine. This must be observed in particular in the proximity of the engine and the exhaust system, but also in the swivel frame, the track frame, and the boom.
- Check the condition and wear of all fuel lines and hydraulic hoses. To avoid leakage, replace any worn parts immediately.
- Electric cables and connections must be checked regularly for signs of damage. Damaged components and lines must be replaced or repaired before starting up the machine. All electric connections must be kept clean and tight.
- Exhaust pipes and mufflers must be checked daily for leaks, damage and any loose or missing joints. Leaking or damaged exhaust system components must be replaced or repaired before starting up the machine.
- Always keep a multi-purpose fire extinguisher on or close to the machine. Familiarise yourself with the operation of the fire extinguisher. In the event of a fire in the electrical or hydraulic system, use a CO_2 fire extinguisher to put it out.
- If you park on a ground with flammable material (e.g. straw waste, withered weeds, etc.), a fire may break out. Park on a ground without flammable material.

NOTE

- **A fire extinguisher is not included in the standard equipment of the machine.**

SAFETY INSPECTION

All safety inspections are based on the national worker's protection regulations, safety regulations and technical specifications applicable to the country in which the machine is operated.
The owner (operator) should arrange for the safety inspections to be performed at specified interval s according to national rules and regulations.
Based on their technical training and experience, the qualified personnel should have sufficient knowledge in the domain of the machine described here and be familiar with the applicable national work safety regulations, accident prevention regulations and the generally accepted technical rules so that they can assess the sound operating condition of the machine.
The qualified person must keep his appraisal and evaluation neutral and must not be influenced by personal, economic or operational interests. The inspection is a visual and functional check of all components for condition an d completeness and of the effectiveness of the safety devices.
The performance of the inspection must be documented in the form of an inspection report containing at least the following information.

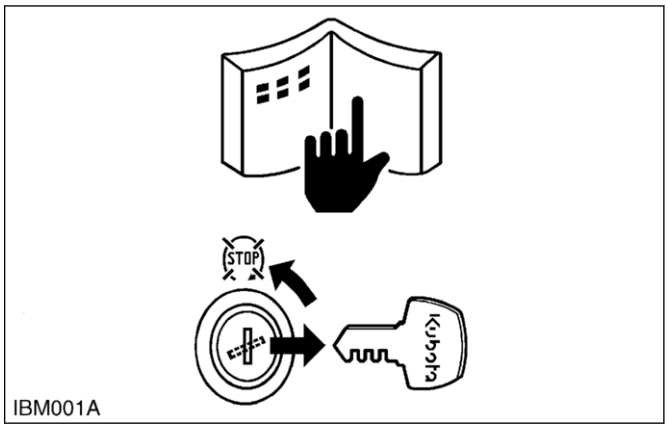
- Date and scope of the inspection indicating all pending checks,
- Result of the inspection with a report of the determined faults,
- Assessment with respect to commencing or continuing operation,
- Information on necessary follow-up inspections,
- Name, address and signature of the inspector.

The owner/employer (company) is responsible for the observance of the inspection intervals. The acknowledgment and the elimination of the determined faults must be confirmed by the owner/employer in writing, along with the date, in the inspection report.
The inspection report must be kept on file at least until the next inspection.

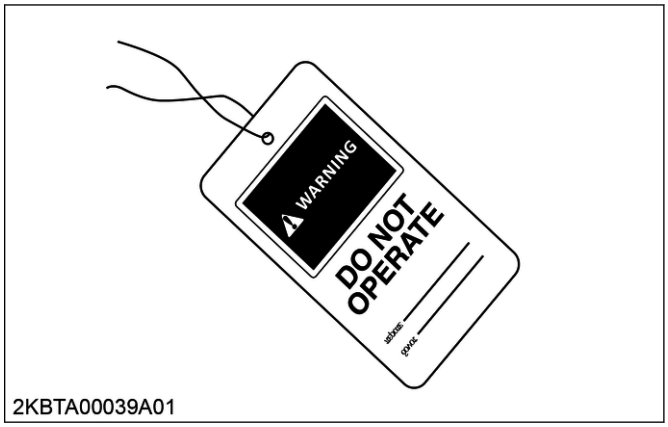
2. GENERAL

GENERAL WORKING INSTRUCTIONS

1. General working precautions



- When servicing, observe the safety instructions in the operator's manual and workshop manual.
- Clean the machine before maintenance.
- Service the machine at a clean location.
- Park the machine on a stable and level ground then lower the attachment to check the machine safely.
- Stop the engine and remove the key when leaving the operator's seat for cleaning, maintenance, and servicing.
- Before working, remove the negative (-) terminal from the battery or turn off the battery isolator switch.
- Whenever a special tool is required, use the special tool that Kubota recommends.
- Use genuine Kubota parts to ensure safety and machine performance.



- Hang a DO NOT OPERATE tag near the operator's seat.
- Observe workplace safety rules when performing service and work.

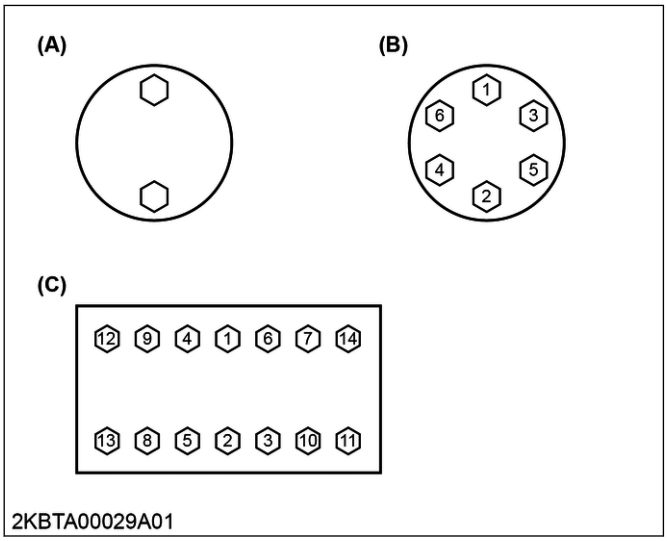
2. Tightening bolts and nuts

- Tighten the bolts and nuts to their specified torque.

■ NOTE

– Tighten the bolts and nuts alternately from top to bottom and left to right so the torque is distributed evenly.

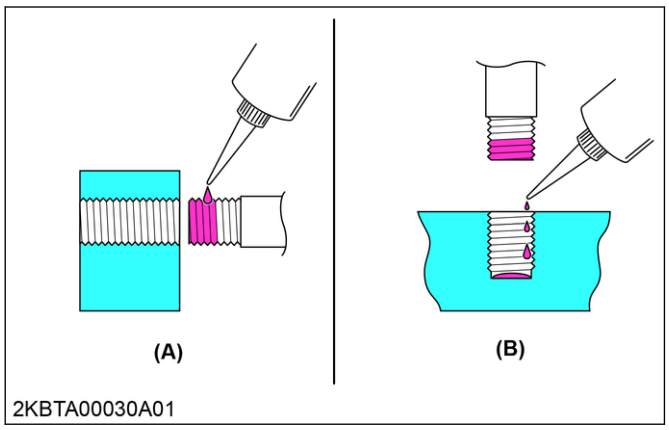
– Gradually tighten the bolts and nuts two or three times.



(A) Alternately
(B) Diagonally
(C) Diagonally from center to outside

3. Applying thread-locking fluid

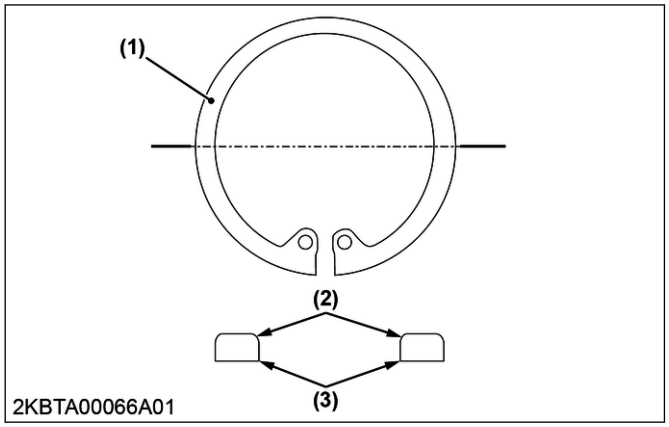
1. Clean and dry the location where a thread-locking fluid will be applied with a solvent to remove moisture, oil, and dirt.
2. Apply the thread-locking fluid to the tip of the bolt.
3. If the threads are large, apply the thread-locking fluid all around the bolt hole.



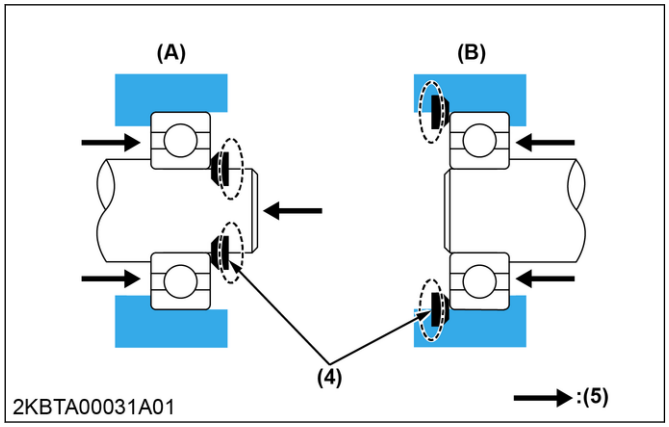
(A) Bolt hole (bolts, nuts) (B) Screw hole

4. Installing circlips

- When installing the circlip, assemble the circlip's angular side (3) toward the side that receives force (4) as shown in the figure.



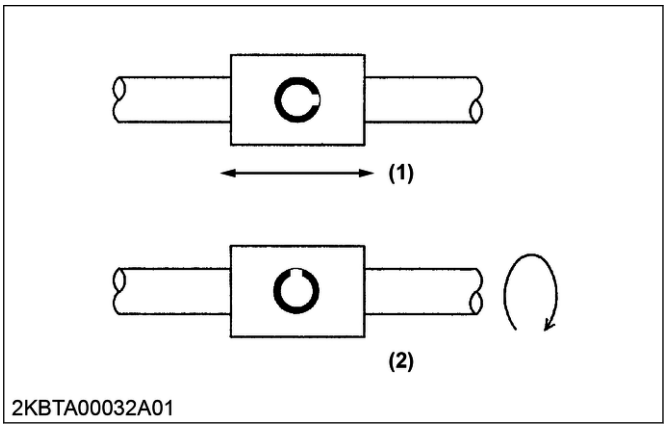
(1) Circlip
(2) Rounded side
(3) Angular side



(4) Side that receives force
(5) Force
(A) External circlip
(B) Internal circlip

5. Installing spring pins

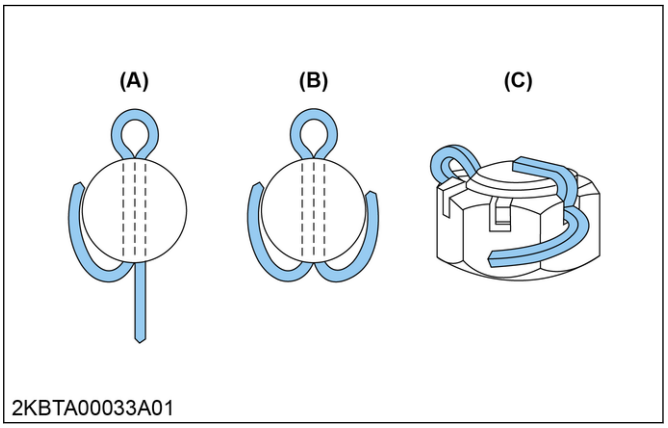
- When installing the spring pin, assemble the slit of the spring pin in the direction that receives force as shown in the figure.



(1) Parallel movement (2) Rotational movement

6. Handling split pin

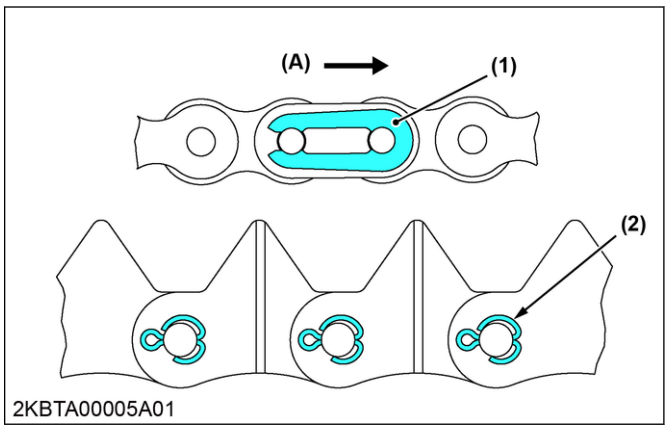
- Replace split pins with new ones. Insert the split pins: once inserted, the two ends of the pin are bent apart to fix it in place.
- Tighten a grooved nut to the specified torque, align the hole of the split pin to the tighten direction and use an S-shaped split.



(A) Single side split
(B) Double side split
(C) S-shaped split

7. Handling chain joint and split pin

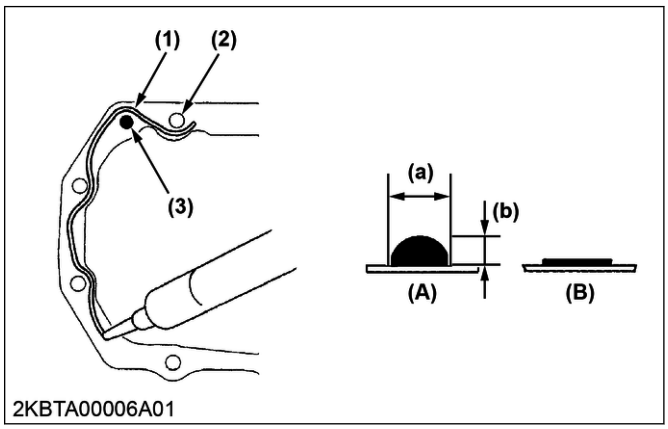
- Assemble the chain joint with its opening facing the opposite direction of travel.
- Assemble the split pin with its opening facing the direction of travel.



(1) Chain joint
(2) Split pin
(A) Direction of chain moving

8. Handling liquid gasket

- Use the specified liquid gasket.
- When using liquid gasket, fully remove the old gasket and grease or oil.
- When applying liquid gasket, apply it on the joint surface with a thickness of 3.0 to 5.0 mm (0.12 to 0.13 in.) without making any gaps.
- When applying liquid gasket near the bolt hole (2), apply it in the inner side.
- If there is a risk of oil leakage or if the hole goes all the way through when applying liquid gasket near the dowel pin (3) hole, apply it in the inner side.
  If there is no concern of oil leakage, apply it on the outer side.
- Reassemble within 15 minutes after applying; wait for 30 minutes or more then fill with oil.

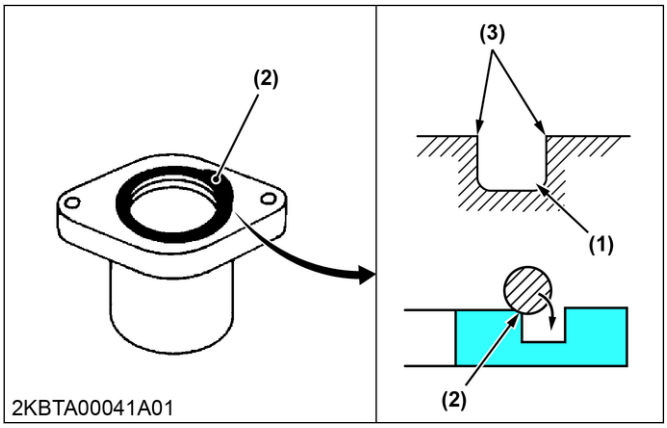


(1) Application route
(2) Bolt hole
(3) Dowel pin
(A) Correct
(B) Incorrect
(a) 3.0 to 3.5 mm (0.12 to 0.13 in.)
(b) 3.0 to 5.0 mm (0.12 to 0.19 in.)

9. Replacing O-rings

1. Remove the burr and clean the O-ring groove.
2. Lubricate the O-ring. Do not apply any grease to the floating seal.
3. Put the O-ring in the groove.

■ NOTE
- **Do not twist the O-ring.**
- **Remove the burr to avoid damage on the O-ring caused by the burr.**



(1) O-ring groove
(2) O-ring
(3) Burr

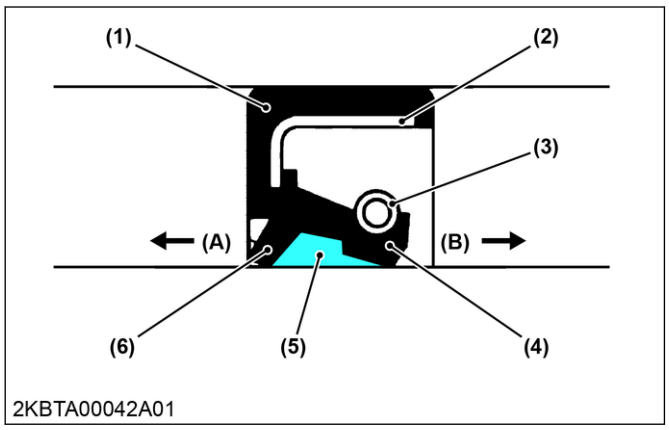
10. Replacing oil seals

1. Do not face the lip of the oil seal in the wrong direction. Face the seal lip toward the material to be sealed.
2. Use a press to install the oil seal until firmly fixed to the boss.

■ NOTE
- **In cases when installing an oil seal without a press, place a wooden board on the seal and gently tap the board with a hammer; install the oil seal straightly and evenly.**

3. Grease the seal lip and dust lip.

■ NOTE
- **If the seal has a dust lip, grease the gap between the lips.**
- **After oil seals are replaced, grease the moving parts around the lip to prevent the dry surfaces from wearing against each other during engine start up.**

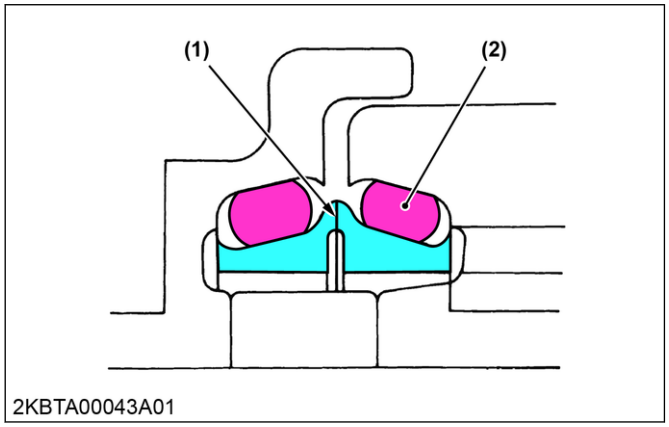


2KBTA00042A01

(1) Packing
(2) Metal ring
(3) Spring
(4) Seal lip
(5) Grease
(6) Dust lip
(A) Air side
(B) Oil side

11. Replacing floating seals

1. Apply oil appropriately to both sides of the O-ring and the contact surface.
2. Do not twist the O-ring when installing the floating seal.
3. Apply oil thinly to the sliding surfaces.
4. Install the floating seal in parallel to the sliding surfaces, O-rings, and housings.
5. After installation, rotate the floating seal for 3 times to make an oil film on the sliding surface.



2KBTA00043A01

(1) Sliding surface
(2) O-ring

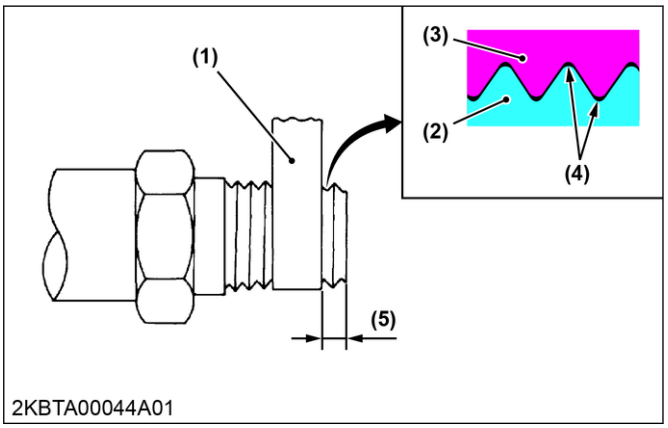
12. Connecting hydraulic hoses

1. Clean the inside of the hose fittings.
2. Tighten with the specified torque.
3. Apply pressure on the hydraulic hose to check for oil leakage.

13. Wrapping thread seal tape

1. Wrap the thread seal tape around the taper threads two or three turns.
2. Tighten the taper thread with the specified torque.

NOTE
- **Do not loosen the taper thread after tightening to avoid oil leakage.**
- **Do not wrap the thread seal tape on the first and second threads to avoid contamination in the hydraulic circuit.**

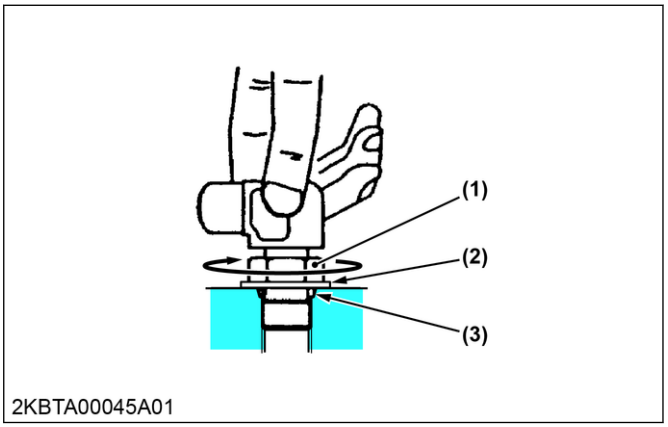


2KBTA00044A01

(1) Thread seal tape
(2) Male thread
(3) Female thread
(4) Clearance
(5) First and second threads from the screw tip

14. Installing elbows with male seat

1. Clean the male seat surface and seal.
2. Loosen the lock-nut until the top end.
3. Install and tighten the elbow by hand until the male seat touches the material surface.

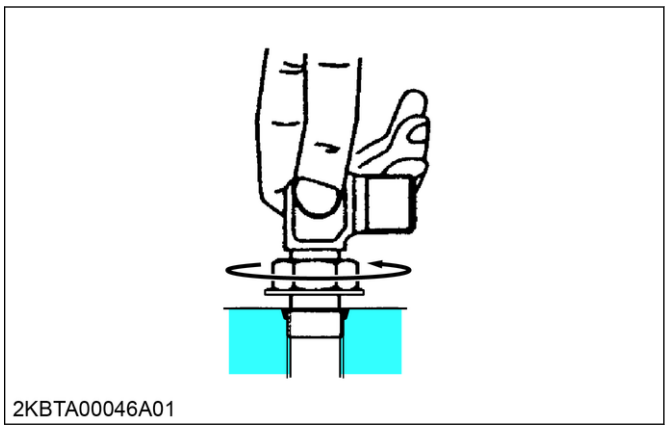


2KBTA00045A01

(1) Lock-nut
(2) Seat
(3) Seal

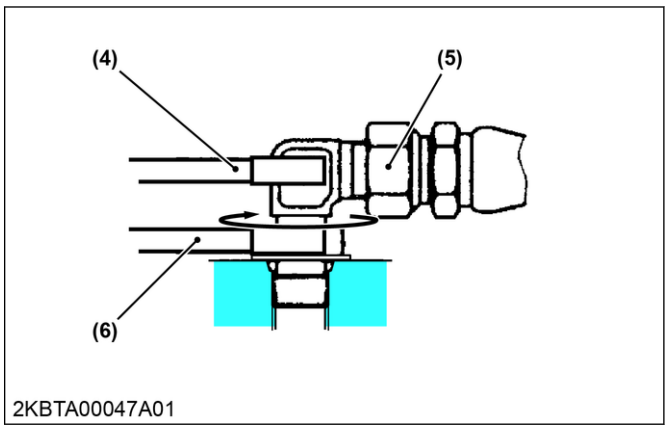
4. Adjust the direction of the elbow.

NOTE
- **Do not loosen to more than one turn.**


2KBTA00046A01

5. Tighten the lock-nut with the specified torque.

■ NOTE
- **Check for oil leakage.**

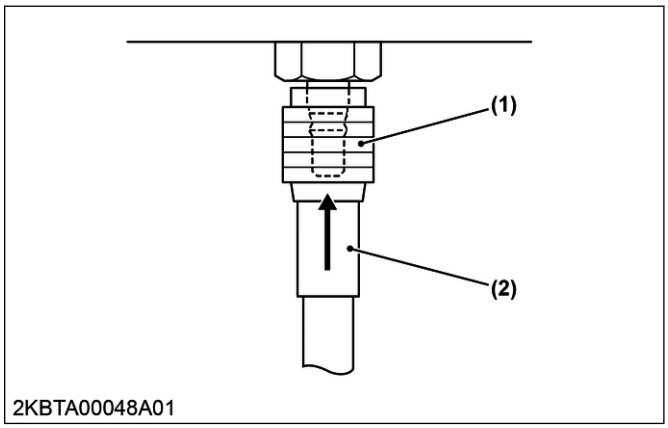


2KBTA00047A01

(4) Wrench
(5) Hose
(6) Torque wrench

15. Connecting and disconnecting quick hose couplings

1. Push the metal fittings in the direction of the arrow mark.



2KBTA00048A01

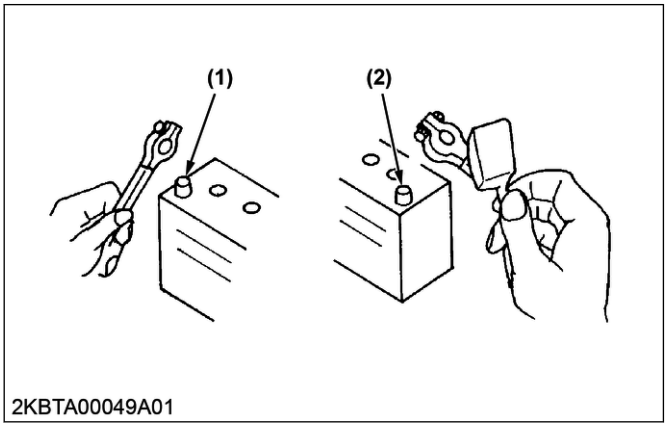
(1) Plastic part
(2) Metal fitting

2. Pull the plastic part in the opposite direction of the arrow mark.
3. Disconnect the quick hose coupling.
4. Push the quick hose coupling in the direction of the arrow mark to connect.
5. Make sure that the hose is installed correctly.

16. Handling the battery

⚠ CAUTION
- **When removing battery cables, disconnect negative (-) terminal first.**
- **When installing battery cables, connect positive (+) terminal first.**

- Do not install any battery with a capacity (Ah) other than is specified.
- Securely attach the terminal covers on the cables when connecting the cables to the battery terminal posts. There is a danger of short-circuiting if the tip of the cables attached to the battery terminal post is exposed.
- Do not allow dirt and dust to collect on the battery.
- Connect the battery terminals after removing dust, old grease, blue rust and others.
- Apply conductive grease thinly to the battery terminal posts to prevent corrosion.



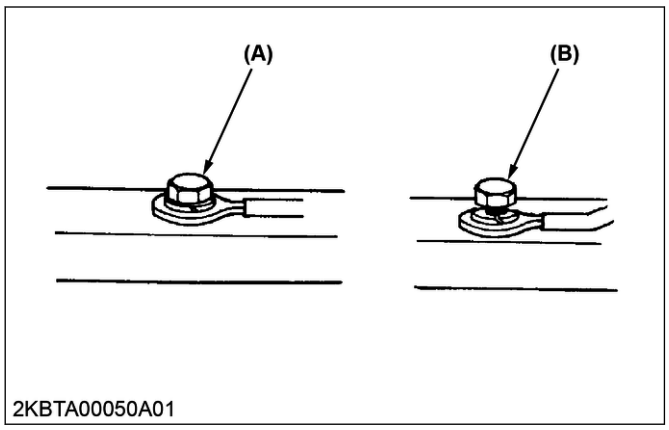
2KBTA00049A01

(1) Battery negative (-) terminal
(2) Battery positive (+) terminal

17. Handling wire harness

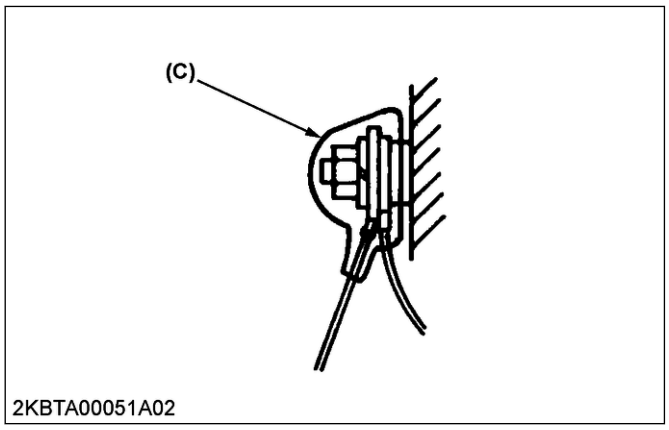
⚠ CAUTION
- **Do not let an unprotected wire harness to come in contact with other components.**
- **Do not clamp the wire harness to fuel hoses.**
- **If the wire harness is damaged, replace it immediately with a new one.**
- **Do not alter the electrical device and wire harness.**

- Tighten the electrical terminals securely.



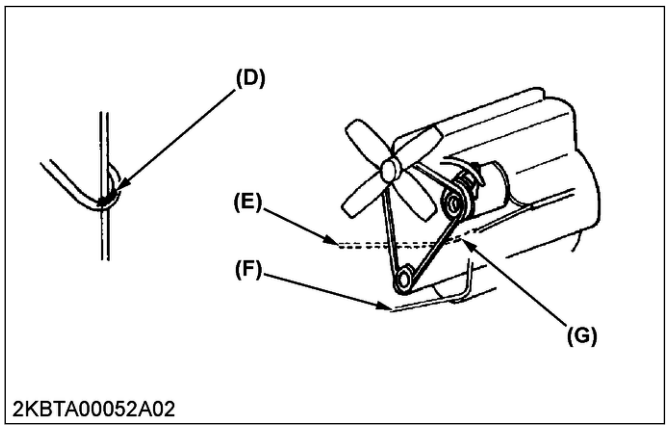
(A) Good (B) Bad: Loose bolt

- Check the electrical terminal protection and clamping conditions before connecting the battery cable.



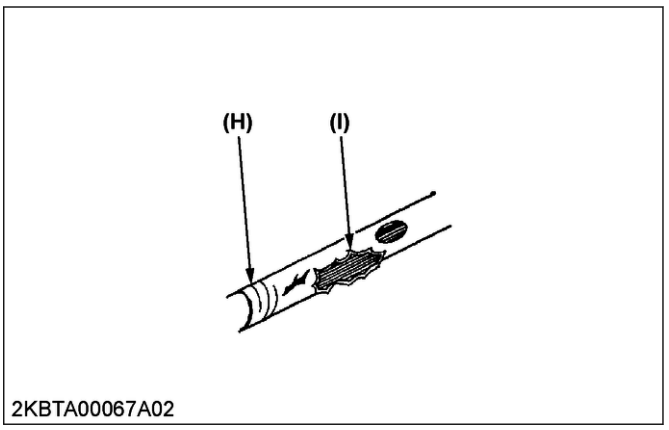
(C) Covered completely with a protection cover

- Keep the wire harness away from hazardous positions such as rotating parts or high-temperature sections.



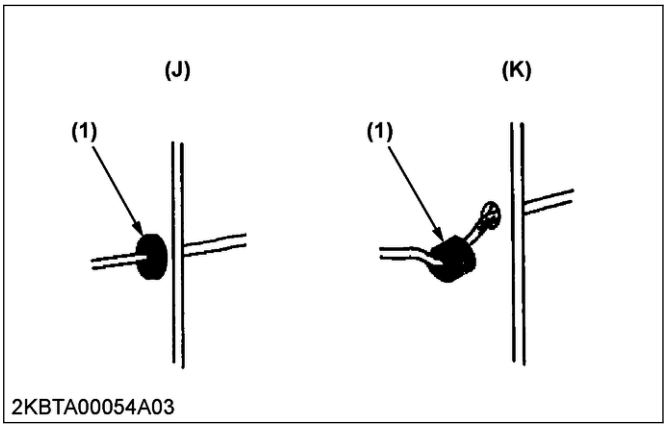
(D) Hazardous position (G) Hazardous position
(E) Wiring position: bad
(F) Wiring position: good

- If wire harness is damaged or degraded, replace immediately.



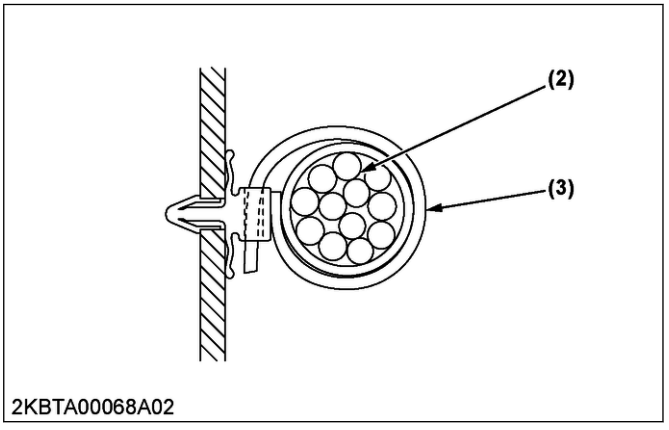
(H) Damaged (I) Torn

- Install the grommet securely.



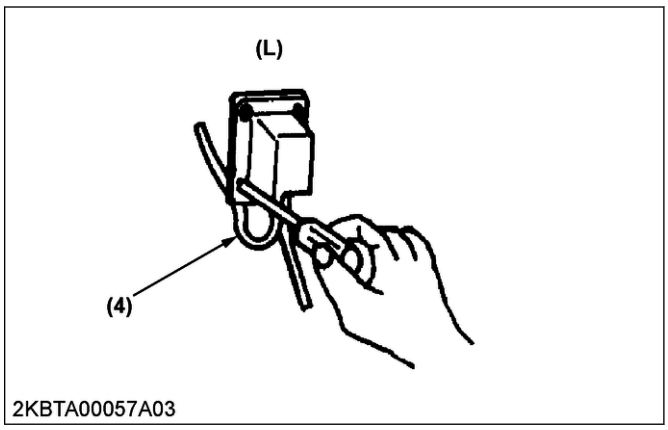
(1) Grommet (K) Bad: poor installation
(J) Good

- Clamp the wire harness securely. Do not damage the wire harness by the clamp.
- Clamp the wire harness correctly. Do not slack, twist, and pull.



(2) Wire harness (3) Clamp

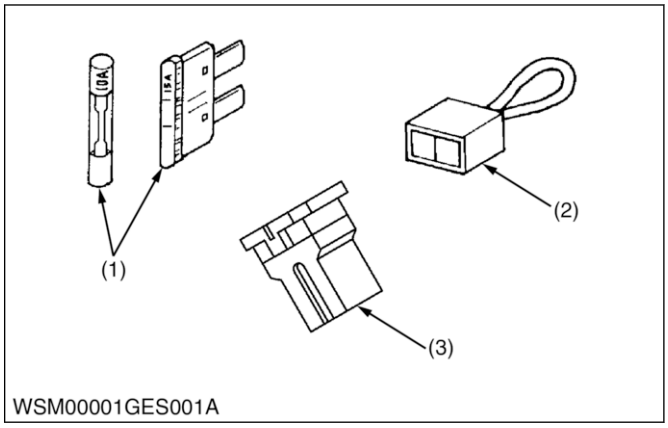
- Do not pinch the wire harness when installing parts.



(4) Wire harness (L) Bad

18. Handling fuses

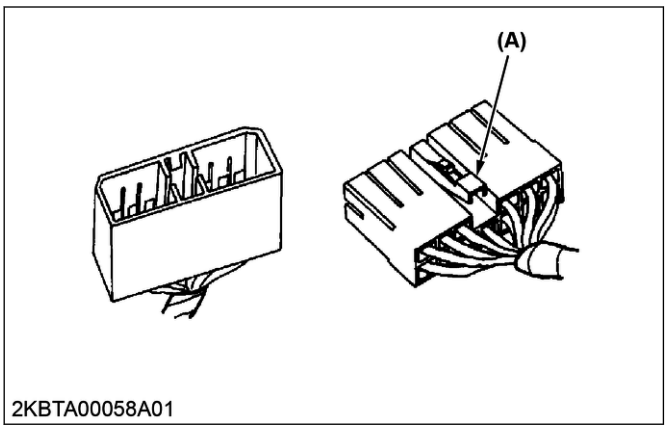
- Always use fuses of the specified capacity.
- Do not use steel or copper wiring instead of fuse.
- Do not install work light or radio without auxiliary power line.
- Do not install auxiliaries to the fuses. The fuses may blow.



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

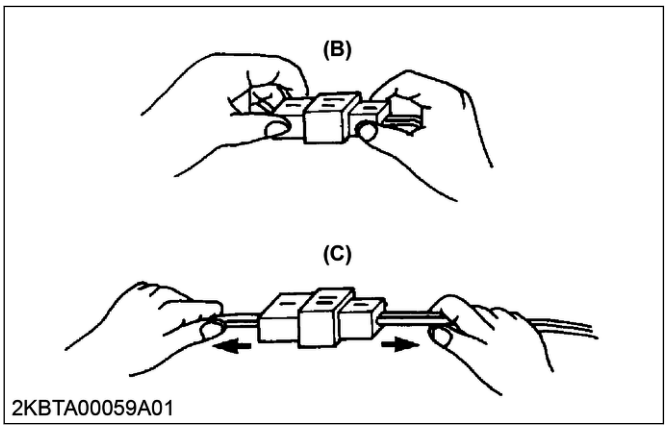
19. Handling connectors

- When disconnecting the locking connectors, be sure to disengage the lock before disconnecting. There are two kinds of locks: one requires pressing and the other requires pulling.



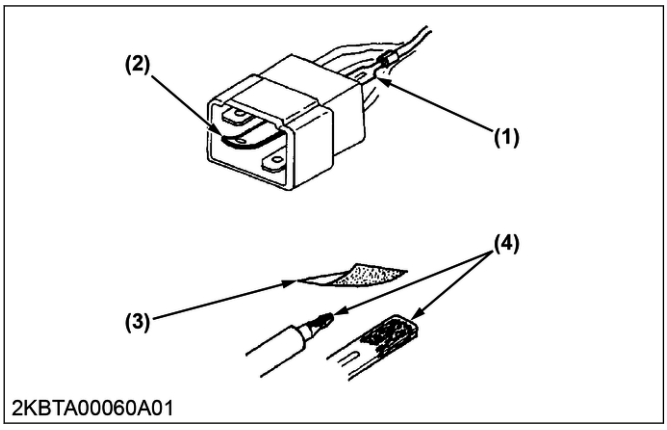
(A) Press

- Hold on tightly to the connectors when disconnecting them.
- Do not pull wire harness itself.



(B) Correct method (C) Incorrect method

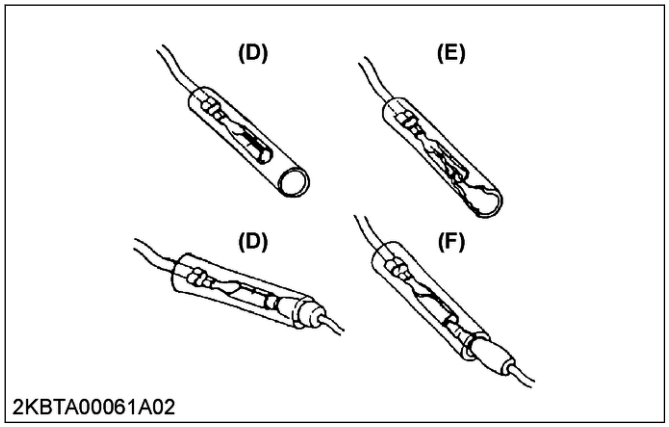
- Make sure the terminal condition of the connectors is not bent, rusty, and so on.
- If the terminal is rusted, remove rust with sandpaper.
  However, do not polish the terminal of the waterproof connector or the plated terminal.



(1) Missing terminal (4) Rust
(2) Bent terminal
(3) Sandpaper

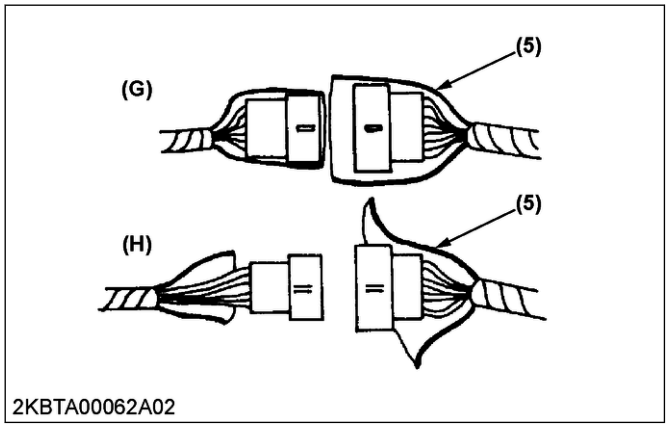
- Cover the female bullet terminals and male bullet terminals securely with the plastic covers.

- Make sure that the bullet terminals are secure and connected securely to the tip.



(D) Good
(E) Bad: damaged cover
(F) Bad: poor connection

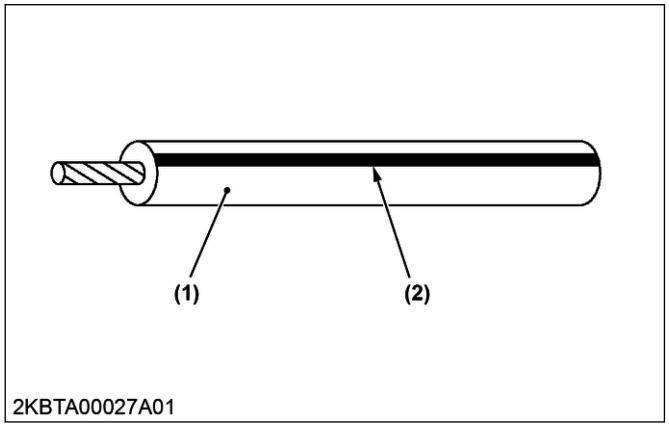
- Cover the female connectors and male connectors securely with the plastic covers.



(5) Cover
(G) Good
(H) Bad: damaged cover

20. Wiring color

- Wire colors are specified in the color codes.



(1) Wire color
(2) Stripe

Wiring Colors	Color code
Black	B
Brown	BR, Br
Green	G
Gray	GY, GR, Gr
Blue	L
Light green	LG, Lg
Orange	OR, Or
Pink	P
Purple	PU, Pu, V
Red	R
Sky blue	SB, Sb
White	W
Yellow	Y

- This symbol of "/" shows color with stripe(s).

(An example)
W/R:
White with red stripe

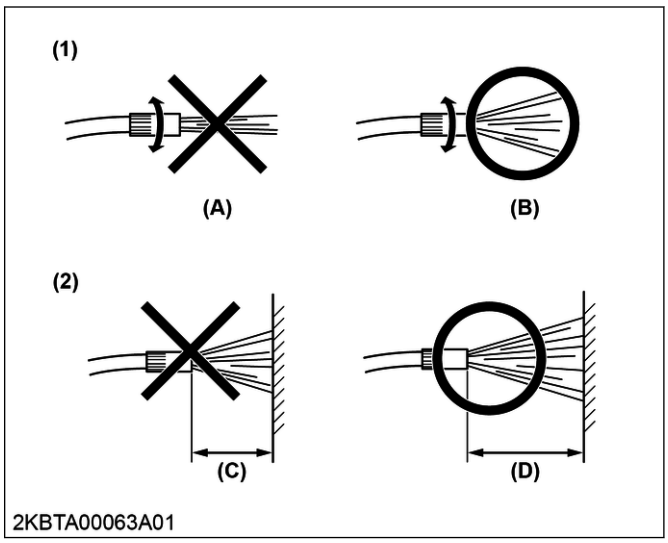
21. Washing the machine with a high pressure washer

Use a high pressure washer properly to avoid personal injuries and damages to the machine.

⚠ CAUTION
- **Damaged or cut the wire harness may cause fire.**
- **Damaged hydraulic hoses or oil seals may cause injury due to hydraulic oil gushing out.**

■ IMPORTANT
- **Water infiltration may cause machine problems.**

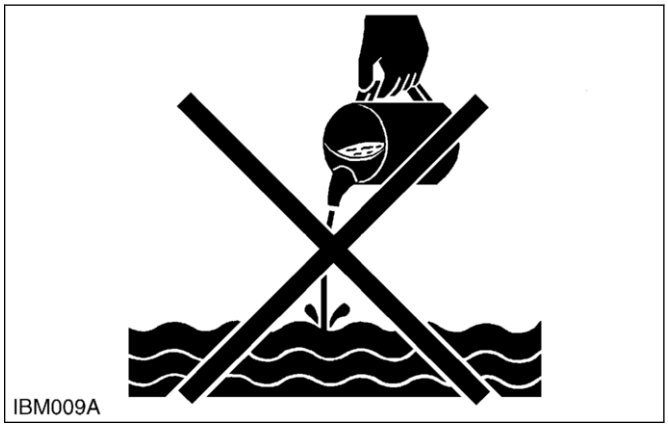
- Adjust the high pressure washer nozzle for a wide spray. Do not adjust to pencil point spray.
- Spray the water at least 2 m away from the machine.



(1) Adjusting the washer power
(2) Washing distance
(A) Pencil point spray
(B) Wide spray
(C) Less than 2 m (80 in.)
(D) Over 2 m (80 in.)

22. Dispose fluids correctly

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

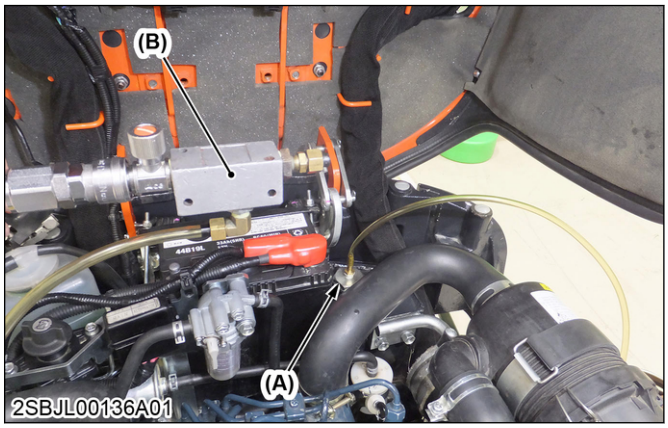


PRELIMINARY WORKING INSTRUCTIONS

1. Vacuuming the hydraulic oil tank

When removing the hydraulic devices and hydraulic hoses, vacuum the hydraulic oil tank to reduce the hydraulic oil leakage.

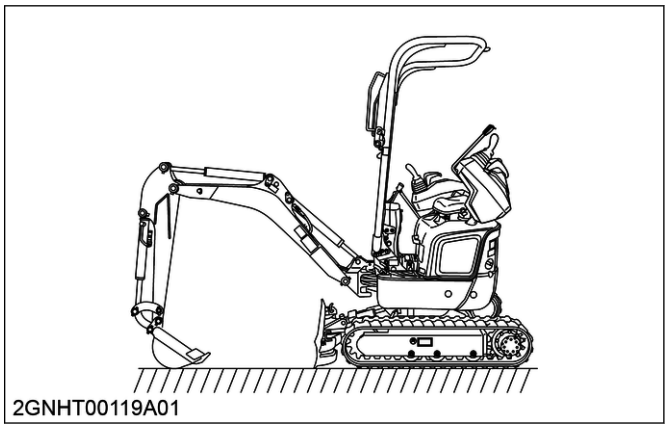
1. Remove the hydraulic oil tank cap and attach the adapter.
2. Connect a vacuum pump to the adapter.
3. Connect an air hose to the vacuum pump and vacuum the hydraulic oil tank.



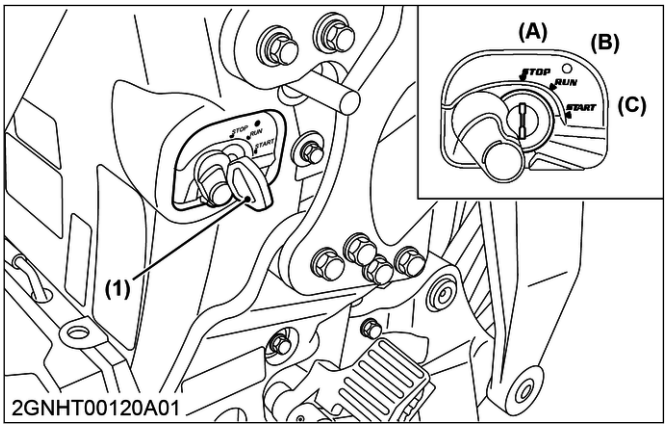
(A) Adapter (B) Vacuum pump

2. Releasing residual pressure of the hydraulic circuit

1. Park the machine on the firm and level ground, lower the front attachment and blade to the ground, and stop the engine.

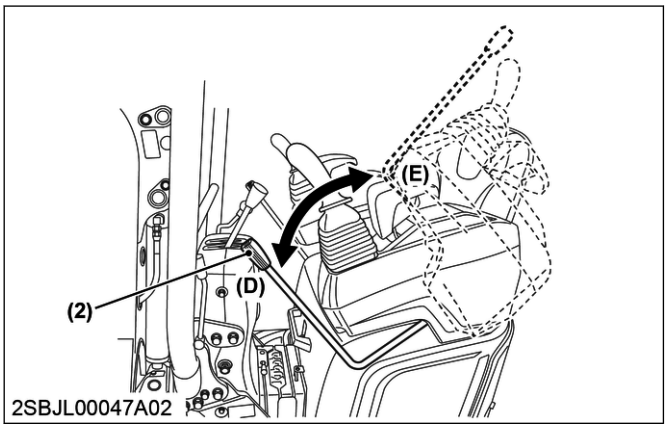


2. Turn the starter switch to **[RUN]** without starting the engine.



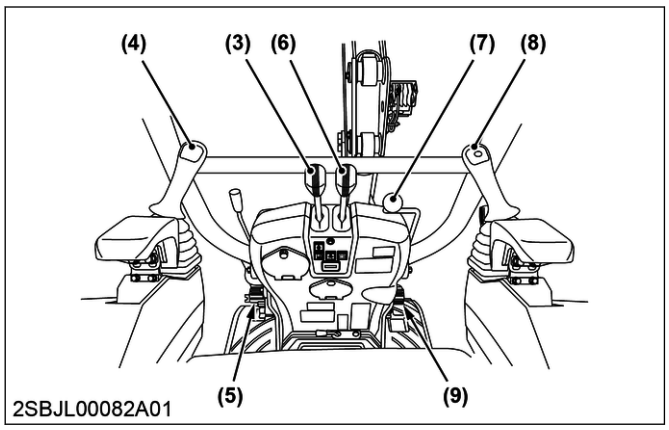
(1) Starter switch (C) **[START]**
(A) **[STOP]**
(B) **[RUN]**

3. Lower the lever lock.



(2) Lever lock (E) Lock
(D) Release

4. Operate the pilot control levers (boom, arm, bucket, and swivel) several times in full stroke.
5. Operate the travel control levers, blade control lever, swing control pedal, and AUX control pedal several times in full stroke.



(3) Travel control lever LH
(4) Pilot control lever LH
(5) AUX control pedal
(6) Travel control lever RH
(7) Blade control lever
(8) Pilot control lever RH
(9) Swing control pedal

6. Raise the lever lock and turn the starter switch to **[STOP]**.

3. Removing the battery

CAUTION

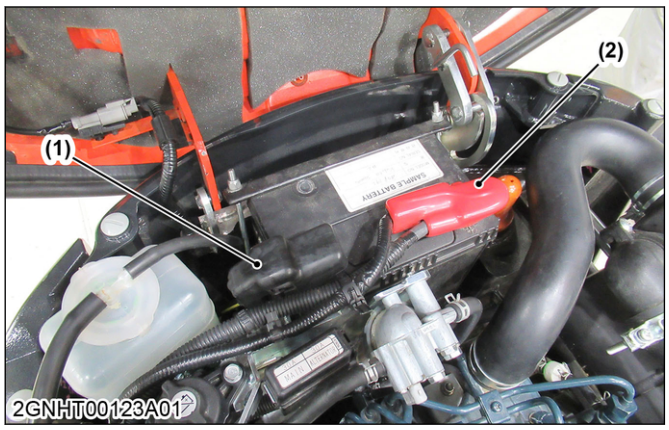
- **Keep fire (welding sparks, grinding sparks, cigarettes) away from the battery. The battery produces oxygen and hydrogen gases which are flammable.**
- **Disconnect the negative (-) terminal first when removing the battery.**
- **Connect the positive (+) terminal first when connecting the battery cable.**

Preparing

1. Open the bonnet.

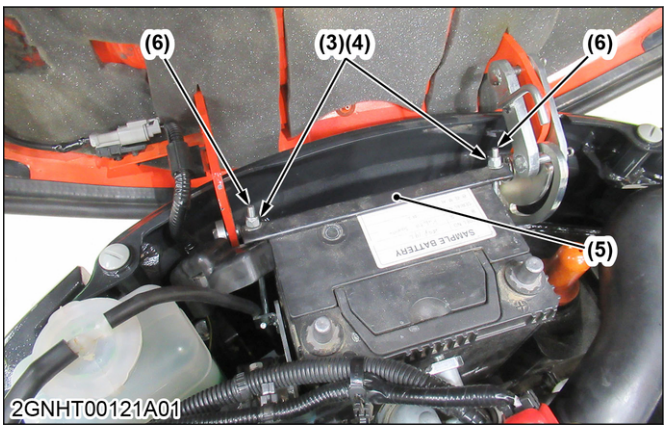
Removing

1. Disconnect the negative (-) terminal and the positive (+) terminal in order.



(1) Negative (-) terminal
(2) Positive (+) terminal

2. Remove the 2 nuts and 2 washers to remove the stay and the 2 clamps.



(3) Nut ×2
(4) Washer ×2
(5) Stay
(6) Clamp ×2

3. Remove the battery.

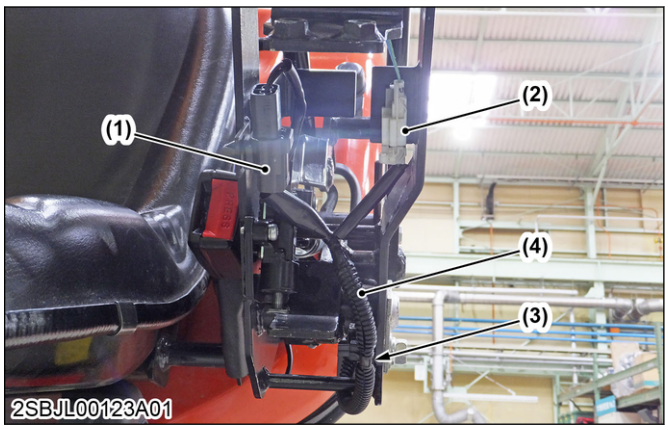
4. Removing and installing the bonnet, cover, and floor plate

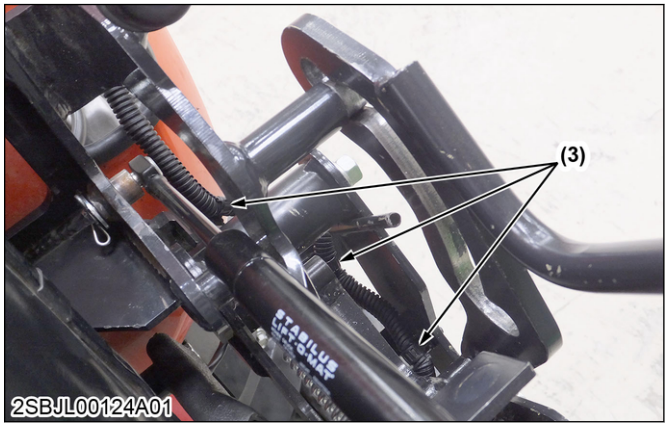
Preparing

1. Park the machine on the firm and level ground, lower the front attachment and blade to the ground, and stop the engine.

Removing the bonnet

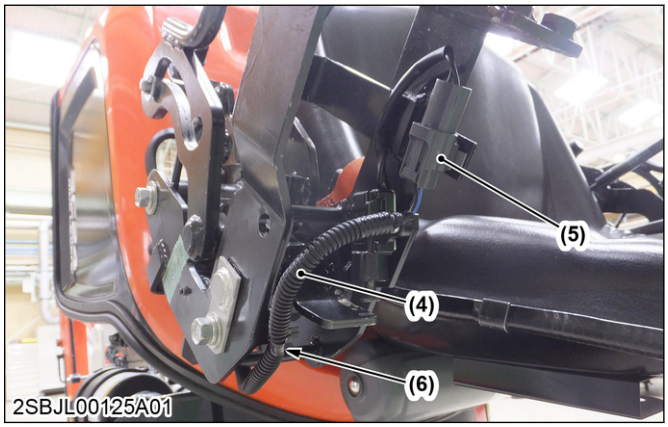
1. Remove the pilot control valve RH (see 5-46).
2. Disconnect the lever lock switch connector RH and horn switch connector.
3. Remove the 4 clamps, and pull out the wire harness to the engine side.

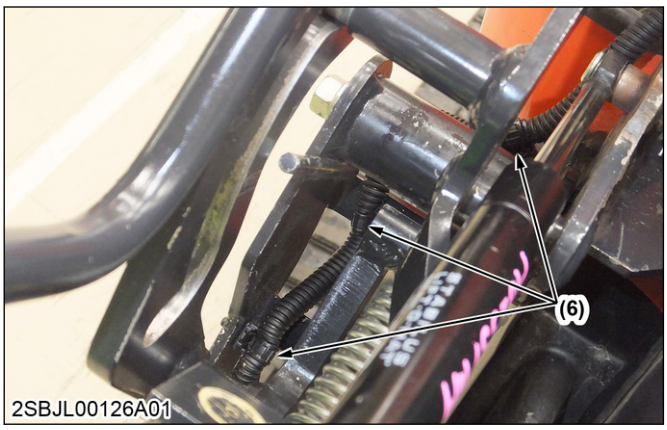




(1) Lever lock switch connector RH
(2) Horn switch connector
(3) Clamp ×4
(4) Wire harness

4. Remove the pilot control valve LH (see 5-46).
5. Disconnect the lever lock switch connector LH.
6. Remove the 4 clamps, and pull out the wire harness to the engine side.



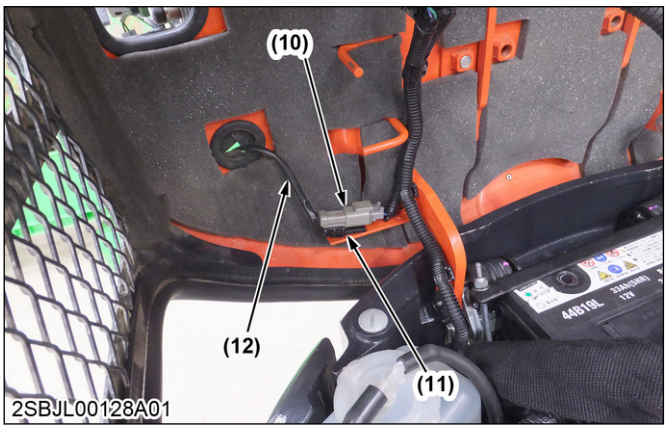


(4) Wire harness
(5) Lever lock switch connector LH
(6) Clamp ×4

7. Open the bonnet.
8. Pull out the pilot hose RH and pilot hose LH to the engine side.

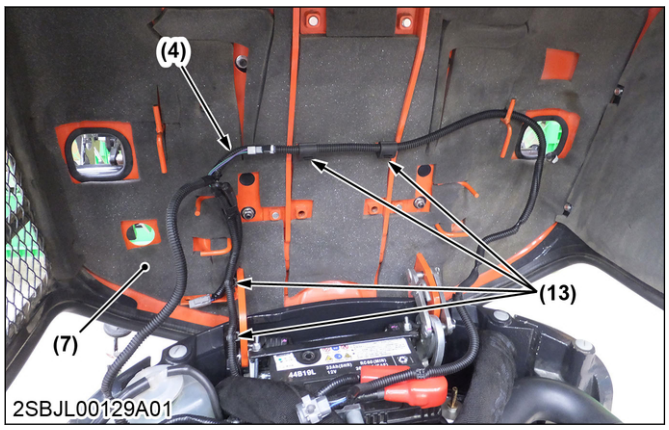
(7) Bonnet
(8) Pilot hose RH
(9) Pilot hose LH

9. Disconnect the seat belt switch connector.
10. Remove the clamp, and pull out the wire harness to the seat support side.



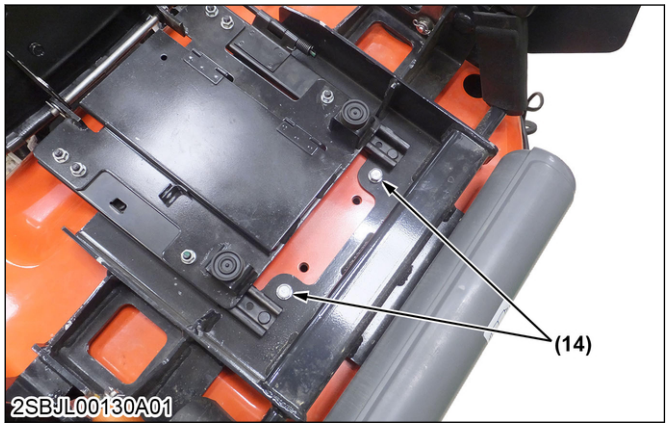
(10) Seat belt switch connector
(11) Clamp
(12) Wire harness

11. Remove the 4 clamps.
12. Remove the wire harness from the bonnet.



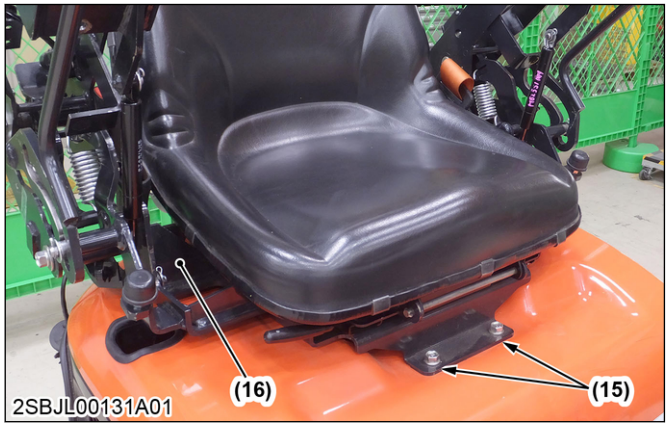
(4) Wire harness (13) Clamp ×4
(7) Bonnet

13. Close the bonnet.
14. Tilt the seat.
15. Remove the 2 bolts.



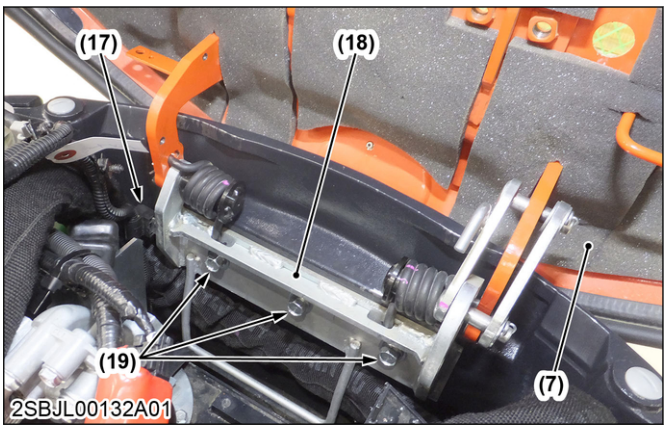
(14) Bolt (M10 × 20) ×2

16. Return the seat to the normal position.
17. Remove the 2 bolts.
18. Remove the seat support.



(15) Bolt (M10 × 20) ×2 (16) Seat support

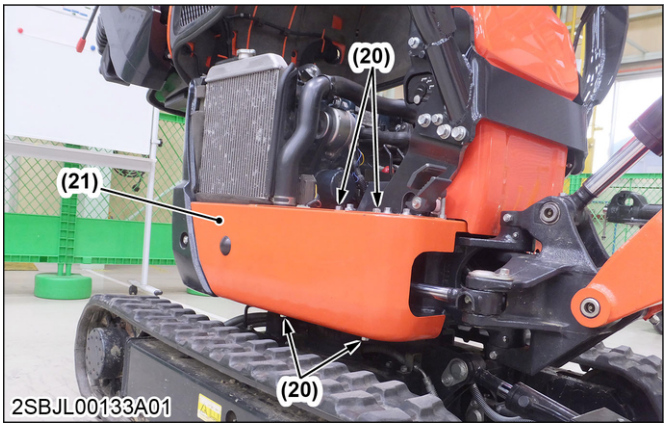
19. Open the bonnet.
20. Remove the battery (see 2-12).
21. Remove the clamp from the bracket.
22. Remove the 3 bolts.
23. Remove the bonnet.



(7) Bonnet (19) Bolt (M10 × 25) ×3
(17) Clamp
(18) Bracket

Removing the swivel cover RH

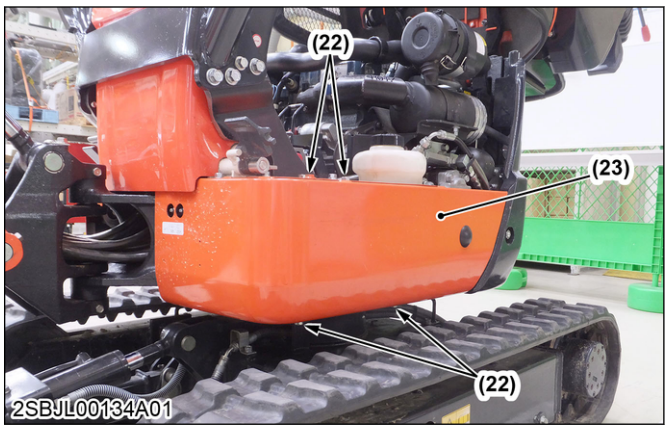
1. Open the bonnet.
2. Remove the rubber mat.
3. Remove the 2 upper bolts, and loosen the 2 lower bolts.
4. Remove the swivel cover RH.



(20) Bolt (M10 × 16) ×4 (21) Swivel cover RH

Removing the swivel cover LH

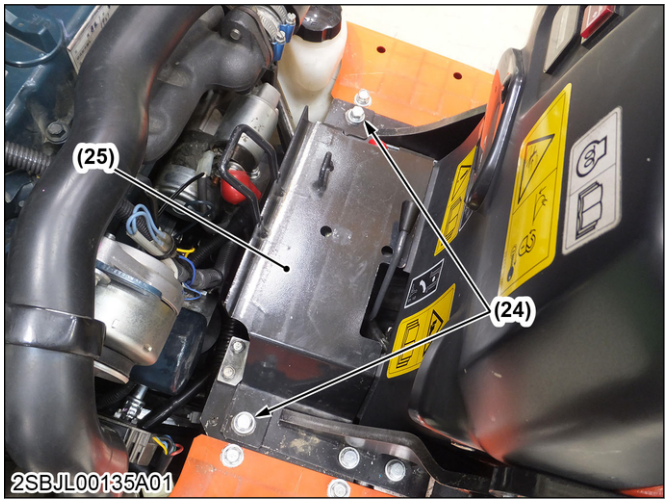
1. Open the bonnet.
2. Remove the rubber mat.
3. Remove the 2 upper bolts, and loosen the 2 lower bolts.
4. Remove the swivel cover LH.



(22) Bolt (M10 × 16) ×4 (23) Swivel cover LH

Removing the floor plate

1. Open the bonnet.
2. Remove the rubber mat.
3. Remove the 2 bolts to remove the floor plate.



(24) Bolt (M10 × 25 × 1.25) ×2 (25) Floor plate

Installing

Tightening torque

(24) Bolt	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft	Thread lock (Loctite® 263)

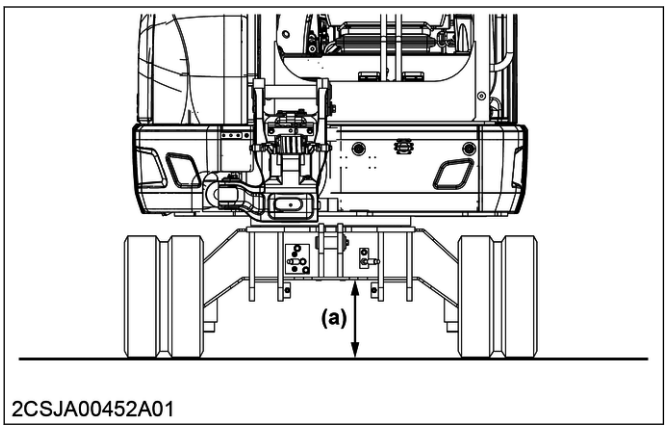
5. Jacking up the machine

⚠ CAUTION

- **Do not work underneath when the machine is jacked up.**
- **Place the machine on jack stands securely when lifting the machine.**

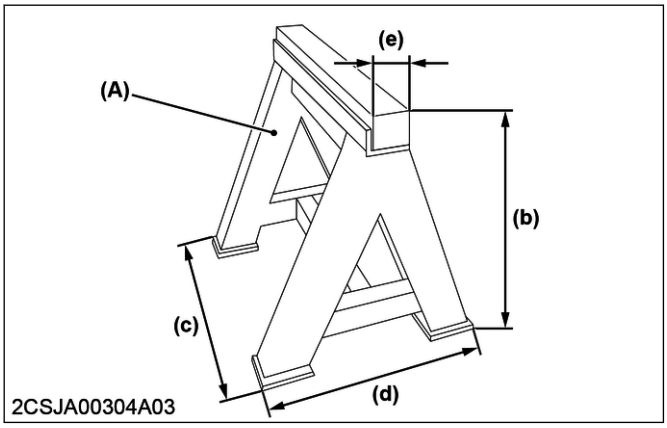
Preparing

1. Park the machine on the firm and level ground.
2. Prepare the proper jack stands based on dimension (a).



(a) 140 mm (5.5 in.)

Recommended jack stand

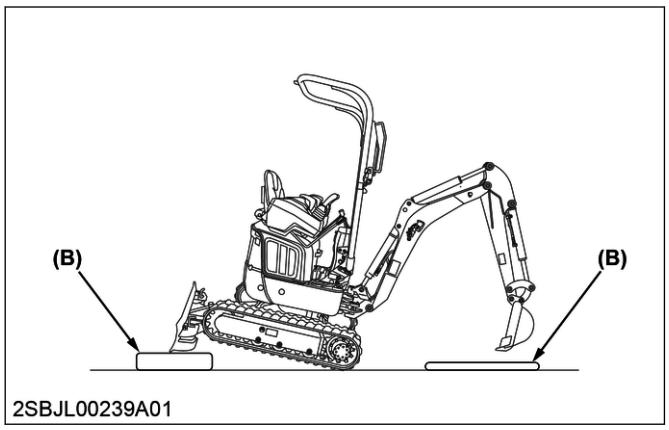


(A) Jack stand

	Dimension
(b)	320 mm 12.6 in.
(c)	390 mm 15.4 in.
(d)	290 mm 11.4 in.
(e)	60 mm 2.4 in.

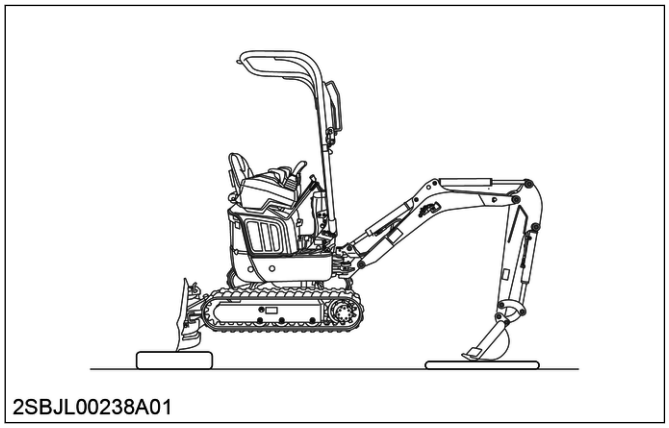
Jacking up the machine

1. Raise the front attachment.
2. Swivel the upper structure of the machine to 180°.
3. Put 2 cushions under the bucket and the blade.
4. Operate the blade to jack up the front side of the machine.

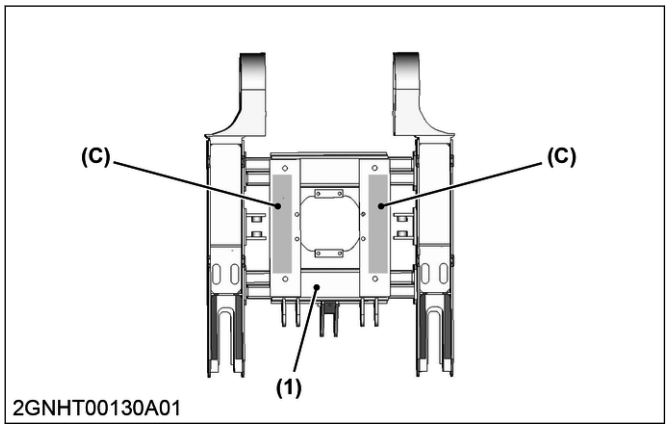


(B) Cushion

5. Operate the boom, the arm, and the bucket to jack up the rear side of the machine.



6. Place 2 jack stands under the track frame.



(1) Track frame (C) Contact surface

7. Lower the machine and place the machine on the jack stands.

8. Place the bucket and blade on the ground.

CONCLUDING WORKING INSTRUCTIONS

1. Bleeding the air from the hydraulic cylinder

Bleed air from the hydraulic cylinder after removing and disassembling the hydraulic cylinder to prevent cavitation and seizure of the internal parts.

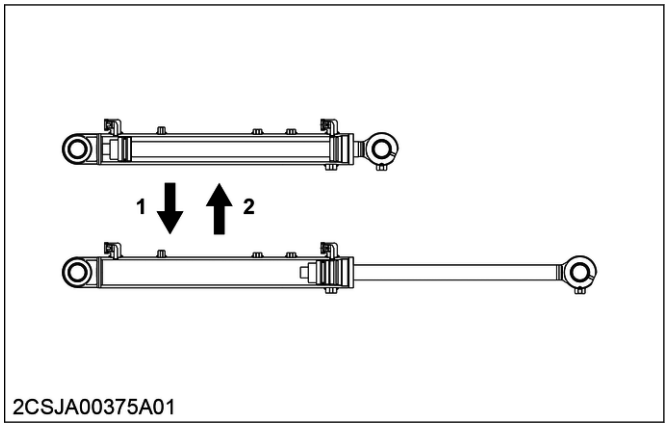
1. Set the engine speed to less than 1500 rpm.

■ IMPORTANT
- **If the engine speed is more than 1500 rpm, the seals and bushings may be damaged.**

2. Compress and extend the hydraulic cylinder slowly to bleed air.

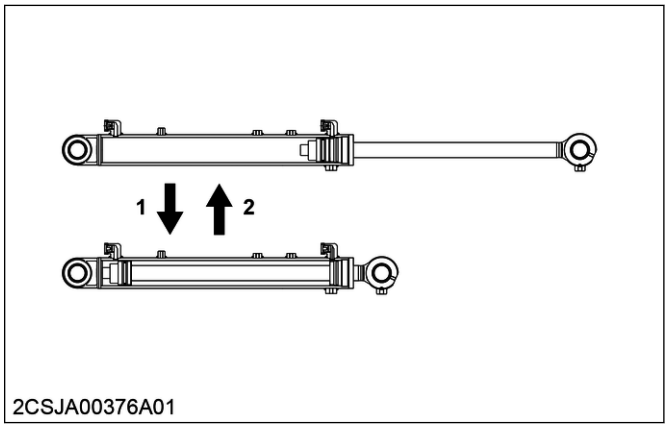
■ IMPORTANT
- **Do not relieve the main relief valve of the hydraulic cylinder at the end of stroke.**

When the cylinder is fully retracted



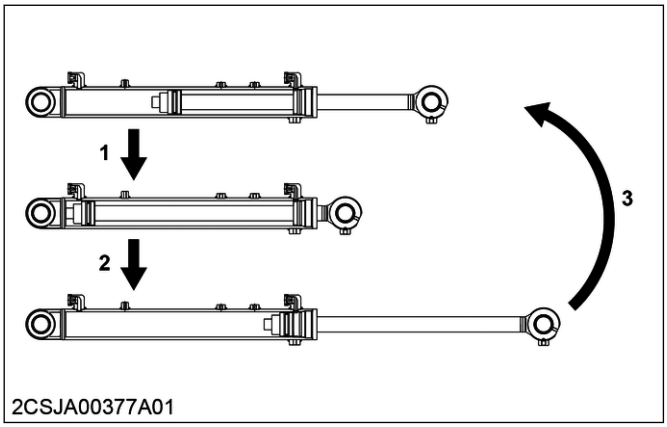
2CSJA00375A01

When the cylinder is fully extended



2CSJA00376A01

When the cylinder is in mid-stroke



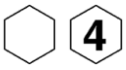
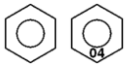
2CSJA00377A01

TIGHTENING TORQUES

1. Bolts and nuts tightening torque

■ NOTE

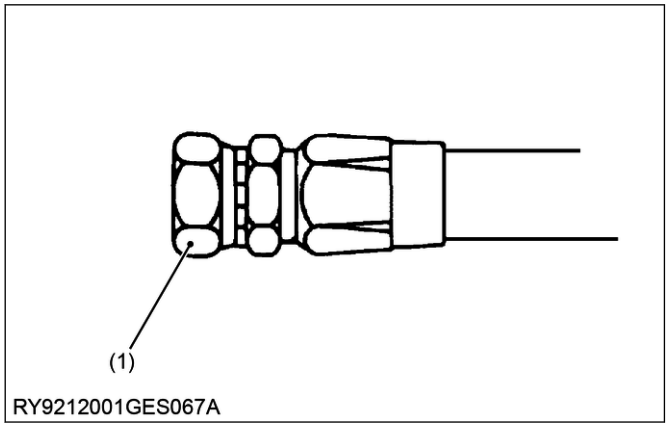
- **Screws, bolts and nuts which tightening torques are not specified in this workshop manual should be tightened according to the table below.**

Mark on top of bolt	 No grade or 4T						 7T						 9T		
Mark on top of nut	 No grade or 4T												 6T		
Material	Steel			Aluminum			Steel			Aluminum			Steel		
Units	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 tightening torque

Material	Steel			Aluminum		
Units	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 hose fitting tightening torque

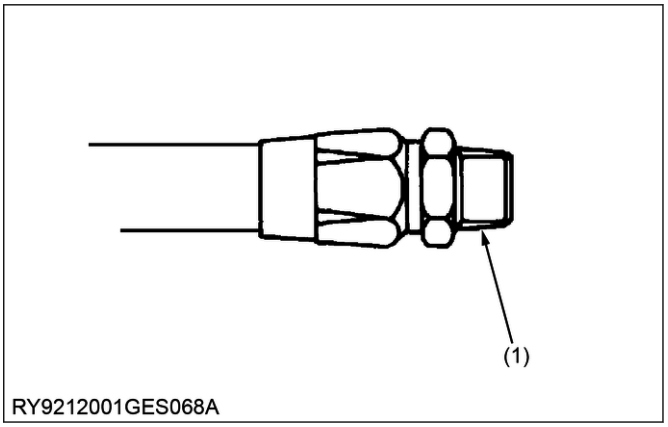


(1) Union nut

Units	N·m	kgf·m	lbf·ft
1/8	7.8 to 11.8	0.8 to 1.2	5.8 to 8.7
1/4	24.5 to 29.2	2.5 to 3.0	18.1 to 21.5
3/8	37.2 to 42.1	3.8 to 4.3	27.5 to 31.0
1/2	58.8 to 63.7	6.0 to 6.5	43.4 to 46.9
3/4	117.6 to 127.4	12.0 to 13.0	86.7 to 94.0
1	181.3 to 191.1	18.5 to 19.5	133.8 to 140.9
1-1/4	220.5 to 230.3	22.5 to 23.5	162.8 to 170.0

Units	N·m	kgf·m	lbf·ft
9/16-18 (ORS type)	35.2 to 43.1	3.6 to 4.4	26.0 to 31.8
11/16-16 (ORS type)	60.0 to 73.5	6.0 to 7.5	44.3 to 54.2
13/16-16 (ORS type)	70.6 to 86.2	7.2 to 8.8	52.1 to 63.6
1-14 (ORS type)	105.8 to 129.4	10.8 to 13.2	78.0 to 98.4

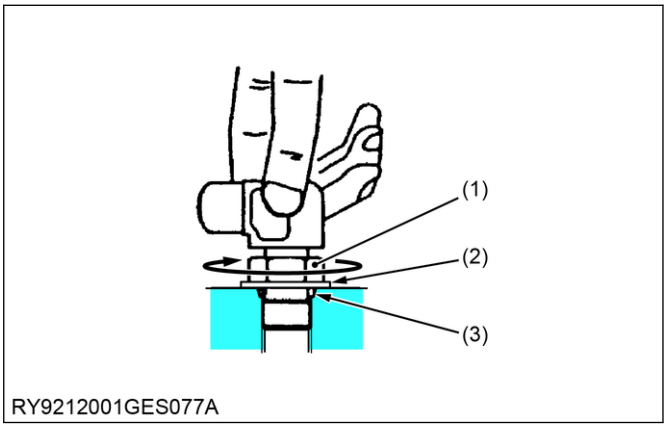
4. Hydraulic hoses tightening torque (taper thread)



(1) Taper thread

Units	N·m	kgf·m	lbf·ft
1/8	19.6 to 29.4	2.0 to 3.0	14.5 to 21.6
1/4	36.6 to 44.1	3.7 to 4.5	27.0 to 32.5
3/8	68.6 to 73.5	7.0 to 7.5	50.6 to 54.2
1/2	83.4 to 88.3	8.5 to 9.0	61.6 to 65.1
3/4	166.6 to 181.3	17.0 to 18.5	122.9 to 133.7

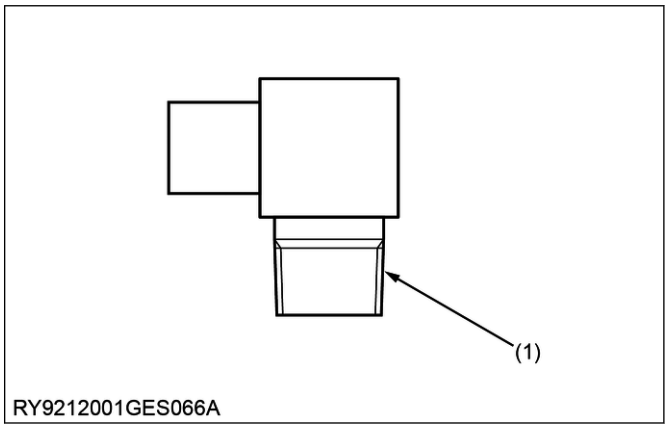
5. Locknuts of adapters with O-ring tightening torque (straight thread)



(1) Locknut
(2) Seat
(3) Seal (O-ring)

Units	N·m	kgf·m	lbf·ft
1/8	15.0 to 16.5	1.5 to 1.7	11.1 to 12.1
1/4	24.5 to 29.4	2.5 to 3.0	18.1 to 21.5
3/8	49.0 to 53.9	5.0 to 5.5	36.2 to 39.7
1/2	58.8 to 63.7	6.0 to 6.5	43.4 to 46.9
3/4, 1	117.6 to 127.4	12.0 to 13.0	86.74 to 93.96
1-1/4	220.5 to 230.3	22.5 to 23.5	162.7 to 169.8

6. Adapters tightening torque (taper thread)



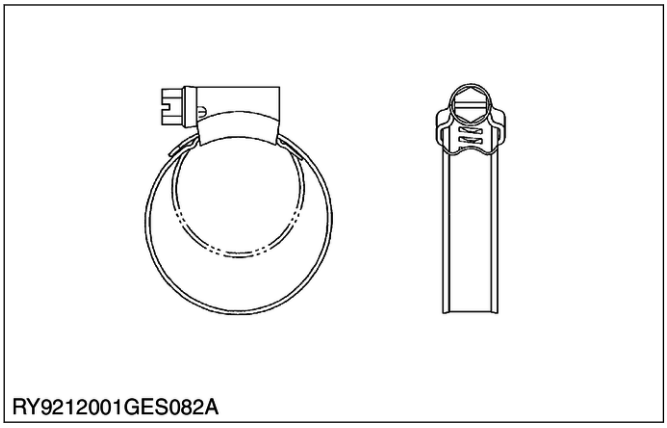
RY9212001GES066A

(1) Taper thread

Units	N·m	kgf·m	lbf·ft
1/8	19.6 to 29.4	2.0 to 3.0	14.5 to 21.6
1/4	36.3 to 44.1	3.7 to 4.5	27.0 to 32.5
3/8	68.6 to 73.5	7.0 to 7.5	50.6 to 54.2
1/2	83.4 to 88.3	8.5 to 9.0	61.6 to 65.1
3/4	166.6 to 181.3	17.0 to 18.5	122.9 to 133.7

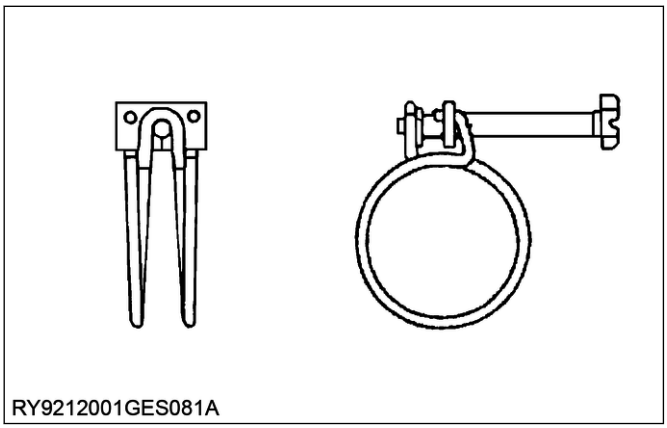
7. Hose clamps tightening torque

Steel band type


RY9212001GES082A

Units	N·m	kgf·m	lbf·ft
ϕ13-ϕ20	2.5 to 3.4	0.3 to 0.4	1.9 to 2.5
ϕ15-ϕ25	4.9 to 5.9	0.5 to 0.6	3.7 to 4.3
ϕ19-ϕ28			
ϕ22-ϕ32			
ϕ26-ϕ38			
ϕ32-ϕ44			
ϕ44-ϕ56			
ϕ50-ϕ65			
ϕ58-ϕ75			
ϕ60-ϕ80			
ϕ68-ϕ85			
ϕ77-ϕ95			

Wire band type


RY9212001GES081A

Units	N·m	kgf·m	lbf·ft
ϕ10-ϕ14	2.5 to 3.4	0.3 to 0.4	1.9 to 2.5

(Continued)

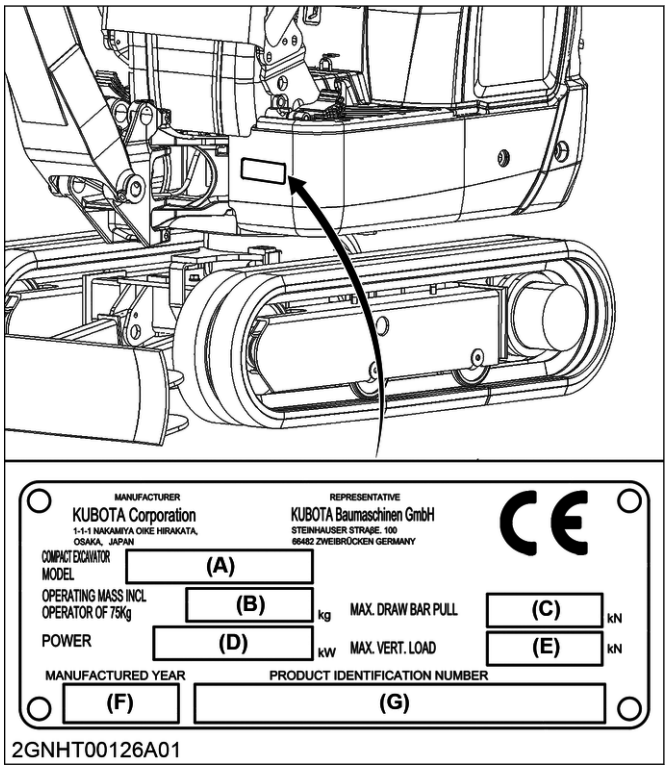
Units	N·m	kgf·m	lbf·ft
ϕ12-ϕ16	2.5 to 3.4	0.3 to 0.4	1.9 to 2.5
ϕ19-ϕ25			
ϕ31-ϕ40			
ϕ36-ϕ46			
ϕ44-ϕ53	3.9 to 4.9	0.4 to 0.5	2.9 to 3.6
ϕ51-ϕ59			
ϕ86-ϕ96	2.5 to 3.4	0.3 to 0.4	1.9 to 2.5

GENERAL MACHINE INFORMATION

1. Machine model identification

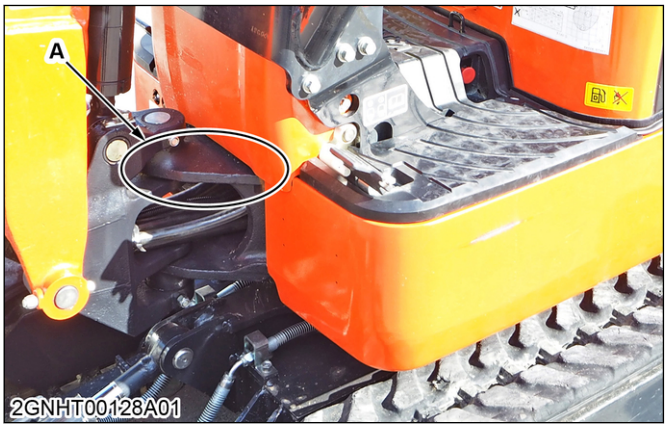
■ IMPORTANT

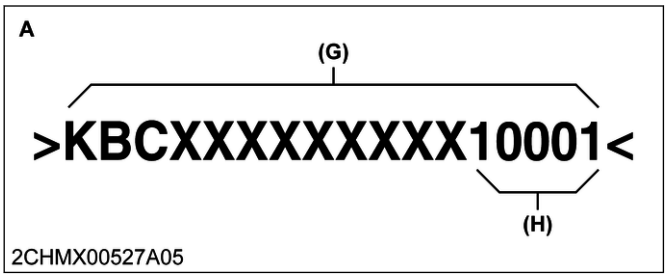
- **Before contacting customer support, take notes of the excavator model, serial number, engine type, engine serial number, and hour meter.**



2GNHT00126A01

(A)	Model
(B)	Operating weight
(C)	Maximum pulling capacity at the towing eyes
(D)	Engine performance
(E)	Maximum vertical load at the towing eyes
(F)	Year of production
(G)	Product identification number [PIN] (17 digits)



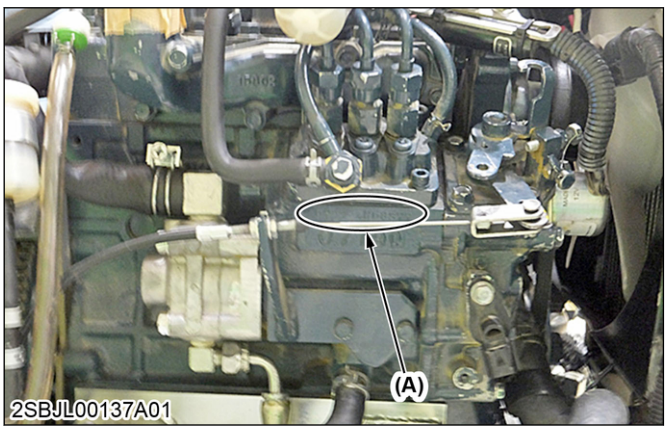


(G) Product identification number [PIN] (17 digits)
(H) Serial number (5 digits)

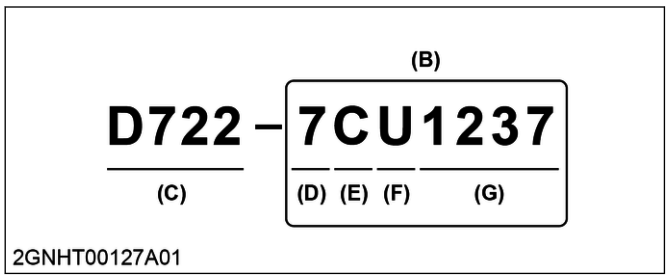
2. Engine model identification

■ IMPORTANT

- **Before contacting customer support, take notes of the excavator model, serial number, engine type, engine serial number, and hour meter.**



(A) Engine model and serial number



(B) Engine serial number
(C) Engine model
(D) Engine series
(E) Production year
(F) Production month
(G) Sequence number

Engine serial number

The engine serial number indicates the engine series, production year, production month, and sequence number.

Engine series

Number or letter	Series
1	05 (including WG)
2	V3
3	08
4	SM (including WG)
5	Air-cooled gasoline
6	GZ, OC, AC, EA, E
7	03
8	07
A	EA, RK
B	03 (KET production)

Production year

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

* Alphabetical letters "I" and "O" are not used.

Production month

Letter	Month
A or B	January
C or D	February
E or F	March
G or H	April
J or K	May
L or M	June
N or P	July
Q or R	August
S or T	September
U or V	October
W or X	November
Y or Z	December

* Alphabetical letters "I" and "O" are not used.

Sequence number

Sequence number
0001 to 9999 or A001 to Z999

* Alphabetical letters "I" and "O" are not used.

3. Specifications

Model			U10-5
Type			Rubber tracks
Machine weight			1125 kg 2480 lbs
Operating weight*			1200 kg 2646 lbs
Bucket	Capacity (CECE)		0.020 m^3 1200 cu.in.
	Width with teeth		398 mm 15.7 in.
Engine	Type		Water-cooled 4-cycle diesel engine with 3 cylinder
	Model name		D722-E4-BH-5EU
	Total displacement		719 cc 43.9 cu.in.
	Rated output / speed	Net SAE J1349	7.5 kW / 2050 min^{-1} (rpm) 10.1 HP / 2050 min^{-1} (rpm)
		Net ISO 8178	7.5 kW / 2050 min^{-1} (rpm) 10.1 HP / 2050 min^{-1} (rpm)
		Net ISO 9249	7.5 kW / 2050 min^{-1} (rpm) 10.1 HP / 2050 min^{-1} (rpm)
		Gross SAE J1995	7.7 kW / 2050 min^{-1} (rpm) 10.3 HP / 2050 min^{-1} (rpm)
	Rated engine speed		2050 min^{-1} (rpm)
	Idling engine speed		1300 min^{-1} (rpm)
	CO_2 emission*1 (Engine family HKBXL01.5BCB)		1019.8 g/kWh
Performance	Swivel speed		8.3 min^{-1} (rpm)
	Travel speed	Low speed	2.0 km/h 1.2 mph
		High speed	4.0 km/h 2.5 mph
	Ground pressure (without an operator)		29.0 kPa 0.296 kgf/cm^2 4.21 psi
	Climbing performance		27% (15 degrees)
	Maximum lateral sway		18% (10 degrees)
Blade	Width (extended) × Height		750 (990) × 200 mm 29.5 (39.0) × 7.9 in.
Boom swing angle	LH		0.96 rad 55°
	RH		0.96 rad 55°
AUX	Maximum flow rate (theoretical)		21.0 L/min 5.5 U.S.gals/min
	Maximum pressure		17.2 MPa 175 kgf/cm^2 2495 psi
Fuel tank capacity			12.0 L 3.17 U.S.gals
Pulling capacity at the towing eyes			17640 N 1799 kgf 3966 lbf

(Continued)

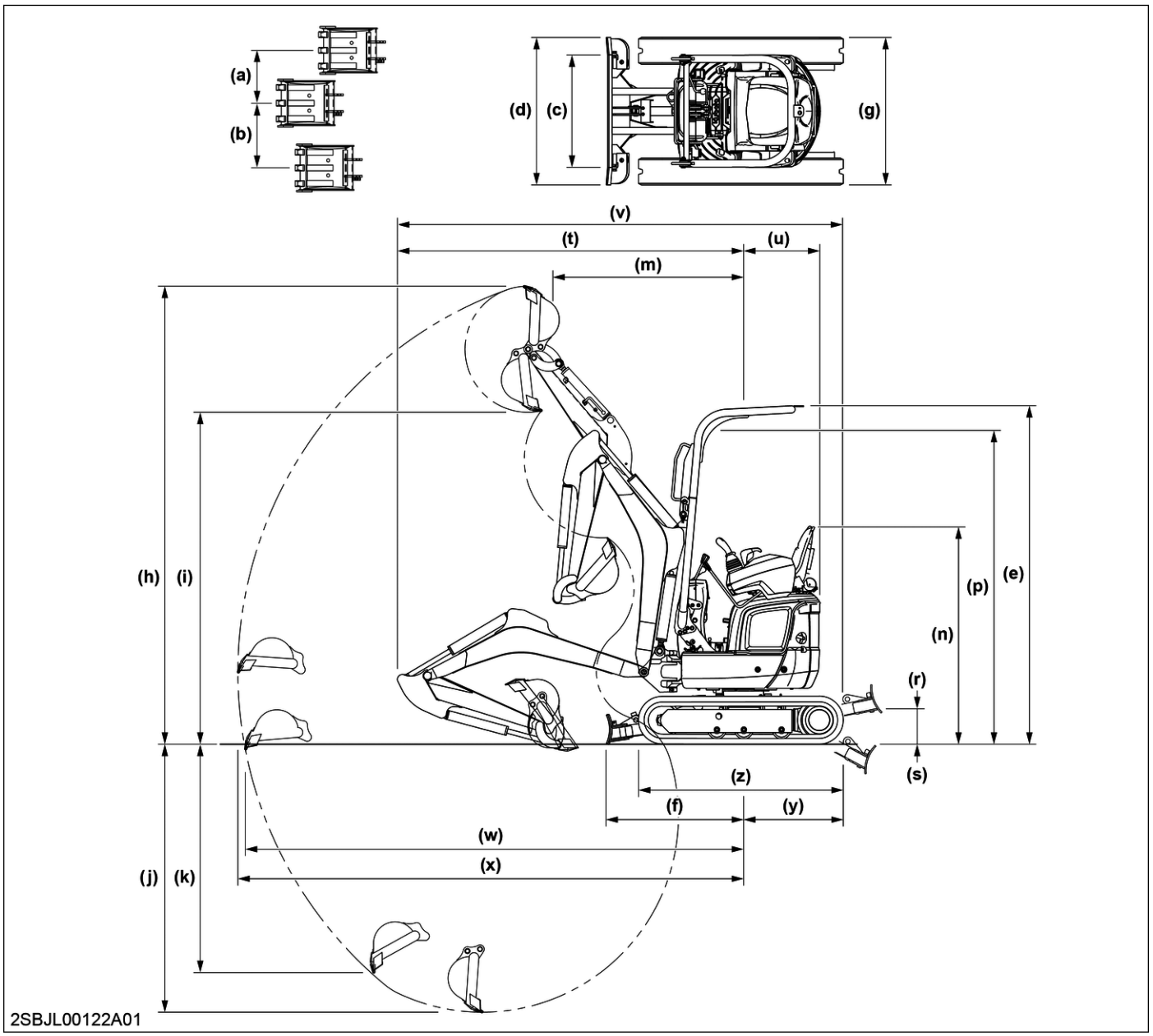
Model			U10-5
Vertical load at the towing eyes			3063 N 312 kgf 689 lbf
Noise level		LpA	77 dB (A)
		LwA (2000 / 14 / EC)	90 dB (A)
Vibration*2	Hand-arm system (ISO 5349-2:2001)	Digging	Less than 2.5 m/s^{2}RMS
		Levelling	Less than 2.5 m/s^{2}RMS
		Driving	Less than 5.93 m/s^{2}RMS
		Idling	Less than 2.5 m/s^{2}RMS
	Whole body (ISO 2631-1:1997)	Digging	Less than 0.5 m/s^{2}RMS
		Levelling	Less than 0.5 m/s^{2}RMS
		Driving	Less than 2.32 m/s^{2}RMS
		Idling	Less than 0.5 m/s^{2}RMS

* Machine weight including operator's weight (75 kg)

*1 CO_2 measurement results shown above are test results gathered under a certain laboratory condition and test cycle, and using one or more models of engines which represent the engine family. Therefore, those results do not guarantee performance of any particular engine.
*2 These values are measured under specific conditions at the maximum engine speed, and can deviate depending on the operating situation.

NOTE
- **Specifications are based on the machine with the standard bucket.**
- **Specifications are subject to change without prior notice.**
- **Climbing ability and angle are based on the condition below. Worse condition or heavier attachment will decrease the climbing performance.**
  - **Machine with an unloaded bucket**
  - **Firm and compacted soil**

4. Machine dimensions



(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
355 mm 14.0 in.	435 mm 17.1 in.	750 mm 29.5 in.	990 mm 39.0 in.	2260 mm 89.0 in.	920 mm 36.2 in.	750 / 990 mm 29.5 / 39.0 in.	3060 mm 120.5 in.
(i)	(j)	(k)	(m)	(n)	(p)	(r)	(s)
2220 mm 87.4 in.	1790 mm 70.5 in.	1530 mm 60.2 in.	1275 mm 50.2 in.	1450 mm 57.1 in.	2100 mm 82.7 in.	210 mm 8.3 in.	200 mm 7.9 in.
(t)	(u)	(v)	(w)	(x)	(y)	(z)	-
2310 mm 90.9 in.	510 mm 20.1 in.	2980 mm 117.3 in.	3330 mm 131.1 in.	3380 mm 133.1 in.	670 mm 26.4 in.	1340 mm 52.8 in.	-

NOTE

- **Dimensions are based on the machine with the standard bucket.**
- **Specifications are subject to change without prior notice.**

5. Machine mass table

NOTE

- **Mass values described here are reference values based on actual measured values (marked with @) and drawing values.**

		Mass	Remarks
Front attachment	Boom	43 kg 95 lbs	-
	Boom cylinder	12 kg 26 lbs	-
	Arm	21 kg 46 lbs	-
	Arm cylinder	9.0 kg 19.8 lbs	-
	Bucket	19 kg 42 lbs	-
	Bucket cylinder	9.0 kg 19.8 lbs	-
	Swing bracket	13 kg 29 lbs	-
Upper structure	Canopy	66 kg 146 lbs	-
	Seat	8.0 kg 17.6 lbs	-
	Center counterweight	97 kg 214 lbs	@
	Counterweight RH	28 kg 62 lbs	-
	Counterweight LH	27 kg 59 lbs	-
	Engine	70 kg 154 lbs	-
	Alternator	2.0 kg 4.4 lbs	-
	Starter motor	3.0 kg 6.6 lbs	-
	Radiator	2.0 kg 4.4 lbs	-
	Fuel tank	3.0 kg 6.6 lbs	-
	Hydraulic pump	4.0 kg 8.8 lbs	-
	Control valve	17 kg 38 lbs	@
	Hydraulic oil tank	12 kg 26 lbs	-
	Swivel motor	8.0 kg 17.6 lbs	-
	Swivel joint	8.0 kg 17.6 lbs	-

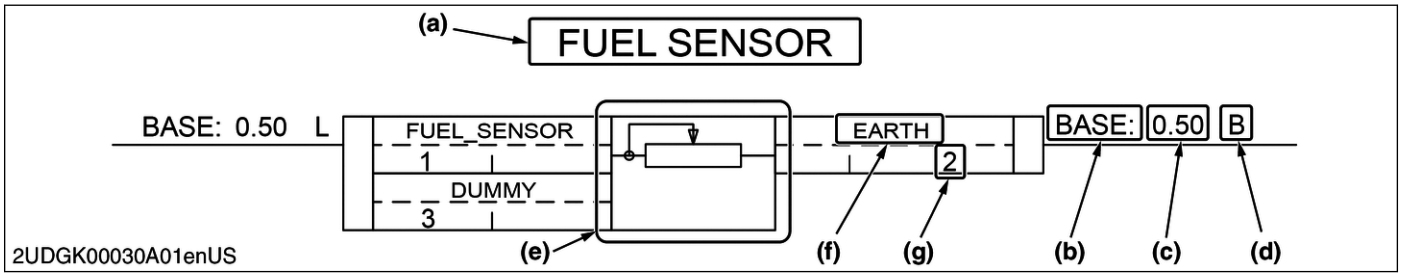
(Continued)

		Mass	Remarks
Upper structure	Swivel bearing	15 kg 33 lbs	-
	Swing cylinder	7.0 kg 15.4 lbs	-
Undercarriage	Rubber track	36 kg 79 lbs	-
	Front idler	8.0 kg 17.6 lbs	-
	Grease cylinder	1.0 kg 2.2 lbs	-
	Track roller	4.0 kg 8.8 lbs	-
	Blade	36 kg 79 lbs	-
	Blade cylinder	6.0 kg 14 lbs	-
	Track cylinder	5.0 kg 11.0 lbs	-
	Travel motor	20 kg 44 lbs	Without the sprocket

GENERAL ELECTRICAL INFORMATION

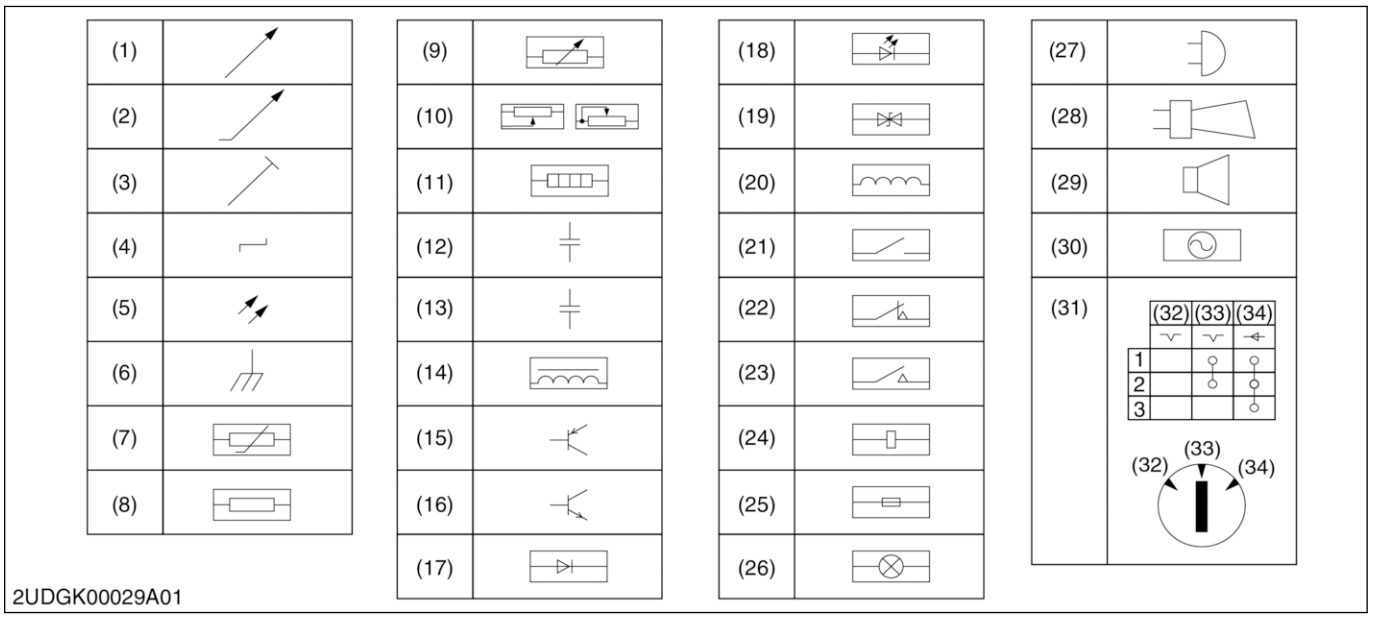
1. Electrical circuit general description

1.1 Electrical circuit diagram description



(a) Part name
(b) Specification code
(c) Electrical wiring size
(d) Wiring color coding
(e) Unit symbol
(f) Pin name
(g) Pin number

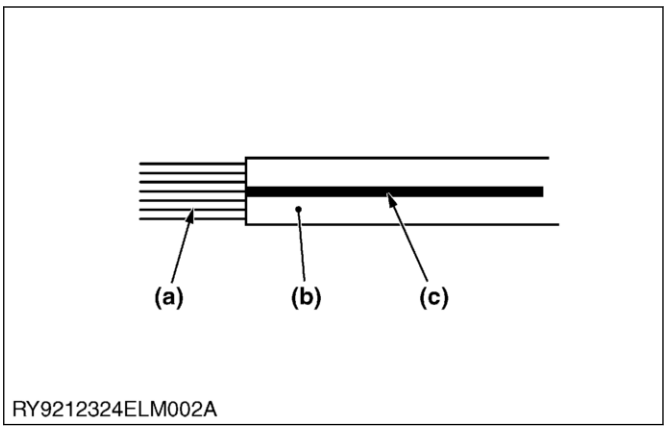
1.2 Electrical circuit diagram unit symbol



(1) Variable
(2) Nonlinear variable
(3) Fixed setting
(4) Step variable
(5) Non-ionizing radiation (NIR)
(6) Body GND
(7) Thermistor
(8) Resistor
(9) Variable resistor
(10) Potentiometer with sliding contact
(11) Heating element
(12) Capacitor
(13) Electrolytic capacitor
(14) Magnetic core inductance
(15) PNP transistor
(16) NPN transistor
(17) Semiconductor diode
(18) Light-emitting diode (LED)
(19) Two-way breakdown diode
(20) Coil
(21) NO (normally open)
(22) Auto-resetting NC (normally closed)
(23) Auto-resetting NO (normally open)
(24) Relay coil
(25) Fuse
(26) Lamp
(27) Buzzer
(28) Horn
(29) Speaker
(30) AC voltage source
(31) Starter switch
(32) STOP
(33) RUN
(34) START

1.3 Electrical wiring color coding

Wiring color	Color code	Wiring color	Color code
Black	B	Blue/Green	L/G
Green	G	Blue/Orange	L/O
Blue	L	Blue/Red	L/R
Pink	P	Blue/White	L/W
Red	R	Blue/Yellow	L/Y
White	W	Yellowish green/Blue	LG/L
Yellow	Y	Yellowish green/Red	LG/R
Brown	BR	Yellowish green/White	LG/W
Gray	GR	Yellowish green/Yellow	LG/Y
Yellowish green	LG	Orange/White	O/W
Orange	O	Pink/White	P/W
Light blue	SB	Pink/Blue	P/L
Black/Green	B/G	Red/Black	R/B
Black/Blue	B/L	Red/Green	R/G
Black/Pink	B/P	Red/Blue	R/L
Black/Violet	B/V	Red/White	R/W
Black/Red	B/R	Red/Yellow	R/Y
Black/White	B/W	Violet/White	V/W
Black/Yellow	B/Y	White/Black	W/B
Brown/Black	BR/B	White/Green	W/G
Brown/Yellow	BR/Y	White/Blue	W/L
Brown/Red	BR/R	White/Red	W/R
Green/Black	G/B	White/Yellow	W/Y
Green/Blue	G/L	Yellow/Black	Y/B
Green/Red	G/R	Yellow/Green	Y/G
Green/White	G/W	Yellow/Blue	Y/L
Green/Yellow	G/Y	Yellow/Red	Y/R
Blue/Black	L/B		

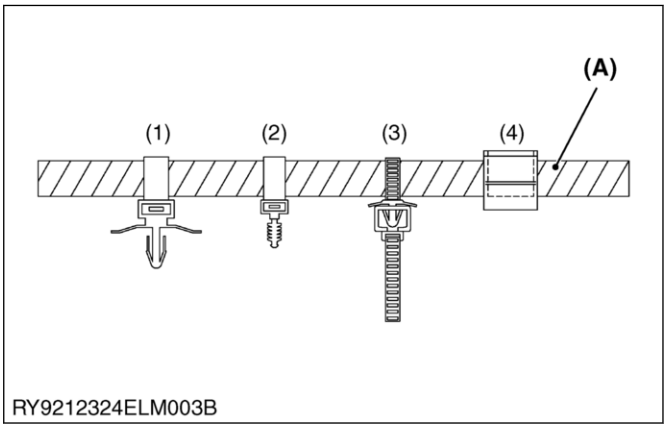


(a) Electric wiring size (mm^2)
(b) Base color
(c) Stripe color

- 1.25-Y/R

1.25 mm^2 (electric wiring size)
Y: Yellow (base color)
R: Red (stripe color)

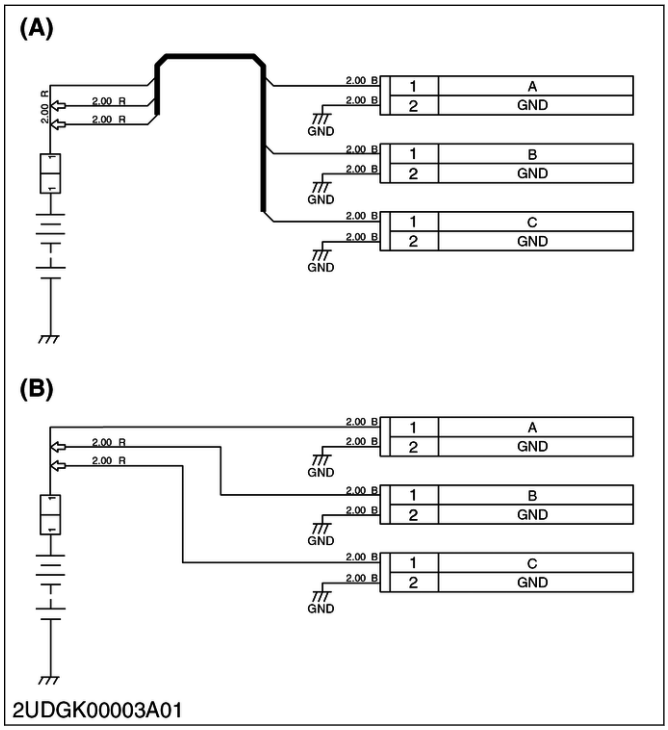
1.4 Electrical wiring clamp



(1) Anchor type (insert to the anchor)
(2) Screw type (insert to the screw end)
(3) Plug-in type (insert until it locks)
(4) Plug-in type (insert until it locks)
(A) Wire harness

1.5 Bus description

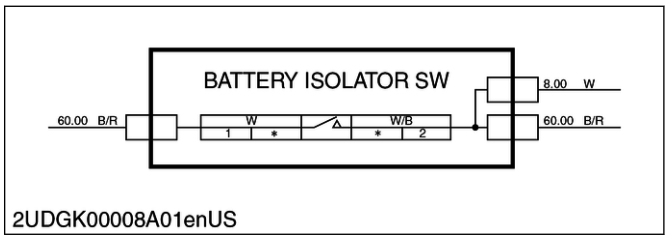
Bus simplifies complex circuits with many branches.

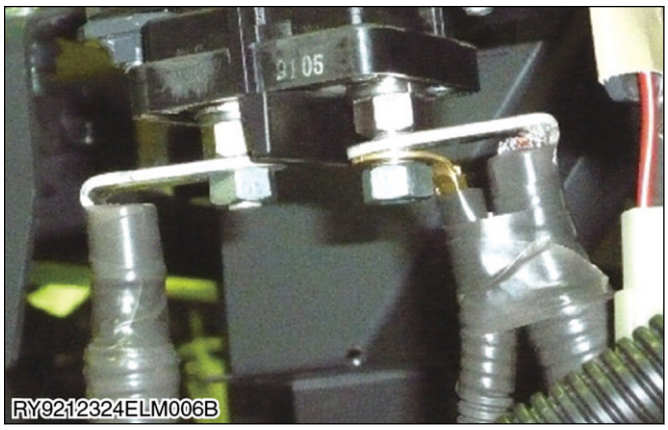


(A) Diagram with bus (B) Diagram without bus

1.6 Composite terminal description

Connects 2 or more terminals together to a device.





2. Connector

2.1 Connector handling precaution

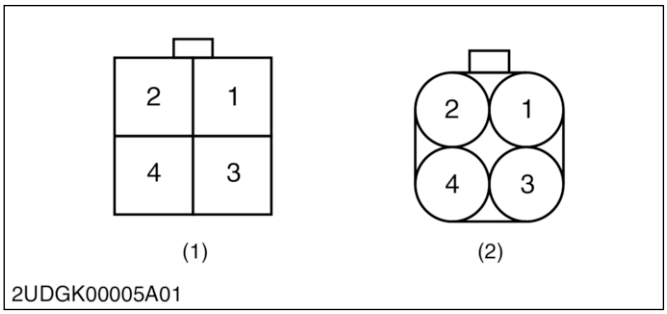
IMPORTANT

- **When disconnecting a connector, grasp the connector to pull it out. Do not pull the wiring.**
- **When disconnecting a locking type connector, release the lock and pull it out.**
- **When removing the waterproof plastic cover of the connector, do not allow water to enter the connector.**
- **Repair any connector terminal deformations. Ensure that there is no protruding, loose, or rusty wiring.**
- **Ensure that the locking type connector is locked when inserted.**

2.2 Connector diagram description

Fewer than 10 pins

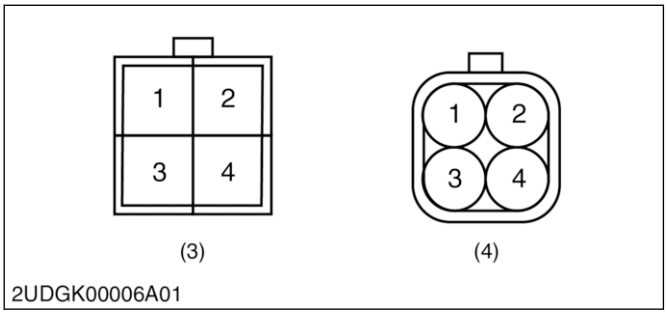
Female



(1) Non-waterproof (2) Waterproof

- Numbers are arranged from the top right.
- Number 1 is located on the top right.

Male

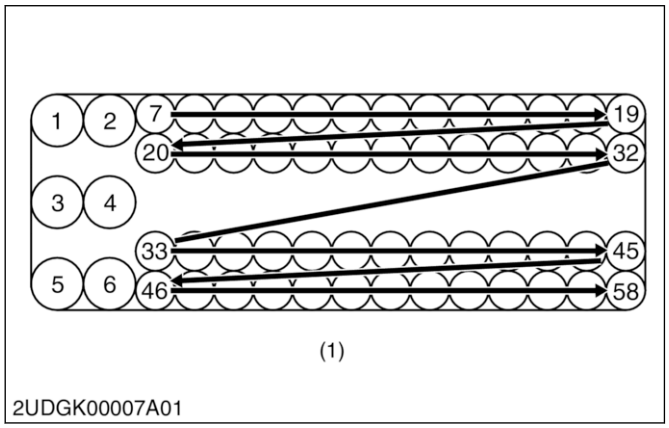


(3) Non-waterproof (4) Waterproofed

- Numbers are arranged from the top left.
- Number 1 is located on the top left.

More than 11 pins

Female



(1) Main ECU connector (female)

TRANSPORTING THE MACHINE

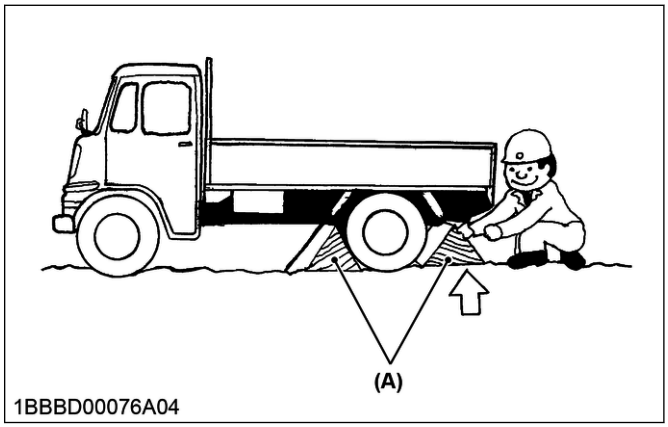
1. Loading and unloading the machine on a truck

⚠ DANGER

- **Do not use a wet loading ramp. The machine may fall from the loading ramp.**
- **Do not operate the front attachment, or turn or steer the machine while loading or unloading the machine. The machine may fall from the loading ramp.**
- **Do not operate the machine with high speed while loading or unloading the machine.**
- **Set wheel stoppers to the truck.**

Preparing

1. Park the truck on the firm and level ground and stop the engine.
2. Set wheel stoppers to the truck.



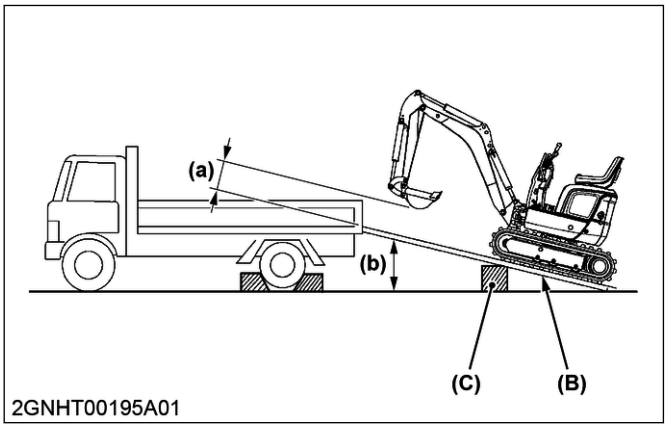
(A) Wheel stopper

Loading

1. Set a loading ramp securely.
2. Set a support block under the loading ramp to prevent the front side of truck from lifting by the machine weight.
3. Travel the machine with low speed to load the machine.

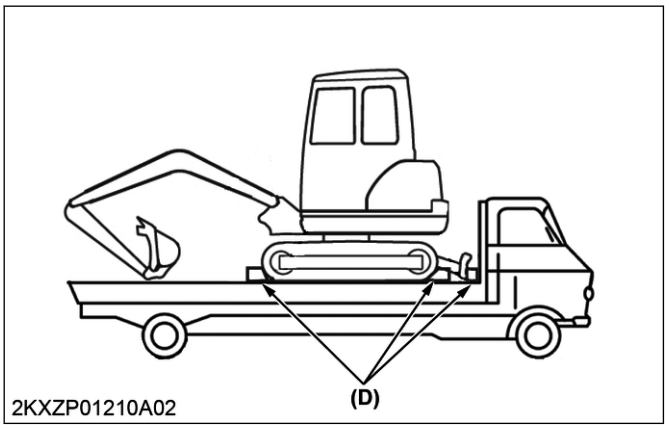
■ NOTE

- **Make sure to position the bucket not to hit the ground or loading ramp.**



(a) 200 to 400 mm (7.9 to 15.7 in.)
(b) 10 to 15°
(B) Loading ramp
(C) Support block

4. After loading the machine on the center of the truck bed, lower the blade.
5. Swivel the machine 180° and place the bucket on the truck bed.
6. Stop the engine.
7. Set support blocks.



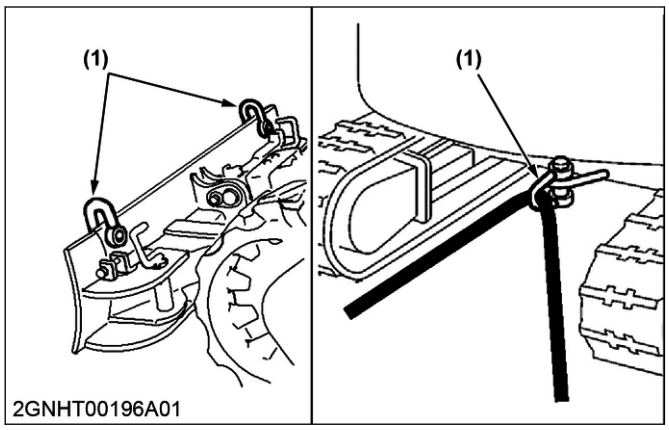
(D) Support block

8. Keep the machine locked with nylon slings while transporting.

■ NOTE

- **Drive the truck carefully to prevent the machine from moving while transporting.**

9. To secure the machine, use the tie-down position.



(1) Tie-down position

Unloading

1. Start the engine.
2. Operate the machine with low speed to unload the machine.

■ NOTE

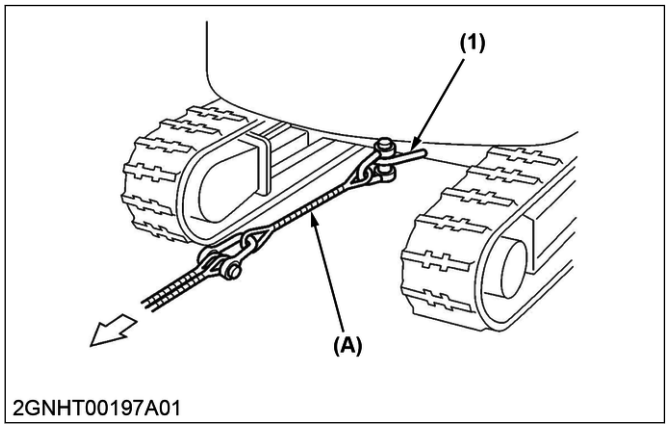
- **Make sure to position the bucket not to hit the ground or loading ramp.**

2. Towing the inoperable machine

■ IMPORTANT

- **Towing is only allowed when the machine gets stuck in mud and so on.**
- **Do not tow for a long distance.**
- **Tow at walking speed.**
- **Use a chain or rope that is capable of towing an object 1.5 times heavier than the machine.**
- **Towing should only be carried out by trained or licensed personnel.**
- **During towing, operator must be seated on the operator seat.**

1. Attach chain or rope to the towing point.



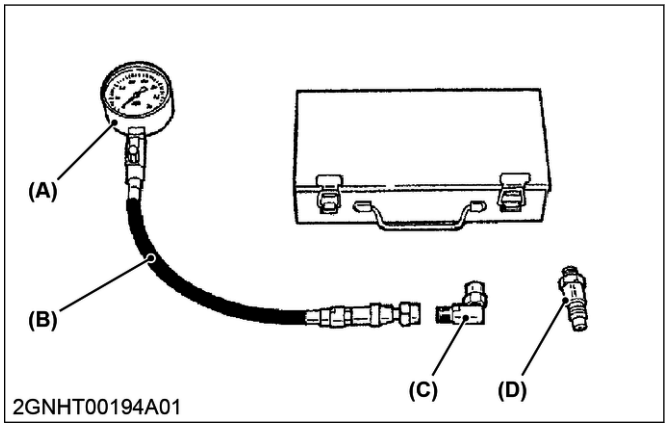
(1) Towing point (A) Chain or rope

2. Tow the machine at walking speed with a truck.

SPECIAL JIGS AND TOOLS

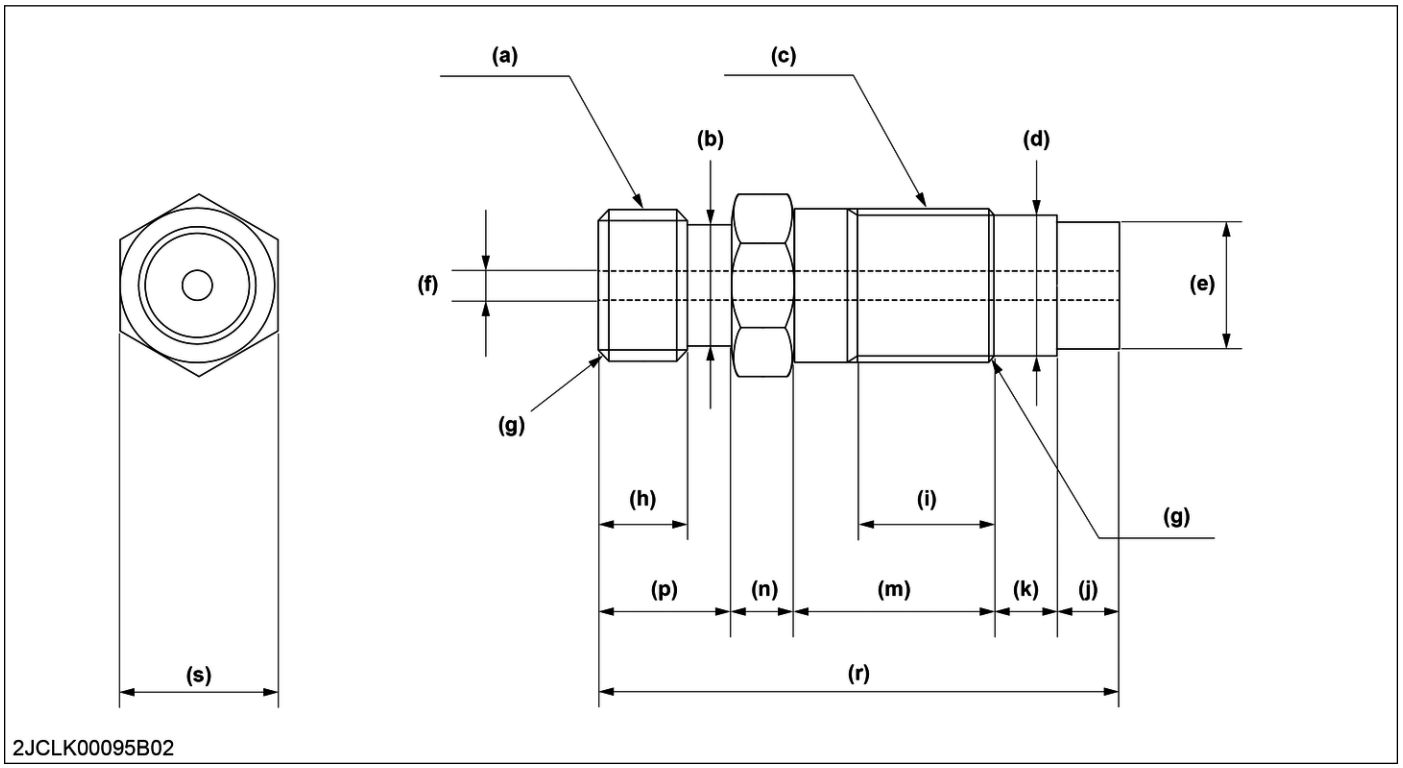
1. Engine compression pressure measuring kit

Diesel engine compression tester



(A) Pressure gauge (B) Hose assembly (C) L-joint (D) Adapter

Adapter



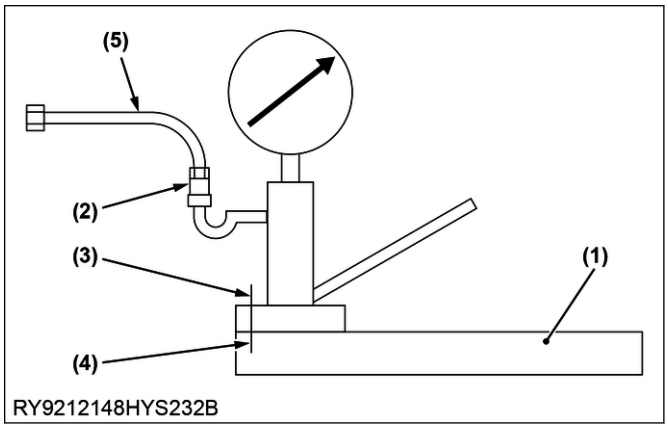
	Dimension
(a)	5/8-18UNF
(b)	ϕ13 mm ϕ0.51 in.
(c)	M20 × 1.5
(d)	17.2 to 17.5 mm 0.678 to 0.688 in.
(e)	10.8 to 10.9 mm 0.426 to 0.429 in.
(f)	ϕ3 mm ϕ0.1 in.
(g)	Chamfer 1 mm Chamfer 0.04 in.
(h)	10 mm 0.39 in.
(i)	13 mm 0.51 in.
(j)	7 mm 0.3 in.
(k)	7 mm 0.3 in.
(m)	20 mm 0.79 in.
(n)	7 mm 0.3 in.
(p)	15 mm 0.59 in.
(r)	56 mm 2.2 in.
(s)	21 mm 0.83 in.
Material	SS400

2. Overload relief valve measuring kit

CAUTION

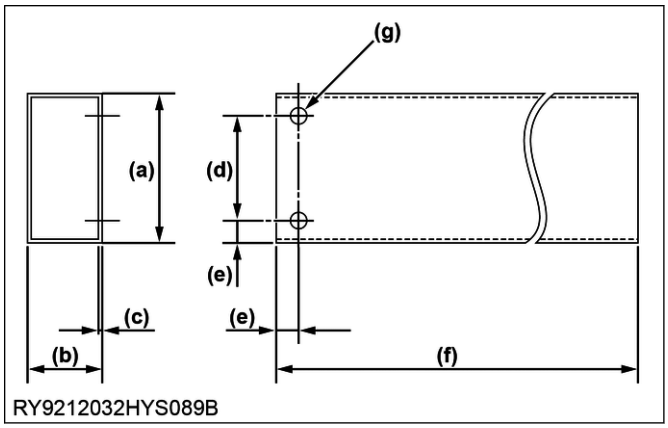
- **When measuring overload relief pressure, use a test hose which has enough pressure endurance.**

Nozzle tester



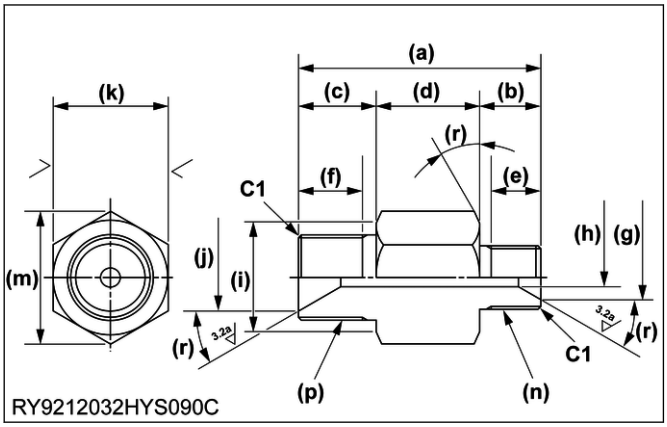
(1) Support
(2) Pipe fitting (M12-G1/4)
(3) Bolt (M10 × 35) ×2
(4) Nut (M12) ×2
(5) Test hose

Support



	Dimension
(a)	100 mm 3.94 in.
(b)	50 mm 1.97 in.
(c)	2.3 mm 0.09 in.
(d)	70 mm 2.76 in.
(e)	15 mm 0.59 in.
(f)	600 mm 23.62 in.
(g)	11 mm 0.43 in.

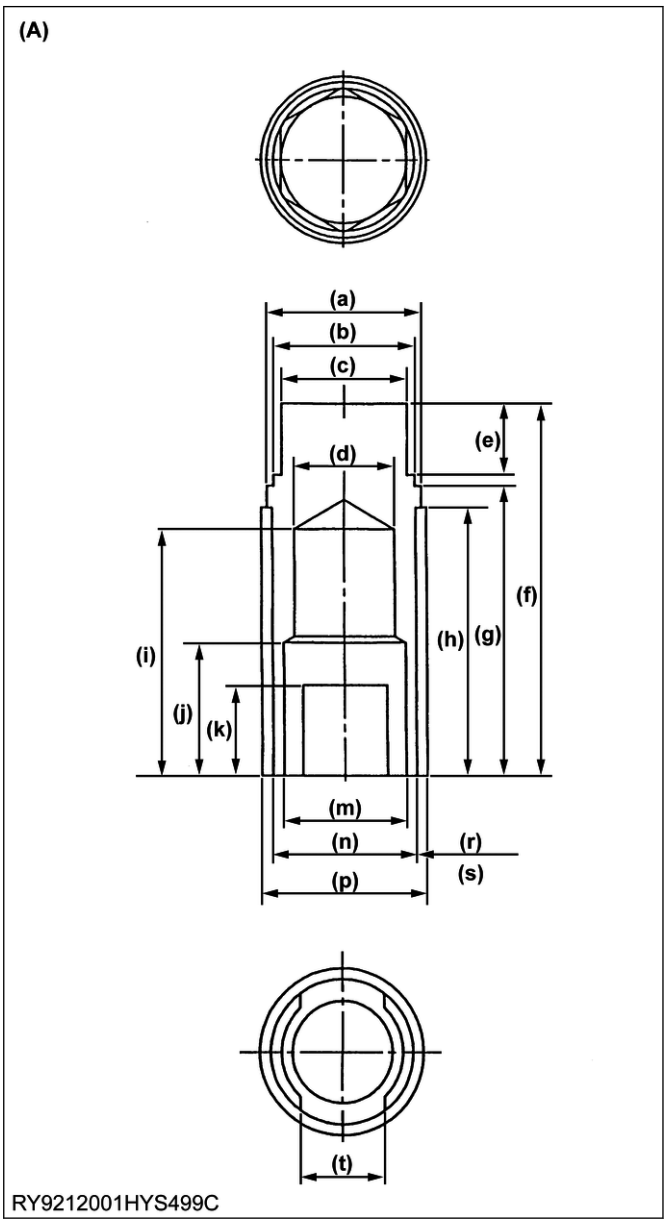
Pipe fitting (M12-G1/4)



	Dimension
(a)	47 mm 1.85 in.
(b)	12 mm 0.47 in.
(c)	15 mm 0.59 in.
(d)	20 mm 0.79 in.
(e)	10 mm 0.39 in.
(f)	12 mm 0.47 in.
(g)	ϕ8 mm ϕ0.31 in.
(h)	ϕ3 mm ϕ0.12 in.
(i)	ϕ18 mm ϕ0.71 in.
(j)	ϕ9±0.2 mm ϕ0.35±0.01 in.
(k)	19 mm 0.75 in.
(m)	21.9 mm 0.86 in.
(n)	M12 × 1.5
(p)	G1/4
(r)	0.52 rad 30°

3. Universal joint tightening jig

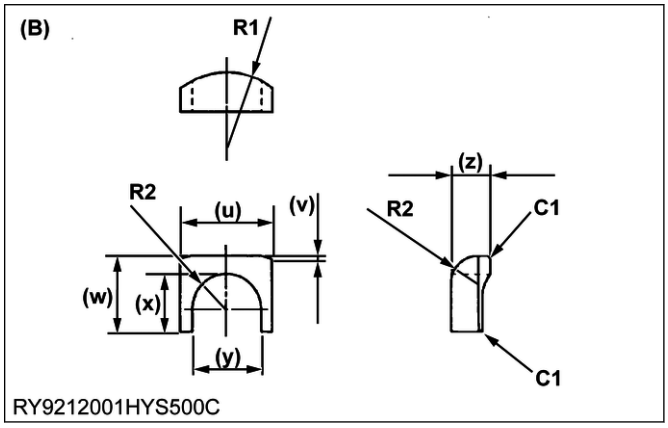
Universal joint tightening jig 1



(A) Universal joint tightening jig
1 detail view

	Dimensions
(a)	ϕ29 mm ϕ1.14 in.
(b)	ϕ26.5 mm ϕ1.04 in.
(c)	23.5 mm 0.93 in.
(d)	ϕ19 mm ϕ0.75 in.
(e)	Less than 13 mm Less than 0.51 in.
(f)	Less than 69 mm Less than 2.72 in.
(g)	54 mm 2.13 in.
(h)	50 mm 1.97 in.
(i)	46 mm 1.81 in.
(j)	25 mm 0.98 in.
(k)	17 mm 0.67 in.
(m)	ϕ23 mm ϕ0.91 in.
(n)	ϕ27 mm ϕ1.06 in.
(p)	ϕ31 mm ϕ1.22 in.
(r)	H6 mm
(s)	N6 mm
(t)	ϕ16 mm ϕ0.63 in.

Universal joint tightening jig 2



(B) Universal joint tightening jig 2 detailed view

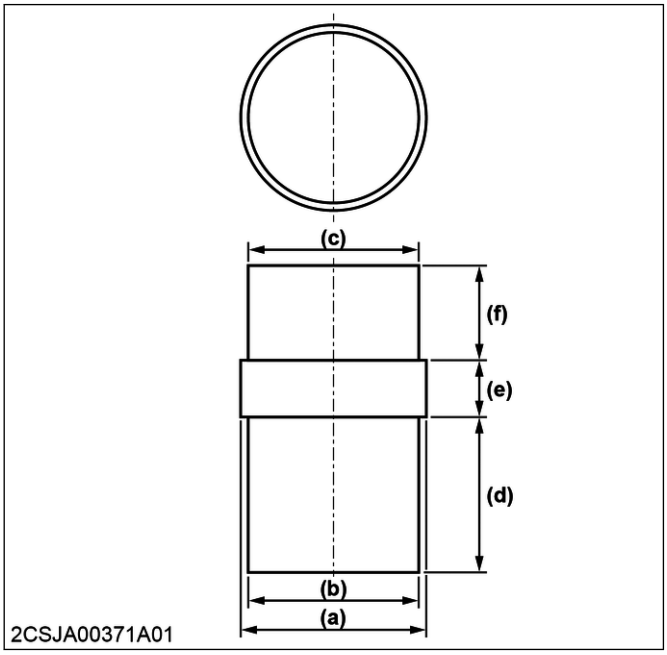
	Dimensions
(u)	15.5 mm 0.61 in.
(v)	0.5 × 15 mm 0.02 × 0.59 in.
(w)	12.5 mm 0.49 in.
(x)	9.5 mm 0.37 in.
(y)	Less than 11.6 mm Less than 0.46 in.
(z)	Less than 6.5 mm Less than 0.26 in.
C1	0.5 mm chamfer 0.02 in. chamfer
R1	R13 mm R0.51 in.
R2	R5.8 mm R0.23 in.

4. Hydraulic cylinder special jigs

■ IMPORTANT

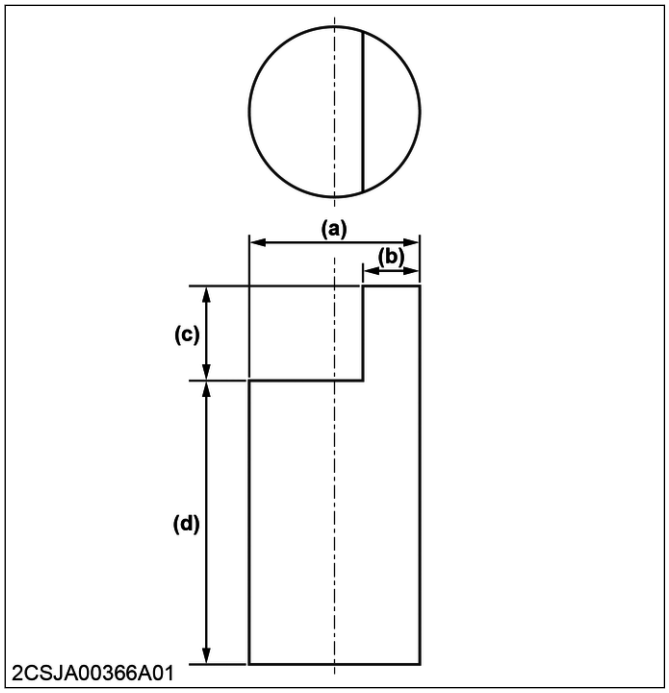
- **Process the jigs so that roughness of their surfaces is less than 3.2a to protect the seal from damage.**

Bushing installation jig



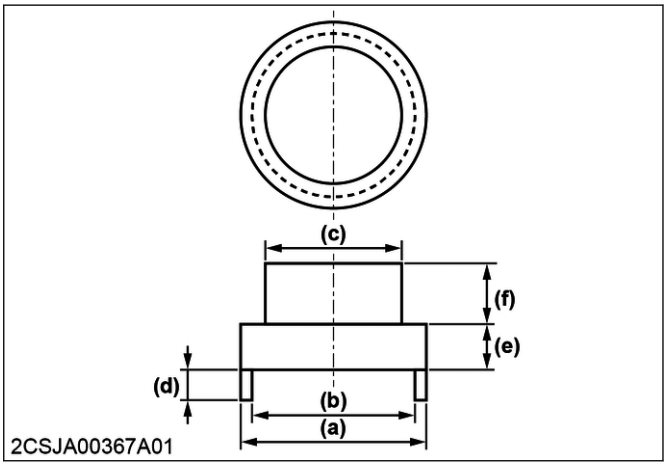
No.	Size
(a)	Rod diameter + 3 mm Rod diameter + 0.118 in.
(b)	Rod diameter - 0.1 mm Rod diameter - 0.004 in.
(c)	Rod diameter + 1 mm Rod diameter + 0.039 in.
(d)	40 mm 1.57 in.
(e)	15 mm 0.59 in.
(f)	25 mm 0.98 in.
Material	S45C

U-ring installation jig



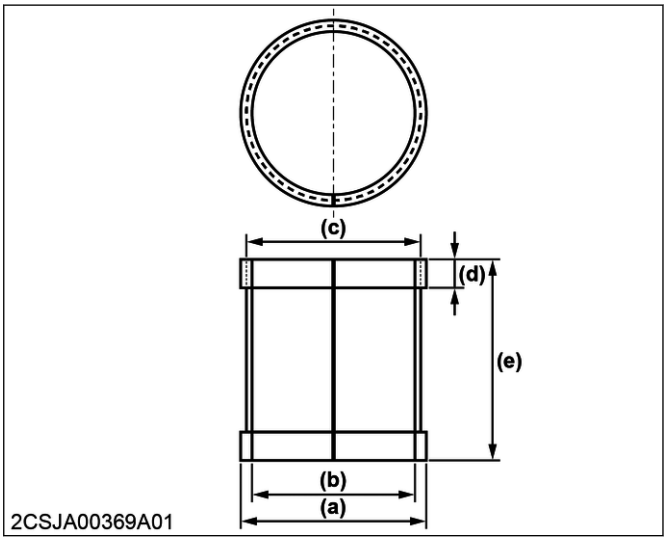
No.	Size
(a)	Rod diameter + 10 mm Rod diameter + 0.39 in.
(b)	15 mm 0.59 in.
(c)	25 mm 0.98 in.
(d)	75 mm 2.95 in.
Material	MC nylon

Wiper ring installation jig



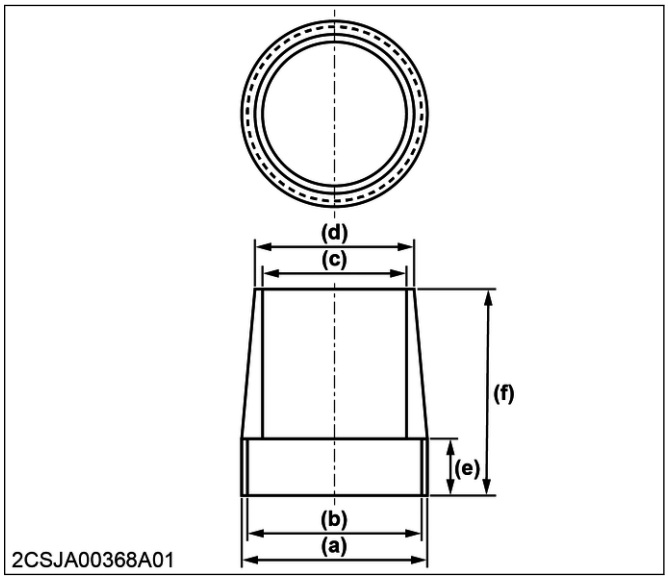
No.	Size
(a)	Rod diameter + 13 mm Rod diameter + 0.51 in.
(b)	Rod diameter + 8 mm Rod diameter + 0.31 in.
(c)	45 mm 1.77 in.
(d)	10 mm 0.39 in.
(e)	15 mm 0.59 in.
(f)	20 mm 0.79 in.
Material	S45C

Seal ring installation jig 1



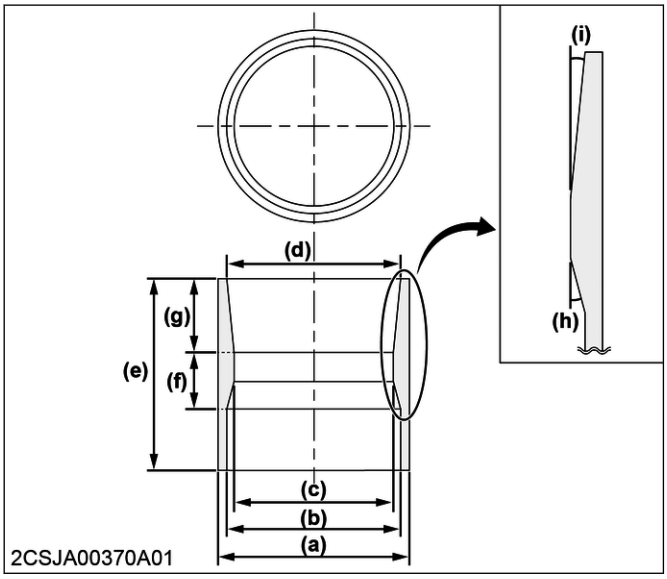
No.	Size
(a)	Piston diameter + 2 mm Piston diameter + 0.08 in.
(b)	Piston diameter - 5 mm Piston diameter - 0.20 in.
(c)	Piston diameter - 2 mm Piston diameter - 0.08 in.
(d)	10 mm 0.39 in.
(e)	72 mm 2.83 in.
Material	MC nylon

Seal ring installation jig 2



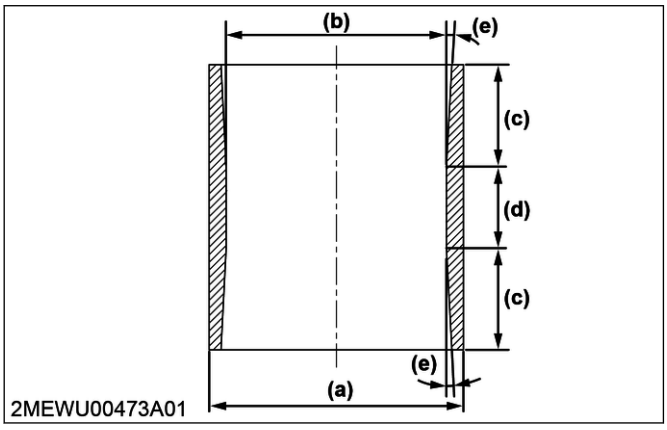
No.	Size
(a)	Piston diameter + 2 mm Piston diameter + 0.08 in.
(b)	Piston diameter
(c)	Piston diameter - 15 mm Piston diameter - 0.59 in.
(d)	Piston diameter - 10 mm Piston diameter - 0.39 in.
(e)	20 mm 0.79 in.
(f)	72 mm 2.83 in.
Material	S45C

Seal ring correction jig



No.	Size
(a)	Piston diameter + 10 mm Piston diameter + 0.39 in.
(b)	Piston diameter + 3.0 mm Piston diameter + 0.12 in.
(c)	Piston diameter
(d)	Piston diameter + 6.3 mm Piston diameter + 0.25 in.
(e)	78 mm 3.07 in.
(f)	23 mm 0.91 in.
(g)	30 mm 1.2 in.
(h)	0.26 rad 15°
(i)	0.10 rad 6°
Material	S45C

Seal ring outer diameter correction jig



	Dimensions
(a)	Piston diameter + 10 mm Piston diameter + 0.39 in.
(b)	Piston diameter
(c)	30 mm 1.18 in.
(d)	More than 24 mm More than 0.94 in.
(e)	0.052 rad 3°
Material	S45C

3. MAINTENANCE

MAINTENANCE INTERVAL TABLE

Operator maintenance chart

No.	Check point		Measure	Hour meter indication										Interval
				50	100	150	200	250	300	350	400	450	500	
1	Engine hood cover lock		Check	Daily check										-
2	Walk-around inspection		Check	Daily check										-
3	Engine oil level		Check	Daily check										-
4	Coolant level		Check	Daily check										-
5	Fan belt		Check	Daily check										-
6	Radiator		Check	Daily check										-
7	Hydraulic oil level		Check	Daily check										-
8	Water separator		Check	Daily check										-
9	Fuel level		Check	Daily check										-
10	Lubrication points		Grease	Daily check										-
11	Electrical equipments		Check	Daily check										-
12	Fuel tank		Drain	○	○	○	○	○	○	○	○	○	○	Every 50 h
13	Battery		Check	○	○	○	○	○	○	○	○	○	○	Every 50 h
14	Swivel gear		Grease	○	○	○	○	○	○	○	○	○	○	Every 50 h
15	Track tension		Check	○	○	○	○	○	○	○	○	○	○	Every 50 h
			Adjust	○	○	○	○	○	○	○	○	○	○	Every 50 h
16	Swivel bearing		Grease				○				○			Every 200 h
17	Engine air cleaner element[*1]	Outer element	Check				○				○			Every 200 h
			Clean				○				○			Every 200 h
18	Fuel line		Check				○				○			Every 200 h

* 550 through 1000 continues to the following table.

No.	Check point		Measures	Hour meter indication										Interval
				550	600	650	700	750	800	850	900	950	1000	
1	Engine hood cover lock		Check	Daily check										-
2	Walk-around inspection		Check	Daily check										-
3	Engine oil level		Check	Daily check										-
4	Coolant level		Check	Daily check										-
5	Fan belt		Check	Daily check										-
6	Radiator		Check	Daily check										-
7	Hydraulic oil level		Check	Daily check										-
8	Water separator		Check	Daily check										-
9	Fuel level		Check	Daily check										-
10	Lubrication points		Grease	Daily check										-
11	Electrical equipments		Check	Daily check										-
12	Fuel tank		Drain	○	○	○	○	○	○	○	○	○	○	Every 50 h
13	Battery		Check	○	○	○	○	○	○	○	○	○	○	Every 50 h
14	Swivel gear		Grease	○	○	○	○	○	○	○	○	○	○	Every 50 h
15	Track tension		Check	○	○	○	○	○	○	○	○	○	○	Every 50 h
			Adjust	○	○	○	○	○	○	○	○	○	○	Every 50 h
16	Swivel bearing		Grease		○				○				○	Every 200 h
17	Engine air cleaner element*1	Outer element	Check		○				○				○	Every 200 h
			Clean		○				○				○	Every 200 h
18	Fuel line		Check		○				○				○	Every 200 h

*1 Clean or replace the engine air cleaner element more frequently if used under dusty conditions. If the element are very dirty due to dusty conditions, replace the element.

Skilled personnel maintenance chart

No.	Check point		Measures	Hour meter indication										Interval
				50	100	150	200	250	300	350	400	450	500	
1	Nuts and bolts		Check		○		○		○		○		○	Every 100 h
2	Radiator hoses and clamps		Check					○					○	Every 250 h
3	Fan belt		Adjust					○					○	Every 250 h
4	Engine oil and engine oil filter		Replace										○	Every 500 h
5	Fuel filter*1		Replace										○	Every 500 h
6	Return filter*2		Replace					●					○	Every 1000 h
7	Hydraulic oil*2 and suction filter		Replace											Every 1000 h
8	Engine air cleaner elements*3	Outer element	Replace											Every 1000 h
		Inner element	Replace											Every 1000 h
9	Oil in the front idler and track roller		Replace											Every 2000 h
10	Alternator		Check											Every 2000 h
11	Starter motor		Check											Every 2000 h
12	Electrical wiring and fuses		Check											Every 1 years
13	Safety inspection		Check											Every 1 years
14	Fuel line		Replace											Every 2 years
15	Coolant		Replace											Every 2 years
16	Hydraulic hoses		Replace											Every 6 years

* 550 through 1000 continues to the following table.

No.	Check point		Measures	Hour meter indication										Interval
				550	600	650	700	750	800	850	900	950	1000	
1	Nuts and bolts		Check		○		○		○		○		○	Every 100 h
2	Radiator hoses and clamps		Check					○					○	Every 250 h
3	Fan belt		Adjust					○					○	Every 250 h
4	Engine oil and engine oil filter		Replace										○	Every 500 h
5	Fuel filter*1		Replace										○	Every 500 h
6	Return filter*2		Replace										○	Every 1000 h
7	Hydraulic oil*2 and suction filter		Replace										○	Every 1000 h
8	Engine air cleaner elements*3	Outer element	Replace										○	Every 1000 h
		Inner element	Replace										○	Every 1000 h
9	Oil in the front idler and track roller		Replace											Every 2000 h
10	Alternator		Check											Every 2000 h
11	Starter motor		Check											Every 2000 h
12	Electrical wiring and fuses		Check											Every 1 years

(Continued)

No.	Check point	Measures	Hour meter indication										Interval
			550	600	650	700	750	800	850	900	950	1000	
13	Safety inspection	Check											Every 1 years
14	Fuel line	Replace											Every 2 years
15	Coolant	Replace											Every 2 years
16	Hydraulic hoses	Replace											Every 6 years

* Servicings marked with ● must be carried out once the specified hours of operation after initial commissioning have been reached.
*1 Replace earlier if necessary.
*2 If using a hydraulic breaker, change the hydraulic oil and the return filter according to the table on the operator's manual.
*3 Clean or replace the engine air cleaner elements more frequently if used under dusty conditions. If the elements are very dirty due to dusty conditions, replace the elements.

LUBRICANT QUANTITY

		Quantity	Remarks
Engine oil	Engine	2.8 L 0.74 U.S.gals	Including the engine oil filter
Coolant	Total capacity (Including reservoir tank)	2.8 L 0.74 U.S.gals	-
	Reserve tank	0.5 L 0.13 U.S.gals	At the **[FULL]** mark
Hydraulic oil	All hydraulic system	17.1 L 4.52 U.S.gals	At the center of the gauge
	Hydraulic oil tank	12.6 L 3.33 U.S.gals	At the center of the gauge
Fuel	Fuel tank	12.0 L 3.17 U.S.gals	-

RECOMMENDED LUBRICANTS

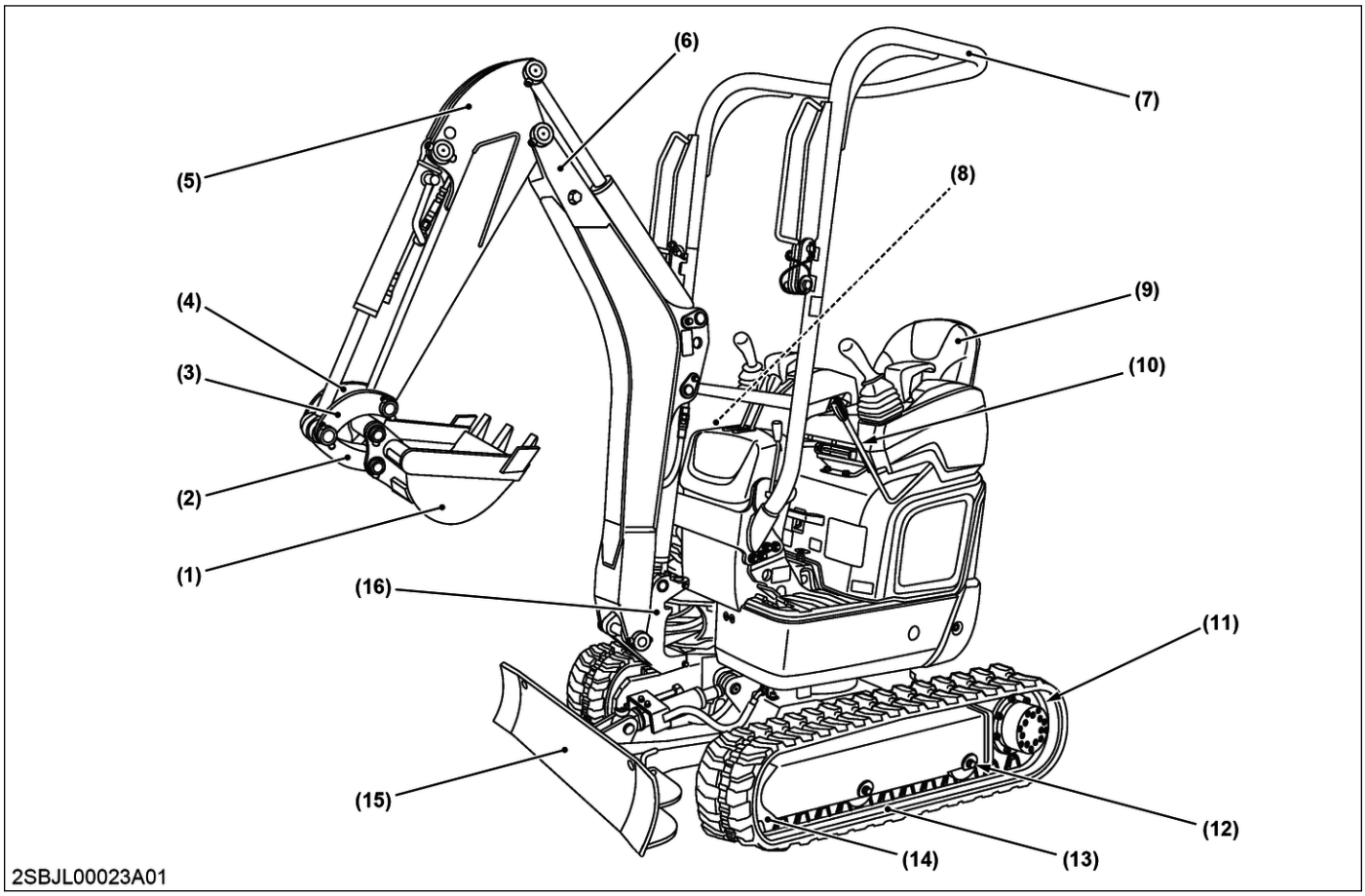
	Recommendation			Filled at the factory		Note
	Ambient temperature conditions	Viscosity	Quality standard	Brand	Type	
Engine oil	In winter and/or at low temperatures	SAE 10W SAE 20W	API CF API CI-4 API CJ-4	-	-	• When diesel fuel with a high sulphur content (between 0.50% and 1.00%) is used, the engine oil and engine oil filter must be replaced at shorter intervals. • Never use diesel fuel with a sulphur content exceeding 1.00%.
	In summer and/or at high ambient temperatures	SAE 30 SAE 40 SAE 50		-	-	
	All weather	15W-40		-	-	
		15W-30	-	JOMO	DH-1 (API CF)	
Coolant	-	-	G048 SAE J1034 MB 325.0 ASTM D3306 D4985	Kubota	LLC-N-50F (mixing ratio 50%)	• Always use distilled water to dilute antifreeze. • Always follow the recommendations of the coolant manufacturer for mixing ratio. Do not mix with other coolants.
Grease (Pin, Bushing, Bearing, Gear)	-	NLGI-2	DIN 51825 KP2K-30	Cosmo	Dynamax EP2*1	• NLGI-2 grease verified by JCMAS GK can also be used*2.
				IDEMITSU	Daphne grease MP No. 2	
Hydraulic oil	In winter and/or at low temperatures	ISO 32 ISO 46	-	Shell	Tellus S2M 46*1	-
	In summer and/or at high ambient temperatures	ISO 46 ISO 68	-	-	-	-
Biodegradable hydraulic oil (Option)	-	-	ISO 15380	Panolin	HLP SYNTH 46	• In accordance with ISO 15380, the hydraulic oil contains less than 2% of mineral oil.
Gear oil	In winter and/or at low temperatures	SAE 75 SAE 80	MIL-L-2105C	-	-	-
	In summer and/or at high ambient temperatures	SAE 90 SAE 140		-	-	-
	All weather	80W-90		Nippon Oil Corporation	Hypoid gear oil	-
Fuel*3	-	-	EN 590 ASTM D975	-	-	• To prepare the excavator for use in winter, fill the fuel tank with winter diesel and allow the engine to run for a few minutes. • Never use diesel fuel with a sulphur content exceeding 1.00%.

*1 These lubricants are used by the manufacturer for the initial filling.
*2 Further information can be found on Japan Lubricating Oil Society's website (JALOS).
*3 Only use fuels with a maximum sulphur content of 10 mg/kg (20 mg/kg at the last distribution point to the end user), a minimum cetane rating of 45, and a maximum fatty acid methyl ester (FAME) percentage of 7%.

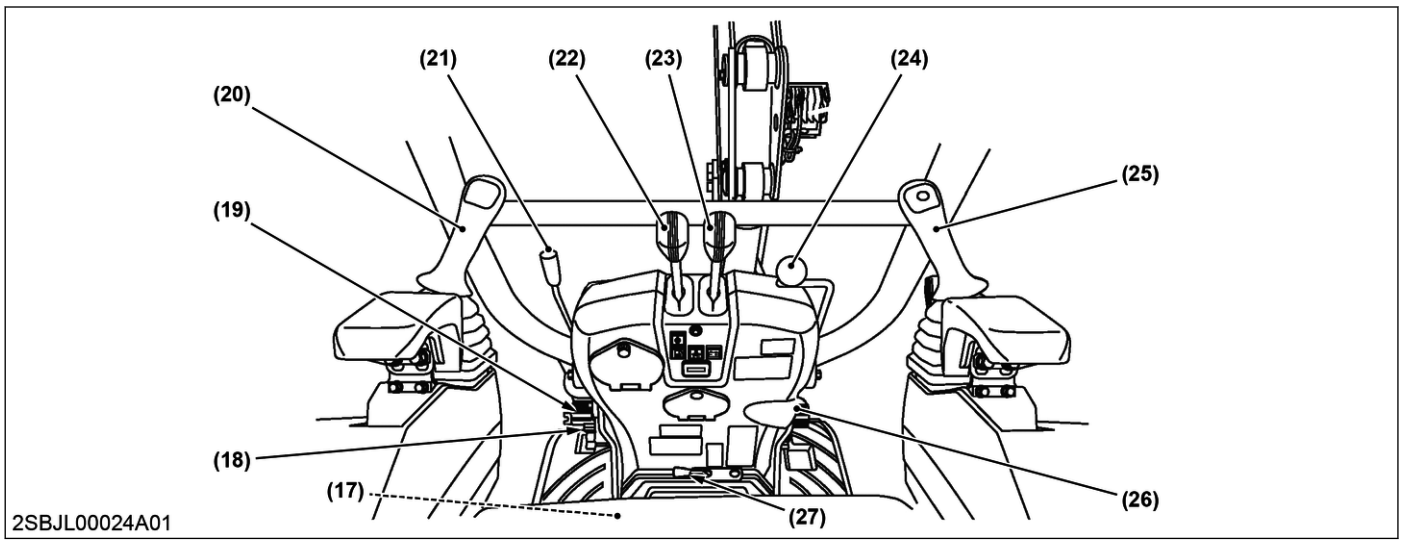
4. MACHINE BODY

MECHANISM

1. Machine device layout



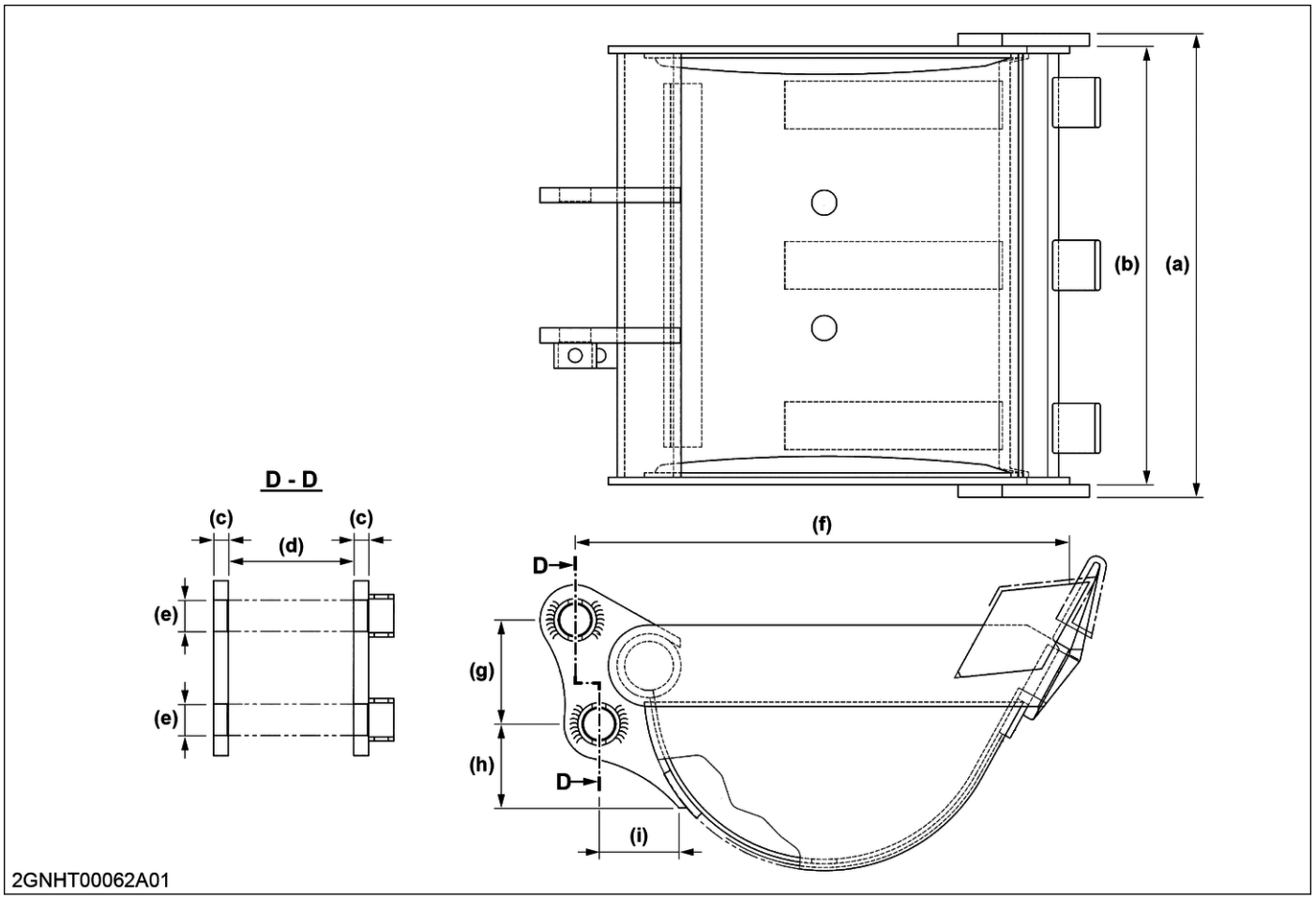
(1) Bucket
(2) Bucket link 1
(3) Bucket link 2
(4) Bucket link 3
(5) Arm
(6) Boom
(7) Canopy
(8) Lever lock RH
(9) Seat
(10) Lever lock LH
(11) Sprocket
(12) Track roller
(13) Rubber track
(14) Front idler
(15) Blade
(16) Swing bracket



(17) Swivel frame lock lever
(18) Travel speed control pedal
(19) AUX control pedal
(20) Pilot control lever LH
(21) Accelerator lever
(22) Travel control lever LH
(23) Travel control lever RH
(24) Blade control lever
(25) Pilot control lever RH
(26) Swing control pedal
(27) Variable-width undercarriage lever

2. Bucket

2.1 Bucket dimensions

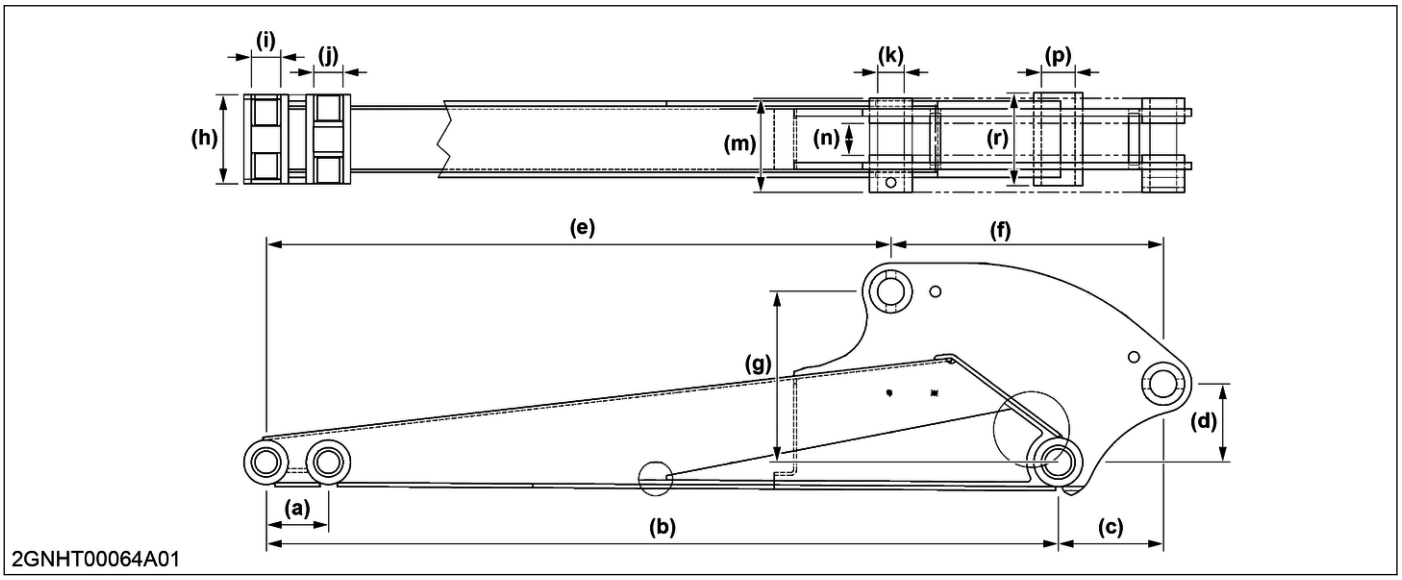


	Dimension		Dimension
(a)	400 mm 15.75 in.	(f)	377 mm 14.84 in.
(b)	380 mm 14.96 in.	(g)	82.5 to 83.5 mm 3.25 to 3.29 in.
(c)	12 mm 0.47 in.	(h)	66.5 to 67.5 mm 2.62 to 2.66 in.
(d)	100 to 101 mm 3.94 to 3.98 in.	(i)	63.5 to 64.5 mm 2.50 to 2.54 in.
(e)	ϕ25.05 to 25.10 mm ϕ0.99 in.	-	-

3. Arm

3.1 Arm dimensions

Arm

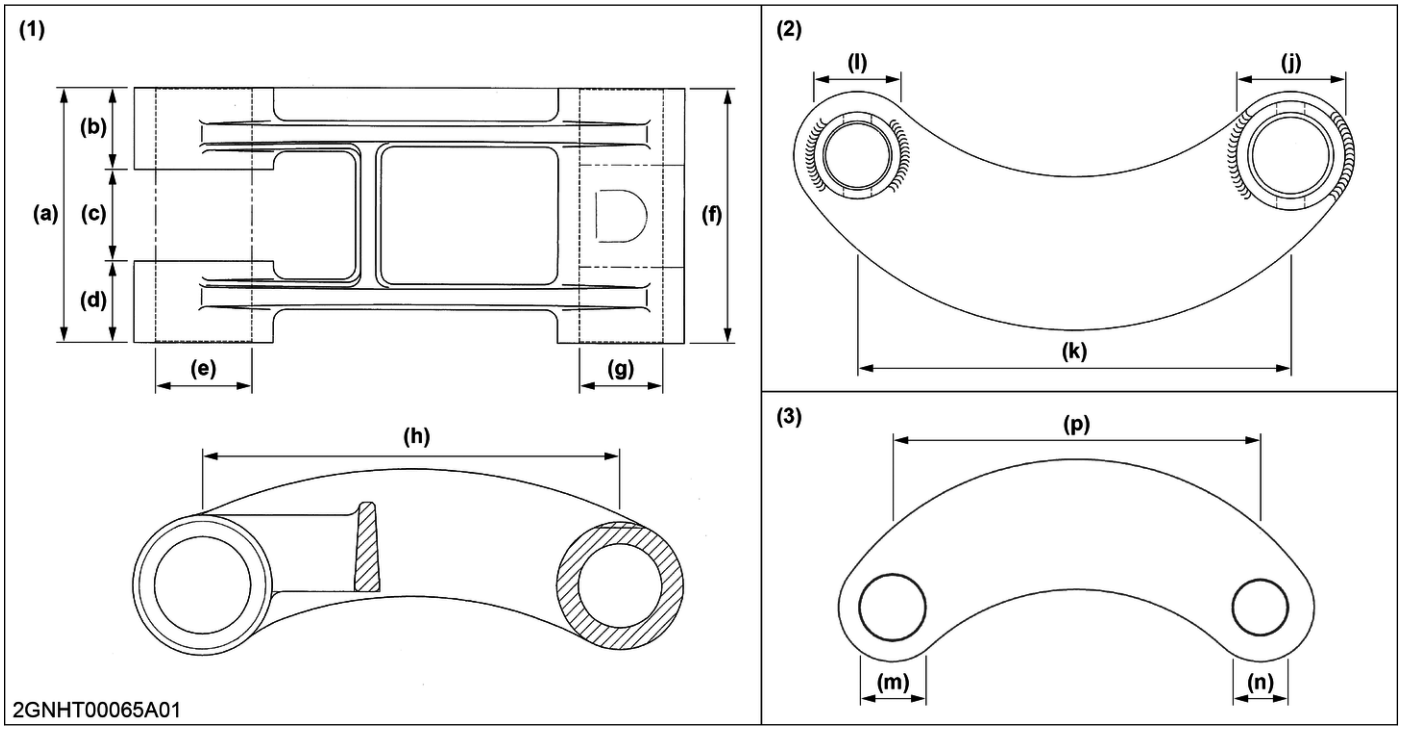


NOTE

- **(i), (j), and (p) show inner dimensions with bushings installed.**

	Dimension		Dimension
(a)	69.5 to 70.5 mm 2.74 to 2.78 in.	(i)	ϕ25.10 to 25.13 mm ϕ0.99 in.
(b)	888 to 892 mm 34.96 to 35.12 in.	(j)	ϕ25.10 to 25.13 mm ϕ0.99 in.
(c)	144 to 146 mm 5.67 to 5.75 in.	(k)	ϕ30.05 to 30.10 mm ϕ1.18 to 1.19 in.
(d)	89 to 91 mm 3.50 to 3.58 in.	(m)	105 to 106 mm 4.13 to 4.17 in.
(e)	701 to 703 mm 27.60 to 27.68 in.	(n)	35.5 to 36.5 mm 1.40 to 1.44 in.
(f)	329 to 337 mm 12.95 to 13.27 in.	(p)	ϕ30.10 to 30.13 mm ϕ1.19 in.
(g)	190.5 to 192.5 mm 7.50 to 7.58 in.	(r)	103.4 to 103.7 mm 4.07 to 4.08 in.
(h)	99.4 to 99.7 mm 3.91 to 3.93 in.	-	-

Bucket link



(1) Bucket link 1 (2) Bucket link 2 (3) Bucket link 3

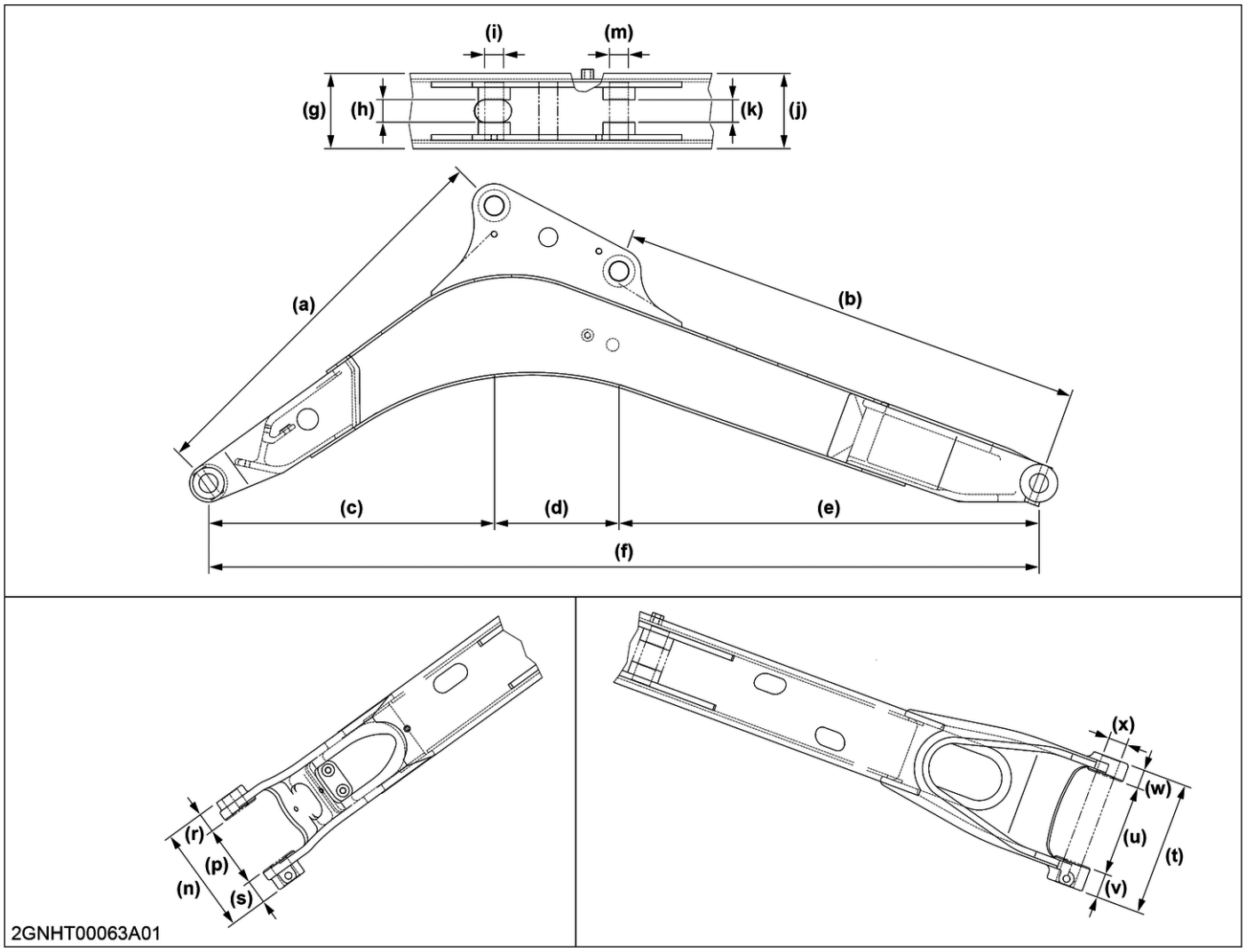
NOTE

- **(e), and (g) show inner dimensions with bushings installed.**

	Dimension		Dimension
(a)	99.4 to 100 mm 3.91 to 3.94 in.	(h)	164.8 to 165.2 mm 6.49 to 6.50 in.
(b)	31.7 to 32.0 mm 1.25 to 1.26 in.	(i)	ϕ25.00 to 25.10 mm ϕ0.98 to 0.99 in.
(c)	36 mm 1.42 in.	(j)	ϕ30.00 to 30.10 mm ϕ1.18 to 1.19 in.
(d)	31.7 to 32.0 mm 1.25 to 1.26 in.	(k)	169.8 to 170.2 mm 6.69 to 6.70 in.
(e)	ϕ30.10 to 30.13 mm ϕ1.19 in.	(m)	ϕ30.00 to 30.10 mm ϕ1.18 to 1.19 in.
(f)	100 mm 3.94 in.	(n)	ϕ25.00 to 25.10 mm ϕ0.98 to 0.99 in.
(g)	ϕ25.10 to 25.13 mm ϕ0.99 in.	(p)	169.8 to 170.2 mm 6.69 to 6.70 in.

4. Boom

4.1 Boom dimensions



NOTE

- **(x) shows the inner dimension with the bushing installed.**

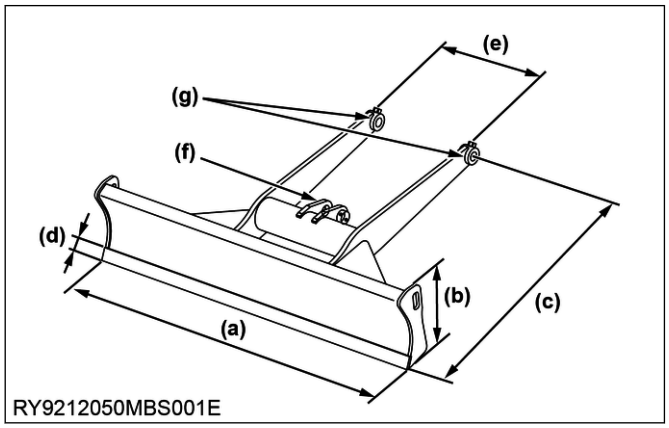
	Dimension		Dimension
(a)	702.6 to 704.6 mm 27.66 to 27.74 in.	(m)	ϕ30.05 to 30.10 mm ϕ1.18 to 1.19 in.
(b)	747 to 749 mm 29.41 to 29.49 in.	(n)	171 mm 6.73 in.
(c)	576 mm 22.68 in.	(p)	104.0 to 104.5 mm 4.09 to 4.11 in.
(d)	199 mm 7.83 in.	(r)	30 mm 1.18 in.
(e)	672 mm 26.46 in.	(s)	37 mm 1.46 in.
(f)	1446 to 1448 mm 56.93 to 57.01 in.	(t)	215 mm 8.46 in.

(Continued)

	Dimension		Dimension
(g)	120 mm 4.72 in.	(u)	150.0 to 150.5 mm 5.91 to 5.93 in.
(h)	36 mm 1.42 in.	(v)	37 mm 1.46 in.
(i)	ϕ30.05 to 30.10 mm ϕ1.18 to 1.19 in.	(w)	28 mm 1.10 in.
(j)	120 mm 4.72 in.	(x)	ϕ30.10 to 30.13 mm ϕ1.19 in.
(k)	36 mm 1.42 in.	-	-

5. Blade

5.1 Blade dimensions

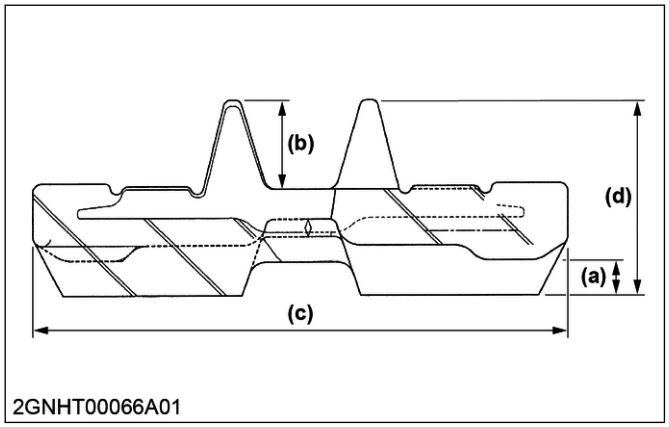


RY9212050MBS001E

	Dimension
(a)	750 mm 29.53 in.
(b)	198.5 mm 7.82 in.
(c)	612.2 mm 24.10 in.
(d)	35.7 mm 1.41 in.
(e)	263 mm 10.35 in.
(f)	ϕ30.2 to 30.3 mm ϕ1.19 in.
(g)	ϕ30.2 to 30.3 mm ϕ1.19 in.

6. Rubber track

6.1 Rubber track dimensions

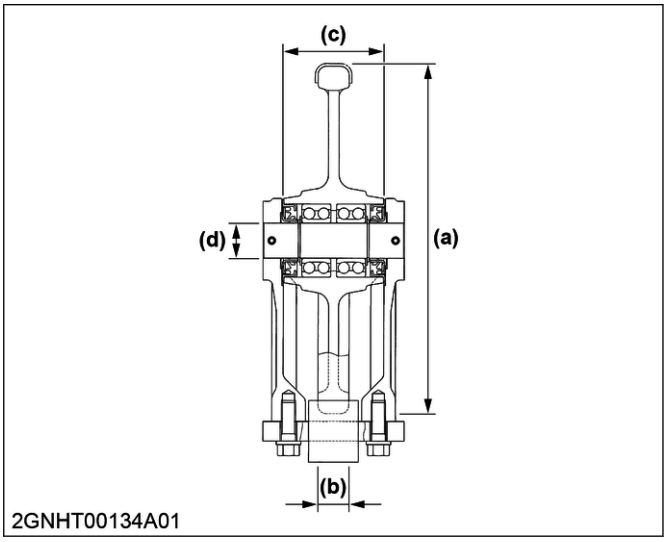


2GNHT00066A01

	Dimension
(a) Lug height	17 mm 0.67 in.
(b) Link height	28.5 mm 1.12 in.
(c) Width	182 mm 7.17 in.
(d) Height	67 mm 2.64 in.

7. Front idler

7.1 Front idler dimensions

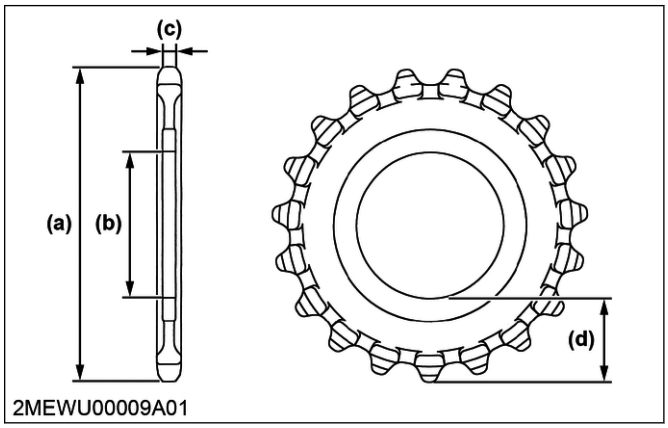


2GNHT00134A01

	Dimension
(a) Idler outer diameter	ϕ247 mm ϕ9.72 in.
(b) Idler width	70.8 to 71.2 mm 2.79 to 2.80 in.
(c) Guide width	21 to 23 mm 0.83 to 0.91 in.
(d) Shaft outer diameter	ϕ25 mm ϕ0.98 in.

8. Sprocket

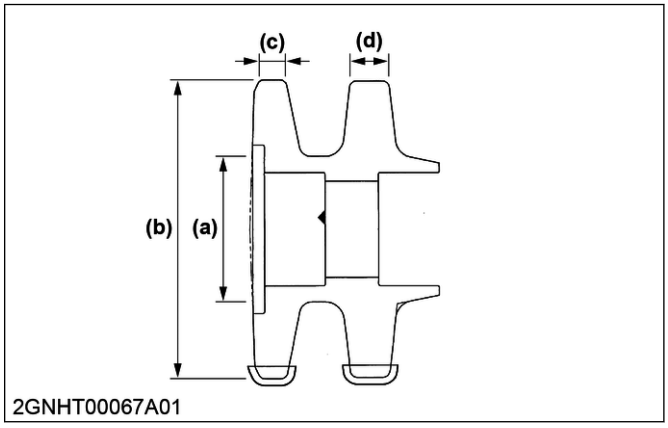
8.1 Sprocket dimensions



	Dimension
(a) Sprocket outer diameter	ϕ288 to 291 mm ϕ11.34 to 11.46 in.
(b) Sprocket inner diameter	ϕ140.08 to 140.14 mm ϕ5.52 in.
(c) Sprocket width	12 mm 0.47 in.
(d) Gear height	73.96 to 75.43 mm 2.91 to 2.97 in.

9. Track roller

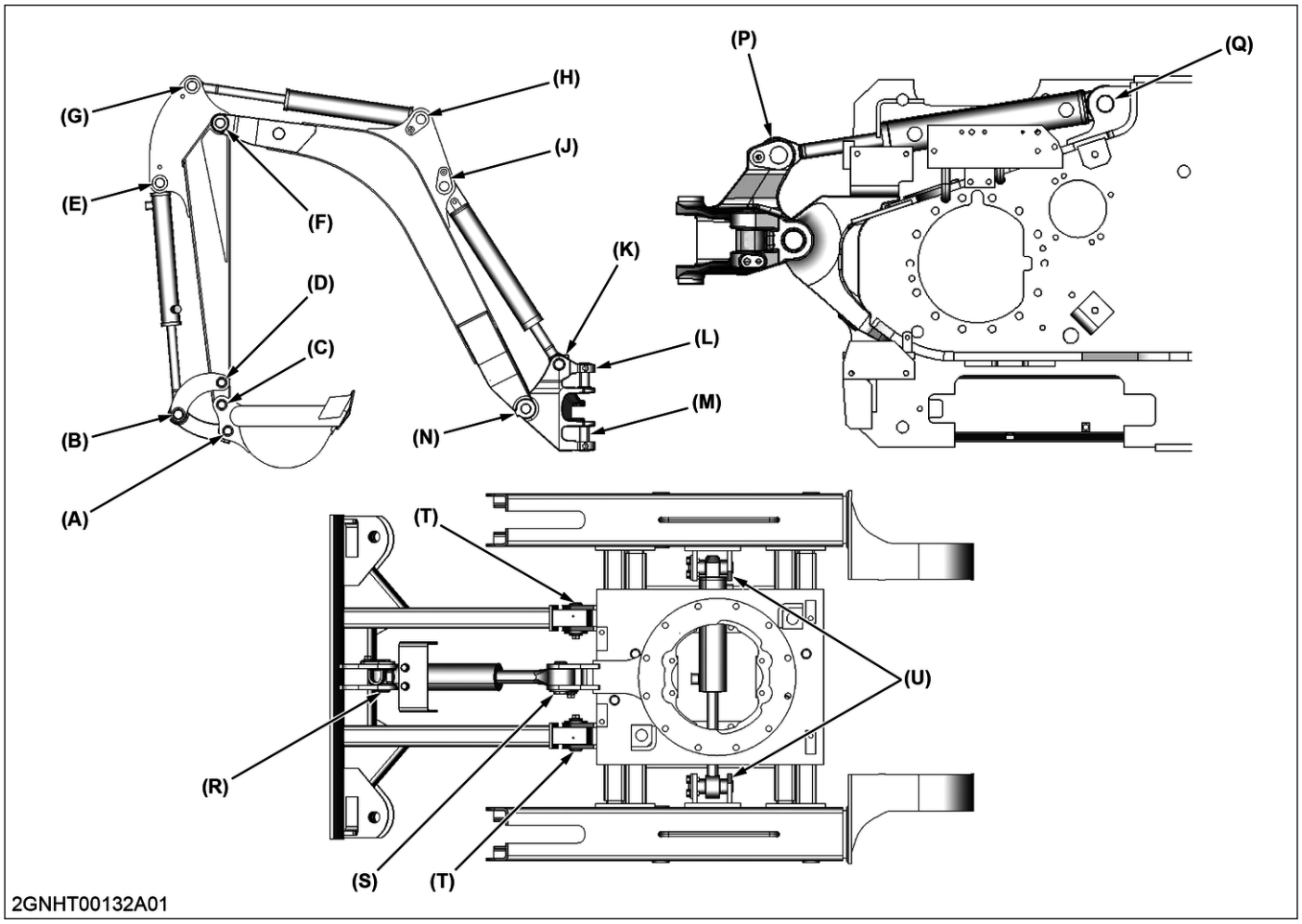
9.1 Track roller dimensions

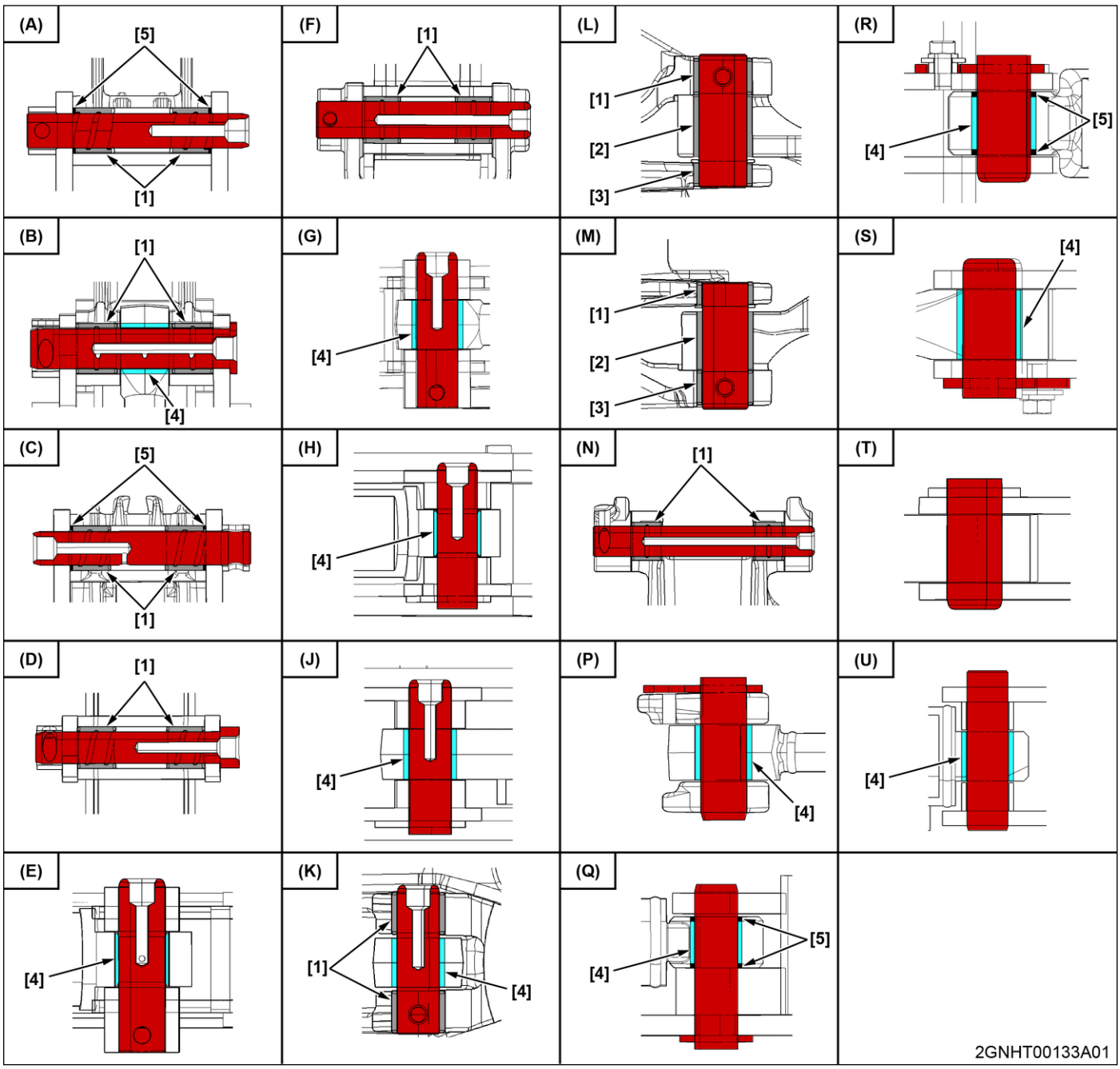


	Dimension
(a) Guide diameter	ϕ60.5 mm ϕ2.38 in.
(b) Outer diameter	ϕ123.5 to 124.5 mm ϕ4.86 to 4.90 in.
(c) Roller width	11 mm 0.43 in.
(d) Roller width	16 mm 0.63 in.

10. Pins, bushings, and shims

10.1 Pin, bushing, and shim dimensions





(A) Bucket link 1 - Bucket
(B) Bucket link 1 - Bucket cylinder (rod side)
(C) Arm - Bucket
(D) Bucket link 2, 3 - Arm
(E) Arm - Bucket cylinder (bottom side)
(F) Boom - Arm
(G) Arm - Arm cylinder (rod side)
(H) Boom - Arm cylinder (bottom side)
(J) Boom - Boom cylinder (bottom side)
(K) Swing bracket - Boom cylinder (rod side)
(L) Swing bracket upper side - Swivel frame
(M) Swing bracket lower side - Swivel frame
(N) Swing bracket - Boom
(P) Swing cylinder (rod side) - Swing bracket
(Q) Swing cylinder (bottom side) - Swivel frame
(R) Blade - Blade cylinder (bottom side)
(S) Frame - Blade cylinder (rod side)
(T) Blade - Track frame
(U) Track cylinder - Track frame

IMPORTANT

- **Dimensions of pins and bushings correspond to new and unused parts.**
- **Bushing dimensions are based on the values while not being assembled. Generally, bushings slightly shrink after assembly.**

Dimensions table (mm unit)

No.	Pin		[1] Bushing [2] Bushing [3] Bushing		Shim	[4] Cylinder bushing	[5] Dust seal
	Diameter × length	Diameter tolerance	ID × OD × length	Bushing ID tolerance	ID × OD × thickness	ID × OD × length	ID × OD × thickness
(A)	ϕ25 × 160	-0.05 -0.08	[1] ϕ25 × ϕ33 × 30	+0.13 +0.10	-	-	[5] ϕ25 × ϕ33 × 4.2
(B)	ϕ30 × 150	-0.05 -0.08	[1] ϕ30 × ϕ38 × 30	+0.13 +0.10	ϕ31 × ϕ60 × (0.5 or 1.0 or 1.6)	[4] ϕ30 × ϕ40 × 35	-
(C)	ϕ25 × 160	-0.05 -0.08	[1] ϕ25 × ϕ33 × 30	+0.13 +0.10	ϕ26 × ϕ48 × (0.5 or 1.0 or 1.6)	-	[5] ϕ25 × ϕ33 × 4.2
(D)	ϕ25 × 160	-0.05 -0.08	[1] ϕ25 × ϕ33 × 30	+0.13 +0.10	ϕ26 × ϕ48 × (0.5 or 1.0 or 1.6)	-	-
(E)	ϕ30 × 111	-0.05 -0.08	-	-	-	[4] ϕ30 × ϕ40 × 35	-
(F)	ϕ30 × 173	-0.05 -0.08	[1] ϕ30 × ϕ38 × 30	+0.13 +0.10	ϕ31 × ϕ60 × (0.5 or 1.0 or 1.6)	-	-
(G)	ϕ30 × 111	-0.05 -0.08	-	-	ϕ31 × ϕ60 × (0.5 or 1.0 or 1.6)	[4] ϕ30 × ϕ40 × 35	-
(H)	ϕ30 × 108	-0.05 -0.08	-	-	ϕ31 × ϕ60 × (0.5 or 1.0 or 1.6)	[4] ϕ30 × ϕ40 × 35	-
(J)	ϕ30 × 108	-0.05 -0.08	-	-	ϕ31 × ϕ60 × (0.5 or 1.0 or 1.6)	[4] ϕ30 × ϕ40 × 35	-
(K)	ϕ30 × 106	-0.05 -0.08	[1] ϕ30 × ϕ38 × 30	+0.07 +0.04	ϕ31 × ϕ60 × (0.5 or 1.0 or 1.6)	[4] ϕ30 × ϕ40 × 35	-
(L)	ϕ35 × 95	-0.05 -0.08	[1] ϕ35 × ϕ43 × 26	+0.07 +0.04	-	-	-
			[2] ϕ35 × ϕ43 × 43.5	+0.13 +0.10			
			[3] ϕ35 × ϕ43 × 19	+0.07 +0.04			
(M)	ϕ35 × 95	-0.05 -0.08	[1] ϕ35 × ϕ43 × 26	+0.07 +0.04	-	-	-
			[2] ϕ35 × ϕ43 × 43.5	+0.13 +0.10			
			[3] ϕ35 × ϕ43 × 19	+0.07 +0.04			
(N)	ϕ30 × 218	-0.05 -0.08	[1] ϕ30 × ϕ38 × 30	+0.13 +0.10	ϕ31 × ϕ60 × (0.5 or 1.0 or 1.6)	-	-
(P)	ϕ30 × 91	-0.05 -0.08	-	-	ϕ31 × ϕ60 × (0.5 or 1.0 or 1.6)	[4] ϕ30 × ϕ40 × 35	-
(Q)	ϕ30 × 112.5	-0.05 -0.08	-	-	-	[4] ϕ30 × ϕ40 × 25	[5] ϕ25 × ϕ33 × 4.2

(Continued)

No.	Pin		[1] Bushing [2] Bushing [3] Bushing		Shim	[4] Cylinder bushing	[5] Dust seal
	Diameter × length	Diameter tolerance	ID × OD × length	Bushing ID tolerance	ID × OD × thickness	ID × OD × length	ID × OD × thickness
(R)	ϕ30 × 70	-0.05 -0.08	-	-	-	[4] ϕ30 × ϕ40 × 25	[5] ϕ25 × ϕ33 × 4.2
(S)	ϕ30 × 70	-0.05 -0.08	-	-	-	[4] ϕ30 × ϕ40 × 35	-
(T)	ϕ30 × 70	-0.05 -0.08	-	-	-	-	-
(U)	ϕ25 × 118	-0.05 -0.08	-	-	-	[4] ϕ25 × ϕ28 × 30	-

Dimensions table (inch unit)

No.	Pin		[1] Bushing [2] Bushing [3] Bushing		Shim	[4] Cylinder bushing	[5] Dust seal
	Diameter × length	Diameter tolerance	ID × OD × length	Bushing ID tolerance	ID × OD × thickness	ID × OD × length	ID × OD × thickness
(A)	ϕ0.98 × 6.30	-0.00197 -0.00315	[1] ϕ0.98 × ϕ1.30 × 1.18	+0.00512 +0.00394	-	-	[5] ϕ0.98 × ϕ1.30 × 0.17
(B)	ϕ1.18 × 5.91	-0.00197 -0.00315	[1] ϕ1.18 × ϕ1.50 × 1.18	+0.00512 +0.00394	ϕ1.22 × ϕ2.36 × (0.02 or 0.04 or 0.06)	[4] ϕ1.18 × ϕ1.57 × 1.38	-
(C)	ϕ0.98 × 6.30	-0.00197 -0.00315	[1] ϕ0.98 × ϕ1.30 × 1.18	+0.00512 +0.00394	ϕ1.02 × ϕ1.89 × (0.02 or 0.04 or 0.06)	-	[5] ϕ0.98 × ϕ1.30 × 0.17
(D)	ϕ0.98 × 6.30	-0.00197 -0.00315	[1] ϕ0.98 × ϕ1.30 × 1.18	+0.00512 +0.00394	ϕ1.02 × ϕ1.89 × (0.02 or 0.04 or 0.06)	-	-
(E)	ϕ1.18 × 4.37	-0.00197 -0.00315	-	-	-	[4] ϕ1.18 × ϕ1.57 × 1.38	-
(F)	ϕ1.18 × 6.81	-0.00197 -0.00315	[1] ϕ1.18 × ϕ1.50 × 1.18	+0.00512 +0.00394	ϕ1.22 × ϕ2.36 × (0.02 or 0.04 or 0.06)	-	-
(G)	ϕ1.18 × 4.37	-0.00197 -0.00315	-	-	ϕ1.22 × ϕ2.36 × (0.02 or 0.04 or 0.06)	[4] ϕ1.18 × ϕ1.57 × 1.38	-
(H)	ϕ1.18 × 4.25	-0.00197 -0.00315	-	-	ϕ1.22 × ϕ2.36 × (0.02 or 0.04 or 0.06)	[4] ϕ1.18 × ϕ1.57 × 1.38	-
(J)	ϕ1.18 × 4.25	-0.00197 -0.00315	-	-	ϕ1.22 × ϕ2.36 × (0.02 or 0.04 or 0.06)	[4] ϕ1.18 × ϕ1.57 × 1.38	-
(K)	ϕ1.18 × 4.17	-0.00197 -0.00315	[1] ϕ1.18 × ϕ1.50 × 1.18	+0.00276 +0.00158	ϕ1.22 × ϕ2.36 × (0.02 or 0.04 or 0.06)	[4] ϕ1.18 × ϕ1.57 × 1.38	-
(L)	ϕ1.38 × 3.74	-0.00197 -0.00315	[1] ϕ1.38 × ϕ1.69 × 1.02	+0.00276 +0.00158	-	-	-
			[2] ϕ1.38 × ϕ1.69 × 1.71	+0.00512 +0.00394			
			[3] ϕ1.38 × ϕ1.69 × 0.75	+0.00276 +0.00158			
(M)	ϕ1.38 × 3.74	-0.00197 -0.00315	[1] ϕ1.38 × ϕ1.69 × 1.02	+0.00276 +0.00158	-	-	-
			[2] ϕ1.38 × ϕ1.69 × 1.71	+0.00512 +0.00394			
			[3] ϕ1.38 × ϕ1.69 × 0.75	+0.00276 +0.00158			
(N)	ϕ1.18 × 8.58	-0.00197 -0.00315	[1] ϕ1.18 × ϕ1.50 × 1.18	+0.00512 +0.00394	ϕ1.22 × ϕ2.36 × (0.02 or 0.04 or 0.06)	-	-
(P)	ϕ1.18 × 3.58	-0.00197 -0.00315	-	-	ϕ1.22 × ϕ2.36 × (0.02 or 0.04 or 0.06)	[4] ϕ1.18 × ϕ1.57 × 1.38	-
(Q)	ϕ1.18 × 4.43	-0.00197 -0.00315	-	-	-	[4] ϕ1.18 × ϕ1.57 × 0.98	[5] ϕ0.98 × ϕ1.30 × 0.17

(Continued)

No.	Pin		[1] Bushing [2] Bushing [3] Bushing		Shim	[4] Cylinder bushing	[5] Dust seal
	Diameter × length	Diameter tolerance	ID × OD × length	Bushing ID tolerance	ID × OD × thickness	ID × OD × length	ID × OD × thickness
(R)	ϕ1.18 × 2.76	-0.00197 -0.00315	-	-	-	[4] ϕ1.18 × ϕ1.57 × 0.98	[5] ϕ0.98 × ϕ1.30 × 0.17
(S)	ϕ1.18 × 2.76	-0.00197 -0.00315	-	-	-	[4] ϕ1.18 × ϕ1.57 × 1.38	-
(T)	ϕ1.18 × 2.76	-0.00197 -0.00315	-	-	-	-	-
(U)	ϕ0.98 × 4.65	-0.00197 -0.00315	-	-	-	[4] ϕ0.98 × ϕ1.10 × 1.18	-

SERVICING

1. Service specifications

1.1 Service specifications for the machine body

- Standard measurement condition is as follows:
  – Engine speed: Maximum

				Unit	Service specification		Service limit
					Value	Tolerance	Value
Wear	Pin			-	-	-	1 mm (0.04 in.) of wear on the pin outer diameter
	Bushing			-	-	-	1 mm (0.04 in.) of wear on the bushing inner diameter
Play	Swivel bearing (vertical play)			mm in.	Less than 1.04 Less than 0.04	-	Less than 2.08 Less than 0.08
	Front attachment			mm in.	Less than 50 Less than 1.97	-	Less than 100 Less than 3.94
Clearance	Front attachment (each pin)			mm in.	0.6 0.02	-	-
Force	Control lever	Pilot control lever	Forward	N kgf lbf	11.0 1.12 2.47	±5.0 ±0.51 ±1.12	-
			Backward	N kgf lbf	7.9 0.81 1.78	±5.0 ±0.51 ±1.12	-
			RH and LH	N kgf lbf	7.2 0.73 1.62	±5.0 ±0.51 ±1.12	-
		Travel control lever	Forward	N kgf lbf	7.8 0.80 1.75	±5.0 ±0.51 ±1.12	-
			Backward	N kgf lbf	7.8 0.80 1.75	±5.0 ±0.51 ±1.12	-
		Blade control lever	Forward	N kgf lbf	18.0 1.84 4.05	±5.0 ±0.51 ±1.12	-
			Backward	N kgf lbf	18.0 1.84 4.05	±5.0 ±0.51 ±1.12	-
		Lever lock	Raising	N kgf lbf	13.0 1.33 2.92	±1.5 ±0.15 ±0.34	-
			Lowering	N kgf lbf	11.6 1.18 2.61	±1.5 ±0.15 ±0.34	-

(Continued)

				Unit	Service specification		Service limit
					Value	Tolerance	Value
Force	Control lever	Accelerator lever	Forward	N kgf lbf	34.3 3.50 7.71	±9.8 ±1.00 ±2.20	-
			Backward	N kgf lbf	34.3 3.50 7.71	±9.8 ±1.00 ±2.20	-
	Control pedal	Swing control pedal	RH	N kgf lbf	49.0 5.00 11.02	±9.8 ±1.00 ±2.20	-
			LH	N kgf lbf	49.0 5.00 11.02	±9.8 ±1.00 ±2.20	-
Dimension	Track	Rubber track	Lug height	mm in.	17 0.67	-	-
			Link height	mm in.	30 1.18	-	-
			Width	mm in.	180 7.09	-	-
			Height	mm in.	66 2.60	-	-
			Tension dimension	mm in.	10.5 0.41	2.5 0.10	-
	Front idler		Outer diameter	mm in.	ϕ247 ϕ9.72	-	ϕ241 ϕ9.49
			Guide width	mm in.	22 0.87	±1.0 ±0.04	16 0.63
			Idler width	mm in.	71 2.80	±0.2 ±0.01	-
	Sprocket		Outer diameter	mm in.	ϕ290 ϕ11.42	-2.0 to +1.0 -0.08 to +0.04	284 11.18
			Inner diameter	mm in.	ϕ140 ϕ5.51	+0.08 to +0.14 +0.003 to +0.006	-
			Sprocket width	mm in.	12 0.47	-	-
			Gear height	mm in.	150 5.91	-1.5 -0.06	144 5.67
	Track roller		Guide width	mm in.	ϕ60.5 ϕ2.38	-	-
			Outer diameter	mm in.	124 4.88	±0.5 ±0.02	118 4.65
			Roller width	mm in.	11 0.43	-	5.00 0.20
			Roller width	mm in.	16 0.63	-	10.00 0.39

2. Testing

2.1 Measuring the front attachment horizontal play

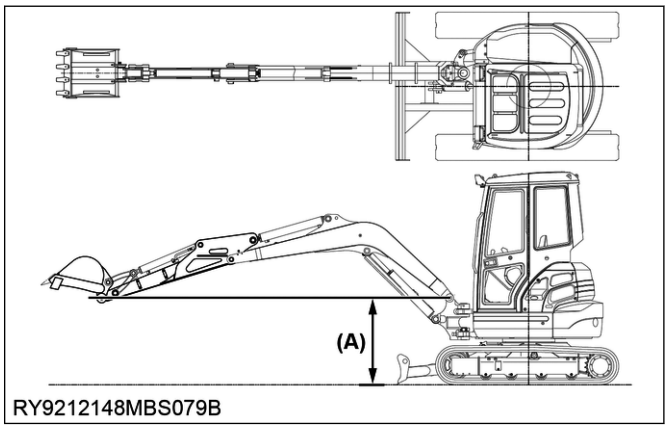
Measure the horizontal play of the front attachment to check the wear condition of the pins and bushings.

■ IMPORTANT

- **Measured value is the sum of all clearances of pins and bushings used in the connections of the front attachment.**
- **When adjusting clearance of pin connections, start with the one that has the largest play.**
- **Consider the swivel gear backlash when measuring the front attachment play.**

Preparing

1. Dump the arm and the bucket to the stroke end.
2. Make the line which connects the boom support pin and the bucket pin horizontal to the ground.



(A) Boom support pin height

3. Stop the engine.

Measuring

1. Press the bucket to the right side by 50 N (5 kgf, 11 lbf) to set the zero point.

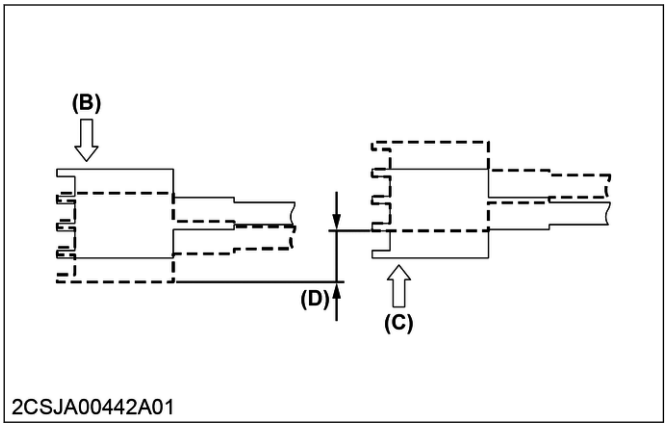
   ■ NOTE

   - **Set a pole or put a mark on the ground to recognize the zero point.**

2. Press the bucket to the left side by 300 N (31 kgf, 67.4 lbf) and measure the value of play.

   ■ NOTE

   - **Measure the distance from the zero point to the stroke end with a scale or measuring tape.**



(B) 50 N (5 kgf, 11 lbf)
(C) 300 N (31 kgf, 67.4 lbf)
(D) Play

3. Measure 3 times to calculate the average.
4. Measure in the opposite direction as well.

Service specification

Play	Less than 50 mm Less than 1.97 in.

Service limit

Play	100 mm 3.94 in.

Adjusting

1. Install designated shims to each pin to reduce clearance.

   ■ IMPORTANT

   - **Install the designated shims to both sides equally to reduce the clearance.**

Service specification

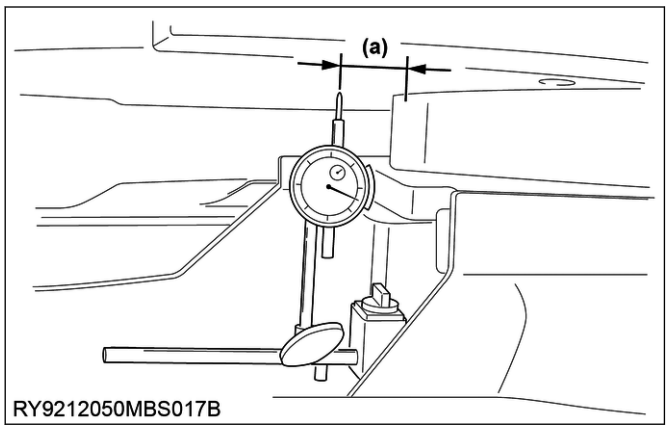
Clearance	0.6 mm 0.02 in.

2.2 Measuring the swivel bearing vertical play

Measure the vertical play of the swivel bearing to check the wear condition of the balls, inner ring, and outer ring.

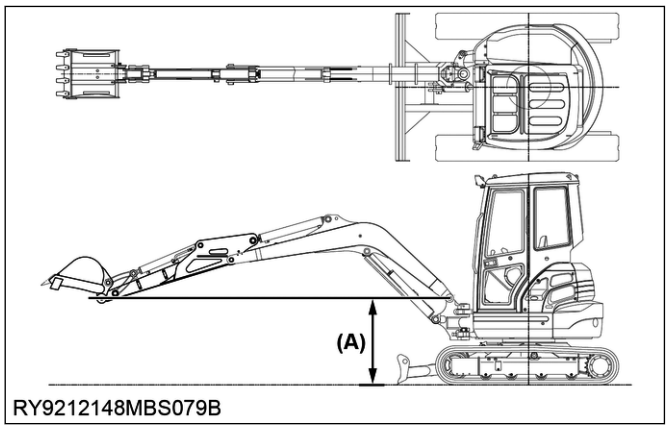
Preparing

1. Fix a dial gauge to the track frame with a magnet and make the tip of the dial gauge contact the swivel frame.



(a) 170 mm (6.69 in.)

2. Dump the arm and bucket to the stroke end.
3. Make the line which connects the boom support pin and the bucket pin horizontal to the ground.

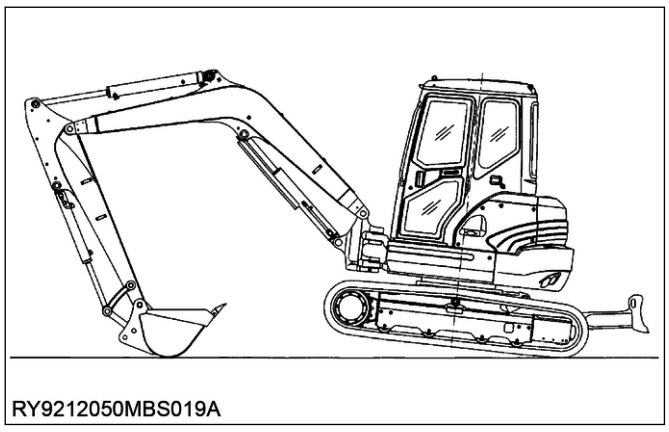


(A) Boom support pin height

4. Set the dial gauge to zero.

Measuring

1. Jack up the machine with the front attachment and measure the vertical play of the swivel bearing with the dial gauge.



2. Measure 3 times to calculate the average.

Service specification

Play	Less than 1.04 mm Less than 0.04 in.

Service limit

Play	Less than 2.08 mm Less than 0.08 in.

2.3 Measuring the operating force for levers and pedals

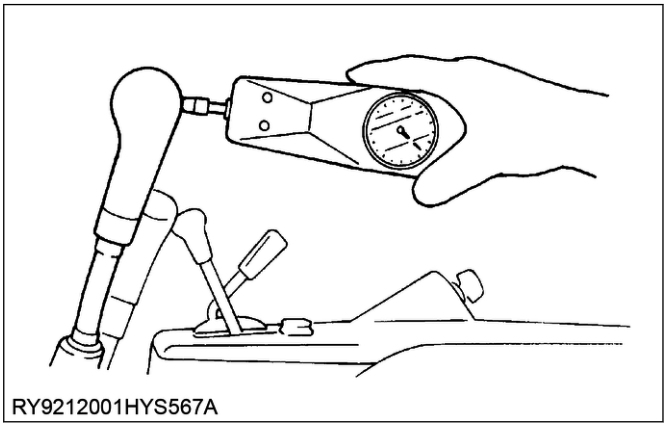
Measure the operating forces for levers and pedals to check the wear or fixation condition of their internal parts.

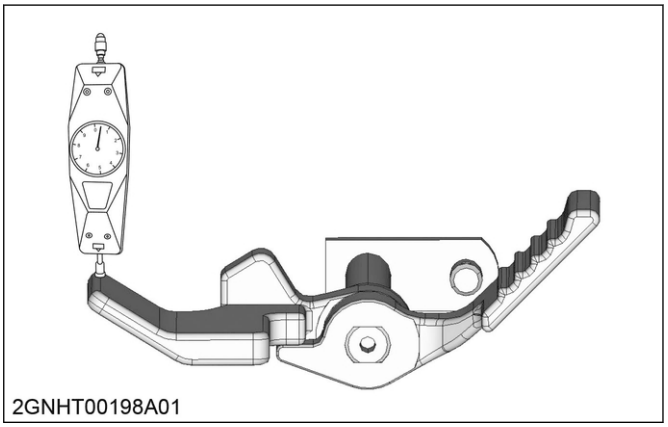
⚠ CAUTION

- **Make sure that the lever lock is raised before the measurement.**

Measuring

1. Start the engine and accelerate the engine to maximum speed.
2. Set an operating force measuring device to the lever or pedal.
   - Control lever: 30 mm (1.18 in.) below the grip edge
   - Swing control pedal: At the edge of the pedal





3. Operate the lever or pedal and measure the force right before the lever or pedal reaches the end.
4. Measure 3 times to calculate the average.

Service specification

			Service specification	
			Value	Tolerance
Operating force	Pilot control lever	Forward	11.0 N 1.12 kgf 2.47 lbf	±5.0 N ±0.51 kgf ±1.12 lbf
		Backward	7.9 N 0.81 kgf 1.78 lbf	±5.0 N ±0.51 kgf ±1.12 lbf
		RH and LH	7.2 N 0.73 kgf 1.62 lbf	±5.0 N ±0.51 kgf ±1.12 lbf
	Travel control lever	Forward	7.8 N 0.80 kgf 1.75 lbf	±5.0 N ±0.51 kgf ±1.12 lbf
		Backward	7.8 N 0.80 kgf 1.75 lbf	±5.0 N ±0.51 kgf ±1.12 lbf
	Blade control lever	Forward	18.0 N 1.84 kgf 4.05 lbf	±5.0 N ±0.51 kgf ±1.12 lbf
		Backward	18.0 N 1.84 kgf 4.05 lbf	±5.0 N ±0.51 kgf ±1.12 lbf
	Lever lock	Raising	13.0 N 1.33 kgf 2.92 lbf	±1.5 N ±0.15 kgf ±0.34 lbf
		Lowering	11.6 N 1.18 kgf 2.61 lbf	±1.5 N ±0.15 kgf ±0.34 lbf
	Accelerator lever	Forward	34.3 N 3.50 kgf 7.71 lbf	±9.8 N ±1.00 kgf ±2.20 lbf
		Backward	34.3 N 3.50 kgf 7.71 lbf	±9.8 N ±1.00 kgf ±2.20 lbf
	Swing pedal	RH	49.0 N 5.00 kgf 11.02 lbf	±9.8 N ±1.00 kgf ±2.20 lbf
		LH	49.0 N 5.00 kgf 11.02 lbf	±9.8 N ±1.00 kgf ±2.20 lbf

3. Repairing

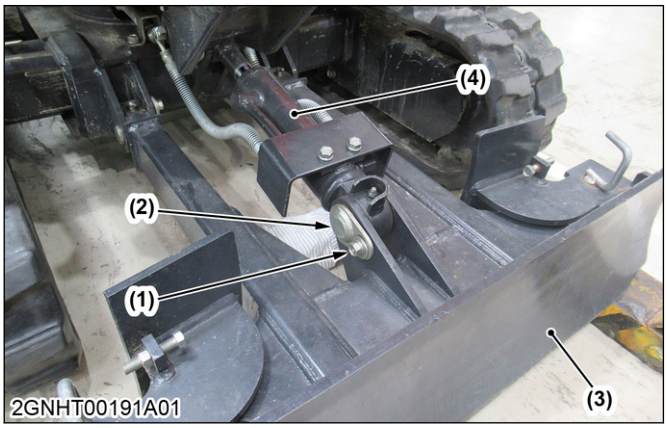
3.1 Blade

3.1.1 Removing the blade

⚠ CAUTION
- **The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.**
- **Do not put your finger into the pinhole, especially when adjusting the hole position.**

Preparing
1. Swivel the upper structure 180° against the blade.
2. Lower the front attachment and blade to the ground and stop the engine.

Removing
1. Attach a nylon sling to the blade cylinder and hoist for support.
2. Remove the pin-fixing bolt on the rod side of the blade cylinder.
3. Hit the pin with a hammer and round bar to remove the blade cylinder from the blade.



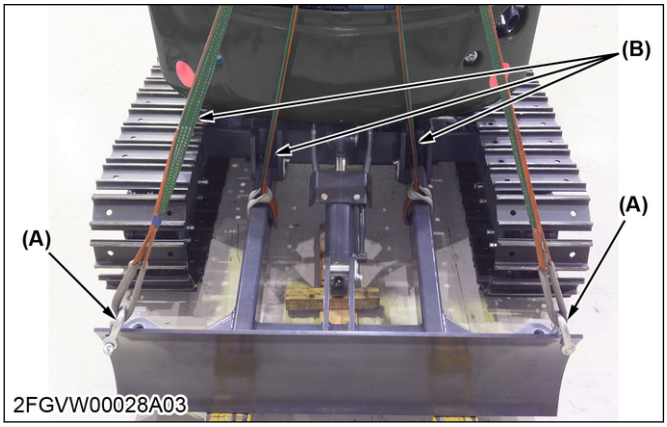
(1) Bolt (M10 × 18)
(2) Pin
(3) Blade
(4) Blade cylinder

Mass

(4) Blade cylinder	Approximately 6.0 kg Approximately 14 lbs

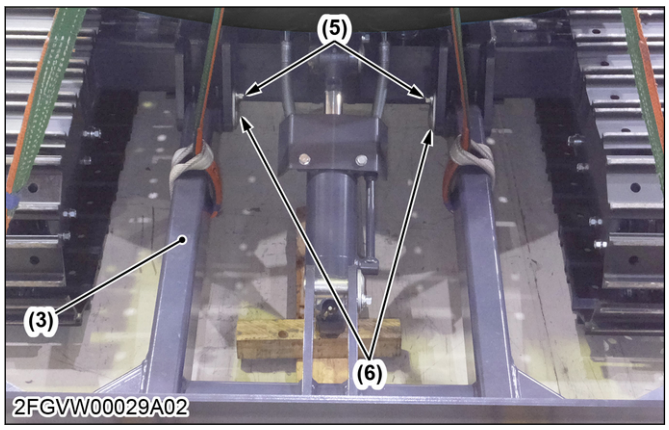
■ NOTE
- **This value does not include the mass of hydraulic oil.**

4. Attach 2 shackles to the blade.
5. Attach 3 nylon slings on the blade and hoist for support.



(A) Shackle ×2
(B) Nylon sling ×3

6. Remove the 2 pin-fixing bolts of the blade.
7. Hit the 2 pins with a hammer and round bar to remove the blade from the track frame.



(3) Blade
(5) Bolt (M10 × 18) ×2
(6) Pin ×2

Mass

(3) Blade	Approximately 36 kg Approximately 79 lbs

3.2 Counterweight

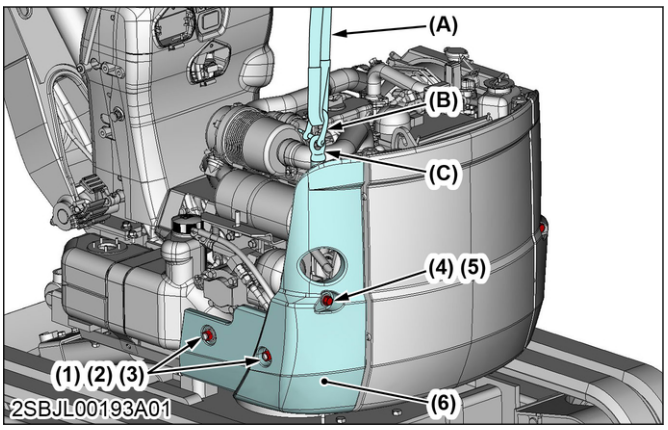
3.2.1 Removing and installing the counterweight

Preparing

1. Lower the front attachment and blade to the ground, and stop the engine.
2. Remove the swivel cover LH.
3. Remove the swivel cover RH.
4. Remove the bonnet.

Removing

1. Remove the drain plug and drain all of the hydraulic oil.
2. Install an eye bolt and shackle to the counterweight LH.
3. Attach a nylon sling to the shackle and hoist for support.
4. Remove the 2 nuts, 2 spring washers and 2 washers.
5. Remove the bolt and washer to remove the counterweight LH.

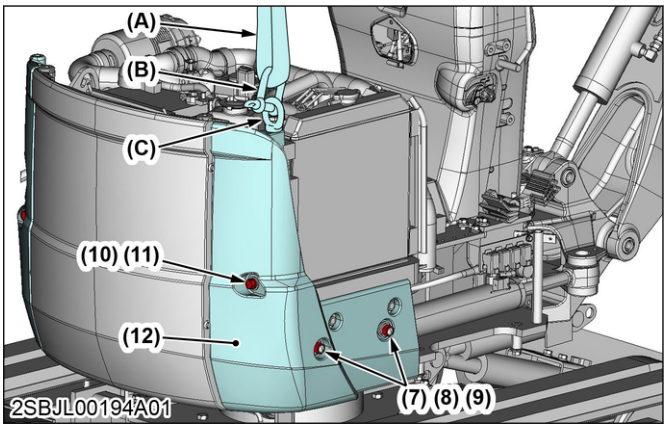


(1) Nut (M14) ×2
(2) Spring washer × 2
(3) Washer × 2
(4) Bolt (M12 × 60)
(5) Washer
(6) Counterweight LH
(A) Nylon sling
(B) Shackle
(C) Eye bolt

Mass

(6) Counterweight LH	Approximately 27 kg Approximately 59 lbs

6. Install an eye bolt and shackle to the counterweight RH.
7. Attach a nylon sling to the shackle and hoist for support.
8. Remove the 2 nuts, 2 spring washers and 2 washers.
9. Remove the bolt and washer to remove the counterweight RH.

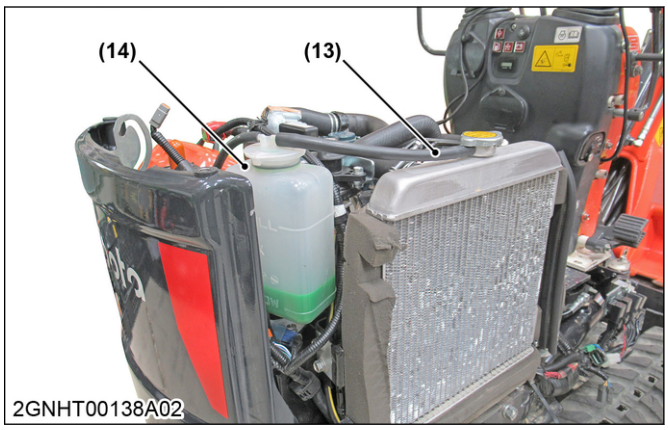


(7) Nut (M14) ×2
(8) Spring washer × 2
(9) Washer × 2
(10) Bolt (M12 × 60)
(11) Washer
(12) Counterweight RH
(A) Nylon sling
(B) Shackle
(C) Eye bolt

Mass

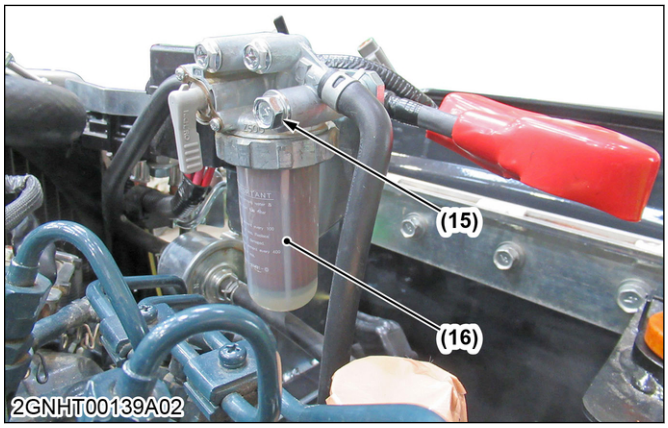
(12) Counterweight RH	Approximately 28 kg Approximately 62 lbs

10. Remove the overflow hose to remove the reserve tank.



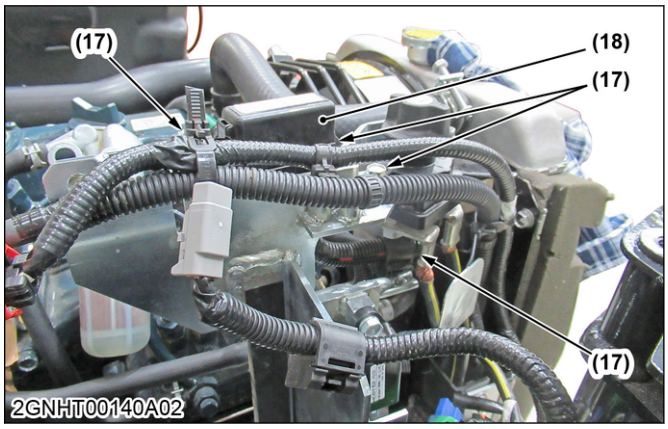
(13) Overflow hose (14) Reserve tank

11. Remove the bolt to separate the water separator.



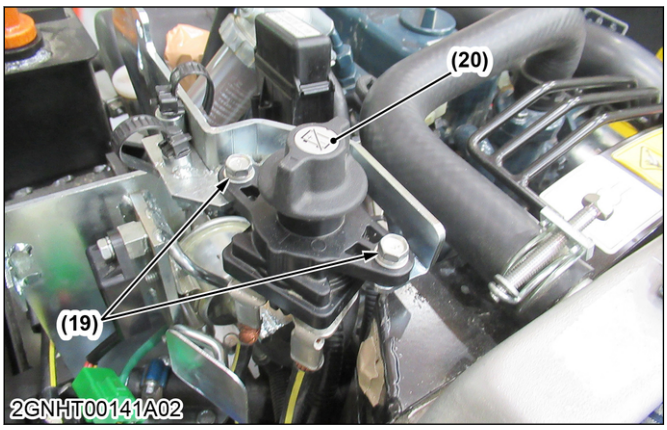
(15) Bolt (M8 × 60) (16) Water separator

12. Remove the 4 clamps and slow blow fuse box.



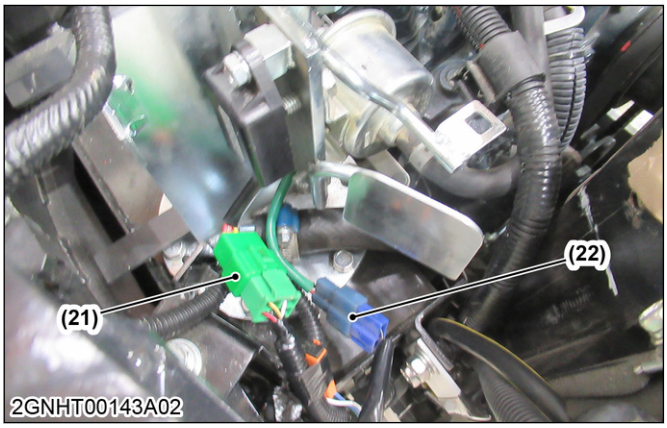
(17) Clamp ×4 (18) Slow blow fuse box

13. Remove the 2 bolts to remove the battery isolator.



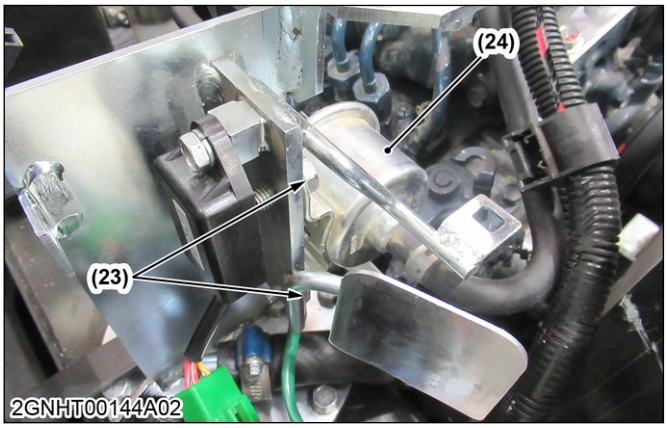
(19) Bolt (M6 × 20) ×2 (20) Battery isolator

14. Disconnect the electromagnetic fuel feed pump connector and timer connector.



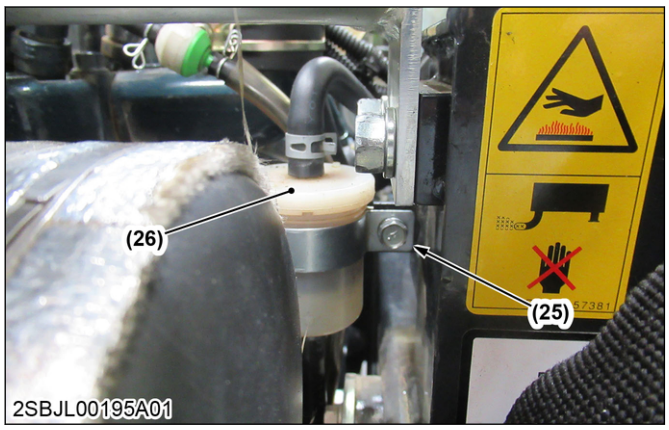
(21) Electromagnetic fuel feed pump connector (22) Timer connector

15. Remove the 2 bolts to separate the electromagnetic fuel feed pump.



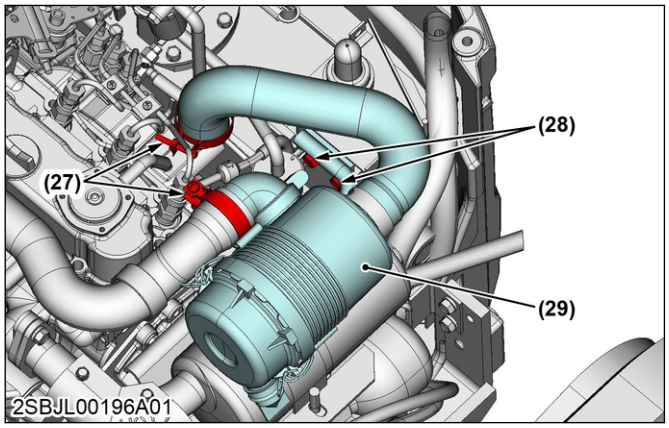
(23) Bolt (M8 × 16) ×2 (24) Electromagnetic fuel feed pump

16. Remove the bolt to separate the fuel filter.



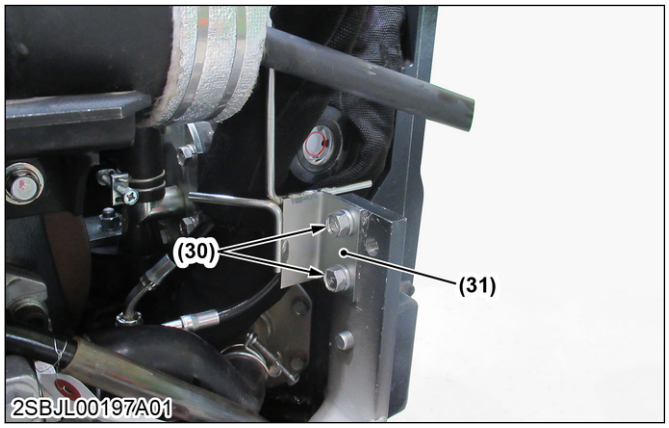
(25) Bolt (M6 × 20) (26) Fuel filter

17. Loosen the 2 clamps and 2 bolts to remove the engine air cleaner.



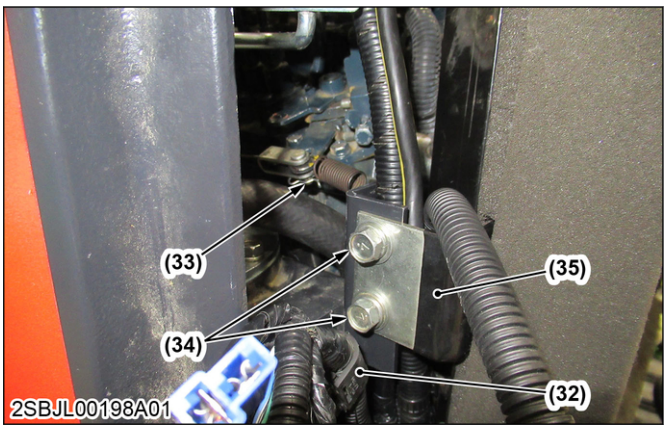
(27) Clamp ×2 (29) Engine air cleaner
(28) Bolt (M10 × 16) ×2

18. Remove the 2 bolts to remove the hose guide.



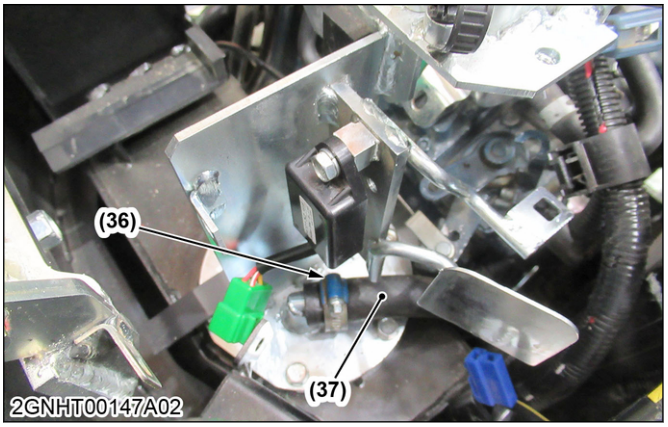
(30) Bolt (M10 × 16) ×2 (31) Hose guide

19. Remove the clamp and spring.
20. Remove the 2 bolts to remove the radiator support.



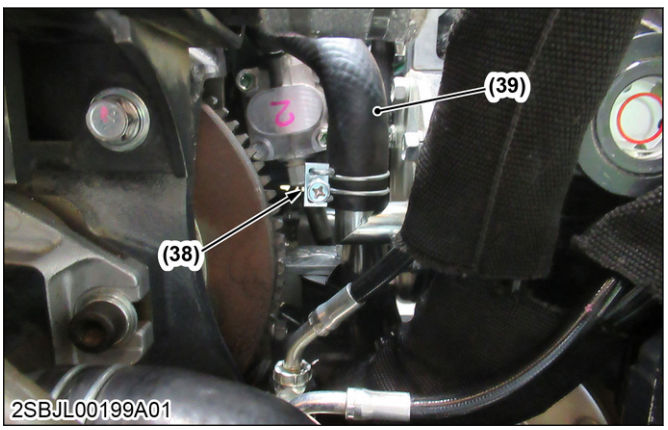
(32) Clamp (35) Radiator support
(33) Spring
(34) Bolt (M8 ×16) ×2

21. Loosen the clamp to separate the return hose.



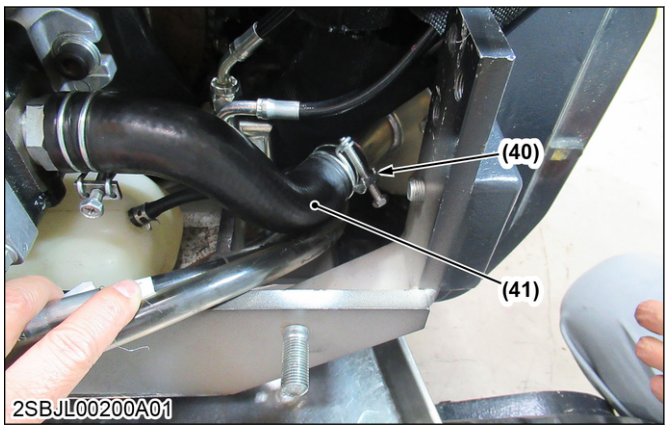
(36) Clamp (37) Return hose

22. Loosen the clamp to separate the suction hose 2.



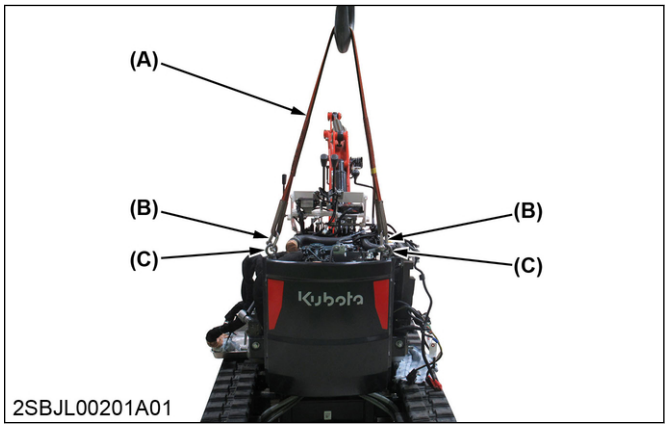
(38) Clamp (39) Suction hose 2

23. Loosen the clamp to separate the suction hose 1.



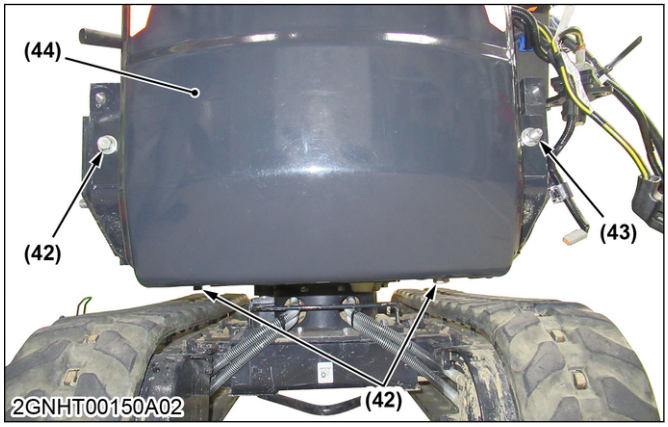
(40) Clamp (41) Suction hose 1

24. Install 2 eye bolts and 2 shackles to the center counterweight.
25. Attach a nylon sling to the shackles and hoist for support.



(A) Nylon sling (C) Eye bolt ×2
(B) Shackle ×2

26. Remove the 3 bolts and nut to remove the center counterweight.



(42) Bolt (M12 × 35) ×3 (44) Center counterweight
(43) Nut (M12)

Mass

(44) Center counterweight	Approximately 98 kg Approximately 214 lbs

Installing

Tightening torque

(1) (7) Nut	107.9 to 125.5 N·m 11.0 to 12.8 kgf·m 79.6 to 92.6 lbf·ft	-
(43) Nut	62.8 to 72.6 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 lbf·ft	-

3.3 Canopy

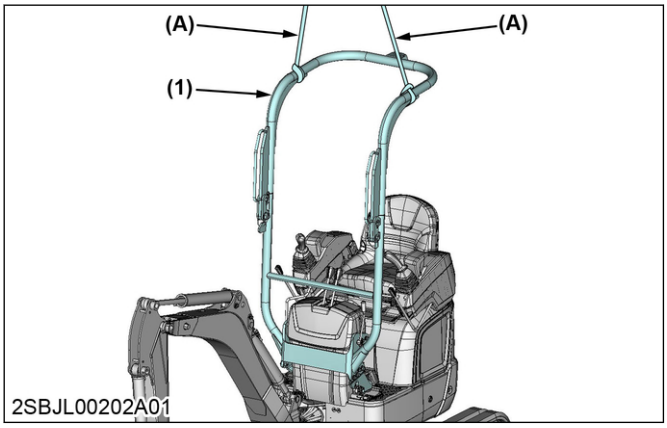
3.3.1 Removing and installing the canopy

Preparing

1. Lower the front attachment and blade to the ground, and stop the engine.

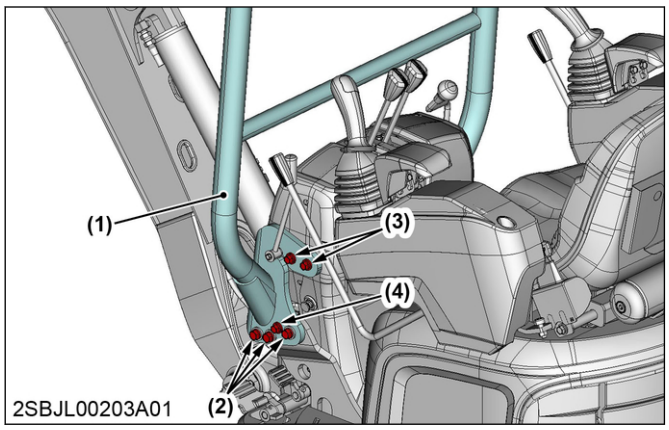
Removing

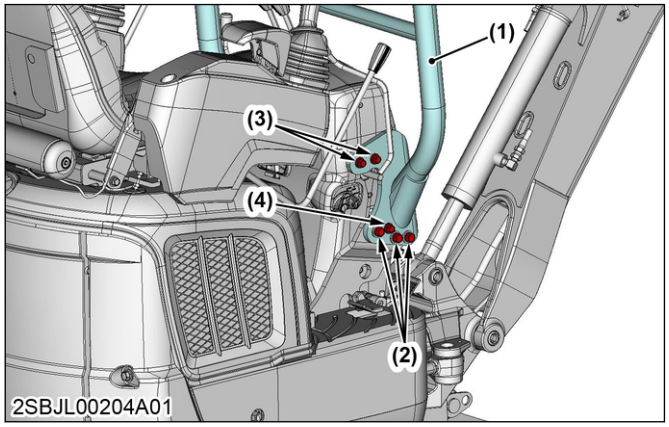
1. Attach 2 nylon slings to the canopy and hoist for support.



(1) Canopy (A) Nylon sling ×2

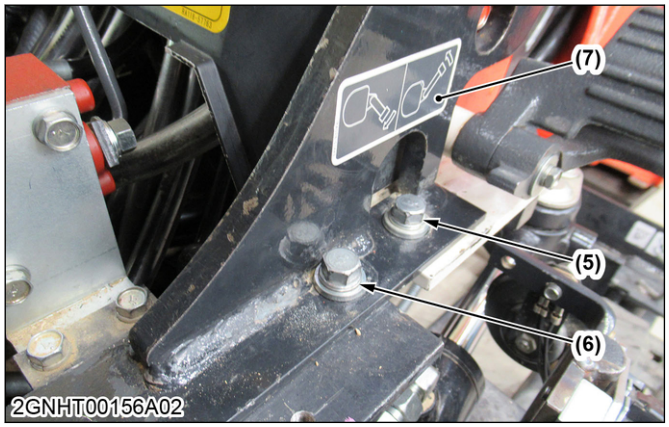
2. Remove the 12 bolts from the canopy.





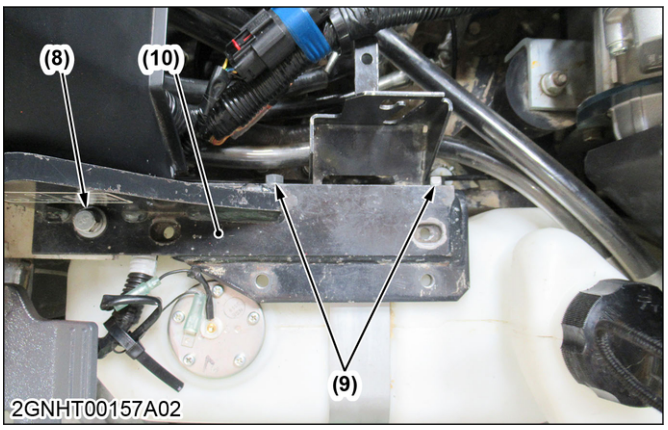
(1) Canopy
(2) Bolt (M12 × P1.25 × 35) ×6
(3) Bolt (M10 × P1.25 × 30) ×4
(4) Bolt (M10 × P1.25 ×55) ×2

3. Loosen the 2 bolts from the bracket RH.



(5) Bolt (M10 × P1.25 × 30)
(6) Bolt (M10 × P1.25 ×25)
(7) Bracket RH

4. Loosen the 3 bolts from the bracket LH.



(8) Bolt (M10 × P1.25 × 30)
(9) Bolt (M10 × 30) ×2
(10) Bracket LH

5. Remove the canopy.

Mass

(1) Canopy	Approximately 66 kg Approximately146 lbs

Installing

Tightening torque

(2) Bolt	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft	Thread lock (Loctite® 263)
(3) (4) (5) (6) (8) Bolt	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft	Thread lock (Loctite® 263)
(9) Bolt	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft	-

3.4 Lever lock

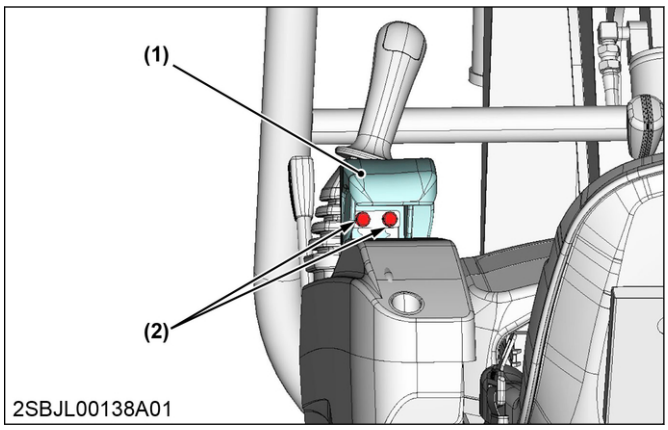
3.4.1 Removing and installing the lever lock

Preparing

1. Lower the front attachment and blade to the ground, and stop the engine.

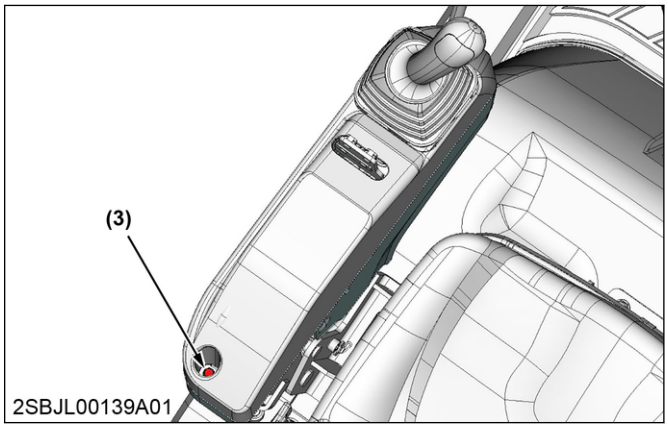
Removing the lever lock LH

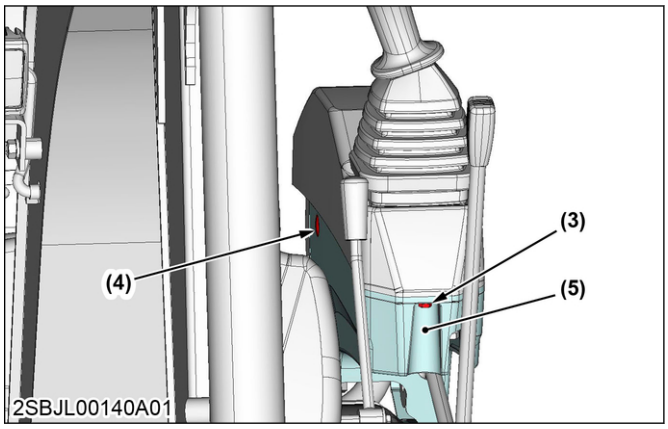
1. Remove the 2 bolts to remove the wrist rest LH.



(1) Wrist rest LH (2) Bolt (M8 × 20) ×2

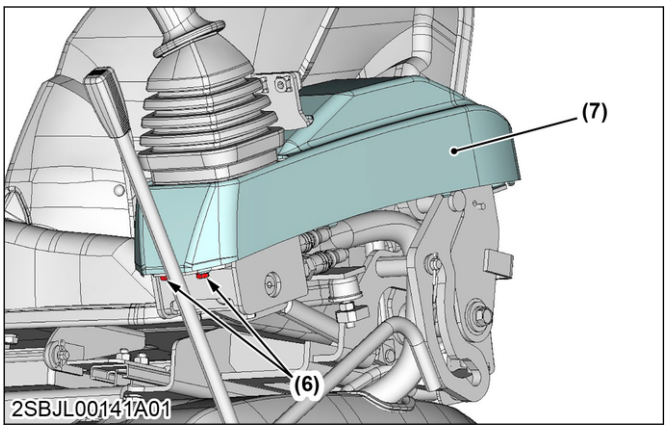
2. Remove the 2 bolts and rivet to remove the lower cover.





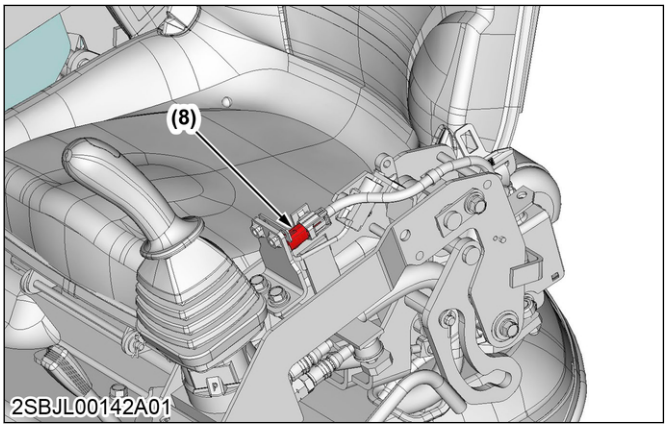
(3) Bolt (M6 × 20) ×2 (5) Lower cover
(4) Rivet

3. Remove the 2 bolts to remove the upper cover.



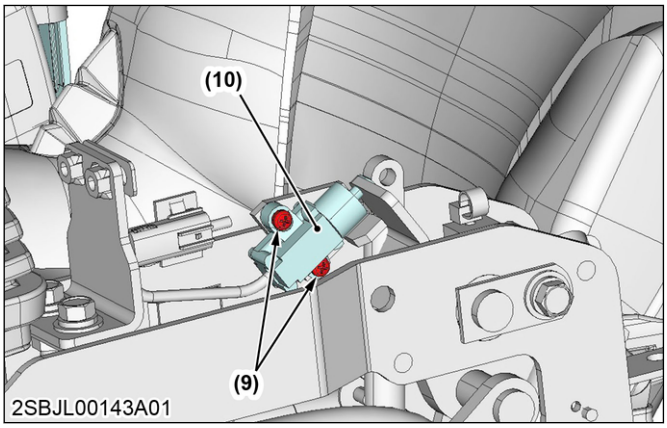
(6) Bolt (M6 × 20) ×2 (7) Upper cover

4. Disconnect the lever lock switch LH connector.



(8) Lever lock switch LH connector

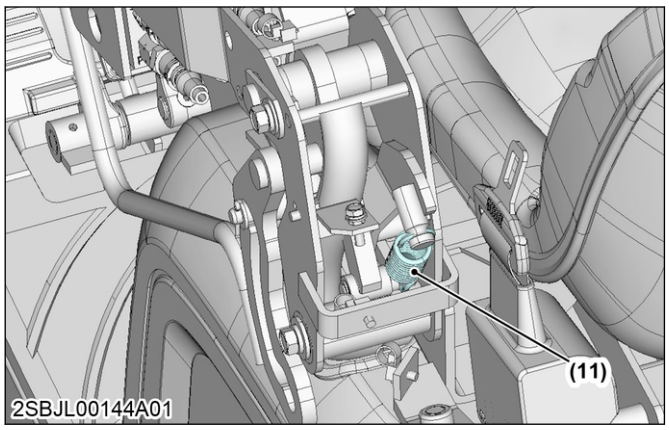
5. Remove the 2 screws to remove the lever lock switch LH.



(9) Screw ×2 (10) Lever lock switch LH

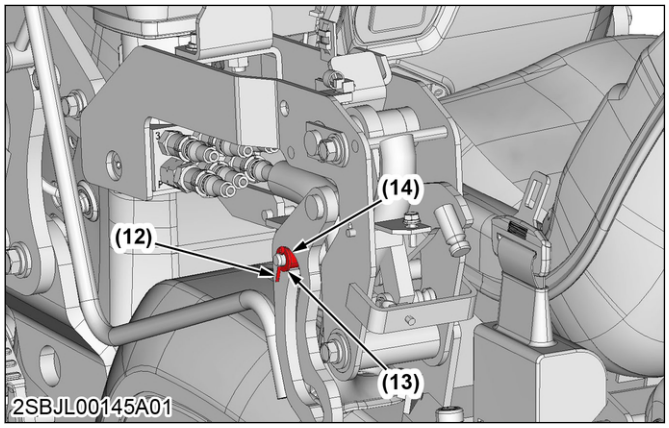
6. Remove the spring.

⚠ CAUTION
- **The spring may pop out rapidly when removing.**



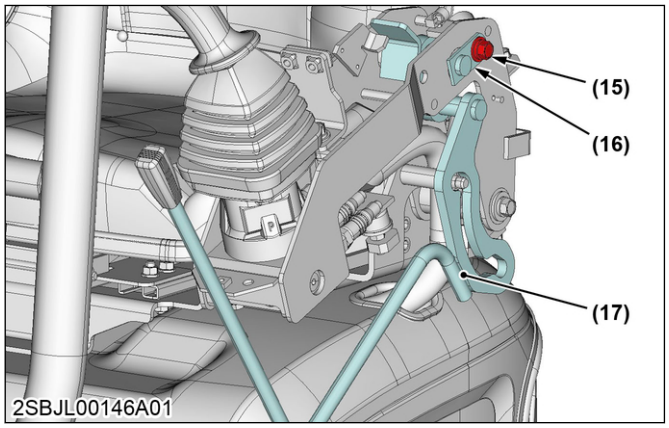
(11) Spring

7. Remove the split pin, washer, and collar.



(12) Split pin
(13) Washer
(14) Collar

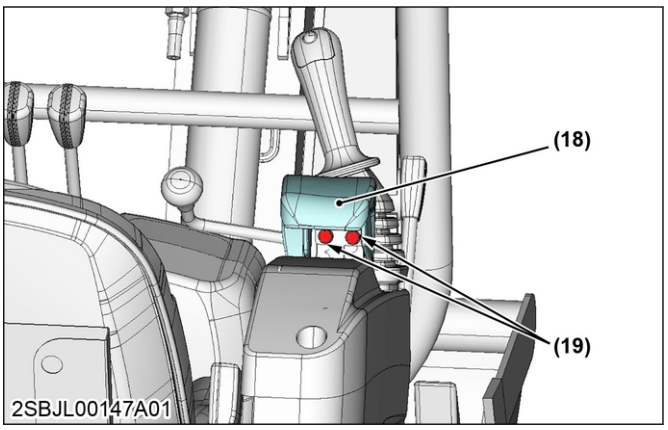
8. Remove the bolt and shaft to remove the lever lock LH.



(15) Bolt (M10 × 20)
(16) Shaft
(17) Lever lock LH

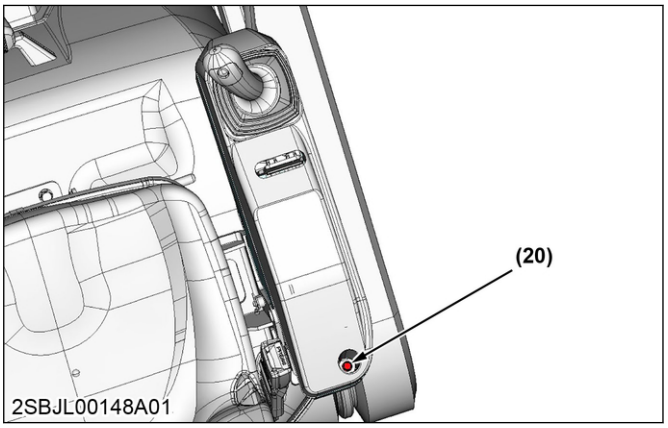
Removing the lever lock RH

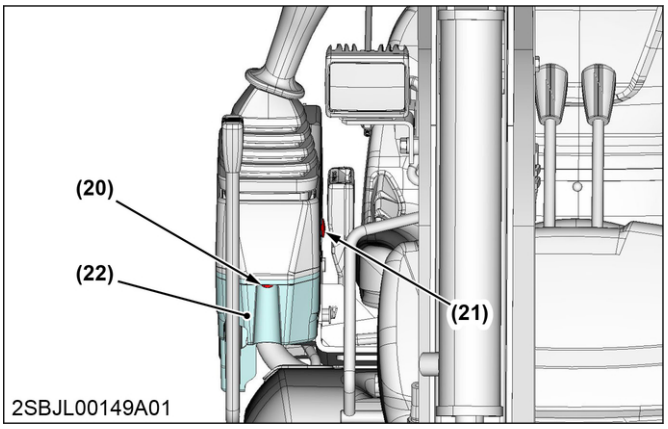
1. Remove the 2 bolts to remove the wrist rest RH.



(18) Wrist rest RH
(19) Bolt (M8 × 20) ×2

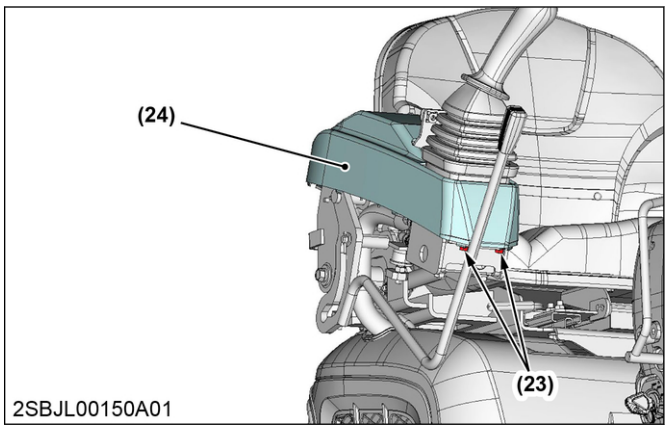
2. Remove the 2 bolts and rivet to remove the lower cover.





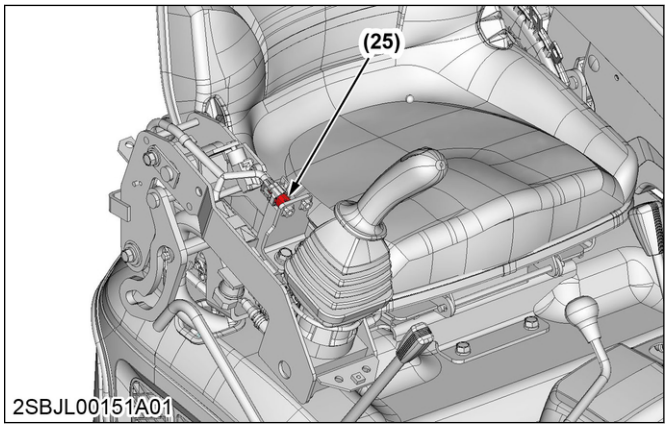
(20) Bolt (M6 × 20) ×2
(21) Rivet
(22) Lower cover

3. Remove the 2 bolts to remove the upper cover.



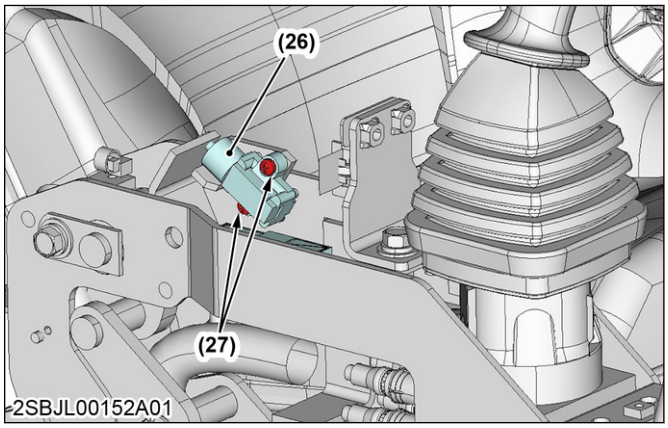
(23) Bolt (M6 × 20) ×2
(24) Upper cover

4. Disconnect the lever lock switch RH connector.



(25) Lever lock switch RH connector

5. Remove the 2 screws to remove the lever lock switch RH.

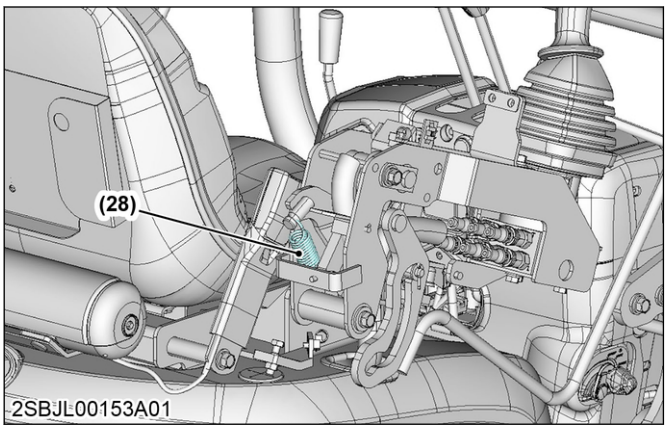


(26) Lever lock switch RH
(27) Screw ×2

6. Remove the spring.

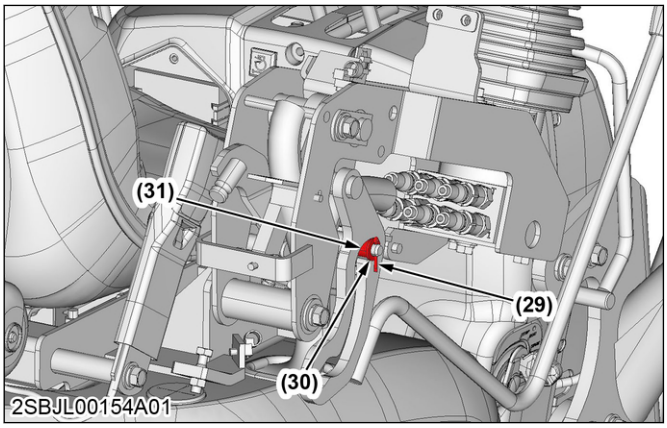
⚠ CAUTION

- **The spring may pop out rapidly when removing.**



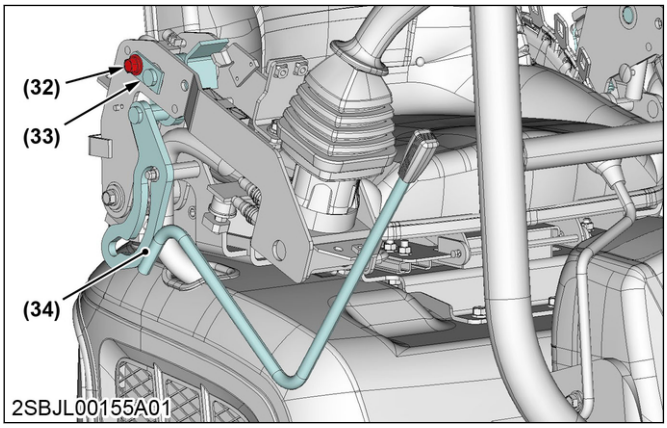
(28) Spring

7. Remove the split pin, washer, and collar.



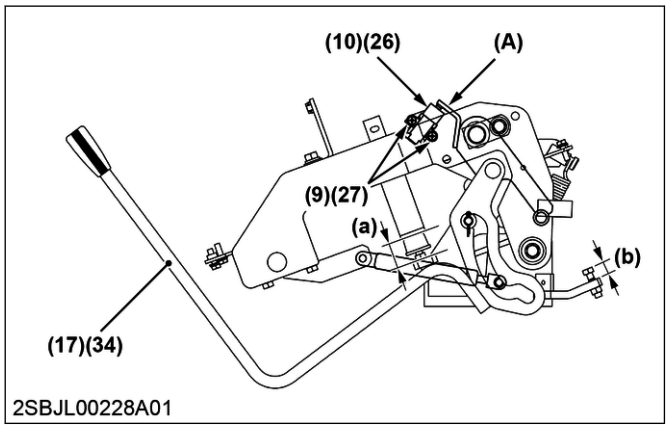
(29) Split pin
(30) Washer
(31) Collar

8. Remove the bolt and shaft to remove the lever lock RH.



(32) Bolt (M10 × 20)
(33) Shaft
(34) Lever lock RH

Installing



(9) Screw ×2
(10) Lever lock switch LH
(17) Lever lock LH
(26) Lever lock switch RH
(27) Screw ×2
(34) Lever lock RH

NOTE

- **(A) : Lower the lever lock, and check that the clearance is 0 mm (0 in.).**

Tightening torque

(9) (27) Screw	3.9 to 4.9 N·m 0.4 to 0.5 kgf·m 2.9 to 3.6 lbf·ft	Thread lock TB1401B

Adjusting dimension

(a)	30 mm 1.18 in.
(b)	15 mm 0.59 in.

3.5 Travel control lever

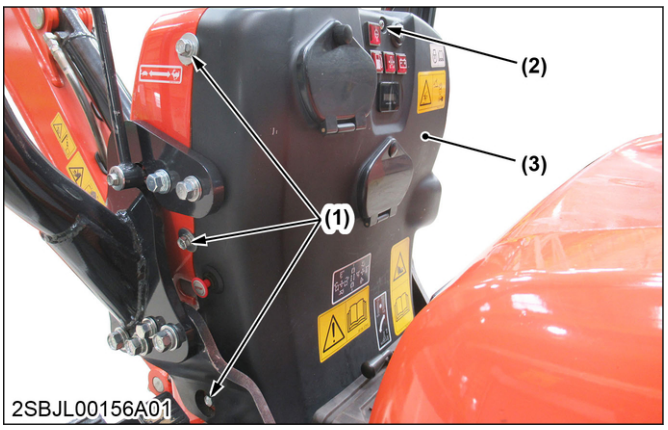
3.5.1 Removing the travel control lever

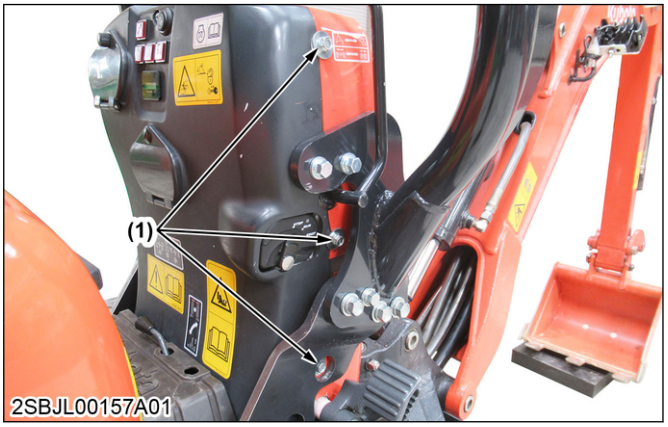
Preparing

1. Lower the front attachment and blade to the ground and stop the engine.
2. Open the bonnet.
3. Remove the step.
4. Disconnect the battery cable from the negative (-) terminal.

Removing

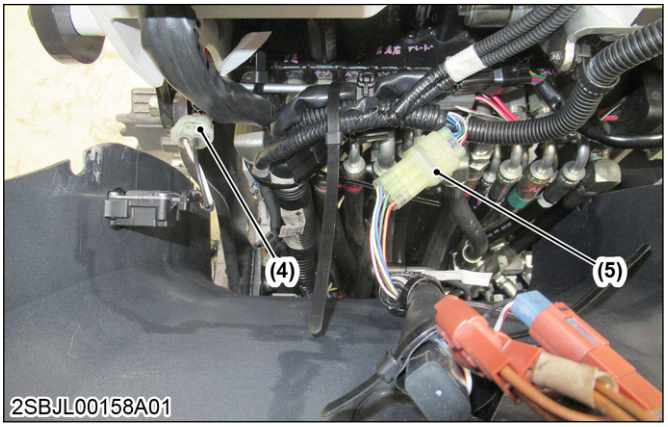
1. Remove the 6 bolts and screw to remove the rear cover.





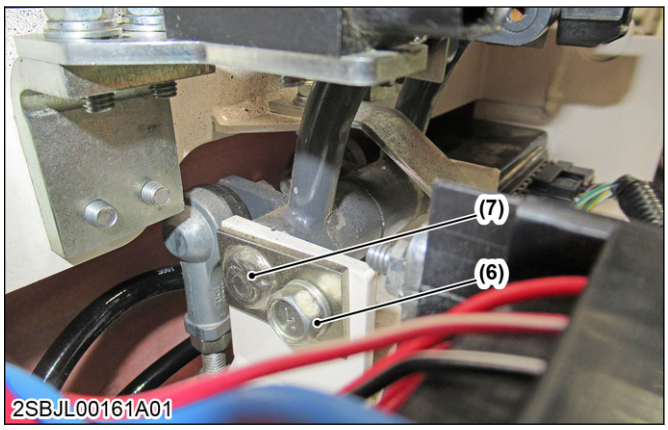
(1) Bolt (M8 × 20) ×6
(2) Screw
(3) Rear cover

2. Disconnect the engine stop connector and joint connector.



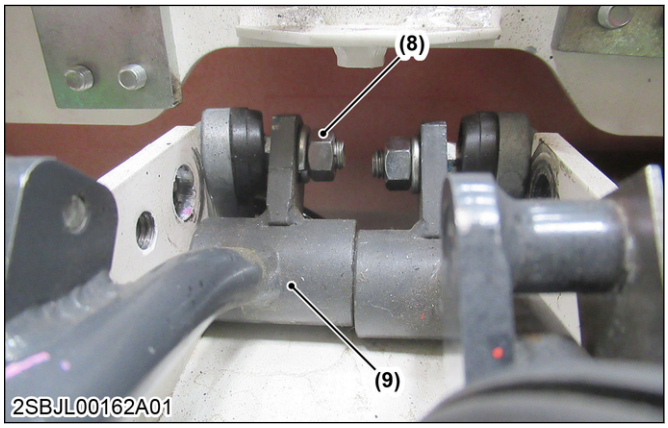
(4) Engine stop switch connector
(5) Joint connector

3. Remove the bolt to remove the pin.



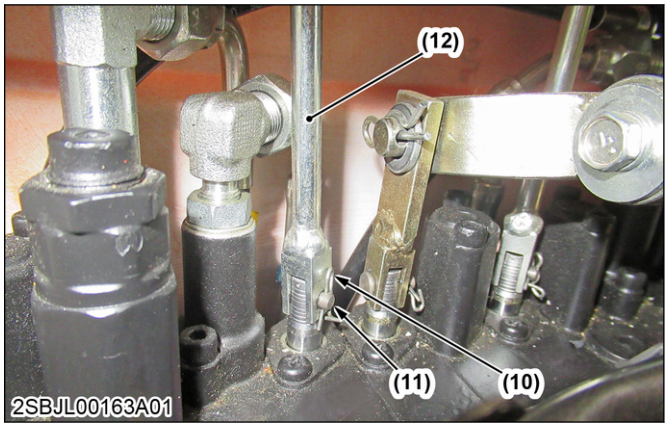
(6) Bolt (M8 × 16) (7) Pin

4. Remove the nut to remove the travel control lever LH.



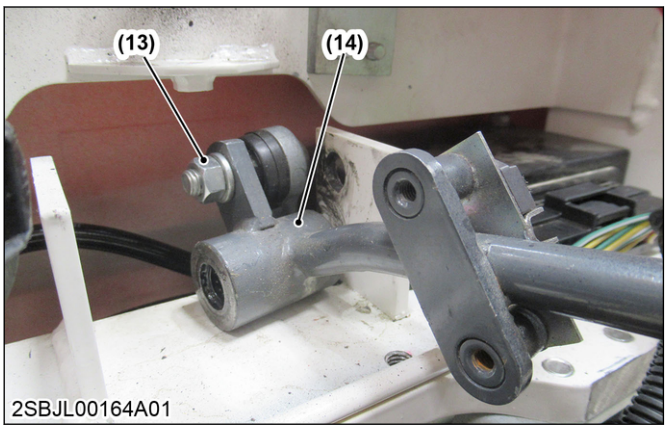
(8) Nut (M8) (9) Travel control lever LH

5. Remove the snap pin and pin to remove the travel rod.



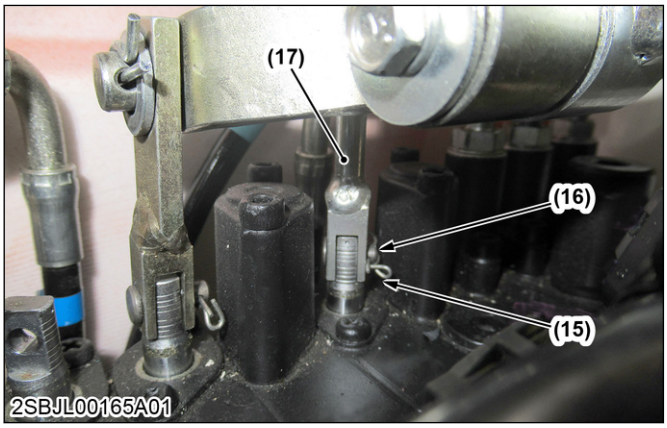
(10) Snap pin (12) Travel rod
(11) Pin

6. Remove the nut to remove the travel control lever RH.



(13) Nut (M8) (14) Travel control lever RH

7. Remove the snap pin and pin to remove the travel rod.

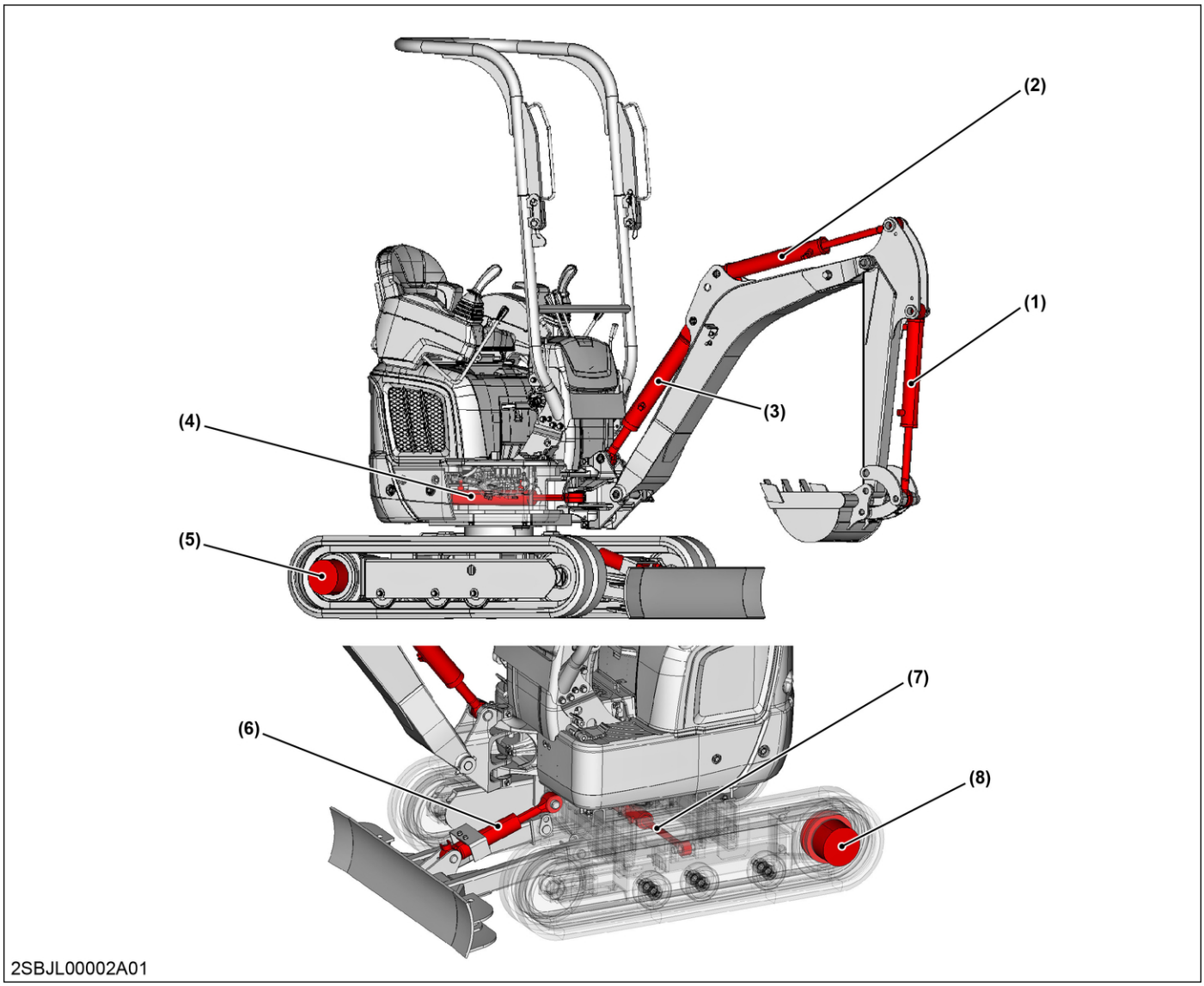


(15) Snap pin (17) Travel rod
(16) Pin

5. HYDRAULIC SYSTEM

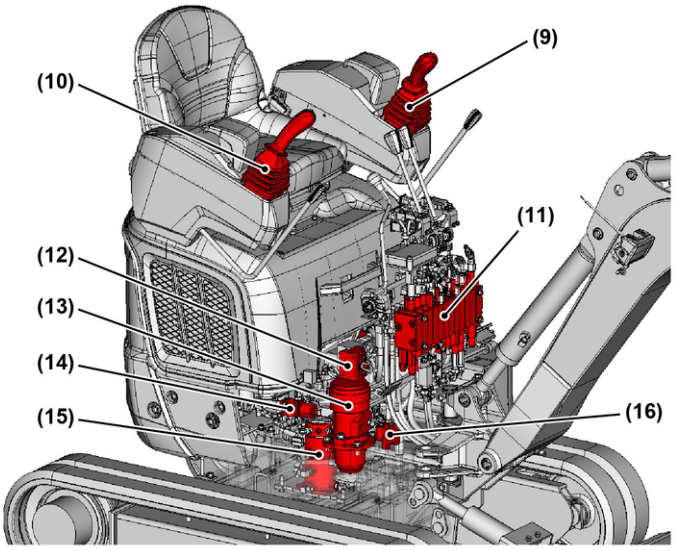
MECHANISM

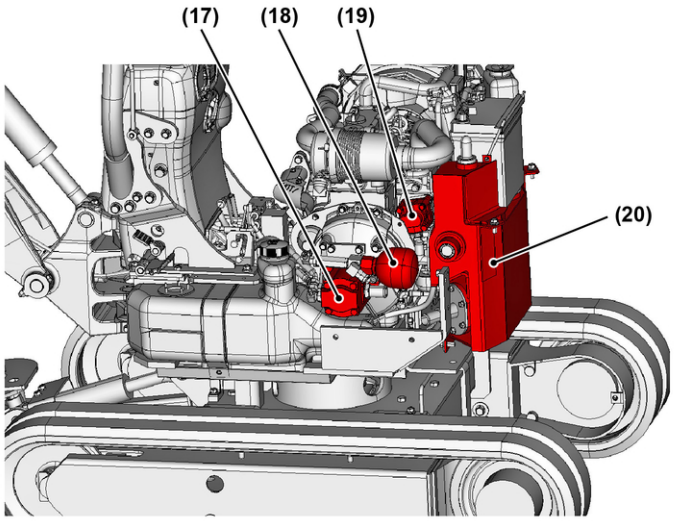
1. Hydraulic device layout



(1) Bucket cylinder
(2) Arm cylinder
(3) Boom cylinder
(4) Swing cylinder
(5) Travel motor RH
(6) Blade cylinder
(7) Track cylinder
(8) Travel motor LH

5. HYDRAULIC SYSTEM





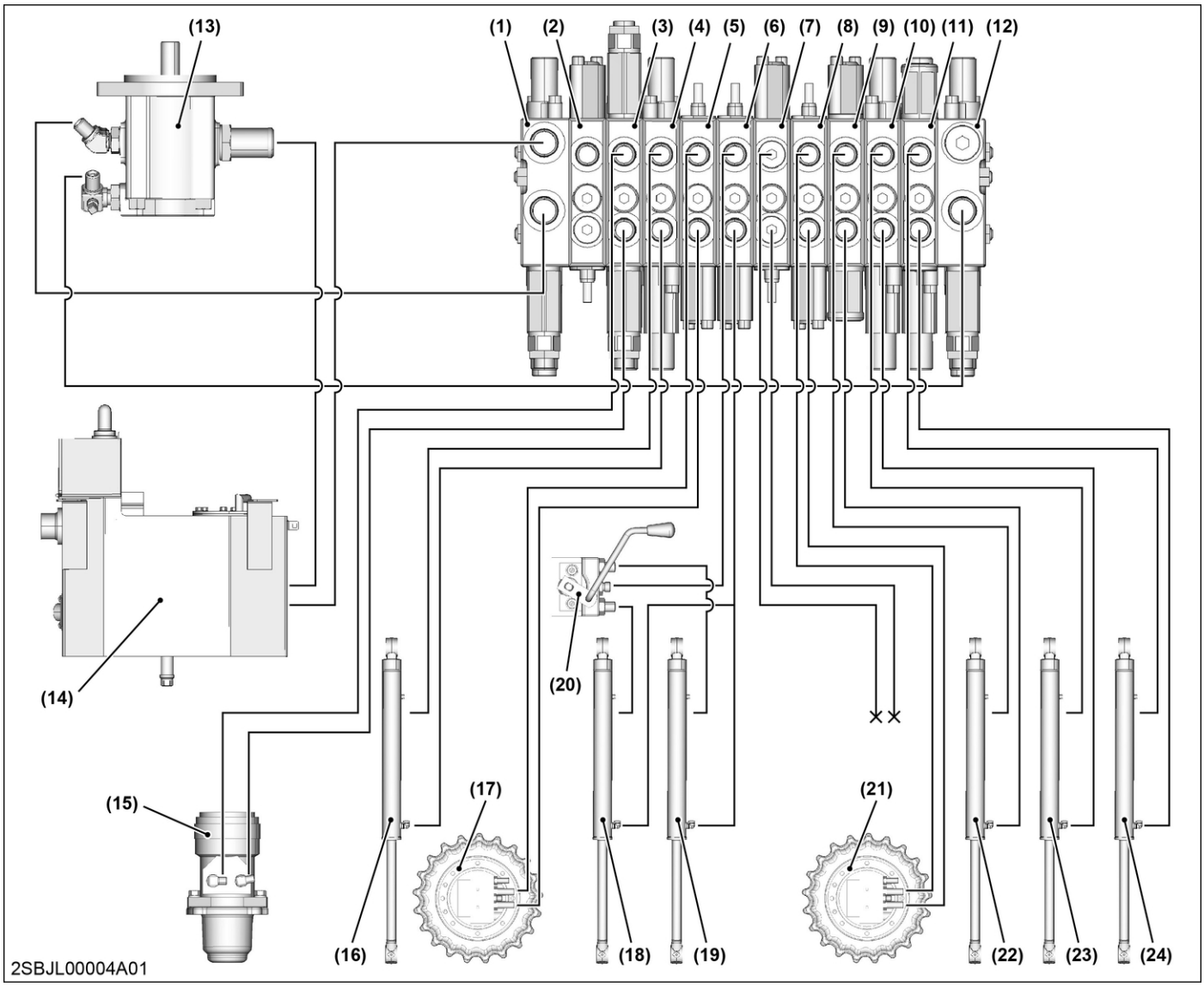
2SBJL00003A01

(9) Pilot control valve LH
(10) Pilot control valve RH
(11) Control valve
(12) Telescopic valve
(13) Swivel motor
(14) Unload valve
(15) Swivel joint
(16) Relief valve
(17) Hydraulic pump (main)
(18) Accumulator
(19) Hydraulic pump (pilot)
(20) Hydraulic oil tank

2. Hydraulic system general description

2.1 Main hydraulic system general description

The actuators are powered by hydraulic oil from the P1 and P2 pumps, and operates by switching oil passages inside of the control valve.



(1) Inlet P1 section
(2) Travel shift speed section
(3) Swivel section
(4) Arm section
(5) Travel LH section
(6) Blade, track section
(7) AUX section
(8) Travel RH section
(9) Swing section
(10) Bucket section
(11) Boom section
(12) Inlet P2 section
(13) Hydraulic pump (main)
(14) Hydraulic oil tank
(15) Swivel motor
(16) Arm cylinder
(17) Travel motor LH
(18) Blade cylinder
(19) Track cylinder
(20) Telescopic valve
(21) Travel motor RH
(22) Swing cylinder
(23) Bucket cylinder
(24) Boom cylinder

When the machine is not operating

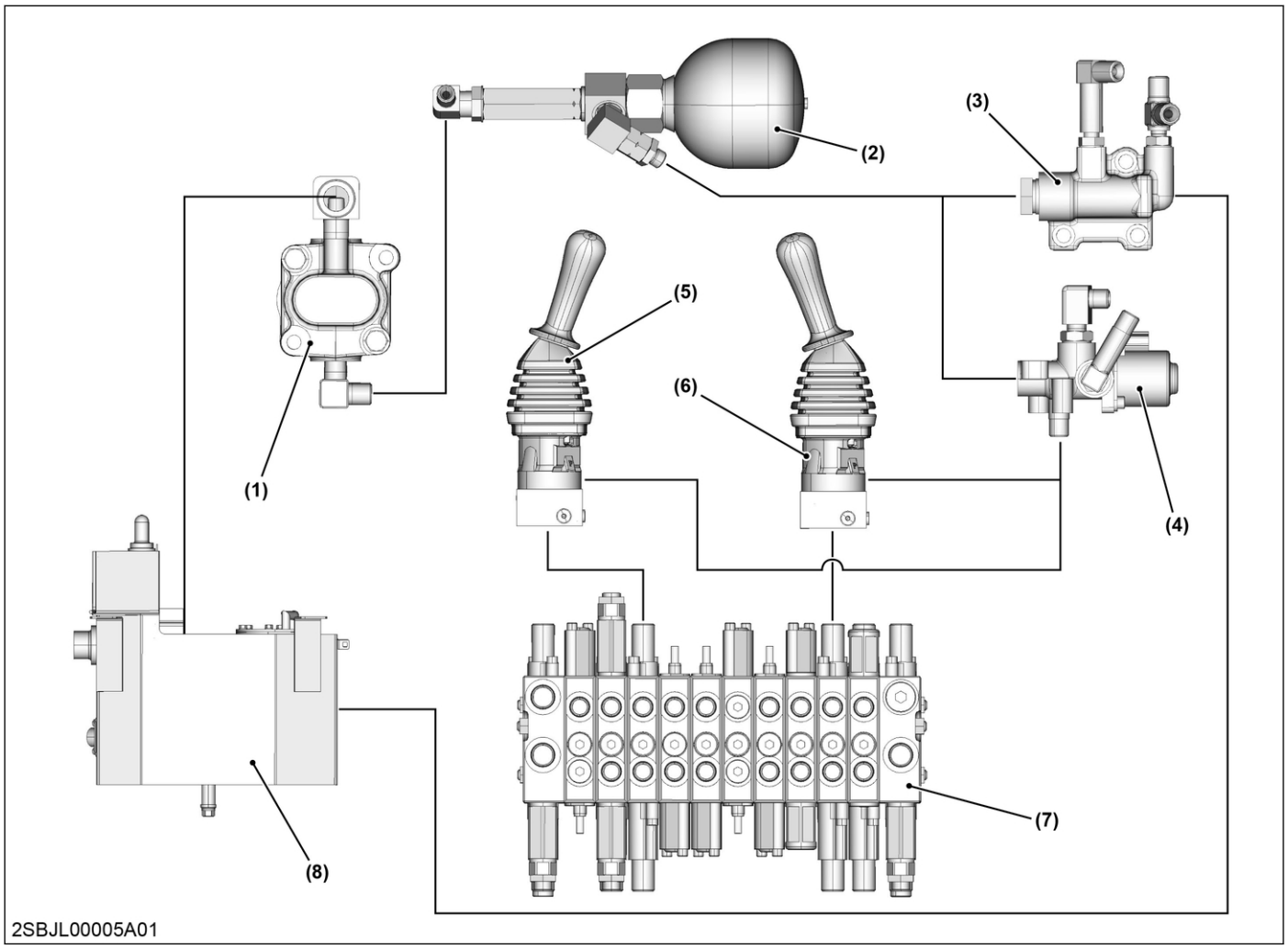
- The hydraulic pump (main) discharges the hydraulic oil to the control valve.
- After entering the inlet section, the oil flows to the hydraulic oil tank line and returns to the hydraulic oil tank.

When the machine is operating

- When the pilot control lever or pedal is operated, oil passages inside of the control valve switch, and hydraulic oil from the hydraulic pump flows into actuators to start their operation.
- Oil returned from the actuators flow back into the hydraulic oil tank line and returns to the hydraulic oil tank.

2.2 Pilot control system general description

The pilot control system is powered by oil from the hydraulic pump (pilot), and the pilot oil shifts the spools in the control valve according to the operation of the pilot control levers.



(1) Hydraulic pump (pilot)
(2) Accumulator
(3) Relief valve
(4) Unload valve
(5) Pilot control valve RH
(6) Pilot control valve LH
(7) Control valve
(8) Hydraulic oil tank

When the lever lock is raised

- Since the unload valve is not excited, the oil passage inside the unload valve is cut off.
- The pressurized oil from the hydraulic pump (pilot) returns to the hydraulic oil tank through the relief valve.

When the lever lock is lowered

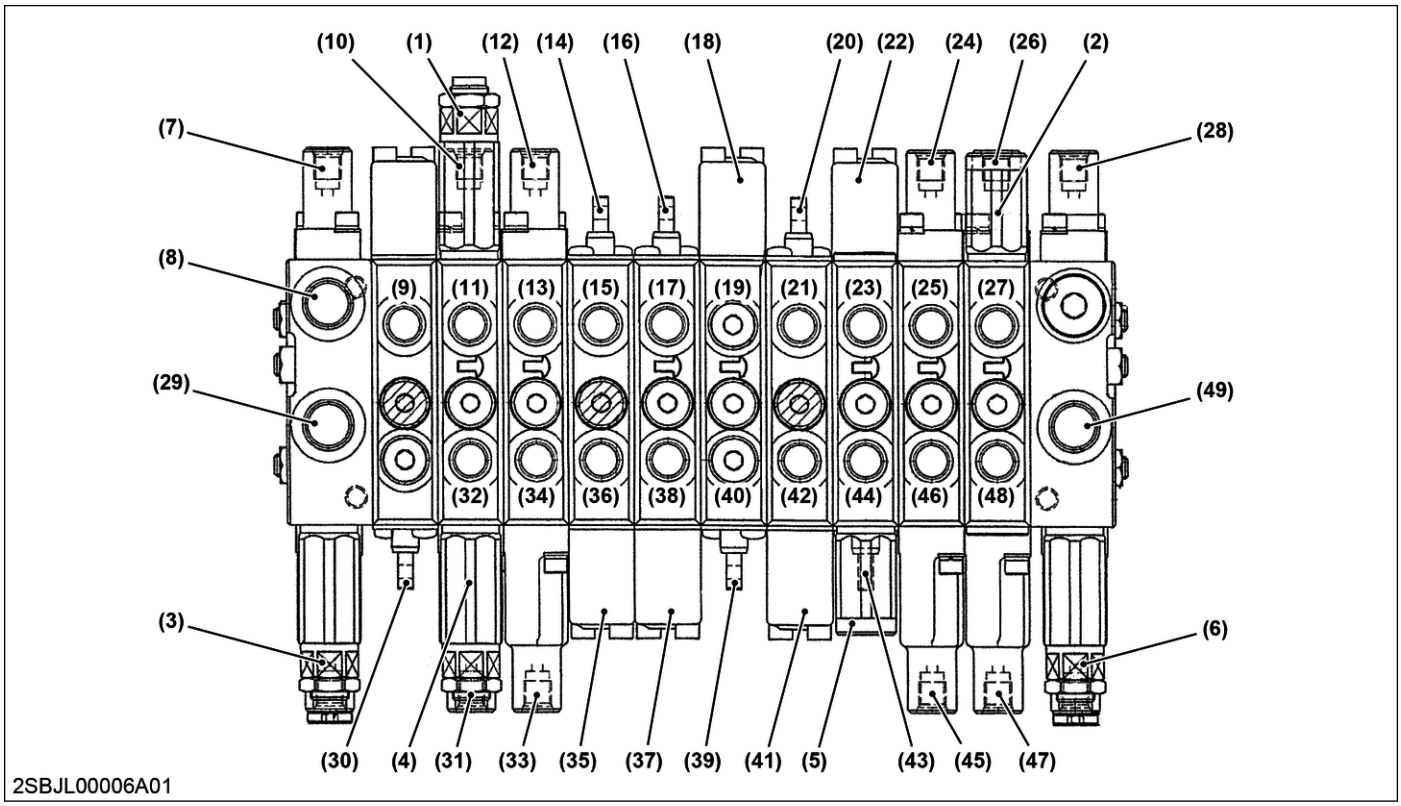
- The unload valve is excited to flow the pilot oil to the pilot control valves and port Pp of the control valve.
- The unload spool is shifted by the pilot oil so as to flow the pressurized oil from the hydraulic pump (main) to each section in the control valve.
- According to the pilot control lever operation, the pilot control valve switches hydraulic oil circuits inside the control valve.

■ NOTE

- **The following actuators are controlled by the mechanical linkage, and not by the hydraulic pilot.**
  - **Travel LH and RH**
  - **Blade and track**
  - **AUX**
  - **Swing**

3. Control valve

3.1 Control valve specifications



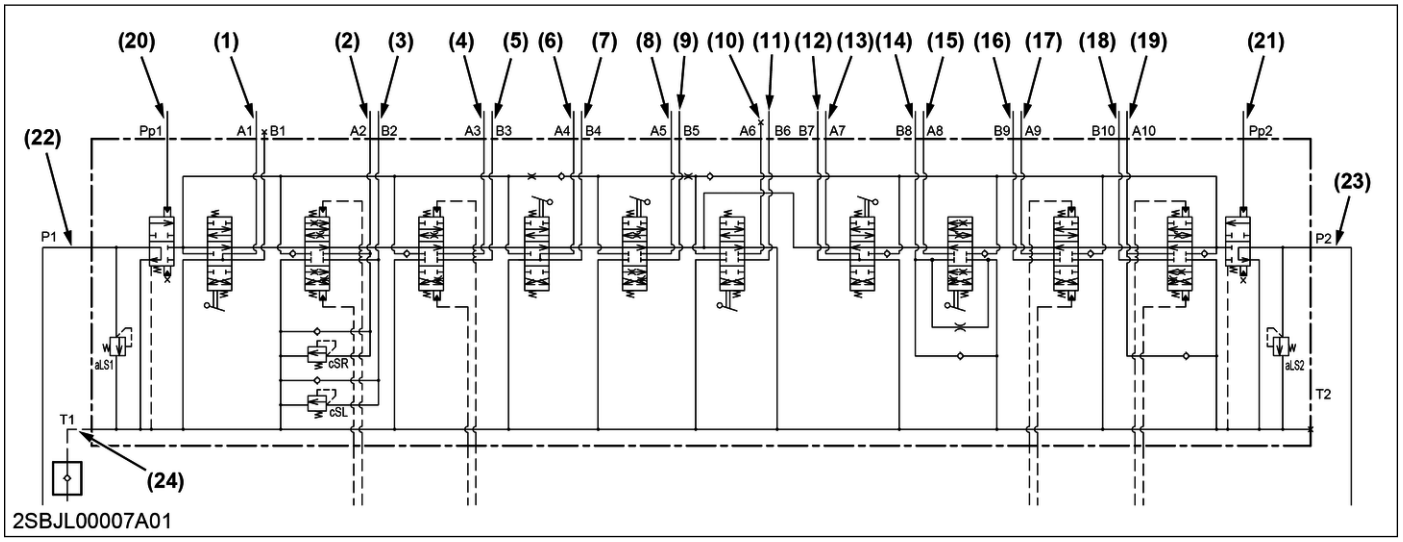
(1) Overload relief valve (cSR)
(2) Anti-cavitation valve
(3) Main relief valve (aP1)
(4) Overload relief valve (cSL)
(5) Anti-cavitation valve
(6) Main relief valve (aP2)

		Specifications	Remarks
Manufacturer		Nabtesco	-
Main relief valve setting pressure	aP1 aP2	17.20 to 17.69 MPa 175.4 to 180.4 kgf/cm^2 2495 to 2566 psi	At 12 L/min At 3.2 U.S.gals/min
Overload relief valve setting pressure	Swivel left (cSL) Swivel right (cSR)	6.86 to 7.35 MPa 70.0 to 74.9 kgf/cm^2 995 to 1070 psi	At 12 L/min At 3.2 U.S.gals/min

Port location table

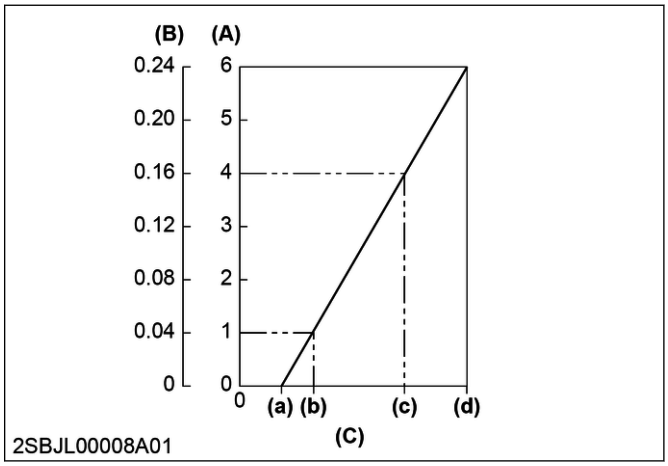
No.	Port	Location	No.	Port	Location
(7)	Pp1	Hydraulic pump (pilot) (Pp)	(29)	P1	Hydraulic pump (main) (P1)
(8)	T1	Hydraulic oil tank	(30)	Link	Travel speed shift
(9)	A1	Travel motor LH (Pp) Travel motor RH (Pp)	(31)	Pb2	Pilot control valve LH (3) Swivel left
(10)	Pa2	Pilot control valve LH (1) Swivel right	(32)	B2	Swivel motor (A) Swivel left
(11)	A2	Swivel motor (B) Swivel right	(33)	Pb3	Pilot control valve LH (2) Arm crowd
(12)	Pa3	Pilot control valve LH (4) Arm dump	(34)	B3	Arm cylinder (bottom) Arm crowd
(13)	A3	Arm cylinder (rod) Arm dump	(35)	-	Travel LH backwards
(14)	Link	Travel LH forwards	(36)	B4	Travel motor LH (B) Travel LH backwards
(15)	A4	Travel motor LH (A) Travel LH forwards	(37)	-	Blade lift Track frame extend
(16)	Link	Blade lower Track frame retract	(38)	B5	Blade cylinder (rod) Blade lift Track cylinder (bottom) Track frame extend
(17)	A5	Blade cylinder (bottom) Blade lower Track cylinder (rod) Track frame retract	(39)	Link	AUX discharging port
(18)	-	AUX returning port	(40)	B6	AUX discharging port
(19)	A6	AUX returning port	(41)	-	Travel RH backwards
(20)	Link	Travel RH forwards	(42)	B7	Travel motor RH (A) Travel RH backwards
(21)	A7	Travel motor RH (B) Travel RH forwards	(43)	Link	Swing right
(22)	-	Swing left	(44)	B8	Swing cylinder (rod) Swing right
(23)	A8	Swing cylinder (bottom) Swing left	(45)	Pb9	Pilot control valve RH (3) Bucket crowd
(24)	Pa9	Pilot control valve RH (1) Bucket dump	(46)	B9	Bucket cylinder (bottom) Bucket crowd
(25)	A9	Bucket cylinder (rod) Bucket dump	(47)	Pb10	Pilot control valve RH (2) Boom lift
(26)	Pa10	Pilot control valve RH (4) Boom lower	(48)	B10	Boom cylinder (rod) Boom lift
(27)	A10	Boom cylinder (bottom) Boom lower	(49)	P2	Hydraulic pump (main) (P2)
(28)	Pp2	Hydraulic pump (pilot) (Pp)	-	-	-

3.2 Control valve hydraulic circuit



(1) Travel motor (Pp)
(2) Swivel motor right
(3) Swivel motor left
(4) Arm cylinder rod
(5) Arm cylinder bottom
(6) Travel motor LH forward
(7) Travel motor LH backward
(8) Blade cylinder bottom
Track cylinder rod
(9) Blade cylinder rod
Track cylinder bottom
(10) AUX returning port
(11) AUX discharging port
(12) Travel motor RH backward
(13) Travel motor RH forward
(14) Swing cylinder rod
(15) Swing cylinder bottom
(16) Bucket cylinder bottom
(17) Bucket cylinder rod
(18) Boom cylinder rod
(19) Boom cylinder bottom
(20) Port Pp1
(21) Port Pp2
(22) Port P1
(23) Port P2
(24) Port T1

3.3 Control valve spool shift performance



(A) Spool stroke (mm)
(B) Spool stroke (in.)
(C) Pilot pressure

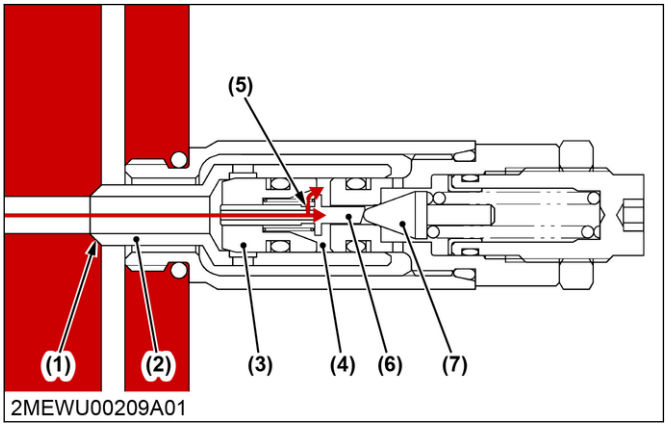
(a)	0.37 MPa 3.8 kgf/cm^2 54 psi
(b)	0.63 MPa 6.4 kgf/cm^2 91 psi
(c)	1.40 MPa 14.3 kgf/cm^2 203 psi
(d)	1.96 MPa 20.0 kgf/cm^2 284 psi

3.4 Control valve function and structure

3.4.1 Main relief valve

Prevents surge pressure in the hydraulic circuit.

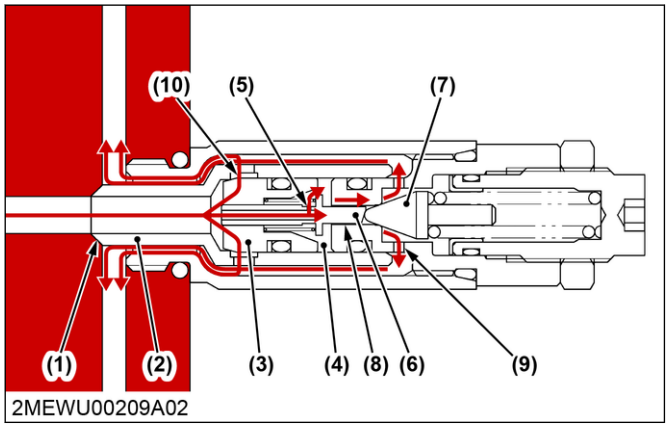
When normal (working pressure < set pressure)



(1) Seat
(2) Main poppet
(3) Poppet
(4) Chamber
(5) Orifice a
(6) Piston
(7) Pilot poppet

- The hydraulic oil pushes the piston, but the pilot poppet does not shift since the set pressure is higher than the hydraulic pressure.
- The hydraulic oil flows through the orifice a to fill the chamber.
- The hydraulic oil does not flow into the tank circuit since the pilot poppet shuts off the oil.

When relieving (working pressure > set pressure)



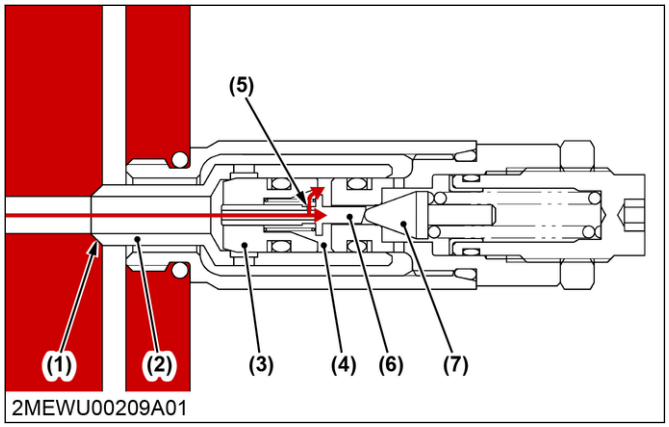
(1) Seat
(2) Main poppet
(3) Poppet
(4) Chamber
(5) Orifice a
(6) Piston
(7) Pilot poppet
(8) Orifice b
(9) Orifice c
(10) Orifice d

- The piston and pilot poppet are shifted by the hydraulic pressure.
- The hydraulic oil in the chamber flows into the tank circuit through the orifice b and orifice c.
- Pressure inside of the chamber decreases to shift the main poppet to the right.
- The hydraulic oil also flows into the tank circuit through the orifice d.

3.4.2 Overload relief valve

Releases hydraulic oil in the case of the overload. Provides hydraulic oil in the case of negative pressure.

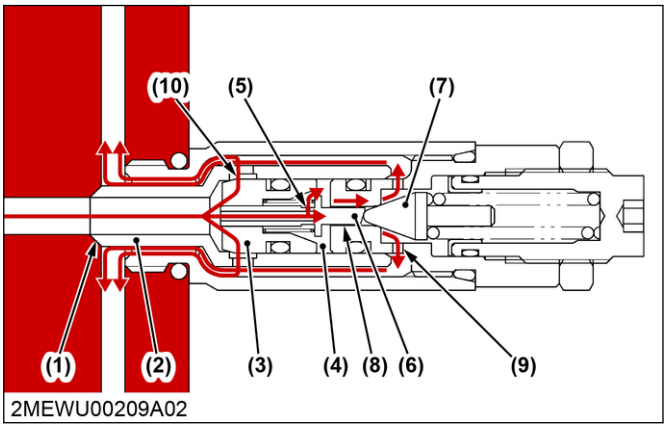
When normal (working pressure < set pressure)



(1) Seat
(2) Main poppet
(3) Poppet
(4) Chamber
(5) Orifice a
(6) Piston
(7) Pilot poppet

- The hydraulic oil pushes the piston, but the pilot poppet does not shift since the set pressure is higher than the hydraulic pressure.
- The hydraulic oil flows through the orifice a to fill the chamber.
- The hydraulic oil does not flow into the tank circuit since the pilot poppet shuts off the oil.

When relieving (working pressure > set pressure)

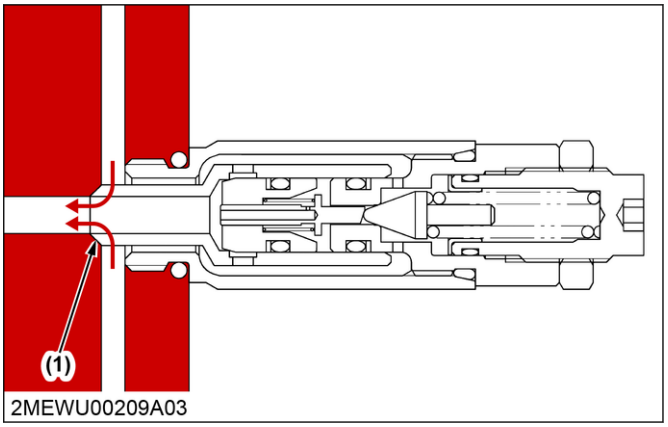


(1) Seat
(2) Main poppet
(3) Poppet
(4) Chamber
(5) Orifice a
(6) Piston
(7) Pilot poppet
(8) Orifice b
(9) Orifice c
(10) Orifice d

- The piston and pilot poppet are shifted by the hydraulic pressure.
- The hydraulic oil in the chamber flows into the tank circuit through the orifice b and orifice c.
- Pressure inside of the chamber decreases to shift the main poppet to the right.
- The hydraulic oil also flows into the tank circuit through the orifice d.

When make-up

The hydraulic oil is supplied to the cylinder port from the tank circuit when the actuator's pressure becomes negative.



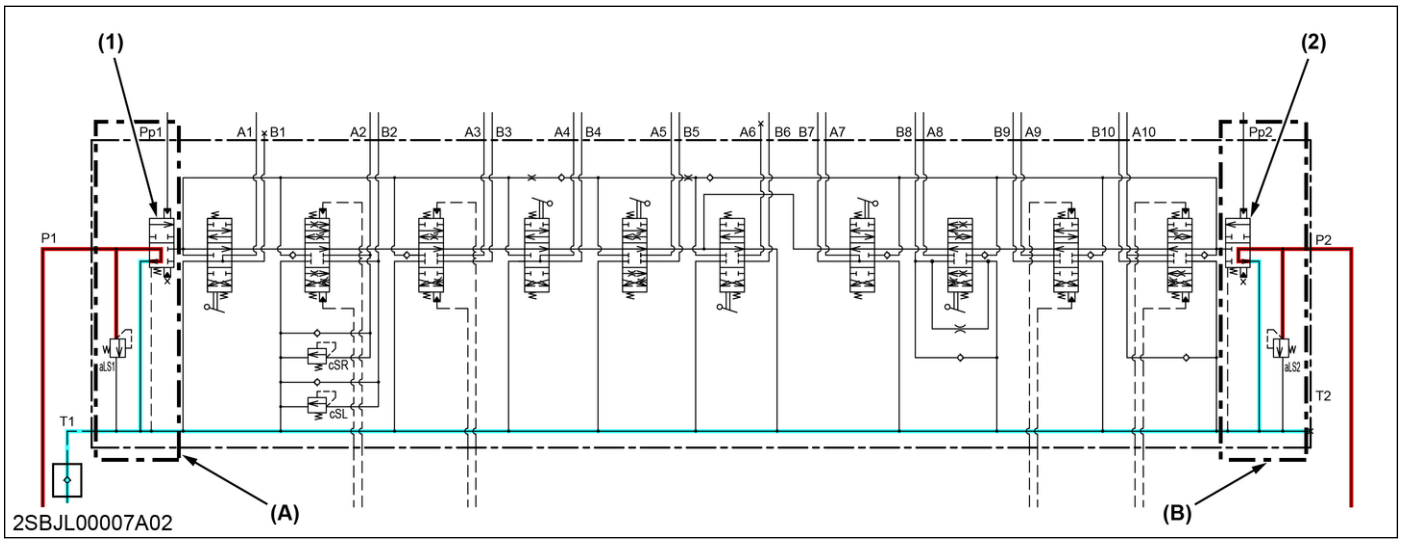
(1) Seat

- Due to the negative pressure, the seat moves to the right.
- The hydraulic oil in the tank circuit flows into the cylinder port.

3.4.3 Unload valve circuit

Flows of P1 and P2 pressurized oils are switched by operating the lever lock.

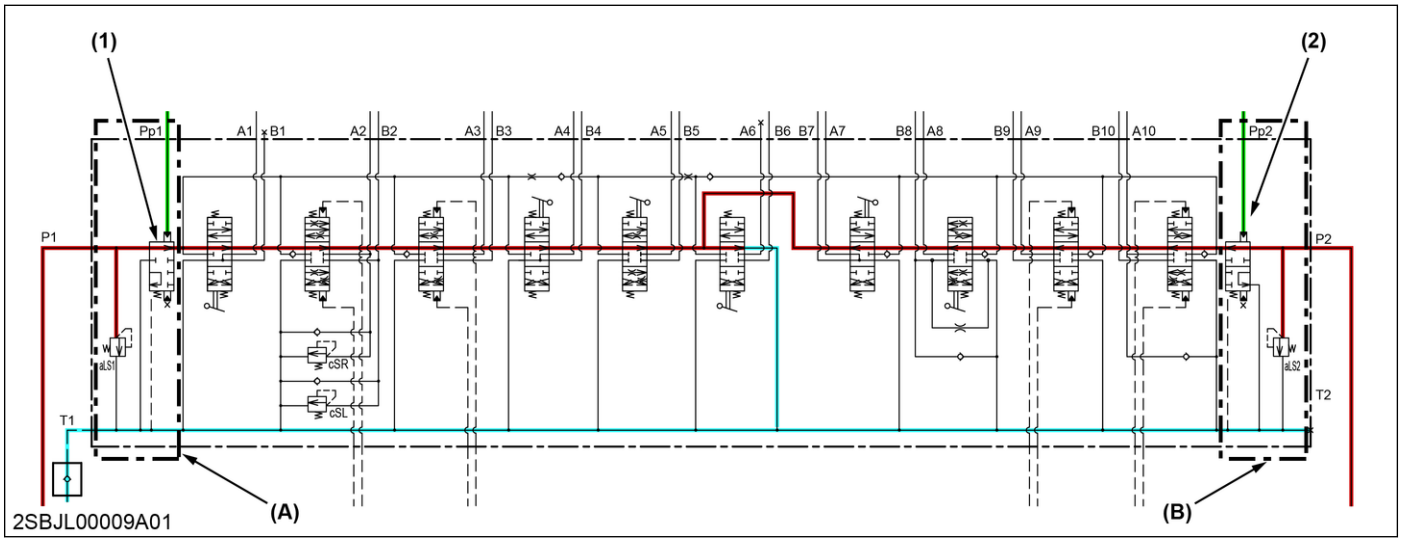
When the lever lock is OFF (when the lever lock is raised)



(1) Unload spool 1 (2) Unload spool 2 (A) Inlet P1 section (B) Inlet P2 section

- When the unload lever is raised, flow of Pp pressurized oil becomes cut off.
- Since the unload spools 1 and 2 is shifted upward by spring force, P1 and P2 oil passages are connected to the hydraulic oil tank circuit.
- P1 and P2 pressurized oils flow to the hydraulic oil tank.

When the lever lock is ON (when the lever lock is lowered)



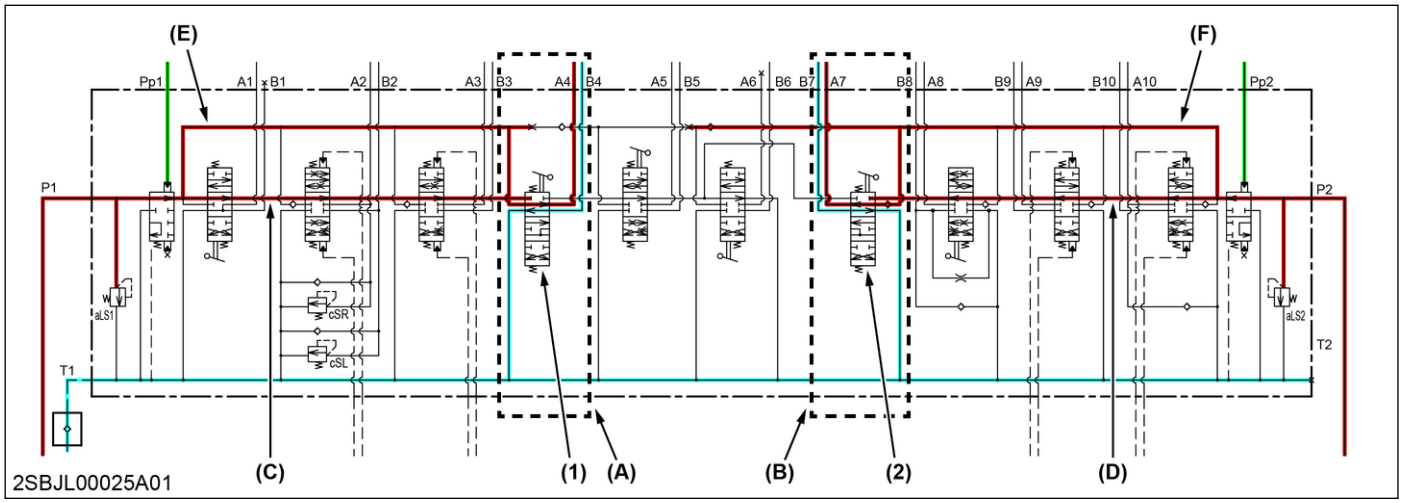
(1) Unload spool 1 (2) Unload spool 2 (A) Inlet P1 section (B) Inlet P2 section

- When the unload lever is lowered, Pp pressurized oil flows to the port Pp.
- The Pp pressurized oil shifts the unload spools 1 and 2 downward.
- P1 and P2 pressurized oils pass through each section and flow to the hydraulic oil tank.
- P1 and P2 circuit sections become operable.

3.4.4 Straight traveling circuit

When operating the blade during travel, P1 and P2 pressurized oils converge and flow to the blade cylinder to ensure the straight travel.

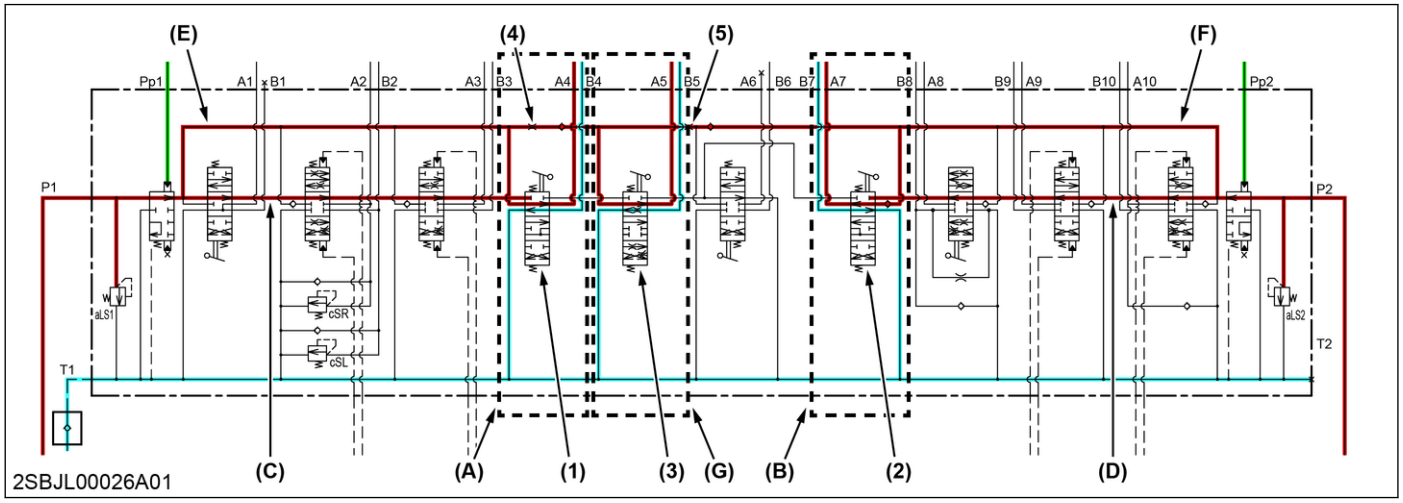
When operating the travel control levers only



(1) Travel LH spool
(2) Travel RH spool
(A) Travel LH section
(B) Travel RH section
(C) P1 bypass circuit
(D) P2 bypass circuit
(E) P1 parallel circuit
(F) P2 parallel circuit

- When the travel control levers LH and RH are operated forward, the travel LH and RH spools are shifted downward.
- The travel LH and RH spools shut off the P1 and P2 bypass circuits and the hydraulic oil tank circuits of P1 and P2.
- The P1 and P2 pressurized oils pass through the P1 and P2 parallel circuits and travel LH and RH spools, and flow to the travel motors LH and RH.
- The P1 and P2 pressurized oils flow independently to each travel motor to ensure the straight travel.

When operating the travel control levers and blade control lever

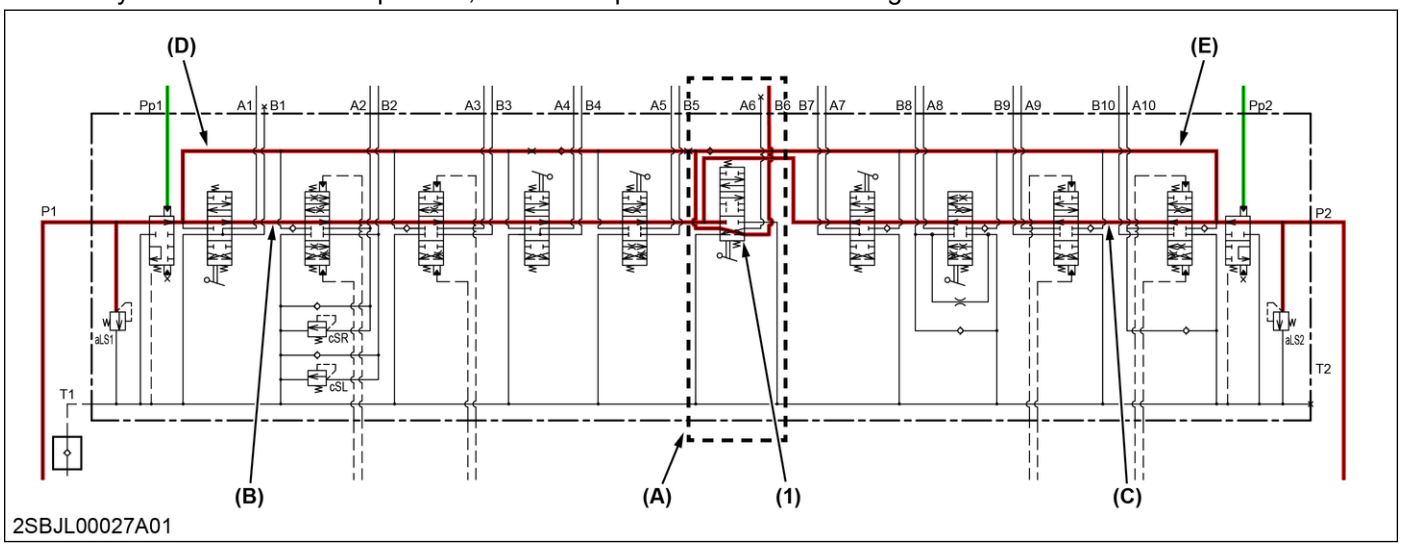


(1) Travel LH spool
(2) Travel RH spool
(3) Blade spool
(4) Orifice 1
(5) Orifice 2
(A) Travel LH section
(B) Travel RH section
(C) P1 bypass circuit
(D) P2 bypass circuit
(E) P1 parallel circuit
(F) P2 parallel circuit
(G) Blade section

- When the blade control lever is lowered, the blade spool shifts downward.
- The travel LH and RH spools shut off the P1 and P2 bypass circuits.
- P1 and P2 pressurized oils flow to the blade section through the orifices 1 and 2.
- Due to the flow control of the orifices 1 and 2, P1 and P2 pressurized oils flow to the blade cylinder at the almost same flow rate.
- Travel straightness is secured even if the blade is operated during travel.

3.4.5 AUX converge circuit

When only the AUX section is operated, P1 and P2 pressurized oils converge.



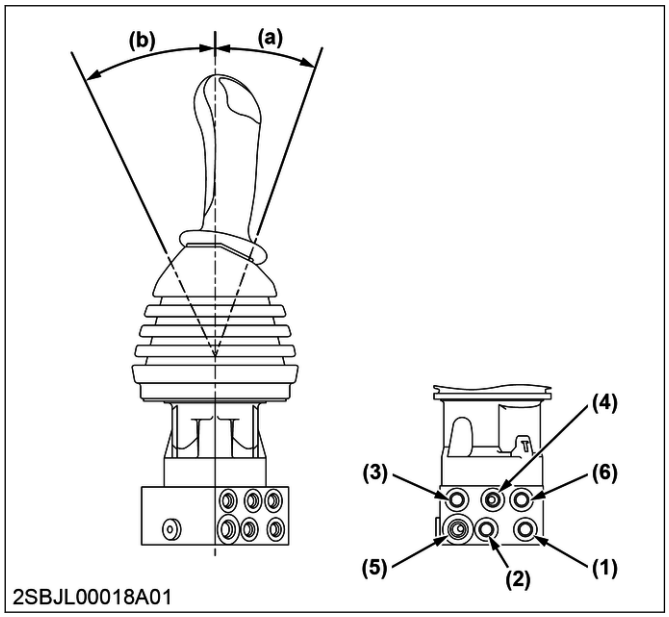
(1) AUX spool
(A) AUX section
(B) P1 bypass circuit
(C) P2 bypass circuit
(D) P1 parallel circuit
(E) P2 parallel circuit

- When the AUX control pedal is operated, the AUX spool is shifted downward.
- The AUX spool shuts off the P1 and P2 bypass circuits and the hydraulic oil tank circuits of P1 and P2.
- The P1 and P2 pressurized oils pass through each parallel circuit and flow to the AUX section.
- The P1 and P2 pressurized oils converge in the AUX section, pass through the AUX spool, and flow to the AUX.

4. Pilot control valve

4.1 Pilot control valve specifications

Pilot control valve LH



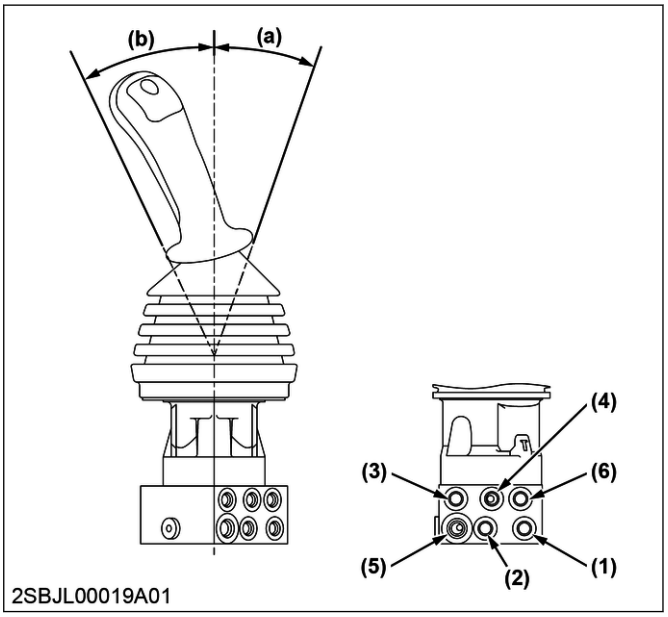
(a) Single operation angle: 19° (b) Simultaneous operation angle: 25°

	Specification
Manufacturer	Kawasaki Heavy industries, Ltd.

Port location table

No.	Port	Location
(1)	1	Control valve (Pa2) Swivel right
(2)	2	Control valve (Pb3) Arm crowd
(3)	3	Control valve (Pb2) Swivel left
(4)	4	Control valve (Pa3) Arm dump
(5)	P	Unload valve (A) Pilot pressure
(6)	T	Hydraulic oil tank

Pilot control valve RH



(a) Single operation angle: 19° (b) Simultaneous operation angle: 25°

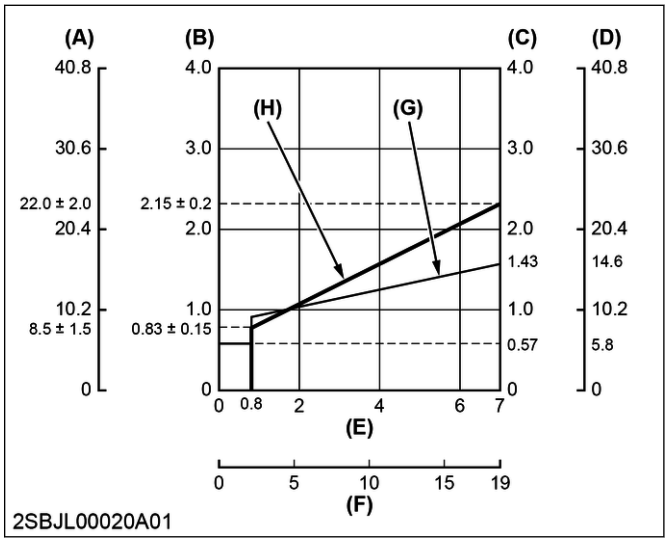
	Specification
Manufacturer	Kawasaki Heavy industries, Ltd.

Port location table

No.	Port	Location
(1)	1	Control valve (Pa9) Bucket dump
(2)	2	Control valve (Pb10) Boom lift
(3)	3	Control valve (Pb9) Bucket crowd
(4)	4	Control valve (Pa10) Boom lower
(5)	P	Unload valve (A) Pilot pressure
(6)	T	Hydraulic oil tank

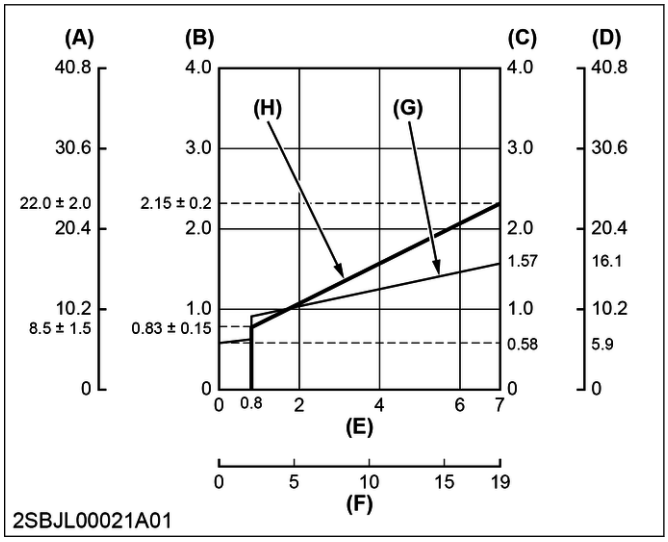
4.2 Pilot control valve performance diagram

Port 1, 3



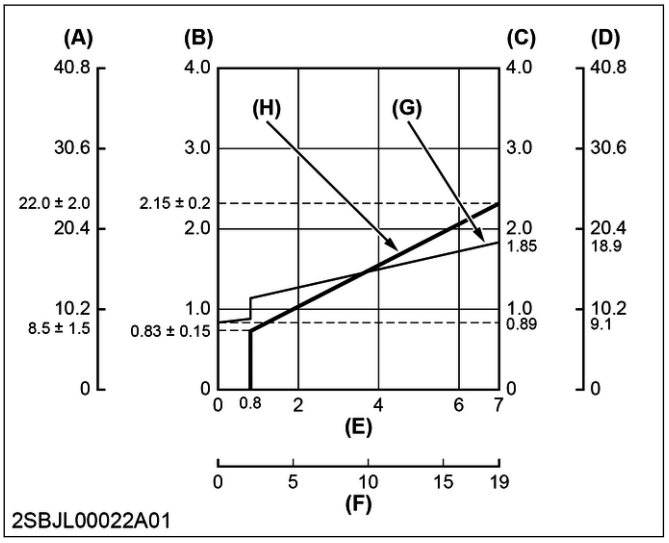
(A) Secondary pressure (kgf/cm^2)
(B) Secondary pressure (MPa)
(C) Operating torque (N·m)
(D) Operating torque (kgf·cm)
(E) Push rod stroke (mm)
(F) Operating angle (deg)
(G) Single operation torque
(H) Secondary pressure

Port 2



(A) Secondary pressure (kgf/cm^2)
(B) Secondary pressure (MPa)
(C) Operating torque (N·m)
(D) Operating torque (kgf·cm)
(E) Push rod stroke (mm)
(F) Operating angle (deg)
(G) Single operation torque
(H) Secondary pressure

Port 4

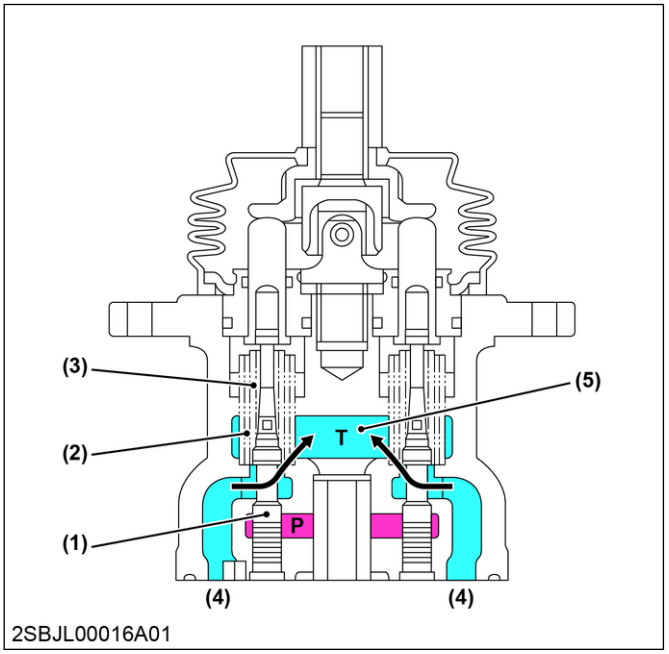


(A) Secondary pressure (kgf/cm^2)
(B) Secondary pressure (MPa)
(C) Operating torque (N·m)
(D) Operating torque (kgf·cm)
(E) Push rod stroke (mm)
(F) Operating angle (deg)
(G) Single operation torque
(H) Secondary pressure

4.3 Pilot control valve function and structure

Reduces pressure of Pp pressurized oil to control the direction and stroke of the spool in the control valve.

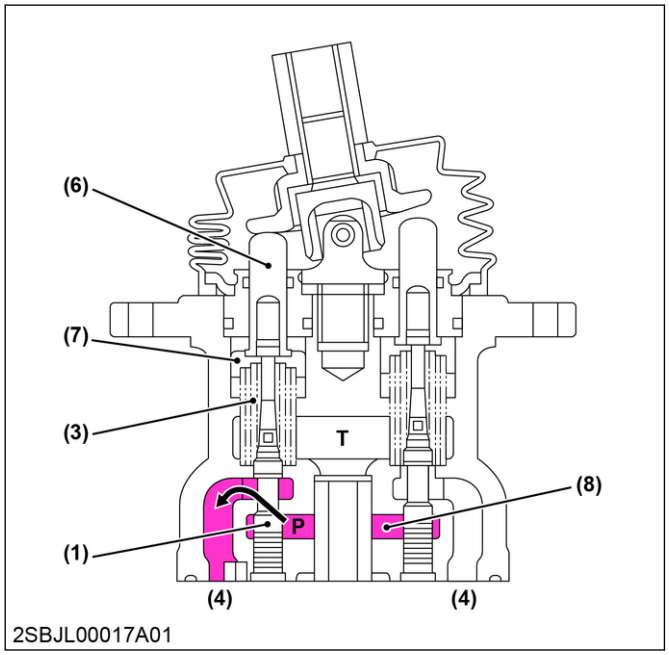
When not being operated



(1) Spool
(2) Return spring
(3) Secondary setting spring
(4) Output port
(5) Port T

- Pp pressurized oil is cut off by the spool.
- Output port is connected to the hydraulic oil tank.

When being operated

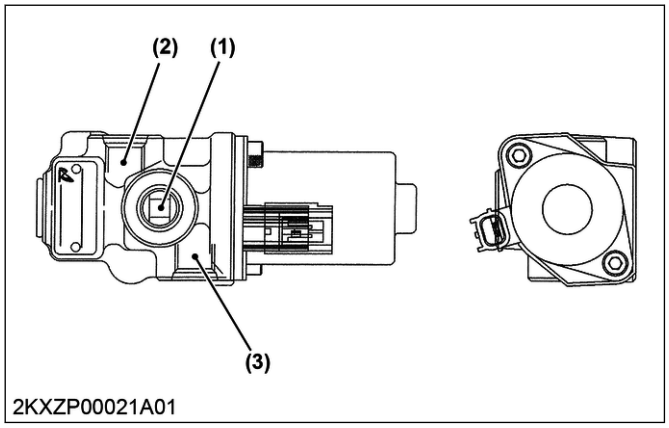


(1) Spool
(3) Secondary setting spring
(4) Output port
(6) Push rod
(7) Spring seat
(8) Port P

- The push rod pushes the spring seat.
- As the spring seat is pushed, the spool pushes the spring.
- The spool reduces the Pp pressure to the outlet port due to spool stroke.
- Reduced Pp pressurized oil flows to the control valve through the output port.

5. Unload valve

5.1 Unload valve specifications



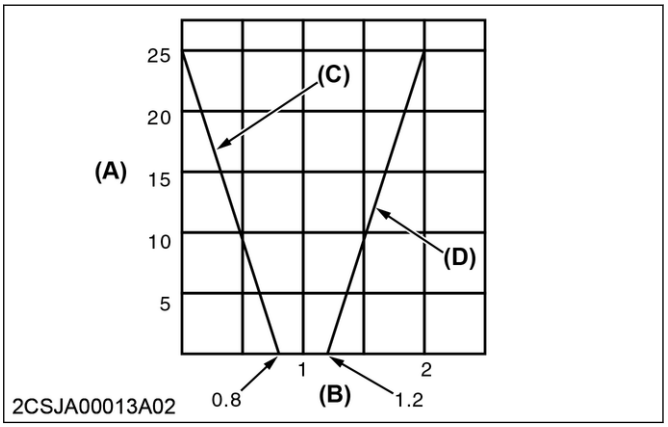
	Specification	Remark
Manufacturer	Nishina Industrial	-
Maximum pressure	4.9 MPa 50 kgf/cm^2 710 psi	-
T port allowable pressure	0.98 MPa or less 10 kgf/cm^2 or less 140 psi or less	-
Rated flow rate at port P → port A	7.0 L/min 1.8 U.S.gals/min	-
Internal leak volume at port P → port T	0.1 L/min or less 0.03 U.S.gals/min or less	At 4.9 MPa At 50 kgf/cm^2 At 710 psi

Port location table

No.	Port	Location
(1)	A	Pilot control valve (P) Control valve (Pp1) Control valve (Pp2)
(2)	P	Hydraulic pump (Pp)
(3)	T	Hydraulic oil tank

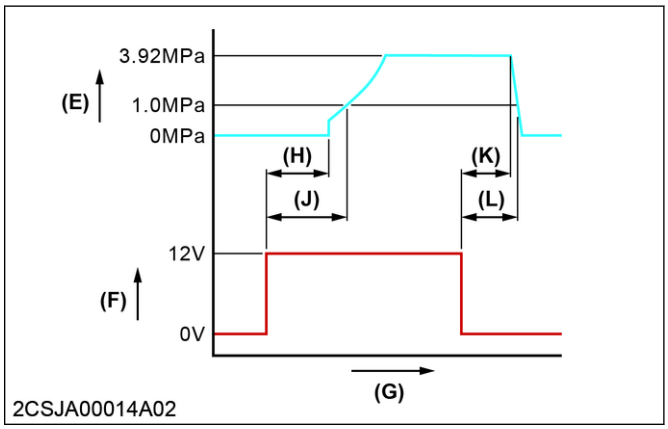
5.2 Unload valve control diagram

Spool opening diagram



(A) Opening area [mm^2]
(B) Stroke [mm]
(C) A → T
(D) P → A

Solenoid response diagram



(E) Port A pressure
(F) Solenoid voltage
(G) Time

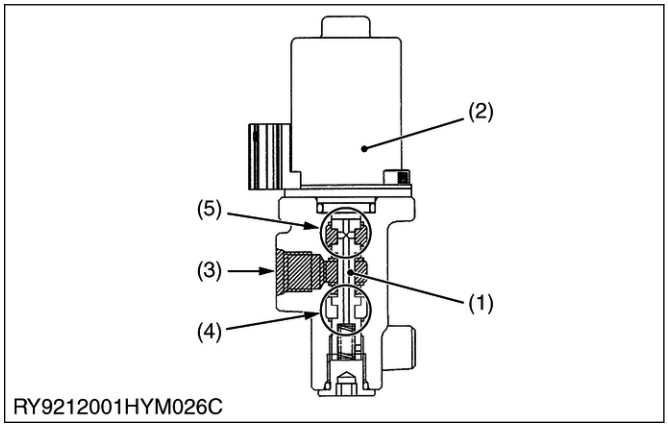
	Start (OFF to ON)		Stop (ON to OFF)	
Temperature condition	(H)	(J)	(K)	(L)
Low temperature	275 msec	375 msec	300 msec	350 msec

5.3 Unload valve function and structure

5.3.1 Unload valve working principles

The unload valve selects whether to flow or cut off the Pp pressurized oil to port Pp of the control valve.

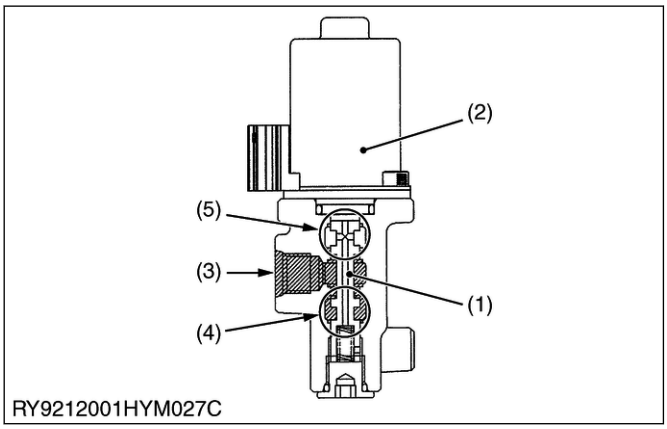
Solenoid OFF



(1) Spool
(2) Solenoid
(3) Port A
(4) Port P
(5) Port T

- Pp pressurized oil is cut off by the spool.
- No hydraulic oil flows to port Pp of the control valve.

Solenoid ON



(1) Spool
(2) Solenoid
(3) Port A
(4) Port P
(5) Port T

- The spool is pushed down to connect port P to port A.
- Pp pressurized oil flows to port Pp of the control valve through the opened spool.

SERVICING

1. Troubleshooting

1.1 Hydraulic troubleshooting for front attachment

The front attachment does not operate or operates slowly

Causes	Inspections	Actions
The engine is malfunctioning.	Measure the engine speed.	Adjust each part of the engine.
The hydraulic oil level is low. The hydraulic oil quality is low.	Check for the hydraulic oil level and oil quality.	Replenish or replace the hydraulic oil.
The suction line or suction filter is clogged.	Check if the suction line or suction filter is clogged.	Clean the suction line. Replace the suction filter.
The pilot filter is clogged.	Check if the pilot filter is clogged.	Replace the pilot filter.
The pilot primary pressure relief valve setting pressure is too low.	Measure the pilot primary pressure.	Adjust or replace the pilot primary pressure relief valve.
The pilot primary pressure relief valve spring is weakened or damaged.	Measure the pilot primary pressure.	Adjust or replace the pilot primary pressure relief valve.
The pilot primary pressure relief valve is clogged by contamination.	Measure the pilot primary pressure.	Clean or replace the pilot primary pressure relief valve.
The pilot pump is damaged.	Check for damage of the pilot pump.	Replace the pilot pump.
The main relief valve setting pressure is too low.	Measure the main relief valve pressure.	Adjust or replace the main relief valve.
The main relief valve spring is weakened or damaged.	Measure the main relief valve pressure.	Adjust or replace the main relief valve.
The main relief valve is clogged by contamination.	Measure the main relief valve pressure.	Clean or replace the main relief valve.
The hydraulic pump coupling is damaged.	Check for damage of the hydraulic pump coupling.	Replace the hydraulic pump coupling.
The drive shaft of the hydraulic pump is damaged.	Check for damage of the hydraulic pump drive shaft.	Replace the hydraulic pump drive shaft.
The internal parts of the hydraulic pump are damaged or worn.	Measure the hydraulic pump P-Q performance. Check for damage of the internal parts of the hydraulic pump.	Repair or replace the internal parts of the hydraulic pump.

The pilot control valve RH or LH does not operate or operates slowly

Causes	Inspections	Actions
The pilot line filter is clogged.	Check if the pilot line filter is clogged.	Clean the pilot line filter.
The pilot control valve spring is weakened or damaged.	Measure the pilot secondary pressure.	Replace the pilot control valve.
The pilot control valve is clogged by contamination.	Measure the pilot secondary pressure.	Clean or replace the pilot control valve.

Power of the entire hydraulic system is weak

Causes	Inspections	Actions
The pilot primary pressure relief valve setting pressure is too low.	Measure the pilot primary pressure.	Replace the pilot primary pressure relief valve.
The pilot primary pressure relief valve spring is weakened or damaged.	Measure the pilot primary pressure.	Adjust or replace the pilot primary pressure relief valve.
The pilot primary pressure relief valve is clogged by contamination.	Measure the pilot primary pressure.	Clean or replace the pilot primary pressure relief valve.
The main relief valve setting pressure is too low.	Measure the main relief valve pressure.	Adjust or replace the main relief valve.
The main relief valve spring is weakened or damaged.	Measure the main relief valve pressure.	Adjust or replace the main relief valve.
The main relief valve is clogged by contamination.	Measure the main relief valve pressure.	Clean or replace the main relief valve.

One of the cylinders does not operate or operates slowly

Causes	Inspections	Actions
The pilot control valve spring is weakened or damaged.	Measure the pilot secondary pressure.	Replace the pilot primary pressure relief valve.
The pilot control valve is clogged by contamination.	Measure the pilot secondary pressure.	Clean or replace the pilot control valve.
The overload relief valve setting pressure is too low.	Measure the overload relief valve pressure.	Adjust the overload relief valve.
The overload relief valve spring is weakened or damaged.	Measure the overload relief valve pressure.	Replace the control valve travel section.
The overload relief valve is clogged by contamination.	Measure the overload relief valve pressure.	Clean or replace the control valve travel section.
The spool of the control valve is damaged or stuck.	Check for damage or sticking of the control valve.	Disassemble and clean or replace the control valve section.

Large amount of cylinder leakage has occurred

Cause	Inspections	Actions
The overload relief valve setting pressure is too low.	Measure the overload relief valve pressure.	Adjust the overload relief valve.
The overload relief valve spring is weakened or damaged.	Measure the overload relief valve pressure.	Replace the control valve travel section.
The overload relief valve is clogged by contamination.	Measure the overload relief valve pressure.	Clean or replace the control valve travel section.
The spool of the control valve is damaged or stuck.	Check for damage or sticking of the control valve.	Disassemble and clean or replace the control valve section.
The internal leakage of the cylinder is too much.	Measure the cylinder internal leakage. Check for damage of the seal.	Repair or replace the cylinder.

1.2 Hydraulic troubleshooting for swivel

The swivel does not operate or operates slowly

Causes	Inspections	Actions
The pilot control valve spring is weakened or damaged.	Measure the pilot secondary pressure.	Replace the pilot primary pressure relief valve.
The pilot control valve is clogged by contamination.	Measure the pilot secondary pressure.	Clean or replace the pilot primary pressure relief valve.
The spool of the control valve swivel section is damaged or stuck.	Check for damage or sticking of the control valve swivel section.	Disassemble and clean or replace the control valve swivel section.
The overload relief valve setting pressure is too low.	Measure the overload relief valve pressure.	Adjust the overload relief valve.
The overload relief valve spring is weakened or damaged.	Measure the overload relief valve pressure.	Replace the overload relief valve.
The overload relief valve is clogged by contamination.	Measure the overload relief valve pressure.	Clean or replace the overload relief valve.
The internal leakage or drain of the swivel motor is too much.	Measure the swivel motor internal leakage. Measure the swivel motor drain.	Repair or replace the swivel motor.

The swivel is overrunning

Causes	Inspections	Actions
The pilot control valve spring is weakened or damaged.	Measure the pilot secondary pressure.	Replace the pilot primary pressure relief valve.
The pilot control valve is clogged by contamination.	Measure the pilot secondary pressure.	Clean or replace the pilot primary pressure relief valve.

(Continued)

Causes	Inspections	Actions
The spool of the control valve swivel section is damaged or stuck.	Check for damage or sticking of the control valve swivel section.	Repair or replace the control valve swivel section.
The overload relief valve setting pressure is too low.	Measure the overload relief valve pressure.	Adjust the overload relief valve.
The overload relief valve spring is weakened or damaged.	Measure the overload relief valve pressure.	Replace the overload relief valve.
The overload relief valve is clogged by contamination.	Measure the overload relief valve pressure.	Clean or replace the overload relief valve.
The internal leakage or drain of the swivel motor is too much.	Measure the swivel motor internal leakage. Measure the swivel motor drain.	Repair or replace the swivel motor.

1.3 Hydraulic troubleshooting for traveling

Does not travel, travel slowly, or not running straight

Cause	Inspections	Actions
The track tension is too loose or tight. The base carrier is clogged with dirt.	Check the track tension. Check for dirt clogging.	Adjust the track tension. Clean the base carrier.
The travel control lever or mechanical link is malfunctioning.	Check the travel control lever and mechanical link.	Adjust or replace the travel control lever and mechanical link.
The spool of the control valve travel section is damaged or stuck.	Check for damage or sticking of the control valve travel section.	Disassemble and clean, or replace the control valve travel section.
The spool of the counterbalance valve is damaged or stuck.	Check for damage or sticking of the counterbalance valve.	Disassemble and clean, or replace the counterbalance valve.
The internal leakage or drain of the travel motor is too much.	Measure the travel motor internal leakage. Measure the travel motor drain.	Disassemble or replace the travel motor.
The internal leakage of the swivel joint is occurring.	Disconnect the travel outlet hose of the swivel joint and install a plug, and then measure the relief pressure.	Replace the seal of the swivel joint.

2. Service specifications

2.1 Service specifications for hydraulic system

■ NOTE

- **Standard measurement condition is as follows:**
  - **– Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).**
  - **– Accelerate the engine to the maximum speed.**
  - **– Hydraulic cylinder speed does not include cushioning.**

			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Pressure	Main relief valve	P1 (aP1)	MPa kgf/cm^2 psi	17.7 180.5 2567	-0.5 to +0.3 -5.1 to +3.1 -73 to +44	-
		P2 (aP2)	MPa kgf/cm^2 psi	17.7 180.5 2567	-0.5 to +0.3 -5.1 to +3.1 -73 to +44	-
	Pilot primary pressure relief valve	Pilot primary (aPP)	MPa kgf/cm^2 psi	3.9 39.8 566	0 to +0.5 0 to +5.1 0 to +73	-
	Overload relief valve	Swivel left (cSL)	MPa kgf/cm^2 psi	7.5 76.5 1088	0 to +0.49 0 to +5.0 0 to +71	-
		Swivel right (cSR)	MPa kgf/cm^2 psi	7.5 76.5 1088	0 to +0.49 0 to +5.0 0 to +71	-
Flow rate	Hydraulic pump (main) (P1) (Engine speed: maximum, no load, maximum flow rate)		L/min U.S.gals/min	11.5 3.04	-	9.2 2.43
	Hydraulic pump (main) (P2) (Engine speed: maximum, no load, maximum flow rate)		L/min U.S.gals/min	11.6 3.06	-	9.3 2.46
	AUX (Engine speed: maximum, no load, maximum flow rate)		L/min U.S.gals/min	22.5 5.94	-	-
Internal leakage	Hydraulic cylinder	Boom (10 min, engine stopped)	mm in.	Less than 20.0 Less than 0.78	-	100.0 3.94
		Arm (10 min, engine stopped)	mm in.	Less than 11.0 Less than 0.43	-	55.0 2.17
		Bucket (10 min, engine stopped)	mm in.	Less than 10.0 Less than 0.39	-	50.0 1.97
		Blade (10 min, engine stopped)	mm in.	Less than 20.0 Less than 0.78	-	40.0 1.57
	Swivel motor	Engine stopped	mm in. °	Less than 93.4 Less than 3.7 Less than 30	-	93.4 3.7 30
	Travel motor	(20° slope)	mm in.	Less than 300 Less than 11.8	-	300 11.8

(Continued)

			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Speed	Boom cylinder	Lifting (Ground to highest)	s	2.5	±0.3	-
		Lowering (Highest to ground)	s	2.8	±0.3	-
	Arm cylinder	Crowding	s	4.0	±0.3	-
		Dumping	s	2.8	±0.3	-
	Bucket cylinder	Crowding	s	2.9	±0.3	-
		Dumping	s	2.0	±0.3	-
	Blade cylinder	Lifting (Lowest to highest)	s	1.6	±0.3	-
		Lowering (Highest to lowest)	s	1.2	±0.3	-
	Swing cylinder	Swing left	s	3.9	±0.3	-
		Swing right	s	3.6	±0.3	-
	Swivel motor	Left	rpm s/3 rotations	8.3 21.7	±0.8 -1.9 to +2.3	-
		Right	rpm s/3 rotations	8.3 21.7	±0.8 -1.9 to +2.3	-
	Travel motor	Low speed	s/10 m km/h mph	18.0 2.0 1.2	-1.6 to +2.0 ±0.2 ±0.1	-
		High speed	s/10 m km/h mph	9.0 4.0 2.5	-0.8 to +1.0 ±0.4 ±0.2	-
Travel straightness (10 m)			mm in.	-	-	1000 39.4

3. Testing

3.1 Measuring the hydraulic devices

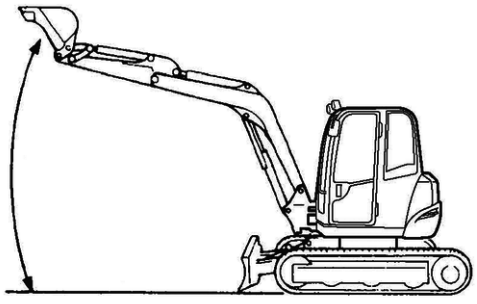
3.1.1 Measuring the boom cylinder speed

⚠ CAUTION
- **Keep any persons or objects away from the machine.**

Measuring
1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Dump the arm to the stroke end, dump the bucket to the stroke end, lower the boom to the ground, and accelerate the engine to the maximum speed.
3. Lift the boom to the stroke end in full-stroke operation to measure the boom cylinder speed.

■ NOTE
- **Do not include cushion range.**

4. Measure 3 times to calculate the average.
5. Measure the boom lowering speed as well.



RY9212001HYS564A

Service specification

Boom cylinder speed	Lifting (Ground to highest)	2.2 to 2.8 s
	Lowering (Highest to ground)	2.5 to 3.1 s

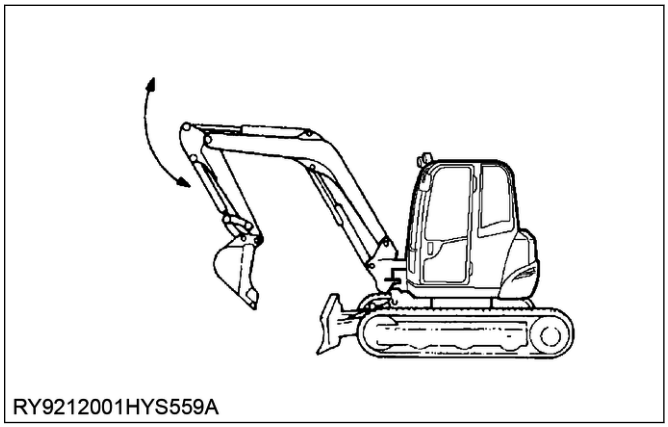
3.1.2 Measuring the arm cylinder speed

⚠ CAUTION
- **Keep any persons or objects away from the machine.**

Measuring
1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Dump the arm to the stroke end and accelerate the engine to the maximum speed.
3. Crowd the arm to the stroke end in full-stroke operation to measure the arm cylinder speed.

■ NOTE
- **Do not hit the ground or blade with the bucket.**

4. Measure 3 times to calculate the average.
5. Measure the arm dumping speed as well.


RY9212001HYS559A

Service specification

Arm cylinder speed	Crowding	3.7 to 4.3 s
	Dumping	2.5 to 3.1 s

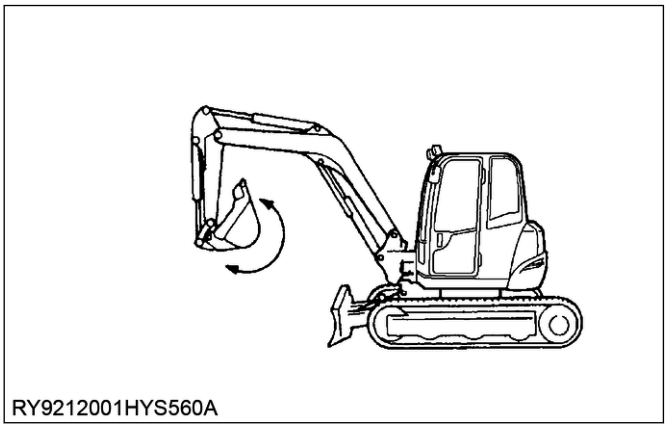
3.1.3 Measuring the bucket cylinder speed

⚠ CAUTION
- **Keep any persons or objects away from the machine.**

Measuring
1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Dump the bucket to the stroke end and accelerate the engine to the maximum speed.
3. Crowd the bucket to the stroke end in full-stroke operation to measure the bucket cylinder speed.

■ NOTE
- **Do not hit the ground or blade with the bucket.**

4. Measure 3 times to calculate the average.
5. Measure the bucket dumping speed as well.


RY9212001HYS560A

Service specification

Bucket cylinder speed	Crowding	2.6 to 3.2 s
	Dumping	1.7 to 2.3 s

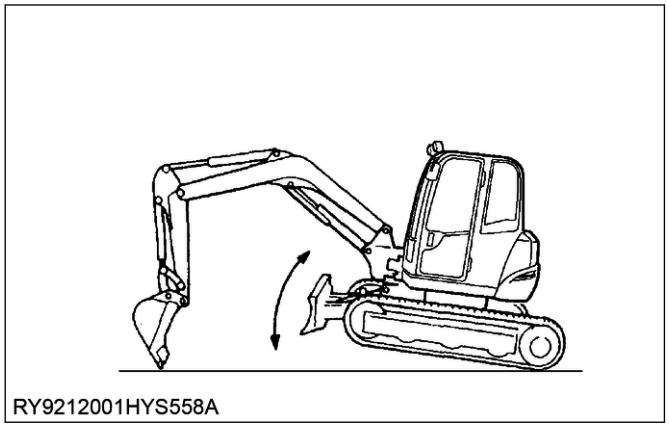
3.1.4 Measuring the blade cylinder speed

⚠ CAUTION
- **Keep any persons or objects away from the machine.**

Measuring
1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Jack up the machine with the front attachment, lower the blade to the stroke end, and accelerate the engine to the maximum speed.

■ NOTE
- **Do not hit the ground with the lower end of the blade.**

3. Lift the blade to the stroke end in full-stroke operation to measure the blade cylinder speed.
4. Measure 3 times to calculate the average.
5. Measure the blade lowering speed as well.


RY9212001HYS558A

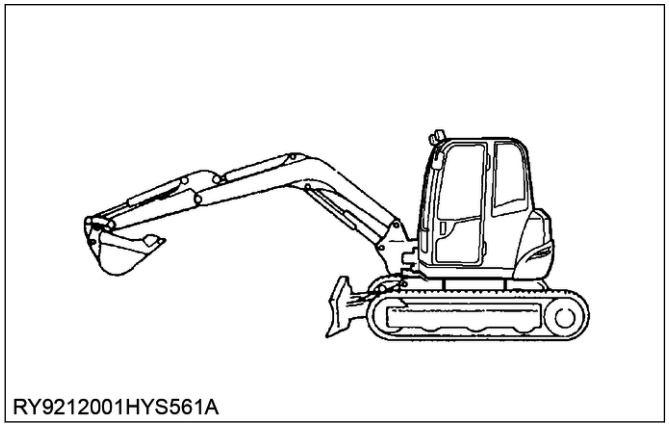
Service specification

Blade cylinder speed	Lifting (Lowest to highest)	1.3 to 1.9 s
	Lowering (Highest to lowest)	0.9 to 1.5 s

3.1.5 Measuring the swing cylinder speed

⚠ CAUTION
- **Keep any persons or objects away from the machine.**

Measuring
1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Dump the arm to the stroke end, crowd the bucket to the stroke end, set the bottom surface of the bucket at 1 meter above the ground, and accelerate the engine to the maximum speed.
3. Swing the boom from the left end to the right end in full-stroke operation to measure the swing cylinder speed.
4. Measure 3 times to calculate the average.
5. Measure the reverse direction speed as well.


RY9212001HYS561A

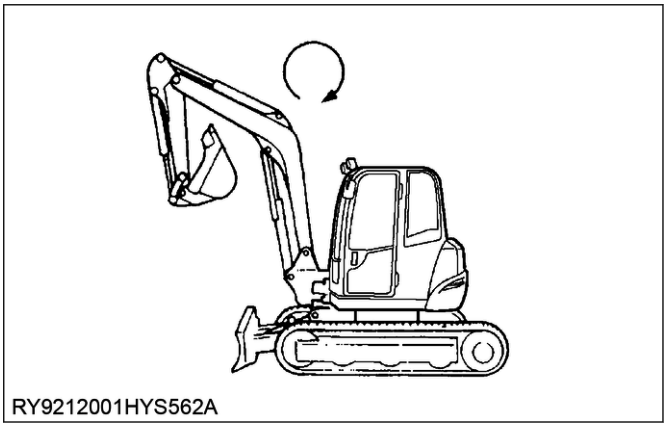
Service specification

Swing cylinder speed	Swing left	3.6 to 4.2 s
	Swing right	3.3 to 3.9 s

3.1.6 Measuring the swivel speed

⚠ CAUTION
- **Keep any persons or objects away from the machine.**

Measuring
1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Lift the boom to the stroke end, crowd the arm to the stroke end, crowd the bucket to the stroke end, and accelerate the engine to the maximum speed.
3. Swivel to left in full-stroke operation until the swivel speed becomes uniform, and measure the swivel speed for 3 rotations.
4. Measure 3 times to calculate the average.
5. Measure the right swivel speed as well.


RY9212001HYS562A

Service specification

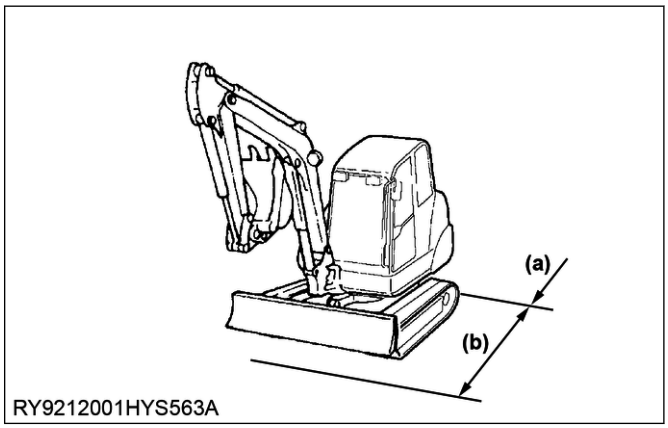
Swivel speed	Left	19.8 to 24.0 s/3 rotations (7.5 to 9.1 rpm)
	Right	

3.1.7 Measuring the travel speed

⚠ CAUTION
- **Keep any persons or objects away from the machine.**

Measuring
1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Set the machine to the traveling position and accelerate the engine to the maximum speed.

3. Perform an approach run for 5 m (196.8 in.), and measure the time for traveling 10 m (393.7 in.) in full-stroke operation after the said approach run.
4. Measure 3 times to calculate the average.



(a) Approach run distance (5 m (196.8 in.))
(b) Measuring distance (10 m (393.7 in.))

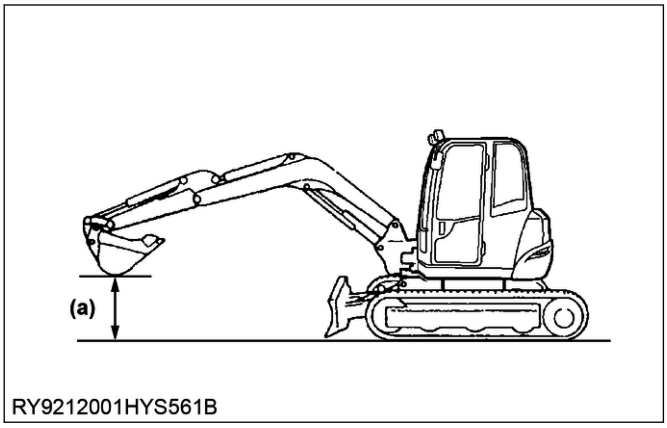
Service specification

Travel speed	Low speed	16.4 to 20.0 s/10 m 1.8 to 2.2 km/h 1.1 to 1.3 mph
	High speed	8.2 to 10.0 s/10 m 3.6 to 4.4 km/h 2.3 to 2.7 mph

3.1.8 Measuring the cylinder internal leakage

⚠ CAUTION
- **Keep any persons or objects away from the machine.**

Measuring the boom, arm, and bucket cylinders
1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Put an approximately 36.0 kg (79.4 lbs) of weight (soil) on the bucket.
3. Park the machine on the firm and level ground.
4. Dump the arm to the stroke end, crowd the bucket to the stroke end, set the bucket bottom surface at 1 m (39.4 in.) above the ground, and stop the engine.

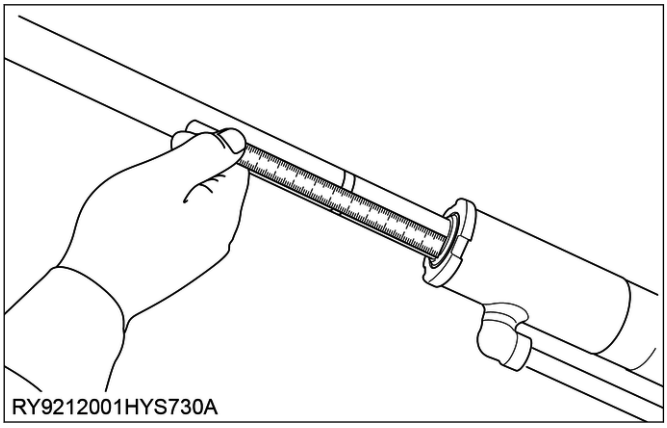


(a) 1 m (39.4 in.)

5. Put marks on the boom, arm, and bucket cylinder rods.
6. Measure internal leakage for each cylinder after waiting for 10 minutes.

■ NOTE
- **Measure the compressed distance of the rod of the bucket cylinder.**
- **Measure the extended distance of the rod of the boom and arm cylinder.**

7. Measure 3 times to calculate the average.



Service specification

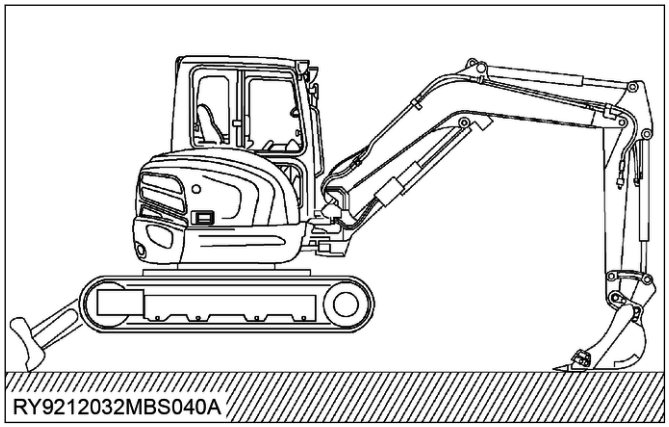
Internal leakage	Boom cylinder	Less than 20 mm Less than 0.78 in.
	Arm cylinder	Less than 11.0 mm Less than 0.43 in.
	Bucket cylinder	Less than 10.0 mm Less than 0.39 in.

Service limit

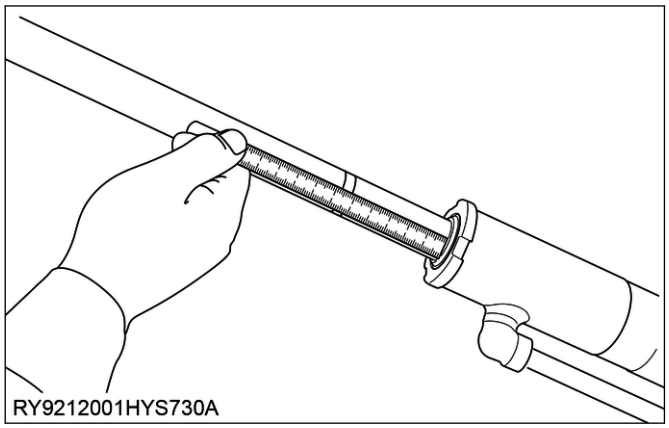
Internal leakage	Boom cylinder	100.0 mm 3.94 in.
	Arm cylinder	55.0 mm 2.17 in.
	Bucket cylinder	50.0 mm 1.97 in.

Measuring the blade cylinder

1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Operate the front attachment and blade to jack up the machine.
3. Fully extend the blade and crowd the arm to the vertical position.


RY9212032MBS040A

4. Stop the engine and put a mark on the blade cylinder rod.
5. Measure internal leakage for each cylinder after waiting for 10 minutes.
6. Measure 3 times to calculate the average.


RY9212001HYS730A

Service specification

Internal leakage	Blade cylinder	Less than 20.0 mm Less than 0.78 in.

Service limit

Internal leakage	Blade cylinder	40.0 mm 1.57 in.

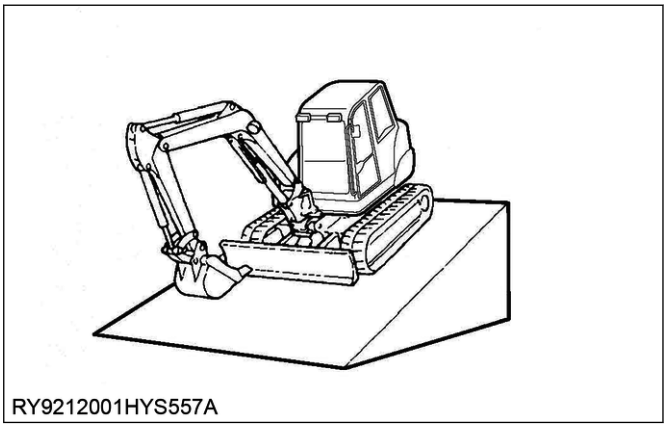
3.1.9 Measuring the travel motor internal leakage

⚠ CAUTION

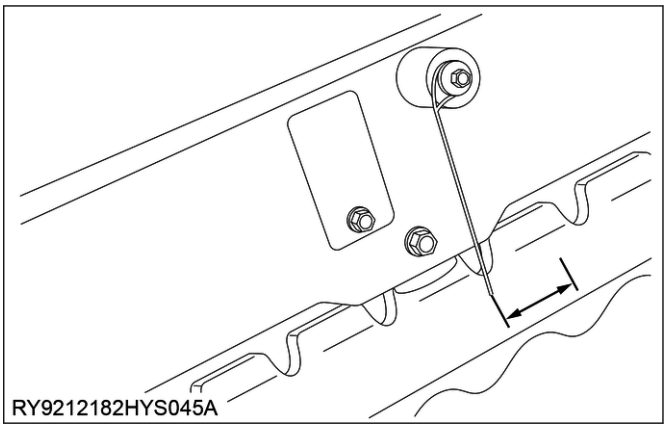
- **Keep any persons or objects away from the machine.**

Measuring

1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Park the machine on the firm slope with 20° of inclination.
3. Set the machine to the traveling position and stop the engine.


RY9212001HYS557A

4. Put a mark on the track frame and track.
5. Measure the internal leakage between the track frame and track after 10 minutes.
6. Measure 3 times to calculate the average.


RY9212182HYS045A

Service specification

Internal leakage	Travel motor (20° slope)	300 mm 11.8 in.

3.1.10 Measuring the swivel motor internal leakage

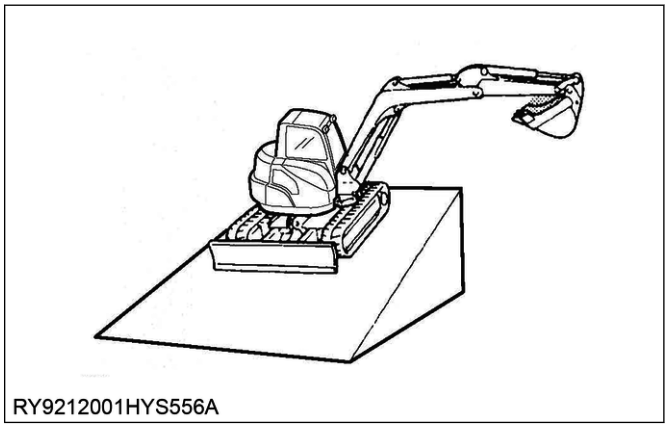
⚠ CAUTION

- **Keep any persons or objects away from the machine.**

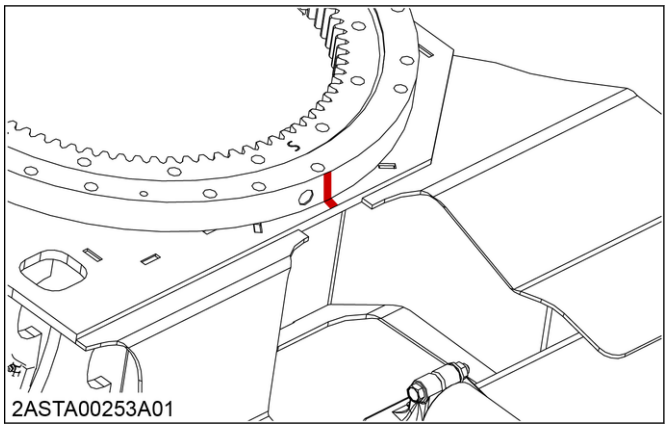
Measuring

1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Put an approximately 36.0 kg (79.4 lbs) of weight (soil) into the bucket.

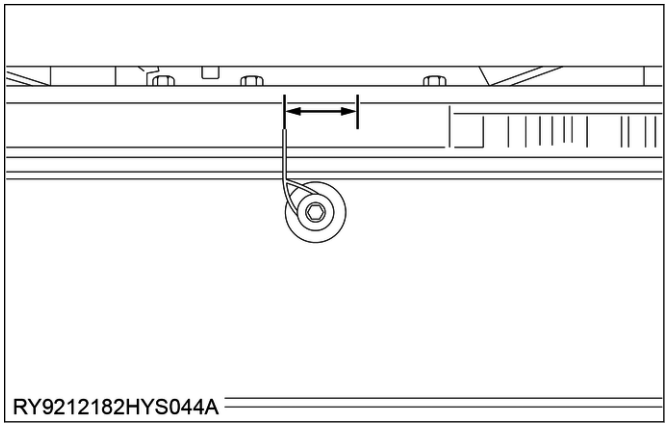
3. Park the machine on a firm slope with 15° of inclination. Swivel the machine 90° against the slope.
4. Dump the arm to the stroke end, crowd the bucket to the stroke end, and set the boom support pin and the bucket pin in straight line and stop the engine.


RY9212001HYS556A

5. Put a mark on the swivel bearing and track frame.


2ASTA00253A01

6. After waiting for 1 minute, measure the internal leakage between the swivel bearing and the track frame.
7. Measure 3 times to calculate the average.
8. Measure for the opposite direction (180°) as well.


RY9212182HYS044A

Service specification

Internal leakage	Swivel motor (Engine is stopped)	Less than 93.4 mm Less than 3.7 in. Less than 30°

Service limit

Internal leakage	Swivel motor (Engine is stopped)	93.4 mm 3.7 in. 30°

3.1.11 Testing the travel straightness

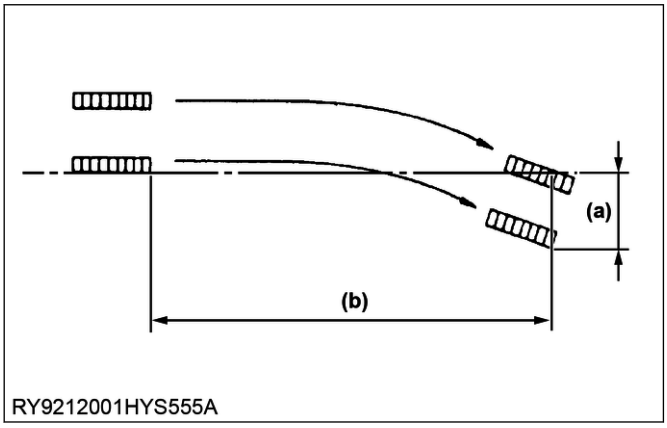
⚠ CAUTION
- **Keep any persons or objects away from the machine.**

Measuring

1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Adjust the tensions of left and right tracks to be equal.
3. Set the machine to the traveling position.
4. Mark the starting position.
5. Accelerate the engine to the maximum speed.
6. Operate the travel control lever in full stroke to make the machine travel forwards for 10 m (393.7 in.).

■ NOTE
- **Make sure to start the machine straightly.**

7. Measure the distance (a).
8. Measure 3 times to calculate the average.
9. Measure the distance for backward travel as well.



RY9212001HYS555A

(a) Distance (b) 10 m (393.7 in.)

Service limit

(a)	1000 mm 39.4 in.

3.2 Measuring the hydraulic pump

3.2.1 Measuring the main pump flow rate

The hydraulic pump may have a problem in case that hydraulic devices are slow and hydraulic force is insufficient. Measure the hydraulic pump flow rate to check if it is normal.

⚠ CAUTION

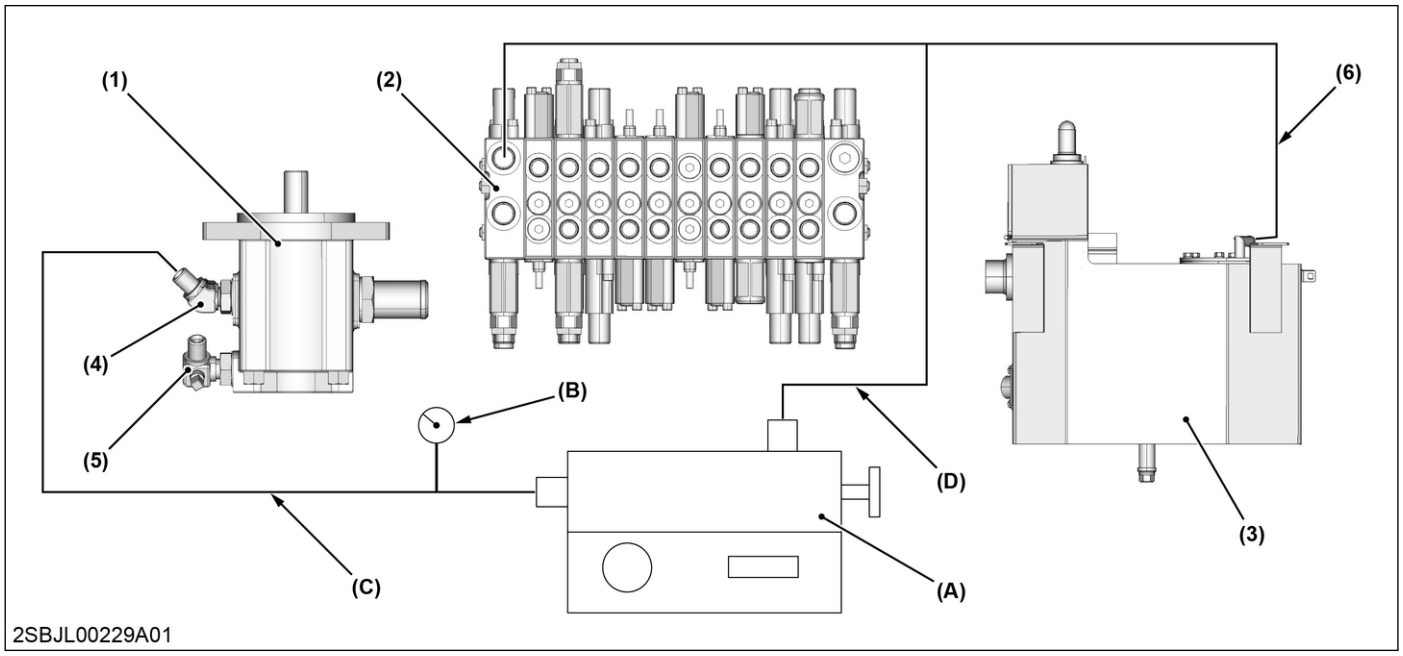
- **The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.**
- **Before disconnecting the hydraulic hoses, release the residual pressure first.**
- **Keep any persons or objects away from the machine.**

■ IMPORTANT

- **Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.**

Preparing

1. Park the machine on the firm and level ground, and stop the engine.
2. Release the residual pressure of the hydraulic circuit.
3. Vacuum the hydraulic oil tank.
4. Disconnect the port P1 delivery hose on the hydraulic pump side and plug the disconnected hoses.
5. Connect test hose (A) to the hydraulic pump port P1 and the flow meter **[IN]** port.
6. Connect test hose (B) to the flow meter **[OUT]** port and the return hose.
7. If the flow meter does not have an integrated pressure gauge, install pressure gauges to the ports P1 of the hydraulic pump.
8. Remove the vacuum pump and check for oil leakage in each piping hose in idling.



(1) Hydraulic pump (main)
(2) Control valve
(3) Hydraulic oil tank
(4) Port P1
(5) Port P2
(6) Return hose
(A) Flow meter
(B) Pressure gauge
(C) Test hose (A)
(D) Test hose (B)

Measuring

1. Open the loading valve (restrictor valve) of the flow meter completely and start up the engine.
2. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
3. Set the engine speed to the maximum.
4. Measure the flow rate 3 times and calculate the average.
5. Measure the flow rate the P2 in the same way.

Service specification

P1 main pump flow rate	11.5 L/min 3.04 U.S.gals/min
P2 main pump flow rate	11.6 L/min 3.06 U.S.gals/min

Service limit

P1 main pump flow rate	9.2 L/min 2.43 U.S.gals/min
P2 main pump flow rate	9.3 L/min 2.46 U.S.gals/min

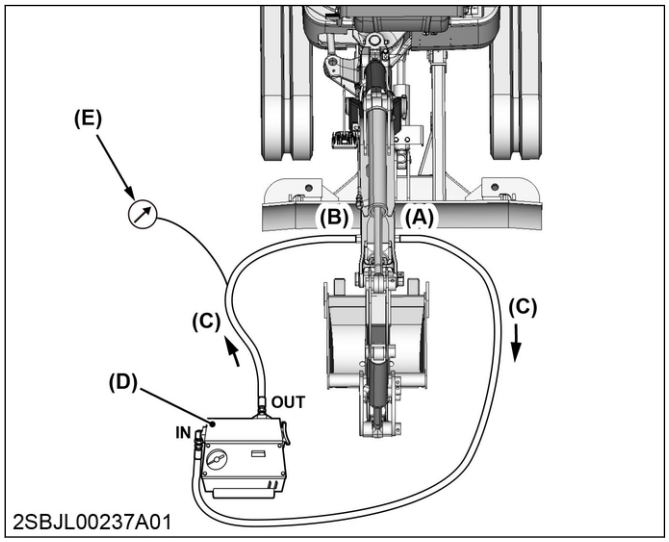
- The service limit is 80% of the service specification.

3.2.2 Measuring the AUX flow rate

⚠ CAUTION
- **The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.**
- **Before disconnecting the hydraulic hoses, release the residual pressure first.**
- **Keep any persons or objects away from the machine.**

■ IMPORTANT
- **Install the plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.**

Preparing
1. Park the machine on the firm and level ground and stop the engine.
2. Release the residual pressure of the hydraulic circuit.
3. Vacuum the hydraulic oil tank.
4. Connect a test hose from the AUX discharging port to the flow meter **[IN]** port.
5. Connect a test hose from the AUX returning port to the flow meter **[OUT]** port.



(A) AUX discharging port
(B) AUX returning port
(C) Test hose
(D) Flow meter
(E) Pressure gauge

6. Install the pressure gauge to the return side.
7. Remove the vacuum pump and check for oil leakage in each piping hose in idling.

Measuring
1. Open the loading valve (restrictor valve) of the flow meter completely and start up the engine.
2. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
3. Set the engine speed to the maximum.
4. Measure the flow rate 3 times and calculate the average.

Service specification

AUX flow rate	22.5 L/min 5.94 U.S.gals/min

3.3 Measuring the control valve

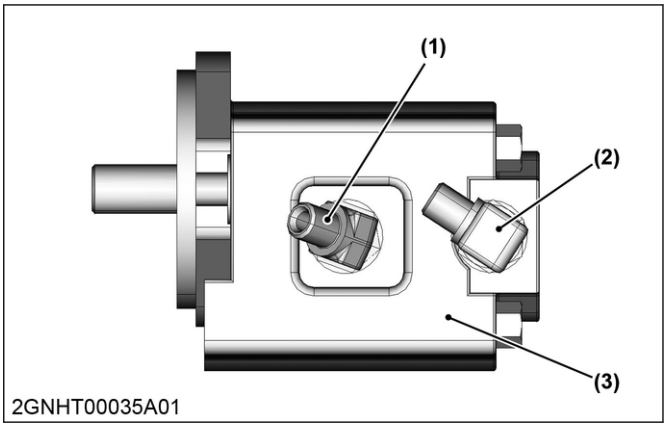
3.3.1 Measuring the main relief valve pressure

The main relief valves may have a problem in case that the hydraulic force is insufficient. Measure the relief pressures of the main relief valves to check the condition of the main relief valves.

⚠ CAUTION
- **The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.**
- **Before disconnecting the hydraulic hoses, release the residual pressure first.**
- **Keep any persons or objects away from the machine.**

■ IMPORTANT
- **Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.**

Preparing
1. Park the machine on the firm and level ground and stop the engine.
2. Release the residual pressure of the hydraulic circuit.
3. Vacuum the hydraulic oil tank.
4. Install a pressure gauge to port P1, P2.



(1) Port P1
(2) Port P2
(3) Hydraulic pump

5. Remove the vacuum pump and check for oil leakage in each piping hose in idling.

Measuring

1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Set the engine speed to the maximum.
3. To measure the pressure of main relief valve, operate the pilot control lever gradually until the main relief valve is relieved.

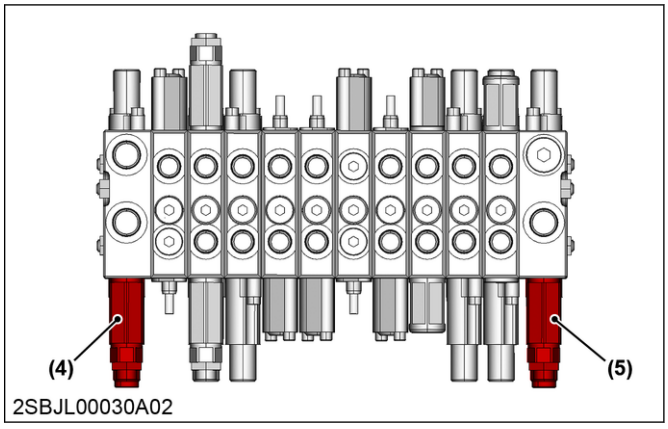
   NOTE
   - **P1 main relief valve: swivel, arm, travel motor LH, blade, AUX**
   - **P2 main relief valve: boom, bucket, swing, travel motor RH**
4. Measure 3 times to calculate the average.

Service specification

P1 main relief valve pressure	17.2 to 18.0 MPa 175.4 to 183.6 kgf/cm^2 2494 to 2611 psi
P2 main relief valve pressure	17.2 to 18.0 MPa 175.4 to 183.6 kgf/cm^2 2494 to 2611 psi

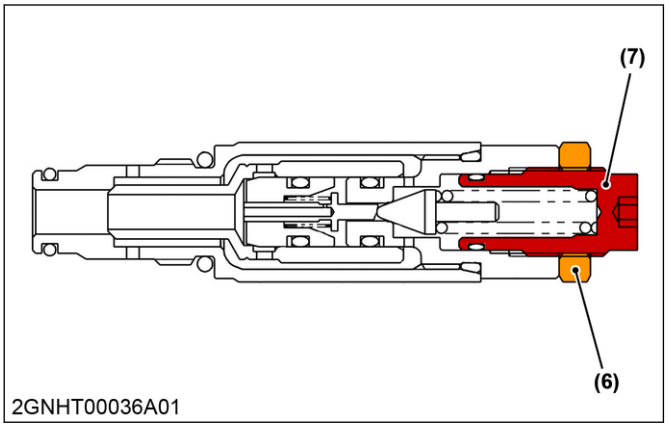
Adjusting

CAUTION
- **Adjust main relief valves only if their pressures are too low.**
- **Do not set main relief pressures exceeding their setting pressures to avoid damage on the machine components.**



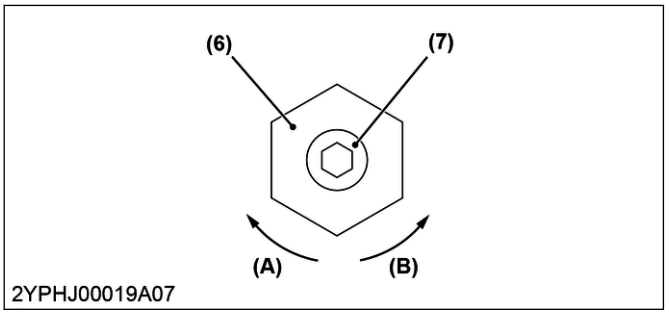
(4) P1 main relief valve (aP1) (5) P2 main relief valve (aP2)

1. Loosen the locknut of the relief valve.



(6) Locknut (7) Adjusting screw

2. Adjust the relief pressure with the adjusting screw and tighten the locknut.



(6) Locknut (B) Decrease relief pressure
(7) Adjusting screw
(A) Increase relief pressure

Tightening torque

(6) Locknut	19.6 N·m 2.0 kgf·m 14.5 lbf·ft	-

3. Operate the pilot control lever while the engine speed is maximum, and check the main relief pressure.

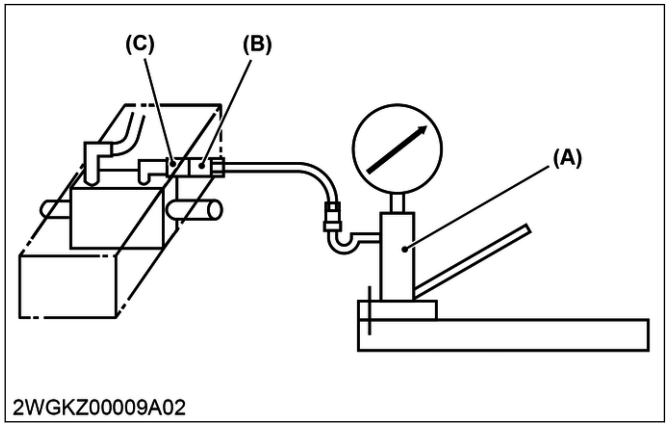
3.3.2 Measuring the overload relief valve pressure

The overload relief valve may have a problem in case that hydraulic force is insufficient. Measure the relief pressure of the overload relief valve to check the condition of the overload relief valve.

CAUTION
- **Park the machine on the firm and level ground and stop the engine.**
- **The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.**
- **Before disconnecting the hydraulic hoses, release the residual pressure first.**

IMPORTANT
- **Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.**

Preparing
1. Park the machine on the firm and level ground and stop the engine.
2. Release the residual pressure of the hydraulic circuit.
3. Vacuum the hydraulic oil tank.
4. Disconnect the high pressure hose which is connected to the overload relief valve.
5. Install the pressure measurement kit.



(A) Pressure measurement kit
(B) Pipe fittings
(C) Pipe fittings

6. Remove the vacuum pump.

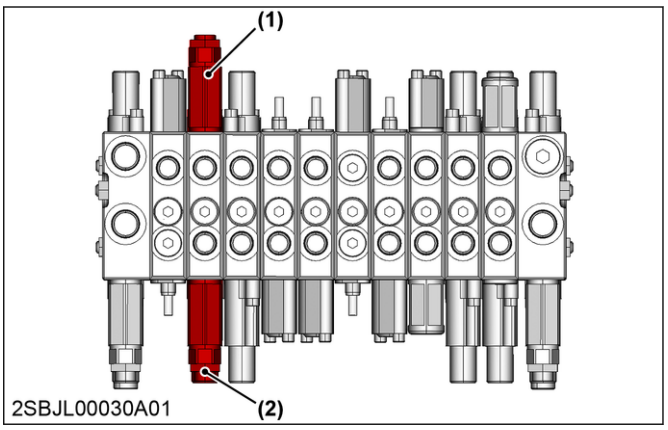
Measuring
1. Apply pressure with the pressure measurement kit to relieve the overload relief valve, and measure the pressure when the overload relief valve relieves.
2. Measure 3 times to calculate the average.

Service specification

Swivel	Right (cSR)	7.50 to 7.99 MPa 76.5 to 81.5 kgf/cm^2 1088 to 1159 psi
	Left (cSL)	7.50 to 7.99 MPa 76.5 to 81.5 kgf/cm^2 1088 to 1159 psi

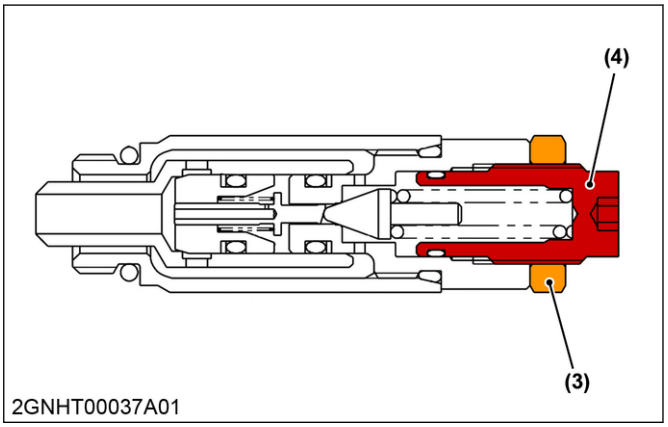
Adjusting

IMPORTANT
- **Adjust the overload relief pressure only if the overload relief pressure is too low.**
- **When disconnecting the pressure measuring kit, take appropriate care in removing it as the line is pressurized.**
- **Do not set the overload relief pressure exceeding the setting pressure to avoid damage on the machine components.**



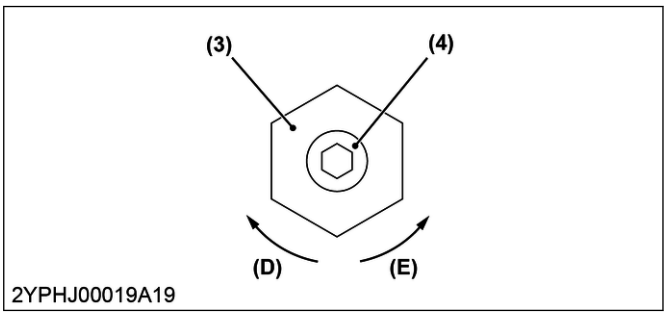
(1) Swivel right
(2) Swivel left

1. Loosen the locknut of the relief valve.



(3) Locknut
(4) Adjusting screw

2. Adjust the relief pressure with the adjusting screw and tighten the locknut.



(3) Locknut
(4) Adjusting screw
(D) Increase relief pressure
(E) Decrease relief pressure

Tightening torque

(3) Locknut	19.6 N·m 2.0 kgf·m 14.5 lbf·ft	-

3. Check the overload relief pressure with the pressure measurement kit.

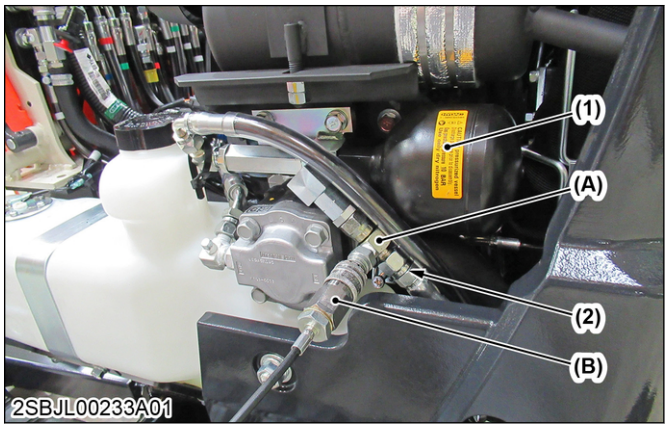
3.4 Measuring the pilot control valve

3.4.1 Measuring the pilot primary pressure

CAUTION
- **The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.**
- **Before disconnecting the hydraulic hoses, release the residual pressure first.**

IMPORTANT
- **Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.**

Preparing
1. Park the machine on the firm and level ground, lower the front attachment to the ground, and stop the engine.
2. Release the residual pressure of the hydraulic circuit.
3. Vacuum the hydraulic oil tank.
4. Connect the T-joint to the pilot hose of the accumulator and install the pressure gauge.



(1) Accumulator
(2) Pilot hose
(A) T-joint
(B) Pressure gauge

5. Remove the vacuum pump and check for oil leakage in each piping hose in idling.

Measuring
1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Set the engine speed to the maximum.
3. Measure the pilot primary pressure when unloaded.
4. Measure 3 times to calculate the average.

Service specification

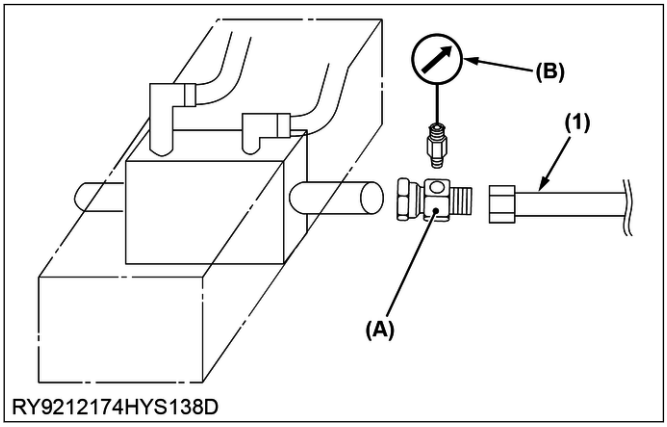
Pilot primary pressure	3.9 to 4.4 MPa 39.8 to 44.9 kgf/cm^2 566 to 639 psi

3.4.2 Measuring the pilot secondary pressure

CAUTION
- **The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.**
- **Keep any persons or objects away from the machine.**
- **Before disconnecting the hydraulic hoses, release the residual pressure first.**

IMPORTANT
- **Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.**

Preparing
1. Park the machine on the firm and level ground, lower the front attachment to the ground, and stop the engine.
2. Release the residual pressure of the hydraulic circuit.
3. Vacuum the hydraulic oil tank.
4. Connect the T-joint to the pilot port of the control valve and install the pressure gauge.



(1) Pilot hose
(A) T-joint
(B) Pressure gauge

5. Remove the vacuum pump and check for oil leakage in each piping hose in idling.

Measuring
1. Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).
2. Set the engine speed to the maximum.
3. Operate the lever in full stroke and measure the pressure.
4. Measure 3 times to calculate the average.

Service specification

	Specification
Swivel left	2.2 MPa 22.4 kgf/cm^2 319.1 psi
Swivel right	2.2 MPa 22.4 kgf/cm^2 319.1 psi
Arm dump	2.1 MPa 21.4 kgf/cm^2 304.6 psi
Arm crowd	2.2 MPa 22.4 kgf/cm^2 319.1 psi
Bucket dump	2.2 MPa 22.4 kgf/cm^2 319.1 psi
Bucket crowd	2.2 MPa 22.4 kgf/cm^2 319.1 psi
Boom lift	2.2 MPa 22.4 kgf/cm^2 319.1 psi
Boom lower	2.1 MPa 21.4 kgf/cm^2 304.6 psi

4. Repairing

4.1 Control valve

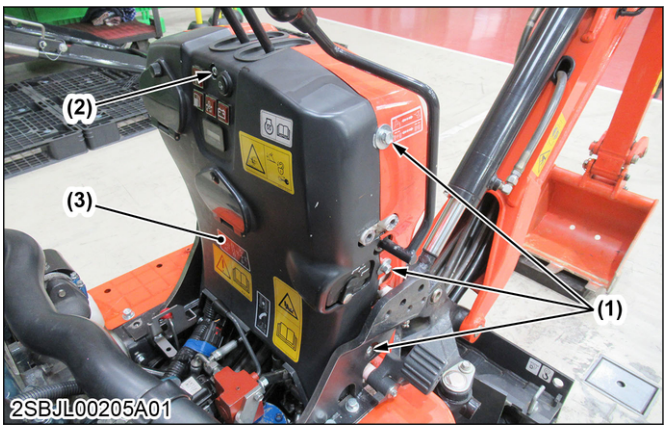
4.1.1 Removing and installing the control valve

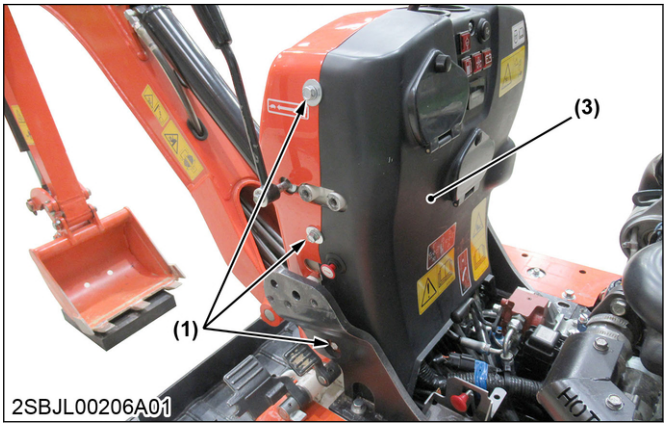
⚠ CAUTION
- **The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.**
- **Before disconnecting the hydraulic hoses, release the residual pressure first.**

■ IMPORTANT
- **Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.**
- **Put a mark on the disconnected hydraulic hoses to reconnect each hose correctly.**

Preparing
1. Release the residual pressure.
2. Remove the rubber mat.
3. Remove the step.
4. Remove the canopy.
5. Vacuum the hydraulic oil tank.

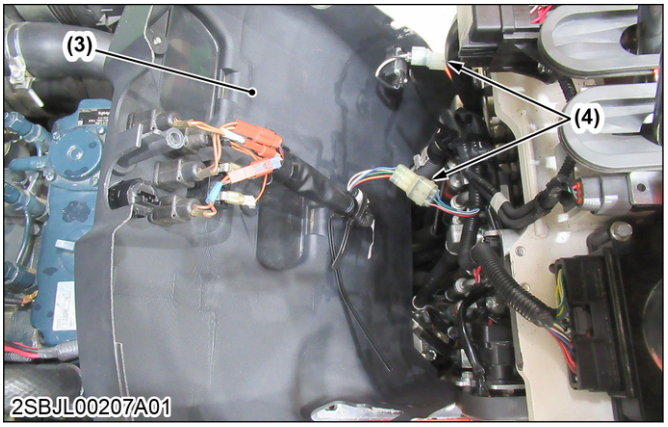
Removing
1. Remove the 6 bolts and screw.





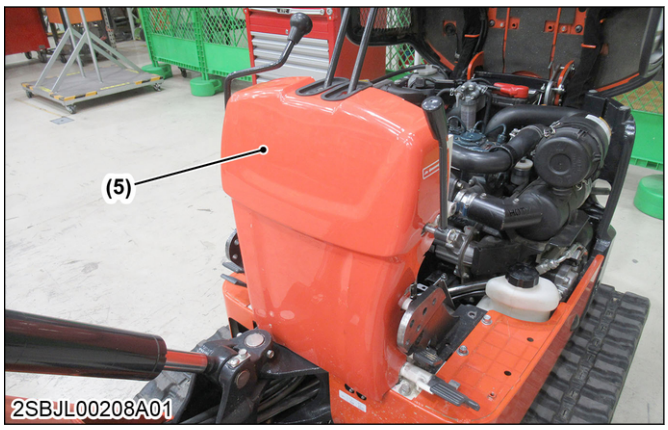
(1) Bolt (M8 × 20) ×6
(2) Screw
(3) Rear cover

2. Disconnect the 2 connectors to remove the rear cover.



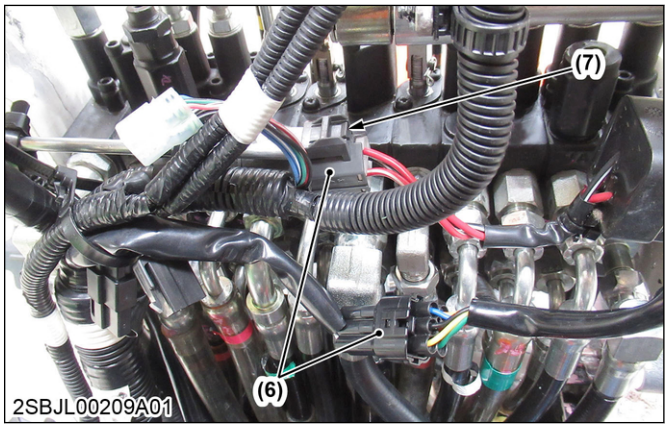
(3) Rear cover
(4) Connector ×2

3. Remove the front cover.



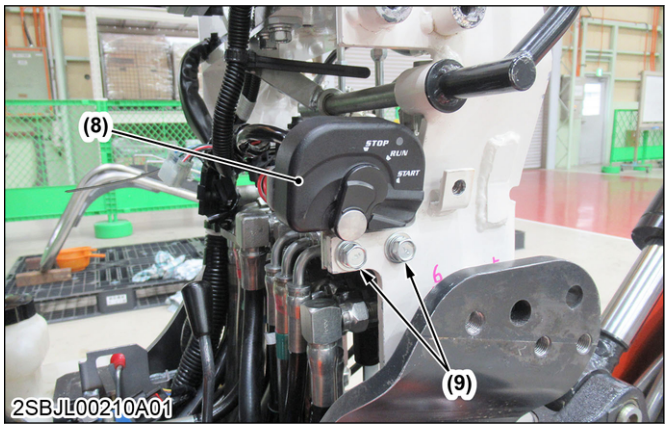
(5) Front cover

4. Disconnect the 2 connectors and clamp.



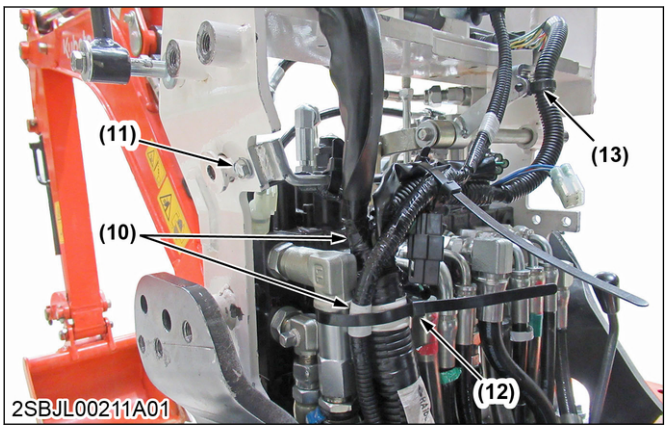
(6) Connector ×2
(7) Clamp

5. Remove the 2 bolts to remove the starter switch.



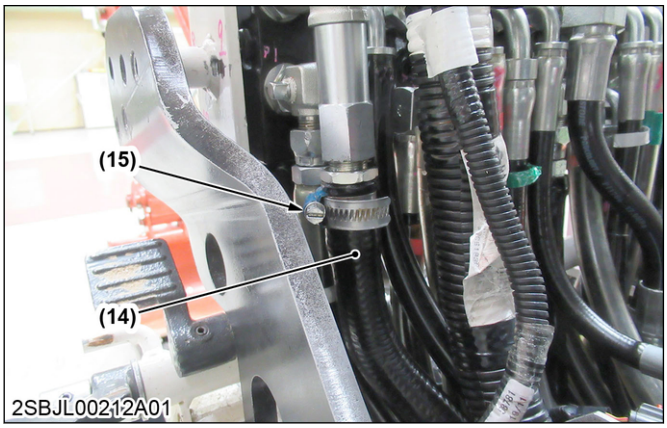
(8) Starter switch
(9) Bolt (M8 × 25) ×2

6. Remove the bolt and 2 clamps to remove the 2 wire harnesses.



(10) Wire harness ×2
(11) Bolt
(12) Clamp
(13) Clamp

7. Loosen the clamp to disconnect the return hose from the control valve assembly.



(14) Return hose
(15) Clamp

8. Disconnect all of the hydraulic hoses from the control valve assembly.

■ IMPORTANT

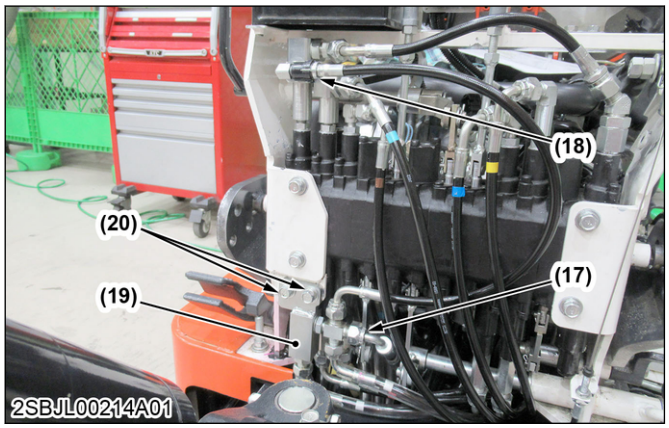
- **Put marks on the disconnected hydraulic hoses to reconnect each hose correctly.**

(16) Control valve assembly

9. Disconnect the hydraulic hose and quick coupler.

■ IMPORTANT

- **Put marks on the disconnected hydraulic hose to reconnect hose correctly.**

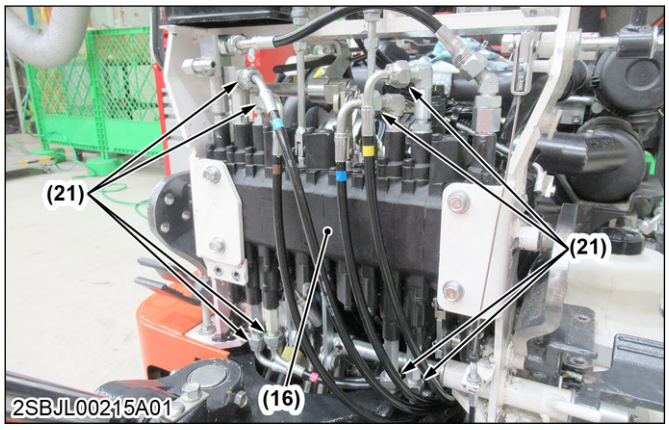


(17) Hydraulic hose
(18) Quick coupler
(19) Manifold block
(20) Bolt (M8 × 20)× 2

10. Remove the 2 bolts to remove manifold block.
11. Disconnect the 8 pilot hoses from the control valve assembly.

■ IMPORTANT

- **Put marks on the disconnected hydraulic hoses to reconnect each hose correctly.**

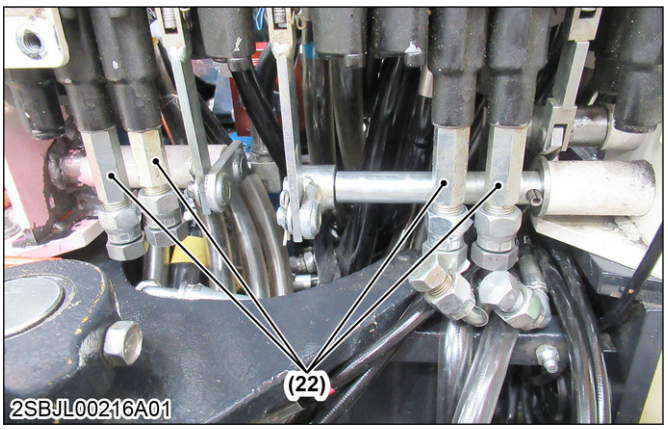


(16) Control valve assembly
(21) Pilot hose ×8

12. Remove the 4 pipe joints from the control valve assembly.

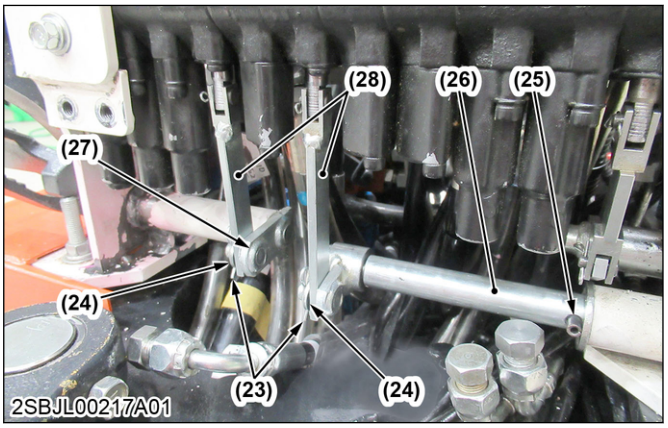
■ IMPORTANT

- **Put marks on the removed pipe joints to reconnect each pipe joint correctly.**



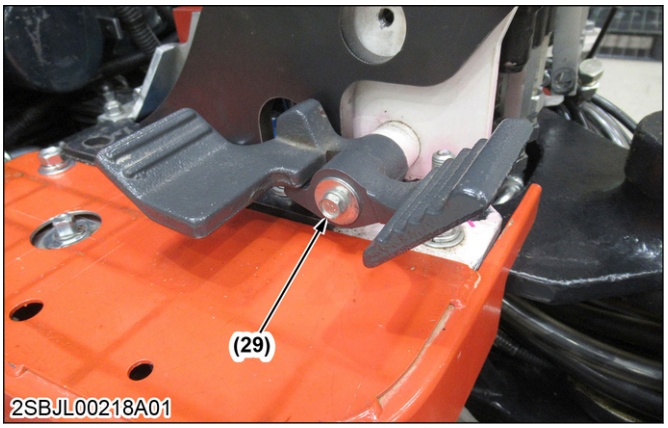
(22) Pipe joint ×4

13. Remove the clip, washer, and pin to remove the AUX pedal assembly from the link.



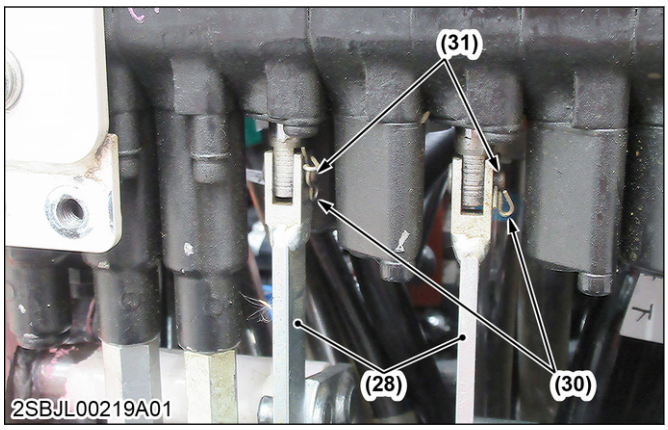
(23) Clip ×2
(24) Washer ×2
(25) Pin
(26) AUX pedal assembly
(27) Swing pedal rod
(28) Link ×2

14. Remove the bolt, clip and washer to remove the swing pedal rod from the link.



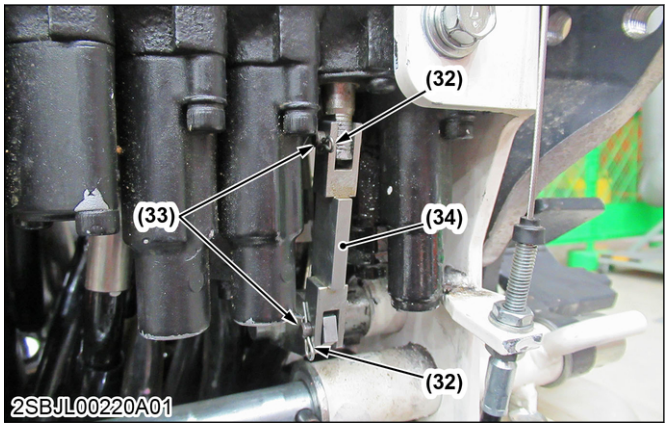
(29) Bolt (M6 × 12)

15. Remove the 2 clips and 2 pins to remove the 2 links from the control valve assembly.



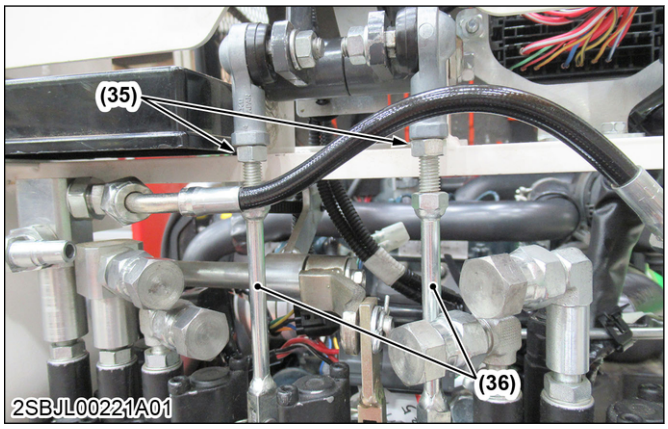
(28) Link ×2
(30) Clip ×2
(31) Pin ×2

16. Remove the 2 clips and 2 pins to remove the link from the control valve assembly.



(32) Clip ×2
(33) Pin ×2
(34) Link

17. Loosen the 2 locknuts.

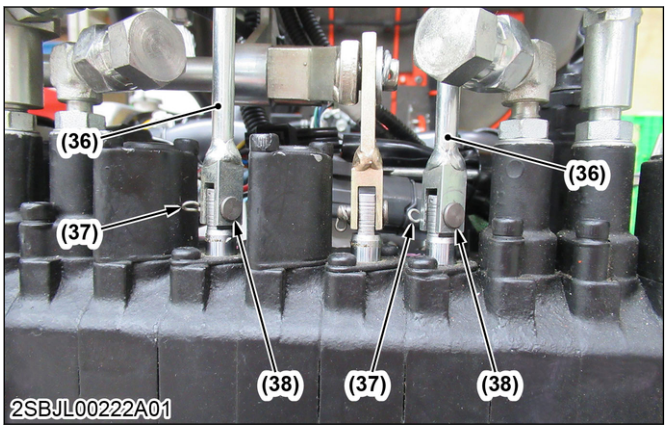


(35) Locknut ×2
(36) Rod ×2

18. Remove the 2 clips and 2 pins to remove the 2 rods from the control valve assembly.

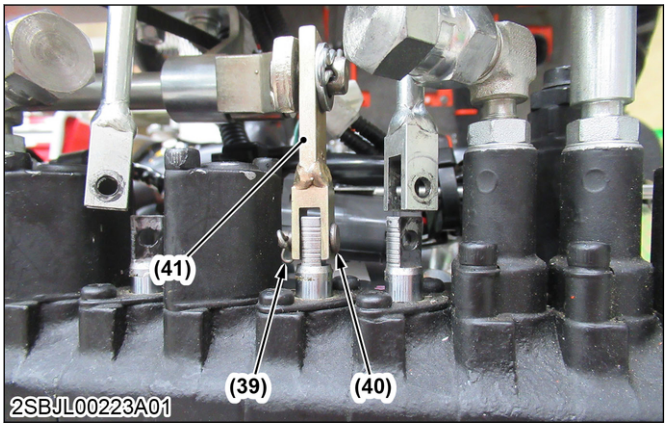
■ NOTE

- **Rotate the rod 90° to remove the pin.**



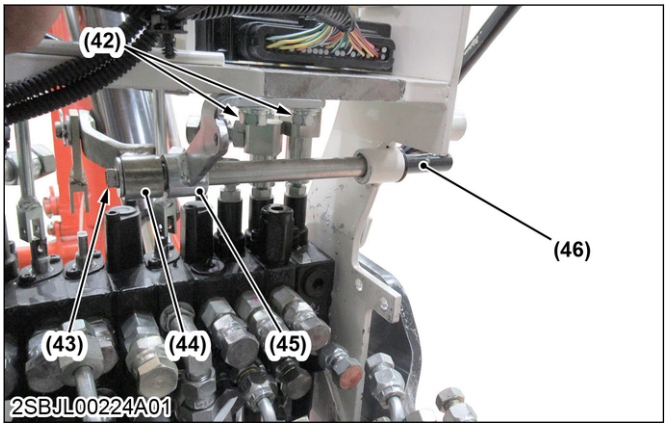
(36) Rod ×2
(37) Clip ×2
(38) Pin ×2

19. Remove the clip and pin to remove the link from the control valve assembly.



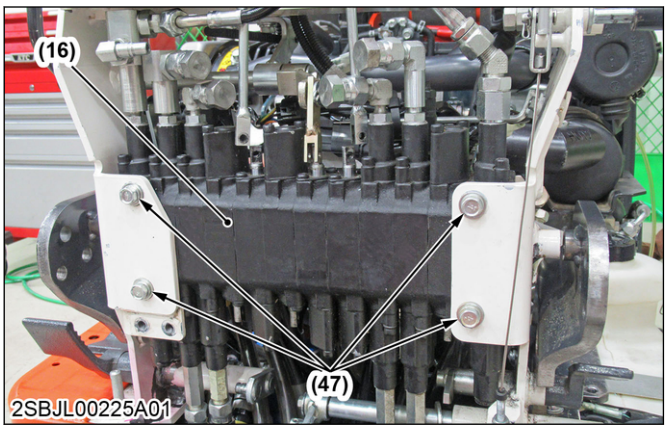
(39) Clip
(40) Pin
(41) Link

20. Remove the 3 bolts to remove the plate, bracket and blade lever.



(42) Bolt (M8 × 20) ×2
(43) Bolt (M6 × 12)
(44) Plate
(45) Bracket
(46) Blade lever

21. Remove the 4 bolts to remove the control valve assembly.



(16) Control valve assembly (47) Bolt (M8 × P1.25 × 20) ×4

Mass

(16) Control valve assembly	Approximately 17 kg Approximately 38 lbs

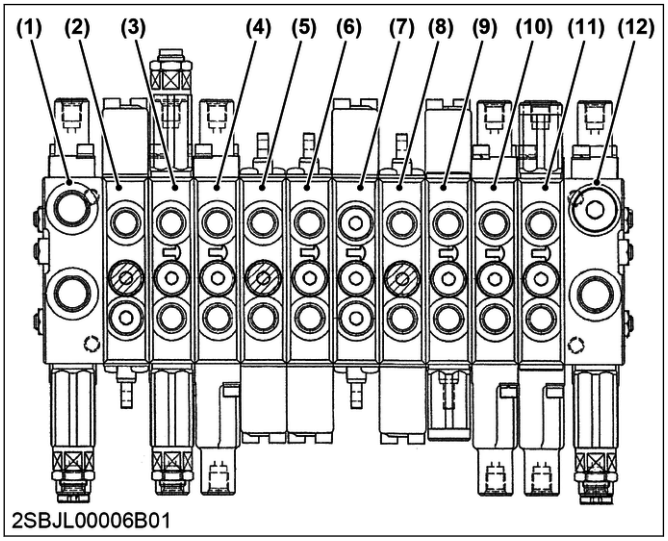
Installing

Tightening torque

(20) Bolt	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.3 to 20.3 lbf·ft	-
(47) Bolt	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.3 to 20.3 lbf·ft	Thread lock (Loctite® 263)

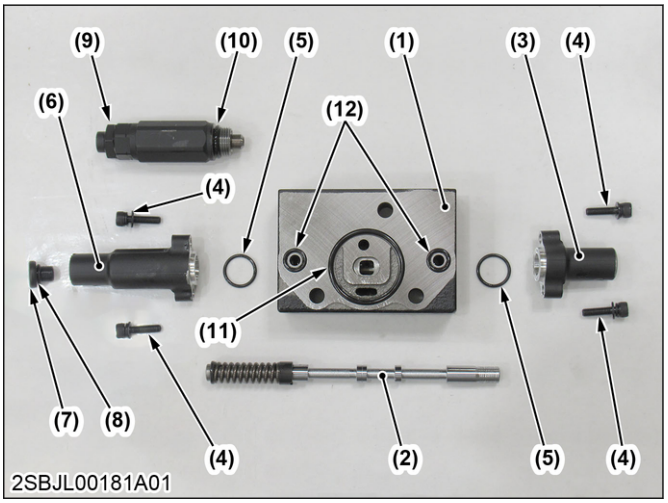
4.1.2 Control valve components

4.1.2.1 Control valve section components



(1) Inlet P1
(2) Travel shift speed
(3) Swivel
(4) Arm
(5) Travel LH
(6) Blade, track
(7) AUX
(8) Travel RH
(9) Swing
(10) Bucket
(11) Boom
(12) Inlet P2

4.1.2.2 Control valve inlet P1 section

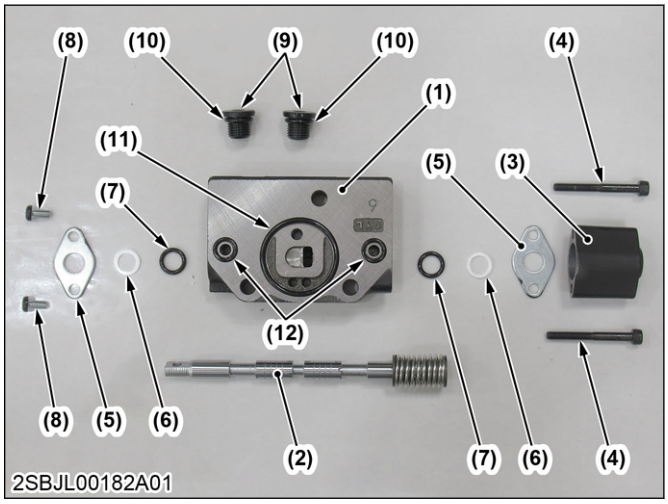


(1) Valve body
(2) Spool
(3) Cap
(4) Bolt ×4
(5) O-ring ×2
(6) Cap
(7) Plug
(8) O-ring
(9) Main relief valve
(10) O-ring
(11) O-ring
(12) O-ring ×2

Tightening torque

(4) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(7) Plug	9.81 to 14.7 N·m 1.0 to 1.5 kgf·m 7.2 to 10.8 lbf·ft	-
(9) Main relief valve	39.2 N·m 4.0 kgf·m 28.9 lbf·ft	-

4.1.2.3 Control valve travel shift speed section

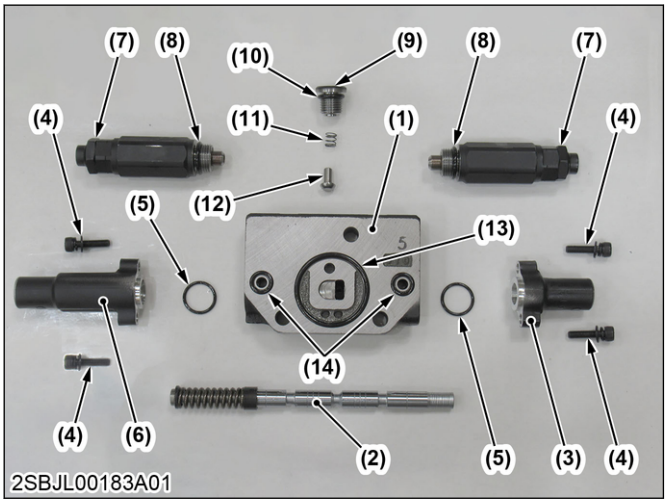


(1) Valve body
(2) Spool
(3) Cap
(4) Bolt ×2
(5) Retainer ×2
(6) Back-up ring ×2
(7) O-ring ×2
(8) Screw ×2
(9) Plug ×2
(10) O-ring ×2
(11) O-ring
(12) O-ring ×2

Tightening torque

(4) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(8) Screw	1.96 to 2.94 N·m 0.2 to 0.3 kgf·m 1.5 to 2.2 lbf·ft	-
(9) Plug	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft	-

4.1.2.4 Control valve swivel section

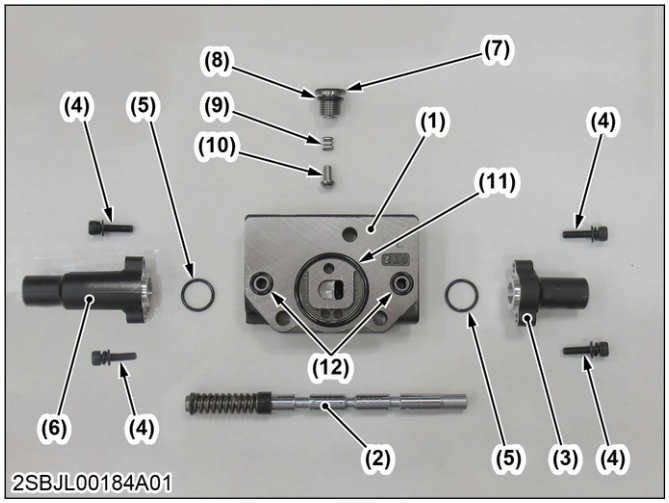


(1) Valve body
(2) Spool
(3) Cap
(4) Bolt ×4
(5) O-ring ×2
(6) Cap
(7) Overload relief valve ×2
(8) O-ring ×2
(9) Plug
(10) O-ring
(11) Spring
(12) Poppet
(13) O-ring
(14) O-ring ×2

Tightening torque

(4) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(7) Overload relief valve	39.2 N·m 4.0 kgf·m 28.9 lbf·ft	-
(9) Plug	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft	-

4.1.2.5 Control valve arm section

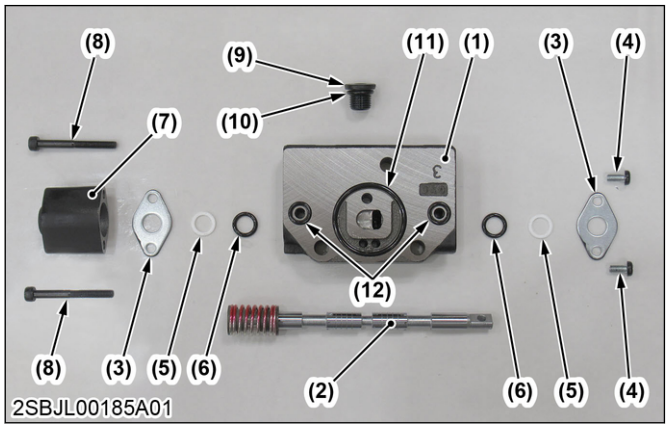


(1) Valve body
(2) Spool
(3) Cap
(4) Bolt ×4
(5) O-ring ×2
(6) Cap
(7) Plug
(8) O-ring
(9) Spring
(10) Poppet
(11) O-ring
(12) O-ring ×2

Tightening torque

(4) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(7) Plug	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft	-

4.1.2.6 Control valve travel LH section

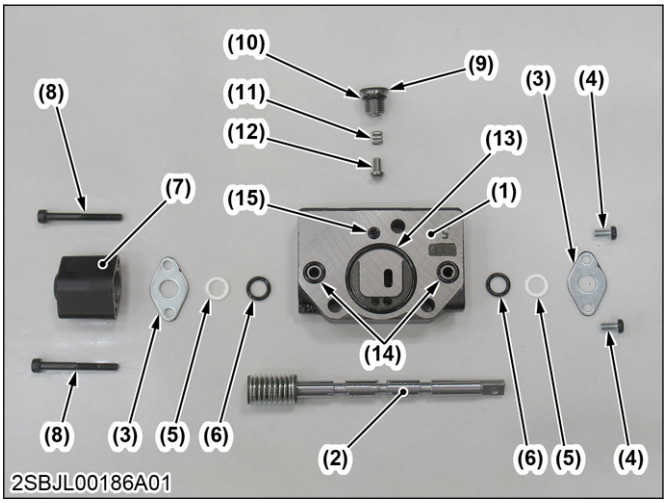


(1) Valve body
(2) Spool
(3) Retainer ×2
(4) Screw ×2
(5) Back-up ring ×2
(6) O-ring ×2
(7) Cap
(8) Bolt ×2
(9) Plug
(10) O-ring
(11) O-ring
(12) O-ring ×2

Tightening torque

(4) Screw	1.96 to 2.94 N·m 0.2 to 0.3 kgf·m 1.5 to 2.2 lbf·ft	-
(8) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(9) Plug	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft	-

4.1.2.7 Control valve blade, track section

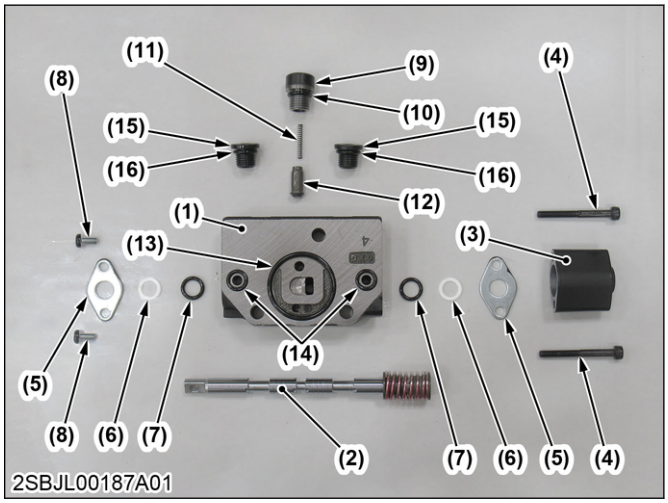


(1) Valve body
(2) Spool
(3) Retainer ×2
(4) Screw ×2
(5) Back-up ring ×2
(6) O-ring ×2
(7) Cap
(8) Bolt ×2
(9) Plug
(10) O-ring
(11) Spring
(12) Poppet
(13) O-ring
(14) O-ring ×2
(15) O-ring

Tightening torque

(4) Screw	1.96 to 2.94 N·m 0.2 to 0.3 kgf·m 1.5 to 2.2 lbf·ft	-
(8) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(9) Plug	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft	-

4.1.2.8 Control valve AUX section

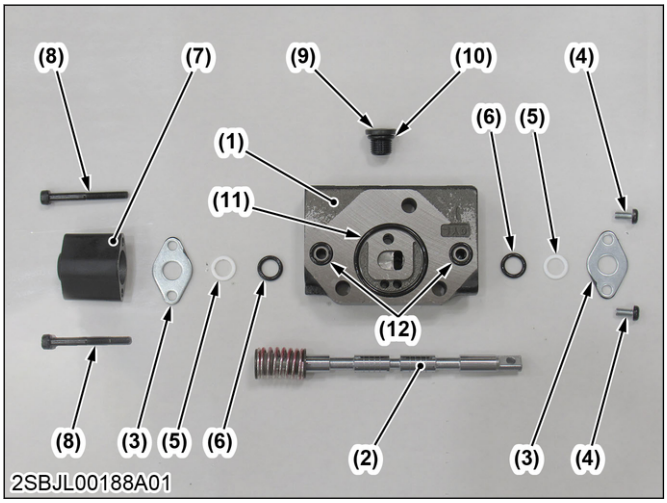


(1) Valve body
(2) Spool
(3) Cap
(4) Bolt ×2
(5) Retainer ×2
(6) Back-up ring ×2
(7) O-ring ×2
(8) Screw ×2
(9) Plug
(10) O-ring
(11) Spring
(12) Poppet
(13) O-ring
(14) O-ring ×2
(15) Plug ×2
(16) O-ring ×2

Tightening torque

(4) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(8) Screw	1.96 to 2.94 N·m 0.2 to 0.3 kgf·m 1.5 to 2.2 lbf·ft	-
(9) (15) Plug	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft	-

4.1.2.9 Control valve travel RH section

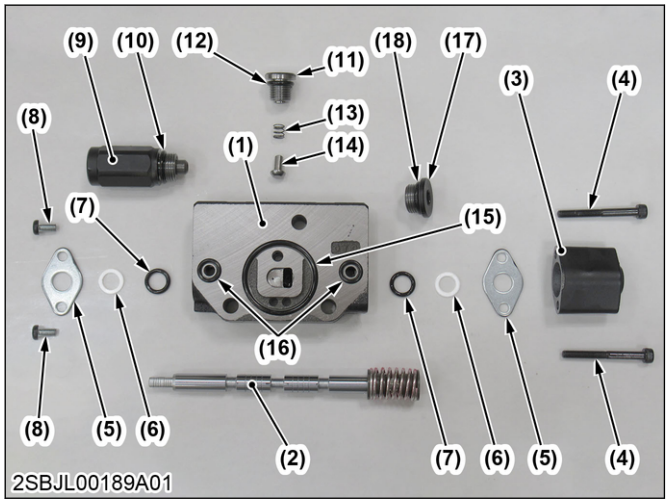


(1) Valve body
(2) Spool
(3) Retainer ×2
(4) Screw ×2
(5) Back-up ring ×2
(6) O-ring ×2
(7) Cap
(8) Bolt ×2
(9) Plug
(10) O-ring
(11) O-ring
(12) O-ring ×2

Tightening torque

(4) Screw	1.96 to 2.94 N·m 0.2 to 0.3 kgf·m 1.5 to 2.2 lbf·ft	-
(8) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(9) Plug	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft	-

4.1.2.10 Control valve swing section

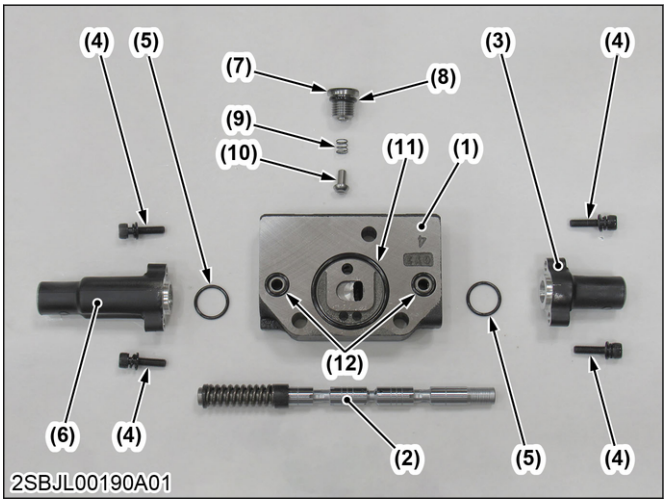


(1) Valve body
(2) Spool
(3) Cap
(4) Bolt ×2
(5) Retainer ×2
(6) Back-up ring ×2
(7) O-ring ×2
(8) Screw ×2
(9) Anti-cavitation valve
(10) O-ring
(11) Plug
(12) O-ring
(13) Spring
(14) Poppet
(15) O-ring
(16) O-ring ×2
(17) Plug
(18) O-ring

Tightening torque

(4) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(8) Screw	1.96 to 2.94 N·m 0.2 to 0.3 kgf·m 1.5 to 2.2 lbf·ft	-
(9) Anti-cavitation valve	39.2 N·m 4.0 kgf·m 28.9 lbf·ft	-
(11) Plug	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft	-
(17) Plug	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.1 lbf·ft	-

4.1.2.11 Control valve bucket section

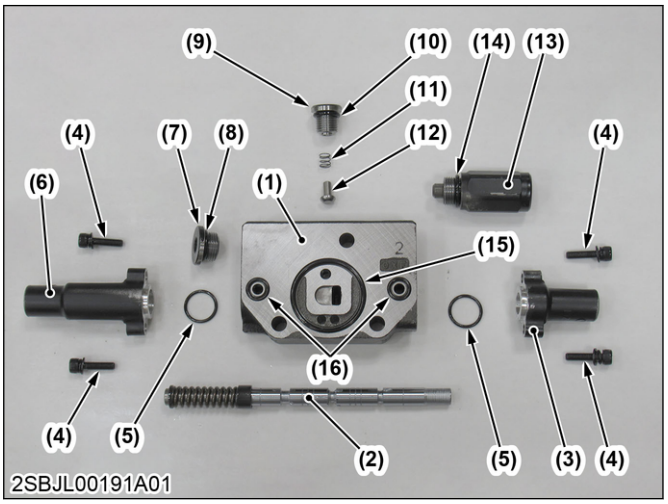


(1) Valve body
(2) Spool
(3) Cap
(4) Bolt ×4
(5) O-ring ×2
(6) Cap
(7) Plug
(8) O-ring
(9) Spring
(10) Poppet
(11) O-ring
(12) O-ring ×2

Tightening torque

(4) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(7) Plug	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft	-

4.1.2.12 Control valve boom section

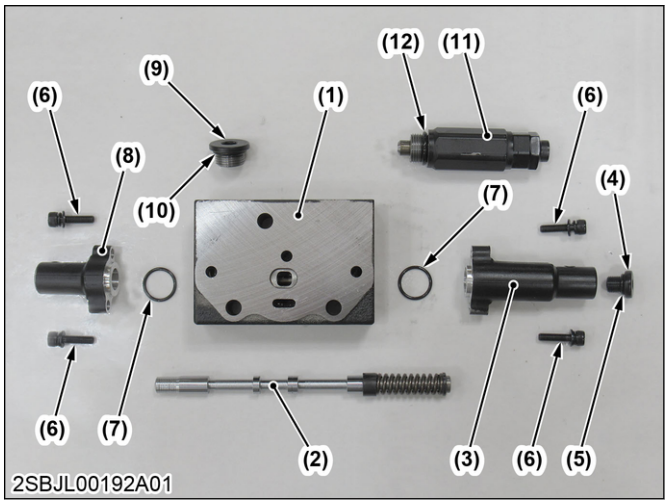


(1) Valve body
(2) Spool
(3) Cap
(4) Bolt ×4
(5) O-ring ×2
(6) Cap
(7) Plug
(8) O-ring
(9) Plug
(10) O-ring
(11) Spring
(12) Poppet
(13) Anti-cavitation valve
(14) O-ring
(15) O-ring
(16) O-ring ×2

Tightening torque

(4) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(7) Plug	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.1 lbf·ft	-
(9) Plug	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft	-
(13) Anti-cavitation valve	39.2 N·m 4.0 kgf·m 28.9 lbf·ft	-

4.1.2.13 Control valve inlet P2 section



(1) Valve body
(2) Spool
(3) Cap
(4) Plug
(5) O-ring
(6) Bolt ×4
(7) O-ring ×2
(8) Cap
(9) Plug
(10) O-ring
(11) Main relief valve
(12) O-ring

Tightening torque

(4) Plug	9.81 to 14.7 N·m 1.0 to 1.5 kgf·m 7.2 to 10.8 lbf·ft	-
(6) Bolt	5.88 to 6.86 N·m 0.6 to 0.7 kgf·m 4.3 to 5.1 lbf·ft	-
(9) Plug	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.1 lbf·ft	-
(11) Main relief valve	39.2 N·m 4.0 kgf·m 28.9 lbf·ft	-

4.1.3 Disassembling and assembling the control valve

■ IMPORTANT

- **Do not reuse removed O-rings or floating seals for assembly to avoid oil leakage.**
- **Work at clean work space with clean tools and lubricants when assembling or disassembling hydraulic devices.**
- **Check for scratches or damages carefully on the sliding and mating surfaces for every part. They might cause the oil leakage.**
- **Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.**
- **Apply lubricants or greases to every seal to avoid damage when assembling.**

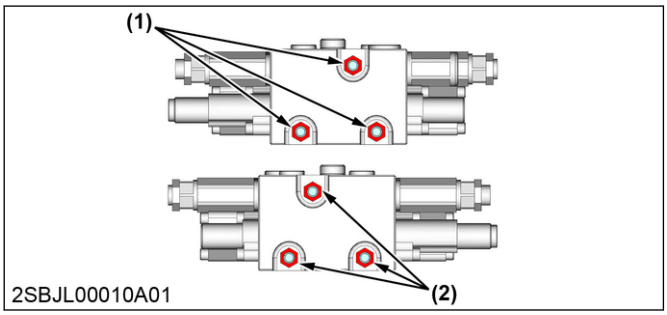
Disassembling

1. Remove 3 nuts on each side.

■ NOTE

- **Fix the nuts on the other side with a ring wrench.**

2. Remove the 3 rods to disassemble each section.



(1) Nut ×3
(2) Nut ×3

Assembling

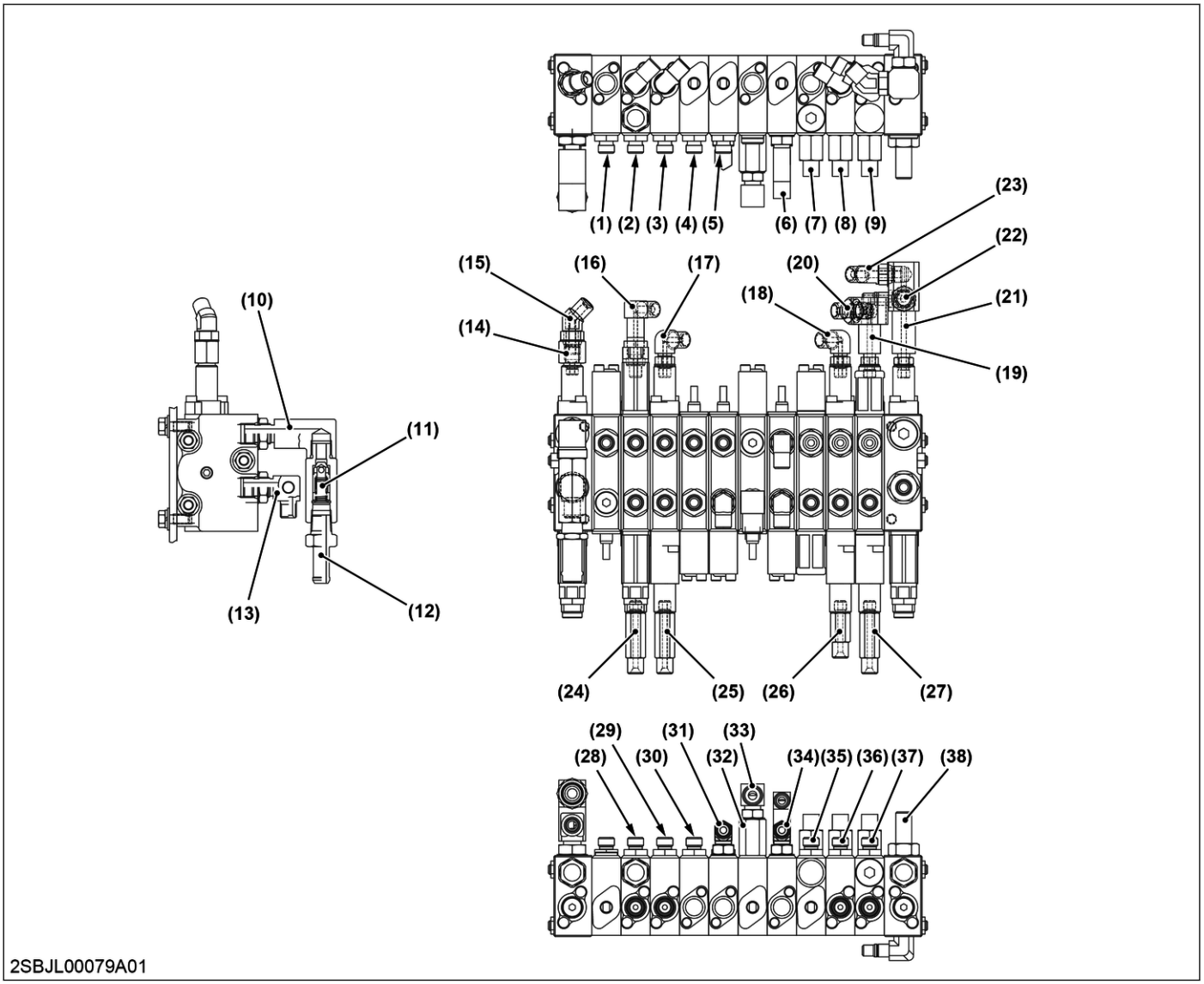
■ IMPORTANT

- **If the torque of the screw is too high, it may cause the spool to malfunction. Therefore, be sure to use the specified torque.**
- **When installing the spools, mind the direction of each of them, align them with the holes correctly, and insert carefully.**
- **To avoid distortion by assembling, alternately tighten the nuts in diagonal direction, separate the tightening into 2 or 3 times and tighten each nut evenly.**

Tightening torque

(1) (2) Nut	13.7 to 14.7 N·m 1.4 to 1.5 kgf·m 10.1 to 10.8 lbf·ft	-

4.1.4 Installing adapters for the control valve



Adapter No.	Port	Adapter size	Angle	Adapter No.	Port	Adapter size	Angle
(1)	A1	G1/4-G1/4	-	(20)	Pa10	G1/4-G1/4	-
(2)	A2	G1/4-G1/4	-	(21)	Pp2	G1/4-G1/4-G1/8	-
(3)	A3	G1/4-G1/4	-	(22)		G1/4-Quick coupler	-
(4)	A4	G1/4-G1/4	-	(23)		G1/4-G1/4	-
(5)	A5	G1/4-G1/4	-	(24)	Pb2	G1/4-G1/8	-
(6)	A7	G1/4-G1/4	-	(25)	Pb3	G1/4-G1/8	-
(7)	A8	G1/4-G1/4	-	(26)	Pb9	G1/4-G1/8	-
(8)	A9	G1/4-G1/4	-	(27)	Pb10	G1/4-G1/8	-
(9)	A10	G1/4-G1/4	-	(28)	B2	G1/4-G1/4	-
(10)	T1	G3/8-G3/8	-	(29)	B3	G1/4-G1/4	-
(11)		G3/8-Rc3/8	-	(30)	B4	G1/4-G1/4	-

(Continued)

Adapter No.	Port	Adapter size	Angle	Adapter No.	Port	Adapter size	Angle
(12)	T1	R3/8-ϕ16	-	(31)	B5	G1/4-G1/4	-
(13)	P1	G3/8-G1/4-Rc1/8	-	(32)	B6	G1/4-G1/4	-
(14)	Pp1	G1/4-G1/8	-	(33)		G1/4-G3/8	-
(15)		G1/4-G1/4	16°	(34)	B7	G1/4-G1/4	-
(16)	Pa2	G1/4-G1/8	45°	(35)	B8	G1/4-G1/4	-
(17)	Pa3	G1/4-G1/8	45°	(36)	B9	G1/4-G1/4	-
(18)	Pa9	G1/4-G1/8	32°	(37)	B10	G1/4-G1/4	-
(19)	Pa10	G1/4-G1/8	30°	(38)	P2	G1/4-G3/8	-

4.2 Pilot control valve

4.2.1 Removing and installing the pilot control valve

⚠ CAUTION

- **The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.**
- **Before disconnecting the hydraulic hoses, release the residual pressure first.**

■ IMPORTANT

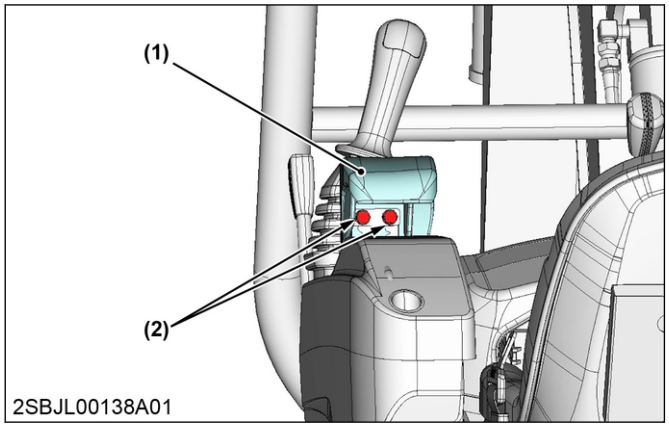
- **Install plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.**

Preparing

1. Release the residual pressure.
2. Vacuum the hydraulic oil tank.

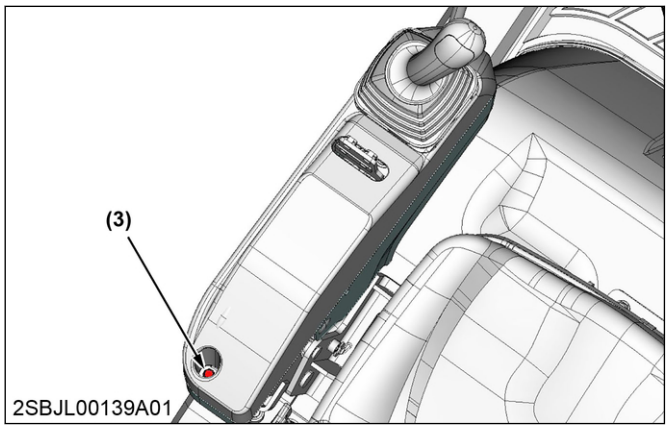
Removing

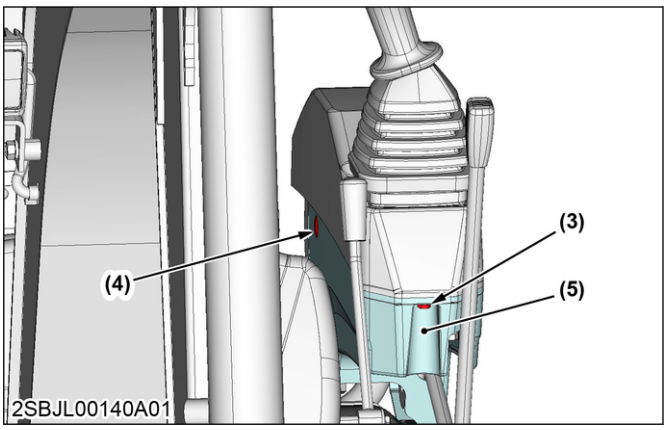
1. Remove the 2 bolts to remove the wrist rest LH.



(1) Wrist rest LH (2) Bolt (M8 × 20) ×2

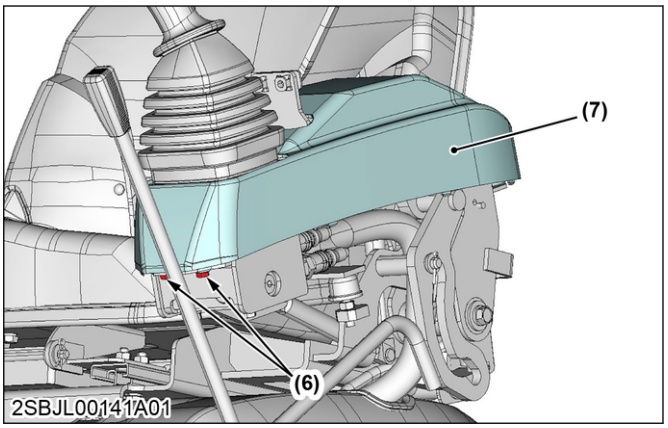
2. Remove the 2 bolts and rivet to remove the lower cover.





(3) Bolt (M6 × 20) ×2 (5) Lower cover
(4) Rivet

3. Remove the 2 bolts to remove the upper cover.

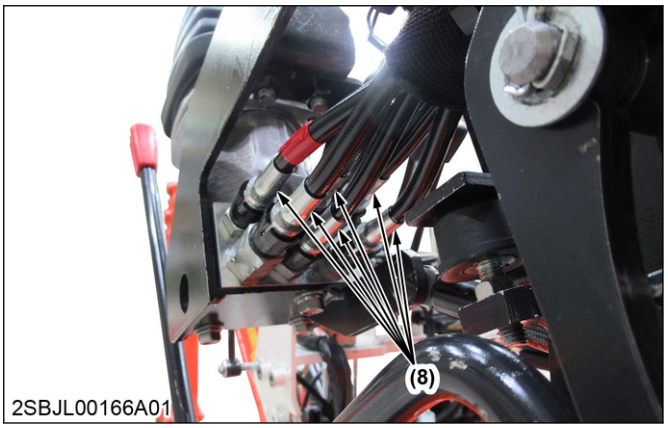


(6) Bolt (M6 × 20) ×2 (7) Upper cover

4. Disconnect all of the hydraulic hoses from the pilot control valve LH.

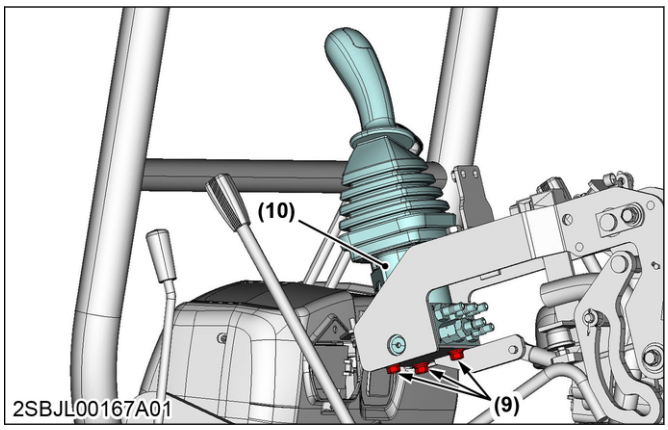
■ NOTE

- **Put marks on the disconnected hydraulic hoses to reconnect each hose correctly.**



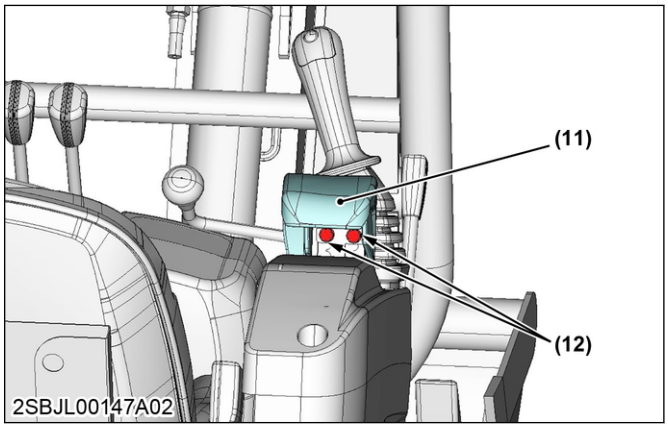
(8) Hydraulic hose

5. Remove the 3 bolts and pilot control valve LH.



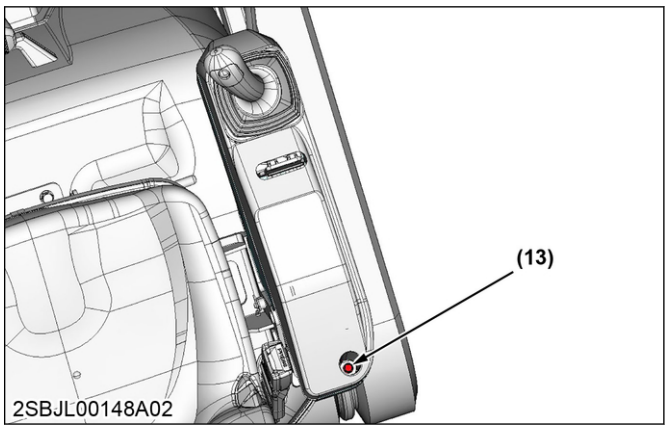
(9) Bolt (M8 × 16) ×3 (10) Pilot control valve LH

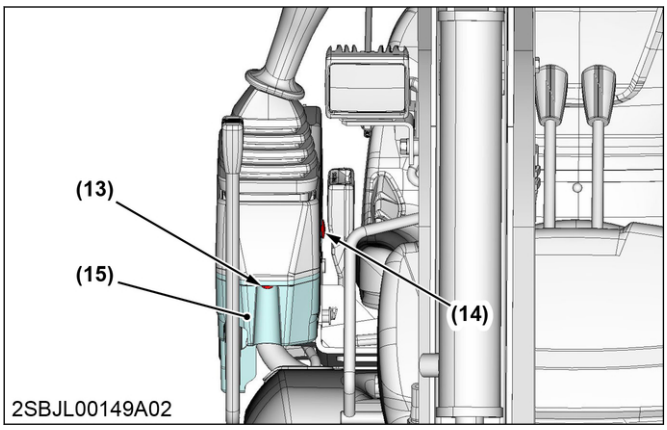
6. Remove the 2 bolts to remove the wrist rest RH.



(11) Wrist rest RH (12) Bolt (M8 × 20) ×2

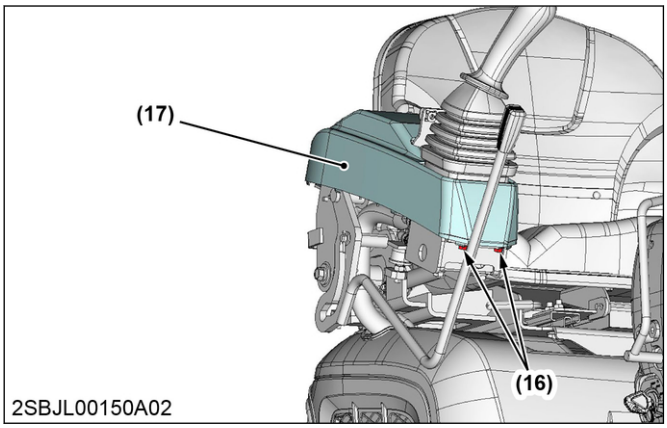
7. Remove the 2 bolts and rivet to remove the lower cover.





(13) Bolt (M6 × 20) ×2 (15) Lower cover
(14) Rivet

8. Remove the 2 bolts to remove the upper cover.

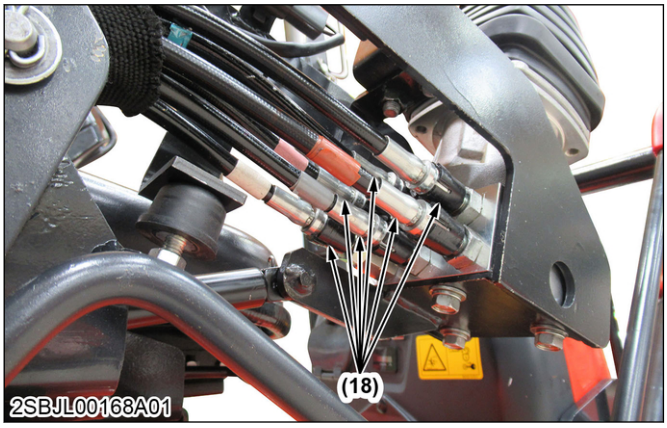


(16) Bolt (M6 × 20) ×2 (17) Upper cover

9. Disconnect the connector from the pilot control lever RH.
10. Disconnect all of the hydraulic hoses from the pilot control valve RH.

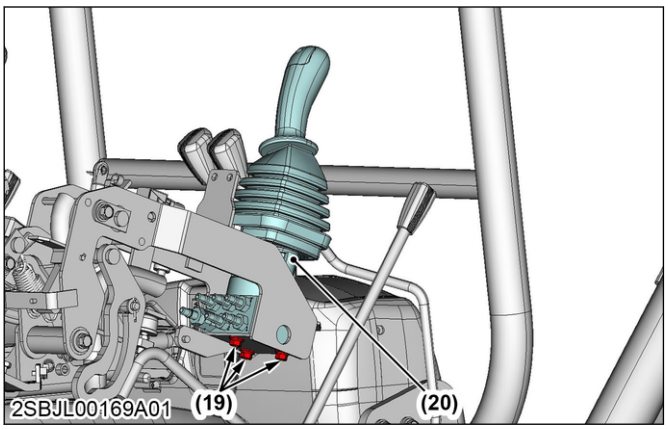
■ NOTE

- **Put marks on the disconnected hydraulic hoses to reconnect each hose correctly.**



(18) Hydraulic hose

11. Remove the 3 bolts and pilot control valve RH.

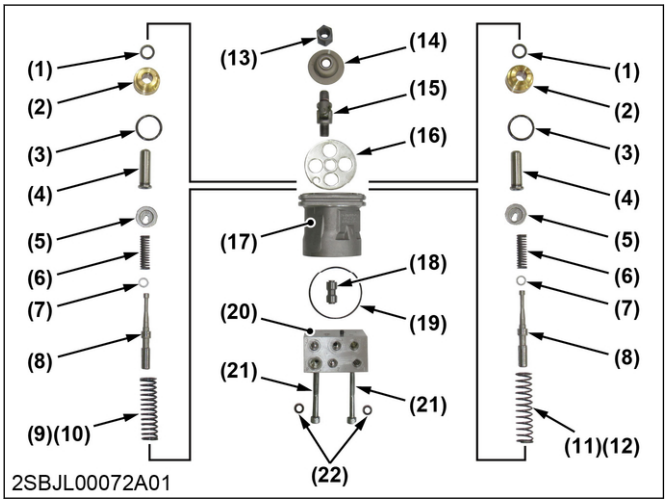


(19) Bolt (M8 × 16) ×3
(20) Pilot control valve RH

Installing

■ NOTE
- **Make sure to connect the hydraulic hoses correctly.**

4.2.2 Pilot control valve components



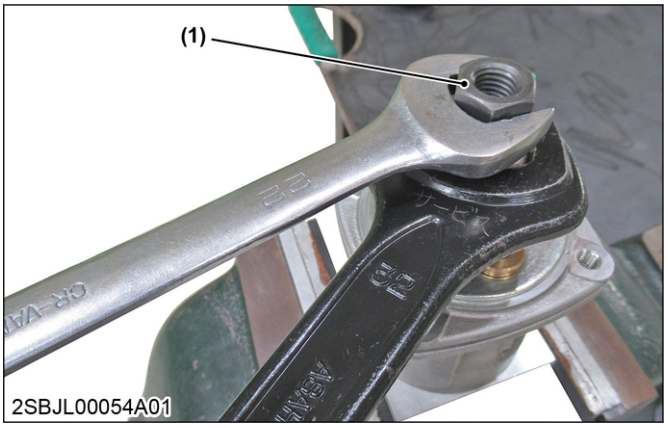
(1) Seal ×4
(2) Plug ×4
(3) O-ring ×4
(4) Push rod ×4
(5) Spring seat ×4
(6) Spring ×4
(7) Seat ×4
(8) Spool ×4
(9) Spring
(10) Spring
(11) Spring
(12) Spring
(13) Adjusting nut
(14) Disc nut
(15) Universal joint
(16) Plate
(17) Casing
(18) Bushing
(19) O-ring
(20) Port plate
(21) Bolt ×2
(22) Seal washer ×2

4.2.3 Disassembling the pilot control valve

■ IMPORTANT
- **Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.**
- **Check for scratches or damages carefully on the sliding and mating surfaces for every part. They might cause oil leakage.**
- **Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.**

Removing the pressure reducing valves

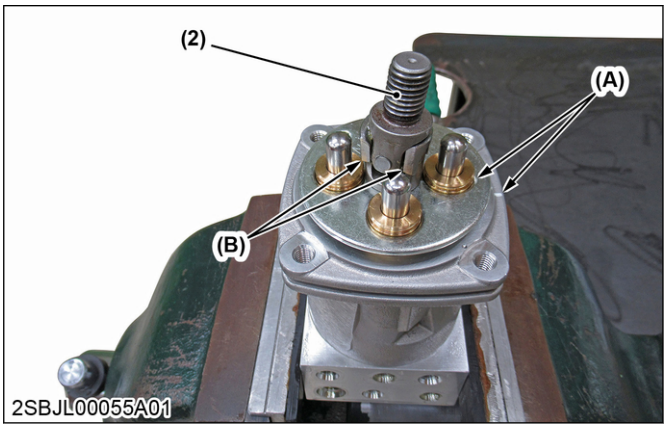
1. Fasten the pilot control valve in a vice.
2. Remove the adjusting nut and disk nut.



(1) Adjusting nut

3. Put a mark on the casing and pressure reducing valves.

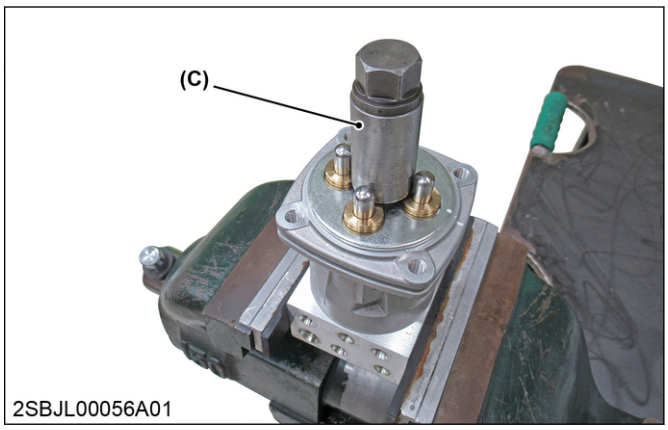
■ NOTE
- **Make sure to install the pressure reducing valves in the same locations.**



(2) Universal joint
(A) Mark
(B) Universal joint tightening jig 2

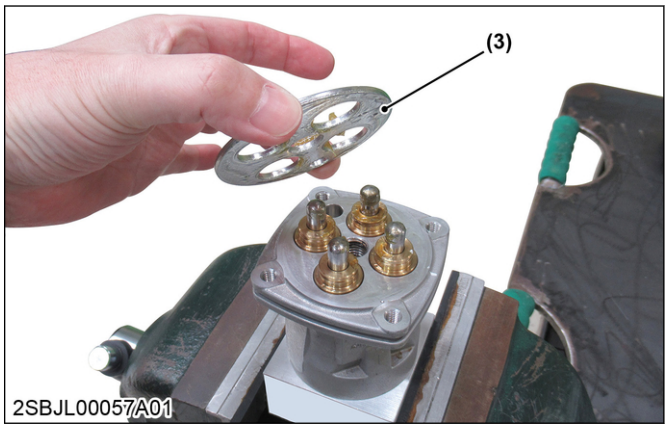
4. Install the universal joint tightening jig 2 to the universal joint.
5. Remove the universal joint with the universal joint tightening jig 1.

■ NOTE
- **Loosen the universal joint slowly to avoid the pressure reducing valves popping out.**



(C) Universal joint tightening jig 1

6. Remove the plate.



(3) Plate

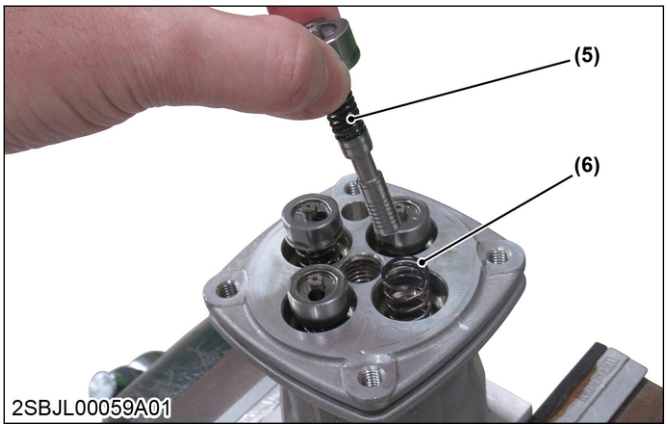
7. Remove the plug with a flat tip screwdriver.

■ NOTE
- **Hold the plug with a hand to avoid popping out.**
- **Make sure not to damage the plugs.**

(4) Plug

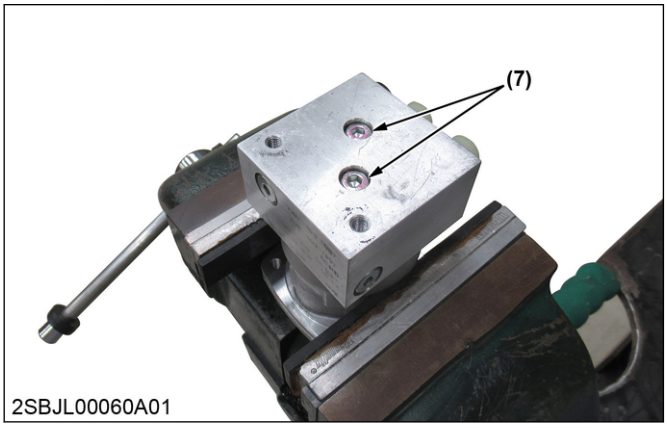
8. Remove the 4 pressure reducing valve assemblies and 4 springs.

■ NOTE
- **Put marks on each removed spring for reassembly.**



(5) Pressure reducing valve assembly ×4 (6) Spring ×4

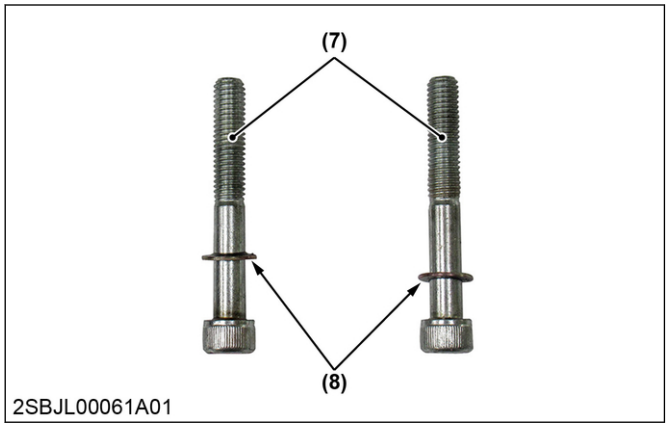
9. Remove the 2 bolts from the port plate.



(7) Bolt (M8 × 60) ×2

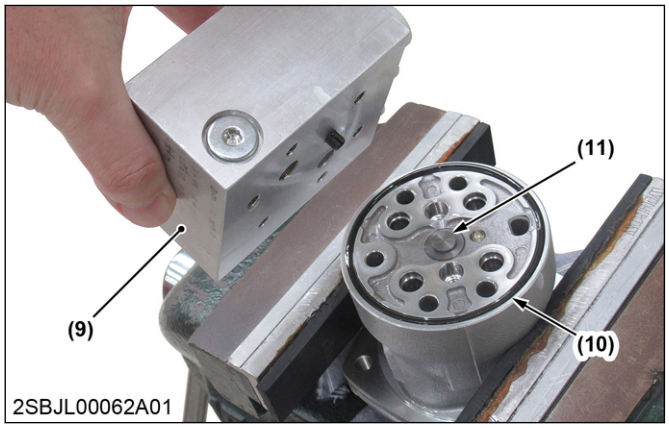
10. Remove the 2 seal washers from the 2 bolts.

■ IMPORTANT
- **Always replace the removed seal washer with a new one.**



(7) Bolt (M8 × 60) ×2 (8) Seal washer ×2

11. Remove the port plate, O-ring and bushing from the casing.



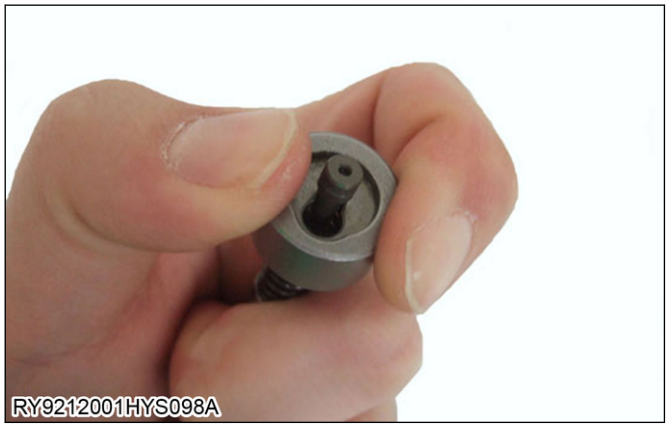
(9) Port plate (11) Bushing
(10) O-ring

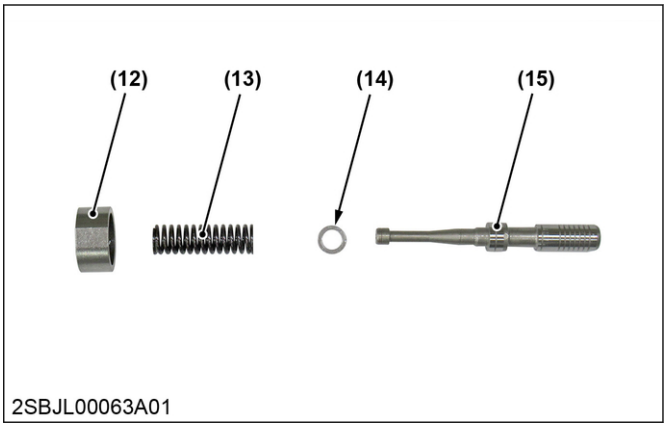
Disassembling the pressure reducing valves

1. Remove the spring seat.

■ NOTE

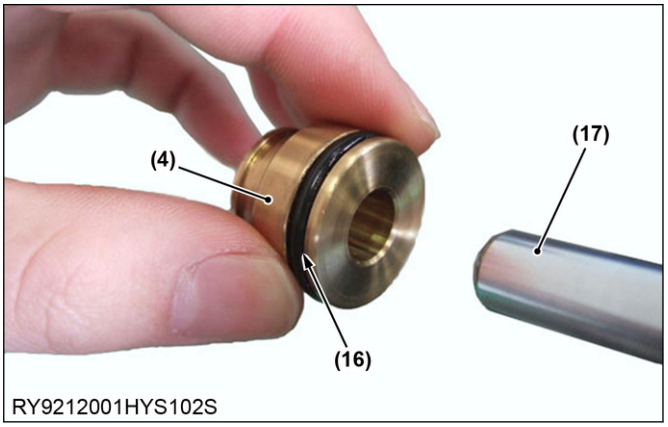
- **Press the spring seat to compress the spring and slide to remove.**
- **Do not damage the spool.**
- **Do not compress the spring more than 6 mm (0.2 in.).**





(12) Spring seat (15) Spool
(13) Spring
(14) Seat

2. Remove the push rod from the plug.

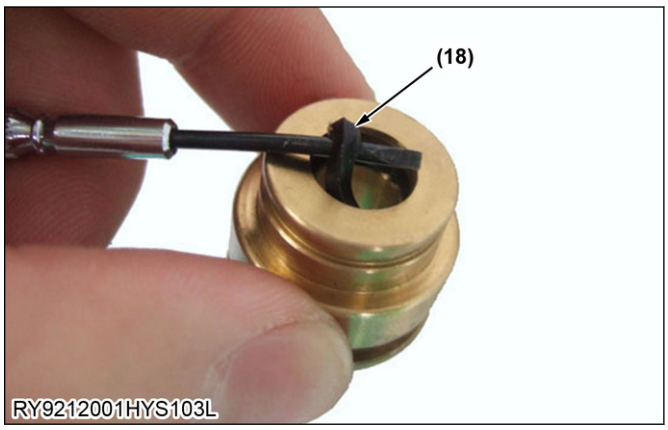


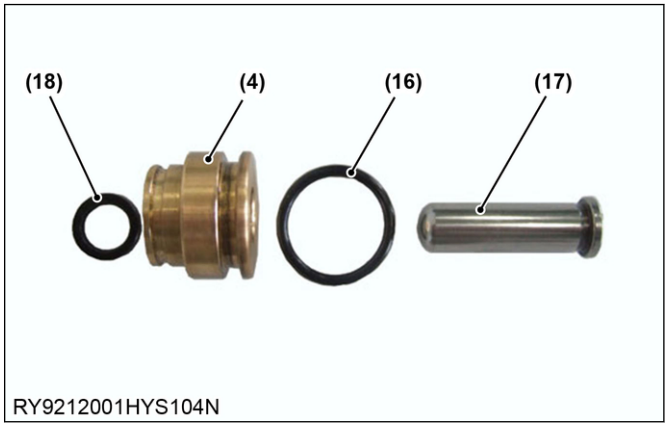
(4) Plug (17) Push rod
(16) O-ring

3. Remove the O-ring and seal from the plug.

■ NOTE

- **Do not damage the plug.**





(4) Plug
(16) O-ring
(17) Push rod
(18) Seal

4.2.4 Assembling the pilot control valve

■ IMPORTANT

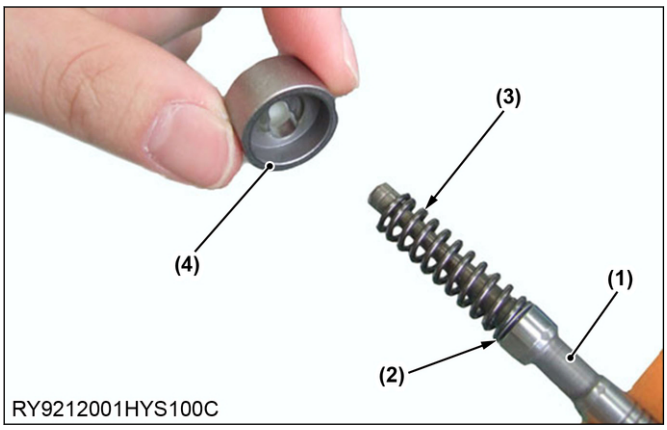
- **Do not reuse removed O-rings and oil seals for assembly to avoid oil leakage.**
- **Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.**
- **Check for scratches or damages carefully on the sliding and mating surfaces for every part. They might cause oil leakage.**
- **Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.**
- **Apply lubricant or grease to every seal to avoid damage when assembling.**

Assembling the pressure reducing valves

1. Assemble the seat, spring, and spring seat to the spool in order.

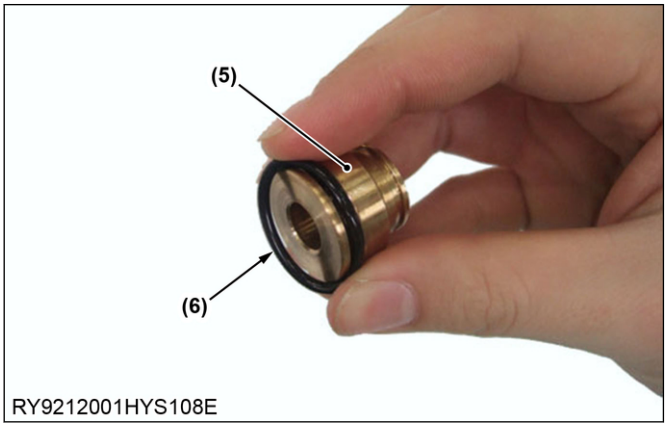
■ IMPORTANT

- **Do not compress the spring more than 6 mm (0.2 in.).**



(1) Spool
(2) Seat
(3) Spring
(4) Spring seat

2. Install the O-ring to the plug.

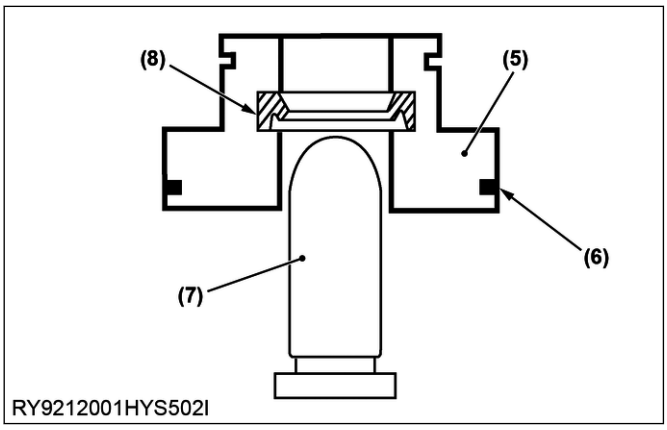


(5) Plug
(6) O-ring

3. Install the seal to the plug.

■ NOTE

- **Apply hydraulic oil to the seal.**
- **Install the seal in correct direction.**

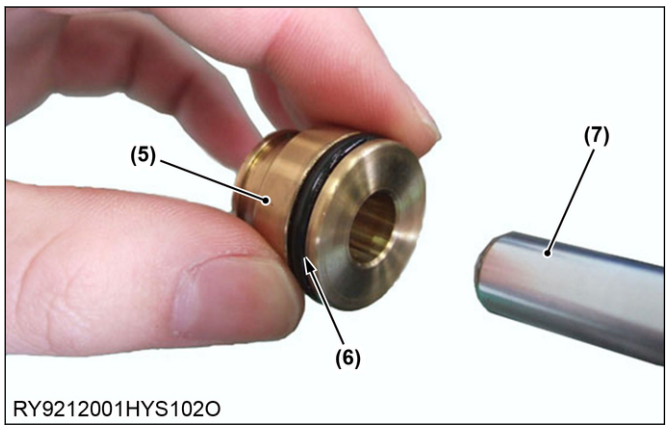


(5) Plug
(6) O-ring
(7) Push rod
(8) Seal

4. Install the push rod to the plug.

■ NOTE

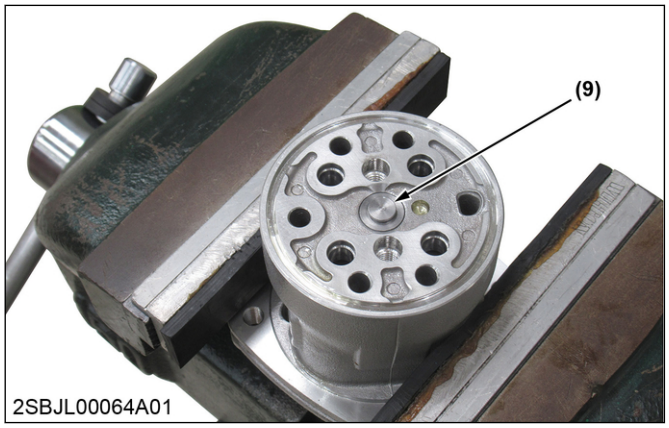
- **Apply hydraulic oil to the plug.**



(5) Plug
(6) O-ring
(7) Push rod

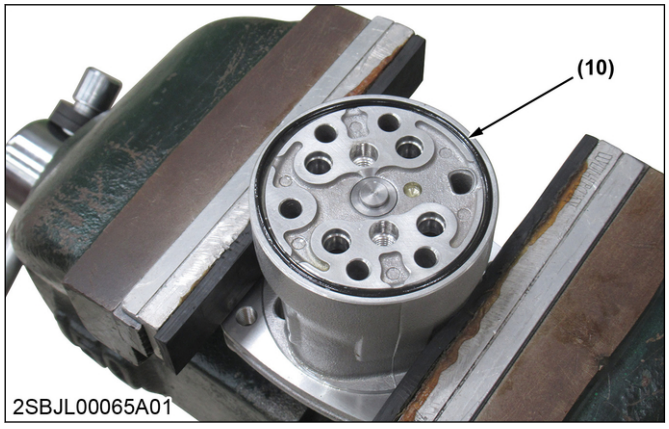
Installing the pressure reducing valves

1. Install the bushing to the casing.



(9) Bushing

2. Install the O-ring to the casing.

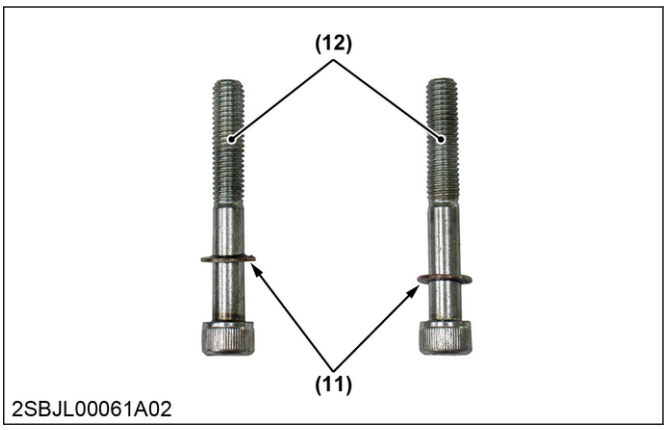


(10) O-ring

3. Install the 2 seal washers to the 2 bolts.

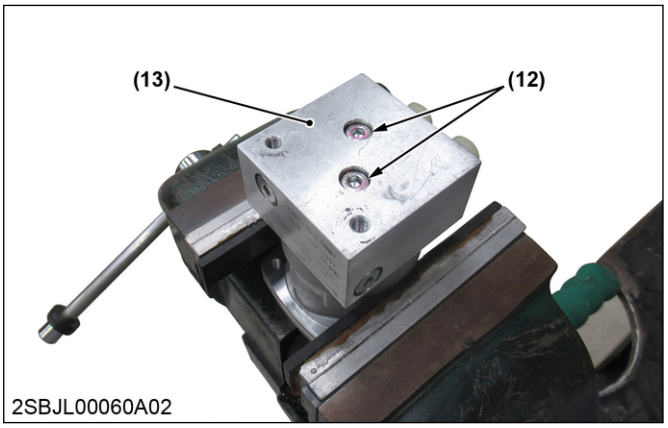
IMPORTANT

- **Always replace the removed seal washer with a new one.**



(11) Seal washer ×2
(12) Bolt (M8 × 60) ×2

4. Install the port plate to the casing with the 2 bolts.



(12) Bolt (M8 × 60) ×2
(13) Pot plate

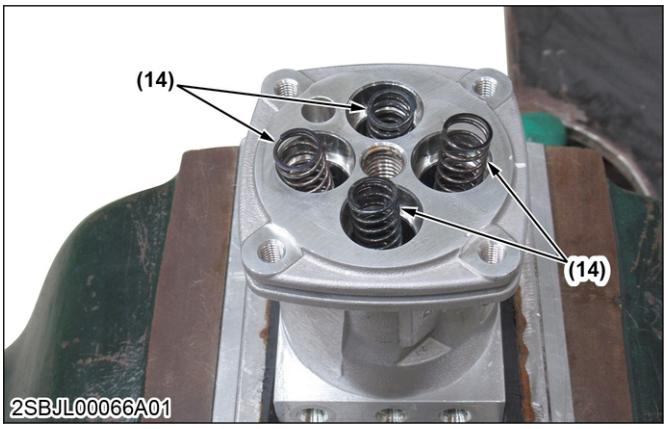
Tightening torque

(12) Bolt	19.1 to 22.1 N·m 1.95 to 2.25 kgf·m 14.1 to 16.3 lbf·ft	-

5. Install the 4 springs to the casing.

NOTE

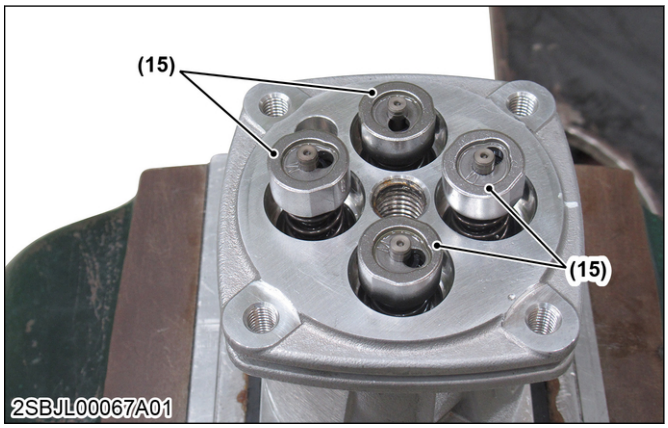
- **Install each part to the same location.**



(14) Spring ×4

6. Install the 4 pressure reducing valve assemblies to the casing.

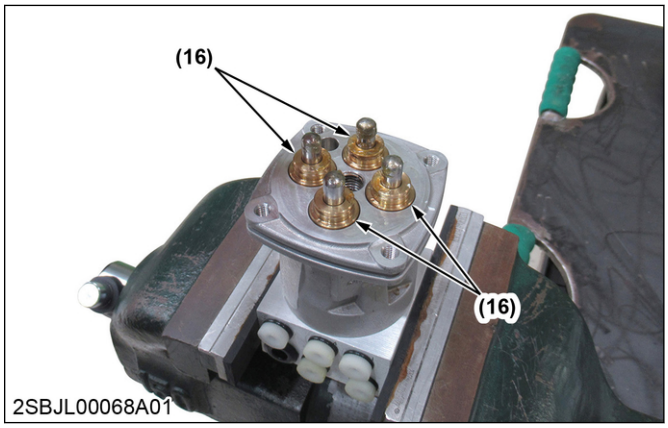
■ NOTE
- **Install each part to the same location.**



(15) Pressure reducing valve assembly ×4

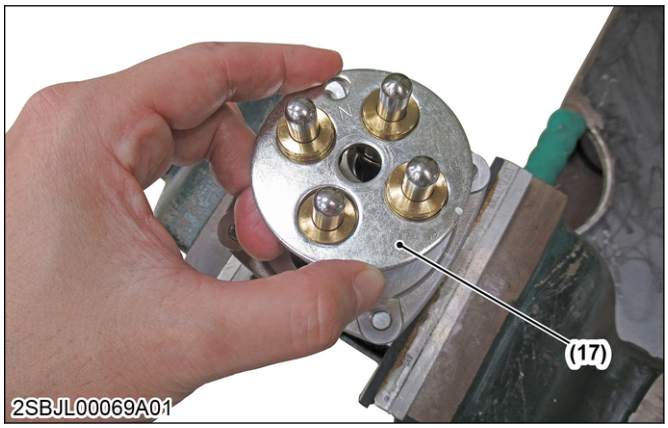
7. Install the 4 plugs to the casing.

■ NOTE
- **Install each part to the same location.**



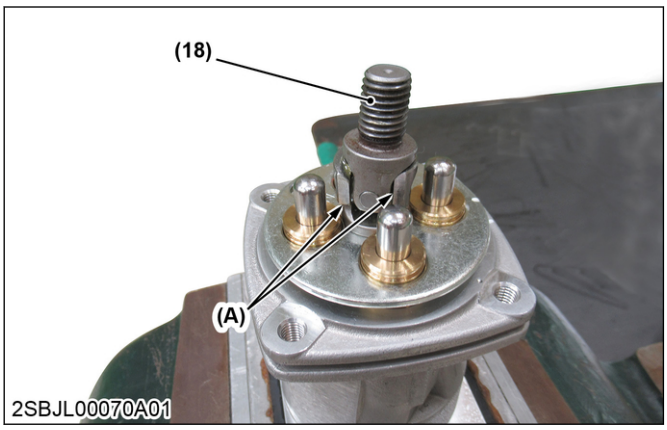
(16) Plug ×4

8. Install the plate.



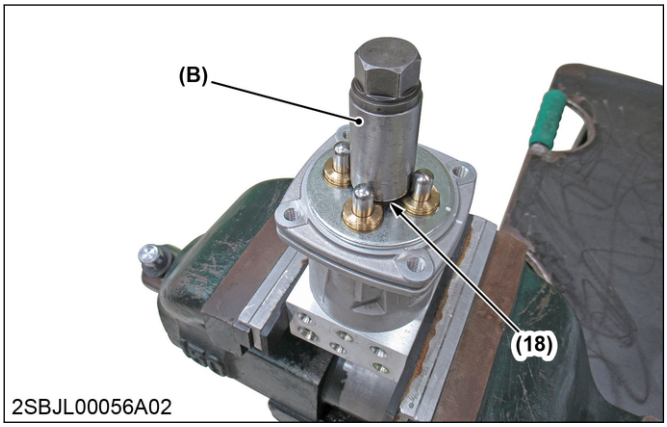
(17) Plate

9. Temporary install the universal joint.



(18) Universal joint (A) Universal joint tightening jig 2

10. Install the universal joint tightening jig 2 to the universal joint.
11. Using the universal joint tightening jig 1, and tighten the universal joint.



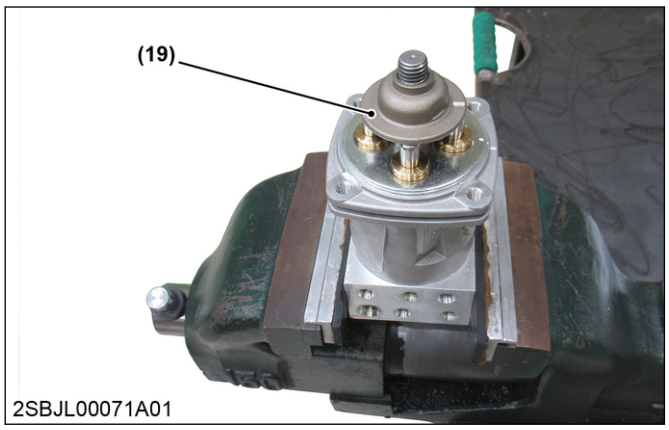
(18) Universal joint (B) Universal joint tightening jig 1

Tightening torque

(18) Universal joint	44.2 to 50.0 N·m 4.51 to 5.10 kgf·m 32.6 to 36.9 lbf·ft	-

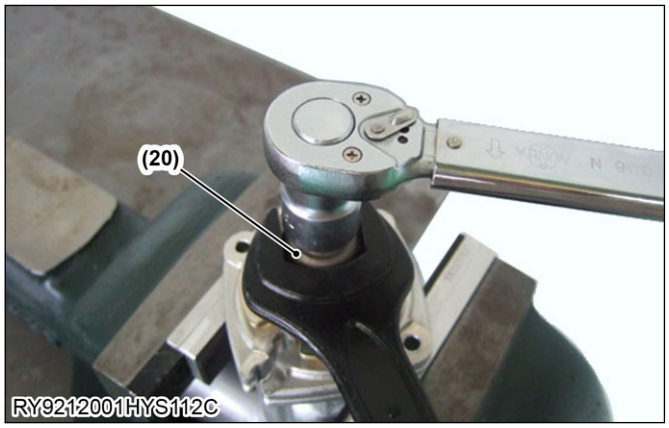
12. Install the disk nut.

■ NOTE
- **Tighten the disk nut until the tips of the 4 push rods of the pressure reducing valves touch evenly.**
- **Do not screw in the disc nut excessively to avoid machine malfunction.**



(19) Disk nut

13. Tighten the adjusting nut.

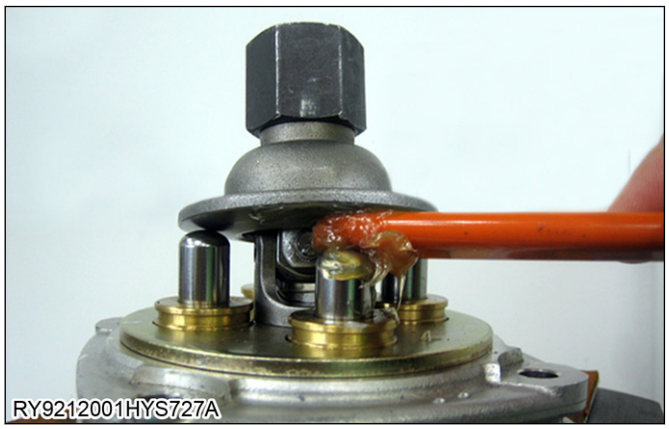


(20) Adjusting nut

Tightening torque

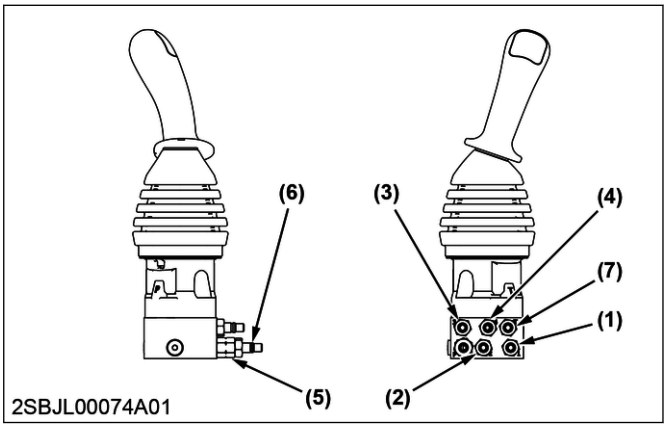
(20) Adjusting nut	63.7 to 73.5 N·m 6.50 to 7.49 kgf·m 47.0 to 54.2 lbf·ft	-

14. Grease the universal joint and push rods.



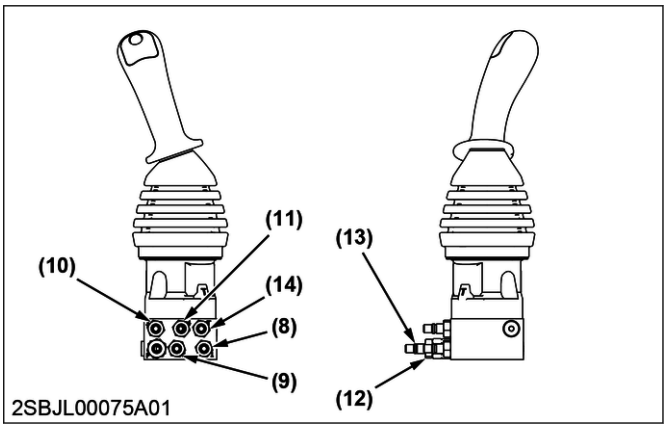
4.2.5 Installing adapters for the pilot control valve

Pilot control valve LH



Adapter No.	Port	Adapter size	Angle
(1)	1	G1/8-Quick coupler	-
(2)	2	G1/8-Quick coupler	-
(3)	3	G1/8-Quick coupler	-
(4)	4	G1/8-Quick coupler	-
(5)	P	G1/4-G1/4	-
(6)		G1/4-Quick coupler	-
(7)	T	G1/8-Quick coupler	-

Pilot control valve RH



Adapter No.	Port	Adapter size	Angle
(8)	1	G1/8-Quick coupler	-
(9)	2	G1/8-Quick coupler	-
(10)	3	G1/8-Quick coupler	-
(11)	4	G1/8-Quick coupler	-
(12)	P	G1/4-G1/4	-
(13)		G1/4-Quick coupler	-
(14)	T	G1/8-Quick coupler	-

4.3 Unload valve

4.3.1 Removing and installing the unload valve

CAUTION

- **The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, or restoration.**
- **Before disconnecting the hydraulic hoses, release the residual pressure first.**

IMPORTANT

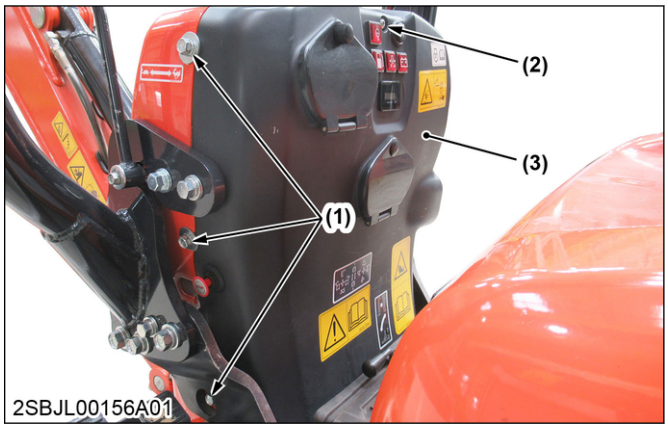
- **Install plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.**

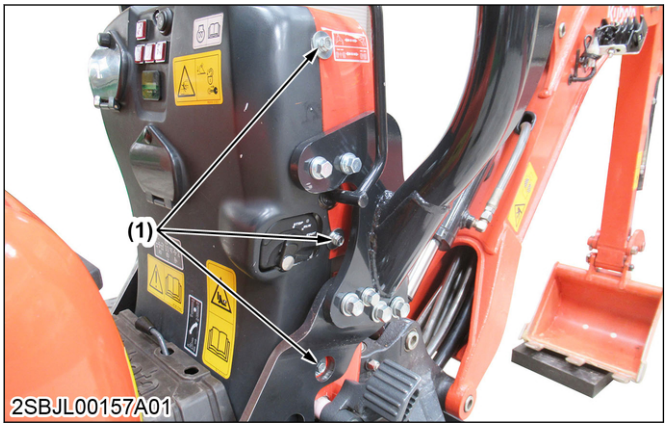
Preparing

1. Release the residual pressure.
2. Open the bonnet.
3. Remove the floor plate.
4. Remove the swivel cover RH.
5. Vacuum the hydraulic oil tank.
6. Disconnect the battery cable from the negative (-) terminal.

Removing

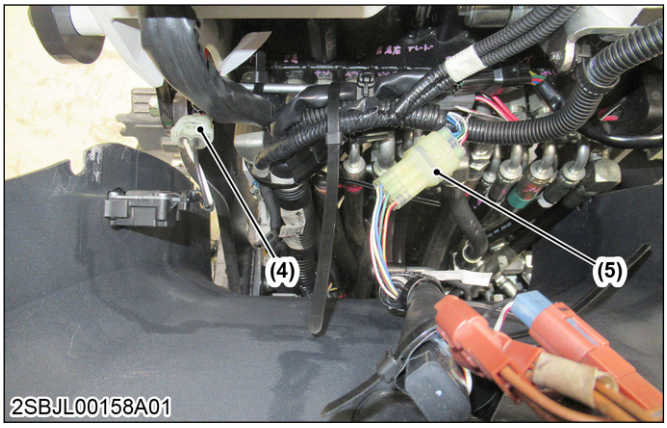
1. Remove the 6 bolts and screw to remove the rear cover.





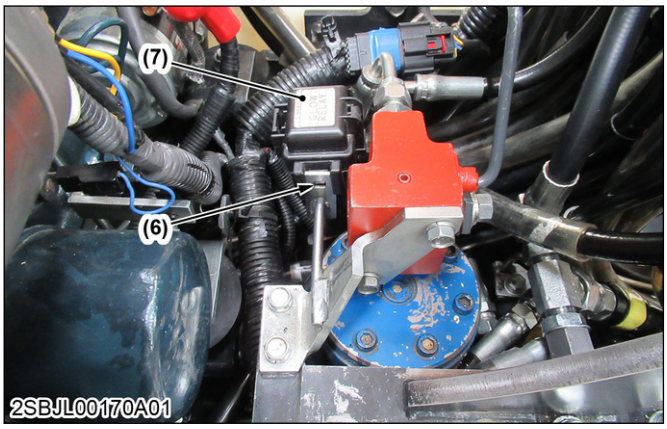
(1) Bolt (M8 × 20) ×6
(2) Screw
(3) Rear cover

2. Disconnect the engine stop connector and joint connector.



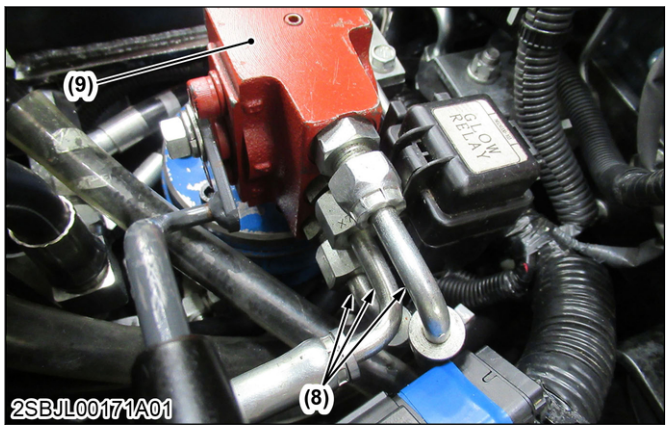
(4) Engine stop switch connector
(5) Joint connector

3. Disconnect the clamp to separate the glow relay.



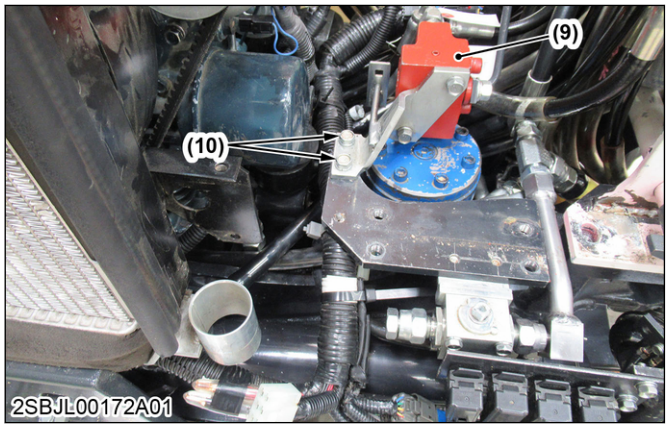
(6) Clamp
(7) Glow relay

4. Disconnect all of the hydraulic hoses from the telescopic valve.



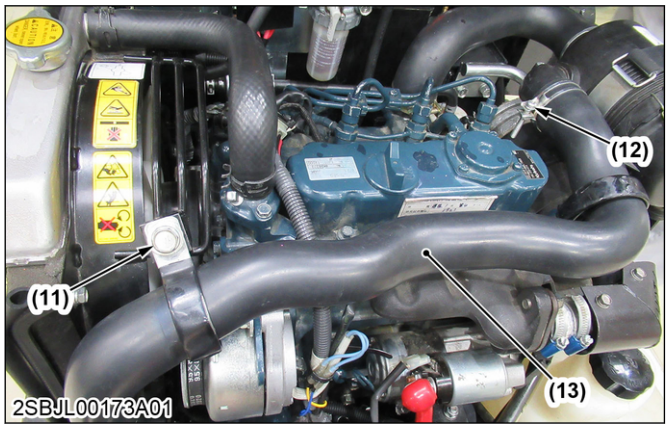
(8) Hydraulic hose (9) Telescopic valve

5. Remove the 2 bolts and then the telescopic valve.



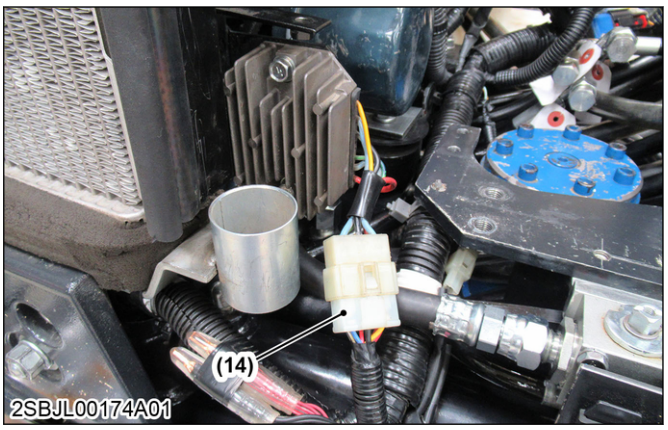
(9) Telescopic valve (10) Bolt (M8 × 16) ×2

6. Remove the 2 bolts.



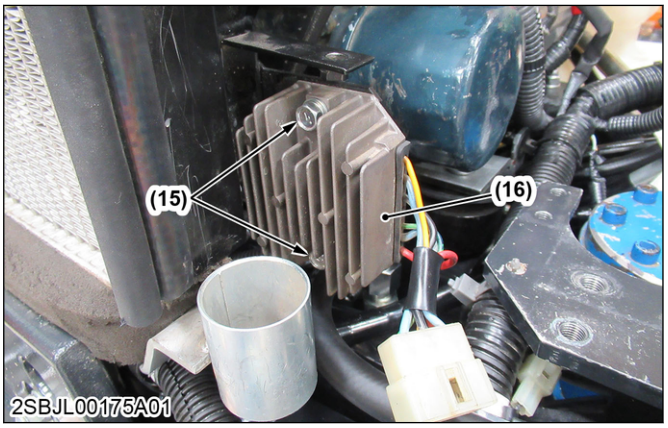
(11) Bolt (M10 × 20) ×2 (13) Inlet pipe
(12) Clamp ×2

7. Loosen the 2 clamps to remove the inlet pipe.
8. Disconnect the connector.



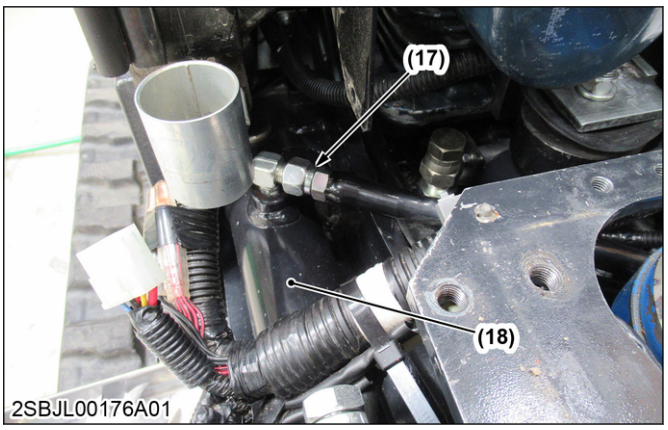
(14) Connector

9. Remove the 2 bolts and then the regurator.



(15) Bolt (M6 × 25) ×2 (16) Regurator

10. Disconnect the hydraulic hose from the swing cylinder bottom side.

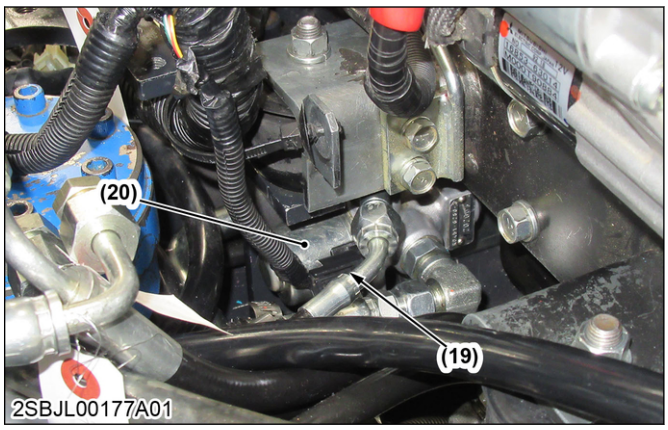


(17) Hydraulic hose (18) Swing cylinder

11. Disconnect the clamps and connectors to separate the main wire harness from the body.

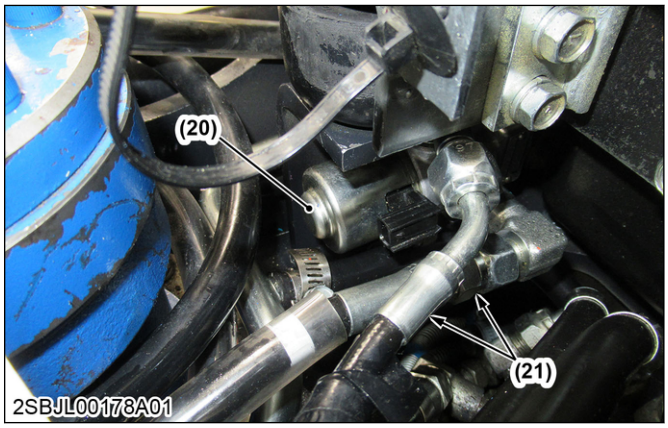
■ NOTE
- **Slide the main wire harness to provide space for removing the unload valve.**

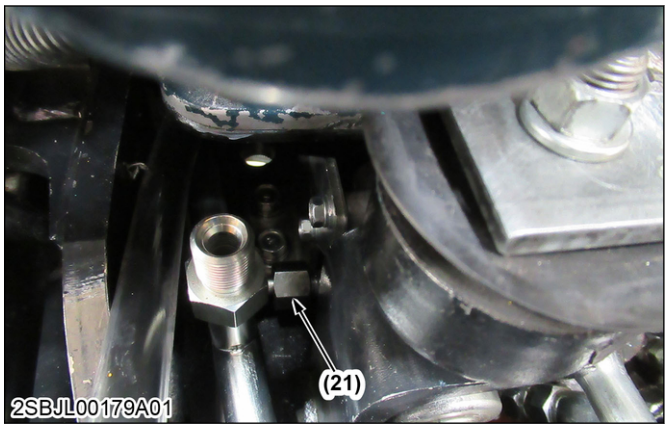
12. Disconnect the connector from the unload valve.



(19) Connector (20) Unload valve

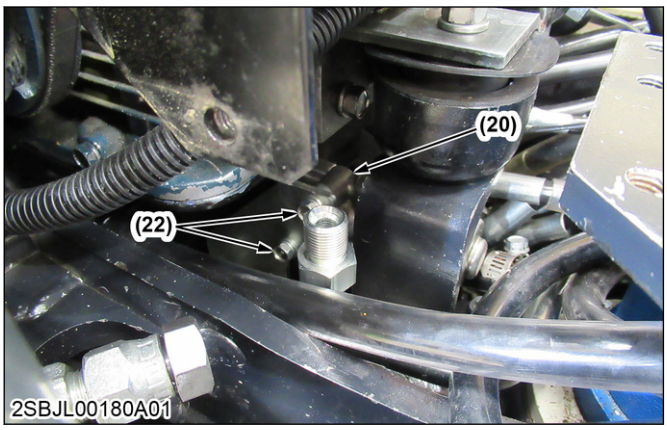
13. Disconnect all of the hydraulic hoses from the unload valve.





(20) Unload valve (21) Hydraulic hose

14. Remove the 2 bolts and then the unload valve.



(20) Unload valve (22) Bolt (M6 × 16) ×2

Installing

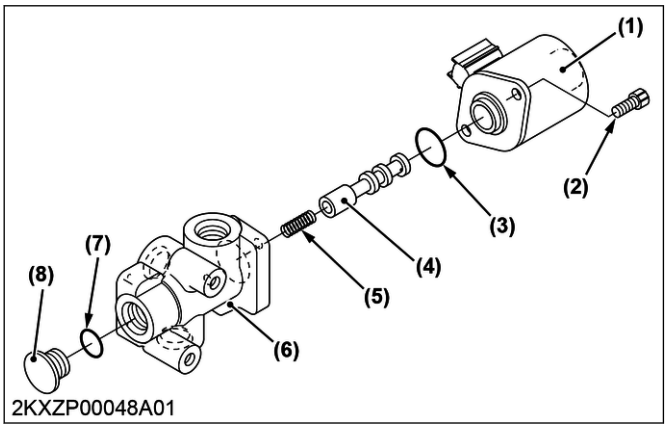
■ NOTE

- **Make sure to connect the hydraulic hoses correctly.**

Tightening torque

(22) Bolt	9.80 to 11.3 N·m 0.99 to 1.15 kgf·m 7.23 to 8.33 lbf·ft	-

4.3.2 Unload valve components



(1) Solenoid (5) Spring
(2) Bolt ×2 (6) Body
(3) O-ring (7) O-ring
(4) Spool (8) Plug

4.3.3 Disassembling and assembling the unload valve

■ IMPORTANT

- **Do not reuse removed O-rings for assembling to avoid oil leakage.**
- **Work at clean work space with clean tools and lubricants when assembling or disassembling hydraulic devices.**

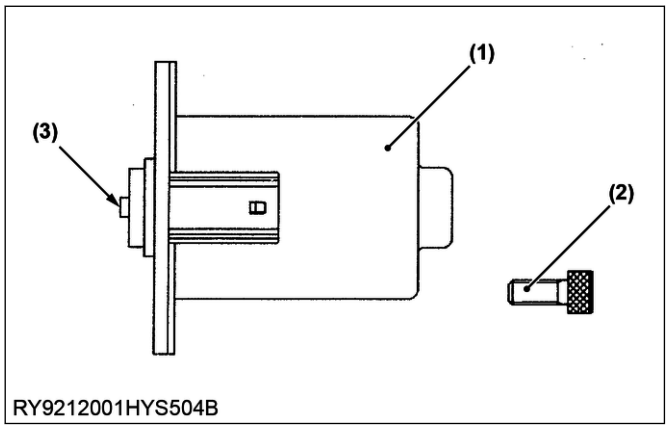
- **Check for scratches or damages carefully on the sliding and mating surfaces for every part. They might cause the oil leakage.**
- **Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.**
- **Apply lubricants or greases to every seal to avoid damage when assembling.**

Disassembling

1. Put a mark on the solenoid and body.
2. Remove the 2 bolts and the solenoid.

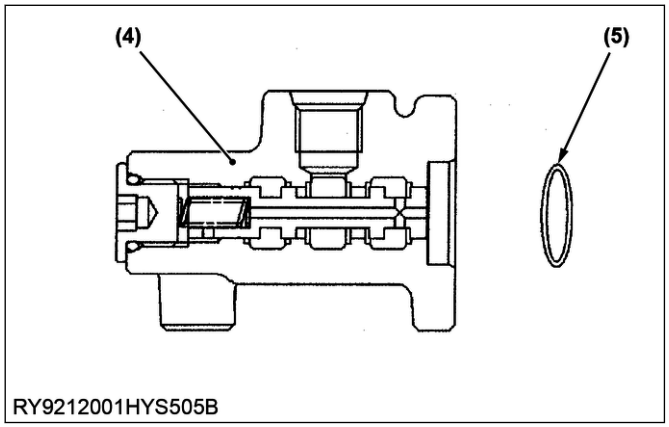
■ NOTE

- **Make sure not to drop the push rod from the solenoid.**



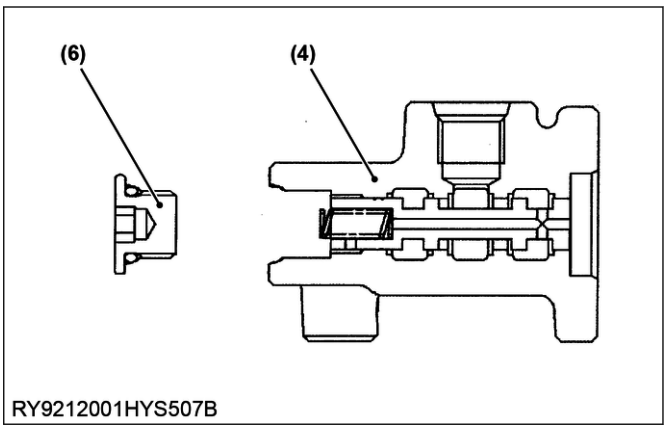
(1) Solenoid (3) Push rod
(2) Bolt (M5 × 10) ×2

3. Remove the O-ring from the body.



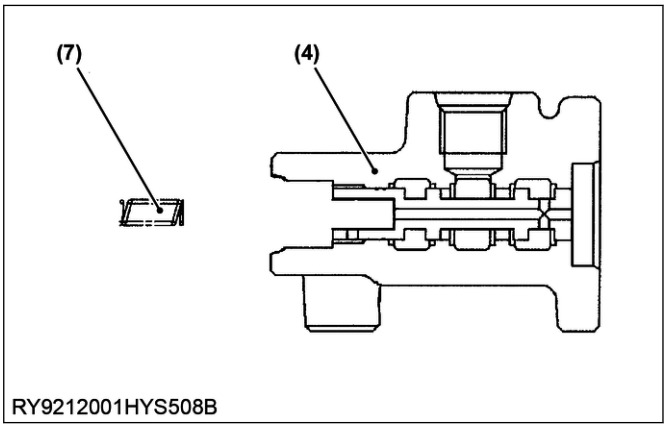
(4) Body (5) O-ring

4. Remove the plug from the body.



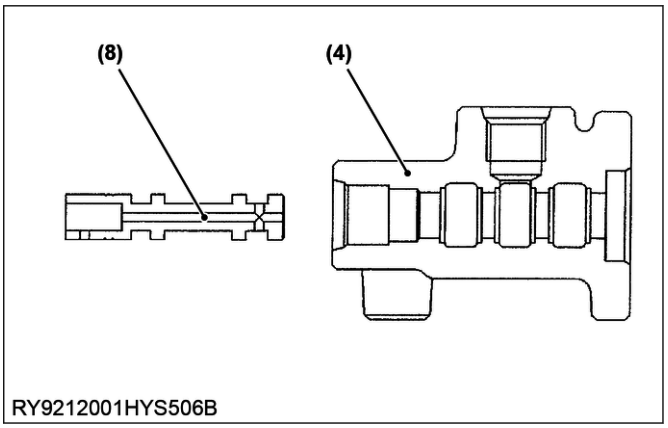
(4) Body (6) Plug

5. Remove the spring from the body.



(4) Body (7) Spring

6. Remove the spool from the body.



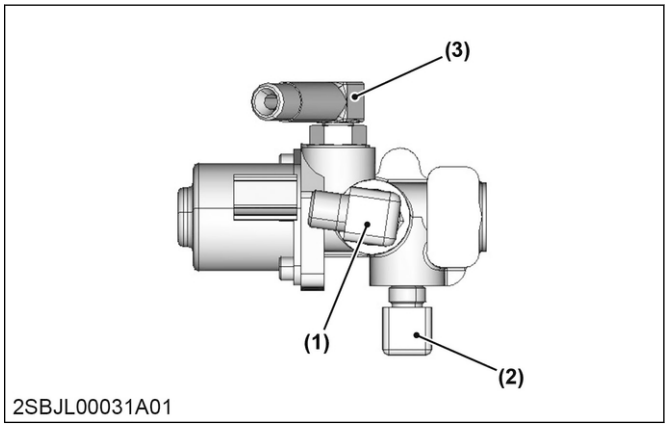
(4) Body (8) Spool

Assembling

■ IMPORTANT

- **Before installing the solenoid to the body, set the O-ring to the solenoid.**
- **Grease the O-rings.**
- **Apply hydraulic oil to the spool.**

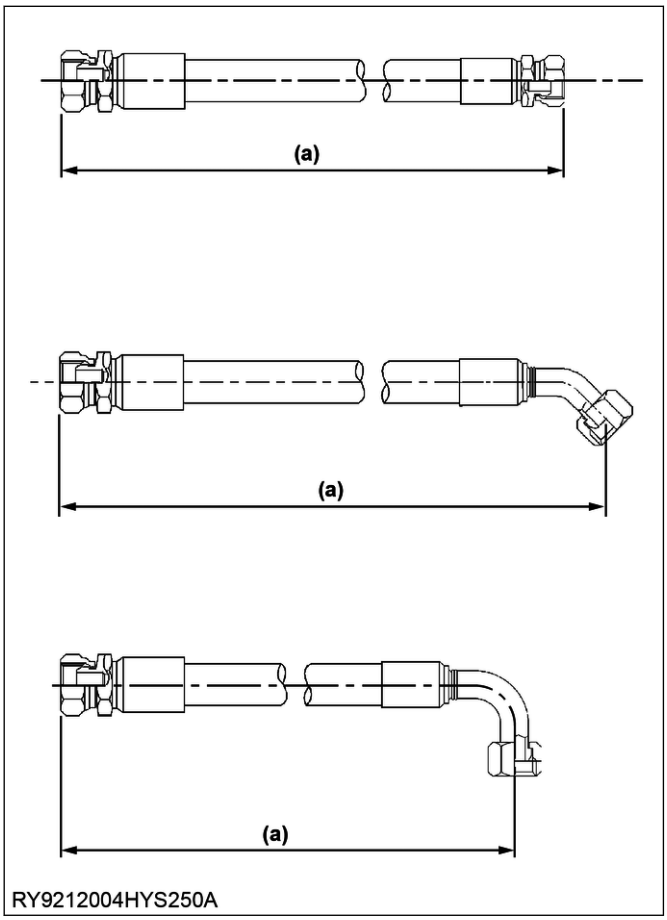
4.3.4 Installing adapters for the unload valve



Adapter No.	Port	Adapter size	Angle
(1)	A	G1/4-G1/4	5°
(2)	P	G1/4-G1/4	-
(3)	T	G1/4-G1/4	30°

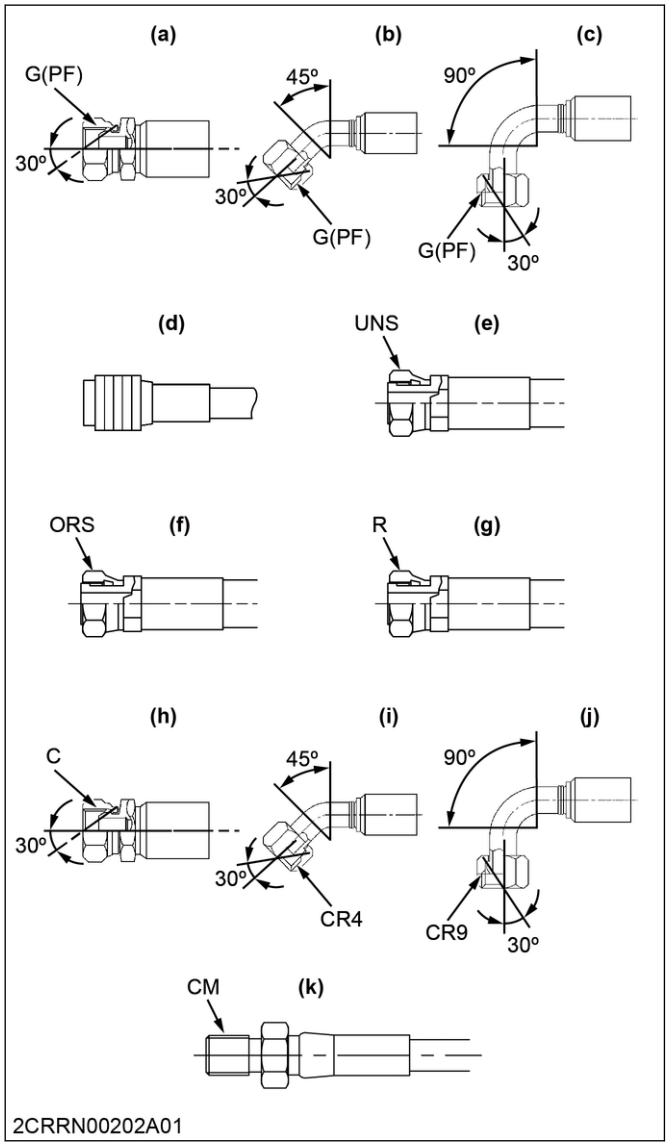
4.4 Hydraulic hose

4.4.1 Length description of hydraulic hoses



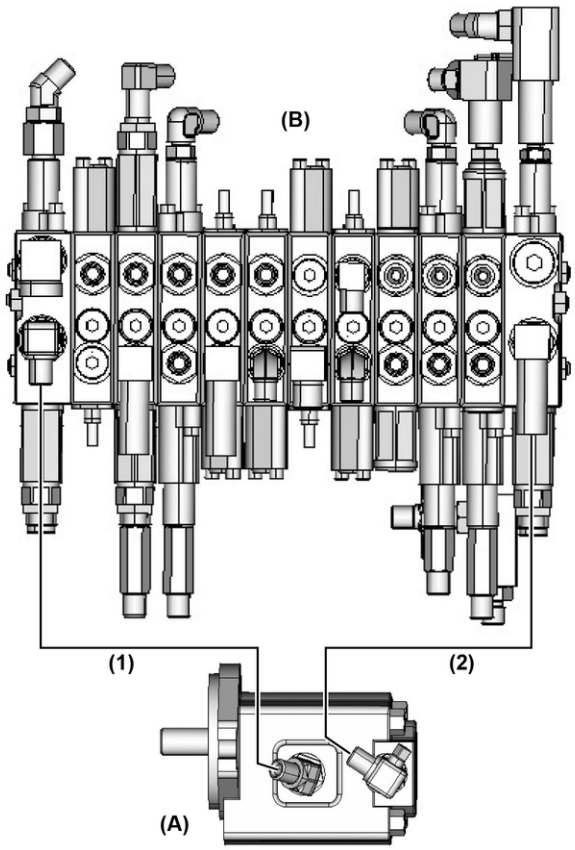
(a) Length

4.4.2 Metal fittings of hydraulic hoses



(a) Straight type parallel pipe thread (Male 30° seat)
(b) 45° type parallel pipe thread (Male 30° seat)
(c) 90° type parallel pipe thread (Male 30° seat)
(d) Quick hose coupling type
(e) UNS thread
(f) ORS thread
(g) R thread
(h) C thread
(i) 45° type CR4 thread (Male 30° seat)
(j) 90° type CR9 thread (Male 30° seat)
(k) Straight type CM thread

4.4.3 Delivery hose routing

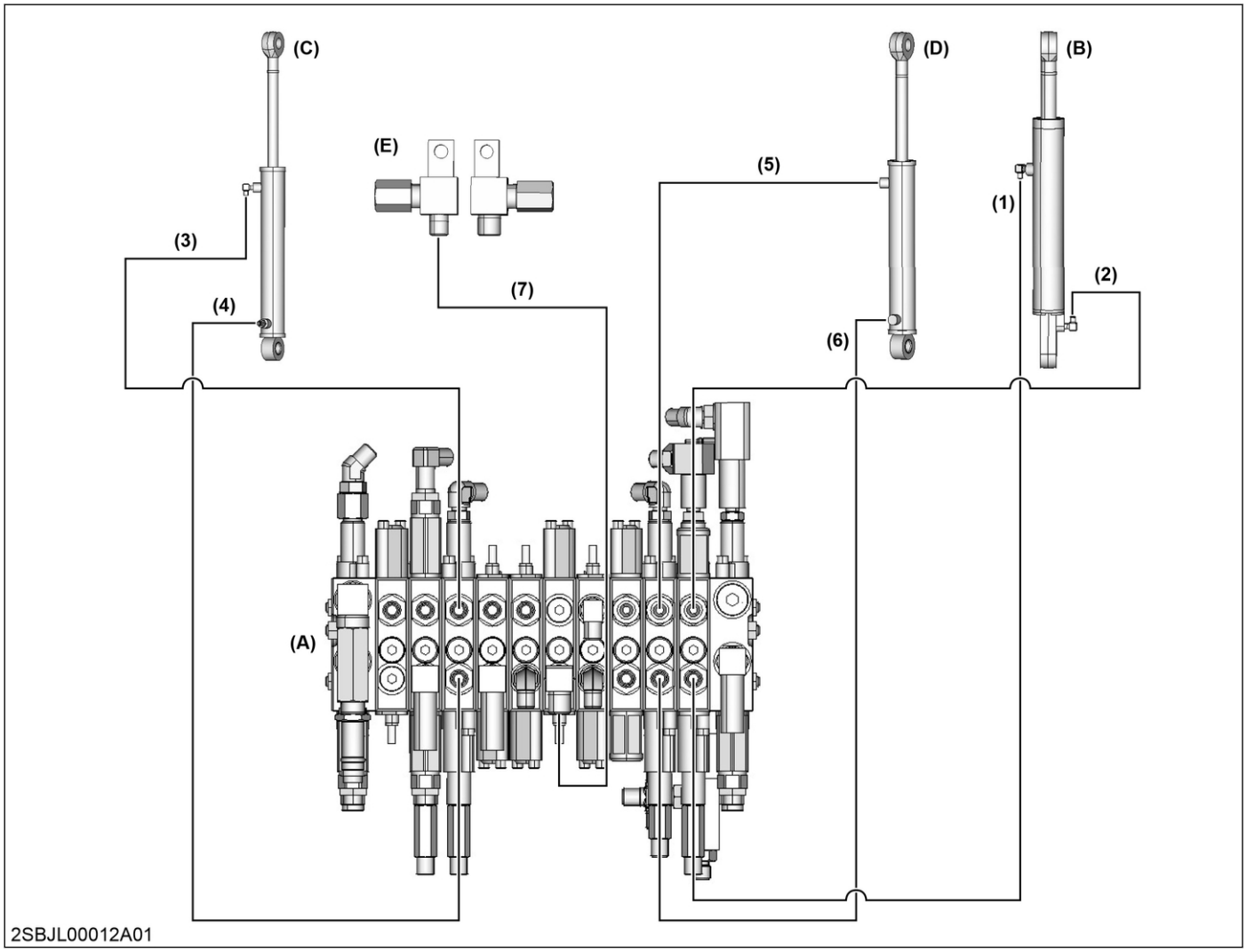


2SBJL00011A01

(A) Hydraulic pump (B) Control valve (C/V)

No.	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(1)	Hydraulic pump (P1) - C/V (P1)	560 mm 22.0 in.	White	G1/4 straight	G1/4 straight	-
(2)	Hydraulic pump (P2) - C/V (P2)	660 mm 26.0 in.	White	G1/4 90°	G1/4 45°	-

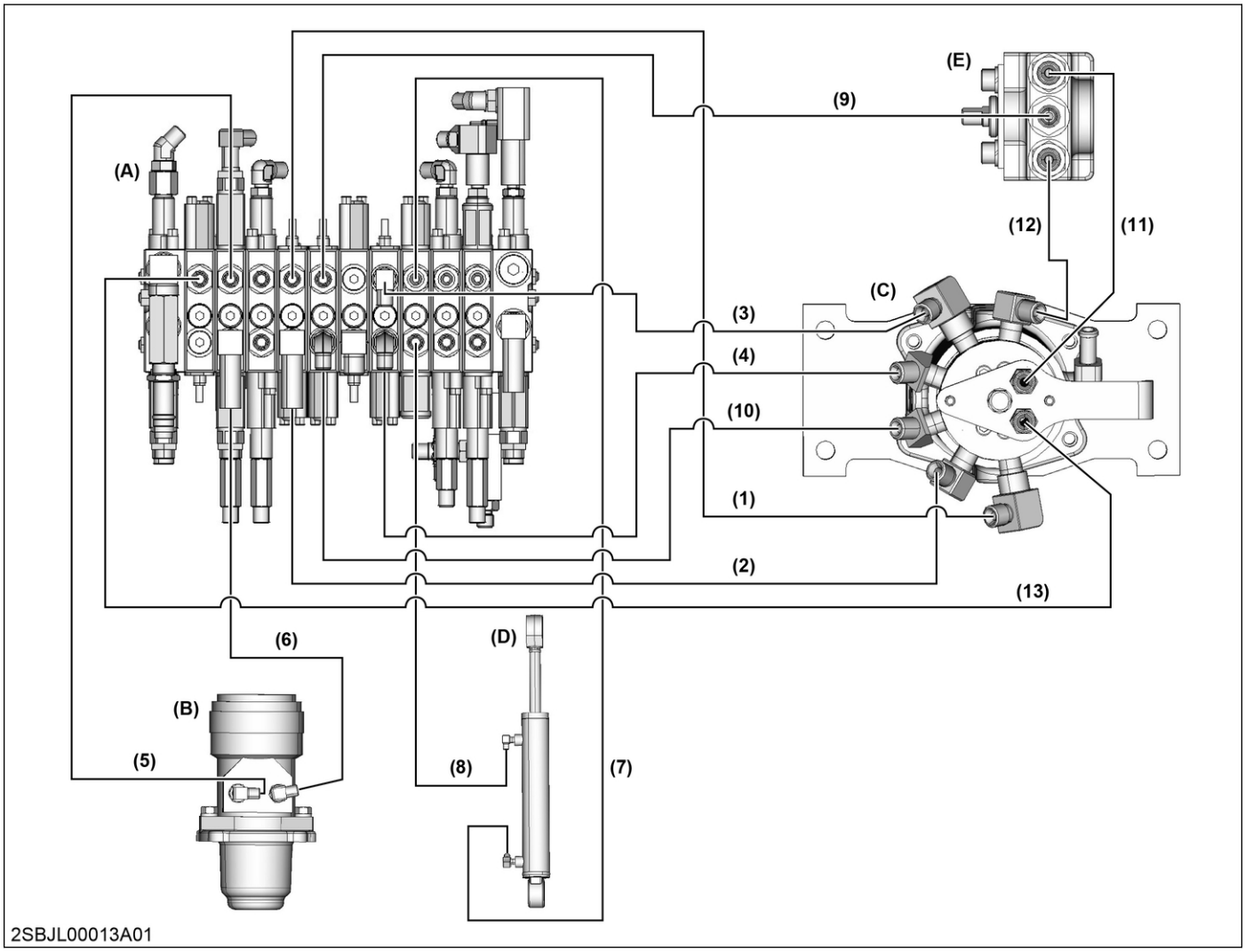
4.4.4 Front hose routing



(A) Control valve (C/V)
(B) Boom cylinder
(C) Arm cylinder
(D) Bucket cylinder
(E) AUX discharging port

No.	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(1)	C/V (B10) - Boom cylinder (rod)	1430 mm 56.30 in.	-	G1/4 90°	G1/4 straight	-
(2)	C/V (A10) - Boom cylinder (bottom)	1360 mm 53.54 in.	White	G1/4 90°	G1/4 straight	-
(3)	C/V (A3) - Arm cylinder (rod)	1980 mm 77.95 in.	Red	G1/4 90°	G1/4 straight	-
(4)	C/V (B3) - Arm cylinder (bottom)	1620 mm 63.78 in.	Blue	G1/4 90°	G1/4 straight	-
(5)	C/V (A9) - Bucket cylinder (rod)	2850 mm 112.2 in.	Green - White	G1/4 90°	G1/4 straight	-
(6)	C/V (B9) - Bucket cylinder (bottom)	2580 mm 101.6 in.	Yellow - White	G1/4 90°	G1/4 straight	-
(7)	C/V (B6) - AUX discharging port	1910 mm 75.20 in.	-	G3/8 straight	G3/8 straight	-

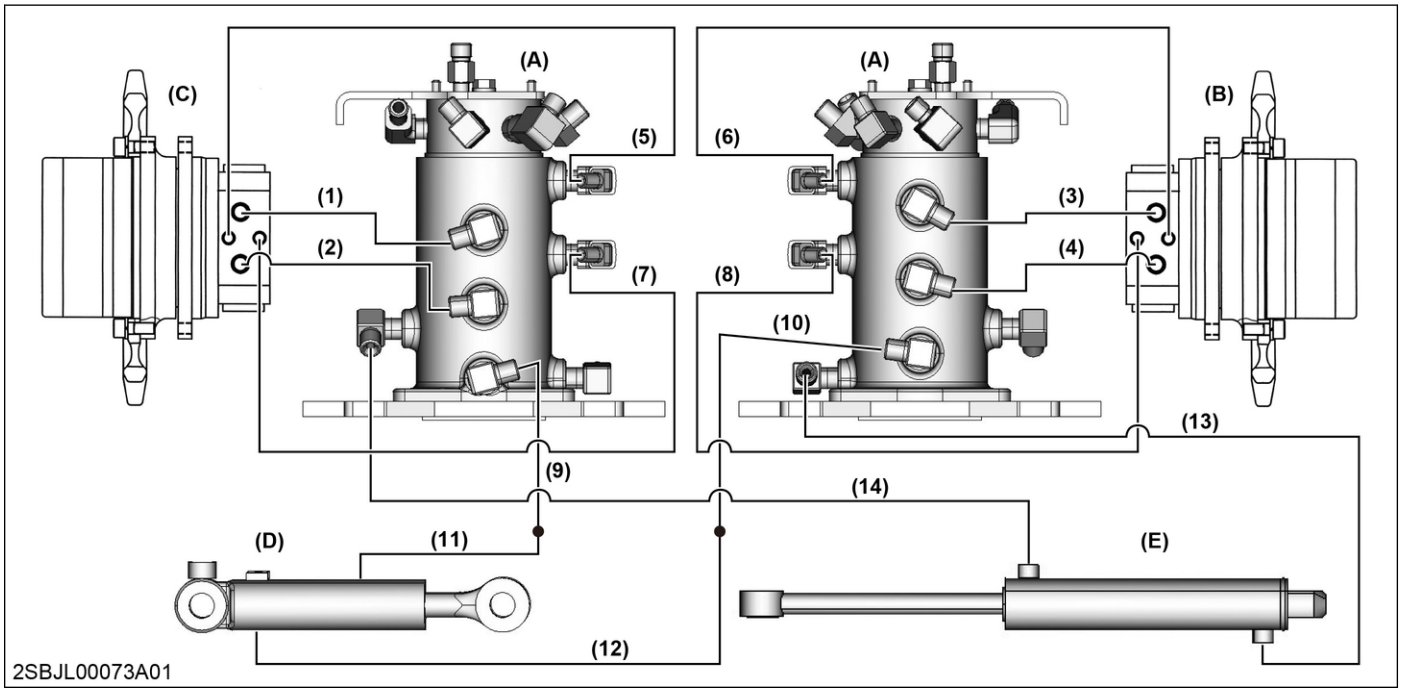
4.4.5 Swivel and swing hose routing



(A) Control valve (C/V)
(B) Swivel motor
(C) Swivel joint (S/J)
(D) Swing cylinder
(E) Telescopic valve

No.	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(1)	C/V (A4) - S/J (C)	545 mm 21.5 in.	Green	G1/4 90°	G1/4 straight	-
(2)	C/V (B4) - S/J (B)	490 mm 19.3 in.	Yellow	G1/4 90°	G1/4 straight	-
(3)	C/V (A7) - S/J (H)	490 mm 19.3 in.	Red	G1/4 straight	G1/4 straight	-
(4)	C/V (B7) - S/J (I)	460 mm 18.1 in.	Blue	G1/4 straight	G1/4 straight	-
(5)	C/V (A2) - Swivel motor (B)	450 mm 17.7 in.	Brown	G1/4 90°	G1/4 straight	-
(6)	C/V (B2) - Swivel motor (A)	410 mm 16.1 in.	Pink	G1/4 90°	G1/4 straight	-
(7)	C/V (A8) - Swing cylinder (bottom)	620 mm 24.4 in.	White	G1/4 90°	G1/4 straight	-
(8)	C/V (B8) - Swing cylinder (rod)	685 mm 27.0 in.	-	G1/4 90°	G1/4 straight	-
(9)	C/V (A5) - Telescopic valve (P)	265 mm 10.4 in.	-	G1/4 90°	G1/4 90°	-
(10)	C/V (B5) - S/J (A)	460 mm 18.1 in.	Light blue	G1/4 straight	G1/4 straight	-
(11)	Telescopic valve (B) - S/J (F)	290 mm 11.4 in.	-	G1/4 90°	G1/4 45°	-
(12)	Telescopic valve (A) - S/J (G)	280 mm 11.0 in.	Brown	G1/4 90°	G1/4 90°	-
(13)	C/V (A1) - S/J (D)	530 mm 20.9 in.	-	G1/4 90°	G1/4 45°	-

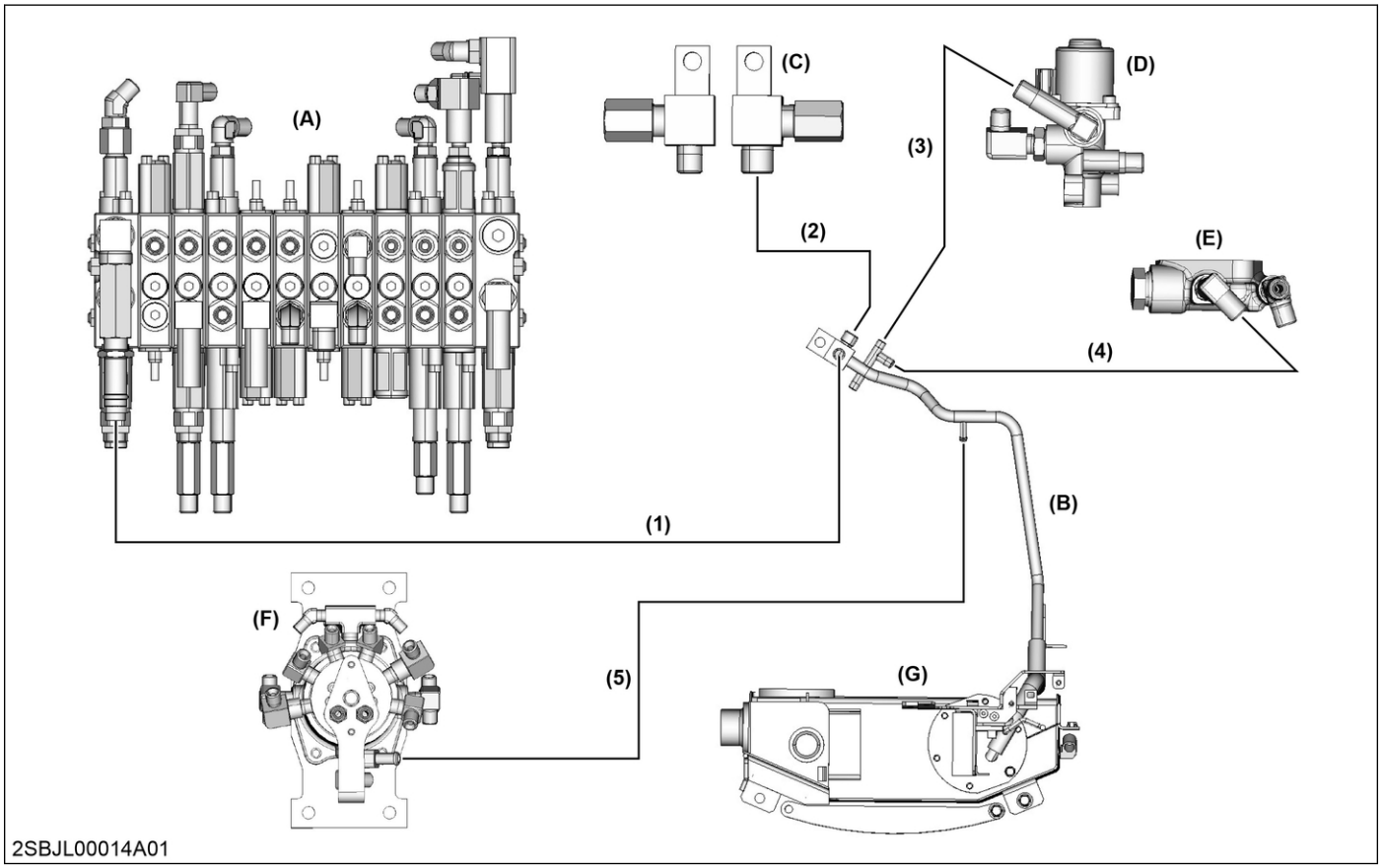
4.4.6 Travel, blade, and track hose routing



(A) Swivel joint (S/J)
(B) Travel motor LH
(C) Travel motor RH
(D) Blade cylinder
(E) Track cylinder

No.	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(1)	S/J (H) - Travel motor RH (B)	610 mm 24.0 in.	-	G1/4 straight	G1/4 straight	Spring
(2)	S/J (I) - Travel motor RH (A)	610 mm 24.0 in.	-	G1/4 straight	G1/4 straight	Spring
(3)	S/J (C) - Travel motor LH (A)	610 mm 24.0 in.	-	G1/4 straight	G1/4 straight	Spring
(4)	S/J (B) - Travel motor LH (B)	610 mm 24.0 in.	-	G1/4 straight	G1/4 straight	Spring
(5)	S/J (E) - Travel motor RH (Dr)	700 mm 27.6 in.	Blue	G1/8 straight	G1/8 straight	Spring
(6)	S/J (E) - Travel motor LH (Dr)	700 mm 27.6 in.	Blue	G1/8 straight	G1/8 straight	Spring
(7)	S/J (D) - Travel motor RH (Pp)	700 mm 27.6 in.	-	G1/8 straight	G1/8 straight	Spring
(8)	S/J (D) - Travel motor LH (Pp)	700 mm 27.6 in.	-	G1/8 straight	G1/8 straight	Spring
(9)	S/J (A) - Hydraulic hose (11)	245 mm 9.65 in.	-	G1/4 straight	G1/4 straight	Spring
(10)	S/J (F) - Hydraulic hose (12)	245 mm 9.65 in.	-	G1/4 straight	G1/4 straight	Spring
(11)	Hydraulic hose (9) - Blade cylinder (rod)	415 mm 16.3 in.	-	G1/4 45°	G1/4 straight	Spring
(12)	Hydraulic hose (10) - Blade cylinder (bottom)	415 mm 16.3 in.	-	G1/4 45°	G1/4 straight	Spring
(13)	S/J (A) - Track cylinder (bottom)	445 mm 17.5 in.	White	G1/4 90°	G1/4 straight	-
(14)	S/J (G) - Track cylinder (rod)	350 mm 13.8 in.	-	G1/4 90°	G1/4 45°	-

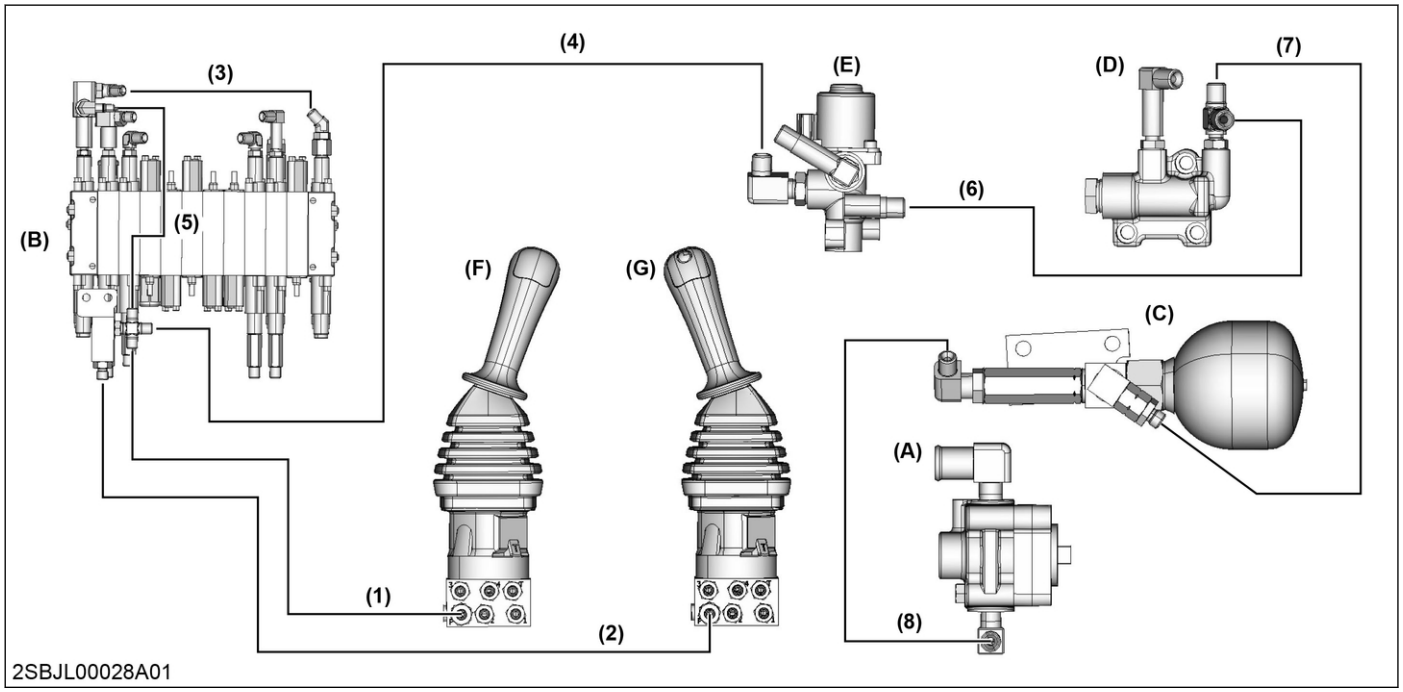
4.4.7 Drain hose routing



(A) Control valve (C/V)
(B) Return pipe
(C) AUX returning port
(D) Unload valve
(E) Relief valve
(F) Swivel joint (S/J)
(G) Hydraulic oil tank

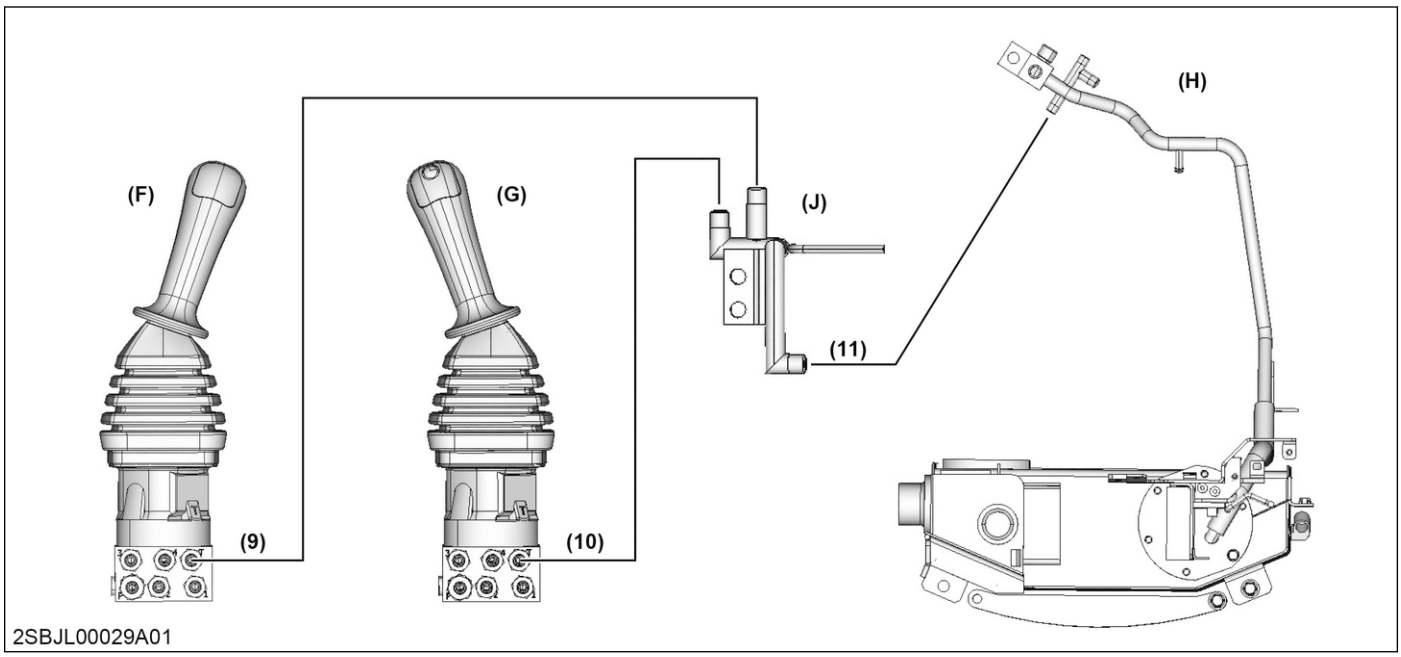
No.	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(1)	C/V (T1) - Return pipe	Molded hose	-	-	-	-
(2)	AUX returning port - Return pipe	1820 mm 71.65 in.	-	G1/2 straight	G1/2 straight	-
(3)	Unload valve (T) - Return pipe	415 mm 16.3 in.	-	G1/4 45°	G1/4 straight	-
(4)	Relief valve - Return pipe	375 mm 14.8 in.	-	G1/4 straight	G1/4 straight	-
(5)	S/J (E) - Return pipe	190 mm 7.48 in.	-	-	-	-

4.4.8 Pilot hose routing (delivery, drain)



(A) Hydraulic pump
(B) Control valve (C/V)
(C) Accumulator
(D) Relief valve
(E) Unload valve
(F) Pilot control valve LH
(G) Pilot control valve RH

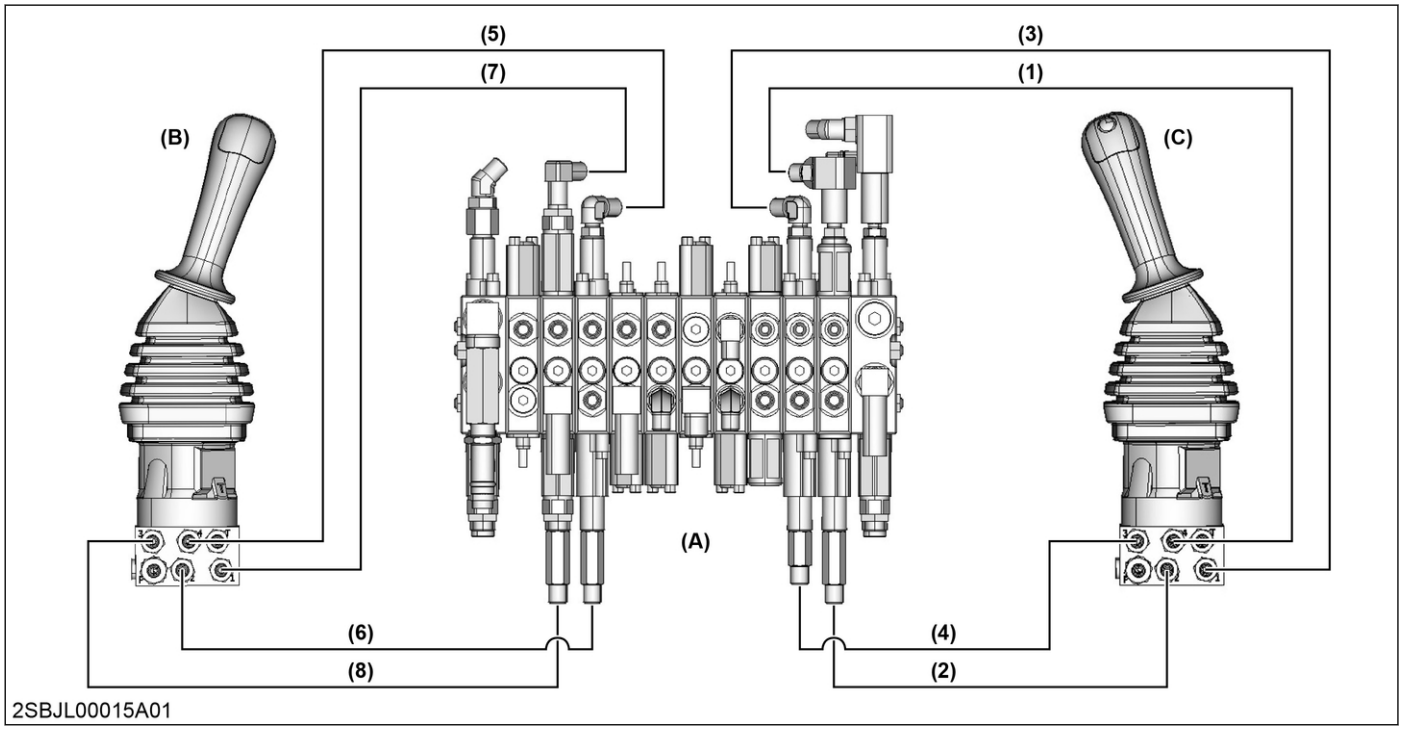
No.	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(1)	Pilot control valve LH (P) - C/V (Manifold block)	2150 mm 84.65 in.	White	Quick coupler	G1/4 90°	-
(2)	Pilot control valve RH (P) - C/V (Manifold block)	2480 mm 97.64 in.	White - White	Quick coupler	G1/4 90°	-
(3)	C/V (Pp2) - C/V (Pp1)	250 mm 9.84 in.	-	G1/4 45°	G1/4 straight	-
(4)	Unload valve (A) - C/V (Manifold block)	460 mm 18.1 in.	White	G1/4 straight	G1/4 90°	-
(5)	C/V (Pp2) - C/V (Manifold block)	520 mm 20.5 in.	-	Quick coupler	G1/4 90°	-
(6)	Relief valve - Unload valve (P)	305 mm 12.0 in.	White	G1/4 straight	G1/4 90°	-
(7)	Accumulator - Relief valve	1145 mm 45.08 in.	White	G1/4 straight	G1/4 90°	-
(8)	Hydraulic pump (Pp) - Accumulator	785 mm 30.9 in.	-	G1/4 90°	G1/4 90°	-



(F) Pilot control valve LH (G) Pilot control valve RH (H) Return pipe (J) Return bracket

No.	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(9)	Pilot control valve LH (T) - Return bracket	1180 mm 46.46 in.	-	Quick coupler	G1/4 45°	-
(10)	Pilot control valve RH (T) - Return bracket	1580 mm 62.20 in.	-	Quick coupler	G1/4 90°	-
(11)	Return bracket - Return pipe	410 mm 16.1 in.	-	G1/4 90°	G1/4 straight	-

4.4.9 Pilot hose routing (operation)



(A) Control valve (C/V) (B) Pilot control valve LH (C) Pilot control valve RH

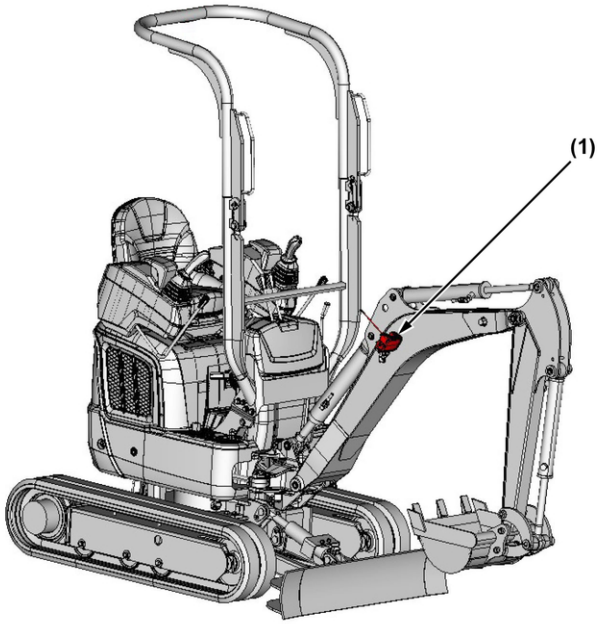
No.	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(1)	Pilot control valve RH (4) - C/V (Pa10)	2720 mm 107.1 in.	Light blue	Quick coupler	G1/4 45°	-
(2)	Pilot control valve RH (2) - C/V (Pb10)	2490 mm 98.03 in.	Gray	Quick coupler	G1/4 90°	-
(3)	Pilot control valve RH (1) - C/V (Pa9)	2660 mm 104.7 in.	Brown	Quick coupler	G1/4 90°	-
(4)	Pilot control valve RH (3) - C/V (Pb9)	2490 mm 98.03 in.	Pink	Quick coupler	G1/4 90°	-
(5)	Pilot control valve LH (4) - C/V (Pa3)	2330 mm 91.73 in.	Blue	Quick coupler	G1/4 90°	-
(6)	Pilot control valve LH (2) - C/V (Pb3)	1990 mm 78.35 in.	Green	Quick coupler	G1/4 90°	-
(7)	Pilot control valve LH (1) - C/V (Pa2)	2320 mm 91.34 in.	Yellow	Quick coupler	G1/4 90°	-
(8)	Pilot control valve LH (3) - C/V (Pb2)	1950 mm 76.77 in.	Red	Quick coupler	G1/4 90°	-

6. ELECTRICAL SYSTEM

MECHANISM

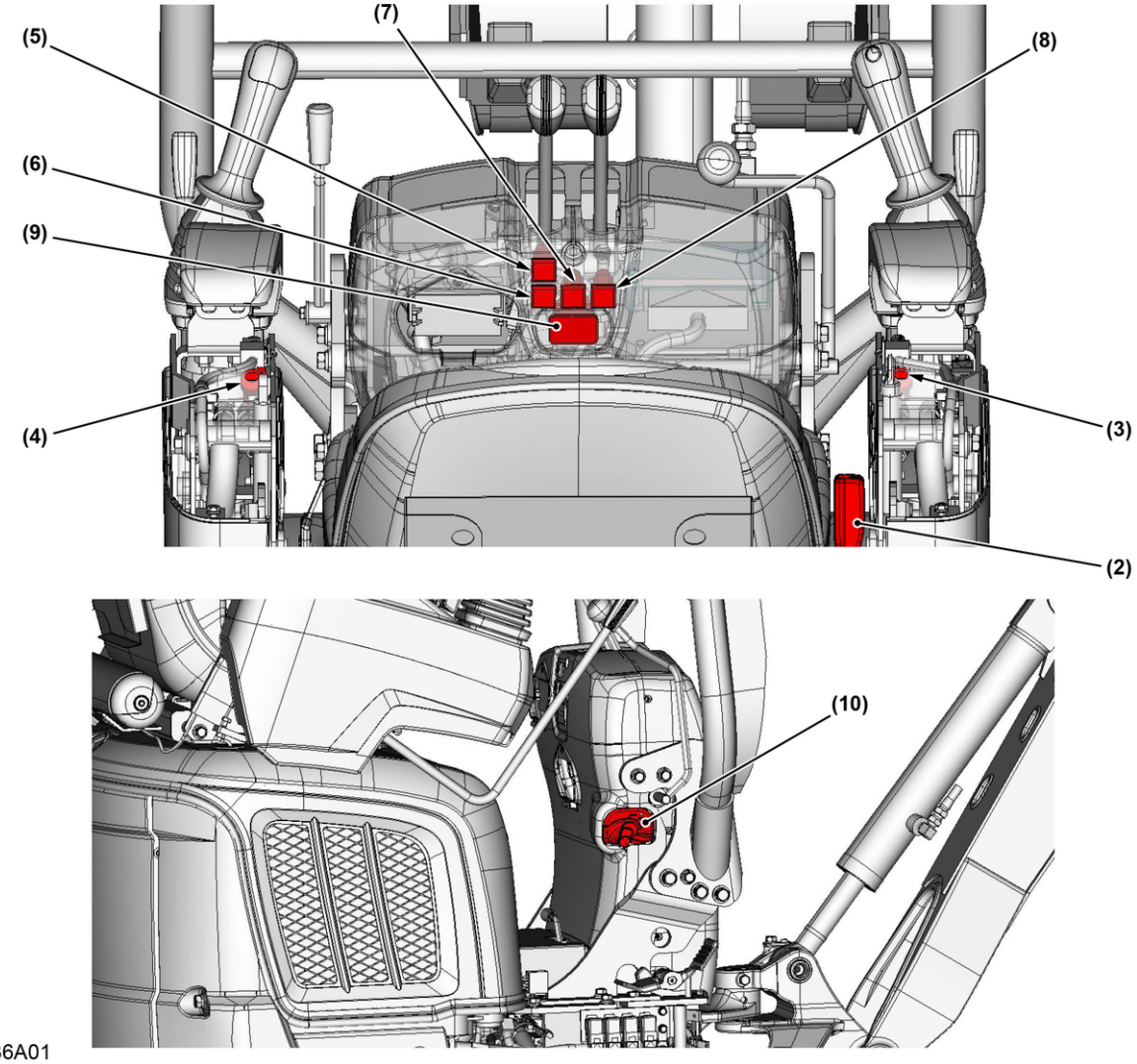
1. Electrical device

1.1 Electrical device layout



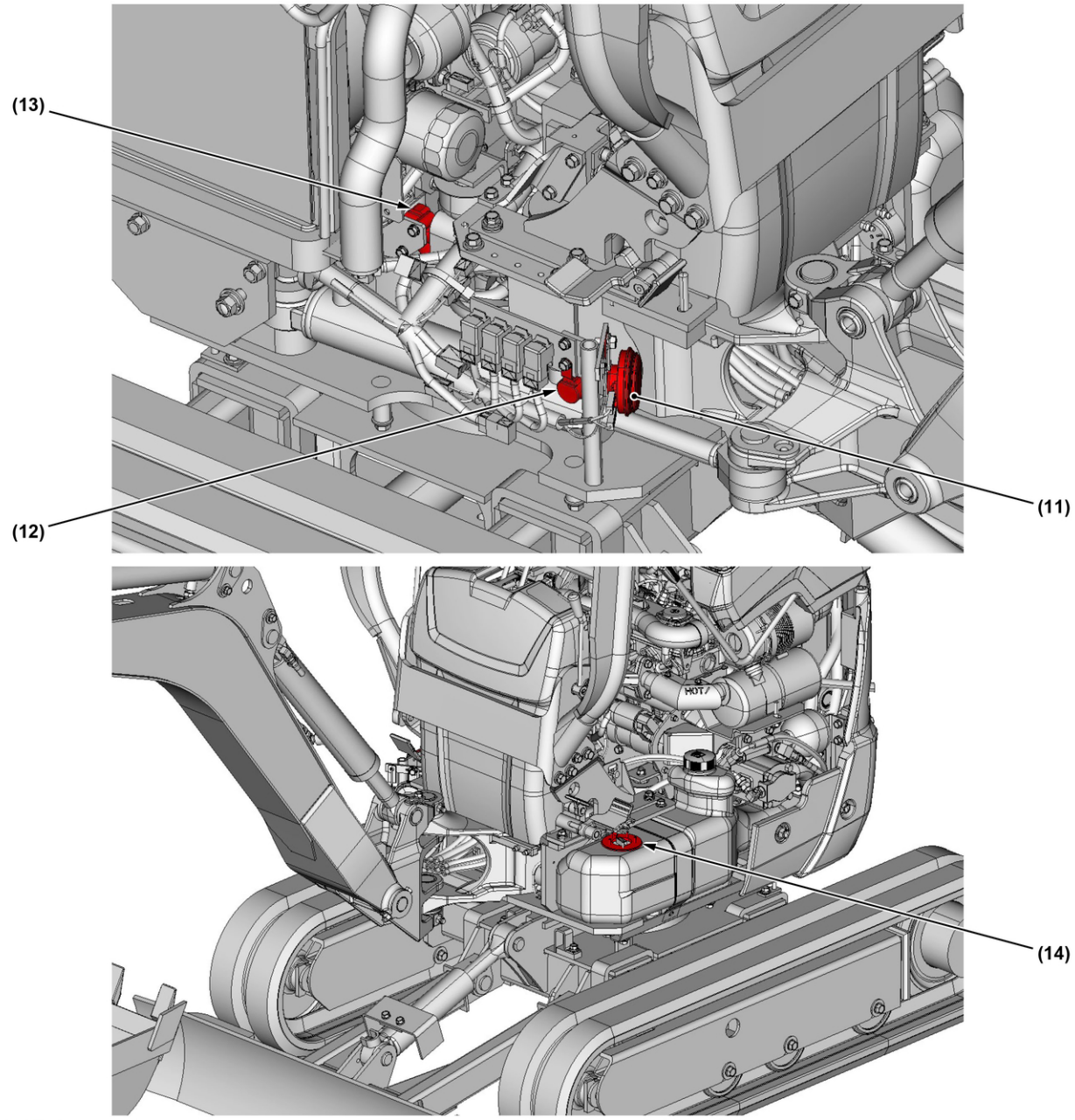
2SBJL00035A01

(1) Work light (boom)

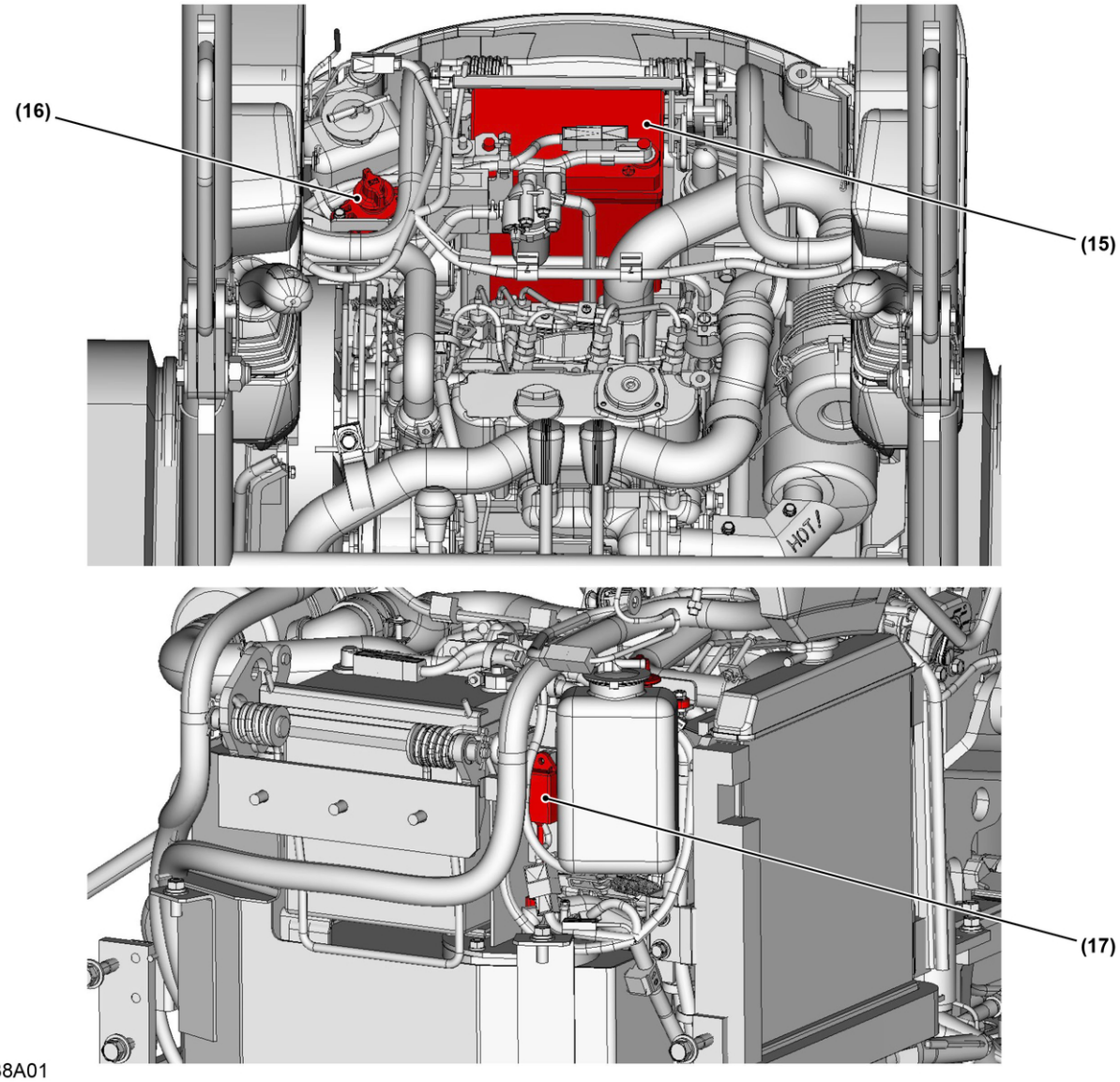


2SBJL00036A01

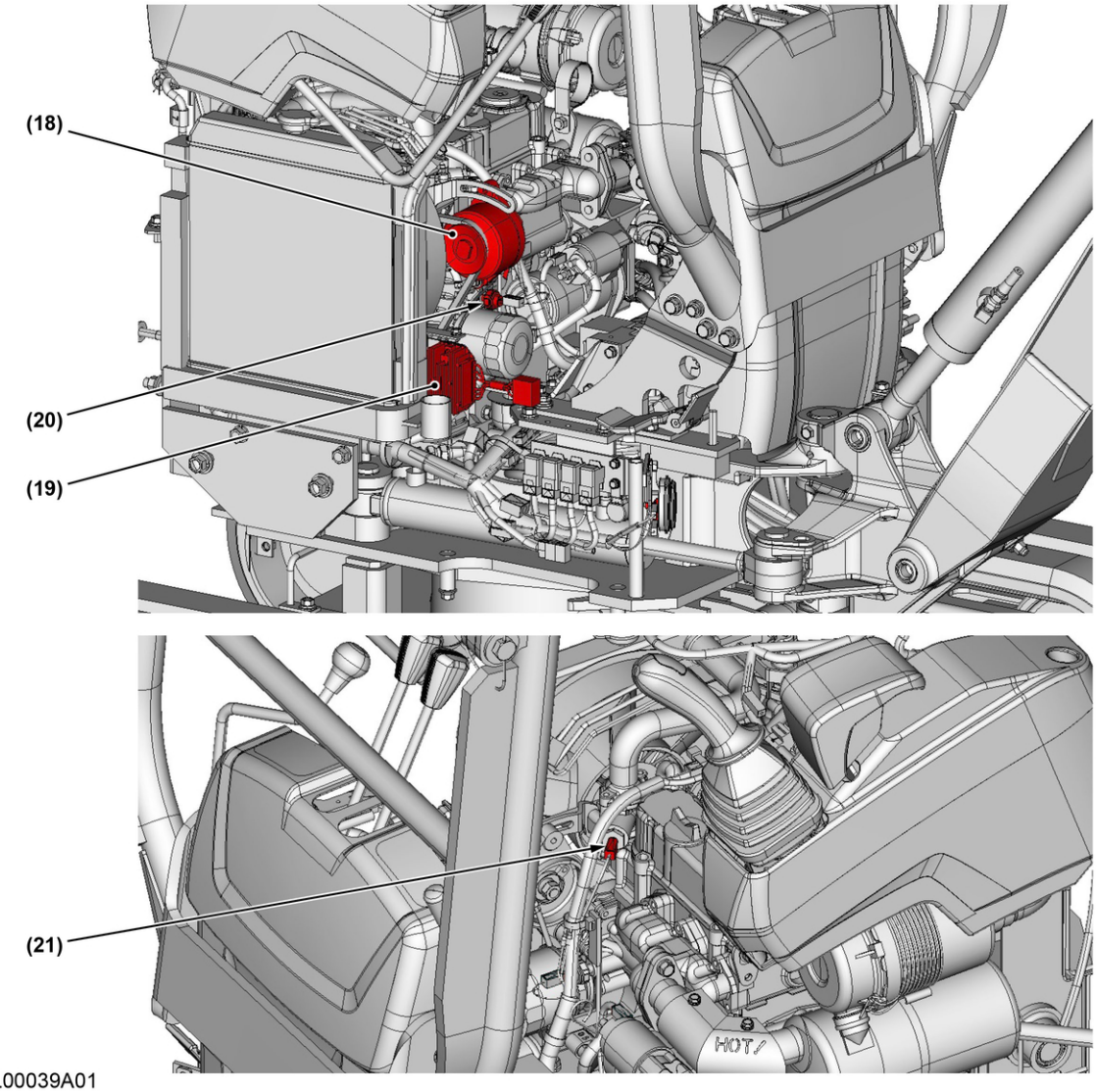
(2) Seat belt switch
(3) Lever lock switch RH
(4) Lever lock switch LH
(5) Coolant temperature lamp
(6) Fuel level lamp
(7) Engine oil pressure lamp
(8) Charge lamp
(9) Hour meter
(10) Anti-theft antenna



(11) Horn (12) Buzzer (13) Lever lock solenoid (14) Fuel level sensor

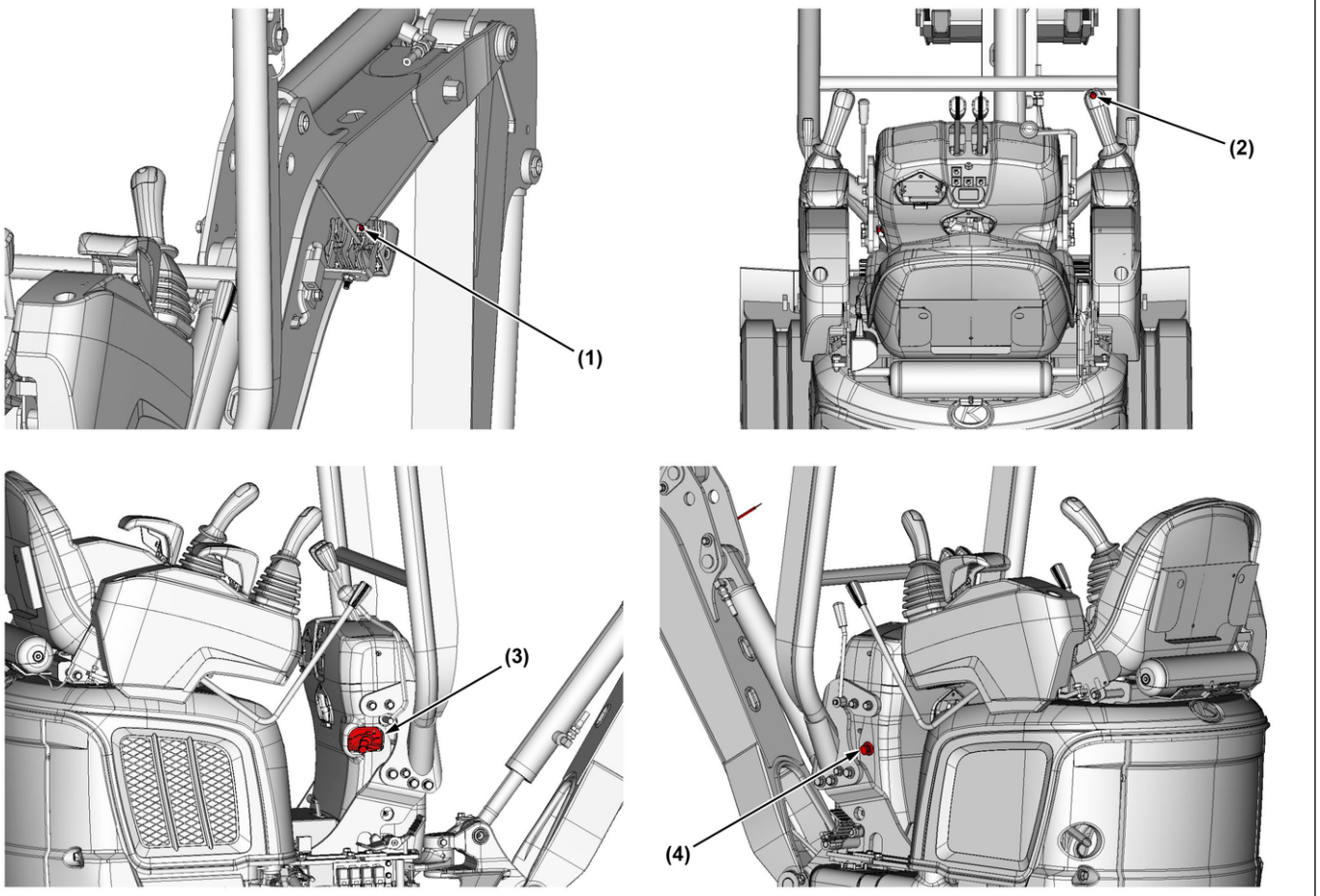


(15) Battery (16) Battery isolator (17) Timer



(18) Dynamo (19) Regurator (20) Engine oil pressure switch (21) Coolant temperature switch

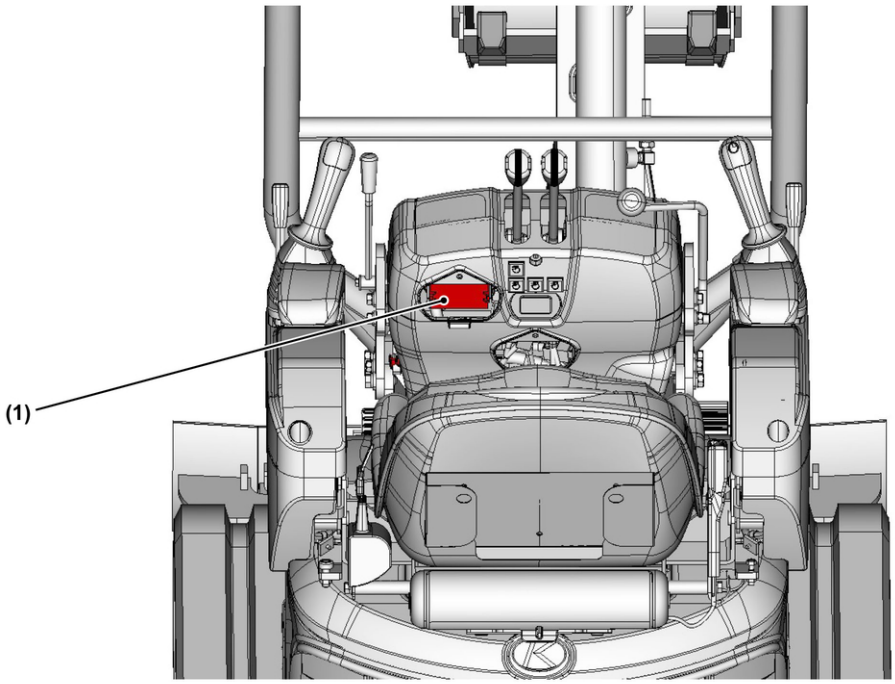
1.2 Switch layout



2SBJL00040A01

(1) Work light switch
(2) Horn switch
(3) Starter switch
(4) Engine stop switch

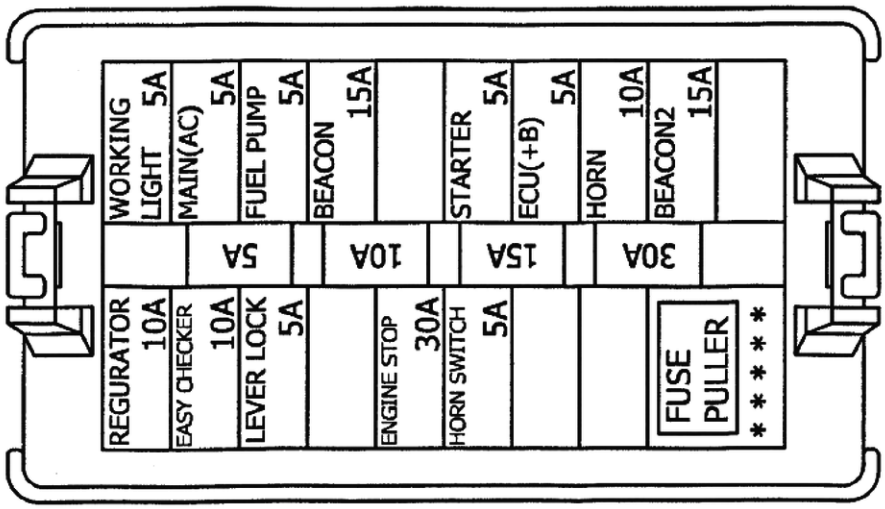
1.3 Fuse layout



2SBJL00041A01

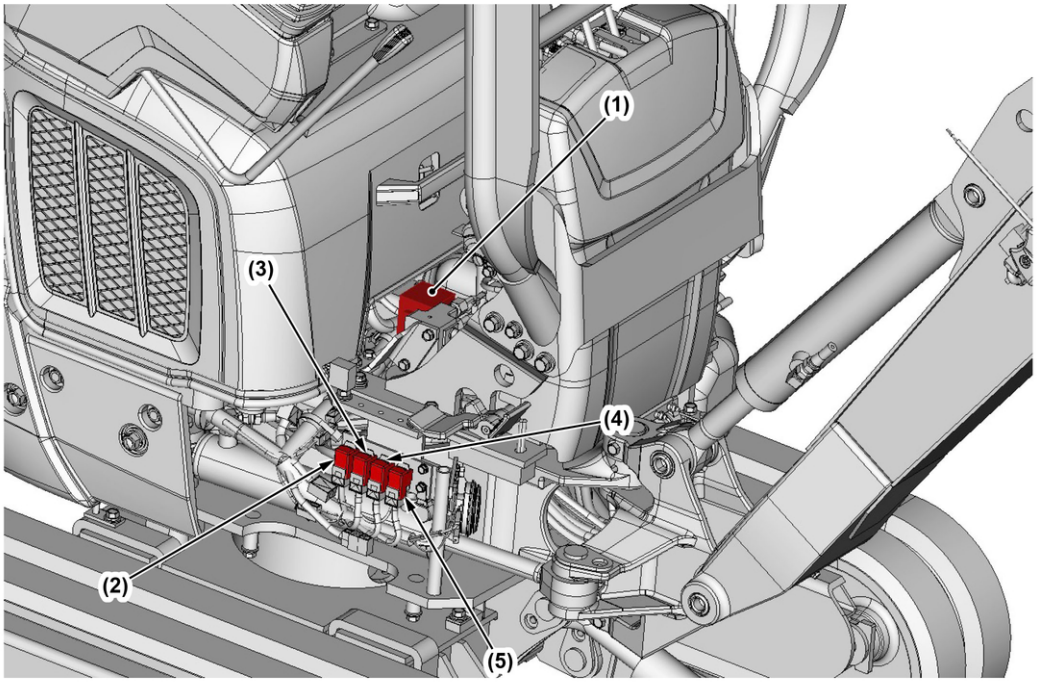
(1) Fuse box

Fuse label



2SBJL00042A01

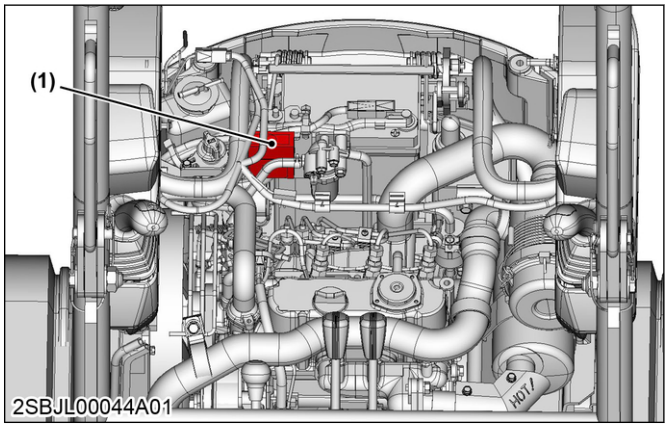
1.4 Relay layout



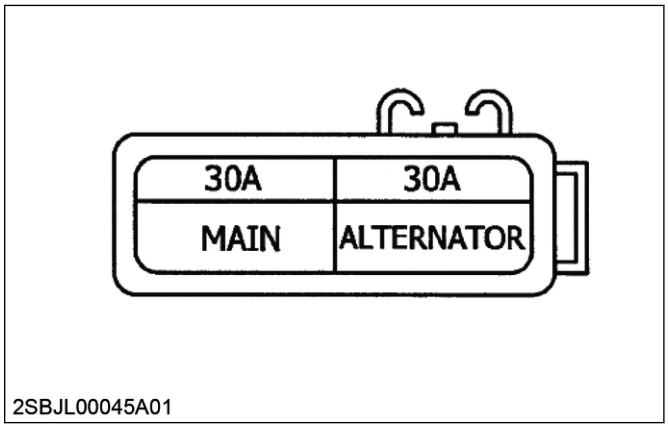
2SBJL00043A01

(1) Glow relay box
(2) Starter relay
(3) Horn relay
(4) Engine stop solenoid relay
(5) Starter relay

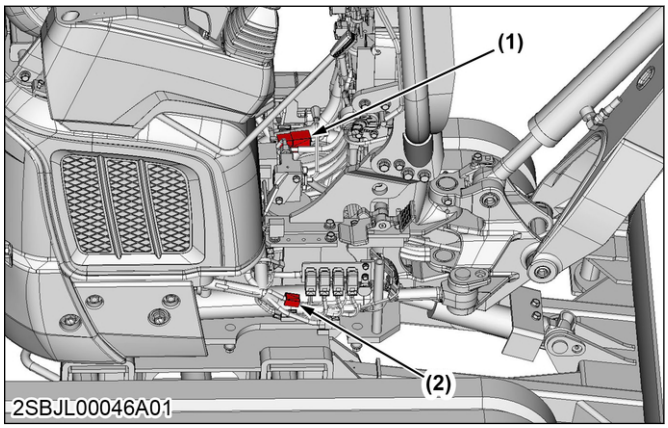
1.5 Slow blow fuse layout



(1) Slow blow fuse box

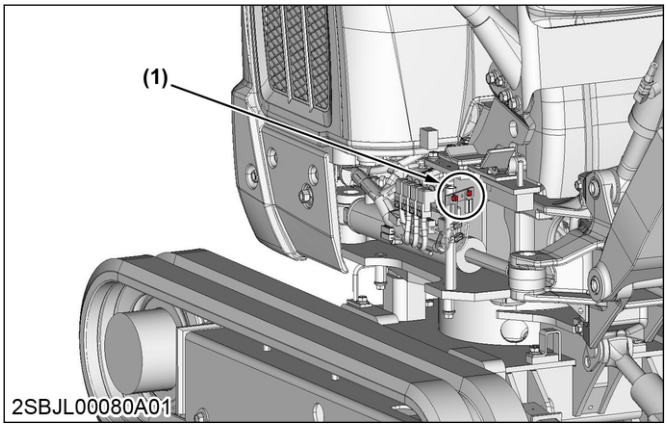


1.6 Communication port layout

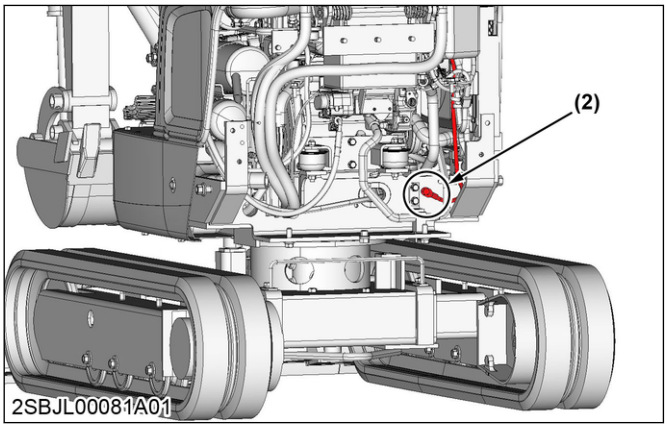


(1) KOBD ACE connector
(2) Service tool connector (main ECU setting kit)

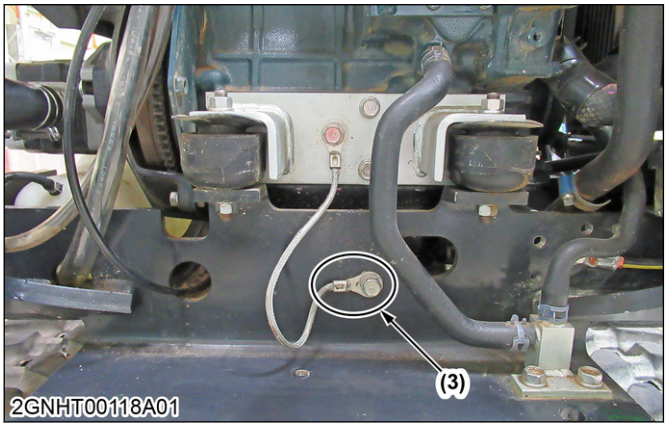
1.7 Ground wiring layout



(1) Ground wiring 1



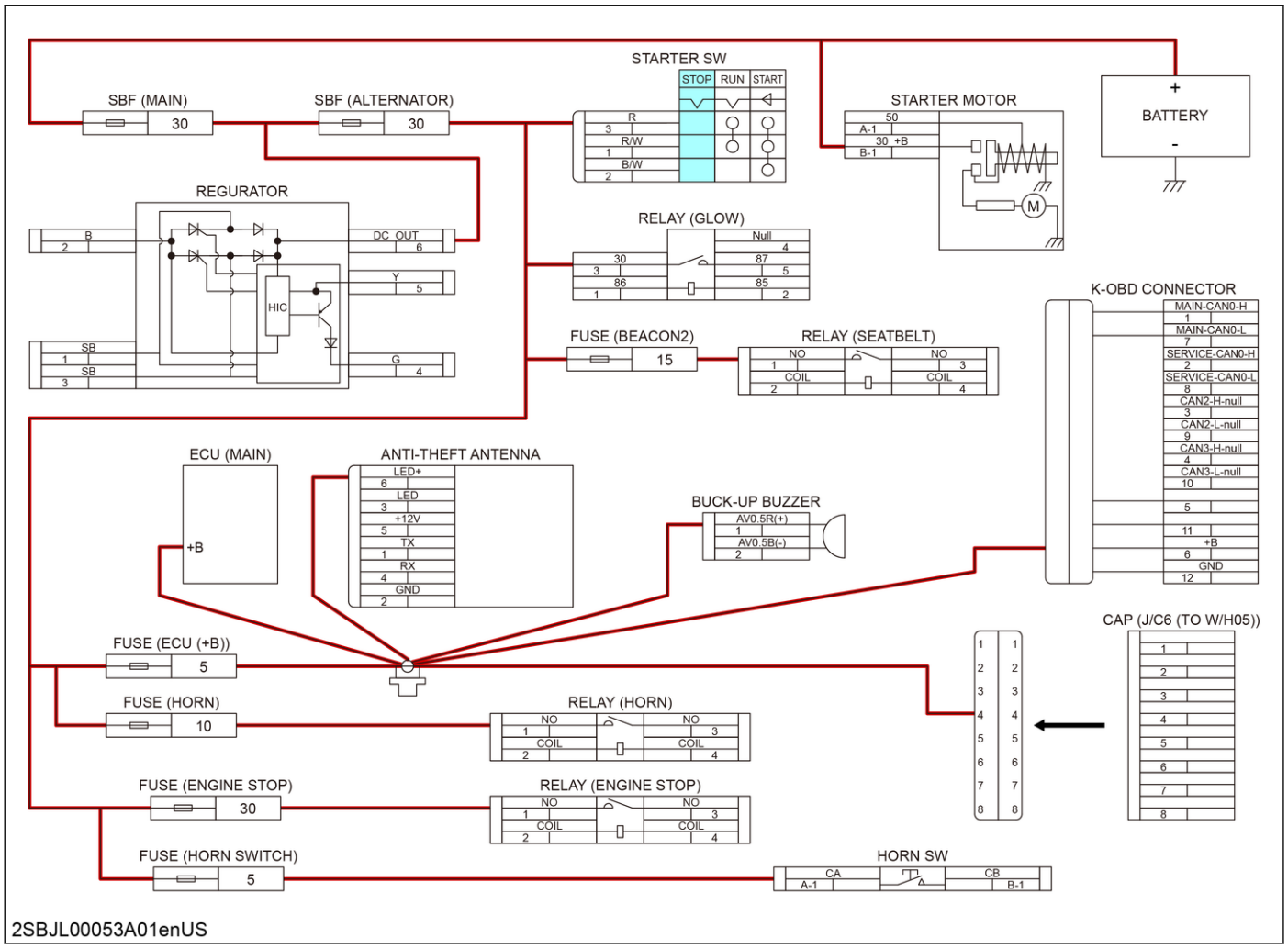
(2) Ground wiring 2



(3) Ground wiring 3

2. Functional electrical circuit

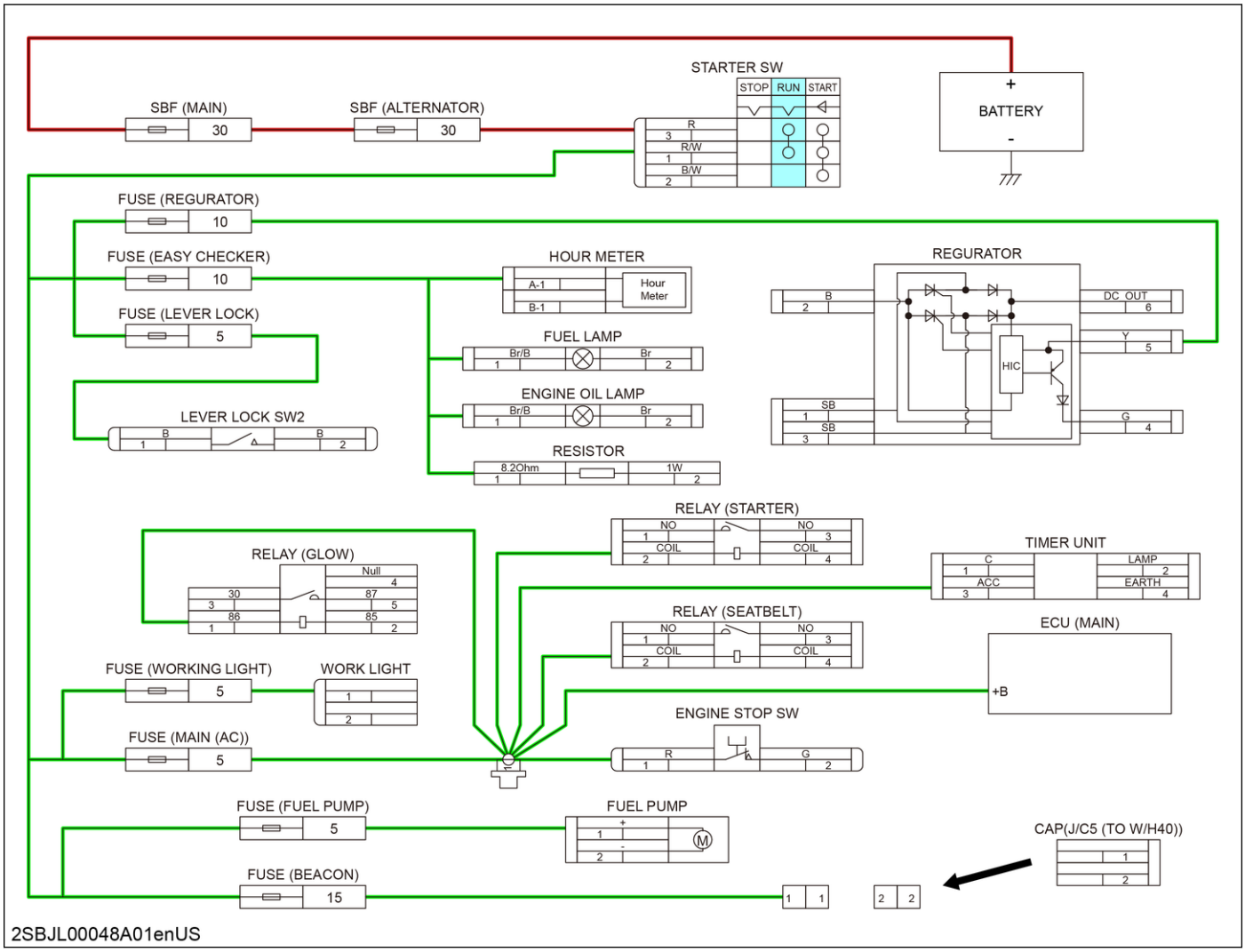
2.1 Power supply electrical circuit diagram



2SBJL00053A01enUS

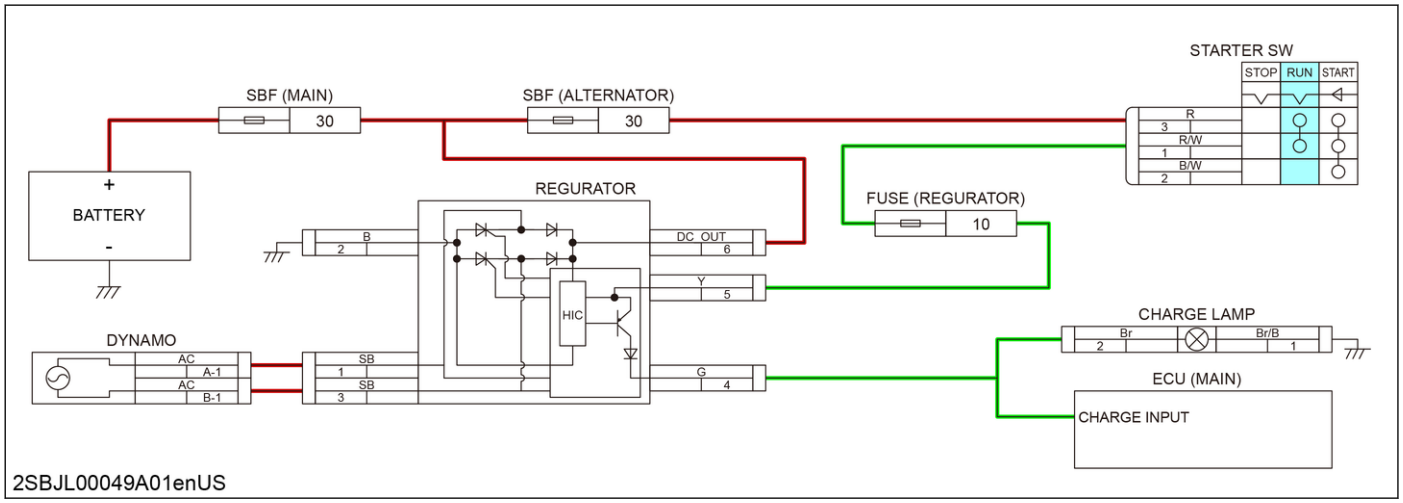
- The ground terminal of the battery is grounded to the machine body.
- When the STARTER SW is in the **[STOP]** position, the electrical current from the positive terminal flows to the SBF, REGURATOR, FUSE, RELAY, STARTER SW, ECU (MAIN), ANTI-THEFT ANTENNA, K-OBD CONNECTOR, and STARTER MOTOR.
- When the engine is stopped, the battery supplies approximately 12.0 V of electricity.
- When the engine is running, the alternator supplies approximately 14.5 V of electricity.
- The regurator supplies power to the battery and all electrical devices.

2.2 Accessory electrical circuit diagram



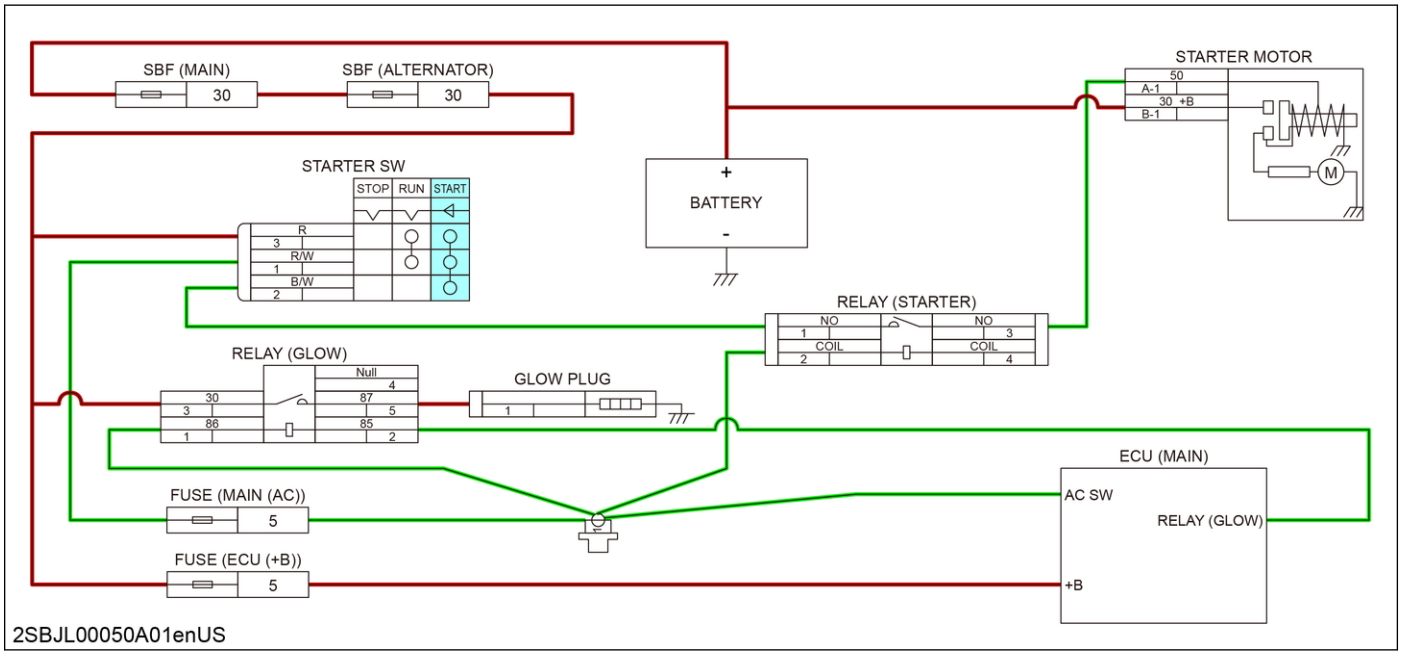
- When the STARTER SW is turned to **[RUN]**, the terminals #1 and #3 become connected inside the STARTER SW.
- The electrical current from the STARTER SW flows to each device through the fuses.
- The devices become active.

2.3 Battery charge electrical circuit diagram



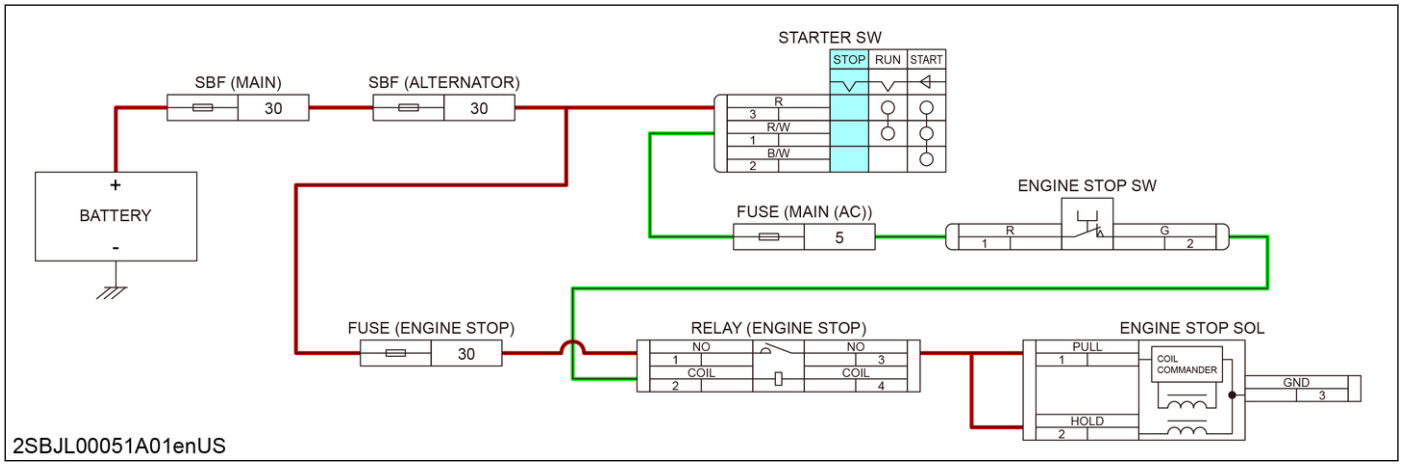
- When the STARTER SW is in **[RUN]** position, the electrical current from the STARTER SW #1 flows to the REGURATOR.
- The battery is charged by the electrical current from the DC OUT terminal of the REGURATOR.
- While the engine is stopped, REGURATOR sends electrical current to CHARGE LAMP and ECU (MAIN) to turn on the CHARGE LAMP.
- When the engine turns on, DYNAMO starts generating electricity.
- The REGURATOR performs rectification and voltage adjustment, and converts the alternating current generated by DYNAMO into direct current.
- Voltage adjustment prevents overcharge by stopping battery charging when its voltage exceeds 14.5 V.
- When the DYNAMO starts generating electricity, the REGURATOR shuts off the power to CHARGE LAMP and ECU (MAIN), and the CHARGE LAMP turns off.

2.4 Engine start electrical circuit diagram



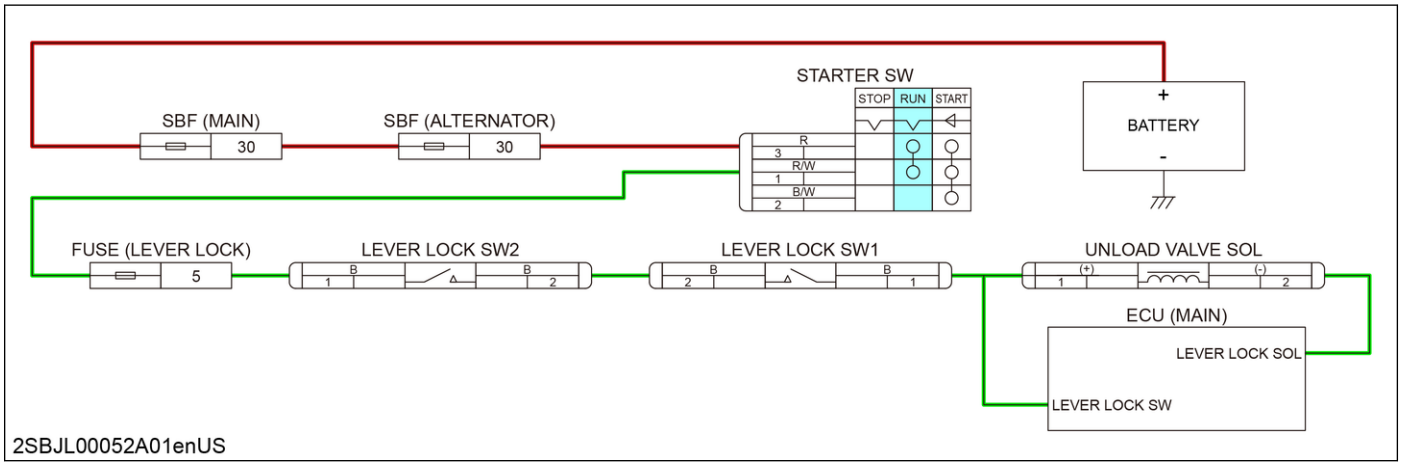
- When the STARTER SW is turned to **[RUN]**, the terminals #1 and #3 become connected inside the STARTER SW.
- The electrical current from the STARTER SW flows to the ECU (MAIN) via the FUSE **[MAIN (AC)]**.
- When the STARTER SW is turned to **[START]**, the terminals #2 and #3 become connected inside the STARTER SW, and a signal is sent from the STARTER SW to the RELAY (STARTER).
- The RELAY (STARTER) becomes magnetized to flow the electrical current from the battery to the STARTER MOTOR.
- The STARTER MOTOR rotates to crank the engine.

2.5 Engine stop electrical circuit diagram



- When the STARTER SW is in **[STOP]** position, the electrical current from the STARTER SW terminal #1 does not flow to the RELAY (ENGINE STOP).
- When the STARTER SW is in **[RUN]** position and the ENGINE STOP SW pulled to OFF, the electrical current from the STARTER SW terminal #1 does not flow to the RELAY (ENGINE STOP).
- The RELAY (ENGINE STOP) is not magnetized. The electrical current from the BATTERY does not flow to the ENGINE STOP SOL via the FUSE **[ENGINE STOP]**.
- The fuel is cut off and the engine stops.

2.6 Lever lock electrical circuit diagram



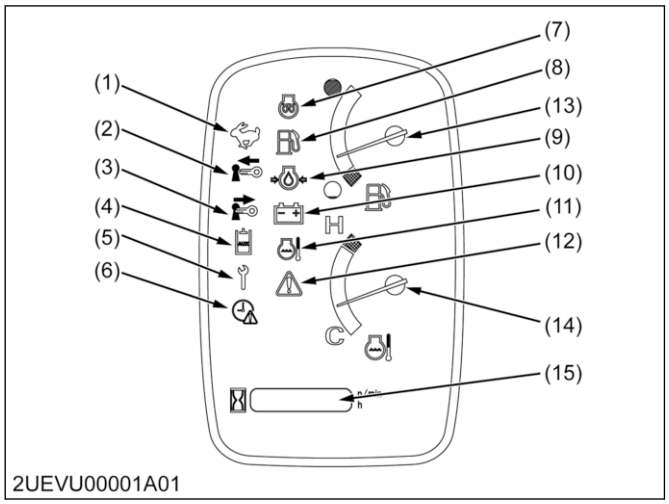
- When the STARTER SW is in the **[RUN]** position, the electrical current from the STARTER SW #1 flows to the LEVER LOCK SW1 and the LEVER LOCK SW2 via the FUSE (LEVER LOCK).
- When the lever lock is lowered, the electrical current from the LEVER LOCK SW flows to the LEVER LOCK SOL.

3. Meter panel

Main ECU setting kit consists of the meter panel and switches. Main ECU setting kit is optional.

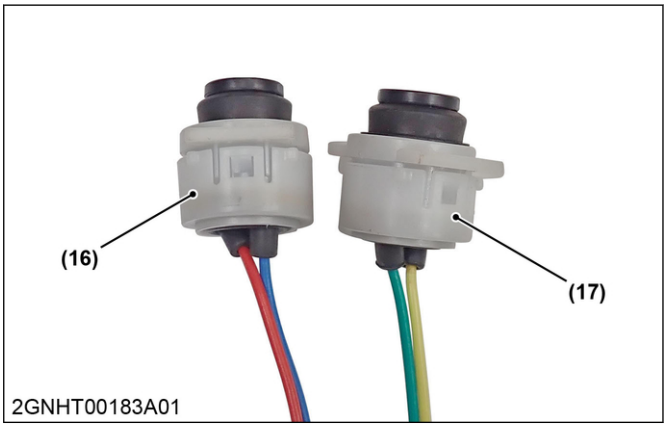
3.1 Meter panel function

Panel



No.	Name	Function
(1)	Travel speed shift lamp	Light - high speed
(2)	Key insertion lamp (anti-theft specification only)	Blink - requesting to insert key (registered key)
(3)	Key pull out lamp (anti-theft specification only)	Blink - requesting to pull out key (registered key), notifying that the key is left inserted
(4)	AUX lamp (proportional AUX specification only)	Blink - AUX setting, AUX error
(5)	Periodic check lamp	Blink - requesting periodic check Blink or light - periodic check mode
(6)	Clock setting lamp	Blink - set clock, clock offset
(7)	Glow lamp	Light - warming up the engine
(8)	Fuel gauge warning lamp	Blink - low fuel
(9)	Engine oil pressure warning lamp	Light - engine oil pressure switch is ON, low engine oil
(10)	Charging warning lamp	Light - low battery voltage
(11)	High coolant temperature warning lamp	Blink - high coolant temperature
(12)	Warning lamp	Blink - warning (error) occurred
(13)	Fuel meter	-
(14)	Coolant temperature meter	-
(15)	LCD	-

Switch



(16) Display select switch (SW2) (17) User switch (SW1)

Switch	Wiring color	Operation	Symbol	Function
SW2	Blue - Red	Press	----►	Select a mode Select a function Increase a number
		Press and hold	——►	Enter a mode Set a mode
SW1	Yellow - Green	Press	----►	Select a mode Select a function Decrease a number
		Press and hold	——►	Return to a mode Exit a mode

3.2 Display mode

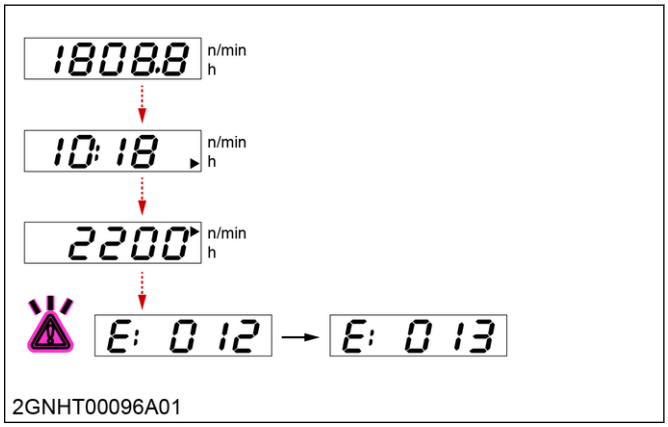
Mode	Function	Operation
Normal mode	Clock	Turn the starter switch to **[RUN]** (press SW2 to change display).
	Error code	Displayed when an error has occurred.
User setting mode	Clock setting	Press SW1 in the normal mode.
Service dealer mode	Tester mode	Turn the starter switch to **[RUN]** while pressing SW2.
	Reading error history	
	Clearing error history	
	Dealer setting	
	Reading all error history	

3.3 Operating normal mode

Displays 4 items: hour meter, clock, tachometer (engine speed) and error codes.

1. Turn the starter switch to **[RUN]**.
2. Press SW2 to switch a function to be displayed.

- Hour meter → Clock → Tachometer → Error code

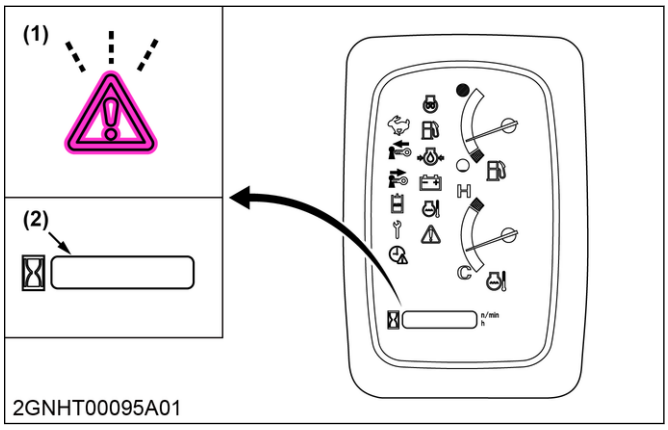


NOTE

- **The error code is displayed only when an error occurred.**

In case of an error

- The warning lamp blinks and an error code is displayed on the LCD.

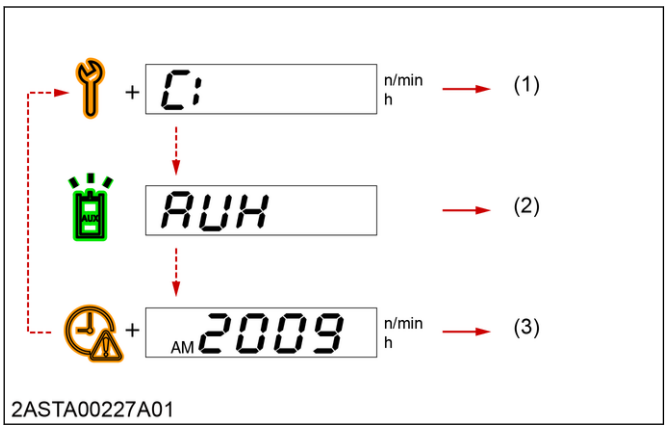


(1) Warning lamp (2) LCD

3.4 Operating user setting mode

Displays 3 functions: periodic check mode, AUX flow rate setting, and clock setting.

1. Press SW1 in the normal mode.
2. Press SW2 to switch a function to be displayed.
   - Periodic check mode → AUX flow rate setting → Clock setting



(1) Periodic check mode (3) Clock setting
(2) AUX flow rate setting

NOTE

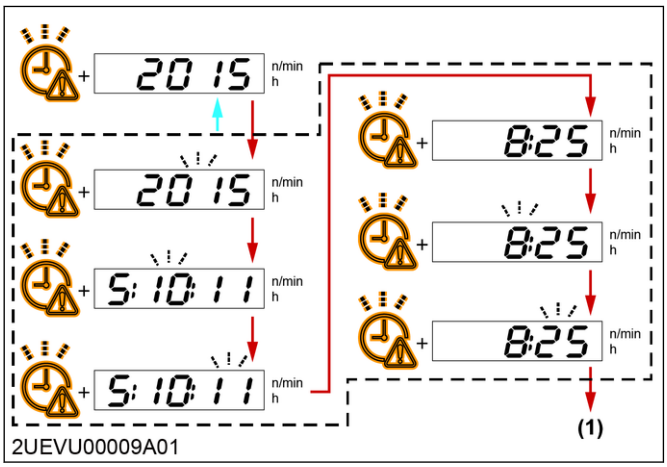
- **AUX flow rate is displayed only for proportional AUX specification.**
- **(1) and (2) are not functional.**

3.4.1 Operating clock setting mode

Set the calendar and clock.

1. Press SW2 in the user setting mode to display the clock settings.
2. Press and hold SW2 to make the number (year) blink.
3. Press SW1 and SW2 to select numbers and press and hold SW2 to set the calendar and clock.
4. Set the calendar and clock in the following order: year, month, date, 12 h or 24 h, hour, and minute.

   2015/10/11 AM 8:25



(1) Normal mode

Other settings for clock

NOTE

- **Perform the clock setting lamp setting in the service dealer mode.**

- Clock setting lamp

– Whether to display the clock setting lamp can be configured.
  • "Y": (display) Inform of time offset by blinking clock setting lamp.
  • "N": (does not display) Does not inform of time offset.

3.5 Service dealer mode

3.5.1 Service dealer mode list

The service dealer mode is used for maintenance such as checking the machine condition, setting parameters, adjusting the devices and etc. Turn the starter switch to **[RUN]** while pressing SW2 to enter the service dealer mode.

■ IMPORTANT

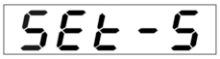
- **It is necessary to set no-5 (model setting) after replacing the main ECU.**

■ NOTE

- **Turn the starter switch to [STOP] to exit the service dealer mode.**

Mode		Detail	
SEt-1	Tester mode	Displays the machine information, status of sensors and solenoids.	
SEt-2	Reading error history	Displays the previous error code and hour meter from memory.	
SEt-3	Clearing error history	Clears error history of "set-2".	
SEt-4	Dealer setting	no-01 No function	No function
		no-02 No function	No function
		no-03 No function	No function
		no-04 No function	No function
		no-05 Model setting	Individual setting for the machine.
		no-06 No function	No function
		no-07 No function	No function
		no-08 No function	No function
		no-09 No function	No function
		no-10 No function	No function
		no-11 No function	No function

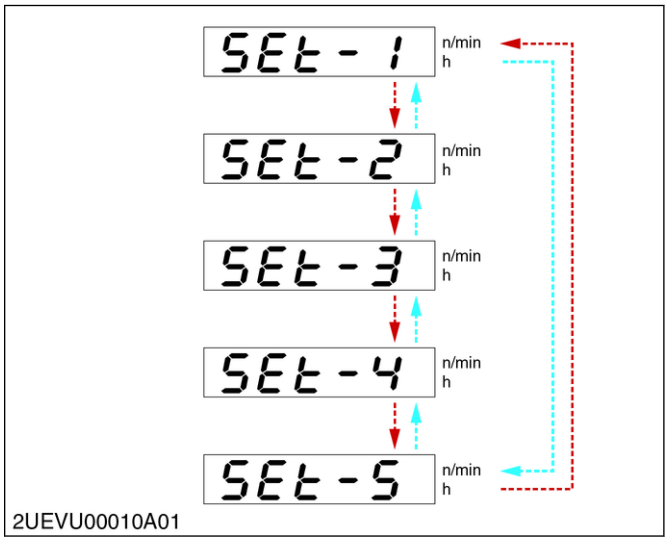
(Continued)

Mode		Detail
	Reading all error history	Displays the previous error code and hour meter from memory. • Unable to clear in “set-3” (clear error history).

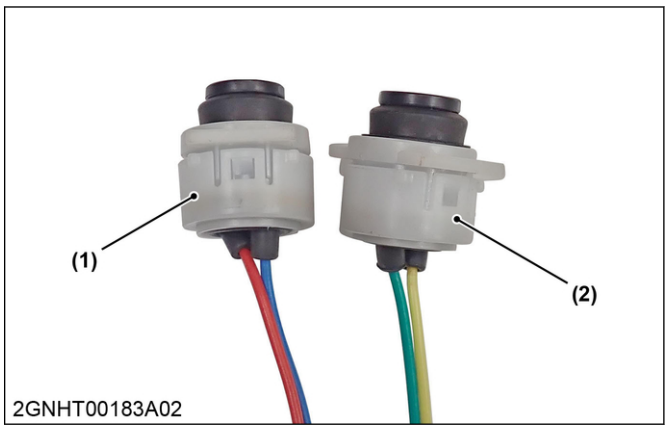
3.5.2 Operating service dealer mode

Operating service dealer mode

1. Turn the starter switch to **[RUN]** with pressing SW2.
2. Display "set-1".
3. Press SW2 to select the function (mode).
4. Press and hold SW2 to enter the function (mode).
5. Press and hold SW1 to return to the selected function (mode).
6. Turn the starter switch to **[STOP]** to exit the service dealer mode.



Switch



(1) Display select switch (SW2) (2) User switch (SW1)

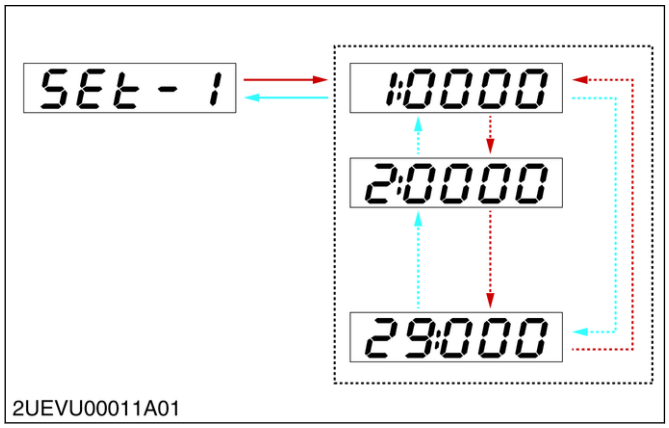
Switch	Wiring color	Opera-tion	Symbol	Function
SW2	Blue - Red	Press	----►	Select a mode Select a function Increase a number
		Press and hold	——►	Enter a mode Set a mode
SW1	Yellow - Green	Press	----►	Select a mode Select a function Decrease a number
		Press and hold	——►	Return to a mode Exit a mode

3.5.3 Operating SET-1 (Tester mode)

Displays the machine information, status of sensors, and solenoids.

Operating SET-1 (Tester mode)

1. Select "set-1" in the service dealer mode.
2. Press SW1 or SW2 to select a tester mode number (from "1" to "29").
3. Press and hold SW1 to return to "set-1".



2UEVU00011A01

Tester mode list

No.		Display	Description	Remarks
1	Engine speed	"oooo" rpm	-	No function
2	Battery voltage	"oo.o" V	• Engine stopped: approximately 12.0 V • Engine running: approximately 14.0 V	-
3	Engine oil pressure switch	"ON" or "OFF"	• Engine stopped (49 kPa or lower) • Engine running (higher than 49 kPa)	No function
4	Battery charging switch	"ON" or "OFF"	• Engine stopped • Engine running	-
5	Starter switch	"ON" or "OFF"	• Starter SW at **[START]** • Starter SW at **[STOP]** or **[RUN]**	-
6	Work light switch	"ON" or "OFF"	• Press SW • Press SW again	No function
7	Coolant temperature sensor (voltage)	"o.oo" V	• Starter SW at **[STOP]**: 0 V • Starter SW at **[RUN]**: 5 V	No function
8	Coolant temperature sensor (temperature)	"oo" ℃	• Normal: -49 to 149 ℃	No function
9	Fuel level sensor (voltage)	"o.oo" V	• Starter SW at **[STOP]**: 0 V • Starter SW at **[RUN]**: 12 V	No function
10	Fuel level sensor (resistance)	"ooo" Ω	• Full: 3±1 Ω • Half: 32.5 Ω • Empty: 110±2.5 Ω	No function
11	Fuel level indication switch	"ON" or "OFF"	• SW pressed • SW released	No function
12	Travel speed shift switch	"ON" or "OFF"	• SW pressed • SW released	No function
13	Travel speed shift SOL	"ON" or "OFF"	• SW pressed • SW released	No function
14	Lever lock switch	"ON" or "OFF"	• Lever lock lowered • Lever lock raised	-
15	Lever lock SOL	"ON" or "OFF"	• Lever lock lowered • Lever lock raised	-

(Continued)

No.		Display	Description	Remarks
16	AUX knob switch (voltage) and travel pressure sensor (voltage)	“o.oo” V	• 0.26 to 4.74 V	No function
17	AUX knob switch (setting voltage left)	“o.oo” V	• 0.26 to 4.74 V	No function
18	AUX knob switch (setting voltage neutral)	“o.oo” V	• 0.26 to 4.74 V	No function
19	AUX knob switch (setting voltage right)	“o.oo” V	• 0.26 to 4.74 V	No function
20	AUX SOL (current)	“o.oo” A	• 0 to 1.7 A	No function
21	AUX hold switch	“ON” or “OFF”	• Press SW • Press SW again	No function
22	AUX switch	“ON” or “OFF”	• Press SW • Press SW again	No function
23	AUX RH setting	“oo” × 10 mA	-	No function
24	AUX LH setting	“oo” × 10 mA	-	No function
25	Key type	“0” (Unknown) “1” (Red) “2” (Black) “3” (Yellow) “4” (Green) “5” (Red Yellow) “6” (Red Green)	• Unknown • Red • Black • Yellow • Green • Red yellow • Red green	-
26	Anti-theft key analysis (registered key)	“ON” (Match) “OFF” (Mismatch)	• Match • Mismatch	-
27	Anti-theft	“ON” (Deactivated) “OFF” (Activated)	• Deactivated • Activated	-
28	Communication between anti-theft key and anti-theft antenna	“ON” (Activated) “OFF” (Deactivated)	• Exists • Does not exist	-
29	Anti-theft antenna	“ON” (Error) “OFF” (Normal)	• Error • Normal	-

3.5.4 Operating SET-2 (Reading error history)

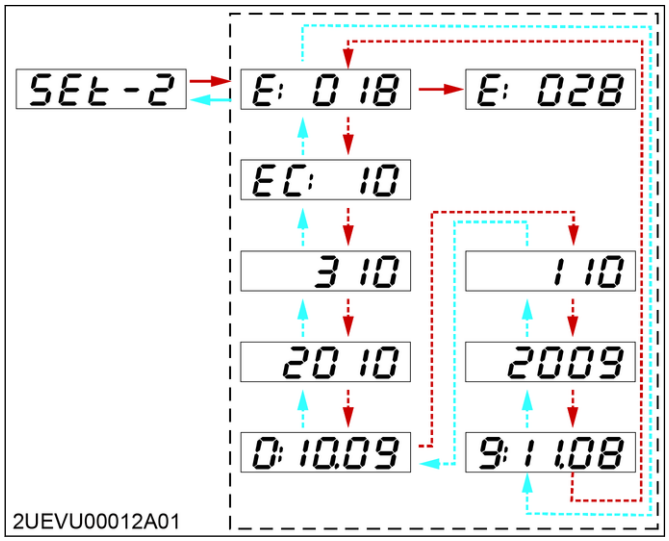
Displays the error code and hour meter from the last "set-3" error history clear.

NOTE

- **Displays 7 items for each error code.**
  - **Number of occurrences**
  - **Hour meter indication at the most recent occurrence**
  - **Year of the most recent occurrence**
  - **Month and date of the most recent occurrence**
  - **Hour meter indication at the first occurrence**
  - **Year of the first occurrence**
  - **Month and date of the first occurrence**

1. Select "set-2" in the service dealer mode.
2. Display a previous error code from the memory.
3. Press SW1 or SW2 to switch items to be displayed.
4. Press and hold SW2 to display other error codes.
5. Press and hold SW1 to return to "set-2".

"E:018": Issued 10 times
Recent data: 310 h, 2010/10/9
First data: 110 h, 2009/11/8



2UEVU00012A01

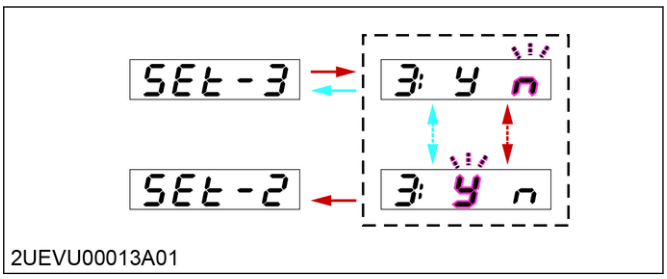
3.5.5 Operating SET-3 (Clearing error history)

Clears error history from memory.

1. Select "set-3" in the service dealer mode.
2. Press SW1 or SW2 to make "Y" or "N" blink.
3. Press and hold SW2 to apply the change and return to "set-2".

NOTE

- **"Clearing error history" can be cleared in "set-3".**
- **"Reading all error history" cannot be cleared in "set-5".**



2UEVU00013A01

"Y"	Clear

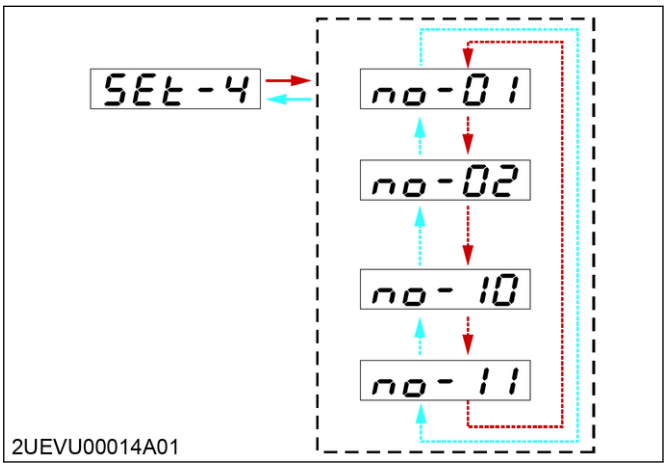
3.5.6 Operating SET-4 (Dealer settings)

Settings which can be configured here differ by specification (11 items).

1. Select "set-4" in the service dealer mode.
2. Press SW1 or SW2 to select from "no-01" to "no-11".
3. Press and hold SW2 to proceed to the selected setting.
4. Press and hold SW2 to apply the change and return to "set-4".

NOTE

- **"no-01", "no-02", "no-03", and "no-04" are settings for proportional AUX specification.**



2UEVU00014A01

3.5.6.1 Operating SET-4 (Dealer setting) No-05 (Model settings)

Settings which can be configured here differ by specification (3 items).

1. Select "set-4" in the service dealer mode.
2. Press SW1 or SW2 to select "no-05".
3. Press and hold SW2 to proceed to the "no-05" setting.
4. Set the following 3 items: model, region, and AUX function.
5. Press and hold SW2 to apply the change and return to "no-05".

51. Model

001	U17, U-17, U17-3, U-17-5 U17-3α, U-17-5S 017CR	018	K008-5
002	U-20-3S, U20-5S U20-3α 020CR	024	KX015-4
003	U25, U-25S	025	KX016-4
012	KX61, KX027-4	026	KX018-4
013	KX71, KX030-4	027	KX019-4
017	U10-5	028	U27-4

52. Region

001	Japan
002	USA
003	Australia
004	EU
005	China
007	Others

53. Proportional AUX

"Y"	Proportional AUX
"N"	-

3.5.6.2 Default settings for SET-4 (Dealer settings)

	U10-5
"no-05" Model settings	"51: 017" "52: 004" "53: N"

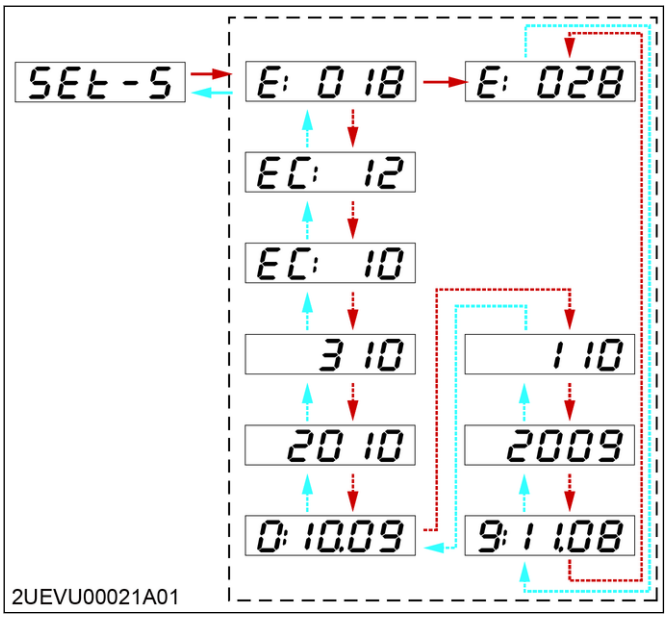
3.5.7 Operating SET-5 (Reading all error history)

Displays all error details from the memory.

■ NOTE

- **This history is will not be erased even if the "set-3" (clearing error history) is done.**

1. Select "set-5" in the service dealer mode.
2. Display a previous error code from memory.
3. Press SW1 or SW2 to switch the items to be displayed.
4. Press and hold SW2 to display other error codes.
5. Press and hold SW1 to return to "set-5".



- **Displays 8 items for each error code.**
  - **Number of occurrences**
  - **Number of occurrences after clearing error history**
  - **Hour meter indication at the most recent occurrence**
  - **Year of the most recent occurrence**
  - **Month and date of the most recent occurrence**
  - **Hour meter indication at the first occurrence**
  - **Year of the first occurrence**
  - **Month and date of the first occurrence**

SERVICING

1. Troubleshooting

1.1 Electrical troubleshooting

The starter motor does not work

Causes	Inspections	Actions
The anti-theft system is activated.	Turn the starter switch to **[RUN]** and check if the key pull-out lamp is blinking.	Use the registered key.
The ground terminals are disconnected or connected loosely.	Check if the related ground terminals are connected to the machine.	Tighten the loosened ground terminals.
The battery has discharged or is damaged.	Check the battery voltage.	Recharge or replace the battery.
The fuse or slow blow fuse has blown.	Check if the fuses and slow blow fuses for the lever lock, starter switch, starter signal, or ECU main AC have blown.	Specify the cause of the fuse blowing and replace the fuse.
The starter motor relay is malfunctioning.	Check for the conduction of the starter motor relay.	Replace the starter motor relay.
The wire harnesses are damaged.	Check for the conduction of the wire harnesses related to the starter motor, starter switch, and lever lock switch.	Repair or replace the damaged wire harnesses.
The starter switch is damaged.	Check for the conduction between the starter switch terminals.	Replace the starter switch.
The lever lock switch is damaged or adjusted improperly.	Check for the conduction between the lever lock switch terminals.	Adjust or replace the lever lock switch.
The starter motor is malfunctioning.	Measure the voltage of the starter motor. Check the condition of the starter motor.	Replace the starter motor.

The engine does not start

Causes	Inspections	Actions
Engine stop solenoid relay is malfunctioning.	Check for the conduction of the engine stop solenoid relay.	Replace the engine stop solenoid relay.
Engine stop solenoid switch is damaged.	Check for the conduction between the engine stop solenoid switch terminals.	Replace the engine stop solenoid switch.
Wire harnesses are damaged.	Check for the conduction of the wire harnesses related to the starter motor, starter switch, and lever lock switch.	Repair or replace the damaged wire harnesses.
Engine stop solenoid is malfunctioning.	Check for the conduction of the engine stop solenoid connector.	Replace the engine stop solenoid.
Engine stop switch is pulled to stop the engine.	Check the position of the engine stop switch.	Turn off the engine stop switch.

The engine does not start occasionally

Cause	Inspection	Action
The anti-theft antenna does not recognize the key.	Check if there is interference from metallic matter attached to the key ring.	Remove metallic matter from the key ring.

The engine starts with a non-registered key

Cause	Inspection	Action
The anti-theft settings are OFF.	Check if the anti-theft settings are activated.	Turn ON the anti-theft settings. Register the keys.

1.2 Warning lamp list

When the starter switch is in [RUN] position (engine is not running)

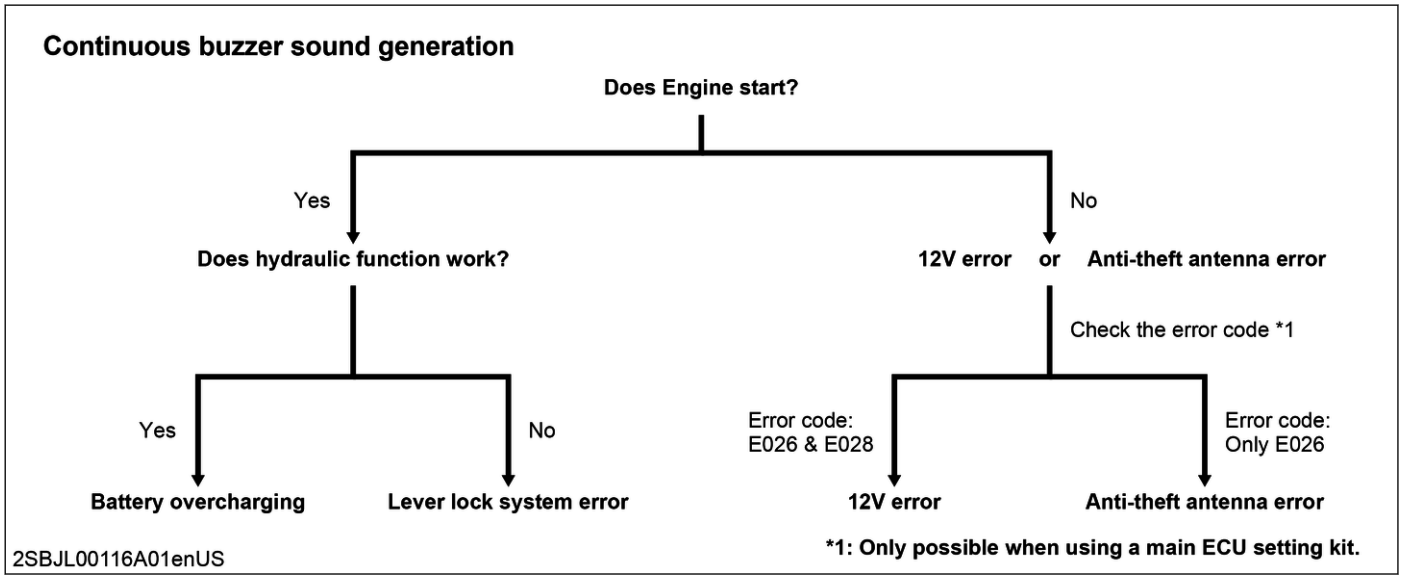
These lamps usually light up when the starter switch is in **[RUN]** position (engine is not running).

Troubles	Lamp	Probable cause(s)	Reference
Fuel level lamp not lighting up		• Fuse **[EASY CHECKER]** is blown. • Lamp bulb is burnt out. • Timer is malfunctioning. • Diode (timer) is malfunctioning. • Wire harness is broken.	6-31
Engine oil pressure lamp not lighting up		• Fuse **[EASY CHECKER]** is blown. • Lamp bulb is burnt out. • Engine oil pressure switch is malfunctioning. • Wire harness is broken.	6-38
Charge lamp not lighting up		• Fuse **[REGURATOR]** is blown. • Lamp bulb is burnt out. • Regurator is malfunctioning. • Wire harness is broken or short-circuited.	6-42
Coolant temperature lamp not lighting up		• Fuse **[EASY CHECKER]** is blown. • Lamp bulb is burnt out. • Resister is malfunctioning. • Timer is malfunctioning. • Diode (timer) is malfunctioning. • Wire harness is broken or short-circuited.	6-47

When the starter switch is in [RUN] position (engine is running)

Troubles	Lamp	Probable cause(s)	Reference
Fuel level lamp lighting up		• Fuel level is low. • Fuel level sensor is malfunctioning. • Timer is malfunctioning. • Wire harness is short-circuited.	6-35
Engine oil pressure lamp lighting up		• Engine oil level is low. • Engine oil pressure switch is malfunctioning. • Wire harness is short-circuited. • Engine is malfunctioning (engine oil pressure is low).	6-40
Charge lamp lighting up		• Fan belt is loose. • Dynamo is malfunctioning. • Regurator is malfunctioning. • Wire harness is broken or short-circuited.	6-44
Coolant temperature lamp lighting up		• Engine coolant level is low. • Coolant temperature switch is malfunction. • Timer is malfunctioning. • Wire harness is short-circuited. • Engine is overheating (thermostat malfunction). • Engine is overheating (radiator clogging). • Engine is overheating (radiator cap malfunction). • Engine is overheating (radiator coolant leakage).	6-51

1.3 Warning alarm list



Display*	Lamp*	Error	Cause(s)	Remarks	Malfunction	Reference
E: 020		Lever lock system error	• Lever lock solenoid is malfunctioning. • Wire harness is short-circuited. • Main ECU is malfunctioning.	Short circuit has occurred in the lever lock solenoid circuit.	Engine may be started but the machine cannot move.	6-56
E: 025		Battery overcharging	• Regurator is malfunctioning. • 24 V power supply is connected. • Main ECU is malfunctioning.	Power supply voltage is over 18 V.	-	6-58
E: 026		Anti-theft antenna error	• Anti-theft antenna power supply is malfunctioning. • Wire harness is broken or short-circuited. • Anti-theft antenna is malfunctioning. • Main ECU is malfunctioning.	There is no signal from the anti-theft antenna to main ECU.	• The anti-theft system has failed. • The engine cannot start.	6-60
E: 028		12 V error	• Wire harness is Short-circuited. • Main ECU is malfunctioning.	Short circuit has occurred in the 12 V line.	• The anti-theft system has failed. • The engine cannot start.	6-62

*Display and lamp can be checked by using the main ECU setting kit.

2. Handling error warning

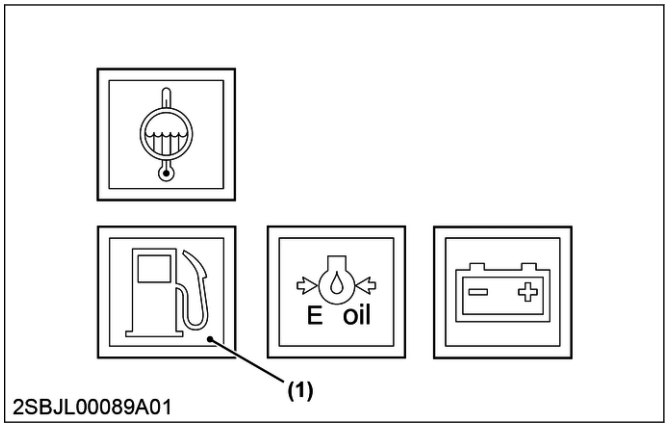
2.1 Handling Fuel level error

2.1.1 Fuel level lamp not lighting up

If the fuel level lamp does not light up when the starter switch is **[RUN]** (engine is not started), perform the following inspection.

Checking the warning lamp

1. Check the lighting status of the fuel level lamp.



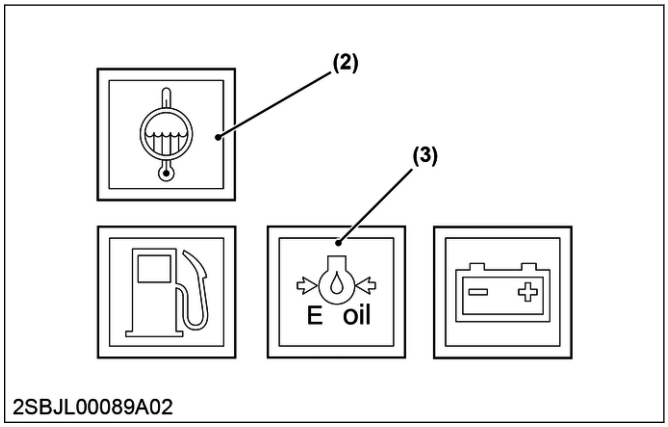
(1) Fuel level lamp

Normal	Starter switch at **[RUN]**	
	Fuel level lamp lights up for 2 to 4 seconds, and then turns off.	

2. Check the lighting status of the coolant temperature lamp and engine oil pressure lamp.

■ NOTE

- **If both coolant temperature lamp and engine oil pressure lamp are unlit at the same time, the fuse [EASY CHECKER] may be blown.**

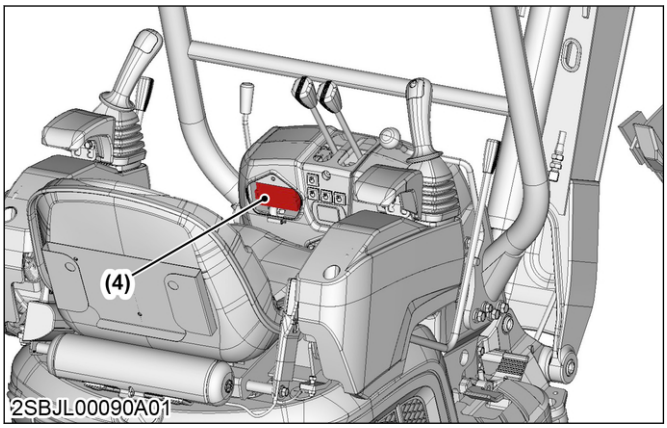


(2) Coolant temperature lamp (3) Engine oil pressure lamp

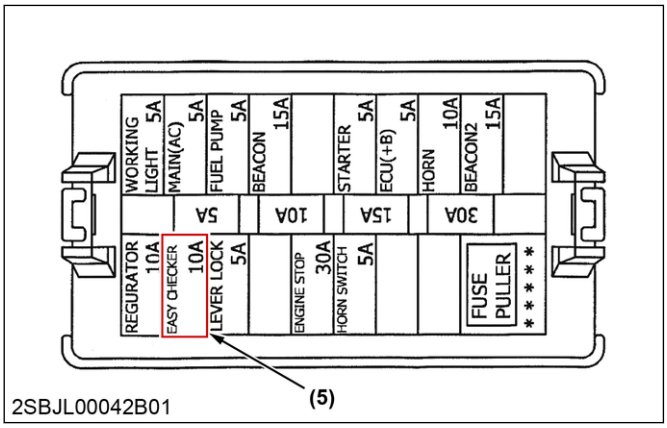
Normal	Coolant temperature lamp	Starter switch at **[RUN]**
		Coolant temperature lamp lights up for 2 to 4 seconds, and then turns off.
	Engine oil pressure lamp	Starter switch at **[RUN]**
		Engine oil pressure lamp lights up, and turns off when the engine is started.

Checking the devices

1. Remove the fuse **[EASY CHECKER]** from the fuse box, and check its conduction.

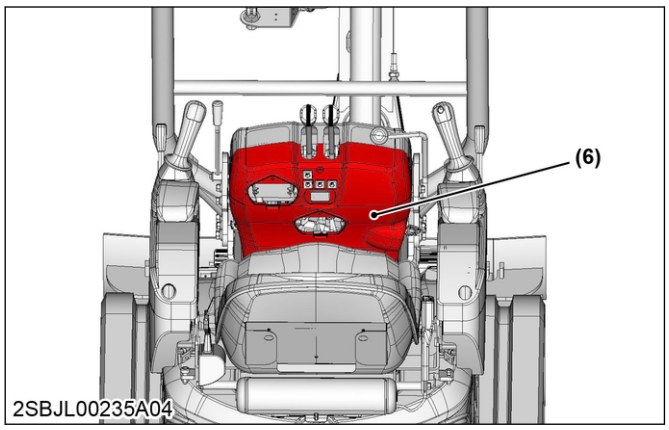


(4) Fuse box

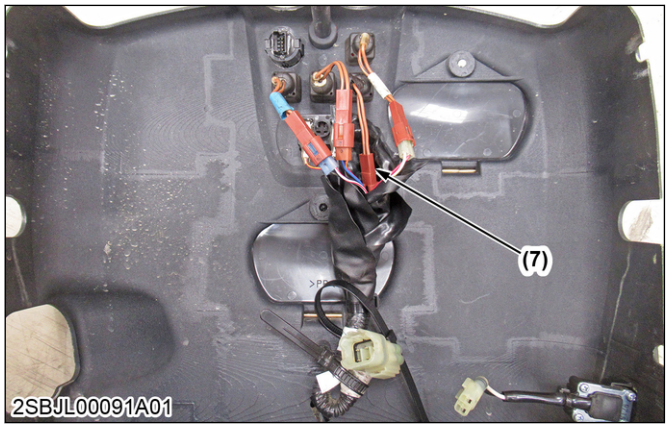


(5) Fuse **[EASY CHECKER]**

2. Remove the cover and check the fuel level lamp connector.
   - Check the connectors for loose connection or poor contact.
   - Separate the lamp connector, and check if the lamp bulb is burnt out.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

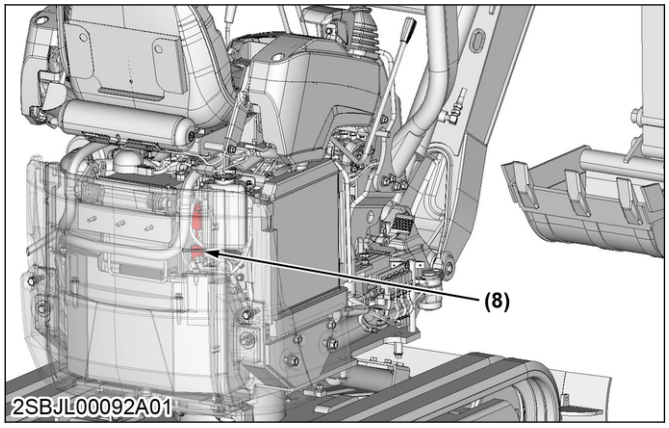


(6) Cover



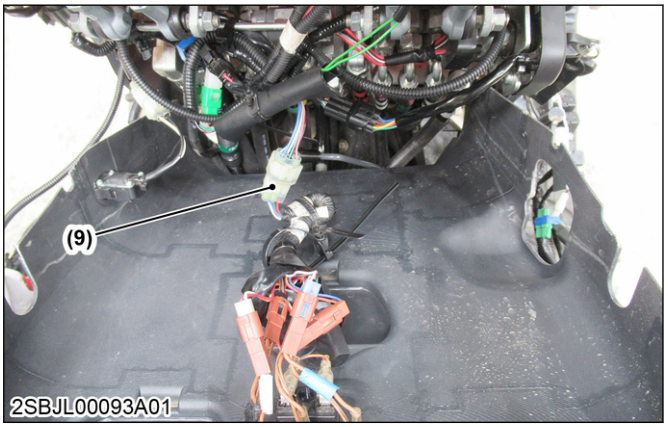
(7) Fuel level lamp connector

3. Check the timer connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.



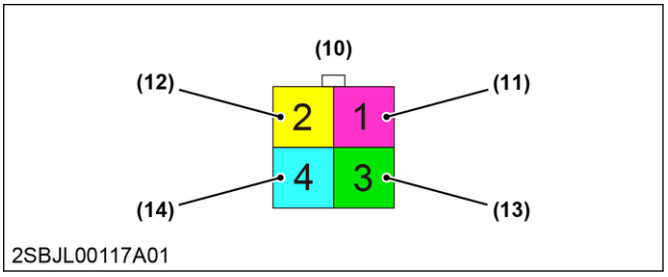
(8) Timer connector

4. Check the joint connector J/C1.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.



(9) Joint connector J/C1

5. Check the timer.
   - Disconnect the timer connector and measure the voltage of the wire harness.



(10) Timer connector (wire harness side)
(11) Terminal 1
(12) Terminal 2
(13) Terminal 3
(14) Terminal 4

	12 V	GND
(10) Timer connector (wire harness side)	1	Body ground
	2	Body ground
	3	Body ground

	Terminal No.	Starter switch at [STOP]	Starter switch at [RUN]	Starter switch at [START]
Normal	1	0 V	0 V	Approximately 12 V
	2	0 V	Approximately 12 V	Approximately 12 V
	3	0 V	Approximately 12 V	Approximately 12 V

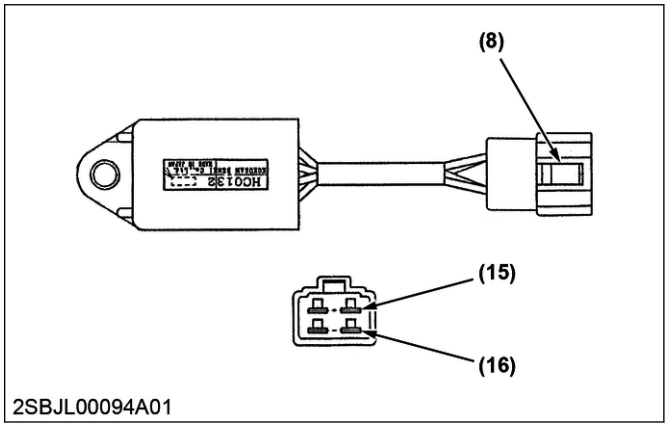
   - Disconnect the timer connector and measure the resistance of the wire harness.

	(+)	(-)
(10) Timer connector (wire harness side)	4	Body ground

Normal	Conducting

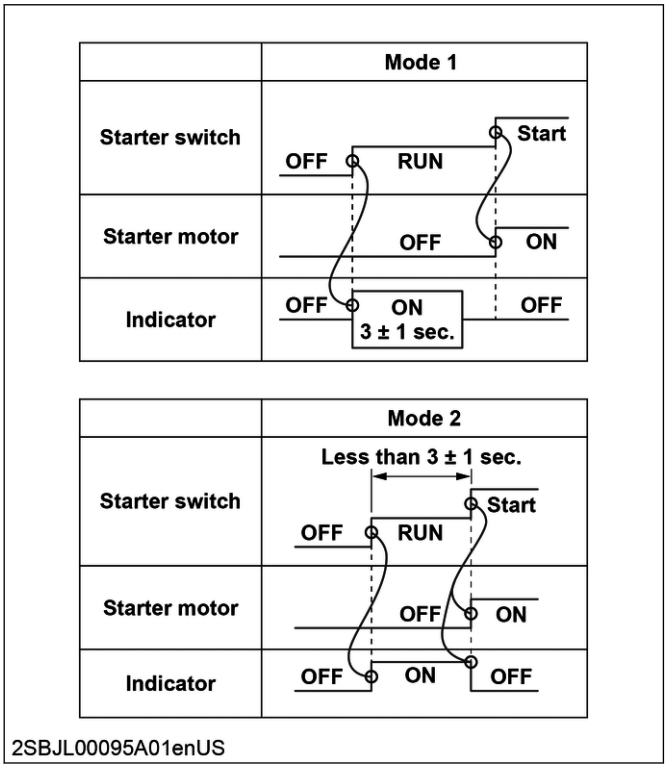
- Connect the timer connector and measure the voltage of the timer connector.

■ NOTE
- **Operation check of the timer can be performed by measuring the voltage of terminal 2.**
- **When the timer is operating normally, the voltage of terminal 2 changes from 0 V to 12 V when 2 to 4 seconds has passed since switching the starter switch to [RUN].**
- **When measuring voltage, the timer connector must be connected to the wire harness.**



(8) Timer connector
(15) Terminal 2
(16) Terminal 4

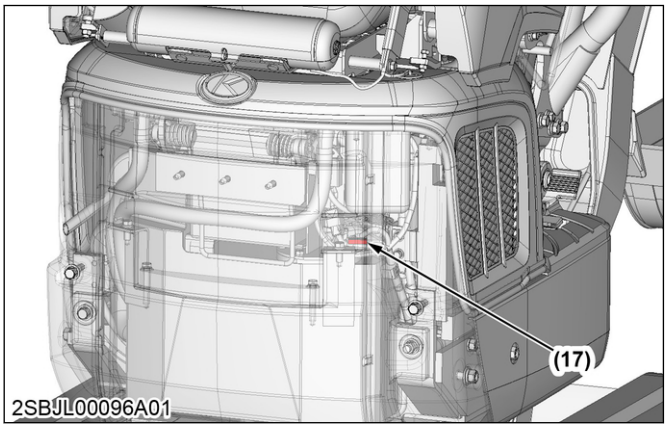
Timer mode sequence



	12 V	GND
(8) Timer connector	2	4

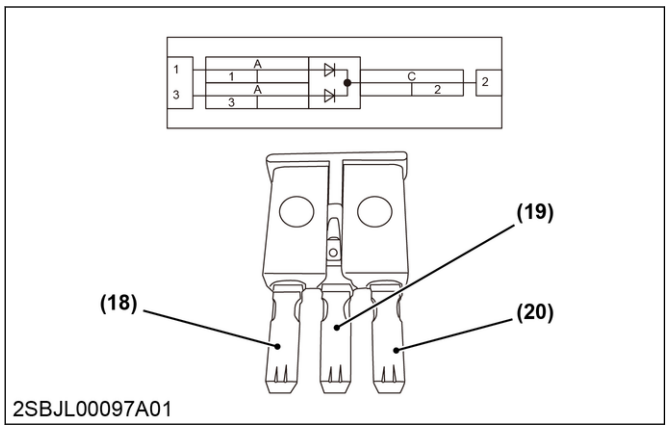
	Starter switch position	Voltage
Normal	**[STOP]**	0 V
	[RUN] (2 to 4 sec.)	0 V
	[RUN] (After 4 sec.)	Approximately 12 V
	[START]	Approximately 12 V

6. Check the diode (timer).
   - Remove the diode (timer).



(17) Diode (timer)

- Measure the resistance of the diode (timer).



(18) Terminal 1
(19) Terminal 2
(20) Terminal 3

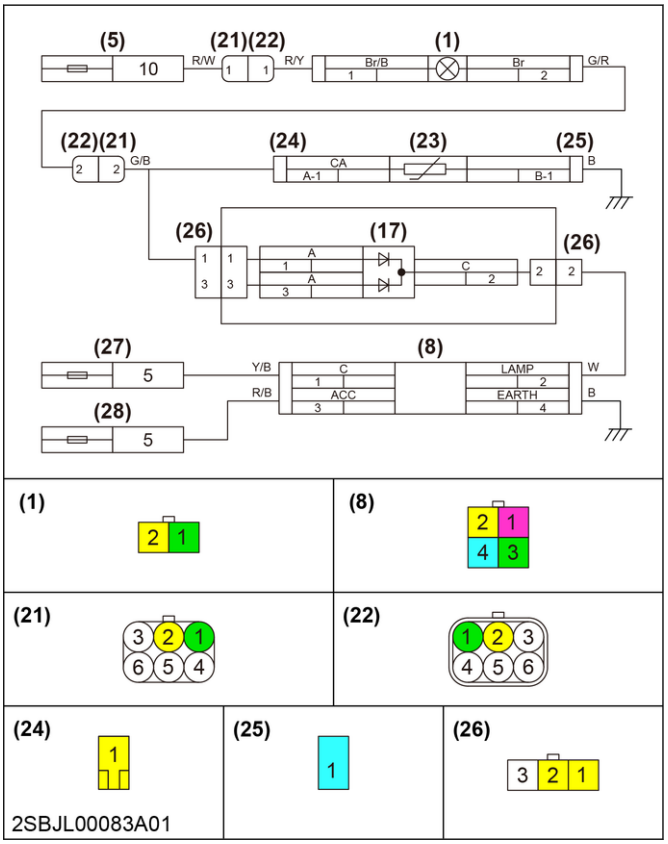
	(+)	(-)
(17) Diode (timer)	1	2
	3	2

Normal	Conducting

	(+)	(-)
(17) Diode (timer)	2	1
	2	3

Normal	Not conducting

Checking the wire harness



(1) Fuel level lamp
(5) Fuse **[EASY CHECKER]**
(8) Timer connector
(17) Diode (timer)
(21) Joint connector J/C1 (to W/H03)
(22) Joint connector J/C1 (to W/H00)
(23) Fuel level sensor
(24) Fuel level sensor connector (+)
(25) Fuel level sensor connector (-)
(26) Diode (timer) connector
(27) Fuse **[STARTER]**
(28) Fuse **[MAIN (AC)]**

1. Measure voltage of the wire harness.
   - Disconnect the fuel level lamp connector, and turn the starter switch to **[RUN]**.

	12 V	GND
(1) Fuel level lamp	1	Body ground

Normal	Starter switch at **[STOP]**	Starter switch at **[RUN]**
	0 V	Approximately 12 V

2. Check conduction of the wire harness.
   - Turn the starter switch to **[STOP]**, and disconnect the fuel level lamp connector, joint connector, timer connector, and remove the diode (timer).

	12 V
(1) Fuel level lamp	2
(22) Joint connector J/C1 (to W/H00)	2

	12 V
(21) Joint connector J/C1 (to W/H03)	2
(26) Diode (timer) connector	1

	12 V
(26) Diode (timer) connector	2
(8) Timer connector	2

Normal	Conducting

2.1.2 Fuel level lamp lighting up

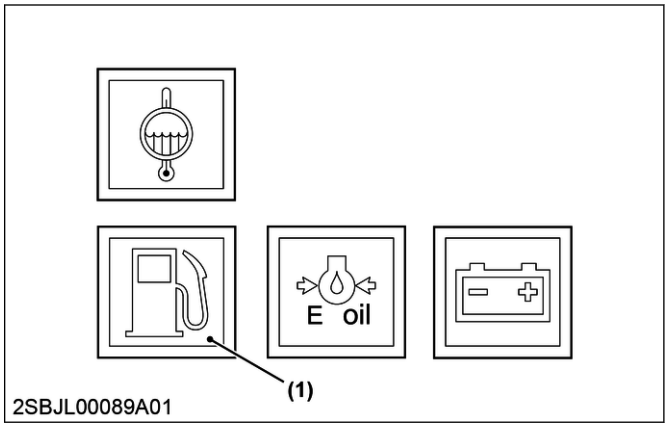
When the fuel level lamp lights up after starting the engine, perform the following inspection.

NOTE

- **If the fuel level lamp lights up after all the following inspections have been performed, there is a possibility of fuel level sensor malfunction.**

Checking the warning lamp

1. Check the lighting status of the fuel level lamp.

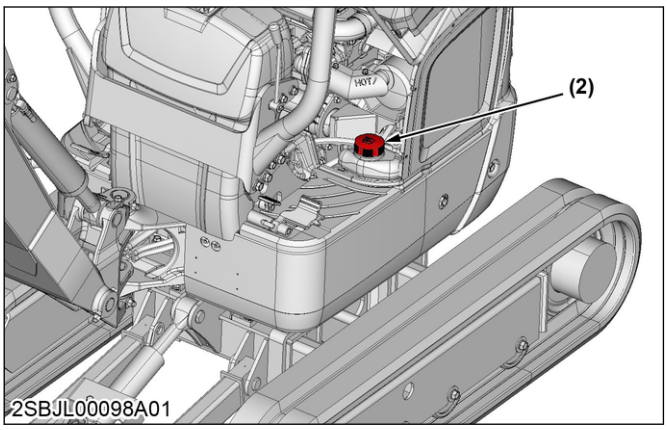


(1) Fuel level lamp

Normal	Starter switch at **[RUN]**
	Fuel level lamp lights up for 2 to 4 seconds, and then turns off.

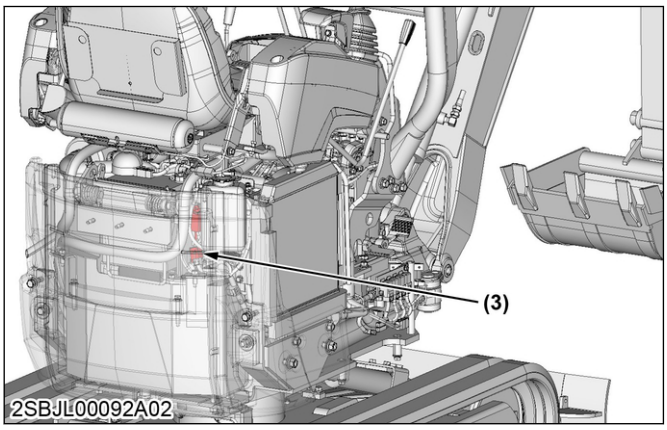
Checking the devices

1. Check the fuel level.
   - Open the fuel tank cap and check the fuel level.
   - Replenish the fuel if necessary.



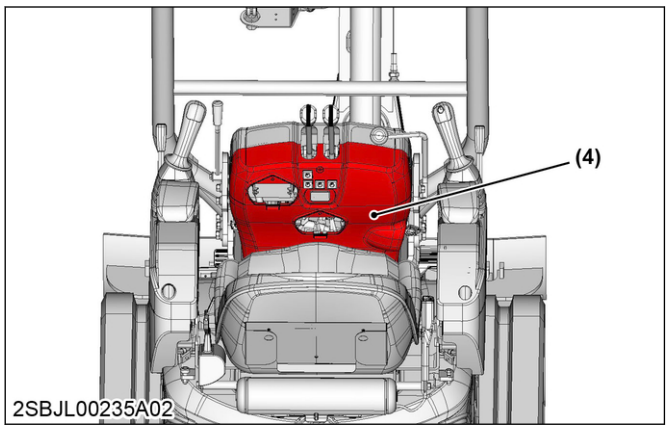
(2) Fuel tank cap

2. Check the timer connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

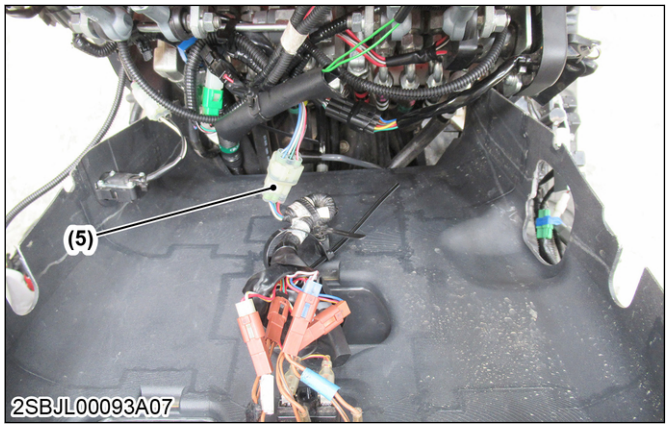


(3) Timer connector

3. Remove the cover and check the joint connector J/C1.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

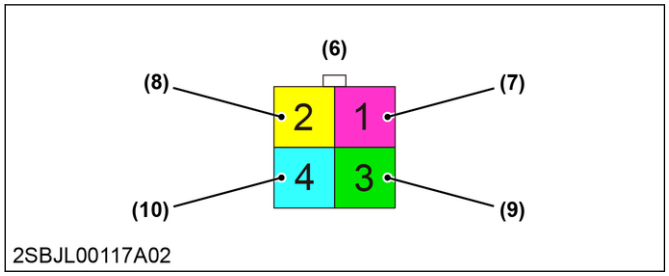


(4) Cover



(5) Joint connector J/C1

4. Check the timer.
   - Disconnect the timer connector and measure the voltage of the wire harness.



(6) Timer connector (wire harness side)
(7) Terminal 1
(8) Terminal 2
(9) Terminal 3
(10) Terminal 4

	12 V	GND
(6) Timer connector (wire harness side)	1	Body ground
	2	Body ground
	3	Body ground

	Terminal No.	Starter switch at [STOP]	Starter switch at [RUN]	Starter switch at [START]
Normal	1	0 V	0 V	Approximately 12 V
	2	0 V	Approximately 12 V	Approximately 12 V
	3	0 V	Approximately 12 V	Approximately 12 V

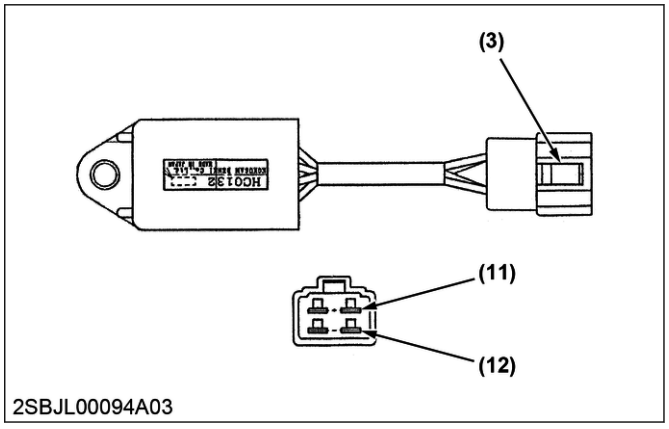
- Disconnect the timer connector and measure the resistance of the wire harness.

	(+)	(-)
(6) Timer connector (wire harness side)	4	Body ground

Normal	Conducting

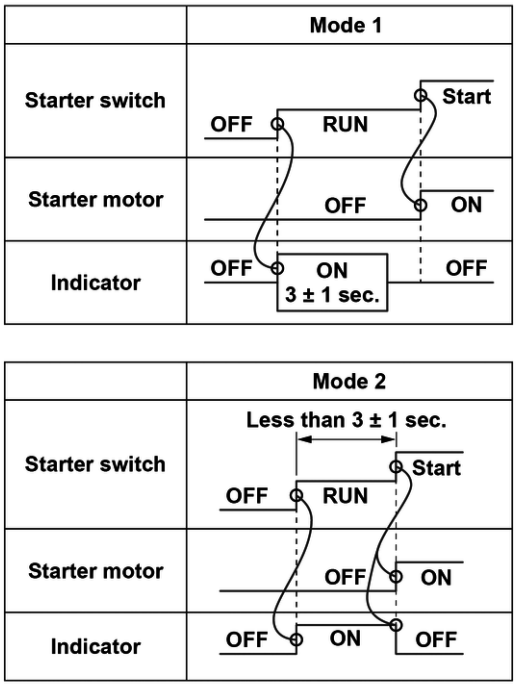
- Connect the timer connector and measure the voltage of the timer connector.

■ NOTE
- **Operation check of the timer can be performed by measuring the voltage of terminal 2.**
- **When the timer is operating normally, the voltage of terminal 2 changes from 0 V to 12 V when 2 to 4 seconds has passed since switching the starter switch to [RUN].**
- **When measuring voltage, the timer connector must be connected to the wire harness.**



(3) Timer connector
(11) Terminal 2
(12) Terminal 4

Timer mode sequence

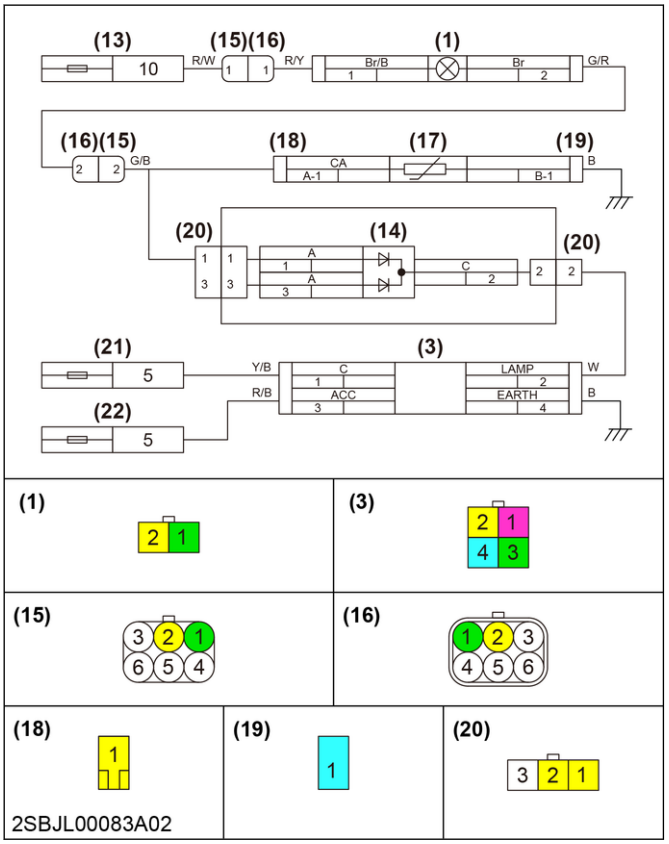


2SBJL00095A01enUS

	12 V	GND
(3) Timer connector	2	4

	Starter switch position	Voltage
Normal	[STOP]	0 V
	[RUN] (2 to 4 sec.)	0 V
	[RUN] (After 4 sec.)	Approximately 12 V
	[START]	Approximately 12 V

Checking the wire harness



(1) Fuel level lamp
(3) Timer connector
(13) Fuse **[EASY CHECKER]**
(14) Diode (timer)
(15) Joint connector J/C1 (to W/H03)
(16) Joint connector J/C1 (to W/H00)
(17) Fuel level sensor
(18) Fuel level sensor connector (+)
(19) Fuel level sensor connector (-)
(20) Diode (timer) connector
(21) Fuse **[STARTER]**
(22) Fuse **[MAIN (AC)]**

1. Check conduction of the wire harness.
   - Turn the starter switch to **[STOP]**, and disconnect the fuel level lamp connector, joint connector, fuel level sensor connector, timer connector, and remove the diode (timer).

	(+)	(-)
(1) Fuel level lamp	2	Body ground
(15) Joint connector J/C1 (to W/H03)	2	Body ground
(16) Joint connector J/C1 (to W/H00)	2	Body ground
(18) Fuel level sensor connector (+)	A-1	Body ground
(3) Timer connector	2	Body ground
(20) Diode (timer) connector	1	Body ground
(20) Diode (timer) connector	2	Body ground

Normal	Not conducting

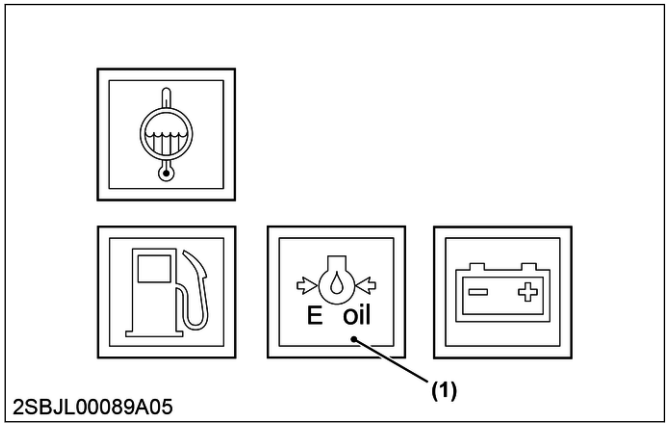
2.2 Handling Engine oil pressure error

2.2.1 Engine oil pressure lamp not lighting up

If the engine oil pressure does not light up when the starter switch is **[RUN]** (engine is not started), perform the following inspection.

Checking the warning lamp

1. Check the lighting status of the engine oil pressure lamp.



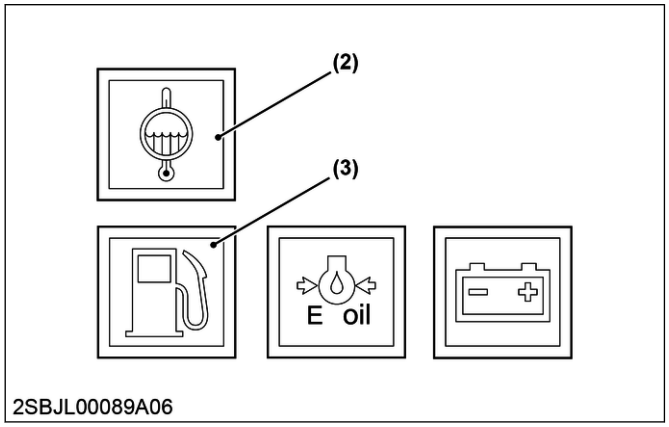
(1) Engine oil pressure lamp

Normal	Starter switch at **[RUN]**
	Engine oil pressure lamp lights up, and turns off when the engine is started.

2. Check the lighting status of the coolant temperature lamp and fuel level lamp.

NOTE

- **If both coolant temperature lamp and fuel level lamp are unlit at the same time, the fuse [EASY CHECKER] may be blown.**

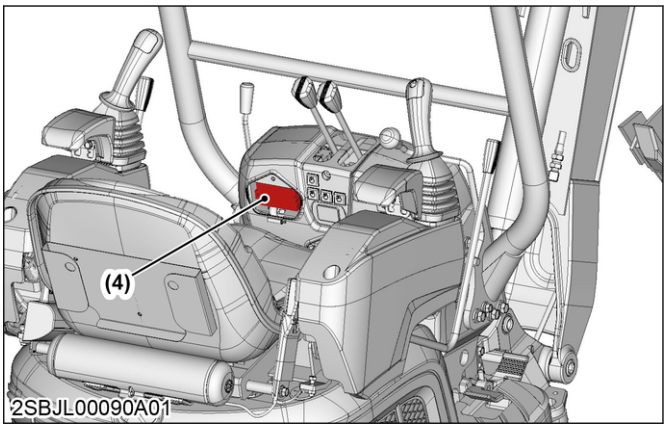


(2) Coolant temperature lamp (3) Fuel level lamp

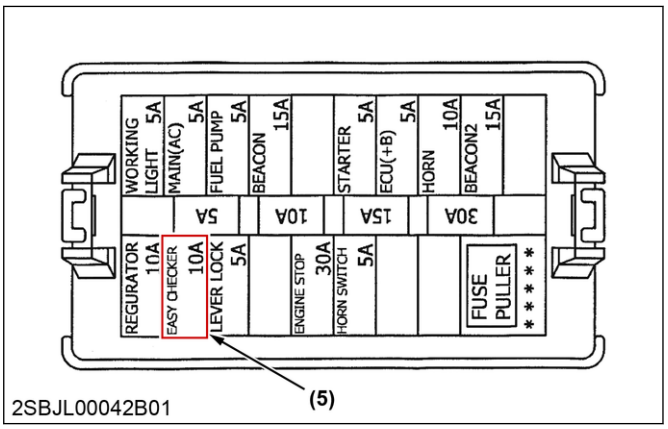
Normal	Coolant temperature lamp	Starter switch at **[RUN]**
		Coolant temperature lamp lights up for 2 to 4 seconds, and then turns off.
	Fuel level lamp	Starter switch at **[RUN]**
		Fuel level lamp lights up for 2 to 4 seconds, and then turns off.

Checking the devices

1. Remove the fuse **[EASY CHECKER]** from the fuse box, and check its conduction.

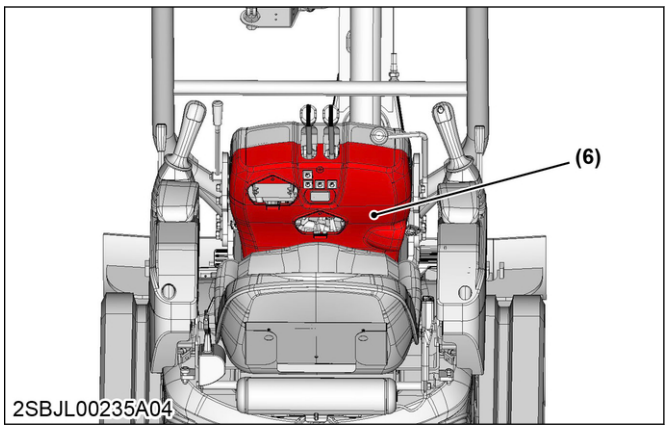


(4) Fuse box

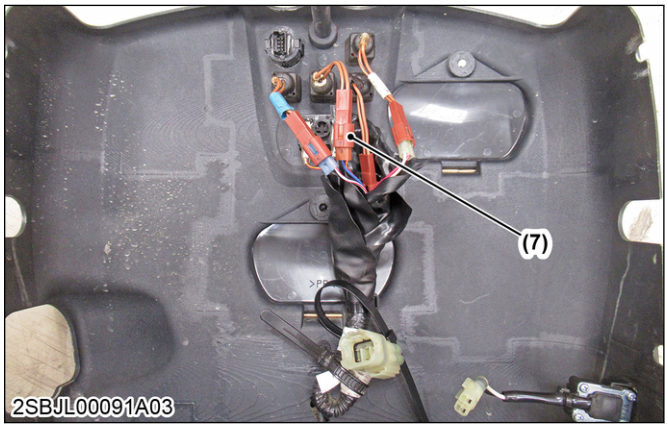


(5) Fuse **[EASY CHECKER]**

2. Remove the cover and check the engine oil pressure lamp connector.
   - Check the connectors for loose connection or poor contact.
   - Separate the lamp connector, and check if the lamp bulb is burnt out.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

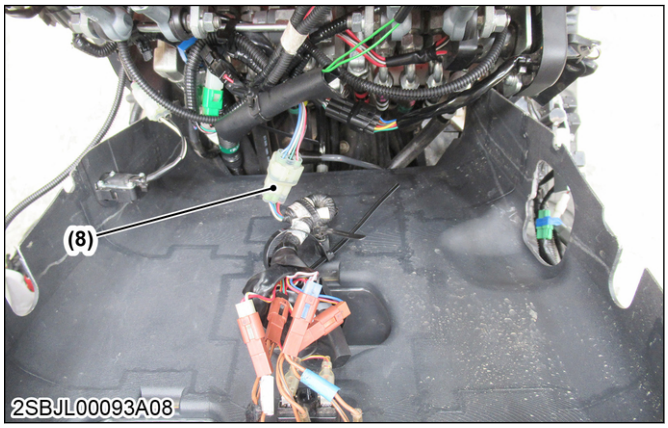


(6) Cover



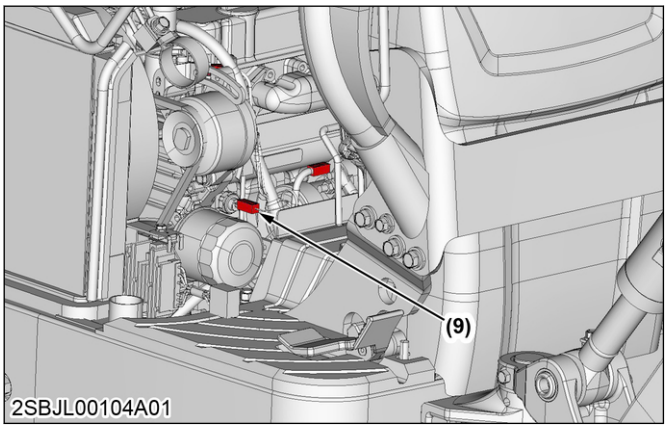
(7) Engine oil pressure lamp connector

3. Check the joint connector J/C1.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.



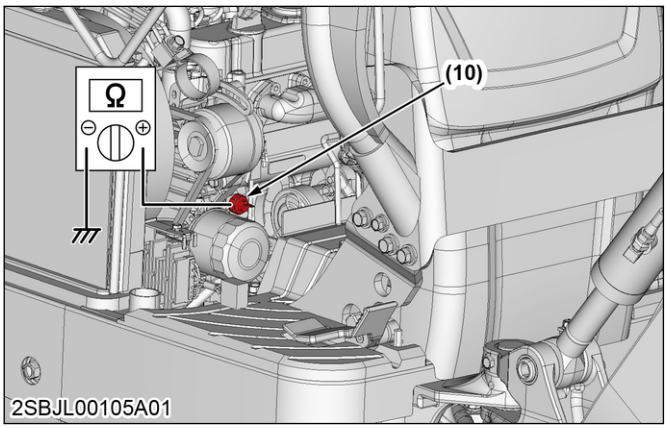
(8) Joint connector J/C1

4. Check the conduction of the engine oil pressure switch.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.



(9) Engine oil pressure switch connector

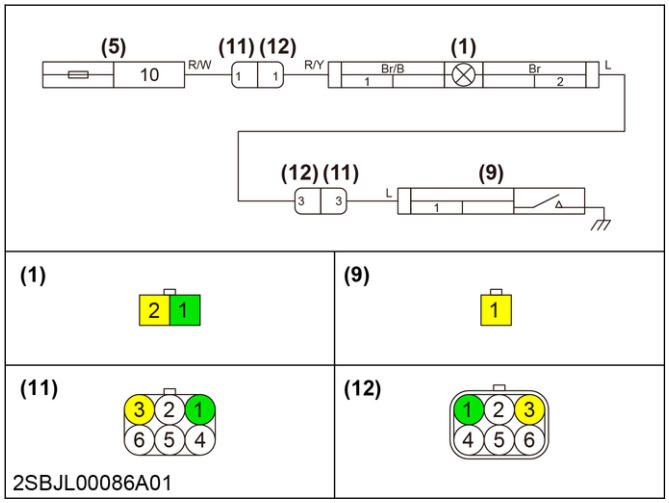
   - Disconnect the engine oil pressure switch connector, and check the conduction of the engine oil pressure switch.



(10) Engine oil pressure switch

Normal	Engine is stopped	Engine is running
	Conducting	Not conducting

Checking the wire harness



(1) Engine oil pressure lamp
(5) Fuse **[EASY CHECKER]**
(9) Engine oil pressure switch connector
(11) Joint connector J/C1 (to W/H03)
(12) Joint connector J/C1 (to W/H00)

1. Measure the voltage of the wire harness.
   - Disconnect the engine oil pressure switch connector, and turn the starter switch to **[RUN]**.

	12 V	GND
(9) Engine oil pressure switch connector	1	Body ground

Normal	Starter switch at **[STOP]**	Starter switch at **[RUN]**
	0 V	Approximately 12 V

2. Check conduction of the wire harness.
   - Turn the starter switch to **[STOP]**, and disconnect the engine oil pressure lamp connector, engine oil pressure switch connector, and joint connector.

	12 V
(1) Engine oil pressure lamp	2
(12) Joint connector J/C1 (to W/H00)	3

	12 V
(11) Joint connector J/C1 (to W/H03)	3
(9) Engine oil pressure switch connector	1

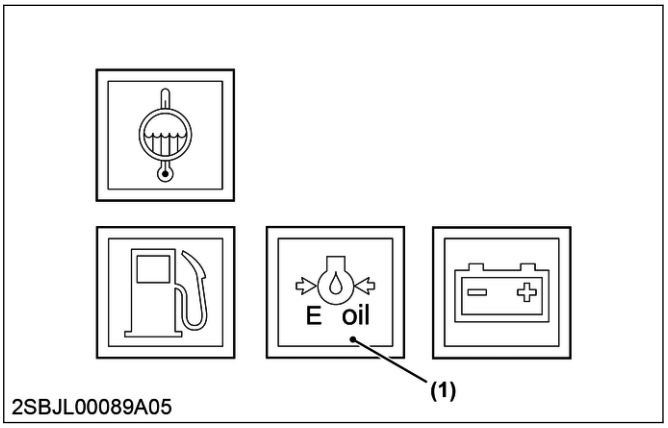
Normal	Conducting

2.2.2 Engine oil pressure lamp lighting up

When the engine oil pressure lamp lights up after starting the engine, perform the following inspection.

Checking the warning lamp

1. Check the lighting status of the engine oil pressure lamp.

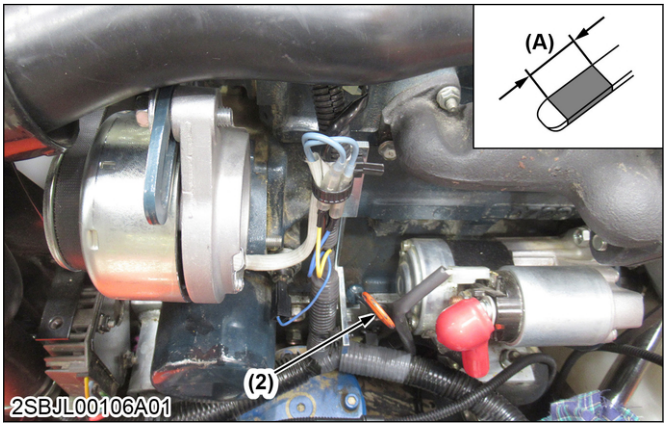


(1) Engine oil pressure lamp

Normal	Starter switch at **[RUN]**
	Engine oil pressure lamp lights up, and turns off when the engine is started.

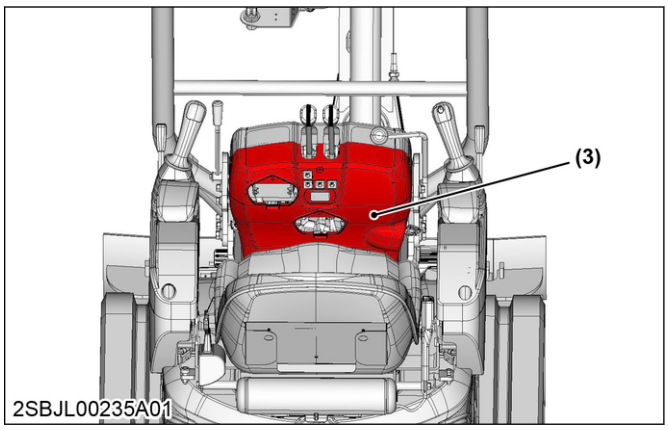
Checking the devices

1. Check the engine oil level.
   - Remove the engine oil dipstick and check the engine oil level.
   - Replenish the engine oil if necessary.

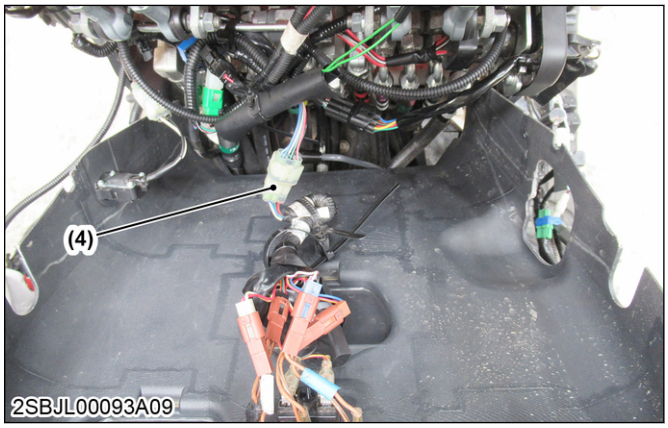


(2) Engine oil dipstick
(A) Correct oil level range

2. Remove the cover and check the joint connector J/C1.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

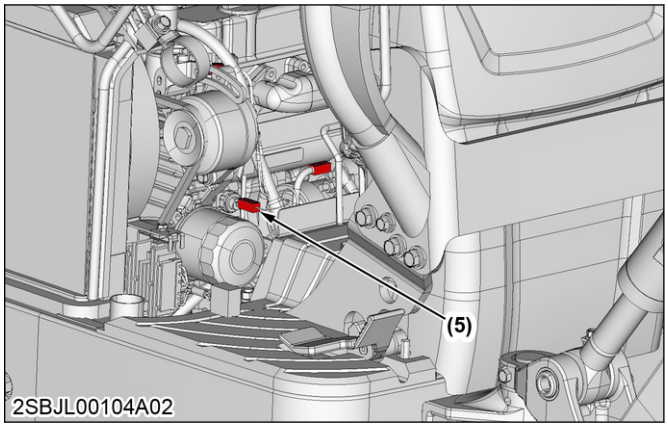


(3) Cover



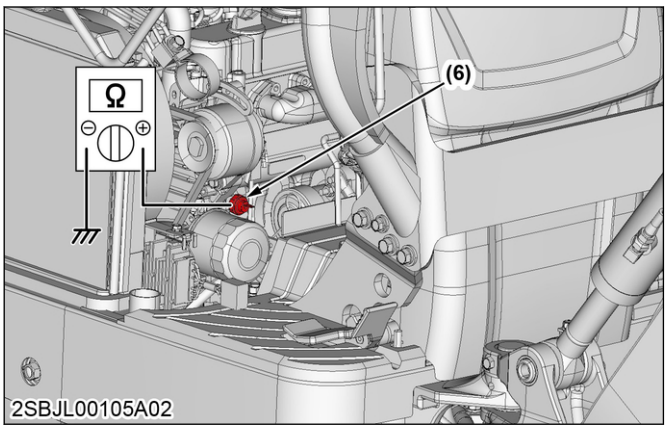
(4) Joint connector J/C1

3. Check the conduction of the engine oil pressure switch.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.



(5) Engine oil pressure switch connector

   - Disconnect the engine oil pressure switch connector, and check the conduction of the engine oil pressure switch.



(6) Engine oil pressure switch

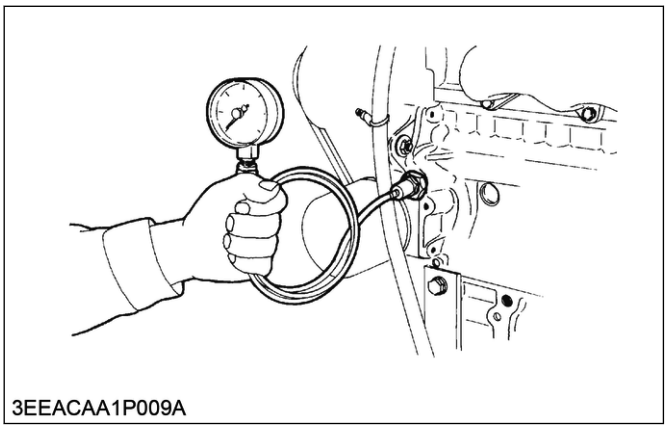
Normal	Engine is stopped	Engine is running
	Conducting	Not conducting

Measuring the engine oil pressure

1. Measure the engine oil pressure at the engine maximum speed.

■ NOTE

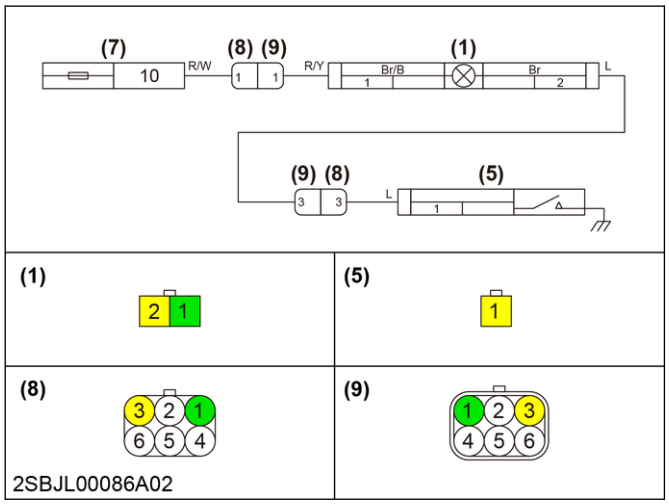
- **The oil pressure switch turns on when the pressure is less than 49 kPa (0.50 kgf/cm^2, 7.1 psi).**



Service specification

Engine oil pressure	At the engine maximum speed	197 to 441 kPa 2.0 to 4.5 kgf/cm^2 28.6 to 63.9 psi

Checking the wire harness



(1) Engine oil pressure lamp
(5) Engine oil pressure switch connector
(7) Fuse **[EASY CHECKER]**
(8) Joint connector J/C1 (to W/H03)
(9) Joint connector J/C1 (to W/H00)

1. Check conduction of the wire harness.
   - Turn the starter switch to **[STOP]**, and disconnect the engine oil pressure lamp connector, engine oil pressure switch connector, and joint connector.

	(+)	(-)
(1) Engine oil pressure lamp	2	Body ground
(8) Joint connector J/C1 (to W/H03)	3	Body ground
(9) Joint connector J/C1 (to W/H00)	3	Body ground
(5) Engine oil pressure switch connector	1	Body ground

Normal	Not conducting

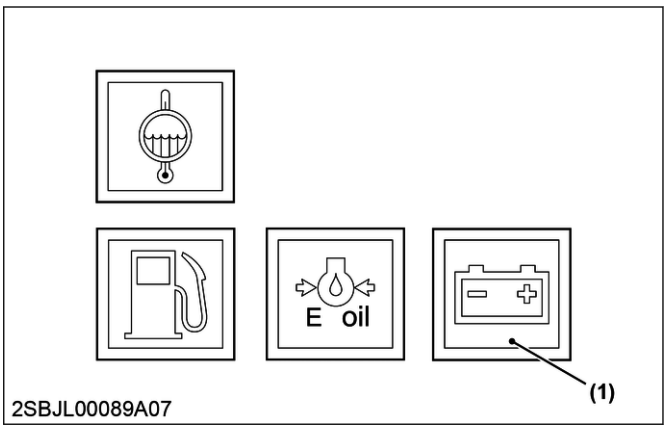
2.3 Handling Charging error

2.3.1 Charge lamp not lighting up

If the charge lamp does not light up when the starter switch is **[RUN]** (engine is not started), perform the following inspection.

Checking the warning lamp

1. Check the lighting status of the charge lamp.

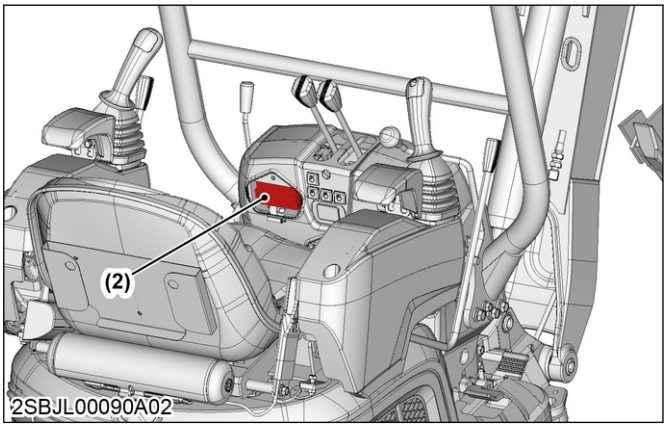


(1) Charge lamp

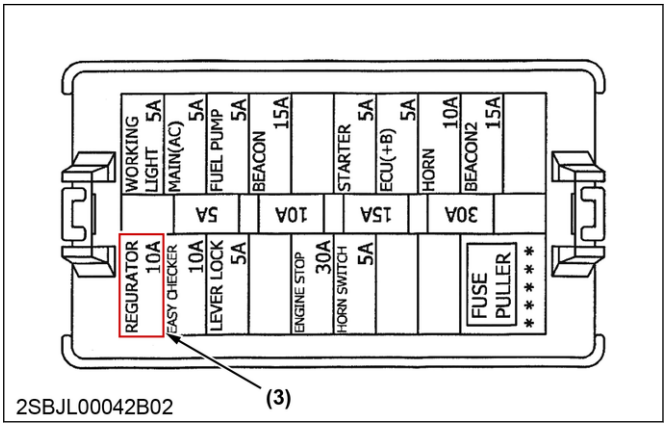
Normal	starter switch at **[RUN]**
	Charge lamp lights up, and turns off when the engine is started.

Checking the devices

1. Remove the fuse **[REGURATOR]**) from the fuse box, and check its conduction.



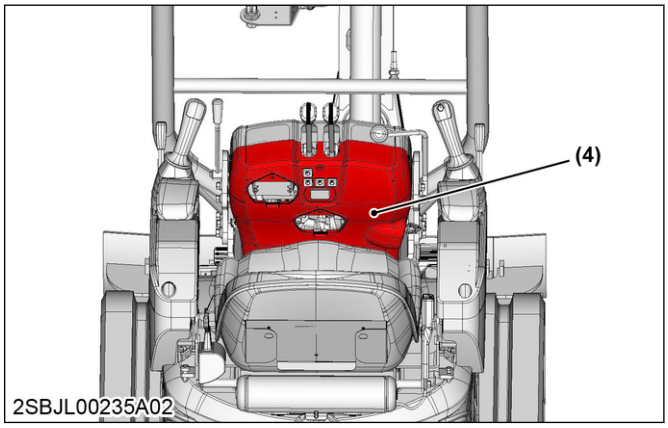
(2) Fuse box



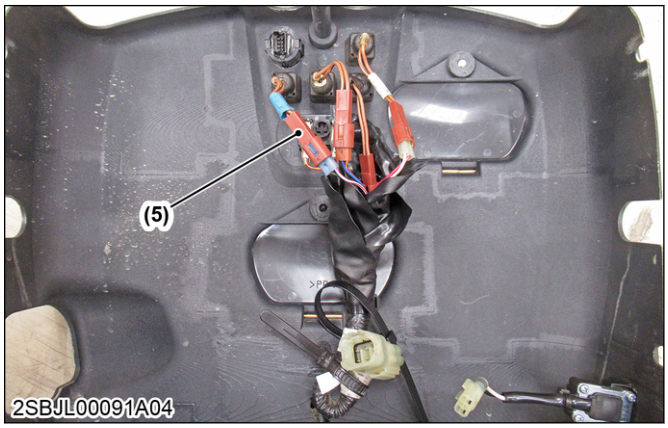
(3) Fuse **[REGURATOR]**

2. Remove the cover and check the charge lamp connector.
   - Check the connectors for loose connection or poor contact.

- Separate the lamp connector, and check if the lamp bulb is burnt out.
- Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
- Check the cover of the wires for damage and that they are not touching the body.

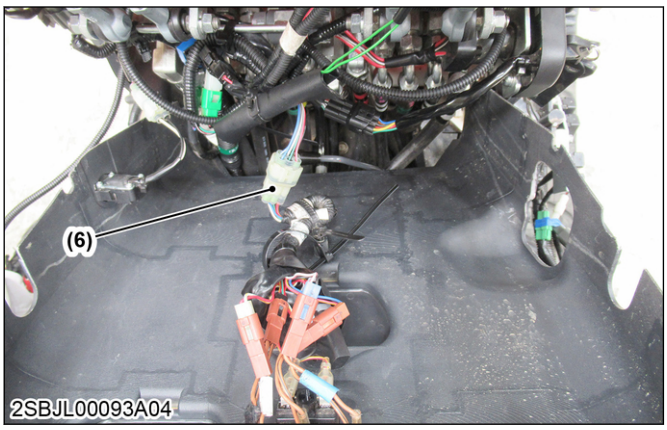


(4) Cover



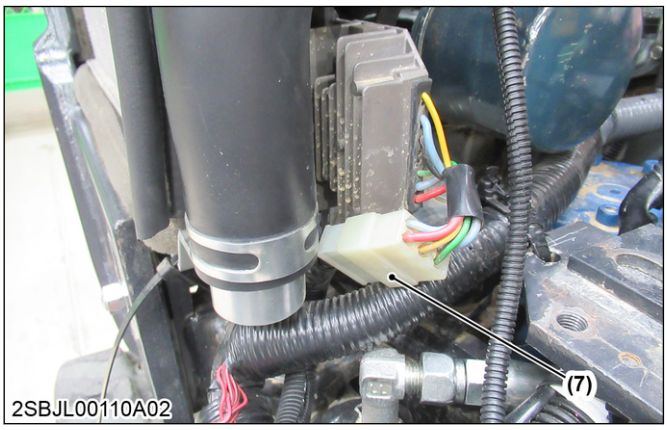
(5) Charge lamp connector

3. Check the joint connector J/C1.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.



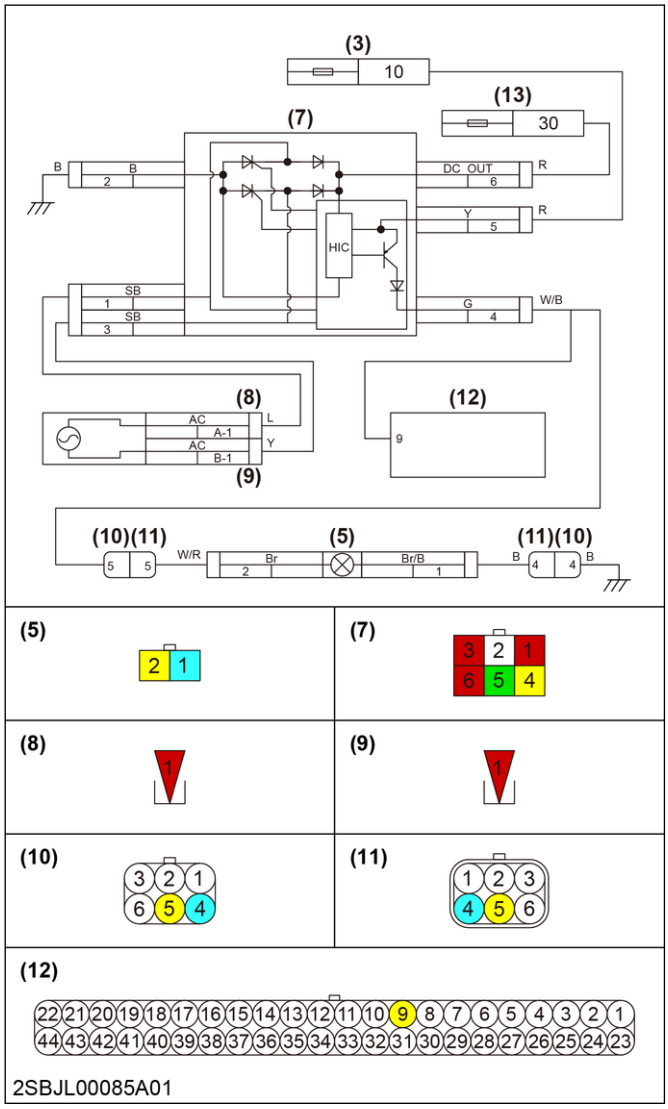
(6) Joint connector J/C1

4. Check the regurator connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.



(7) Regurator connector

Checking the wire harness



(3) Fuse **[REGURATOR]**
(5) Charge lamp connector
(7) Regurator connector
(8) Dynamo connector A
(9) Dynamo connector B
(10) Joint connector J/C1 (to W/H03)
(11) Joint connector J/C1 (to W/H00)
(12) Main ECU connector
(13) SBF **[MAIN]**

1. Measure the voltage of the wire harness.
   - Turn the starter switch to **[RUN]**, and measure the voltage of the regurator connector.

	12 V	GND
(7) Regurator connector	5	Body ground

Normal	Starter switch at **[STOP]**	Starter switch at **[RUN]**
	0 V	Approximately 12 V

   - Disconnect the charge lamp connector and main ECU connector.

	12 V	GND
(5) Charge lamp connector	2	Body ground

Normal	Starter switch at **[STOP]**	Starter switch at **[RUN]**
	0 V	Approximately 12 V

2. Check conduction of the wire harness.
   - Turn the starter switch to **[STOP]**, and disconnect charge lamp connector.

	(+)	(-)
(5) Charge lamp connector	1	Body ground

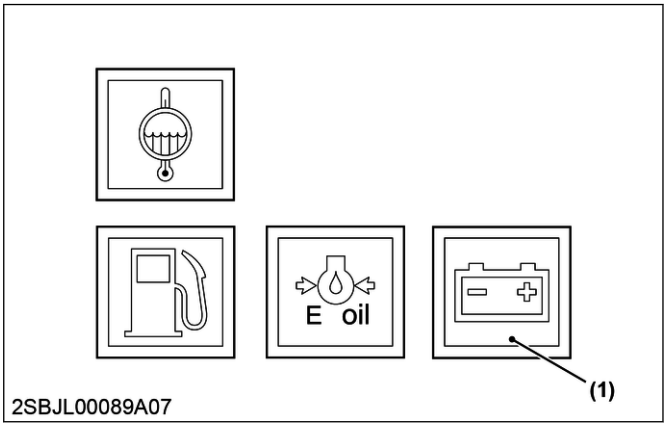
Normal	Conducting

2.3.2 Charge lamp lighting up

When the charge lamp lights up after starting the engine, perform the following inspection.

Checking the warning lamp

1. Check the lighting status of the charge lamp.

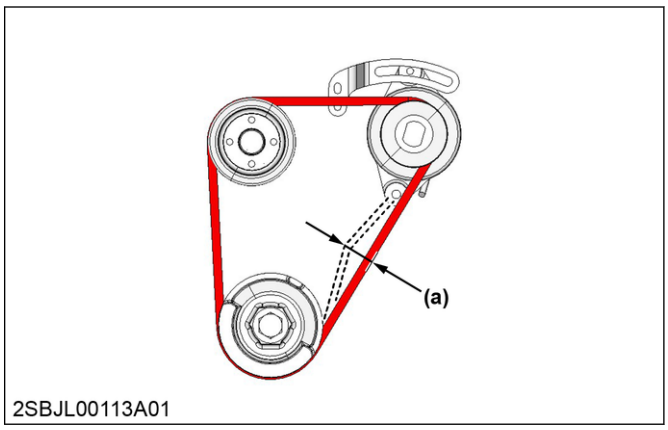


(1) Charge lamp

Normal	Charge lamp lights up, and turns off when the engine is started.

Checking the devices

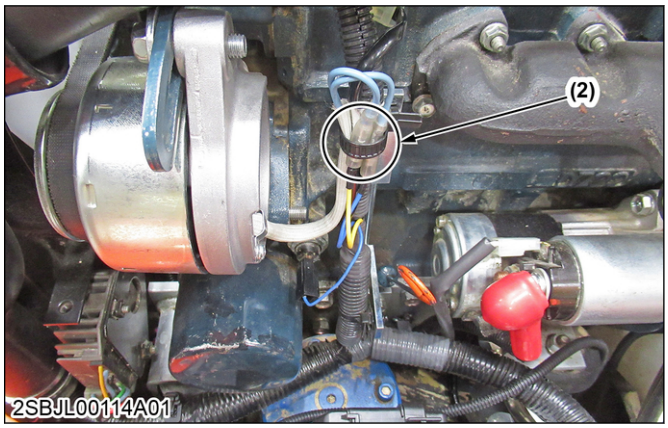
1. Check the tension and damage of the fan belt.
   - Check the tension of the fan belt, and check for its damage and slippage.



Service specification

(a) Fan belt tension	7.0 to 9.0 mm 0.26 to 0.35 in.	Push with 98 N Push with 10 kgf

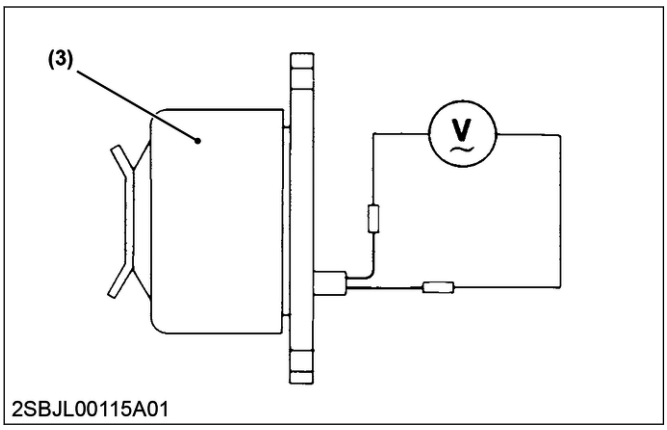
2. Check the dynamo connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.



(2) Dynamo connector

3. Measure voltage of the dynamo.
   - Measure the voltage between the each terminal of the dynamo.

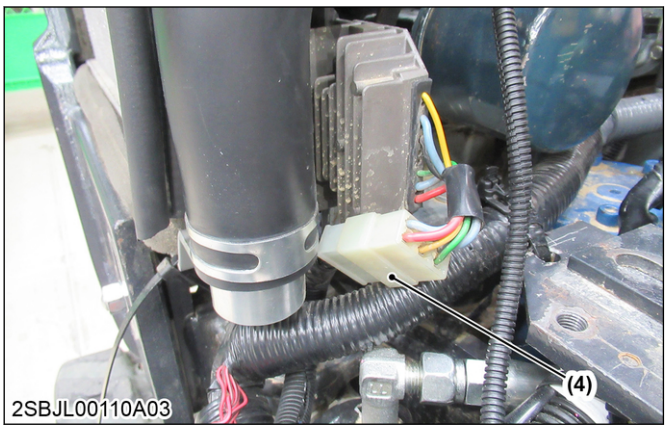
■ NOTE
- **Inspect with the tester set to the AC voltage measurement mode.**
- **Inspect with the dynamo connector connected.**



(3) Dynamo

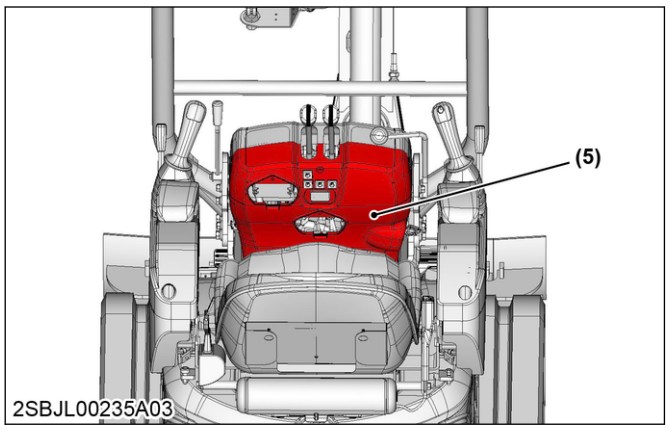
Normal	Engine maximum speed	AC voltage 16 V or more

4. Check the regurator connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

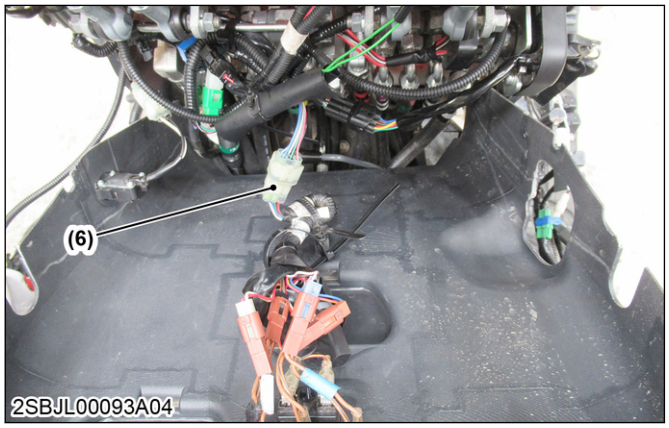


(4) Regurator connector

5. Remove the cover and check the joint connector J/C1.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

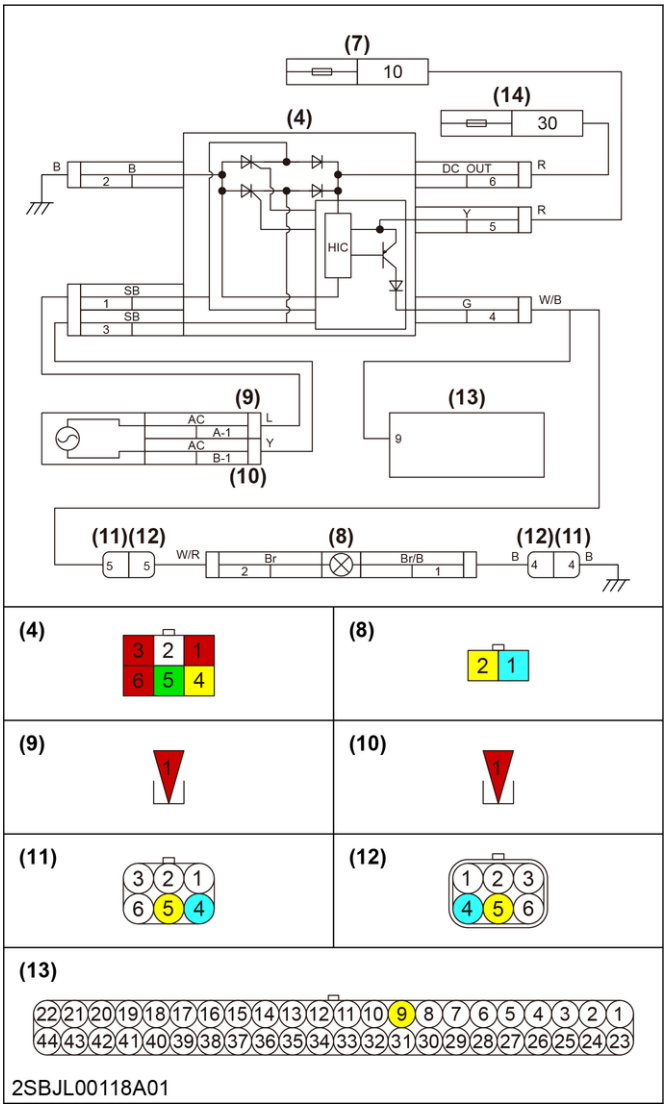


(5) Cover



(6) Joint connector J/C1

Checking the wire harness



(4) Regurator connector
(7) Fuse **[REGURATOR]**
(8) Charge lamp connector
(9) Dynamo connector A
(10) Dynamo connector B
(11) Joint connector J/C1 (to W/ H03)
(12) Joint connector J/C1 (to W/ H00)
(13) Main ECU connector
(14) SBF **[MAIN]**

1. Measure the voltage of the wire harness.

■ NOTE

- **If the voltage of the charge lamp connector does not drop to 0 V when the engine is running during this voltage inspection, there is a possibility of regurator malfunction.**

- Measure the voltage of charge lamp connector.

	12 V	GND
(8) Charge lamp connector	2	Body ground

	Starter switch position	Voltage
Normal	[STOP]	0 V
	[RUN] (Engine is stopped)	Approximately 12 V
	[RUN] (Engine is running)	0 V

2. Check conduction of the wire harness.
   - Turn the starter switch to **[STOP]**, and disconnect the dynamo connector and regurator connector.

	12 V
(4) Regurator connector	1
(9) Dynamo connector A	A-1

	12 V
(4) Regurator connector	3
(10) Dynamo connector B	B-1

Normal	Conducting

	(+)	(-)
(9) Dynamo connector A	A-1	Body ground
(10) Dynamo connector B	B-1	Body ground
(4) Regurator connector	1	Body ground
(4) Regurator connector	3	Body ground

Normal	Not conducting

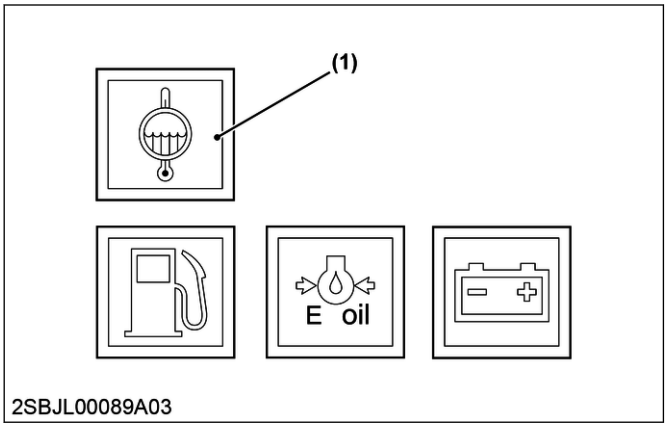
2.4 Handling Coolant temperature error

2.4.1 Coolant temperature lamp not lighting up

If the coolant temperature lamp does not light up when the starter switch is **[RUN]** (engine is not started), perform the following inspection.

Checking the warning lamp

1. Check the lighting status of the coolant temperature lamp.



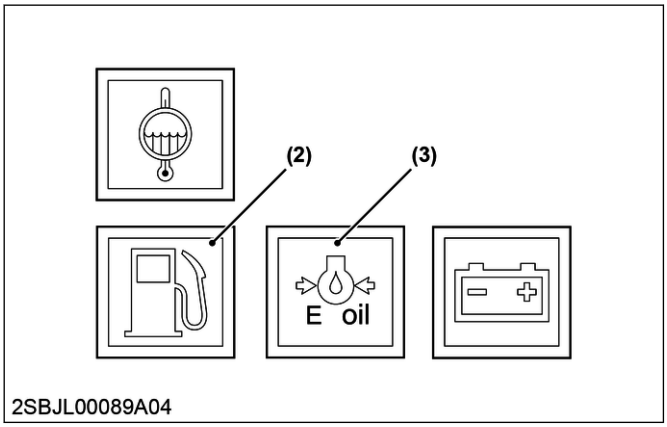
(1) Coolant temperature lamp

Normal	Starter switch at **[RUN]**
	Coolant temperature lamp lights up for 2 to 4 seconds, and then turns off.

2. Check the lighting status of the fuel level lamp and engine oil pressure lamp.

■ NOTE

- **If both fuel level lamp and engine oil pressure lamp are unlit at the same time, the fuse [EASY CHECKER] may be blown.**

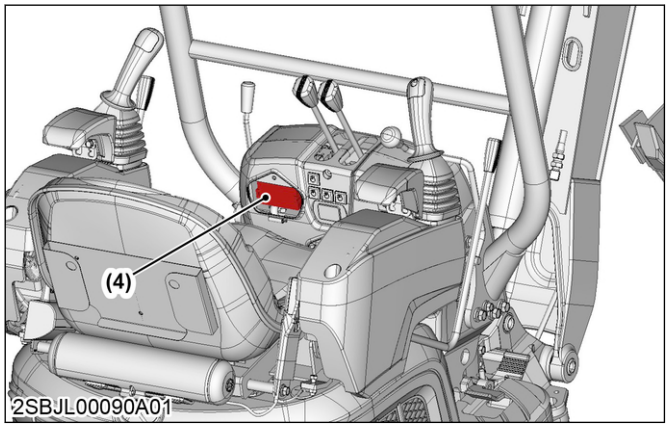


(2) Fuel level lamp (3) Engine oil pressure lamp

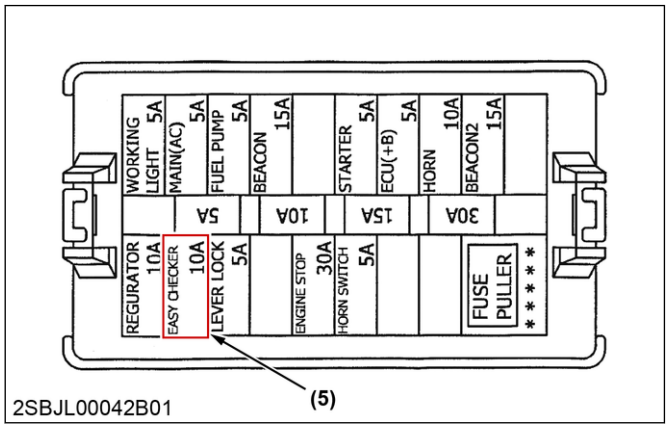
Normal	Fuel level lamp	Starter switch at **[RUN]**
		Fuel level lamp lights up for 2 to 4 seconds, and then turns off.
	Engine oil pressure lamp	Starter switch at **[RUN]**
		Engine oil pressure lamp lights up, and turns off when the engine is started.

Checking devices

1. Remove the fuse **[EASY CHECKER]** from the fuse box, and check its conduction.

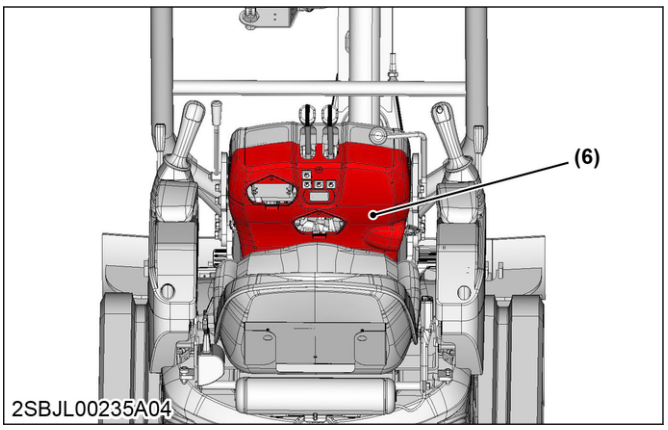


(4) Fuse box

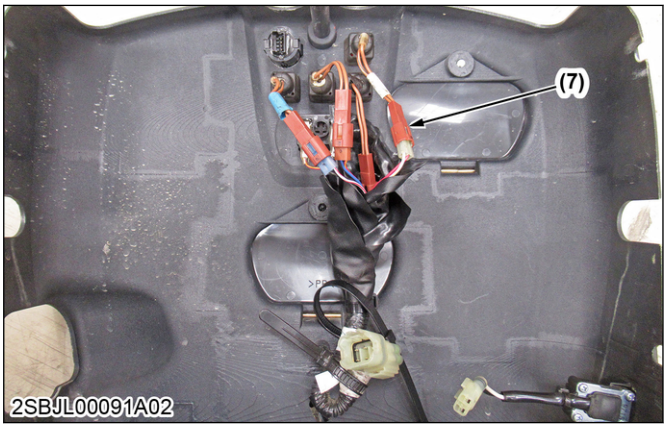


(5) Fuse **[EASY CHECKER]**

2. Remove the cover and check the coolant temperature lamp connector.
   - Check the connectors for loose connection or poor contact.
   - Separate the lamp connector, and check if the lamp bulb is burnt out.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

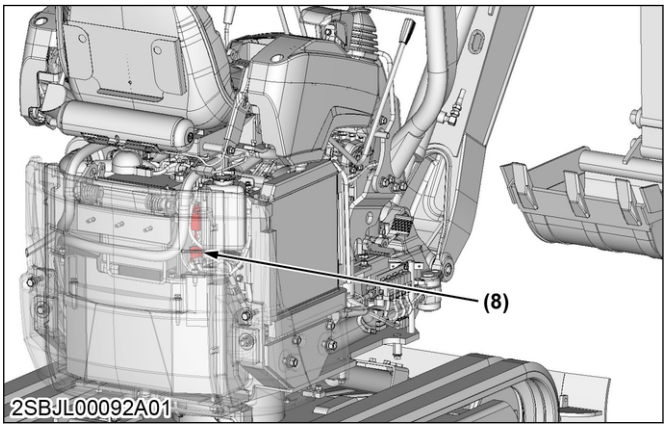


(6) Cover



(7) Coolant temperature lamp connector

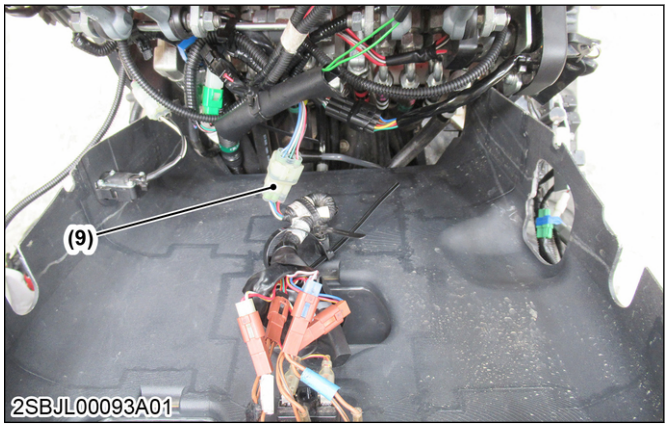
3. Check the timer connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.



(8) Timer connector

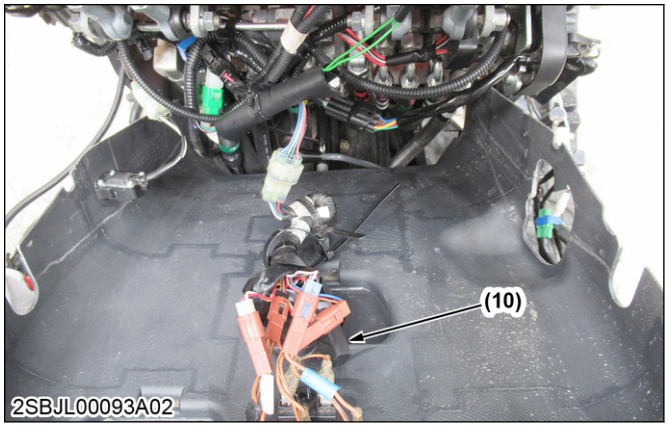
4. Check the joint connector J/C1.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.

- Check the cover of the wires for damage and that they are not touching the body.



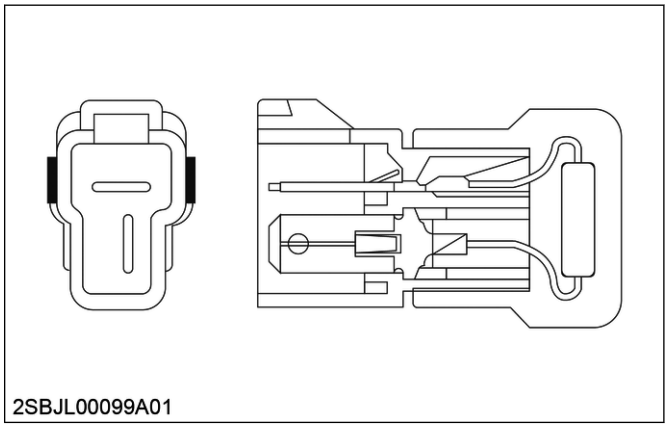
(9) Joint connector J/C1

5. Check the resister.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.



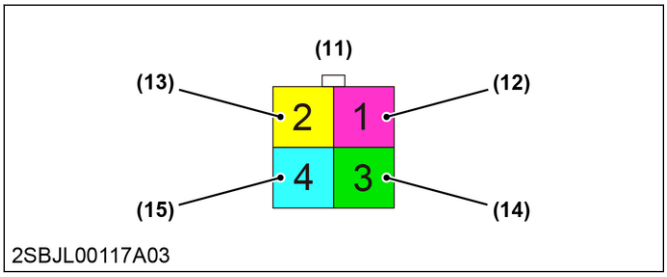
(10) Resister

- Measure the resistance of the resister.



Normal	7.8 to 8.6 Ω

6. Check the timer.
   - Disconnect the timer connector and measure the voltage of the wire harness.



(11) Timer connector (wire harness side)
(12) Terminal 1
(13) Terminal 2
(14) Terminal 3
(15) Terminal 4

	12 V	GND
(11) Timer connector (wire harness side)	1	Body ground
	2	Body ground
	3	Body ground

	Terminal No.	Starter switch at [STOP]	Starter switch at [RUN]	Starter switch at [START]
Normal	1	0 V	0 V	Approximately 12 V
	2	0 V	Approximately 12 V	Approximately 12 V
	3	0 V	Approximately 12 V	Approximately 12 V

- Disconnect the timer connector and measure the resistance of the wire harness.

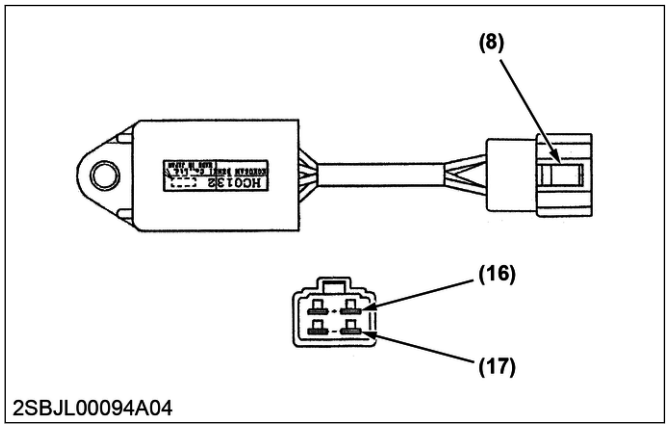
	(+)	(-)
(11) Timer connector (wire harness side)	4	Body ground

Normal	Conducting

- Connect the timer connector and measure the voltage of the timer connector.

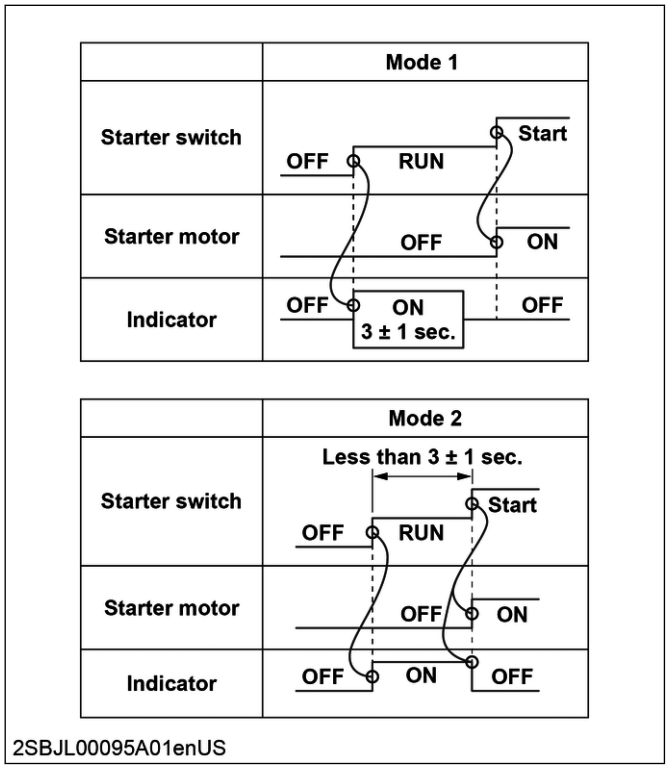
■ NOTE
- **Operation check of the timer can be performed by measuring the voltage of terminal 2.**
- **When the timer is operating normally, the voltage of terminal 2 changes from 0 V to 12 V when 2 to 4 seconds has passed since switching the starter switch to [RUN].**

– When measuring voltage, the timer connector must be connected to the wire harness.



(8) Timer connector
(16) Terminal 2
(17) Terminal 4

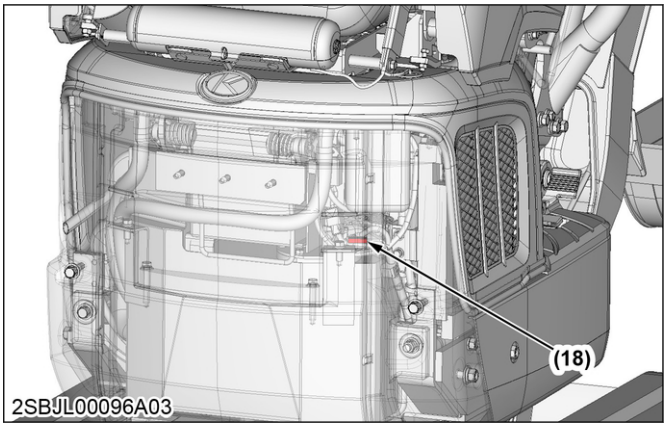
Timer mode sequence



	12 V	GND
(8) Timer connector	2	4

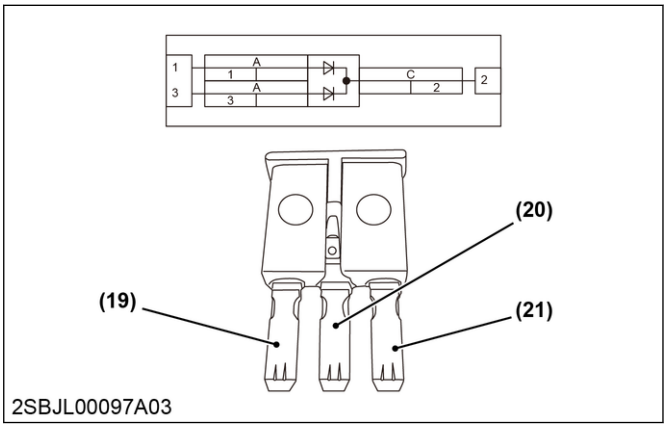
	Starter switch position	Voltage
Normal	[STOP]	0 V
	[RUN] (2 to 4 sec.)	0 V
	[RUN] (After 4 sec.)	Approximately 12 V
	[START]	Approximately 12 V

7. Check the diode (timer).
   - Remove the diode (timer).



(18) Diode (timer)

- Measure the resistance of the diode (timer).



(19) Terminal 1
(20) Terminal 2
(21) Terminal 3

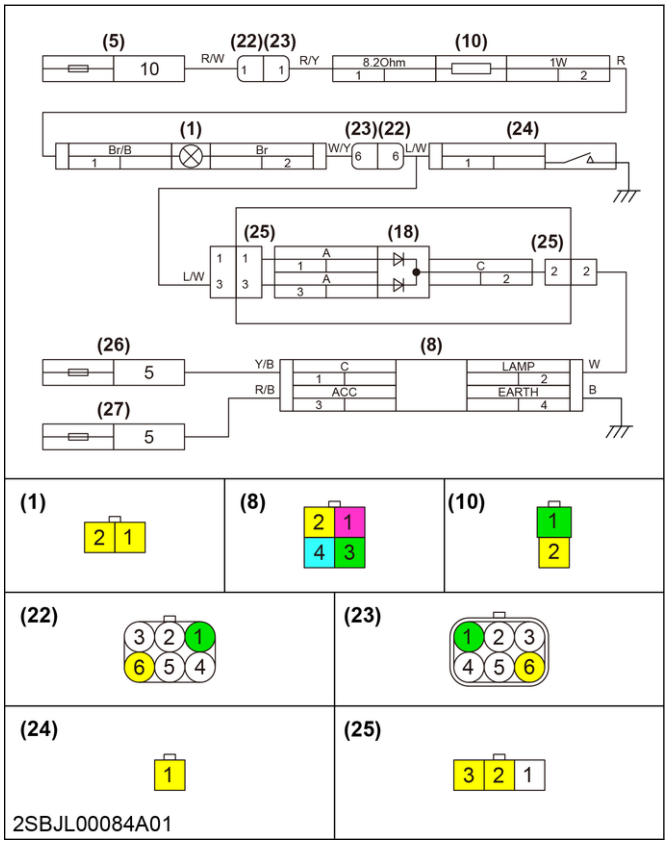
	(+)	(-)
(18) Diode (timer)	1	2
	3	2

Normal	Conducting

	(+)	(-)
(18) Diode (timer)	2	1
	2	3

Normal	Not conducting

Checking the wire harness



(1) Coolant temperature lamp
(5) Fuse **[EASY CHECKER]**
(8) Timer connector
(10) Resister
(18) Diode (timer)
(22) Joint connector J/C1 (to W/H03)
(23) Joint connector J/C1 (to W/H00)
(24) Coolant temperature switch connector
(25) Diode (timer) connector
(26) Fuse **[STARTER]**
(27) Fuse **[MAIN (AC)]**

1. Measure voltage of the wire harness.
   - Disconnect the resister and, and turn the starter switch to **[RUN]**.

	12 V	GND
(10) Resister	1	Body ground

Normal	Starter switch at **[STOP]**	Starter switch at **[RUN]**
	0 V	Approximately 12 V

2. Check conduction of the wire harness.
   - Turn the starter switch to **[STOP]**, and disconnect the coolant temperature lamp, joint connector, timer connector, and remove the diode (timer).

	12 V
(10) Resister	2
(1) Coolant temperature lamp	1

	12 V
(1) Coolant temperature lamp	2
(23) Joint connector J/C1 (to W/H00)	6

	12 V
(22) Joint connector J/C1 (to W/H03)	6
(25) Diode (timer) connector	3

	12 V
(25) Diode (timer) connector	2
(8) Timer connector	2

Normal	Conducting

	(+)	(-)
(10) Resister	2	Body ground
(1) Coolant temperature lamp	2	Body ground
(22) Joint connector J/C1 (to W/H03)	6	Body ground
(23) Joint connector J/C1 (to W/H00)	6	Body ground
(8) Timer connector	2	Body ground
(25) Diode (timer) connector	3	Body ground
(25) Diode (timer) connector	2	Body ground

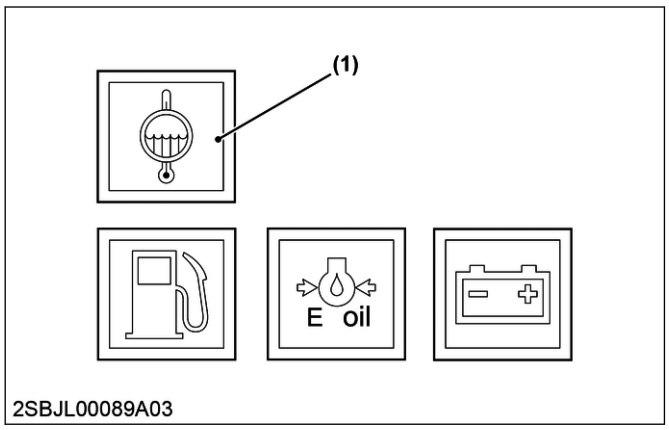
Normal	Not conducting

2.4.2 Coolant temperature lamp lighting up

When the coolant temperature lamp lights up after starting the engine, perform the following inspection.

Checking the warning lamp

1. Check the lighting status of the coolant temperature lamp.

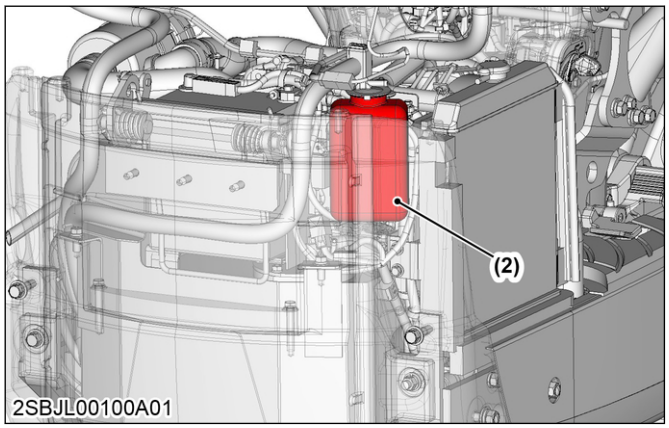


(1) Coolant temperature lamp

Normal	Starter switch at **[RUN]**
	Coolant temperature lamp lights up for 2 to 4 seconds, and then turns off.

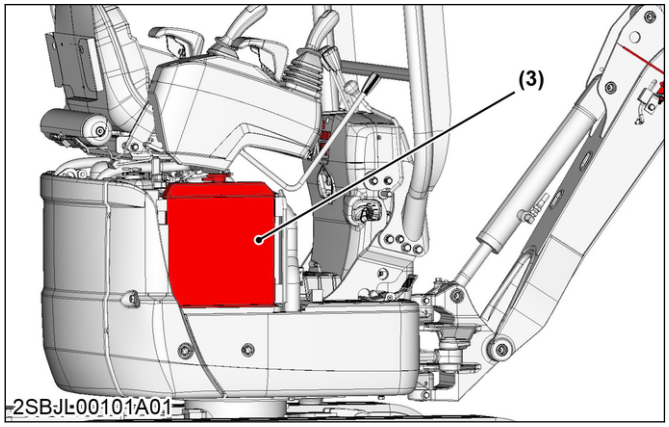
Checking the devices

1. Check the engine coolant level.
   - Open the reserve tank cap and check the engine coolant.
   - Replenish the engine coolant if necessary.



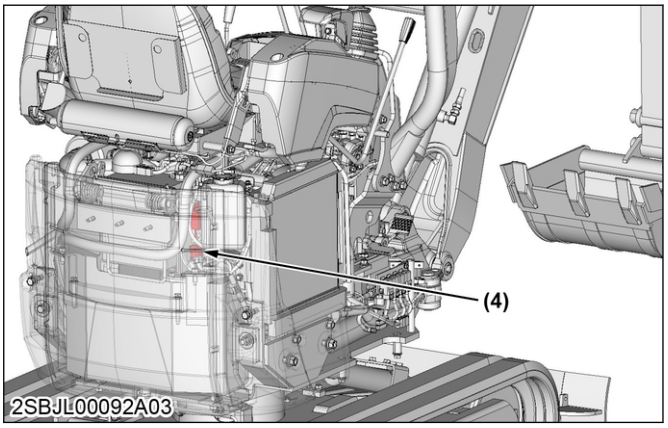
(2) Reserve tank

2. Check the condition of radiator fin.



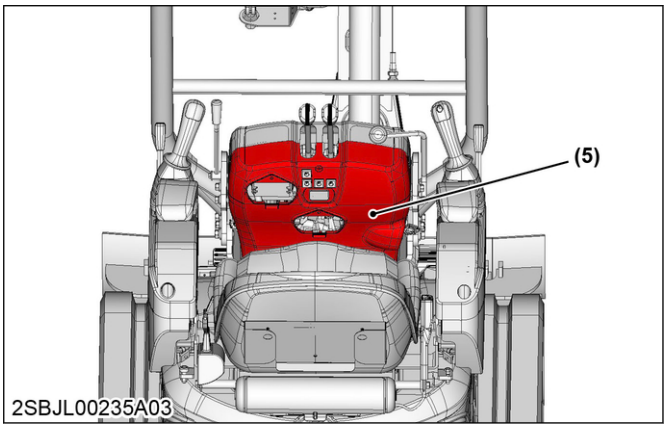
(3) Radiator fin

3. Check the timer connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

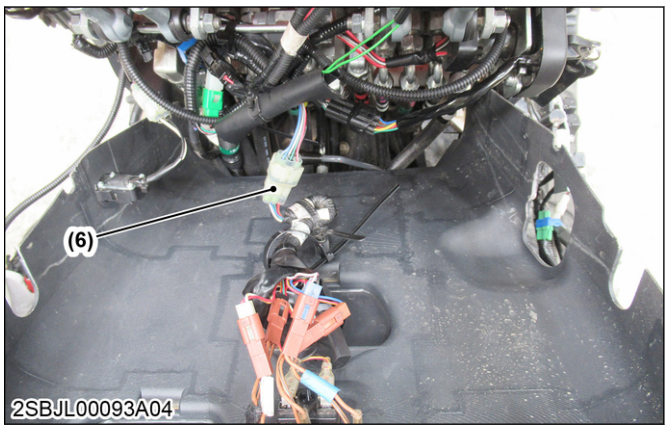


(4) Timer connector

4. Remove the cover and check the joint connector J/C1.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

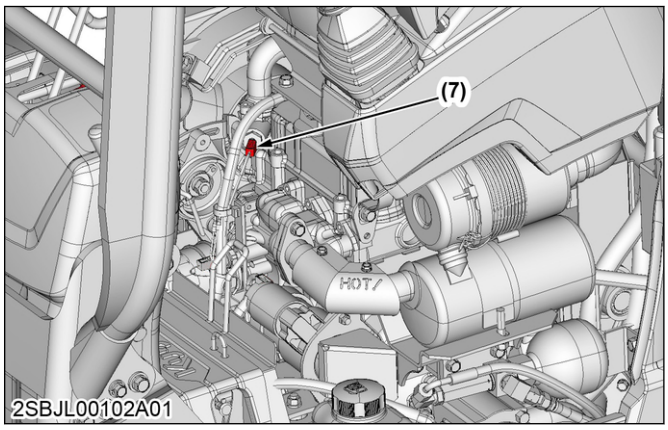


(5) Cover



(6) Joint connector J/C1

5. Check the coolant temperature switch connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check the lighting status of the lamp again.
   - Check the cover of the wires for damage and that they are not touching the body.

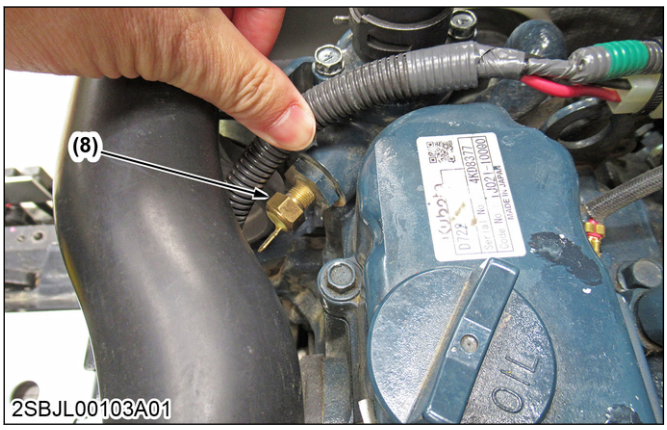


(7) Coolant temperature switch connector

   - Disconnect the coolant temperature switch connector, and check the conduction of the coolant temperature switch.

■ NOTE

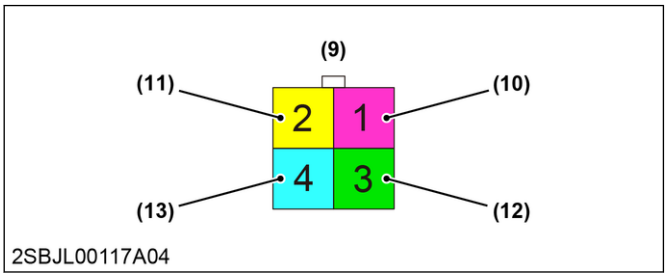
– The coolant temperature switch conducts electricity when the coolant temperature is between 112 ℃ (233 ˚F) and 118 ℃ (244 ˚F). It does not conduct electricity when the coolant temperature is 108 ℃ (226 ˚F) or below.



(8) Coolant temperature switch

Normal	Coolant temperature less than 108 ℃ (226 ˚F)	Not conducting

6. Check the timer.
   - Disconnect the timer connector and measure the voltage of the wire harness.



(9) Timer connector (wire harness side)
(10) Terminal 1
(11) Terminal 2
(12) Terminal 3
(13) Terminal 4

	12 V	GND
(9) Timer connector (wire harness side)	1	Body ground
	2	Body ground
	3	Body ground

	Terminal No.	Starter switch at [STOP]	Starter switch at [RUN]	Starter switch at [START]
Normal	1	0 V	0 V	Approximately 12 V
	2	0 V	Approximately 12 V	Approximately 12 V
	3	0 V	Approximately 12 V	Approximately 12 V

   - Disconnect the timer connector and measure the resistance of the wire harness.

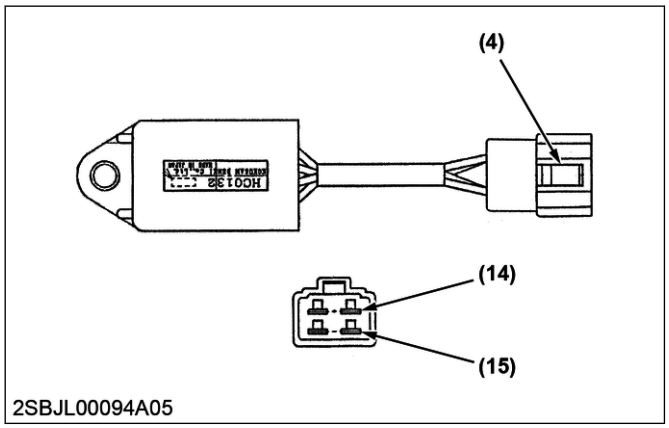
	(+)	(-)
(9) Timer connector (wire harness side)	4	Body ground

Normal	Conducting

- Connect the timer connector and measure the voltage of the timer connector.

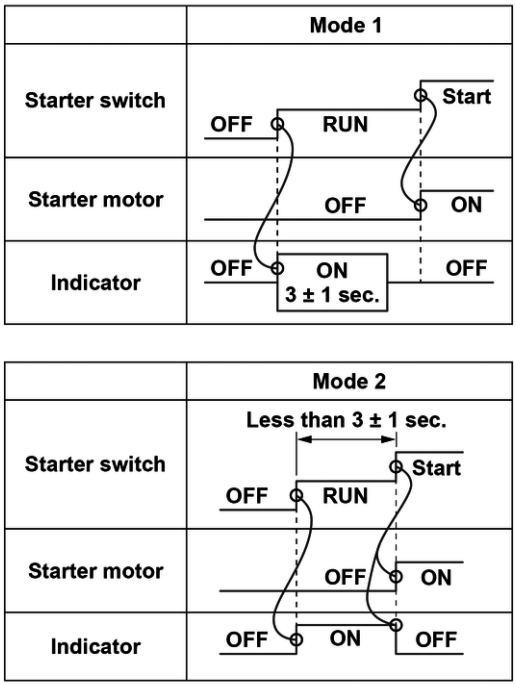
■ NOTE

– Operation check of the timer can be performed by measuring the voltage of terminal 2.
– When the timer is operating normally, the voltage of terminal 2 changes from 0 V to 12 V when 2 to 4 seconds has passed since switching the starter switch to [RUN].
– When measuring voltage, the timer connector must be connected to the wire harness.



(4) Timer connector
(14) Terminal 2
(15) Terminal 4

Timer mode sequence



	12 V	GND
(4) Timer connector	2	4

	Starter switch position	Voltage
Normal	[STOP]	0 V
	[RUN] (2 to 4 sec.)	0 V
	[RUN] (After 4 sec.)	Approximately 12 V
	[START]	Approximately 12 V

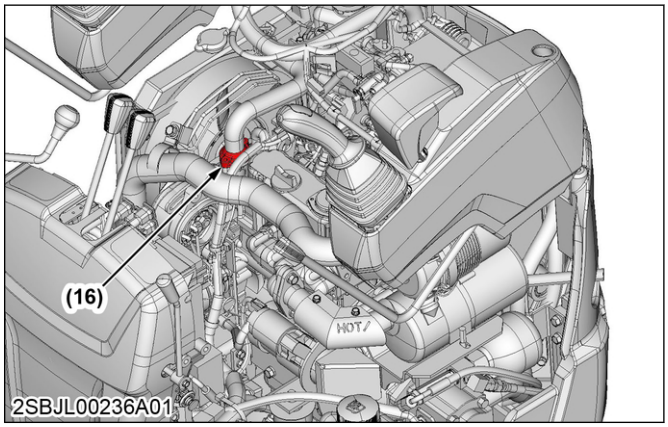
7. Remove the thermostat and check the thermostat valve opening temperature.

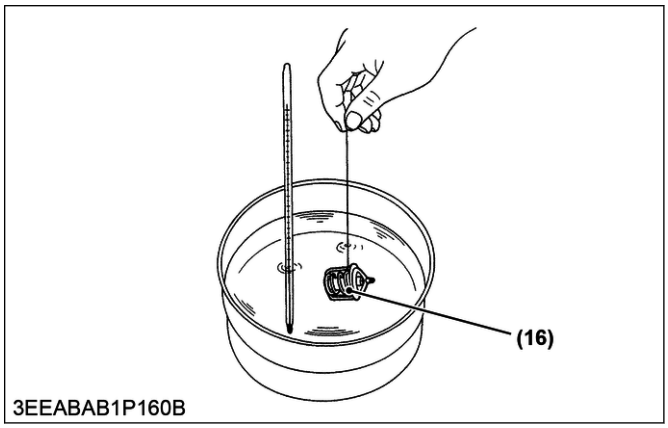
⚠ CAUTION

- **When removing the thermostat, wait at least 10 minutes after the engine has stopped and cooled down. Otherwise, hot water may gush out, scalding nearby people.**

- Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
- Heat the water gradually, and read the temperature when the valve opens and leaves the string.
- Continue heating and read the temperature when the valve opens by approx. 6.0 mm (0.24 in.).

- If the measurement is not within the specifications, replace the thermostat.





(16) Thermostat

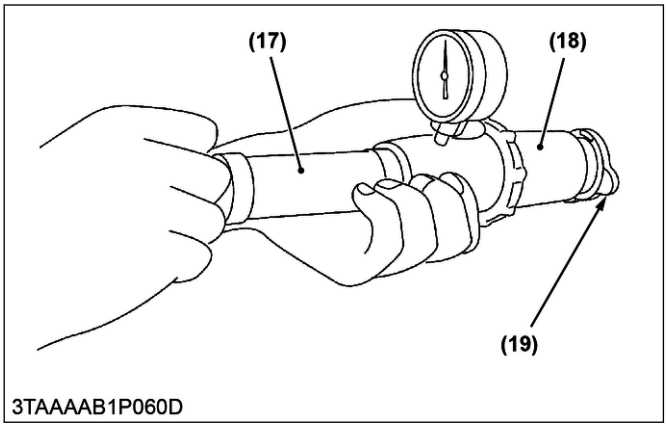
Normal	Thermostat's valve opening temperature	80.5 to 83.5 ℃ 177 to 182 ˚F
	Temperature at which thermostat completely opens	95 ℃ 203 ˚F

8. Check the radiator cap air leakage.

⚠ CAUTION

- **When removing the radiator cap, wait at least 10 minutes after the engine has stopped and cooled down. Otherwise, hot water may gush out, scalding nearby people.**

- Set a radiator tester and an adapter on the radiator cap.
- Apply the specified pressure of 88 kPa (0.90 kgf/cm^2, 12.8 psi), and measure the time for the pressure to fall to 59 kPa (0.60 kgf/cm^2, 8.5 psi).
- If the measurement is less than the specification, replace the radiator cap.



(17) Radiator tester
(18) Adapter
(19) Radiator cap

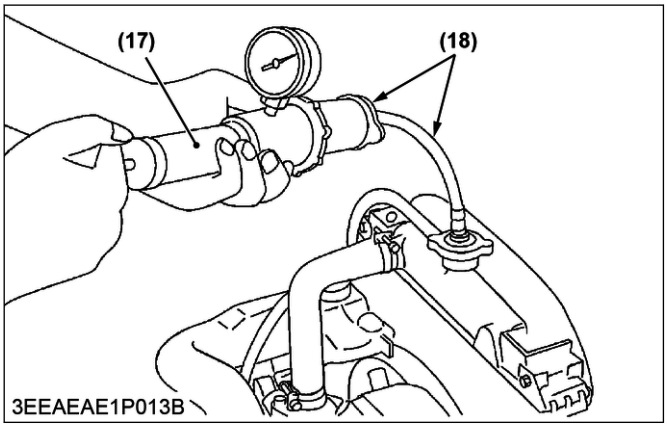
Normal	Pressure falling time (More than 10 seconds for pressure fall)	88 → 59 kPa 0.90 → 0.60 kgf/cm^2 12.8 → 8.5 psi

9. Check the radiator coolant leakage.

■ NOTE

- **The pressure of the leak test is different from each radiator specification.**

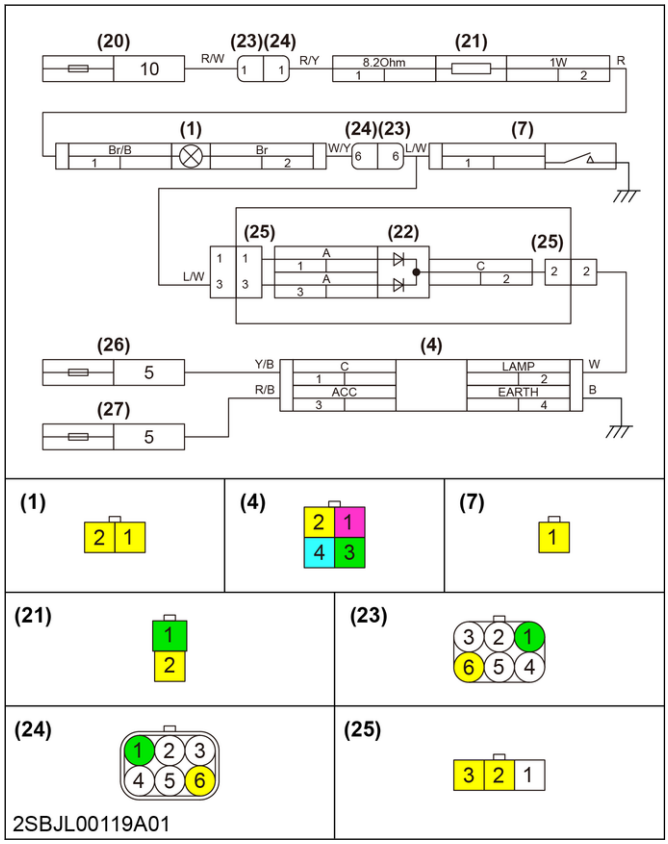
- Check that the radiator is filled with coolant.
- Set a radiator tester and an adapter and raise the coolant pressure to the 103 kPa (1.05 kgf/cm^2, 14.9 psi).
- Check the radiator for coolant leaks.
- For coolant leak from the pinhole, replace the radiator or repair with the radiator cement. If water leak is excessive, replace the radiator.



(17) Radiator tester
(18) Adapter

Normal	Radiator coolant leakage test pressure	No leak
	103 kPa 1.05 kgf/cm^2 14.9 psi	

Checking the wire harness



(1) Coolant temperature lamp
(4) Timer connector
(7) Coolant temperature switch connector
(20) Fuse **[EASY CHECKER]**
(21) Resister
(22) Diode (timer)
(23) Joint connector J/C1 (to W/H03)
(24) Joint connector J/C1 (to W/H00)
(25) Diode (timer) connector
(26) Fuse **[STARTER]**
(27) Fuse **[MAIN (AC)]**

1. Check conduction of the wire harness.
   - Turn the starter switch to **[STOP]**, and disconnect the coolant temperature lamp, joint connector, timer connector, and remove the diode (timer).

	(+)	(-)
(1) Coolant temperature lamp	2	Body ground
(23) Joint connector J/C1 (to W/H03)	6	Body ground
(24) Joint connector J/C1 (to W/H00)	6	Body ground
(7) Coolant temperature switch connector	1	Body ground
(4) Timer connector	2	Body ground
(25) Diode (timer) connector	3	Body ground
(25) Diode (timer) connector	2	Body ground

Normal	Not conducting

2.5 Handling Lever lock system error

Short circuit has occurred in the lever lock solenoid line.

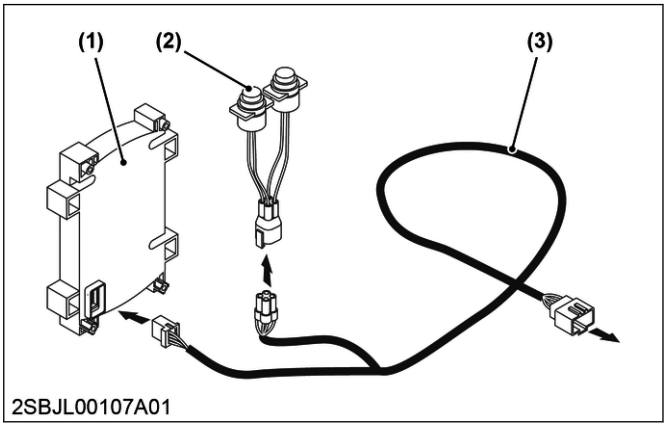
Checking on the main ECU setting kit (optional)

■ NOTE

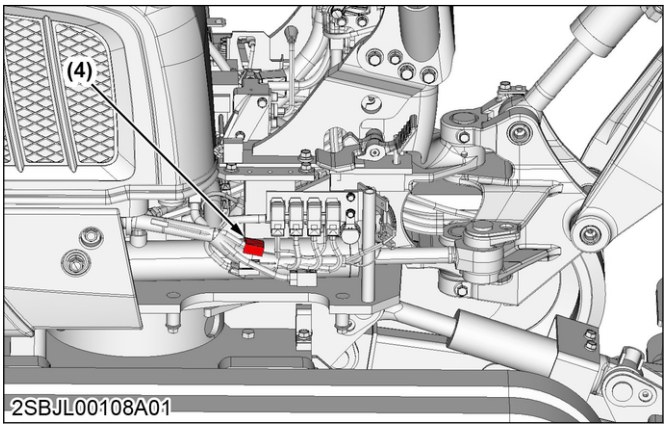
- **This procedure is performed using the main ECU setting kit (optional).**

1. Connect the main ECU setting kit to the service tool connector (main ECU setting kit).

Main ECU setting kit

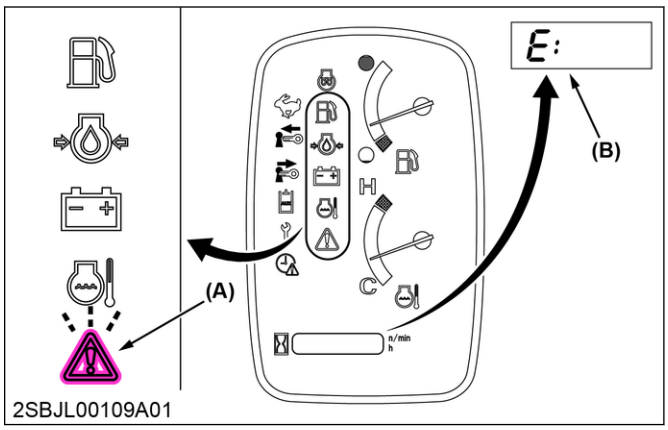


(1) Meter panel
(2) Switch
(3) Wire harness



(4) Service tool connector (main ECU setting kit)

2. Check if there is any warning lamp or error indication on the meter panel.



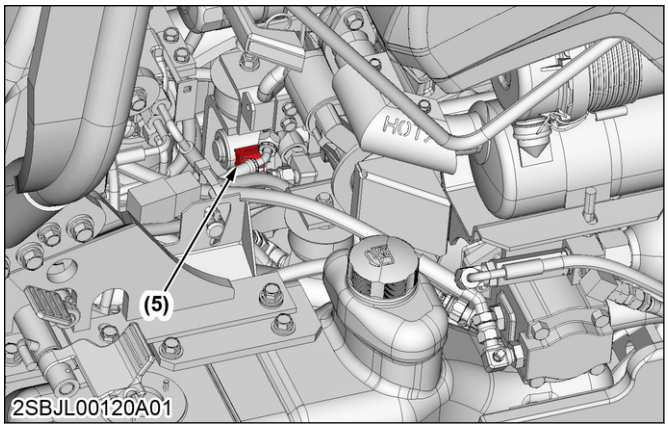
(A) Warning lamp
(B) "E:020" Lever lock system error

3. Check if the lever lock switch and the lever lock solenoid operate in the tester mode.
   - Start the engine and lower the lever lock.
   - Operate the lever lock switch, and check the items of No. 14 and 15 in the tester mode.

	Tester mode		Lever lock lowered	Lever lock raised
Normal	"set-1"	"14: ON/OFF" Lever lock switch	"ON"	"OFF"
		"15: ON/OFF" Lever lock solenoid	"ON"	"OFF"

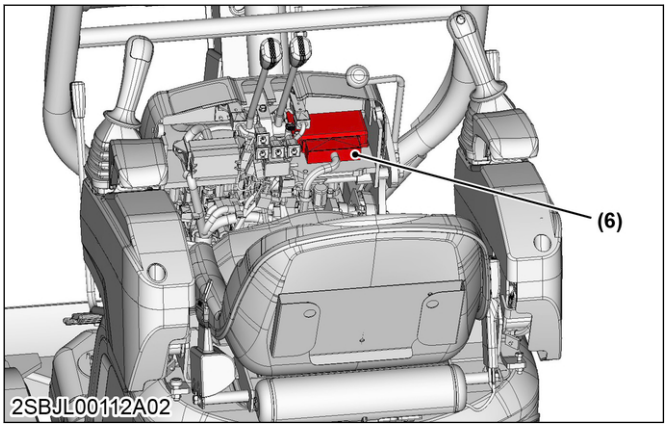
Checking the devices

1. Check the lever lock solenoid connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check if the error is resolved.
   - Check the cover of the wires for damage and that they are not touching the body.



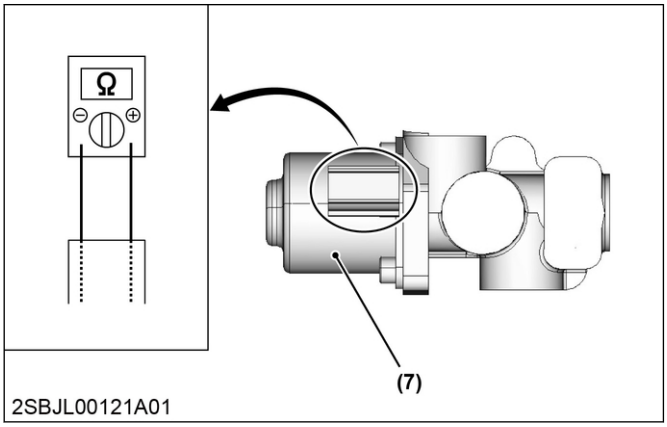
(5) Lever lock solenoid connector

2. Check the main ECU connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check if the error is resolved.
   - Check the cover of the wires for damage and that they are not touching the body.



(6) Main ECU connector

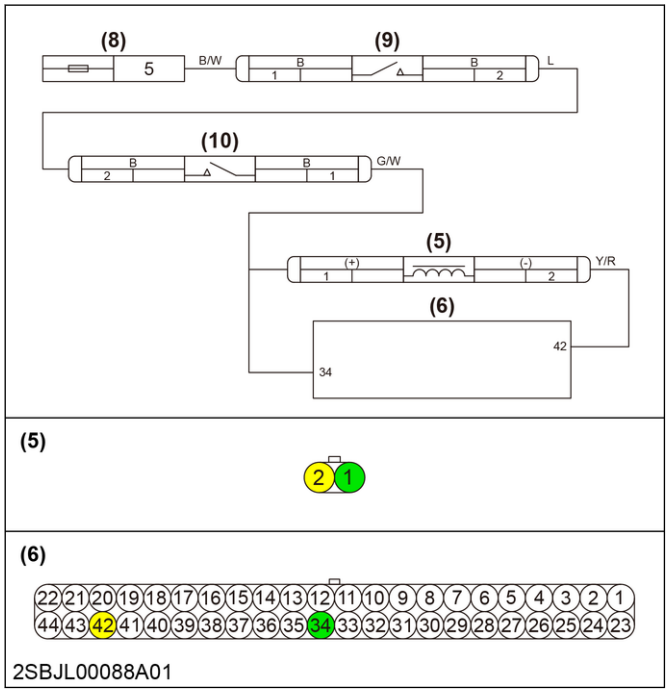
3. Measure the resistance of the lever lock solenoid.
   - Turn the starter switch to **[STOP]**, and disconnect the lever lock solenoid connector.



(7) Lever lock solenoid

Normal	10.8 to 13.2 Ω

Checking the wire harness



(5) Lever lock solenoid connector
(6) Main ECU connector
(8) Fuse **[LEVER LOCK]**
(9) Lever lock switch 2
(10) Lever lock switch 1

1. Measure voltage of the wire harness.
   - Disconnect the lever lock solenoid connector.
   - Turn the starter switch to **[RUN]**, and operate the lever lock switch.

	12 V	**GND**
(5) Lever lock solenoid connector	1	2

Normal	Lever lock switch **[OFF]** (Lever lock up)	Lever lock switch **[ON]** (Lever lock down)
	0 V	Approximately 12 V

2. Check conduction of the wire harness.
   - Turn the starter switch to **[STOP]**, and disconnect the lever lock solenoid connector and main ECU connector.

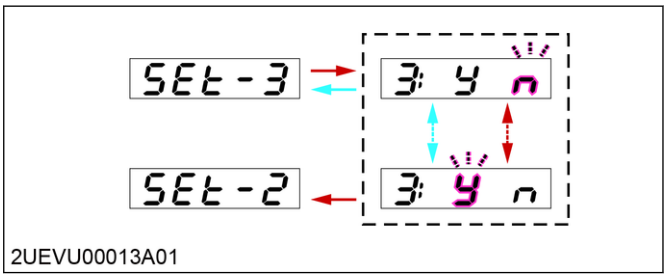
	(+)	**(-)**
(5) Lever lock solenoid connector	1	Body ground
	2	Body ground
(6) Main ECU connector	34	Body ground
	42	Body ground

Normal	Not conducting

Steps to take after completing repairs
Clears error history from main ECU memory.

■ NOTE
- **This procedure is performed using the main ECU setting kit (optional).**
- **"Clearing error history" can be cleared in "set-3".**
- **"Reading all error history" cannot be cleared in "set-5".**
- **After deleting the record, start the engine again and check to make sure that the warning is not shown on the meter panel.**

1. Connect the main ECU setting kit to the service tool connector.
2. Turn the starter switch to **[RUN]**, and select "set-3" in the service dealer mode.
3. Press SW1 or SW2 to make "Y" or "N" blink.
4. Press and hold SW2 to apply the change and return to "set-2".



"Y"	Clear

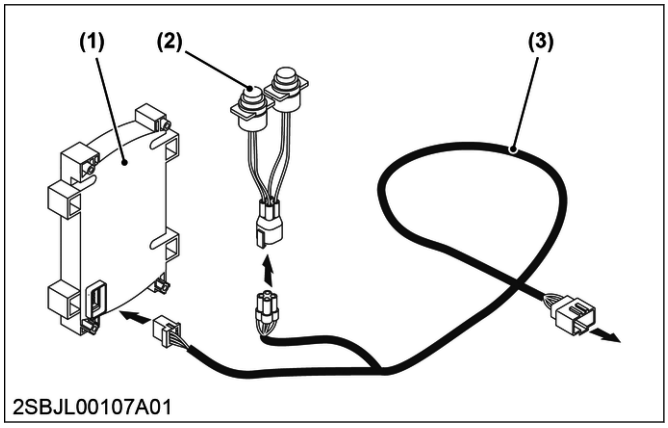
2.6 Handling Battery overcharging

Power supply voltage is over 18 V.
Checking on the main ECU setting kit (optional)

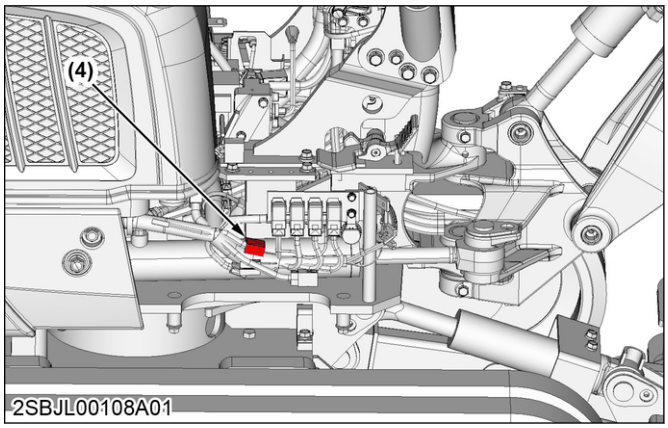
■ NOTE
- **This procedure is performed using the main ECU setting kit (optional).**

1. Connect the main ECU setting kit to the service tool connector (main ECU setting kit).

Main ECU setting kit

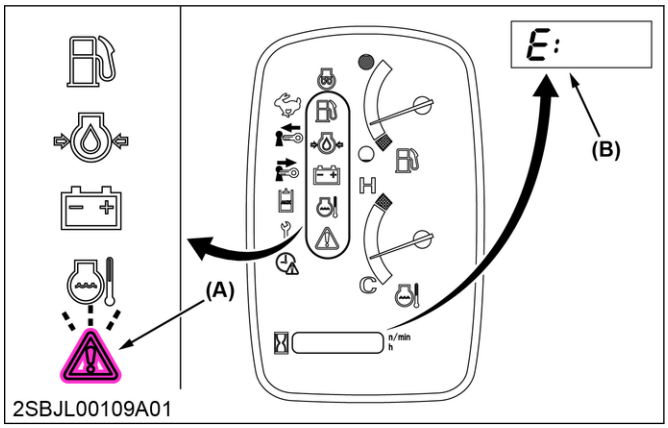


(1) Meter panel
(2) Switch
(3) Wire harness



(4) Service tool connector (main ECU setting kit)

2. Check if there is any warning lamp or error indication on the meter panel.



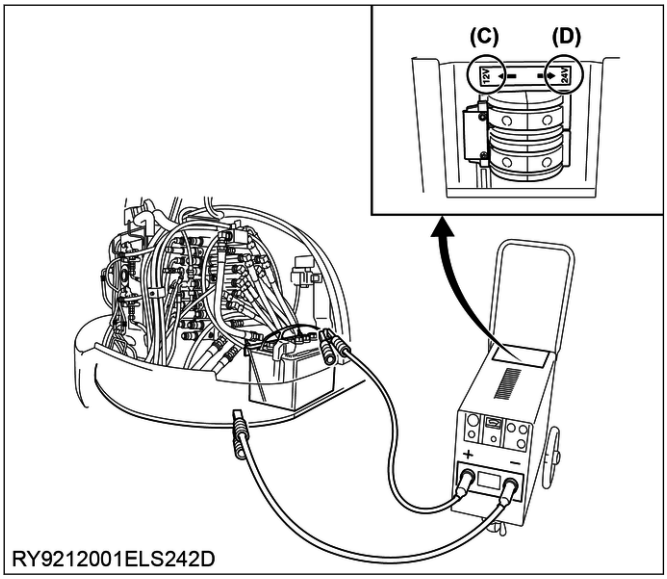
(A) Warning lamp
(B) "E:025" Battery overcharging

3. Check the battery voltage in the tester mode.
   - Start the engine, and check the items of No. 2 in the tester mode.

	Tester mode		Engine stopped	Engine running
Normal	"set-1"	"2: ON/OFF" Battery voltage	Approximately 12 V	Approximately 14 V

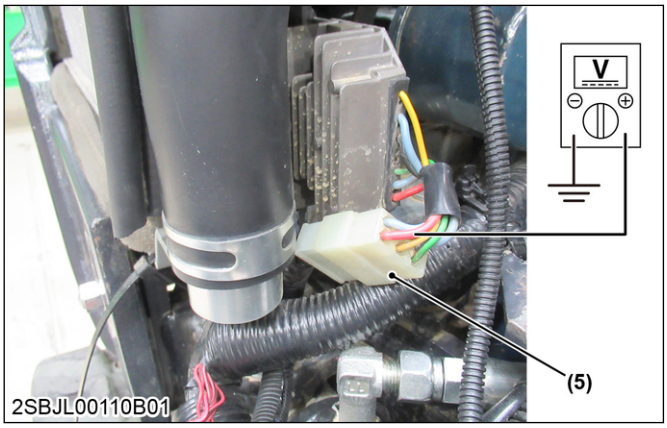
Checking the devices

1. Check the battery.
   - Check if not jump-starting with 24 V.
   - Check if not using with the 24 V battery.



(C) 12 V
(D) 24 V

2. Measure voltage of the regurator.
   - Measure the voltage between terminal 6 of the regurator and body ground.



(5) Regurator connector

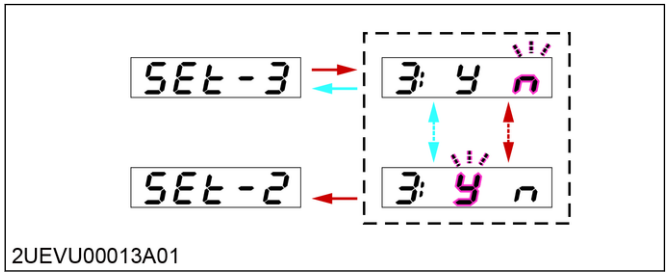
	12 V	GND
(5) Regurator connector	6	Body ground

Normal	Engine is stopped	Engine is running
	Approximately 12 V	Approximately 14 V

Steps to take after completing repairs
Clears error history from main ECU memory.

NOTE
- **This procedure is performed using the main ECU setting kit (optional).**
- **"Clearing error history" can be cleared in "set-3".**
- **"Reading all error history" cannot be cleared in "set-5".**
- **After deleting the record, start the engine again and check to make sure that the warning is not shown on the meter panel.**

1. Connect the main ECU setting kit to the service tool connector.
2. Turn the starter switch to **[RUN]**, and select "set-3" in the service dealer mode.
3. Press SW1 or SW2 to make "Y" or "N" blink.
4. Press and hold SW2 to apply the change and return to "set-2".



"Y"	Clear

2.7 Handling Anti-theft antenna error

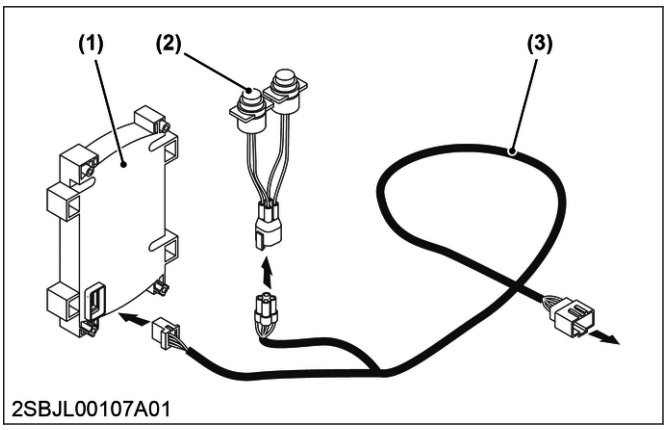
There is no signal from the anti-theft antenna to main ECU.

Checking on the main ECU setting kit (optional)

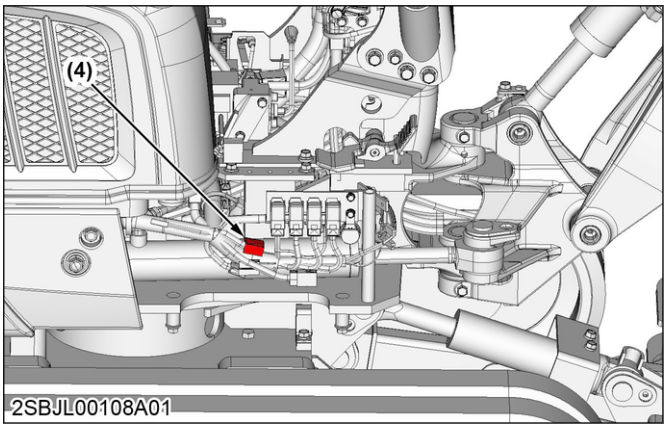
NOTE
- **This procedure is performed using the main ECU setting kit (optional).**

1. Connect the main ECU setting kit to the service tool connector (main ECU setting kit).

Main ECU setting kit



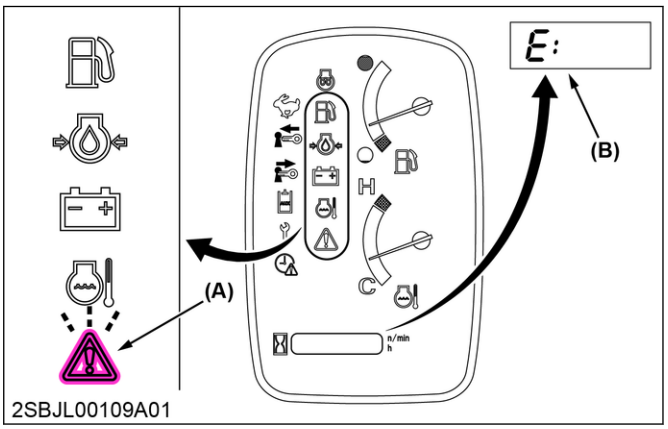
(1) Meter panel
(2) Switch
(3) Wire harness



(4) Service tool connector (main ECU setting kit)

2. Check if there is any warning lamp or error indication on the meter panel.

NOTE
- **If the error "E:028" is detected at the same time, repair "E:028" firstly and then repair "E:026".**



(A) Warning lamp
(B) "E:026" Anti-theft antenna error

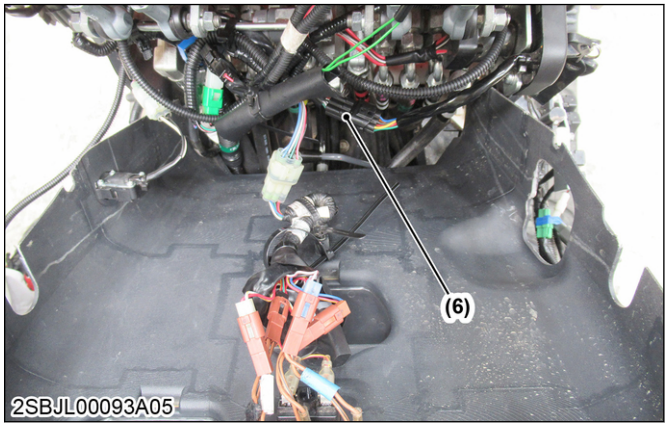
Checking the devices
1. Check whether the anti-theft lamp is blinking or not.

- Check if the Anti-theft lamp is blinking when the starter switch is **[STOP]**.

(5) Anti-theft lamp

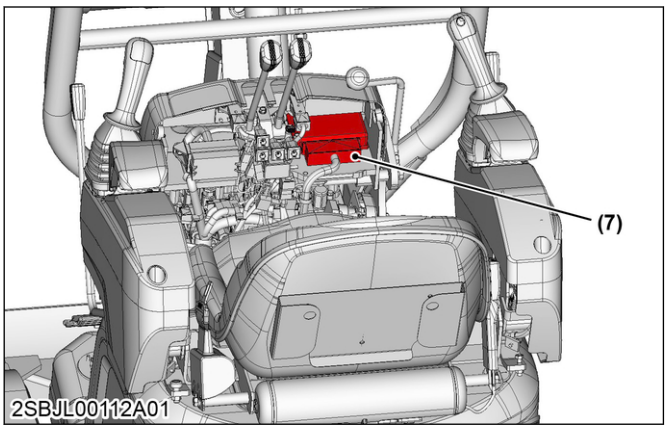
Normal	Blinking

2. Check the anti-theft antenna connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check if the error is resolved.
   - Check the cover of the wires for damage and that they are not touching the body.



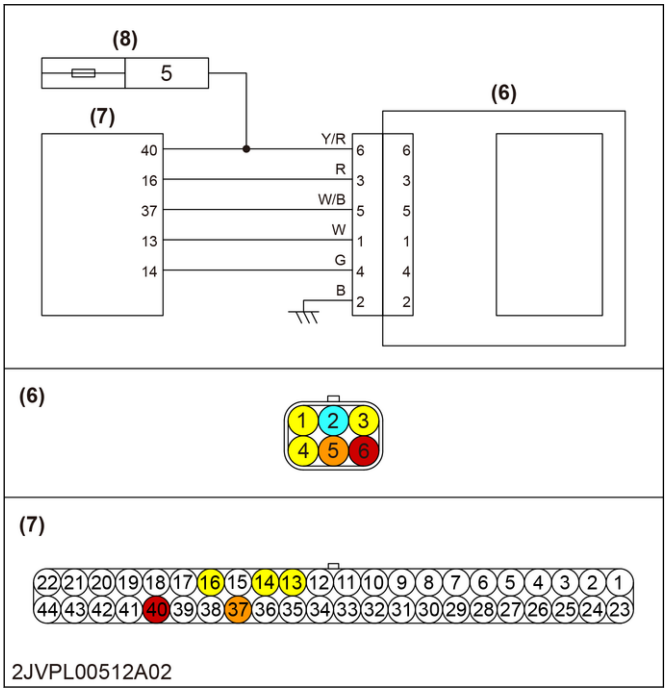
(6) Anti-theft antenna connector

3. Check the main ECU connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check if the error is resolved.
   - Check the cover of the wires for damage and that they are not touching the body.



(7) Main ECU connector

Checking the wire harness



(6) Anti-theft antenna connector (8) Fuse **[ECU (+B)]**
(7) Main ECU connector

1. Measure the voltage of the wire harness.
   - Disconnect the anti-theft antenna connector.

	12 V	GND
(6) Anti-theft antenna connector	6	2

Normal	Approximately 12 V

- Turn the starter switch to **[RUN]**.

	12 V	GND
(6) Anti-theft antenna connector	5	2

Normal	Starter switch at **[STOP]**	Starter switch at **[RUN]**
	0 V	Approximately 12 V

2. Check the conduction of the wire harness.
   - Turn the starter switch to **[STOP]**, and disconnect the anti-theft antenna connector and main ECU connector.

Terminal	Anti-theft antenna connector	Main ECU connector	GND
T × D	1	13	-
GND	2	-	○
ANTI-THEFT LED	3	16	-
R × D	4	14	-
12 V OUT	5	37	-
+B	6	40	-

Normal	Conducting

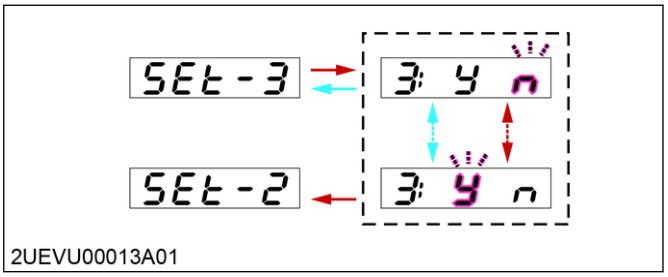
	(+)	(-)
(6) Anti-theft antenna connector	1	Body ground
	3	Body ground
	4	Body ground
	5	Body ground
(7) Main ECU connector	13	Body ground
	16	Body ground
	14	Body ground
	37	Body ground

Normal	Not conducting

Steps to take after completing repairs
Clears error history from main ECU memory.

NOTE
- **This procedure is performed using the main ECU setting kit (optional).**
- **"Clearing error history" can be cleared in "set-3".**
- **"Reading all error history" cannot be cleared in "set-5".**
- **After deleting the record, start the engine again and check to make sure that the warning is not shown on the meter panel.**

1. Connect the main ECU setting kit to the service tool connector.
2. Turn the starter switch to **[RUN]**, and select "set-3" in the service dealer mode.
3. Press SW1 or SW2 to make "Y" or "N" blink.
4. Press and hold SW2 to apply the change and return to "set-2".



2UEVU00013A01

"Y"	Clear

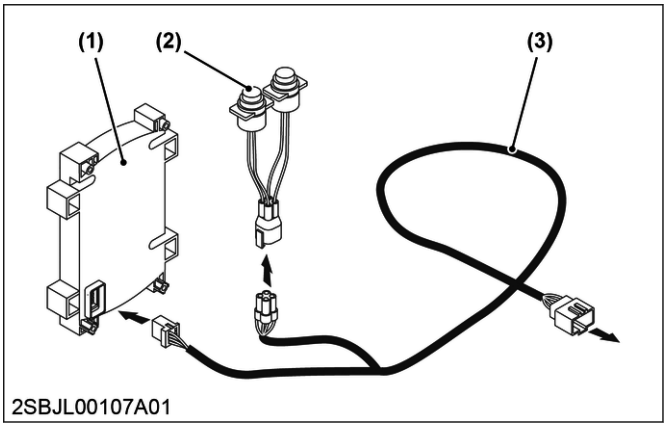
2.8 Handling 12 V error

Short circuit has occurred in the external 12 V line.
Checking on the main ECU setting kit (optional)

NOTE
- **This procedure is performed using the main ECU setting kit (optional).**

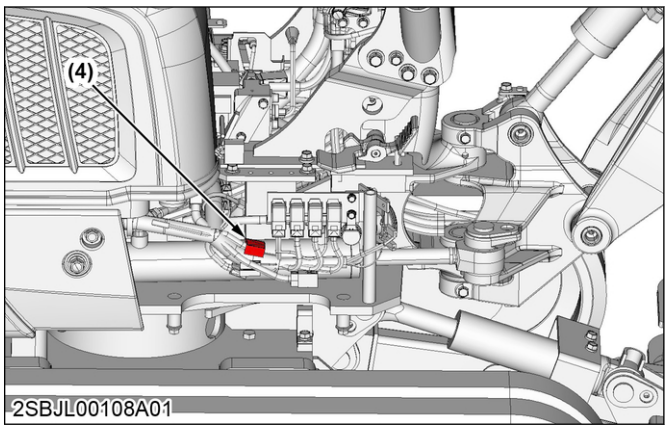
1. Connect the main ECU setting kit to the service tool connector (main ECU setting kit).

Main ECU setting kit



2SBJL00107A01

(1) Meter panel
(2) Switch
(3) Wire harness

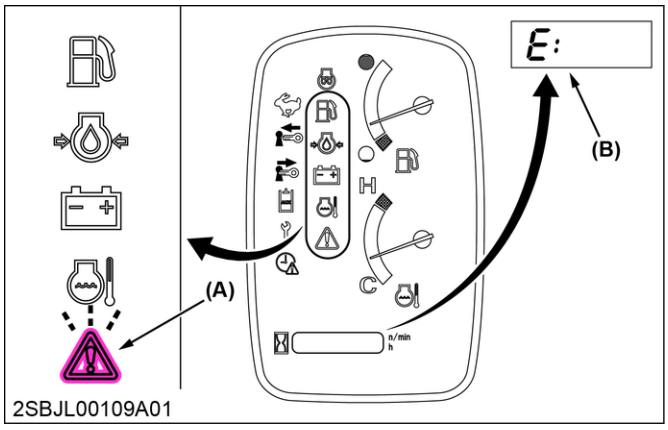


(4) Service tool connector (main ECU setting kit)

2. Check if there is any warning lamp or error indication on the meter panel.

NOTE

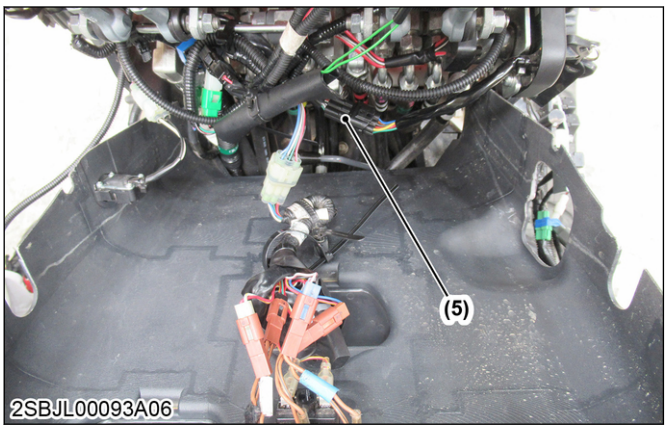
- **If the error "E:026" is detected at the same time, reconfirm whether the error "E:026" is output after repairing "E:028".**



(A) Warning lamp (B) "E:028" 12 V error

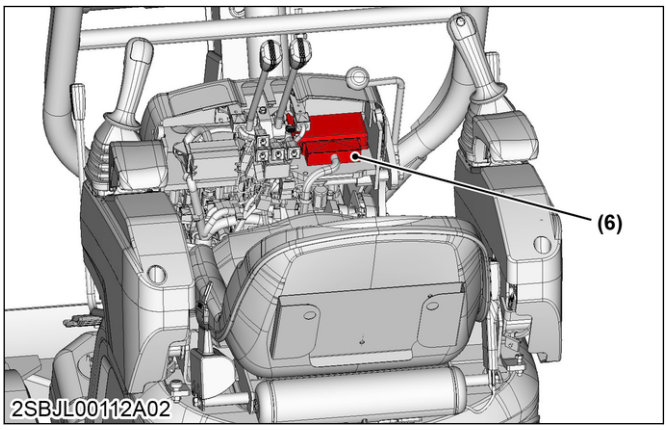
Checking the devices

1. Check the anti-theft antenna connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check if the error is resolved.
   - Check the cover of the wires for damage and that they are not touching the body.



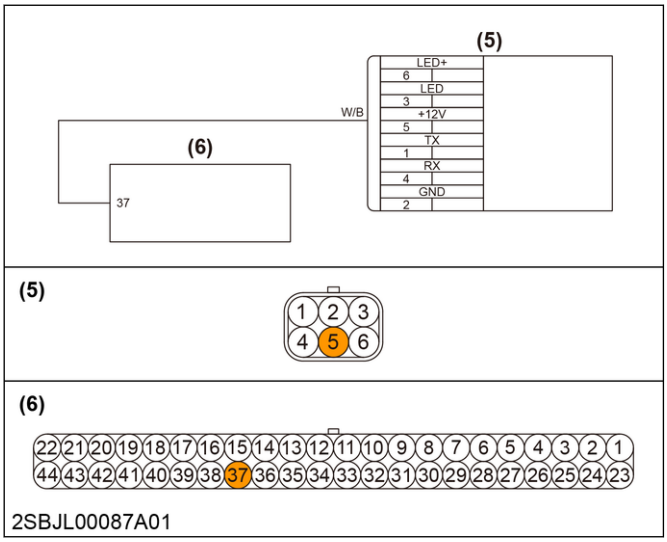
(5) Anti-theft antenna connector

2. Check the main ECU connector.
   - Check the connectors for loose connection or poor contact.
   - Disconnect and reconnect the connectors, and check if the error is resolved.
   - Check the cover of the wires for damage and that they are not touching the body.



(6) Main ECU connector

Checking the wire harness



(5) Anti-theft antenna connector (6) Main ECU connector

1. Measure voltage of the wire harness.

- Disconnect the anti-theft antenna connector.

	12 V	GND
(5) Anti-theft antenna connector	5	2

Normal	Starter switch at [STOP]	Starter switch at [RUN]
	0 V	Approximately 12 V

2. Check conduction of the wire harness.
   - Turn the starter switch to **[STOP]** and disconnect the anti-theft antenna connector and main ECU connector.

	12 V	GND
(5) Anti-theft antenna connector	5	2
(6) Main ECU connector	37	-

Normal	Conducting

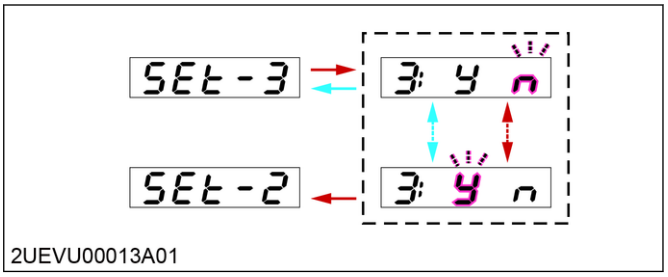
	(+)	(-)
(5) Anti-theft antenna connector	5	Body ground
(6) Main ECU connector	37	Body ground

Normal	Not conducting

Steps to take after completing repairs
Clears error history from main ECU memory.

■ NOTE
- **This procedure is performed using the main ECU setting kit (optional).**
- **"Clearing error history" can be cleared in "set-3".**
- **"Reading all error history" cannot be cleared in "set-5".**
- **After deleting the record, start the engine again and check to make sure that the warning is not shown on the meter panel.**

1. Connect the main ECU setting kit to the service tool connector.
2. Turn the starter switch to **[RUN]**, and select "set-3" in the service dealer mode.
3. Press SW1 or SW2 to make "Y" or "N" blink.
4. Press and hold SW2 to apply the change and return to "set-2".



2UEVU00013A01

"Y"	Clear

7. APPENDICES

APPENDICES

1. Servicing information

1.1 Service specifications for the machine body

- Standard measurement condition is as follows:
  – Engine speed: Maximum

				Unit	Service specification		Service limit
					Value	Tolerance	Value
Wear	Pin			-	-	-	1 mm (0.04 in.) of wear on the pin outer diameter
	Bushing			-	-	-	1 mm (0.04 in.) of wear on the bushing inner diameter
Play	Swivel bearing (vertical play)			mm in.	Less than 1.04 Less than 0.04	-	Less than 2.08 Less than 0.08
	Front attachment			mm in.	Less than 50 Less than 1.97	-	Less than 100 Less than 3.94
Clearance	Front attachment (each pin)			mm in.	0.6 0.02	-	-
Force	Control lever	Pilot control lever	Forward	N kgf lbf	11.0 1.12 2.47	±5.0 ±0.51 ±1.12	-
			Backward	N kgf lbf	7.9 0.81 1.78	±5.0 ±0.51 ±1.12	-
			RH and LH	N kgf lbf	7.2 0.73 1.62	±5.0 ±0.51 ±1.12	-
		Travel control lever	Forward	N kgf lbf	7.8 0.80 1.75	±5.0 ±0.51 ±1.12	-
			Backward	N kgf lbf	7.8 0.80 1.75	±5.0 ±0.51 ±1.12	-
		Blade control lever	Forward	N kgf lbf	18.0 1.84 4.05	±5.0 ±0.51 ±1.12	-
			Backward	N kgf lbf	18.0 1.84 4.05	±5.0 ±0.51 ±1.12	-
		Lever lock	Raising	N kgf lbf	13.0 1.33 2.92	±1.5 ±0.15 ±0.34	-
			Lowering	N kgf lbf	11.6 1.18 2.61	±1.5 ±0.15 ±0.34	-

(Continued)

				Unit	Service specification		Service limit
					Value	Tolerance	Value
Force	Control lever	Accelerator lever	Forward	N kgf lbf	34.3 3.50 7.71	±9.8 ±1.00 ±2.20	-
			Backward	N kgf lbf	34.3 3.50 7.71	±9.8 ±1.00 ±2.20	-
	Control pedal	Swing control pedal	RH	N kgf lbf	49.0 5.00 11.02	±9.8 ±1.00 ±2.20	-
			LH	N kgf lbf	49.0 5.00 11.02	±9.8 ±1.00 ±2.20	-
Dimension	Track	Rubber track	Lug height	mm in.	17 0.67	-	-
			Link height	mm in.	30 1.18	-	-
			Width	mm in.	180 7.09	-	-
			Height	mm in.	66 2.60	-	-
			Tension dimension	mm in.	10.5 0.41	2.5 0.10	-
	Front idler		Outer diameter	mm in.	ϕ247 ϕ9.72	-	ϕ241 ϕ9.49
			Guide width	mm in.	22 0.87	±1.0 ±0.04	16 0.63
			Idler width	mm in.	71 2.80	±0.2 ±0.01	-
	Sprocket		Outer diameter	mm in.	ϕ290 ϕ11.42	-2.0 to +1.0 -0.08 to +0.04	284 11.18
			Inner diameter	mm in.	ϕ140 ϕ5.51	+0.08 to +0.14 +0.003 to +0.006	-
			Sprocket width	mm in.	12 0.47	-	-
			Gear height	mm in.	150 5.91	-1.5 -0.06	144 5.67
	Track roller		Guide width	mm in.	ϕ60.5 ϕ2.38	-	-
			Outer diameter	mm in.	124 4.88	±0.5 ±0.02	118 4.65
			Roller width	mm in.	11 0.43	-	5.00 0.20
			Roller width	mm in.	16 0.63	-	10.00 0.39

1.2 Service specifications for hydraulic system

■ NOTE

- **Standard measurement condition is as follows:**
  - **– Warm up the hydraulic oil and devices to 50±5 ℃ (122±9 ℉).**
  - **– Accelerate the engine to the maximum speed.**
  - **– Hydraulic cylinder speed does not include cushioning.**

			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Pressure	Main relief valve	P1 (aP1)	MPa kgf/cm^2 psi	17.7 180.5 2567	-0.5 to +0.3 -5.1 to +3.1 -73 to +44	-
		P2 (aP2)	MPa kgf/cm^2 psi	17.7 180.5 2567	-0.5 to +0.3 -5.1 to +3.1 -73 to +44	-
	Pilot primary pressure relief valve	Pilot primary (aPP)	MPa kgf/cm^2 psi	3.9 39.8 566	0 to +0.5 0 to +5.1 0 to +73	-
	Overload relief valve	Swivel left (cSL)	MPa kgf/cm^2 psi	7.5 76.5 1088	0 to +0.49 0 to +5.0 0 to +71	-
		Swivel right (cSR)	MPa kgf/cm^2 psi	7.5 76.5 1088	0 to +0.49 0 to +5.0 0 to +71	-
Flow rate	Hydraulic pump (main) (P1) (Engine speed: maximum, no load, maximum flow rate)		L/min U.S.gals/min	11.5 3.04	-	9.2 2.43
	Hydraulic pump (main) (P2) (Engine speed: maximum, no load, maximum flow rate)		L/min U.S.gals/min	11.6 3.06	-	9.3 2.46
	AUX (Engine speed: maximum, no load, maximum flow rate)		L/min U.S.gals/min	22.5 5.94	-	-
Internal leakage	Hydraulic cylinder	Boom (10 min, engine stopped)	mm in.	Less than 20.0 Less than 0.78	-	100.0 3.94
		Arm (10 min, engine stopped)	mm in.	Less than 11.0 Less than 0.43	-	55.0 2.17
		Bucket (10 min, engine stopped)	mm in.	Less than 10.0 Less than 0.39	-	50.0 1.97
		Blade (10 min, engine stopped)	mm in.	Less than 20.0 Less than 0.78	-	40.0 1.57
	Swivel motor	Engine stopped	mm in. °	Less than 93.4 Less than 3.7 Less than 30	-	93.4 3.7 30
	Travel motor	(20° slope)	mm in.	Less than 300 Less than 11.8	-	300 11.8
Speed	Boom cylinder	Lifting (Ground to highest)	s	2.5	±0.3	-

(Continued)

			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Speed	Boom cylinder	Lowering (Highest to ground)	s	2.8	±0.3	-
	Arm cylinder	Crowding	s	4.0	±0.3	-
		Dumping	s	2.8	±0.3	-
	Bucket cylinder	Crowding	s	2.9	±0.3	-
		Dumping	s	2.0	±0.3	-
	Blade cylinder	Lifting (Lowest to highest)	s	1.6	±0.3	-
		Lowering (Highest to lowest)	s	1.2	±0.3	-
	Swing cylinder	Swing left	s	3.9	±0.3	-
		Swing right	s	3.6	±0.3	-
	Swivel motor	Left	rpm s/3 rotations	8.3 21.7	±0.8 -1.9 to +2.3	-
		Right	rpm s/3 rotations	8.3 21.7	±0.8 -1.9 to +2.3	-
	Travel motor	Low speed	s/10 m km/h mph	18.0 2.0 1.2	-1.6 to +2.0 ±0.2 ±0.1	-
		High speed	s/10 m km/h mph	9.0 4.0 2.5	-0.8 to +1.0 ±0.4 ±0.2	-
Travel straightness (10 m)			mm in.	-	-	1000 39.4

1.3 Service dealer mode

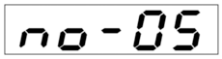
1.3.1 Tester mode list

No.		Display	Description	Remarks
1	Engine speed	“oooo” rpm	-	No function
2	Battery voltage	“oo.o” V	• Engine stopped: approximately 12.0 V • Engine running: approximately 14.0 V	-
3	Engine oil pressure switch	“ON” “OFF”	• Engine stopped (49 kPa or lower) • Engine running (higher than 49 kPa)	No function
4	Battery charging switch	“ON” “OFF”	• Engine stopped • Engine running	-
5	Starter switch	“ON” “OFF”	• Starter SW at **[START]** • Starter SW at **[STOP]** or **[RUN]**	-
6	Work light switch	“ON” “OFF”	• Press SW • Press SW again	No function
7	Coolant temperature sensor (voltage)	“o.oo” V	• Starter SW at **[STOP]**: 0 V • Starter SW at **[RUN]**: 5 V	No function
8	Coolant temperature sensor (temperature)	“oo” ℃	• Normal: -49 to 149 ℃	No function
9	Fuel level sensor (voltage)	“o.oo” V	• Starter SW at **[STOP]**: 0 V • Starter SW at **[RUN]**: 12 V	No function
10	Fuel level sensor (resistance)	“ooo” Ω	• Full: 3±1 Ω • Half: 32.5 Ω • Empty: 110±2.5 Ω	No function
11	Fuel level indication switch	“ON” “OFF”	• SW pressed • SW released	No function
12	Travel speed shift switch	“ON” “OFF”	• SW pressed • SW released	No function
13	Travel speed shift SOL	“ON” “OFF”	• SW pressed • SW released	No function
14	Lever lock switch	“ON” “OFF”	• Lever lock lowered • Lever lock raised	-
15	Lever lock SOL	“ON” “OFF”	• Lever lock lowered • Lever lock raised	-
16	AUX knob switch (voltage) and travel pressure sensor (voltage)	“o.oo” V	• 0.26 to 4.74 V	No function
17	AUX knob switch (setting voltage left)	“o.oo” V	• 0.26 to 4.74 V	No function
18	AUX knob switch (setting voltage neutral)	“o.oo” V	• 0.26 to 4.74 V	No function
19	AUX knob switch (setting voltage right)	“o.oo” V	• 0.26 to 4.74 V	No function
20	AUX SOL (current)	“o.oo” A	• 0 to 1.7 A	No function
21	AUX hold switch	“ON” “OFF”	• Press SW • Press SW again	No function
22	AUX switch	“ON” “OFF”	• Press SW • Press SW again	No function

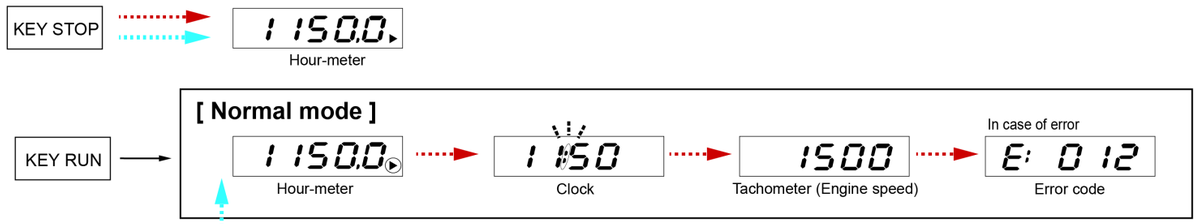
(Continued)

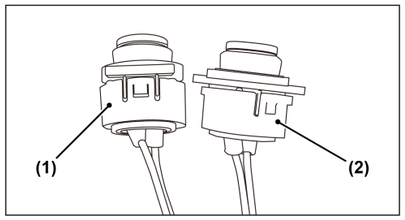
No.		Display	Description	Remarks
23	AUX RH setting	"oo" × 10 mA	-	No function
24	AUX LH setting	"oo" × 10 mA	-	No function
25	Key type	"0" "1" "2" "3" "4" "5" "6"	• Unknown • Red • Black • Yellow • Green • Red yellow • Red green	-
26	Anti-theft key analysis (registered key)	"ON" "OFF"	• Match • Mismatch	-
27	Anti-theft mode	"ON" "OFF"	• Deactivated • Activated	-
28	Communication between anti-theft key and anti-theft antenna	"ON" "OFF"	• Exists • Does not exist	-
29	Anti-theft antenna	"ON" "OFF"	• Error • Normal	-

1.3.2 Default settings

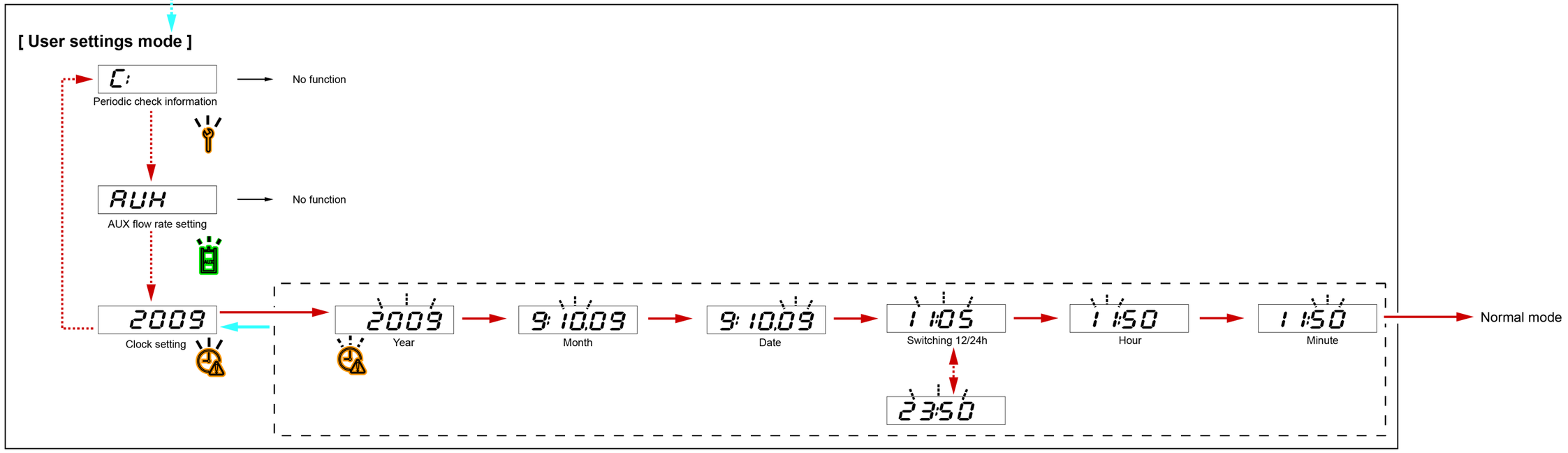
Display	Mode	U10-5
	Model settings	"51: 017" "52: 004" "53: N"

2. Normal mode and user setting mode flow chart



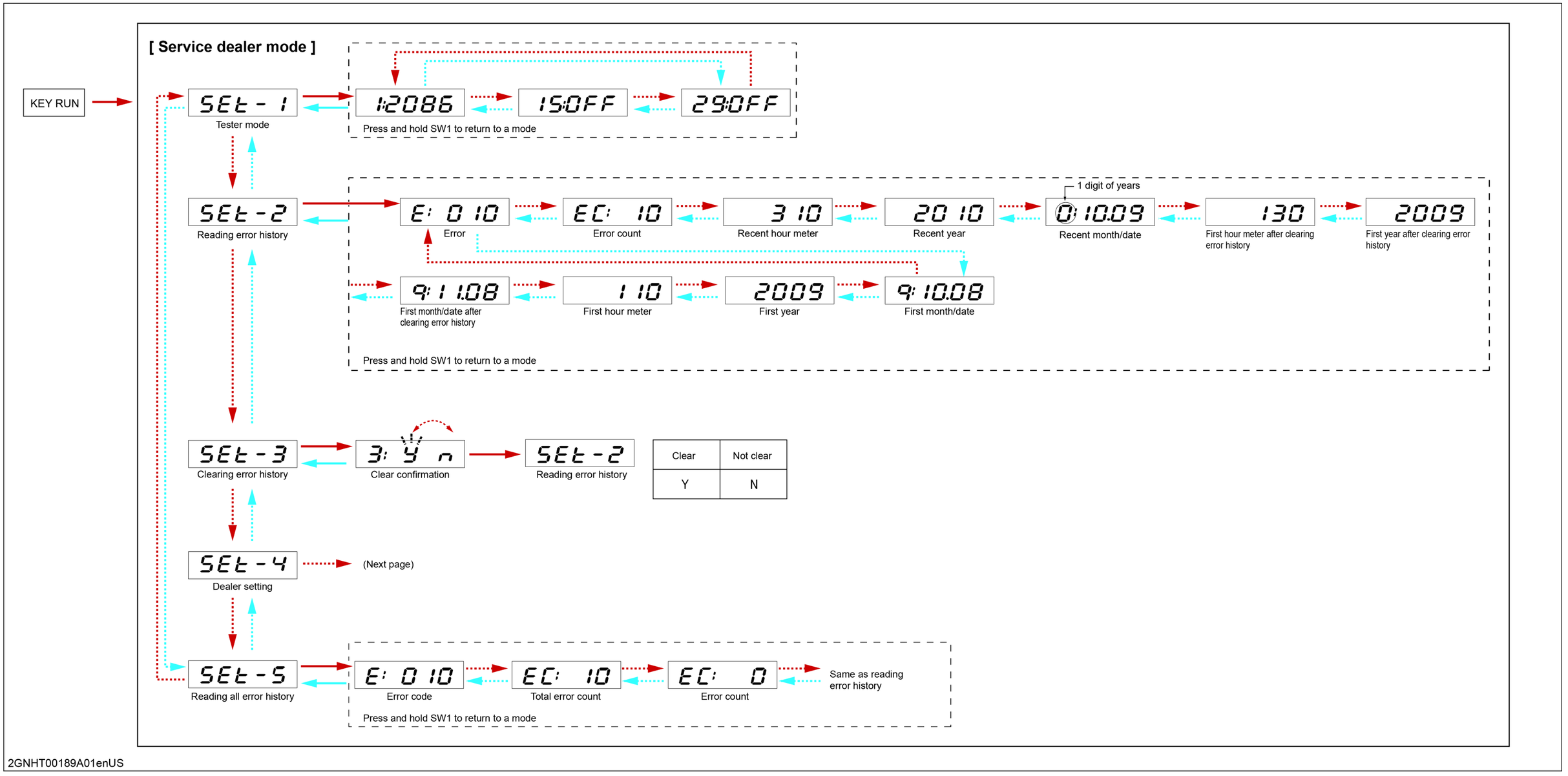


Switch	Wiring color	Operation	Symbol
(1) SW2	Blue - Red	Press	
		Press and hold	
(2) SW1	Yellow - Green	Press	
		Press and hold	

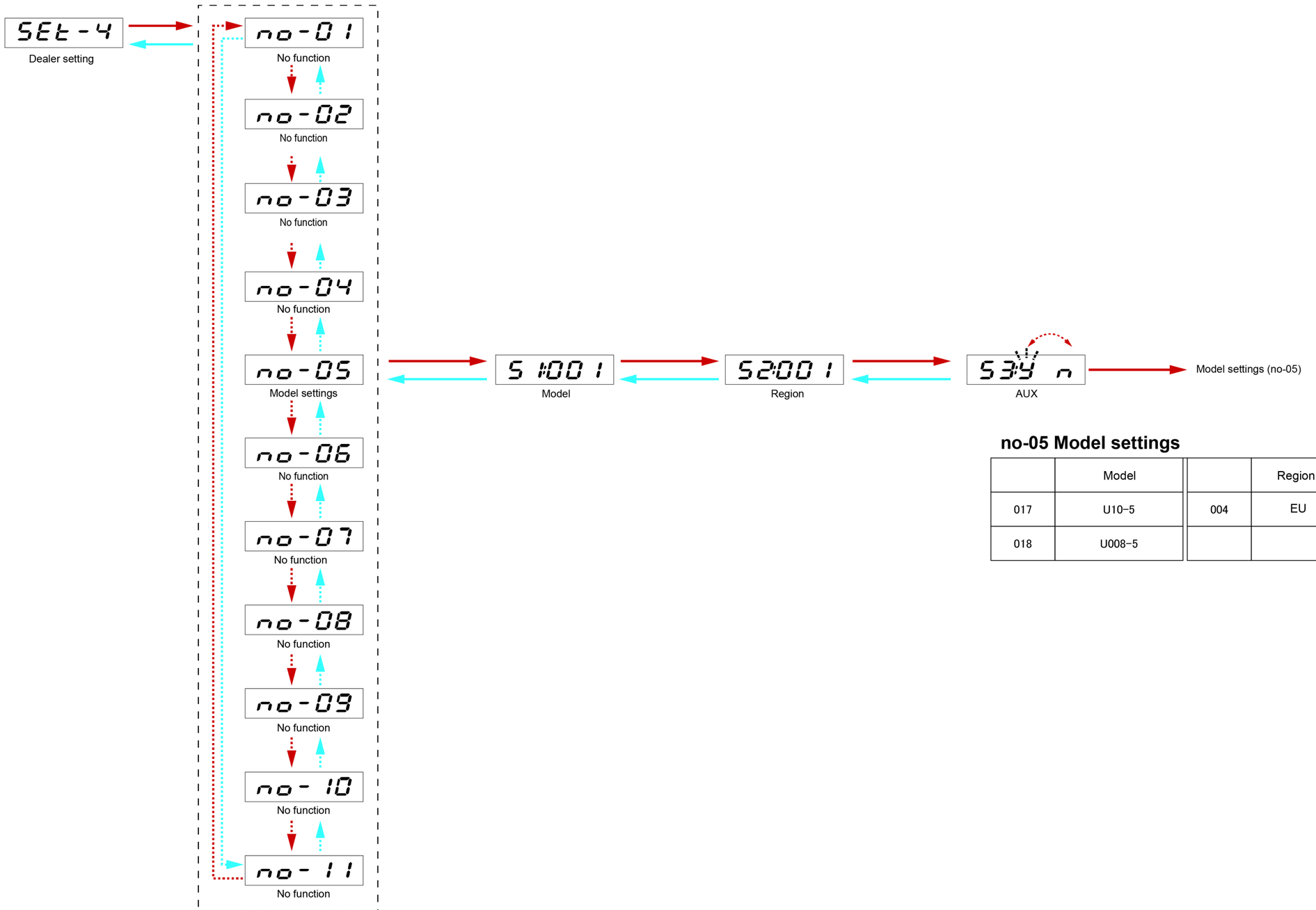


2GNHT00181A01enUS

3. Service dealer mode flow chart



2GNHT00189A01enUS

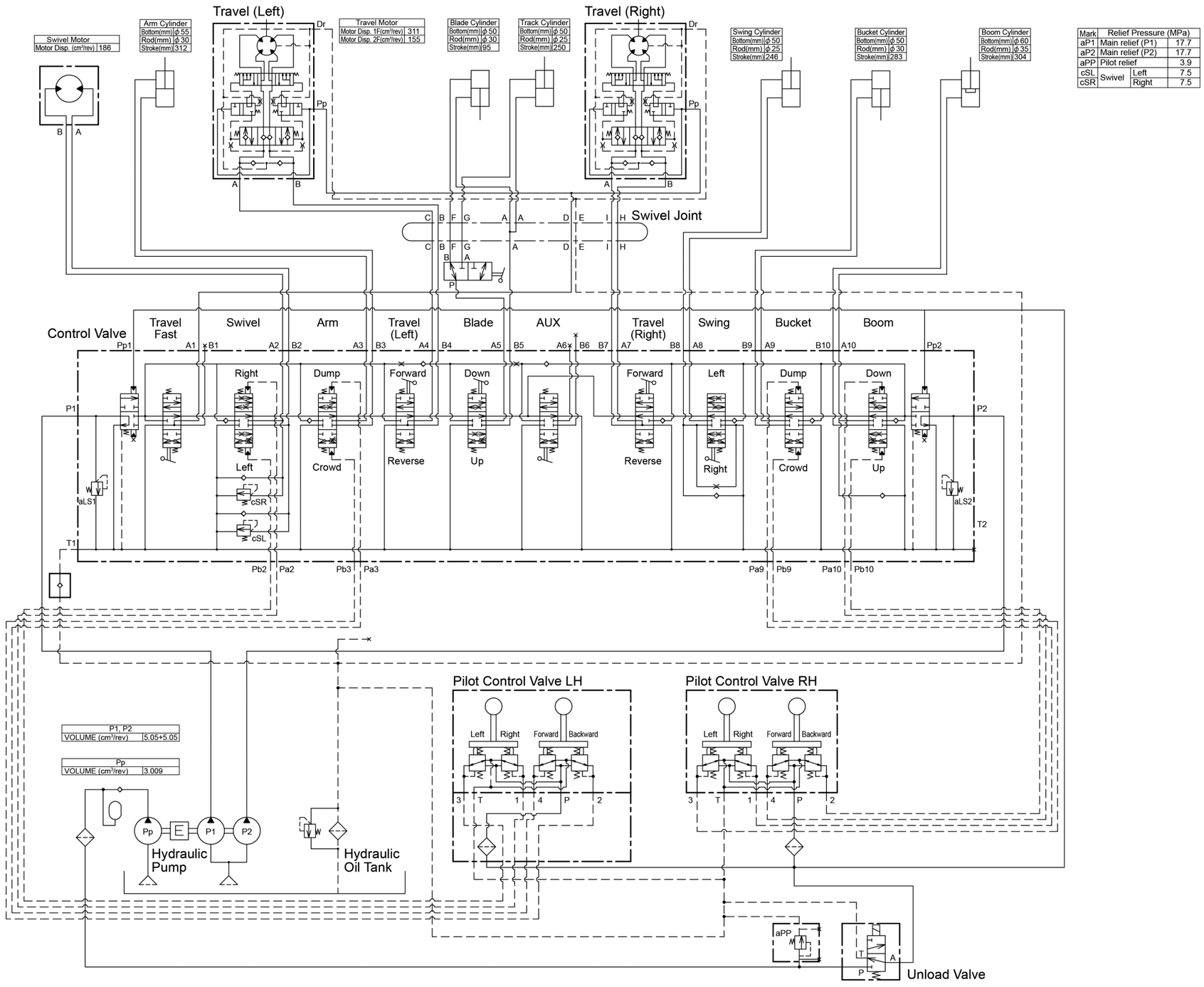


no-05 Model settings

	Model		Region		AUX
017	U10-5	004	EU	N	–
018	U008-5				

2GNHT00182A01enUS

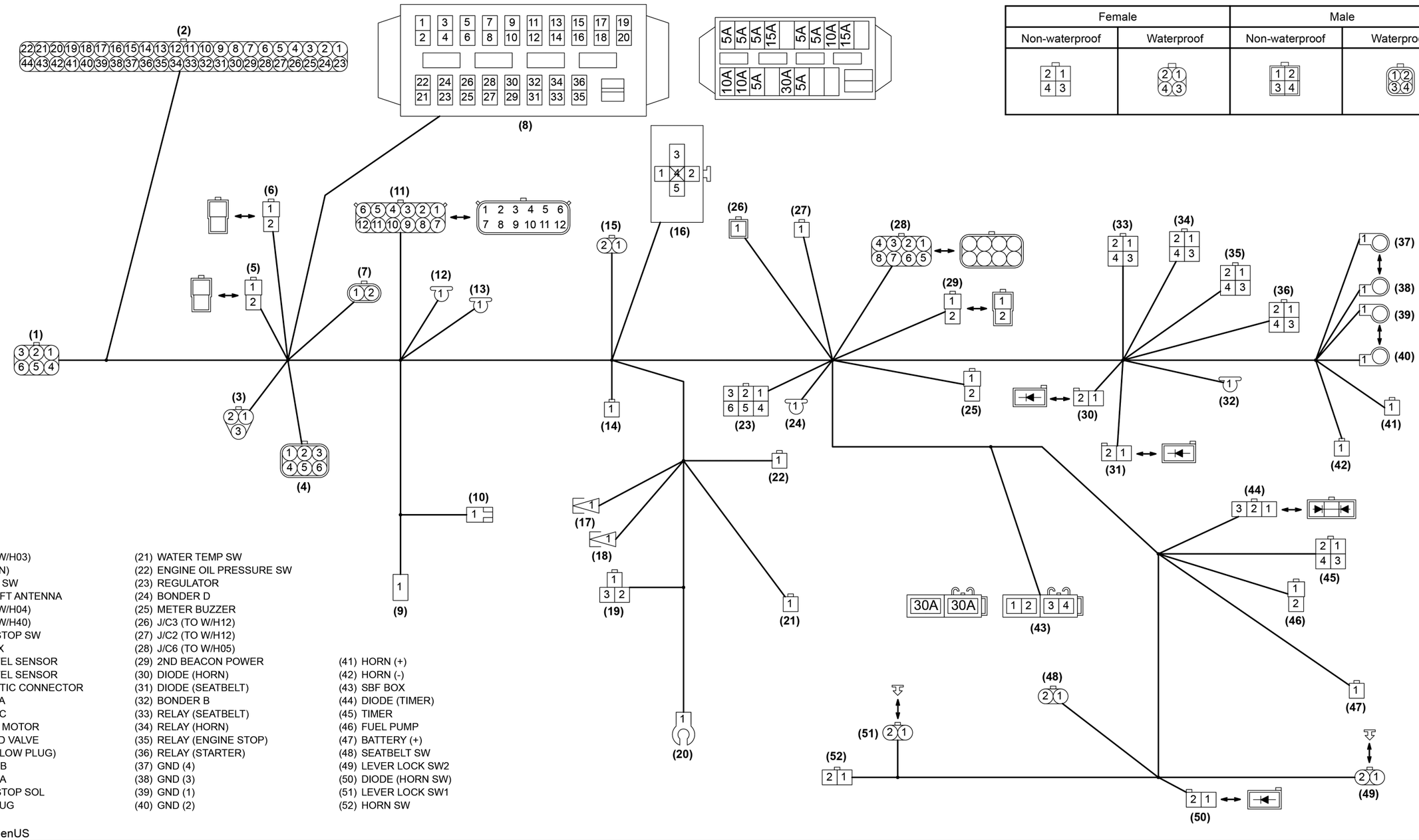
4. Hydraulic circuit diagram



2SBJL00001A01enUS

5. Wire harness

W/H00 MAIN HARNESS

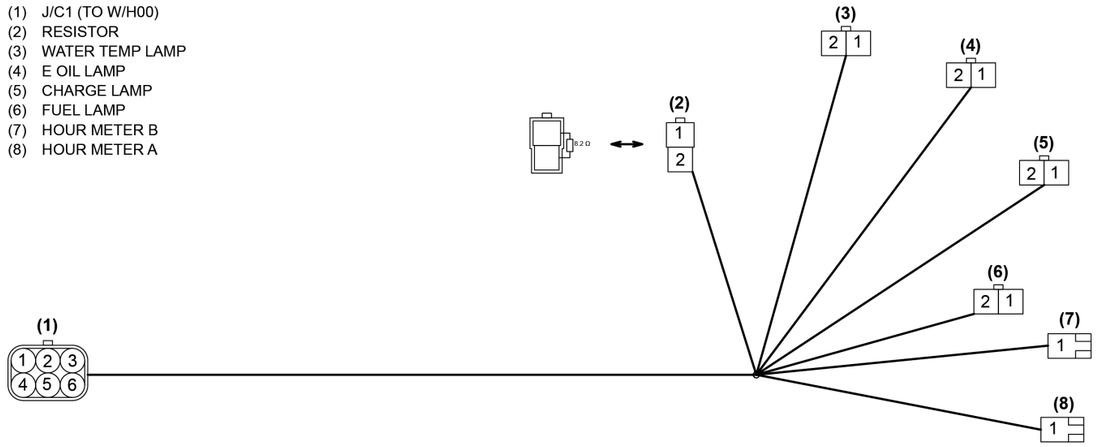


(1) J/C1 (TO W/H03)
(2) ECU (MAIN)
(3) STARTER SW
(4) ANTI-THEFT ANTENNA
(5) J/C4 (TO W/H04)
(6) J/C5 (TO W/H40)
(7) ENGINE STOP SW
(8) FUSE BOX
(9) FUEL LEVEL SENSOR
(10) FUEL LEVEL SENSOR
(11) DIAGNOSTIC CONNECTOR
(12) BONDER A
(13) BONDER C
(14) STARTER MOTOR
(15) SOLENOID VALVE
(16) RELAY (GLOW PLUG)
(17) DYNAMO B
(18) DYNAMO A
(19) ENGINE STOP SOL
(20) GLOW PLUG
(21) WATER TEMP SW
(22) ENGINE OIL PRESSURE SW
(23) REGULATOR
(24) BONDER D
(25) METER BUZZER
(26) J/C3 (TO W/H12)
(27) J/C2 (TO W/H12)
(28) J/C6 (TO W/H05)
(29) 2ND BEACON POWER
(30) DIODE (HORN)
(31) DIODE (SEATBELT)
(32) BONDER B
(33) RELAY (SEATBELT)
(34) RELAY (HORN)
(35) RELAY (ENGINE STOP)
(36) RELAY (STARTER)
(37) GND (4)
(38) GND (3)
(39) GND (1)
(40) GND (2)
(41) HORN (+)
(42) HORN (-)
(43) SBF BOX
(44) DIODE (TIMER)
(45) TIMER
(46) FUEL PUMP
(47) BATTERY (+)
(48) SEATBELT SW
(49) LEVER LOCK SW2
(50) DIODE (HORN SW)
(51) LEVER LOCK SW1
(52) HORN SW

2SBJL00076A01enUS

W/H03 WIRE HARNESS (LAMP)

(1) J/C1 (TO W/H00)
(2) RESISTOR
(3) WATER TEMP LAMP
(4) E OIL LAMP
(5) CHARGE LAMP
(6) FUEL LAMP
(7) HOUR METER B
(8) HOUR METER A



W/H12 FRONT HARNESS

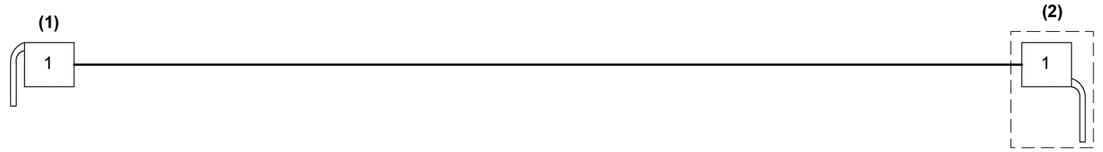
(1) WORK LIGHT (RH F)
(2) J/C2 (TO W/H00)
(3) J/C3 (TO W/H00)

W/H30 BATTERY CORD (+) HARNESS

(1) STARTER MOTOR (+B)
(2) BATTERY (+)

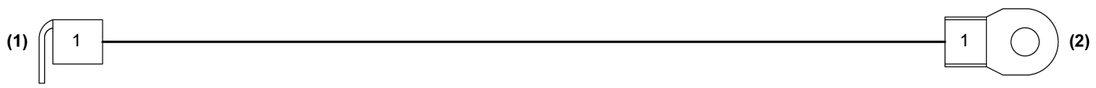
W/H33 BATTERY CORD (1, -) HARNESS

(1) BATTERY ISOLATER (-)
(2) BATTERY (-)



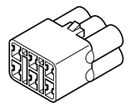
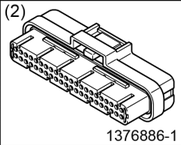
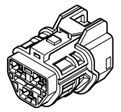
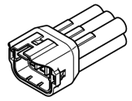
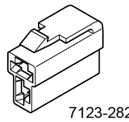
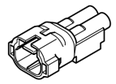
W/H34 BATTERY CORD (2, -) HARNESS

(1) BATTERY ISOLATER (-)
(2) SWIVEL FRAME (-)

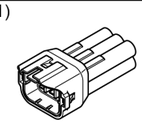
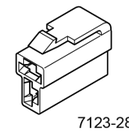
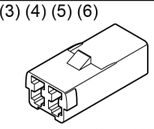


2SBJL00077A01enUS

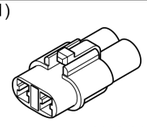
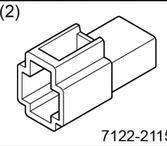
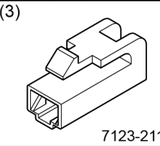
W/H00 MAIN HARNESS (U10-5)

(1)  6181-6181	(2)  1376886-1	(3)  7123-6234-40	(4)  6189-6172	(5) (6) (25) (29) (46)  7123-2820	(7)  6187-2801	(8) No Image 6359-1572	(9)  CB
(10) 1500-0045	(11) 33472-1206	(12) (13) (24) (32) No Image	(14) (21) (22) 172320-2	(15) 7283-2090-30	(16) No Image 6420-0050	(17) (18) CA	(19) 7123-2830
(20) LE-M4	(23) 6070-6611	(26) 7122-2115	(27) 7123-2115	(28) 1300-3189	(30) (31) (50) 6098-0017	(33) (34) (35) (36) 7123-2840-30	(37) 8167-5973
(38) 8167-5972	(39) 8100-0716	(40) 8100-0717	(41) (42) 7123-2010	(44) 6098-0022	(45) 7123-2249-60	(43) 7157-5470	
(47) 6090-2502	(48) DTM06-2S	(49) (51) 6195-0003	(52) 6099-0504				

W/H03 LAMP HARNESS

(1)  6189-6171	(2)  7123-2820	(3) (4) (5) (6)  7123-1520-40	(7) No Image 7116-2030-02

W/H12 FRONT HARNESS

(1)  6180-2181	(2)  7122-2115	(3)  7123-2115	

W/H30 BATTERY CORD (+) HARNESS

(1)  7003-1171-02	(2) No Image 7106-1104		

W/H33 BATTERY CORD (-) HARNESS

(1) No Image 7003-2071-02	(2) No Image 7003-2327-02		

W/H34 CORD BODY GROUND

(1) No Image 7003-2071-02	(2)  7003-1172-02		

2SBJL00078A01enUS

ELECTRICAL CIRCUIT DIAGRAM (U10-5)

Composition Specification Code	Notes
BASE	All use
BINC	Battery/Isolator & NoClock
AT	Anti-theft
TRB	Travel Alarm
HS	Horn SW (Right grip)
ATHS	AntiTheft & HornSW (Right Grip)
SCHS	SC24 Horn SW (Right Grip)
BCN	Beacon
2BCN	2nd Beacon
3LLSW	3 Lever Lock Switch

W/H00 W/H (MAIN)
W/H03 W/H (LAMP)
W/H12 W/H (FRONT)
W/H30 CABLE, BATTERY (+)
W/H33 CORD, BATTERY (1, -)
W/H34 CORD, BATTERY (2, -)
W/H35 CORD, BODY EARTH

INDEX

Symbols

A

B

C

D

E

F

G

H

I

J

L

M

N

O

P

Q

R

S

T

U

V

W

Editor : Kubota Corporation Construction Machinery Service Technical Support Dept.
Address : 1-1 Nakamiya-Ohike 1-Chome, Hirakata-City, Osaka, 573-8573, Japan
Phone : +81-72-840-1195
Fax : +81-72-890-2883
E-mail : kbt_g.ce-sv@kubota.com

KUBOTA Corporation Printed in Japan 2021. 04, H, EI, EI, engusa Code No. RY911-29760